Tamar Lake – Barrage Design and Costing

Barrage Location

The general location of the barrage in the Rowella/Long Reach area has been determined by the strategic requirements of flood mitigation, silt transport and economic costs/benefits.

As shown earlier in this document, the Long Reach site is now the preferred option, but alternative sites, and community acceptance must be explored before a final site is chosen.

Figure 1 – Preferred barrage site

Barrage Design

Construction Materials and cost

The barrage, located in the Long Reach section of the river (see figure 4,) will be constructed with a concrete faced rock wall for the deep and non-operational section of the total 800 metre long barrage, with the 350 metre wide gate section and the two locks constructed of pre-formed concrete on the much shallower rock ledge section off the West shore.

The barrage design consultants, CDM Smith, have provided a preliminary cost estimate of $320m, with 75% of the labour and materials locally sourced, 20% from interstate, and 5 % internationally. This figure includes a 50% contingency cost factor.

Barrage Functions

The functions that the barrage must perform are:

- To provide a clear separation between the freshwater lake environment and the saltwater estuary environment for all tidal events up to a sea level rise of 0.8m.

- The ability to pass all normal and up to 200 year ARI flood flows without negatively affecting flood levels upstream in Launceston.

- The ability to maintain a constant water level in the lake, but to operationally vary that water level from current mid to high tide level.

- The ability for small leisure craft and larger commercial vessels to transit the barrage via two locks.

- The ability for migrating fish and eels to transit the barrage for life cycle purposes.

Barrage Components

To achieve the above functions, the following components will be incorporated in the barrage design.

- ***Crest Level***
  Crest level of at least 2.2 metres AHD to block current tidal levels plus provision for a sea level rise of 0.8 metres.

- ***Spillway Gates***
  Size - 10 vertical lift gates each 35 metres wide by 5.2 metres high

  Flood Safety Control – The flood analysis carried out by our consultants, BMT WBM, has shown that with normal operation of the gates, there will be no detrimental effect on flood levels in the valley south of the barrage or in Launceston, when compared with flood levels in the current tidal regime.
  However, if for some reason the gates are unable to operate, the barrage presents as a weir with a crest at 2.2m AHD, in which case the flood levels in Launceston and the Valley could be increased by as much as 1.0m for a 200 year ARI flood event.
  To prevent this from ever occurring, the barrage will be designed to be completely fail safe.
  This will occur at two levels:
  - ***Redundancy/backup***
    The system has 10 independently operated gates, with a backup power supply from a diesel powered generator
  - ***Fail Safe***
    Under normal operation, each of the 10 vertical lift gates will be constrained in the vertical plane by a shear pin or bolt.

Should any or all of the gates fail to operate with rising flood waters, the water pressure will cause the shear pin/bolt to break and allow the gate to pivot on a horizontal plane about an axis at the top of the gate, allowing unconstrained flow down river to relieve potential flooding.

The design of this mechanism will be included in the detailed design of the barrage.

- ***Locks***
  Barrage will be fitted with two locks for the passage of boats and small ships up and down the river. To reduce cycle time, the small lock will accommodate pleasure powerboats and yachts, with a larger, less frequently used lock for the commercial tugs, ferries, tourist boats etc. The small lock will be user operated with suitable security.
  A preliminary estimate of the lock sizes are:
  - Small lock – 40m long by 8m wide
  - Large lock – 70m long by 18m wide
- ***Footbridge/bike path***
  An elevated footbridge/bike path will be constructed on top of the wall; integrated into the vertical lift gate assembly; and mounted on top of the lock gates.
  This will provide passage for pedestrians and cyclists except when a lock is in operation
- ***Fish Ladders***
  Fish ladders, principally for the passage of eels and Australian Grayling will be incorporated in the wall.

Barrage Costing.

CDM Smith were the designers/project Managers for the Marina Barrage in Singapore, completed in 2008.

With the benefit of marine surveys conducted by Tamar Lake Inc, CDM Smith has determined that the most cost effective location for the barrage is at the South End of Long Reach.

Based on this siting, CDM Smith has produced the following preliminary report on the cost of construction of the barrage, with 75% of labour and materials sources locally, 20% interstate, and 5% internationally.

Tamar Barrage Estimate (large boat lock) 9/01/2014

Major assumptions				
1. modelling will confirm that dumped rockfill with a dumped concrete upstream face will provide a sufficient barrier to salt intrusion				
2. the right side of the channel is basically rock with very little overlying alluvium				
3. quality of rock is reasonably good and only 1.5 m of rock needs to be excavated				
4. assumes vertical lift gates				
	Unit	Quantity	Rate	Cost
Direct costs				
Mobilisation	item	1	2000000	$2,000,000
Temporary works				
site access roads	item	1	1000000	$1,000,000
steel sheet piling supply cofferdam	m2	15000	650	$9,750,000
steel sheet piling install cofferdam	m2	15000	650	$9,750,000
fill between rows of piling	m3	72000	20	$1,440,000
Dumped Rockfill				
rockfill	m3	750000	65	$48,750,000
dumped concrete upstream face	m3	20000	400	$8,000,000
Concrete Spillway				
foundation excavation	m3	4500	100	$450,000
foundation preparation	m2	3000	50	$150,000
anchors	item	1	5000000	$5,000,000
mass concrete base with reinforced crest	m3	10000	500	$5,000,000
reinforced piers	m3	2000	1200	$2,400,000
concrete deck on top of piers	item	1	5000000	$5,000,000
supply gates	tonne	600	15000	$9,000,000
lifting gear	item	1	5000000	$5,000,000

Boat Lock (large 70mX18m)				
steel sheet piling supply cofferdam	m2	3000	650	$1,950,000
steel sheet piling install cofferdam	m2	3000	650	$1,950,000
fill between rows of piling	m3	14500	20	$290,000
foundation excavation	m3	2100	100	$210,000
foundation preparation	m2	1400	50	$70,000
anchors	item	1	1500000	$1,500,000
mass concrete base with reinforced crest	m3	4200	500	$2,100,000
reinforced concrete walls	m3	1300	1200	$1,560,000
supply gates	tonne	240	15000	$3,600,000
supply pumps operational gear etc	item	1	1200000	$1,200,000
Spillway access from right bank	m3	25000	100	$2,500,000
sub-total				$129,620,000
Contingency			50%	$64,810,000
Total Direct Cost				$194,430,000
Indirect costs			30%	$58,329,000
Margin plus profit			15%	$37,913,850
TOTAL CONTRACTOR COST				**$290,672,850**
Design and investigation costs			10%	$29,067,285
TOTAL PROJECT COSTS				**$319,740,135**
Owners costs finance , project management, legal, permits, approvals etc not included				