

# Googong Township water cycle project: Stage A - Network (west)

Flora and fauna management plan  
November 2012

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# 1 Introduction

## 1.1 Context

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This Flora and Fauna Management Plan (FFMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the Googong Township water cycle project Stage A – Network (west) (the Project).

Refer to Section 1 and Section 2 of the CEMP for additional detail on the scope of the Project to which this FFMP applies.

This FFMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the Statement of Commitments (SoC), the safeguards listed in the Googong Township water cycle project Environmental Assessment (EA), submissions report, and all applicable legislation.

## 1.2 Background

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The Googong Township water cycle project EA assessed the impacts of construction and operation of the Project on flora and fauna.

As part of EA development, a detailed assessment was prepared to address the Director General's Requirements issued by the **former** Department of Planning and Infrastructure (DP&I), **now known as the Department of Planning and Environment (DP&E)**. The flora and fauna assessment was addressed in Section 11 and Appendix F of the EA.

The EA concluded that there is unlikely to be significant flora and fauna impacts associated with the construction and operation of the Project, following the implementation of the proposed mitigation measures identified in the EA.

The Googong Township water cycle project was referred to the **former** Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), **now known as the Department of Environment (DoE)**, under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to potential impacts on matters of national environmental significance, including migratory species, threatened species and communities. The Googong Township water cycle project was declared a controlled action under the EPBC Act, and subsequently approved on 19 May 2011, subject to conditions.

## 1.3 Environmental management systems overview

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The overall Environmental Management System and approach to managing environmental impacts for the Project is described throughout the CEMP.

This FFMP forms part of the environmental management framework for the Project, as described in Section 1.5 of the CEMP. In accordance with CoA C20(e), this Plan has been developed in consultation with the Office of Environment and Heritage (OEH), Queanbeyan City Council (QCC) and the **DoE DSEWPaC**.



# 2 Purpose and objectives

## 2.1 Purpose

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The purpose of this Plan is to describe how the Googong Township Proprietary Limited (GTPL) and the contractor will manage and protect flora and fauna during construction of the Project.

This Plan also assists in ensuring the Project meets the environmental objectives and targets as defined in Section 3.5 of the CEMP.

## 2.2 Objectives

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The key objective of the FFMP is to ensure that impacts to flora and fauna are minimised. To realise this objectives, the following will be undertaken:

- Ensure appropriate measures are implemented to address the relevant CoA and SoC, and the safeguards detailed in the EA and submissions report (refer to Sections 3.2 and 3.3 respectively).
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 of this Plan.
- Ensure appropriate controls and procedures are implemented during construction activities to avoid or minimise potential adverse impacts to flora and fauna (refer to Section 5.1).

# 3 Environmental requirements

## 3.1 Relevant legislation and guidelines

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Section 3.1 of the CEMP identifies the legal and other requirements applicable to the Project. This section identifies the key legislation and guidelines applicable to managing flora and fauna.

### 3.1.1 Legislative requirements

Legislation relevant to flora and fauna management includes the following.

#### *Environmental Planning and Assessment Act 1979 (EP&A Act)*

As outlined in Section 3.1 of the CEMP, the Project has been assessed and approved by the NSW Department of Planning and Environment (DP&I) ~~Infrastructure (DP&I)~~ under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Section 75U of the EP&A Act lists various approval requirements that do not apply to an approved Part 3A project, including a permit under section 201, 205 or 219 of the *Fisheries Management Act 1994* (FM Act), an authorisation referred to in section 12 of the *Native Vegetation Act 2003* (or under any Act to be repealed by that Act) to clear native vegetation or State protected land, a permit under Part 3A of the *Rivers and Foreshores Improvement Act 1948*, a water use approval under section 89, a water management work approval under section 90 or an activity approval under section 91 of the *Water Management Act 2000*.

The following directions, orders or notices cannot be made or given so as to prevent or interfere with the carrying out of the Project, an interim protection order (within the meaning of the *National Parks and Wildlife Act 1974* (NPW Act) or the *Threatened Species Conservation Act 1995* (TSC Act)), an order under Division 1 (Stop work orders) of Part 6A of the NPW Act, Division 1 (Stop work orders) of Part 7 of the TSC Act or Division 7 (Stop work orders) of Part 7A of the FM Act.

#### *National Parks and Wildlife Act 1974*

While Section 75U of the EP&A Act provides an exemption for some sections of the NPW Act, some provisions of the Act still apply. Accordingly, where required the relevant personnel, such as the Project ecologist, will hold the following.

- Scientific licence under Section 132(c) of NPW Act (including fauna – harm/ trap/ hold/ release/ collect samples from protected fauna, and flora – pick/ study native flora).
- Permit to conduct scientific research, under the Animal Research Act, 1985 (Approval); Scientific Use Registration Certificate under Animal Care and Protection Act, 2001.

#### *Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth)*

The Googong Township water cycle project was referred to the ~~DoE-DSEWP&C~~ under the EPBC Act due to potential impacts on matters of national environmental significance, including migratory species, threatened species and communities. The Googong Township water cycle project was declared a controlled action under the EPBC Act, and subsequently approved on 19 May 2011, subject to conditions.



This FFMP will comply with the conditions of the EPBC Act approval, where relevant. The relevant conditions of approval, and a reference to where the condition is addressed in this Plan or other management documents is included in Table 3.3.

#### Other legislation

- TSC Act.
- FM Act.
- *Noxious Weeds Act 1993* (NW Act).
- *Pesticides Act 1999*.

The relevant provisions of legislation are further explained in the register of legal and other requirements included in Appendix M of the CEMP.

### 3.1.2 Relevant guidelines

The following guidelines and documents have been reviewed in the preparation of this FFMP:

- *Queanbeyan City Council Development Construction Specification C212 – Clearing and grubbing* (QCC, 2011).

## 3.2 Minister's Conditions of Approval

The CoA relevant to this Plan are listed in Table 3.1. A cross reference is also included to indicate where the condition is addressed in this Plan or other management documents.

**Table 3.1** Conditions of approval relevant to flora and fauna management

CoA No.	Condition requirements	Document reference
B11	The Proponent shall limit the clearing of native vegetation to the minimum extent practicable. Details regarding the procedures for clearing vegetation, minimising the extent of clearing and the extent and location of these reductions shall be included in the Flora and Fauna Management Plan prepared in accordance with condition C20.	Section 4.3 Table 5.1 (FF6, FF7) Appendix B
B12	All hollow bearing trees shall be retained to the greatest extent practicable. Where this is not feasible, trees containing hollows shall be inspected by a suitably qualified ecologist prior to disturbance, and where native fauna are located using the tree hollows, procedures shall be developed and implemented under the guidance of the qualified ecologist to minimise impacts on the native fauna. Details of actions to be taken and measures to monitor their effectiveness shall be included in the Flora and Fauna Management Plan.	Table 5.1 (FF10, FF22) Section 7.2 Appendix B
B13	Where possible, the removal of trees which form potential habitat for the Speckled Warbler ( <i>Chthonicola sagittata</i> ) shall occur outside of the August to January period breeding season of the species. If clearing cannot be avoided during this time, the area must be inspected by a qualified ecologist prior to any disturbance to identify potential nesting sites. If a nesting site is observed and it contains young, the area must be retained for at least 3 weeks to allow the young to fledge.	Table 5.1 (FF16, FF17, FF18, FF19) Appendix B

CoA No.	Condition requirements	Document reference
B14	The Proponent shall establish and maintain in perpetuity a dedicated area of land on the project site for the conservation of the Pink-tailed Worm Lizard ( <i>Aprasia parapulchella</i> ) as outlined in the plan prepared in accordance with condition D9 and shown in Appendix 2 (of the Project Approval).	Aprasia Conservation Management Plan Not applicable to Stage A – Network (west)
C20 (e)	A Flora and Fauna Management Plan to outline measures to protect, and minimise the loss of, terrestrial, riparian and aquatic native vegetation and native fauna habitat as a result of construction of the project. The Plan shall be prepared in consultation with OEH, DSEWPaC and Queanbeyan City Council, and include, but not necessarily be limited to:	This Plan
	(i) procedures for pre-construction surveys to identify key flora and fauna features within and adjacent to the construction area;	Table 5.1 (FF5) Appendix A
	(ii) procedures to accurately determine the total area, type and condition of vegetation community to be cleared;	Section 4.3 Section 6.4.1
	(iii) plan/s showing terrestrial vegetation communities, important flora and fauna habitat areas, EECs, threatened species (Hoary Sunray <i>Leucochrysum albicans</i> var. <i>tricolor</i> , Speckled Warbler <i>Chthonicola sagittata</i> and Pink-tailed Legless Lizard <i>Aprasia parapulchella</i> ), weeds and areas to be cleared. The plans shall also identify vegetation adjoining the site which contains important habitat areas and/or threatened species, populations or ecological communities;	Table 5.1 (FF3) Appendix E
	(iv) methods to avoid and manage potential impacts on flora and fauna species and their habitat which may be directly or indirectly affected by the project, such as location of fencing to exclude access to sensitive areas, procedures for vegetation clearing or soil removal/stockpiling and procedures for re-locating hollows or installing nesting boxes and managing weeds;	Table 5.1 Appendix A Appendix B Appendix C
	(v) measures for conserving and reusing topsoil;	Table 5.1 (FF12)
	(vi) procedures to be implemented for controlling weeds and feral pests;	Table 5.1 (FF14, FF23) Appendix D
	(vii) rehabilitation details and success criteria;	Table 5.1 (FF13, FF24) Landscape Management Plan
	(viii) a program for reporting on the effectiveness of flora and fauna management measures; and	Section 6.5
	(ix) a procedure to review management methods where they are found to be ineffective.	Section 7 Section 8.3, 8.4 and 8.5 of CEMP

### 3.3 Statement of commitments

The SoC relevant to this Plan are listed Table 3.2. A cross reference is also included to indicate where the condition is addressed in this Plan or other management documents.

**Table 3.2** Statement of commitments relevant to flora and fauna management

Objective	Ref. No.	Commitment	Timing	Document reference
Protect native flora and fauna	F1	<p>A flora and fauna management plan will be prepared prior to construction as part of the CEMP. All feasible and reasonable measures will be undertaken to minimise the impact of construction on native vegetation and fauna including:</p> <ul style="list-style-type: none"> <li>• Minimising the disturbance of native flora and hollow-bearing trees.</li> <li>• Implementing weed control measures.</li> <li>• Revegetating with endemic species.</li> <li>• Minimising soil disturbance.</li> <li>• Implementing clearing protocols to protect flora and fauna.</li> </ul>	Prior to and during construction	This Plan Table 5.1 Appendix B Appendix D
Protect threatened flora and fauna	F2	<p>The Flora and fauna management plan (within the CEMP) will contain specific additional measures for threatened species, including:</p> <ul style="list-style-type: none"> <li>• Only approved works will be undertaken within 5m of a threatened species and exclusion fencing will be erected around threatened flora species and threatened fauna habitats and maintained in place until such time as construction works are completed, unless otherwise approved by OEH.</li> <li>• Site-specific management measures will be implemented for the protection of the Pink-Tailed Worm Lizard near the site proposed for SPS2 and at Hill 800, and for the Hoary Sunray near the BWPS site, including exclusion zones, signage and pre-construction surveys. These works will be undertaken under the supervision of an appropriately qualified ecologist.</li> </ul>	Prior to and during construction	Table 5.1 (FF3, FF6, FF7, FF17) Appendix E  Not relevant to construction of Stage A – Network (west)

Objective	Ref. No.	Commitment	Timing	Document reference
Avoid impacts on and monitor changes to aquatic ecology	A1	<p>Aquatic ecology impacts are considered under WQ4.</p> <p>A water quality and aquatic ecology monitoring program will be developed to monitor construction and operation impacts of the Project on waterways (refer to WQ4 for further details). The monitoring program will include siting of the aquatic ecology monitoring location to ensure viable comparison with historical and other recent river ecology data.</p> <p>Riparian vegetation, weeds and invasive scrub will be managed within the Googong township site. This will include surveying, mapping and managing invasive species.</p>	Prior to and during construction, and during operation	Water quality and aquatic ecology monitoring program is not applicable to Stage A – Network (west). Monitoring to commence 12 months prior to commissioning of the WRP. Refer to SoC WQ4. Table 5.1 (FF24)
Minimise impacts on aquatic habitats	A2	<p>Riparian zones within the Googong township site will be revegetated with species of local provenance to increase stability.</p> <p>Further measures to ensure minimal impact on aquatic habitats are addressed in Statement of Commitments WQ1-WQ5.</p>	Construction	Not applicable to Stage A – Network (west)

Objective	Ref. No.	Commitment	Timing	Document reference
Monitor impacts on waterways	WQ4	<p>A monitoring program to assess the potential impacts of the Project on the Queanbeyan River (including water quality, flow, fish migration, macrophytes and macro invertebrate communities) will be undertaken.</p> <ul style="list-style-type: none"> <li>• Details of the monitoring program will be determined in consultation with relevant government authorities/stakeholders (including the OEH, DPI and, potentially, ACTEW Corporation). Such consultation will ensure the sharing of available data for the Queanbeyan River for comparative and impact assessment purposes.</li> <li>• A new monitoring site within the Queanbeyan River is proposed to measure water quality and aquatic ecology impacts over the medium term. This site will be located near the confluence of Googong Creek and Queanbeyan River (and will be sited to enable comparison with data collected from upstream and downstream sites).</li> <li>• Monitoring will commence approximately 12 months prior to commissioning the water recycling plant.</li> </ul>	Prior to, during construction and during operation	Not applicable to Stage A – Network (west). Monitoring to commence 12 months prior to commissioning of the WRP.

### 3.4 EPBC Act conditions of approval

The EPBC Act conditions of approval relevant to this Plan are listed in Table 3.3. A cross reference is also included to indicate where the condition is addressed in this Plan or other management documents.

**Table 3.3** EPBC conditions of approval relevant to flora and fauna management (for the Project)

CoA No.	Condition requirements	Document reference
4	To prevent impacts on the Hoary Sunray ( <i>Leucochrysum albicans</i> var. <i>tricolor</i> ) during construction, the person taking the action must fence and sign 'no go areas' of Hoary Sunray habitat in the vicinity of the Bulk Water Pumping Station and existing ACTEW Googong Water Treatment Plant.	Not applicable to Stage A – Network (west)
5	Within 30 days from the commencement of the action, the person taking the action must advise the department in writing of the actual date of commencement.	Table 5.1 (FF4)

# 4 Environmental aspects and impacts

The following sections summarise existing vegetation communities, threatened flora, fauna and habitat. Identified impacts are then reviewed. The key reference documents are Section 11 and Appendix F of the EA.

## 4.1 Environmental aspects

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### 4.1.1 Vegetation communities

The Project will pass through three vegetation communities (refer Appendix E). These communities are:

#### *Exotic pasture*

Areas that have been disturbed to the point that they retain few natural values and the groundstorey is greater than 50 per cent exotic. This vegetation community is dominated by Phalaris, with some smaller areas dominated by Cocksfoot, Umbrella Sedge or African Lovegrass. Exotic pasture may still contain value in the canopy species. Along Old Cooma Road, although the vegetation community is exotic pasture, Yellow Box is the dominant tree species.

#### *Native pasture with scattered planted native trees*

Native pasture is defined as areas where over 50 per cent groundcover biomass is comprised of native species. Within the Googong Dam Road road reserve, frequent mowing and the influx of weeds and exotic pasture grass species have removed and prevented the reestablishment of all but the most disturbance-tolerant native grasses and forbs. Remaining grasses include Redgrass (*Bothriochloa macra*), Tall Speargrass (*Austrostipa bigeniculata*), Corkscrew (*Austrostipa scabra*), and Hairy Panic (*Panicum effusum*).

In the paddock in the western part of the study area, where the native pasture vegetation community has not been mown or recently grazed, Kangaroo Grass (*Themeda australis*) occurs and is co-dominant with Tall Speargrass. Scattered planted trees within the road reserve include Red Box, Blakely's Red Gum, Apple Box (*Eucalyptus bridgesiana*), and Black Wattle.

Exotic species frequently encountered within this vegetation type in the study area include African Lovegrass (*Eragrostis curvula*), Umbrella Sedge (*Cyperus eragrostis*), Phalaris (*Phalaris aquatica*), Cocksfoot (*Dactylis glomerata*) and St John's Wort (*Hypericum perforatum*). The resulting native pasture is highly modified and floristically non-diverse.

#### *Scribbly Gum/Red Box/Bundy Dry Forest*

- Canopy: The canopy consists of mature and semi-mature Eucalypt trees, the dominant species being Bundy (*Eucalyptus goniocalyx*), Scribbly Gum (*E. rossii*), and Red Box (*E. polyanthemus*). Additionally, in the vicinity of the intersection between Googong Dam Road and Old Cooma Road, this vegetation community supports a few individuals of Snow Gum (*E. pauciflora*).

- Midstorey: A sparse to mid-dense shrubby midstorey is present. Scattered shrubs include Burgan (*Kunzea ericoides*), Shiny Cassinia (*Cassinia longifolia*), Australian Indigo (*Indigofera australis*), Narrow-leaf Bitter-pea (*Davisia mimisoides*) and Black Wattle (*Acacia mearnsii*).
- Groundstorey: A moderate to high diversity of native groundstorey species is present including grasses and many small or prostrate shrubs. It is possible that some of the more disturbance-sensitive species may become recognisable during spring/summer, particularly in the least disturbed areas of the vegetation community. Some dominant species visible at the time of survey include Speargrasses (*Austrostipa spp*), Nineawn Grass (*Aristida ramosa*), Red-anther Wallaby Grass (*Joycea pallida*), Kangaroo Grass (*Themeda australis*), Urn Heath (*Melichrus urceolatus*), Black-anther Flax-lily (*Dianella revoluta*), Mat-rush (*Lomandra bracteata*), and Prickly Broom-heath (*Monotoca scoparia*). The most common exotic species within this vegetation community in the study area is Variable Plantain (*Plantago lanceolata*).

#### **4.1.2 Endangered ecological communities**

No endangered ecological communities (EEC) were identified within the Project area.

#### **4.1.3 Threatened flora species**

No threatened flora species were identified within the Project area.

#### **4.1.4 Fauna habitats**

##### *Threatened woodland bird potential habitat*

The Project provides low quality potential habitat for a number of threatened woodland birds including the Speckled Warbler (*Chthonicola sagittata*) and the Scarlet Robin (*Petroica boodang*), both listed as vulnerable under the TSC Act (refer Section 4.1.6).

An area of low quality threatened woodland bird potential habitat within the Project area, near the intersection of Old Cooma Road and Googong Dam Road, was identified in the July 2012 pre-clearing survey. This patch of vegetation was not previously identified and assessed as threatened woodland bird potential habitat during the EA. Refer to Appendix E for the location of this potential habitat. The Project would impact upon this patch of low quality threatened woodland bird potential habitat (refer to Section 4.3.2).

##### *Rocky slopes and outcrops*

Common in areas adjacent to the Project works, such as Reservoir Hill. Some surface rock sitting on the surface of the ground may provide habitat for a range of invertebrates, such as ants, scorpions and centipedes.

#### **4.1.5 Hollow bearing trees**

Two hollow bearing trees and a stick nest are located within the Project area. Refer to Appendix E for the location of hollow bearing trees.

#### **4.1.6 Threatened fauna**

The Project provides potential habitat for threatened woodland birds. The Speckled Warbler listed as vulnerable under the TSC Act was recorded just outside the Project area during 2009 field survey for the EA.

During the July 2012 pre-clearing survey, a previously unrecorded threatened woodland bird, the Scarlet Robin was identified to the east of the Project. The Scarlet Robin is listed as vulnerable under the TSC Act. Listing under the TSC Act occurred in December 2010, after the field survey and ecological assessment was completed for the EA. The Project would impact upon the area of potential habitat for this species (refer to Section 4.3.2).

The mitigation measure proposed in CoA B13 (refer Table 3.1) will be extended to cover the Scarlet Robin so that clearing of this potential habitat occurs outside of the July to January breeding season where possible, or that if clearing cannot be avoided during this period, that the potential habitat area be inspected prior to any disturbance (refer Table 5.1 (FF20, FF21)).

The recording of this unexpected threatened woodland bird and the proposed management measures will be discussed with the OEH as outlined in the **Vegetation Clearing Procedure** (refer Appendix B). Any change to the proposed management measures would be reflected in a revised version of this FFMP where required.

The location of threatened woodland bird potential habitat is identified in the environmental constraints maps included in Appendix E to this document.

Two additional threatened fauna species were recorded in the broader study area for the Googong Township water cycle project during field surveys. These are:

- Eastern Bent-wing bat (*Miniopterus schreibersii oceanensis*).
- Pink-tailed Legless Lizard (*Aprasia parapulchella*).

Potential habitat for these two species fall outside the Project area.

#### **4.1.7 Aquatic habitat**

The Project crosses a tributary of Googong Creek. Googong Creek is an ephemeral creek that flows through agricultural land and discharges into the Queanbeyan River. The surrounding agricultural land use has altered the creek's natural flow regime and aquatic ecology. The overall ecological health is considered to be somewhat degraded. While there are a small number of native trees, the majority of vegetation in the area is degraded grassland, with moderate weed infestation.

#### **4.1.8 Weeds**

Areas of high, medium and low weed infestation were identified within (and in the vicinity of) the Project. The criteria for classification are as follows:

##### *High weed infestation*

In these areas, the groundstorey is dominated by exotic weed species, and a proportion of the biomass is comprised of at least one Weed of National Significance. These areas require targeted control and extreme care should be taken not to spread seed to surrounding areas.

##### *Moderate/scattered weed infestation*

These areas either have a predominantly native groundstorey or a groundstorey dominated by naturalised exotic pasture species of low-moderate concern (such as Phalaris). They contain a moderate level of weed infestation. Weeds present in these areas are mostly common agricultural land weed species although there may be scattered plants or small clumps of one Weeds of National Significance which will require targeted control to prevent them becoming a more significant problem.



### Low or no weed infestation

The area of low or no weed infestation occurs within the Scribbly Gum/Red Box/Bundy Dry Forest vegetation community. This category support no weeds or the weeds present are common, mostly considered 'naturalised' and occur at low density. Native grasses and shrubs dominate the understorey and there are currently no weeds within that present a significant threat (although there are Weeds of National Significance adjacent to these areas).

Weed species recorded during the field survey (July 2012) are listed in Table 4.1. The distribution of each weed infestation category within the Project is presented in Appendix E.

**Table 4.1** Weed species recorded during the field survey (July 2012)

Scientific name	Common Name	Weed of National Significance
<b>Trees and Shrubs</b>		
<i>Crataegus monogyna</i>	Hawthorn	
<i>Rosa rubiginosa</i>	Sweet Briar	
<i>Rubus fruticosus</i>	Blackberry	x
<b>Groundcover (grasses)</b>		
<i>Eragrostis curvula</i>	African Lovegrass	x
<i>Dactylis glomerata</i>	Cocksfoot	
<i>Holcus lanatus</i>	Yorkshire Fog	
<i>Nasella trichotoma</i>	Serrated Tussock	x
<i>Paspalum dilatatum</i>	Paspalum	
<i>Phalaris aquatica</i>	Phalaris	
<b>Groundcover (non-grassy weeds)</b>		
<i>Acetosella vulgaris</i>	Sheep Sorrel	
<i>Arctotheca calendula</i>	Capeweed	
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	
<i>Echium plantagineum</i>	Paterson's Curse	
<i>Hirschfeldia incana</i>	Hairy Mustard	
<i>Hypericum perforatum</i>	St John's Wort	

Scientific name	Common Name	Weed of National Significance
<i>Hypochaeris radicata</i>	Flatweed	
<i>Onopordum acanthium</i>	Scotch Thistle	
<i>Plantago lancolata</i>	Ribwort Plantain	
<i>Sonchus oleraceus</i>	Common Sowthistle	
<i>Verbascum thapsus</i>	Great Mullein	

## 4.2 Construction activities

Key aspects of the project that could result in adverse impacts to flora and fauna include:

- Clearing of native vegetation and fauna habitat, particularly in proximity to the Bulk Water Supply Station and access road.
- Disturbance of soils, consequential erosion and sedimentation, and/or spread of weeds.
- Work adjacent to and within watercourses.

## 4.3 Flora and fauna impacts

Likely and potential impacts associated with the Project include:

- Disturbance of habitat for native flora and fauna species or ecological communities, including the removal of hollow bearing trees or rock.
- Disturbance to foraging or breeding resources for threatened species.
- Edge effects (such as weed invasion, pests and disease).
- Disturbance of watercourses resulting in contamination or sedimentation of waterways, degrading water quality and impacts on the quality of aquatic habitats.

The Project trench alignment and layout has been designed to avoid impacts on native vegetation and fauna habitat as far as practical. Clearing will generally be limited to a ten metre offset from the infrastructure (including trenches for pipelines, pumping station and reservoirs), to enable construction (refer Appendix B). The clearing limits are identified in the flora and fauna constraints maps (refer Appendix E).

In areas adjacent to native vegetation or fauna habitat, the clearing limits will be reviewed by the Environment Manager, with assistance from the Project ecologist where required, to ensure that the Project results in the least possible impact on native vegetation. Based on the current design and clearing limits presented in Appendix E, the Project is likely to result in the loss of:

### 4.3.1 Vegetation communities

The area of impact on each vegetation community is outlined below. The area of impact is based on a clearing limit of ten metres offset from the infrastructure (including trenches for pipelines, pumping station and reservoirs), to enable construction.

- Exotic pasture: 0.55 hectares
- Native pasture with scattered planted native trees: 5.7 hectares
- Scribbly Gum/Red Box/Bundy Dry Forest: 0.52 hectares

The final area, type and condition of vegetation to be removed will be verified as outlined in Section 6.4.1.

### 4.3.2 Threatened fauna habitat

The Project would result in the removal of 0.55 hectares of low quality threatened woodland bird potential habitat.

The significance of the impact of the Project on the Speckled Warbler (via the removal of its habitat) was assessed through the assessments of significance (AoS) prepared for the EA and Submissions Report. The removal of this additional area of potential threatened woodland bird habitat would result in impacts consistent with the Approved Project. The impact of the removal of potential Speckled Warbler habitat would not alter the outcome of the previous AoS which concluded that the Project is unlikely to significantly impact this species.

The CoA B13 provides mitigation measures for the Speckled Warbler habitat (refer Table 3.1). The Project will apply the same mitigation to this additional patch of threatened woodland bird potential habitat (refer Table 5.1 measures including FF16, FF17, FF18, FF19).

The discovery of this additional patch of threatened woodland bird potential habitat and the proposed management measures will be discussed with the OEH as outlined in the **Vegetation Clearing Procedure** (refer Appendix B). Any change to the proposed management measures would be reflected in a revised version of this FFMP where required.

### 4.3.3 Hollow bearing trees

The Project would result in the removal of two hollow bearing trees and one stick nest. A two-stage approach to clearing will be carried out in areas where habitat trees have been identified. Refer to **Vegetation Clearing Procedure** (refer Appendix B).

# 5 Environmental control measures

## 5.1 Flora and fauna mitigation and management measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the CoA, SoC and the EA. Specific measures and requirements to address impacts on flora and fauna are outlined in Table 5.1.

**Table 5.1** Mitigation measures

ID	Measure	When to implement	Reference	Responsibility
FF1	All Project personnel will be provided training on the requirements of this Plan through site inductions, toolbox talks or specific training.	Prior to construction; construction	CoA A8	Environment Manager
FF2	A Project ecologist will be appointed prior to the commencement of construction to provide technical advice and assist the Project implement management measures.	Prior to construction		<del>Environment Manager</del> Construction Manager
FF3	Flora and fauna constraints maps will be developed that identify plan/s showing vegetation communities, important flora and fauna habitat areas, endangered ecological communities, threatened species (Hoary Sunray and Speckled Warbler), weeds and clearing limits. The plans will also identify vegetation adjoining the site that contains important habitat areas and/or threatened species, populations or ecological communities (7.2Appendix E).	Prior to construction; construction	CoA C20(e)(iii)	Environment Manager
FF4	The Project will advise the DSEWPaC within 30 days from the commencement of the action, the person taking the action must advise the department in writing of the actual date of commencement.	Prior to construction	EPBC CoA 5	GTPL Assistant Project Director

ID	Measure	When to implement	Reference	Responsibility
<b>Vegetation clearing, protection and management</b>				
FF5	A pre-construction clearing survey will be carried out by a qualified ecologist prior to construction in accordance with the <b>Pre-construction Clearing Survey Procedure</b> (Appendix A).	Prior to construction; construction	CoA C20(e)(i)	<del>Environment Manager</del> <del>Project Engineer</del> GTPL Assistant Project Director
FF6	The limits of clearing will generally be limited to a ten metre offset from the footprint of the infrastructure (including trenches for pipelines, pumping stations, access roads and reservoirs), to enable construction. In areas adjacent to native vegetation or fauna habitat, the clearing limits will be reviewed to ensure that the Project results in the least possible impact on native vegetation.	Construction	CoA B11	Environment Manager <del>Superintendent</del> <del>Project Engineer</del>
FF7	The limits of clearing will be clearly marked on construction work plans and on site prior to clearing. Vegetation to be retained will be protected through exclusion fencing and 'no-go zone' signage, where appropriate. Exclusion fencing is to include the use of fencing or flaggings suitable to indicate a 'no clearing zone'.	Prior to construction; construction	CoA B11	Environment Manager
FF8	Erosion and sediment controls will be installed prior to and during clearing, in order to protect adjacent vegetation and watercourses. Refer to Soil and Water Management Plan.	Prior to construction; construction	CoA C20(e)(v) SoC F1	Environment Manager <del>Construction Manager</del> <del>Superintendent</del> <del>Project Engineer</del> <del>Foreman</del>
FF9	At least half the required nest boxes will be installed prior to the commencement of vegetation clearance. Host trees are to be identified. Where they are located on private land, permission from landowners will be sought to install boxes. Refer to <b>Hollow Relocation and Nest Box Strategy</b> (Appendix C).	Construction	CoA C20(e)(iv)	Environment Manager
FF10	Clearing will be undertaken in a two-staged process in accordance with the <b>Vegetation Clearance Procedure</b> (Appendix B).	Prior to construction; construction	CoA B12 CoA C20(e)(iv) SoC F1	Environment Manager <del>Construction Manager</del> <del>Project Engineer</del> <del>Foreman</del>

ID	Measure	When to implement	Reference	Responsibility
FF11	Hollows will be relocated where possible in accordance with the <b>Hollow Relocation and Nest Box Strategy</b> (Appendix C). Generally, native vegetation cleared for the Project will be mulched for reuse in rehabilitation works and erosion control.	Construction	CoA C20(e)(iv)	Environment Manager
FF12	Topsoil will be stripped and stockpiled for reuse. Topsoil and other soil stockpiles will not be located in 'no-go zones'.	Construction	CoA C20(e)(v) SoC F1	Environment Manager <del>Project Engineer</del> <del>Foreman</del>
FF13	Revegetation/rehabilitation of the site will be conducted progressively during the construction phase to ensure the timely reuse of collected topsoil. Disturbed areas will be rehabilitated to a condition consistent with the pre-construction state, in accordance with the Landscape Management Plan.	Construction	CoA C20(e)(vii) SoC F1	Environment Manager <del>Project Engineer</del> <del>Foreman</del>
FF14	Weed management measures, such as bush regeneration and weed spraying will be implemented in accordance with the <b>Weed and Pest Management Strategy</b> (Appendix D).	Prior to construction; construction	CoA C20(e)(vi) SoC F1	Environment Manager <del>Project Engineer</del>
<b>Threatened flora and endangered ecological communities</b>				
FF15	Any threatened flora habitat will be identified on the environmental constraints maps (Appendix I of the CEMP). Exclusion fencing and signage of 'no-go zones' will be installed to avoid disturbance, where required. Exclusion fencing will be installed at least five metres from the location of threatened flora.	Prior to construction; construction	CoA C20(e)(iv) SoC F1	Environment Manager
<b>Threatened fauna and fauna protection</b>				
FF16	A suitably qualified ecologist would undertake searches for native fauna in the construction footprint immediately prior to clearing. Searches would include nests and large hollow-bearing trees, and target habitats of hollow dwelling species and threatened fauna (eg the Speckled Warbler). Refer to the <b>Vegetation Clearance Procedure</b> (Appendix B).	Prior to construction; construction	CoA B13 SoC F1	Environment Manager

ID	Measure	When to implement	Reference	Responsibility
FF17	Threatened fauna habitat will be identified on the environmental constraints maps. Exclusion fencing and signage of 'no-go zones' will be installed to avoid disturbance, where required. Exclusion fencing will be installed at least five metres from the location of threatened fauna habitat.	Prior to construction; construction	CoA C20(e)(iv) SoC F1	Environment Manager <del>Project Engineer</del>
FF18	Where possible, clearing of vegetation in potential habitat for the Speckled Warbler will not be undertaken during the August to January breeding season. If clearing cannot be avoided during this period, the area to be cleared should be inspected by a qualified ecologist prior to any disturbance in accordance with the <b>Vegetation Clearance Procedure</b> (Appendix B).	Construction	CoA B13	Environment Manager <del>Project Engineer</del>
FF19	Should the pre-clearing survey identify a Speckled Warbler nesting site that contains young, exclusion fencing and signage of 'no-go zones' will be installed to avoid disturbance, where required. Clearing will be postponed for at least three weeks to allow the young to fledge. Clearing will continue only upon advice from the Project ecologist.	Prior to construction; construction	CoA B13	Environment Manager <del>Project Engineer</del>
FF20	Where possible, clearing of vegetation in potential habitat for the Scarlet Robin will not be undertaken during the July to January breeding season. If clearing cannot be avoided during this period, the area to be cleared should be inspected by a qualified ecologist prior to any disturbance in accordance with the <b>Vegetation Clearance Procedure</b> (Appendix B).	Construction		Environment Manager <del>Project Engineer</del>
FF21	Should the pre-clearing survey identify a Scarlet Robin nesting site that contains young, exclusion fencing and signage of 'no-go zones' will be installed to avoid disturbance, where required. Clearing will be postponed for at least three weeks to allow the young to fledge. Clearing will continue only upon advice from the Project ecologist.	Prior to construction; construction		Environment Manager <del>Project Engineer</del>
FF22	Hollows will be relocated or nest boxes will be installed to offset the loss of hollow bearing trees where feasible and reasonable, as per the <b>Hollow Relocation and Nest Box Strategy</b> (Appendix C). Hollow relocation or nest box installation would be undertaken so as to limit damage to existing vegetation.	Construction	CoA C20(e)(iv) SoC F1	Environment Manager <del>Project Engineer</del>

ID	Measure	When to implement	Reference	Responsibility
FF23	Pest management measures, such as construction equipment washing procedures will be implemented in accordance with the <b>Weed and Pest Management Strategy</b> (Appendix D).	Prior to construction; construction	CoA C20(e)(iv) CoA C20 (e)(vi) SoC F1	Environment Manager <del>Project Engineer</del>
<b>Watercourses and aquatic ecology</b>				
FF24	Creek banks or waterways disturbed during the laying of pipes will be stabilised through rehabilitation and revegetation in accordance with the <b>Landscape Management Plan</b> .	Construction	SoC A2	Environment Manager <del>Project Engineer</del>
<b>Revegetation</b>				
FF25	The top 50 – 100 mm of topsoil will be stripped, scalped for weeds and stockpiled separately. Weed infested topsoil will be reused as fill where possible, and will not be reused for landscaping.	Construction		Construction Manager <del>Project Engineer</del> <del>Foreman</del>
FF26	Weed free topsoil will be respread for landscaping purposes. Where possible, topsoil will be stripped and reinstated by soil horizon (B horizon reinstated first and finishing with A horizon).	Construction		Environment Manager <del>Project Engineer</del> <del>Foreman</del>
<b>Weed and pest management. Refer to Weed and Pest Management Strategy (Appendix D).</b>				
FF27	Prior to vegetation clearance, woody weeds will be removed. This will include the physical removal and stump poisoning (ie cut-and-daub technique) for Sweet Briar, Blackberry and Hawthorn located in 'high weed infestation' area.	Construction	SoC A2	Environment Manager <del>Project Engineer</del>
FF28	Earth moving vehicles will, as far as possible, be cleaned of dirt before entering the Project site and when leaving areas of 'high weed infestation'. Construction personnel will, as far as possible, clean their boots and clothing of all seed laden material prior to leaving high weed infested areas.	Construction	SoC A2	Construction Manager Environment Manager <del>Project Engineer</del> <del>Foreman</del>



ID	Measure	When to implement	Reference	Responsibility
FF29	<ul style="list-style-type: none"> <li>Any topsoil that is imported from offsite for use in landscaping will be weed free.</li> <li>Topsoil will be stripped from areas of 'high weed infestation' and buried as fill or disposed of off site.</li> <li>Topsoil from moderate and low weed infestation categories will be stripped and stockpiled separately. Topsoil will only be reused in an area of the same weed category.</li> </ul>	Construction	SoC A2	Construction Manager Project Engineer Foreman
FF30	No domestic pets will be brought on site.	Construction	SoC A2	Construction Manager Superintendent Foreman
FF31	Vegetation will not be left in piles to create potential habitat for rabbits and other vermin.	Construction	SoC A2	Construction Manager Project Engineer Foreman

# 6 Compliance management

## 6.1 Roles and responsibilities

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The Project team's roles and responsibilities are outlined in Section 4.1 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 5 of this Plan.

## 6.2 Training

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All personnel working on site will undergo site induction training relating to flora and fauna issues. The induction training will address elements related to flora and fauna management including:

- The objectives and requirements of this Plan.
- Relevant legislation.
- Pre-clearing and clearing protocols.
- Environmental exclusion fencing and 'no-go zones'.
- General flora and fauna management measures.
- Weed control measures.

Targeted training for personnel directly involved in vegetation clearing would be provided as required. Training would be developed and delivered through environmental work method statements and toolbox talks.

Further details regarding induction and training are outlined in Section 5 of the CEMP.

## 6.3 Inspections

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Inspection of actual or potential impacts to flora and fauna will occur as required for the duration of construction. ~~the Project. Daily visual inspections of the construction site will be undertaken by the Environment Manager and construction personnel to identify actual or potential flora and fauna management concern.~~

Weekly environmental inspections including of flora and fauna management and mitigation measures will be undertaken by the Environment Manager. This will include auditing of construction activities to ensure there is no impact on threatened species, endangered ecological communities or habitats in addition to that already permitted. It will also include inspection of retained vegetation and environmental exclusion fencing. These inspections will be documented on the weekly checklist.

The Environmental Representative will inspect the site regularly.

Requirements and responsibilities in relation to inspections are documented in Section 8.1 of the CEMP.

## 6.4 Auditing

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Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this Plan, CoA, SoC and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 8.4 of the CEMP.

### 6.4.1 Auditing native vegetation impacts

Section 4.3 outlines the extent of impacts on native vegetation. The contractor will verify the impacts on native vegetation after significant clearing events. The auditing of native vegetation impacts will generally include the following key steps:

- Map the survey the data collected on the limits to clearing on site (refer to the **Vegetation Clearing Procedure** (Appendix B)).
- Quantify the actual impacts on site on the following (with assistance from the Project ecologist as required):
  - Threatened flora.
  - Native vegetation communities, including endangered ecological communities.
  - Threatened fauna habitat.
  - Ensure any information collected during the **Pre-construction Clearing Survey** (Appendix A) is considered.
- Compare the actual impacts against those predicted (refer Section 4.3). Where the Project has resulted in significant additional impacts to native vegetation, manage the event as a non-conformance. Refer to Section 8.3 of the CEMP for managing non-conformances.
- The outcome of native vegetation audits will be reported through six-monthly construction compliance reports. Refer to Section 8.4 of the CEMP.

## 6.5 Reporting

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Results and outcomes of inspections, monitoring and auditing will be reported internally on a monthly basis. Six-monthly construction compliance reports will be prepared to report on compliance with the Project Approval. Reporting requirements and responsibilities are documented in Section 8.5 of the CEMP.

# 7 Review and improvement

## 7.1 Non-conformity, corrective and preventative actions

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A non-conformance is an action or omission that does not conform with the requirements of this Plan or any legal and other requirements. Any member of the Project team or the Environmental Representative can identify a non-conformance or opportunity for improvement. Section 8.3 of the CEMP identifies the process for identifying, reporting, recording and reviewing non-conformances. This will ensure continual improvement.

## 7.2 Management plan update and amendment

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The processes described in Section 7 and Section 8 of the CEMP may result in the need to update or revise this Plan. This will occur as needed.

# Appendix A Pre-construction clearing survey procedure

## A.1 Distribution

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There are no restrictions on the distribution or circulation of this procedure within the Googong Integrated Water Cycle Stage A – Network (west) project (the Project).

## A.2 Purpose

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This procedure details the requirements for conducting a flora and fauna survey on site prior to the commencement of construction.

The procedure will assist to identify any additional mitigation measures required to manage impacts on flora and fauna.

## A.3 Induction/training

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Where required, Project personnel will be made aware of this procedure as required through toolbox talks.

## A.4 Scope

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This procedure is applicable to all activities conducted by the Project contractor or subcontractors that have the potential to impact on vegetation or fauna habitat. This procedure includes the following key elements:

- Confirm location of biodiversity features.
- Identify habitat trees.
- Locate suitable habitat for fauna that may require relocation.
- Update management measures.

## A.5 Procedure

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### *Identify biodiversity features*

- Review the environmental assessment and submissions report and any other ecological investigations carried out on site to identify the known and potential locations of threatened flora (eg Hoary Sunray (*Leucochrysum albicans* var. *tricolor*)), threatened fauna (eg Speckled Warbler (*Chthonicola sagittate*)) and endangered ecological communities (eg White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grasslands).

### *Conduct pre-clearing survey*

- Prior to the commencement of clearing, the Project ecologist is to conduct an on site survey to check for the presence of threatened flora and fauna species identified in the assessment as likely to occur.
- Record the location of hollow-bearing trees, threatened flora and trees containing threatened fauna, including (where relevant):
  - GPS location.
  - Species.
  - Type of habitat.
  - Size of hollow.
  - Type of hollow.
- Mark identified hollow-bearing trees, threatened flora and trees containing threatened fauna on site with suitable materials, eg flagging tape or paint.

### *Locate suitable habitat for fauna relocation*

- In consultation with the Project ecologist, identify (including GPS location) of nearby habitat that would be suitable for the release of fauna that may require relocation.

### *Update management measures*

- The Environment Manager is to incorporate the results of the pre-construction clearing survey into the Construction Environmental Management Plan or Flora and Fauna Management Plan and constraints maps as required. This may include:
  - The location of threatened flora and fauna identified.
  - The location of nearby habitat that would be suitable for the release of fauna.
  - Any additional biodiversity management measures, eg an update to identified 'no-go zones'.

# Appendix B Vegetation clearance procedure

## B.1 Distribution

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There are no restrictions on the distribution or circulation of this procedure within the Googong Integrated Water Cycle Stage A – Network (west) project (the Project).

## B.2 Purpose

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This procedure details the requirements for clearing and grubbing of vegetation on site. It will be used to identify the limits to clearing.

This procedure relates to the measures to be put in place prior to, during and following clearing of vegetation.

## B.3 Induction/training

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Where required, Project personnel will be made aware of this procedure through toolbox talks or targeted training.

## B.4 Scope

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This procedure is applicable to all activities conducted by the Project contractor or subcontractors that have the potential to impact on vegetation or fauna habitat. This procedure includes the following key elements:

- Inspect vegetation prior to commencement of clearing.
- Implement environmental controls.
- Remove vegetation.
- Inspect site after felling.
- Manage cleared vegetation.

## B.5 Procedure

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### *Mark out clearing limits*

- In consultation with the Environment Manager, identify the limits of clearing. The limits of clearing will generally be limited to a 10 metre offset from the infrastructure (including trenches for pipelines, pumping stations, access roads and reservoirs). In areas adjacent to native vegetation or fauna

habitat, clearing limits will be reviewed to ensure the least possible impact on native vegetation. Where working in proximity to identified 'no go' areas, the limits of clearing should be identified in consultation with the Project ecologist.

- Install fencing or flagging to identify the clearing limits.
- Record the limits to clearing using accurate survey technology. This will enable the recording and auditing of the area of native vegetation cleared by the Project.

#### *Pre-clearing activities*

- Where possible, clearing of vegetation in potential habitat for the:
  - Speckled Warbler will not be undertaken during the August to January breeding season.
  - Scarlet Robin will not be undertaken during the July to January breeding season.
- At least two days prior to clearing, the Project ecologist is to check for the presence of threatened flora and fauna, and fauna habitat.
- If not already done, record details of all hollow-bearing trees, including:
  - Location of tree (GPS).
  - Species of tree.
  - Size of entrance/s (estimated in centimetres).
  - Estimation of hollow volume (small, medium or large).
  - Location of hollow (branch or trunk).
  - Height of tree (metres).
  - Tree diameter at breast height.
- Within the clearing limits, mark all habitat trees. A habitat tree includes hollow bearing trees and any trees that contain nests or cavities that may act as a hollow.
- Within the clearing limits, mark any trees found to contain threatened fauna, or the location of any threatened flora. Should any threatened flora or fauna species be unexpectedly encountered, the Environment Manager and Project ecologist would determine the significance, assess impacts and identify management measures, approvals/licences or permits required, in consultation with the Office of Environment and Heritage (OEH), Department of Primary Industries – Fisheries Conservation and Aquaculture and Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), as appropriate.
- Should the Project ecologist identify a Speckled Warbler (*Chthonicola sagittata*) or Scarlet Robin (*Petroica boodang*) nesting site that contains young, the area must be retained for at least three weeks to allow the young to fledge. Clearing will continue upon advice from the Project ecologist.
- The Project ecologist should capture or remove fauna that have potential to be disturbed, injured or killed as a result of clearing. Fauna should be relocated in to suitable nearby habitat, identified by the Project ecologist.
- If grubbing is to take place, erosion and sediment controls are to be in place prior to grubbing.

#### *Obtain approval to clear*

- The Environment Manager should issue the approval to clear, indicating that clearing limits and environmental controls are adequate.



#### *Non-woody vegetation*

- Where the Project ecologist has not identified the presence of habitat features, non-woody vegetation (grasses and groundcover species) can be removed.
- Grasses and groundcover species should be incorporated into the stripping of topsoil to retain any organic material and stockpiled according the Soil and Water Management Plan (CEMP Appendix A).

#### *Implement a two-stage clearing process*

- A two-stage approach to clearing will be carried out in areas where habitat trees have been identified.
- Stage 1 of clearing will include the felling of all non-habitat trees, ensuring that there is minimal disturbance to the habitat trees.
- Habitat trees will be left standing for a minimum of 24 hours. This will ensure fauna have an opportunity to relocate of their own accord.
- The Project ecologist is to be on site for felling of all habitat trees.
- Fell habitat trees carefully, allowing trees to be lowered to the ground.
- The Project ecologist is to inspect the felled habitat trees for fauna. Fauna identified should be captured, inspected for injury and relocated to suitable habitat (as identified by the Project ecologist).
- Tree hollows that do not contain fauna at the time of clearance will be stockpiled for later use in adjacent habitat. Refer to Appendix C the Hollow Relocation and Nest Box Strategy.

#### *Management of cleared vegetation*

- Where advised by the Environment Manager, hollows are to be relocated, in accordance with the Hollow Relocation and Nest Box Strategy (Appendix C).
- Mulch remaining native vegetation and stockpile for reuse in rehabilitation works and erosion control.

#### *Reporting*

- The Environment Manager should record the outcomes of the clearing process, including:
  - Clearing dates, areas cleared, surveyed limits to clearing etc.
  - Details of habitat trees, the number of trees, nests etc.
  - Fauna species present, captured and located.
  - Fauna injured or killed.
  - Discussion on the effectiveness of methods.
  - Recommendations, if any, to review and improve the vegetation clearing procedure.

#### *Verify impacts of vegetation clearing*

After each significant clearing event, the Environment Manger is to incorporate the outcomes of the clearing process, including an audit of native vegetation impacts, as per the process outlined in Section 6.4.1.

# Appendix C **Hollow relocation and nest box strategy**

## **C.1 Distribution**

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There are no restrictions on the distribution or circulation of this procedure within the Googong Integrated Water Cycle Stage A – Network (west) project (the Project).

## **C.2 Purpose**

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This procedure details the requirements to mitigate the impacts of vegetation clearance on hollow-dependent fauna. It outlines the procedures for relocating hollows and/or installing nest boxes.

## **C.3 Induction/training**

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All Project personnel will be provided with a general site induction including an outline of their responsibilities relating to reducing impacts on flora and fauna. Personnel involved in vegetation clearance and nest box installation will be inducted into this procedure. If required, additional training will be provided through toolbox talks.

## **C.4 Scope**

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This procedure is applicable to all activities conducted by the Project contractor or subcontractors that are involved in the removal of hollow bearing trees.

## **C.5 Hollow bearing trees**

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Two hollow bearing trees supporting five hollows were recorded within the Project site. For each hollow bearing tree the following data were collected:

- Location of tree (GPS).
- Species of tree.
- Size of entrance/s (estimated in centimetres).
- Estimation of hollow volume (small, medium or large).
- Location of hollow (branch or trunk).
- Height of tree (metres).
- Tree diameter at breast height.

- Additional information including potential native fauna occupant type or likely current occupancy (ie parrot, glider, possum, bat etc).

The table below details this information. The locations of hollowing bearing trees are provided in Appendix E (Flora and fauna constraints maps).

*Hollow data set*

GPS Point	Hollow ID	Tree Species	Comments	Diameter of Entrance (cm)	Estimate of volume	Location	Hollow Height (m)	Tree Height (m)	DBH (cm)
T1	T1H1	Yellow Box	Stag	15	Small	Branch	8	18	100
T2	T2H1	Brittle Gum	Stag	8	Small	Branch	6	6	80
T2	T2H2	Brittle Gum	Stag	8	Small	Trunk	5	6	80
T2	T2H3	Brittle Gum	Stag	12	Small	Branch	4.5	6	80
T2	T2H4	Brittle Gum	Stag	8	Small	Branch	4.5	6	80

## C.6 Nest boxes

- For every hollow that is removed during vegetation clearance, up to two nest boxes will be installed. If the hollow can be relocated, one nest box will be installed. While the relocation of hollows is preferred, it may not always be feasible, particularly where hollows are located within the tree trunk.
- Up to ten nest boxes will be required to offset the loss of five hollows to be removed for the Project.
- A range of boxes will be installed. Based on the types/sizes of hollows recorded during survey and the fauna species known and likely to occur, they will comprise of:
  - 2 insectivorous bat roots, with a three centimetre entrance over three metres in height.
  - 3 small glider boxes
  - 2 possum boxes
  - 3 medium nest boxes suitable for parrots and Brown Treecreepers, with a six centimetre entrance over three metres in height.

## C.7 Procedure

*Identity host trees and seek landowner permission to install nest boxes prior to vegetation clearing*

- Potential host trees are identified in Appendix E (Flora and fauna constraints maps). Due to the limited availability of trees suitable for hosting nest boxes or relocated hollows within the Project area, potential host trees are located outside of the Project, on adjacent private land.
- The availability of these trees will be confirmed through negotiations with the relevant landowners.

- Once permission to install nest boxes is granted, the specific host trees within these patches will be chosen by the Project Ecologist, in consultation with the Environment Manager and landowner.
- Order nest boxes.

#### *Install nest boxes prior to vegetation clearing*

- At least half the required nest boxes will be installed prior to the commencement of vegetation clearance, including:
  - 1 insectivorous bat roots, with a three centimetre entrance over three metres in height.
  - 2 small glider boxes
  - 1 possum boxes
  - 1 medium nest boxes suitable for parrots and Brown Treecreepers, with a six centimetre entrance over three metres in height.
- Nest boxes will be mounted between two and eight metres above the ground, depending on target fauna group, subject to advice from the Project Ecologist.
- A maximum of two relocated hollows or replacement nest boxes will be placed in each chosen host tree.

#### *Implement the Vegetation Clearing Procedure*

The Vegetation Clearing Procedure (Appendix B) outlines the steps to be taken during vegetation clearing. This includes:

- Pre-clearing activities including the need to check hollows for the presence of threatened fauna, recording of hollow bearing trees, trapping and relocation of fauna.
- Implementation of a two-stage clearing process for clearing in areas where habitat trees have been identified.

#### *Install nest boxes or hollows after vegetation clearing*

- Hollows that can be cut from the felled trees will be installed in adjacent host trees.
- Where hollows cannot be relocated, additional nest boxes will be ordered and installed. Based on the fauna identified during the clearing process, the Project Ecologist will confirm the type of nest boxes that will be required. Section C.6 details the types of nest boxes that will likely be required.
- Landowner permission will be required for the installation of relocated hollows or nest boxes as outlined above.

#### *Monitoring*

- Monitoring will be undertaken in the Spring or Summer following the clearance of vegetation (ie Spring or Summer 2013).
- All nest boxes/relocated hollows will be inspected for fauna occupation.
- Monitoring will be conducted by the Project Ecologist.

# Appendix D Weed and pest management strategy

## D.1 Distribution

---

There are no restrictions on the distribution or circulation of this procedure within the Googong Integrated Water Cycle Stage A – Network (west) project (the Project).

## D.2 Purpose

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This procedure details the requirements for managing weeds and feral pests.

## D.3 Induction/training

---

All Project personnel will be provided with a general site induction including an outline of their responsibilities relating to weed management. Personnel involved in weed management will be inducted into this procedure. If required, additional training will be provided through toolbox talks.

## D.4 Scope

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This procedure is applicable to all activities conducted by the Project contractor or subcontractors that have the potential to introduce or spread weeds/feral pests within the Project site.

## D.5 Weed species present

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### *Weed Species*

Numerous weeds species common to pastoral lands occur at varying levels of infestation throughout the study area. The weed species recorded during the field survey are listed in the table overleaf.

Two species are considered to be of higher threat within the study area than the remainder of the weed species present in the site. These are two Weeds of National Significance, African Lovegrass and Serrated Tussock.

African Lovegrass (*Eragrostis curvula*) is considered to be of the highest immediate concern. A dense stand of this species was recorded in the western part of the Project, at the corner of Old Cooma Road and Googong Dam Road. In addition, scattered individuals and small clumps of plants were observed along the Googong Dam Road reserve. African Lovegrass is currently present at high density.

Weed species recorded during the field survey (July 2012)

Scientific name	Common Name	Weed of National Significance
<b>Trees and Shrubs</b>		
<i>Crataegus monogyna</i>	Hawthorn	
<i>Rosa rubiginosa</i>	Sweet Briar	
<i>Rubus fruticosus</i>	Blackberry	x
<b>Groundcover (grasses)</b>		
<i>Eragrostis curvula</i>	African Lovegrass	x
<i>Dactylis glomerata</i>	Cocksfoot	
<i>Holcus lanatus</i>	Yorkshire Fog	
<i>Nasella trichotoma</i>	Serrated Tussock	x
<i>Paspalum dilatatum</i>	Paspalum	
<i>Phalaris aquatica</i>	Phalaris	
<b>Groundcover (non-grassy weeds)</b>		
<i>Acetosella vulgaris</i>	Sheep Sorrel	
<i>Arctotheca calendula</i>	Capeweed	
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	
<i>Echium plantagineum</i>	Paterson's Curse	
<i>Hirschfeldia incana</i>	Hairy Mustard	
<i>Hypericum perforatum</i>	St John's Wort	
<i>Hypochaeris radicata</i>	Flatweed	
<i>Onopordum acanthium</i>	Scotch Thistle	
<i>Plantago lancolata</i>	Ribwort Plantain	
<i>Sonchus oleraceus</i>	Common Sowthistle	

Scientific name	Common Name	Weed of National Significance
<i>Verbascum thapsus</i>	Great Mullein	

Scattered tussocks may be found along the remainder of the road reserve. African lovegrass is of considerable concern to the ecological values of the Project area and surrounds as it thrives in low fertility soils, forms dense swards, produces large quantities of seed which may be viable for up to 17 years, and is unfavourable as grazing fodder for native fauna and livestock.

Serrated Tussock (*Nasella trichotoma*), another Weed of National Significance, is considered a less immediate (although still considerable) threat which will likely require future management. This species is another extremely unpalatable and low fodder-value weed, which can form dense monocultures, particularly in degraded or disturbed areas. Serrated Tussock was not recorded within the Project site at the time of survey. In addition to the above, the three species of woody weeds (Sweet Briar, Blackberry and Hawthorn) have the potential to form dense stands and once formed, these stands can be difficult and costly to remove.

Exotic pasture grasses such as Phalaris (*Phalaris aquatica*) and Cocksfoot (*Dactylis glomerata*) are generally considered to be 'naturalised' in the locality however in this instance they are considered to be weeds wherever they are threatening the integrity of otherwise high value native vegetation communities or where they have extended beyond the agricultural areas in which they may have been previously sown or otherwise encouraged.

#### *Weed infestation classification*

Three weed infestation categories were identified within (and in the vicinity of) the Project. Areas of high, medium and low weed infestation), as outlined below.

- High weed infestation: Includes areas where the groundstorey is dominated by exotic weed species, and a proportion of the biomass is usually comprised of at least one Weed of National Significance (namely African Lovegrass). These areas required targeted control and care must be taken to minimise spread of seed into surrounding areas.
- Moderate/scattered weed infestation: Includes areas with a predominantly native groundstorey or a groundstorey dominated by naturalised exotic pasture species of low-moderate concern (such as Phalaris) and moderate weed infestation. Weeds present in these areas are mostly common agricultural land weed species although there may be scattered plants or small clumps of one Weeds of National Significance which will require targeted control to prevent them becoming a more significant problem.
- Low or no weed infestation: This category support no weeds or the weeds that are present are common, mostly considered 'naturalised' and occur at low density. Native grasses and shrubs dominate the understorey and there are currently no weeds within that present a significant threat.

Weed categories are mapped in Appendix E (Flora and fauna constraints maps).

## **D.6 Procedure**

The following measures will be adopted during all clearing and construction works. Construction personnel will be informed of the importance of these measures during toolbox talks.

These measures are also included in Table 5.1, where appropriate.

#### *Management measures during construction*

- Earth moving vehicles will, as far as possible, be cleaned of dirt before entering the Project site and when leaving areas of 'high weed infestation'. This is particularly important if vehicles are moving between the Project and Stage A – Network (east) (where weeds are less prevalent).
- Construction personnel will, as far as possible, clean their boots and clothing of all seed laden material prior to leaving high weed infested areas.
- Any topsoil that is imported from offsite for use in landscaping will be weed free.
- Topsoil will be stripped from areas of 'high weed infestation' and buried as fill or disposed of off site.
- Topsoil from moderate and low weed infestation categories will be stripped and stockpiled separately. Topsoil will only be reused in an area of the same weed category.
- No domestic pets will be brought on site.

#### *Targeted weed control*

- Prior to vegetation clearance, woody weeds will be removed. This will include the physical removal and stump poisoning (ie cut-and-daub technique) for Sweet Briar, Blackberry and Hawthorn located in 'high weed infestation' area. Woody weed removal will be limited to the weeds present within the Project corridor.
- Targeted weed control includes the spraying/poisoning and/or physical removal of specific weed species within the site. Targeted control is not considered warranted prior to construction provided the construction mitigation measures (below) are implemented.
- Targeted weed control will be carried out for two consecutive years following construction and the species targeted will be informed by this management plan and by subsequent monitoring. Details would be included in the operational environment management plan.

#### *Pest control*

- To avoid the creation of additional areas of rabbit harbour, felled vegetation will be distributed throughout the surrounding woodland (where possible) and/or mulched for use in erosion and sedimentation control or landscaping.
- Vegetation will not be left in piles to create potential habitat for rabbits and other vermin.
- **If monitoring of nest boxes determines that pest birds or invertebrates such as Mynas, Starlings or honeybees have taken up residence, pest control may be required.**

#### *Rehabilitation*

- Seeding of areas for rehabilitation will be involve either:
  - an exotic crop of mixed infertile grasses and clovers etc;
  - native grasses (refer to Landscape Management Plan for detail on species to be seeded).
- Sowing is to occur immediately after the completion of construction.
- The sowing rate will aim to deliver a minimum 200 germinable seeds per square metre. This is to prevent significant weed establishment.

#### *Monitoring and rehabilitation*

Landscaping and rehabilitation will be carried out as per the Landscape Management Plan (LMP).



Where possible the following measures will be implemented:

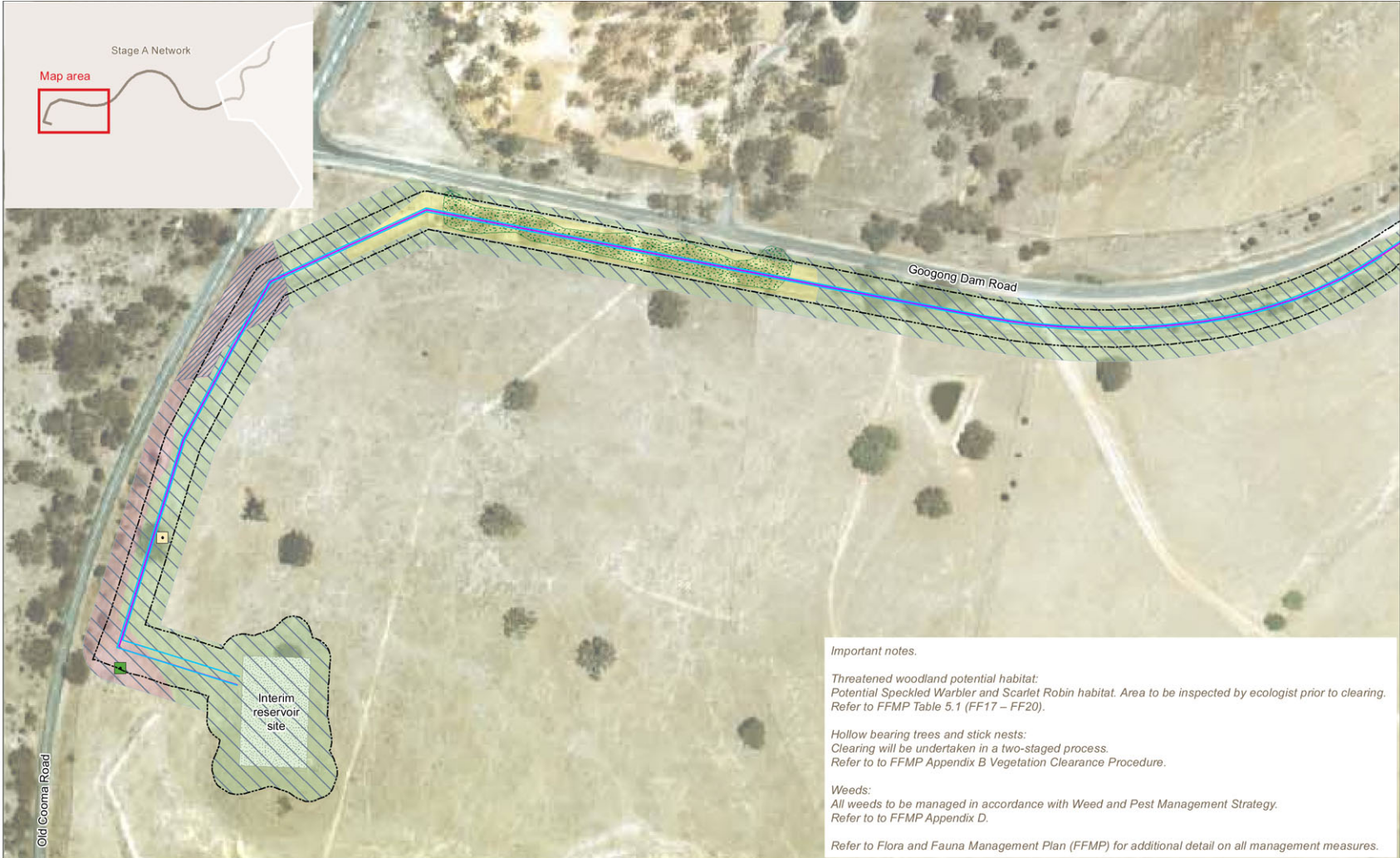
- Seeding of areas for rehabilitation will include only native species of local provenance, as advised by the Project Ecologist.
- Sowing is to occur immediately after the completion of construction.
- The sowing rate will aim to deliver a minimum 200 germinable seeds per square metre. This is to prevent significant weed establishment.

Upon completion of the landscaping works (including areas of native grass seeding) annual monitoring will be undertaken to monitor the success of the revegetation works and to identify areas where additional weed management is required.

Species which may require future management include Chilean Needle Grass (*Nassella neesiana*) (not currently present within the Project area, however a Weed of National Significance of considerable threat, should it establish), Horehound (*Marrubium vulgare*), Patterson's Curse (*Echium plantagineum*) and Great Mullein (*Verbascum thapsus*).

Appendix E

# Flora and fauna constraints maps



**Important notes.**

**Threatened woodland potential habitat:**  
 Potential Speckled Warbler and Scarlet Robin habitat. Area to be inspected by ecologist prior to clearing.  
 Refer to FFMP Table 5.1 (FF17 – FF20).

**Hollow bearing trees and stick nests:**  
 Clearing will be undertaken in a two-staged process.  
 Refer to FFMP Appendix B Vegetation Clearance Procedure.

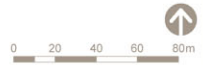
**Weeds:**  
 All weeds to be managed in accordance with Weed and Pest Management Strategy.  
 Refer to FFMP Appendix D.

Refer to Flora and Fauna Management Plan (FFMP) for additional detail on all management measures.

Source Brown Consulting, Biosis  
 Drawing no. 11122g\_FFMP\_west01

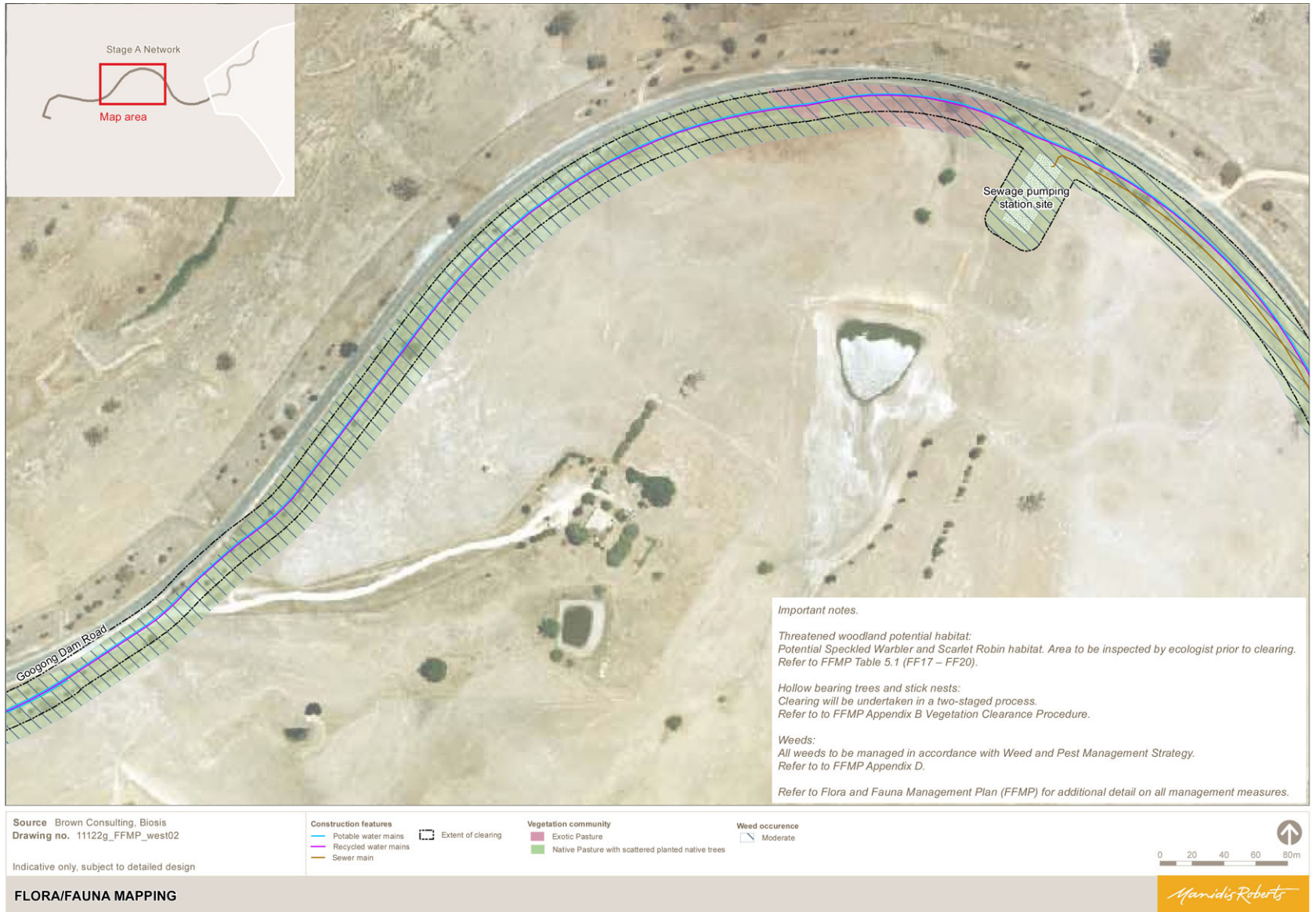
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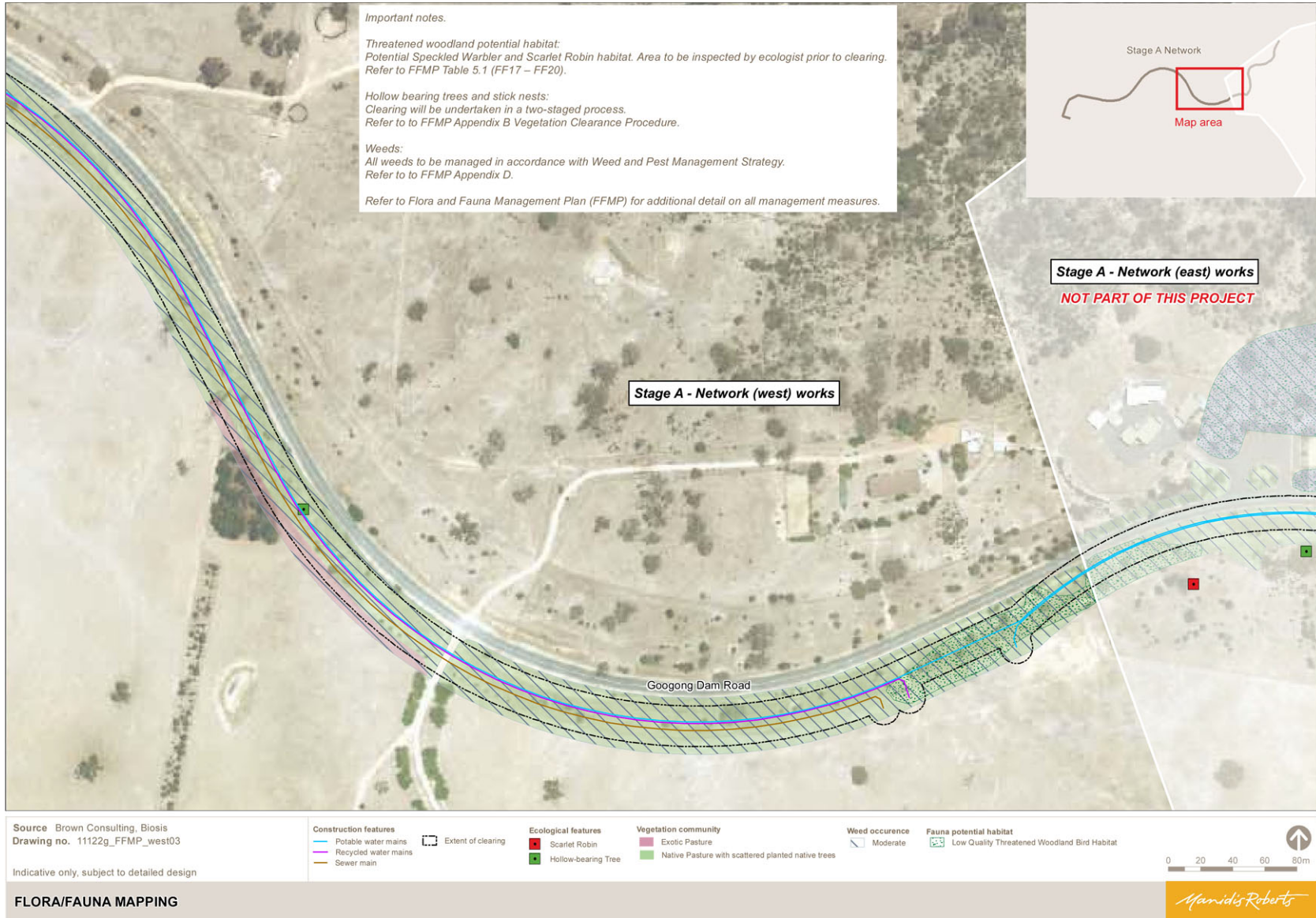
Construction features	Ecological features	Vegetation community	Weed occurrence	Fauna potential habitat
— Potable water mains	■ Stick Nest	■ Exotic Pasture	▨ High	■ Low Quality Threatened Woodland Bird Habitat
— Recycled water mains	■ Hollow-bearing Tree	■ Native Pasture with scattered planted native trees	▨ Moderate	
▭ Extent of clearing		■ Scribbly-gum / Red Box / Bundy Dry Forest	▨ Low	



**FLORA/FAUNA MAPPING**







**FLORA/FAUNA MAPPING**