



Tamar Lake Inc.
Incorporation Number IA 10501

Tamar Lake Feasibility Report

Part 1

Strategy and Benefits

September 2017



Tamar Lake from Landfall – 24/7

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Strategy Summary

Introduction

Tamar Lake Inc., a not-for-profit member funded association, was formed in 2010 to investigate the feasibility of installing a barrage in the Tamar River to provide a solution to the Upper Reaches sedimentation and water quality problems.

Because of the transformational nature of this project, it was realised by the founders that the feasibility and benefits of this proposal would need to be demonstrated before asking the Tasmanian community for a social license and funding for planning and implementation.

After 7 years and an investment of more than \$500K into a total of 23 individual reports into the technical, environmental, economic and funding viability of this proposal, the feasibility of this project and the very significant benefits that could be realised by the Northern Tasmanian community are shown in this final report. If this level of study had been commissioned under normal commercial terms it would have cost the proponent between \$1m and \$2m.

This report is segmented into two parts:

- **Part 1 – Strategy and Benefits** – the strategy adopted, the reasons for this strategy, and the benefits that could accrue to Launceston and the whole Tamar Valley.
- **Part 2 – The Technical, Environmental, Economic and Funding Studies** that support the feasibility findings and benefits shown in Part 1.

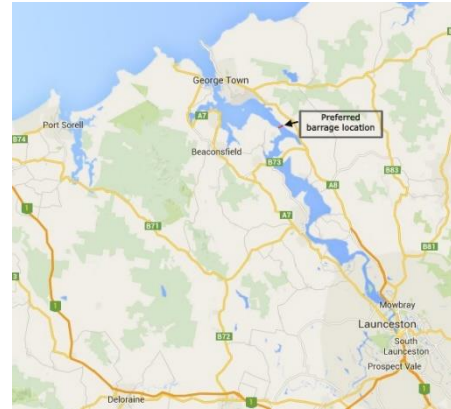
The Tamar Lake Strategy

A review of all the government funded studies into the causes and effects of sedimentation and water quality in the Upper Reaches around Launceston, identified that the natural processes of flocculation¹ and the asymmetrical tidal action of the long Tamar estuary causes the fine clay silt particles entering the Tamar from the South and North Esk rivers to precipitate in the area near Tamar Island and are then “pumped” back upstream into the Yacht Basin/Home Reach/Lower North Esk where they settle in this quiescent area.

The same asymmetric tidal action also locks in pollutants entering the Tamar from the catchments and the Launceston sewerage plants into the same Yacht Basin/Home Reach/Lower North Esk area.

¹ **Flocculation** - The process by which individual particles of clay aggregate into clot-like masses or precipitate into small lumps of mud called flocs. **Flocculation** occurs as a result of a chemical reaction between the clay particles and another substance, usually salt water.

To remove these effects the strategy formulated by Tamar Lake Inc. in 2010 was to move the flocculation zone as close as possible to Bass Strait, and to remove the asymmetrical tidal action from this section of the river.



This strategy not only provides an almost immediate solution to any new sediment accumulation in the whole Tamar Valley and enables the erosion and migration of existing sediment into Bass Strait with every major flood event, but also provides an immediate improvement in water quality in the Yacht Basin/Home Reach area.

The method of achieving this is to install a barrage² just south of the Bell Bay Port in Long Reach to separate the tidal estuary from the freshwater flowing into the Tamar from the very extensive catchments.

The Tamar lake – a large freshwater reservoir

This installation of a barrage forms a reservoir behind the barrage that retains approximately 405 GL of freshwater, or 80% the size of Sydney Harbour.

This reservoir receives freshwater from a catchment the size of approximately 20% of the Tasmanian land area and is fed by the South Esk, North Esk, Meander and Macquarie Rivers, and by Brumbys Creek and the Poatina Tailrace with an annual flow of between 1,500 and 4,500 GL depending on rainfall in the catchment.

In addition to the reduction in sediment accumulation and water quality improvement, this very large body of freshwater provides a major new asset for the State with a 24/7 minimum navigation depth of 5 metres, and a resource that will stimulate major new economic growth in the agricultural, tourist, commercial and industrial sectors of Northern Tasmania.

These benefits will be further explained in the next section of this Part 1 of the Feasibility Report, and the technical and scientific modelling studies that support these benefit claims are covered in Part 2 of the Feasibility Report.

² A barrage is a special form of weir with a series of gates that facilitate the passage of flood waters and allow for the control at the water height behind the barrage. Under normal, non-flood conditions, the water level is maintained no higher than the current normal high tide.

Benefits

The following benefits to Northern Tasmania could be realised with the implementation of the Tamar Lake project.

The science and technology that make these benefits realisable is covered in full in Part 2 of this Feasibility Report.

For the whole valley:

- **Protection against sea level rise**

All the valley south of the barrage, and especially Launceston, “global warming proofed” against sea level rise.

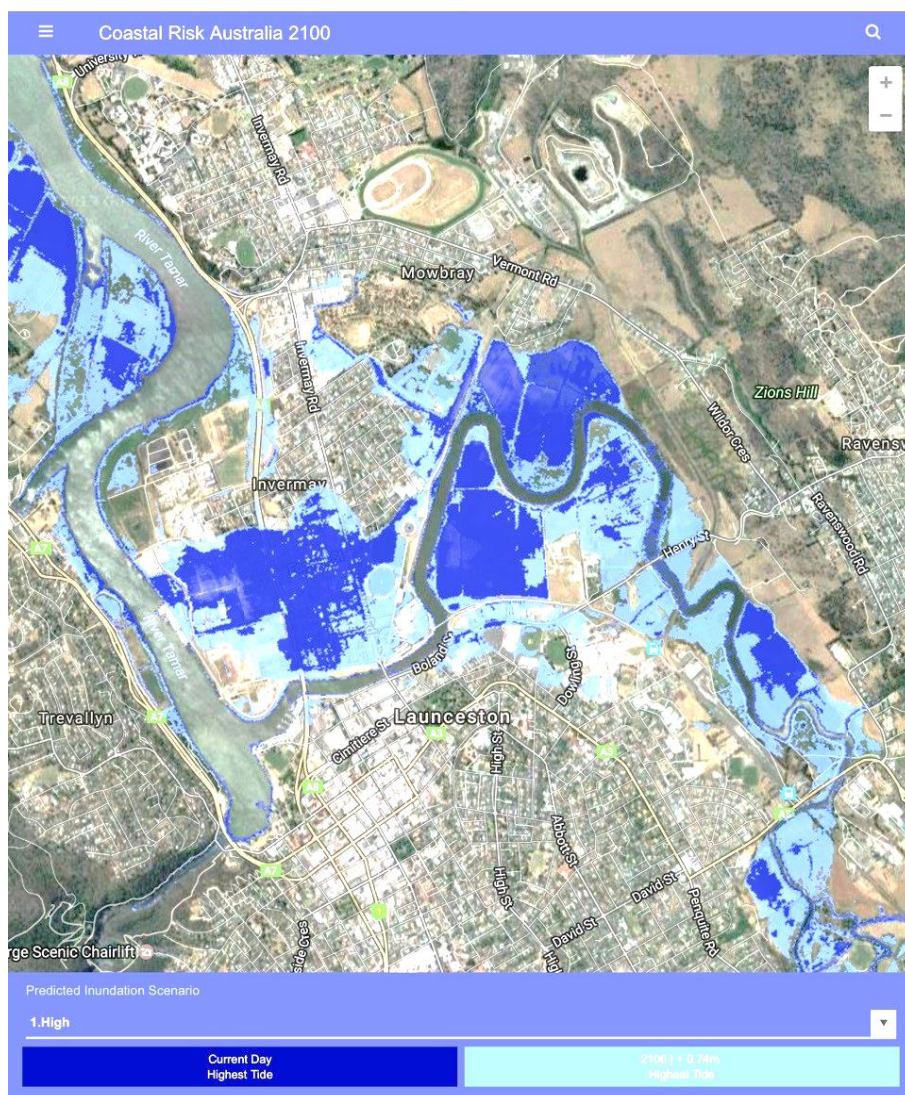


Figure 1- Tidal inundations around Launceston – current highest tide and projected sea level rise

The above Google Earth chart Figure 1. compiled by Coastal Risk Australia shows the current spring tide inundation of the low levels of Launceston in dark blue shading, and the forecast inundation with a sea level rise of 0.74 m by the year 2100 in light blue shading.

The Tamar barrage will not only protect this area against a sea level rise of up to 0.8 m, but provide immediate protection against the current spring tides and all forecast rises over the next 80 years.

A permanent sea level rise of this magnitude is not blocked by the Launceston flood levee system, so if not a barrage, what alternative does Launceston have?

- **A clean, green, low pollution lake**

A large freshwater lake extending from the Cataract Gorge and the St Leonards weir in the south, to the barrage located at the Rowella/Long Reach area in the north, with a permanent water level near current high tide, and water clarity with a visual depth of up to 2 metres.

- **The Tamar – a mecca for luxury yachts and power boats**

With a ship lock in the barrage, and a minimum 24/7 navigation depth of 5 metres, large private yachts and power boats would visit the Tamar from interstate and overseas during the tourist season, berthing at the Launceston Seaport, a new proposed marina at Kings Wharf, and the proposed marina at Rosevears.

- **River cruising**

Large 100 to 200 passenger tourist boats on day excursions from Launceston to Low Head with stops at waterfront access vineyards, and resorts, with no navigational time restrictions

- **Sale of freshwater to Victoria**

In the longer term, the sale of up to 10% of the wasted freshwater flowing from the Tamar catchments out to Bass Strait. Tamar Lake studies have shown that a water volume equivalent to the production capacity of the Wonthaggi desalination plant could be delivered by new technology undersea pipeline to Wonthaggi at a delivery cost of \$100 per ML.

For the area, north of the barrage:

which includes George Town, Bell Bay, Beauty Point etc.:

- **No sediment accumulation downstream the barrage**

The 3 D sediment modelling has shown that despite the movement of the sediment flocculation zone from near Tamar Island to downstream the barrage the fine particle sediment remains in suspension in a freshwater layer over the outgoing saltwater tidal flows out to Bass Strait. This is achieved by releasing accumulated freshwater in the lake through the gates at the top of the barrage on the ebb tides twice per day.

- **Flood level mitigation for all flood events up to a 200 Year event**

With the ability within 12 hours of the next high tide in the Tamar estuary to lower the level of the lake by 1 metre to provide a flood buffer of at least 45,000 ML, flood levels upstream of the barrage can be reduced by at least 1 metre.

With the same buffer size of 45,000 ML, the beneficial effect on flood levels for the more frequent flood events of 1 in 5 years to 1 in 50 years is more significant. For example, during the 1 in 50 year event in June 2016 flood waters would not have inundated the low lying areas around Launceston on the “wet” side of the levee system, such as Royal Park, the Boardwalk, Tamar Rowing Club, Newstead etc.

- **A large cruise liner mooring facility**

The possibility of the Tamar Estuary and George Town becoming a must do stop for cruise liners visiting Tasmania, with the larger vessels (2,000 to 3,000 passengers) moored in the sheltered waters between Kelso and Lagoon Bay, Low Head, (see Figure 2) and the smaller (300 to 500 passengers) luxury liners (Silversea etc.) berthing at Inspection Head wharf.

For the larger vessels, the ships tenders could unload passengers at George Town or Beauty Point for shore excursions.

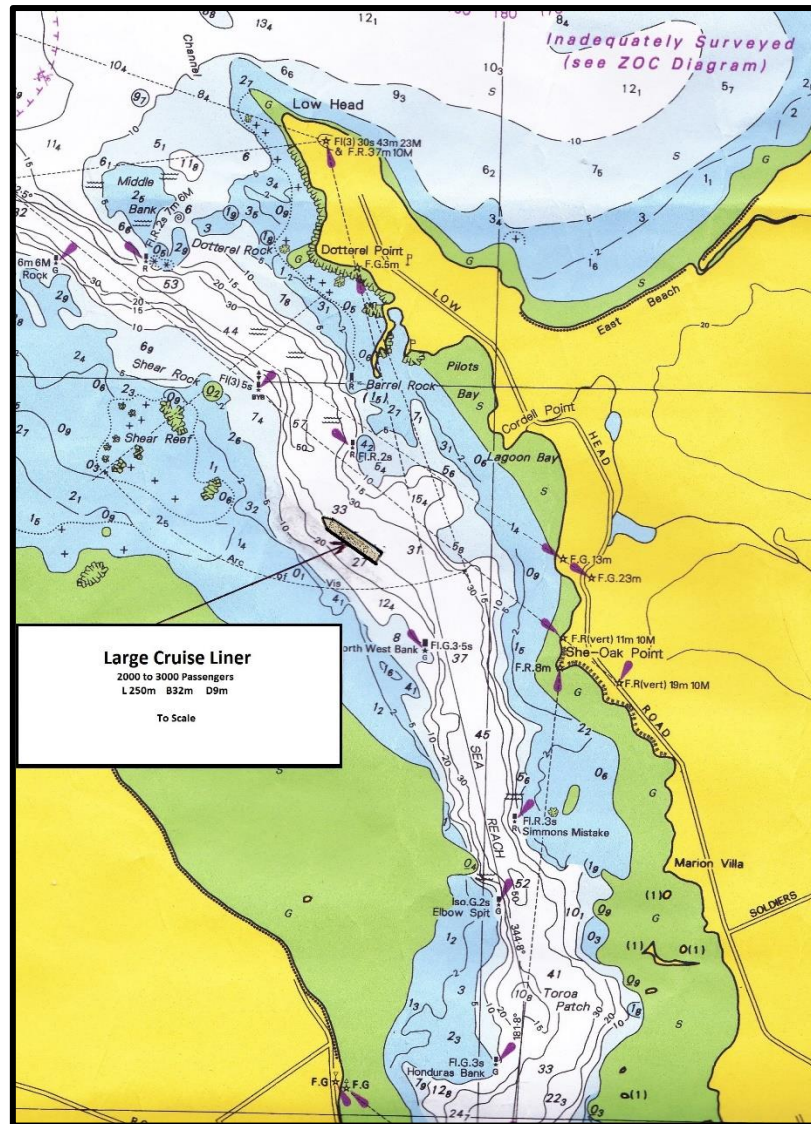


Figure 2 - Navigation Chart - Port Dalrymple area

The mooring facility and navigation depth is very similar to the current mooring facility at Port Arthur that is visited by many large cruise vessels each tourist season. This would be possible because the large reduction in tidal prism between the barrage and the estuary entrance would reduce the peak tidal currents past George Town from 1.7 m/s (6.12 km/hour) to a more manageable 0.3 m/sec (1.08 km/hour). Shore excursions could include:

- A history and sightseeing tour to Launceston and surrounding areas by bus or tour boat
- A round of golf at Barnbougle and/or Lost Farm golf courses
- Full day Tamar Valley wine tour
- ½ day history tour of George Town, and Low Head including Maritime Museum and Penguin Rookery
- ½ day tour of Beaconsfield Mine Museum, and Platypus and Sea Horse exhibits.

- The potential to cater for greatly increased freight traffic at the Bell Bay Port**

According to TasPort's Bell Bay Port Information there are currently time limitations for cargo vessels wishing to berth at and depart from Bell Bay wharves.

Entry: Vessels over 140m in length must enter on a flood tide only, with the earliest entry at low water at Low Head up to 30 minutes before high tide at Low Head.

Departure: From 1 hour before to 1 hour after high water or low water, depending on draught and tide.

This has yet to be confirmed by TasPorts, but because these limitations are all tidal flow rate dependent, it seems likely that in a Tamar Lake environment that these limitations would be removed because the reduction in the peak tidal flows from 1.7m/s (6 kms/hr) to 0.3m/sec (1 kms/hr).
- Bell Bay industrial development**

With increased port capability and nearby access to an unlimited supply of freshwater, there is the potential for greatly increased production in the Bell Bay industrial zone.

Bell Bay could once more be a thriving industrial zone and port with a wide range of additional manufacturing and freshwater dependent industries, which in turn would boost the economic development of George Town.

For the area between the barrage at Rowella and Freshwater Point/Dilston:

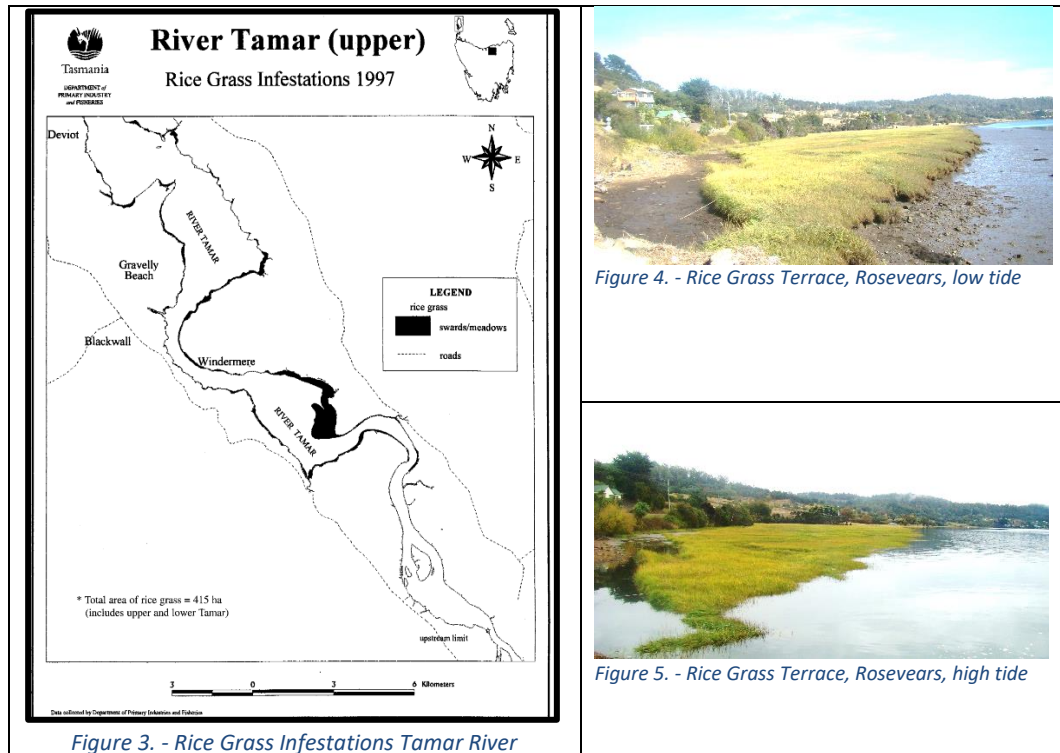
- A Tamar Valley Irrigation Scheme**

Greatly expanded agricultural development on both sides of the Tamar Valley. The Tamar Valley becoming a major wine and fruit growing area with 95% irrigation certainty. The studies showed a potential irrigable area on both inside slopes of the Tamar of 15,000 hectares, and a concept scheme by Tas Irrigation identified a potential 22,000 hectares of irrigable land on both the inside and outside slopes of the west bank.
- Freshwater recreational fishing**

The Tamar Lake becoming a major centre for freshwater aquaculture and recreational fishing, but at the expense of moving snapper and flathead fishing downstream the barrage from the current Batman Bridge/Moriartys Reach area. Further studies would be required into the type of fish that could be stocked in Tamar Lake, but anecdotally eels and trout should thrive in this environment.
- Rice grass eradication**

Improved aesthetic presentation and amenity access to the lake waters with the elimination of rice grass terraces along the banks between Rosevears/Dilston and the Batman Bridge on both sides of the lake. In a freshwater Tamar Lake environment, the rice grass will to die off and decay, allowing the removal of the terraces and re-colonisation of native species.

Figure 3. shows the extent of the 450 hectares of rice grass infestation in this section of the river, with Figures 4. and 5. showing the extent of rice grass terracing restricting access to the waterway in front of Rosevears Tavern.



- **Water quality upstream of the barrage**

As with any large body of constrained freshwater fed from a large rural and urban catchment area, Tamar Lake will have the potential for algal blooms to form on the surface of the lake during the warmer days of mid to late summer.

The 3D water quality modelling carried out for these studies by BMT WBM³ confirmed that despite a reasonable average flushing rate of the lake of 8 times per annum, and Tasmania's cool temperate climate feeding cool water from the Tasmanian highlands, the 20 km stretch of the lake just upstream of the barrage would be highly susceptible to the formation of anoxic (low dissolved oxygen levels) at depth which would threaten the local ecology, and to the formation of late summer algal blooms on the lake surface, reducing the amenity value of this area.

The modelling carried out for this report, however, provided only a worst-case snapshot of the environmental conditions for a single year (2010/2011) and based on theoretical nutrient sediment flux rates sourced from a distributed sediment bed and the catchment at some unknown future point in time.

The desirable results of a forecast of the frequency and duration for any outbreak to occur to provide certainty to any decision to proceed, should be based on measured nutrient sediment flux rates in the period immediately following the formation of the lake, and for an extended time after construction, and on a wide range of simulated weather conditions over 50 to 100-years.

³ Tamar Lake sedimentation and water quality modelling - B20921.008.Scenarios_Update.

With constraints on the Tamar Lake budget at this feasibility stage, coupled with the very high cost of using the Tamar Estuary 3D model over multi-year simulation periods, the level of certainty that was obtained for all the other modelling carried out for this study, was not able to be achieved in this case.

These studies are covered in detail in Section 3 of Part 2 of this report, with recommendations for the additional modelling that would need to be carried out by the proponent in the planning and approvals stage for this project to achieve a higher degree of certainty of the risks associated with the frequency and duration of degraded water quality conditions in the area just upstream of the barrage.

For the area between Freshwater Point/Dilston and the Cataract Gorge in Launceston

- **No new silt deposition in this section of the lake**

A “clean, green” silt free and low turbidity⁴ Tamar that enhances the clean, green image of the State. This section has been accumulating new sediment at an average rate of about 39,300 tonnes per annum⁵ since before European settlement, with the consequent reduction in river width and depth making navigation in this section very restricted.

Bucket dredging and sediment raking since the 1880s has been used to maintain minimum navigation depth in the channel with no permanent results. The current raking program costing has been quoted at \$300,000 per annum.

Recent raking of the Yacht Basin and Home Reach has simply moved a quantity of sediment down river only for it to return within 12 months⁶ on the asymmetrical tidal action.

The following navigation charts for the years 1833 and 2008 show the increase in size of Tamar Island (Mud Island) and the reduction in low tide navigation channel depths from 2 to 3 fathoms (3.6m to 5.4m) in that area to the current 2 to 3 metres.

⁴ **Turbidity** is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. The measurement of **turbidity** is a key test of water quality.

⁵ Foster (1986) Report on Sedimentation Processes

⁶ LFA – Tracer Analysis of Sediment Redistribution of Tamar Estuary for Launceston Flood Authority – May 2015

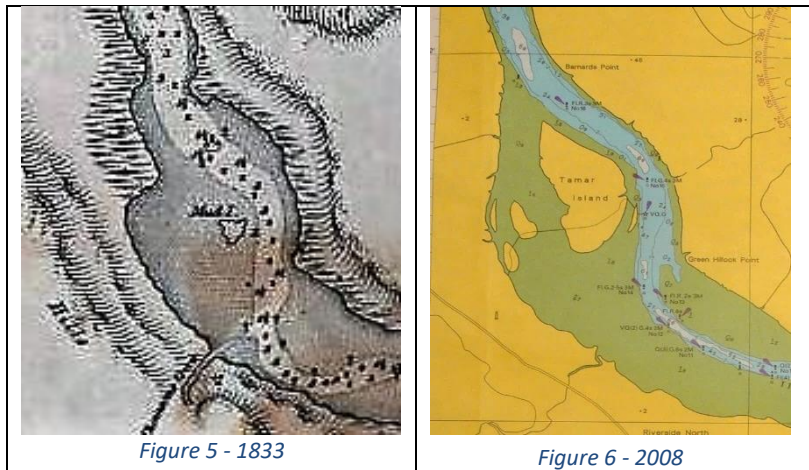


Figure 5 - 1833

Figure 6 - 2008

- **Water quality improvement in Zone 1**

The studies showed that prior to the implementation of the medium term TasWater Launceston Sewerage Improvement Plan (LSIP) and the longer term NRM North catchment focused Water Quality Improvement Plan (WQIP), the water quality in Zone 1 would, in the short term, improve from current D to B quality which would be the same as the current water quality in Zone 2.

The principal reasons for this is that 80% of the pollutants entering the Tamar do so either from the South Esk catchments through the Tailrace or from the sewerage treatment plants (STPs) at Ti Tree Bend and Riverside. With the removal of the asymmetrical tidal action, these pollutants are washed one way downstream instead of being pumped back upstream into the Yacht Basin and Home Reach.

This also applies to any Combined System Overflow (CSO) situations when the strong storm water flows combined with sewerage overflows, including solids, are moved rapidly one way downstream instead of being locked into the Home Reach/Yacht Basin area with the asymmetrical tidal action.



A permanent increase in flows down the Cataract Gorge could only enhance this rapid clearance of pollutants downstream. The Tamar Lake Inc. modelling of the water quality in this zone presumed a permanent flow down the Cataract Gorge of 20 cumecs; up from the current metered 2.5 cumecs.

- **Greatly increased aquatic recreational amenity**

A permanent high-water level combined with low turbidity, low pollution water will greatly enhance the recreational amenity for visiting tourists and residents of Launceston.

This would facilitate a very wide range of white water, swimming, and aquatic sports 365 days per year at multiple locations on the lake, including the Yacht Basin, Home Reach and the Launceston surrounds.

These sports could include:

- State, National and International rowing events on the Home Reach 2,000 metre course without having to worry about tides and water quality.
- A rejuvenated Tamar Yacht Club conducting sailing training in cadet dinghies in the Yacht Basin, and sailing races from the clubhouse down to the Barrage and back.
- Other sports that are currently run on Lake Trevallyn could be run on the more convenient Tamar Lake at Home Reach.

- **High water flows down the Cataract Gorge**

A combination of the large economic benefits that will accrue to the State from the implementation of the Tamar Lake project, and the plans by Hydro Tasmania to almost double the State's power generating capacity with wind, solar and pumped hydro technologies, should enable the Cataract gorge flows to be permanently increased to say 25 cubic metres per second (the same flows that were used for the white water rafting program) from the current 2.5 cubic metres per second, with an economic penalty of about 1% of the current hydro generating capacity of 2,600 MW.

These increased water flows will also greatly assist in sweeping any pollutants entering the Tamar from the Launceston urban area more rapidly downstream.

- **Why implement the LSIP and WQIP programs?**

If the Tamar Lake implementation provides a substantial improvement in the Zone 1 water quality in the short term, why expend limited capital on these longer-term projects?

In the case of the TasWater Launceston Sewerage Improvement Plan (LSIP), for a modern society and particularly to ensure that there is no detrimental effect on Tasmania's clean, green image, any discharge from Launceston's STPs must meet the relevant legislated EPA requirements.

The current LSIP plan also has the economic benefit for TasWater of the rationalisation of the current 7 seven STPs into 2 STPs located at Ti Tree Bend, and specifically the removal of the discharge points into the North Esk at Hoblers Bridge and Norwood, and into the South Esk at Prospect.

In the case of the NRM North Water Quality Improvement Plan (WQIP), all pollutants entering the Tamar from the farmlands and logging activities in the extensive South Esk catchments, including nutrients from farm fertilization and waste products (enterococci) from sheep and cattle are excessive and must be reduced with improved farm and land management practices.

In the case of both plans, the expenditure for implementation produces no direct or indirect returns for the Tasmanian economy; it is a straight expenditure of taxation revenue.

In contrast, the Tamar Lake project is a capital infrastructure investment with a forecast onetime benefit to the Northern Tasmanian economy of 10% of Gross Regional Product in the 15 years post construction of the barrage.

Funding the project

Acknowledging the significant level of funding required to implement the project, Tamar Lake Inc. commissioned AECOM in February 2017 to estimate the potential for value capture funding methods to contribute to private funding of the Tamar Lake project.

This report concluded that given the current indicated construction cost of \$320 million, the benefits to property values alone from the project greatly exceed its costs:

- The uplift in median residential property values in Launceston following construction of the Project and stabilisation of values is conservatively estimated to be \$1 billion.
- The uplift in median unimproved commercial land values in the Launceston CBD within 500m of the riverfront following construction of the Project and stabilisation of values is estimated to be \$434m.

AECOM identified the following potential value capture funding methodologies to be applied to the Tamar Lake project:

- Selling development rights and / or density above existing zoning controls.
- Sale of government-owned land that is enhanced or made developable by the project.
- Captured through public taxation system such as land tax and stamp duty, (possibly captured through sharing value uplift with surrounding landowners).

The encouraging outputs from this AECOM study support further work being undertaken into the application of value capture funding to the Tamar Lake project. Tamar Lake Inc. recommends this work be included in the broader socio-economic study that would be initiated as part of preparation of formal business case for the development of the Tamar Lake.

Strategy summary

In summary, the logical strategy for Launceston and the Tamar Valley is to INVEST in the Tamar Barrage implementation in the short term to provide the justification and increased revenue to pay for the EXPENDITURE on the LSIP and WQIP in the longer term.

Conclusion

In conclusion, within 12 months of the completion of the Tamar Barrage, the following would occur:

- The water behind the barrage would transition to a freshwater storage reservoir of approximately 405 GL with a 24/7 water level close to the current normal high tide level
- There would be no more sediment accumulation in this reservoir, or in the area between the barrage and Bass Strait provided the excess freshwater is released through the barrage on an ebb tide.
- Flood mitigation for the low-lying areas of Launceston and the Tamar Valley that are not behind the flood levee system
- A significant improvement in water quality and turbidity in the Yacht Basin/Lower North Esk and Home Reach sections around Launceston

These almost immediate benefits would stimulate the Northern Tasmania economy with new tourism infrastructure developments; increased attraction for existing waterside facilities; residential and commercial property construction; and would enable the planning and implementation of a comprehensive Tamar Valley Irrigation Scheme to stimulate agricultural production in the Valley.

Above all, while Launceston is already an attractive place to live and work, it would benefit enormously from increased migration from mainland capital cities with residents seeking to escape the traffic and residential congestion of those cities and enjoy the year-round aquatic amenity afforded only a limited number of small cities around the world.
