Tasmania's Next Iconic Walk

Aquatic Values Assessment

13 September 2024

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Executive summary

The Next Iconic Walk project (NIW) being developed by the Tasmanian Parks and Wildlife Service (PWS) proposes to use a combination of micro-hydro schemes and solar to power the huts near Lake Mary and Lake Huntley on Tasmania's West Coast. The micro-hydro schemes would abstract water directly from the lakes and will therefore affect water levels in the lakes and the flow regime in the streams which exit the lakes.

Native aquatic biological values surveyed in both lakes include the fish species *Galaxias brevipinnis* (climbing galaxias), the crayfish *Astacopsis tricornis*; macroinvertebrates, and the aquatic plant species *Isolepis fluitans*. A platypus was observed in Lake Huntley and are likely to be present in Lake Mary. Introduced brown trout (*Salmo trutta*) have also been stocked in Lake Mary and would have a self-sustaining population.

The design take for micro-hydropower schemes is 10 l/s. However, the energy modelling assessment recommended that this aquatic assessment, and the subsequent request for water licences, should allow for the 2 x hut load in case of load growth/consumption in excess of expectations.

Hydrological modelling indicates operation of the scheme under 10 l/s or 20 l/s schemes would result in rare and small (a few millimetres) reductions in lake level. Lake level drawdowns of this magnitude would have no impact on lake habitats or species.

For the outlet streams, the modelled changes in hydrology during operation are more noticeable but are still minor, particularly for the Lake Mary scheme. Baseflows and very low flows are the only components of the flow regime that are affected. The moderate and high flow regime are maintained at both sites.

Operation would maintain a flow during the dryer months (generally summer and early autumn) except during exceptionally dry periods. The modelling suggests periods of zero flow only occurred for the Lake Mary scheme under a 20 l/s take and these were very rare (two events over the 65-year record).

A single zero flow event occurred at Lake Huntley under the 10 l/s scheme and 15 events occurred under the 20 l/s scheme. The conservative approach taken with the solar inputs are likely to have increased the use of hydropower over solar compared to how the schemes would operate in practice. Solar operation would be highest over summer and would reduce the use of the hydro schemes which is likely to further the limit the occurrence of zero flow events.

Operation of the schemes are predicted to have minimal impacts on the downstream environment as they will not affect flow regime variability (i.e. peak to low flow elements) and will maintain flow connectivity under all but the most extreme events.

Zero flow events are modelled to occur more frequently for a 20 l/s scheme at Lake Huntley compared to a 10 l/s scheme but are still rare. For the 1.8 km reach between Lake Huntley and Lake Rolleston, rare zero flow events are not predicted to significantly impact aquatic values as most of the reach is downstream the influence of the scheme. Also, the reach that is affected is very steep and would offer minimal permanent aquatic habitat for most species.

1. Introduction

The Tasmanian Parks and Wildlife Service (PWS) are investigating power supply options for the proposed new huts at Lake Mary and Lake Huntley as part of their Next Iconic Walk project (NIW). Current options being investigated include micro-hydro systems that would abstract water directly from the lakes and will therefore affect water levels in the lakes and the flow regime in the streams which exit the lakes. Lake Huntley is part of the Lake Beatrice Conservation Area while Lake Mary is crown land vested in Hydro Tasmania (HT).

The PWS are undertaking an assessment of the potential impact that construction and operation of the micro-hydro systems may have on surrounding values for the Environmental Impact Statement (EIS) in response to the PWS Reserve Activity Assessment (RAA) process. The EIS is being managed by ERA Planning and Environment (ERA) and Entura has been engaged to assess the potential aquatic impacts from operation of the micro-hydro schemes on the lakes and the downstream environment.

Hydro-power developments in Tasmania which have the potential to result in aquatic impacts are subject to an application for a water allocation under the Tasmania *Water Management Act 1999*. Water allocations are administered by the Water Management Branch of the Department of Natural Resources and Environment (NRE). The aquatic values assessment outlined below also would form part of the assessment required by the Water Management Branch.

The scope of the aquatic values assessment provided in this report also complies with HT's expectations for environmental impact assessments for projects which affect their catchments.

1.1 Approach

The following tasks were undertaken to assess the potential aquatic impacts of operating the micro-hydropower schemes:

1. Desktop assessment of any listed and general aquatic values recorded in the lakes and outlet streams or potentially present based on known distributions;
2. A field survey to collect data on habitat, fish and freshwater macroinvertebrates;
3. Analysis of modelled baseline and operational hydrology data;
4. Assessment of changes in hydrology (lake level and flow regime in the outlet streams);
5. Impact assessment of changes in hydrology on aquatic values.

2. Methods

2.1 Desktop assessment

The freshwater natural values assessment included a review of aquatic flora and fauna data held on the Natural Values Atlas (NVA) and the EPBC Act Protected Matters Search Tool (PMST) to identify the potential for the occurrence of threatened species listed under the *Threatened Species Protection Act 1995* (Tas) (TSP Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

2.2 Field survey

A field survey was conducted on the 17th of April 2024 with each lake accessed via helicopter.

The following information/sampling was undertaken at each site:

- Habitat assessment:
    - A low level, slow, flight around the lake shoreline was conducted to allow an inspection (and video) of the lake shoreline habitats. Detailed shoreline mapping was not done on the day of the survey due to time limitations and because a boat would be required to navigate around the steeper shorelines which are present around majority of the shorelines of both lakes.
    - Record instream, lake and riparian habitat conditions on the ground including:
        - Stream and lake geomorphology (flow types, gradient, bank character; instream substrate types);
        - Aquatic plants, algal cover; detritus and large woody debris;
        - Riparian condition (density; vegetation type; dominant species; stream shading);
        - Spot physico-chemical water quality parameters: temperature, conductivity, dissolved oxygen, and pH;
        - Site photos.
- Aquatic macroinvertebrates. Apart from their intrinsic value, aquatic macroinvertebrates are useful indicators of impacts arising from changes in flow regime and are often used to monitor the impacts of abstractions. Macroinvertebrates are also the key prey for platypus and fish.
    - Lake shoreline
        - Samples were collected using the same net sweep technique used to collect an edge sample from slack water habitats in rivers/streams as per AusRivAS protocols (ausrivas.ewater.org.au).
        - A single sample was collected from the shoreline of Lake Mary as the habitat which could be accessed was relatively uniform (Figure 2.1). Two samples were collected from Lake Huntly: 1) from bare bedrock shoreline which appears to characterise most of the shoreline; and 2) from the bay on the outlook stream which contained a greater diversity of habitats (large and small submerged woody debris; aquatic macrophytes and diversity of rock substrate) (Figure 2.2).

    - Each macroinvertebrate sample was live picked on site for 30 minutes as per AusRivAS protocols.
  - Outlet streams
    - Macroinvertebrates and aquatic habitat parameters were collected from the outlet stream of Lake Mary according to the Tasmanian AusRivAS (Australian Rivers Assessment System) protocols (ausrivas.ewater.org.au), which involves collecting samples from riffle habitat. Elevated flows reduced the areas of the stream bed which could be sampled, and quality of the sample may have been compromised. The sample was live-picked onsite for a minimum of 30 minutes and preserved in 70% ethanol.
    - No sample was collected from the outlet of Lake Huntley (headwaters of the Anthony River) as high flows prevented access to the watercourse. AusRivAS sampling would not have been appropriate in this stream as the form of the outlet stream consists of steep cascade dominated by bedrock.
- Fish
  - A fish survey was undertaken using a Smith-Root LR-20B or LR-24 backpack electrofisher (duty time using the 20-min CPUE method) within wadable areas of the lake shoreline at each site (low gradient habitat shown in Figure 2.1; Figure 2.2).
  - All fish caught were identified, counted, measured, and then released back into the river at the site. All fish were caught and handled under the relevant permits:
    - *Inland Fisheries Act 1995* exemption permit (No. D23-266898)
    - *Animal Welfare Act 1993* animal research approval certificate (Animal Ethics Committee project no 4/2023-24).
  - No electrofishing was conducted in the outlet streams due to elevated flows at both sites.

Figure 2.1: Habitats and sampling locations associated with Lake Mary

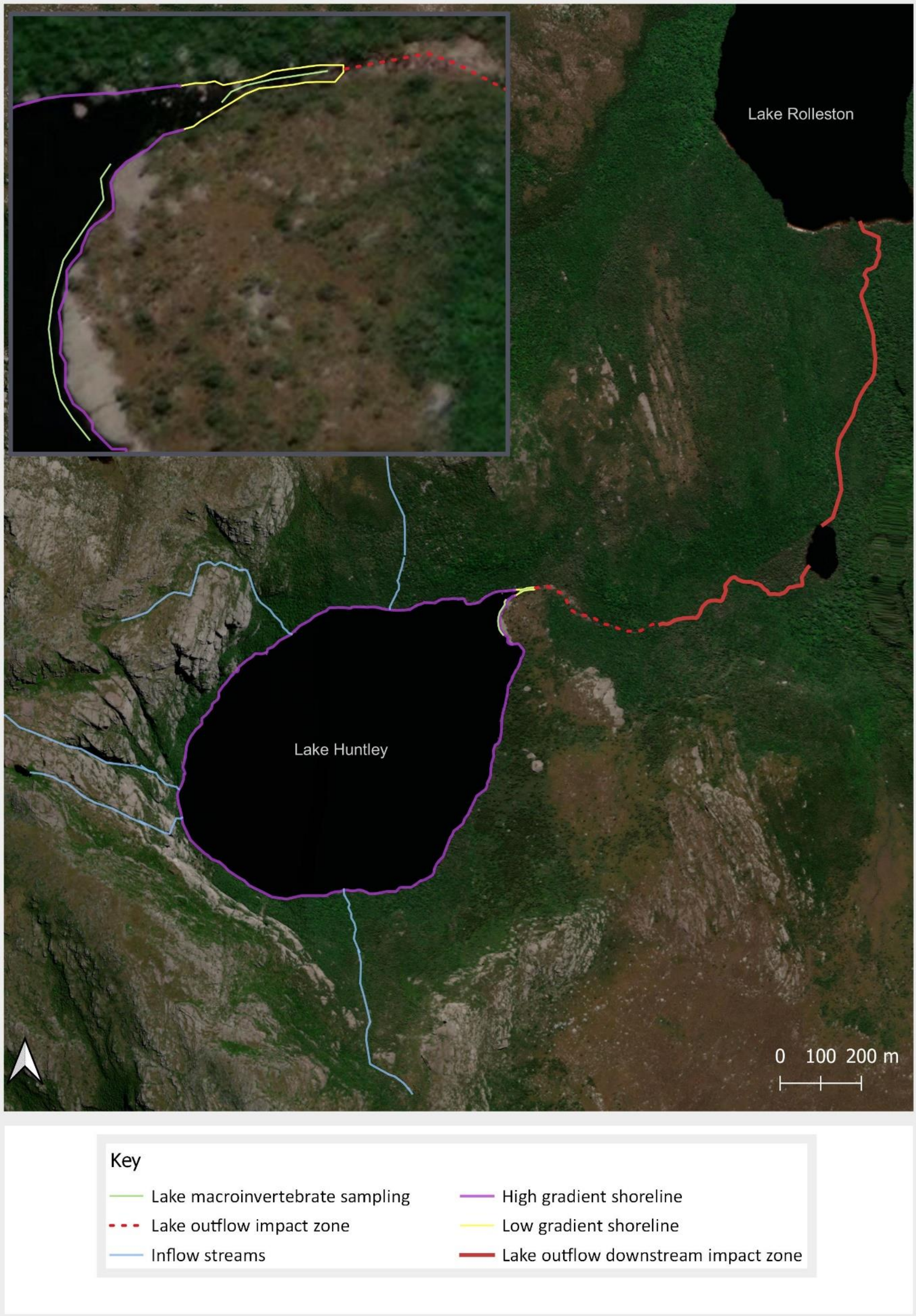

Figure 2.2: Habitats and sampling locations associated with Lake Huntley.

2.3 Laboratory and analysis

2.3.1 Macroinvertebrates

The Tasmanian AusRivAS state-wide predictive models for presence absence and rank/abundance of taxa were used to assess the biological health of the outflow stream of Lake Mary using the qualitative macroinvertebrate data collected in riffle habitats.

AusRivAS presence/absence (O/Epa) models are based on large 'reference' site datasets that contain macroinvertebrate and habitat data from a set of unpolluted, 'least disturbed' reference sites (DPIPWE 2018). The model then generates a list of macroinvertebrate taxa expected to occur at the test site in the absence of environmental stress, such as pollution or habitat degradation (DPIPWE 2018). The rank abundance models (O/Erk) assess the predicted community structure of taxa (i.e., their relative or rank abundances) at a test site compared to the structure predicted in the reference site group (Davies 2002).

The single-season autumn models were used to derive an O/E (observed/expected) score (ausrivas.ewater.org.au), where the expected taxa were calculated using the probability of reference group membership in the predictive models that were most likely to represent the monitoring site in a 'natural' condition based on 'predictor' variables (i.e. habitat and topographic features of the site). The O/E scores were calculated as the ratio of observed/expected values. The O/E scores are divided into O/E bands that describe the relative health of the river (based on macroinvertebrate community composition) compared to the reference streams. The thresholds and description for the condition bands for the autumn O/Epa and O/Erk models are provided in Table 2.1 and Table 2.2 respectively.

Table 2.1: NRE Tas AusRivAS state-wide seasonal models O/E presence absence lower band of river health within riffle habitats

Band	AusRivAS state-wide seasonal model (Autumn O/Epa) – lower band bound	Description
X	1.15	More diverse than reference
A	0.86	Equivalent to reference condition
B	0.58	*Significantly impaired or modified.*
C	0.3	*Severely impaired or highly modified.*
D	0	Extremely impaired

Table 2.2: NRE Tas AusRivAS state-wide seasonal models O/E rank-abundance lower band of river health within riffle habitats

Band	AusRivAS state-wide seasonal model (Autumn O/Erk) – lower band bound	Description
X	1.236	More diverse than reference
A	0.775	Equivalent to reference condition
B	0.314	*Significantly impaired or modified.*
C	0.000	*Severely impaired or highly modified.*

2.4 Hydrology modelling

A dynamic rainfall-runoff model was developed to estimate the baseline hydrological regime at each lake site (Entura 2024). A dynamic hydrological model is required to capture the wetting/drying non-linearities of runoff production - As the catchment dries, less runoff is generated per unit rainfall - this is considered important in this case as we are focussed on reliability and hence the low flow periods.

No rainfall or runoff data is available for either of the lake sites. To estimate flows, a catchment rainfall-runoff model was used. Given the lack of in situ data, a nearby catchment, the Tyndall Raceline (Site ID100014), was identified as being similar in terms of the terrain, land cover and hydrological function. The model was calibrated to available flow and rainfall data at the Tyndall Raceline to achieve parameters representative of the study reach (Entura 2024).

Long-term daily rainfall was used from the Lake Margaret site maintained by HT, located just south of Lake Mary (TSM Site ID 370). This was chosen due to it being the nearest long-term rainfalls site to the project sites. The period is limited to 1924 to 1990 due to limitations in data availability as this gauge was discontinued in 1990. The 67-year period contains significant periods of drought and hence is deemed representative of the dynamic range of behaviour expected within the catchments (Entura 2024).

The baseline hydrology series was then used to develop an operational flow time series harnessing the hydro resource based on the estimated load and inputs from solar PV and battery (Island Renewables 2024). Conservative settings were applied to the modelling to ensure aquatic impacts were not understated.

The operational modelling included estimates of lake drawdown due to hydro-turbine operation. As there is no bathymetric or water level data for either lake, the modelling assumed the lakes to have a rectangular geometry, which is considered reasonable given the very low drawdown expected (Island Renewables 2024). To calculate lake drawdown, for each timestep that natural lake outflows were less than the turbines take, the water volume consumed by the hydro in that timestep was converted to a reduction in lake level. Subsequent deficits were added until the natural outflows again exceeded the turbine take.

3. Results

There is no bathymetry or water level data for Lakes Mary and Huntley and the descriptions of the shoreline and water depths are based on observations taken during the field survey and available desktop information. Lake and stream levels were high during the field survey due to rain events in the days preceding. High lake levels did not affect the assessment of values in the lakes but did affect the ability to sample and assess the outflow streams.

3.1 Listed values

No aquatic threatened species listed under the *Threatened Species Protection Act 1995* (Tas) (TSP Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) have been recorded in Lake Mary, Lake Huntley and the catchments immediately downstream from these lakes.

Species observations available on databases such as the NVA provide useful information but depend on surveys being done in the area of interest. It is unlikely that any dedicated aquatic surveys have previously been conducted in the waterways affected by this project.

The Protected Matters Search Tool (PMST) is another GIS based tool which can provide a useful crosscheck for assessing if listed species or communities may be present. The only aquatic species nominated as potentially present by the PMST in the catchment of either lake is the native fish species Australian grayling (*Prototroctes maraena*). Australian grayling is listed as vulnerable under the TSP Act (1995) and the EPBC Act (1998). This species is an amphidromous migratory species, adults inhabit and breed in rivers and streams, hatched larvae are washed downstream to the marine environment to develop before returning to the rivers as juveniles. The nearest record for Australian grayling in the catchment of Lake Mary is near the junction of the Henty and Yolande River in 2004. The nearest record in the catchment of Lake Huntley was in the Pieman River in 1987 just prior to completion of the Reece Dam on the river.

Margaret Dam on Lake Margaret would prevent the upstream migration of Australian grayling into the upper reaches of the Yolande River and Lake Mary. Similarly, Pieman Dam on Lake Pieman prevents the upstream migration of Australian grayling. Even prior to the development of these dams, Australian grayling are highly unlikely to have penetrated into the upland areas associate with this project as the distribution of this species appears to be limited to rivers at relatively low elevations. Thus, there is no potential for Australian grayling to be in the immediate catchments of Lake Mary and Huntley.

3.2 Lake Mary

3.2.1 Catchment

Lake Mary is managed by HT and is bordered by the Tyndall Regional Reserve on Tasmania’s West Coast. Lake Mary is at 730 mASL and is the last of five small lakes which enter Lake Margaret as part of the Lake Margaret Power Scheme. Historically, the raising of lake level via the stop logs on the outlet stream allowed HT to store winter flows to be released to Lake Margaret for additional power generation over summer. The stop logs are now permanently closed. The Yolande River (hereafter referred to as the lake outflow or outflow stream) exits the southern point of the lake and flows for 560 m before entering Lake Margaret (Figure 2.1).

The underlying geology comprises Pleistocene glacial and glacigene deposits and Late Cambrian - Lower Devonian sedimentary sequences dominated by conglomerate. Most of the vegetation communities adjacent to the south and western shoreline is western buttongrass moorland (TASVEG MBW); western subalpine scrub; (MBR) Sparse buttongrass moorland on slopes (TASVEG MBR); and patches of Pure buttongrass moorland (TASVEG MBP); and, Leptospermum forest (TASVEG NLE)**.** The northern and eastern shoreline are vegetated by rainforest: *Athrotaxis selaginoides* rainforest (TASVEG RKP) and *Nothofagus* - *Leptospermum* short rainforest (TASVEG RML).

3.2.2 Physical aquatic habitat

3.2.2.1 Lake

Most of the shoreline of Lake Mary is comprised of boulder/bedrock conglomerate which provides a high gradient (generally >45^{o}) slope between the shore and water's edge (Figure 2.1). The area of high gradient shoreline appears to result in relatively deep water (>1 m) directly adjacent to the shore and these areas were not accessible via wading during the field survey.

An approximate 450 m length of the southwest shoreline has a shallower gradient (~5 - 20^{0}). This section was nearly entirely wadable during the field survey (i.e. ~ < 1 m water depth) within 1 – 10 metres from the shore (Figure 2.1; Figure 3.1) apart from a deeper section around a large conglomerate outcrop. The area of low gradient shoreline begins to merge into the steeper bank morphology near the lake outflow (Figure 2.1).

The small bay in front of the lake outflow is armoured with boulder and cobble conglomerate; however, the substrate in most of the remaining area of the southwest shoreline is dominated by quartz sands and gravels with occasional overlying loose pebble and cobble. The aquatic sedge *Isolepis fluitans* was recorded growing in shallow areas (< 1 m water depth) along the southwest shoreline. No other fully aquatic plants were observed; however, the water tolerant rushes *Baloskion tetraphyllum* and *Empodisma minus* were common along the shore and in places were partially submerged by the high lake levels.

Occasional submerged large woody debris was present and smaller woody and leaf detritus was relatively abundant along the southwest shoreline.

Water quality

Spot water quality measurements taken at the bay immediately upstream of the lake's outlet were within the expected range for these parameters in an unimpacted highland lake/stream on the west coast of Tasmania:

- Temp: 11.2
- pH: 4.56
- Conductivity: 33
- Oxygen (mg/l): 10.3
- Dissolved oxygen (%): 99.7
- Turbidity (NTU): 0.5

3.2.2.2 Lake outlet

The reach of the outlet stream is steep (0.13 rise/run) and heavily shaded by tea tree (*Leptospermum* sp.). High flows during the survey obscured most of the channel and prevented an accurate assessment of the substrate and flow types. However, the steep gradient of the watercourse indicates that short sections of alternating cascades, riffle and run habitats would dominate the flow habitats under median flow conditions with pool and backwater areas becoming more prominent during low flows.

The marginal areas which could be waded during the survey indicated that boulder, cobble and pebble are abundant but an accurate estimate of percentage breakdown from bedrock to silt size classes was not possible. The high flows during the survey also prevented estimates of other instream attributes such as benthic algae cover, moss, detritus, large woody debris and aquatic macrophytes.

A separate field survey was undertaken on the 16th of January 2024 by Island Renewables and PWS as part of the assessment for the micro-hydro scheme. The photos from this survey show the stream during lower flows from where it exits Lake Mary to where it enters Lake Margaret (Figure 3.2–Figure 3.9). The photos show that most of the flow habitats are high energy, riffles (Figure 3.2) small to medium sized cascades (Figure 3.5; Figure 3.6); and short sections of braided run and riffle habitat between boulders (Figure 3.7). Lower energy side channel/backwater habitats (Figure 3.4) are also present and the downstream end of the reach contain some longer, lower gradient run/pool sections (Figure 3.8). Overall, there appear to be a variety of flow habitats within this 560 m reach.

3.2.3 Ecological values

3.2.3.1 Fish

Enough shoreline was accessible via wading to undertake 20 minutes of electrofishing time. The only species recorded was the native galaxiid species, *Galaxias brevipinnis* (climbing galaxias). Eleven climbing galaxias were captured during the survey of the lake. Flows were too high to electro-fish the outlet stream; however, two *G. brevipinnis* were captured in the kick net during macroinvertebrate sampling.

No introduced trout were captured; however, brown trout (*Salmo trutta*) have been stocked in Lake Mary and this species is known to be present (French 2011).

3.2.3.2 Macroinvertebrates

Lake shoreline

Fifteen families were recorded from the shore sample (Table 3.1). Most families were spread across five insect orders with stoneflies (Order Plecoptera) in the family Gripopterygidae the most abundant taxa (Table 3.1). Leptoceridae cased caddis larvae (long-horned caddisflies) were the second most abundant taxa (Order Trichoptera) with Hydropsychidae (net-spinning caddisflies) and Philorheithridae families the other trichopteran families present (Table 3.1). Dipteran taxa were in the Chironomidae (non-biting midges) and Tipulidae (crane flies) families. The larvae of a single mayfly (Order Ephemeroptera) in the family Oniscigastridae and a dragonfly (Order Odonata) in the family Synthemistidae were the other insect orders recorded.

Outside of insects, amphipods in the crustacean family Paramelitidae were the most abundant taxa. Other non-insect taxa included isopods (Family Janiridae), water mites (Order Acarina), round worms (Order Oligochaeta), and flatworms (Turbellaria) (Table 3.1).

Outlet stream

The diversity of taxa was low in the outlet stream with 10 taxa recorded (Table 3.1). Hydropsychidae larvae (net-spinning caddisflies) and Leptophlebiidae mayflies were the most abundant taxa. Families which were not present in the lake shoreline sample included three families of trichopterans (Conoesucidae, Hydrobiosidae, Philopotomidae); a family of stonefly (Eustheniidae); and a family of mayfly (Leptophlebiidae) (Table 3.1).

The abundance in the sample was also low with only 75 animals collected. It is typical to collect at least 200 animals during a 30 minute live-pick unless a site is impaired by pollution or an altered flow regime.

It is likely that high flows preceding and during the survey, affected the quality of the sample that could be collected. The kick sample was collected near the channel margin as it was the only area accessible under the flow and may have included at least some patches of substrate that are only inundated during higher flows. Also, high flows can temporarily denude macroinvertebrate populations, or change behaviours, and this may also explain the low diversity and abundance in the sample.

The outputs for the AusRivAS state-wide presence absence and rank-abundance autumn models satisfied the chi-square statistic. This statistical test ensures that the groups of reference sites selected within the model to compare with monitoring site are statistically valid and comparable based on habitat and topographic features.

The outlet stream was assessed as band B (significantly impaired) for the presence absence (O/E 0.82) and rank abundance model (O/E 0.52). The high flows prior to and during the survey are very likely to have impacted the sample taken at this site. This assessment is given because the outlet stream is essentially unregulated (the stop logs at the outlet of the lake are unlikely to substantially alter the flow regime) and the riparian condition and overall catchment is in pristine condition. Therefore, it is highly likely that this site would be assessed as in reference condition (band A) if sampled during a more stable flow period.

3.2.3.3 Other aquatic values

The native Tasmanian crayfish, *Astacopsis tricornis*, was recorded during the electrofishing surveys in the lake. This species is adapted to lake and flowing water habitats and would also be present in the outlet stream.

There are no NVA records of platypus in Lake Mary. However, this species is widespread in Tasmania and they are highly likely to be present in the lake.

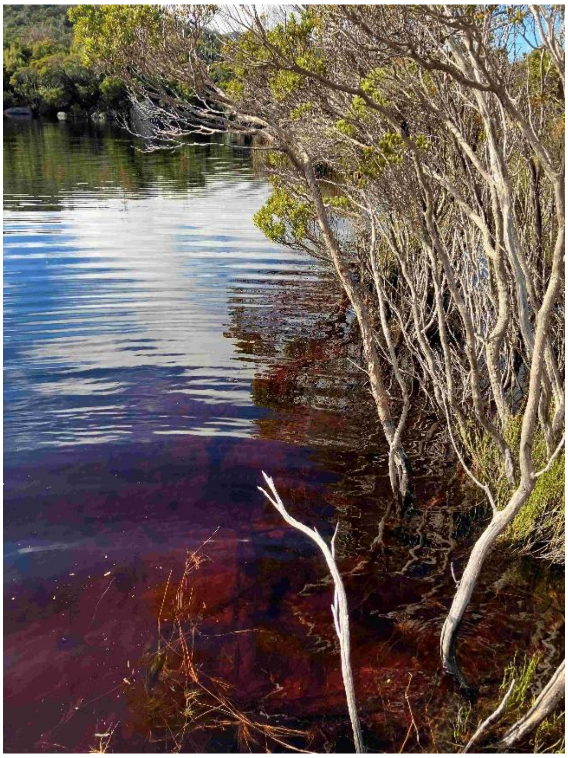

Figure 3.1: Low gradient shoreline in Lake Mary

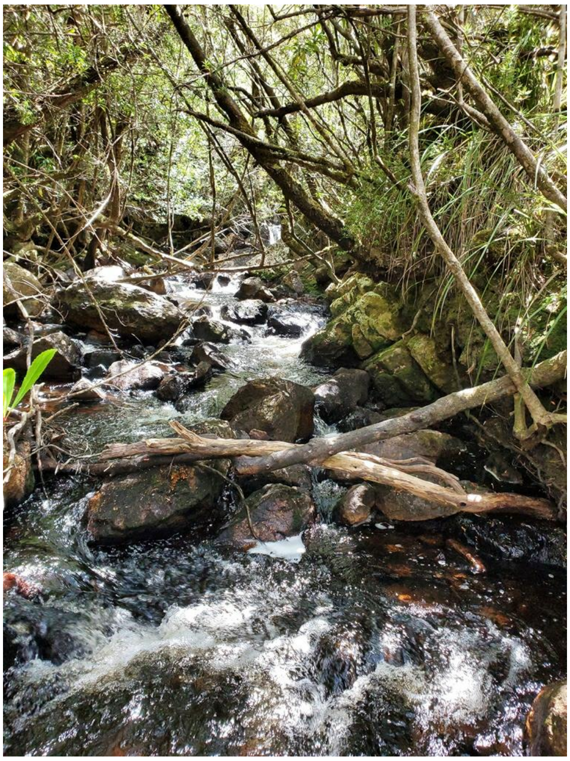

Figure 3.2: Yolande River approximately 110 m downstream the outlet from Lake Mary (January 16, 2024, photo supplied by Paul Coull).

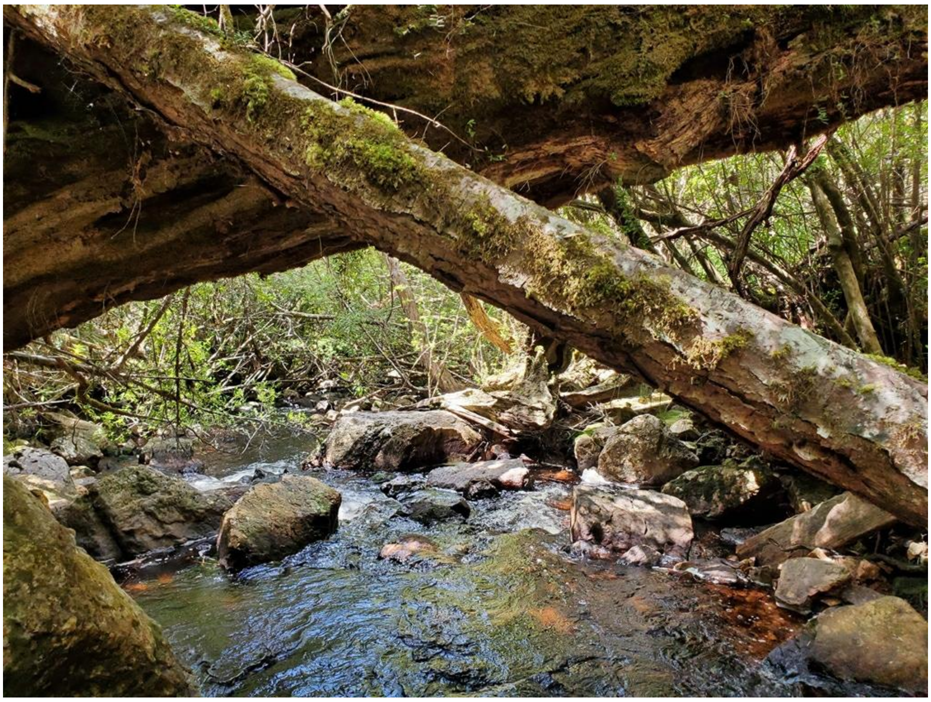

Figure 3.3: Approximately 190 m downstream the outlet from Lake Mary (January 16, 2024, photo supplied by Paul Coull).

Figure 3.4: 290 m downstream the outlet from Lake Mary

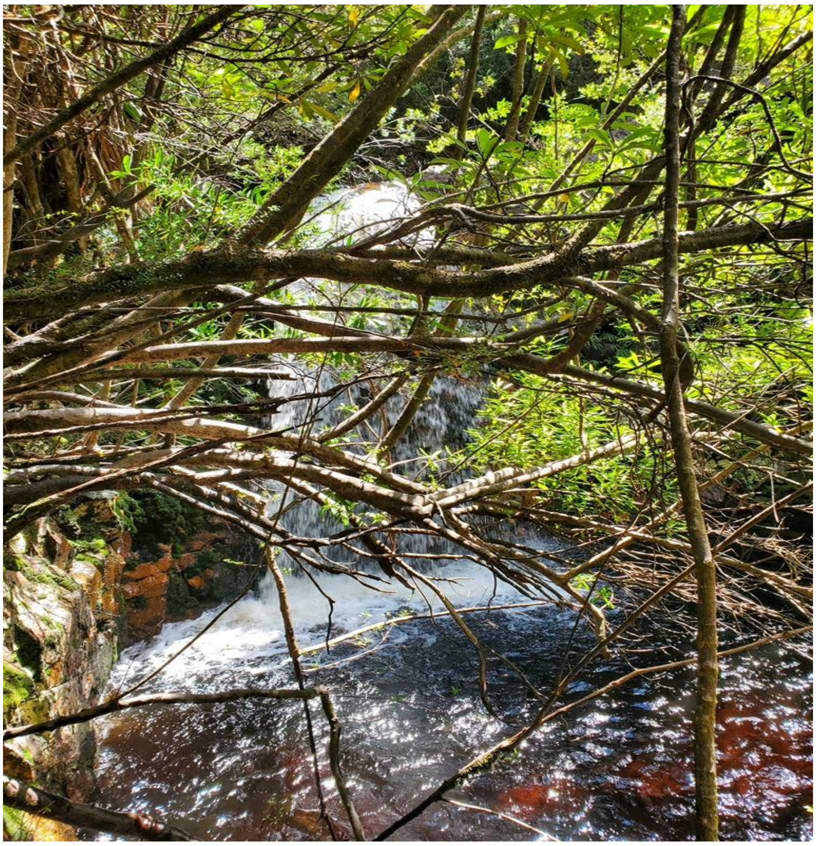

Figure 3.5: Small water fall on the Yolande River approximately 310 m downstream the outlet from Lake Mary (January 16, 2024, photo supplied by Paul Coull).

Figure 3.6: The Yolande River approximately 420 m downstream the outlet from Lake Mary (January 16, 2024, photo supplied by Paul Coull).

Figure 3.7: Reach of the Yolande River approximately 450 m downstream the outlet from Lake Mary (January 16, 2024, photo supplied by Paul Coull).

Figure 3.8: Lower gradient section of the Yolande River approximately 460 m downstream the outlet from Lake Mary (January 16, 2024, photo supplied by Paul Coull).

Figure 3.9: Reach of the Yolande River approximately 510 m downstream the outlet from Lake Mary (January 16, 2024, photo supplied by Paul Coull).

Table 3.1: Freshwater macroinvertebrates recorded along the shoreline and in the outlet stream from Lake Mary during the field survey in April 2024

Phylum or Class	Order	Family	Shoreline	Outflow
Annelida	Oligochaeta		2	4
Turbellaria			1	
Arachnida	Acarina		1	2
Crustacea	Amphipoda	Ceinidae		
		Paramelitid	10	4
	Isopoda	Janiridae	1	
Insecta	Diptera	Chironomidae		
		Sub-fam: Chironominae	5	
		Sub-fam: Orthocladiinae	5	1
		Sub-fam: Tanypodinae	2	
		Tipulidae	1	
	Trichoptera	Conoesucidae		3
		Hydrobiosidae		2
		Hydropsychidae	1	34
		Leptoceridae	19	
		Philopotomidae		3
		Philorheithridae	2	
	Plecoptera	Eustheniidae		6
		Gripopterygidae	27	
	Ephemeroptera	Leptophlebiidae		16
		Oniscigastridae	1	
	Odonata	Synthemistidae	1	
		Number of families	15	10

3.3 Lake Huntley

3.3.1 Catchment

Lake Huntley is directly next to the Tyndall Range on Tasmania's West Coast at approximately 725 mASL and is situated within the Lake Beatrice Conservation Area. The outlet from the lake forms the headwaters of the Anthony River, which continues in a north easterly direction for 1.8 km to Lake Rolleston. After Lake Rolleston, the Anthony River flows for another 2 km before its natural course is inundated and regulated by Lake Plimsoll for hydro power generation.

Lake Huntley is a crater lake at the head of a glacial valley and the cliffs of the Tyndall Range directly abut the western shore of the lake (Figure 2.2). The geology of the area is comprised of Late Cambrian - Lower Devonian sedimentary sequences which are dominated by conglomerate but include quartz sandstone, siltstone, chert, glacial and glacigene deposits.

Most of the lake shoreline is vegetated with *Nothofagus* - *Phyllocladus* short rainforest (TASVEG RMS) with a section of *Eucalyptus* nitida forest over *Leptospermum* (TASVEG WNL) and patches of Western buttongrass moorland (TASVEG MBW) on the east border. The vegetation along the outlet stream is classed as *Athrotaxis selaginoides* rainforest (TASVEG RKP) with patches of Western buttongrass moorland (TASVEG MBW).

3.3.2 Physical aquatic habitat

3.3.2.1 Lake

The shoreline of Lake Huntley is characterised by sheer cliffs and exposed boulder/bedrock conglomerate which provides a high gradient (generally >60°) slope between the shore and water's edge (Figure 3.10). The high gradient shoreline results in relatively deep water (>1 m) directly adjacent to the shore (Figure 3.10). The small bay (~0.03 hectare) in front of the outlet stream differs from other areas of the shoreline with a lower gradient lakebed adjacent to the shore and areas of shallow (<1 m) water (Figure 3.11). There is a hydraulic drop near the mouth to this small bay and during the survey there was a relatively strong current flowing through the bay (Figure 3.12). Even under low lake levels, there is likely to be a noticeable current through this area and the habitats within it are more like a low gradient river than a lake.

No aquatic macrophytes were observed along the main shoreline although only a short section (~180 m) was accessible near the helicopter landing site. However, the deep water, rock bed and tannin-stained water all probably limit areas which are suitable for aquatic macrophytes.

The aquatic sedge *Isolepis fluitans* was recorded growing in the shallow bay in front of the outlet stream. Submerged large woody debris was present and smaller woody and leaf detritus was relatively abundant in this small bay. There was no large woody debris present along the ~170 m section of the main shoreline which was accessible during the survey. Large woody debris may be more common along the remaining areas of the shoreline where more trees are growing adjacent to the shore.

Water quality

Spot water quality measurements taken at the bay immediately upstream of the lake's outlet were within the expected range for these parameters in an unimpacted highland lake/stream on the west coast of Tasmania:

- Temp: 10.9
- pH: 4.68
- Conductivity: 31
- Oxygen (mg/l): 10.2
- Dissolved oxygen (%): 98.7
- Turbidity (NTU): 0.3

3.3.2.2 Outlet stream

The headwater of the Anthony River (hereafter referred to as the lake outlet or outlet stream) exits the Northeast corner of the lake and runs for ~ 860 m before entering a small unnamed tarn. The river then flows for another 820 m before entering Lake Rolleston. The slope of the watercourse over this reach is high, particularly over the first 200 metres (~0.3 rise/run) and provides a steep cascade over predominately bare bedrock (Figure 3.13). The high flows on the day of the survey made it difficult to assess variations in the flow and substrate conditions and made it unfeasible to walk the length of the outlet stream from the lake to the proposed turbine site (340 m). However, photos from the energy modelling report (Island Renewables 2024) taken under lower flows indicate that short (~ 2 - 10 m long) breaks in the slope provide at least some lower gradient sections where riffle/run and pool habitats would occur among the boulder, cobble and pebble that has accumulated over the bedrock.

3.3.3 Ecological values

3.3.3.1 Fish

Most of the 20 minutes of electrofishing time was undertaken in the lower gradient bay immediately upstream of the outlet stream from the lake. An approximate 130 m long section of the shoreline could be fished immediately adjacent to the outlet bay; however, there were no shorelines that are accessible to wading based electrofishing beyond this section of the shore (Figure 2.2).

The only species recorded was the native galaxiid species, *Galaxias brevipinnis* (climbing galaxias) with 13 fish captured. Brook trout (*Salvelinus fontinalis*) are present in Lake Rolleston and Lake Plimsoll downstream from Lake Huntley. No trout have been stocked in Lake Huntley (French 2011) and trout would be unable to migrate upstream through the high gradient sections of the Anthony River upstream from Lake Rolleston into Lake Huntley.

Flows were too high to electro-fish any lower gradient sections of the outlet stream from Lake Huntley. The 340 m of the reach that would be affected by the micro-hydropower scheme would provide minimal habitat for electrofishing even under low flow conditions due to the high gradient topography. Climbing galaxias can climb wet vertical surfaces by using its pectoral and pelvic fins to clasp to the rock (McDowall 1996). Their presence in the lake indicates that they do migrate upstream from the Anthony River and Lake Rolleston; however, the steep sections immediately downstream from Lake Huntley (i.e. those within the impact zone of the micro-hydropower scheme) would provide minimal permanent habitat for this species.

3.3.3.2 Macroinvertebrates

Lake shore

The sample collected from the high gradient and bare bedrock shoreline of Lake Huntley was low in diversity and abundance with taxa recorded from six families (Table 3.2). Flatworms in the family Dugesiidae were the most abundant taxa (Table 3.2). Other taxa recorded included round worms (Order Oligochaeta); water mites (Order Acarina), and insect families (Chironomidae, Ecnomidae and Gripopterygidae) (Table 3.2). A single sample collected on a single date can only provide an approximation of the composition of the macroinvertebrate communities around the lake shoreline. However, the sample is likely to be representative of most areas of the shoreline of this steep sided lake in that diversity and abundance is likely to be low.

The sample collected from the outlet bay was more diverse and abundant with 16 taxa present (Table 3.2). Stoneflies (Order Plecoptera) in the family Gripopterygidae and caddisflies (Order Trichoptera) in the family Ecnomidae were the most abundant taxa (Table 3.2). Other taxa that were not recorded in the sample from the high gradient shore included amphipods; fish lice (Branchiura); Leptoceridae and Hydropsychidae (Order Trichoptera); Leptophlebiidae mayflies (Order Ephemeroptera); Gomphidae and Corduliidae and Gomphidae dragonflies (Order Odonata); and, Dytiscidae and Psephenidae beetle larvae (Order Coleoptera) (Table 3.2).

Lake outlet

As discussed, the outlet stream could not be sampled due to the high flows. Based on observations during the field survey, and a desktop assessment of contour lines, at least the first approximate 200 m downstream is a steep cascade which is unsuitable for AusRivAS sampling. The contours suggest the stream is still steep for the remaining 140 m to the proposed turbine site and it is also unlikely that this reach would provide suitable habitat for AusRivAS sampling. However, a macroinvertebrate community would occur in this reach and is likely to be most abundant and diverse in the lower gradient breaks in slope where flow habitats would be most stable and offer a variety of habitat niches.

3.3.3.3 Other aquatic values

A platypus was observed in Lake Huntley during the field survey. Platypus are classified as a special value in Tasmania as a phylogenetically distinct fauna species and are protected under the *Wildlife (General) Regulations Act (2010)*.

The native Tasmanian crayfish, *Astacopsis tricornis*, was recorded during the electrofishing surveys in the bay upstream from the lake outlet.

Table 3.2: Macroinvertebrates recorded in Lake Huntley during the field survey.

Phylum or Class	Order	Family	High gradient shore	Bay of outlet stream
Annelida	Oligochaeta		2	2
Turbellaria		Dugesiidae	24	
Arachnida	Acarina		5	4
Crustacea	Amphipoda	Paramelitid		2
	Branchiura	Argulidae		1
Insecta	Diptera	Chironomidae		
		Sub-fam: Orthocladiinae	3	5
		Sub-fam: Chironominae		2
		Sub-fam: Tanypodinae		1
	Trichoptera	Ecnomidae	3	12
		Leptoceridae		4
		Hydropsychidae		6
	Plecoptera	Gripopterygidae	1	25
	Ephemeroptera	Leptophlebiidae		1
	Odonata	Gomphidae		1
		Corduliidae		1
	Coleoptera	Dytiscidae larvae		1
		Psephenidae		1
		Number of families	**6**	**16**

Figure 3.10: High gradient conglomerate bedrock shoreline which characterise Lake Huntley.

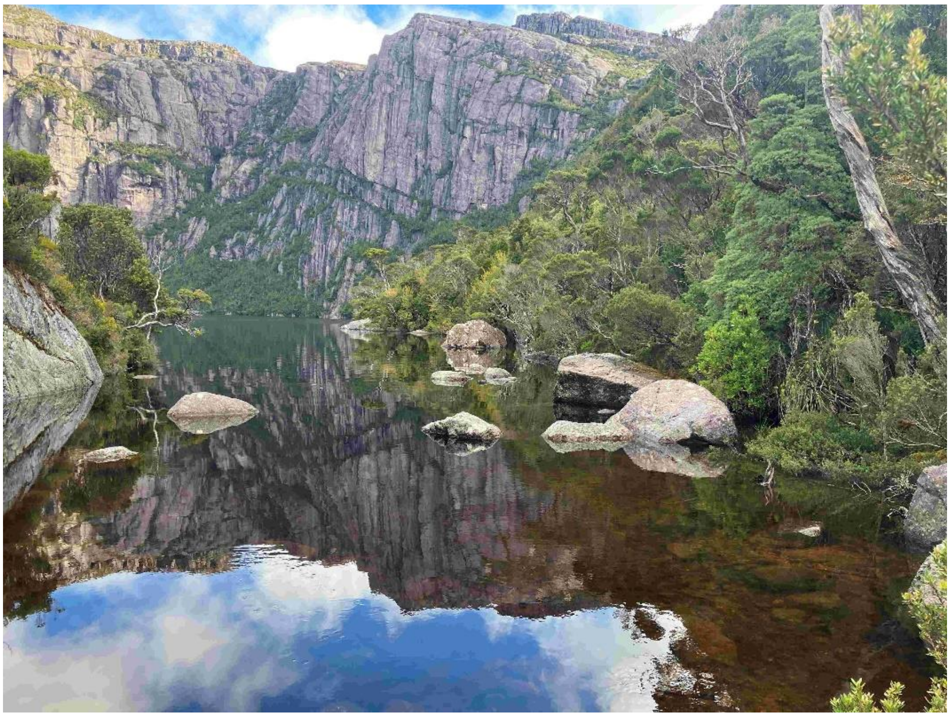

Figure 3.11 Lower gradient habitat in the bay leading to the outlet for Lake Huntley

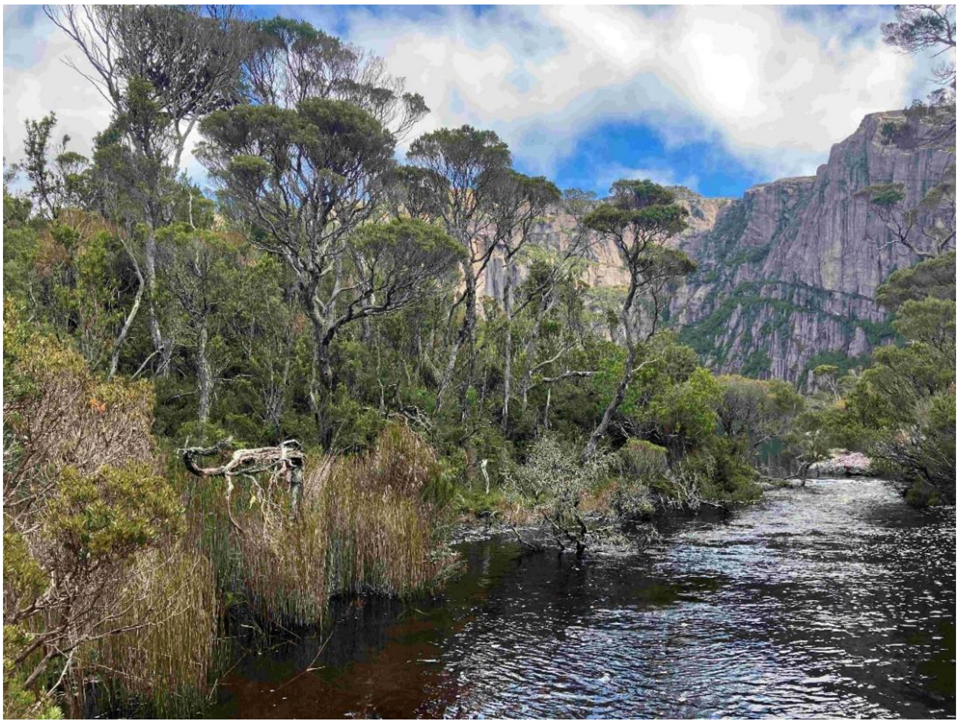

Figure 3.12 Flowing water through the bay leading to the outlet for Lake Huntley

Figure 3.13: Start of the outlet stream from Lake Huntley showing the steep cascade over bedrock which characterises most of the reach influenced by the scheme.

3.4 Hydrological changes

This section presents the results for the modelled baseline flow regime (i.e. the scenario used to assess current flow conditions) and the flow regime under a 10 l/s (proposed design) and 20 l/s (2 x proposed design load) turbine flow. The 20 l/s scenario is presented to account for potential changes in the design and or future load growth/consumption (Island Renewables 2024).

3.4.1 Lake Mary water levels

For the design turbine flow of 10 l/s, no drawdown events were modelled across the 67-year dataset (Island renewables 2024). A single drawdown was modelled under the 20 l/s operation and resulted in a maximum drawdown of 7 mm (Island renewables 2024).

3.4.2 Lake Mary outlet stream

Figure 3.14 shows monthly boxplots under the baseline scenario with the outlying values included. The monthly flow patterns show a typical seasonal trend for the west coast of Tasmania, with the lowest flows over summer and early autumn and the highest flows over winter and early spring.

Peak flows, as indicated by the outlying points on the box plots, can occur in any month with 6 m^3/s (May) the highest flow and 2.9 m^3/s the mean annual peak flow over the 67 year modelled record (Figure 3.14; Figure 3.15; Table 3.3). The median annual flow is 0.244 m^3/s; a baseflow[1] equivalent flow (percentile 30) is 0.12 m^3/s; and, a low baseflow (percentile 5) is 0.034 m^3/s (Figure 3.15; Table 3.3).

[1] i.e., Flows in a waterway that occurs between runoff events which generally provides a continuous flow through the channel

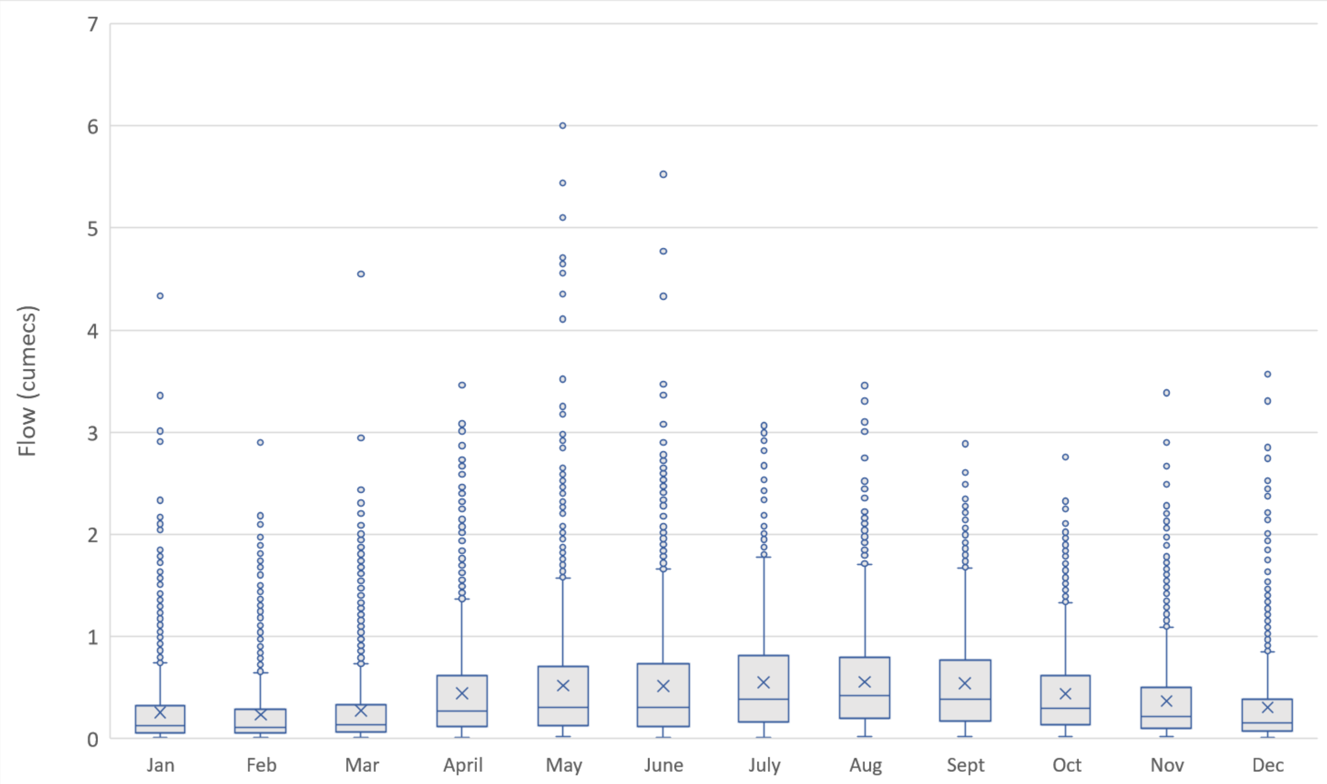

Figure 3.14: Box and whisker plot for modelled data for the outlet stream from Lake Mary. Plot shows the monthly median (blue line within bar), mean (x mark), the spread between the 25th and 75th quartiles (extent of the bar). The whiskers represent 1.5 the interquartile range. Dots represent outlying points.

3.4.2.1 Changes during operation (10 l/s)

The location of the turbine is near the bottom of the reach before the stream enters Lake Margaret (Island Renewables 2024) and therefore an approximate 560 m reach would be affected by operation of the micro-hydro scheme (Figure 2.1).

Under the design turbine flow (10 l/s), operation of the scheme results in very little change to the flow regime in any month. Figure 3.15 shows the flow duration curve (FDC) for the whole record; Figure 3.18 the February FDC; and Figure 3.16 the August FDC. February was chosen as representative of conditions during the driest period (late summer/early winter) and August as representative of conditions over the wettest period (winter/early spring).

Regardless of the month, operational impacts on the peak to moderate flow regime (i.e. mean annual or monthly peak to median flows) are undetectable on the FDC's (Figure 3.15 - Figure 3.16). Calculated at the whole record and mean annual level, the percentage reduction on this part of the flow regime is < 2% (Table 3.3).

The reduction in baseflow magnitude flows is also small, with an approximate 3% reduction in typical baseflow conditions (percentile 20 – 30) and 6% reduction in low baseflows (percentile 5 – 10) (Table 3.3). The patterns described above for the whole record and mean annual level are the same when assessing individual months, so the monthly figures are not shown.

The mean annual minimum flow is 0.018 m^3/s for the baseline and 0.016 m^3/s during operation (11% reduction) and the number of days below the annual percentile 5 flow (0.034 m^3/s) increases from 18.8 days to 21.9 days during operation (Table 3.3). The modelling indicates there are no days of zero flow under the baseline or during operation (Table 3.3).

Operation at 20 l/s

A scheme operating at 20 l/s also has minimal impacts on the peak to moderate flow regime (Figure 3.18 - Figure 3.20; Table 3.3). Typical baseflow conditions (percentile 20 – 30 flows) are reduced by approximately 7 – 9% (Figure 3.18 - Figure 3.20; Table 3.3). Low baseflows are more affected with a 14% reduction in percentile 10 flows and an 18% reduction in percentile 5 flows (Figure 3.18 - Figure 3.20; Table 3.3). Twelve zero flow days were modelled under the 20 l/s operation over two separate events with ten days occurring during a single event in 1937 (Table 3.3).

Table 3.3: Flow statistics for Lake Mary outlet stream under baseline, a 10 l/s and a 20 l/s turbine calculated at the whole record and mean annual level.

Period	Flow component	Flow statistic	Baseline	10 l/s		20 l/s	
				Value	*% Reduction from Baseline*	Value	*% Reduction from Baseline*
Whole of record	*Peak, high and moderate flows*	Maximum (m^3/s)	6.00	6.00	*0.08*	5.99	*0.22*
		Percentile 90 (m^3/s)	1.03	1.03	*0.48*	1.02	*0.97*
		Percentile 80 (m^3/s)	0.70	0.70	*0.57*	0.69	*1.43*
		Percentile 70 (m^3/s)	0.49	0.48	*0.82*	0.48	*1.85*
		Mean (m^3/s)	0.419	0.415	*1.0*	0.41	*2.1*
		Median (m^3/s)	0.244	0.24	*1.6*	0.235	*3.7*
	Baseflow and low flows	Percentile 30 (m^3/s)	0.12	0.116	*3.3*	0.112	*6.7*
		Percentile 20 (m^3/s)	0.081	0.079	*2.5*	0.074	*8.6*
		Percentile 10 (m^3/s)	0.05	0.047	*6.0*	0.043	*14.0*
		Percentile 5 (m^3/s)	0.034	0.032	*5.9*	0.028	*17.6*
		Zero flow days (over 24455 days[2])	0	0	0.0	12	0.0
Mean annual	*Peak flows*	Mean annual maximum (m^3/s)	2.934	2.929	*0.2*	2.9	*0.3*
	Low flow	Mean annual minimum (m^3/s)	0.018	0.016	*11.1*	0.011	*38.9*
		Mean annual days < 0.034 m^3/s	18.8	21.9	*16.6*	26.5	*40.9*
		Mean annual zero flow days	0	0	-	0.2	-

[2] i.e., days over the 67-year modelled flow record

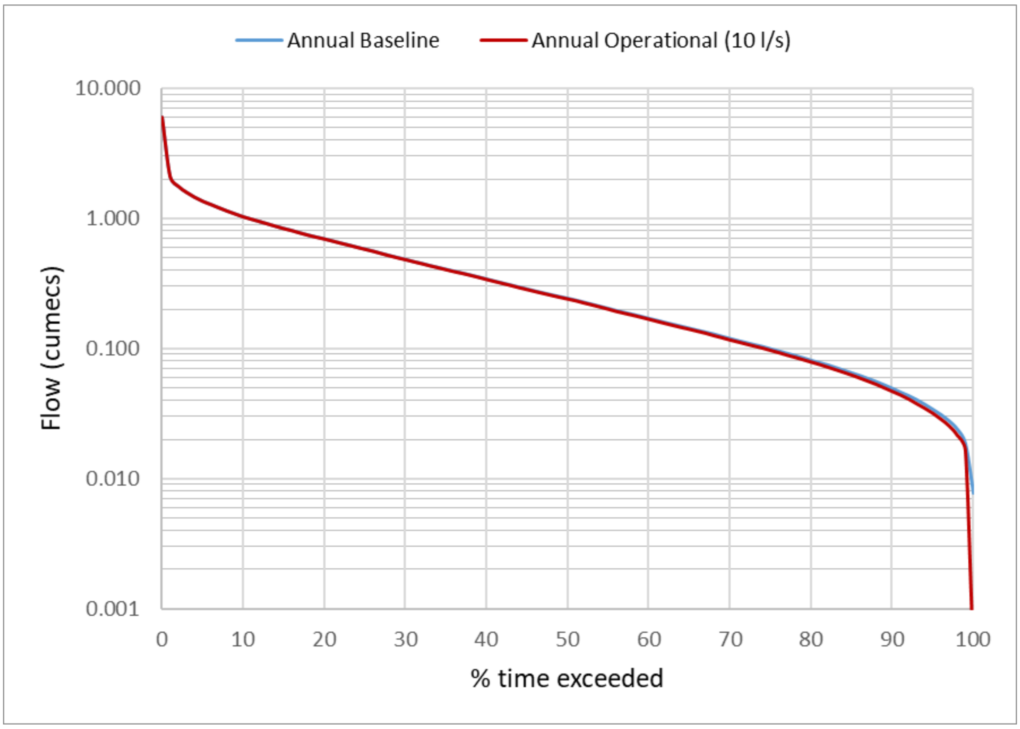

Figure 3.15: Lake Mary flow outlet stream flow duration curve (log) for the whole record under the modelled baseline and with a 10 l/s turbine flow.

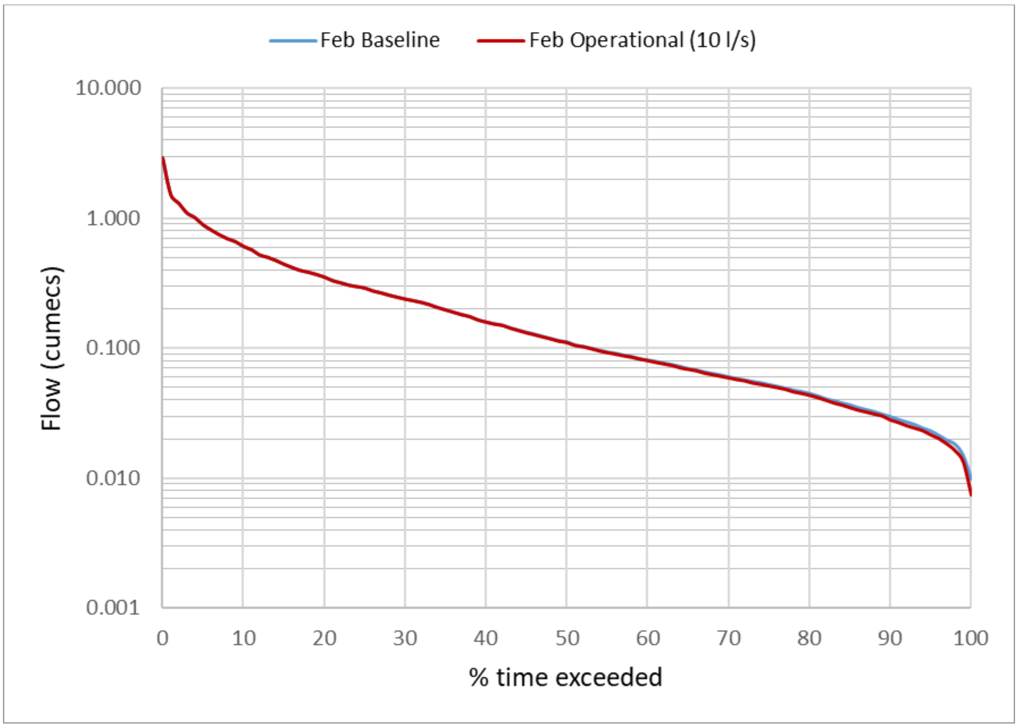

Figure 3.16: Lake Mary flow outlet stream flow duration curve (log) for February under the modelled baseline and with a 10 l/s turbine flow.

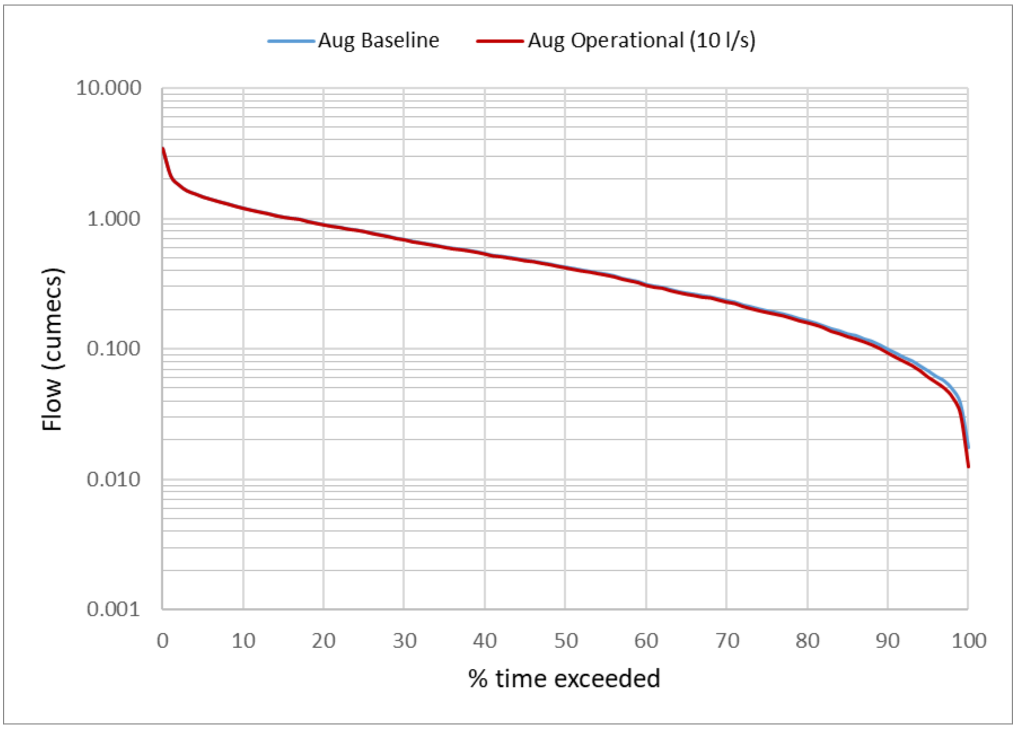

Figure 3.17: Lake Mary flow outlet stream flow duration curve (log) for August under the modelled baseline and with a 10 l/s turbine flow.

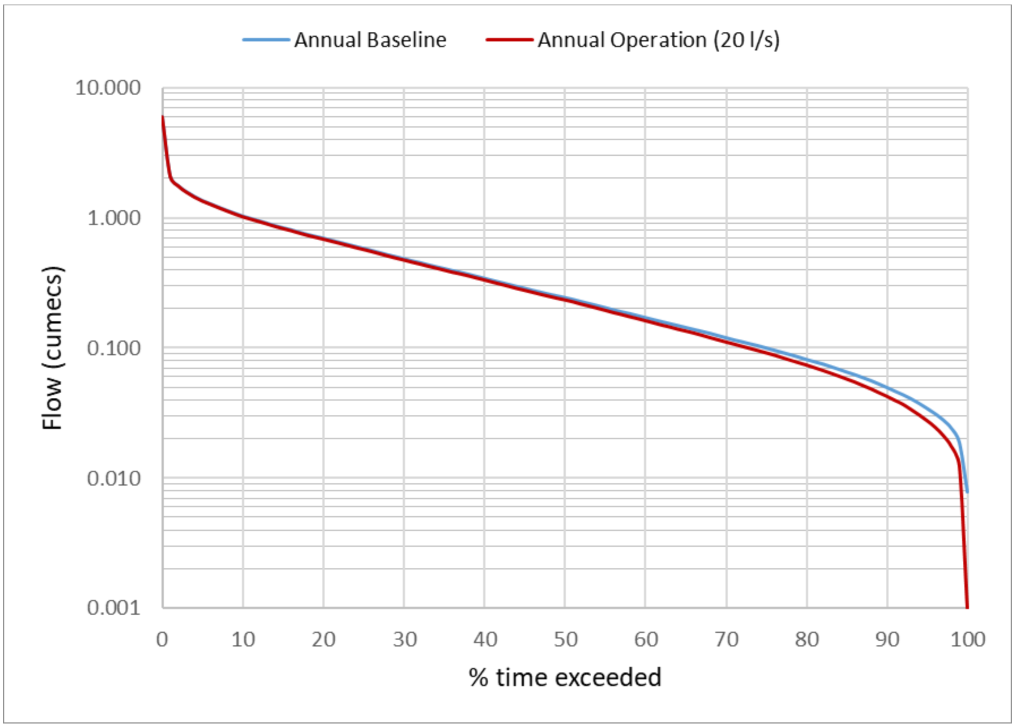

Figure 3.18: Lake Mary flow outlet stream flow duration curve (log) for the whole record under the modelled baseline and with a 20 l/s turbine flow.

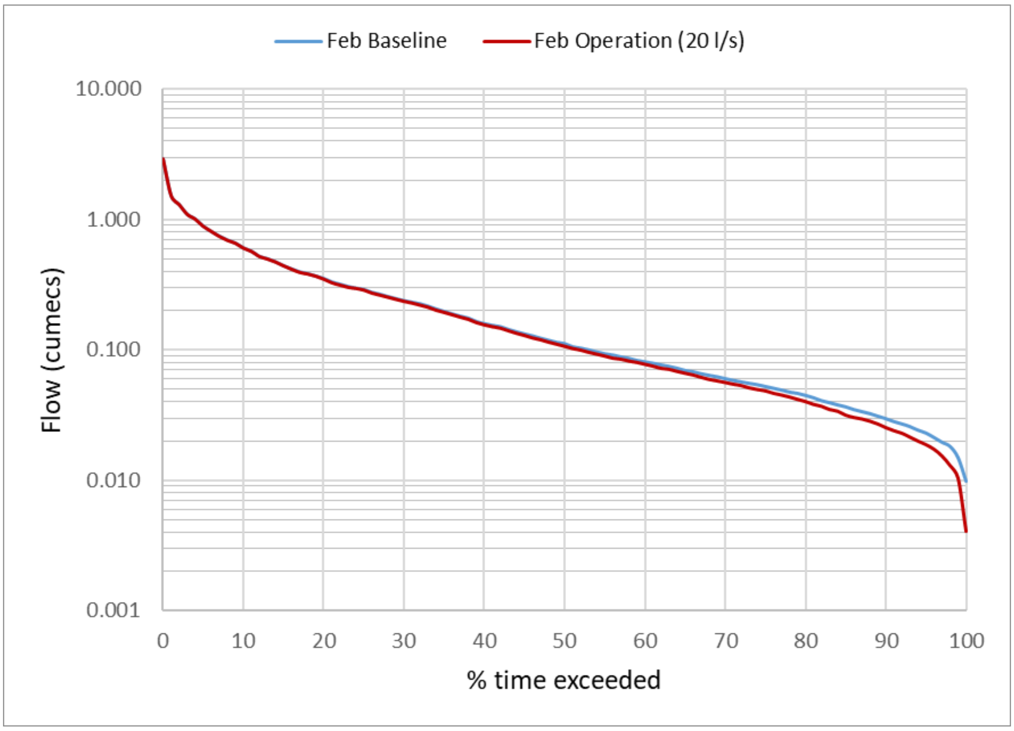

Figure 3.19: Lake Mary flow outlet stream flow duration curve (log) for February under the modelled baseline and with a 20 l/s turbine flow.

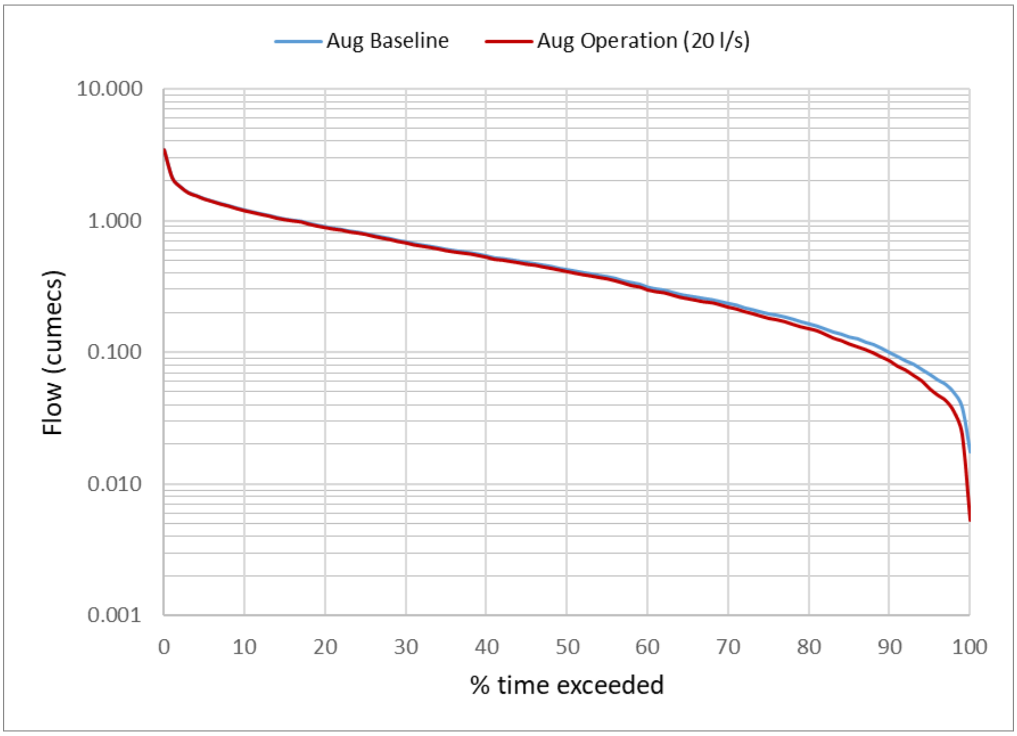

Figure 3.20: Lake Mary flow outlet stream flow duration curve (log) for August under the modelled baseline and with a 20 l/s turbine flow.

3.4.3 Lake Huntley water levels

For the design turbine flow of 10 l/s, a single drawdown event was modelled over the 67-year dataset which resulted in an approximate 1 mm reduction in lake level (Island renewables 2024). Sixteen drawdown events were modelled under the 20 l/s operation with the largest of these resulting in a maximum drawdown of 13 mm (Island renewables 2024).

3.4.4 Lake Huntley outlet stream

Figure 3.21 shows monthly boxplots under the baseline scenario with the outlying values included. The monthly flow patterns show the same seasonal patterns as described for the Lake Mary catchment.

Peak flows, as indicated by the outlying points on the box plots, can occur in any month with 1.7 m^3/s (May) the highest flow and 0.9 m^3/s the mean annual peak flow over the 67 year modelled record (Figure 3.21; Figure 3.22; Table 3.4). The median annual flow is 0.122 m^3/s; a baseflow equivalent flow (percentile 30) is 0.07 m^3/s; and a low baseflow (percentile 5) is 0.023 m^3/s (Figure 3.22; Table 3.4).

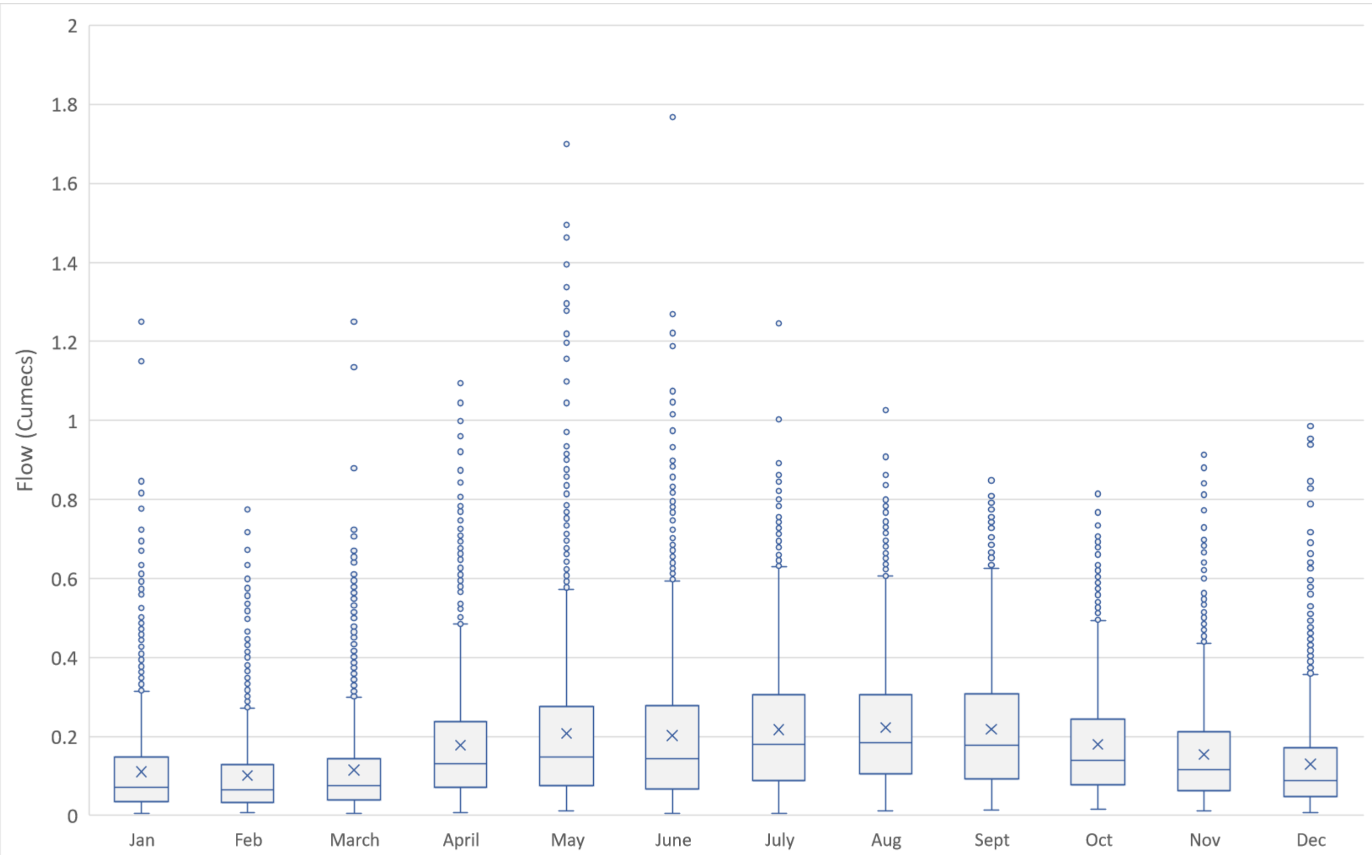

Figure 3.21: Box and whisker plot for modelled data for the outlet stream from Lake Huntley. Plot shows the monthly median (blue line within bar), mean (x mark), the spread between the 25th and 75th quartiles (extent of the bar). The whiskers represent 1.5 the interquartile range. Dots represent outlying points.

3.4.4.1 Changes during operation (10 l/s)

The first 340 m of the outlet stream downstream from the lake would experience reduced flows from the proposed micro-hydropower scheme before the tailrace/exit pipe of the turbine returns water to the channel.

Under the design turbine flow (10 l/s), operation of the scheme results in very little change to the flow regime in any month. The FDC's for the whole record, February and August are shown in Figure 3.22 - Figure 3.24). February was chosen as representative of conditions during the driest period (late summer/early winter) and August as representative of conditions over the wettest period (winter/early spring).

The operational impacts on the peak to moderate flow regime (i.e. mean annual or monthly peak to median flows) are undetectable on the FDC's (Figure 3.22; Figure 3.24). Calculated at the whole record and mean annual level, the percentage reduction on this part of the flow regime is < 3% (Table 3.4)

The reduction in baseflow magnitude flows is also small, with an approximate 4 - 6% reduction in typical baseflow conditions (percentile 20 – 30) and a 9% reduction in low baseflows (percentile 5 – 10) (Table 3.4). The patterns described above for the whole record and mean annual level are the same when assessing individual months, so the monthly figures are not shown.

The mean annual minimum flow is 0.012 m^3/s for the baseline and 0.009 m^3/s during operation (25% reduction) and the number of days below the annual percentile 5 flow (0.023 m^3/s) increases from 18.9 days to 23.6 days during operation (Table 3.4). The modelling indicates there are no days of zero flow under the baseline record and 8 days under operation which occurred over a single event in June/July 1937 (Table 3.4).

Operation at 20 l/s

A scheme operating at 20 l/s also has minimal impacts on the peak to moderate flow regime (Figure 3.26 - Figure 3.27; Table 3.4). Typical baseflow conditions (percentile 20 – 30 flows) are reduced by approximately 10 – 14% (Figure 3.26 - Figure 3.27; Table 3.4). Low baseflows are more affected with a 21% reduction in percentile 10 flows and an 26% reduction in percentile 5 flows (Figure 3.26 - Figure 3.27; Table 3.4).

Sixty-five zero flow days were modelled under the 20 l/s operation over the whole record which equates to 1 flow days per year on average (Table 3.4). However, cease to flow events would not occur each year – the 65 zero flow days were spread over 15 events and over ¼ of all zero flow days were during a single event in 1937.

Table 3.4: Flow statistics for Lake Huntley outlet stream under baseline, a 10 l/s and a 20 l/s turbine calculated at the whole record and mean annual level.

Period	Flow component	Flow statistic	Baseline	10 l/s		20 l/s	
				Value	*% Reduction from Baseline*	Value	*% Reduction from Baseline*
Whole record	*Peak, high and moderate flows*	Maximum (m^3/s)	1.768	1.762	*0.3*	1.755	*0.7*
		Percentile 90 (m^3/s)	0.378	0.374	*1.1*	0.368	*2.6*
		Percentile 80 (m^3/s)	0.269	0.265	*1.5*	0.26	*3.3*
		Percentile 70 (m^3/s)	0.205	0.201	*2.0*	0.196	*4.4*
		Mean (m^3/s)	0.17	0.167	*1.8*	0.162	*4.7*
		Median (m^3/s)	0.122	0.119	*2.5*	0.114	*6.6*
	Baseflow and low flows	Percentile 30 (m^3/s)	0.07	0.067	*4.3*	0.063	*10.0*
		Percentile 20 (m^3/s)	0.051	0.048	*5.9*	0.044	*13.7*
		Percentile 10 (m^3/s)	0.033	0.03	*9.1*	0.026	*21.2*
		Percentile 5 (m^3/s)	0.023	0.021	*8.7*	0.017	*26.1*
		Zero flow days (over 24455 days)	0	8	-	65	-
Mean annual	*Peak flows*	Mean annual maximum (m^3/s)	0.909	0.905	*0.4*	0.899	*1.1*
	Low flow	Mean annual minimum (m^3/s)	0.012	0.009	*25.0*	0.004	*66.7*
		Mean annual days < 0.023 m^3/s	18.9	23.6	*25.1*	31.9	*68.7*
		Mean annual zero flow days	0	0.123	-	1	-

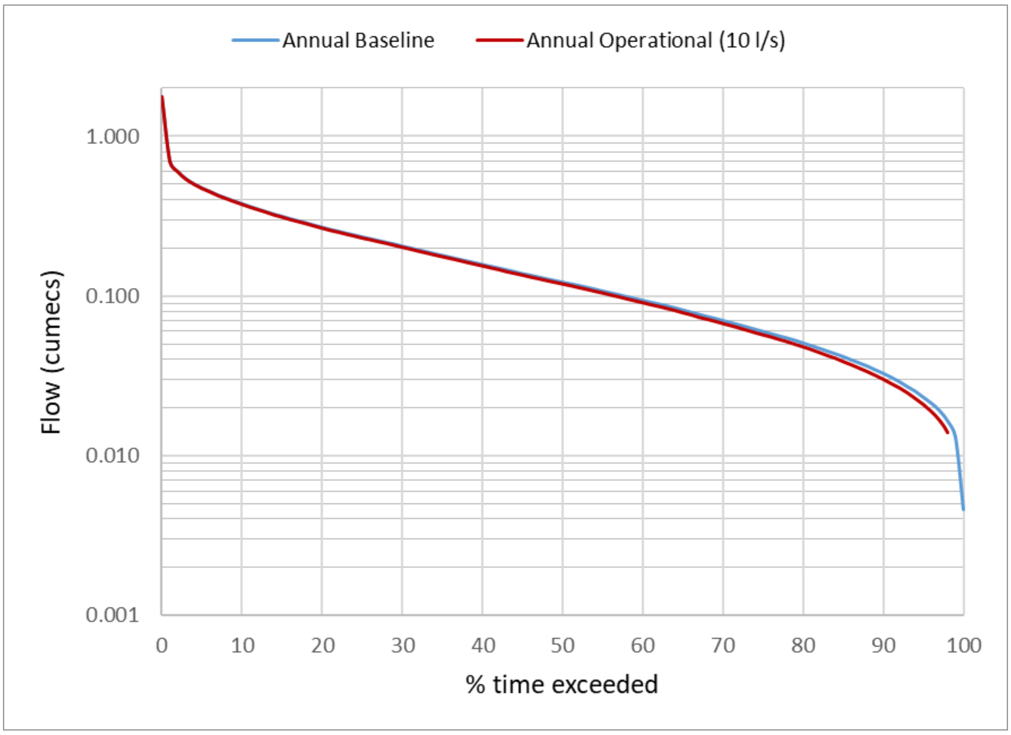

Figure 3.22: Lake Huntley flow outlet stream flow duration curve (log) for the whole record under the modelled baseline and with a 10 l/s turbine flow.

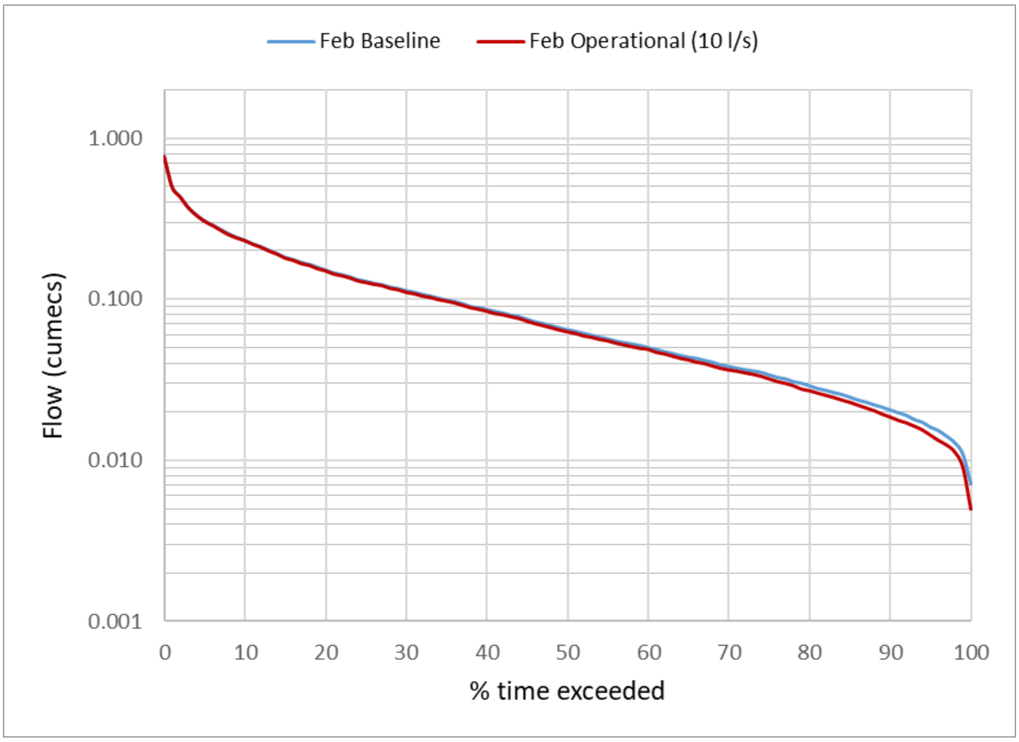

Figure 3.23: Lake Huntley flow outlet stream flow duration curve (log) for February under the modelled baseline and with a 10 l/s turbine flow.

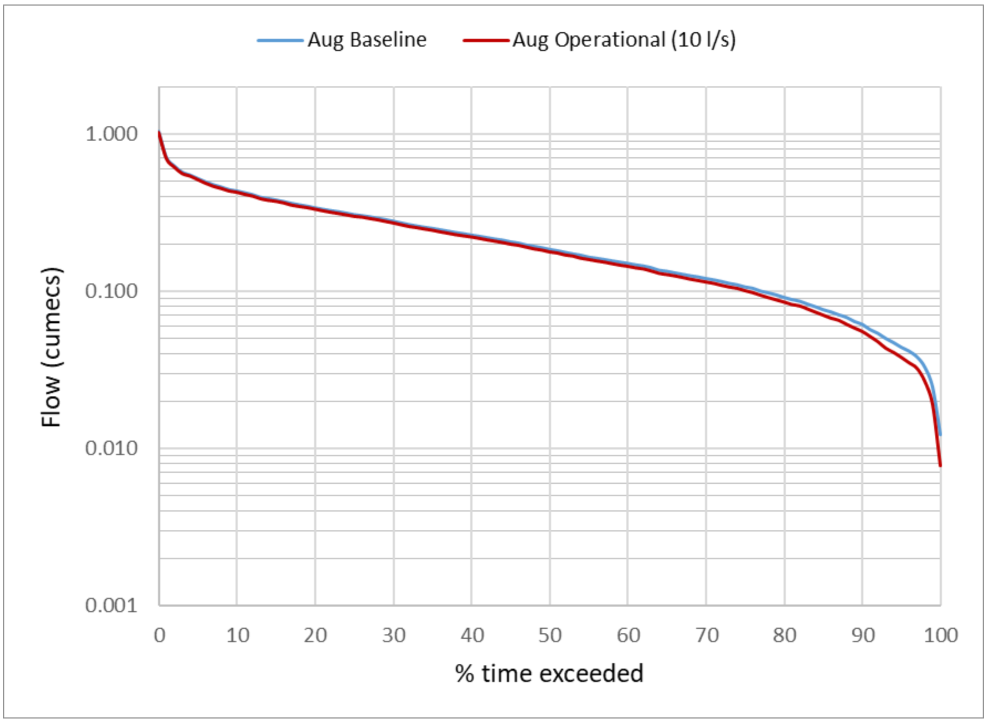

Figure 3.24: Lake Huntley flow outlet stream flow duration curve (log) for August under the modelled baseline and with a 10 l/s turbine flow.

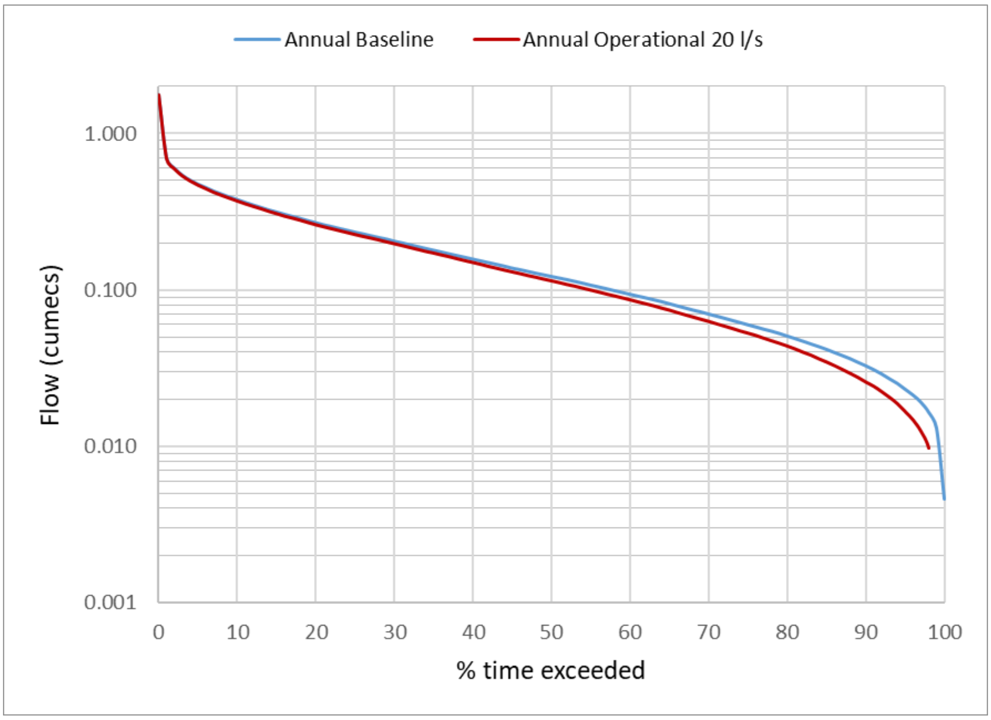

Figure 3.25: Lake Huntley flow outlet stream flow duration curve (log) for the whole record under the modelled baseline and with a 20 l/s turbine flow.

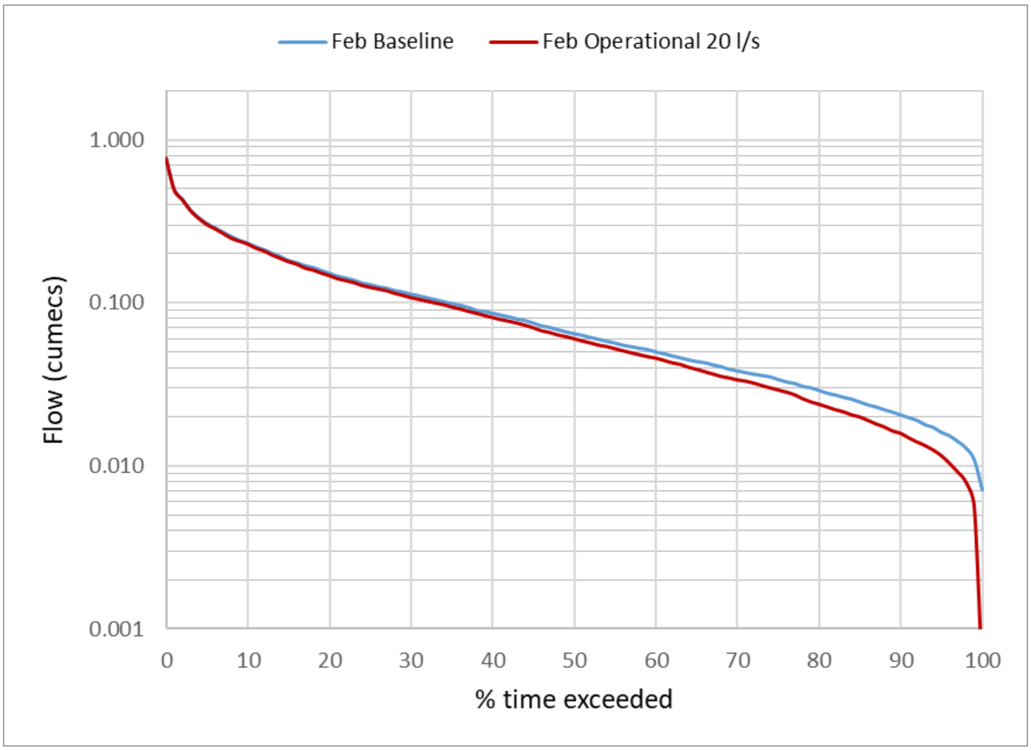

Figure 3.26: Lake Huntley flow outlet stream flow duration curve (log) for February under the modelled baseline and with a 20 l/s turbine flow.

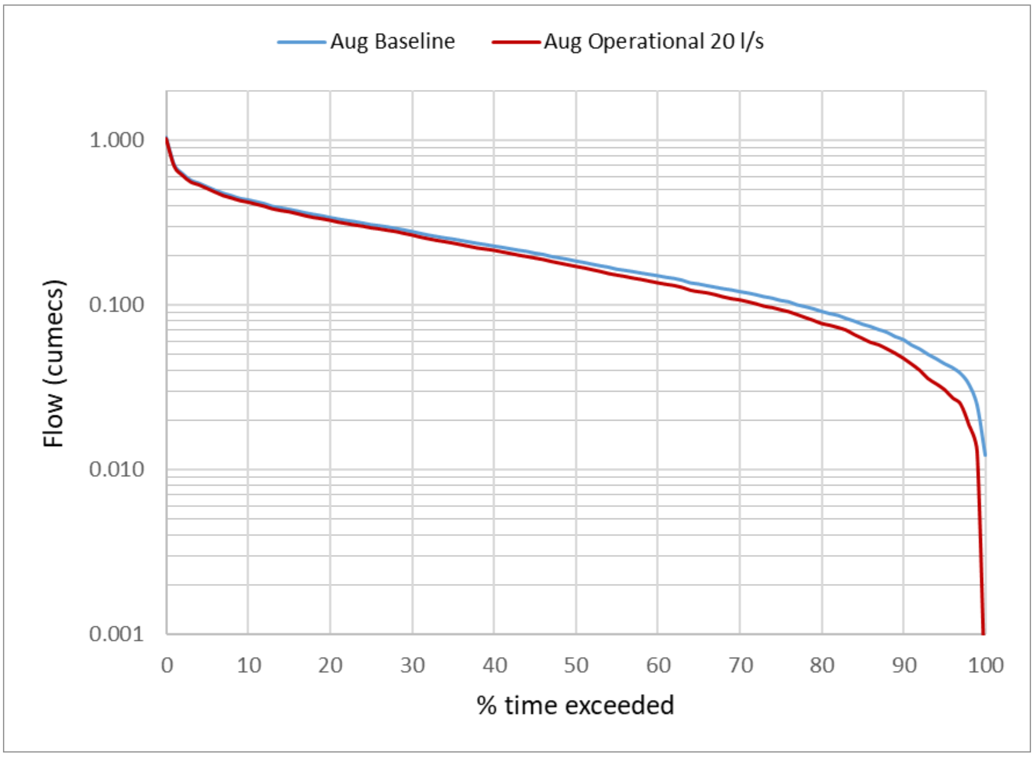

Figure 3.27: Lake Huntley flow outlet stream flow duration curve (log) for August under the modelled baseline and with a 20 l/s turbine flow.

4. Impact assessment

4.1 Lakes

Native aquatic biological values surveyed in both lakes include the freshwater fish species climbing galaxias (*Galaxias brevipinnis*), crayfish (*Astacopsis tricornis*); macroinvertebrates, and the macrophyte species *Isolepis fluitans*. A platypus was observed in Lake Huntley and are likely to be present in Lake Mary (Section 3.2; Section 3.3).

The modelling indicates that reductions in lake levels under the design take of 10 l/s and 2 x the design take rarely occur and are of small magnitude in both lakes (i.e. less than 2 cm: Section 3.4.1; 3.4.3). Even if the modelled reductions in lake level were several times higher, they are unlikely to cause any detectable changes in shoreline habitats or in the health, distribution and composition of aquatic species. Overall, operation is predicted to have no impact on lake habitats or ecological values.

4.2 Outlet streams

The assessments given for the outlet streams rely on interpretation of the hydrology modelling and the desktop and field-based observations on the habitats and values. Assessments of changes in flow regime on stream habitats are often aided using hydraulic models; however, in this instance the surveys required to develop a useful model for each reach would be very difficult to undertake. This is especially the case for this project as a high level of resolution would be required for a hydraulic model to accurately simulate habitat/flow associations under low flows (which are the only noticeable part of the flow regime predicted to change during operation) through a complex stream bed.

For the outlet stream from Lake Huntley, on ground hydraulic surveys would be limited by the steep topography. A drone-based LiDAR or photogrammetry survey may be possible but would still require some on ground surveying and calibration through flow hydrography. This would be a major undertaking and is unlikely justified given the magnitude of change predicted by the hydrology modelling and because of the short reach affected by changed flows.

The outlet stream for Lake Mary has extremely thick riparian vegetation, including an extensive and low canopy cover. These factors would prohibit a drone-based survey and a ground-based survey without extensive vegetation clearing. Again, the magnitude of changes predicted by the hydrology modelling do not justify the effort required to attempt building a hydraulic model for this reach.

4.2.1 Lake Mary outlet stream

The hydrology modelling indicates that a take of 10 l/s has minimal impact on the flow regime of the outlet stream (Section 3.4.2). In relative terms, low baseflows are the most impacted component of the flow regime but even these are only a few percent changed compared to baseline conditions. These small reductions in baseflow would have negligible (i.e. likely undetectable) to no impact on any of the functions that baseflows provide including:

- provision of permanent aquatic habitat;
- longitudinal flow connectivity to maintain habitat quality, water quality and migratory/movement pathways for aquatic species;
- keeping the riverbed and lower banks wet helping to maintain native plants and trees along the banks;

Overall, operation under a 10 l/s is predicted to have a negligible impact on the flow regime and the physical and ecological processes it supports.

Baseflows remain the only component of the flow regime which would be noticeably affected if the scheme operated under a 20 l/s turbine (Section 3.4.2). The modelling indicates that average baseflow conditions would be reduced by approximately 7 – 9% and low baseflow conditions by approximately 14 to 18%. This reduction would result in some retraction in inundation but are not predicted to cause significant harm to ecological processes. For example, if AusRivAS macroinvertebrate modelling was used to monitor for operational impacts on river health then no decline in condition scores would be expected from operating at 20 l/s. Similarly, if population numbers of climbing galaxias were used as monitoring indicators, then no change in population size would be expected from operation.

The modelling indicated that operation under a 20 l/s take would result in rare periods of zero flow (Section 3.4.2). Twelve days over the 24455 days of the modelled flow record reported zero flow with ten of these in a single event in July 1937. Zero flow events would impact aquatic habitats and species in the outlet stream; however, these events appear to be exceptionally rare and would not result in the permanent degradation of aquatic habitats or in the loss of species.

The conservative modelling of solar operation (Island Renewables 2024) is another factor which is likely to exaggerate the frequency of very low flows and zero flow days in the hydrology modelling. Under real world operation, solar is likely to contribute more than the modelling shows and this will reduce turbine operation, particularly during periods when inflows are typically at the lowest of summer and early autumn.

Monitoring operation though river health (AusRivAS) and or fish populations under the scenario of a 20 l/s take would be predicted to remain in the same condition as prior to operation.

4.2.2 Lake Huntley

Aside from the hydrological change, the assessment of this reach also takes into consideration that the zone of impact (340 m) is approximately 1/5th of the 1.8 km section of the watercourse between Lake Huntley and Lake Rolleston. The diversity and abundance of aquatic species in the 340 m section downstream from the lake is likely to be low as the gradient of the river channel is very high (Section 3.3.3).

The gradient of the channel becomes progressively lower in the ~1.5 km downstream from where the turbine discharges back into the watercourse and most of the diversity and abundance of aquatic species would occur in these lower reaches with more diverse and benign hydraulic conditions. The reaches downstream from the turbine would be unaffected by the scheme.

As for the scheme on Lake Mary, the impacts on operation are confined to the baseflow component with moderate and high flows showing minimal change (Section 3.4.4.1). Under a 10 l/s take, the size of a typical baseflow is reduced by 5% and low baseflows by approximately 10% (Section 3.4.4.1). A baseflow reduced by 5 - 10% is predicted to have negligible impact (i.e. undetectable) on aquatic habitats and species.

The hydrology modelling indicated that periods of zero flows occurred under a 10 l/s operation; however, this was limited to a single 8-day event in 1937. Therefore, it is reasonable to conclude that zero flows would be exceptionally rare during operation and likely less than shown in the modelling. That is, solar operation is likely to reduce hydro operation more than was shown in the energy modelling due to the conservative approach which was adopted (Island Renewables 2024).

Overall, operation under a 10 l/s take is predicted to have a negligible impact on the aquatic values in this reach as flow connectivity is maintained during dry periods and moderate and high flows are unaffected.

Under a 20 l/s take, typical baseflows are reduced by ~10 – 14% and low baseflows by ~25% (Section 3.4.4.1). This reduction would result in some retraction of aquatic habitat but is not predicted to cause significant harm to ecological processes as flow connectivity is maintained except under rare zero flow events (discussed below).

Under a 20 l/s operation, zero flows were modelled to occur for 65 days over 15 separate events (Section 3.4.4.1). Approximately ¼ of zero flow days occurred over a single event in 1937. Zero flow events would impact aquatic habitats and species in the zone of impact. Hydraulic information would be required to quantify the loss of aquatic habitat during zero flows, but aquatic species would be restricted to refuge pools at the breaks in slope. The main permanent biotic values present in this high gradient reach are likely to be macroinvertebrates and crayfish. Again, most of these would be confined to the short sections were breaks in the slope allow more benign hydraulic conditions. Platypus and climbing galaxias are probably only transitory through the impact zone as they migrate upstream from the lower gradient sections (i.e. downstream from the proposed turbine site) into Lake Huntley. Climbing galaxias tend to move upstream during periods of elevated flow and therefore the scheme is predicted to have a negligible impact on this species. Platypus can migrate upstream over land and are not predicted to be impacted by the scheme.

Any zero flow events which occur would not result in the loss of species, or in the permanent degradation of aquatic habitats, as these events are likely to be very rare and because most of the 1.8 km reach downstream from Lake Huntley would be unaffected by the scheme. That is, the reaches downstream from the turbine would provide a refuge which would aid the recolonisation of the reaches upstream. Recolonisation would also occur via the downstream migration of animals from the lake.

Overall, operation under 20 l/s is predicted to have a negligible to minor impact on aquatic values in this reach as baseflow connectivity is generally maintained, other than rare periods of zero flow, and moderate and high flows are unaffected.

5. Recommendations

High flows during the survey limited the ability to assess the condition of the outlet streams. These watercourses should be resurveyed prior to operation if NRE Tas deem that monitoring is required as condition for the water licences as part of an operational environmental monitoring plan (OEMP). If an OEMP is required, then annual (spring or autumn) or twice-yearly (spring and autumn) surveys are likely to be required for at least two years prior to commissioning and then yearly after commissioning. Fish surveys in the outlet stream may also be required as part of an OEMP.

The PWS may also wish to resurvey the streams for their RAA process; however, another survey is unlikely to change the conclusions of this assessment. The earliest another survey could be undertaken is spring 2024 to align with spring AusRivAS season.

6. References

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