



Review of revised modelling outputs -
Review of Supply mix optimisation
May 2013

SA Water feedback

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Executive Summary

Thank you for the opportunity to provide feedback on the *Review of Revised Modelling Outputs* prepared by Cardno with regard to the recent review of Supply Mix Optimisation. SA Water's comments are provided throughout this document.

As with previous responses to this body of work, every effort has been taken to conduct a thorough review of the information provided, however it should be noted that, SA Water has been given limited time to review the information. SA Water previously provided a response to the draft report. It appears that some of the issues raised in that response have been addressed. However the original errors, as highlighted by SA Water in its response to the draft report, appear to have significantly influenced the final recommendations (which have not changed since the draft version) and therefore in some cases are repeated here.

SA Water notes that the final version of the report, *Review of SA Water supply mix optimisation, Cardno May 2013*, which "should be read in conjunction"¹ with the subject report is not significantly different to the draft report received in May 2013.. SA Water and Tonkin Consulting (as an independent expert reviewer) raised numerous errors and issues with the *Review of SA Water supply mix optimisation* report.

SA Water is still concerned as to the accuracy and substantiation of statements made by Cardno on a range of elements of SA Water's system. It is noted that Cardno has acknowledged that it "may have overlooked important considerations in the operating environment"². In SA Water's view, this statement brings into question all other statements in the report, despite Cardno's comments in the final version to the contrary.

If Cardno is not confident in its findings, as appears from reading of the report, to accept or adopt any of the recommendations in the Final Determination would be equally uncertain and possibly flawed.

In particular, as SA Water further outlines, the report does not adequately account for e-flows. The draft report stated that "Scenario 5 would still result in 6GL less pumping from the River Murray than the RBP scenario"³ even if e-flows are considered. This is not correct and SA Water notes that this statement has been removed in the final version. However the final version does not clearly show that Scenario 5 includes approximately 7GL (over three years) of extra pumping from the River Murray over and above what was assumed in SA Water's Regulatory Business Proposal 2012 (RBP 20130) once e-flows are appropriately accounted for.

SA Water is concerned that previous significant errors by Cardno appear to be the basis of some of Cardno's recommendations, for example, "whether a supply strategy that makes greater use of water from the Hope Valley WTP may lead to a more optimal outcome"⁴. As SA Water has previously mentioned on numerous occasions, "greater use" of Hope Valley Water Treatment Plant is limited by system constraints. The continual inclusion of this raises further concerns over the quality of advice Cardno is providing.

Further detailed comments follow throughout the body of this document.

¹ Cardno, Review of revised modelling outputs, Supply Mix Optimisation, May 2013, p.1

² Ibid, p.11

³ Ibid, p.10

⁴ Ibid, p.12

1 Summary of HOMA model review

1.1 Findings from initial review of HOMA model

SA Water notes that Cardno has stated that “due to time constraints, we have not analysed each claim”⁵. This further reinforces SA Water’s concerns over the approach used in undertaking this review. For example, SA Water’s response dated 9 April 2013 details “an error in Cardno’s discussion on the water balance in the South Para system” and that accounting for this error “shows that there is no excessive transfer of River Murray water into the South Para system”. SA Water further explained that it was “concerned that this error has influenced some of Cardno’s recommendations”.

As this error may have influenced some of the recommendations made by Cardno in the earlier report (and possibly in the subject version), it is clear that this issue is material in the context of this review. It appears Cardno has chosen instead to rely on SA Water’s responses to document their significant errors in understanding⁶.

In addition, Cardno’s representation of SA Water’s response to the previous report shows that they have misconstrued several of the statements. For example, the comments surrounding the ability of HOMA to optimise the mix of supply sources shows a lack of understanding, on Cardno’s part, of the information provided in SA Water’s response.

SA Water further disagrees with the unsubstantiated comments regarding the use of Millbrook Reservoir and that SA Water’s operating strategy will result in “higher customer bills”.

1.2 Assessment of HOMA against leading practice

As SA Water has previously stated, HOMA provides a fit-for-purpose approach to determining the optimal supply mix for the regulatory period. Cardno has provided no evidence to the contrary. In particular, SA Water provides the following comments on Table 2-1 of the report:

- HOMA does have the ability to model restrictions, however these were not modelled for the purposes of RBP 2013, as SA Water had assumed that ESCOSA would seek not to have restrictions implemented during the regulatory period. Cardno have made a small change to the wording in this section of the Final Report, but continue to misrepresent the ability of HOMA to model restrictions.
- Cardno continue to misunderstand the use of HOMA in weekly operations planning. As detailed in the *Input to Opex Assumptions* document provided to ESCOSA, HOMA is a linearly programmed, water balance model that provides an optimal operating scenario for the bulk-water supply system from the current month to the end of the financial year. By calculating volumes of pumping needed over longer time periods, HOMA is able to minimise pumping costs across entire financial years. This optimal strategy from HOMA then informs operational decision-making about the optimal periods in which to utilise infrastructure allowing capital projects and day-to-day maintenance to be scheduled around the optimal operation.
- Given the above misunderstanding, Cardno then confuse water balance models such as HOMA with real-time operational models, such as hydraulic models which “use small time steps, tending toward real-time control to match supply with demand which fluctuates continually”⁷.

⁵ Ibid, p.3

⁶ Ibid, p.3

⁷ Ibid, p.5

These types of models are designed to inform and optimise short term operations, examining peak flows in detailed sections of a distribution network.

- Based on its literature review, Cardno suggested best practice optimisation utilises Genetic Algorithms to optimise rather than the linear programming used in HOMA. Cardno would be aware there is no single optimisation algorithm which is well suited to every optimisation problem. Linear Programming is a well known optimisation technique which out performs Genetic Algorithms in both its ability to consistently find the optimal solution for appropriate problems and the speed with which this optimisation occurs. In the case of the optimisation of SA Water's system, HOMA and its objective function are explicitly designed to ensure it is appropriate for optimisation using linear programming.

Cardno has chosen to quote the second and third dot point above in the final report, but has not provided any substantiated evidence to support their arguments. SA Water continues to strongly disagree with Cardno's statements regarding the use of HOMA in this process.

2 Further modelling undertaken by SA Water

2.1 Further modelling of Scenarios 1-4

This section of the report provides a large amount of discussion without clearly making the conclusion that even though e-flows are not in Scenario 1 and 2, the cost is still higher than SA Water’s RBP 2013 scenario (which does include e-flows). A statement implying this is provided on page 7, however, this is before the detailed discussion on Scenario 1 and leaves the discussion inconclusive.

2.2 Modelling of Scenario 5 and further operating scenarios

In the draft report, Cardno stated that “the modelling of this scenario did result in lower operating costs, totalling \$2.50M across the RBP period”. This has now been amended to note that there is no allowance for E-flows. Although the text has been slightly amended, SA Water understands that Cardno has based its conclusions on an incorrect analysis. This is not communicated accurately in the report.

The table below shows that when adjusted for e-flows Scenario 5 includes more pumping from the River Murray.

Table 1 Scenario 5 adjusted for e-flows

	Total in RBP Scenario*	Total Scenario 5*	Total RBP less Eflows	Variance Scenario 5 vs RBP less e-flows
Morgan-Whyalla	81.55	86.45	80.40	+6.05
Swan Reach - Stockwell	34.04	26.47	32.43	-5.96
Mannum - Adelaide	91.64	86.19	79.12	+7.07
Murray Bridge - Onkaparinga	61.71	50.32	50.31	+0.01
Millbrook Transfer**	24.45	24.18	24.45	-0.27
Difference in pumping				6.9

*as presented on page 10 of the report.

**SA Water has included this as it is included in the costing for electricity costs. This is an internal transfer of water and does not involve pumping “additional water from the River Murray” as implied by Cardno in the description under the table.

SA Water indicated to ESCOSA at the time the information was provided that e-flows would change the results. In the draft report Cardno indicated an error in understanding by taking the 13.3GL previously mentioned by SA Water (and quoted in the report on page 10) as being across all three years, when in fact this is a per annum figure. This is clear in the quote provided on page 10. Rather than “scenario 5 would still result in 6GL less pumping from the River Murray than the RBP scenario” (as provided in the draft report), Scenario 5 (when appropriately compared with RBP without e-flows) actually includes 6.9GL of additional pumping over and above the RBP 2013 submission.

We note that Cardno have removed the conclusion in this section (as it appeared in the draft report) that “this one scenario that has been trialled has resulted in lower costs than the RBP scenario”. This conclusion was fundamentally flawed and we note that Cardno have revised this to “On the basis of the environmental flow volumes provided by SA Water, the RBP scenario would appear to be a lower cost scenario” which Cardno now “accept” as correct. SA Water was asked to provide the results of 3 additional scenarios (excluding the two scenarios with ADP off). None of these scenarios provide a more optimal solution for SA Water customers than the scenario provided in RBP 2013.

3 Recommendations

Cardno correctly states in its recommendations that “SA Water has reservations regarding some of the conclusions drawn from the further modelling”. SA Water has particular reservations with regard to Cardno’s continual failure to appropriately account for the removal or otherwise of e-flows. SA Water notes that Cardno have adjusted some of the text surrounding the errors we highlighted in our response to the draft report, however there has been no change in the recommendations. These recommendations are based on the previous incorrect analysis and are therefore fundamentally flawed.

In response to the recommendations presented by Cardno in this section of the report, SA Water makes the following comments:

3.1.1 Pumping of water from the River Murray that is unnecessarily lost to the bulk water supply system should be eliminated from an optimal supply mix

SA Water agrees that pumping of water from the River Murray that is unnecessarily lost should be eliminated. SA Water has shown above that when e-flows are accounted for there is no unnecessary pumping of water from the River Murray in the existing RBP 2013 supply mix.

3.1.2 Whether a supply strategy that makes greater use of water from the Hope Valley WTP may lead to a more optimal outcomes as discussed in Section 4.

SA Water’s RBP already makes use of water from the Hope Valley Water Treatment Plant in accordance with the system constraints. As previously stated, this recommendation appears to originate from a significant error of understanding made by Cardno in previous work. This lack of understanding by Cardno of SA Water’s systems puts into question the recommendations of the reports.

3.1.3 Whether a different optimisation model with increased capability in line with leading practice may lead to a more optimal outcome. An assessment of HOMA against leading practice is presented in Section 2.2.

SA Water rejects the conclusion that HOMA is not leading practice as discussed previously in this document. SA Water has previously indicated that there would be limited benefits to SA Water’s customers in this recommendation.