Marion Water Efficiency Project

Marion Water Efficiency Project Technical Evaluation

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Department of Agriculture, Water and the Environment

DAWE

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Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Floor 11, 452 Flinders Street
Melbourne, VIC 3000
PO Box 312, Flinders Lane
Melbourne, VIC 8009
Australia
T +61 3 8668 3000
F +61 3 8668 3001
www.jacobs.com

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Executive Summary

The Department of Environment and Water (Applicant) has applied for $2.3M of funding under the Off Farm Efficiency Program designed to recover water for the environment. The project that the funding relates to is for an expansion of an existing stormwater harvesting and recycling scheme at Oaklands Park in the City of Marion, South Australia. The expansion is via two network extensions totalling 9.5km for the purpose of irrigating schools, council reserves, ovals at Flinders University and a major sporting field. Under its application, the project cost is estimated to cost $4.27M and generate a per annum water savings of143.49ML.

In reviewing the application and relevant supporting information, Jacobs found that the water savings stated were achievable and no technical issues were identified with the solutions being proposed. On the cost review of the applicant's proposed budget, Jacobs found that the budget appeared to substantially underestimate the cost of the works involved. The applicant outlined its approach to mitigate this through its contracting processes and to fund any shortfall in its original proposed budget.

1. The Project

An existing urban stormwater harvesting and recycling scheme was developed in Oaklands Park in the City of Marion in South Australia after the millennium drought. It captures stormwater flows from the Sturt River channel during high rainfall events which is then treated through a series of wetlands and stored in aquifers, a process referred to as a managed aquifer recharge.

The applicant's Project involves building two network extensions from the Oaklands Park scheme in order to provide increased supply for the purposes of open space irrigation. One of the extensions is to the south towards the Seacliff area and will supply school and council reserves, while the other extension is to the east to Flinders University and the Women's Memorial Playing Field (WMPF). Through replacing the irrigation of these areas that total 42.5ha, the applicant has calculated an average water saving of 143.49 ML of potable water from the Adelaide mains water supply, which is sourced partly from the River Murray.

The works include 9 km of pipe to transport the recycled stormwater and site connections to Seacliff, a further 0.5 km of pipe to the WMPF and Flinders University, a chlorination treatment plant, connections, filters and meters to each site, and an additional injection and extraction bore. There will also be customer funded irrigation equipment that may be required to be installed at certain sites.

The South Australian government, via the Department for Environment and Water is seeking $2.3M under the Off-Farm Efficiency Program to implement the Project.

1.1 Purpose of this report

This report has been prepared for the Department of Agriculture, Water and Environment (DAWE) to assist the assessment panel in determining the technical and cost feasibility of the project. It has been prepared based on the information provided including the application and its supporting materials, in addition to relevant reports that DAWE deemed relevant as well responses to queries from Jacobs and the panel members.

2. Technical Evaluation

2.1 Demand Estimate Assessment

The demand estimates are considered generally suitable, derived using a simple Area x Application Rate (for a specified turf quality visual standard or TQVS) alongside climate estimates with the average rainfall scenario being used as the basis for the water savings applicable. The sites irrigation requirements were rated based on the following TQVS desired being:

- Sports ovals – TQVS2 (premier sports turf) for 3 sites
- School ovals – TQVS3 (local sports turf) for 4 sites
- Reserves – TQVS4 (passive recreation turf) for 9 sites

It was noted that actual demand from metered connections was not possible due to mixed end uses such as the same supply being used for both drinking water and irrigation. There are possible future savings available through unmet demand, for example at schools. These demands are not related to the current application and as such were not considered further.

2.2 Groundwater Assessment

Injection wells are in the order of 100m depth and into the T1 aquifer and the extent of the aquifer is such that there is likely minimal effect expected on local Groundwater users. To guard against this, a monitoring and evaluation plan has been proposed to measure and detect changes in aquifer pressure and head levels in surrounding bores in the area.

2.3 Supply vs Demand

The Oaklands Scheme is currently licensed to inject 700 ML/a, and extract up to 333 ML/a[1]. The current scheme however only has capacity to inject 400ML/a.

Current demands from the scheme are in the order of 150 ML/a, and estimates suggest 200-250 ML/a is injected into the aquifer.

Through extension of the scheme by 142 ML/a, as outlined within the Project application, this would increase total demand to around 300ML/a. As described in the application, this suggests additional bores to fulfil the injection requirement. It is considered that this is serviceable by the scheme with the additional infrastructure. Further, the volumes quoted here are within the bounds of the licence agreement.

The total demands described in the proposal are confirmed by letters of support from the various customers (City of Marion, Enwave). The source water for supply to injection wells is from the Sturt Creek, a concrete lined drainage channel with ~11GL of passing flows, which can easily supply the additional requested water. Additionally, there appears to be a deficit between current extractions for irrigation and injected water. This should allow some interannual buffer in the event of variations in the water balance (where input <> output).

[1] TONKIN, 2020. Stormwater Capture and Reuse Efficiency Measures Stage 2 – Option Development. 20191197.01 R002 Rev0. Prepared for the Department for Environment and Water 16 September 2020

2.4 Licencing

The scheme is currently licenced by the EPA/DEW for 333 ML/a to be extracted. With the proposed extra extraction of 142 ML/a, the total expected extractions of circa 300 ML/a can be accommodated within the existing licence without any need for a new application.

The application notes that the only constraints existing relate to injection and extractions which will be managed through the use of a 300KL balancing storage (existing), and construction of 2 new injection bores.

2.5 Summary

The assessment found that the proposed water savings were reasonable and likely to generate the proposed returns. There were no significant technical issues or risks identified.

3. Cost Estimate

3.1 Applicant's Budget Assessment

The budget provided in the applicant's submission was estimated at $4.26M with the proposed Commonwealth funding representing 54% of this value or $2.3M. This was broken down into earthworks covering the piping costs, bore and tank costs, metering and outlets, chlorination treatment plant, pump upgrades and traffic management and permits, and lastly program management including design and contingency.

Jacobs found that the overall estimate from the applicant appeared low given the indicated scope of works provided. In particular the piping costs which were costed based on a trenchless approach using Horizontal Directional Drilling, as was done for the initial pipeline installed under the original scheme, appeared considerably below the costs likely to be encountered in an open tender process. This represented a $3.78M difference on this particular cost category based on the approach outlined. The other direct costs had minor differences which resulted in $0.26M of higher costs, with the largest difference being for the pump station which Jacobs estimates would cost double the applicant's estimate of $0.1M based on benchmarks from similar projects.

Indirect costs such as for project management, insurance as well as the contractor's overhead and margin were all higher as they form a percentage of the increased direct costs. Contingency of 10% which Jacobs would have expected to normally have been higher particularly for a project of this nature was queried with the applicant who indicated that it was advised previously by the Federal Government that this was the maximum contingency that it could seek funding for.

Overall, the Jacobs estimate totalled $10.94M representing a $6.67M difference to the applicant's budget. The Jacobs estimate breakdown and assumptions is included in Appendix A.

The applicant indicated that the project budget had already been escalated by CPI twice since the original estimate to account for time delays and Covid-19 induced higher costs. It stated that its approach for the funding would be to secure the outcome and to then tender the project as a Design and Construct job which would include any alternative solutions. The applicant's approach is for any future price increases beyond the set funding to be managed through its contracting processes.

3.2 Summary

Based on the assessment of the costs, Jacobs considers that despite the assurance from the applicant around any potential budget shortfall being managed through their procurement process and internal funding, the significant differences in costs will impact the core financial viability of the project based on the initial forecast demand. Despite the escalation by CPI of the applicant's cost estimate, it is likely to be faced with much higher costs once it goes to market based on our analysis.

4. Risk Management

The Risk register supplied by the applicant had a list of 14 items.

Of these 14 the initial Risk Rating is:

- High rating for 3 risks
- Medium rating for 6 risks, and
- Low rating for the remaining 5 risks.

The assessment of the likelihood and consequence ratings for all items appears reasonable overall, noting the following points:

- Risk Item “Costs are higher than estimated” yields an initial ‘Medium’ risk rating. Its mitigation approach is for the council to drive a competitive tender and bear any increased costs through other funding sources. However, this may also lead to a compounding risk for the Risk Item “Council reallocates funding due to funding delays”, which has an initial rating of “High”.
- These two items provide the highest overall risk to realisation of Water Savings for this project. An unforeseen blowout in expected project construction costs, whilst initially a corporate risk, could conceivably lead to a cessation of the project if any shortfall in funding to proceed with the project cannot be secured by the project owner within the required timeframes.
- Risks relating to the ongoing ability of the scheme to source and supply the required volume of water savings are considered low given the large volume of stormwater available to be extracted and injected. Operational and technical problems such as pump failures as an example could be considered as intermittent and should be easily managed by a competent operator and maintainer.

Appendix A. Jacobs Cost Estimate

A.1 Market Pricing

Jacobs review of the suggested costs provided has been based on current market pricing (2022) and benchmark data with any historical rates adjusted to reflect construction constraints and other additional costs relating to the constructability and design of the proposed development.

A.2 COVID-19 Impact

The assessment has been prepared based on the current economic and industry circumstances. The future impact of COVID-19 is unknown at this stage and is a developing situation. Our assessment makes no provision for future impacts of COVID-19 virus which has not been inherently built into the current market rates.

A.3 Estimating accuracy

The accuracy of the estimates as per AACE Cost Estimate Classification System, fall between Class 4, as shown in the Table 2 below. Whereby Class 4 prepared on low level of scope definition, and used for feasibility, concept evaluation and preliminary budget approval.

Table 2: Accuracy of Estimate per Class

	Primary Characteristic	***Secondary Characteristic***			
ESTIMATE CLASS	**LEVEL OF PROJECT DEFINITION** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges [a]	**PREPARATION EFFORT** Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/ Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%	5 to 100

A.4 Capital Cost Estimates

The cost structure to be applied to the projects have been developed to include the following key components:

Direct Costs

- Based on a 1st Principles approach - The costs are calculated for project-specific costs based on the resources required (labour, plant, materials and subcontracts) to accomplish each work activity. Productivity assumptions are applied to all labour and plant costs with adjustments made to account for unique or unusual site characteristics with scope and design information relatively well defined.

- Unit rate estimating – unit rate estimating calculates the cost of each item of the project, by multiplying the quantity of work by an adopted rate. The project direct cost is determined by the sum of the elemental cost. Unit rates are typically obtained from benchmarking rates from databases of similar projects where scope and design information is limited, or applicable to a low complexity project.
- Allowances – In some instances where limited available information and/ or limited time precluded a cost breakdown or unit rate estimate, a cost allowance has been provided for a work activity. This represents an 'allowance' to be made for the cost where scope and design information is low.

Indirect Costs, Client Costs and Contingency

- Contractor's Indirect costs – Includes mobilisation, site establishment, project management, site facilities, general site plant and equipment, general site running consumables, travel, margins, overheads, contractor's risk, design and insurances, calculated as a percentage of the direct cost.
- Client costs – includes project management calculated as a percentage of the sum of the direct cost and contractor's indirect cost. This includes all project management costs, contract administration, client design, business case and development phase costs, preparation of contract documents, procurement, delivery phase, to project completion and to handover to operations.
- Contingency – Deterministic method to calculating contingency allowances to be applied as percentage of the sum of the direct, indirect and client costs.
- Escalation – The rates used will be 2022 rates and escalated along with the anticipated delivery program.

This would form the functional make-up of the estimate structure as shown in Figure 1 below:

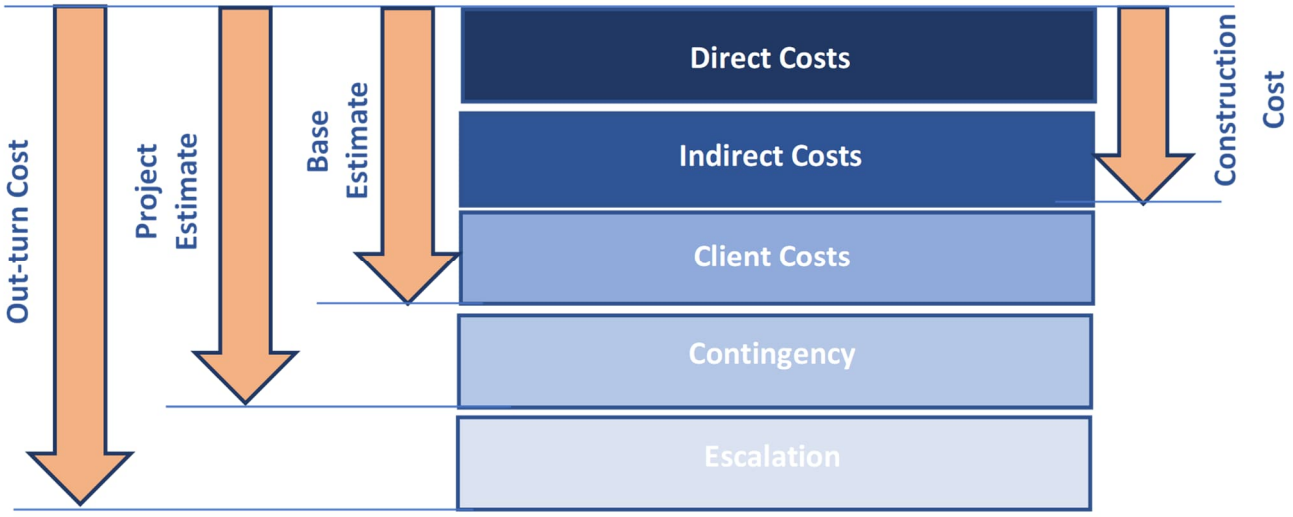

Figure 1

A.5 Cost Estimate format

The estimates will generally be presented in a format shown in Figure 2 below:

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Marion Water Efficiency Program

Cost Estimate

1 Cost Estimate

Capital Cost

Total Outturn Costs ($)
$ 10,939,398.08

Estimate Class	Level of accuracy
Class 4	L: -15% to -30% & H: +20% to +50%

Date	24-Jan-22
Time	5:05:44 PM

Work Lot	Description	Unit	Qty	Rate $	Cost $
WL-DC	Direct Costs				$ 7,602,083
WL-DC-MSC	Moderation of Scheme Channels				
WL-DC-MSC-1	Supply and install DN225 PN16 PE100 using directional drilling method	m	3,900	$ 720	$ 2,808,000
WL-DC-MSC-2	Supply and install DN225 PN12.5 PE100 using directional drilling method	m	2,600	$ 667	$ 1,734,200
WL-DC-MSC-3	Supply and install DN90 PN16 PE100 using directional drilling method	m	2,270	$ 299	$ 678,658
WL-DC-MSC-4	Supply and install OD180 PN16 PE100 using directional drilling method	m	630	$ 564	$ 355,074
WL-DC-MSC-5	Reinstatement along DPI road	m	45	$ 150	$ 6,750
WL-DC-CE	Channel Extension				
WL-DC-CE-1	Tank	each	1	$ 53,000	$ 53,000
WL-DC-CE-2	New injection and extraction bore	each	1	$ 605,902	$ 605,902
WL-DC-MO	Metering and Outlets				
WL-DC-MO-1	Fittings, valves, preliminaries, surveys (Seacliff)	each	1	$ 200,000	$ 200,000
WL-DC-MO-2	Connections for each site (Seacliff)	each	15	$ 5,500	$ 82,500
WL-DC-SR	Scheme Rationalisation (Decommissioning Scheme Channels)				
WL-DC-SR-1	Chlorination Treatment Plant	each	1	$ 785,000	$ 785,000
WL-DC-PSU	Pump Site Upgrade				
WL-DC-PSU-1	Pump station, nominal demand 30L/s (for Seacliff)	each	1	$ 210,000	$ 210,000
WL-DC-PSU-2	Pump for Tonsley extension (pump and set up costs)	each	1	$ 40,000	$ 40,000
WL-DC-CST	Control System & Telemetry				
WL-DC-CST-1	Traffic management	each	1	$ 38,000	$ 38,000
WL-DC-CST-2	Permits and licencing	each	1	$ 5,000	$ 5,000
WL-IC	Contractor Indirect Costs				$ 1,638,248.91
WL-IC-1	Indirect cost including project management	item	5.0%	$ 7,602,083	$ 380,104.16
WL-IC-2	Insurance	item	2.5%	$ 7,602,083	$ 190,052.08
WL-IC-3	Design	item	3.0%	$ 7,602,083	$ 228,062.49
WL-IC-4	Contractor's overheads and margin	item	10%	$ 8,400,302	$ 840,030.18
	Contractor's Cost				$ 9,240,332.03
WL-CC	Client Costs				
WL-CC-1	Project management	item	2.5%	$ 9,240,332	$ 231,008.30
	Client Cost				$ 231,008.30
	Contractor and Client Costs				$ 9,471,340.33
WL-CON	Contingency				
WL-CON-1	Allow for contingency	%	10.0%	$ 9,471,340	$ 947,134.03
	Contractor and Client Costs including Contingency				$ 10,418,474.37
WL-ESC	Escalation				
WL-ESC-1	Allow for 2 years Escalation	%	5.0%	$ 10,418,474.37	$ 520,923.72
	Contractor and Client Costs including Contingency and Escalation				$ 10,939,398.08
	Total Outturn Cost Estimate				$ 10,939,398.08

Figure 2

A.6 Basis of Estimate

The estimate classes are to be developed using the following methods/ input from design. Note the information detailed in IW264100-ZE-REG-0001 – Infrastructure Asset Class Record spreadsheet.

This is based on the high-level Design and Engineering methodology outlined for each asset class with key steps for Jacobs and the client, to follow in order to produce and assist in delivering the estimates. It is anticipated that most classes will be derived in a collaborative nature with Jacobs, client and key stakeholders during the engagement.

A.6.1 Moderation of Scheme Channels

A.6.1.1 The estimate of supply and install pipes was done based on the following:

- 100% Trenchless using Horizontal Directional Drilling (HDD) method.
- 100% residential in road reserves or Public open space.
- 90% material other than rock (OTR) and 10% in rock.
- Butt fusion welded joints.
- Standard working hours.
- Services relocation classified as low.

A.6.1.2 Cost included the following:

- Production rate: 250m/day.
- Allowed for preliminaries, mobilisation, testing and demobilisation.
- Site setup (approx. 50x50m) including receiving and launch pits.
- Pits Restoration.
- Pipe supply.
- Sleeve.
- Pipe welding.
- Drilling in 10% rock.
- Drilling in 90% OTR.
- Drill fluids return line.
- Remove spoil off site.

A.6.2 Channel Extension

A.6.2.1 Tank

- Allowed for $53k to cover the connection to existing tank at golf club.

A.6.2.2 New injection and extraction bore

- Allowed for $606k based on the quote provided by Alano Water in 2015 with 17.5% escaltion (2.5% per annum) to meet the current rate in 2022.

A.6.3 Metering and Outlets

A.6.3.1 Fittings, valves, preliminaries, surveys (Seacliff)

- Allowed for $200k to cover the cost of fittings and valves required for the pipes, the amount can be increased according to the detailed design.

A.6.3.2 Connections for each site (Seacliff)

- Allowed for 15 connections.

A.6.4 Scheme Rationalisation (Decommissioning Scheme Channels)

A.6.4.1 Chlorination Treatment Plant

- The plant capacity is 70L/s.

- Allowed for $785k based on benchmarking for similar projects.
- Price included
  i. Civil works.
  ii. Metal works.
  iii. Mechanical works.
  iv. Power.
  v. Control.

A.6.5 Pump Site Upgrade

A.6.5.1 Pump station, nominal demand 30L/s (for Seacliff)

- The pump station capacity is 30L/s.
- Allowed for $210k based on benchmarking for similar projects.
- Price included:
  i. 2 pumps, 1 duty and 1 standby.
  ii. Earthworks.
  iii. Concrete works.
  iv. Metal works.
  v. Piping, fittings, and valves.
  vi. Mechanical works.
  vii. Power.
  viii. Control.

A.6.5.2 Pump for Tonsley extension (pump and set up costs)

- Allowed for $40k based on benchmarking for similar projects.

A.6.6 Control System & Telemetry

A.6.6.1 Traffic management

- Allowed for 38 days based on 250m/day for pipelines installation.
- Priced as $1000/day based on 2 men crew, if more crew will be required then the unit rate per day will be increased.

A.6.6.2 Permits and licencing

- Allowed for $5.5k.

A.6.7 Contractor's Indirect Cost

A.6.7.1 Indirect cost including project management

- The City of Marion (CoM) already employs a Water Resources Coordinator who will manage the procurement and implementation of the project. This cost is already funded by CoM, so allowed for 5% to cover the limited project management costs which have been sought through this project.

A.6.7.2 Insurance

- Allowed for 2.5% based on benchmarking of similar projects.

A.6.7.3 Design

- Allowed for 3%.

A.6.7.4 Contractor's overheads and margin

- Allowed for 10% based on benchmarking of similar projects.

A.6.8 Client Costs

A.6.8.1 Project management

- Allowed for 2.5% based on benchmarking of similar projects.

A.6.9 Contingency

- The contingency was set at 10% as council have been previously advised by the Australian Government that maximum contingency council could seek funding.

A.6.10 Escalation

- Allowed for 2.5% per annum to cover the increase in cost till 2024.