



## Contact

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# Water quality

## King River Power Development, Australia

### Overview

The King River Power Development is located in the rugged south west of Tasmania. The site was proposed and widely accepted by the community as an alternative to a more controversial site (the 'Lower Gordon' scheme) that would have flooded parts of the Tasmanian Wilderness World Heritage Area. The Lower Gordon scheme was dramatically halted by Commonwealth Government intervention.

The King River scheme is situated in a catchment that contains numerous mine leases both working and expired and is close to the World Heritage Area.

Construction commenced in 1983 and the scheme was commissioned in 1993. Both before construction commenced and since, studies have been carried out to determine water quality, the effect of power station operations, appropriate mitigation measures and the level of impacts on the downstream environment.

### Scheme Specifications

#### Dam Name

**Scheme operator**

Hydro Tasmania

**Size of scheme (MW)**

134 MW

**Country**

Tasmania, Australia

**Catchment area**

559 km<sup>2</sup>

**River**

King River

**Effective reservoir capacity**

971 000 000 m<sup>3</sup>

**Construction years**

1983-93

**Reservoir size**

53 km<sup>3</sup>

## **External recognition**

2001 awarded IHA Blue Planet Prize

1994 Highly Commended Award (for King River Power Development) - Resource Development Category, National Engineering Excellence Awards, The Institution of Engineers, Australia

1993 Winner (for King River Power Development) – Resource Development Category, Tasmanian Division Engineering Excellence Awards, The Institution of Engineers, Australia

1993 Highly Commended (for Bradshaw Bridge) – Public Works Category, Tasmanian Division Engineering Excellence Awards, The Institution of Engineers, Australia

## **Details on sustainability aspect**

At the time of site investigations for the KRPD, a copper mine was still continuing its 78 year practice of directly discharging tailings (fine-grained waste sediments) into the Queen River. This river drains into the King River approximately 15 km from Macquarie Harbour on the coast.

Considerable sulphidic rock is found exposed to air and rainfall on the mining lease. Heavy metals associated with this sulphidic rock, notably copper, aluminium and zinc, are liberated due to the creation of acid drainage and were present in high concentrations in the run-off from the lease site.

Based on extensive studies, the dam and power station were located upstream from the Queen River tributary that delivers tailings to the lower King River, but acid drainage from the lease site into the proposed storage would still occur. Remediation works were designed and implemented to reduce a significant amount of the copper flux entering the new storage. The work involved passive diversion of some flows to the already heavily polluted Queen River, and the sealing and revegetation of old tailings dumps to reduce leaching by rainwater. Diversion works were undertaken on the lease site to address this occurrence.

On commissioning there were concerns regarding:

- heavy metals and water quality associated with the filling of the storage, Lake Burbury; and
- low dissolved oxygen levels in the power station discharges.

By 1996 ongoing monitoring had established there were no major problems with either copper toxicity or the development of the Lake Burbury fishery. Testing found that even though mean soluble copper concentrations were 2-3 times higher than recommended levels, the toxicological response in fish was much less than predicted. This was attributed to the presence of high levels of naturally occurring dissolved organic matter in the water which bound with the copper, rendered it biologically unavailable, and protected organisms from any toxic effect of this heavy metal.

Based on these results, the remediation works were determined to be adequate for the protection of a recreational fishery in Lake Burbury. The lake presently supports a successful recreational trout fishery, and copper surveys continue to be conducted on a routine basis to ensure these conditions do not deteriorate.

Soon after commissioning of the power station in 1992, water containing very low levels of oxygen accompanied by hydrogen sulphide were noted in the tailrace, a common problem in the early life of a reservoir. The low level of oxygen was caused by thermal stratification in the reservoir resulting in the release of cold, de-oxygenated bottom water into the King River. After investigation and consideration of ameliorative measures, water discharged downstream from the power station was aerated by operation of a jet pump installed on the turbine. Continuous monitoring of the water quality leaving the tailrace ensures adequate notice of low dissolved oxygen levels, and timely utilisation of the air injection facilities in the turbines.

Since commissioning, the interactions of power station operations with downstream water quality and tailings transport, particularly in light of the growing aquaculture industry in the receiving waters, Macquarie Harbour, have been studied. Arising from these investigations was the essential understanding of how power station operating patterns influence patterns of pollutant transport to the downstream environment. 'Worst case' conditions for the fish farms are now well understood, a monitoring system allows early detection of the conditions and they can be mitigated by strategic operations of the station.

## Other Aspects

### Siting and design

Community concerns regarding a previous proposal were recognised and subsequently this development was proposed at a new, less environmentally sensitive site. Significant stakeholder consultation was conducted during design and construction phases and the storage is now used for recreational fishery and boating.

The intended future of the lake as a major recreational trout fishery was a consideration guiding numerous design and construction activities affecting the lake. The local community has greatly appreciated efforts to establish a recreational fishery in the lake by the diversion works to reduce the inflow of heavy metals. Several construction roads have been converted into convenient boat ramps for public use, and the clearing of timber from the lake has made it safer for boating.

A notable feature of the scheme is the Crotty concrete-faced rockfill dam that incorporates an articulated chute spillway on the downstream face.

The headrace tunnel was excavated from upstream - the tunnel intake is permanently submerged and the highest point in the tunnel is near its downstream end. Where the headrace tunnel becomes the power tunnel and descends to the power station, a vertical surge shaft would normally be provided. The cost of a surge shaft was avoided by constructing a tunnel rising to the surface at road grade from this point. Surges take place in the access tunnel, which also meets the need for road access when inspection or maintenance is required.

### Construction impacts

An Environmental Management Plan was voluntarily prepared for the construction of the King River scheme by the electricity utility. This was the first hydro-power scheme built in Australia to have a formal Environmental Management Plan, and this plan influenced the design and construction activities of the development. An Environmental Committee was formed for the construction period to examine potential impacts and provide advice on avoidance and mitigation.

Due to the scheme's proximity to the World Heritage Area, there was great awareness that visual impacts should be minimised as much as possible. Many environmental management plans were drawn up and adhered to from design through to construction and commissioning. Measures included stockpiling of peat and topsoil generated during construction for later re-use, use of native species for revegetation, and developing and utilising hydro-mulching for rocky and steep sites as well as:

- siting temporary access tracks, camps, works areas and quarries for rockfill below minimum water levels so they would not be visible after commissioning;
- placing excess road spoil and material from other engineering works below minimum water levels;
- locating permanent roads and structures as unobtrusively as possible;
- salvaging 48,900 m<sup>3</sup> of timber from the storage area before commissioning to avoid unsightly dead trees and hazards for boats using the lake; and
- using naturally brown (Austen) steel towers, non-reflective conductors and brown insulators helps to make the line generally unobtrusive across various terrains.

Further environmental issues addressed in the Environmental Management Plan included: designation of special "no-go" areas; strategies to limit waterway siltation and erosion; considerations for drainage and the disposal of effluent; guidelines for drilling and blasting; the removal of litter and rubbish; and fire management

### Heritage

Relics of the late 19th century mining era were recorded in an archaeological study commissioned by Hydro Tasmania.

Considerable effort was devoted to the sensitive issue of studying the potential impact of the inundation of the King River valley on Aboriginal heritage. Expert external archaeological resources of national repute were engaged to investigate and report on this potential impact, with findings carefully and exhaustively chronicled. The investigations proceeded with the involvement of representatives of the Aboriginal community. The findings of these comprehensive studies were provided to the Aboriginal community and the authorities with legislative authority to approve or prevent the inundation of the valley. As a result, the permit to inundate the valley was issued without delay.

### Environmental assessment and monitoring

Hydro Tasmania, working with the Inland Fisheries Commission Biological Consultancy, began a Lake Burbury water quality monitoring program with the commencement of filling of the lake in 1991. The monitoring program included

ongoing water, soil and sediment sampling for analysis of metal levels; lake productivity measurements; physio-chemical monitoring particularly for thermal stratification and the influence of vegetation decay on the storage; assessment of the effect of releases on downstream water quality; and investigations into aspects of the fishery such as heavy metal levels in trout, distribution of fish in the lake, growth rates, physiological condition and reproductive success of the fish.

### **Further Information**

[www.hydro.com.au](http://www.hydro.com.au)