

Location of Stockpiles

As far as practical, cover material should generally be stockpiled along the west or south of the active landfill cell in order to provide additional shielding to the most affected receivers.

Minimise Dozer and Scraper Operations

Noise levels at all receivers would be typically dominated by dozer and scraper operations. Therefore, the use of these items of plant would be minimised as far as practical, particularly when working at the extremities of the site.

Dozer and scraper operations would not be undertaken prior to 7am on weekdays and prior to 8am on weekends and public holidays, therefore there would be no noise impact during the night time assessment period.

The operational hours as outlined in the Landfill Licence would be adhered to at all times. In the event that operational works need to be conducted outside of the normal hours DECCW would be informed and the contractor would contact local residents.

8.8 Biodiversity

EA Systems conducted a flora, fauna and habitat assessment of the Project Site in 2006 based on surveys conducted in spring and autumn 2005 and 2006. A final fauna survey was also conducted in November 2009. The *Flora and Fauna Assessment Report* (EA Systems, 2010) is presented in **Appendix E**. The format of the assessment followed the suggested structure outlined in the working draft *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004b). The assessment also applied the 'Assessment of Significance' (seven part test) to threatened species, populations or ecological communities found, or with potential habitat, in accordance with the *Threatened Biodiversity Survey and Assessment* guidelines (DEC, 2004b), the *Threatened Species Assessment Guidelines* (DECC, 2007) and the *Significant Impact Guidelines and Matters of National Significance* (DEH, 2006).

8.8.1 Methodology

Flora

The site was surveyed for flora on three occasions in autumn (3 April) and spring (15 October) in 2005 and in September 2006. On each occasion an assessment of vegetation communities and significant flora species was conducted using a Random Meander search (Cropper 1993). The 2006 survey entailed (20 x 50) nested quadrats consistent with the *Native Vegetation Regulation 2005*, Environmental Outcomes Assessment Methodology (DNR 2005) and random meander targeted searches for threatened species. A number of condition variables were recorded to assess current site condition of remnant woodland areas that are proposed to be cleared including:

- Native plant species.
- Native over-storey cover.
- Native mid-storey cover.
- Native ground cover of grasses, shrubs, and other components.
- Exotic plant cover.
- Number of trees with hollows.
- Over-storey regeneration.
- Total length of fallen logs.

Fauna

Fauna surveys were carried out in autumn (29th and 30th March) and spring (18th and 19th October) 2005, again in September (spring) 2006 and a final survey in November (spring) 2009, to record fauna present on the Project Site and the adjacent TSR. Daytime bird presence was surveyed visually and aurally by habitat search. Searches for reptiles and signs of presence of fauna species involved scanning of trees and logs, searching under rocks, litter and logs, and inspection of tree cavities and hollow stumps. Reptiles and frogs were identified with reference to Cogger (2000) and Swan (1990). Searches for mammals and Koala presence included visual scans, diurnal searches for scats and tracks, and nocturnal spotlighting.

A search for nocturnal fauna was conducted by two to three observers on five nights. On each night a megaphone was used to play back owl calls. Spotlight searches of nocturnal birds were also undertaken. Frogs were identified from their calls with reference to Stewart (1998). An ultrasonic bat detector was used to record bat calls.

Survey conditions were generally conducive to good quality results during the survey period. A total of 119.6 person hours was spent surveying for fauna and 37 person hours was spent surveying flora on the site.

8.8.2 Botanical Survey – Flora

The botanical survey identified 180 species (refer **Appendix E**), including the following:

- 11 trees.
- 29 shrubs (3 exotic).
- 3 climbers/vines.
- 2 mistletoes.
- 35 grasses (7 exotic).
- 98 herbs (24 exotic).
- 2 aquatic plants.

One threatened plant species, Narrow-leaved black peppermint (*Eucalyptus nicholii*) was found on the Project Site. *E. nicholii* is listed as vulnerable under both the *TSC Act* and *EPBC Act*. One Rare or Threatened Australian (ROTAP) plant species, Bendemere white gum (*E. elliptica*) was recorded within the study area (but not within areas of the Project Site identified for clearing), and although locally and regionally significant it is not subject to legal provisions under the *TSC Act* or *EPBC Act*.

8.8.3 Vegetation Communities

Five distinct vegetation communities occur at the site as shown on **Figure 18**. The vegetation communities include:

- Stringybark Woodland
- Cleared Grasslands
- Sedgeland
- Wetlands (dams)
- Box-Gum Woodland

These vegetation communities are summarised in **Table 8-35** and described in more detail in **Appendix E**.



- Box-gum woodland
- Grassland
- Sedgeland
- Stringybark woodland
- Wetland

Project site

ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
VEGETATION COMMUNITIES

Source:

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Fig. **18**

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Table 57: Description of the Vegetation Communities Found in the 361 hectare Surveyed Area of the Proposed Armidale Landfill Site

Community Name	Area (% of total surveyed)	Condition/Habitat Quality	Status	Dominant species	Other species	Characteristics	Disturbances
Stringybark woodland	62.8 ha (17%)	Moderate	Widespread	Trees: - New England stringybark <i>Eucalyptus caliginosa</i> - Yellow box <i>E. melliodora</i> Shrubs: - Blackthorn <i>Bursaria spinosa</i> - Peach heath <i>Lissanthe strigose</i> - Guinea flower <i>Hibbertia linearis</i> Grasses: - Slender rat's tail grass <i>Sporobolus creber</i> - Red-leg grass <i>Bothriochloa macra</i> - Rough speargrass <i>Austrostipa scabra</i> - Couch <i>Cynodon dactylon</i> - Snow grass <i>Poa sieberiana</i> - Small lovegrass <i>Eragrostris leptostachya</i> - Purple wiregrass <i>Aristida ramosa</i> - Slender wallaby grass <i>Austrodanthonia racemosa</i>	Trees: - Fern-leaved wattle <i>Acacia filicifolia</i> - Black she-oak <i>Allocasuarina littoralis</i> - Blakely's red gum <i>E. blakelyi</i> Shrubs: - Hawthorn <i>Crataegus monogyna</i> * - Blackberry <i>Rubus fruticosus</i> * - Sweet briar <i>Rosa rubiginosa</i> * Grasses / herbs: - Native stinging nettle <i>Urtica incisa</i> - Exotic stinging nettle <i>U. urens</i> * - Slender sedge <i>Cyperus gracilis</i> - Pin rush <i>Juncus usitatus</i> - Burr-daisy <i>Calotis cuneifolia</i>	- Patchy with largest contiguous patch 32 ha - Trees 4 – 20 metres apart - Very few fully mature trees - Very few hollows - Poor community diversity - Sparse shrub layer - Weed invasion of shrub layer - Forms part of an intermittent band of woodland that is likely to be a significant flora and fauna corridor	- Partially cleared and subsequently regrown 11-17 log piles per ha
Cleared grasslands	212.6 ha (68%) - 3.3 ha to be cleared for proposed development	Low	EEC – “White box, yellow box, Blakely's red gum woodland (box-gum woodland) under the TSC Act	Trees: - Nil Shrubs: - Nil Grasses / herbs: - Couch <i>Cynodon dactylon</i> - Slender rats tail grass <i>Sporobolus creber</i> - Blown grass <i>Lachnagrostis avenaceus</i> - Red-leg grass <i>Bothriochloa macra</i> - Small lovegrass <i>Eragrostris leptostachya</i>	Trees: - Nil Shrubs: - Hawthorn <i>Crataegus monogyna</i> * - Sweet briar <i>Rosa rubiginosa</i> * Grasses / herbs: - Pale pigeon grass <i>Setaria pumila</i> - Paspalum <i>Paspalum dilatatum</i> <i>Juncus usitatus</i> - Spear thistle <i>Cirsium vulgare</i> - Pinrush <i>Juncus usitatus</i>	- Historically was woodland prior to clearance - Isolated trees remain - No recent regeneration - Lack of non-grass understorey excludes it from the EPBC Act listed critically endangered box-gum woodland and derived native grassland ecological community	- Historical clearance - Existing, intensive grazing by sheep and cattle
Sedgeland	9.4 (3%)	Low to moderate	Widespread	Trees: - Nil Shrubs: - Nil Grasses / herbs: - Tall sedge <i>Carex appressa</i> - Umbrella sedge <i>Cyperus eragrostis</i> - Paspalum <i>Paspalum dilatatum</i> - Pinrush <i>Juncus usitatus</i>		- Occupies shallow drainage lines throughout the grassland - Intergrades with grassland	Heavily grazed by sheep and cattle
Wetlands (dams)	< 1 ha (< 1%)	Low to moderate	Widespread	- Tall sedge <i>Carex appressa</i> - Umbrella sedge <i>Cyperus eragrostis</i> - Water couch <i>Paspalum distichum</i> - Spreading knotweed <i>Persicaria prostrata</i> - Ribbonweed <i>Vallisneria gigantea</i> - Swamp lily <i>Ottelia ovalifolia</i>		Dams support an artificial assemblage of wetland plants	Heavy trampling by domestic livestock

Community Name	Area (% of total surveyed)	Condition/ Habitat Quality	Status	Dominant species	Other species	Characteristics	Disturbances
Box – gum woodland	29.6 ha (9.4%)	Good	EEC – “White box, yellow box, Blakely’s red gum woodland (box-gum woodland) under the <i>TSC Act</i> and as the ‘box-gum woodland and derived native grasslands’ critically EEC under the <i>EPBC Act</i>	Trees: • New England stringybark <i>E. caliginosa</i> • Yellow box <i>E. melliodora</i> • Blakely’s red gum <i>E. blakelyi</i> • Apple-topped box <i>E. bridgesiana</i> • Bendemeer white gum <i>E. elliptica</i> <i>T</i> Grasses / herbs: • Kangaroo grass <i>Themeda australis</i> • Snow grass <i>Poa sieberiana</i> • Slender wallaby grass <i>Austrodanthonia racemosa</i> var. <i>racemosa</i> • Native sorgum <i>Sarga leiocladum</i>	Trees: • Narrow-leaved peppermint <i>E. nicholli</i> <i>T</i> Shrubs: • Spiny parrot pea <i>Dillwynia sieberi</i> • Chinese lespedeza <i>Lespedeza juncea</i> * • Peach heath <i>Lissanthe strigosa</i>	• Occurs on the TSR and is contiguous to a larger patch in the main Gara TSR to the north of Waterfall Way • 140 species recorded • Trees 6 – 20 metres apart • Regeneration common • Abundant hollows and denning sites for mammals and birds • 1 vulnerable and 1 ROTAP species present	• Low levels of grazing through use as a TSR for 90 years • Localised road realignment-previous route of Waterfall Way. • Kangaroo grass and native sorghum rare to absent from heavily grazed block to the south and are indicative of a relatively intact understorey

8.8.4 Threatened Plant Species

Threatened flora species identified at the site and within 20km of the site are shown in **Figures 19** and **20**, respectively. Sixteen threatened plant species have been recorded within 20 kilometres of the study site (**Figure 20**). Ten are considered to have suitable habitat represented in the study area (refer **Appendix E**). These are:

- *Amphibromus pithogastrus* which occurs in moist, grassy seepages.
- *Asperula charophyton* which also occurs in moist, grassy seepages.
- *Bothriochloa biloba* which occurs in disturbed grasslands.
- *Dichanthium setosum* which occurs in grassy woodlands.
- *Discaria pubescens* which occurs in woodlands and forests in rocky situations.
- *Diuris pedunculata* which occurs in moist areas, open sclerophyll forest and grasslands.
- *Eucalyptus nicholii* which occurs in grassy, open forests or woodlands on poor soils.
- *Ozothamnus adnatus* which occurs in grassy open forest and woodland on poor soils.
- *Senecio macranthus* which occurs in moist gullies in sclerophyll forest.
- *Thesium australe* which occurs in grassy woodlands.

Narrow-leaved black peppermint (*Eucalyptus nicholii*) is listed as vulnerable under both the *TSC Act* and *EPBC Act*. Six adult and five juvenile trees were located within the access way corridor (refer **Figure 19**). Narrow-leaved peppermint is endemic to the Northern Tablelands, where it occurs from Niangala to Glen Innes. This species is recorded frequently along Waterfall Way to the east of the study site.

Assessments of Significance (also known as “seven part tests”, conducted under the requirements of Section 5A of the *EP&A Act*) of potential impacts on these species arising from the proposed development are presented in **Appendix E**. The Assessments concluded that there would be no significant impact of the Project Site on threatened species, populations or ecological communities as long as the appropriate compensatory habitat is provided, as well as the appropriate implementation of all other proposed mitigation measures.

A Bendemeer white gum (*Eucalyptus elliptica*) population was located in the Gara TSR to the east of the proposed access way but not within the area identified for clearing. This is a ROTAP species on the Northern Tablelands, where it prefers grassy woodland on sandy soils. The nearest known population is 22 kilometres east of the study area.

8.8.5 Endangered Ecological Communities (EEC)

Box-gum woodland community is classified as an EEC under the *TSC Act* and is also classified as critically endangered under the *EPBC Act* (refer **Appendix E**). Box-gum woodland is an open woodland or forest community dominated by white box (*Eucalyptus albens*), yellow box (*E. melliodora*) and Blakely's red gum (*E. blakelyi*). Intact sites have a high species diversity, although such stands that contain diversity in all structural layers are rare. The box-gum woodland in the Gara TSR is considered to be relatively intact, with a high diversity of plant species. The cleared grassland community has also retained enough native grasses to qualify as an EEC under the definitions that pertain to the *TSC Act*. The cleared area of grassland is considered to have the potential to regenerate, as it is dominated by native grasses and forbs.

An Assessment of Significance of potential impacts on the box-gum woodland community present on the site is presented in **Appendix E**. The Assessment concludes that there would be no significant impact of the proposed landfill facility on this community as long as the appropriate compensatory habitat is provided, and management measures are implemented.

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- Project site
- Narrow-leaved Black Peppermint (*Eucalyptus nicholii*)
- Bendemeer White Gum (*Eucalyptus elliptica*)

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**INDICATIVE LOCATION OF THREATENED
FLORA SPECIES ON THE PROJECT SITE**

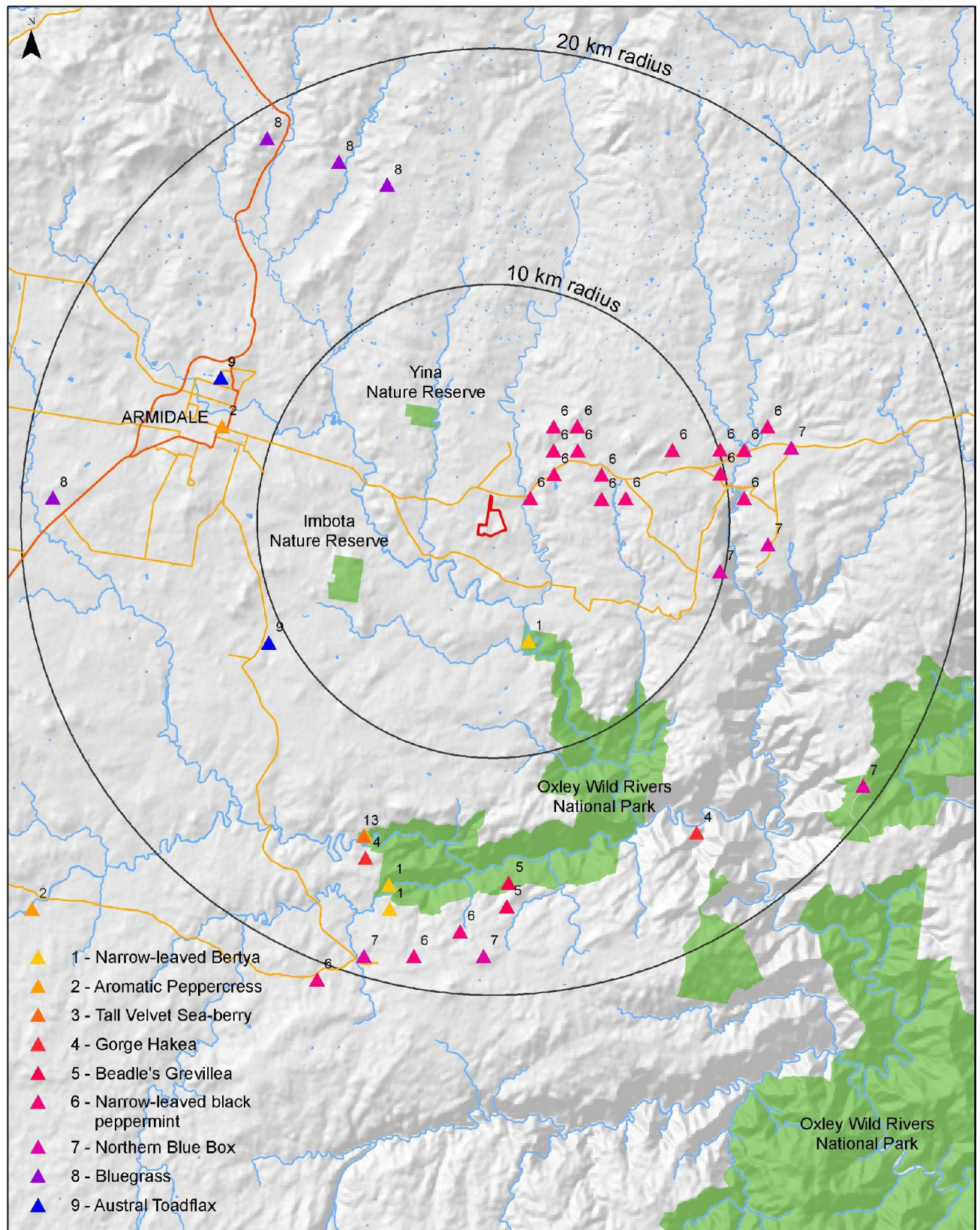
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Fig. **19**

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Project site

National Park or Nature Reserve

ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
 RECORDS OF THREATENED FLORA WITHIN 20 KM OF THE PROJECT SITE
 FROM DECCW NPWS ATLAS OF NSW FLORA DATABASE

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Fig 20

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8.8.6 Fauna Survey

Fauna surveys were undertaken to determine the presence of fauna within the Project Site and in the adjacent TSR. The following summarises the results:

Birds

Eighty species of birds (1 exotic) were identified within the study area (refer **Appendix E**). Two of these bird species are listed as vulnerable under the *TSC Act*, these being:

- Speckled warbler.
- Diamond firetail.

These two species were located in the box-gum woodland of the TSR and in the stringybark woodland of the Project Site. Three (3) bird species currently subject of a Preliminary Determination to be listed as Vulnerable under the *TSC Act* were also detected in this area including;

- The Little Eagle.
- Scarlet Robin.
- Varied Sittella.

Mammals

Fifteen species of mammals (4 exotic) were detected in the study area (refer **Appendix E**). Two threatened mammal species were amongst this group, these being a single koala which was observed in the box-gum woodland of the Gara TSR (during 2005 survey only) and the eastern bent-wing bat which was detected by echo-location calls in the stringybark woodland. Both these species are listed as vulnerable under the *TSC Act*.

Amphibians

The fauna survey detected eight frog species on the site (refer **Appendix E**), however none of these are listed as threatened species.

Reptiles

Of the ten reptile species detected on the site (**Appendix E**), none are listed as threatened species.

8.8.7 Threatened Fauna Species

Four species of threatened fauna were detected in the study area (**Figure 21**):

- Speckled Warbler.
- Diamond Firetail.
- Koala.
- Eastern Bent-wing Bat.

Family groups of two to three speckled warblers were observed during the autumn and spring surveys in the stringybark woodland and another in the box-gum woodland. Diamond firetails were observed in spring and autumn at the dam in the stringybark woodland and in the box-gum woodland, 100 metres west of the dam in the TSR.

One koala was observed during spotlighting in spring in the box-gum woodland beside Waterfall Way. A detailed search for koala in November 2009 revealed evidence of koala (scats and scratches) near several trees in the stringybark woodland, however no koalas were observed at either the Project Site or the TSR.

Echo-location calls indicated the presence of the eastern bent-wing bat in the stringybark woodland in 2005.

Three bird species currently subject of a Preliminary Determination to be listed as Vulnerable on the *TSC Act* were also detected in this area. One Scarlet Robin territory, a group of Varied Sittellas and a Little Eagle's nest were identified in the stringybark woodland within the landfill footprint.

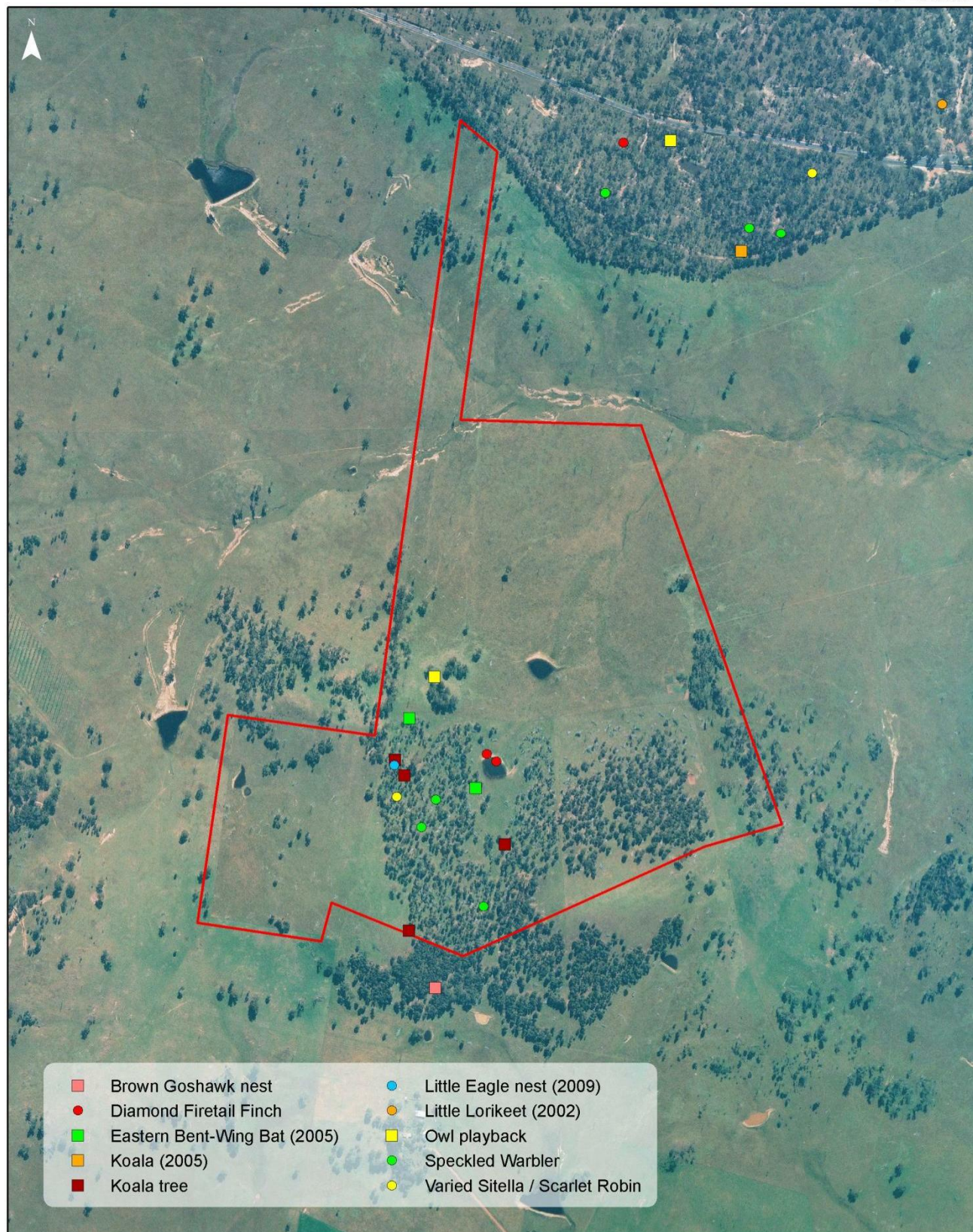
Searches of DECCW's NPWS Atlas of NSW Wildlife and EPBC Protected Matters search tool revealed 29 threatened species that have been recorded within 20 kilometres of the study area (refer **Figure 22**). Habitat assessments of these species (refer **Appendix E**) revealed that 14 would have suitable habitat within the study site. These are as follows:

- Barking Owl, which forage in eucalypt woodland.
- Black-chinned Honeyeater, which forage in eucalypt woodland.
- Brown Treecreeper, which forage in eucalypt woodland.
- Diamond Firetail, which occur in grassy eucalypt woodland and were recorded on site.
- Eastern Bent-wing Bat, which forage in eucalypt woodland.
- Eastern False Pipistrelle, which forage and roost in eucalypt woodland.
- Hoary Wattled Bat, which forage and roost in tree hollows and rock fissures of eucalypt forest and rainforest.
- Hooded Robin, which forage and breed in eucalypt woodland.
- Koala, which forage and breed in eucalypt woodland and forests and were recorded on site.
- Little Lorikeet, which forage and breed in box-gum and riparian gum woodland.
- Regent Honeyeater, that has marginal foraging habitat by way of eucalypt woodland on site.
- Speckled Warbler, which was recorded on site.
- Square-tailed Kite, which forages in the canopy of eucalypt woodland.
- Squirrel Glider; which forages in eucalypt woodland and nests in small hollows.
- Yellow-bellied Sheath-tail Bat, which forages above woodland canopies and roosts in tree hollows.

A seven part test assessment of the significance of the proposed development on all these species is presented in **Appendix E**.

8.8.8 Other Fauna of Conservation Significance

A pair of Little Eagles was observed nesting during the 2005 spring survey in a stringybark tree in the gully above the dam within the stringybark woodland (**Figure 21**). Little Eagles usually breed from the same nest over a number of years but have also been known to readily build a new nest. In the 2009 spring survey the pair had a new nest site in a tall Yellow Box on the western edge of the proposed landfill footprint. This species is protected in NSW and any clearing that may affect the nest tree should be undertaken outside the breeding season.



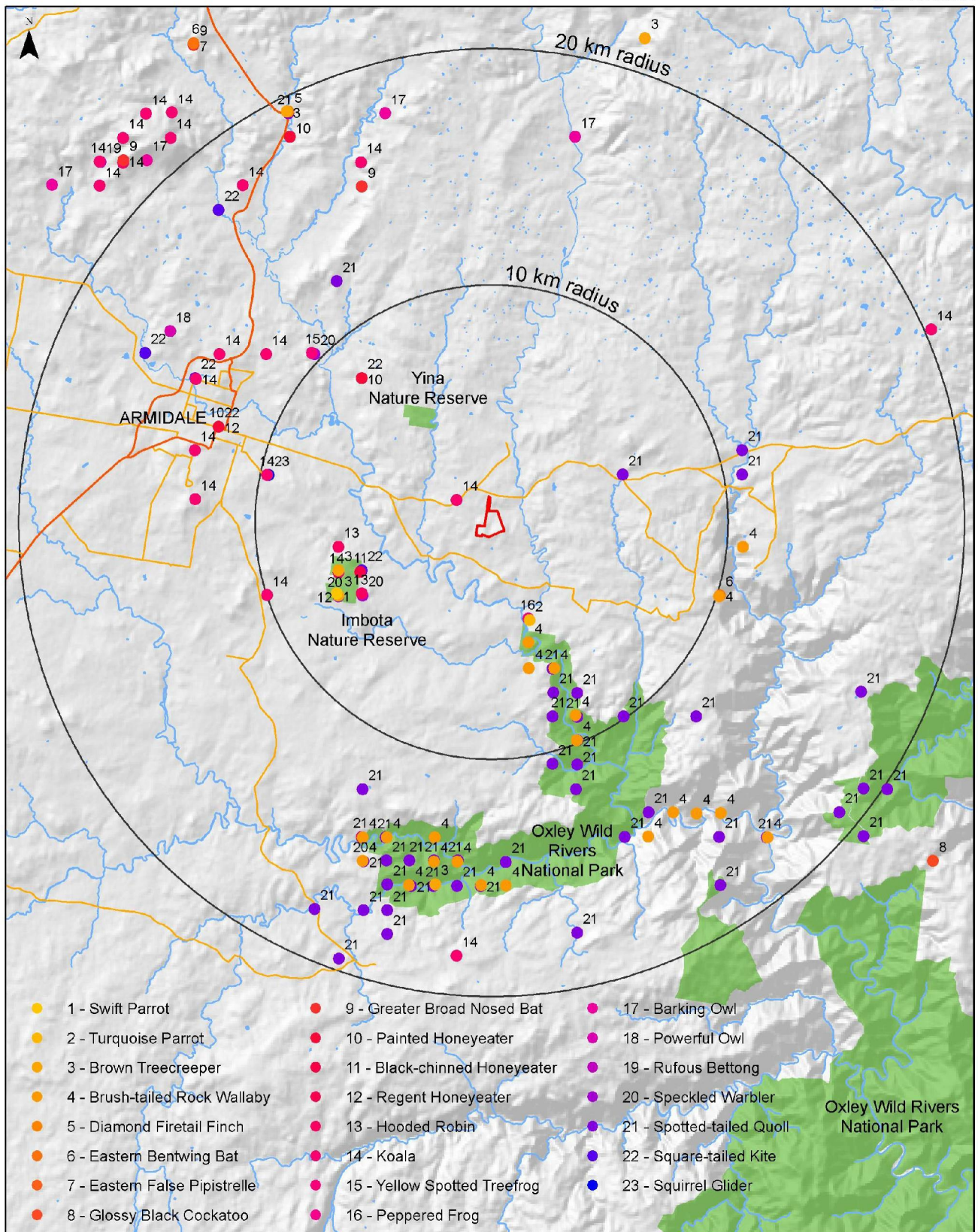
ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
INDICATIVE LOCATION OF THREATENED AND IMPORTANT
FAUNA SPECIES RECORDS OF THE PROJECT SITE

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Fig. 21

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Project site

National Park or Nature Reserve

ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY
 RECORDS OF THREATENED FAUNA WITHIN 20 KM OF THE PROJECT SITE
 FROM DECCW NPWS ATLAS OF NSW WILDLIFE

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Fig. 22

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8.8.9 Fauna Habitat

Overall, the study area provides moderate quality habitat for threatened flora and fauna. The box-gum woodland along the TSR provides high quality habitat, while the proposed operational area of the Project Site is degraded and provides low quality habitat due to historical clearing of vegetation, fragmentation, scarcity of regeneration, creation of log piles, heavy grazing, weed invasion and pest animal invasion.

SEPP 44 (Koala Habitat Protection) Assessment

As previously mentioned in **Section 6.3.3**, Armidale Dumaresq LGA is listed in Schedule 1 of *SEPP 44* and Part 2 requires that prior to granting consent to a development on land subject to the policy, the Council must consider whether the land constitutes 'potential' or 'core' koala habitat.

Core koala habitat is defined as areas which contain a resident koala population and potential koala habitat is defined as areas of native vegetation where the trees (of the type listed in Schedule 2 of the SEPP) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. Should core koala habitat be identified, a Plan of Management would be required to be prepared in respect of the habitat and any consent granted in respect of the land would need to be consistent with the Plan of Management.

As discussed, one koala was observed in the box-woodland of the Gara TSR during the 2005 field survey (refer **Figure 22**) and DECCW's NPWS Atlas records list another observation of koalas 2 kilometres to the west of the study area. However, no evidence of koala activity was found in the proposed landfill access route corridor. A recent ecological investigation by EA Systems in 2009 included an assessment in accordance with the requirements of *SEPP 44* and was aimed at identifying 'core' and 'potential' koala habitat. The survey recorded evidence of koala presence within the landfill footprint (scats and scratches), however no koalas were sighted.

Four tree species (yellow box, Blakely's red gum, apple-topped box, and narrow-leaved black peppermint) occurring on the study area are listed as secondary food tree species for koalas (NPWS, 2003). The Bendemeer white gum is also likely to be a secondary food source of koalas. These species occur mainly in the TSR, where the koala was sighted, although yellow box also occurs in the stringybark woodland. The New England stringybark is considered a supplementary food source.

Secondary koala food trees make up 58% of the total number of assessed trees in the box-gum woodland in the TSR, and the remaining 42% are supplementary koala feed trees. Thus the TSR is considered Secondary Habitat (Class A) according to *Appendix B: Categories of Koala Habitat of the NSW Koala Recovery Plan* (DECC, 2008), given that secondary food tree species alone comprise at least 50% of overstorey trees and primary koala food tree species are absent. Most of the trees (>95%) in the stringybark woodland within the landfill footprint are supplementary koala food tree species, and thus is likely to be Secondary Habitat (Class C).

The survey concluded that as the Project Site does not contain any primary food trees, it would not be considered core or potential koala habitat under *SEPP 44* (**Appendix E**).

8.8.10 Endangered Fauna Populations

The tusked frog population of the New England bioregion is listed as an endangered population under the *TSC Act*. Historically, tusked frogs were located throughout the New England Tableland. Despite substantial survey effort over the past decade, only three records of the tusked frog have been reported from this bioregion since 1976. Each of these was far from the study area and no evidence of tusked frog presence was detected during the site surveys. Consequently, the proposal is not likely to affect this population.

8.8.11 Migratory Species

The *EPBC Act* serves to protect migratory species that may not be listed as threatened but are protected under international conservation agreements (e.g. Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA)). Nine migratory and 13 marine species were recorded within 20 kilometres of the study area and, based on the habitat requirements of these species, six are considered to potentially occur on site. These are:

- White-throated Needletail.
- Regent Honeyeater.
- Fork-tailed Swift.

- White Egret.
- Cattle Egret.
- Rainbow Bee-eater.

A referral to the Commonwealth Minister of the Environment for impacts on migratory and threatened species was made and concluded that there would be no significant impacts on migratory species, if the proposed mitigation measures are adopted.

8.8.12 Key Threatening Processes

Knowledge of past, current and future threats occurring on a site provide information for the conservation management of threatened species. Several threatening processes listed under the *TSC* and *EPBC Acts* are relevant to the Project Site including:

- Clearing of native vegetation*.
- Loss of hollow bearing trees.
- Removal of dead wood and dead trees.
- Anthropogenic climate change*.
- Competition and grazing by the feral European rabbit*.
- Predation by the European red fox.
- Competition from feral honeybees.

* also listed under the *EPBC Act*

The disturbance history of the site indicates that a number of threatening processes have occurred in the past. Some of these processes currently occur on the subject site and include clearing of native vegetation, competition and grazing by the feral European rabbit, predation by the European red fox and removal of dead wood and dead trees.

Clearing of Native Vegetation

Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) of native vegetation resulting in a loss, or long-term modification, of the structure, composition and ecological function of a stand or stands. The definition of clearing does not preclude management activities to control exotic species, or native species growing outside their natural geographic range.

Clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity. Destruction of habitat is the major cause of loss of biological diversity. Clearing has been identified as a threat to a number of species, communities and populations listed under the *TSC Act* and could cause species, populations or ecological communities that are not threatened to become threatened.

Remnants of the EEC known as box-gum woodland are subject to varying degrees of threat that may jeopardise their viability. These threats include the following:

- Further clearing (for cropping, pasture improvement or other development).
- Deterioration of remnant condition (caused by firewood cutting, increased livestock grazing, weed invasion, inappropriate fire regimes, soil disturbance and increased nutrient loads).
- Degradation of the landscape in which remnants occur (including soil acidification, salinity, and loss of connectivity between remnants).

The proposed development would entail clearing of approximately 20 hectares of vegetation, including:

- 12.7 hectares of stringybark woodland. This community on the Project Site is in moderate condition and is currently subject to grazing, weed and pest impacts. This community has also been disturbed by extensive clearing of regrowth some 10 to 20 years ago.
- 6.5 hectares of grassland (including 3.3 hectares of degraded box-gum woodland). This community on the Project Site is in low to moderate condition and is currently subject to grazing impacts. The area proposed to be cleared has been partially cleared in the past for an access easement, prior to the realignment of the Waterfall Way.
- 0.6 hectares of box-gum woodland in the TSR, in an area where the woodland is already partly cleared and open.
- 0.5 hectares of sedgeland.
- Two small dams would also be removed.

Loss of Hollow-Bearing Trees

Hollow-bearing trees provide habitat and nesting sites to several species of fauna. Hollows usually occur in old eucalyptus trees in which the more aged the tree, the greater the presence, abundance and size of hollows. The density of hollow-bearing trees required to sustain viable populations is controlled by factors such as the diversity of competing fauna species, population densities and the number of hollows with suitable characteristics.

Few hollows occur within the stringybark woodland at the Project Site with stumps and piles of dead timber providing most of the hollows for some species. Within the box-gum woodland in the TSR however, an abundance of hollows occur. Some of the hollows lost during construction would be relocated to the offset area for use by birds, bats and arboreal mammals. Given the abundance of hollows in the TSR, a substantial shortage is not anticipated as a result of construction.

Removal of Dead Wood and Dead Trees

The "removal of dead wood and dead trees" includes:

- The removal of forest and woodland waste left after timber harvesting.
- Collecting fallen timber for firewood.
- Burning on site.
- Mulching on site.
- The removal of fallen branches and litter as general tidying up.
- The removal of standing dead trees (stags).

Dead wood and dead trees provide essential habitat for a wide variety of native animals and are important to the functioning of many ecosystems. The removal of dead wood can have a range of environmental consequences, including the loss of habitat (as they often contain hollows used for shelter by animals), disruption of ecosystem process and soil erosion.

Dead trees and fallen logs (left in situ) in the TSR enhance the habitat value in the box-gum woodland community. Conversely, log piles in the stringybark woodland provide above-ground harbour for pests and weeds. Most of the timber in the large log piles has little contact with the soil surface. Such timber remains drier and takes longer to breakdown than logs lying on the ground. The relocation of large logs from these piles, placed flat on the ground, could enhance the habitat value of conservation restoration/revegetation areas elsewhere on the site.

Competition and Grazing by the Feral European Rabbit

Rabbits, *Oryctolagus cuniculus*, have spread over most of the southern two thirds of Australia and now occupy approximately 4.5 million km². Grazing and burrowing by rabbits can cause extensive erosion problems, reduce recruitment and survival of native plants and alter entire landscapes. Rabbits also threaten the survival of a number of native animal species by altering habitat, reducing native food sources, displacing small animals from burrows and attracting introduced predators such as foxes.

Large numbers of rabbits were observed using the numerous large log piles in the stringybark woodland. The soil in the southern section of the Project Site is shallow and it is likely that rabbits are unable to dig extensive burrows on this site. Ripping of warrens may not be effective in the stringybark woodland and therefore habitat modification may be more suitable for rabbit control. Removal of surface refuge greatly enhances the efficiency and effectiveness of control programmes and slows recolonisation (Williams et al 1995). This may be achieved through measures such as dismantling existing log piles and removing blackberry (*Rubus* spp.) thickets. The potential adverse impacts of feral animal control measures on native species and their habitats would be considered by utilising an integrated feral animal control and wildlife management approach.

Predation by the European Red Fox

Foxes are an adaptable and elusive predator common in rural and urban areas throughout southern Australia. They do not appear to favour any particular habitat and the main determinants of their population size and distribution appear to be food supply, disturbance of natural habitats and refuge availability.

Since their introduction into Australia in the 1870s, foxes have contributed to severe declines and extinctions of a suite of native fauna, particularly among medium-sized (450-5000 g) ground-dwelling and semi-arboreal mammals, ground-nesting birds and freshwater turtles. Recent experimental studies have shown that predation by foxes continues to threaten remnant populations of many of these species.

Foxes were observed in the stringybark woodland on the proposed landfill site. Two threatened ground foraging bird species (speckled warbler and diamond firetail) were observed in this habitat. The speckled warbler nests on the ground and so is at risk of predation by foxes. Log piles provide shelter for both rabbits and foxes. The large numbers of rabbits observed are likely to support large numbers of foxes on the site. The creation of a landfill facility is likely to increase the density of foxes in the region via the provision of a permanent, reliable, supplementary food source that is not affected by climatic conditions.

8.8.13 Recovery Actions

DECCW has formulated a Priority Action Statement (PAS) that addresses the requirements for the recovery of threatened species listed under the *TSC Act*. A number of priority actions have been identified to help recover the threatened species known or potentially likely to occur in the study area, as described in **Appendix H**. These have been incorporated into the mitigation measures identified in **Section 8.8.16**.

Recommended recovery actions have been developed for the:

- Box-Gum Woodland.
- Eastern Bent-wing Bat.
- Little Eagle.
- Little Lorikeet.
- Speckled Warbler, Varied Sittella, Scarlet Robin.
- Diamond Firetail Finch.
- Koala.
- Narrow-leaved Black Peppermint.

8.8.14 World Heritage Values

The Oxley Wild Rivers National Park lies approximately four kilometres south-south-east of the study area. It is listed on the Register of World Heritage Sites because it protects extensive areas of dry rainforest that harbour rich biodiversity including several threatened plants and animals. The park is part of the Gondwana Rainforests of Australia World Heritage Area (GRAWHA). An action is likely to have a significant impact on a World Heritage Area if:

- It modifies or inhibits ecological processes of the site.
- Reduces the diversity or composition of plant or animal communities.
- Fragments, isolates or damages habitat important to biological diversity conservation.
- Causes a long term reduction in rare, endemic or unique plant or animal species or populations.
- Fragments, isolates or damages habitat of such species.

The Assessment of Significance for the proposed development considered known or potentially occurring species within 20 kilometres of the study area. This extensive area includes portions of the World Heritage Area. No specific impacts on threatened species or EEC are considered likely if the proposed compensatory habitat is provided and feral animals are reduced in abundance on the site (**Appendix E**).

8.8.15 Potential Impacts

Potential impacts of the proposal on native flora and fauna were considered in relation to direct and indirect impacts; the sensitivity of the environment; and the nature, extent, frequency, duration and timing of their effects. Apart from continuing agricultural practices in the locality, it is unlikely that there would be other developments, activities or actions that could contribute to cumulative impacts during the operational lifetime of the proposed landfill facility as the Project Site is 12 kilometres from urban development and is in a rural zone.

Habitat Loss and Vegetation Clearing

Impacts to biodiversity resulting from the proposed landfill facility could span timescales that are at least inter-generational, if not permanent. The losses that would occur at the Project Site could also contribute to the already significant level of cumulative loss that has occurred at a regional scale on the New England Tablelands (DEC, 2006).

The proposal would involve clearing which would result in a reduction in the area of woodland and grassland habitat that supports native flora and fauna. Some hollow-bearing trees may be lost in the box-gum woodland in the TSR and stringybark woodland.

Fire

Uncontrolled bushfire may result in temporary loss of habitat and thereby affect the viability of local populations of threatened species and the EEC occurring on the site.

Fragmentation, Edge Effects and Reduced Connectivity

Clearing of parts of the box-gum woodland in the TSR and parts of the stringybark woodland may contribute to fragmentation of woodland habitat in the region with associated edge effects and reduced connectivity.

Weeds

The potential introduction and spread of weeds from the proposed landfill may contribute to the loss of biodiversity through competition from aggressive weed species, provision of food resources and harbour for pest species. Woody weeds with fleshy fruit such as hawthorn, pyracantha and blackberry would encourage fruit eating birds that spread seeds that may damage crops in the nearby olive grove on Strathaven (700 metres to the west of the site) and to the Oxley Wild Rivers National Park (4 kilometres to the south east).

Any potential for the spread of weeds from the landfill site could be associated with soil disturbance and earthworks during the construction and rehabilitation phases of the proposed landfill.

Pest Animals

The potential spread of pest species such as rabbits, foxes, rodents, cats, starlings, crows, flies, fruit-flies and cockroaches from the Project Site could contribute to the loss of biodiversity through competition for resources, direct predation on native fauna or damage agricultural production (such as the olive grove located 700m west of the site).

Disease

The potential spread of animal or plant disease from the proposed landfill facility may contribute to the loss of biodiversity or agricultural productivity, for example, exotic animal diseases like foot and mouth or soil borne plant pathogens which may affect olive trees on surrounding properties.

Increased Abundance of Undesirable Native Species

An increase in aggressive native birds such as pied currawongs, magpies and noisy miners, and carrion eaters such as crows and Australian ravens, that may be displaced by the clearing activities for the landfill facility or that may be attracted to the site during the operation of the proposed landfill facility could impact on less aggressive native birds.

Traffic

Inappropriate traffic speeds on site access roads may increase the risk of collisions with wildlife and also contribute to dust and noise levels.

Dust

Excessive dust may lodge onto plants and reduce photosynthesis and respiration, thereby affecting plant health and carbon sequestration.

Noise

Excessive noise may disturb native fauna and disrupt their feeding and breeding.

Erosion and Sedimentation

Erosion and sedimentation from earthworks in the construction phase may result in loss of top soil or changed drainage conditions thereby affecting vegetation health.

Pollution, Litter and Illegal Dumping

Uncontained litter, such as plastic bags, can be hazardous to wildlife. The Gara TSR at the entrance to the Project Site is vulnerable to illegal dumping which would be detrimental to the local environment and may significantly impact threatened flora and fauna in this EEC.

8.8.16 Mitigation Measures

Mitigation measures are proposed to avoid or ameliorate potential adverse impacts of the proposal on threatened biodiversity. Progressive rehabilitation of the Project Site would aim to recreate a landscape that is compatible with the surrounding land and comparable to pre-existing land use.

Habitat Loss

Habitat loss from the proposed landfill would be mitigated by implementing the following measures:

- Preparation and implementation of a VMP, including rehabilitation, landscaping and revegetation works to occur on the Project Site during construction, operation and post operation phases. This plan would provide actions designed to:
 - Minimise the extent of clearing: clearing should be undertaken in a staged process consistent with operational requirements.
 - Avoid clearing areas not immediately required for operational purposes.
 - Provide appropriate wildlife friendly fencing for regeneration and revegetation areas.
 - Undertake planting for landscaping and vegetated buffers using locally occurring native species. These areas would be established and planted as early as possible in the construction phase.
 - The maintenance of adequate ground cover on all parts of the landfill site not required for day-to-day operations.
 - Tubestock planting/direct seeding undertaken following autumn rains.
 - Progressive rehabilitation and revegetation of spent landfill areas. Spent cells within the proposed landfill footprint would be progressively rehabilitated to stabilise soils.
 - Revegetation along fringes of proposed water storages (sedimentation basin and leachate pond) to encourage use by native mammal, reptile, amphibian and bird species.

- On-going monitoring of the condition of native vegetation in areas likely to be impacted by the proposed development including revegetated areas such as pit rehabilitation works, landscaping, vegetated buffers and other native vegetation communities occurring on the Project Site.
- Application of assisted rehabilitation (selected replanting of shrubs and seeding if feasible), if understorey response is minimal, especially in treeless areas.
- Ongoing monitoring and follow-up control of weeds and pests that establish on disturbed areas, with particular attention to the eradication of noxious weeds and pests, such as rabbits and foxes.

Offsetting is a means by which the biological shortfall between a rehabilitated (stabilised) landscape and a pre-disturbance landscape can be narrowed. It is proposed to set aside an area of stringybark woodland and native grassland adjacent to the proposed landfill footprint at a ratio of 3:1 to offset the area lost to development. That is, the stringybark woodland and native grassland offset areas would be three times that proposed to be cleared for the proposed landfill. Management of the offset area would be adaptive and reviewed every five years. The Biodiversity Offset Management Plan proposed for the development is detailed in **Appendix H** and discussed further in **Section 8.8.17**.

Actions to be implemented as part of the Biodiversity Offset Management Plan would include:

- Appropriate wildlife friendly fencing.
- Revegetation to fill gaps.
- Managed beneficial clearing to thin dense regrowth in accordance with DECCW guidelines for thinning regrowth (**Appendix H**).
- Relocation of logs.
- Weed and pest animal control.
- Ongoing maintenance and monitoring.

These actions would be implemented once the land is purchased to minimise ecological risks from time lags.

Vegetation Clearing and Relocation of Log Piles

Measures to mitigate against the impacts of vegetation clearing and pile relocation include:

- A Vegetation Clearing Protocol and Native Fauna Management Plan which would include:
 - Pre-clearing collection of locally sourced seeds for direct seeding and/or propagation of tubestock.
 - Minimise the extent of clearing with clearing to occur in a staged manner consistent with operational requirements.
 - Clearly mark areas occupied by *Eucalyptus nicholii* and *E. elliptica* prior to any clearing or construction works. A minimum buffer of at least 30 metres would be designated around these species and these areas are to be avoided during construction and operational phases.
 - Identify and, where possible, avoid clearing 'habitat trees' that contain significant hollows likely to be used by native fauna (arboreal mammals, birds and bats).
 - Where possible, retain dead trees and logs on the Project Site that have not been pushed into piles.
 - Locate the access road for the proposed landfill facility in the existing partially cleared area in the western part of the Gara TSR to minimise clearing of the box-gum woodland EEC.
 - The Vegetation Clearing Protocol would form part of the VMP contained within the LEMP.
- A Native Fauna Management Plan which would:
 - Develop a protocol for responding to the detection of native fauna present in trees and log piles prior to clearing operations.
 - Restrict, where practical, tree clearing and log-pile relocation to late summer and autumn to avoid disturbing spring-breeding birds, including the Little Eagle and species that nest in hollows, as well as over-wintering bats.
 - Retain, if possible, the Little Eagle nest tree within the offset area. Should the tree be unable to be incorporated into the offset area, or in case the pair of Little Eagles abandon the current nest site during construction, a tree of similar age and size would be included in the offset area. Construction would approach the nest site gradually from a more distant starting point to minimise impacts.

Fire

Preparation and implementation of a Fire Management Plan for the landfill site as well as surrounding bushland. This plan would provide for:

- Monitoring of fuel loads.
- Fuel reduction such as slashing, controlled grazing, and controlled burning where appropriate.
- No hazard reduction burning in offset areas in line with DECCW's requirements for offset areas.

Fragmentation, Edge Effects and Reduced Connectivity

Measures to reduce the impact of fragmentation, edge effects and reduced connectivity would include:

- Design layout of landscaping, vegetated buffers and other revegetation works to enhance connectivity between patches of remnant vegetation.
- Progressively rehabilitate and revegetate successively cleared sections of the proposed landfill to minimise the impact of fragmentation of stringybark woodland.

Weeds

Measures to limit the impact of weeds would include:

- The preparation and implementation of a Weed Management Plan (WMP) for all stages of the proposal to minimise the spread of weeds within the proposed landfill site and to adjacent areas of native vegetation. The plan would provide actions to:
 - Control existing weed infestations (in particular, blackberry and hawthorn) on the site prior to commencement of the construction phase.
 - Ensure strict enforcement of wheel wash facilities for all vehicles entering or leaving the site to prevent inadvertent transport of weed seeds attached to mud and or other plant material adhering to underside of vehicles.
 - Provide targeted monitoring and control of invasive species that are harmful to threatened species and EEC and other potentially harmful weeds that may impact on potential habitat for these species. In particular, control and monitoring of invasive introduced grasses, such as Coolatai grass, African lovegrass, Serrated tussock, and Chilean needlegrass which may spread from the Waterfall Way and access route to the Project Site.
 - Minimise the abundance of introduced pests (e.g. European red foxes) on the proposed landfill site and stop them accessing adjacent land, as these are known to spread weeds.
 - Stockpile local topsoil and mulch during construction within the landfill footprint in areas already cleared of vegetation for use in landscaping and rehabilitation works.
 - Minimise the volume of imported topsoil to reduce the risk of introducing weed propagules.
 - Minimise use/impacts of herbicides.
 - Control drainage and run-off that may spread weed seeds or high levels of nutrients.

Pest Animals

Measures to reduce the impact from pest animals include the preparation and implementation of an appropriate Pest Management Plan for all stages of the development to minimise the spread of pests from the landfill site to adjacent areas. Management measures would include:

- Appropriate fencing around the landfill.
- Initial and continued poisoning (baiting) of rabbits, foxes and cats over the entire Project Site to reduce population densities to ultimate extinction.
- Following protocols to protect native fauna outlined in the Fauna Management Plan, undertake initial relocation of all the logs in the log piles that provide harbour for rabbits and foxes within the stringybark woodland in the southern section of the study area prior to commencement of construction works.
- Monitor and follow-up control of vertebrate and invertebrate pests (e.g. rabbits and foxes, flies and insect pests which can infest olives e.g., olive lace bug *Froggattia olivinia*, black olive scale *Saissetia oleae*). Given that the proposed biodiversity offset area would be fenced, it is unlikely that the Project Site would give rise to any larger animal impacts on neighbouring olive groves;

- Minimise exposure of waste to pest species by covering it in a timely manner (daily).
- Installation of a wheel wash for vehicles prior to exiting the proposed landfill facility.
- Employ professional exterminators if an outbreak is detected.
- Monitor and follow-up control of rabbits and foxes and other pests.

Disease Monitoring Protocol

Preparation of a Disease Monitoring Protocol and appropriate contingency plans to deal with outbreaks that may be detected at some point in time during the operation of the proposed landfill facility and for a nominal period of at least 5 years after rehabilitation works and decommissioning of the site. The Protocol would identify and monitor pests, diseases and natural enemies and provide management options on the basis of monitoring results.

In the unlikely event that infected material is brought on site, well maintained fencing would minimise the risk of diseases such as foot and mouth being transferred off-site by pest or feral animals.

There are currently few instances of olive tree diseases in Australia and those existing are controlled through either preventative or remedial measures. With respect to the olive grove on the adjacent Strathaven property, it is unlikely that the proposed landfill would give rise to nematodes and soil-borne fungi which may impact on the olive trees on the property given the mitigation measures identified in this section and the preparation and implementation of a Disease Monitoring Protocol (EA Systems 2010, **Appendix E**).

Shelter for Native Ovifauna

The proposal includes mitigation measures which would provide shelter for native birds vulnerable to some offensive native species including:

- The provision of areas for planting and rehabilitation using locally occurring native species particularly shrubs that will provide shelter for small native birds.
- Control of exotic shrubs (e.g. hawthorn, privet) which provide food for aggressive native species.

Traffic

Speed limits would be applied to the access road and internal perimeter road and would be low in the box-gum woodland where koalas may occur. Appropriate speed control signage would be constructed on roads associated with the proposed landfill facility.

Dust

Dust suppression measures would be incorporated into the final LEMP for all stages of the development.

Noise

A CNMP would provide measures to control noise emissions during construction. Noise abatement measures during operation would be detailed in the final LEMP (see **Section 8.7**).

Erosion and Sedimentation

An ESCP would be prepared as part of the final LEMP for all stages of the development (see **Section 8.1**).

Pollution, Litter and Illegal Dumping

The preparation and implementation of an appropriate Pollution and Litter Management Plan for the operation of the landfill would include:

- Placement of signage specifying no illegal dumping.
- Promotion of community awareness of the biodiversity value of Gara TSR, which has been identified as key habitat by the NPWS, by placing signage similar to "Significant Roadside Environment" at the entrance to the proposed landfill facility.

8.8.17 Offset Management Strategy

DECCW defines a biodiversity offset as:

one or more appropriate actions that are put in place to counterbalance specific impacts on biodiversity.

The proposal would result in the loss of native vegetation and habitat and as such an appropriate offset (compensatory habitat) is proposed at a 3:1 ratio. The offset area would be contained within the Project Site and would enable direct and intensive management of the offset, minimising the disturbance and relocation distance for some older and hollow-bearing trees and associated habitats.

The proposed landfill facility would result in approximately 20 hectares of vegetation being cleared, including 12.7 hectares of regrowth stringybark woodland, 0.6 hectares of box-gum woodland in the TSR, 6.5 hectares of cleared grassland and 0.5 hectares of sedgeland. An offset area of approximately 61 hectares of land is proposed, comprising 40 hectares of stringybark woodland and 21 hectares of grassland. The stringybark woodland offset areas would be located in the southern part of the Project Site and would form part of an existing remnant of stringybark woodland. Offset grassland areas would be located in the northern part of the Project Site. The offset area is shown on **Figure 23** and the Biodiversity Offset Management Plan that would be implemented is detailed in **Appendix H**.

The proposed compensatory offset areas would surround the proposed landfill footprint and connect to the TSR (as shown on **Figure 23**). The development of a vegetation buffer along this corridor would improve the condition of vegetation at the site through increased connectivity to the Gara Remnant Subregional Corridor (refer Figure 2 of **Appendix H**). Rehabilitation of the site would also provide connectivity between remnant woodlands within the Project Site.

The offset area and Biodiversity Offset Management Plan have been prepared in accordance with the recommendations of the DECCW principles for biodiversity offsetting (refer **Appendix H**). Confirmation of the 3:1 offset ratio and accordance with the DECCW principles for offsetting was received from the then DECC in September 2008 (refer **Appendix A**).

The management approach for the proposed landfill offset area is outlined in the sections below and summarised in the SoC (**Section 9.3**).



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Fencing and Removal of Livestock

Fencing would ensure removal of livestock from the offset area which would substantially improve vegetation, reduce soil compaction, improve soil water availability and enhance plant species richness. The offset area would be fenced and a cattle grid would be built into the access road to prevent cattle movement.

Rehabilitation and Revegetation

Following closure of the landfill, the site would be rehabilitated and revegetated with plant species consistent with the site's pre-existing condition. Revegetation works would include a two year maintenance period and weed control for at least a five year period post-usage of the landfill.

Rehabilitation of offset areas would include:

- Fencing to exclude livestock.
- Ground preparation activities including deep ripping to increase water infiltration and to allow greater root penetration.
- Planting of seeds and saplings (where available) from the site.
- Tree guards (where required) to protect young plants.
- Selected replanting to be undertaken if necessary if understorey regeneration is not satisfactory after one year.

Areas that are not immediately required for operational purposes would not be cleared until necessary, with cells 4 and 5 unlikely to be cleared for at least 30-40 years. Rehabilitation of the landfill footprint would include:

- Progressive rehabilitation of spent cells.
- Topsoil preparation and management (with top soil stored for up to 3 years).
- Planting of tube stock, direct seeding and natural regeneration.
- After one year the survival rates of plants would be assessed and dead plants replaced.
- Adaptive management depending on native flora and fauna response.

Vegetation buffers would be planted along the access road. Buffer planting would be designed to supplement existing native stands and enhance connectivity between patches of remnant vegetation, including the TSR. Native trees and shrubs would be planted to mimic the natural landscape. Planted buffer areas would be maintained for 24 months, with any losses being replaced.

Removal of Mature Trees

Removal of mature trees within the landfill footprint would be limited to the minimum necessary for safe construction. Prior to removal of hollow-bearing trees, hollows would be checked for nestlings and arboreal mammals. All fauna found would be relocated to the offset area.

Weed Control

The management of weeds would be undertaken as required under the *Noxious Weeds Act 1993*. Weed control would involve spot-spraying and thinning/slashing/pulling of noxious weeds where required, and would continue for up to 5 years after planting/seeding of offset areas and spent landfill cells. The following measures would be considered to prevent the spread of weeds:

- Wash down of vehicles in a dedicated area where runoff can be contained.
- Ensure all imported materials to the site are free of weed and disease.
- Avoid transport of topsoil.
- Monitor and control weeds following ground disturbance.
- Appropriate control of drainage and runoff.

Feral Animal Control

Reduction of rabbits through habitat modification would help to control fox and potential cat populations in the area. Other feral animal control measures include:

- The removal of log piles to reduce available harbour for these species.
- Covering waste in a timely manner to reduce exposure.

Relocation of Dead Wood and Dead Trees

Hollow-bearing trees and stags would be relocated to the offset area as logs or erected as stags (if feasible).

Enhancing Structural Complexity

Structural complexity is considered to be a measure of the presence and relative abundance of characteristics such as the number and type of flora species, foliage arrangement, canopy cover, tree diameter and height, tree spacing, understorey vegetation and deadwood. Structurally complex vegetation would support a greater diversity of species.

To re-establish structural complexity and layers of vegetation in the offset area, the following measures would be considered:

- Selecting a mixture of plant species for regrowth.
- Selecting plants that grow to different heights (including different sized trees, shrubs and groundcover species).
- Spacing trees and shrubs at irregular distances.
- Ensuring complex groundcover is provided (including fallen logs and debris).

Monitoring

On-going annual monitoring would include:

- Establishment of plots for ongoing vegetation monitoring.
- Monitoring vegetation regeneration (diversity assessment).
- Monitoring groundcover.
- Photo points.
- Reporting.
- Details of proposed monitoring are included in the Biodiversity Offset Management Plan (**Appendix H**).

8.8.18 Conclusions

The stringent controls to be implemented, the potential eradication of introduced species from the site and the inclusion of approximately 61 hectares of offset compensatory habitat would provide adequate mitigation to ensure there would be no net loss of biodiversity. With the proposed mitigation measures and Biodiversity Offset Management Plan, it is concluded that the proposal would have no long term significant impacts on biodiversity.

8.9 Socio-Economic

8.9.1 Existing Environment

Population

Armidale Dumaresq LGA has experienced moderate growth since the last population census in 2006, with a population increase of 1.6% between 2007-08. The estimated resident population at 30 June 2008 was in the order of 25,000 for the LGA.

Analysis of the age structure of the Armidale Dumaresq LGA in 2006 compared to the State shows Armidale has a relatively younger population than the NSW average with a higher percentage of the population aged under 24, and fewer adults aged over 25 compared with NSW (refer **Table 58**). The median age is significantly lower than NSW at 34 years of age compared to the NSW average of 37.