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WATER FOR LIFE

MBRI Inc
MID BRISBANE RIVER IRRIGATORS
Promoting Effective Sustainable Catchment Management

Ref: D19/156581

1 November 2019

Flavio Menezes
Chair Queensland Competition Authority
GPO Box 2257
BRISBANE QLD 4001

Dear Mr Menezes,

JOINT RESPONSE SUBMISSION FOR CENTRAL BRISBANE WATER SUPPLY SCHEME

This submission is a joint submission prepared by Seqwater and the Mid-Brisbane River Irrigators (MBRI). This submission responds to the QCA's draft report in respect to the Central Brisbane River Water Supply Scheme and represents the positions jointly held by both Seqwater and the MBRI in respect to the matters contained in section 6.4 of the "Draft report Rural irrigation price review 2020-24, Part C: Seqwater".

Yours sincerely

Ross Muir
General Manager
Customer, Planning and Strategy
Seqwater

Tom Wilkinson
Chair
Mid-Brisbane River Irrigators

Seqwater and Mid-Brisbane River Irrigators joint submission to draft report

Introduction

In response to section 6.4 of the "Draft report Rural irrigation price review 2020-24, Part C: Seqwater", Seqwater and the Mid-Brisbane River Irrigators (MBRI) jointly submit herewith additional information, explanations and arguments further supporting the claims made in the earlier joint submission and the report by SLR consulting[1].

In support of the information provided below, Seqwater and MBRI attach to this joint submission:

- a technical response to the Water Solutions[2] report prepared by SLR Consulting [3]
- a review prepared by Badu Advisory of Water Solutions' application of the HUF methodology to the Central Brisbane Water Supply Scheme (WSS) [4]
- a desktop review prepared by Badu Advisory of considerations relevant to the determination of a HUF in the Central Brisbane WSS and selected other schemes within Queensland. [5]

The MBRI has made a separate submission addressing matters of wider concern on behalf of its membership.

Differentiating the concepts of supplemented water and hydrologic benefit

Seqwater and MBRI submit that while medium priority water allocations in the Central Brisbane River WSS fall under the definition of "supplemented water" under the *Moreton Water Plan (2007)*, it does not necessarily follow that they are actually wholly supplied by infrastructure within the scheme.

Supplemented water is defined in the *Moreton Water Plan (2007)* as meaning "*surface water supplied under an interim resource operations licence, resource operations licence or other authority to operate water infrastructure*". [6] The definition of supplemented water in the water plan does not mean that water **must** be supplied from water infrastructure in order for surface water to be deemed as supplemented[7]. This is acknowledged by the QCA who note that *"Supplemented water is provided in a regulated scheme, usually supplied from either a dam, weir or other improvements (e.g. barrage, off-stream storage), but can include natural stream flow".* [8] However, it is noted that the subsequent commentary within the QCA report has

[1] Note that DES comments on SLR's previous work were noted in Seqwater's initial submission regarding the Central Brisbane scheme. DES have not reviewed SLR's recent response to the Water Solutions report.

[2] *Report to Queensland Competition Authority on Rural Irrigation Price Review 2020-24: Assessment of Hydrologic Factors*, Water Solutions, 3 September 2019.

[3] *Response to the Water Solutions Review of Central Brisbane Benefits Study Report for the QCA*, SLR, October 2019 (attached).

[4] *Headworks Utilisation Factors for the Central Brisbane Water Supply Scheme*, Badu Advisory, October 2019. (attached).

[5] *Consideration of HUF issues in other schemes relevant to Central Brisbane*, Badu Advisory, 19 December 2018 (attached).

[6] *Moreton Plan (Moreton) 2007*, current as at 29 September 2017.

[7] It is acknowledged that decisions regarding whether or not a water allocation is granted as supplemented water under an interim resource operations licence, resource operations licence or other authority to operate water infrastructure are matters for the Queensland Government following consultation with affected parties through water planning processes. Seqwater also notes that it supports the decisions made by its Responsible Ministers and the Queensland Government in relation to water planning.

[8] Page 56, Draft report – Rural irrigation price review 2020-24 Part C: Seqwater, QCA, August 2019.

narrowed this interpretation as illustrated in the statement that "*… the Moreton Water Management Protocol… indicates that the allocations of both priority groups are considered supplemented by the Wivenhoe Dam and Somerset Dam infrastructure".* [5]

There are several examples in Queensland where water allocations managed under a ROL fall within the definition of supplemented water and have been recognised (appropriately) by the QCA as not being supplied by scheme infrastructure like a dam, weir, barrage etc for the purposes of calculating a HUF. For example, in the Upper Condamine Water Supply Scheme, water allocations within the Risk Class A and Risk Class B priority groups are managed by Sunwater under a ROL and therefore fall within the definition of supplemented water within that scheme. However, as recognised by the QCA, these water allocations have been assigned a HUF of 0% as they essentially rely on run of the river flows and receive no hydrologic benefit from the existence of the dams and the associated operations in that scheme[9]. A further example relates to medium priority water allocations in the Bowen-Broken Water Supply Scheme which have also been assigned a HUF of 0%. In this case, the medium priority water allocations rely on being supplied from infrastructure that has been assessed as having a very low probability of utilisation.

While the water sharing and operational arrangements that apply to such examples are clearly different to those that apply to the medium priority water allocations in Central Brisbane, they illustrate the point that specific types of supplemented water allocation may be excluded from the priority groups assessed under the standard HUF methodology[10] or assigned a HUF of zero as an outcome of applying the HUF methodology[11] to allocate costs between different priority groups within a scheme.

Seqwater and MBRI submit that the assessment of hydrologic benefit in the SLR study suggests that medium priority water allocations are a further example of where a specific priority group of entitlements to supplemented water should be afforded special consideration within the HUF analysis and be assigned a HUF of zero.

This has important and unique implications when assessing a HUF for medium priority water allocations in the Central Brisbane River compared to other water supply schemes. Badu Advisory undertook a desktop review of a selection of other water supply schemes in Queensland that highlighted the uniqueness of the Central Brisbane water supply scheme with respect to considerations relevant to the determination of a HUF. [12] The Central Brisbane WSS is unique in that such a small volume of water entitlements long-held by irrigators – whose hydrologic performance has been shown by SLR to provide irrigators with no significant change to the benefit from the dams and their associated operations – now co-exists with such a large volume of high priority urban water entitlements (the existence of which was – and is – made possible by the presence of the two dams).

The above provides the special context as to why Seqwater and MBRI contend that it is essential to consider the extent of **hydrologic** benefit that is being derived from these dams in this scheme as an input to the QCA's assessment of the relative benefit of the Central Brisbane River WSS's bulk water assets (the two dams) that is attributable to each WAE priority group.

Seqwater and MBRI submits that this is a critical point which has not been taken into account and is deserving of full consideration. Seqwater and MBRI also note, consistent with the initial

[9] The standard HUF methodology explicitly recognises that some supplemented water entitlements utilise storage headworks to either little or no extent and may therefore excluded from the analysis and assigned a HUF of zero.

[10] As documented under step 1 ('identify the water entitlement groupings') of the standard HUF methodology.

[11] Such as in the case of the Bowen Broken medium priority water allocations.

[12] Badu Advisory, 2018.

joint submission, that the Central Brisbane considerations in assessing an MP HUF are considered unique to the circumstances and context of this particular scheme.

Differentiating hydrologic benefit from other types of benefits or constraints

Seqwater and MBRI also notes that the difference between hydrologic benefit and the other types of benefits – or constraints – arising from the existence of regulatory frameworks (including water plans, operations manuals, sharing rules, flood operations etc.) was not recognised within the Water Solutions Report. As SLR observed:

…the WS Report has merely proposed a number of outcomes of applying the regulatory framework [and] they should be acknowledged as such (i.e. a selective rather than comprehensive assessment of regulatory benefits with no consideration of the corresponding disbenefits to irrigators from the imposition of regulatory framework). [13, 14]

The analysis, conclusions and recommendations within the Water Solutions Report includes many examples of this. SLR highlighted a number of these points including, for example:

- *…achievement of EFOs and WASOs are outcomes of imposing the overall regulatory framework (including implementing the provisions of the Water Plan (Moreton)) rather than a hydrologic benefit arising from the existence of the dams and the associated operations. The recommendations in the WS Report are symptomatic of the WS Report incorrectly seeking to include a range of other regulatory benefits arising from the Water Plan (Moreton) when assessing the relative benefit of the scheme's bulk water assets (i.e. the two dams) that is attributable to each WAE priority group*. [15]

- *Assessing such regulatory benefits is not relevant to the assessment of the relative benefit of Somerset and Wivenhoe dams attributable to the medium priority irrigation entitlements versus high priority entitlements.* [16]

- [Water Solutions'] *assessment of benefit relating to predictability and steadiness of flow, and of flood mitigation are outcomes of the regulatory framework and do not relate to the relative benefit of the scheme's bulk water assets (i.e. the two dams) attributable to each WAE priority group*. [17]

Seqwater and MBRI are not aware of any other scheme where the above types of benefits due to the existence of regulatory frameworks (water plans etc.) is stated factor in HUF calculations underpinning the assessments of the relative benefit of bulk water assets that is attributable to each WAE priority group. Seqwater and MBRI submit that Water Solutions have introduced aspects that are irrelevant and inappropriate in this analytical context.

Assessment of the relative benefit attributable to each WAE priority group

It is within the above context that The *Central Brisbane Benefits Study, Technical Modelling Report* (prepared by independent hydrology experts, SLR Consulting) was specifically commissioned by Seqwater in close collaboration with the Mid Brisbane River Irrigators (MBRI). SLR were charged with exploring the extent of *hydrologic* benefit that is being afforded to irrigators in the mid-Brisbane River zone from the two dams in this system. This is an important input to the assessment of the relative benefit of the Wivenhoe and Somerset dams attributable to each WAE priority group. SLR's report, which was included as part of

[13] Note that MBRI's position on this point is set out in a separate submission.
[14] SLR, 2019.
[15] SLR, 2019, page 4.
[16] SLR, 2019, page 4.
[17] SLR, 2019, page 6.

Seqwater's and MBRI's joint submission to the Queensland Competition Authority (QCA), found that:

The effect of the dams – coupled with the operational and access rules that are applied to irrigators within this supplemented system – effectively quarantine the flows in the river primarily for urban water supply in critically dry periods. This results in less water being available to the irrigators in a very dry period than is predicted to be been available under the natural flow regime in the river in the hypothetical no-dam no-urban water supply scenario. (page vii)

Furthermore, in their subsequent review of the Water Solutions Report to the QCA, SLR point out that:

Following normal hydrologic practice of assessing and comparing the likely hydrologic performance of irrigators in the driest period or "critical period", it is clear that the dams do not benefit the CBI. In years of drought (particularly prolonged drought periods), access to water is the most critical for irrigators. The CBB Report found that in 5% of years in dry periods, the CBI receive up to 87 % less diversion volume than would be available from the flow regime. ***This is a significant hydrologic disbenefit***. [18]

It should be noted that SLR acknowledge that the significant hydrologic disbenefit in critically dry periods is "*partly offset by a slight improvement in irrigator's access in non-critical years*"[19]. These two aspects were taken into account in SLR's overall conclusion that Wivenhoe and Somerset Dams (and the associated operational and entitlements) provide Central Brisbane Irrigators with no significant change to modelled hydrologic benefit compared to a Without Dams case.

The importance of accounting for irrigator performance in a critically dry period

Seqwater and MBRI note that Water Solutions challenged the validity of considering the critical period when assessing the benefits of the dams. Seqwater and MBRI submit that Water Solutions' approach is incorrect and inconsistent with normal hydrologic practice. As SLR point out:

It is common hydrologic practice in full entitlement modelling to assess the hydrologic performance in a "critical period" which is typically at the time when the dam storage is at the lowest. The ability for the irrigators to manage in times of drought is key to the assessment and comparison of their hydrologic performance. In years of drought, particularly prolonged drought periods, access to entitlements is the most critical for irrigators. In the simulated drought period with the characteristics of the period 2006 – 2010, the simulated annual diversion for the CBI was up to 87 % lower in the Without Dams case compared to the Existing Dams case. That is, in the simulated years between 2006 – 2010 the CBI, as a total group, would be able to divert up to 87 % less volume due to the system regulation than what would have been available based on the natural flows. This is due to the Dams and the sharing rules restricting medium priority water users' access to water supplies in order to sustain supplies to high priority users. Inspection of the IQQM model for the existing case shows the outcome of these restrictions with HP water entitlements being maintained at 100 % reliability throughout the entire simulation period i.e. the HP priority entitlement at Mt Crosby does not fail in the simulation period for the Existing Case. [20]

The HUF methodology is also clear on this point. Step 4 of the HUF methodology states that:

[18] SLR, 2019, page 7.
[19] SLR, 2019, page 7.
[20] SLR, 2019, page 5

ROP-based hydrologic models (based on Integrated Quantity Quality Models or IQQM) are used to assess the probabilities of each component of headworks storage being accessible to the relevant water entitlement priority group during periods of relative supply shortage… This is an important step because the probability of the lower layers of the headworks storage storing water is likely to be greater than the probability of upper layers of headworks storage storing water. This in turn means that high priority water entitlements effectively have access to – and therefore are able to utilise – headworks storage capacity more often and with less restriction than medium priority water entitlements… 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 . A fifteen-year period is also representative of the typical horizon over which irrigation enterprises plan for and base their business investment decisions. [21]

Furthermore, Water Solutions propose a number of other modelling methodological changes such as modelling a range of diversion patterns, crop types, local rainfall events etc. Again, these proposals are inconsistent with the standard hydrological modelling approaches that are applied – and underpin – Queensland's statutory water planning processes. As SLR observe:

The approach recommended in the WS Report is not valid and contrary to Queensland's statutory planning and modelling approach. Under the standard modelling approach that has been adopted in the hydrologic models underpinning Queensland's statutory water plans, full entitlement modelling is assumed. This means that medium priority water entitlements are assumed to take all of their allocated water in accordance with set, pre-defined seasonal demand patterns irrespective of rainfall, annual cropping decisions or other variations or changes that may occur or be possible within a scheme. [22]

and:

Applying the assumption that rainfall does not reduce demand for extraction by the irrigators represented as unregulated in the Without Dams case is considered appropriate and inconsistent with the statutory approach used in Queensland as outlined above. The IQQM model used in Queensland's statutory water planning process applies the assumption of full entitlement usage and ignores rainfall for regulated irrigation nodes. To allow for a comparison, the assumption of zero rainfall was also applied in the Without Dams Case. To account for rainfall in one case but not another would not allow a reasonable comparison and not consistent with the modelling approach used in unsupplemented areas in other water plans in Queensland. [23]

Analysis of Water Solutions' proposed HUF

Seqwater and MBRI engaged Badu Advisory to review Water Solutions' application of the HUF methodology to the Central Brisbane WSS[24].

Badu Advisory reported a number of shortcomings in Water Solutions approach to estimating a HUF:

- *Water Solutions did not take account of the effect of setting the high priority nominal volume to the maximum allowable under the ROP rules and calculating the reduced medium priority nominal volume by applying the ROP conversion factor. This step is explicitly allowed for*

[21] The updated technical methodology associated with determining HUFs is outlined in *Headworks Utilisation Factors: Technical Paper,* Seqwater & SunWater, 24 April 2018.
[22] SLR, 2019, page 6
[23] SLR, 2019, page 6
[24] Badu Advisory, 2019.

within the HUF methodology. Not accounting for this step would have the effect of over-estimating the MP HUF.

- *The Water Solutions analysis represents an incorrect approximation of the relationship between CPUVS and the medium priority announced allocation percentages. This is because their analysis effectively simplified the sharing rules by considering the combined storage volume in terms of a three-slice approximation (plus dead storage) rather than properly accounting for the individual apportionment within eight separate slices (plus dead storage). Water Solutions' treatment would almost certainly have the effect of over-estimating the value of the MP HUF.*

- *Water Solutions introduced a ratio (or 'scaling factor') referred to in their report as a 'MP1F factor" in order to "to cover the operational losses associated in storing and delivering water for MP users". Inclusion of this factor as a means of approximating operational losses is:*
  - *not justified – given that projected storage losses are already explicitly accounted for in the water sharing rules and may be better dealt with by directly establishing the utilized storage volumes as described in this report*
  - *not appropriate – given that the choice of a MP1F factor is entirely empirical and, as Water Solutions acknowledge: "The resultant MP HUF is quite sensitive to the adopted MP1F".*

    Systematically building the volumes of each storage component utilized by medium and high priority water allocations is recommended over the scaling-factor assumption-based approach suggested by Water Solutions.

- *Water Solutions have not been transparent in relation to their selection of the probability factors that are applied to each component of storage to determine the utilised volumes (Step 4 in the HUF procedure). Figure 3-4 of Water Solutions' report present separate storage volume / percent exceedance curves for Wivenhoe and Somerset dams. This suggests that Water Solutions may not have derived and used a combined exceedance curve (i.e. relating to the combined volume of Somerset and Wivenhoe dams as calculated on a daily basis throughout the entire simulation period) in determining probability factors.* [25]

Badu Advisory estimated that "*applying the standard HUF methodology to the Central Brisbane Water Supply Scheme (with modifications to address the technical issues identified above) would be likely to result in a HUF of less than one percent*". [26]

Conclusion

In conclusion, Seqwater and MBRI remain of the view that the cost share for the irrigation medium priority allocations in the Central Brisbane should be zero.

This is based on the arguments outlined above which remain grounded in the conclusions of the SLR Study – i.e. that there is no benefit when compared to the predicted access under a hypothetical scenario where irrigators were able to take water from natural river flows and where there were no dams and system regulation for urban purposes.

In reaching this joint proposition, Seqwater and MBRI reiterate that the Central Brisbane's circumstances are unique compared to other water supply scheme across Queensland.

[25] Badu Advisory, 2019.
[26] Badu Advisory, 2019.

28th October 2019

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SEQWATER
PO BOX 328
Ipswich QLD 4305

Attention: Colin Nicolson

Dear Colin

Response to the Water Solutions Review of Central Brisbane Benefits Study Report for the QCA

This letter provides a response to the technical matters from the Water Solutions (WS) Report *Rural Irrigation Price Review 2020-24, Assessment of Hydrologic Factors* (September 2019) on the *Central Brisbane Benefits Study, Technical Modelling Report (October 2018).*

1 Introduction

The *Central Brisbane Benefits Study, Technical Modelling Report* (2018) (CBB Study) was commissioned by Seqwater in collaboration with the Mid Brisbane River Irrigators (MBRI). The report was included as part of the submission to the Queensland Competition Authority (QCA). WS undertook a review of the CBB Study, this letter provides a technical response to the issues identified in the WS Report, relating to the assessment of hydrologic benefit in the CBB Study.

2 SLR Terms of Reference

The CBB study scope was to address the following question as outlined in the Terms of Reference (ToR):

> *Has the effect of the dams (and their associated operations and entitlements) been to increase or decrease – or have no significant change to – the hydrologic performance for irrigators in the mid-Brisbane River zone compared with how they might have performed in a no-dams scenario?*

The answering of this question would then inform the subsequent calculation of the Headwork Utilisation Factor (HUF) in accordance with the benefit attributable to each water entitlement priority group. (*Headworks Utilisation Factors, Technical Paper, T, Vanderbyl, April 2018*)

The scenarios were outlined in SLR's ToR (that were jointly developed and agreed by Seqwater and MBRI) as below:

1. *Current development (Moreton Water Plan) case under full utilisation of existing entitlements, existing instream water infrastructure and current storage operational strategies (the "Existing Case")*
2. *Pre-Wivenhoe dam development case under full utilisation of pre-Wivenhoe dam water entitlements, water infrastructure and conditions of water access (the "Pre-Wivenhoe Dam Case").*
3. *Pre-Wivenhoe Dam Case to further removing Somerset Dam and associated water entitlements (the "Pre-Wivenhoe and Somerset Dam Case").*

Importantly, this response is made in the context that:

- the key question that the CBB study was asked to consider related to assessing the extent of hydrologic benefit rather than identify or analyse other types of benefits or disbenefits (which were beyond the scope of the CBB study); and

- the modelling scenarios analysed in the CBB study were jointly developed by consultation between Seqwater and MBRI prior to the engagement of SLR (and this response does not provide comment on the selection of these scenarios).

3 Water Solutions Report

Water Solutions was tasked by QCA as follows:

> *The consultant is required to provide expert advice and guidance that the QCA may wish to draw on when considering the appropriate approach to allocating fixed asset-related costs based on the relative benefit of the Central Brisbane River WSS's bulk water assets that is attributable to each WAE priority group.*
>
> *In doing so, the consultant is required to provide expert advice and guidance on specific aspects of the Central Brisbane River benefits study. Specifically, the consultant is required to assess:*
>
> - *the appropriateness of comparing the two modelled scenarios as a basis for assessing the relative benefit of the scheme's bulk water assets that is attributable to each WAE priority group, or whether the assessment should be based solely on the existing case reflecting existing regulatory arrangements*
>
> - *the comprehensiveness and relevance of output statistics presented, in terms of assessing the relative benefit of the scheme's bulk water assets that is attributable to each WAE priority group.*
>
> *The consultant is also required to provide its views on whether the results from this study, or additional modelling undertaken by the consultant, provide an improved approach to assigning benefits attributable to each WAE priority group in the Central Brisbane River WSS, as compared to the adjusted nominal WAE used by the QCA in the 2013 review.*

The WS Report in relation to the CBB study presents a number of matters that are purported to be a benefit, however many of the benefits discussed are in fact regulatory benefits not hydrologic benefits. That is, a number of the benefits proposed and discussed in the WS Report are really outcomes of the existence of the regulatory framework rather than a true hydrologic benefit. SLR note that there are likely to be a range of other outcomes (i.e. benefits or disbenefits to MBRI) arising from the application of the regulatory framework to the scheme that are not mentioned or considered in the WS Report (and were beyond the scope of the CBB study).

The WS Report fails to make this important distinction in its analysis, conclusions and recommendations i.e. what might be the hydrologic benefits (or disbenefits) of the dams and associated operations on irrigators versus the other types of benefits (or disbenefits) that might arise from the regulatory framework.

The WS Report refers to the CBB Study in Sections 3, 5 and 6. The main recommendations contained within the WS Report in relation to these sections are:

> *To re-evaluate the apportionment of costs to MP WAE in the Central Brisbane WSS based on a modified HUF approach.*
>
> *The recommendation above does not require an update of the Central Brisbane Benefits Study. However, if this study is updated, it is recommended that:*
>
> - *Results are presented against the Water Plan's required EFOs or WASOs.*
> - *The presented statistic, Diversion Days, is considered to be potentially misleading, and its use is therefore not recommended.*
> - *While volumes of diversion are of interest, the evaluation of benefit in the report should focus on the security of supply. Dams and weirs do not create water, they create security.*
> - *The flexibility of supply is also a significant benefit. Statistics should be presented to provide an appreciation of this benefit, perhaps through the modelling of a range of diversion patterns, crop types, etc.*
> - *To provide a full appreciation of benefits, further statistics could be included to provide an indication of the benefits associated with the predictability and steadiness of the flow and the flood mitigation provided by the dams.*

Reponses to the above are presented in the table below. The issues have been grouped by theme and assigned an issue number to reduce repetition in the response. The table addresses these key recommendations along with other points raised in the WS Report.

Table 1 Response Table

Issue No.	Issue Title	Water Solutions Report References	WS Issue Summary	SLR Response
Water Plan Moreton EFOs and WASOs				
1.	WS Report Recommendation 1 (from Section 5.2, dotpoint 2, dashpoint 1)	Section 5.2 Section 6.2 Section 3.2.2 Section 3.2.3 Section 3.3.1	• If… [the Central Brisbane Benefits Study were to be] … updated, it is recommended that… results are presented against the Water Plan's required Environmental Flow Objectives (EFOs) or Water Allocation Security Objectives (WASOs).	This is not relevant as achievement of EFOs and WASOs are outcomes of imposing the overall regulatory framework (including implementing the provisions of the Water Plan (Moreton)) rather than a hydrologic benefit arising from the existence of the dams and the associated operations. The recommendations in the WS Report are symptomatic of the WS Report incorrectly seeking to include a range of other regulatory benefits arising from the Water Plan (Moreton) when assessing the relative benefit of the scheme's bulk water assets (i.e. the two dams) that is attributable to each WAE priority group. Assessing such regulatory benefits is not relevant to the assessment of the relative benefit of Somerset and Wivenhoe dams attributable to the medium priority irrigation entitlements versus high priority entitlements. Furthermore, it is noted that the WS Report has failed to identify or consider the potential disbenefits to MBRI from the imposition of the overarching regulatory framework to this system.
2.	Appropriateness of Two Cases to assess relative benefit	Section 6.2	• The two cases do not present results against the Environmental Flow Objectives (EFOs) in the Water Plan. If one case meets the EFOs while the other does not, then evaluating benefits by comparing these two cases is not a fair comparison. • The two cases do not present results against the Water Allocation Security Objectives (WASOs) in the Water Plan. If one case meets the WASOs while the other does not, then evaluating benefits by comparing these two cases is not a fair comparison.	Refer to above
3.	Water for Other Users and Their Performance (WASOs)	Section 3.2.3	• The Water Plan (Moreton) details Water Security Objectives (WASOs) for the plan area, which include monthly water sharing indexes for the Medium Priority and High Priority in the Central Brisbane • The Without Dams case is unlikely to meet the WASOs requires in the Water Plan • If one case meets the WASOs for the other users in the system, while the other case does no, then evaluating the benefits is not a fair comparison • The Without Dams case does not appear to have any rules to protect water required for other users	Refer to above. For simplicity in the modelling approach, although the town water supplies (TWS) within the unregulated reach of the Without Dams case were set to zero, the water not extracted by the CBI or lost in the river reach was continued to be modelled as flowing to the Mt Crosby Weir node. Setting the TWS to zero along with removing Somerset and Wivenhoe Dams in the Without Dams case, removed the effect of flow regulation on the CBI in accordance with the intent of that case. Clearly, the amount of flow available for extraction at the Mt Crosby weir node can still be assessed in the Without Dams Case; however, this was not the objective of the analysis of the CBB study.
4.	Use of Ponds	Section 3.2.4	• That extraction of water from standing river pools in time of drought may decrease the EFOs from the Water Plan (Moreton) • Under the Water Plan (Moreton), extraction of the water holes and lakes is only permitted if authorised by the chief executive	Refer to above. For the Without Dams case, the MBRI contend that the Central Brisbane River was a pool and riffles system that had significant volumes of water in waterholes available for irrigation. It was noted in the CBB Study that the access to this water was not modelled, therefore there may be more water available in the Without Dams case than was able to be modelled in the IQQM assessment. This is consistent with the Brisbane River IQQM calibration report as well as the associated third party audit report (which was incidentally prepared by Water Solutions) which noted that there was lower confidence in the low flows in the model. It is therefore considered valid to highlight the model limitations and the potential water that is likely to have been available to irrigators from within the ponds during low and zero flows in the CBB Study for the Without Dams scenario.

Issue No.	Issue Title	Water Solutions Report References	WS Issue Summary	SLR Response
Diversion Days				
5.	WS Report Recommendation 2 (from Section 5.2, dotpoint 2, dashpoint 2)	Section 5.2 Section 3.3.2 Section 3.3.4	If… [the Central Brisbane Benefits Study were to be]… updated, it is recommended that… the presented statistic, Diversion Days, is considered to be potentially misleading, and its use is therefore not recommended.	In the IQQM, as supplied by Department of Environment and Science (DES), a daily diversion is set for the Central Brisbane Irrigators (CBI). There is a water demand for diversion on every day of the year for the CBI. The static of diversion days, in combination with the Mean Annual Diversion, aims to provide a comparison of the frequency of availability to extract water based on the regulated system of the Existing Case versus the more natural flow regime of the Without Dams Case. The diversion days statistics illustrates when either the natural flow regime or the system regulation is the limiting factor for extraction of water for the irrigators in the CBB Study.
Diversion volume versus other measures of "benefit"				
6.	WS Report Recommendation 3 (from Section 5.2, dotpoint 2, dashpoint 3)	Section 5.2 Section 6.2 Section 3.3.3	If… [the Central Brisbane Benefits Study were to be]… updated, it is recommended that… while volumes of diversion are of interest, the evaluation of benefit in the report should focus on the security of supply. Dams and weirs do not create water, they create security.	The evaluation of the hydrologic benefit in the CBB Study was undertaken on a long term basis as well as the lowest diversion period. It is common hydrologic practice in full entitlement modelling to assess the hydrologic performance in a "critical period" which is typically at the time when the dam storage is at the lowest. The ability for the irrigators to manage in times of drought is key to the assessment and comparison of their hydrologic performance. In years of drought, particularly prolonged drought periods, access to entitlements is the most critical for irrigators. In the simulated drought period with the characteristics of the period 2006 – 2010, the simulated annual diversion for the CBI was up to 87 % lower in the Without Dams case compared to the Existing Dams case. That is, in the simulated years between 2006 – 2010 the CBI, as a total group, would be able to divert up to 87 % less volume due to the system regulation than what would have been available based on the natural flows. This is due to the Dams and the sharing rules restricting medium priority water users' access to water supplies in order to sustain supplies to high priority users. Inspection of the IQQM model for the Existing Case shows the outcome of these restrictions with HP water entitlements being maintained at 100 % reliability throughout the entire simulation period i.e. the HP priority entitlement at Mt Crosby does not fail in the simulation period for the Existing Case. This is the primary driver for restriction to annual diversion to the CBI, not the requirement to meet environmental flows as the reviewer suggests. As outlined in the CBB Study Report (Figure 8-4), there is hydrologic benefit to the CBI, in terms of Annual Simulated Diversion Volume, in 15 % of years in the Existing Case, however there is a serious reduction in Annual Simulated Diversion Volume for 5 % of years as predicted in the Without Dams Case. On balance, the conclusion was there was no significant change to the hydrologic benefit.
7.	Annual Failure Probability	Section 6.2	Based on the presented results, the dams reduce the annual probability of failure to deliver the full MP allocation from 1 in 2 (50%) to 1 in 10 (10%), a five times improvement.	It is noted that in the Without Dams Case at least 6,200 ML (90 % MAD/NV) is achieved for 80% of years, a change from 90 % of years in the Existing Case. This is not considered to be a significant change to the hydrologic benefit. However, as outlined above in 5 % of years in dry periods (when irrigation supply from the dams is most critical) the CBI receive up to 87 % less diversion volume than would be available from the flow regime. This is considered to be a significant hydrologic disbenefit.
8.	Evaluation of Benefit	Section 6.2	Evaluation of the results presented in the report indicates that the dams do provide substantial benefit to MP irrigators.	Refer to Issue Number 6.

Issue No.	Issue Title	Water Solutions Report References	WS Issue Summary	SLR Response
Flexibility of supply				
9.	WS Report Recommendation 4 (from Section 5.2, dotpoint 2, dashpoint 4)	Section 5.2 Section 6.2 Section 3.2.6 Section 3.3.4	If… [the Central Brisbane Benefits Study were to be] … updated, it is recommended that…the flexibility of supply is also a significant benefit [and] statistics should be presented to provide an appreciation of this benefit, perhaps through the modelling of a range of diversion patterns, crop types, etc. In the Existing Case the MP users have significant flexibility in when they extract their water during the year. They might choose to extract all their water early in the water year, all their water late in the water year, or any pattern in between. The large size of the dam allows this significant flexibility, and MP users do not suffer from, for example, additional evaporative losses from leaving their water in the dam until later in the year, or additional transmission losses if they choose to draw their water in the driest part of year, etc.	The approach recommended in the WS Report is not valid and contrary to Queensland's statutory planning and modelling approach. Under the standard modelling approach that has been adopted in the hydrologic models underpinning Queensland's statutory water plans, full entitlement modelling is assumed. This means that medium priority water entitlements are assumed to take all of their allocated water in accordance with set, pre-defined seasonal demand patterns irrespective of rainfall, annual cropping decisions or other variations or changes that may occur or be possible within a scheme.
10.	Rain on Irrigated Areas	Section 3.2.5	• Rainfall on crop has been set to zero in the Without Dams Case and run of river irrigators would therefore extract water when there was rainfall • The Existing Case full entitlement philosophy applied, irrigators will not draw as much water during significant rainfall events but will draw more later in the week or month based on flows from the dam and the water balance over the year is reasonably reflected in the model. • With the lack of dam storage means that there are no extended periods of flow from the dam in dry periods, from which the irrigator node can make up the error in taking water in the flow periods	Applying the assumption that rainfall does not reduce demand for extraction by the irrigators represented as unregulated in the Without Dams case is considered appropriate and consistent with the statutory approach used in Queensland as outlined above. The IQQM model used in Queensland's statutory water planning process applies the assumption of full entitlement usage and ignores rainfall for regulated irrigation nodes. To allow for a comparison, the assumption of zero rainfall was also applied in the Without Dams Case. To account for rainfall in one case but not another would not allow a reasonable comparison and not consistent with the modelling approach used in unsupplemented areas in other water plans in Queensland.
Predictability and steadiness of flow and flood mitigation				
11.	WS Report Recommendation 5 (from Section 5.2, dotpoint 2, dashpoint 5)	Section 5.2 Section 6.2 Section 3.3.7 Section 3.3.8	If… [the Central Brisbane Benefits Study were to be]… updated, it is recommended that… to provide a full appreciation of benefits, further statistics could be included to provide an indication of the benefits associated with the predictability and steadiness of the flow and the flood mitigation provided by the dams	As mentioned in Issue 1 above, the assessment of benefit relating to predictability and steadiness of flow, flood mitigation are outcomes of the regulatory framework and do not relate to the relative benefit of the scheme's bulk water assets (i.e. the two dams) attributable to each WAE priority group. In addition, it is again noted that the wording of this recommendation in the WS Report again fails to identify or consider the potential disbenefits to MBRI from the imposition of the overarching regulatory framework to this system.

4 Conclusion

The WS Report provided a number of recommendations and conclusions, some of which related directly or indirectly to the CBB Study. The majority of the recommendations and conclusions in the WS Report relate to the purported benefits to MBRI. However, the WS Report has merely proposed a number of outcomes of applying the regulatory framework – they should be acknowledged as such (i.e. a selective rather than comprehensive assessment of regulatory benefits with no consideration of the corresponding disbenefits to irrigators from the imposition of regulatory framework). Seqwater and MBRI may wish to consider the implications of this point in a further joint submission on the QCA draft report.

In summary, the CBB study:

- assessed the change to the *hydrologic* benefit to the CBI as a result of the dams and the associated operations. Following normal hydrologic practice of assessing and comparing the likely hydrologic performance of irrigators in the driest period, it is clear that the dams do not benefit the CBI. In years of drought (particularly prolonged drought periods), access to water is the most critical for irrigators. The CBB Study found that in 5% of years in dry periods, the CBI receive up to 87 % less diversion volume than would be available from the flow regime. **This is a significant hydrologic disbenefit.**

- also showed that this disbenefit is partly offset by a slight improvement in access in non-critical years as illustrated by where in the Without Dams Case at least 6,200 ML (90 % MAD/NV) being achieved for 80% of years, a change from 90 % of years in the Existing Case.

After review and analysis of the recommendations in the WS Report as outlined in Table 1, it is concluded that the findings of the CBB study remains unchanged viz.:

> *The conclusion of this study is that, using the existing department's IQQM model (including its key assumptions, limitations and extended to include the recent driest period of record), Wivenhoe and Somerset Dams (and the associated operational and entitlements) provide Central Brisbane Irrigators with no significant change to modelled hydrologic benefit, when compared to the predicted access under a hypothetical scenario where irrigators were able to take water from natural river flows and where there were no dams and system regulation for urban purposes. The effect of the dams – coupled with the operational and access rules that are applied to irrigators within this supplemented system – effectively quarantine the flows in the river primarily for urban water supply in critically dry periods. This results in less water being available to the irrigators in a very dry period than is predicted to be been available under the natural flow regime in the river in the hypothetical no-dam no-urban water supply scenario.*

Yours sincerely

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Seqwater

Consideration of HUF issues in other schemes relevant to Central Brisbane

19 December 2018

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1 Introduction

1.1 Context

In October 2018, SLR Consulting was engaged by Seqwater to:

> undertake an independent Technical Study to determine the extent of hydrologic benefit, if any, that the irrigators in the Central Brisbane River Zone (between Wivenhoe Dam and Mt Crosby Weir) derive from the existence and operation of Seqwater's headworks storage (Wivenhoe and Somerset dams), using the existing Integrated water Quantity and Quality simulation Model (IQQM) for the study area[1].

The Technical Study aimed to provide input into a revised Headworks Utilisation Factor (HUF) for the Central Brisbane River Water Supply Scheme by answering the following question:

> Has the effect of the dams (and their associated operations and entitlements) been an increase or decrease – or have no significant change to – the hydrologic performance of the irrigators in the Mid-Brisbane River zone compared with how they might have performed in the no-dams scenarios?[1]

The conclusions of SLR Consulting's study were that:

> Using the existing department's IQQM model (including its key assumptions, limitations and extended to include the recent driest period of record), Wivenhoe and Somerset Dams (and the associated operational and entitlements) provide Central Brisbane Irrigators with no significant change to modelled hydrologic benefit, when compared to the predicted access under a hypothetical scenario where irrigators were able to take water from natural river flows and where there were no dams and system regulation for urban purposes.
>
> The effect of the dams – coupled with the operational and access rules that are applied to irrigators within this supplemented system – effectively quarantine the flows in the river primarily for urban water supply in critically dry periods.
>
> This results in less water being available to the irrigators in a very dry period than is predicted to be been available under the natural flow regime in the river in the hypothetical no-dam no-urban water supply scenario[2].

SLR consulting provided a number of technical commentary and observations in relation to their assessment of, and conclusions about, the extent of hydrologic benefit of the dams to irrigators in the Central Brisbane Water Supply Scheme[3]. These included the following:

- The Central Brisbane River is a pool and riffle system, with numerous pools in the system. These pools represent a significant volume of stored water that is below the cease to flow level in the Brisbane River. The hydrologic benefit predicted by the IQQM model does not consider the river pools in the Central Brisbane River system that will hold water below the cease to flow measured level in the River.
- SLR also outlined some limitations in the IQQM model that relate specifically to the assessment of the access to water for the Central Brisbane Irrigators as part of this study:
    - Representation of Irrigators
    - Limited Representation of River Pools
    - Groundwater systems representation

[1] Central Brisbane Benefits Study: Technical Modelling Report, SLR Consulting, 26 October 2014, p iii.

[2] SLR Consulting, October 2014, p vii.

[3] SLR Consulting, October 2014.

    - Low Confidence in Low Flow Condition

- The Moreton Resource Operations Plan 2009 (Amended 2014) provides for water allocations categorised into 279,000 ML HP and 7,376 ML MP (the latter represents around 2.6% of the total HP and MP water allocations)
- Announced allocation rules are applied to medium priority water users based on a stepped scale that reduces as the combined volume that is stored in WIvenhoe and Somerset dams decline
- The IQQM model has recently undergone an extension process by DNRM and DES to extend the simulation period to 30/06/2011. The IQQM model, as extended from 2000 to 2011, now covers the significant drought period experienced in the early to mid 2000's and the flood experienced in early 2011.
- As the HUF methodology is based on a storage analysis for the lowest diversion period which relates to the modelled driest period of record for the dam infrastructure, the lowest diversion period for supply for the dam infrastructure was determined to be 1997 to 2011 for the Central Brisbane system. This extension was not available, and could not be taken into consideration, in previous HUF estimates.

1.2 Scope

The purpose of this report is to present, in tabulated form, a brief summary of HUF issues in a selection of other water supply schemes in Queensland that are relevant considerations to the Central Brisbane water supply scheme. The schemes that are considered in this report relate to irrigation (if any) supplied from:

- Fitzroy Barrage
- Eden Bann Weir
- Leslie Dam
- Boondooma Dam
- Baroon Pocket dam
- Hinze Dam
- Awoonga Dam.

2 Summary of relevant HUF considerations in selected schemes

Table 1 presents a summary of relevant HUF considerations in selected schemes.

Table 1 - HUF considerations in selected Queensland water supply schemes

Headworks storage/scheme (& operator)	Water planning instruments	Nature of irrigation supply	Indicative volume of irrigation supplied from scheme	Basis for irrigation pricing	2012-17 Irrigation HUF (if applicable)	Other comments
1. Fitzroy Barrage, Fitzroy Barrage Water Supply Scheme (Rockhampton Regional Council)	Water Plan (Fitzroy Basin) 2011) and Fitzroy Barrage Water Supply Scheme Operations Manual	The Barrage is the water source for the town of Rockhampton and surrounding areas of Gracemere, in addition to supplying agriculture water to approximately 292 registered rural users (as at October 2014). The Stanwell Power Station draws approximately 20,000ML of high priority water from the Barrage storage each year. This 20,000ML is stored in the upstream Eden Bann Weir as part of a 24,000ML allocation held by Stanwell Corporation in the upstream scheme. Water is released from Eden Bann Weir as required to keep the Barrage storage close to full supply level. This enables the Stanwell Power Station to pump the water it needs for its operation directly from the Barrage storage.	11,619 ML MP out of 62,093 ML (MP & HP) (=18.7%)	Schedule 2 of Standard Contract – Fitzroy River Barrage Storage for Water Allocation	Not reported	Water sharing rules effectively allow irrigators to take up to their nominal volume except during "medium priority restriction periods" that apply when the water level in Fitzroy Barrage are below defined levels. Although irrigation pricing does not appear to be set based on price path recommended by QCA, competitive neutrality complaints may be made under sections 52(3) and 190(1)(j) LGR 2012.
2. Eden Bann Weir, Lower Fitzroy Water Supply Scheme (SunWater)	Water Plan (Fitzroy Basin) 2011) and Lower Fitzroy Water Supply Scheme Operations Manual June 2018	The main purpose of the Lower Fitzroy Water Supply Scheme is to store and pump water from the Fitzroy River for use as cooling water by the Stanwell Power Station. The scheme also supplies agricultural and riparian allocation holders along the Fitzroy River and stock, domestic, and industrial users along the Stanwell Pipeline.	3,101 ML MP out of a total of 28,621 ML (MP & HP) (=10.8%)	QCA regulated prices	10%	As per Fitzroy Barrage WSS, water sharing rules effectively allow irrigators to take up to their nominal volume except during "medium priority restriction periods" that apply when the water level in Fitzroy Barrage are below defined levels. The Lower Fitzroy Water Supply Scheme currently operates as an on-demand water supply with no water ordering system in place.
3. Leslie Dam, Upper Condamine WSS (SunWater)	Water Plan (Condamine and Balonne) 2004 and Condamine and Balonne Resource Operations Plan	Upper Condamine Bulk Water's customer base includes irrigation and urban customers, as well as SunWater (relating to channel system distribution losses). Following dry summers in 1969 and 1970 the Government approved the raising of Leslie Dam to increase storage capacity to service water	22,165 ML MP out of a total of 25,552 ML* (MP & HP) (=86.7%) *excludes Risk A and Risk B priority	QCA regulated prices	11%	Water sharing rules establish rules for announced allocations for the different water allocation priority groups. Leslie Dam has been at low levels more often than not in recent years, which means that announced allocations in the

Headworks storage/scheme (& operator)	Water planning instruments	Nature of irrigation supply	Indicative volume of irrigation supplied from scheme	Basis for irrigation pricing	2012-17 Irrigation HUF (if applicable)	Other comments
	(Amended July 2015)	users along the Condamine River as well as providing alternative surface water supplies to irrigators along the North Branch of the Condamine River who had previously relied on groundwater supplies. The scheme provides water to the towns of Warwick and Cecil Plains.				first half of each water year has been low or zero. Irrigators are allowed access to water during "stream flow periods" which relate to flow events that occur downstream of the dam but do not result in an increase in announced allocations. To protect water supplies for urbane water needs, the ROP specifies a High B & Medium Priority release (cut-off) rule applies whenever the level of Leslie Dam is equal to or below 460.35mAHD (volume 15,005ML). Previous HUFs did not take account of this storage cut-off rule in Leslie Dam for which irrigators (and SunWater) are likely to seek recognition of (and a reduced HUF calculation) in next QCA pricing round.
4. Boondooma Dam, Boyne River and Tarong WSS (SunWater)	Water Plan (Burnett Basin) 2014 and Burnett Basin Resource Operations Plan (Amended November 2014)	The Boyne River and Tarong Water Supply Scheme supplies the water requirements of the Tarong Power Station, of irrigators along the Boyne River and of the towns of Mundubbera, Kingaroy and Wondai. Irrigators source water from the Boyne River. Water from the Boondooma Dam was designed to be released to supplement natural flow in the lower Boyne River.	11,809 ML MP out of a total of 44,799 ML (MP & HP) (=26.4%)	QCA regulated prices	10%	The ROP specifies water sharing rules that establish announced allocations for the different groups of water allocations in the scheme. Critical water supply arrangements are also specified in the ROP to protect water supplies for high priority water allocations. For example, when the storage level in Boondooma Dam is less than or equal to EL 268.7 m AHD (approximately 70 000 ML), medium priority access must be suspended (except for water that accessed through bed sands and/or waterholes). Irrigators have experienced application of this cut-off rule in recent years and are therefore likely to seek a reduction in their HUF in recognition of this in the next QCA pricing round.
5. Eungella Dam, Bowen Broken WSS (SunWater)	Water Plan (Burdekin Basin) 2007 and Bowen Broken WSS	Eungella Dam was constructed in 1969 to meet the requirements of a thermal power station at Collinsville and the town water requirement of towns of Collinsville/Scottsville, Glendon and	5,676 ML MP out of a total of 38,930 ML (MP & HP) (=14.6%)	QCA regulated prices	0% (MP)	The operations Manual sets out announced allocation rules for the different groups of water allocations in the scheme.

Headworks storage/scheme (& operator)	Water planning instruments	Nature of irrigation supply	Indicative volume of irrigation supplied from scheme	Basis for irrigation pricing	2012-17 Irrigation HUF (if applicable)	Other comments
	Operations Manual May 2017	Moranbah. Irrigation supplies are also made available to landholders in the lower Bowen River Valley (and originally to the Burdekin River Water Supply Scheme although this no longer occurs).				The 2012-17 HUF calculations suggested that, during the driest 15-year period, Eungella Dam could expect to never reach levels that would result in a positive medium priority announced allocation percentage.
6. Baroon Pocket Dam, Baroon Pocket WSS (Seqwater)	Water Plan (Mary Basin) 2006 Mary Basin Resource Operations Plan September 2011	Baroon Pocket Dam was built across Obi Obi Creek and completed in 1989. It is one of the 12 key water supply dams in the SEQ which collectively supply up to 90 per cent of the region's drinking water supply. Its primary water use is for urban water supply for Caloundra and Maroochy areas.	No MP water allocations. Table 3 of Attachment 4 of the Mary ROP provides for releases of up to 2,000 ML/a which compares to a total maximum allowable use volume for the scheme of 36,500 ML* *It is not clear whether the 2000 ML/a of released water is included in the maximum allowable use volume	N/A	N/A	The Mary ROP sets out provisions that requires Seqwater to release water from Baroon Pocket Dam into Obi Obi Creek to meet the requirements of downstream landowners on Obi Obi Creek when: • requested by the Obi Obi Creek Water Advisory Committee • the storage level in Baroon Pocket Dam is at or above EL 193.5 metres AHD. Releases for the above may: • be up to 2000 ML/a • count towards low flow releases from the dam.
7. Hinze Dam, Nerang WSS (Seqwater)	Water Plan (Gold Coast) 2006 and Nerang Water Supply Scheme Operations Manual December 2016	The Hinze Dam is the main drinking water supply for the Gold Coast region. The most recent upgrade raised the wall by 15 metres doubling the dam's capacity and providing increased water security and flood mitigation.	84,000 HP only	N/A	N/A	The Operations Manual establishes announced allocation rules for high priority water allocations only, and allows releases from the dam of up to 300 ML/day subject to specified minimum operating levels being maintained in storage.
8. Awoonga Dam, Awoonga WSS (Gladstone Area Water Board)	Water Plan (Boyne River Basin) 2013 and Awoonga Water Supply Scheme Operations Manual December 2016	GAWB owns and operates Awoonga Dam on the Boyne River at which it holds an allocation of 78,000 ML per annum of high priority water allocations. Its customer base is heavily skewed towards major industry, rather than local governments/ retailers or irrigators and is comprised of industrial demand (approximately 80%) and residential/commercial demand for local government supplies (approximately 20%).	78,000 ML HP only	N/A	N/A	The Operations Manuals state HP announced allocations must be 100%. HP carryover (of unused allocation) is also allowed within the scheme.

3 Checklist of considerations that distinguish Central Brisbane from other water supply schemes

The following check-list of considerations that distinguish Central Brisbane from other water supply schemes has been developed from the commentary presented in Section 1.1 and in Table 1 above:

- Irrigators supplied under MP water allocations?
- Is MP as a proportion of (MP+HP) less than 5%?
- Are sharing rules clearly geared to protecting urban, industrial supplies (and does recent experiences in the schemes show this)?
- Does the current hydrologic performance of irrigators precede the existence of – and is therefore independent of – existing headworks?
- Has previous 2012-17 assessment of HUF resulted in MP% of less than 5%?
- Have concerns about scheme HUF estimates been flagged previously?

Assessment against this check-list for the small selection of schemes considered above as well as the Central Brisbane WSS illustrate that the latter scheme is quite unique in these characteristics.

Water Supply Scheme:	A. Irrigators supplied under MP water allocations?	B. Is MP as a proportion of (MP+HP) less than 5%?	C. Are sharing rules clearly geared to protecting urban, industrial supplies (and does recent experience in the schemes show this)?	D. Does the current hydrologic performance of irrigators precede the existence of – and is therefore independent of – existing headworks?	E. Has previous 2012-17 assessment of HUF resulted in MP% of less than 5%?	F. Have concerns about scheme HUF estimates been flagged previously?
Fitzroy Barrage WSS	Yes	No (18.7%)	No	No	N/A	N/A
Lower Fitzroy WSS	Yes	No (10.8%)	No	No	No (10%)	No
Upper Condamine WSS	Yes	No (86.7%)	Yes	No	No (11%)	No
Boyne River and Tarong WSS	Yes	No (26.4%)	Yes	No	No (10%)	No
Bowen Broken WSS	Yes	No (14.6%)	No	No	Yes (0%)	No
Baroon Pocket WSS	No	N/A	No	No	N/A	N/A
Nerang WSS	No	N/A	N/A	N/A	N/A	N/A
Awoonga WSS	No	N/A	N/A	N/A	N/A	N/A
Central Brisbane WSS	Yes	Yes (2.6%)	Yes	Yes	Yes (1.6%)	Yes[4]
Logan WSS	Yes	No (20.3%[5])	Yes	No	No[6] (16%)	No[6]

[4] In p47 of its *Final Report: Seqwater Irrigation Price Review 2013-17 (Volume 2 Central Brisbane River Water Supply Scheme, April 2013*, QCA stated that it "does not propose to use the HUF to allocate costs in this scheme"

[5] Proportion calculated as = MP / (HP + HP reserve + MP) x 100%

[6] Changes within the Logan WSS since 2012-17 to include Wyaralong and associated strategic reserves have been estimated as resulting in a revised MP HUF of 2%.

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Headworks Utilisation Factors for the Central Brisbane Water Supply Scheme

31 October 2019

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1 Introduction

1.1 Context

A Headworks Utilisation Factor (HUF) describes the percentage of a WSS's storage headworks volumetric capacity that is effectively utilised by each priority group of water entitlements in that scheme. This factor is a key consideration in, and input to, the allocation of the relevant capital costs (i.e. asset value and renewal costs) associated with Seqwater's bulk water assets.

In 2019, Seqwater and the Mid-Brisbane River Irrigators (MBRI) made joint submissions proposing that based on there being no hydrologic benefit to irrigation from the existence of Wivenhoe and Somerset Dams and associated operations, the HUF for medium priority (MP) water allocations in the Central Brisbane WSS should be zero.

The QCA have rejected this proposition in their draft report[1] and cited a MP HUF that was based (but not equal to) work that was commissioned by their consultant, Water Solutions. Accordingly, Water Solutions reported the outcome of their preliminary estimate of a HUF for the Central Brisbane WSS. They report applying a modified version of the standard HUF approach[2] and recommended that:

> Seqwater re-evaluate the apportionment of costs to MP WAE in the Central Brisbane WSS based on a modified HUF approach, subdividing the central MP1 zone to its primary purposes of supply to MP users and to HP users. The preliminary estimated MP HUF given above, 1.12%, may provide a guide for this revised procedure[3].

1.2 Purpose of this report

The purpose of this report is to:

- present the outcome of attempting to apply the standard HUF methodology to the Central Brisbane WSS
- report on any modifications made in seeking to apply the standard HUF methodology to this scheme
- provide commentary about Water Solutions preliminary estimated MP HUF for the Central Brisbane WSS.

Note that this report does not provide any commentary about whether use of a HUF in this scheme is actually appropriate, relevant or recommended. This issue is the subject of ongoing separate submissions by Seqwater and MBRI relating to the degree of hydrologic benefit that may or may not be afforded to irrigators by the existence of dams and associated operations, and the implications of this on the HUF and water pricing considerations for the scheme.

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[1] *Draft report - Rural irrigation price review 2020–24 Part C: Seqwater*, QCA, August 2019

[2] The updated technical methodology associated with determining HUFs is outlined in *Headworks Utilisation Factors: Technical Paper,* Seqwater & SunWater, 24 April 2018.

[3] *Report to Queensland Competition Authority on Rural Irrigation Price Review 2020-24: Assessment Of Hydrologic Factors*, Water Solutions, 3 September 2019.

2 Analysis

2.1 Data worksheets

Appendix 1 presents the data worksheet associated with applying the HUF methodology to the Central Brisbane WSS.

2.2 Commentary re application of the methodology

The following provides commentary about the application of the HUF methodology to this scheme including areas where modifications were made to account for the unique peculiarities of the scheme's sharing rules:

2.2.1 HPAmax and MPAmin

As per steps 1 and 2 of the HUF methodology, the analysis set the high priority nominal volume to the maximum allowable under the ROP rules and calculating the reduced medium priority nominal volume by applying the ROP conversion factor. The conversion factor applied was 1 (as specified in the Water Management Protocol) The maximum allowable high priority nominal volume was also set to that specified in the Water Management Protocol.

As stated in the HUF methodology, this step ensures that the headworks utilisation factors take account of the effect of converting medium priority water entitlements to high priority water entitlements. This step has been applied in the estimation of HUFs for all other WSS schemes in Queensland. The results for the Central Brisbane WSS are set out in Section A within Appendix A.

2.2.2 Progressive sharing rules

In applying step 3 of the HUF methodology, it is necessary to consider the Central Brisbane River WSS Operations Manual which sets out water sharing rules for medium priority and high priority water allocations[4].

The medium priority water sharing rules are described in terms of a table of announced allocation percentages versus the "Combined Percentage of Useable Volume in Storage of Wivenhoe and Somerset dams (as a percentage%)" or CPUVS. This latter parameter is indirectly related to (but not equal to) the combined percentage of water stored in Wivenhoe and Somerset dams. Importantly, the definition of CPUVS includes making provision of projected storage losses which are in turn defined in the water sharing rules in terms of a table of projected storage loss depths.

Conceptually, the medium priority water sharing rules in this scheme differ from every other WSS in Queensland. In essence, a proportion of each slice of the combined storage volume incrementally contributes to the medium priority announced allocations up to a CPUVS of 50% as per the water sharing rules. The remainder of the storage contributes to the water that is reserved for high priority water allocations. Section B within Appendix A sets out the relationships between the CPUVS and medium priority storage volumes utilised in each storage slice.

Figure 1[5] shows the conceptual breakdown and apportionment of the volumes within the headworks storage capacity for the combined Wivenhoe and Somerset storage.

[4] Central Brisbane River Water Supply Scheme Operations Manual - Water Plan (Moreton) 2007, January 2018.

[5] Note that Figure 1 is a diagrammatic representation only and not to scale.

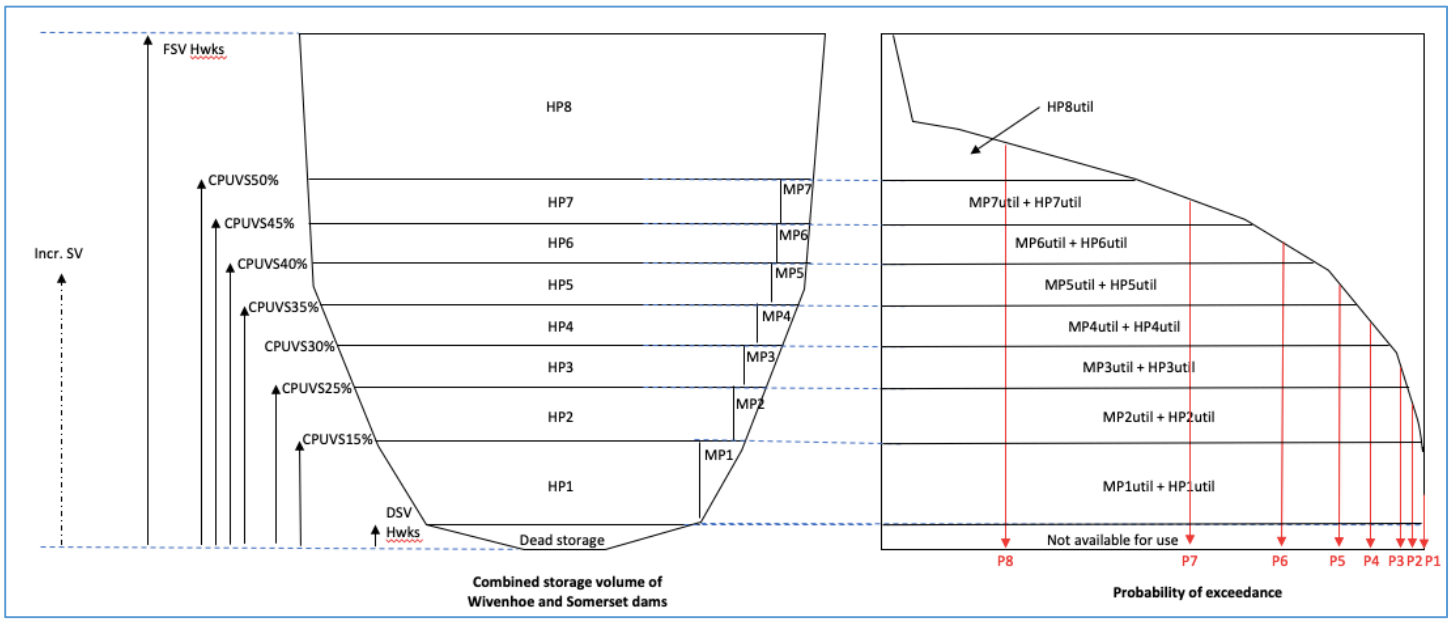

Figure 1 – Conceptual breakdown and apportionment of combined headworks storage capacity.

2.2.3 Hydrologic performance

Step 4 of the HUF methodology requires that the hydrologic performance of each component of the headworks storage be assessed and accounted for. In accordance with the HUF methodology, probabilities were derived for each horizontal component (or slice) of the combined storage by extracting and analysing:

- the modelled headworks storage levels for the driest contiguous fifteen-year driest period (as derived by the Department of Environment and Science) and
- the driest fifteen-year period from recent actually recorded storage levels.

The driest sequence from the IQQM model was found to be from 01/07/1899 to 30/06/1914 whereas the driest sequence from actual recent recorded data was found to be from 01/07/1996 to 30/06/2011. A sensitivity was undertaken to check the effect of each sequence on the HUF results. It found that there was negligible difference in the HUF estimates between the two sequences (with a difference of around 0.01%)[6].

Figure 1 shows the conceptual probabilities associated with each slice of storage that were used to calculate the hydrologic performance of each component of the combined headworks storage. The values of these probabilities are set out in Section C within Appendix A.

2.3 Results

Based on the above (and reiterating that this report does not provide any commentary about whether use of a HUF in this scheme is actually appropriate, relevant or recommended) applying the standard HUF methodology to the Central Brisbane Water Supply Scheme (with modifications to address the technical issues identified above) would be likely to result in a HUF of less than one percent.

As set out in Section D of Appendix 1, applying the standard HUF methodology with modifications described above would result in a value of 0.8% for medium priority water allocations and 99.2% for high priority water allocations.

Note that it is not considered appropriate to round these values up (or down). This was recognised by Water Solutions who recommended:

[6] For completeness, sensitivity analysis was undertaken to check the effect of applying a modelled sequence from 01/07/1996 to 30/06/2011. Again, this was found to result in a difference in the HUF estimates of around 0.01%.

…[ensuring] that an appropriate number of significant figures are quoted on the determined HUFs when the HUFs are being used to calculate prices, particularly for small percentage HUF values[7].

3 Discussion

3.1 Differences to Water Solutions preliminary estimate of MP HUF

The following are a summary of the key differences between the analyses described in this report and those undertaken by Water Solutions:

- Water Solutions did not take account of the effect of setting the high priority nominal volume to the maximum allowable under the ROP rules and calculating the reduced medium priority nominal volume by applying the ROP conversion factor. This step is explicitly allowed for within the HUF methodology. The parameters used in the calculation is this report (HPA_{max} and MPA_{min}) is described in Section 2.2.1 and presented in Section A within Appendix A. Not accounting for this step would have the effect of over-estimating the MP HUF.
- The Water Solutions analysis represents an incorrect approximation of the relationship between CPUVS and the medium priority announced allocation percentages. This is because their analysis effectively simplified the sharing rules by considering the combined storage volume in terms of a three-slice approximation (plus dead storage) rather than properly accounting for the individual apportionment within eight separate slices (plus dead storage) as set out in this report (and illustrated in Figure 1 above). Water Solutions' treatment would almost certainly have the effect of over-estimating the value of the MP HUF.
- Water Solutions introduced a ratio (or 'scaling factor') referred to in their report as a 'MP1F factor" in order to "to cover the operational losses associated in storing and delivering water for MP users". Inclusion of this factor as a means of approximating operational losses is:
    - not justified – given that projected storage losses are already explicitly accounted for in the water sharing rules and may be better dealt with by directly establishing the utilized storage volumes as described in this report
    - not appropriate – given that the choice of a MP1F factor is entirely empirical and, as Water Solutions acknowledge: "The resultant MP HUF is quite sensitive to the adopted MP1F".

  Systematically building the volumes of each storage component utilized by medium and high priority water allocations (as outlined in this report) is recommended over the scaling-factor assumption-based approach suggested by Water Solutions.
- Water Solutions have not been transparent in relation to their selection of the probability factors that are applied to each component of storage to determine the utilised volumes (Step 4 in the HUF procedure). Figure 3-4 of Water Solutions' report present separate storage volume / percent exceedance curves for Wivenhoe and Somerset dams. This suggests that Water Solutions may not have derived and used a combined exceedance curve (i.e. relating to the combined volume of Somerset and Wivenhoe dams as calculated on a daily basis throughout the entire simulation period) in determining probability factors.

In summary, based on the above the HUF methodology applied by Water Solutions is considered almost certain to over-estimate the value of the MP HUF compared to the more robust methodology outlined in this report.

[7] Water Solutions (2019), p10.

Appendix 1 – Central Brisbane Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DNRME)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume[8]:		Water entitlement grouping (in HUF calc.) :	ROP Conversion Factor	
Medium Priority	7194 ML	→	= MPA 7194 ML	1.0 as specified in Section 14(a)(i) Moreton Water Management Protocol (January 2018)	MPAmin = 7041 ML
High Priority	278847 ML	→	= HPA 278847 ML	HPAmax taken from Section 14(a)(ii) and Table 1, Moreton Water Management Protocol (January 2018)	HPAmax = 279000 ML

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP15 AA	= combined storage volume at which water sharing rules give medium priority announced allocation of 15% at the commencement of the water year = 321946 ML. Equates to combined CPUVS 15% of 230425 ML, combined MOV of 8886ML, projected loss at 1 July (as per sharing rules) of 82635 ML	
Adjustments	• None	
MP15	= max {MP15 AA, Adjustment}	321946 ML

MP25 AA	= combined storage volume at which water sharing rules give medium priority announced allocation of 25% at the commencement of the water year = 507224 ML. Equates to combined CPUVS 25% of 384041 ML, combined MOV of 8886ML, projected loss at 1 July (as per sharing rules) of 114297 ML	
Adjustments	• None	
MP25	= max {MP25 AA, Adjustment}	507224 ML

MP40 AA	= combined storage volume at which water sharing rules give medium priority announced allocation of 40% at the commencement of the water year = 596542 ML. Equates to combined CPUVS 30% of 460849 ML, combined MOV of 8886ML, projected loss at 1 July (as per sharing rules) of 126806 ML	
Adjustments	• None	
MP40	= max {MP40 AA, Adjustment}	596542 ML

MP55 AA	= combined storage volume at which water sharing rules give medium priority announced allocation of 55% at the commencement of the water year = 685513 ML. Equates to combined CPUVS 35% of 537657 ML, combined MOV of 8886ML, projected loss at 1 July (as per sharing rules) of 138969 ML	
Adjustments	• None	
MP55	= max {MP55 AA, Adjustment}	685513 ML

[8] Based on locations of water allocations reported by Seqwater as at 19 July 2019.

MP70 AA	= combined storage volume at which water sharing rules give medium priority announced allocation of 70% at the commencement of the water year = 773894 ML. Equates to combined CPUVS 40% of 614466 ML, combined MOV of 8886ML, projected loss at 1 July (as per sharing rules) of 150542 ML	
Adjustments	• None	
MP70	= max {MP70 AA, Adjustment}	773894 ML

MP85 AA	= combined storage volume at which water sharing rules give medium priority announced allocation of 85% at the commencement of the water year = 861864 ML. Equates to combined CPUVS 45% of 691274 ML, combined MOV of 8886ML, projected loss at 1 July (as per sharing rules) of 161704 ML	
Adjustments	• None	
MP85	= max {MP85 AA, Adjustment}	861864 ML

MP100 AA	= combined storage volume at which water sharing rules give medium priority announced allocation of 100% (maximum) at the commencement of the water year = 949483 ML. Equates to combined CPUVS 50% of 768082 ML, combined MOV of 8886ML, projected loss at 1 July (as per sharing rules) of 172515 ML	
Adjustments	• None	
MP100	= max {MP100 AA, Adjustment}	949483 ML

FSV Hwks	= to the full supply volume of the major headworks storage/s in the scheme Wivenhoe: 1165200; Somerset: 379850 As per Central Brisbane River WSS ROL and Stanley River WSS ROL.	1545050ML
DSV Hwks	= to the dead storage volume of the major headworks storage/s in the scheme Wivenhoe: 4886; Somerset: 4000 As per Central Brisbane River WSS ROL and Stanley River WSS ROL.	8886 ML

C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
HP8 = 595567 ML		P8 = 45.1%	HP8util = 268601 ML	
MP7 = 1707 ML	HP7 = 85912 ML	P7 = 76.7%	MP7util = 1308 ML	HP7util = 65852 ML
MP6 = 1666 ML	HP6 = 86304 ML	P6 = 81.0%	MP6util = 1349 ML	HP6util = 69906 ML
MP5 = 1624 ML	HP5 = 86757 ML	P5 = 85.5%	MP5util = 1388 ML	HP5util = 74177 ML
MP4 = 1580 ML	HP4 = 87391 ML	P4 = 89.5%	MP4util = 1414 ML	HP4util = 78171 ML
MP3 = 1534 ML	HP3 = 87784 ML	P3 = 92.4%	MP3util = 1417 ML	HP3util = 81068 ML
MP2 = 992 ML	HP2 = 184286 ML	P2 = 96.5%	MP2util = 957 ML	HP2util = 177836 ML
MP1 = 1368 ML	HP1 = 311692 ML	P1 = 99.8%	MP1util = 1364 ML	HP1util = 310913 ML

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	0.8%	Medium Priority	0.8%
HPA	99.2%	High Priority	99.2%

IQQM STORAGE EXCEEDENCE CURVE – COMBINED WIVENHOE DAM AND SOMERSET DAM

15 YEAR DRIEST PERIOD from 01/07/1899 to 30/06/1914 (as supplied to Seqwater from the Department of Environment and Science).