Contact
Sustainable Hydropower Website
C/- Hydro Tasmania
4 Elizabeth St
Hobart TAS 7000
AUSTRALIA

sustainable.hydropower@hydro.com.au

Environmental flows

Environmental flows can be set to ensure protection of instream values; they require a sound understanding of ecosystem function, and should be derived through a consultative process to establish the environmental and social values to be protected.

Issue

Hydropower schemes alter the hydrological and sediment regimes of rivers, hence modifying the aquatic ecosystems to varying degrees. Hydropower discharges are regulated, and although it is not possible to make sweeping generalisation, the downstream flow regimes may provide a higher percentage of average flow conditions and reduce the occurrence of high and low flow events. For base load stations, discharges can be at a consistent flow for long periods; for peaking stations, flows can fluctuate rapidly on timescales of hours. Where diversions have occurred into river basins, power stations can deliver prolonged periods of higher than natural flows, whilst dewatering the river system downstream of the diversion dam.

Changes to downstream hydrology can impact on river hydraulics, instream and streamside habitat, and can affect local biodiversity. Altered flow regimes from natural patterns can disadvantage native species to the advantage of introduced species. Altered flow regimes create a number of potential issues depending on the specific context and degree of change - fish cues for migration, connectivity of habitat and quality of habitat refuges, habitat area available for macroinvertebrates and fish, changes to habitat quality through altered riparian zones, increased erosion or sedimentation, and delivery of organic materials and nutrients. The retention of flood flows in the reservoir can affect the natural productivity and stability of riparian zones, floodplains and deltas. In estuarine systems, altered flows can change the extent of salt-water intrusion due to changed freshwater inflow patterns to the estuary.

The ecosystem impacts from altered flow regimes can lead to or are accompanied by impacts on the local communities and economies. Loss of silt and nutrient delivery to floodplains can have major implications for agriculture, as can loss of water in diverted river systems, and impacts to fishery productivity can in cases significantly affect local economies.

Management

The response to minimize impacts of altered flow regimes has been the design of environmental flows, also called compensation flows. Setting of environmental flows requires a sound understanding of ecosystem function. There should be a consultative process to establish the environmental and social values to be protected, and hence the environmental flow objectives.

Managed flow regimes to enhance environmental or social values can comprise maintenance of a minimum flow in the river, capping of maximum flow releases, constraints on draw-down or ramp-up rates, and periodic flushing flows. Agreed environmental flow regimes may include some or all of these considerations, and may be specified for year-round or by season. In some cases agreements have been reached where particular operating rules are not established for the power scheme to follow, but rather a bulk annual allocation of water is set aside for ecosystem requirements, and decisions on the pattern of delivery of this water is made by an independent scientific and stakeholder reference committee.

By utilizing a good process of establishing environmental flow objectives, it may be possible to find ways to address these objectives without significant loss of generating potential. Downstream regulating ponds and other engineering solutions may provide cost-effective alternatives to environmental flow releases directly from power stations, and construction of smaller off-stream storages can be considered to deliver minimum flows to address particular local issues.

It is essential to have a rigorous and credible monitoring program pre- and post-delivery of environmental flows. There should be agreement on where the benefits or otherwise will be measured, and the indicators of success.