Biodiversity report

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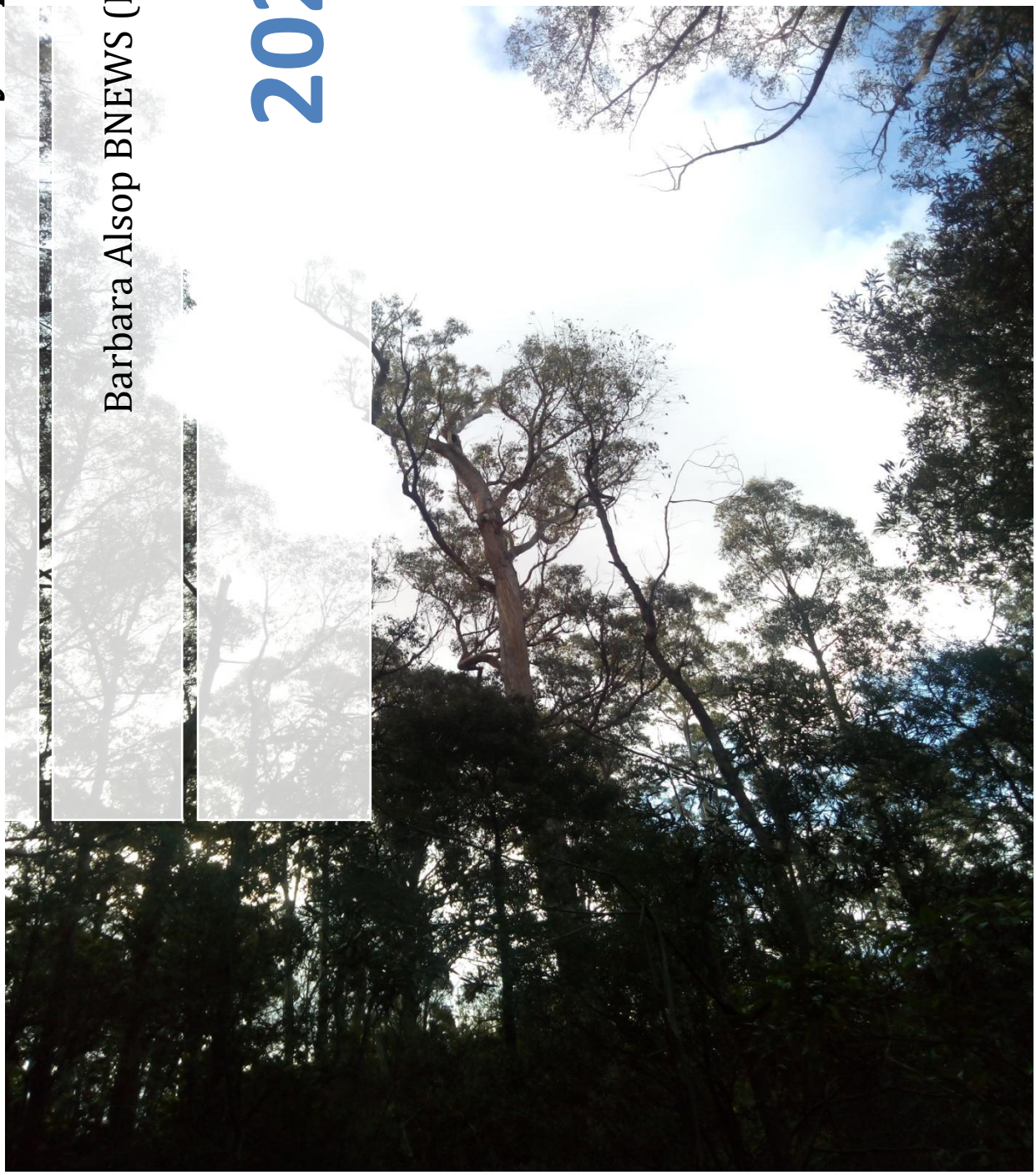

This project was undertaken as a component of the Community Environments Program grant. The project aimed to identify species within the Minnow Catchment in North-western Tasmania. Over 35 hectares of land was surveyed across remnant natural forest, plantation verges, and riparian buffer zones. Bird, macroinvertebrate, and fungi surveys were also undertaken. Fungi surveys were dependent on climatic conditions and were not possible at many of the sites.

Surveys were undertaken between July 2020 and May 2021.

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1 Introduction

Mount Roland Rivercare Catchment Incorporated (MRRCI) received a Federal Government Grant under the Communities Environmental Program (CEP) during 2020, a component of which was assessing biodiversity in the Minnow Catchment. Identifying the species present in the catchment was recommended in 2016 when MRRCI commissioned the construction of a Minnow Action Plan (Stronach2016) **"There is an opportunity today to protect and enhance the natural values of the Minnow that provide essential refuge for threatened and endangered species and vegetation communities as well as ensuring that the natural assets that humans rely upon are sustainably managed for our long-term future and survival."**

The recommendation was to identify species that were present, particularly vegetation, and vegetation community structure, while observing faunal species such as avian, macroinvertebrate, fungi, and others. By identifying the species present, a greater understanding of the ecosystems in the area will be achieved, endangered and vulnerable species will be noted, and plans prepared to assist in protecting habitats can be designed. Prior to 2016, research in the catchment had been very limited, and little was known about the ecosystems and species present.

Small areas of remnant natural forest are important for protecting native species, though their value is greatly increased if there is connectivity between native stands (Lloyd, undated).

2. Background

The Minnow Catchment is located in north-west Tasmania (Figure 1) and is a sub-catchment of the 1740 km² Mersey River system which flows from the Central Highlands through to Bass Strait at Devonport. The Minnow Catchment is approximately 30 km south of the coast, minimising the impacts from most coastal storm activity.

The headwaters of the Minnow River is located on the top of Mount Roland, in the Fossey Mountain Range, at an altitude of 1080 m, and is joined by two tributaries before reaching the four stage falls on the eastern face. The dendritic drainage pattern of the many small tributaries from the Gog Range and many hills in the area contribute to the Minnow flow

regime. The Minnow Catchment covers an area of approximately 85 km^2, with the river length being approximately 28 km long (Listmap 28/04/21), 17 km of which flows through reserved areas. Of these reserved areas, only one side of the river is fully protected by the Mount Roland Regional Reserve along a 0.9 km reach, and a further 6.7 km are reserved under the *Mineral Resources Development Act 1995.*

The Upper Minnow Catchment covers an area of less than 20 km^2, and is contorted in the reaches upstream from Lower Beulah, where it becomes predominantly bedrock confined. The upper reaches have low sinuosity due to valley alignment, with occasional flood plain pockets, while the lower reaches vary between meandering gravel beds, gorges and partially confined valleys for approximately 30 km (Lampert, 2000). Run-off via small waterways from the Gog Range contributes to the Minnow as it flows through Beulah, with minor tributaries flowing from the many hills in the region. The Minnow flows through natural forest, softwood plantations, hard wood plantations and rural land at varying stretches before joining the Dasher River at Lower Beulah at an altitude of 200 m. The Minnow River has been described as having the least impacted geomorphic condition (Lampert, 2000) within the Mersey Catchment, although adjacent landuse has impacted on river condition.

Figure 1 The Minnow River in north-western Tasmania

2.2 Minnow Catchment climate

The climate of the Minnow region is described as cool temperate, with a mean annual rainfall of 1100 mm. The nearest current BOM weather station is located at the School Farm in Sheffield, which is approximately 20 km from most reaches of the Minnow River. Data has been collected at the Sheffield station since 1997, though data is inconsistent and missing for some years. Climatic variations occur in the Minnow region due to the morphology of the landscape and altitude variations, resulting in slightly higher rainfall than neighbouring areas, and temperature variations of approximately ± 2° C. The source of the Minnow on Mount Roland is subjected to snow falls during winter, with occasional extension of falls across the catchment. The region is prone to high velocity winds which prevail from the North, West and North-west, though wind speeds are consistently less than coastal Devonport.

2.3 Minnow Catchment geology

The Minnow Catchment between Mount Roland and Lower Beulah lies over a Cambrian pluton of andesite, formerly referred to as Beulah granite (Leaman 2006), and from Lower Beulah to Kimberley lies over Ordovician sedimentary rock. The whole catchment was

glaciated during the Cenozoic Period (Kiernan 1990. The three major geological formations in the basin are the Gog Range Greywacke, Beulah andesitic lavas and the Minnow Keratophyre (felsic lavas and sediments) with intrusions of mafic granitoids in both the Gog Range Greywacke and the Minnow Keratophyre (Vicary and Jackson 1993).

2.4 Flora and fauna

Many of Tasmania's vulnerable and endangered species are present in the Minnow Catchment including the largest freshwater crayfish *Astacopsis gouldi* (Growns 1995), the Wedge-tailed eagle sub-species *Aquila audax fleayi,* the Tasmanian white morphology of the Grey goshawk *Accipiter novaehollandiae* (Olsen 1985), and the locally endemic Minnow snail (*Beddomeia turnerae*) (TSS 2020). Despite the creation of recovery plans for the Giant Freshwater crayfish and Wedge-tailed eagles, habitat degradation is continuing, and the recommended 30 m riparian buffer preferred by the Giant crayfish is not consistently adhered to. Crayfish populations in some locations have diminished, particularly where riparian vegetation has been removed or seriously degraded, and recreational riders have cleared access tracks through the river and tributaries.

2.5 Landuse

The Upper Minnow region is dominated by mainly softwood plantations of Radiata pine *(Pinus radiata)* and natural forest area in the upper foothills of Mount Roland. The remainder of the natural forest is in the form of remnant 'islands' along riparian zones, or areas that are difficult to access.

The Middle catchment has a mix of soft and hardwood plantation, consisting of Radiata pine, Shining gum (*Eucalyptus nitens*), and Blue gum (*Eucalyptus globulus*). Remnant patches of native vegetation are similar to upper catchment, occurring along riparian zones and some strategic locations at the top of large hills, with small remnant stands on some rural properties. Agriculture land borders many of the tributaries in this area, and along the main channel of the Minnow River at Lower Beulah. Very little riparian vegetation remains along most of these reaches, and remnant stands of native vegetation have recently been removed from a large agricultural property.

The Lower Catchment is also dominated by forests, both native and production.

Productive forests are managed by three major stakeholders, Sustainable Timbers Tasmania (STT), Forico, and Reliance Forest Fibre (RFF). Natural forests are mainly managed by Parks and Wildlife Services, with some remnant and riparian zones managed by Forico and RFF. Most rural or agricultural properties have only small of stand of native vegetation remaining, with some important small patches having been cleared in Lower Beulah during the last two years, reducing the available habitat and refugia for many species

The Minnow catchment encompasses an area from the top of Mount Roland to Lower Beulah (Figure 2)

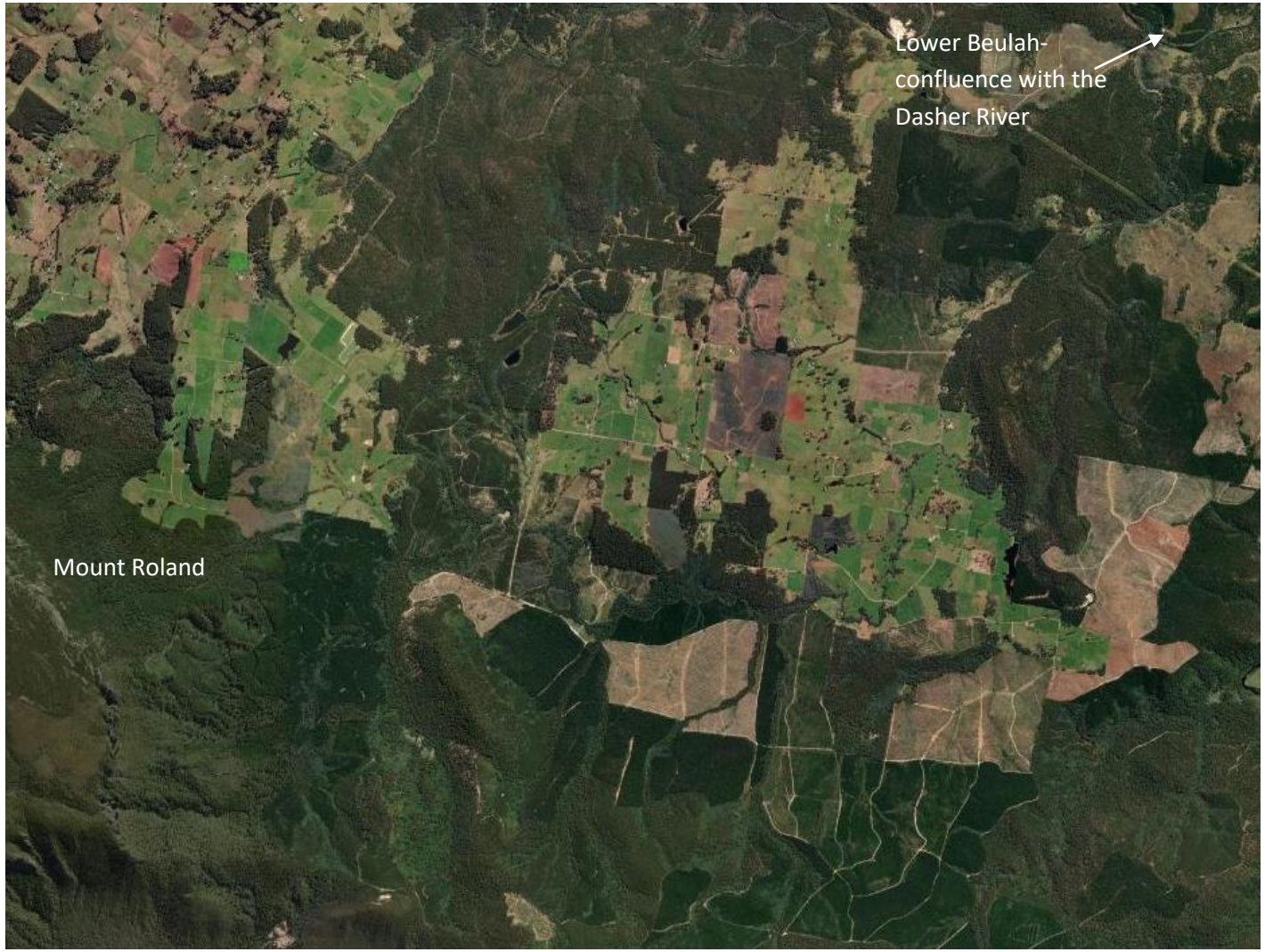

Figure 2 Satellite image of the Minnow Catchment

3 Aim of the project

The aim of the project is to record the species that are present in the Minnow Catchment, identify the vegetation communities present in larger remnant patches of natural forest, particularly forest types which are threatened communities. By identifying the species and communities present, action can be undertaken to protect these areas and the habitats utilized by vulnerable and endangered species.

Avian assemblages are a valuable bio-indicator of ecosystem health, yet little is recorded on the species present in the Minnow Catchment. Australian studies in other areas have indicated that species diversity I greatest when there is combination of natural riparian vegetation edged on pasture land, and the lowest diversity occurs within dry land eucalypt plantations (Hsu et al., 2010). Avian species in Tasmania tend to prefer undisturbed old growth forest, although some species are tolerant to disturbance such as logging (Lefort and Grove, 2009) and weed infestations.

4 Methods

Areas of natural forest were identified by desktop surveys using satellite imagery (Google Earth Pro and ESRI Basemap on LIST), and by site visits throughout the Minnow Catchment (Figure 3). Where possible an area of at last one hectare was surveyed, or where vegetation community seemed ambiguous or uncertain, a greater area was surveyed. In small remnant stands this was not possible, and the best assessment possible was made on the species assemblage present. The results were compared with the TASVEG 4.0 layer on LIST to establish if the community type listed was accurate. For very small remnant stands, and narrow production forest verges, species lists were recorded, though these were unable to be assessed as a community type.

Access permits were sourced from STT, Forico and RFF prior to surveys being conducted.

4.1 Vegetation

Vegetation species incidence was compared across the study sites to evaluate the number of species at each site, and compare species presence and diversity.

Weed species were listed in a separate spreadsheet to identify locations, and spread across the catchment, comparing with weed mapping undertaken by MRRCI during 2019. Where TASVEG analysis was able to be undertaken, percentage of weed cover was estimate for inclusion in results.

4.2 Avian species

Multiple visits were made to each study to record bird sightings. Bird watching by nature is time consuming, and dependent on a number of variables that facilitate sightings, such as weather, activities nearby that produce noise, such as chainsaws and machinery, so incidence of many species that could be present may not have been sighted during the

surveys. While at least 4 hours of observations were undertaken at all sites, more time was available for site 9, which was closest to the author's residence. As the main object of avian surveys was to identify species present in the Minnow Catchment, the actual locations within the study area were less important than the actual presence within the catchment.

4.3 Fungi species

Fungi occurrence is dependent on specific climatic conditions, and cannot be consistently surveyed across all study sites, therefore, fungi species were listed as occurring in the catchment, and not by specific sites.

4.4 Macroinvertebrates

Studies of macroinvertebrate species were undertaken at some riparian study sites (not all sites were beside streams). The studies were to give an indication of the diversity of species which would typically be present at sites of similar habitat quality and health within the catchment. Specimens collected were identified to family group, using a portable microscope, and The Waterbug Book. Specimens were then returned to the location where they were found. Species identified were then scored with the Stream Invertebrate Grade Number = Average Level (SIGNAL) system to establish if pollution sensitive species were present.

4.5 Other species observed

During the surveys, remote sensor cameras were places at some sites to capture species which may be present, including feral animals, as another component of the CEP Grant. The species are recorded as generally present in the catchment, and not necessarily site specific. Camera footage of target species has been undertaken periodically since 2016, particularly focusing on Spotted tailed quolls and Tasmanian devils. Other introduced species observed during the project include weeds. Weed mapping took place across the whole Minnow Catchment between 2018 and 2019. During this project weeds observed will be listed for each site, to compare with formerly recorded locations of incidence.

4.6 The study sites

Survey sites in the upper and middle catchments located on STT, Forico and Reliance managed properties.

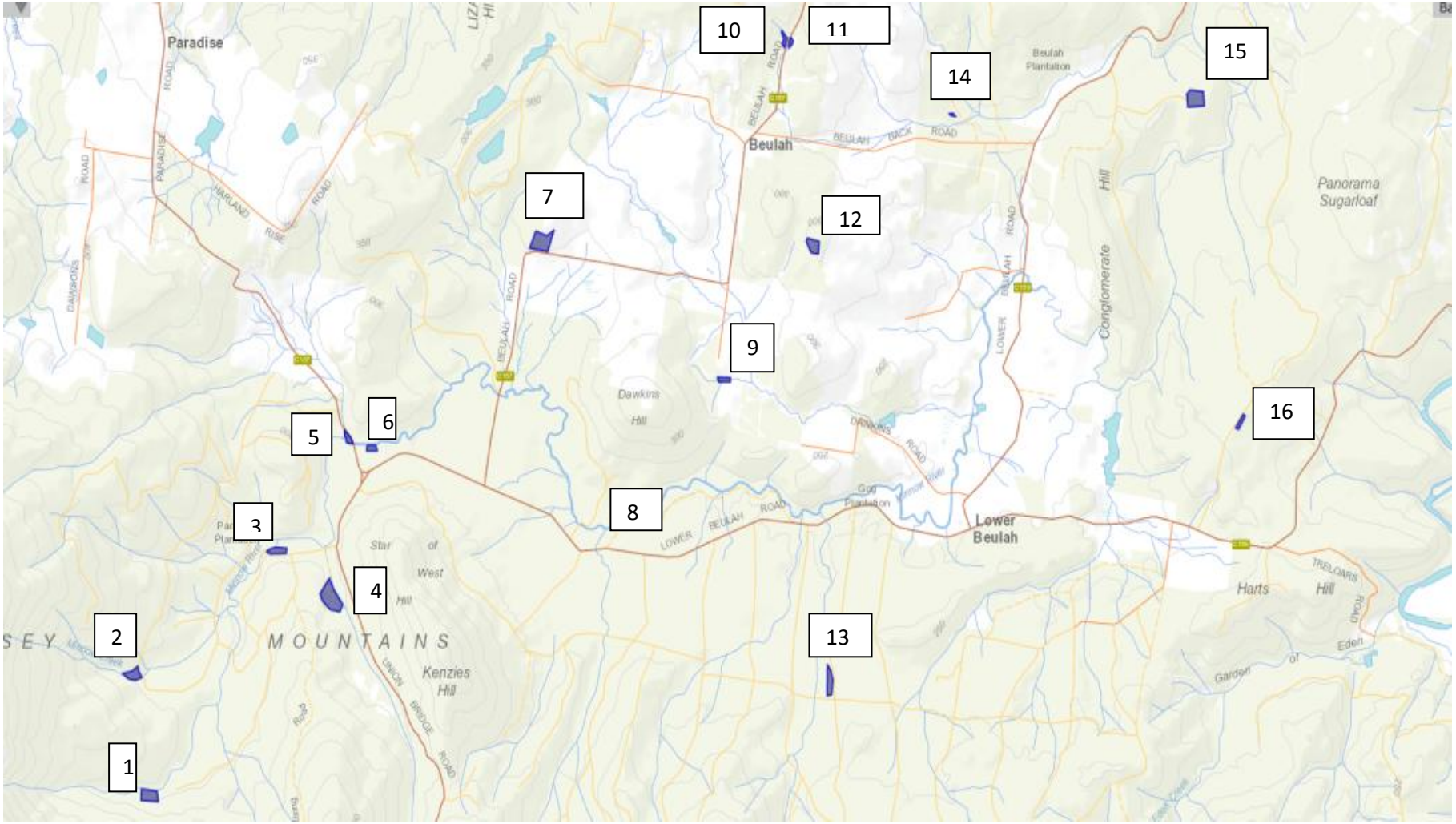

Figure 3 Site locations in the Minnow Catchment

5 Results

5.1 Site 1 in the Mount Roland Reserve – MR1.2

Site 1 is an area of natural forest along a headwater reach of the Minnow River, and is a part of the Mount Roland Regional Reserve. The forest type identified in the TASVEG layer of the LIST is *Acacia dealbata* forest (NAD), identified by 'photo'. In the vegetation survey undertaken for this project, no *Acacia dealbata* were present in the study site. The vegetation assemblage present in the survey area does not fit within any of the listed TASVEG communities. The dominant tree species in the forest is *Pomaderris apetala* with occasional eucalypts, which is an unusual assemblage of canopy species. There is evidence of selective removal of large eucalypt trees historically, although no recent evidence of tree removal was observed. There is also no evidence of bushfires having impacted on the area, supported by a search on the fire history layer of the LIST. There were 27 vegetation species identified (Annex 1), and 16 bird species (Annex 2) were observed in the area, two of which were introduced species, Blackbird and European goldfinch. Twenty four macroinvertebrate species were identified (Annex 3) including seven pollution sensitive species. The relatively low understorey species diversity and altitude may indicate that the forest community is rainforest.

No weed species were present at this site.

Figure 4 The understorey at Site 1 near the headwaters of the Minnow River

5.2 Site 2 at Minnow Creek – MA2

There was a very diverse assemblage of vegetation species at this site, though it was not possible to identify the forest community accurately. The area would appear to be a transitional area between forest types, due to the steep climb in altitude, resulting in ecoclines across the area surveyed. Fern species are quite diverse in the area, compared with other areas of the catchment, with 10 species being recorded. Further studies upstream of the site could result in a greater number of species being identified. A total of 37 vegetation species and 3 weed species (Annex 4) were identified at this site (Annex 1). Nine bird species were observed while undertaking the surveys, of which only was introduced, the Kookaburra (Annex 2). Macroinvertebrate surveying at the site showed that 22 species were present of which 7 were highly sensitive to pollutants (Annex 3)

Figure 5 A riparian area along Minnow Creek

5.3 Site 3 near Belstone Ford –MR3.1

This site was chosen as the previous coup of Radiata pine was harvested to the banks of the Minnow River in the late 1980's. Following harvesting a buffer zone was left between the river and the new plantings, though no native re-vegetation was undertaken. While there has been the establishment of 'wildling' Radiata pines up to the edge of the banks, there has also been a regeneration of native species along this reach. This has assisted in improving water and habitat quality, with 14 macroinvertebrate species recorded (Annex 3), 2 of which are pollution sensitive. 23 vegetation species (Annex 1) were recorded at the site, 5 weed species (Annex 4) and 8 species of birds (Annex 2), one of which was the introduced Kookaburra. The yellow-tailed black cockatoo was abundant at this site.

Figure 6 The study area adjacent to Belstone Ford within the Paradise plantation

5.4 MU1 tributary

The MU1 tributary receives run-off from Kenzies Hill, the Star of the West Hill and the western side of the Gog Range. The vegetation listed on the TASVEG layer of the LIST map is *Eucalyptus obliqua* wet forest (undifferentiated) (WOR) whereas the actual forest type is closer to a *Eucalyptus regnans* forest (WRE). Forest type is to be confirmed as conversations with DPIPWE suggest results are still not clear. A larger area needs to be surveyed to establish an accurate forest type, although results also indicate that the species community does not fit any existing described community. The survey showed that 32 vegetation species were and 6 weed species were present. 10 bird species were identified, the only introduced species being the Kookaburra. The yellow-tailed black cockatoo was abundant at this site. No macroinvertebrate survey was conducted at this site.

5.5 Picnic ground on Paradise Road- MR3.2

The PWS managed Picnic Site 5 is a remnant area of natural forest that under the TASVEG 4.0 layer on LIST is identified as *Acacia dealbata* forest (Figure 2). The Forico managed area

of riparian vegetation is listed as *Eucalyptus amygdalina* forest and woodland on sandstone (Figure 2). When survey results were scored against the benchmarks for these forest types, both were found to be inaccurate. Site 5 was assessed and identified as a threatened forest community of *Eucalyptus viminalis* wet forest (confirmed by the DPIPWE)(See Appendix for vegetation survey results). The results of this survey are in keeping with the aims of the Minnow Action Plan "Identify High Conservation Value Forest in priority reaches and at a catchment-scale." There were 28 vegetation species identified (Annex 1) and 8 weed species (Annex 4). 14 bird species were observed of which 2 were introduced, the Kookaburra and European goldfinch (Annex 2). There were 21 macroinvertebrate species (Annex 3) of which 7 were pollution sensitive species. The endangered species *Astacopsis gouldi* (Giant freshwater crayfish) has been observed at this site, with one tagged in 2016 by Todd Walsh.

Figure 7 The Picnic ground on Paradise Road, and riparian zone off Lower Beulah Road (Forico)

5.6 Riparian area managed by Forico – MR4

The site is a riparian forest which is a buffer between a *Eucalyptus nitens* plantation and the Minnow River. There 36 vegetation species identified (Annex 1), and only 3 weed species (Annex 4). There were 8 bird species (Annex 2) of which the Kookaburra and European goldfinch were introduced species. No macroinvertebrate survey was undertaken at the site. The forest community on LIST map is recorded as *Acacia dealbata forest* (NAD). The vegetation survey undertaken (confirmed by DPIPWE) was Wet *Eucalyptus obliqua* forest (WOB). The decision for this site was a difficult one, as the result was also closely aligned with Wet *Eucalyptus viminalis* forest, and further surveys along a much larger area could result in a redefinition.

A female *Astacopsis gouldi* (Giant freshwater crayfish) was tagged at the site during 2016 by Todd Walsh. The vulnerable *Dasyurus maculatus* (Spotted-tail quoll) (Threatened Species Section, 2021) also visits this site as supported by remote camera footage which was set up at the site during early 2021.

Figure 8 The area of riparian buffer between the Minnow River and *Eucalyptus nitens* plantation

5.7 Beulah Rd – MNB1

The study site near the southern end of Beulah Road is near the foothills of Lizard Hill and incorporates an area of regrowth forest, and native forest remnant stand. The LIST TASVEG layer has the area recorded as *Eucalyptus amygdalina- Eucalyptus obliqua* damp sclerophyll forest (DSC) and *Eucalyptus obliqua* forest with broad-leaf shrubs (WOB). Assessment of the area surveyed indicates the area may be *Wet Eucalyptus viminalis* forest community. The site is visited by wombats. A much larger survey area would be required to fully assess the area, requiring private landholder access permission, not covered under this project.

There were 28 vegetation species identified in the survey site (Annex 1), and 8 weed species (Annex 4). 25 bird species were observed (Annex 2), which included 4 introduced species, the European goldfinch, Kookaburra, House sparrow, and starling. No macroinvertebrate survey was undertaken.

Figure 9 The survey site in the foothills of Lizard Hill

5.8 Lower Beulah Rd Forico – MR6.1

The site off Lower Beulah Rd is an area of native riparian vegetation which is a buffer between the Minnow River and a *Eucalyptus nitens* plantation which was harvested and replanted between 2019 and 2020. The area is listed as *Eucalyptus obliqua* forest with broad-leaf shrubs which the survey undertaken would confirm. As with some of the other sites, a more extensive survey would increase the accuracy of the community type assessment. The area is visited by recreational riders/drivers who are damaging river banks and disturbing native fauna by driving through the river, and removing native vegetation.

Vegetation species numbered 28 (Annex 1) and there were 9 weed species (Annex 4). 9 bird species were observed at the site (Annex 2), with the Kookaburra being the only introduced species. No macroinvertebrate survey was conducted at the site. The site was had large populations of *Astacopsis gouldi* c. 2008, which were dramatically reduced from illegal 'fishing'. There are still populations near the site, one male being tagged by Todd Walsh during 2016.

Figure 10 The riparian buffer is adjacent to harvested and replanted *Eucalyptus nitens* plantation

5.9 Jacksons Rd – MND7

The site is native remnant forest which borders two small tributaries adjacent to a *Eucalyptus nitens* plantation which was harvested during 2018, burnt, and replanted. The site is also adjacent to rural land. The TASVEG layer on List identifies the area as *Eucalyptus obliqua* dry forest (DOB) which is an inaccurate assessment. The survey conducted suggests wet eucalypt forest with transitional zones between wet *Eucalyptus obliqua* and Wet *Eucalyptus viminalis* forests. Access to most of this site is quite difficult due to steep slopes along the small waterways, and blackberry infestation. Surveying adjacent areas would most likely confirm the transitional forest types.

There were 26 vegetation species (Annex 1) and 15 weed species (Annex 4). 56 bird species were identified (Annex 2) of which 3 were introduced species, and 3 were Endangered species. Only 5 macroinvertebrate species were identified (Annex 3), none of which were pollution sensitive species.

Remote sensor cameras and traps have been used at this site during the survey period. At least 5 Spotted-tail Quolls and 3 *Sarcophilus harrisii* (Tasmanian devils) visit this site regularly. Six feral cats were also captured at this site during the survey period.

Sheep are grazing the understorey of the site, which is impacting on native understorey species.

Figure 11 The study sites is adjacent to *Eucalyptus nitens* plantation and rural land

5.10 Beulah Rd Reliance – MNP1

The site is beside Beulah Road and is bordered by a *Eucalyptus nitens* plantation which was harvested and replanted in 2020. The site is managed by Reliance Forest Fibre.

There were 21 vegetation species (Annex 1) and 12 weed species (Annex 4). 15 bird species were observed (Annex 2) of which 2 were introduced, the Kookaburra and Starling. No macroinvertebrate study was conducted at the site. The remnant vegetation was too small to assess vegetation community.

Remote cameras set up in the area during the survey period showed that feral cats visit the site, and also the Spotted-tail Quoll.

Figure 12 The site is surrounded by *Eucalyptus nitens* plantation and is a buffer for a small tributary

5.11 Reliance – MNP1

The site is a narrow strip of native vegetation along Beulah Road managed by Reliance Forest Fibre. The species present are dominated by *Acacia dealbata* and is consistent with a pioneer stand of vegetation, and is consistent with the TASVEG NAD community.

There were 9 vegetation species present (Annex 1), and 4 weed species. 12 bird species were observed (Annex 2) of which 1 was the endangered Wedge-tailed eagle, and 2 were the introduced Kookaburra and Starling. No macroinvertebrate study was undertaken.

Figure 13 A small stand of native vegetation along Beulah Road

5.12 Hill in Beulah -Reliance –MND7/MNL2

An area of remnant forest east of the township off Beulah Road, encompassing the top of a hill, is surrounded by *Eucalyptus nitens* plantation which was harvested in 2019, burnt, and

replanted. The area identifies as *Eucalyptus amygdalina-Eucalyptus obliqua* damp sclerophyll forest (DSC) and *Bursaria-Acacia* woodland (NBA). Survey results for the DSC area were consistent with classification. The NBA classification is inaccurate, as no *bursaria spinosa* were present in the survey site. The dominant understorey species was *Coprosma quadrifida* (Figure 15). The community type is unlisted at present, and another survey of the whole area covered by this community would be recommended, and attempts to identify other similar communities in remnant vegetation would be ideal.

There were 23 vegetation species present (Annex 1) and 18 weed species (Annex 4). 14 bird species were observed (Annex 2) including 2 endangered species, the Wedge-tailed eagle and the Grey goshawk. No macroinvertebrate survey was undertaken. The spotted-tail quoll was captured by remote camera during the survey period.

Figure 14 the remnant side east of Beulah Rd has an unidentified forest community

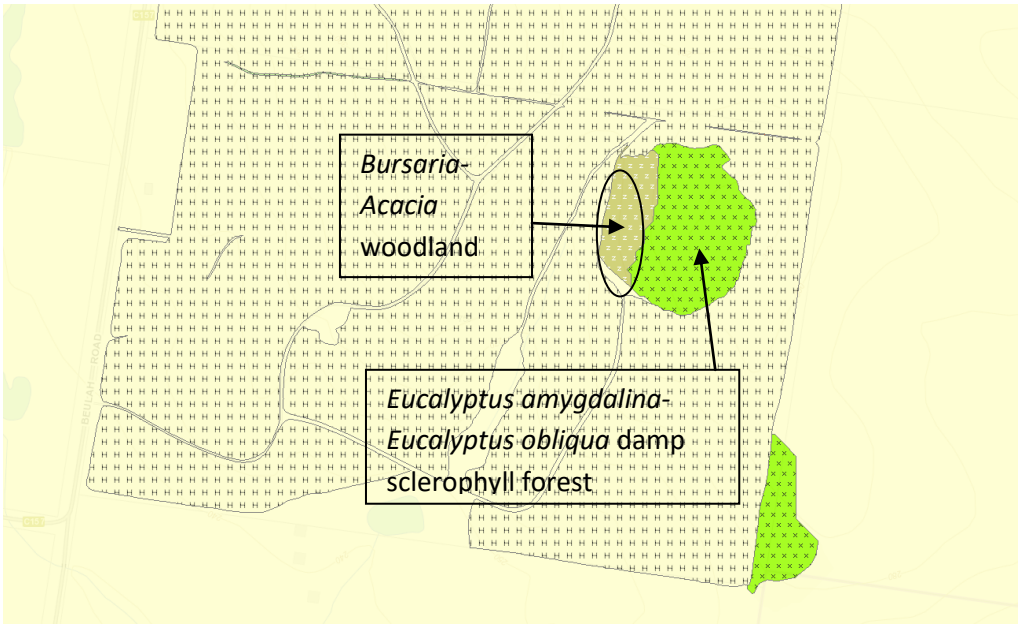

Figure 15 Remnant forest off Beulah Rd with TASVEG current classifications

5.13 Gregory's road – MS4 (STT managed property)

The site is adjacent to *Pinus radiata* plantations, the western side being harvested during 2014, and the eastern side which was harvested in 2016. Both areas have been replanted to *Pinus radiata.* The native forest classification is *Acacia dealbata forest.* No *Acacia dealbata* were observed at the site and the survey would suggest the area is consistent with *Eucalyptus amygdalina-Eucalyptus obliqua* damp sclerophyll forest (DSC).

Figure 16 The site is between two coups of *Pinus radiata* plantation

There were 28 vegetation species identified (Annex 1) and 3 weed species (Annex 4). 5 bird species were observed (Annex 2), 1 of which was the introduced Kookaburra. No macroinvertebrate study was undertaken at the site.

5.14 Beulah Back Road STT – MNP1

The adjacent areas to the study site were *Pinus radiata* plantations which were harvested in 2016, and replanted. The site is a riparian area along a small tributary running from the hillsides south from Beulah heights.

There were 10 vegetation species (Annex 1), and 10 weeds species (Annex 4). 11 bird species were observed (Annex 2)including 3 introduced species, the Kookaburra, European goldfinch, and Starling. No macroinvertebrate survey was undertaken.

Figure 17 The riparian site is surrounded by a harvested and replanted *Pinus radiata* plantation

5.15 Conglomerate Hill STT – MR9

The site is a natural forest area at the northern end of Conglomerate Hill which is designated as *Eucalyptus amygdalina-Eucalyptus obliqua* damp sclerophyll forest (DSC). The survey results were more consistent with a dry eucalypt forest community such as a Dry *Eucalyptus obliqua* (DOB) community. A larger survey area, with measurement of all large trees in the area would confirm this assessment.

There were 23 vegetation species identified (Annex 1), and 2 weed species (Annex 4). 6 bird species were observed (Annex 2), 1 of which was the introduced Kookaburra. No macroinvertebrate survey was undertaken.

Figure 18 An area of natural forest at the northern end of Conglomerate Hill.

5.16 Conglomerate Hill Forico – MR8.3

The thin strip of native vegetation assessed borders an area which was burnt during a bushfire in 2014, with the eastern side *Pinus radiata* plantation which was harvested in 2020 and replanted.

There were 31 vegetation species identified (Annex 1), and 8 weed species (Annex 4). 5 bird species were observed (Annex 2), with the Kookaburra being the only introduced species. No macroinvertebrate survey was undertaken.

Figure 19 A strip of native remnant vegetation adjacent to a bushfire impacted area, and *Pinus radiata* plantation

6 Discussion

Site 1- The forest type at this site is not one that is currently listed by TASVEG, due to the unusual dominance of *Pomaderris apetala.* The area would seem to be a transitional forest community between wet sclerophyll forest and rainforest.

Further surveys of both banks will be required to make an assessment which will not be possible until river levels are lower, enabling safe access to undertake the surveys.

Site 2 – to identify the ecoclines present it would require an area greater than 4 hectares to be surveyed. The area is difficult to access and would require an extensive period of time to undertake such a survey. It would be of value to undertake the survey, as the diverse species present could be part of unusual community assemblages. The area is also at risk of potential logging, therefore understanding the communities present at this site would be important if protection of the site is to be achieved.

Site 3 - – Biodiversity is good at this site, and water quality is good. While the spread of Radiata pine wildlings is impacting on the site, and weed species are greater than the upstream sites, the area is providing habitat for a number of species. Removal of the wildlings from the banks of the river would facilitate a great improvement in habitat condition.

Site 4 – This site is diverse in vegetation species, though weeds will continue to impact on the site, particularly the spread of foxgloves. A survey of all the vegetation along this

tributary would be advantageous, as it could support a previously undescribed vegetation community. It would be important to undertake this survey, so that protection could be afforded the area when harvesting of the Radiata pine plantation is undertaken.

Site 5 – The site is an important area of *Eucalyptus viminalis* wet forest which is listed as a Threatened forest community under the *Nature Conservation Act 2002.* The site is providing essential habitat for at least one endangered species, *Astacopsis gouldi.*

Site 6 – The site is an important riparian natural forest area, that provides essential habitat for the endangered Giant freshwater crayfish and the Spotted-tail quoll. The community is in good condition. Protection from recreational riders/drivers may be required.

Site 7 – This is an important site for wildlife corridor which links to the reserved area on Lizard Hill. The area would benefit from additional corridors through private land and along riparian areas managed by Forico.

Site 8 – The site forms part of an important network of riparian buffers within the catchment, particularly due to the presence of the Giant freshwater crayfish. The area has been impacted by recreational activities, which Forico have attempted to mitigate by preventing access to the river. Further work at this site could include fencing of the zone, and planting more native vegetation to enhance and strengthen the southern access to the site.

Site 9 – The site is an important corridor for native endangered fauna. Further surveying and monitoring of the site is recommended. The site is grazed by sheep which is having some negative impacts. The diversity of bird species is greatest here, probably due to the mix of forest, rural land, and semi-wetland, which is accepted as prime habitat.

Site 10 – The site is an important corridor for native species, and would benefit from some enhancement ie size increase and vegetation planting. The site is also frequently visited by feral cats which pose a risk to faunal diversity in the area.

Site 11- This site is also an important corridor. It is very sparsely vegetated and could benefit from an increase in size to facilitate a permanent corridor for native species.

Site 12 – The site is the top of a hill and is an ‘island’ of native vegetation amidst plantation, which is visited by endangered fauna. Establishing some connective native vegetation to the site would provide important corridors for these endangered fauna. Further surveys at the site would aid in accurately identifying the eastern section of vegetation community.

Site 13 – This site is another important corridor for native species, which links to a network of riparian buffers in the area. Increased native vegetation could be planted to connect smaller tributaries to this site.

Site 14- Planting a diverse range of species at this site, and along the small tributaries would improve the location and provide corridors for native fauna. The main tributary is choked with willows, which if removed and re-vegetated, would improve the general habitat in this area.

Site 15- This is an important and healthy are of native forest, which could potentially be impacted by harvesting activities. Protecting of this site would maintain water quality in the Minnow which receives run-off from the site. Further evaluation is required to confirm the forest community at this site.

Site 16 – The remnant vegetation at this site is in condition, and has a high diversity of species, which may have been assisted by the bushfire adjacent to the site. If the area is to continue to rehabilitate it will provide important are for native fauna.

A total of 64 bird species have been observed in the Minnow Catchment, of which 5 were introduced species. House sparrow, starlings, and Blackbirds were mainly observed close to rural properties with houses nearby. European goldfinches were observed in large flocks near either rural properties or harvested plantation areas. Kookaburras were observed across the whole catchment, apart from the headwater area of the Minnow River.

Three bird species present are endangered:

Accipiter novaehollandiae -Grey goshawk – White morphology

Aquilla audax fleayi- Tasmanian wedge-tailed eagle

Tyto novaehollandiae castanops -Tasmanian Masked owl

And three species are vulnerable:

Haliaeetus leucogaster - White-bellied sea eagle

Haliastur sphenurus – Whistling kite

Hirundapus caudacutus – White-throated needletail

Other endangered fauna in the catchment include *Dasyurus maculatus* (Spotted-tail quoll), *Sarcophilus harrisii* (Tasmanian devil), and *Astacopsis gouldi* (Giant freshwater crayfish).

34 weed species were observed across the study sites, which is approximately one third of the known species in the catchment.

7 Conclusion

The Minnow Catchment is home to a diverse range of vegetation species, threatened forest communities, and endangered faunal species.
Maintaining, protecting, and potentially expanding the small remnant stands should be a major focus of activities in the catchment.
Current risks are mainly from private landholders who are removing native stands of trees from their properties. It is unknown what these particular communities were, and now harvested, they have reduced the available corridor and 'island' of vegetation for native species.
Fungi species identified so far are listed in Annex 5 with TASVEG assessment of forest communities. More fungi species were located and photographed, though not all have been identified as yet.

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Annex 1

Species	Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Acacia dealbata	Silver wattle		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔			✔	
Acacia melanoxylon	Blackwood		✔	✔		✔		✔		✔	✔		✔	✔		✔	✔
Acacia mucronata	Caterpillar wattle		✔	✔	✔	✔										✔	
Acacia verticillata	Prickly Moses						✔	✔									
Acaena novae-zelandiae	Common buzzy		✔			✔		✔	✔	✔	✔	✔	✔		✔		
Allocasuarina littoralis	Black she-oak															✔	
Anopterus glandulosus	Native laurel	✔															
Aristotelia peduncularis	Heartberry						✔										
Austrodanthonia	Wallaby grass	✔	✔				✔	✔	✔	✔			✔	✔	✔		✔
Baloskion australe	Cordrush																✔
Banksia marginata	Silver banksia																✔
Bauera rubioides	River rose		✔														
Bedfordia salicina	Blanket leaf		✔	✔	✔					✔							
Beyeria viscosa	Pinkwood						✔										
Billardiera longiflora	Purple apple-berry			✔	✔		✔						✔				
Blechnum nudum	Fishbone fern	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔		✔			
Blechnum patersonii	Strap water-fern	✔															
Blechnum watsii	Hard water-fern	✔	✔				✔			✔				✔			
Bursaria spinosa	Sweet bursaria									✔							
Carex fasicularis	Tassel sedge					✔			✔	✔				✔			
Cassinia aculeata	Dolly bush			✔	✔		✔	✔	✔	✔	✔		✔	✔	✔	✔	✔
Chilloglottis sp.	Bird orchid	✔				✔											

Species	Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Clematis aristata	Australian clematis	✔	✔		✔		✔		✔	✔			✔			✔	
Coprosma hirtella	Coffee-berry				✔												
Coprosma nitida	Mountain currant	✔	✔		✔	✔	✔						✔	✔		✔	
Coprosma quadrifida	Native currant		✔		✔		✔	✔	✔		✔	✔	✔	✔			
Corybus sp.	Helmet orchid	✔															
Cyathodes glauca	Cheeseberry				✔		✔										✔
Dicksonia antarctica	Soft tree fern	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔	
Epacris impressa	Common heath															✔	✔
Eucalyptus amygdalina	Black peppermint	✔							✔	✔			✔	✔		✔	✔
Eucalyptus delegatensis	Gum-topped stringy-bark		✔														
Eucalyptus obliqua	Stringy-bark	✔	✔		✔	✔	✔	✔	✔	✔	✔		✔	✔		✔	✔
Eucalyptus regnans	Mountain ash				✔												
Eucalyptus viminalis	White gum	✔	✔		✔	✔	✔	✔	✔	✔						✔	
Eucryphia lucida	Leatherwood	✔	✔		✔	✔				✔							
Exocarpus cupressiformus	Native cherry				✔											✔	✔
Ficinia nodosa	Knobby club-rush					✔											
Gahnia grandis	Cutting grass	✔		✔	✔	✔	✔	✔	✔					✔	✔	✔	✔
Galium australe	Tangled bedstraw			✔		✔											
Galium gaudichaudii	Rough bedstraw			✔		✔											
Geranium potentilloides	Crane's bill	✔		✔				✔	✔		✔	✔	✔	✔	✔		✔
Gleichenia microphylla	Scrambling coral fern	✔		✔		✔	✔										✔
Gonocarpus teucrioides	Forest raspwort						✔		✔		✔		✔	✔			✔
Hibbertia procumbens	Guinea-flower																✔
Histiopteris incisa	Bat's-wing fern		✔	✔	✔	✔								✔			
Hymenoophyllum flabellatum	Shiny filmy-fern		✔														
Juncus pallidus	Pale rush		✔	✔	✔	✔	✔	✔	✔		✔		✔	✔	✔	✔	✔

Species	Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Leptospermum lanigerum	Woolly tea tree																✔
Leptspermum scoparium	Manuka	✔					✔	✔		✔							✔
Lomandra longifolia	Spiny-headed mat-rush		✔	✔		✔	✔	✔			✔			✔			✔
Lomatia tinctoria	Guitar plant						✔									✔	✔
Melaleuca squarrosa	Scented paperbark																✔
Microsorum pustulatum	Kangaroo fern		✔														
Monotoca glauca	Goldy wood		✔		✔												
Muehlenbeckia gunnii	Macquarie vine		✔								✔						
Nematolepis squamea	Satin wood		✔			✔											
Nothofagus cunninghamii	Myrtle	✔			✔		✔	✔	✔								
Notogrammitis billardierei	Finger fern		✔							✔							
Olearia argophylla	Musk	✔	✔	✔				✔					✔				
Olearia lirata	Snowy daisy bush			✔	✔	✔	✔	✔	✔	✔	✔			✔		✔	✔
Orchid sp.		✔	✔				✔									✔	✔
Oxalis perennans	Oxalis		✔	✔	✔		✔	✔	✔	✔	✔		✔	✔		✔	
Ozothasmus diosmifolius	Riceflower						✔		✔		✔		✔	✔	✔		✔
Pelargonium australe	Australian stork's bill										✔						
Pimelia drupacea	Cherry rice-flower					✔	✔	✔	✔								✔
Pittosporum bicolor	Cheesewood	✔	✔		✔	✔	✔	✔	✔	✔	✔		✔	✔			
Poa labillarderia	Tussock grass								✔	✔					✔		
Polystichum proliferum	Mothershield fern	✔	✔	✔	✔		✔			✔		✔					✔
Pomaderris apetala	Dogwood	✔	✔		✔	✔	✔	✔	✔	✔	✔		✔	✔		✔	
Prostanthera lasianthos	Christmas bush		✔	✔		✔	✔							✔			
Pteris tremula	Tender brake		✔	✔	✔		✔							✔			
Pteridium esculentum	Bracken	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Pterostylis pedunculata	Maroonhood orchid	✔															

Species	Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Pultenaea juniperina	Prickly bush-pea					✔	✔	✔		✔	✔			✔		✔	✔
Senecio liniearifolius	Fireweed							✔	✔		✔	✔	✔	✔	✔		✔
Solanum aviculare	Kangaroo apple												✔				
Stackhousia monogyna	Creamy candles							✔									
Stylidium graminifolium	Trigger plant							✔									✔
Tasmannia lanceolata	Mountain pepper-berry	✔	✔		✔				✔								
Viola hederacea	Native violet		✔		✔				✔					✔		✔	✔
Ziera arborescens	Stinkwood				✔			✔									

Annex 2

Species	Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Acanthiza ewingii	Tasmanian thornbill									✔							
Accipiter cirrhocephalus	Collared sparrow-hawk									✔							
Accipiter fasciatus	Brown goshawk									✔		✔	✔				
Accipiter novaehollandiae	Grey goshawk							✔		✔			✔				
Acanthiza chrysorrhoa	Yellow-rumped thornbill									✔							
Acanthomis magnus	Scrubtit	✔								✔							
Acanthorhynchus tenuirostrus	Eastern spine-bill									✔							
Aegotheles cristatus	Owlet nightjar									✔							
Anthochaera paradoxa	Yellow wattlebird					✔	✔			✔							
Aquilla audax fleayi	Wedge-etailed eagle	✔							✔	✔	✔	✔	✔				
Artamus cyanopterus	Dusky woodswallow								✔	✔					✔		
Cacatula galerita	Sulphur-crested cockatoo							✔		✔							
Calchites basalis	Horsfield's Bronze-cuckoo									✔							
Calyyptorhynchus funereus	Yellow-tailed black cockatoo	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Carcomantis flabelliformis	Fan-tailed cuckoo							✔		✔							
Carduelis carduelis	European goldfinch	✔				✔	✔	✔		✔					✔		
Chenonetta juvata	Australian wood duck									✔							
Circus approxximans	Swamp harrier									✔			✔				
Collluricincla harmonica	Grey shrike-thrush	✔	✔	✔	✔	✔	✔			✔			✔				
Coraciina nobaehollandiae	Black-faced cuckoo-shrike									✔							
Corvus tasmanicus	Forest raven	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Coturnix ypsilophora	Brown quail				✔				✔	✔							
Cracticus torquatus	Grey butcherbird					✔		✔		✔			✔				
Cuculus pallidus	Pallid cuckoo									✔			✔				
Dacelo novaeguineae	Kookaburra		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

Species	Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Egretta novaehollandiae	White-faced heron							✔		✔					✔		
Falco berigora	Brown falcon							✔			✔	✔			✔		
Falco cenchroides	Australian kestrel	✔								✔							
Falco longipennis	Australian hobby							✔									
Falco peregriinus	Peregrine falcon							✔		✔					✔		
Gallinula mortierii	Tasmanian native hen							✔		✔	✔						
Gymnirhina tibicen	Australian magpie							✔		✔	✔	✔					
Haliaeetus leucogaster	White-bellied sea eagle							✔		✔			✔				
Haliastur sphenurus	Whistling kite									✔							
Hirundapus caudacutus	White-throated needletail									✔							
Hirundo neoxena	Welcome swallow							✔		✔	✔						
Lichenostomus flavicollis	Yellow-throated honeyeater									✔							
Maulurus cyaneus	Superb fairy wren	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Melanodryas vittata	Dusky robin									✔							
Microcarbo melanoleucos	Little pied cormorant								✔								
Neophema chrysostoma	Blue-winged parrot	✔															
Ninox novaeseelandiae	Morepork	✔								✔							
Pachycephala olivacea	Olive whistler	✔	✔	✔	✔	✔				✔							
Pachycephala pectoralis	Golden whistler	✔	✔			✔				✔							
Pardalotus striatus	Striated pardalote									✔							
Passer domesticus	House sparrow							✔									
Petroica multicolor	Scarlet robin	✔			✔	✔				✔							
Petroica phoenicea	Flame robin					✔		✔		✔							
Pezoporus wallicus	Ground parrot									✔							
Phaps chalcoptera	Common bronzewing										✔						
Phylidonyris pyrrhopterus	Crescent honeyeater									✔							

Species	Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Platycersys caledonicus	Green rosella							✔		✔	✔	✔					
Podargus strigoides	Tawny frogmouth							✔		✔	✔	✔				✔	
Porphyrio porphyrio	Purple swamp hen												✔				
Rhipidura fuliginisa	Grey fantail	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Sericornis humilis	Tasmanian scrubwren									✔							
Stagonopleura bella	Beautiful firetail									✔							
Strepera fuliginosa	Black currawong							✔		✔							
Sturnus vulgaris	Common starling							✔			✔	✔			✔		
Tadoma tadmoides	Australian shelduck									✔							
Turdus merula	Blackbird	✔								✔							
Tyto novaehollandiae castanops	Tasmanian masked owl									✔							
Vanellus miles	Masked lapwing							✔		✔	✔						
Zosterops lateralis	Silvereye	✔	✔	✔	✔	✔				✔							

Annex 3

Macroinvertebrate	Score	1	2	3	4	5	6	7	8	9
Acarina	6	✔	✔		✔	✔				
Amphipoda Parameletidae	4	✔	✔		✔					
Chilopoda	0	✔								
Coleoptera Elmidae	7	✔	✔	✔	✔	✔	✔			
Coleoptera Scirtidae	6	✔			✔					
Diptera culcidae	1	✔	✔	✔	✔	✔	✔	✔	✔	✔
Diptera Orthocladiinae	4	✔	✔	✔	✔	✔				
Diptera Podonominae	6	✔	✔	✔	✔	✔	✔			
Ephemeroptera Leptophlebidae	8	✔	✔		✔	✔				
Fletchamia sugdeni	0	✔								✔
Gastropoda Hydrobiidae	1	✔	✔	✔	✔	✔	✔			
Hirudinea Hirudinidae	1	✔	✔	✔	✔	✔		✔	✔	✔
Lepidoptera pyralidae	3		✔	□	✔	✔				✔
Odonata Aeshnidae	3	✔	✔	✔	✔	✔	✔			
Oligochaeta	2	✔	✔	✔	✔	✔	✔	✔	✔	✔
Plecoptera Austroperlidae	10		✔			✔				
Plecoptera Eustheniidae	10	✔	✔		✔	✔				
Plectoptera Gripopterygidae	8	✔	✔	□	✔	✔				
Plecoptera Notonemouridae	6	✔	✔	✔	✔	✔	✔			
Trichoptera Helicophidae	10	✔	✔	✔	✔	✔				
Trichoptera Helicopsychidae	8	✔	✔	✔	✔	✔	✔			
Trichoptera Leptoceridae	6	✔	✔	✔	✔	✔	✔			
Trichoptera Tasimiidae	8	✔	✔		✔	✔				
Trichoptera Conoesucidae	7	✔	✔	✔	✔	✔	✔			
Trichoptera Ecnomidae	4	✔	✔	✔	✔	✔	✔			

Annex 4

Species	Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Anagallis arvensis	Scarlet pimpernel						✔	✔			✔	✔	✔		✔		✔
Anthoxanthum odoratum	Sweet vernal												✔		✔		
Brassica rapa	Wild turnip												✔				
Centaurium erythraea	Centaury				✔	✔			✔		✔		✔				✔
Cirsium arvense	Californian thistle								✔								✔
Cirsium vulgare	Spear thistle								✔				✔				
Digitalis purpurea	Foxglove		✔	✔	✔	✔			✔					✔			
Echium vulgare	Viper's bugloss														✔		
Erigeron bonariensis	Fleabane												✔				
Epilobium cliatum	Willow herb														✔		
Eucalyptus nitens	Shining gum				✔					✔							
Genista monspessulana	Montpellier broom			✔		✔											
Holcus lanatus	Yorkshire fog										✔		✔				
Hypochaeris radicata	Flatweed			✔					✔		✔		✔				
Leicesteria formosa	Elisha's tears										✔				✔		
Leontodon	Hawkbit								✔					✔			
Leucanthemum vulgare	Oxeye daisy														✔		
Linum trigynum	French flax																✔
Lolium perenne	Perennial rye grass										✔						✔
Lotus corniculatus	Bird's-foot trefoil												✔				
Onopordum acanthium	Scotch thistle				✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔	✔
Pinus radiata	Radiata pine		✔	✔	✔	✔					✔		✔				
Plantago	Plantain												✔		✔		
Prunella vulgaris	Self-heal					✔					✔		✔				

Species	Common name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Pseudotsuga menziesii	Douglas fir					✔											
Rubus fruticosus	Blackberry		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔	✔	
Salix fragilis	Crack willow											✔			✔		
Senecio jacobaea	Ragwort										✔		✔				
Solanum nigram	Black nightshade												✔				✔
Taraxicum officinalis	Dandelion												✔				✔
Verbascum virgatum	Twiggy mullein								✔		✔		✔				

Annex 5

Species	Common name	Species	Common name
Amanita muscaria	Fly agaric	*Galerina hypnorum*	Moss bell
Armillaria sp.		*Geastrum triplex*	Earth star
Arrhenia acerosa	Moss oysterling	*Heterotexrus miltinus*	Golden jelly bells
Bisparella citrina	Yellow fairy cups	*Heterotexrus peziziformis*	Jelly bells
Boletellus emodensis	Shaggy cap	*Lachnum virgineum*	
Caprinus comatus	Shaggy ink-cap	*Leotia lubrica*	Jelly baby
Chlorociboria aeruginascens	Green elf cup	*Hygrocybe graminicolor*	Slimy green waxcap
Clavulinopsis amoena	Yellow coral fungus	*Macrolepiota clelandii*	Slender parasol
Clavulinopsis miniata	Flame fungus	*Marasmius crinisequi*	Horse hair fungi
Coprinellus flocculosus		*Mycena interrupta*	Pixie's parasol
Cortinarius austrovenetus	Green skin-head	*Nidula niveotomentosa*	Birds-nest fungus
Crepidotus crocophyllus	Orange crep	*Stereum sp.*	
Crepidotus variabilis	Variable oysterling	*Trametes versicolor*	Bracket fungi
Datronia brunneoleuca		*Tremella fuciformis*	White brain jelly
Flammulina velutipes	Enoki	*Tricholomopsis rutilans*	Plums and custard

Study site	TASVEG	Actual	Study site	TASVEG	Actual
1	NAD	Unknown	9	DOB	WOB/WVI
2	WOU	Undecided	10	NAD	NAD
3	FFU	WOB	11	NAD	NAD
4	NAD	WRE	12	NBA/DSC	?/DSC
5	WOB	WVI	13	NAD	DSC
6	DAS	WOB	14	DSC	DSC
7	DSC/DOB	WVI	15	DSC	DOB
8	WOB	WOB	16	DAS	DOB