

# Balancing increased capacity and flexibility with environmental values in a proposed redevelopment of an existing hydropower scheme

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# Acknowledgement



A special thank you to these key contributors and many more



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# Background – Hydro Tasmania

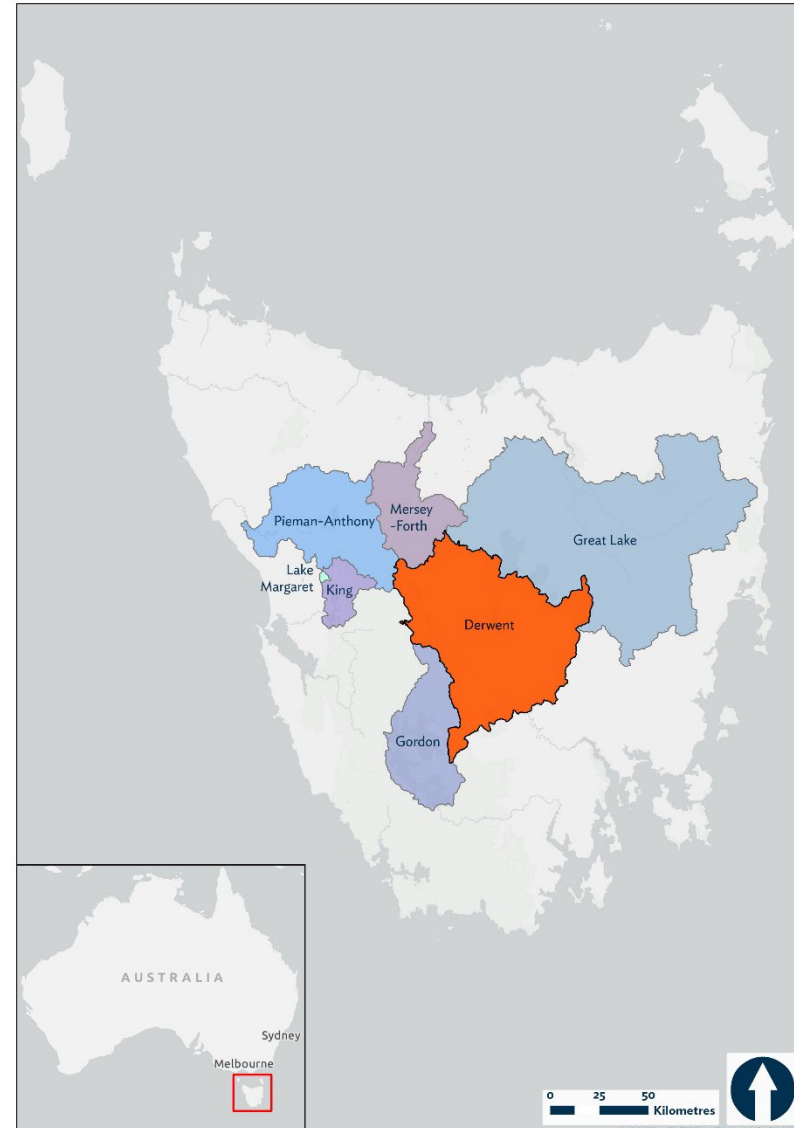
Australia's largest water manager and largest generator of renewable energy

- Manage water from 35% of the State
- Manage over 13,500 GL/year
- More than 2600 MW of installed capacity
- Approximately 9 TWh of output
- 30 hydropower stations across six catchments

Connected to mainland via Basslink undersea cable. More interconnection is proposed.

Consulting business Entura delivers clever solutions in water and energy to clients locally, nationally and internationally.

Electricity retail business Momentum Energy operates in mainland Australia and the Bass Strait islands.





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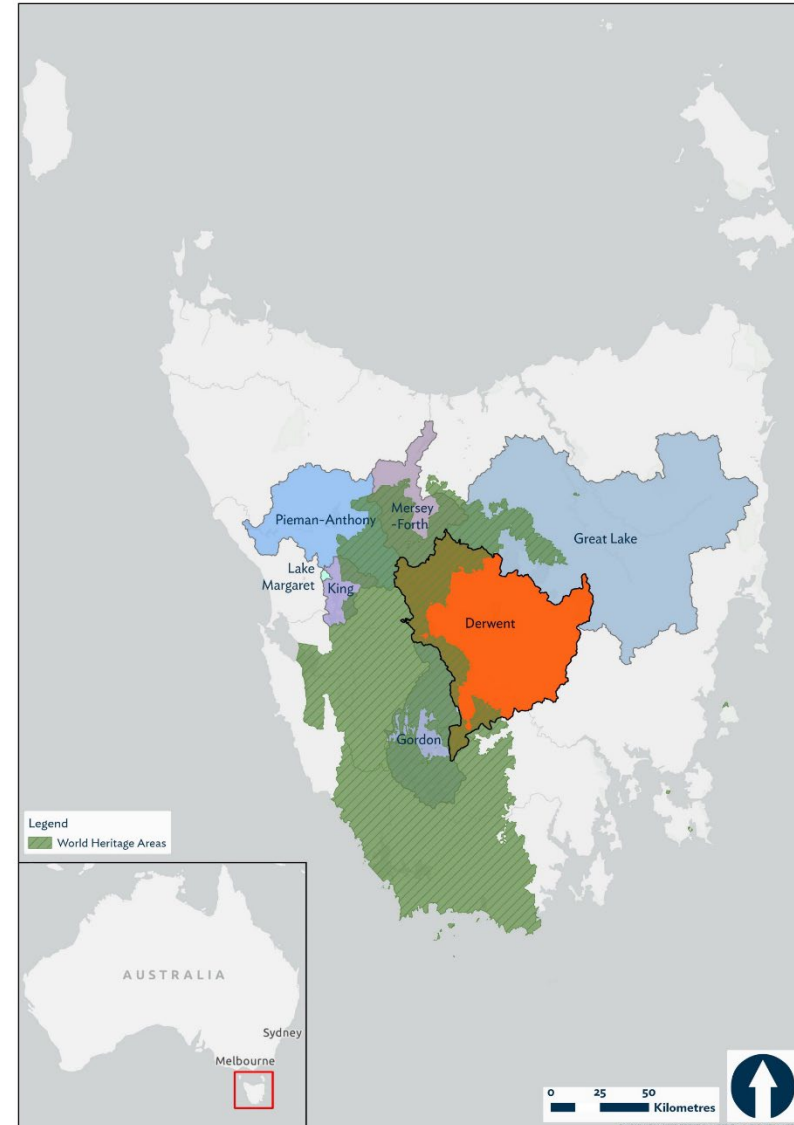
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# About the Tarraleah scheme

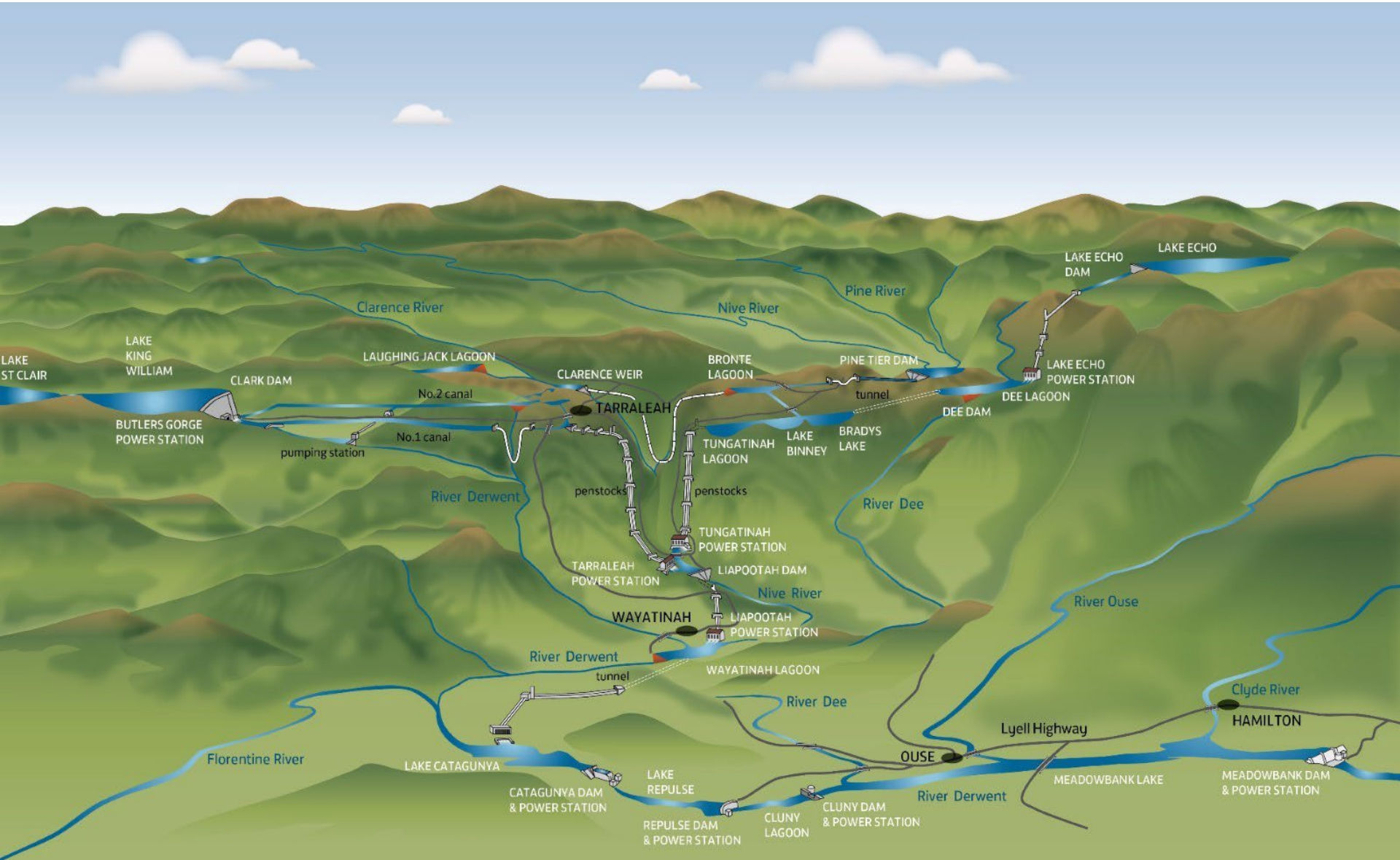
- 6.5% of Hydro Tasmania's total annual generation - baseload
- Head storage – Lake King William
- Two canals from head storage to power station
- Over 80 years old - coming to end of life

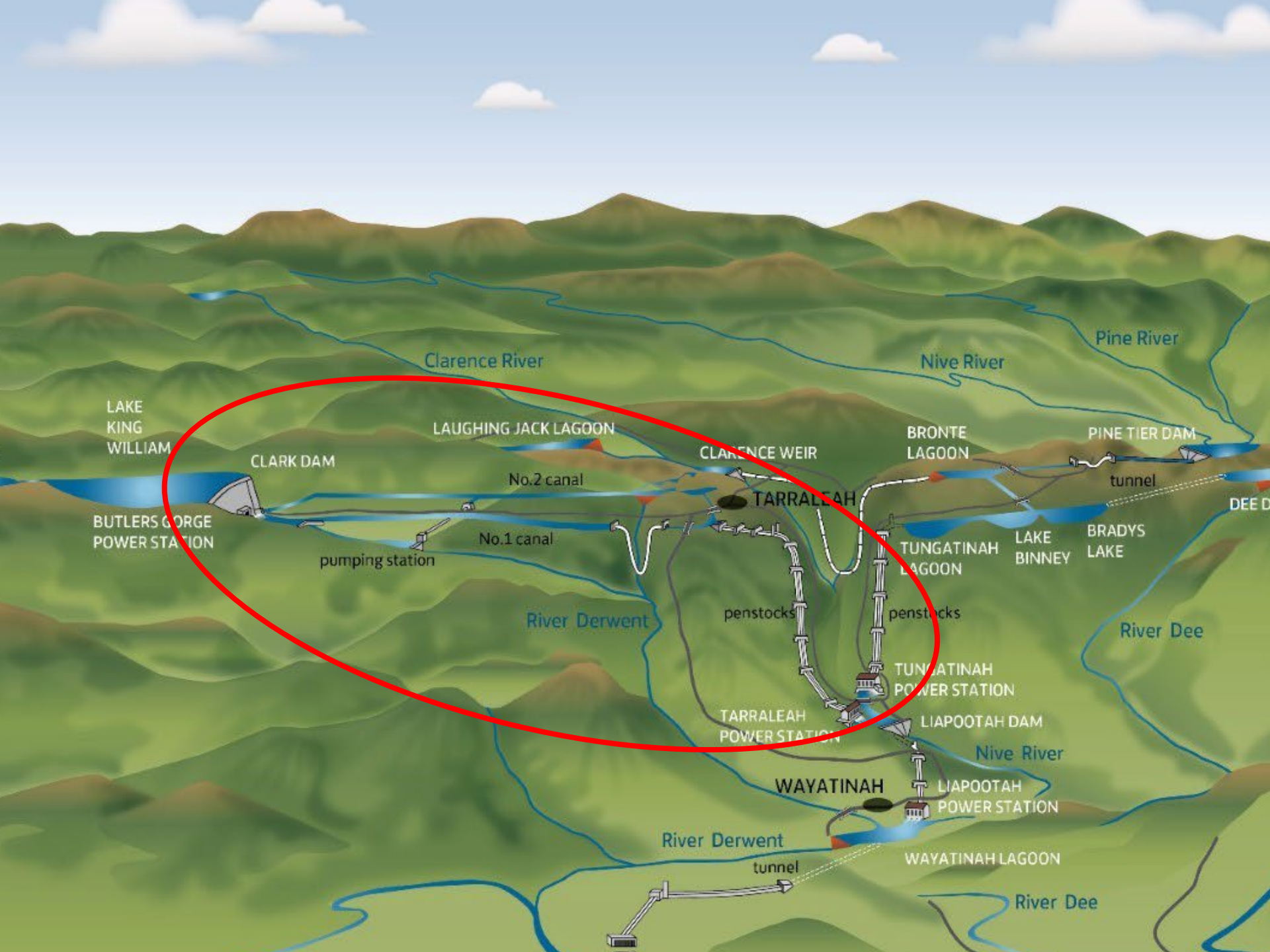


- Feasibility study assessed options for how to deliver more renewable energy, more flexibly
- Planning the next stages of work on a potential redevelopment.



# Derwent hydropower scheme







# River Derwent condition

- Highly regulated and reduced flow regime
- Reduced supply and mobilisation of riverbed sediments
- Terrestrial vegetation encroachment
- Channel narrowing, armoring of the riverbed and a reduced area of active channel





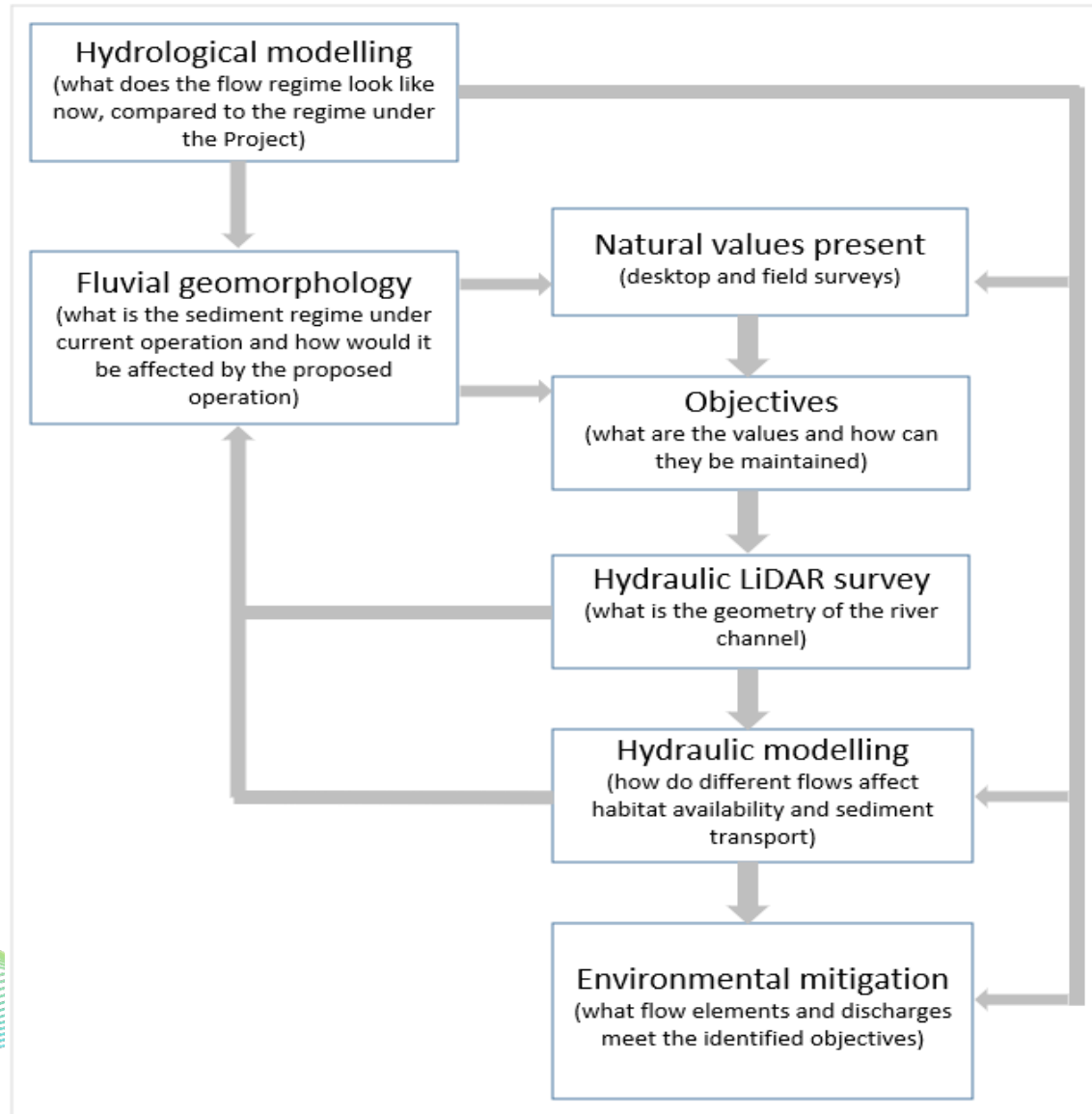
Upstream of the Counsel  
River inflow



Downstream of the Counsel  
River inflow

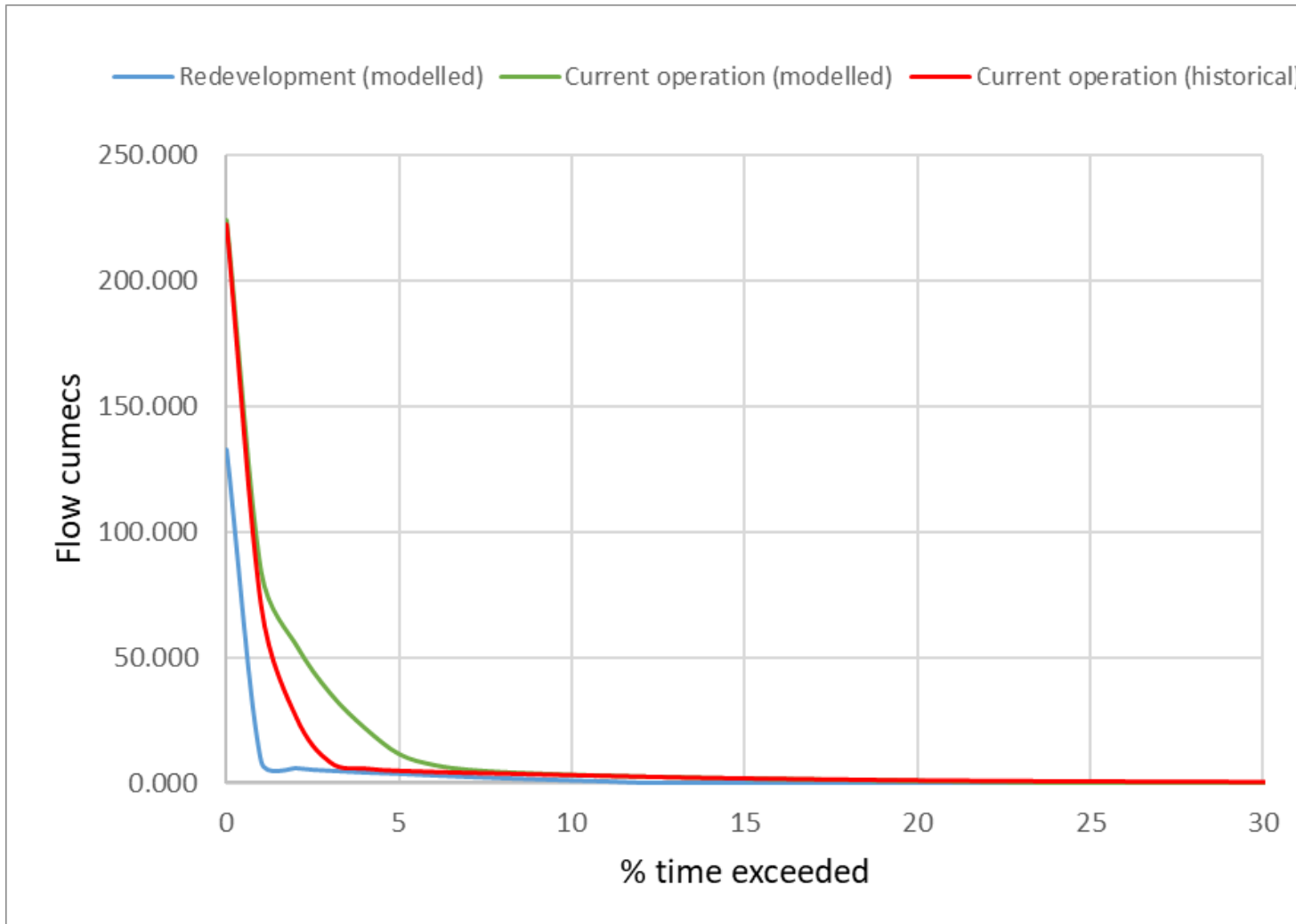


# Overview of approach





# Flow duration curves for downstream of Derwent Pumps



# Matters of National Environmental Significance

- The Tasmanian Wilderness World Heritage Area– a 23 km reach
- Suitable habitat for the threatened riparian plant *Barbarea australis*
- No existing populations were found in the River Derwent downstream Clark Dam, however, there are historic records at the lower end of the reach.





# *Barbarea australis* habitat

- Colonises along river margins in areas of loose substrate where relatively regular flow disturbance reduces the density of competing plants species
- Flood disturbance and turnover of substrate appears to be an important process for creating areas where *B. australis* can establish
- Reduced frequency and magnitude of flood/peak flows are listed as a threatening process for this species.



# Tasmanian Wilderness World Heritage Area criteria potentially affected



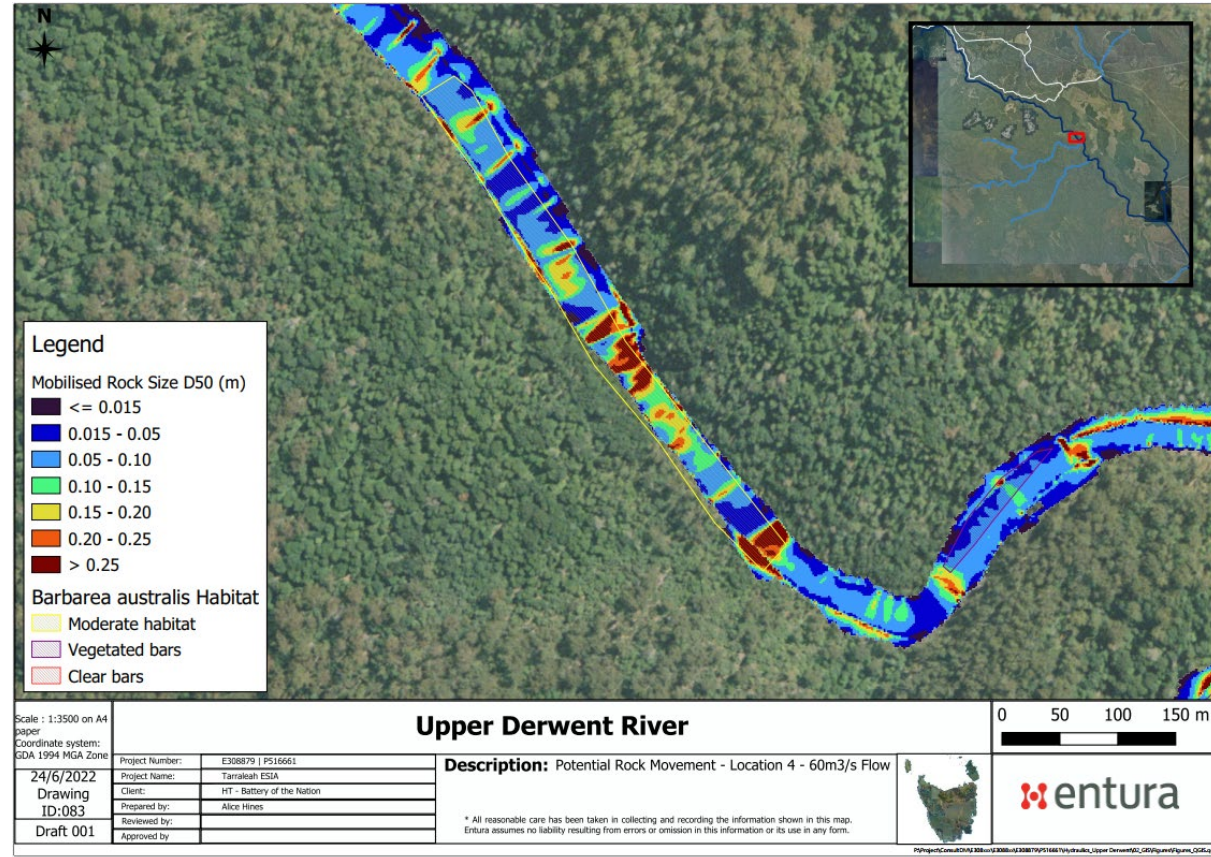
- Modify, alter or inhibit **landscape processes**
- **Divert, impound or channelise** a river, wetland or other water body.
- Modify or inhibit **ecological processes**
- Reduce **diversity** of or habitat for **plant and animal species**
- Reduce **diversity** of or habitat for **threatened species**.





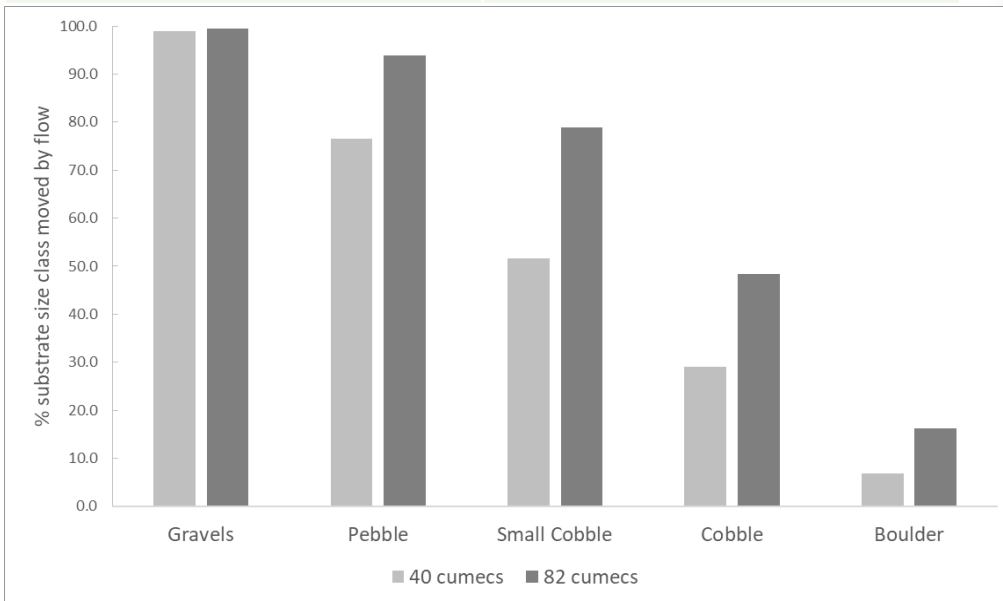
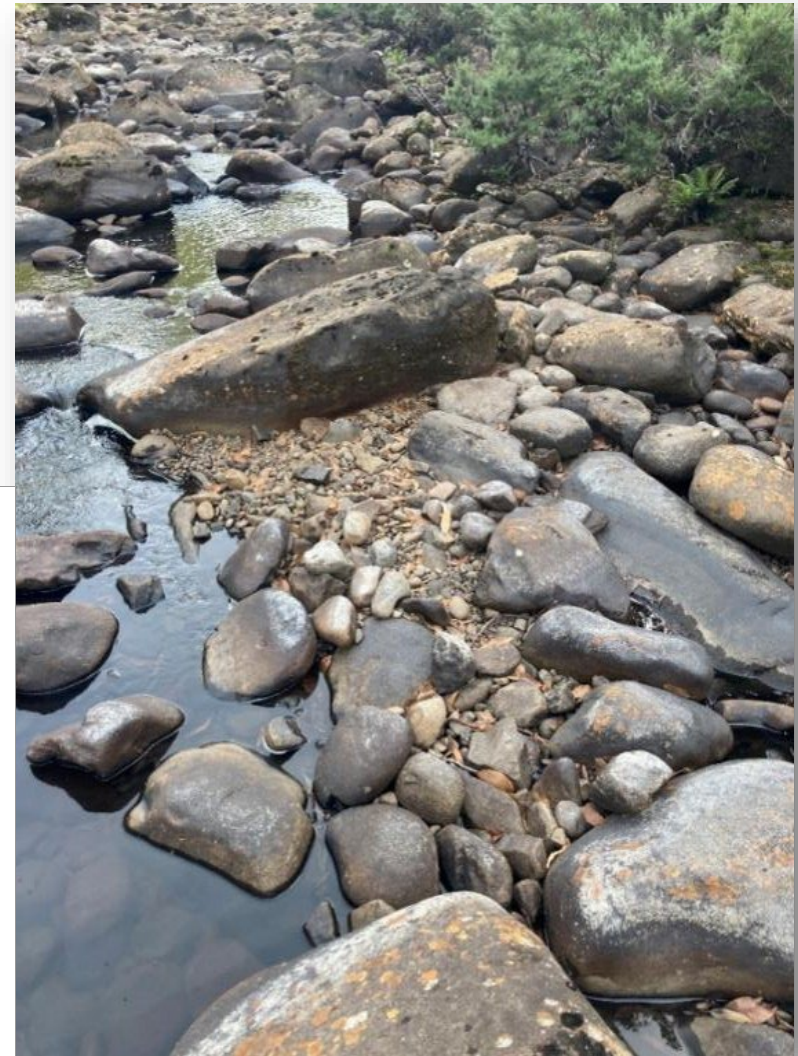
# Hydraulic model

- TUFLOW-HPC modelling software used to model the entire reach
- Input included terrain LiDAR, survey and observed channel features
- 9 representative locations used to determine critical flows required to mobilise cobbles and gravels within the main channel and to bank margins.



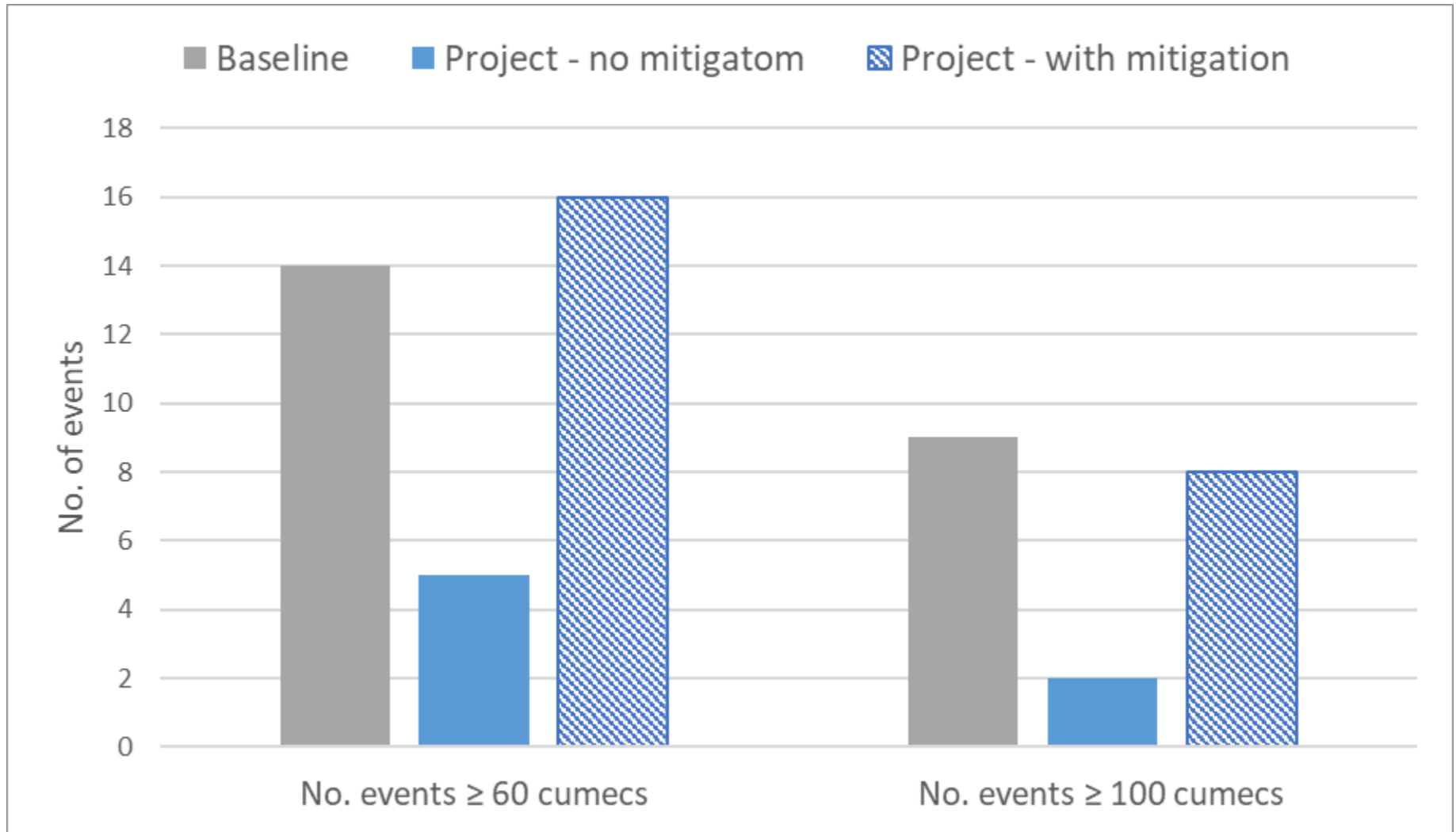
# Hydraulic model outputs

Sediment type mobilised	Average flow (m <sup>3</sup> /s)
Cobbles near banks	59
Cobbles in channel	44
Gravel near banks	22
Gravel in channel	12





# Number of high flow events



# Proposed mitigations

**Aim of mitigation is to maintain flow events considered important to maintain *Barbarea* habitat and TWWHA values**

## **High flow releases:**

- mobilise gravel and small cobbles to the bank margins ( $\geq 60 \text{ m}^3/\text{s}$  annually)
- mobilise substrate up to the boulder size class and reduce the extent and slow the encroachment of terrestrial vegetation ( $\geq 100 \text{ m}^3/\text{s}$  biennially)

## **Lower flow releases (freshes):**

- assist in flushing algae and biofilms from instream habitats
- provide high flow cues for instream species
- increase nutrient exchange between the banks and low flow channel
- recharge water supply to banks and riparian zone (5 to 10 cumecs in different seasons)



# Validation of hydraulic model

- Trial underway to assess rock movement following high flow events.
- Rocks painted and measured where suitable habitat is present.



Pebble and cobble patch pre (left) and post (right) a 98 cumec spill - Derwent River downstream of Wayatinah Lagoon



# Conclusion

- Targeted mitigation measures acknowledge limitations in predicting future operation
- Mitigation adapted to actual flows each year
- Size of planned flows can be finetuned over time
- Offer a balance that allows more flexible operation without compromising existing environmental values in a regulated system.





**Thank you.**



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