State of the Derwent

Year 2005–06 Report Card

The Derwent estuary

The Derwent estuary lies at the heart of the Hobart metropolitan area and is an asset of great natural beauty and diversity. Named after the Celtic word for 'clear water' in 1794, the Derwent is an integral part of Tasmania's cultural, economic and natural heritage. The estuary is an important and productive ecosystem and supports a wide range of habitats and species.

The Derwent estuary

Approximately 40% of Tasmania's population – 203,000 people – live around the estuary's margins. The Derwent is widely used for recreation, boating, fishing, marine transport and industry. Further upstream, the Derwent supplies the majority of the region's drinking water supply and is a major source of hydroelectric power.

A number of environmental issues affect the Derwent estuary, in particular:

- heavy metal contamination
- introduced marine pests
- loss of estuarine habitat and species
- intermittent faecal contamination of recreational waters
- depressed oxygen levels and organically enriched sediments in the upper estuary
- elevated nutrient concentrations
- environmental flows and barriers.

Although there have been significant improvements in the treatment of sewage and industrial wastes over the past decade, the Derwent still faces a number of environmental challenges. A strategic and coordinated planning approach across all levels of government, industry and the community is our best hope for a clean and healthy estuary in the future.

Management and restoration

The Derwent Estuary Program (DEP) was established in 1999 as a partnership to restore and protect the Derwent estuary. The program has been highly successful in bringing together a wide range of stakeholders: first to build a common understanding, vision and management framework, and second to progressively implement this vision through formal partnership agreements and practical actions.

The program was initially designed to address environmental quality issues such as industrial and urban water pollution, contaminated sediments, introduced species and loss of estuarine ecosystems. More recently, foreshore issues have also been included within the program.

Our Environmental Management Plan is currently being reviewed to guide management for a further five years. In addition to the State Government, regional councils and the Australian Government, many other stakeholders participate in and support the DEP, including major industries and utilities, community groups and research institutions. Part of the review process has been the development of a five-year science plan, which prioritises key environmental issues within the Derwent catchment and focuses on the implementation of monitoring programs and targeted research that support management actions.

Key aspects of implementation include environmental monitoring and reporting, coordination of regional activities and implementation of priority projects such as effluent reuse, stormwater management and wetland conservation.

Derwent Estuary Program

Environmental monitoring and reporting

A fundamental requirement for effective natural resource management is an ongoing and reliable source of environmental data.

This principle formed the basis of the Derwent Estuary Monitoring Agreement, signed in August 2000 by the State Government, six local councils and four commercial partners (Norske Skog Boyer, Zinifex Hobart Smelter, Tasmanian Ports Corporation and Hobart Water). The signatories agreed to coordinate their independent monitoring programs to provide better information on the estuary as a whole, and to report annually on environmental conditions and trends in the Derwent.

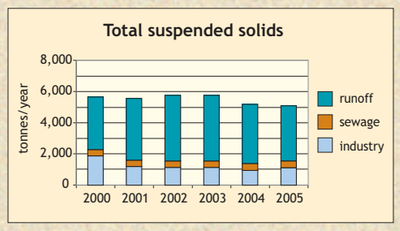
Monitoring water quality

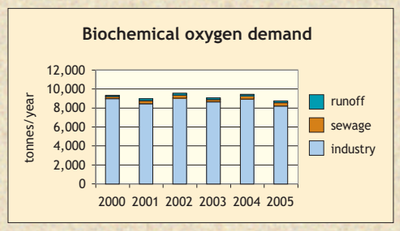
This is our annual 'report card' to the community and summarises monitoring data and other relevant information collected during 2004 and 2005, and the summer of 2005–06. More detailed information can be accessed in the State of the Derwent Estuary report, available on our website at **www.derwentestuary.org.au**

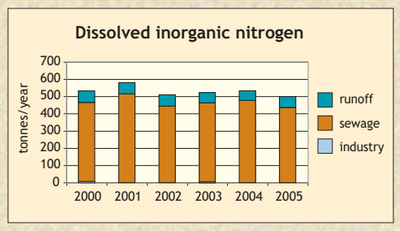
Monitoring activities carried out during 2004–05, and the summer of 2005–06 included the following:

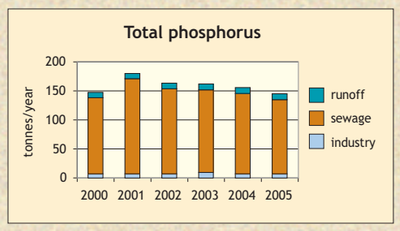
- weekly recreational water quality testing during summer months
- monthly whole-of-estuary water quality monitoring
- monthly monitoring of stormwater outfalls and rivulets
- surveys of sediment condition, and degree of contamination
- routine surveys of mercury in flathead and heavy metals in shellfish.

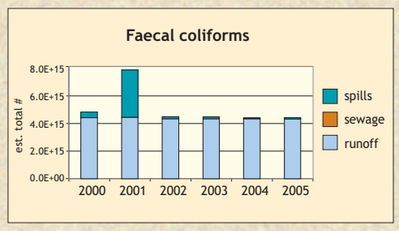
Pollution Sources, Loads and Trends

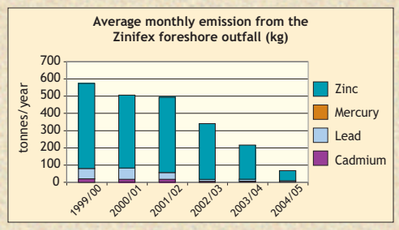












Pollution can enter the Derwent estuary from many sources. These commonly fall into two categories: point sources and diffuse sources. Point sources include Sewage Treatment Plants (STPs) and large industries, such as the Norske Skog paper mill at Boyer and Zinifex Hobart Smelter at Lutana. There are 12 STPs in the estuary catchment, however two of these are on full effluent reuse and therefore do not discharge to the river. Diffuse sources, which can be difficult to quantify, include urban runoff (stormwater), tips and contaminated sites, catchment inputs carried by the Derwent and Jordan rivers, air pollution and wastes associated with shipping, ports and marinas. Sediments within the estuary itself can also be a source of pollutants that are released into the overlying waters.

Contaminants released or transported into the river from these various sources include pathogens, nutrients, organic matter, wood extractives such as resin acids, silt, litter and a range of toxicants including heavy metals and hydrocarbons.

Sewage treatment plants contribute the majority of the nutrient load to the estuary, however there has been a steady decline in total phosphorous loads over the past five years, while suspended solids have increased slightly, due to variations in plant performance. The greatest source of suspended solids transported to the estuary is urban runoff. Stormwater also contributes significant loads of faecal bacteria to the estuary, as a result of animal droppings, aging infrastructure, sewage overflows, and illegal cross connections between the sewage and stormwater systems.

Industry contributed the greatest loads of organic carbon, resulting in increased biochemical oxygen demand or BOD (BOD is the amount of oxygen required to break down biological material in the water). However, loads in 2005 were slightly lower than 2004. Norske Skog reported a 7% reduction in biochemical oxygen demand from 2004 to 2005.

Zinifex continued to report significant reductions in metal loads to the estuary, with a 70% decrease in zinc loads entering the estuary via the foreshore outfall from 2004 to 2005. Cadmium, mercury and lead losses via the outfall were also significantly reduced.

Monitoring stormwater quality

The DEP's Rivulet and Stormwater Monitoring Program includes analysis of various water quality parameters each month in 12 rivulets and five stormwater drains. Quarterly sampling runs are also analysed for additional parameters. The program commenced in July 2002 and is a joint effort between the Derwent Estuary Program, Derwent Valley Waterwatch and five councils: Kingborough, Clarence, Hobart, Brighton and Glenorchy. Base-flow samples were taken from the waterways and analysed for total suspended solids (soil suspended in the water), nutrients, heavy metals and faecal bacteria.

The monitoring program provides local knowledge on stormwater quality and its influences across the region. As the sources and magnitude of stormwater pollution are revealed, informed and targeted management responses can be implemented.

Most rivulets showed acceptable concentrations of turbidity and suspended solids at both upper (undeveloped) and lower (urbanised) sites, under base or low flow conditions. Wet weather flows deliver far higher loads of suspended solids into waterways, and provide visual evidence of the way pollutants can be transported from land into water during rain and flood events. Levels of faecal coliforms were of particular concern, even under dry flow conditions.

Derwent Water and Sediment Quality

Swimming in the Derwent

Each summer, councils and the State Government monitor the recreational water quality at 38 sites around the estuary. Sampling is conducted weekly from November through March, at the locations shown on the map overleaf. The indicator used to detect faecal contamination is enterococci, in line with the recently released national guidelines.

To describe the risk level to swimmers three water quality grades are used: green indicates good, orange indicates intermediate and red indicates poor water quality.

Enterococci levels were generally low during the most recent monitoring season (2005–06). High water quality was consistently observed at swimming beaches at Opposum Bay, Blackmans Bay, Taroona and Hinsby Beach. Water quality at sites located above the Tasman Bridge was generally poor, with heavily urbanised and industrialised areas subject to the greatest contamination.

Poor or variable water quality at several popular beaches in the lower estuary was the focus of in-depth studies by councils. Investigations at Howrah Beach, Kingston Beach and Nutgrove Beach will continue in the 2006–07 monitoring season.

Junior triathlon at Little Sandy Bay Beach

Water quality indicators

The DEP coordinates a comprehensive whole-of-estuary monitoring program that integrates sampling carried out by DEP, Zinifex Hobart Smelter, Norske Skog and Hobart Water. During 2004 and 2005, 28 sites were monitored monthly for a range of parameters, including temperature, salinity, dissolved oxygen, suspended solids, nutrients, organic carbon, chlorophyll a and heavy metals.

Heavy metals, particularly zinc, have significantly declined since monitoring programs commenced in the 1970's. Recent data shows that the major sources of zinc to the estuary are losses from the Zinifex site through contaminated groundwater and loads contributed from the catchment through urban stormwater run-off. The highest concentrations measured are in the embayments in the middle estuary, north of the Tasman Bridge. At the mouth of the estuary, the concentration of zinc is generally below the limit that can be detected in laboratory analysis.

Water clarity in the Derwent is generally good for an estuary that lies at the heart of an urban environment. The clarity of water is affected most during storms and floods, when wind and high river flows keep soil and sediment suspended in the water. The natural tannin colouring of the water is derived from the leaching of peat lands and organic material such as button grass, in the upper catchment. There have been no recorded cases of significant algal blooms in the estuary, other than isolated seasonal occurences of the dinoflagellate *Noctiluca scintillans*. This non-toxic species can bioluminesce (glow) which can be quite spectacular at night.

Nutrients in the Derwent come from two major sources: catchment inputs (influenced by agricultural practices, STPs, urban runoff and industry) and the seasonal influx of nutrient rich water from the Southern Ocean. STPs have a significant impact on the level of nutrients in the estuary, however those plants that incorporate tertiary treatment (Rosny and Selfs Point) and reuse (Brighton and Bridgewater) have the capacity to significantly reduce the concentration of phosphorous and ammonia that enter the estuary.

Contamination in sediments

Derwent sediments

Sediments act as a long-term store of contaminants such as heavy metals, and can provide an accurate record of past metals loads. In 2004, the Australian Government's Coastal Catchment Initiative (CCI) grant to the DEP funded the collection of long cores to determine the rate at which sediments are laid down in various parts of the estuary, and to examine the historical record of metal concentrations. These show recent declines in metals in the uppermost sediments. Zinc and mercury are of most concern in the Derwent, however other metals such as copper, cadmium, lead, and arsenic are also elevated. Most of the sediments in the estuary exceed the Australian guidelines for sediment quality for heavy metals.

Other studies conducted as part of the CCI project included a detailed assessment of the sources of metals to the estuary, identification of hotspots, and the first direct assessment of the toxicity of sediments from a range of locations around the estuary. The project culminated in the preparation of a Water Quality Improvement Plan for Derwent estuary sediments, which contains recommendations about management options (see **www.derwentestuary.org.au**).

Tasmania's new recreational water quality guidelines

In 2005, the National Health and Medical Research Council released a new set of guidelines for measuring the water quality at beaches and swimming areas (NH&MRC 2005). The guidelines are based on new international standards that include a risk-assessment of potential sources of faecal contamination in the classification of beaches. The results of sanitary surveys are combined with the results of microbial monitoring, to give an overall risk category.

Beaches may be closed temporarily if high levels of contamination are detected during routine monitoring, while detailed investigations are carried out. High levels may occur as a result of stormwater during and after rain events or overloading of sewer or septic systems. Animals can also contribute significant loadings of faecal material, as their droppings are washed through the catchment and onto beaches. Poor water quality can be avoided by picking up after your dog, and avoiding feeding ducks, geese and other wildlife.

Be aware of where and when you swim, and avoid swimming in the Derwent for several days after rain, particularly in those areas where stormwater drains or urban rivulets enter the river.

Derwent Habitat and Species

Contaminant levels in seafood

Shellfish filter enormous amounts of water to obtain food. This can lead to the accumulation of high levels of contaminants that are present in the water and sediments.

In the Derwent, shellfish such as oysters and mussels contain high levels of heavy metals, especially zinc, lead and cadmium. Levels are well above the recommended national guidelines, especially north of the Tasman Bridge, and in Ralphs Bay. There are no clear trends for reduction despite significant decreases in water column concentrations.

Water from heavily urbanised estuaries like the Derwent may also contain pathogens that come from urban stormwater runoff, or sewage spills. Shellfish can also accumulate large concentrations of toxins that are produced by certain algae, and consumption of these shellfish may result in potentially fatal paralytic shellfish poisoning. Shellfish should never be collected from the Derwent.

The issue of bioaccumulation in seafood is being investigated in partnership with the University of Tasmania and Zinifex. Caged oysters sourced from clean waters with background levels of metals were put near the sediment to study if metal uptake is influenced by exposure to metal laden sediments. This work forms part of ongoing monitoring by the Zinifex Hobart Smelter.

Monitoring of mercury levels in flathead via annual Zinifex surveys continue to show that fish caught north of the Tasman Bridge and in Ralphs Bay contain elevated levels of mercury, with the average for those areas exceeding the national guideline of 0.5 mg/kg mercury.

Fish and wildlife habitat

Murphy's Flat Wetland

Murphy's Flat Wetland, 66 hectares between Granton and New Norfolk, was purchased and then reserved through the National Reserve Program in 2001. This was achieved through the combined efforts of community and conservation groups, industry and three tiers of government. Before becoming a conservation area the previous owner attempted to drain the wetland for agriculture and there was concern that the site had been damaged and needed rehabilitation. However scientists have found that much of the area is in good condition. Over 40 species of birds were observed during the surveys. Black swans and ducks are particularly abundant gathering in the thousands to feed on underwater grasses. Fish numbers are also high with over 20 species of fish recorded. The upper Derwent wetlands are an important habitat for bream, trout, mullet, eel and whitebait.

Other important habitat types within the Derwent include rocky reefs, inter-tidal mudflats and salt marshes. Recent observations suggest that seagrass habitats have increased in size in parts of the Derwent, and detailed surveys of seagrass distribution are planned for the whole estuary.

Marine pests in the Derwent

No comprehensive monitoring of marine pests has been undertaken in the Derwent since the baseline survey of 2002 found that there are 43 species of introduced marine plants and animals in the Hobart region. Only eight of these species are regarded as pests. The State Government is involved in preparing national monitoring guidelines for annual surveys to detect introduced marine pests.

In 2005, the Tasmanian Aquaculture and Fisheries Institue (TAFI) investigated marine pest species as part of its intensive study of sediment and habitat condition in the Derwent and Huon estuaries. The study focused on pest species that favour soft sediments and observed half the number of soft sediment species present in the 2002 study. The study found that the environmental preferences of pest species was broad and further invasion was limited by opportunity rather than a need for specific environmental conditions.

Rice grass (*Spartina anglica*) is an introduced perennial grass that typically invades tidal mud and sand flats, predominantly in estuaries and bays. It was introduced to Australia in the 1920s for its potential uses in coastal engineering and agriculture, but is now one of Tasmania's most aggressive aquatic weeds. In March 2006 a survey by the Derwent Estuary Program and Marine Resources, Department of Primary Industries and Water (DPIW) found 10 small infestations of rice grass on the western foreshore of the Derwent between Bilton Bay and Elwick Bay. Most infestations in the Derwent are quite small ranging from only a few plants to 5m^2. All infestations were treated with herbicide however the surveys will continue each year until no rice grass is found for at least six years (approximate seed longevity).

DPIW

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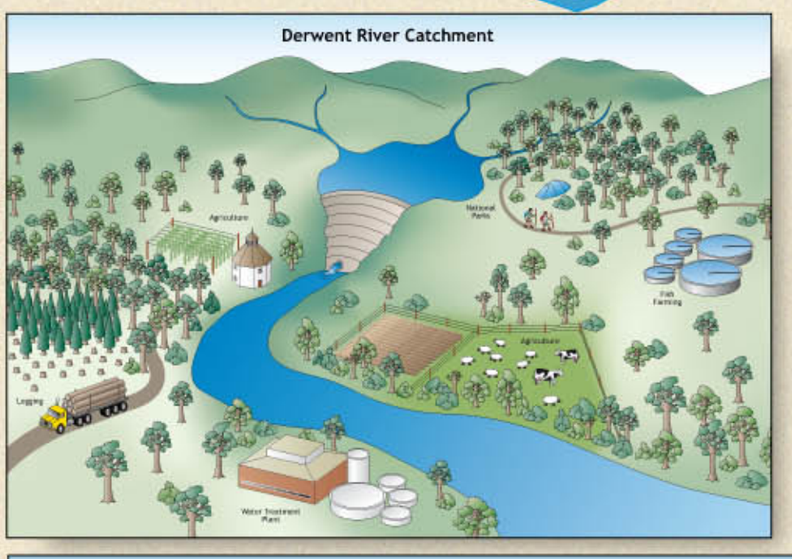
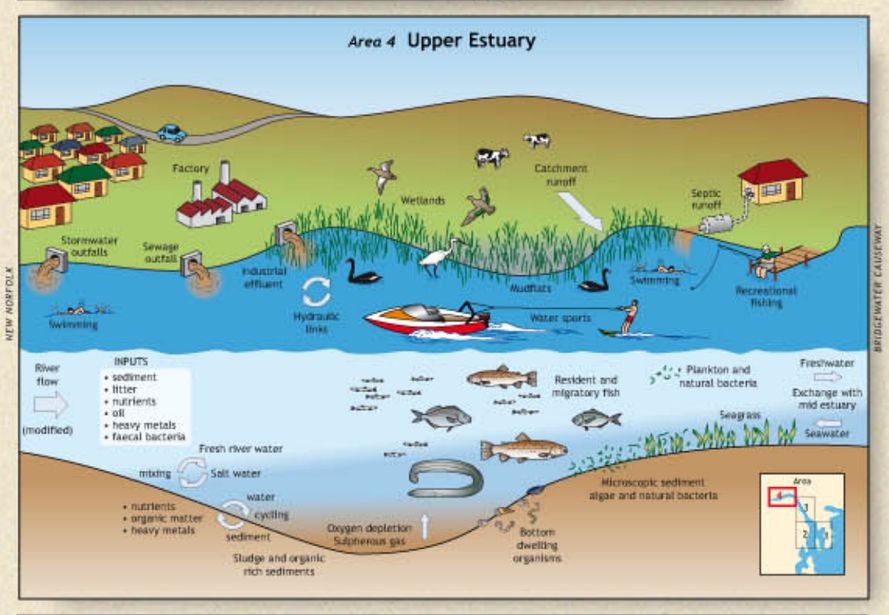
Recent Management Actions, Sampling Sites and Discharge Points

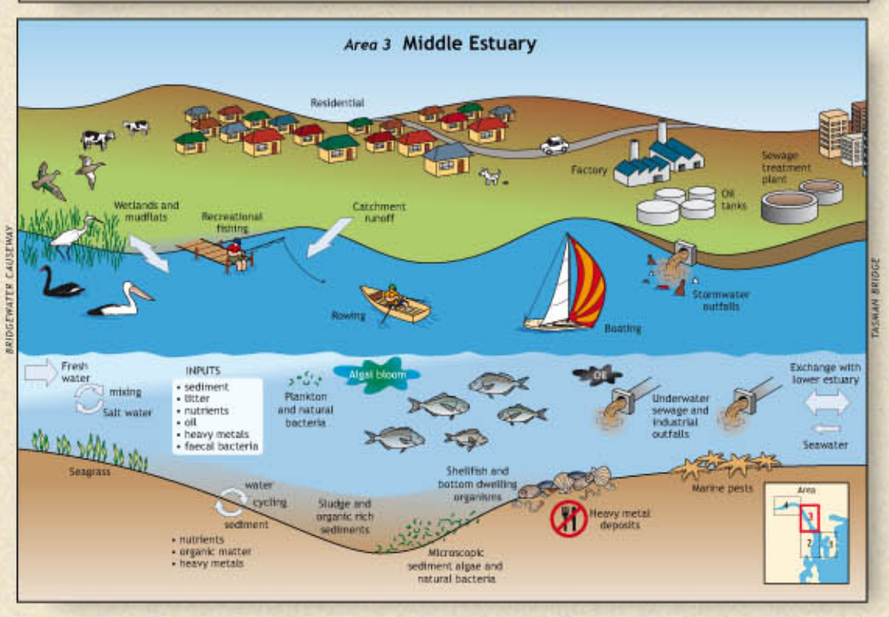
TREATMENT PLANT UPGRADE AT NORSKE SKOG

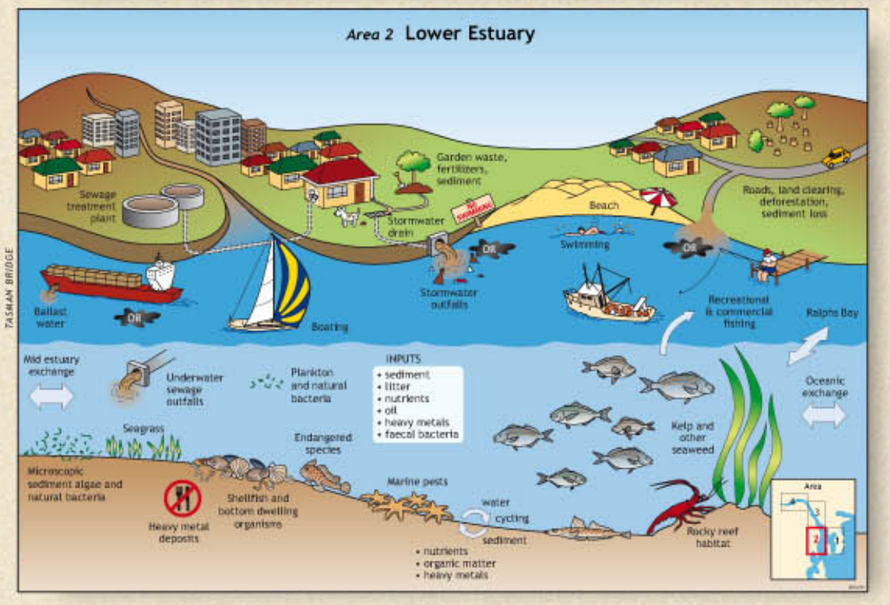
The Boyer Mill operated by papermakers Norske Skog is currently implementing a plan to achieve Best Available Technology (BAT) environmental performance. A key component of this plan is a reduction in the quantity of effluent generated.

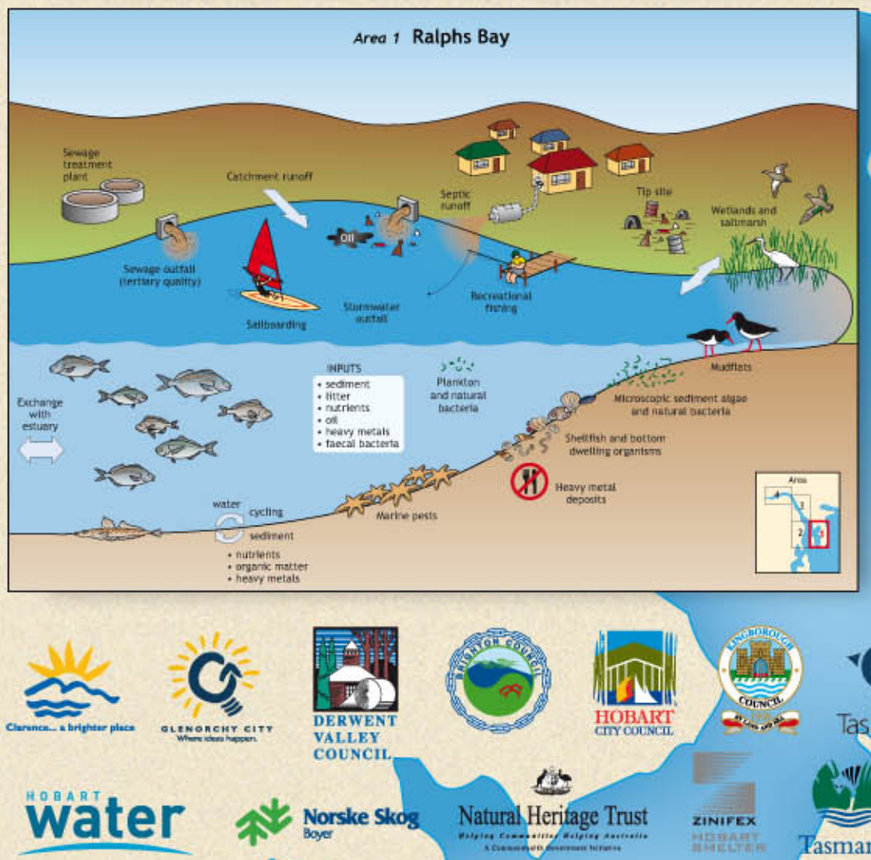
In 2005–06 a two megalitre/day reduction was achieved through behavioural change driven by innovative environmental awareness and education programs. A further 10 ML/day will be achieved with strategic investments in 2006–07 through the upgrade of the existing bleach plant and the reuse of cooling water. These initiatives will also reduce chemical consumption, fibre waste generation and increase the oxygen available in the water for aquatic life through reduction in the BOD (biological oxygen demand) of the effluent entering the Derwent. It will form the foundation for the next stage towards achieving best practice environmental performance, and secondary effluent treatment, which is set for completion in 2007.











WATER SENSITIVE URBAN DESIGN ENGINEERING GUIDELINES

The Derwent Estuary Program with financial support from the Natural Heritage Trust has developed Water Sensitive Urban Design Engineering Guidelines for Southern Tasmania. The guidelines provide councils, developers and landscape architects with the technical details to design water sensitive development in urban areas. The purpose of water sensitive urban design is to reduce stormwater runoff and pollution from subdivisions and towns in simple, innovative and often aesthetic ways. The Guidelines can be found on the Derwent Estuary Program website www.derwentestuary.org.au/publications

GROUNDWATER TREATMENT UPGRADE PLANNED AT ZINIFEX

Zinifex has investigated a number of groundwater interception technologies through five different pilot programs. Since 2001, these programs have recovered approximately 70 tonnes of heavy metals each year, predominantly zinc, which would otherwise leach into the Derwent estuary through groundwater. New projects planned for 2006–07 to further reduce heavy metal emissions include the construction of a new groundwater interception trench. The project uses the most effective technology and is expected to almost double the amount of metal that is recovered from the groundwater. Zinifex will then focus on developing strategies to work towards totally eliminating the problem.

The interception trench will effectively operate as an underground drain, collecting groundwater from beneath the electrolysis department, and then pumping it to the plant's Effluent Treatment to remove the metals. Another major initiative is the planned construction of an additional stormwater containment pond. This will ensure that all stormwater that falls on the site, even in extreme rain events, is collected and treated in the effluent treatment plant before being released into the estuary. Future actions will be strongly focused on extending the groundwater recovery system and ongoing monitoring.

BENTHIC FAUNA COMPARISON

A comparative study of fauna in sediments in the Huon and Derwent estuaries by the Tasmanian Aquaculture and Fisheries Institute revealed that abundant and diverse benthic communities occur in the two estuaries. The Huon and the Derwent estuaries have many similarities in terms of biogeographical, climatic and physical characteristics but differ markedly in their levels of industrialisation. This study showed that the two estuaries also have strong ecological similarities and that the Huon represents a valuable biological reference point for comparison with the Derwent estuary. The study provides information that will be useful for developing management conditions, which will help determine improvement or decline in estuarine conditions. Every site sampled in the Derwent estuary, including those heavily polluted, were still full of life. This suggests that either heavy metals in the Derwent are strongly bound to the sediments and do not cause a direct toxic effect, or that communities have developed strategies for dealing with exposure to high metal loads in sediments. The study also mapped invasive marine pests, providing a point of reference to monitor and manage their spread and distribution.

RAIN GARDEN CLEANS STORMWATER

A good example of a simple water sensitive development is a rain garden. Rain gardens are a great way to slow and cleanse stormwater to protect waterways and save on garden watering. Water tolerant vegetation is planted in a sunken garden bed of sandy-loam soil underlain by a layer of gravel and drainage 'ag-pipe'. Water from hard surfaces is directed into the garden bed and filters down through the soil where it is collected in the under-drainage and returned to a stormwater pipe. As the water percolates into the soil it is filtered by soil particles and cleansed by soil microorganisms. An example of a rain garden can be seen at the Royal Tasmanian Botanical Gardens where this garden cleanses runoff from a plant nursery. The project was developed through an Envirofund project managed by the Master Plumber's Association. Go to www.rtbg.tas.gov.au/raingarden.html for further information.

THE DERWENT ESTUARY LITTLE PENGUIN POPULATIONS

Stage 2 of the Derwent Estuary Community Action for Penguins project in 2005–06 addressed the decline in the Derwent little penguin population by enhancing habitat, creating more nesting opportunities by installing artificial burrows, upgrading existing burrows and reducing encroachment by predators through erecting fencing, swing gates and signs at critical sites. Stage 2 also continued to raise awareness and understanding of how to protect penguins, particularly in schools and communities near penguin colonies. Schools were involved in making artificial burrows and producing a colour brochure about the Derwent penguins.

A total of 21 extant and extinct penguin nesting sites were identified in Stage 1 of the project. Of these, nine are now no longer occupied by little penguins, another 10 have less than 10 breeding pairs, and the remaining two both have 25 breeding pairs. A total of 98 breeding pairs were located during the 2004–05 survey, with two thirds of these located on land managed by local government. A total of 120 breeding pairs of penguins were found during more extensive monitoring in 2005–06.

TRACKS AND PATHS ALONG THE FORESHORE

The aims of the Derwent Estuary Tracks and Paths Project are the development, interpretation, marketing and promotion of a network of tracks and paths on the Derwent estuary foreshore. The vision of the Derwent Estuary Tracks and Paths Project is *to provide a quality walking experience reflecting, imparting and conserving the unique values of the Derwent estuary.* Its mission is *the development of a network of tracks and paths that links communities, significant sites and public open space on the Derwent estuary foreshore, connecting people to place through improved access, interpretation and promotion.* This project is the first step in positioning the Derwent estuary as a major visitor drawcard and the centrepiece of a quality community lifestyle. It is envisaged that following the implementation of the priorities of the project that subsequent stages will see the tracks and paths network connecting land-based attractions, and linking to water-based transport and activities.

Initial projects have included the development of an interpretation plan for the region. The plan presents themes, or take home messages about the Derwent that are designed to enhance the experience and increase the knowledge of the Derwent in meaningful ways for the visitor. In the coming 12 months the condition of existing tracks and paths on the Derwent foreshore will be assessed and their location mapped using GIS technology.

CSIRO

SPOTTED HANDFISH UPDATE

The spotted handfish is found only in the lower Derwent estuary and adjoining areas. It was relatively abundant until about 20 years ago, but is now considered highly endangered. A survey of the population in 2004 discovered two 'new' sites, making the total number of population clusters equal to five. The new populations were found near Hobart and in Ralphs Bay. The total number of individual handfish is now estimated between 800–1000 mature individuals which is an increase from the last estimate in 2003 of 300-600 mature individuals. The Spotted Handfish Recovery Plan is now complete and further actions from the plan will be undertaken over the next 12 months. The focus will be on surveying new areas for the handfish, and checking that transplanted marine algae used by the handfish for spawning is still intact.

River
Bridgewater
Bridgewater Causeway
Jordan
Austins Ferry
Old Beach
Claremont
Dogshear Point
Cameron Bay
RIVER
Bowen Bridge
GLENORCHY
East Risdon
Prince Of Wales Bay
Zinifex Hobart Smelter
Moonah
Selfs Point (outfall at Sandy Bay)
New Town
Lindisfarne
Cornelian Bay
HOBART
Tasman Bridge
Macquarie Point
Rosny
Bellerive
Sandy Bay
DERWENT
Howrah
Sandy Bay (outfall from Selfs Point)
Tranmere
Rokeby
Rokeby
Taroona
Lauderdale
Taroona
Kingston
N
0
5
kilometres
Blackmans Bay
Opossum Bay
Blackmans Bay
RALPHS BAY
Tinderbox
South Arm
Iron Pot
Betsey Island

Water Quality Monitoring Sites in 2004–05
Note: beach rankings are for the past 3 years data

Beach monitoring site *(enterococci)*
- *Good water quality*
- *Intermediate water quality*
- *Poorer water quality under investigation*
- *No ranking applied*
- Ambient monitoring site *(temperature, salinity, pH, dissolved oxygen, nutrients, chlorophyll a, metals)*

Sewage Treatment Plant Discharges in 2004–05
- <2500 kL/d
- 2500–5000 kL/d
- >5000 kL/d

Industrial Discharges in 2004–05
- >50 000 kL/d

Clarence... a brighter place · Glenorchy City, Where ideas happen · Derwent Valley Council · Brighton Council · Hobart City Council · Kingborough Council · TasPorts · Hobart Water · Norske Skog Boyer · Natural Heritage Trust, Helping Communities, Helping Australia · Zinifex Hobart Smelter · Tasmania

TASMAP PRODUCTION