8 Summary and recommendations

The environmental quality of the Tamar Estuary is a function of its physical setting, as well as historic and on-going inputs of pollutants. The estuary's physical features play an important and controlling role in the ultimate fate and distribution of contaminants. The Tamar is a narrow, highly tidal estuary with relatively large freshwater inputs at its head, and is presumed to be well-flushed, although residence time has not been determined. Broad tidal flats and wetlands border a relatively deep central channel, and become more extensive in the estuary's upper reaches. The Tamar's large tidal range (3 m) and strong tidal currents have resulted in an active sediment transport regime - marked by rapid sedimentation in the upper reaches - and a long history of dredging. The Tamar's catchment is very large (10,000 km^2) and land use is predominantly agriculture and forestry. River flows from the South Esk Basin are strongly influenced by hydropower developments at Poatina and Trevallyn.

Contaminants enter the estuary from a variety of point and non-point sources. These include sewage and industrial effluent, urban run-off (sometimes combined with sewer overflows in Launceston), atmospheric and ground-water pollution, as well as agricultural and mining run-off from the catchment. Until fairly recently (1980/90s), the majority of urban, industrial and mining wastewater was poorly treated. Contaminants associated with these sources include pathogens, nutrients, BOD and TSS (sewage and urban run-off), as well as metals, fluoride and cyanide (mining and metal processing industries). There have been significant decreases in most end-of-pipe emissions over the past 5 to 10 years - particularly due to sewage treatment plant upgrades and improved treatment of wastewater from TEMCO and Comalco. At this point, the remaining significant inputs are probably derived from diffuse sources, such as urban run-off (particularly CSOs) ground-and surface-water emissions from tips and contaminated sites, mining wastes and agricultural run-off from the South Esk catchment, and atmospheric contributions from urban and industrial activities. Some pollutants may also be derived from contaminated sediments within or adjacent to the estuary itself.

At present, the Tamar shows indications of environmental degradation in several areas, as outlined in Figure 28 and Table 31. These conclusions, however, are supported by *very limited information.* Most monitoring programs and studies relating to the Tamar's environmental quality are over 10 years old, were of short-duration, surveyed limited areas and focused on a limited range of contaminants. Furthermore, we have a poor understanding of the processes which control environmental quality in the Tamar - particularly with respect to estuarine circulation and sedimentation. It is strongly recommended that a comprehensive environmental survey of water, sediments and biota be carried out and that the on-going monitoring program be revised in light of these findings. It is possible that that the major issues and areas of concern highlighted in this report could shift significantly, once additional information is available.

On the basis of existing information, the following environmental issues appear to be of most concern in the Tamar Estuary. Water quality contamination by ***pathogens*** (faecal indicator bacteria) derived from sewage and abattoir wastes has historically been a problem in the upper estuary, with levels frequently exceeding guidelines for secondary contact recreation. Since 1994, however, when the Hoblers Bridge WWTP was upgraded and began treating industrial wastes, there has been a significant improvement. Still, several sites in North Esk River and upper Tamar (above Freshwater Point) exceed guidelines for primary contact recreation. Sources of faecal contamination have not been identified, but presumably reflect some combination of urban run-off, sewage, agricultural run-off and waterfowl/wildlife.

Heavy metals, particularly zinc and cadmium, appear to be elevated in several areas of the Tamar - notably the upper estuary around Launceston, Deceitful Cove and (possibly) Middle Arm. Heavy metal concentrations in water, sediments and shellfish collected from these areas have been in excess of recommended Australian and international guidelines, and as recently as 1993, it was recommended that oysters collected from the Tamar should not be consumed due to heavy metal contamination (Gawn and Richardson, 1993). There have been significant reductions in end-of-pipe emissions from industries in the lower estuary over the past 5 years, however, mining wastes from the Aberfoyle/Storeys Creek area still appear to be a significant source. Other diffuse sources of heavy metals may include ground-and surface-water emissions from tips and contaminated sites, urban run-off, and contaminated sediments/dredge spoils in or adjacent to the estuary.

The Tamar receives inputs of ***sediments*** from catchments of the South and North Esk Rivers, which, due to estuarine hydrodynamics, accumulate as fine-grained silt deposits in the upper reaches of system. These sediments probably serve as an effective trap for heavy metals and other contaminants from past mining in the South Esk catchment and other industrial activities in the Launceston area. The upper estuary has been extensively dredged over the past 50 to 100 years, as the accumulated sediments impede navigation, exacerbate flooding and are considered aesthetically undesirable. Environmental impacts of dredging activities and dredge spoil disposal have never been fully investigated.

Very little data is available on ***nutrients*** or chlorophyll *a* in the Tamar, beyond some indications of elevated phosphates in upper reaches. However, inputs from sewage treatment plants and agricultural activities in the South Esk catchment are relatively high. The Tamar is not known to experience recurrent nuisance algal blooms.

At the ecosystem level, ***introduced species*** have been identified as an issue of concern, particularly rice grass (*Spartina anglica*), which appears to accelerate siltation rates, and the Pacific oyster, which has colonised large areas of mudflats throughout the estuary. There is concern that other potentially destructive species (e.g. toxic dinoflagellates, Northern Pacific seastar) could also be introduced via ships ballast water. The degradation and potential loss of ***wetlands*** and seagrass beds is another important issue.

In summary, limited environmental monitoring data indicates that the Tamar is environmentally degraded in several areas, particularly in the vicinity of Launceston and near major industrial and mining areas. There have been a number of significant improvements in industrial and sewage emissions over the past 10 years. As major point sources around the estuary are progressively upgraded, it is anticipated that diffuse sources will contribute the majority of contaminants. These diffuse sources - urban, agricultural and mining run-off, atmospheric inputs, ground-water contamination - are typically difficult and expensive to remediate and will require careful planning and catchment-based solutions.

Recommendations

Improve environmental quality information

- A comprehensive survey should be carried for the entire estuary to document existing environmental quality of waters, sediments and biota. This should include the mapping of sediments, ecosystem types and important biological communities;
- The existing Tamar monitoring program conducted by Launceston City Council /DELM should be reworked in light of the findings of this survey and should include a broader range of parameters;
- A weekly bacterial monitoring program should be implemented at bathing and other areas used for primary contact recreation. The program should follow sampling procedures in line with the ANZECC guidelines;
- Hydrology and sediment transport in the estuary should be investigated;
- This 'State of the Tamar' document should be periodically updated/revised to review progress and raise awareness.

Review/refine input estimates

- Periodic review of licensed premises' monitoring data and requirements is recommended within a 'whole-of -estuary' context. Mass emissions should be routinely determined for point and diffuse inputs. Flow-proportional monitoring may be necessary, in some cases;
- Sewage mass loadings should also include inputs from storm-induced overflows and spills;
- Estimates of urban run-off/CSO inputs should be refined, using site-specific data where available;
- Inputs from industrial and municipal RDS and contaminated sites should be estimated;
- Mining inputs from the South Esk catchment may still be a significant source of metals - particularly during flood events. Mass loadings from this source should be estimated;
- Potential inputs from contaminated sediments/dredge spoil deposits should be assessed.

Possible actions to improve environmental quality in the Tamar

- Remediate CSOs in Launceston;
- Determine source and, if possible, remediate elevated bacteriological levels at upper Tamar/North Esk sites;
- Reduce/remediate mining inputs from Storys Creek/Rossarden;
- Evaluate effects of dredging/spoil disposal as regards metal contamination and ecosystem impacts;
- Address sediment contamination at Deceitful Cove;
- Assess viability of controlling existing introduced species, develop/implement strategy to avoid new problems (e.g. ballast water controls);
- Maintain/preserve important ecosystems (e.g. wetlands, seagrasses).

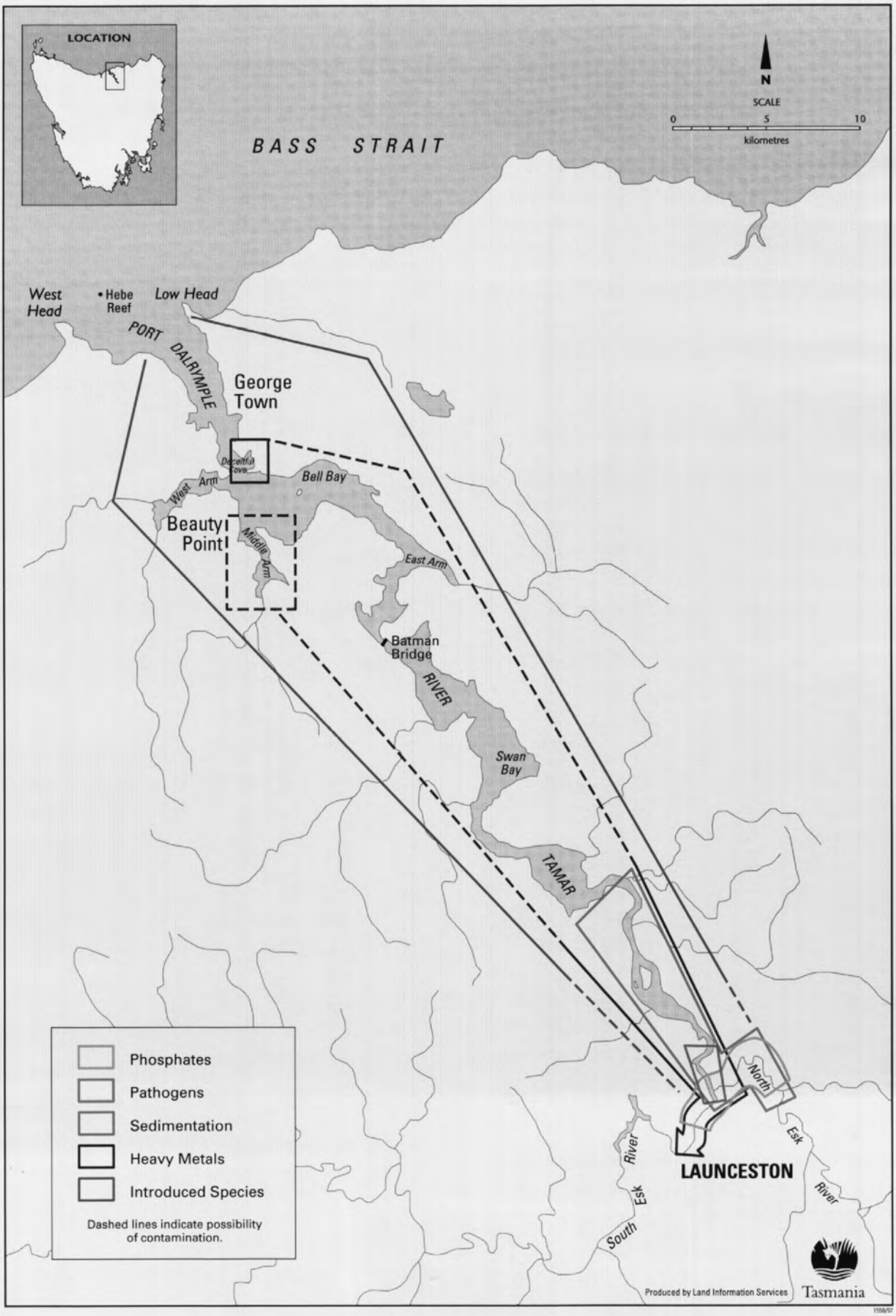

Figure 28 The Tamar Estuary: major environmental issues

Table 31 Summary of environmental issues in the Tamar Estuary

ISSUE	STATE	PRESSURE	POSSIBLE ACTIONS	INFORMATION
Pathogens				
Upper estuary (Hoblers Br. to Freshwater Pt.)	frequently exceeds primary contact recreation guidelines	sewage, agriculture, stormwater, wildlife, recreational boats	investigate; remediate	quarterly surveys @ 16 sites (1971 - present)
Bathing beaches	unknown some high levels recorded at Lagoon Beach, First Basin and Rotary Park in 1989	sewage, agriculture, stormwater, wildlife, recreational boats	investigate.	no recent data surveyed Jan-Mar, 1989
Dissolved oxygen				
Upper estuary	all sites > 6 mg/L (Hoblers and Henry St Bridges often lower until 1992)		no action	quarterly surveys @ 16 sites (1971 - present)
Suspended sediments				
	moderate to high (5-20 mg/L)	natural inputs from catchment, tidal mixing	no action	quarterly surveys @ 16 sites (1971 - present)
Nutrients				
orthophosphate	elevated in upper estuary, above Tamar Yacht Club (> 15 to > 300 µg/L)	sewage, agriculture, stormwater	investigate; remediate	quarterly surveys @ 16 sites (1971 - present)
Other nutrients	unknown		investigate	no clear data
Phytoplankton; chlorophyll a	unknown		investigate	no data
Heavy Metals				
Deceitful Cove	elevated Al, Mn, Zn, Cd, Pb,	industry	remediate	water, sediment and shellfish surveys 1992
Upper Estuary	elevated Zn, Cd, Pb, Cu	mining at Rossarden and Storys Creek, industry at Launceston, contaminated estuarine sediments and dredge spoil piles	investigate; remediate	water survey 1986 sediment/shellfish surveys 1973/74
Lower Estuary	elevated Al, Mn, Zn, Pb	industry at Bell Bay, sources in upper Tamar	investigate remediate	water, sediment and shellfish surveys 1992
Middle Arm	elevated Pb, Zn and Cu	Beaconsfield gold mine	investigate	sediment/shellfish surveys 1974
Fluoride				
	slightly elevated at Big Bay	industry	review guidelines	quarterly surveys @ 16 sites (1971 - present) localised surveys (1992)
Hydrocarbons				
lower estuary	low concentrations	Iron Baron oil spill (July 1995)	on-going monitoring no other action	oyster surveys 1995/96
middle/upper estuary	unknown	NA	investigate	no data

ISSUE	STATE	PRESSURE	POSSIBLE ACTIONS	INFORMATION
PAHS				
Deceitful Cove	low/high (contradictory findings)	industry, shipping	investigate	2 sediment/biota surveys 1992
lower estuary	low	industry, shipping	review reports	sediment/biota survey 1992
upper/mid-estuary	unknown		investigate	no data
Phenols				
Deceitful Cove	elevated	industry	remediate	water survey 1992
lower estuary	elevated	industry, shipping	remediate	water survey 1992
upper/mid-estuary	unknown		investigate	no data
Pesticides				
DDT/Dieldrin	not detected		monitor biota	quarterly surveys @ 16 sites (1971 - 1981)
other pesticides	unknown		investigate	no data
PCBs	unknown		investigate	no data
Sedimentation				
@ Home Reach				
Amenity/safety issues	impedes navigation. flooding concerns	sediments are derived/transported from natural sources	investigate reduce inputs alter hydrodynamics dredge levee augmentation no action	Foster et al., 1986
Dredging/disposal issues lack of disposal sites	approx. 2 years space remaining		identify new sites reduce dredging recycle spoils	
Dredging/disposal issues contaminated sediments contaminated spoil piles	areas being dredged probably contain heavy metals Spoil piles contain heavy metals (Cd, Zn, Cr); run-off/leaching to estuary	industry, mining, contaminated sediments	investigate contaminant levels and distribution identify/reduce inputs monitor/manage spoil sites	DPIF, 1993
Introduced species				
Rice grass	severe infestation	planted in 1950	control/contain	Hedge/DPIF, 1997
Pacific oysters	severe infestation	introduced to Port Sorell self-propagating	control/contain	
Wetlands	unknown		investigate	
Seagrass beds	unknown		investigate	