21. TENDERS FOR SOLIDS CONTACT TANKS & SLUDGE PROCESSING FACILITIES FOR CHRISTCHURCH WASTEWATER TREATMENT PLANT EXPANSION WORKS

RR 10854

Officer responsible Waste Manager	**Author** Mike Bourke, Wastewater Manager
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The purpose of this report is to confirm the recommendation of the Christchurch Wastewater Treatment Plant tenders Subcommittee for the acceptance of a tender for the construction of the Solids Contact Tanks and Sludge Processing Facilities for the Christchurch Wastewater Treatment Plant expansion.

1. BACKGROUND

In February 1998, the Council awarded the first major contract in the Christchurch Wastewater Treatment Plant upgrade project, for the civil and structural construction of clarifiers No. 1 & 2 and associated channels, to Daniel Smith Industries.

In June 1999, the Council approved a short list of eight companies to tender for this second major contract for the construction of the Christchurch Wastewater Treatment Plant expansion, which involves mainly mechanical and electrical equipment - refer Attachment A for plan location of work. Of the eight contractors shortlisted, six tenders were received. One (Daniel Smith Industries) was delivered to the Tender Box late and was not opened and one (Naylor Love) withdrew prior to tenders closing due to pressure of other work.

2. TENDERS RECEIVED AND EVALUATION METHOD

Tenders were received as follows:

Contractor	**Tender Price**	
Downer Construction Ltd	$3,557,600	Refer below for adjustment to these prices to allow for alternatives and removal of tags and conditions.
Hopkins Engineering Ltd	$3,957,006	
Robert Stone	$4,055,751	
Fulton Hogan	$4,187,600	
Gooder	$4.436,067	Not considered further due to significantly greater prices.
Fletcher Construction	$5,320,004	

These tenders all include a contingency sum of $300,000 and were all based on gravity belt WAS thickening equipment except for Hopkins Construction which was based on rotary drum equipment.

The tender evaluation method specified was that the lowest conforming tender would be accepted provided that only the subcontractors named in the tender registration submissions were included in the tenders.

If alternative subcontractors were offered in the tenders, then these subcontractors would be evaluated using a pass/fail criteria for certain attributes namely relevant experience, track record, technical skills, resources, management skills and methodology. (Note: That the same attributes for the main contractors were all checked out and passed as acceptable at the tender registration stage).

The specified construction time is 42 weeks from the date on the letter of tender acceptance. All tenderers have agreed that they can meet this timing.

3. ADJUSTED TENDER PRICES

Tender prices are adjusted to take account of tags and conditions in the table below.

Contractor	Tender Price $	Tender Adjustments $	Adjusted Tender Price $
(a) Downer Construction	$3,557,600	(a) Pegson Marlow pumps 34,000 (b) Hayward Gordon pumps 16,000 (b) Remove tag on services 600 (c) Remove tag on crane 4,250 (d) Paint coating on RAS pipe -2,100 (e) Remove pond baffles 5,350 (f) Change in blower size 29,000 (g) Centrifuges 573,365	$4,218,065
(b) Hopkins Engineering	$3,957,006	(a) Pegson Marlow pumps 31,904 (b) Al. Cover in SWB rooms 6,550 (c) Centrifuges 479,276	$4,474,736
(c) Robert Stone	$4,055,751	(a) Pegson Marlow pumps 46,379 (b) Centrifuges 468,457	$4,570,587
(d) Fulton Hogan	$4,187,600	(a) Pegson Marlow pumps 0 (b) Centrifuges 629,000	$4,816,600
(e) Others	n/a	Not considered further due to significantly higher prices.	n/a

4. DOWNER CONSTRUCTION CREDENTIALS

The credentials of Downer Construction Limited were all checked out and proved excellent during the pre-registration phase so it is not necessary to traverse them in detail here.

Suffice to say that Downer Construction is very well known as a civil construction works contractor with a high reputation, considerable expertise and substantial resources.

They have recently successfully completed the construction of the Picton Sewage Treatment Plant where they were the main contractor responsible for the civil, structural, mechanical and electrical works and the same team is proposed for this Christchurch contract.

5. WASTE ACTIVATED SLUDGE THICKENING (WAS)

The tender documents invited proposals for three short listed methods of WAS thickening.

- gravity belt
- centrifuge
- rotary drum

These technologies have quite different capital and operating cost features. Gravity belt and rotary drum machines have lower capital costs but rely on polymer dosing to achieve the degree of thickening required and this has a high annual operating cost.

Centrifuges employ high rotation forces to thicken the sludge and can operate without polymer, although polymer dosing equipment would be installed as a precaution, if improved solids capture is required from time to time.

While centrifuges have a higher capital cost, the net savings in not using polymer, can be used to "repay" the additional capital cost.

In addition, centrifuges have the further advantage of being fully enclosed for ease of odour capture and the machines can be fully automated. Gravity belts are difficult to make odour tight and can produce aerosols with consequent health risks.

In Downers tender the cost for the three technologies were:

Gravity Belt	$306,291	
Rotary Drum	$409,198	($102,907 additional cost)
Centrifuge	$879,656	($573,365 additional cost)

Note: The above figures include the cost of polymer dosing equipment for each thickening technology.

As the operating costs of Gravity Belt and Rotary Drum are about the same, we have analysed their operating costs against the higher capital cost centrifuge technology to compare them in terms of simple payback period and Net Present Value. The table below summarises the different technologies:

WAS Thickening Cost Comparison

	Gravity Belt	Rotary Drum	Centrifuge	Cost Difference Centrifuge/ Gravity Belt	Cost Difference Centrifuge/ Rotary Drum
Capital Cost	$306,291	$409,198	$879,656	$573,365	$470,458
Operating Costs/yr					
- polymer	220,000	220,000	nil		
- water	10,000	10,000	500		
- power	10,000	10,000	55,500		
- labour	20,000	20,000	20,000		
- maintenance	20,000	20,000	40,000		
Total Operating Cost p.a.	$300,000	$300,000	$115,000	$185,000	$185,000

Simple Payback Analysis - Centrifuge/Rotary Drum $470,458/$185,000 = 2.54 yrs

Simple Payback Analysis - Centrifuge/Gravity Belt $573,365/$185,000 = 3.10 yrs

A whole of life economic comparison was also undertaken and for 15 years life at 8% interest rate, the Net Present Values are:

Gravity Belt - NPV = $2.7m
Rotary Drum - NPV = $3.0m
Centrifuge - NPV = $1.9m

Note: The Net Present Value is determined by converting all disbursements, both current and future, to their present value.

This clearly demonstrates that the centrifuges are the more economic WAS thickening option.

6. **BUDGET AND METHOD OF FINANCING**

(a) This Tender (ie Solids Contact Tank and Sludge Processing Facilities)

Downers adjusted tender price for this contract is $3,747,607 assuming the selection of rotary drums for WAS thickening and $3,644,700 if gravity belts are selected.

If centrifuges are selected for WAS thickening as recommended, Downers adjusted tender price for this contract is **($4,218,065)**

These prices compare with an allowance on the ten year $33.2m budget of $3.8 as below (figures from Attachment B).

- Pond Inlet Revisions $0.6m
- SC Aeration/Electrics $2.60m
- Sec Sludge Thickening $0.6m

$3.8m

If centrifuges are selected as recommended due to payback period of approximately three years, then additional funding of $418,065 is required.

(b) **Overall Project Budget**

The 1999/2000 overall project budget of $33.2m is shown as Attachment B. As the expansion project has progressed (note completed items to date are trickling filter ventilation, new screens, part bypass channel, part odour control works, part AEE and study work), various elements of work need modifying and revaluing and in addition the timing of some has varied.

Set out below recommended changes.

Item		Budget Change
(i)	Early construction of pipeworks relating to Clarifiers 3 & 4 A change in the timing of some expenditure has been made to perform work during the contract for Clarifiers 1 & 2 which is in preparation for Clarifier No. 3 & 4. This work (amounting to $0.7m) can be done more cost effectively during the construction of Clarifier 1 & 2 rather than waiting until the construction of Clarifiers 3 & 4. This will increase the value of the Contract for Clarifiers 1 & 2 from $7.5m to $8.2m and this can be funded from misc. contingency.	0.0
(ii)	Earlier timing of the expenditure for the new primary effluent pump station to the trickling filters (TF). Revised to achieve the most energy efficient use of the combination of trickling filters and solids contact tanks to achieve some nitrogen removal, and to provide an alternative route to the TFs thus allowing refurbishment of the existing TF pump station. The arrangement will also be more earthquake resistant.	0.0
(iii)	Revised timing of the expenditure on the replacement of the distributor arms on the trickling filters. Revised to achieve higher hydraulic capacity and improved flexibility in operation. This item has been advanced because of the corroded condition of the distributors which is worse than originally thought.	0.0
(iv)	Historical expenditure has been slower than in earlier allocations and the table below has been adjusted to reflect actual expenditure.	
(v)	Use of Centrifuge technology as detailed above.	0.420m
		0.420m

The above proposed changes to the 1999/2000 overall project budget are tabulated in Attachment B and summarised year by year below.

	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	Total
1999/00 Budget Totals	**0.4**	**3.2**	**3.9**	**7.5**	**4.9**	**5.0**	**4.3**	**1.2**	**1.4**	**1.4**	**33.2**
Proposed modifications Capital Budget	**0.4**	**2.6**	**3.7**	**7.4**	**4.4**	**5.6**	**4.9**	**1.6**	**1.5**	**1.6**	**33.7**
Difference	**-**	**-0.6**	**-0.2**	**-0.1**	**-0.5**	**0.6**	**0.6**	**0.4**	**0.1**	**0.2**	**-**
Cumulative Difference	**-**	**-0.6**	**-0.8**	**-0.9**	**-1.4**	**-0.8**	**-0.2**	**0.2**	**0.3**	**0.5**	**-**

8. **SUMMARY**

The lowest adjusted tender using centrifuge technology is from Downer Construction Limited for **($4,218,065).** Downer Construction is a very good contractor with an excellent track record and proven special expertise in important areas of this project. Reconciliation of this tender with the budget allowance is discussed in detail above.

It is recommended that the tender of Downer Construction Limited for the construction of solids contact tanks and sludge processing facilities be accepted.

An increase of $0.5m is recommended in the budget for this project based operational savings of approximately $185,000 per annum. (Three year simple payback with ongoing savings thereafter).

Recommendation:

1. That the Tender received from Downers Construction Limited for the sum of **($4,218,065)** be accepted based on centrifuge sludge thickening.

2. That $500,000 be added to the project budget for centrifuge thickening technology increasing the overall budget from $33.2m to $33.7m.

Note: This will be recovered in three years by savings in operational costs which continue at a rate of $185,000 per year thereafter.