APPENDIX 27

Cost estimates for lower Brown Hill Creek upgrade and flow diversions from Keswick Creek to Brown Hill Creek

Lower Brown Hill Creek Upgrade and Keswick Creek Diversions

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1. Summary

1.1 Scope of Report

Costplan Pty Ltd has been engaged by Mr. Michael Salkeld (Project Director, Brown Hill Keswick Creek Stormwater Project) to prepare updated estimates for this project in line with the most current hydrology and design.

This report is one in a series of that review and update previous estimates prepared. A key objective is to provide a consistent approach to the cost estimates for all elements of the project.

This report details development of the construction and project costs associated with two sections of the overall project. These are as follows-

- The Keswick Creek Bypass/ Upgrade
- The upgrade of Lower Brownhill creek

The report also explains Costplan's view for the risk adjusted project costs based on the following parameters:

- Base date for the estimate is quarter one, 2016
- The project battery limits and scope are those described above and elsewhere in this report.
- A traditional construct only tendering process and contract delivery
- A risk allowance appropriate for a construction contract at a conceptual level of design. These allowances include both inherent risk and contingent risk to both the contractors and clients costs
- The concept design detail is approximately 10% documented. The risk adjusted construction costs to include all allowances that a contractor would make in a competitive tender process for a construct only contract.
- The estimates include previous expenditure on the design development to date

1.2 Estimate summary

Four estimates were prepared, three of which make up the Keswick Creek bypass option and the fourth includes the upgrade of Lower Brown Hill creek. These are as follows-

- An additional culvert from Keswick creek at Le Hunte Street, across Goodwood road through the Adelaide show grounds, across the rail line and up Maple Avenue to Keswick barracks open channel immediately downstream of the Rail reserve.
- The upgrade of the existing concrete lined channel of Keswick creek through the Keswick barracks through to ANZAC Highway.
- The supply and installation of twin Reinforced concrete box culverts along ANZAC Highway linking Keswick Creek to Brown Hill creek
- Lower Brown Hill Creek Channel upgrade from ANZAC Highway through to the downstream extent just west of Watson Avenue, Netley.

The estimated project costs for each of these cost centres are as follows-

Project Costs		
Section 1	Lehunte – barracks	$21.7m
Section 2	Barracks	$ 6.0m
Section 3	ANZAC Bypass	$15.4m
Total for sections 1-3	**(Keswick Creek bypass/ upgrade)**	**$43.1m**
Section 4	**Lower Brown Hill Creek upgrade**	**$39.1m**

These estimates are divided into three major cost centres to assist with future cash flow predictions, risk assessment and procurement strategies. These cost centres are as follows;

- Client's costs: This cost centre includes the design development, project and contract management, community liaison requirements, services relocations and land acquisition requirements.
- Contractor costs: This cost centre includes contractor's preliminaries, onsite overheads, traffic management and environmental works, the supply and Installation of the upgrades, reinstatement works and the contractors overhead and profit allowances.
- This includes project inherent and contingent risk.

Table 1.

ITEM	BROWN HILL CREEK STORMWATER UPGRADE	Keswick Creek bypass / upgrade			Section 4 Lower BHC	Sub Total
		Section 1, Le Hunte - Barracks	Section 2 Barracks	Section 3 ANZAC		
1.1	Design and Documentation, Project management etc.	$2,330,940	$830,222	$1,503,322	$4,203,927	$8,868,411
1.2	Services relocations and alterations	$573,985	$157,556	$1,503,322	$1,548,815	$3,783,678
1.3	Land Acquisition	$350,000	$0	$0	$3,820,000	$4,170,000
	TOTAL CLIENTS COSTS	**$3,254,925**	**$987,778**	**$3,006,643**	**$9,572,742**	**$16,822,089**
2.1	Preliminaries and Onsite Overheads	$1,597,078	$511,152	$1,251,837	$1,938,154	$5,298,220
2.2	Traffic management and environmental requirements	$371,807	$114,699	$771,001	$611,794	$1,869,301
2.3	Contract Direct Costs	$11,186,885	$2,989,131	$6,610,679	$17,564,536	$38,351,231
2.4	Contractor Overheads and margin	$1,193,855	$323,909	$762,243	$2,011,448	$4,291,456
	TOTAL CONTRACTOR COSTS	**$14,349,625**	**$3,938,890**	**$9,395,760**	**$22,125,933**	**$49,810,208**
1+2	TOTAL WITHOUT RISK	**$17,604,550**	**$4,926,668**	**$12,402,404**	**$31,698,675**	**$66,632,297**
3	RISK ALLOCATION	**$4,080,196**	**$1,115,011**	**$2,950,269**	**$7,371,520**	**$15,516,996**
1+2+3	GRAND TOTAL	**$21,684,746**	**$6,041,679**	**$15,352,672**	**$39,070,196**	**$82,149,293**

Client costs attributable to the Principal and design costs have been determined by Costplan Consulting based on benchmarked historical data and current trends.
The costs for services and utility relocations have been calculated by both first principles and historical data.
It should be noted that there can be considerable variance in predicting South Australian Power Networks and Telstra relocation costs.
A major difficulty of this project will be working with limited access and in narrow residential streets. In particular the limited airspace available when excavating trenches and placing culvert units needed when restricted by wire and tree canopies.

1.3 Approach and Methodology

The scheduled item costs have generally been created and generally estimated from first principles.
There are numerous services that cross (or run next to) the proposed works, in particular the bypass culvert routes that run down Le Hunte Street, the Goodwood Road crossing, across the rail reserve and down ANZAC Highway. The intent is to retain if possible all services where possible.
Gravity Sewer mains, rail signalling / catenaries and trunk water mains will present the biggest challenges.

With this in mind we have allowed for 2 micro tunnelling operations so as to avoid some of these services clashes.
These would include the jacking of three 1500 diameter pipes and associated transition structures to the proposed adjacent reinforced concrete box culverts.

The first location is adjacent the end of Le Hunte Street and across Goodwood Road to the showgrounds. A high volume of vehicles per day (in excess of 28,000) utilise this road, this combined with an adjacent service station and a SA Water trunk water main will all add to the projects risk.

The Rail Reserve (adjacent to Leader Street) which carries three metro rail tracks and the ARTC controlled freight line to Melbourne will also present considerable challenges if an open cut solution is adopted, particularly now as the metro lines are electrified and notwithstanding the political sensitivity of closing these lines.

Risk has been addressed by way of percentage on cost for the various elements and groups. Where our estimators believe there is greater risk for some elements than others they have reflected this as a greater percentage. For example, the supply cost for culverts has a much lower risk profile than the potential relocation of Telstra services.

1.4 Main assumptions

The key assumptions to which these estimates rely include the following:

- Undertaking the works to provide minimal practical disruption as possible.
- Undertake the works during daylight hours and limiting night works to critical activities (e.g. ANZAC Highway works).
- Costs are current as at January 2016 and escalation has been excluded.
- Costs are inclusive of previous design development expenditure.
- All costs are exclusive of the Goods and Services Tax.

1.5 Moving forward

When further development work is undertaken, we would recommend a number of actions that will have a large effect on the accuracy of the cost estimates, these include -

- Confirmation of culvert / wall sizes and location requirements.
- Confirmation of the vertical alignments of the works.
- Verification of existing service locations and seeking service authority's requirements and quotations for relocations.
- Completion of topographical surveys
- Further design Development

2. Scope of Project

2.1 Project description

This project is for the construction of bypass culverts of various sizes between Brown Hill Creek (Downstream) and Keswick Creek / Le Hunte Street (Upstream).
It also includes the widening of the existing channel and bridge replacements of Lower Brown Hill Creek from ANZAC highway down to Watson Avenue in Netley.

Table 2. Below summarises the various segments of these works.

LEG	TREATMENT	LENGTH (M)
Keswick Creek Bypass Culvert		
Lehunte- Goodwood Road	Single RCBC, 3300 x 1500mm	547
Goodwood Road crossing	Micro tunneled 3 x 1500 RCP	25
Adelaide showgrounds	Single RCBC, 3300 x 1500mm	593
Rail reserve	Micro tunneled 3 x 1500 RCP	30
Mabel Street	Single RCBC, 3300 x 1500mm	128
Keswick Barracks	RC Channel widening	440
ANZAC Highway	Twin RCBC 3600 x 1500mm	490
	TOTAL M =	**2253**
Lower Brown Hill Creek upgrade		
ANZAC Highway - South Road	RC open channel and Gabion structures	360
South Road - Grassmere reserve	RC open channel and Gabion structures	520
Grassmere reserve - Birdwood Terrace	Gabion walled structures	660
Birdwood Terrace - Marion Road	RC open channel and Gabion structures	540
Marion Road - Watson Ave	RC open channel and RCBC	660
	TOTAL M =	**2740**

For the upgrade of Lower Brown Hill Creek there are five bridges of insufficient size that will be required to be upgraded along with a number of footbridges that will need to be removed and replaced to facilitate construction access.

Table 3. Bridge Works

	LEG	TREATMENT	LENGTH
	Lower Brown Hill Creek upgrade		
1	Farnham Bridge addition	addition of adjacent RCBC	20
2	Daly Road Bridge replacement	Twin 3300 x 1800 RCBC	20
3	Marion Road Bridge replacement	Major DPTI road	20
4	Harvey Road Bridge replacement	Twin 3300 x 1800 RCBC (to extend 20m downstream)	40
5	Watson Avenue Bridge replacement	Twin 3300 x 1800 RCBC	20
			120

We have adopted the various treatments for creek widening as shown in Tonkin Consulting's figure 12. It should be noted that we have adopted the concrete lined alternative for section 8 (between ANZAC and Farnham) rather than the closed multi cell culverts as this treatment would incur a significant cost penalty.

The hydraulic modelling design assumes the insertion of a 'choke' in the existing Keswick Creek culvert immediately downstream of the diversions take-off point. The modelled choke is a 2m diameter orifice. In practice, the orifice could be a short length of pipe cast into a block inside the culvert (approximately 3 m wide x 2.9 m) with streamlining of the entry and exit ends.

2.2 Documents reviewed

This particular report is based on the routes and culvert sizes as presented in the Tonkin Consulting drawings set Plan No: 20120679_PLAN-001 (figures 1 -18) as received.
A detailed site inspection was undertaken for the Lower Brown Hill Creek channel upgrade works by representatives from the Brown Hill Creek Project, the city of West Torrens, DPTI, Tonkin Consulting and ourselves in December 2015. From this draft creek widening treatments were discussed and proposed.

2.3 Limitations of estimate

The Estimate is limited by the detail provided in the documents which we believe are currently in the order of 5-15% design complete.

Numerous assumptions have been made where details were not shown on the drawings or drawings were not provided.

3. Project Costs

3.1 Principal's costs.

The principal's costs include the following-

- Design and documentation.
- Investigations (Survey, geotechnical, contamination etc).
- Services locations and potholing.
- Design verification and construction inspection.
- Dilapidation surveys.
- Project management and planning,
- Community engagement and liaison.
- Land acquisition.

For these estimates we have assumed that the majority of services relocations, street tree removals and pruning and culvert supplies will be undertaken by the principal.

Land acquisition costs are based on elemental data as previously prepared by Maloney Field Services. These have been amended to reflect the current route and escalated to reflect today's dollars.

3.2 Construction estimate

3.2.1 Estimate methodology

These estimates were generally prepared from first principles in a manner similar to the development of a tender by an experienced construction contractor.

Construction costs are split into two main groups, Direct Costs and Preliminaries.

The first group, Direct Costs (DC's) include the following sections:

1. Traffic and pedestrian management (typically 2-4 men required)
2. Environmental controls (mainly street sweeping duties).
3. Existing service relocations and protection (generally limited to service connections, existing stormwater modifications and relaying of top stones etc).
4. Culvert clearing, excavation, laying and backfilling.
5. Major structures and pits.
6. Road and street reinstatement works.
7. Miscellaneous works including tree root pruning, tree replacements, fencing etc.

The second group, Contractors Preliminaries include the onsite overheads that cover the recurring and fixed costs required to deliver the project. These typically include the following:

- Supervision and staff allowances.
- FIFO and LAHA allowances for staff if applicable.
- Site vehicles.
- Site equipment, small tools and general cranage.
- Offices, site accommodation and statutory amenities.
- Mobilisation of plant, equipment and men.
- Insurances and fees.
- The SA construction industry training levy.
- Site service installations, removals and usage.
- Training, safety requirements and inductions.
- Survey.
- Testing.
- Demobilisation and site clean-up.

For these project options the total onsite overheads represent approximately 12% - 16% of the direct costs (DC's). This is appropriate for this style of project.

As it is envisaged that this project will be delivered under a construct only model, allowances for design are included in the Principals cost section of the estimate.

An allowance of 10% (of both direct and indirect costs) for the contractor's offsite overhead and margin has been allowed for, this is in line with recently benchmarked construction projects of similar size, complexity and with similar risk profiles.

Costs associated with the Contractors risks and opportunities (Inherent risk) are likely to be in the order of 5%.

Our estimates have been prepared using the guidelines of the Federal Government's 'Best practice cost estimation standard for publicly funded road and rail projects' document as published in May 2011 by the Department of Infrastructure and Transport.

3.2.2 Box culvert supply.

A large portion of the cost for this project is the manufacture and supply of the culverts. The estimates allow for the supply and delivery of precast reinforced concrete box culverts that meet the requirements of AS 1597.1,2010 for small box culverts and AS 1597.2,1996 for large box culverts.

Budget rates for the manufacture, testing and delivery of these culverts were supplied by Humes, South Australia.

We would envisage a separate supply contract(s) for the box culvert crown and base units. This is easily managed, would alleviate any supply issues as manufactures only have so many moulds for any given size, it would also prevent the effect of margin on margin. Temporary stockpile locations would need to be carefully considered.

3.2.3 Construction Methodology

The following methodology was subsequently adopted to be priced in the estimates:

- Excavation: by conventional hydraulic excavators in the order of 25 – 30 tonnes. Material is to be carted to temporary stockpile sites for environmental testing and certification prior to being loaded and carted to appropriate off site dumps.
- Bedding: An 80-100mm layer of sand supplied, laid and screeded to grade in order to receive culvert base units.
- Placement of precast base slabs and crown units: dependent upon size, these units will generally weigh well in excess of the lifting capability of an excavator (used for excavation). Therefore a hydraulic crane up to 90 tonnes capacity will be required to install the majority of the units. A tractor crane will be required as it is unlikely that coordination of delivery truck can be timed exactly to when the units are scheduled to be installed. A security guard will also be required for nights to safeguard expensive cranes against vandalism.
- Densopol tape is subsequently applied to the crown unit joints and the floor pockets grouted up.
- We have allowed backfill to the sides of the units and to 200mm over the crown units to be with 1.5mpa CLSM. This facilitates speedy installation and assists in waterproofing the culvert units.
- Backfill to the upper level to the existing pavement surface shall be with crushed rock. It is envisaged that once the main laying gang moves sufficient distance away then the top layer of the crushed rock can be excavated and reinstated with asphaltic concrete.
- The leading edge of the main trench will need to be sandbagged/ plated over at the end of each day to act as end formwork and to maintain street access out of hours.
- Service connections that are above the overt of the culvert will need to be either temporarily disconnected or removed and re-laid. Where these just under the invert of the culverts base slab protection may also be required.
- Existing stormwater systems will also need to be reconfigured to discharge into the culverts.

It is expected that overall production rates of 5-15LM per day will be achieved. This is dependent upon culvert sizes, obstacles both underground and overhead, access, traffic and train management, dewatering and ground conditions.

When preparing first principal estimates of this nature due consideration should be given to ensuring production rates and plant adopted for individual tasks work within a daily cycle. That is trenching, bedding, placing units and backfilling all need to proceed at the same lineal metre rate per day in order to be trafficable after hours.

Due allowance has been made for the construction of the pits as shown on the drawings. These are significant structures in themselves and will take a considerable duration to construct. We would envisage that skewed box culvert units would be considered during the design development so as to both expedite the programme and increase the hydraulic efficiency of the design. In the absence of any preliminary designs inlet and outlet structures are "best guesses" based on previous experience.

It is expected that final reinstatement will be undertaken once the main construction has advanced to a reasonable distance. For the larger sized culverts we have generally allowed for full road width reconstruction (150mm crushed rock, prime and a 40mm layer of asphaltic concrete) with the assumption that 50% of kerbing will be required to be replaced. This gives the option to slightly shift the horizontal alignment to avoid potential costlier service relocations.

3.2.4 Estimate data and assumptions

Estimate Data

During the preparation of the estimate the following materials and subcontractor budget prices were sought for the precast culvert units, micro tunnelling and shotcrete works with rates for ancillary materials being adopted and updated from other recent estimates Costplan has undertaken in this area.

Reinstatement costs include Kerbing, footpaths, landscaping and pavements to council or DPTI specification requirements.

A full suite of insurances and fees has been allowed for. This includes Contractors All Risk, Public Liability, Professional Indemnity, Work Place Health & Safety, Insurance Excesses and Security.

The statutory South Australian Construction Industry Training Board levy (CITBL) at 0.25 %(+GST) has also been allowed for.

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The labour rates calculated for the Project are as follows:
Skilled labour $55 per hour
Concrete workers $70 per hour
Steel fixers and form workers $75 per hour,
Trades personnel are based on $80 per hour

Plant rates adopted are based on competitive and current civil construction industry direct costs.

Estimate Assumptions

Given the conceptual nature of the design, numerous assumptions have been made during the preparation of these estimates. Whilst too lengthy to list in this report they appear as scope elements and notes in the body of the estimate proper. One such example is the shape, size and details of the junction box's and inlet and outlet structures

Key assumptions are as follows:

- That the works will be carried out during normal daylight construction hours (where possible)
- We have utilised precast base slabs to expedite construction.
- An allowance of one metre from the edge of the culvert to the edge of the trench to facilitate working space and edge forms if necessary
- Backfilling the sides and to 200mm over the top of the trench with CLSM (as discussed above).

3.3 Risks and opportunities

Risks

Risks are categorised as either inherent or contingent.
Inherent risks are those that are known to occur but difficult to quantify. Risks such as slower production rates, dewatering, quantity inconsistencies etc are inherent.

Contingent risks are those that are generally unknown (and or unmeasurable) in nature. Risks such as unknown services, changes in standards and design development are contingent risks.

During the preparation of our estimates we have endeavoured to identify scope omissions and to quantify the obvious inherent risks. We have also included in the contractor's scope an allowance of 5% for this.

In determining contingent risk we have placed differing contingent risk percentages on elements with different risk profiles. For example, existing service relocations at 35% to culvert supply at 10%. This equates to approx. 20 – 25% average contingent risk allowance.

These values are typical in terms of the current status of the concept design. As the design becomes more developed and certainties grow, this percentage will drop. At this stage of development we consider these levels appropriate.

Opportunities

Major opportunities have not been treated in any detail for these estimates. This is primarily due to the conceptual nature of the current design. These should be considered in more detail as the design develops and progresses.

3.4 Programme and Procurement

Although no detailed programme works have been prepared for these estimates, we envisage that these sections of the works will take in the order of three - five years to complete.

Due consideration needs to be given to approvals timeframes, design and investigation durations, Land acquisition, Service authorities constraints, cash flow constraints, industry resourcing availability and that the majority of works in existing channels be undertaken in the drier months to limit construction risk.

We would recommend that a draft programme be developed in parallel to the next stage of design development and budget updates so a more accurate cash flow can be developed.

Our current overview on procurement packaging would be to group the works into three discreet categories, these would include -

- Supply and delivery of Precast Culverts and base units.
- Minor works such as the micro tunnelling, smaller bridge widenings and reconstructions etc.
- Major works in $5- $10m packages undertaken by tier 2 contractors.

When determining project packaging due consideration needs to be given to clear battery limits so as minimise risk between both packages and flood risk.

Table 4 below details potential work packages

Work Packages	
Package 1	Culvert supply
Package 2	Small bridge replacements
Package 3	Marion Road bridge replacement
Package 4	LBHC, Watson to Grassmere
Package 5	LBHC Grassmere - ANZAC
Package 6	ANZAC culverts
Package 7	Micro tunnelling
Package 8	Maple Avenue - Rail reserve Channel/ Culverts
Package 9	Adelaide showgrounds Culverts
Package 10	Le Hunte Street Culverts