

Victorian Murray Floodplain Restoration Project

Flora and Fauna Assessment - Belsar-Yungera Floodplain Restoration Project

IS297762-AP-AP-RP-0012 | Rev 0 22 June 2020

Lower Murray Urban and Rural Water Corporation





7. Inundation Area vegetation ground truthing assessment

7.1 Context

The project has been designed to facilitate environmental watering of up to 2,374 ha of the Belsar Yungera floodplain. The location and extent of the proposed Inundation Area, and the preferred frequency and duration of flooding for each of the vegetation communities targeted for restoration, has been determined through an extensive series of studies (GHD 2013, GHD 2014, Ecology Australia 2016). It is expected that the application of environmental water to water dependent River Red-gum, Black Box, Lignum and wetland habitats will be extremely beneficial to these communities, provided it occurs within the bounds of the water regime requirements of each community.

The earlier desktop assessments undertaken by Ecological Associates (2013) identified that two non-water dependent communities comprising 0.59 ha have been mapped by DELWP (2005 modelled EVC mapping) as being present within the proposed Inundation Area, and therefore potentially receiving environmental water. An additional 70.49 ha was also identified within the Inundation Area where no modelled EVC data was available. As any environmental watering within non-water dependent ecosystems may not be beneficial, these areas were required to be ground-truthed and the EVC mapping confirmed and/or updated.

7.2 Desktop assessment

7.2.1 Ecological Vegetation Classes

A summary of the EVCs making up the 2,374 ha of vegetation proposed for inundation (along with the full extent of these communities in the broader Belsar Yungera Area) is outlined in Table 6. Two non-water dependent EVCs are mapped within the area proposed to receive environmental water). However, the vegetation mapping for the Inundation Area has been ground-truthed and the on-ground inspection confirmed that these areas had been incorrectly mapped, with Semi-arid Woodland and Mallee vegetation only observed at higher elevations above the floodplain where environmental water will not penetrate during periods of inundation.

| EVCs | EVC Conservation Significance | Modelled EVC extent within Inundation Area (ha) |
|--|----------------------------------|---|
| Chenopod Mallee (EVC 158) | Vulnerable | 0.001 |
| Floodway Pond Herbland (EVC 810) | Depleted | 21.38 |
| Grassy Riverine Forest / Floodway Pond Herbland Complex (EVC 106/810) | Depleted | 9.25 |
| Intermittent Swampy Woodland (EVC 813) | Depleted | 116.43 |
| Lake Bed Herbland (EVC 107) | Depleted | 129.78 |
| Lignum Shrubland (EVC 808) | Least Concern | 505.52 |
| Lignum Swamp (EVC 104) | Vulnerable | 152.82 |
| Lignum Swampy Woodland (EVC 823) | Depleted | 879.37 |
| Loamy Sands Mallee (EVC 91) | Least Concern | 0.002 |
| Riverine Chenopod Woodland (EVC 103) | Depleted | 374.56 |
| Riverine Grassy Woodland (EVC 295) | Depleted | 1.02 |
| Semi-arid Chenopod Woodland (EVC 98) | Vulnerable | 0.59 |

Table 6 Ecological Vegetation Classes modelled by DELWP as occurring within the area proposed for inundation for Belsar Yungera



| EVCs | EVC Conservation Significance | Modelled EVC extent within Inundation Area (ha) |
|-------------------------------------|----------------------------------|---|
| Shrubby Riverine Woodland (EVC 818) | Least Concern | 24.11 |
| Spike Sedge Wetland (EVC 819) | Vulnerable | 2.04 |
| Bare Rock/ Ground | | 21.63 |
| Waterbody – Fresh | | 56.36 |
| Shallow Freshwater Marsh | | 8.75 |
| Area of unmapped EVC* | | 70.49 |
| TOTAL | | 2,374.08 |

* An area where EVCs have not been mapped which is due to gaps in the spatial data available

7.2.2 Listed flora communities

The EPBC Act-listed ecological community, *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions*, is consistent with one EVC modelled to occur within the Inundation Area; EVC 98: Semi-arid Chenopod Woodland. Based on a desktop assessment, it was considered unlikely that this EVC would be present within the Inundation Area. However, it was recommended that the areas modelled as potentially containing EVC 98 were ground-truthed to confirm the presence or absence of this EVC, and whether or not the EPBC Act-listed community, *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions,* and the associated FFG Act-listed flora community Semi-arid Shrubby Pine-Buloke Woodland Community, could be present within the Inundation Area.

7.2.3 Listed flora and fauna

VBA and PMST searches identified 103 FFG, DELWP Advisory and/or EPBC listed flora that have been recorded or have the potential to occur within a 10 km buffer of the Inundation Area. Each of these species was then assessed for their likelihood of occurrence (Appendix D), taking into account factors such as the habitat requirements of each species and comparing those to the habitats encountered within the Belsar-Yungera Inundation Area, and also the number of recent records within the Study Area.

VBA and PMST searches identified 52 FFG and/or EPBC listed fauna species that have been recorded or have the potential to occur within a 10 km buffer of the Inundation Area (Table 8).

7.3 Field assessment

The field assessment focused on ground-truthing areas within the proposed Inundation Area that had been mapped (DELWP 2005) as containing non-water dependent ecosystems, namely Semi-arid Woodland (0.59 ha) and Chenopod Mallee (0.001 ha) vegetation communities, in addition to areas where there was no modelled EVC data available (70.49 ha). As there was limited track access to these locations, two R8 ecologists walked over 5 km a day (for two days) through the Inundation Area to reach over 50 discrete locations. The fieldwork confirmed the following:

- The mapping of the Inundation Area is fine scale and aligns well with topography / soil / vegetation types on the ground.
- The EVC mapping (DELWP 2005 modelled mapping) is coarser than the Inundation Area mapping.
- There was no Mallee vegetation or Semi-arid Woodland identified within the Inundation Areas surveyed. Each of the discrete locations where these vegetation communities were mapped by DELWP have now been reclassified, and photographs have been taken of each location (see **Figure 6**).

- The vegetation present in two of the patches modelled as containing Semi-arid Chenopod Woodland contained Lignum Swampy Woodland (EVC 823) (see Plate 1), whilst the third patch contained Lignum Wetland (EVC 104) (see Plate 2. Both of these EVCs are located on alluvial terraces and are prone to flooding and are likely to benefit from the proposed watering regime.
- The patch of vegetation modelled as containing Loamy Sands Mallee (EVC 91), contained Lignum Swampy Woodland (EVC 823).
- The areas that contained no modelled EVC data were ground truthed and confirmed to contain a combination of Black Box and River Red-gum communities that the project is targeting through environmental watering.

A map was prepared highlighting the full extent of the Inundation Area, outlining the results of the EVC ground truthing exercise within areas that had been modelled as containing non-ground water dependent EVCs (**Figure 6**) and the 70.49 ha where there was no modelled EVC data available. Native vegetation (EVC) mapping is only shown for the areas that were assessed during the field assessment.



7.3.1 Listed vegetation communities

The ground-truthing field assessment confirmed that Semi-arid Chenopod Woodland (EVC 98) was not present in any areas where it had been modelled as occurring, or in any areas where modelled EVC data were not available. There was no vegetation identified within the Inundation Areas surveyed that met the criteria to be considered a listed community under the EPBC or FFG Act. Whilst the full extent of the Inundation Area was not assessed as a part of the EVC ground-truthing exercise, based on a desktop review of the available information and observations made during the fieldwork it is considered unlikely that any listed communities are present within the proposed Inundation Area.

7.3.2 Listed flora

No incidental observations of listed flora species were recorded during the ground truthing surveys undertaken in June 2020. However, these surveys were rapid in nature, focusing on ground truthing EVCs and not identifying flora species within the broader Inundation Area. Furthermore, the surveys were not undertaken at an appropriate time of year to undertake targeted surveys for many listed flora species. A determination was made on the likelihood of occurrence for rare or threatened flora within the proposed Inundation Area based on the results of the desktop assessment and the vegetation (EVC) ground truthing field assessment (Appendix D).



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Figure 5 Areas targeted during the EVC ground-truthing exercise



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Figure 5 Areas targeted during the EVC ground-truthing exercise

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Figure 5 Areas targeted during the EVC ground-truthing exercise

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Figure 5 Areas targeted during the EVC ground-truthing exercise

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Figure 6: EVC ground-truthing mapping Belsar Yungera

Path: N:\AU\Melbourne\Projects\31\12510225\GIS\Maps\Working\Belsar_Yungera\12510225_ecology_figure_Belsar_yungera\12510225_ecology_figure_Belsar_yungera.aprx

Annual Manager Street, and August Million in Artistan

8. Overview of potential impacts

This section provides an overview of the proposed project construction and operational activities and an outline of the potential impacts that may be associated with them. The potential for impacts on listed threatened flora and fauna and native vegetation is assessed in Sections 9 and 10. Impact mitigation measures are discussed in Section 11.

8.1 Construction

It will be necessary to construct and/or upgrade a variety of water regulating structures and ancillary infrastructure in order to achieve the proposed environmental watering regimes and objectives (refer Sections 3.2, 3.3 and 3.4). Construction activities would be undertaken in accordance with a CEMP and a variety of sub plans which consider the management of water, soils, flora and fauna.

Construction activities will include:

- Establishment of construction sites, including removal of vegetation, stripping and stockpiling of topsoil, establishing temporary parking and truck turnaround areas, laydown and stockpiling areas
- Removal of existing structures / block banks where required
- Construction / installation of new structures
- Rehabilitation of disturbed areas post-construction.

Construction activities may result in direct and indirect impacts (some permanent and some temporary) associated with:

- Removal, disturbance and lopping of native vegetation
- Borrow, import, excavation and placement of soil, clay, gravel and rock materials
- Movement of machinery, equipment and people
- Works in or adjacent to waterways and wetland areas
- Indirect impacts, e.g. noise, light, dust, etc. associated with construction.

8.2 Operation

Operational activities may also result in a range of positive and negative impacts associated with the managed inundation activities. These activities would be undertaken in accordance with the EWMP and operating plan. Adaptive management is proposed in order to maximise the benefits and minimise the impacts of environmental watering activities. Direct and indirect impacts are potentially associated with:

- Inundation of vegetation communities
- Changed hydraulic regime with consequent changes to aquatic and terrestrial flora and fauna habitat (including pest species)
- Changes in water quality within the floodplain and associated with return flows
- Changes to groundwater levels, quality and mobilisation of salt, noting these issues are regarded as being low risk due to the low to moderate salt store in the area and generally fresh to moderately saline groundwater (R8, 2020).

9. Impacts to threatened flora, fauna and communities

The following chapter outlines the potential for impacts to threatened flora, fauna and communities resulting from the project. Further detail on potential impacts for EPBC Act-listed species is contained in Appendices I, J, K and L.

9.1 Impacts to threatened vegetation communities

The PMST identified one EPBC Act-listed endangered ecological community with potential to occur within 10 km of the Area of Investigation, *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions*. This community is not consistent with vegetation identified within the Construction Footprint or the Inundation Area, and therefore impacts to this threatened vegetation community are considered unlikely.

No other communities listed as threatened under the EPBC Act or FFG Act were identified within the proposed Construction Footprint during detailed surveys or in the Inundation Area during the vegetation ground-truthing surveys.

9.2 Potential impacts to threatened flora

A summary of the likely impacts to flora listed under the EPBC and FFG Acts are outlined below.

9.2.1 EPBC Act-listed flora

No EPBC Act-listed flora species were recorded during current and previous surveys of the area (2013, 2015 and 2019).

Of the seven EPBC Act-listed flora species that were identified by the PMST (10 km radius), the likelihood of occurrence and impact for listed flora species in the Construction Footprint is detailed in Appendix I. None of the flora species identified during the desktop assessment are considered likely to occur within the Construction Footprint:

- Three are considered **highly unlikely** to occur as they are species only known to occur in NSW: *Austrostipa metatoris* (Spear Grass), *Brachyscome papilosa* (Mossgiel Daisy) and *Solanum karsense* (Menindee Nightshade).
- Two are considered **highly unlikely** due to the absence of suitable habitat within the Construction Footprint and/or Inundation Area, and the lack of any records within 100 km of Belsar-Yungera: *Caladenia tensa* (Greencomb Spider-orchid) and *Swainsona murrayana* (Slender Darling-pea).
- One species, *Swainsona pyrophila* (Yellow Swainson-pea) is considered **highly unlikely**, despite a single known record within 10 km of Belsar-Yungera, as this species occupies mallee scrub, and no suitable habitat is present within the Construction Footprint or likely to be present in the Inundation Area.
- One species, *Lepidium monoplocoides* (Winged peppercress) is considered **unlikely** to occur. It is possible that there is suitable habitat for this species within the Construction Footprint and/or the Inundation Area, however this species has been the subject of intensive targeted surveys across the region, and the nearest known record of this species is in Hattah Kulkyne National Park, over 50 km west of Belsar-Yungera.

Inundation Area

The likelihood of occurrence and impact for threatened flora in the Inundation Area has been assessed at a desktop level only. However, as described above it is considered unlikely that flora species listed under the EPBC Act would be present within the Inundation Area (see Appendix D and Table 2).

9.2.2 FFG Act-listed and DELWP Advisory listed flora

Species listed as threatened under the FFG Act along with species considered rare or threatened under the DELWP Victorian Advisory List for Rare or Threatened Species (VROTS) (DEPI 2014) were recorded within the proposed Construction Footprints during the current surveys as well as during previous surveys (Table 4).

Five species listed as threatened under the FFG Act were identified during the recent surveys, either within or nearby the Area of Investigation:

- Acacia melvillei (Yarran) (none recorded in construction footprints in 2019 spring surveys)
- Acacia oswaldii (Umbrella Wattle) (16 plants recorded in construction footprint in 2019 spring surveys)
- Cullen pallidum (Woolly Scurf-pea) (none recorded in construction footprints in 2019 spring surveys)
- Cullen tenax (Tough Scurf-pea) (two plants recorded in construction footprint in 2019 spring surveys)
- *Eremophila maculata* subsp. *maculata* (Spotted Emu-bush) (one plant recorded in construction footprint in 2019 spring surveys)

The number of FFG Act threatened species listed above as being impacted by the proposed construction footprint, are not considered to have a large impact on populations of these species in the area. This is due to the low numbers impacted for *Cullen tenax* and *Eremophila maculata subsp. maculata. Acacia oswaldii* is locally common in the area and impact to 16 individual shrubs is not considered to have a large impact on populations of this species in the local area.

The location of flora species listed as threatened under the FFG Act (see **Figure 4**) should be taken into consideration when finalising the Construction Footprints and efforts should be made to avoid listed species where possible. Additional avoidance and mitigation measures outlined in this report should be followed where possible to minimise the impacts on these species.

Twenty-two flora species listed under the DELWP Advisory list for threatened flora were identified during recent surveys (Table 4) and have the potential to be impacted by the proposed works. These species are considered rare or threatened, however they are common in suitable habitat under the correct conditions, and it is considered that impacts to these species' would be minor and localised, and that the proposed works would be unlikely to impact a significant population of these species or impact the range/distribution of any of these species.

Inundation Area

The likelihood of occurrence and impact for threatened flora in the Inundation Area has only been assessed at a desktop level. It is considered possible that 63 flora species listed under the FFG Act and/or listed as VROTS have the potential to be present within the Inundation Area (see Appendix D and Table 2). It is expected that if these species were present, any impacts resulting from the operational phase of the project will be positive to neutral.

9.2.3 FFG Act protected flora

During comprehensive surveys in 2015, 26 flora listed as protected under the FFG Act were recorded within the Belsar-Yungera area for investigation. Additional surveys of this detail were beyond the scope of the 2019 surveys, however an additional five protected flora were recorded incidentally during the 2019 surveys (Table 4).

The populations of some of these species will vary from year to year. Some of these species are annuals, and/or may be dormant and unidentifiable during any one season, therefore it is difficult to estimate the exact number of each species that will be directly impacted by the vegetation removal associated with the proposed works when construction commences. However, an estimate of the number of individuals that will likely be impacted based on the current construction footprint is provided below, taking in to account the data from the 2015 and 2019 surveys.

However, as the protect flora outlined below are also likely to be present within the inundation area, it is expected that any impacts to these species will be offset by the broader benefits to these species across the Inundation Area.

| Scientific name | Common Name | Possible Impacts within the Construction Footprint |
|---|--------------------------------|---|
| Acacia melvillei | Yarran | 0 |
| Acacia oswaldii | Umbrella Wattle | 16 |
| Acacia rigens | Nealie | 0 |
| Acacia salicina | Willow Wattle | 0 |
| Acacia stenophylla | Eumong | 50-100 |
| Allocasuarina luehmannii | Buloke | 0 |
| Brachyscome lineariloba | Hard-head daisy | 200-300 |
| Brachyscome paludicola | Woodland Swamp-daisy | 10-20 |
| Calocephalus sonderi | Pale Beauty-heads | 10-20 |
| Calotis cuneifolia | Blue Burr-daisy | 100-200 |
| Centipeda cunninghamii | Common Sneezeweed | 100-200 |
| Centipeda elatinoides | Elatine Sneezeweed | 50-100 |
| Cullen pallidum | Woolly Scurf-pea | 0 |
| Cullen tenax | Tough Scurf-pea | 2 |
| <i>Eclipta platyglossa</i> subsp. <i>platyglossa</i> | Yellow Twin-heads | 50-100 |
| Eremophila divaricata subsp. divaricata | Spreading Emu-bush | 25-50 |
| Eremophila longifolia | Berrigan | 0 |
| <i>Eremophila maculata</i> subsp. <i>maculata</i> | Spotted Emu-bush | 1 |
| Helichrysum luteoalbum | Jersey Cudweed | 50-100 |
| Myriocephalus rhizocephalus | Woolly-heads | 10-20 |
| Minuria denticulata | Woolly Minuria | 10-20 |
| Minuria integerrima | Smooth Minuria | 10-20 |
| Olearia pimeleoides | Pimelea Daisy-bush | 10-20 |
| Picris squarrosa | Squat Picris | <20 |
| Senecio glossanthus s.s. | Slender Groundsel | <20 |
| Senecio quadridentatus | Cotton Fireweed | 25-50 |
| Sphaeromorphaea littoralis | Spreading Nut-heads | 100-200 |
| Vittadinia cervicularis | Annual New Holland Daisy | 100-200 |
| <i>Vittadinia dissecta</i> s.s. | Dissected New Holland Daisy | 100-200 |
| Vittadinia gracilis | Woolly New Holland Daisy | 100-200 |
| <i>Vittadinia</i> spp. | New Holland Daisy | 100-200 |

 Table 7
 FFG Act protected flora recorded in the Area of Investigation in 2015 and 2019

9.3 Potential impacts to threatened fauna

Fifty-two fauna species listed under the EPBC Act and/or FFG Act were identified in the VBA and PMST search of the 10 km buffer of the Construction Footprint and the Inundation Area, or recorded from previous reports conducted within the Construction Footprint (Australian Ecosystems 2013, GHD 2013, GHD 2014, Ecology Australia 2016). Twenty-two of these species are considered to have the potential to occur within the Construction Footprint and or Inundation Area (see Appendix E and Appendix F for rational). These species are summarised in Table 8. Impacts to these species are considered further in Section 9.3.1-9.3.3.

The following assessment of likelihood of occurrence and impact to threatened fauna considers the potential to occur at the Construction Footprints and Inundation Area, based on the VBA and PMST searches, the habitat requirements of the species, and the fauna habitat values observed within these areas. This table summarises those species considered possible, likely or present at ONE OR BOTH of the Construction Footprint and Inundation Area. An assessment of likelihood of occurrence and impact to all threatened fauna is provided in Appendix E for the Construction Footprints and Appendix F for the Inundation Area.

Table 8Species considered possible or present likelihood of occurrence of FFG Act and EPBC Act listed threatened fauna species, as developed from VBA and
PMST searches within a 10 km radius of the Construction Footprints and Inundation Area

Key to status: L – Listed EN / en – Endangered. VU / vu – Vulnerable. nt – Near Threatened. cr – Critically Endangered. Rx – Regionally Extinct

| Species Name | Common Name | EPBC Act | FFG Act | DELWP Advisory | Number of Records | Most Recent Record | Source | Likelihood of Occurrence and Impact | |
|-----------------------|---------------------|-------------|------------|-------------------|-------------------------|--------------------------|--------|--|---|
| | | | | | Records | Record | | Construction Areas | Inundation Area |
| BIRDS | | | | | | | | | |
| Struthidea cinerea | Apostlebird | | L | | 11 | 2008 | VBA | Possible . Suitable habitat at all sites Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread | Possible. Species likely to utilise habitats across the Inundation Area. Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. |
| Porzana pusilla | Baillon's Crake | | L | vu | 2 | 1946 | VBA | Unlikely. Suitable habitat not present within Construction Footprints | Possible. Suitable habitat present within inundation extent. Impact Unlikely. Species likely to benefit from environmental water when present. |
| Falco subniger | Black Falcon | | L | vu | 11 | 1980 | VBA | Possible. Species may utilise habitats for foraging Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread, low likelihood of nesting habitat in construction footprint. | Possible. Species may utilise habitats within Inundation Area. Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. |
| Oxyura australis | Blue-billed Duck | | L | en | 8 | 1995 | VBA | Unlikely. Suitable habitat not present within Construction Footprints | Possible. Suitable habitat present within inundation extent.Impact Unlikely. Species likely to benefit from environmental water when present. |


| Species Name | Common Name | EPBC Act | FFG Act | DELWP Advisory | Number of Records | Most Recent | Source | Likelihood of Occurrence and Impact | |
|--------------------------|------------------------|-------------|------------|-------------------|-------------------------|----------------|--------|--|--|
| | | | | | Records | Necolu | | Construction Areas | Inundation Area |
| Hydroprogne caspia | Caspian Tern | | L | nt | 1 | 2003 | VBA | Unlikely. Suitable habitat not present within Construction Footprints | Possible. Suitable habitat present within inundation extent. Impact Unlikely. Species likely to benefit from environmental water when present. |
| Geopelia cuneata | Diamond Dove | | L | | 3 | 1986 | VBA | Possible. Species may utilise habitats for foraging Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread | Possible. Species may utilise habitats within Inundation Area. Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. |
| Stagonopleura guttata | Diamond Firetail | | L | | 2 | 2000 | VBA | Possible. Species may utilise habitats for foraging Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread | Possible. Species may utilise habitats within Inundation Area. Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. |
| Ardea modesta | Eastern Great Egret | | L | vu | 11 | 2007 | VBA | Unlikely. Suitable habitat not present within Construction Footprints | Likely. Suitable habitat present within inundation extent. Impact Unlikely. Species likely to benefit from environmental water when present. |
| Stictonetta naevosa | Freckled Duck | | L | en | 7 | 1993 | VBA | Unlikely. Suitable habitat not present within Construction Footprints | Possible. Suitable habitat present within inundation extent.Impact Unlikely. Species likely to benefit from environmental water when present. |



| Species Name | Common Name | EPBC Act | FFG Act | DELWP Advisory | Number of Records | Most Recent | Source | Likelihood of Occurrence and Impact | | |
|----------------------------|---------------------------------|-------------|------------|-------------------|-------------------------|----------------|--------------------|--|--|--|
| | | | | | Records | Necoru | | Construction Areas | Inundation Area | |
| Pomatostomus temporalis | Grey- crowned Babbler | | L | en | 16 | 2002 | VBA | Possible. Species may utilise habitats for foraging Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread | Possible. Species may utilise habitats for foraging Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. | |
| Melanodryas cucullata | Hooded Robin | | L | | 13 | 2008 | VBA | Possible. Species may utilise habitats for foraging Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread | Present. Species recorded in area, likely to utilise habitats for foraging Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. | |
| Lophochroa leadbeateri | Major Mitchell's Cockatoo | | L | vu | 7 | 1983 | VBA, R8 2019 | Present. Species recorded in area, likely to utilise habitats for foraging Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread | Possible. Suitable habitat within Inundation Area Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. | |
| Grantiella picta | Painted Honeyeater | VU | L | vu | | | PMST | Possible. Species not recorded previously but may occasionally utilise habitats for foraging Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread | Possible. Species not recorded previously but may occasionally utilise habitats for foraging Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. | |
| Ardea intermedia | Plumed Egret | | L | en | 5 | 1994 | VBA | Unlikely. Suitable habitat not present within Construction Footprints | Possible. Suitable habitat present within inundation extent. Impact Unlikely. Species likely to benefit from environmental water when present. | |



| Species Name | Common Name | EPBC Act | FFG Act | DELWP Advisory | Number of Records | Most Recent | Source | Likelihood of Occurrence and Impact | | |
|--|---------------------------------|-------------|------------|-------------------|-------------------------|----------------|---|---|--|--|
| | | | | | Records | Record | | Construction Areas | Inundation Area | |
| Polytelis anthopeplus monarchoides | Regent Parrot | V | L | vu | 10 | 2019 | VBA PMST GHD 2013 GHD 2014 R8 2019 | Present. Recorded within the Study Area and at a number of Construction Footprints, with suitable foraging and potential nesting habitat within some Construction Footprints. Impact Unlikely. Targeted surveys for nesting birds during breeding season at Construction Footprints containing potential nest trees did not record any breeding activity. Losses to relatively small area of foraging habitat proposed, however the species is highly mobile and wide ranging, suitable surrounding habitat widespread. Environmental water is essential to sustain the River Red-gums this species requires for breeding habitat. | Present. Recent previous records within the Study Area, with suitable foraging habitat across the Inundation Area. Impact Unlikely. Species is highly mobile and wide ranging, suitable surrounding habitat widespread. Important breeding habitat is present within the Inundation Area, this breeding habitat (large old River Red-gums) likely to have condition improved, and future breeding habitat sustained by environmental watering. Species likely to benefit from broadly improved habitat condition following environmental water. Environmental water is essential to sustain the River Red-gums this species requires for breeding habitat. | |
| Lophoictinia isura | Square- tailed Kite | | L | vu | 2 | 2013 | VBA GHD 2013 GHD 2014 R8 2019 | Present. Recorded within the Study Area and at a number of Construction Footprints, with suitable foraging and potential nesting habitat within some Construction Footprints. Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread | Present. Recorded within the Study Area. Suitable foraging and potential nesting habitat within Inundation Area. Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread, will likely benefit from improved ecological condition of Inundation Area. | |
| Haliaeetus leucogaster | White- bellied Sea- Eagle | | L | vu | 12 | 2013 | VBA | Present. Recorded within the Study Area. Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread | Present. Suitable habitat across Inundation Area. Impact Unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Will likely benefit from environmental water when present and indirectly from improved habitat condition following environmental water. | |



| Species Name | Common Name | EPBC Act | FFG Act | DELWP Advisory | Number of Records | Most Source Recent | Source | Likelihood of Occurrence and Impact | |
|-----------------------|------------------------|-------------|------------|-------------------|-------------------------|-----------------------|--------------|---|--|
| | | | | | Records | Record | | Construction Areas | Inundation Area |
| AMPHIBIANS | | | | | | | | | |
| Litoria raniformis | Growling Grass Frog | VU | L | en | 4 | 1959 | VBA, PMST | Possible. Potential aquatic habitat within the Murray River and associated waterways (i.e. Yungera Creek). Impact Possible. Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from Construction Footprints must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways as part of a CEMP. | Possible. Potential aquatic habitat within the Murray River and associated waterways (i.e. Yungera Creek). Impact Unlikely. If present, species almost certain to benefit directly from greatly expanded habitat when environmental water is present, and indirectly from improved habitat condition following environmental water. |



| Species Name | Common Name | EPBC Act | FFG Act | DELWP Advisory | Number of Records | Most Recent Record | Source | Likelihood of Occurrence and Impact | | |
|------------------------------|-----------------------------|-------------|------------|-------------------|-------------------------|--------------------------|--------|---|---|--|
| | | | | | Records | Record | | Construction Areas | Inundation Area | |
| REPTILES | | | | | | | | | | |
| Chelodina expansa | Broad- shelled Turtle | | L | en | 1 | 1994 | VBA | Possible. Species is known from the area. May occur in waterways and waterholes especially those that are permanent and have aquatic vegetation, including the Murray River and Narcooyia and Bonyaricall Creeks. Impact Possible. Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from Construction Footprints must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways and include the considerations for turtles. | Possible. Species is known from the area. May occur in waterways and waterholes especially those that are permanent and have aquatic vegetation, including the Murray River and Narcooyia and Bonyaricall Creeks. Suitable habitat expected to increase during environmental watering. Impact Possible. Species almost certain to benefit directly from greatly expanded habitat when environmental water is present and flowing habitat and connectivity is improved through the Narcooyia and Bonyaricall Creeks, and indirectly from improved habitat condition following environmental watering. Project to be designed and operated to minimise risks associated with entrainment via temporary pumping and passage through structures. | |
| Morelia spilota metcalfei | Carpet Python | | L | en | 2 | 2002 | VBA | Possible. Suitable habitat at all sites Impact possible. Localised impacts possible, consideration of finalised footprint required, direct impacts (injury, stress, mortality) through habitat clearing should be mitigated. Suitable habitat surrounding and widespread. | Possible. Suitable habitat across inundation extent. Impact Unlikely. Species likely to benefit from environmental water when present, and indirectly from improved habitat condition following environmental water. | |



| Species Name | Common Name | EPBC Act | FFG Act | DELWP Advisory | Number of Records | Most Recent Record | Source | Likelihood of Occurrence and Impact | | |
|--------------------------|----------------|-------------|------------|-------------------|-------------------------|--------------------------|---------------------|--|---|--|
| | | | | | Records | Record | | Construction Areas | Inundation Area | |
| FISH | | | | | | | | | | |
| Maccullochella peelii | Murray Cod | VU | L | vu | | | PMST GHD 2009 | Present. Species is known from area and suitable habitat present in wetland and waterways. Impact Possible. Localised impacts possible, associated with coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from Construction Footprints, which must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways, as part of the CEMP. | Present. Species is known from area and suitable habitat present in wetland and waterways, will increase during environmental watering. Impact Unlikely. Species likely to benefit from improved habitat conditions following environmental watering. Under minor flood peaks the operation of Narcooyia and Bonyaricall Creeks as flow-through systems will provide seasonal flowing conditions that are likely to be suitable for the species. Larger flood events will lead to a loss of flowing conditions but allow for foraging in wetland habitat. The provision of fish passage at the ER1 regulator and passive fish passage at other regulators will allow for fish to exit to the Murray River, provided a suitable drawdown regime is implemented. | |



| Species Name | Common Name | EPBC Act | FFG Act | DELWP Advisory | Number of Records | Most Recent Record | Source | Likelihood of Occurrence and Impact | | |
|--------------|-----------------|-------------|------------|-------------------|-------------------------|--------------------------|--------|---|---|--|
| | | | | | Records | Record | | Construction Areas | Inundation Area | |
| Bidyanus | Silver Perch | CR | L | vu | | | PMST | Possible. Silver Perch are a main-channel specialist but suitable flowing habitat likely to be present (i.e. Narcooyia, Bonyaricall and Yungera Creeks). Impact Possible. Localised impacts possible, associated with coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from Construction Footprints, which must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways as part of a CEMP. | Possible. Silver Perch are a main-channel specialist but suitable flowing habitat likely to be increased in Narcooyia, Bonyaricall and Yungera Creeks. Floodplain wetlands are likely to provide short-term foraging habitat. Impact Unlikely. Species likely to benefit from improved habitat conditions following environmental watering. Under minor flood peaks the operation of Narcooyia and Bonyaricall Creeks as flow-through systems will provide seasonal flowing conditions that are likely to be suitable for the species. Larger flood events will lead to a loss of flowing conditions but allow for foraging in wetland habitat. The provision of fish passage at the ER1 regulator and passive fish passage at other regulators will allow for fish to exit to the Murray River, provided a suitable drawdown regime is implemented. | |



9.3.1 Impacts to EPBC Act listed fauna species

Five EPBC Act listed fauna species were identified as either present or as possibly occurring within the Construction Footprint and Inundation Area: Regent Parrot (*Polytelis anthopeplus monarchoides*), Painted Honeyeater (*Grantiella picta*), Growling Grass Frog (*Litoria raniformis*), Murray Cod (*Maccullochella peelii*) and Silver Perch (*Bidyanus bidyanus*) (Table 8).

An assessment against the EPBC Act significant impact criteria for each of these five EPBC Act species has been made in Appendix J and Appendix K. The project would not have a significant impact on any of these five species.

A conservative approach to EPBC listed species has been taken for this assessment and a further three EPBC listed species, Corben's Long-eared Bat(*Nyctophilus corbeni*), Australasian Bittern (*Botaurus poiciloptilus*) and Australian Painted Snipe (*Rostratula australis*) species which were not identified as either present or as possibly occurring within the Construction Footprint or Inundation Area have also been considered further to demonstrate that they are unlikely to occur or be adversely impacted by the proposed project. Impacts from the project have been considered below.

Regent Parrot (Polytelus anthopeplus monarchoides) (Vulnerable)

A single EPBC Act listed species, the Regent Parrot, was regularly observed across the Area of Investigation, and within the Construction Footprint, with potential breeding habitat (nest trees) identified within five of the proposed infrastructure Construction Footprints (ER1, ER3, S7, S108 and Bonyaricall Creek Hardstand). Breeding activity has been confirmed in previous studies from the northern and eastern areas of Yungera Island along the Gearbox Loop Track, and on the opposite bank of the Murray River in NSW at Peacock Creek (Figure 7) (Webster 2002, Webster 2004, Webster & Belcher 2005, Webster & Belcher 2008, GHD 2009, GHD 2013, and GHD 2014). Known Regent Parrot breeding habitat was identified close to the S108 Regulator site, and close to the access track to this site along the existing Gearbox Loop Track. Alignment of this track and associated widening has taken into consideration these areas of known Regent Parrot nest tree colonies and direct impacts to large old trees will be avoided. Potential Regent Parrot breeding habitat was identified close to the ER1 South track raising and Bonyaricall Creek hard stand for the Lake Powell pump. These areas were all subsequently targeted for further investigation. A total of 37 targeted surveys for Regent Parrot nest trees were completed using the Two-Hour Point Survey method during the breeding period October and November. Despite Regent Parrot activity being observed in each of these areas, no breeding activity was observed, and it is considered unlikely that nesting was occurring at these sites. The results of these surveys are provided in detail in section 6.4.1.

Impacts to Regent Parrots are expected to be marginal, and will include losses to a relatively small area (~50.35 ha) of low quality potential foraging habitat located in disturbed areas and centred on existing tracks, compared to the broader ~8,300ha of potential feeding and nesting habitat across the Belsar-Yungera floodplain complex habitat. Furthermore, previous reports by Seran BL&A (2018) found that the Belsar-Yungera Project will not likely trigger a significant impact based of the EPBC Act significant impact criteria (DotE 2013). A recent full assessment of the EPBC Act significant impact criteria for this species from the proposed works is provided in Appendix J, and an assessment of the potential for significant effect on FFG Act 1988 listed flora and fauna under the EE Act is provided in Appendix L.

Based on previous experience during the Hattah Lakes TLM project, where works occurred at sites within two well-known Regent Parrot breeding colonies at the Messenger's and Oatey's Regulators and involved vegetation clearing (with eight known Regent Parrot nests removed by that project) for large hollow-bearing tree removal and construction of two large regulators and a 1,000 ML/day pump station), it is highly unlikely that the proposed works for the Belsar project at the S108 regulator will impact on the nearby (~100-300 m from Construction Footprint) Regent Parrot nesting colony. Surveys of Hattah TLM sites following the nest tree removal and construction found Regent Parrots nesting in these areas immediately after construction and over five subsequent years, with no significant change observed in breeding numbers and the peak in active nests recorded the year following construction (Hurley 2014, Robertson and Hurley 2015, GHD 2016, Eyles, Cheers, and Loyn 2018). Mitigation measures were implemented at these sites including the exclusion of tree removal and particularly noisy activities such as pile driving during the breeding season (i.e. managing the impact of indirect impacts such as noise, vibration and dust) and avoiding construction during the breeding season if possible. These mitigation measures will be implemented for the VMFRP project.



The 'National Recovery Plan for the Regent Parrot (eastern subspecies) *Polytelis anthopeplus monarchoides*' (Baker-Gabb and Hurley 2011) lists a range of threatening processes including disturbance around nesting colonies. The proposed Construction Footprint S108 and its associated access track along the existing Gearbox Loop Track is located in an area with historic breeding records for Regent Parrots, with some previously recorded nests within approximately 150 m of the proposed Construction Footprint and additional trees along the access track. Construction activities at this site and access track have the potential to disturb nesting activities, and therefore all construction activities should be completed, where practicable, outside of the Regent Parrot breeding season (August-December, Baker-Gabb and Hurley, 2011). However, similar previous activities for The Living Murray (TLM) project at Hattah-Kulkyne National Park were carried out in close proximity to known Regent Parrot breeding colonies with no long term impacts to the breeding activity (GHD 2017, GHD 2018). Based on current and previous assessment of Regent Parrot habitat in the Area of Investigation it seems reasonable to suggest that disturbance to known nesting colonies is unlikely.

The Belsar project will not result in the fragmentation of important Regent Parrot habitat as the State Park supports over 8,300 ha of contiguous habitat, most of which is suitable for Regent Parrot foraging and nesting, with the proposed Construction Footprint located on existing tracks and disturbed areas within an unbroken canopy of open woodland vegetation. Important nesting habitat will not be adversely impacted by the project and no known nests have been located to date despite extensive survey (GHD 2020). The proposed Construction Footprint areas will not adversely affect habitat critical to the survival of this species, as Construction Footprints represent very small, isolated and discrete areas of habitat within an extensive area of suitable habitat for this highly mobile species. The proposal does not plan to remove any potential nesting habitat.

One of the protection measures outlined in the recovery plan for the Regent Parrot mentions "the use of environmental water to initially rescue River Red-gum from drought was first undertaken in Victoria in 2002". The recovery plan then mentions that this continued under The Living Murray (TLM) project with important breeding sites for Regent Parrot such as Hattah Lakes being listed as one of six 'icon' sites and targeted for the construction of water regulation structures to provide a more natural watering regime to these wetland ecosystems. The VMFRP project has similar objectives to TLM and will aim to maintain and enhance the condition of River Red-gum habitats and broader floodplain and wetland habitats which are likely to assist with the recovery of the Regent Parrot.

Important breeding habitat is present within the Inundation Area, this breeding habitat (large old River Redgums) is likely to improve in condition, and future breeding habitat is expected to be sustained by environmental watering. This species is likely to benefit from broadly improved habitat condition following environmental water. Environmental water is essential to sustain the River Red-gums this species requires for breeding habitat.

Also of note, indications from R. Loyn *pers comm* suggest that early studies emphasised the importance of Mallee as feeding habitat, but this may understate the birds' versatility, and the importance of other feeding habitats including nearby farmland and (of greater relevance to this project) Black Box woodland. Loyn *et al* studies in Black Box woodland since 2014 has shown that flocks of up to ~50 Regent Parrots often feed in Black Box woodland and associated lake-beds, especially when they have been recently flooded (1-3 years post-flooding). At that stage the parrots are attracted to feed on the seeds of a range of low shrubs within the woodland and on the fringes of receding lakes, including introduced and native plant species.

Hence the proposed project is likely to increase food supplies for Regent Parrots by delivering water to substantial areas of Black Box woodland and associated habitats in the Belsar-Yungera floodplain.





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Figure 7 Previous known Regent Parrot nests recorded by Webster and Belcher 2008, and GHD (2009) all are close to the S108 regulator.



Murray Cod (*Maccullochella peelii peelii*) (Vulnerable) and Silver Perch (*Bidyanus bidyanus*) (Critically Endangered)

One other EPBC Act listed species is known to occur within the Area of Investigation; the Murray Cod (*Maccullochella peelii peelii*) (GHD 2009), whilst the Silver Perch (*Bidyanus bidyanus*) has the potential to occur. It is noted that current conditions are likely to allow for entry to the waterways of the Belsar-Yungera complex but without a fishway their ability to exit to the Murray River is limited (DELWP 2018); fish that currently enter the system can only re-enter the Murray River during over-bank flows. These species have the potential to occur at any of the wet sites on the Murray River or major creeks, and localised impacts are possible. Any instream works such as coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from Construction Footprints must consider these species. A construction specific aquatic fauna management plan should be developed for all works around waterways.

Impacts are likely to be beneficial to both species but will depend on the inundation scenario and operational regime. Under the minor flood peak scenario both Narcooyia and Bonyaricall Creeks will operate as a flow-through system – providing lotic (flowing) habitat that both species prefer. During larger inundation events (moderate to large flood peaks) there will be a loss of lotic habitat when regulators are closed but fish passage will be provided through regulator ER1 during these events. The inundation of the floodplain would provide foraging opportunities for these large-bodied species. The ability for fish to exit the floodplain is of importance to avoid impacts to the species. The Fish Management Plan for the site (DELWP 2018) provides details of the recommended operational regime to minimise the risk of stranding during drawdown events. Additional impacts due to operation were identified by DELWP (2018) and included the risk that floodplain inundation will increase carp populations, which may impact native fish species present within the complex. Mitigation measures recommended to minimise this risk include:

- Implementing a winter fill regime
- Develop a native fish exit strategy to strand carp
- Drying of wetlands with high carp density.

Blackwater management measures and a related water quality monitoring program on-site and within the Murray River would be established to adaptively manage risks to the downstream aquatic environment, which would afford protection to Murray Cod and Silver Perch within the Murray River.

A recent full assessment of the EPBC Act significant impact criteria for this species from the proposed works is provided in Appendix J, and an assessment of the potential for significant effect on FFG Act 1988 listed flora and fauna under the EE Act is provided in Appendix L.

Growling Grass Frog (Litoria raniformis) (Vulnerable)

The Growling Grass Frog is one of the largest frog species in Australia, and was once distributed across a large area of south-eastern Australia, including Tasmania. The species was previously widespread across Victoria and absent only from the western desert regions and the eastern alpine regions (Littlejohn 1963, 1982; Hero et al. 1991 in Mahony 1999). The species has disappeared from most of its former range across Victoria, and persists in isolated populations in the greater Melbourne area, in the south-west of Victoria and a few sites in central Victoria and Gippsland (Atlas of Victorian Wildlife database cited in Clemann and Gillespie 2004).

This species is mostly found amongst emergent vegetation (Robinson 1993), including *Typha* sp. (bullrush), *Phragmites sp.* (reeds) and *Eleocharis sp.*(sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams (NSW DEC 2005). The Growling Grass Frog can be found floating in warmer waters in temperatures between 18–25°C. Additionally, this species can occur in clays or well-watered sandy soils; open grassland, open forest, and ephemeral and permanent non-saline marshes and swamps. Growling Grass Frog specifically require areas of basking habitat (such as emergent aquatic vegetation or logs), breeding habitat (shallow freshwater lagoons) and refuge habitat (typically soil cracks, fallen timber and dense low vegetation).



Submerged vegetation is important habitat for breeding success as it provides egg-laying sites, calling stages for males, and food and shelter for tadpoles. Grassland provides habitat for foraging, dispersal and shelter, and may also provide overwintering sites for Growling Grass Frogs (Clemann & Gillespie 2004; Hamer & Organ 2006). Hamer and Organ (2006) found that large and relatively permanent waterbodies, with a high proportion of emergent vegetation cover, were more likely to be occupied by the Growling Grass Frog.

Much of the habitat for this species across the state has been isolated or fragmented, restricting the opportunity for important population processes such dispersal and colonisation. Populations persist in scattered localities throughout lowland regions, particularly along major watercourses. Populations of Growling Grass Frogs in the Mallee region do persist along the Murray River, such as at Lindsay Island in the far north-west, but are likely to have become isolated and fragmented through the lack of regular inundation of the floodplain and provision of suitable areas of habitat between sites, in the form of shallow waterbodies.

Major watercourses such as the Murray River within the species' range have been substantially altered by impoundments, river regulation and irrigation release schemes. Alterations to the timing, frequency and extent of flooding events have resulted in dramatic changes to many natural processes, such as preventing or greatly reducing spring flood events across natural floodplains. Cold water releases from impoundments have had a considerable impact on downstream ecological processes and native fish populations (MDBC 2003), and are likely to adversely affect the development rates and survivorship of eggs and tadpoles. Natural flooding of floodplains probably triggered breeding activity in semi-arid areas in the past (Wassens 2006), and altered hydrological regimes have grossly modified natural processes around extant populations.

The Growling Grass Frog is a highly mobile species, capable of moving up to one kilometre in 24 hours (K. Jervis undated, pers. comm. cited in Robertson et al. 2002; S. Wassens undated, per. comm. cited in NSW DEC 2005). Recent research suggests that, in areas other than the semi-arid/riverine part of the species' range, there are interactions between neighbouring populations (Clemann and Gillespie 2004). When the Growling Grass Frog is occupying ephemeral waterbodies, it has significantly higher levels of dispersal than in permanent waterbodies, indicating lower site fidelity, with individuals moving large distances (Wassens 2005).

The Growling Grass Frog is considered to have potential to utilise habitats within the proposed construction area and broader Inundation Area. Growling Grass Frog has been recorded four times previously within 10 km of the Construction Footprint, most recently in 1959 (Figure 8), and was not recorded during targeted surveys of Construction Footprints in areas of potentially suitable habitat in 2012 (GHD 2013), 2013 (GHD 2014) or 2019 (the current study). Despite the long absence of records of this species, the presence of suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area, and a reintroduction of more suitable ecological watering regimes may help facilitate this.

A broad analysis of potential Growling Grass Frog habitat (i.e. Ecological Vegetation Classes (EVC) across the Belsar project Inundation Area that have potential to support this species) was undertaken, specifically assessing the extent of wetland and associated EVCs within the Belsar project Inundation Area. The analysis returned an area of potential habitat of 1,882.72 ha (see Table 15 in Appendix L) This analysis at least at a broad level demonstrates that there is a very large area of potential habitat that may support this species when the appropriate episodic wetland conditions occur, and that the Construction Footprints represent very small isolated patches within a much broader intact landscape of potentially suitable habitat.

The Belsar project will not result in the loss of preferred habitat for the Growling Grass Frog and will result in the loss of an extremely small proportion of low-value potential habitat only. The proposed Construction Footprint areas represent less than 1.72% of the potential habitat for this species in the area (32.38 hectares of wetland EVCs within 1,882.72 hectares of high quality, suitable wetland EVCs within the Inundation Area (not including current waterways such as the Narcooyia and Bonyaricall Creeks), as per Table 15 in Appendix L), and areas are centred on existing tracks and degraded areas. This will not significantly reduce the area of occupancy of any population should it exist, as the structures will be established on already disturbed tracks and levees. The Belsar project will not result in the fragmentation of important Growling Grass Frog habitat as the park is unlikely to presently support a population of this species, and contains very limited potential habitat.



Whilst direct impacts from works are not predicted for the Growling Grass Frog, indirect impacts from the proposed works may include the introduction or spread of Chytrid Fungus. Transmission of the disease from vehicle is unlikely, however, hygiene protocols for Chytrid Fungus should be included in a site specific EMP (Murray et al 2011) to minimise the risk of water and mud being transferred by vehicles between sites. Additionally if the handling of frogs is required during the proposed works (i.e. during salvage), a suitably qualified and experienced ecologist should be engaged, and employ hygiene protocols identified in Murray et al (2011). No significant impacts are expected, as per the significant impact thresholds by DEWHA 2010 for Growling Grass Frog. Additionally, Seran BL&A (2018) found that the Belsar-Yungera Project will not likely trigger a significant impact based of the EPBC Act significant impact criteria (DotE 2013).

Operation of the proposed Belsar project to deliver environmental water to these areas has the potential to create and maintain a large area (1,882.72+ ha) of potential Growling Grass Frog habitat in the 2,374 Ha inundation zone. If external populations of this species recolonise the area, there is the potential to provide an increased and improved area of habitat that may help link otherwise disjointed populations upstream and downstream of the Belsar project area, thereby the works may increase connectivity for this species across the landscape and Mallee region.

A recent full assessment of the EPBC Act significant impact criteria for this species from the proposed works is provided in Appendix J, and an assessment of the potential for significant effect on FFG Act 1988 listed flora and fauna under the EE Act is provided in Appendix L.



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Figure 8 Growling Grass Frog records from the Victorian VBA



Painted Honeyeater (Grantiella picta) (Vulnerable)

The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The species is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory. The greatest concentrations and almost all records of breeding come from south of 26°S, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland (Higgins et al., 2001). During the winter it is more likely to be found in the north of its distribution

(<u>https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10357</u>). This species generally uses the following habitats:

- Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests.
- A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*.
- Insects and nectar from mistletoe or eucalypts are occasionally eaten.
- Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.

The species exhibits seasonal north-south movements governed principally by the fruiting of mistletoe, with which its breeding season is closely matched (Barea and Watson, 2007). Many birds move after breeding to semi-arid regions such as north-eastern South Australia, central and western Queensland, and central Northern Territory. Considering its dispersive habits, the species is considered to have a single population (Garnett et al., 2011).

Painted Honeyeater, is considered to have potential to utilise habitats within the proposed construction area and broader Inundation Area. This species has not been previously recorded within 10 km of the Construction Footprints, and very few records across local landscape, they are known to be highly mobile and have the potential to rarely forage in the woodlands of the Belsar Project area. The proposed Construction Footprints are however not likely to significantly impact any areas of important habitat to this extremely mobile nomadic species, which forages widely over large areas in pursuit of mistletoe and flowering eucalypts.

The Belsar project is highly unlikely to result in the fragmentation of important Painted Honeyeater habitat (large trees supporting abundant mistletoe) as the park supports more than 8,300 ha of contiguous habitat, with the proposed Construction Footprints located on existing tracks and disturbed areas within an unbroken canopy of open woodland vegetation. The proposed Construction Footprint areas will not adversely affect habitat critical to the survival of this species, as Construction Footprints represent very small, isolated and discrete areas of habitat within an extensive area of rarely used habitats for this highly mobile and infrequently recorded species.

A recent full assessment of the EPBC Act significant impact criteria for this species from the proposed works is provided in Appendix J, and an assessment of the potential for significant effect on FFG Act 1988 listed flora and fauna under the EE Act is provided in Appendix L.

Corben's Long-eared Bat (Nyctophilus corbeni)

The Corben's Long-eared Bat is not considered likely to occur within the Construction Footprint or Inundation Area of the Belsar project, and has not been recorded previously within 10 km of the project. It has however been considered further due to its relatively poorly understood status in Victoria in regards to habitat preferences and use. This species has a scattered distribution, mostly within the Murray-Darling Basin, but with some records outside of this area. It is recorded in mallee, bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities, and most common in box/ironbark/cypress-pine vegetation. It roosts in tree hollows, crevices and under loose bark, and is a slow flying agile bat that hunts for non-flying prey, especially caterpillars and beetles (OEH 2012). Threats to the species include habitat loss and fragmentation, fire and reduction of hollow availability.

The closest records in Victoria to the Belsar project area are in old growth mallee vegetation around the Hattah township and Hattah-Kulkyne National Park, over 50 km away (**Figure 9**). Corben's Long-eared Bat has been



recorded in NSW approximately 15 km north-east of the Belsar project area, but these records, and others in south-western NSW are all from mallee and belah vegetation communities (Figure 10). It is considered unlikely that this species utilises habitats within the Belsar project area, and that if it does occur, it is likely to be in extremely low numbers that would not be impacted by the proposed works or could be mitigated by preclearance surveys and hollow-bearing tree management protocols in the highly unlikely event that an N. corbeni is encountered during site development.

In the unlikely occurrence of this species in the Construction Footprint, impacts as a result of vegetation removal and potential habitat loss will be localised, and therefore resultant impacts to the species are expected to be very low. However, broader mitigation measures for hollow-dependent species as outlined in Section 11.3.3 will also apply to threatened bats including Corben's Long-eared Bat, including pre-clearance surveys and hollowbearing tree management in the unlikely event that a Corben's Long-eared Bat/s were detected.

Further consideration of this species was not considered necessary.



Threatened Species, Corben's Long-eared Bat - Belsar-Yungera Area of Investigation

Figure 9 Corben's Long-eared Bat records from the Victorian VBA





Figure 10 Corben's Long-eared Bat records in NSW, from The NSW Wildlife Atlas.

Australasian Bittern (Botaurus poiciloptilus) (Endangered)

The Australasian Bittern occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats (Marchant and Higgins 2004). It favors wetlands with tall, dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water (Marchant and Higgins 2004). The species favors permanent freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus*) or cutting grass (*Gahnia*) growing over muddy or peaty substrate (Marchant & Higgins 1990; within DoE 2016c).

In Victoria the species is recorded mostly in the southern coastal areas and in the Murray River region of central northern Victoria (Jaensch 2005, as cited in DSEWPaC 2011). The ebird database (accessed 11/6/20) identifies three main hotspots for this species in Victoria: along the south coast between Port Fairy and Portland, around Port Phillip Bay between Geelong and Carrum Downs and along the Murray River between Swan Hill and Yarrawonga.

The nearest record to the Area of Investigation is approximately 30 km to the south towards Prooinga, Vic (VBA, 1954) other records in the vicinity include 45 km west at Hattah-Kulkyne National Park, Vic (VBA, 1994), 59 km north east at Two Bridges Swamp (ebird 2018) and 66 km north east north of Balranald, NSW (NSW Atlas 2016), there are no other records within 100 km of the Area of Investigation. Whilst there are sporadic records in the area there is a distinct paucity of records for an area so heavily surveyed.

Limited data are available about breeding requirements for this species but available data indicate that the Australasian Bittern breeds in relatively deep, densely vegetated freshwater swamps and pools, building its nests in deep cover over shallow water (Marchant & Higgins 1990; within DOE 2020a). In rush land, it may avoid breeding in the densest areas (Marchant & Higgins 1990; within DOE 2020a); alternatively, this may simply reflect the location of the few nests that have been found in wetlands that are difficult to access (Jaensch 2005, as cited in DoE 2020a).

The likelihood of this species using the Area of Investigation as more than an occasional visitor is considered low given the bulk of the Area of Investigation lacks the required habitat features for this species (tall, dense aquatic vegetation) and is comprised predominately of woodland habitat (Table 9).



Australian Painted Snipe (Rostratula australis) (Endangered)

The Australian Painted Snipe is a rare, nomadic bird species that may turn up at any suitable wetland across Australia, when conditions are favourable. This species is widespread but rare throughout most of eastern Australia.

The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (*Melaleuca*). The Australian Painted Snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber (Marchant & Higgins 1993 within DOE 2020b).

The species is reported to have been mainly recorded in the Murray-Darling region however in Victoria and NSW, known records (VBA, Atlas of NSW and ebird) indicate this to be more accurate for the region east of Swan Hill (DOE 2020b).

In the vicinity of the Area of Investigation there are very few records. The ebird database shows a vast area largely unoccupied by the species for 100 km or more in every direction with the exception of a single record at Merbein Common near Mildura from 2011. Whilst we know this not to be true with a handful of other records in the area (i.e. within 50 km) (west of Wandown Flora and Fauna Reserve, Vic, approximately 12 km south from 2007, west of Narrung in NSW approximately 25 km to the south east from 1981 and approximately 30 km to the south towards Prooinga, Vic from 1963) it is reflective of the rarity of this species in the region.

The likelihood of this species using the Area of Investigation as more than an occasional visitor is considered low given the bulk of the Area of Investigation lacks the required habitat features for this species (tall, dense aquatic vegetation) and is comprised predominately of woodland habitat (Table 9).

9.3.2 Impacts to EPBC Act listed migratory species

Eleven species listed is migratory under the EPBC Act are predicted to occur, or were previously recorded from a VBA and PMST search of the Area of Investigation (a 10 km buffer of the Construction Footprint). None of these species were considered as likely to occur within the Construction Footprint during the time of the survey, mostly due to the lack of recent records within the Construction Footprint and/or a lack of suitable habitat present (see Appendix E and Appendix F for rationale).

It is highly unlikely that the Construction Footprint supports habitat that will be considered important for migratory species foraging or breeding activity or support an ecologically significant proportion of a population of migratory species, prior to the proposed construction.

Similarly, from a desktop assessment, eleven EPBC Act listed Migratory Species were predicted to occur or previously recorded within the Inundation Area and broader 10 km buffer (Appendix E and Appendix F). As discussed previously, listed Migratory Species are not considered likely to occur within the Inundation Area at the time of the survey given the lack of habitat available (waterbodies, wetlands etc.), therefore no adverse impacts to these species are predicted to occur as a result of the proposed works. However, reinstating historical environmental flows within the Belsar-Yungera floodplain will improve the quality of habitat present for water dependant avifauna, with several species of Migratory birds including Eastern Great Egret (Ardea modesta) and Glossy Ibis (Plegadis falcinellus) known to respond to environmental watering (Cook et al. 2011 and Wood et al. 2018). Such habitat enhancements include increased productivity of floodplain vegetation communities, increased floral diversity and structure by reducing more dominant drought-tolerant species and increase overall health and integrity of the area to improve breeding, foraging and refuge resources for listed Migratory species, and other wetland-dependant bird species.

There is potential for the introduction of environmental water to lead to an increase in abundance of feral predators (cats, foxes), herbivores (e.g. goats) and omnivores (e.g. pigs) due to the associated increase in productivity. Some of the species such as cats and foxes could potentially prey on migratory waterbirds. An accompanying feral animal management and control program will need to be implemented within the inundation extent, however this may simply require Parks Victoria to expand current pest control programs within the park.



A current full assessment of the EPBC Act significant impact criteria to Migratory listed species from the proposed works for this species is provided in Appendix K. The project is not likely to have a significant impact on EPBC Act-listed migratory species.

9.3.3 Impacts to FFG Act Listed fauna and communities and other list fauna species

Fifteen FFG Act listed species (10 birds, one amphibian, two reptiles, and two fish species) are considered to have potential to occur within the proposed Construction Areas, these are listed in Table 8, Appendix E and Appendix F. All species have been recorded within 10 km of one or more of the Construction Footprint, or have potential habitat in this area, and most will be expected to utilise habitats such as those found within the Construction Footprint or broader Inundation Area. None of these species is considered likely to be significantly impacted by the proposed construction, though localised impacts on hollow-dependent species such as Carpet Python are possible. From a landscape perspective the proposed Construction Footprints represent an comparatively small area of around 50.35 ha, of a total area of approximately ~8,300 ha (0.61%) of Belsar and Yungera Islands, centred largely on existing tracks and degraded areas, within a very large intact area of tens of thousands of hectares of high quality native vegetation along the Murray River corridor. For these reasons the proposed construction impacts are considered unlikely to significantly impact threatened fauna species and communities.

Three FFG Act listed species (Regent Parrot, Major Mitchell's Cockatoo and Square-tailed Kite) were observed during the field assessment in 2019. Twenty species are predicted as possible to occur, or present within the Construction Footprint or the broader Study Area (VBA, PMST, GHD 2013, GHD 2014, Ecology Australia 2016 and the present study). An assessment of the potential for significant effect on FFG Act 1988 listed flora and fauna under the EE Act 1978 has been completed and is summarised in Appendix L for Regent Parrot.

Most of the FFG Act listed species possibly occurring in the Construction Footprint are highly mobile bird species and all have access to large areas of suitable habitat in the immediate surrounding areas in which to disperse. From a landscape perspective the proposed Construction Footprints represent an extremely small area of around 52.15 ha (Seran BL&A 2018), centred on existing tracks and degraded areas wherever possible, within a very large intact area of many tens of thousands of hectares of high quality native vegetation along the Murray River corridor. For these reasons the proposed construction impacts are considered unlikely to significantly impact these threatened fauna species.

Direct impacts as a result of habitat removal, e.g. the removal of hollow-bearing trees, should be mitigated for particularly impacts to species such as the Carpet Python and bats (use hollow-bearing trees for refuge/roosting). An on-site ecologist with a Management Authorisation under the Wildlife Act 1975 should be present during vegetation removal to readily relocate any pythons (and other hollow occupying fauna) found within larger trees. Additionally, all hollow-bearing trees proposed for removal should be thoroughly inspected prior to removal for refuging wildlife and at risk of harm from felling. A Fauna Management Plan (FMP) or equivalent should be developed and implemented during the works associated with the project to mitigate impacts to all native fauna that may result from removal of vegetation during works. This may be incorporated as a sub-document of a Construction Environmental Management Plan (CEMP) and would contain detailed requirements on the approach to pre-clearance surveys, timing of surveys and clearing, clearing methods, options to enhance surrounding habitat using removed vegetation (e.g. hollow bearing trees/limbs), and other measures to mitigate impacts to fauna. The plan would be required to include particular consideration to the threatened fauna (ie. those listed under the EPBC Act, FFG Act and/or the DELWP Advisory List of Threatened Fauna). All native animals encountered during the pre-clearance and other vegetation clearance activities must be treated humanely, ethically, and in accordance with relevant codes under the Victorian Wildlife Act 1975 and Wildlife Regulations 2002.

An Aquatic Fauna Management Plan would be developed and implemented to manage impacts to aquatic values – with emphasis on threatened fish species that may be present in vicinity of construction sites, as well as turtles including the threatened (FFG-listed) Broad-shelled Turtle. Any construction activities that could lead to entrapment of fauna or temporary loss of habitat (e.g. due to the use of coffer dams and dewatering) should be considered.



The proposed Belsar-Yungera Floodplain Restoration Project aims to inundate approximately 2,374 hectares of River Red-gum swamp, woodland, and wetland habitat. Although these habitats are currently dry (at the time of surveys) and occupied by terrestrial ground-layer vegetation, historically these water-dependant EVC's will have received more frequent inundation prior to river regulation (Seran BL&A 2018). Inundation will be achieved from the planned infrastructure, providing much needed environmental water to vegetation communities that are currently not experiencing flooding of the appropriate frequency, duration and extent to meet their water requirements. It is expected that the application of environmental water to water dependent Red Gum, Black Box, Lignum and wetland habitats provided it occurs within the bounds of water regime requirements will be extremely beneficial to these communities.

Many EPBC Act and FFG Act listed threatened fauna species are either known, or have the potential to occur within the inundation extent (Appendix F) including, Growling Grass Frog (*Litoria raniformis*), Regent Parrot (*Polytelis anthopeplus*), Lace Monitor (*Varanus varius*), Carpet Python (*Morelia spilota metcalfei*), Hooded Robin (*Melanodryas cucullata*), Major Mitchell's Cockatoo (*Lophochroa leadbeateri*), Painted Honeyeater (*Grantiella picta*), Diamond Dove (*Geopelia cuneata*). Each of these species either have a broad foraging/dispersal range and are unlikely to be adversely impacted by short and occasional periods of inundation (e.g. Diamond Dove, Major Mitchell's Cockatoo) or will have the ability to continue utilising these habitats during inundation (e.g. Growling Grass Frog, Lace Monitor, Carpet Python) and during times of inundation, these species may utilise wetlands containing suitable habitat. Certainly, the application of episodic environmental water will be expected to maintain and enhance the conditions of these woodland and wetland communities in the face of future climate change scenarios rather than a 'do nothing' approach to leaving these habitats in their current ecological state.

Previous condition monitoring at Hattah-Kulkyne National Park where floodplain environmental watering has been used for over 15 years (e.g. Cook *et al.* 2011 and Wood *et al.* 2018) has shown that the introduction of environmental water has had positive benefits for threatened water birds including observations of the nationally endangered (EPBC) Australian Painted Snipe (*Rostratula australis*) recorded historically and confirmed again in the 2018 Lake Bitterang inundation event Wood *et al.* (2018). Other threatened waterbirds recorded during the 2018 inundation event included Freckled Duck (*Stictonetta naevosa*). Blue-billed Duck (*Oxyura australis*) and Glossy Ibis (*Plegadis falcinellus*), with several White-bellied Sea-eagle (*Haliaeetus leucogaster*) observed including a successful breeding pair.

FFG Act listed communities

One FFG Act listed fauna community was considered with the potential to occur within the Construction Footprint: The Victorian Temperate Woodland Bird Community (VTWBC). This community is defined by a group of woodland dependent bird species, characteristically found in a range of woodland types, and over a broad geographic area. The geographic area is defined as the slopes and plains inland of the Great Dividing Range within Victoria. Riverine floodplains associated with the Murray River are not specifically included or excluded from the VTWBC description. Twenty-six bird species characteristic to the community, of which 11 are considered dependent, were identified in the desktop and field assessments. Impacts to this community are likely to be negligible as Belsar-Yungera is comprised largely of intact vegetation and the proposed construction of floodplain infrastructure is unlikely to impact on habitat connectivity or remove important habitat for the VTWBC.

Loyn and Dutson (2018) have been studying woodland bird habitat use, abundance and diversity in black box habitats during and after inundation events and have shown that frequently inundated sites may be more productive than sites which rarely flood, but are only useful to small birds, including rare species such as Black Honeyeater (*Sugomel niger*) when Noisy Miners are absent. It is expected that the proposed inundation is likely to be beneficial to the VTWBC, particularly in areas of habitat where Noisy Miners are absent.



9.4 Wetlands of International Importance and Directory of Important Wetlands of Australia

According to a PMST Search, the Ramsar Wetland Hattah-Kulkyne Lakesis located 20-30 km downstream of the project. An additional three Ramsar Wetlands were identified 150-400 km downstream (Banrock Station Wetland Complex, Riverland and the Coorong, and Lakes Alexandrina and Albert Wetland).

Whilst impacts to the Hattah-Kulkyne Lakes and other downstream Ramsar Wetlands are expected to be negligible (Seran BL&A 2018) an Environmental Management Framework will be developed that identifies potential environmental risks and puts in place mitigation strategies to avoid or minimise these risks. Any impacts will be localised and site rehabilitation will occur following completion. The Environmental Management Framework will require development of a CEMP that sets out specific measures that will be employed to minimise indirect impacts during construction.

Belsar Island is listed under the Directory of Important Wetlands of Australia. While reinstating a wetting and drying regime of appropriate frequency, duration and extent to the broader Belsar-Yungera area is likely to impart significant ecological benefits for the Belsar-Yungera inundation extent, infrastructure projects such as this can also have environmental risks, particularly localised, short-term impacts during the construction phase.

Belsar Island is proposed to be impacted during construction works for Belsar-Yungera project, although as discussed, proposed impacts are relatively small (50.35 ha / 0.61%) in relation to the broader floodplain area (~8,300 ha) within the State Park. The construction of the proposed infrastructure is critical to the long term maintenance of this wetland system, which through lack of natural flooding over several decades has become dominated by mesic flora species.

Black-water events may also occur following floodplain inundation due to breakdown of leaf litter and terrestrial vegetation by bacteria, which releases nutrients into the water, but again, this is not considered a significant risk associated with the works, as black-water events are a natural process. Operation of the proposed works may reduce the incidence of black-water events by restoring more frequent floods to the system and reducing the accumulation of leaf litter and nutrient loads between inundation events, therefore black water incidence is likely to diminish in the future. Water quality monitoring to inform adaptive management processes is proposed as part of the EWMP and Operating Plan.

Overall, the project is likely to significantly benefit the environment, reinstating appropriate wetting and drying regimes to over 2, 374 ha of wetlands and floodplain. This will increase the extent and condition of habitat for aquatic and floodplain fauna, including water birds, fish, frogs, turtles and terrestrial species reliant on floodplain habitats, such as woodland birds, bats, small/medium mammals and reptiles.

9.5 FFG Act – threatening processes

Potentially threatening processes are listed in accordance with Section 10 of the *Flora and Fauna Guarantee Act 1988 (FFG Act)*. There are a number of threatening processes that are relevant to the Belsar-Yungera Project that have the potential to be exacerbated by either the construction process or proposed inundation of 2,374 ha of floodplain and wetlands.

9.5.1 Construction Phase

FFG Act listed threatening processes could include:

- Loss of hollow-bearing trees from Victorian native forests.
- The spread of *Phytophthora cinnamomi* from infected sites into parks and reserves, including roadsides, under the control of a state or local government authority.
- Increase in sediment input into Victorian rivers and streams due to human activities
- Input of toxic substances into Victorian rivers and streams
- Alteration to the natural flow regimes of rivers and streams
- Prevention of passage of aquatic biota as a result of the presence of instream structures



The Construction Footprint should be refined through the design process to minimise impacts to native vegetation, habitat and hollow-bearing trees.

A qualified ecologist will be on-site to manage the removal of any fauna habitat and capture and translocate fauna observed within the construction area. It is still possible that hollow-bearing trees will be removed as part of the project, however the broader objective to inundate 2,374 ha of swampy woodland and wetland vegetation is likely to contribute to the maintenance of hollow-bearing trees into the future.

Any construction activity that requires works within waterways has the potential to temporarily prevent passage of biota and to alter flow regimes. These impacts are likely to be relatively short-term and an aquatic fauna management plan for the project should be prepared to minimise impacts to aquatic fauna. This may incorporated as a sub-document of a CEMP.

An Environmental Management Framework will be prepared as part of the project that will include measures such as vehicle hygiene protocols to mitigate the potential spread of weeds and *Phytophthora cinnamomi* and measures to minimise sedimentation inputs or toxic substances (e.g. fuel) to waterways.

9.5.2 Operation Phase (Inundation)

FFG Act listed threatening processes could include:

- Predation of native wildlife by the introduced Cat, Felis catus
- Predation of native wildlife by the introduced Red Fox Vulpes vulpes
- Soil degradation and reduction of biodiversity through browsing and competition by Feral Goats (*Capra hircus*)
- Alteration to the natural flow regimes of rivers and streams

There is potential for the introduction of environmental water to lead to an increase in abundance of feral predators (cats, foxes), herbivores (e.g. goats) and omnivores (e.g. pigs) due to the associated increase in productivity. Some of the species such as cats, foxes and pigs could potentially prey on migratory water birds, woodland birds, small mammals, reptiles and frogs that may respond to the application of water to floodplains/wetlands. An accompanying pest animal management and control program will to be implemented within the Inundation Area. Parks Victoria, as a Project Partner, will continue working with government through the planning phase to ensure that funding is available for Parks Victoria to manage known risks of environmental water delivery in accordance with their statutory obligations as the estate manager.

The project aims to implement flow regimes which will benefit both riverine and wetland species. The current flow regime of Narcooyia, Bonyaricall and Yungera Creeks has also been altered to maintain a supply of irrigation water to landholders south of the complex (DELWP 2018). The natural flow patterns have been significantly altered and now are not sufficient to meet the needs of the Belsar-Yungera floodplain ecosystem. This project aims to meet the flow requirements of ecological values across the site.



10. Impacts to native vegetation

This section summarises the likely impacts to native vegetation associated with the proposed works within the Construction Footprint. The impacts described in this section incorporate assessments undertaken at Belsar-Yungera from 2013–2020. The combined Vegetation Quality Assessment (Habitat Hectare) results are outlined in Appendix C for all of the native vegetation proposed to be impacted.

10.1 Objective of the Guidelines

The *Guidelines for the removal, destruction or lopping of native vegetation* (the Guidelines) were incorporated into the Victorian Planning Provisions and all planning schemes in Victoria in December 2017 (DELWP, 2017).

The purpose of the Guidelines is to guide how impacts on biodiversity should be considered when assessing an application for a permit to remove, destroy or lop native vegetation. The Guidelines set out the rules and tools for how the responsible authority (Swan Hill Rural City Council) and referral authority (DELWP) should consider biodiversity when assessing an application. Adherence to the practices and procedures outlined in the Guidelines will help protect native vegetation. They aim to ensure that the proposed removal of native vegetation is appropriately assessed, that opportunities to avoid and minimise removal are considered, and that appropriate offsets are secured (DELWP, 2017).

When native vegetation removal is permitted, an offset must be secured that achieves a no net loss outcome for biodiversity. To achieve this, the offset needs to make a contribution to Victoria's biodiversity that is equivalent to the contribution made by the native vegetation that was removed. Therefore, the type and amount of offset required depends on the native vegetation being removed and the contribution it makes to Victoria's biodiversity.

10.2 Proposed construction impacts to native vegetation

10.2.1 Ecological Vegetation Classes

The proposed direct loss of native vegetation for the project is up to 50.35 hectares, within an extensive surrounding area of native vegetation within the 8,300 ha of public land (with intact native vegetation in the immediate area). All of the impacts are associated with construction access and the installation of infrastructure, and efforts have been made during each iteration of the design, to avoid and minimise impacts to native vegetation and fauna habitat (including large trees where present).

The proposed works will involve impacts to 0.33 ha of vegetation classified as vulnerable, 47.33 ha of vegetation classified as depleted and 2.69 ha of vegetation classified as least concern. However it is anticipated that any impacts to these Ecological Vegetation Classes (EVCs) associated with the proposed works, will be greatly outweighed by the benefits and improvements that these same EVCs will achieve through environmental watering within the Inundation Area. The Inundation Area is expected to cover 2,374 ha of Belsar-Yungera and will directly benefit 155.45 ha of vegetation classified as vulnerable, 1531.79 hectares of vegetation classified as depleted and 529.63 of vegetation classified as least concern. The proposed overall loss of vegetation, 50.35 ha, equates to approximately 2% of the area proposed to benefit from environmental watering.

Of the 50.35 ha of native vegetation that is proposed to be removed, 25.54 ha is potentially impacted by the Construction Footprint of proposed structures, containment banks, hardstands and laydown areas, and 24.81 ha is associated with potential maintenance works along existing access tracks (Table 9).



The scope and requirement for works along access tracks is still to be confirmed and will be designed to avoid and minimise native vegetation removal. The current estimate of potential vegetation removal along tracks is conservative, and assumes a minimum 5 metre buffer where vegetation removal has been accounted for along existing tracks. In some instances these works may be limited to minor maintenance and upgrades that require minimal if any vegetation clearance. Vegetation is not currently proposed to be cleared within this 5 m buffer, however it is acknowledged that use of the tracks by heavy machinery during the construction phase of the project may require some track maintenance that could impact trees. R8 has recommended that once the Construction Footprint and required track access has been confirmed, that a qualified arborist is engaged to undertake an assessment along the existing tracks, with a project engineer and construction contractor, to confirm the extent of works required (if any) and any potential losses to trees along the existing tracks either directly (through removal) or indirectly (through encroachment of their TPZs, or the removal of >30% of their canopy). Once this assessment has been undertaken, the extent of impacts to native vegetation for the project will be confirmed. It is anticipated that the actual impacts to native vegetation along the existing access tracks will be significantly lower than the conservative estimate (24.81 ha) that has been currently accounted for.

The total proposed impacts to each individual EVC within the construction areas is outlined in Table 9. The EVCs that are modelled to occur within the proposed Inundation Area are also shown in **Figure 3**.

During the process of preparing a Native Vegetation Removal Report (NVRR) for the project, a number of patches of vegetation that are proposed to be impacted were excluded from the EnSym simulation. These patches were located on or nearby the Victoria / NSW boundary, and their proximity to the state boundary meant that four polygons (equating to 5.29 ha) were not able to be processed through the EnSym system. Therefore, the native vegetation impacts currently accounted for in the NVRR (Appendix O) account for the removal of only 45.056 ha. These additional areas will be incorporated as native vegetation losses at a later stage and the full 50.35 ha will be incorporated in to the overall impact calculations.

| EVC No. | EVC | EVC conservation significance | Area (ha) impacted by infrastructure | Area (ha) impacted by Tracks |
|------------|---------------------------------|-------------------------------------|--------------------------------------|---------------------------------|
| 86 | Woorinen Sands Mallee | Depleted | 0.00 | 0.06 |
| 103 | Riverine Chenopod Woodland | Depleted | 4.57 | 12.22 |
| 106 | Grassy Riverine Forest | Depleted | 5.40 | 2.32 |
| 295 | Riverine Grassy Woodland | Depleted | 2.80 | 0.50 |
| 808 | Lignum Shrubland | Least Concern | 0.94 | 0.63 |
| 813 | Intermittent Swampy Woodland | Depleted | 0.78 | 0.62 |
| 818 | Shrubby Riverine Woodland | Least Concern | 0.56 | 0.56 |
| 819 | Spike Sedge Wetland | Vulnerable | 0.33 | N/A |
| 823 | Lignum Swampy Woodland | Depleted | 10.16 | 7.90 |
| | | Total | 25.54 | 24.81 |

Table 9 Proposed impacts to each Ecological Vegetation Class (EVC)



10.2.2 Current Wetlands

There are a number of wetlands listed under the DELWP current wetland layer that occur across the Belsar project site (Appendix P). Some of the areas that were mapped as native vegetation during the field assessment within the Construction Footprint have been classified by DELWP as current wetlands (approximately 0.76 hectares)⁶. At the time of the field assessment, these areas were dry and had not received recent rainfall, therefore a VQA assessment was undertaken classifying these patches as the EVC modelled to be present and incorporated in to the current NVRR⁷. Once the Construction Footprint has been finalised for the project a new NVRR will be prepared for the works, with any areas mapped as current wetlands that are proposed to be impacted, accounted for using the DELWP modelled condition data.

10.2.3 Canopy trees

During the field assessments 1,147 trees were recorded within the Area of Investigation (Appendix H). The DBH of each stem of each tree has been recorded at approximately 1.3 m above ground level to determine the size class (as per the guidelines, DELWP 2017a). Of these 1,147 trees, 368 large trees are considered to be a loss for the project, either directly through tree removal or indirectly due to >10% of their TPZs being impacted. However, only 321 large trees have been able to be included as removed in the NVRR, as approximately 5 ha of native vegetation (which included 47 large trees) along the Victorian/NSW border had to be excluded in order to process the NVRR. It is understood that DELWP will be able to manually process the NVRR for this project once the Construction Footprint has been finalised, and this area and the 47 large trees it contains, will be incorporated as native vegetation losses as a part of this process.

A qualified arborist will be engaged to determine the full extent of impacts to native trees (both within and immediately adjacent to the proposed Construction Footprint). This assessment will take into account direct impacts to trees (tree removal) and indirect impacts to trees (through encroachment of their TPZs). Whilst the size class of a tree is determined by measuring the DBH at 1.3 m under the Guidelines, the TPZs of a tree are calculated by recording the DBH of a tree at 1.4 m (and for multi-stemmed trees such as some eucalypts, the TPZ is determined by combining the DBH measurements of each individual stem).

An arborist assessment will also consider the individual tree location and habit, as well as specific characteristics of certain tree species (e.g. mallee eucalypts) where it's possible that individual trees will survive greater than 10% encroachment of their TPZs or the pruning of over 30% of the existing crown (the standard measures for determining indirect tree losses under the guidelines).

It is expected that 368 Large Trees (339 Large trees associated with structures and 29 Large trees associated with access tracks) will be impacted by the proposed works (Appendix O).

10.3 Proposed operational impacts to native vegetation

The project aims to inundate approximately 2,374 ha of water-dependent floodplain ecosystems, containing habitat for rare or threatened flora, fauna and communities. The project aims to reinstate a more natural flooding regime across the Inundation Area, whereas under the current post-river regulation regime, some areas that were formerly dominated by wetland vegetation are now persistently dry and occupied by terrestrial ground-layer vegetation.

The ecological assessments undertaken for the project to date have identified the known or modelled presence of 103 flora and 52 fauna species listed under the EPBC Act, FFG Act and/or the DELWP Advisory list for rare or threatened species, within the 2,374 ha Inundation Area. As the overall project aim is to improve the extent and condition of native vegetation and fauna habitat within Belsar-Yungera, an assessment has been made as to whether the proposed environmental watering will have an impact on native vegetation and habitat in the Inundation Area, particularly any listed species or communities.

⁶ http://maps.biodiversity.vic.gov.au/viewer/?viewer=NatureKit

⁷ https://nvim.delwp.vic.gov.au/



Altering the hydrological regimes in the project area may cause minor negative impacts to some terrestrial species, e.g. flora that have adapted to drying conditions. However, these impacts are likely to be short term through the retention of surface water during inundation events, or through changes in water quality, and it is considered unlikely that the proposed environmental watering will have a negative impact on the ongoing survival of any populations of listed flora that may be present in (or that may colonise) the lnundation Area. It has been illustrated in recent studies within Hattah-Kulkyne National Park (HKNP) that re-instating the natural flooding regime has positively influenced flora and fauna species, including rare and threatened species (Kenny et al. 2017; Duncan et al. 2020). Species that have been recorded to respond positively to inundation events from environmental watering events within the study area include the Winged Peppercress (*Lepidium monoplocoides*), Darling Lily (*Crinum flaccidum*) and Curly Flat-sedge (*Cyperus rigidellus*) (Kenny et al. 2017; GHD, 2018; Moxham et al. 2019a). Moreover, environmental flows may also have contributed to the colonization of new indigenous species for the State of Victoria in Applebush (*Pterocaulon sphacelatum*) and Winged-plains Bush (*Pluchea rubelliflora*) (Moxham et al. 2019b). Many studies have advocated that ongoing management of environmental watering is important for many flora species and communities, particularly those that are water dependent.

The project is designed to maintain and enhance the health of more than 2,374 ha of native vegetation. This will increase the extent and condition of habitat for common indigenous and threatened aquatic and floodplain fauna, including waterbirds, fish, frogs, turtles and terrestrial species reliant on floodplain habitats, such as woodland birds, bats, small/medium mammals and reptiles. The project will enable environmental water to be delivered, which will be of particular benefit during long dry periods and under current climate change scenarios.

For the purposes of this assessment, it is assumed that the proposed environmental watering will be managed to deliver the preferred hydrological regime for native vegetation communities within the proposed Inundation Area, and that native vegetation within the proposed Inundation Areas is expected to be benefited for the project rather than adversely impacted. A summary of the vegetation communities making up the 2,374 hectares of vegetation proposed for inundation is outlined in Table 8. Two non-water dependent communities are modelled as receiving environmental water comprising three EVCs: Chenopod Mallee (EVC 158), Loamy Sands Mallee (EVC 91) and Semi-arid Chenopod Woodland (EVC 98), along with 70.49 ha of vegetation with no EVC modelled data available. These areas underwent a vegetation ground-truthing assessment in June 2020, and the surveys found no non-water dependent EVCs within the Inundation Area (see Section 7.3 and Figure 6).

A more detailed assessment of the potential impacts to vegetation within the Inundation Areas as a result of environmental watering has not been undertaken as part of this impact assessment, as baseline condition monitoring has not yet been undertaken within the proposed Inundation Area.

The Arthur Rylah Institute (ARI) is currently developing a Monitoring, Evaluation and Reporting (MER) Plan designed to collect baseline condition data that will enable ongoing condition monitoring to be undertaken across the site to confirm the gains in the health and condition of native vegetation within the Inundation Area that may result from the proposed environmental watering.

ARI specialists have been adopting and aligning methods with previous The Living Murray (TLM) projects (including the findings of the Hattah Lakes Offsets Monitoring Program and the Mulcra Island Offsets Monitoring Program). The aim here has been to (1) maximise consistency of methods across VMFRP and TLM, (2) take advantage of the current capability that has developed for the monitoring at the TLM sites, and (3) thereby provide maximised future opportunities for cross-VMFRP-TLM analysis and evaluation in order to help meet expectations for evaluation and reporting at state and Basin scales (pers. comm. Ashley Sparrow, ARI[®]).

 $^{^{\}rm 8}$ Email communication between ARI and R8 Ecology staff on 5 June 2020



10.4 Assessment pathway

Applications to remove native vegetation are categorised into one of three assessment pathways with corresponding application requirements and decision guidelines. The assessment pathway for an application to remove native vegetation reflects its potential impact on biodiversity and it is determined from the location and extent of the native vegetation to be removed (DELWP, 2017).

The three assessment pathways recognised by DELWP are:

- Basic: limited impacts on biodiversity
- Intermediate: could impact on large trees, endangered EVCs, and sensitive wetlands and coastal areas
- *Detailed:* could impact on large trees, endangered EVCs, sensitive wetlands and coastal areas, and could significantly impact on habitat for rare or threatened species

The assessment pathway determines the information that is required to accompany an application to remove, lop or destroy native vegetation. There are three location categories that indicate the potential risk to biodiversity from removing a small amount of native vegetation: Location 1, 2 and 3 and play a role in determining the assessment pathway. The higher category is used if native vegetation proposed to be removed includes more than one location category. The process for determining the assessment pathway is summarised in Table 10.

The Construction Footprint is located within a broad area that has mapped as Location 3. Given the scale of the project and both the extent of native vegetation and the number of large trees identified within the Belsar-Yungera Area of Investigation, the project will follow the Detailed Assessment pathway.

Table 10 Risk matrix for determining the assessment pathway that an application to remove native vegetation will take

| Extent of native vegetation | Location Category | | | | | |
|---|-------------------|--------------|------------|--|--|--|
| | Location 1 | Location 2 | Location 3 | | | |
| < 0.5 hectares (ha) and not including any Large Trees | Basic | Intermediate | Detailed | | | |
| < 0.5 hectares (ha) and including one or more Large Trees | Intermediate | Intermediate | Detailed | | | |
| 0.5 hectares (ha) or more | Detailed | Detailed | Detailed | | | |

10.5 Summary of native vegetation impacts

The results of the Habitat Hectare (VQA) assessment used to calculate the impact and offset requirements for the project are outlined in Appendix C. Despite the efforts outlined in Section 11 to avoid and minimise impacts to native vegetation during the design and planning phase of the project, the current Construction Footprint Construction Footprint estimates that 50.35 hectares of native vegetation removal will be required for the project (45.056 ha of which is accounted for in the current NVRR). Further efforts will be made during the next design phase to avoid and minimise impacts to native vegetation and fauna habitat.

The Habitat Hectare assessments were undertaken at the time of the fieldwork in 2016 using the Construction Footprint that was current at the time (Ecology Australia 2016). Due to changes in the Construction Footprint since the 2016 survey and the fact that vegetation along tracks hasn't been fully mapped, some areas of native vegetation proposed to be impacted have not yet been assessed (11.7 ha), in these areas the DELWP modelled condition data has been used to fill these gaps. Once the design process is complete and the Construction Footprint has been finalised, it is recommended that a Vegetation Quality Assessment (Habitat Hectares) is undertaken in these areas (gaps) to confirm the condition and extent of native vegetation within these areas.



Using the current Construction Footprint, a total of approximately 50.35 ha of native vegetation is proposed to be removed. The total proposed impacts to each individual EVC within the Construction Footprint is outlined in Table 9. During the process of preparing a Native Vegetation Removal Report (NVRR) for the project, a number of patches of vegetation that are proposed to be impacted were excluded from the EnSym simulation. These patches were located on or nearby the Victoria / NSW boundary, and their proximity to the state boundary meant that four polygons (equating to 5.29 ha) were not able to be processed through the EnSym system. Therefore, the native vegetation impacts currently accounted for in the NVRR (Appendix O) account for the removal of only 45.056 ha. However, these additional areas will be incorporated as native vegetation losses at a later stage and the full 50.35 ha will be incorporated into the overall impact calculations.

368 Large Trees (321 of which are accounted for in the current NVRR) (i.e. canopy trees within patches with a DBH that meets the threshold to be considered Large for a particular EVC) will be impacted as a part of the project. No Scattered Trees will be impacted as a part of the project.

Table 11 summarises the proposed impacts to native vegetation, as outlined in the NVRR prepared on 15 April 2020, see Appendix O.

| Summary of Impacts | |
|---|---|
| Assessment Pathway | Detailed Assessment Pathway |
| Extent of proposed vegetation removal | 45.056 hectares* |
| No. of Large Trees proposed to be removed | 321 |
| Location Category | Location 3 The native vegetation is in an area mapped as an endangered EVC, sensitive wetland or coastal area. Removal of less than 0.5 hectares of vegetation could have a significant impact on any habitat for rare or threatened species. |

Table 11 Summary of impacts to native vegetation for the project

* The native vegetation impacts currently accounted for in the NVRR (Appendix O) account for the removal of only 45.056 ha. However, additional areas will be incorporated as native vegetation losses at a later stage and the full 50.35 ha will be incorporated in to the overall impact calculations.

Appendix C outlines the results of the Habitat Hectare Assessments undertaken during the site assessments.

10.5.1 Offset requirements

The NVRR outlines the offset requirements for the project, including species offsets for 75 species of rare and threatened flora and fauna, and 321 Large Trees (Appendix H).

Offsets will be sought in accordance with the requirements of the Guidelines for removal, destruction or lopping of native vegetation (DELWP 2017a) or through an alternate arrangement agreed with the Secretary to DELWP. The loss of native vegetation due to construction activities is proposed to be offset, at least in part, by the expected improvement in native vegetation quality in the Inundation Area resulting from environmental watering. The method for confirming this offset will be developed in consultation with DELWP.



11. Avoidance, Minimisation and Mitigation for Threatened Flora and Fauna

Efforts have been made throughout the planning and design phases for the proposed construction to avoid and minimise impacts to ecological values including native vegetation and fauna habitat, threatened flora, fauna and communities. All areas of native vegetation that are proposed to be impacted are adjacent to existing vehicle tracks and areas of previous disturbance, and represent inferior areas of habitat to those which surround them. From a landscape perspective, the proposed Construction Footprints represent a comparatively small area within a very large intact area of high quality native vegetation.

VMFRP is adopting specific design principles which minimise the footprint of the proposed containment banks, whilst also ensuring that the core functions of the bank which are to hold water (and secondly provide a safe trafficable route through the forest) are also being achieved. These principles include:

- **Freeboard:** has been designed to the minimum required to retain bank functionality with expected wearing and wave impacts. The minimisation of freeboard means that bank height and width are also minimised, thereby reducing potential impacts on native vegetation.
- **Crest width:** is the minimum crest width for the relevant design speed and aligned to an existing Parks Victoria asset classification (i.e. 5D). Furthermore, the verge zone has been reduced from 2 m to 0.5 m recognising that a table drain is not required on top of containment banks, further minimising impacts to native vegetation. The final required crest width and potential for further avoidance and minimisation of impacts would be confirmed during detailed design.
- **Batter slopes:** Adoption of the steepest batter slope which still meets batter stability and road safety requirements (i.e. 3H:1V), reducing the width of the batter and the associated vegetation removal.
- Alignment: banks to be located on top of existing tracks within already disturbed areas. The bank alignments will be further refined, taking in to account the results of the ecological and heritage site assessments, to avoid high value areas.

11.1 General mitigation measures

The following should be considered during the construction, planning approval phase and implementation of the project:

- Avoid where practical, the removal of hollow-bearing trees and large old trees (including removal of limbs) within the Construction Footprint with regards to fauna.
- Avoid where possible, areas of native vegetation not approved for removal, areas of high quality vegetation and areas of vegetation that support rare and threatened flora species (e.g. FFG threatened flora). Retain as many Large Trees as practicable where there are potential impacts to Tree Protection Zones for the Construction Footprint area.
- Include the above points to develop and implement mitigation measures for incorporation into an EMP to minimize the potential for ecological impacts within and around the site before, during and after the construction process. These may also include:
 - Minimise and adhere to the approved footprint and supervise construction activities to ensure that activities do not encroach on retained native vegetation.
 - Avoid and minimise disturbance to the Reserve where practicable.
 - Standard vehicle hygiene measures to prevent the spread and introduction of weed species, particularly Weeds of National Significance and noxious weeds listed under the *Catchment and Land Protection Act 1994* (CaLP Act).



- Standard vehicle hygiene measures to prevent the spread or transmission of Chytrid Fungus as per Murray et al. (2011).
- Management of run-off, spills and sediment to avoid impacts on the Murray River, Bonyaricall Creek, and any other waterways.
- Delineation of areas of remnant native vegetation to be retained from those areas to be removed as no-go zones to avoid encroachment into areas of retained vegetation.
- Develop and implement a Flora and Fauna Management Plan as part of the CEMP that contains requirements to avoid, mitigate and manage impacts to flora and fauna values and particularly threatened species and describing the habitat preclearance and clearance process. As a minimum the plan must address the requirements described in measures described within this technical report.

11.2 Design Phase

The following mitigation measures have, and should continue to be implemented during the design phase to minimise and mitigate impacts to threatened flora and fauna identified in previous ecological surveys within the Construction Footprint (Australian Ecosystems 2013, GHD 2013, GHD 2014, Ecology Australia 2016):

- Through refinement of the detailed design, the project shall to the extent practicable, minimise the Construction Footprint and impacts on the environment through:
 - Siting of proposed structures primarily along or immediately adjacent to existing access tracks and other previously disturbed areas.
 - Designing containment banks and batters in consultation with Parks Victoria to minimise extent of native vegetation removal and other construction impacts.
- Design the project to minimise risks to fish and turtles associated with temporary pumping and passage through structures, as per recommendations in the Fish Management Plan (DELWP, 2018).

11.3 Construction phase

The following mitigation measures are recommended to minimise and avoid impacts upon the identified threatened flora, fauna and community values (FFG Act listed threatened species):

- Follow the avoid and minimise protocol in determining the construction works footprint at each site (i.e. make every effort to avoid threatened flora species loss as a high priority).
- Areas of remnant native vegetation to be retained should be delineated from those areas to be removed as 'no-go zones', to avoid encroachment into areas of retained vegetation
- Locations for stockpiles should be within existing cleared areas or areas of non-native vegetation where practicable
- All vehicles and plant must only operate on existing tracks and in areas marked as parking areas or construction zones.
- Manage potential impacts to tree root zones during construction.
- For the protection of threatened flora:
 - Species listed under the FFG Act and EPBC Act which are not permitted to be removed, must be fenced off with temporary 1 metre high orange barrier mesh medium-heavy weight prior to construction commencing.
 - Fencing must be checked on a weekly basis and the population monitored on a monthly basis.
 - All staff onsite should be made aware through inductions and/or signage of the presence of threatened species and how to identify the species. Locations for stockpiles should be within existing cleared areas or areas of non-native vegetation where practicable



- If any threatened flora species additional to those already identified in site plans (i.e. listed as threatened under the EPBC Act, or the FFG Act) are found within the construction area the Project Ecologist will be notified. The number and location of individuals would be recorded and DELWP would be advised.
- Manage the removal of hollow-bearing trees within the Construction Footprint (if required, based on final footprints and potential impacts to tree root zones from track establishment, set down areas) where construction may impact habitat trees of native fauna, particularly FFG Act listed fauna species and communities:
- Avoiding the breeding season of hollow-dependant species is recommended. Where this is not
 practical an assessment must include surveys undertaken by a suitably qualified ecologist of the
 hollow-bearing trees being removed during the breeding season. The survey should also include other
 native hollow-dependent fauna. A protocol needs to be developed prior to/during construction. See
 section 9.3.3 for a more comprehensive list of mitigation measures for the management of hollowbearing trees.
- Where clearing is proposed outside the breeding season, complete pre-clearance surveys for any remnant hollow-bearing trees to be removed. These trees could harbour one or more species of native hollow-dependent fauna. Pre-clearance surveys should be conducted prior to (within 24 hours) the hollow-bearing trees being removed.
- Manage the removal of hollow-bearing trees at all sites identified as potential Regent Parrot nesting area (ER3, S108, S7, ER1 and Bonyaricall Creek hard stand sites) and if required, based on final footprints and potential impacts to tree root zones from track establishment, set down areas, where construction may impact nest trees of EPBC Act – listed Regent Parrot:
 - Scenario 1 Where clearing of hollow-bearing trees is proposed during the Regent Parrot breeding period (September through end of January, DoEE, 2017). Avoiding the breeding season is recommended, however where this is not practicable an assessment must be undertaken to determine if impacts from construction will impact trees identified as Regent Parrot nest trees prior to clearing or modification of the tree. The assessment must include surveys undertaken by a suitably qualified person of the hollow-bearing trees being removed during the breeding season (September and January). The survey should also include other native hollow-dependent fauna. A protocol needs to be developed/refined from the previous Threatened Species Management Plan for 'The Living Murray Hattah Lakes Environmental Flows Project' (GHD 2011) in the event that a Regent Parrot nest is identified just prior to/during construction.
 - Scenario 2 Where clearing is proposed outside the Regent Parrot breeding season. Complete pre-clearance surveys for any remnant hollow-bearing trees to be removed. These trees could harbour one or more species of native hollow-dependent fauna. Pre-clearance surveys should be conducted prior to (within 24 hours) the hollow-bearing trees being removed.
- Temporary fencing should be erected around 'sensitive' areas to indicate areas to avoid during construction.
- Establish work zones for each site to avoid 'sensitive' habitats (including areas containing threatened flora). This could be implemented through an initial briefing of construction works crews by a qualified ecologist and subsequent planning of safe work distances and establishment of each site.
- Develop and implement a Flora and Fauna Management Plan to manage impacts to all flora and fauna values and particularly threatened species and the habitat pre-clearance and clearance process (as per general mitigation measures, Section 11.1).
- Develop and implement an Aquatic Fauna Management Plan to manage impacts to aquatic values with emphasis on threatened fish species and turtles (including the FFG-Act listed Broad-shelled Turtle) that may be present in vicinity of construction sites. Any construction activities that could lead to entrapment of fauna or temporary loss of habitat (e.g. due to the use of coffer dams and dewatering) should be considered.



- If the capture, handling or translocation of fish is required during construction (e.g. dewatering work sites) or operation of the project, persons undertaking these activities will need to hold the appropriate permit or licence under the *Fisheries Act 1995*. Any capture of fish must be carried out by a qualified aquatic ecologist.
- Develop and implement a Construction Environmental Management Plan (CEMP) for the construction
 phase. This EMP should provide appropriate measures to avoid or minimise indirect impacts such as
 erosion, sedimentation and the accidental spill of oils or other chemicals. It will also provide a protocol
 for minimising impacts in ecologically sensitive areas such as creek lines. Ideally, the EMP will be
 audited during and following the construction process to ensure works have been conducted
 appropriately.
- Develop and implement a plan to manage weeds during and after the construction phase within the study area (this will be described in an overarching Environmental Management Framework),
- On completion of works, rehabilitate construction areas, including:
 - Setting aside topsoil to reinstate when works are complete and compacting to original levels.
 - If native vegetation must be removed, re-spreading of stored topsoil should occur, followed by monitoring to assess germination in the following year.
 - Appropriate weed control measures at the site following the works should be incorporated into the rehabilitation program, as soon as possible.
 - If the site is not naturally recolonised by locally indigenous species, planting of locally indigenous species appropriate to that particular position in the landscape may be undertaken in the following year.
 - Ground debris that is temporarily removed to allow construction activities, should be reinstated.

11.4 Operation phase

The following mitigation measures are recommended to minimise and avoid impacts upon the identified threatened flora, fauna and community values (EPBC Act and FFG Act listed threatened species):

- Implement pest animal management and control. This may require Parks Victoria to expand current pest control programs within the reserve to target these areas during inundation events.
- Implement recommended operational regimes and mitigation measures detailed in the Fish Management Plan for the site (DELWP, 2018) to enhance outcomes for threatened fish species.
- Implementation of a Blackwater Management Plan and related water quality monitoring program on-site and within the Murray River to adaptively manage risks to the downstream aquatic environment, which would afford protection to the Murray River during discharge events.



12. Policy and legislative requirements

There are a number of ecological values present within the Construction Footprint as discussed within this report, with the potential to trigger the requirement to obtain permits if impacted (e.g. the removal of native vegetation will require a permit under the Victorian *Planning and Environment Act 1987*). Table 10 below outlines the potential legislative implications for the project that may result from the removal of native vegetation and/or fauna habitat within the Construction Footprint and the environmental watering within the Inundation Area.

| Commonwealth legislation | Relevance to project |
|--|--|
| Environment Protection and Biodiversity Conservation (EPBC) Act 1999 | No listed flora or ecological communities were identified during the assessment, nor are they considered likely to occur within the Construction Footprint. One listed community, <i>Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions</i> , is consistent with one EVC modelled as occurring within the Inundation Area, EVC 98: Semi-arid Chenopod Woodland (0.59 ha). A ground-truthing field assessment was undertaken in June 2020 in locations within the proposed Inundation Area that had been mapped by DELWP as containing this EVC, and other non-water dependent communities. The fieldwork confirmed that there is no Semi-arid Chenopod Woodland present within the Inundation Area where its presence had been modelled by DELWP, and no vegetation was identified that is consistent with the listed community: <i>Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions</i> . Therefore, it is considered unlikely that the construction or operation phases of the project will impact the listed ecological community. The EPBC Act listed Regent Parrot (<i>Polytelis anthopeplus monarchoides</i>) is known to breed in the Belsar-Yungera Area of Investigation, was regularly observed at many sites (ER3, S108, S7, ER1 and Bonyaricall Creek hard stand). These sites were targeted during the peak breeding season for specific surveys using tailored methods for the detection of nesting of this species. A total of 37 surveys were completed in 2019, and despite much general activity by this species in these areas, no breeding was detected. It is likely that Regent Parrot nesting colonies exist within 150 m of the Construction Footprint at S108 on the Gearbox Loop Trail, but that none of these siles will be directly impacted by the proposed works. Indirect impacts through disturbance at this and the other four sites containing potential Regent Parrot nesting habitat (ER3, S7, ER1 and Bonyaricall Creek hard stand) is possible, and it is recommended where possible that construction activities at these sites is completed outside of |

Table 12 Summary of probable legislative requirements



Inundation of floodplain habitat during the operational phase has a high likelihood of increasing carp populations within wetland habitat and also in aquatic habitat that remains following flood events. Increasing carp populations may be detrimental to native fish, including Murray Cod and Silver Perch, as they can compete for habitat and food sources favoured by large-bodied native fish. Mitigation measures (see DELWP, 2018) would be implemented to reduce risks associated with carp.

An additional two EPBC Act listed fauna species are considered possible to occur within the Construction Footprints and to be potentially impacted: the Painted Honeyeater (*Grantiella picta*) and Growling Grass Frog (*Litoria raniformis*). Painted Honeyeater is considered to have potential to utilise habitats within the proposed construction area and broader Inundation Area. This species has not been previously recorded within 10 km of the Construction Footprints, but may occasionally forage in these woodland areas. The proposed Construction Footprints are however not likely to significantly impact any areas of important habitat to this extremely mobile nomadic species, which forages widely over large areas in pursuit of mistletoe and flowering eucalypts. Growling Grass Frog was last recorded within 10 km of the Construction Footprint in 1959, and was not recorded in targeted surveys of potential habitat in 2012 (GHD 2013), 2013 (GHD 2014) and 2019 (this study). Despite the long absence of records of this species, the presence of suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area, and a reintroduction of more suitable ecological watering regimes may help facilitate this.

Three other EPBC-listed species were considered unlikely to occur to a lack of suitable habitat to support an important population and include the Corben's Long-eared Bat (*Nyctophilus corbeni*), Australasian Bittern (*Botaurus poiciloptilus*), and the Australian Painted Snipe (*Rostratula australis*).

None of these species are considered likely to be significantly impacted by the proposed construction activities or inundation. A full assessment of the EPBC Act significant impact criteria to these species from the proposed works is provided in Appendix J for species with potential to occur.

Eleven migratory species were identified as having the potential to occur within the Construction Footprint, and Inundation Area (PMST and VBA). Most of these species are either highly unlikely to occur (e.g. Eastern Curlew) or would very rarely use airspace over these footprints (e.g. Fork-tailed Swift). It is highly unlikely that the Construction Footprint supports habitat that would be considered important for migratory species foraging or breeding activity or support an ecologically significant proportion of a population of migratory species. A current full assessment of the EPBC Act significant impact criteria to Migratory listed species from the proposed works is provided in Appendix K.

The Ramsar Wetland, Hattah-Kulkyne Lakes, is located 20-30 km downstream of the Area of Investigation. It is unlikely that the project will negatively impact on the character of the Ramsar site. Whilst impacts to the Hattah-Kulkyne Lakes are not expected (Seran BL&A 2018), an Environmental Management Plan (EMP) should be developed that identifies potential environmental risks and puts in place mitigation strategies to avoid or minimise these risks (e.g. sediment runoff)

A referral to the Commonwealth Environment Minister for a determination under the EPBC Act is being developed, as although it has been suggested that it is unlikely that a significant impact will occur on Matters of National Environmental Significance (MNES), a precautionary approach to refer the project has been adopted.



| ect can trigger an EES referral if over 10 ha of native vegetation is proposed to be |
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| ed. It is currently estimated that up to 50.35 ha of native vegetation will require al with 368 Large Trees potentially impacted. |
| oject will therefore trigger an EES referral based on the extent of native tion identified within the Construction Footprint. This report will form part referral. |
| onstruction Footprint indicates that 50.35 ha of native vegetation will require al with 368 Large Trees potentially impacted for the project. Of this, 25.54 ha is ally impacted by the Construction Footprint of proposed structures, containment hardstands and laydown areas, and 24.81 ha is associated with access tracks. ope and requirement for works along access tracks is still to be confirmed and will igned to avoid and minimise native vegetation removal. In some instances these may be limited to minor maintenance and upgrades that require minimal if any tion clearance. As such, the current estimate of potential vegetation removal racks is conservative. al under the P&E Act will be required for the removal of any native vegetation exemptions (as specified in Clause 52.17) apply. Given the extent of native tion identified within the Construction Footprint, as well as the presence of ed native individuals (<25% cover) within areas considered to be non-native tion, it is considered that planning permission under the P&E Act will be required |
| rrent Construction Footprint will require the removal of 50.35 ha of native tion. As the location mapping for the Study Area identifies that the construction are classified as Location Risk 3 and given the scale of the project and both the of native vegetation and the number of trees identified within the study site, it is ered likely that the project will need to follow the Detailed Assessment pathway. Is reason, habitat hectare assessments were undertaken in all areas of uction Footprint. The results of this are presented in Appendix C. ted that Habitat hectare assessments were undertaken at the time of the rk in 2016 using the Construction Footprint that was current at the time. Due to es in the Construction Footprint since the 2016 and 2019 surveys, some areas of vegetation proposed to be impacted have not yet been assessed including along tracks, however DELWP modelled condition data has been used to fill these Once the design process is complete and the Construction Footprint has been d, it is recommended that a Vegetation Quality Assessment (Habitat Hectares) is aken in these areas to confirm the condition and extent of native vegetation within |
| |



| Flora and Fauna Guarantee (FFG) Act 1988 | Fauna species and communities |
|--|---|
| | Three FFG Act listed species were observed during the field assessment in 2019 (Regent Parrot, Major Mitchell's Cockatoo and Square-tailed Kite). In total, 20 species are predicted as possible to occur, or previously recorded within the Construction Footprint or the broader area (VBA, PMST, and Australian Ecosystems 2013, GHD 2014, Ecology Australia 2016): |
| | All species have been recorded within 10 km of the Construction Footprints, and utilise habitats such as those found within the Construction Footprint. |
| | None of these species is considered likely to be significantly impacted by the proposed construction, although localised impacts on hollow-dependent species such as Carpet Python are possible. Most are highly mobile bird species and all have access to large areas of suitable habitat in the immediate surrounding areas in which to disperse. |
| | One FFG Act listed fauna community was considered with the potential to occur within the Study Area and the broader Inundation Area: The Victorian Temperate Woodland Bird Community (VTWBC). Impacts to this community are likely to be negligible as Belsar-Yungera is comprised largely of intact vegetation and the proposed construction of floodplain infrastructure is unlikely to impact on habitat connectivity or remove important habitat for the VTWBC. The proposed inundation of floodplain and wetland habitats however, is likely to provide important future benefits to the VTWBC particularly under climate change scenarios of longer, dryer conditions in a semi-arid environment. |
| | Other than VTWBC, no other threatened fauna communities listed under the FFG Act are likely to occur within the Construction Footprint or Inundation Area. |
| | Flora species and communities |
| | Five species listed as threatened under the FFG Act were identified during the recent surveys. These were: |
| | Acacia melvillei (Yarran) Acacia oswaldii (Umbrella Wattle) Cullen pallidum (Woolly Scurf-pea) Cullen tenax (Tough Scurf-pea) Eremophila maculata subsp. maculata (Spotted Emu-bush) |
| | These species have the potential to be impacted by the proposed works, and an FFG Act Permit will be required for their removal. The location of flora species listed as threatened under the FFG Act should be taken into consideration when finalising the Construction Footprints and efforts should be made to avoid listed species where possible. Additional avoidance and mitigation measures outlined in this report should be followed where possible to minimise the impacts on these species. Thirty-one flora species listed as protected under the FFG Act have been identified within the study area. Given the size of the site and the extensive areas of native vegetation identified within the Construction Footprint it is anticipated that protected flora species will be impacted by the proposed works. A permit should be sought for the removal of species listed as protected under the FFG Act. A ground-truthing field assessment was undertaken in June 2020 in locations within the proposed lowed by DELWP as containing non-wrater. |
| | dependent EVCs. The fieldwork confirmed that there is no Semi-arid Chenopod Woodland present within the Inundation Area where its presence had been modelled by DELWP, and no vegetation was identified that is consistent with the FFG-listed community: Semi-arid Shrubby Pine-Buloke Woodland Community. Therefore, it is considered unlikely that the construction or operation phases of the project will impact the listed flora community. |



| | It is recommended that efforts be made to avoid and minimise impacts to any species and/or communities listed as threatened or protected under the FFG Act during the construction phase of the project and that any relevant FFG Act Management Plans for relevant species be adhered to. For turtles, including the threatened (FFG-listed) Broad-shelled Turtle, mitigation measures should be considered and incorporated into the design and operation regime and an aquatic fauna management plan developed to mitigate construction risks such as cofferdams and dewatering. |
|---|---|
| Wildlife Act 1975 | Any persons engaged to remove, salvage, hold or relocate native fauna during construction must hold a current Management Authorisation under the Wildlife Act (e.g. if hollow-bearing trees are removed or fauna are rescued from open trenches during construction). A Management Authorisation (MA) will almost certainly be required for this project as hollow-bearing trees and fauna habitat will likely be removed. The MA will be obtained at the time of the construction, and in the name of the ecologist who will handle/relocate the fauna. |
| Catchment and Land Protection (CaLP) Act 1994 | Thirteen significant weeds were identified within the study area. Eleven of these are CaLP Act-listed weed species (including one WONS), and two of these are listed only as WONS: Asparagus officinalis (Asparagus), Restricted Asphodelus fistulosus (Onion Weed), Restricted Carthamus lanatus (Saffron Thistle); Restricted Cirsium vulgare (Spear Thistle); Restricted Dittrichia graveolens (Stinkwort); Restricted Echium plantagineum (Patterson's Curse); Restricted Emex australis (Spiny Emex); Regionally Controlled Lycium ferocissimum (African Box-thorn), Regionally Controlled / WONS Marrubium vulgare (Horehound), Restricted Opuntia ficus-indica (Indian Fig), WONS Qpuntia spp. (Prickly Pear), WONS Xanthium occidentale (Noogoora Burr), Regionally Controlled Xanthium strumarium spp. agg. (Noogoora Burr aggregate), Regionally Controlled Mitigation measures to prevent the spread of these species (and any other WONS or CaLP Act listed weed species) will need to be incorporated into a CEMP. |
| Fisheries Act 1995 | The <i>Fisheries Act 1995</i> (Fisheries Act) provides a legislative framework for the regulation, management and conservation of Victorian fisheries. A person must not take fish from marine waters or inland waters; or use or possess recreational fishing equipment in or next to Victorian water unless authorised to do so by a licence. Section 119 of the <i>Fisheries Act</i> requires that a person must not create an obstruction across a watercourse or water body that will obstruct the free passage of fish, leave fish stranded, or destroy immature fish without authorisation under the Act. Design, construction and operation of the project should seek to avoid creating obstructions to fish passage, otherwise authorisation may be required under the <i>Fisheries Act</i> . If the capture, handling or translocation of fish is required during construction (e.g. dewatering work sites) or operation of the project, persons undertaking these activities will need to hold the appropriate permit or licence under the <i>Fisheries Act</i> . |


| Environment Protection Act 1970 | The Environment Protection Act 1970 empowers the Environment Protection Authority Victoria (EPA Victoria) to implement regulations, maintain State Environment Protection Policies (SEPPs) and protect the environment from pollution and the management of wastes. The Environmental Protection Act (1970) allowed for the establishment of the State Environmental Protection Policy (Waters) (SEPP Waters), which applies to all surface |
|---------------------------------------|--|
| | waters, estuarine and marine waters and groundwaters across the State (Vic. Gov. 2018). Relevant clauses of this policy must be adhered to. The following clauses (with a brief description of relevant aspects) are applicable to the project. |
| | Clause 40 – Management of instream works |
| | A person undertaking works in or adjacent to surface waters must minimise risks to beneficial uses. |
| | Minimise unnatural erosion, sediment re-suspension and other risks to aquatic habitat. |
| | Ensure that existing and new in situ structures do not pose a barrier to fish movement. |
| | Clause 42 - Construction activities |
| | Minimise soil erosion, land disturbance and discharge of sediment and other pollutants to surface waters |
| | Where construction activities impinge on surface waters, construction managers need to monitor affected surface waters to assess whether beneficial uses are being protected |
| | Clause 45 – Native vegetation protection and rehabilitation |
| | Minimise the removal of and rehabilitate native vegetation within or adjacent to surface waters. |
| Water Act 1989 | The <i>Water Act 1989</i> provides legislative framework for the allocation and management of water. A Works-on-Waterways permit is required to construct works on a waterway identified under section 67 of the Water Act. The permit must be approved by Mallee CMA. |
| | |



13. Recommendations

The proposed Belsar-Yungera Project aims to inundate approximately 2,374 ha of floodplain and wetland habitats that support water dependent vegetation threatened by river regulation, on-going drought and a drying climate.

13.1 Next steps

R8 recommends the following next steps:

- Refine the Construction Footprint within the bounds of the 50.35 ha footprint utilising the existing ecological values.
- Refine the Construction Footprint utilising the existing ecological values mapping (Appendix G) to avoid and minimise impacts to native vegetation and threatened flora/fauna and communities within the Construction Footprint. This should include the consideration of design alternatives as required to mitigate impacts to vulnerable EVCs.
- The Habitat Hectare assessments were undertaken at the time of the fieldwork in 2016 using the Construction Footprint that was current at the time (Ecology Australia 2016). Due to changes in the Construction Footprint since the 2016 survey and the fact that vegetation along tracks hasn't been fully mapped, some areas of native vegetation proposed to be impacted have not yet been assessed (11.7 ha), in these areas the DELWP modelled condition data has been used to fill these gaps. Once the design process is complete and the Construction Footprint has been finalised, it is recommended that a Vegetation Quality Assessment (Habitat Hectares) is undertaken in these areas (gaps) to confirm the condition and extent of native vegetation within these areas.
- Engage with DELWP, discussing the proposed Construction Footprint and the efforts that have been made to avoid and minimise impacts to native vegetation during the preliminary and refinement phases of the project.
- Depending on the extent of impacts to areas of treed vegetation a qualified arborist may need to be
 engaged to determine the full extent of impacts to native trees (both within and immediately adjacent to
 the proposed Construction Footprint). This assessment will take in to account direct impacts to trees
 (tree removal) and indirect impacts to trees (through encroachment of their TPZs). An arborist
 assessment will also consider the individual tree location and habit, as well as specific characteristics of
 certain tree species (e.g. mallee eucalypts) where it's possible that individual trees will survive greater
 than 10% encroachment of their TPZs or the pruning of over 30% of the existing crown (the standard
 measures for determining indirect tree losses under the guidelines).
- Engage with DELWP, discussing the proposed approach for planning approval and obtaining offsets for the project under the *Planning and Environment Act 1987* and whether a conservation exemption may apply to the works at Belsar-Yungera. This approach may include the establishment of a vegetation condition monitoring regime within the proposed Inundation Areas that will identify changes in condition to the vegetation within these areas that results from the environmental watering regime.
- Prepare an Offset Plan for the project to support any application for planning approval to remove native vegetation under the *Planning and Environment Act 1987*.
- Develop specific impact mitigation measures related to the works. These should be incorporated into a Construction Environmental Management Plan (CEMP) for the project.
- Develop and implement a Flora and Fauna Management Plan to manage impacts to all flora and fauna values and particularly threatened species and the habitat preclearance and clearance process
- Develop and implement an Aquatic Fauna Management Plan (as part of the CEMP) to manage impacts to aquatic values with emphasis on threatened fish species as well as turtles that may be present in the vicinity of construction sites. Any construction activities that could lead to entrapment of fauna or temporary loss of habitat (e.g. due to the use of coffer dams and dewatering) should be considered
- A CEMP should be developed for the project and implemented in full to further avoid and minimise impacts to areas of ecological value. The CEMP should be prepared once the footprint and construction methods for the proposed works have been finalised, and should include provisions relevant to protecting the ecological values identified within the Construction Footprints (Appendix G).



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