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Preliminary Ecological Assessment

**Avonbank Heavy Mineral Sands Project
Horsham, Victoria**

**Prepared for:
WIM Resources Pty Ltd**



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Document Information


Preliminary Ecological Assessment of the Avonbank Heavy Mineral Sands Project
Horsham, Victoria

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Document Control

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Summary

Okologie Consulting was engaged by WIM Resource Pty Ltd to undertake a preliminary ecological assessment for the Avonbank Heavy Mineral Sands project, Horsham, Victoria.

The preliminary assessment was required to determine the extent of native vegetation and ascertain the presence of any listed threatened flora and fauna species, and associated habitats within the project area. The assessment outcome will inform the opportunities and constraints associated with future project works.

The majority of the project area was highly modified from previous and current agricultural use, with areas of private land cropped or cultivated. Native vegetation has been largely cleared from the project area, and was limited to isolated remnant patches of Plains Woodland, Plains Savannah and Plains Grassland and scattered trees in paddocks or along road reserves.

One State listed threatened flora species (*Buloke Allocasuarina luehmannii*) was recorded during the field assessment. There is a low likelihood of occurrence for any additional listed threatened flora species within the project area due to the highly modified condition of habitat. No listed threatened fauna species were recorded during the assessment. However, Buloke trees provide critical feeding habitat for the Endangered Red-tail Black Cockatoo *Calyptorhynchus banksii graptogyne*, and there is a moderate likelihood of occurrence for this species within the project area.

Remnant patches of Plains Savannah and Plains Woodland within the project area are attributed to the *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions* ecological community listed as Endangered under the *Environment Protection Biodiversity Conservation Act 1999*. It is recommended that WIM Resource review the requirement for a referral to the Commonwealth Environment Minister based on the likelihood of a significant impact on a Matter of National Environmental Significance (*Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions* ecological community).

One listed *Flora and Fauna Guarantee Act 1988* listed Threatened flora species (Buloke) occurs throughout the project area in remnant patches and as scattered trees. A permit application will be required from the Department of Environment, Land, Water and Planning to remove this species from areas of public land (i.e. road reserves).

The proposed removal, destruction or lopping of any native vegetation will require a permit under Clause 52.17 (Native Vegetation) of the Horsham Planning Scheme (unless an exemption applies). The proposed removal of native vegetation also requires a Risk-based Biodiversity Assessment under the *Permitted clearing of native vegetation - Biodiversity assessment guidelines*. It is recommended that project design applies the principles of 'avoid and minimise' to reduce impacts to native vegetation as much as practicable.



1 Introduction

1.1 Project Background

Okologie Consulting was engaged by WIM Resource Pty Ltd to undertake a preliminary ecological assessment for the Avonbank Heavy Mineral Sands project, Horsham, Victoria.

The assessment was required to determine the extent of native vegetation and ascertain the presence of any listed threatened flora or fauna species or associated habitats within the project area.

Okologie Consulting (2016) previously prepared a desktop assessment, which informed the requirement for a site assessment. This report summarises the findings of the ecological assessment and discusses environmental legislation and policy implications associated with future works.

1.2 Objectives

The objectives of the assessment were to:

- Identify and assess terrestrial ecological values (i.e. vegetation communities, flora and fauna species and associated habitats) within the project area.
- Ensure ecological values are identified in the early planning phase.
- Identify environmental legislation and policy requirements.

1.3 Site Description

The project area covers 6,545 hectares and is located approximately nine kilometres northeast of the Township of Dooen (Figure 1). It is bound by private property to the north, Drung-Jung Road to the east, Longerenong Road to the south and Henty Highway to the west.

The majority of the project area occurs on private properties used for agricultural purposes (primarily cropping and grazing). Native vegetation has been largely cleared from the project area, and was limited to isolated remnant patches and scattered trees in paddocks or along road reserves. The topography is generally flat or comprises low undulating slopes. Surface soils generally comprise brown medium-heavy clays in the southern section and light-medium clays in the northern section of the project area.


The project area falls within the Wimmera bioregion, the Wimmera Catchment Management Authority boundary and the Horsham Rural City municipality. The

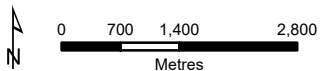


Native Vegetation Location Risk mapping shows the project area occurs within Location A, with several small sections mapped as Location C (DELWP 2017a).

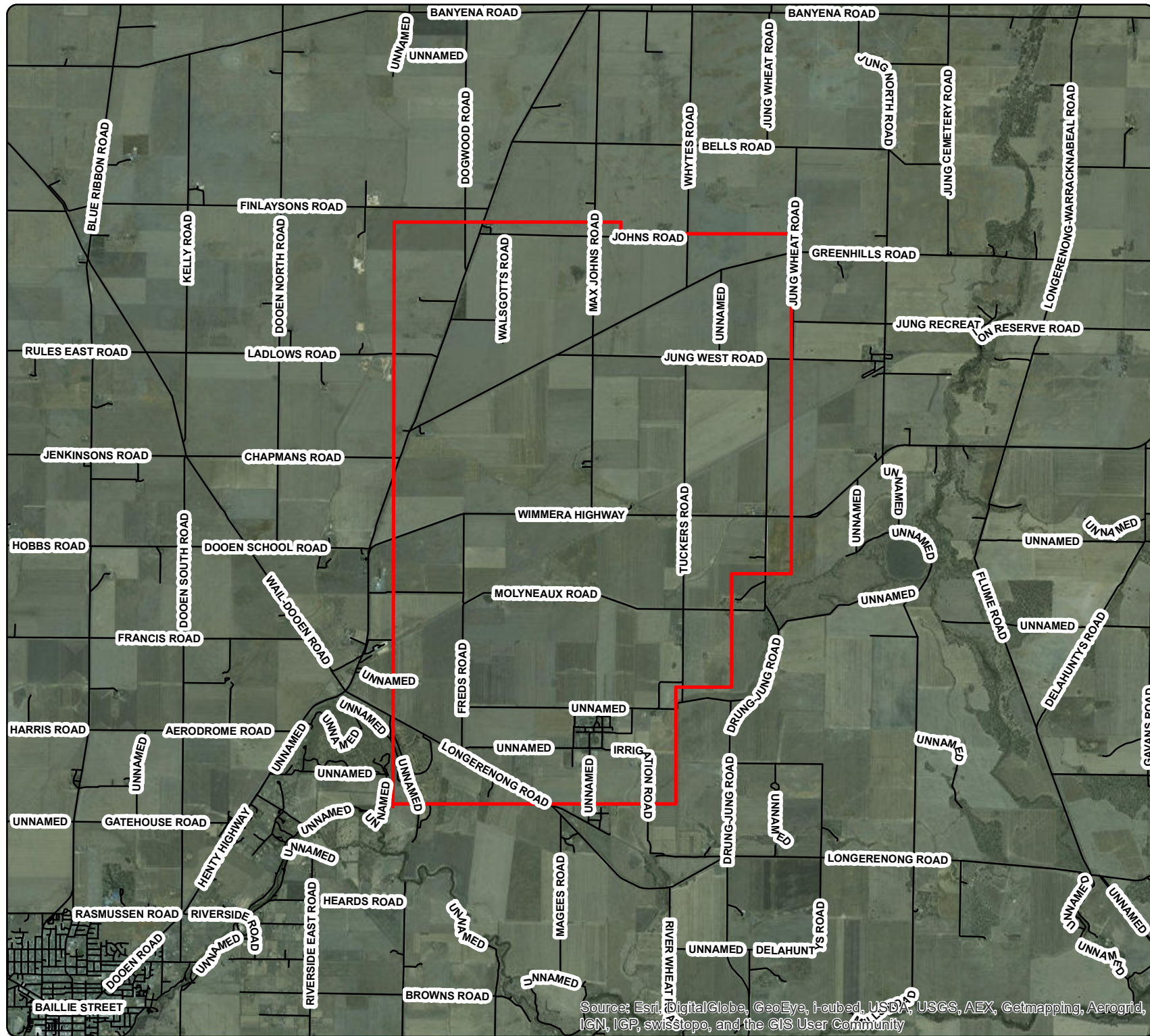
The majority of the project area is zoned Farm Zone (FZ), with Wimmera and Henty Highway zoned Road Zone – Category 1 (RDZ1). It is not subject to any environmental overlays under the Horsham Planning Scheme (DELWP 2017b).

Figure 1
Site Location
 Avonbank Mineral
 Sands Project

Legend
 Subject Site



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Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



2 Methodology

2.1 Species Information

Scientific and common names of flora species follow the Australian Plant Census (Australian National Botanic Gardens 2017). The names of terrestrial vertebrate fauna follow the Victorian Biodiversity Atlas (VBA) (DELWP 2017c). Vegetation communities follow the Ecological Vegetation Class (EVC) bioregion benchmarks (DELWP 2017a).

Native flora and fauna species referred to as 'threatened' include species:

- Listed as critically endangered, endangered or vulnerable under the *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act) (DoEE 2017).
- Listed as Threatened under the *Flora and Fauna Guarantee Act 1988* (FFG Act) (DELWP 2015a).
- Listed as critically endangered, endangered, vulnerable or rare on Victoria's rare or threatened flora and fauna advisory lists (DEPI 2014a; DSE 2013).

2.2 Desktop Assessment

A desktop assessment was undertaken of relevant databases and other resources, including:

- The Biodiversity Interactive Map for modelled biodiversity data (DELWP 2017a).
- Planning Schemes Online for planning information (DELWP 2017b).
- The VBA for threatened flora and fauna species records (DELWP 2017c).
- The Protected Matters Search Tool (PMST) for information relating to Matters of National Environmental Significance (MNES) (listed species and communities) under the EPBC Act (DoEE 2017).
- Relevant environmental legislation, policies and strategies.

2.3 Field Assessment

The field assessment was undertaken between 8 and 10 March 2017, to determine the extent of native vegetation and ascertain the presence of any listed threatened species or species habitats with the project area. The assessment was undertaken on foot and by vehicle, including all road reserves throughout the project area. Note that cropped paddocks were generally not surveyed and access to several properties was not permitted during the field survey.

Vegetation mapping of the site included mapping vegetation polygons and points with a Trimble Juno differential GPS (accuracy \pm one metre post processing), with



coordinates recorded to GDA 94 (WGS 84). EVCs were determined by reference to the relevant bioregion pre-1750 and extant EVC mapping and benchmarks descriptions (DELWP 2017a), and review of remnant vegetation in the local area.

2.4 Biodiversity Assessment Guidelines

The *Permitted clearing of native vegetation – Biodiversity assessment guidelines* (the Guidelines) outlines how impacts on biodiversity should be considered when assessing a permit application to remove, lop or destroy native vegetation under Clause 52.17 (DEPI 2013a).

The objective for permitted clearing of native vegetation is that it results in no net loss, or a neutral impact on Victoria's biodiversity. This is achieved in part by either avoiding or minimising native vegetation removal, so that all or some of the removal of native vegetation does not occur. When native vegetation removal is permitted, an offset must be secured which achieves a no net loss outcome for biodiversity. To achieve this the offset makes a contribution to Victoria's biodiversity that is equivalent to the contribution made by the native vegetation that was removed (DEPI 2013a).

The definition of native vegetation in Clause 72 of the Victoria Planning Provisions is *plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses* (DELWP 2015b).

Under the Guidelines native vegetation is classified as a *remnant patch* or a *scattered tree*.

A remnant patch of native vegetation (measure in hectares) is either:

- An area of native vegetation¹, with or without trees, where at least 25 per cent of the total perennial understorey plant cover is native plants.
- An area with three or more indigenous canopy trees where the tree canopy cover is at least 20 per cent.

Scattered tree

- An indigenous canopy tree² that does not form part of a remnant patch (DEPI 2013a).

¹ An area of native vegetation is defined as *continuous and unbroken native vegetation*. A break in remnant patch will occur where the definition of remnant patch has not been met for a continuous width of at least 10 metres (DEPI 2013a).

² DEPI defines a scattered tree as *A canopy tree is a mature tree that is greater than three metres in height and is normally found in the upper layer of a vegetation type or A standing dead tree with a trunk diameter of 40 cm or more at a height of 1.3 metres above the ground* (DELWP 2015b).



The native vegetation permitted clearing regulations have been designed to manage the risk to biodiversity associated with removing native vegetation. There are three risk-based pathways for assessing an application for a permit to remove native vegetation: low risk, moderate risk and high risk. The risk-based pathway is determined by combining the extent risk and the location risk of the native vegetation proposed to be removed (DEPI 2013a) (Table 1).

Table 1: Risk-based pathways for remnant patches and scattered trees

For remnant patch		Location		
Extent*		Location A	Location B	Location C
< 0.5 hectares		Low	Low	High
≥ 0.5 hectares and < 1 hectare		Low	Moderate	High
≥ 1 hectare		Moderate	High	High
For scattered trees		Location		
Extent*		Location A	Location B	Location C
< 15 scattered trees		Low	Moderate	High
≥ 15 scattered trees		Moderate	High	High

Source: DEPI (2013a)

2.5 Limitations

The preferred survey period for undertaking vegetation assessments in Victoria is spring, which maximises the likelihood of detecting all flora species within a site. Flora surveys provide a valuable ‘snapshot’ of vegetation at a point in time; however, the limitations of seasonal influence (autumn) on the presence/absence of flora species (particularly annuals or cryptic species) must be considered. The short duration of the assessment limited the opportunity to observe migratory, transitory or uncommon fauna species.

Note that access to several properties was not permitted during the field survey and the presence of native vegetation was observed from the property boundary, and mapped onto an aerial photograph. If future project works is required on these properties, a detailed site assessment will be required determine potential impacts to native vegetation.

The information outlined in this report relies on the accuracy of ecological database information, GIS layers and spatial imagery. To minimise potential errors, the most current available data was obtained from relevant sources.

The Department of Environment, Land, Water and Planning (DELWP) bioregion and EVC mapping are subject to inherently broad environmental and ecological parameters used in the mapping process. Where the observed EVC was not reflective of what would be expected from EVC mapping and classification, it was attributed to the most appropriate EVC based on combination of its floristic, life form and ecological characteristics, and particular environmental conditions.



3 Results

3.1 Ecological Vegetation Classes

The Biodiversity Interactive Map modelling indicates that pre-1750 EVC mapping for the project area would have predominantly comprised of Plains Grassland (EVC 132), Plains Savannah (EVC 862), Plains Woodland (EVC 803), Sand Ridge Woodland (EVC 264) and Riverine Chenopod Woodland (EVC 103), with Cane Grass Wetland (EVC 291) in the immediate surrounds. Extant (2005) EVC mapping shows the project area contains a sparse cover of Plains Grassland, Plains Savannah, Plains Woodland, Sand Ridge Woodland and Riverine Chenopod Woodland (DELWP 2017a).

Remnant indigenous vegetation within the project area was attributed to Plains Woodland, Plains Savannah and Plains Grassland based on floristic, life form, ecological characteristics and soil type (Figures 2a to 2r).

3.2 Vegetation Condition

The project area was highly modified from previous and current agricultural use, with the majority of land cropped or cultivated. Native vegetation has been largely cleared from the project area, and was limited to isolated remnant patches of Plains Woodland, Plains Savannah and Plains Grassland and scattered trees in paddocks or along road reserves (Figures 2a to 2r). A description of the vegetation types observed during the assessment is outlined below.

Plains Woodland

Plains Woodland is described as *grassy or sedgy woodland to 15 metres tall with large inter-tussock spaces potentially supporting a range of annual or geophytic herbs adapted to low summer rainfall, with low overall biomass. Mostly occurs on terrain of low relief in areas receiving <600 mm rainfall per annum* (DELWP 2017a).

Plains Woodland along Molyneaux Road comprised isolated, fragmented patches dominated by Black Box *Eucalyptus largiflorens* to 15 metres tall (Plate 1) (Figure 2o). The shrub layer was generally absent and the ground layer comprised a highly modified cover of exotic species such as Wimmera Rye-grass *Lolium rigidum*, Great Brome *Bromus diandrus*, Bearded Oat *Avena barbata*, Barley-grass *Critesion murinum*, Onion Grass *Romulea rosea*, Squirrel-tail Fescue *Vulpia bromoides* and Horehound *Marrubium vulgare*. Indigenous species present included Tangled Lignum *Duma florulenta*, Wingless Bluebush *Maireana enchylaenoides*, Nodding Saltbush *Einadia nutans* and Black Roly-poly *Sclerolaena muricata* (<5% cover) (Plate 2).

Plains Woodland north of John Road (Figure 2c) comprised a modified cover of Buloke, Black Box, Yellow Gum *Eucalyptus leucoxylon* and Grey Box *Eucalyptus microcarpa*.



The understorey was highly modified and dominated by exotic grasses and herbs including Wimmera Rye-grass, Great Brome, Bearded Oat, Barley-grass, Horehound and Bathurst Burr *Xanthium spinosum*.

Plains Savannah

Plains Savannah is described as *structurally diverse vegetation, which includes 'grassy openings' of a few to many hundreds of hectares, with a variable tree density ranging from a very sparse savannah to woodland. The relative absence of eucalypts is particularly characteristic, with Buloke and perhaps Slender Cypress-pine to 10 metres tall being the dominant trees* (DELWP 2017a).

Plains Savannah was generally present as isolated, fragmented patches in cropped paddocks, dominated by Buloke *Allocasuarina luehmannii* to 10 metres tall (Plate 3). The understorey was highly modified and comprised a dense cover (70-90%) of exotic Bearded Oat, Barley-grass, Wimmera Rye-grass, Great Brome, Onion Grass, Horehound and Capitulate Rush *Juncus capitatus*. Indigenous species present included emergent Buloke shrubs, Brown-back Wallaby-grass *Rytidosperma duttonianum*, Rough Spear-grass *Austrostipa scabra*, Nodding Saltbush and Black Roly-poly (~5% cover) (Plate 4).

Scattered Buloke trees present in paddocks were also attributed to Plains Savannah (Plates 5 and 6).

Plains Grassland

Plains Grassland is described as *treeless vegetation dominated by largely grass and herb life forms. Shrubs and trees may be also occasionally present* (DELWP 2017a).

Greenhills Road reserve contained a modified cover of Plains Grassland that has been subject to varying levels of disturbance from cultivation and weed invasion (Figures 2c and 2d). It generally comprised a simplified cover (30-70%) of native Rough Spear-grass, Spurred Spear-grass *Austrostipa gibbosa*, Common Wallaby-grass *Rytidosperma caespitosum*, Spider Grass *Enteropogon acicularis* and Rigid Panic *Whalleya prolata*, with Wingless Bluebush and Ruby Saltbush *Enchylaena tomentosa* also present (Plate 7). Exotic species present included Wimmera Rye-grass, Great Brome, Bearded Oat, Barley-grass, Capitulate Rush, Ox-tongue *Helminthotheca echioides*, Couch Grass *Cynodon dactylon*, Cat's Ear *Hypochoeris radicata*, Ribwort *Plantago lanceolata*, Burr Medic *Medicago polymorpha*, Common Peppergrass *Lepidium africanum* and Bathurst Burr.

A modified cover of Plains Grassland was also present along sections of Henty Highway and Wimmera Highway road reserves (Figures 2e and 2k).

Predominantly Introduced Vegetation



The majority of road reserves throughout the project area were highly modified and dominated by exotic weed species such as Wimmera Rye-grass, Great Brome, Bearded Oat, Barley-grass, Capitata Rush, Ox-tongue, Couch Grass, Cat's Ear, Ribwort, Burr Medic, Bathurst Burr, Kikuyu *Cenchrus clandestinus* and *Paspalum dilatatum*. A sparse cover (<5%) of indigenous grasses Rough Spear-grass and Common Wallaby-grass were occasionally present in these areas (Plate 8). Areas of planted native trees and shrubs with an exotic dominated understorey were present along windrows, property boundary and road reserves (Plate 9). This vegetation is mapped as Predominantly Introduced Vegetation (Figures 2a to 2r).

Cropped and cultivated paddocks were generally devoid of any indigenous vegetation (Plate 10).

3.3 Threatened Flora Species

The VBA (DELWP 2017c) contains records of 17 listed threatened flora species in local area (within a five kilometre radius of the site). The PMST (DoEE 2017) identified 10 EPBC Act listed flora species or species habitats as likely to occur within the local area (within a five kilometre radius of the site). The Biodiversity Interactive Map (DELWP 2017a) contains records of four state listed threatened flora species within the site (Buloke *Allocasuarina luehmannii*, Weeping Myall *Acacia pendula*, Winged New Holland Daisy *Vittadinia pterochaeta* and Hairy Tails *Ptilotus erubescens*).

One state listed threatened species (Buloke) was recorded within the project area, as scattered trees and within remnant patches of native vegetation. There is a low likelihood of occurrence for any additional listed threatened flora species within the project area due to the highly modified condition of habitat (Appendix 3).

3.4 Threatened Fauna Species

No listed threatened fauna species were recorded during the field assessment. The VBA (DELWP 2017c) contains records of 20 listed threatened fauna species in the project area. The PMST (DoEE 2017) identified 16 EPBC Act listed fauna species (terrestrial) or species habitats as likely to occur within the project area.

The Biodiversity Interactive Map (DELWP 2017a) contains records of one listed threatened fauna species (Grey Falcon *Falco hypoleucos*) within the project area. This species is likely to occur within the project area on an occasional basis.

Red-tail Black Cockatoo *Calyptorhynchus banksii graptogyne* has been recorded south west of Horsham. While there are no records within the local area, Buloke trees (i.e. Plains Savannah) have been identified as providing critical feeding habitat in the southern Wimmera, and Buloke seed is only available between January and March



(Swift 2017). There is a moderate likelihood of occurrence for Red-tail Black Cockatoo within the project area.

There is a low likelihood of occurrence for any additional listed threatened fauna species within the project area due to the highly modified condition of habitat (Appendix 4).

3.5 Fauna Habitat

The site supports three main habitat types: woodland, grassland and planted vegetation. A description of each habitat type is outlined below.

Woodland Habitat

Woodland habitat was attributed to Plains Woodland and Plains Savannah as these EVCs support a similar habitat component for a range of fauna species, and is of moderate habitat value.

The composition, cover and structure of woodland habitat provides perching, roosting and foraging habitat for a wide range of native bird species such as Brown Thornbill *Acanthiza pusilla*, Grey Fantail *Rhipidura albiscapa*, New Holland Honeyeater *Phylidonyris novaehollandiae*, Grey Shrike-thrush *Colluricincla harmonica*, Galah *Eolophus roseicapilla*, Welcome Swallow *Hirundo neoxena*, Willie Wagtail *Rhipidura leucophrys* and Superb Fairy-wren *Malurus cyaneus*. Mature trees with hollows also provides habitat for mammals Brush-tailed Possum *Trichosurus vulpecular* and Common Ring-tailed Possum *Pseudocheirus peregrines*, and hollow dependent birds Crimson Rosella *Platycercus elegans* and Rainbow Lorikeet *Trichoglossus moluccanus*.

Grassland Habitat

Grassland habitat provides suitable foraging habitat for several native bird species such as Stubble Quail *Coturnix pectoralis*, Australasian pipit *Anthus novaeseelandiae*, Australian Magpie *Cracticus tibicen*, Nankeen Kestrel *Falco cenchroides*, Australian Pratincole *Stiltia isabella*, and Banded Lapwing *Vanellus tricolor*.

Planted Vegetation

Planted trees (i.e. Sugar Gum) provide habitat for common birds associated with modified habitats including Australian Raven *Corvus coronoides*, Brown Falcon *Falco berigora*, Magpie-lark *Grallina cyanoleuca*, Sulphur-crested Cockatoo *Cacatua galerita* and Australian Magpie. Planted shrubs provide habitat for smaller passerine birds such as Grey Fantail, Welcome Swallow, Willie Wagtail and Brown Thornbill.



3.6 Threatened Ecological Communities

Commonwealth Listed Ecological Communities

Review of the PMST (DoEE 2017) identified four EPBC Act listed threatened ecological communities may or are likely to occur within the local area, including:

- *Natural Grasslands of the Murray Valley Plains* (Critically Endangered).
- *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (Critically Endangered).
- *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia* (Endangered).
- *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions* (Endangered).

Two EVCs, Plains Savannah and Plains Woodland, present within the project area are attributed to the *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions* ecological community. The ecological community is described as Buloke being the structurally dominant or co-dominant tree. Other prominent trees in this community include Black Box, Grey Box, Yellow Box, Slender Pine *Callitris gracilis* and Murray Pine *Callitris glaucophylla* (Cheal *et al.* 2011). Generally, the condition and quality of this ecological community within the project area is moderate to poor due to the simplified indigenous species cover and exotic dominant understorey.

As there are no qualitative threshold levels used to define this community, all remnant patches of Plains Savannah and Plains Woodland within the project area (covering 52 hectares) are considered to form the *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions* ecological community (Figures 2a to 2r).

The *Natural Grasslands of the Murray Valley Plains* (NGMVP) ecological community is attributed to Plains Grassland EVC. While remnant patches of Plains Grassland along Greenhills Road reserve meet the key diagnostic characteristics (Table 2), it does not meet all of the required condition thresholds and to be considered the NGMVP ecological community (Table 3).

Table 2: Key Diagnostic Characteristics for NGMVP

Key Diagnostic Characteristics	Response	Criteria
Distribution is primarily in the Riverina Bioregion and the Wimmera plains of the Murray Darling Depression Bioregion	The site occurs within the Victorian Volcanic Plain bioregion over basalt soils.	Meets criteria
It typically occurs on a landscape of flat alluvial lowland plains with heavy-textured grey, brown and red clays	Areas of Plains Grassland occur on alluvial lowland plains with brown medium-heavy clay soils	Meets criteria



Key Diagnostic Characteristics	Response	Criteria
<p>The ecological community is typically dominated by a range of perennial grasses and/or forbs or co-dominated by small shrubs. Sites are not necessarily dominated by any particular plant species. Characteristic species present typically include:</p> <ul style="list-style-type: none"> grasses – <i>Rytidosperma</i>, <i>Austrostipa</i>, <i>Chloris</i> and <i>Enteropogon</i>. forbs – <i>Arthropodium</i>, <i>Bulbine</i>, <i>Calotis</i>, <i>Chrysocephalum</i>, <i>Leptorhynchos</i>, <i>Minuria</i>, <i>Ptilotus</i>, <i>Sida</i> and <i>Swainsona</i>. small shrubs – <i>Atriplex</i> and <i>Maireana</i>. 	<p>The dominant grass species is Rough Spear-grass, Spurred Spear-grass, Common Wallaby-grass and Spider Grass. No herbs were present. Small shrubs present included Wingless Bluebush.</p>	<p>Meets criteria</p>

Table 3: Condition Thresholds for NTGVVP

Condition Thresholds	Response	Criteria
<ul style="list-style-type: none"> The percentage cover of native vascular plants (annual and perennial) in the patch is greater than the percentage cover of perennial exotic species, and; Category B. For larger patches that have good ground layer diversity: This applies where patches of the ecological community do not meet the high diversity or lack of disturbance criteria in Category A, but still retain sufficient elements of their natural diversity. <p>Ground layer diversity:</p> <ul style="list-style-type: none"> B1. 10 or more native vascular plant species are present in the patch. <p>AND</p> <p>Patch size:</p> <ul style="list-style-type: none"> B2. The size of the grassland patch is at least 1 ha or more in size (i.e. at least 10 000 m² or a 100m x 100m square or equivalent area in any shape). 	<ul style="list-style-type: none"> Native species cover in Plains Grassland is >50% Less than 10 native plant species were present in the patch (7 species present) (criteria not met) The patch size is <1ha 	<ul style="list-style-type: none"> Meets criteria Does not meet criteria Does not meet criteria

Source: Threatened Species Scientific Committee (2012)

State Listed Ecological Communities






Areas of Plains Grassland within the project area (Figures 2c-2d and 2e-2k) meet the criteria for *Northern Plains Grasslands Floristic Community 210*, listed as a Threatened community under the FFG Act (DELWP 2015a).

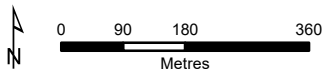
Figure 2a

Ecological Values

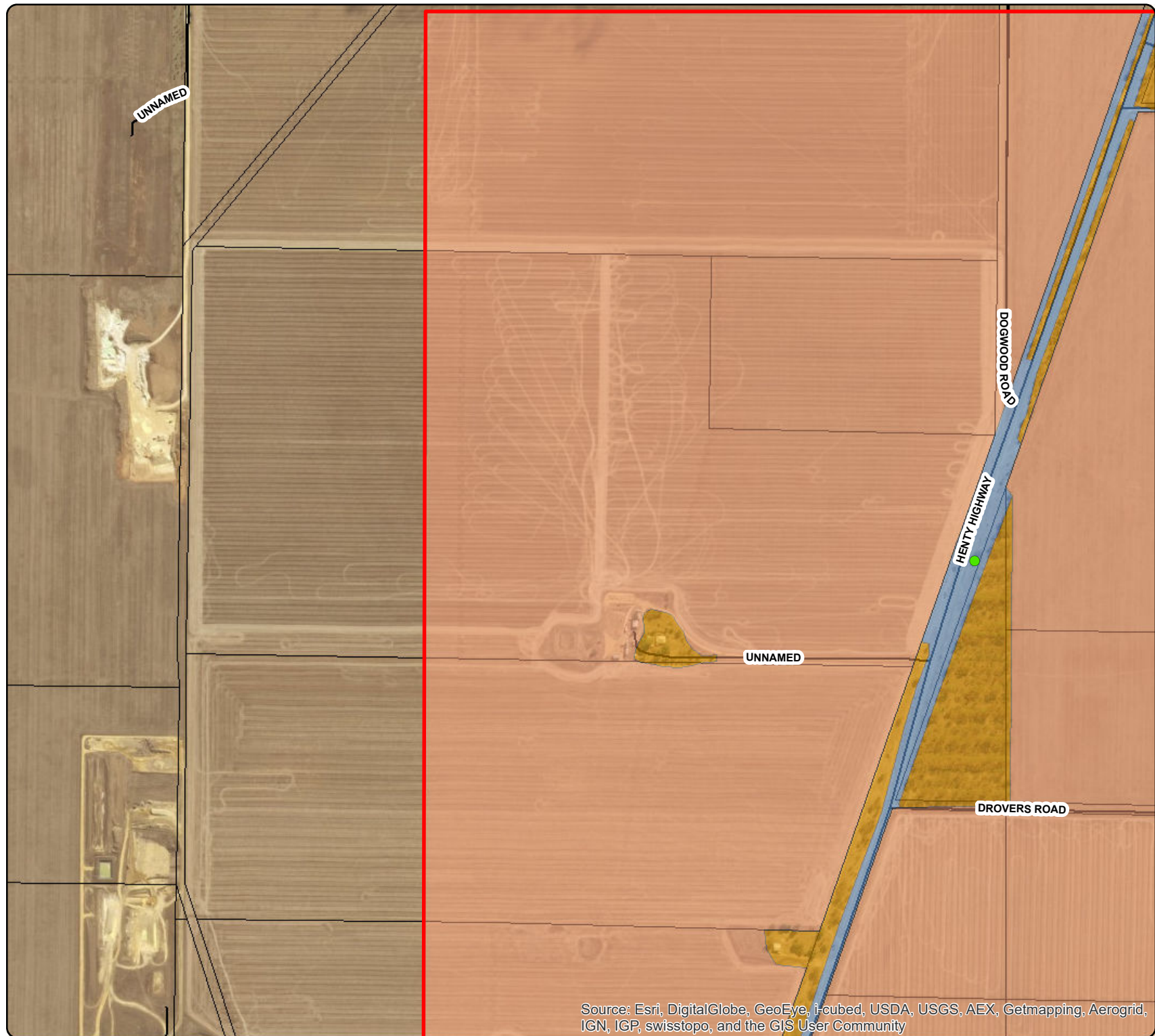
Avonbank Mine Project

Legend

-  Subject Site
-  Cropped Vegetation
-  Planted Vegetation
-  Predominantly Introduced Vegetation
-  Scattered Tree



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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

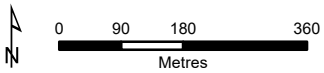
Figure 2b

Ecological Values

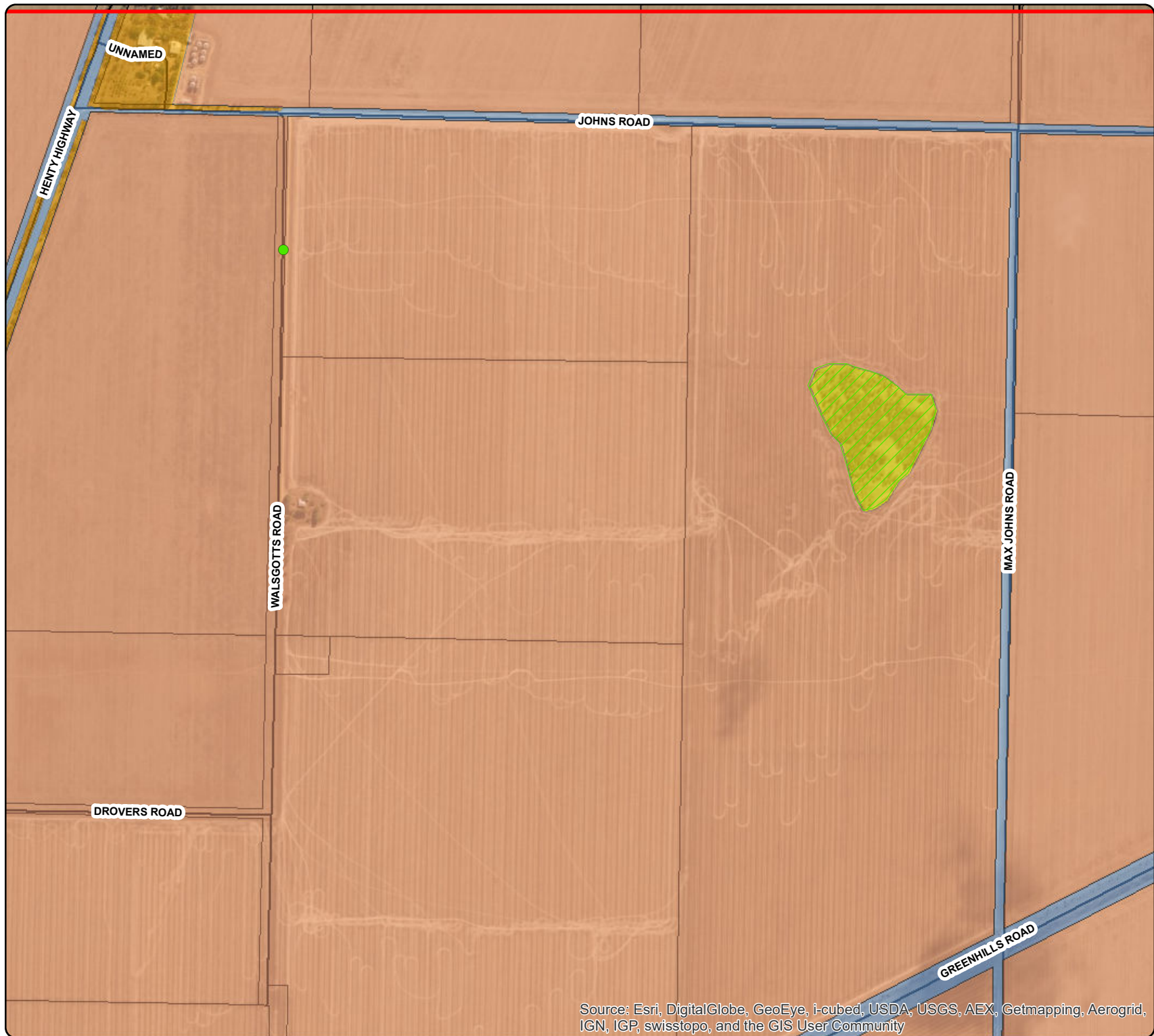
Avonbank Mine Project

Legend

- Subject Site
- Cropped Vegetation
- Plains Savanagh
- Planted Vegetation
- Predominantly Introduced Vegetation
- Scattered Tree
- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions



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


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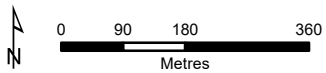
Figure 2c

Ecological Values

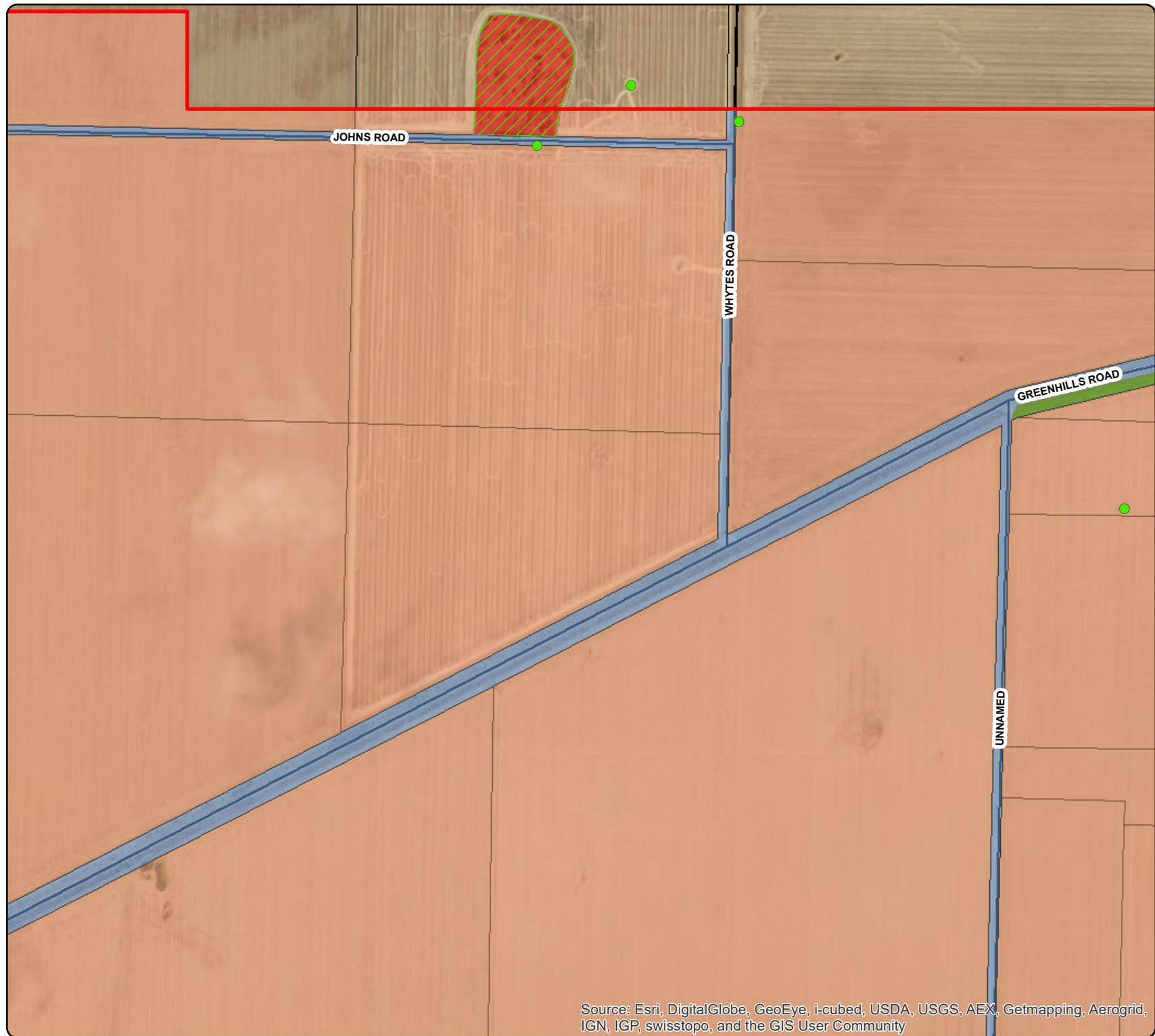
Avonbank Mine Project

Legend

-  Subject Site
-  Cropped Vegetation
-  Plains Grassland
-  Plains Woodland
-  Predominantly Introduced Vegetation
-  Scattered Tree
-  Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions



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


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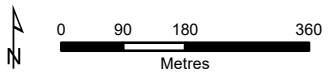
Figure 2d

Ecological Values

Avonbank Mine Project

Legend

-  Subject Site
-  Cropped Vegetation
-  Plains Grassland
-  Planted Vegetation
-  Predominantly Introduced Vegetation
-  Planted Tree
-  Scattered Tree



ÖKOLOGIE CONSULTING

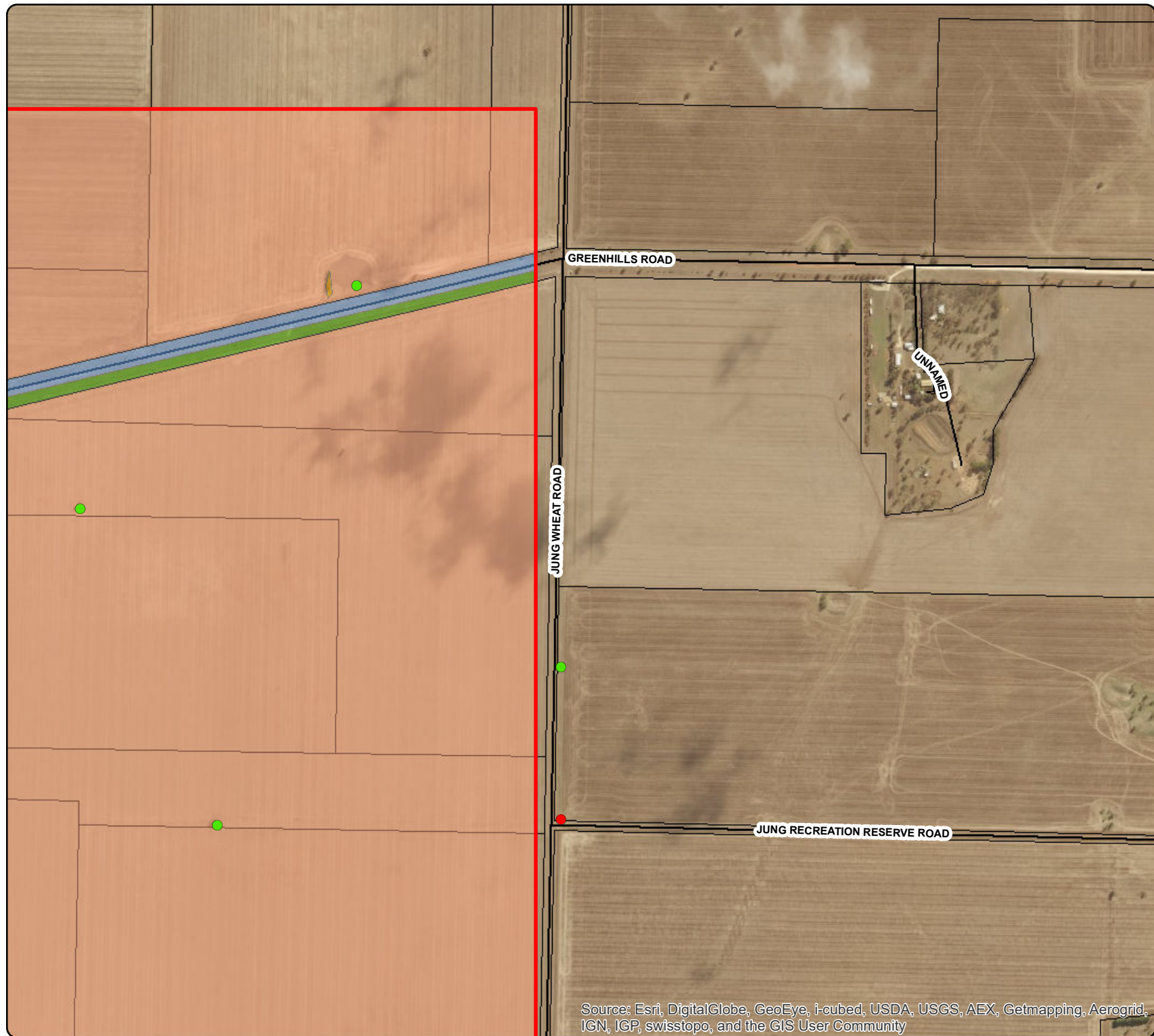
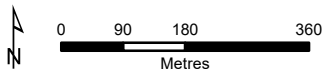


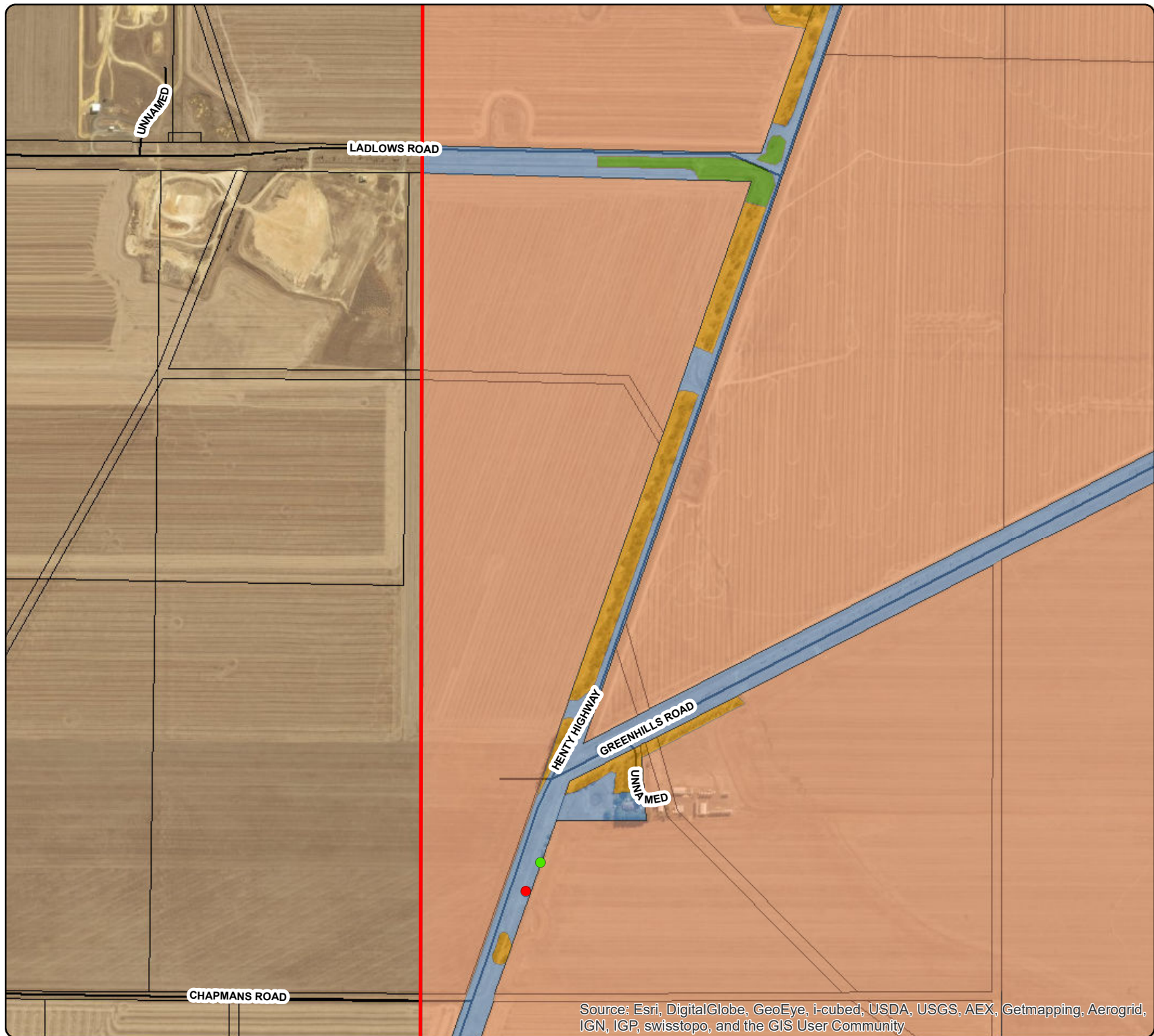
Figure 2e
 Ecological Values
 Avonbank Mine Project

Legend

- Subject Site
- Cropped Vegetation
- Plains Grassland
- Planted Vegetation
- Predominantly Introduced Vegetation
- Planted Tree
- Scattered Tree



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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

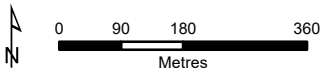
Figure 2f

Ecological Values

Avonbank Mine Project

Legend

- Subject Site
- Cropped Vegetation
- Plains Savanagh
- Plains Woodland
- Planted Vegetation
- Predominantly Introduced Vegetation
- Planted Tree
- Scattered Tree
- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions



ÖKOLOGIE CONSULTING

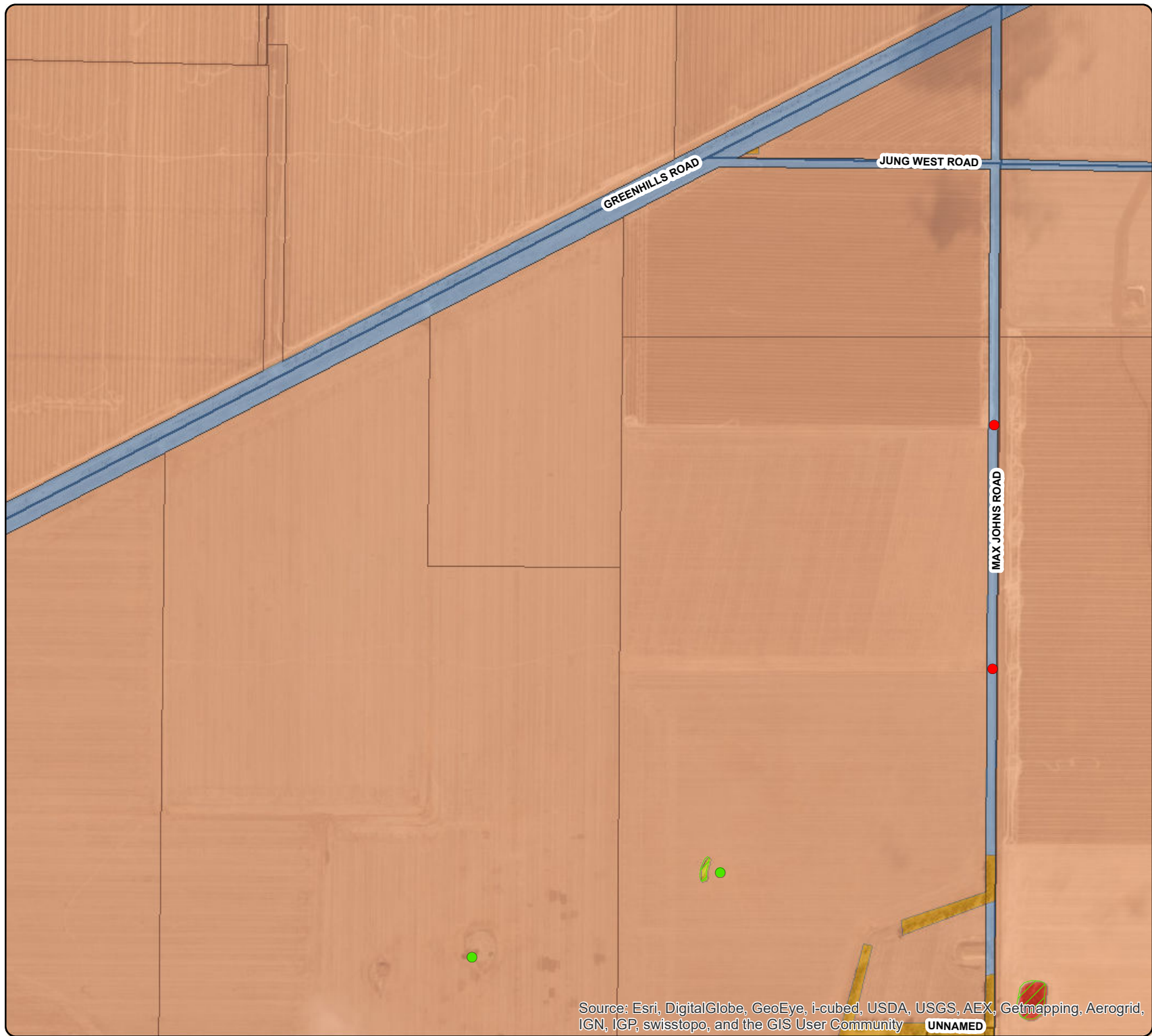







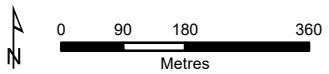
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Ecological Values

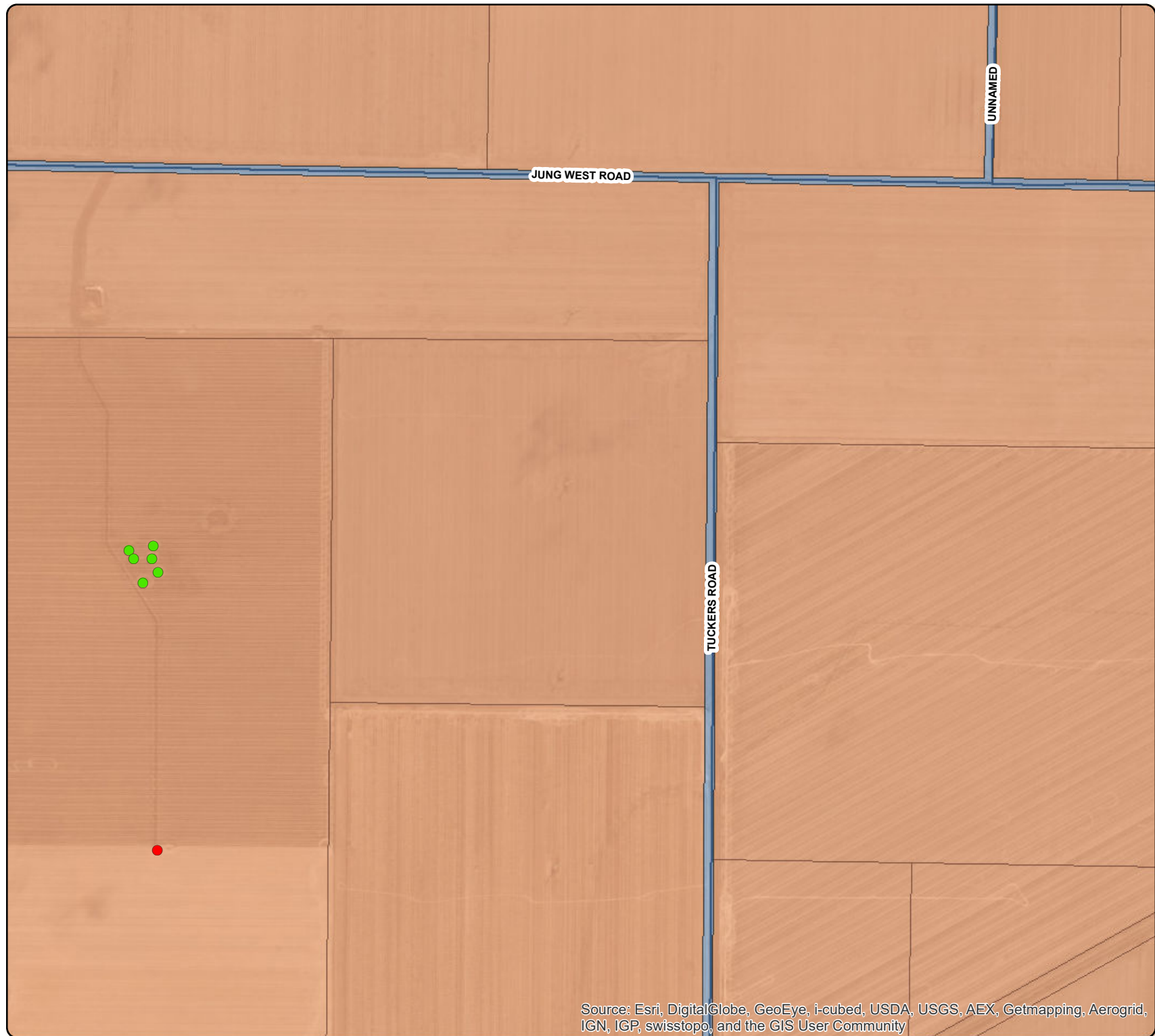
Avonbank Mine Project

Legend

-  Subject Site
-  Cropped Vegetation
-  Predominantly Introduced Vegetation
-  Planted Tree
-  Scattered Tree



ÖKOLOGIE CONSULTING









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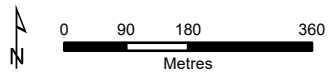
Figure 2h

Ecological Values

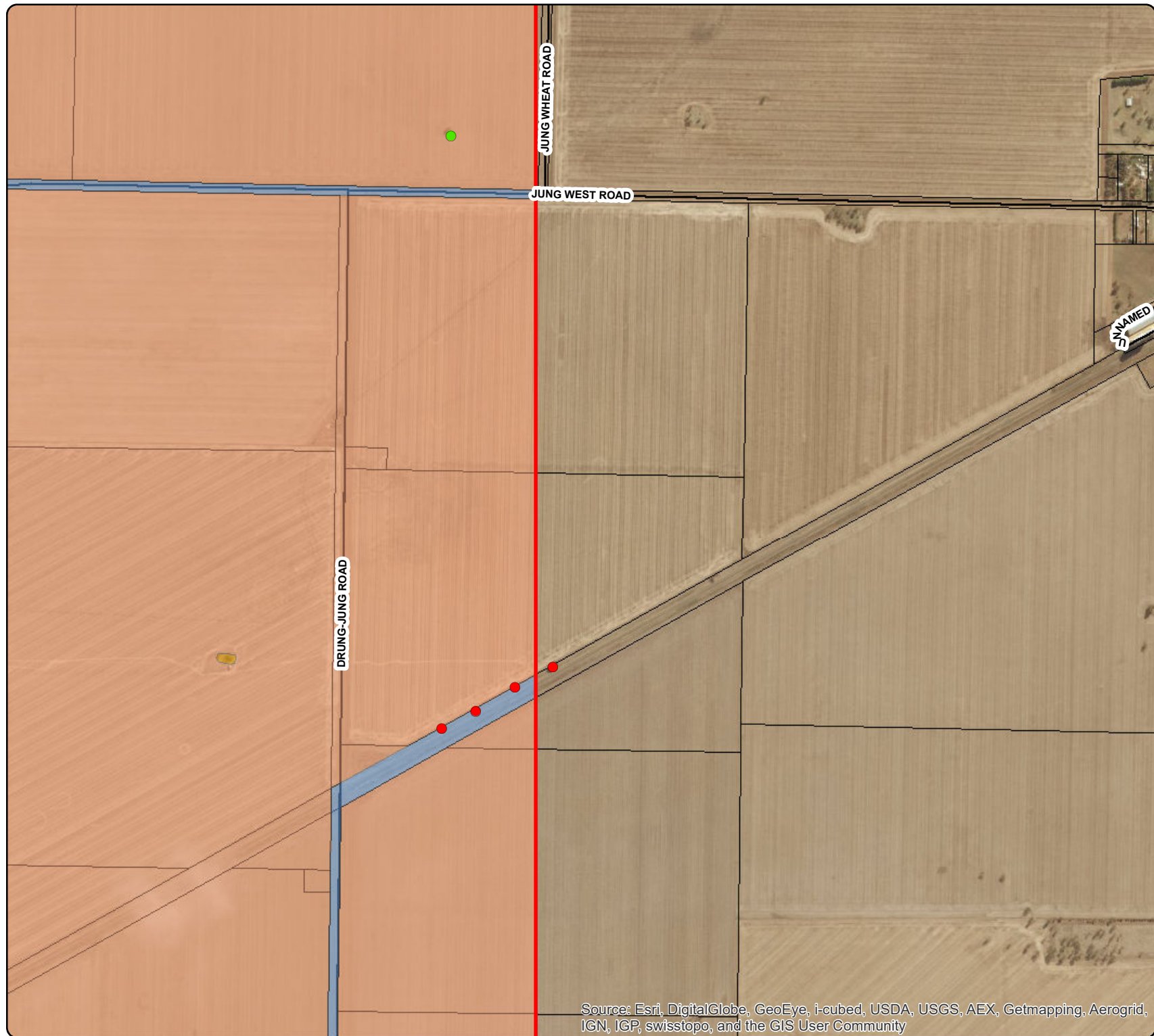
Avonbank Mine Project

Legend

-  Subject Site
-  Cropped Vegetation
-  Planted Vegetation
-  Predominantly Introduced Vegetation
-  Planted Tree
-  Scattered Tree



ÖKOLOGIE CONSULTING








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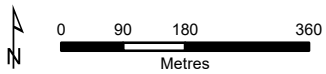
Figure 2i

Ecological Values

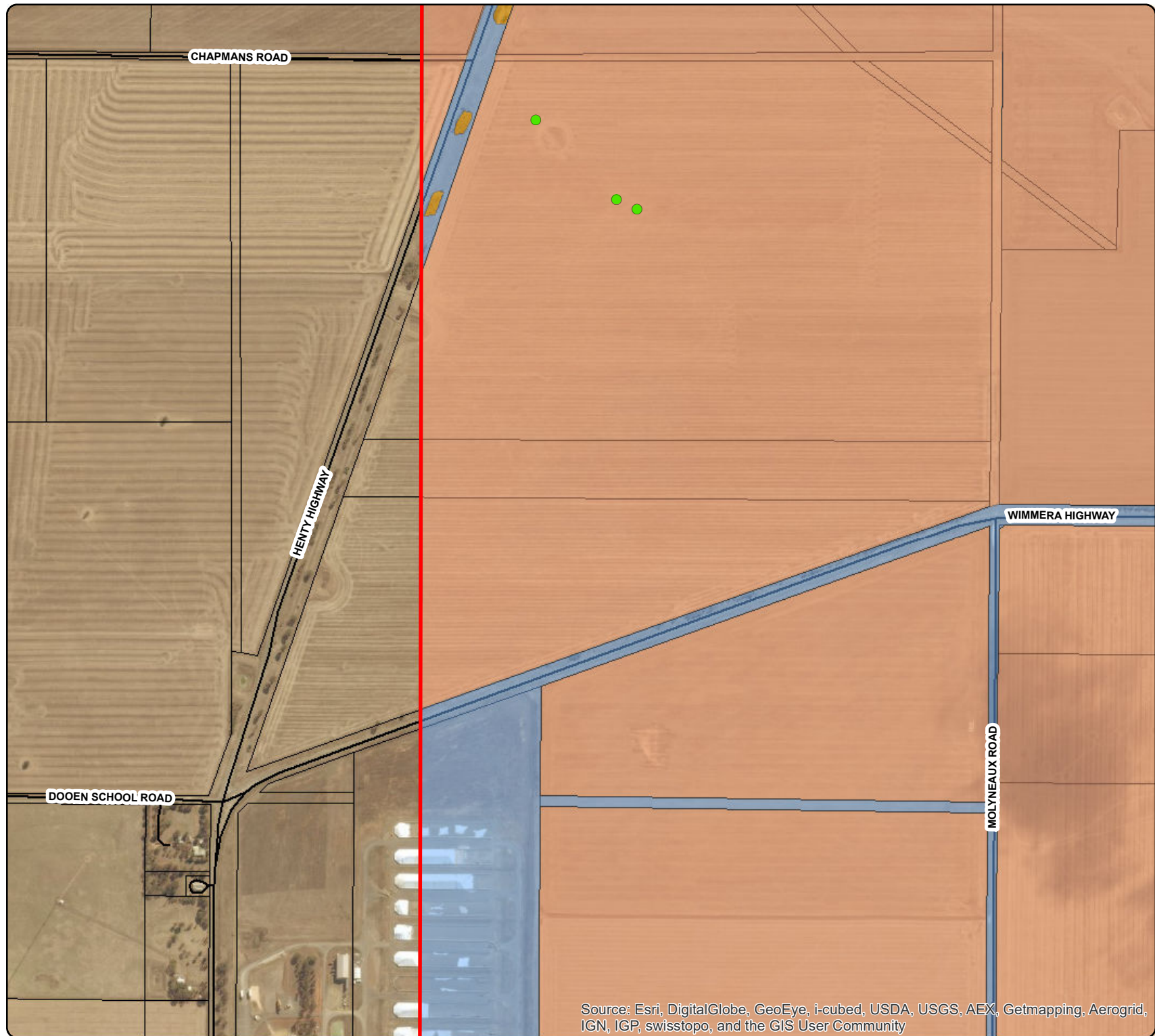
Avonbank Mine Project

Legend

-  Subject Site
-  Cropped Vegetation
-  Planted Vegetation
-  Predominantly Introduced Vegetation
-  Scattered Tree











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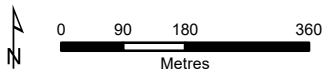


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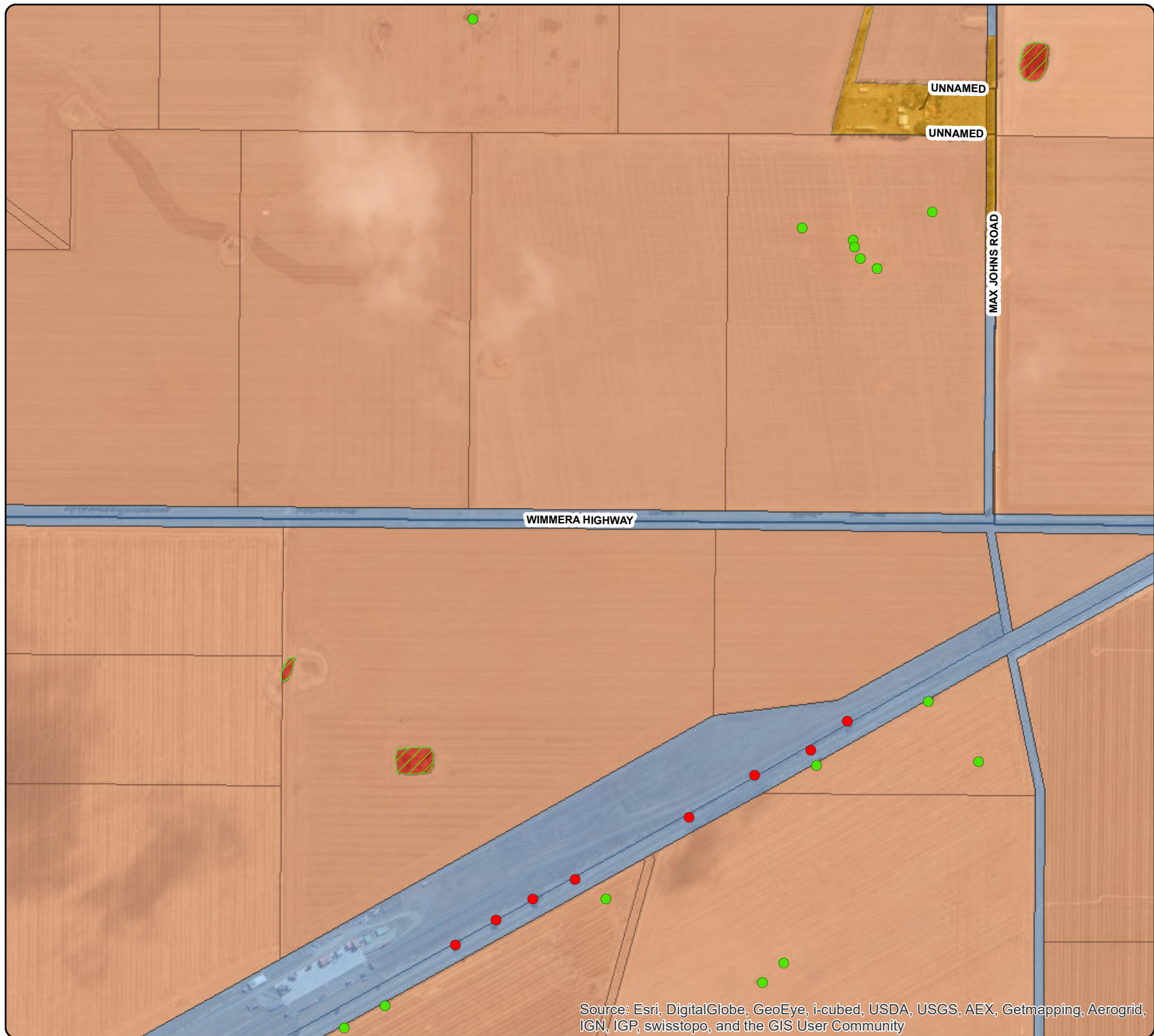
Figure 2j Ecological Values Avonbank Mine Project

Legend

-  Subject Site
-  Cropped Vegetation
-  Plains Woodland
-  Planted Vegetation
-  Predominantly Introduced Vegetation
-  Planted Tree
-  Scattered Tree
-  Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions



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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

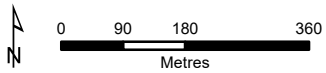
Figure 2k

Ecological Values

Avonbank Mine Project

Legend

-  Subject Site
-  Cropped Vegetation
-  Plains Grassland
-  Plains Savanagh
-  Planted Vegetation
-  Predominantly Introduced Vegetation
-  Scattered Tree
-  Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions



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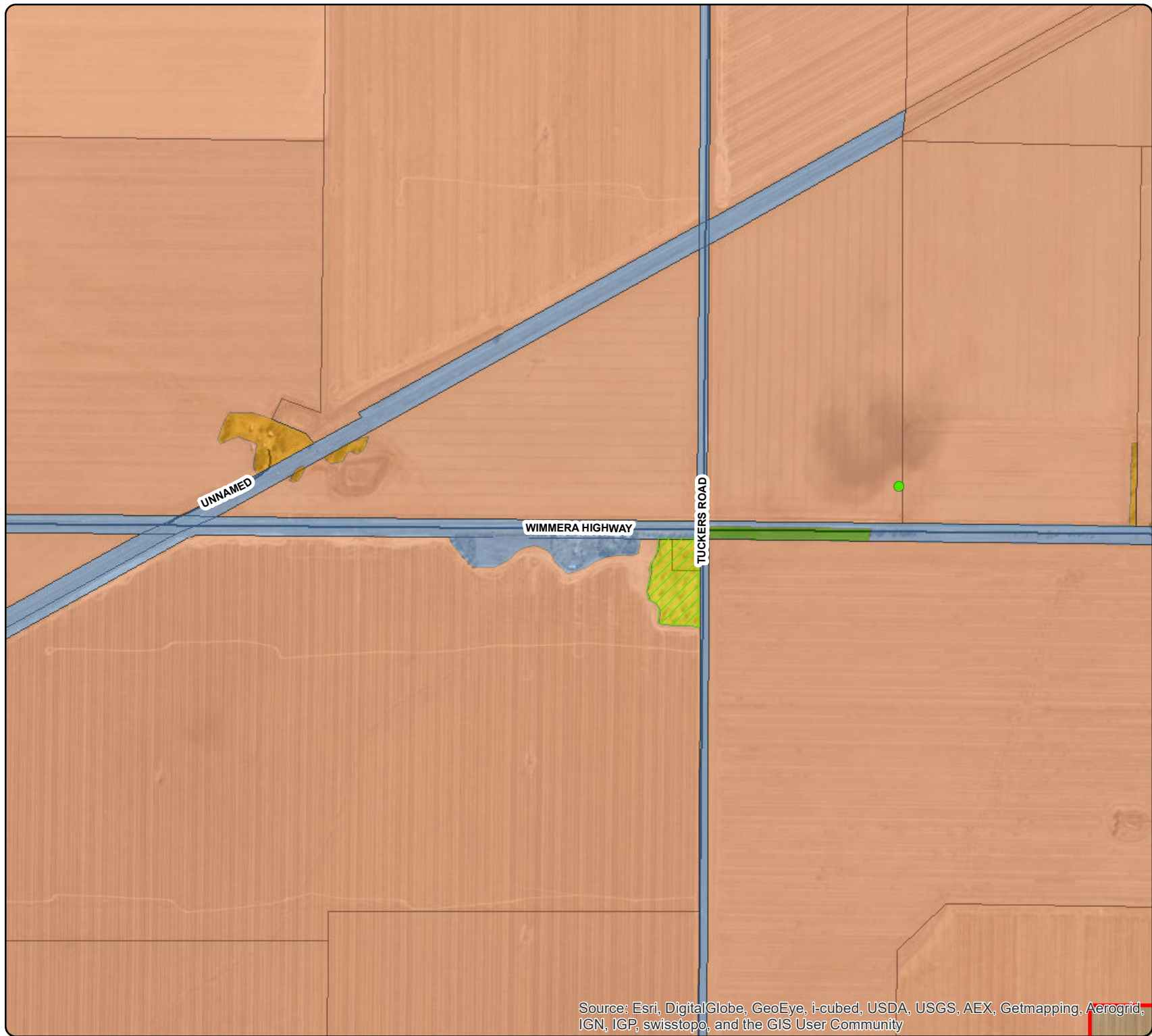


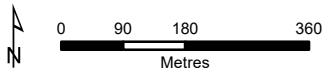
Figure 2I

Ecological Values

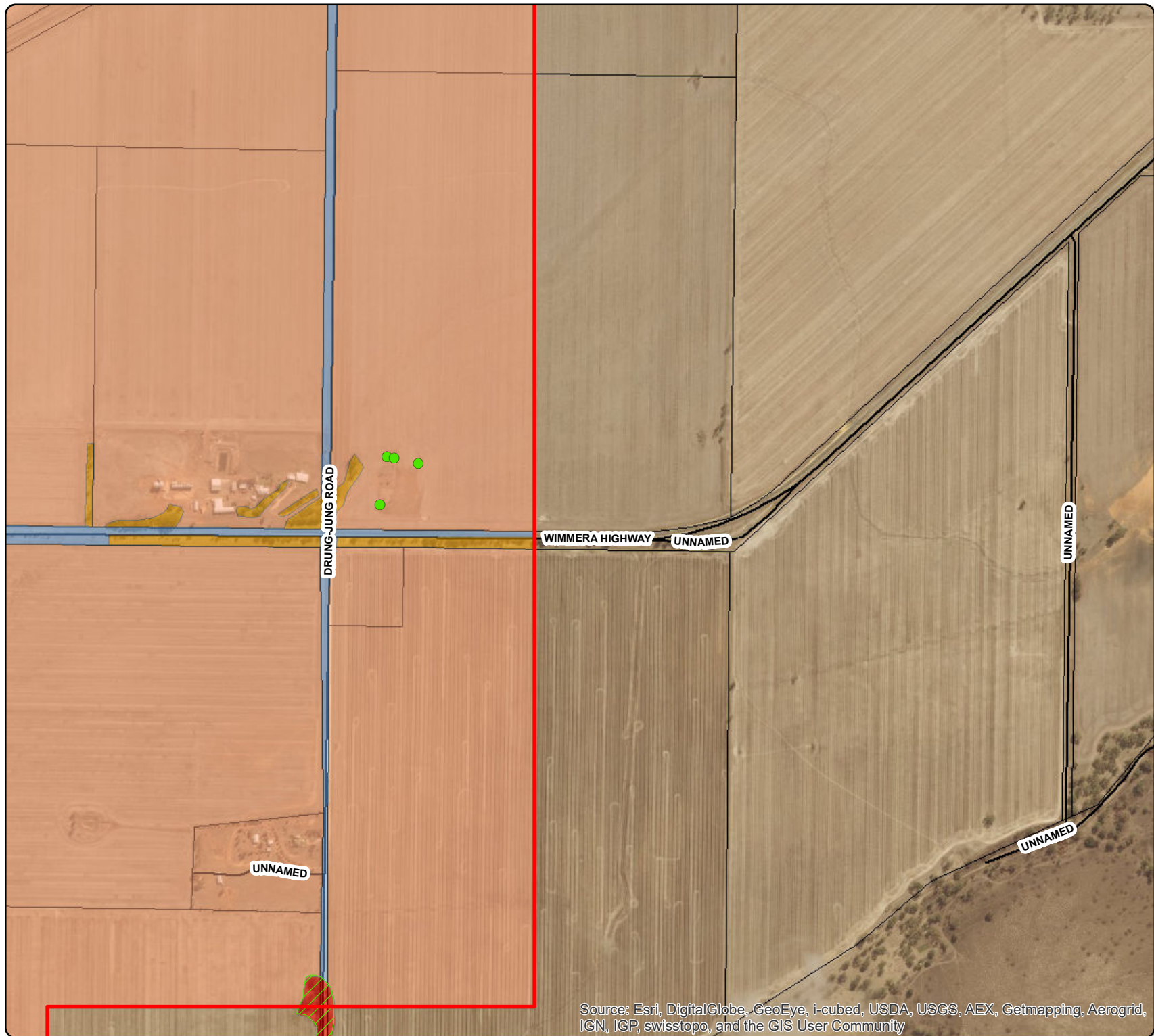
Avonbank Mine Project

Legend

- Subject Site
- Cropped Vegetation
- Plains Woodland
- Planted Vegetation
- Predominantly Introduced Vegetation
- Scattered Tree
- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions



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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

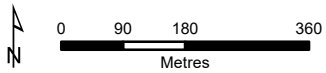
Figure 2m

Ecological Values

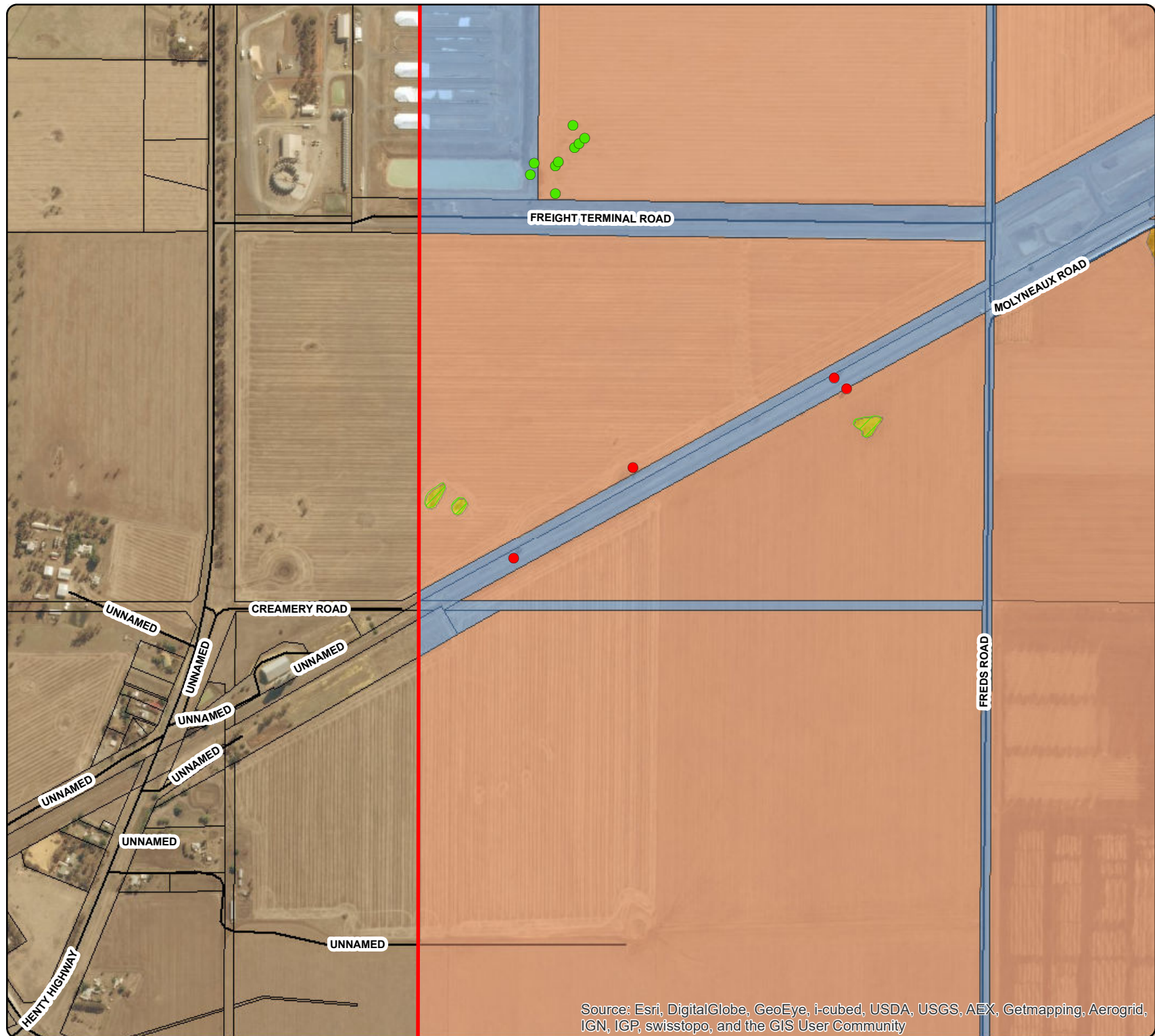
Avonbank Mine Project

Legend

- Subject Site
- Cropped Vegetation
- Plains Savanagh
- Planted Vegetation
- Predominantly Introduced Vegetation
- Planted Tree
- Scattered Tree
- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions



ÖKOLOGIE CONSULTING









Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

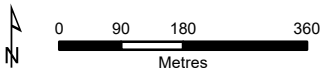
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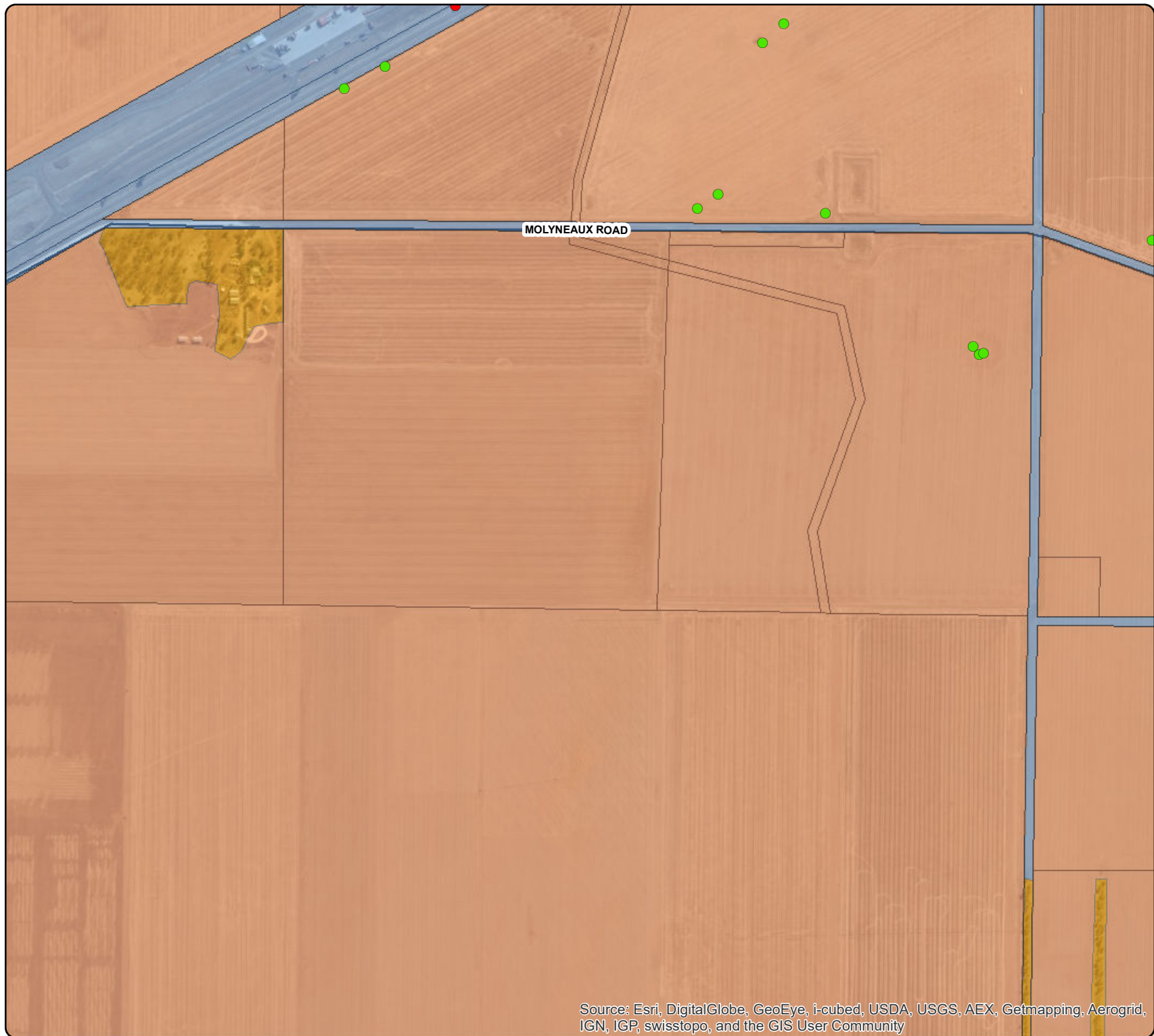
Avonbank Mine Project

Legend

-  Subject Site
-  Cropped Vegetation
-  Planted Vegetation
-  Predominantly Introduced Vegetation
-  Planted Tree
-  Scattered Tree



ÖKOLOGIE CONSULTING



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

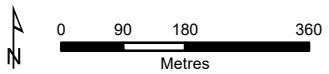
Figure 2o

Ecological Values

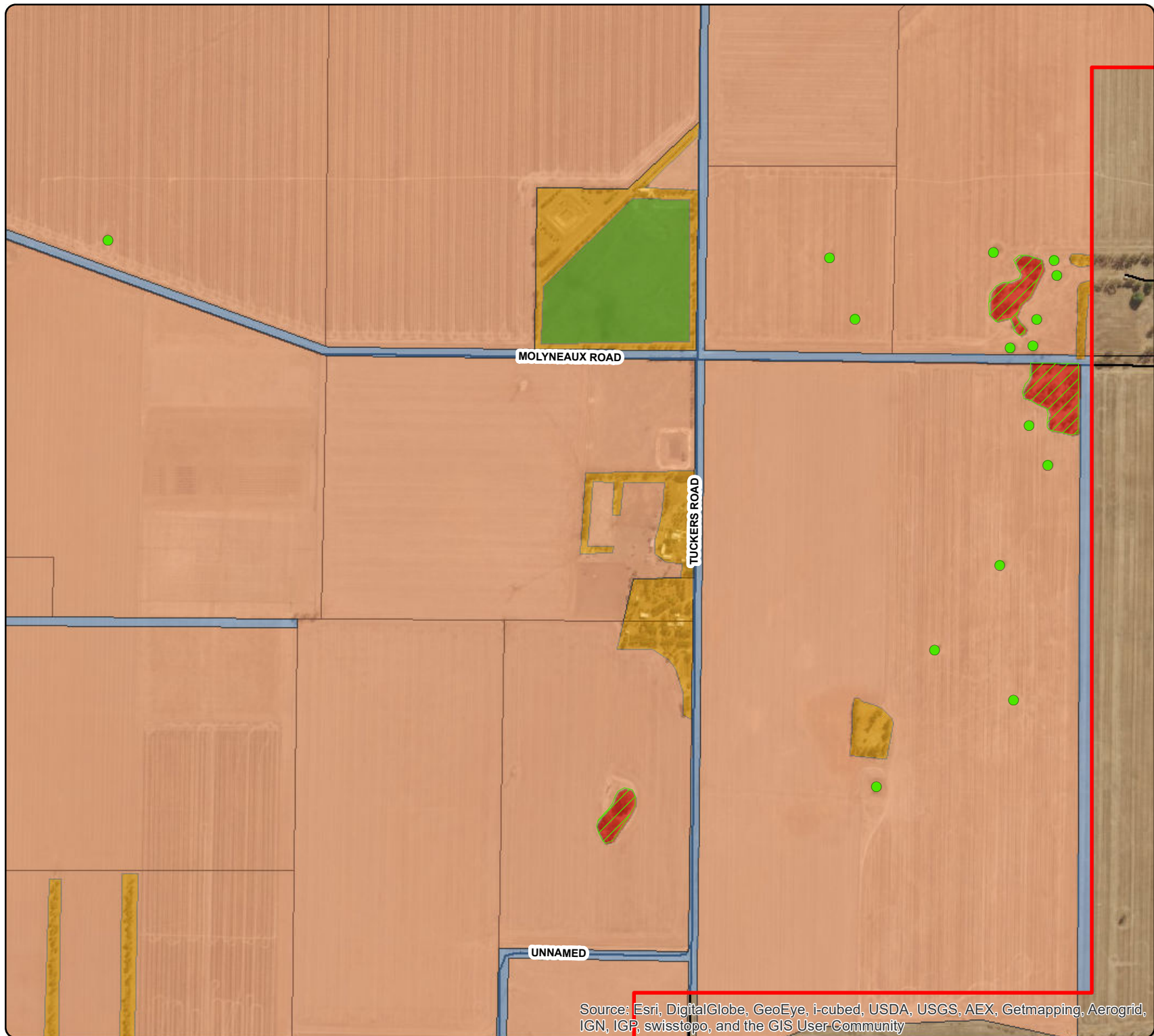
Avonbank Mine Project

Legend

- Subject Site
- Cropped Vegetation
- Plains Grassland
- Plains Woodland
- Planted Vegetation
- Predominantly Introduced Vegetation
- Scattered Tree
- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions



ÖKOLOGIE CONSULTING



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

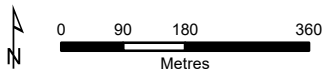
Figure 2p

Ecological Values

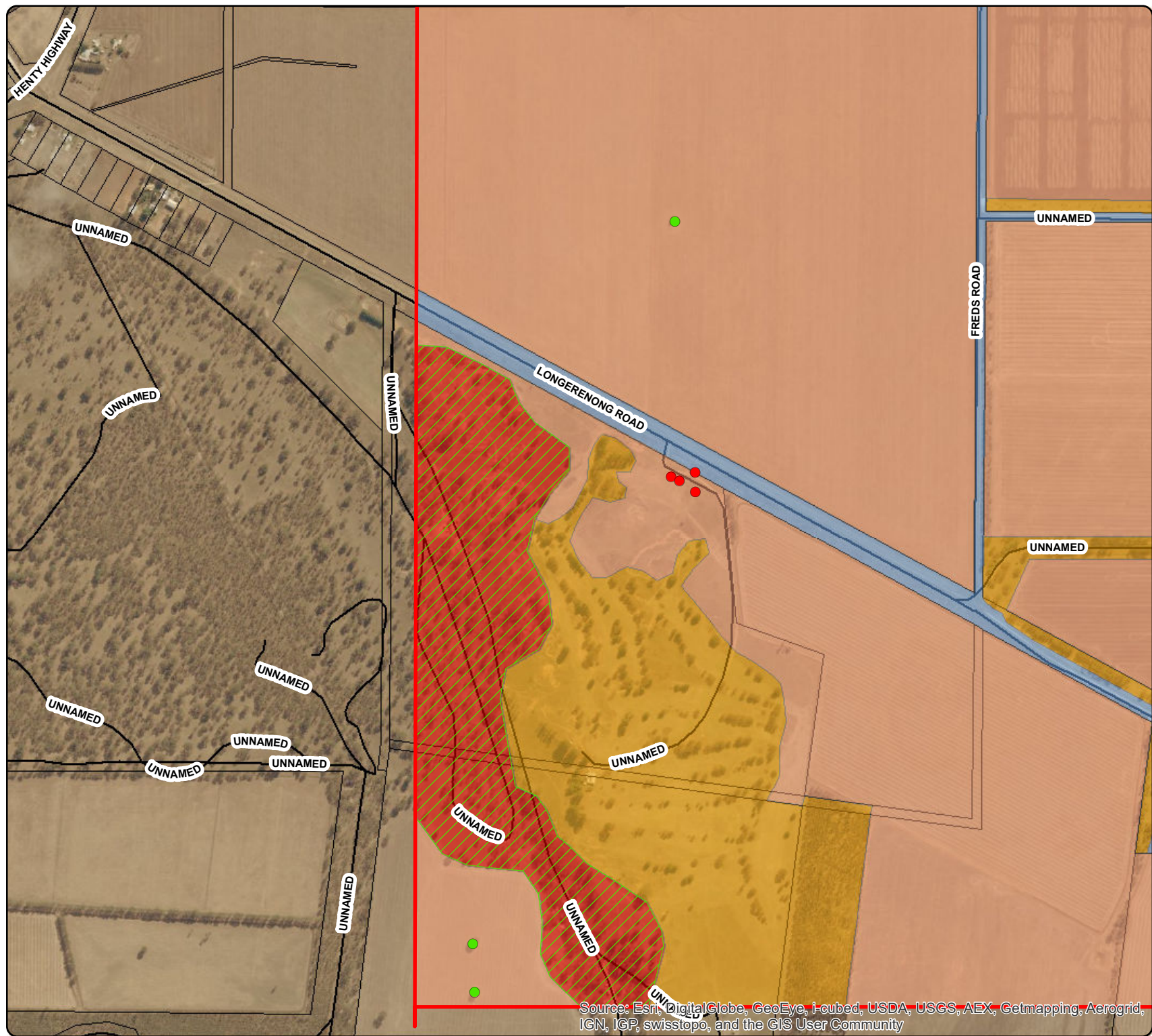
Avonbank Mine Project

Legend

- Subject Site
- Cropped Vegetation
- Plains Woodland
- Planted Vegetation
- Predominantly Introduced Vegetation
- Planted Tree
- Scattered Tree
- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions



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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

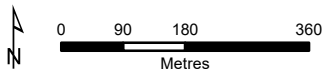
Figure 2q

Ecological Values

Avonbank Mine Project

Legend

- Subject Site
- Cropped Vegetation
- Plains Savanagh
- Plains Woodland
- Planted Vegetation
- Predominantly Introduced Vegetation
- Scattered Tree
- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions



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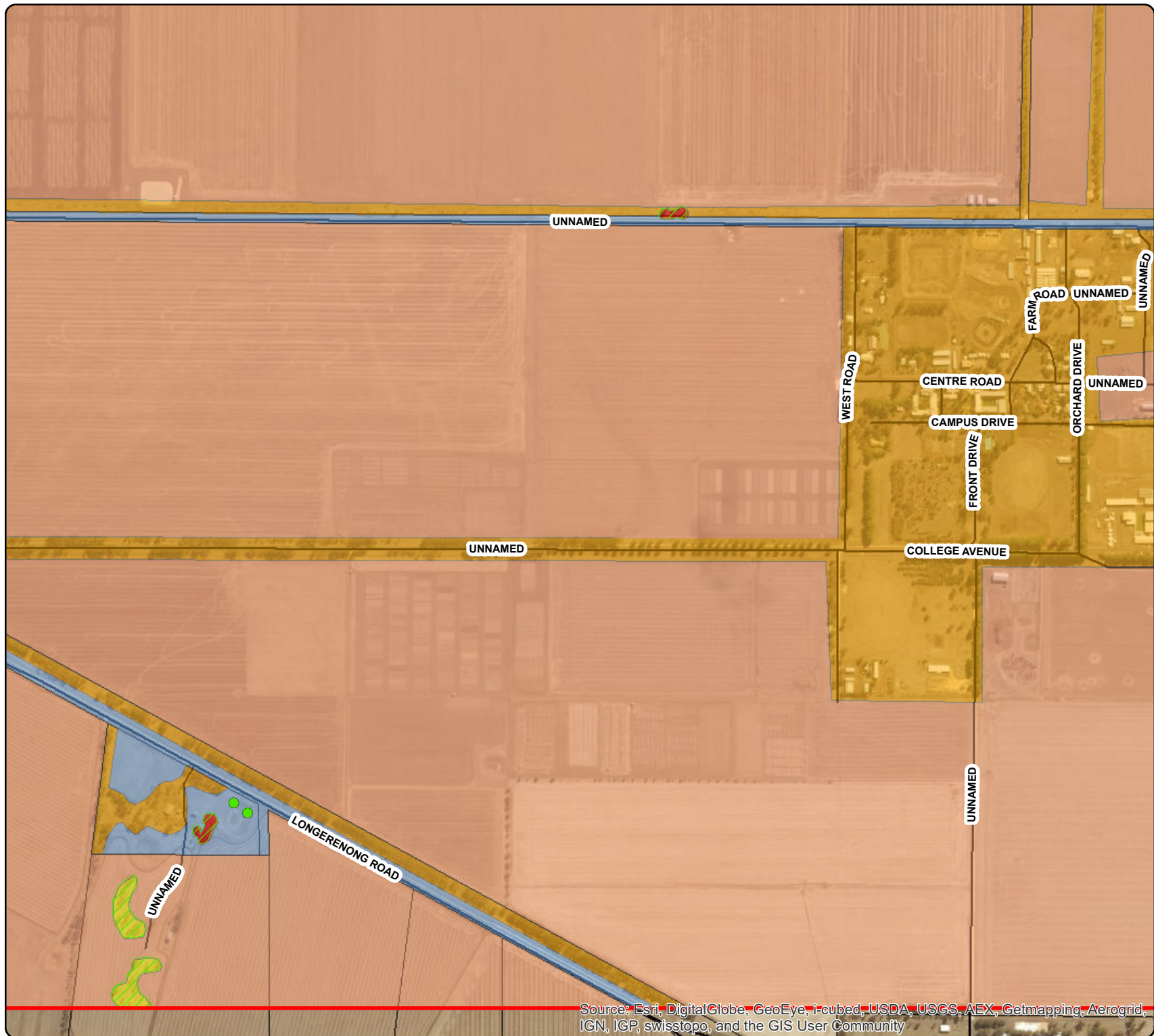






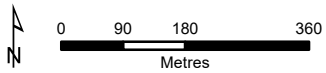
Figure 2r

Ecological Values

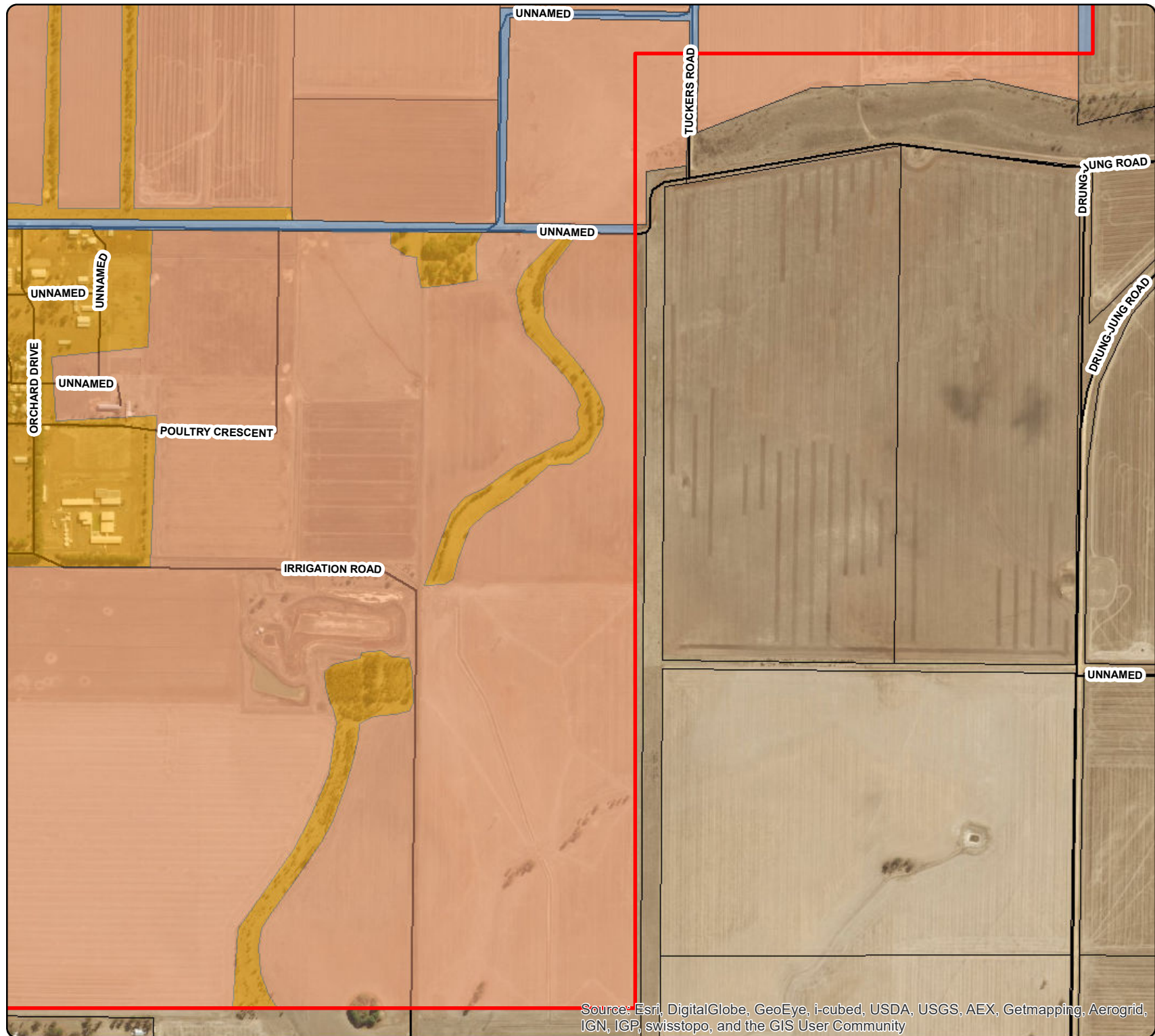
Avonbank Mine Project

Legend

-  Subject Site
-  Cropped Vegetation
-  Planted Vegetation
-  Predominantly Introduced Vegetation



ÖKOLOGIE CONSULTING



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



4 Environmental Legislation and Policy Implications

4.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a process for assessment of proposed actions that may have a significant impact on a Matter of National Environmental Significance (MNES), which includes EPBC Act listed flora, fauna and ecological communities (DOE 2013).

The EPBC Act affects any group or individual (including companies) whose actions (i.e. proposal or project) are assessed for environmental impacts under the EPBC Act. An action requires approval from the Commonwealth Environment Minister if it is considered likely to have a significant impact on a MNES (DOE 2013).

No EPBC Act listed flora species were recorded during the assessment, and none are considered likely to occur due to the absence of suitable habitat within the project area. Buloke trees within the project area provide critical feeding habitat for the Red-tail Black Cockatoo listed as Endangered under the EPBC Act. There is a moderate likelihood of occurrence for this species within the project area. A review of flora and fauna species (terrestrial) listed on the PMST report (DoEE 2017) that may or are likely to occur with the site have been summarised in Appendix 5.

Remnant patches of Plains Savannah and Plains Woodland within the project area (covering approximately 52 hectares) (Figures 2a to 2r) are attributed to the *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions* ecological community listed as Endangered under the EPBC Act.

When determining if a referral is required under the EPBC Act, the proponent must consider whether the proposed action is likely to have a significant impact on a MNES. The relevant trigger determining the need for a referral under the EPBC Act for the project is 'ecological community' if the *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions* ecological community will be impacted by future works.

It is recommended that WIM Resource review the requirement for a referral to the Commonwealth Environment Minister based on the likelihood of a significant impact on a MNES (*Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions* ecological community).

4.2 Flora and Fauna Guarantee Act 1988

The FFG Act is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes.



A permit is required from DEPI to 'take' (kill, injure, disturb or collect) listed flora species, flora species that are members of listed communities or protected flora from public land. Protected flora species includes all members of the following plant families Asteraceae (Daisies), Epacridaceae (Heaths) and Orchidaceae (Orchids), all clubmosses, ferns and fern allies (excluding *Pteridium esculentum*). All species of the following genera are also protected: *Acacia* (excluding *Acacia dealbata*, *Acacia decurrens*, *Acacia implexa*, *Acacia melanoxylon* and *Acacia paradoxa*), *Baeckea*, *Calytrix*, *Correa*, *Darwinia*, *Eremophila*, *Eriostemon*, *Gompholobium*, *Grevillea*, *Prostanthera*, *Sphagnum*, *Thryptomene*, *Thysanotus* and *Xanthorrhoea* (Grass-trees) (DELWP 2015a).

One listed FFG Act listed Threatened flora species, Buloke, occurs throughout the project area in remnant patches and as scattered trees. No Protected flora species were recorded within the project area during the assessment. An FFG Act permit is generally not required for private property; however, permit application will be required from DELWP to remove Buloke from areas of public land (i.e. road reserves).

4.3 Planning and Environment Act 1987

The purpose of the *Planning and Environment Act 1987* is to establish a framework for planning the use, development and protection of land in Victoria. Native vegetation clearance is managed under the Act and through municipal planning schemes (DELWP 2016b).

Under Clause 52.17 Native Vegetation, a permit is required to remove, destroy or lop native vegetation, including dead vegetation (on a site of more than 0.4 hectares) but this does not apply if the application is exempt under the schedule to Clause 52.17 (DELWP 2016b).

Planning schemes may contain other provisions in relation to the removal of native vegetation. For example several environment and land management overlays include requirements to obtain a planning permit to remove, destroy or lop any vegetation that are separate to the permit requirements in Clause 52.17 (DELWP 2016b).

The impact on Victoria's biodiversity associated with removal of native vegetation requires consideration under the Guidelines, when applying for a permit under Clause 52.17. An application is classified under the low, medium or high risk-based pathway as defined in the Guidelines. Each risk pathway has specific application requirements and decision guidelines that must be considered (DEPI 2013b).

Clause 66.02-2 requires that the following applications to remove native vegetation, triggered under Clause 52.17, be referred to DEPI for assessment:

- Applications in the low risk-based pathway where the native vegetation to be remove is 0.5 hectares or more;



- All applications in the moderate risk-based pathway;
- All applications in the high risk-based pathway;
- Applications where a property vegetation plan applies to the site; and,
- Applications on Crown land that is occupied or managed by the responsible authority (DEPI 2013b).

Implications for the proposed development

The project area supports a modified cover of native vegetation, comprising:

- 44.07 hectares of Plains Woodland;
- 8.38 hectares of Plains Savannah;
- 13.63 hectares of Plains Grassland; and,
- 76 scattered trees (Figures 2a to 2r).

The proposed removal, destruction or lopping of any native vegetation will require a permit under Clause 52.17 (Native Vegetation) of the Horsham Planning Scheme (DELWP 2017b) (unless an exemption applies). It is recommended that project design applies the principles of 'avoid and minimise' to reduce impacts to native vegetation as much as practicable.

Biodiversity Assessment Guidelines

The impact on Victoria's biodiversity associated with removal of native vegetation requires consideration under the Guidelines. An application is classified under the low, medium or high risk-based pathway as defined in the Guidelines. Each risk pathway has specific application requirements and decision guidelines that must be considered (DEPI 2013a).

Review of the Biodiversity Interactive Map (DELWP 2017a), shows the site is mapped as Location A and C. The proposed removal of any remnant patches of native vegetation (Plains Woodland, Plains Savannah and Plains Grassland) or scattered indigenous trees would require either a low, moderate or high risk-based pathway biodiversity application, depending on the location and extent of native vegetation proposed for removal. The proposed removal of native vegetation also requires a proponent to obtain offsets under the Guidelines (DEPI 2013a).

4.4 Environmental Effects Act 1978

Environment assessment is the process of investigating and considering the potential environmental impacts or effects of a proposed development, according to the *Environment Effects Act 1978*. It is not an approval process itself, but instead is a way of enabling Ministers, local government and statutory authorities to make informed decisions about whether a project with potentially significant environmental effects should proceed. The central part of the process is the preparation of a rigorous



Environment Effects Statement (EES). The proponent of the development is responsible for preparing an EES if the Minister for Planning decides that one is required (DSE 2006).

Individual types of potential effects on the environment (relevant to the project) of State significance that warrant referral of a project include:

- Potential clearing of 10 ha or more of native vegetation from an area that is of an Ecological Vegetation Class identified as endangered (i.e. Plains Woodland, Plains Savannah and Plains Grassland).

It is recommended that WIM Resource review the requirement for an EES referral to the State Minister for Planning based on the potential for a significant effect on the environment.



5 Conclusion

The project area was highly modified from previous and current agricultural use, with the majority of land cropped or cultivated. Native vegetation has been largely cleared from the project area, and was limited to isolated remnant patches of Plains Woodland, Plains Savannah and Plains Grassland and scattered trees in paddocks or along road reserves.

One State listed threatened flora species (*Buloke Allocasuarina luehmannii*) was recorded during the field assessment. There is a low likelihood of occurrence for any additional listed threatened flora species within the project area due to the highly modified condition of habitat. No listed threatened fauna species were recorded during the assessment. However, Buloke trees provide critical feeding habitat for Red-tail Black Cockatoo, and there is a moderate likelihood of occurrence for this species within the project area.

Remnant patches of Plains Savannah and Plains Woodland within the project area are attributed to the *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions* ecological community listed as Endangered under the EPBC Act. It is recommended that WIM Resource review the requirement for a referral to the Commonwealth Environment Minister based on the likelihood of a significant impact on a MNES (*Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions* ecological community).

One listed FFG Act listed Threatened flora species (Buloke) occurs throughout the project area in remnant patches and as scattered trees. A permit application will be required from the DELWP to remove this species from areas of public land (i.e. road reserves).

The proposed removal, destruction or lopping of any native vegetation will require a permit under Clause 52.17 (Native Vegetation) of the Horsham Planning Scheme (unless an exemption applies). The proposed removal of native vegetation also requires a Risk-based Biodiversity Assessment under the *Permitted clearing of native vegetation - Biodiversity assessment guidelines*.

It is recommended that project design applies the principles of 'avoid and minimise' to reduce impacts to native vegetation as much as practicable



6 References

Australian National Botanic Gardens 2017. Australian Plant Census.

<http://www.anbg.gov.au/cpbr/databases/apni-search-full.html>

DELWP 2017a. Biodiversity Interactive Map. Department of Environment, Land, Water and Planning: www.depi.vic.gov.au

DELWP 2017b. Planning Schemes Online. Department of Environment, Land, Water and Planning: <http://planningschemes.dpcd.vic.gov.au>

DELWP 2017c. Victorian Biodiversity Atlas. Version 3.1.0. Publication date: 9 April 2017. Department of Environment, Land, Water and Planning: <https://vba.dse.vic.gov.au>

DELWP 2015a. *Flora and Fauna Guarantee Act 1988 Protected Flora List, May 2015*: <http://www.depi.vic.gov.au>

DELWP 2015b. *Biodiversity assessment handbook – Permitted clearing of native vegetation. Version 1.0*. Department of Environment, Land, Water and Planning: www.depi.vic.gov.au

DEPI 2013a. *Permitted clearing of native vegetation: Biodiversity Assessment Guidelines*. Department of Environment and Primary Industries: <http://www.dse.vic.gov.au>

DEPI 2013c. *Flora and Fauna Guarantee Act - Victorian Threatened Communities*. Department of Environment and Primary Industries: <http://www.depi.vic.gov.au>

DEPI 2014a. *Advisory List of Rare or Threatened Plants in Victoria*. Department of Environment and Primary Industries, Victoria.

DSE 2013. *Advisory List of Threatened Vertebrate Fauna in Victoria*. Department of Sustainability and Environment, Victoria

DoEE 2017. Protected Matters Search Tool. Department of Environment: <http://www.environment.gov.au/epbc/pmst/>

Okologie Consulting 2016. Desktop ecological assessment for the Avonbank Heavy Mineral Sands project, near Horsham, Victoria.

Threatened Species Scientific Committee 2012. *Commonwealth Listing Advice on Natural Grasslands of the Murray Valley Plains*. Department of Sustainability, Environment, Water, Population and Communities. Canberra.



7 Plates



Plate 1: Plains Woodland surrounded by cropped vegetation



Plate 2: Plains Woodland with an exotic dominated understorey



Plate 3: Plains Savannah surrounded by exotic vegetation



Plate 4: Plains Savannah with an exotic dominated understorey



Plate 5: Scattered indigenous tree (Buloke)



Plate 6: Scattered indigenous trees (Buloke)



Plate 7: Plains Grassland along the Greenhills Road reserve



Plate 8: Exotic dominated vegetation along the road reserve (mapped as Predominantly Introduced Vegetation)



Plate 9: Planted native trees within private property



Plate 10: Cropped vegetation within private property



Appendices

Appendix 1 – Likelihood of Occurrence

One or more of the following criteria was used to establish the likelihood of occurrence for threatened flora and fauna species within the subject site:

Present: Recorded within the project area during the survey

High likelihood:

- Previously recorded in the site.
- Likely to visit the site during seasonal movements.
- Frequently recorded within the local area.
- Known or likely to maintain resident populations in the local area.
- Presence of preferred habitat within the site.

Moderate likelihood:

- May regularly move through or visit the site as a seasonal visitor.
- Previous records within the local area.
- Some characteristics of a species preferred habitat is present although in a modified condition.
- Unlikely to maintain a population within the site.

Low Likelihood:

- Species likely to occur as a rare or opportunistic visitor.
- Few previous records within the local area.
- Habitat within the site is highly modified and does not represent the species preferred habitat.

Unlikely:

- No suitable habitat present on the site or in the surrounding area.
- No species records in the local area.
- Beyond the species natural distribution or considered locally extinct.

The outcome of the assessment of likelihood of occurrence for threatened flora is Appendix 3 and Appendix 4 for threatened fauna.



Appendix 2 – Flora species recorded

Table 2: Flora species recorded during the field assessment

Scientific Name	Common Name
<i>Acetosella vulgaris</i>	Sheep Sorrel*
<i>Allocasuarina luehmannii</i>	Buloke
<i>Arctotheca calendula</i>	Cape Weed*
<i>Asperula conferta</i>	Common Woodruff
<i>Aster subulatus</i>	Aster-weed*
<i>Atriplex semibaccata</i>	Berry Saltbush
<i>Austrostipa gibbosa</i>	Spurred Spear-grass
<i>Austrostipa nodosa</i>	Knotty Spear-grass
<i>Austrostipa scabra</i> subsp. <i>falcata</i>	Rough Spear-grass
<i>Avena fatua</i>	Wild Oat*
<i>Bothriochloa macra</i>	Red-leg Grass
<i>Briza minor</i>	Lesser Quaking-grass*
<i>Bromus hordeaceus</i>	Soft Brome*
<i>Cenchrus clandestinus</i>	Kikuyu*
<i>Centaurium tenuiflorum</i>	Slender Centaury*
<i>Chloris truncata</i>	Windmill Grass
<i>Cirsium vulgare</i>	Spear Thistle**
<i>Cynodon dactylon</i>	Couch
<i>Cyperus eragrostis</i>	Drain Flat-sedge*
<i>Daucus glochidiatus</i>	Australian Carrot
<i>Daviesia benthamii</i> subsp. <i>humilis</i>	Spiny Bitter-pea
<i>Distichlis distichophylla</i>	Australian Salt-grass
<i>Duma florulenta</i>	Tangled Lignum
<i>Einadia nutans</i>	Nodding Saltbush
<i>Epilobium billardierianum</i>	Variable Willow-herb
<i>Eucalyptus cladocalyx</i>	Sugar Gum#
<i>Eucalyptus largiflorens</i>	Black Box
<i>Eucalyptus leucoxylon</i>	Yellow Gum
<i>Eucalyptus micorcarpa</i>	Grey Box
<i>Helichrysum luteoalbum</i>	Jersey Cudweed
<i>Helminthotheca echioides</i>	Ox-tongue*
<i>Hordeum leporinum</i>	Barley-grass*
<i>Hordeum vulgare</i>	Barley*
<i>Hypochaeris radicata</i>	Flatweed*
<i>Juncus capitatus</i>	Capitate Rush*
<i>Juncus subsecundus</i>	Finger Rush
<i>Lachnagrostis filiformis</i>	Common Blown-grass
<i>Lepidium africanum</i>	Common Peppercross*



Scientific Name	Common Name
<i>Lolium rigidum</i>	Wimmera Rye-grass*
<i>Lycium ferocissimum</i>	African Boxthorn**
<i>Lysimachia arvensis</i>	Pimpernel*
<i>Lythrum hyssopifolia</i>	Small Loosestrife
<i>Maireana enchylaenoides</i>	Wingless Bluebush
<i>Medicago polymorpha</i>	Burr Medic*
<i>Onopordum acanthium</i> subsp. <i>acanthium</i>	Scotch Thistle**
<i>Paspalum dilatatum</i>	Paspalum*
<i>Paspalum distichum</i>	Water Couch*
<i>Phalaris minor</i>	Lesser Canary-grass*
<i>Plantago lanceolata</i>	Ribwort*
<i>Polygonum aviculare</i> s.l.	Prostrate Knotweed*
<i>Polypogon monspeliensis</i>	Annual Beard-grass
<i>Romulea rosea</i>	Onion Grass*
<i>Rytidosperma caespitosum</i>	Common Wallaby-grass
<i>Rytidosperma duttonianum</i>	Brown-back Wallaby-grass
<i>Rytidosperma setaceum</i>	Bristly Wallaby-grass
<i>Schinus molle</i>	Peppercorn Tree#
<i>Sclerolaena muricata</i>	Black Roly-poly
<i>Sonchus asper</i>	Rough Sow-thistle*
<i>Sonchus oleraceus</i>	Common Sow-thistle*
<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover*
<i>Trifolium repens</i> var. <i>repens</i>	White Clover*
<i>Trifolium subterraneum</i>	Subterranean Clover*
<i>Vicia sativa</i>	Common Vetch*
<i>Vulpia bromoides</i>	Squirrel-tail Fescue*
<i>Vulpia myuros</i>	Rat's-tail Fescue*
<i>Walwhalleya proluta</i>	Rigid Panic
<i>Xanthium spinosum</i>	Bathurst Burr**

Notes: *Exotic species; #Planted species; **Listed noxious weed



Appendix 3 – Threatened Flora Records

Table 4. Threatened flora records

Scientific Name	Common Name	Status	Records	Likely Occurrence	Comments
<i>Allocasuarina luehmannii</i>	Buloke	en L	5	P	Present throughout the project area
<i>Acacia pendula</i>	Weeping Myall	en L	1	M	Modified habitat
<i>Daviesia pectinata</i>	Thorny Bitter-pea	r	2	U	Modified habitat
<i>Eucalyptus froggattii</i>	Kamarooka Mallee	r L	1	U	Modified habitat
<i>Leptorhynchos waitzia</i>	Button Immortelle	vu	1	U	Modified habitat
<i>Duma horrida subsp. horrida</i>	Spiny Lignum	r	1	U	Modified habitat
<i>Ptilotus erubescens</i>	Hairy Tails	vu L	3	M	Modified habitat
<i>Ranunculus undosus</i>	Swamp Buttercup	vu	2	U	No suitable habitat
<i>Swainsona swainsonioides</i>	Downy Swainson-pea	en L	4	U	Modified habitat
<i>Vittadinia megacephala</i>	Giant New Holland Daisy	vu	1	U	Modified habitat
<i>Vittadinia pterochaeta</i>	Winged New Holland Daisy	vu	2	M	Modified habitat
<i>Brachyscome chryso glossa</i>	Yellow-tongue Daisy	vu L	1	U	Modified habitat
<i>Picris squarrosa</i>	Squat Picris	r	1	U	Modified habitat
<i>Cardamine lineariloba</i>	Western Bitter-cress	vu	2	L	Modified habitat
<i>Cardamine moirensis</i>	Riverina Bitter-cress	r	3	L	Modified habitat
<i>Vittadinia cuneata var. morrisii</i>	Fuzzy New Holland Daisy	r	1	U	Modified habitat
<i>Eucalyptus X oxypoma</i>	Deniliquin Box	r	1	U	Modified habitat
<i>Centipeda nidiformis</i>	Cotton Sneezeweed	r	2	U	Modified habitat

Notes: Threatened species records were sourced from the VBA (DELWP 2017c), within a 5 km radius of the site.

Likelihood of occurrence: P= Present; H = High likelihood; M = Moderate likelihood; L = Low likelihood; U = Unlikely to occur (Appendix 1).

EPBC Act listed species (DoEE 2017)

Cr Critically Endangered
En Endangered
V Vulnerable

FFG Act listed species (DEPI 2015)

L Listed as Threatened

DEPI listed species (DEPI 1014; 2013):

cr Critically endangered
e Endangered
v Vulnerable
r Rare



Appendix 4 – Threatened Fauna Records

Table 5. Threatened fauna records

Scientific Name	Common Name	Status	Records	Likely Occurrence	Comments
<i>Pedionomus torquatus</i>	Plains-wanderer	CR cr L	9	U	Modified habitat
<i>Porzana pusilla palustris</i>	Baillon's Crane	vu L	3	U	Modified habitat
<i>Burhinus grallarius</i>	Bush Stone-curler	en L	24	U	Modified habitat
<i>Grus rubicunda</i>	Brolga	vu L	1	U	No suitable habitat
<i>Ardea modesta</i>	Eastern Great Egret	vu L	16	L	May occasionally fly over
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EN en L	3	U	No suitable habitat
<i>Anas rhynchotis</i>	Australasian Shoveler	vu	2	L	May occasionally fly over
<i>Stictonetta naevosa</i>	Freckled Duck	en L	2	L	May occasionally fly over
<i>Aythya australis</i>	Hardhead	vu	4	L	May occasionally fly over
<i>Oxyura australis</i>	Blue-billed Duck	en L	1	L	May occasionally fly over
<i>Biziura lobata</i>	Musk Duck	vu	7	M	May occasionally fly over
<i>Lophoictinia isura</i>	Square-tailed Kite	vu L	1	L	May occasionally fly over
<i>Falco hypoleucos</i>	Grey Falcon	en L	1	M	May occasionally fly over
<i>Falco subniger</i>	Black Falcon	vu	5	M	May occasionally fly over
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler	en L	1	U	Modified habitat
<i>Petaurus norfolcensis</i>	Squirrel Glider	en L	1	U	Modified habitat
<i>Delma impar</i>	Striped Legless Lizard	VU en L	4	L	Modified habitat
<i>Pogona barbata</i>	Bearded Dragon	vu	1	U	Modified habitat
<i>Litoria raniformis</i>	Growling Grass Frog	VU en L	1	U	No suitable habitat
<i>Synemon selene</i>	Pale Sun Moth	cr	1	U	Modified habitat

Notes: Threatened species records were sourced from the VBA (DELWP 2017c), within a 5 km radius of the site.

Likelihood of occurrence: H = High likelihood; M = Moderate likelihood; L = Low likelihood; U = Unlikely to occur (Appendix 1).

EPBC Act listed species (DoEE 2017)

Cr Critically Endangered

En Endangered

V Vulnerable

FFG Act listed species (DEPI 2015)

L Listed as Threatened

DEPI listed species (DEPI 1014; 2013):

cr Critically endangered

e Endangered

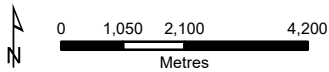
v Vulnerable

r Rare

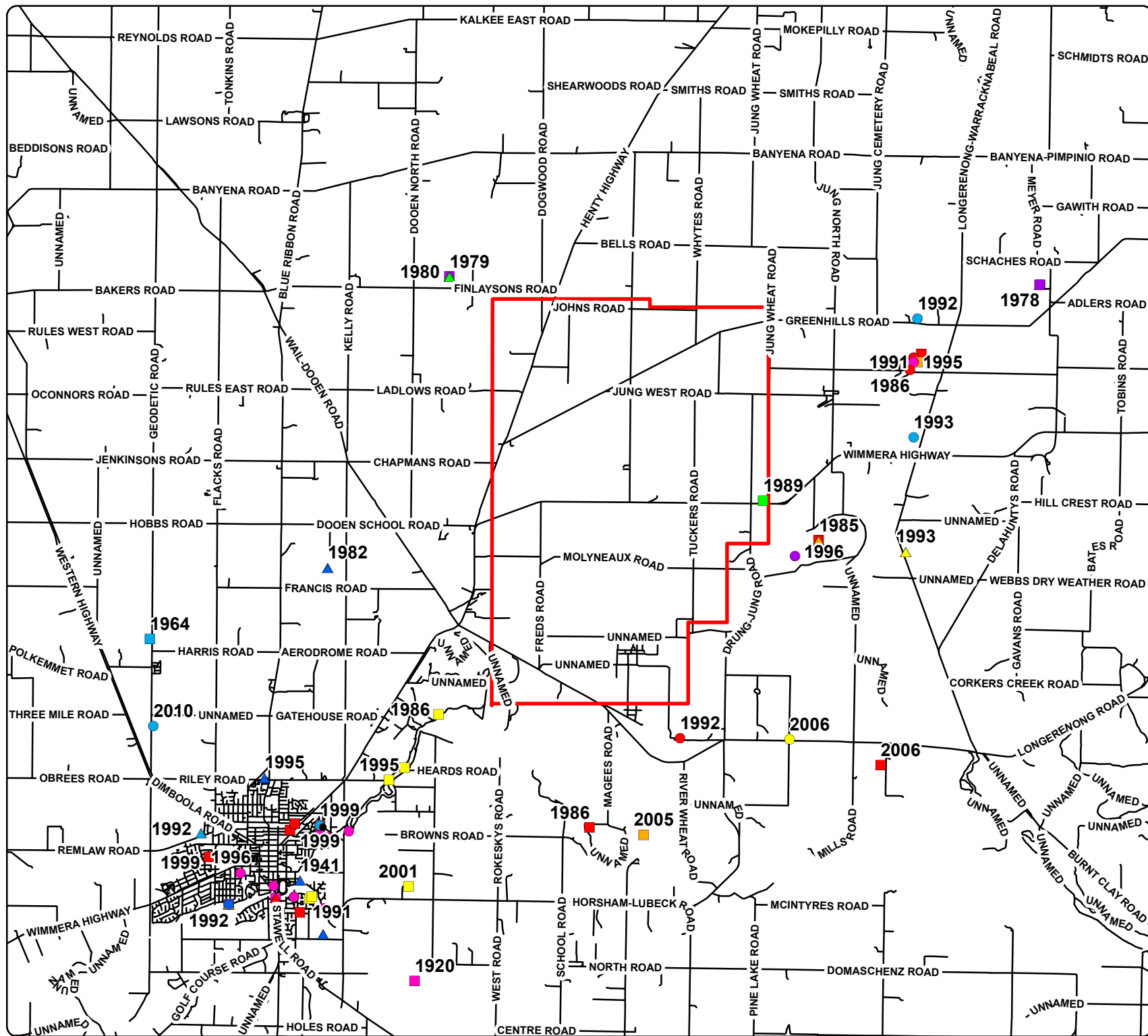
Figure 4
Threatened Fauna Species
 Avonbank Mine Project

Legend

- Subject Site
- Australasian Bittern
- Australasian Shoveler
- Baillon's Crake
- Bearded Dragon
- Black Falcon
- Blue-billed Duck
- Brolga
- Bush Stone-curlew
- Eastern Great Egret
- Freckled Duck
- Freshwater Catfish
- Grey Falcon
- Grey-crowned Babbler
- Growling Grass Frog
- Hardhead
- Macquarie Perch
- ▲ Murray Cod
- ▲ Musk Duck
- ▲ Pale Sun Moth
- ▲ Square-tailed Kite
- ▲ Squirrel Glider
- ▲ Striped Legless Lizard



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Appendix 5 – Matters of MNES Table

Table 6: Matters of MNES identified in the PMST

MNES*	Likelihood of occurrence	Comments
Flora		
Hairy-pod Wattle	Unlikely to occur	Not recorded in the local area and marginal habitat
Downy Star-bush	Unlikely to occur	Not recorded in the local area and marginal habitat
Greencomb Spider-orchid	Unlikely to occur	Not recorded in the local area and no suitable habitat present
Candy Spider-orchid	Unlikely to occur	Not recorded in the local area and no suitable habitat present
Trailing Hop-bush	Unlikely to occur	Not recorded in the local area and marginal habitat
Wimmera Rice-flower	Unlikely to occur	Not recorded in the local area and no suitable habitat present
Floodplain Rustyhood	Unlikely to occur	Not recorded in the local area and no suitable habitat present
Turnip Copperburr	Unlikely to occur	Not recorded in the local area and marginal habitat
Slender Darling-pea	Unlikely to occur	Not recorded in the local area and marginal habitat
Metallic Sun-orchid	Unlikely to occur	Not recorded in the local area and no suitable habitat present
Fauna		
Golden Sun Moth	Unlikely to occur	Not recorded in the local area and modified habitat present
Growling Grass Frog	Low likelihood of occurrence	1 record in the local area but modified habitat
Striped Legless Lizard	Low likelihood of occurrence	4 records in the local area but modified habitat
Grey-headed Flying-fox	Unlikely to occur	Not recorded in the local area and modified habitat present
Australasian Bittern	Unlikely to occur	3 records in the local area but no suitable habitat present
Painted Honeyeater	Unlikely to occur	Not recorded in the local area and no suitable habitat present
Red-tail Black Cockatoo	Moderate likelihood of occurrence	Not recorded in the local area, however, Buloke trees provide suitable habitat
Malleefowl	Unlikely to occur	Not recorded in the local area and modified habitat present
Eastern Curlew	Unlikely to occur	Not recorded in the local area and no suitable habitat present
Swift Parrot	Unlikely to occur	Not recorded in the local area and modified habitat present
Plains-wanderer	Low likelihood of occurrence	9 records in the local area but modified habitat
Australian Painted Snipe	Unlikely to occur	Not recorded in the local area and no suitable habitat present
Curlew Sandpiper	Unlikely to occur	Not recorded in the local area and no suitable habitat present
White-throated Needletail	Unlikely to occur	Not recorded in the local area and no suitable habitat present
Yellow Wagtail	Unlikely to occur	Not recorded in the local area and no suitable habitat present
Satin Flycatcher	Unlikely to occur	Not recorded in the local area and no suitable habitat present
Ecological Community		
<i>Natural Grasslands of the Murray Valley Plains</i>	Not present	Areas of Plains Grassland in the project area do not meet the condition thresholds for this community
<i>Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions</i>	Present	Remnant patches of Plains Savannah and Plains Woodland within the project area are attributed to this ecological community



MNES*	Likelihood of occurrence	Comments
<i>Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia</i>	Not present	Does not occur in the assessment area
<i>White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland</i>	Not present	Does not occur in the assessment area

*Sourced from the PMST within a 5 km radius of the project area (DoEE 2017).