
ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

Infinite Green Energy

ecoscape



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Arrowsmith Hydrogen Detailed Flora and Vegetation Survey
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EXECUTIVE SUMMARY

Infinite Green Energy (IGE, previously known as Infinite Blue Energy; IBE) is proposing to develop a green hydrogen plant at Arrowsmith in the Midwest of Western Australia, south of Dongara. This plant will be powered by wind turbines and a photovoltaic array and use groundwater available on-site.

In 2020 IBE appointed Ecoscape to undertake a Reconnaissance-level flora and vegetation survey and a Basic-level fauna survey of its Arrowsmith site. The resulting report was provided to the Western Australian Environmental Protection Authority (EPA) as part of the environmental review process. The EPA identified a number of survey constraints including lack of information on a significant proportion of the site due to inaccessibility as a result of impenetrable vegetation, and the level of detail of the survey, particularly the flora and vegetation component (Reconnaissance rather than Detailed flora and vegetation). As a result, the EPA informed IGE that further information was required.

In 2022 IGE appointed Ecoscape to conduct investigations to meet the EPA requirements in regard to the flora and vegetation survey and terrestrial fauna, particularly for Carnaby's Cockatoo, components.

The IGE survey area occupied 768.95 ha overall, inclusive of a 50 m buffer applied to the proposed development footprint.

The 2022 Detailed flora and vegetation survey, conducted over 5 days during October and incorporating the results of the 2020 survey, identified the following significant findings:

- 234 vascular flora species recorded from 14 floristic quadrats (2022), 13 descriptive relevés (2022) and 20 quadrats and relevés (2020), including:
 - five Priority-listed flora (*Eucalyptus foecunda* subsp. *aeolica*, P2; *Scholtzia calcicola*, P2; *Beyeria cinerea* subsp. *cinerea*, P3; *Dampiera tephrea*, P3; *Eucalyptus zopherophloia*, P4)
 - three range extension or range infill species, although two are introduced
 - 44 introduced flora including one Declared Pest plant and one WoNS species that were only recorded during the 2020 field survey; neither (*Echium plantagineum* and *Lycium ferocissimum*, respectively) have management requirements
- 10 vegetation types plus mosaics of these:
 - **ArLOF**; *Acacia rostellifera* low open forest on sandy slopes/disturbed areas
 - **ArMcMhTS**; *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland on near coastal dunes and swales
 - **ArMIMhTS**; *Acacia rostellifera*, *Melaleuca lanceolata* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland on near coastal dunes and swales
 - **AsaAscTOS**; *Acacia saligna* and *Acacia scirpifolia* tall open shrubland on sandy slopes/disturbed areas
 - **AspBsBIMS**; *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland on sandplain/lower slopes
 - **BpLW**; *Banksia prionotes* low woodland on sandplain/lower slopes
 - **EcArMW**; *Eucalyptus camaldulensis* subsp. *obtusa* and *Acacia rostellifera* mid woodland on riparian and low-lying areas
 - **EeLOW**; *Eucalyptus erythrocorys* low open woodland on exposed limestone/cap
 - **EobEorEzMOMF**; *Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland on near coastal dunes and swales
 - **McAxGaTDS**; *Melaleuca cardiophylla*, *Acacia xanthina* and *Grevillea argyrophylla* tall dense shrubland on near coastal dunes and swales
- vegetation type **EobEorEzMOMF** is likely to be representative of the *Coastal sands dominated by Acacia rostellifera, Eucalyptus oraria and Eucalyptus obtusiflora (Geraldton area)* P1 PEC, noting that this PEC has a likely 125 km north-south distribution. It occupied 40.60 ha in the survey area (5.28%) plus representation in mosaics, although only 6.96 ha (2.89%) of the proposed disturbance footprint.
- vegetation types **AspBsBIMS** and **BpLW** are considered as foraging habitat for Carnaby's Cockatoo due to the high proportion of proteaceous species within them, including the characteristic *Banksia* species. They occupied 93.17 ha (12.12%) and 5.59 ha (0.73%) of the survey area respectively, plus representation

in mosaics, or 11.86 ha (4.95%) and 2.73 ha (4.14%) within the proposed development footprint plus mosaics

- the vegetation ranged from Completely Degraded condition to Excellent condition with 21.93% not having native vegetation (cleared). Overall, 24.03% was in Degraded-Completely Degraded condition and 54.04% in Good or better condition.

An assessment of the utilisation of the sandplain vegetation (vegetation types **AspBsBIMS** and **BpLW**) by Carnaby's Cockatoo indicates that:

- the survey area is not within the modelled breeding range of Carnaby's Cockatoo (DAWE 2022), however, the site is of significance to the species for foraging (Williams *et al.* 2017) and likely has a semi-resident population (Johnstone & Kirkby 2019)
- there are significant numbers of preferred foraging species, particularly *Banksia sessilis* and *Banksia prionotes*, present thus these vegetation types represent potential high quality foraging, however, no evidence of presence or use by Carnaby's Cockatoo were observed
- due to the seasonal nature of nearby water sources (Arramall Lake) that has water only in winter-spring it is likely that the foraging vegetation is not utilised during summer-autumn as the birds potentially move elsewhere to access water (although this would require confirmation)
- the likelihood of use of these vegetation types by Carnaby's Cockatoo is further reduced as the survey area represents the northern edge of a far larger extent of similar vegetation to the south in Beekeepers Nature Reserve.

It is considered likely that Carnaby's Cockatoo only utilise the foraging habitat within the survey area on infrequent occasions.

ACRONYMS AND ABBREVIATIONS

Table 1: Acronyms and abbreviations

Acronyms	
BAM Act	Western Australian <i>Biosecurity and Agriculture Management Act 2007</i>
BC Act	Western Australian <i>Biodiversity Conservation Act 2016</i>
BoM	Bureau of Meteorology
C1, C2, C3	Declared Pest categories under the BAM Act
CD	Conservation Dependent (fauna; specially protected species under the Western Australian BC Act)
CR	Critically Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
DAWE	Commonwealth Department of Agriculture, Water and Environment (2020-2022, now DCCEEW)
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts (2007-2010, now DCCEEW)
DotEE	Commonwealth Department of the Environment and Energy (2016-2020)
EN	Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
Ecoscape	Ecoscape (Australia) Pty Ltd
EP Act	Western Australian <i>Environmental Protection Act 1986</i>
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ha	hectare/hectares
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre/kilometres
m	metre/metres
NVIS	National Vegetation Inventory System
MNES	Matters of National Environmental Significance
OS	Other specially protected species (fauna; specially protected species under the Western Australian BC Act)
P; P1, P2, P3, P4, P5	Priority Flora and Fauna species rankings (P1-P4) or Priority Ecological Communities (P1-P5)
PEC	Priority Ecological Community
PF	Priority Flora
PMST	Protected Matters Search Tool (hosted by DAWE, used to search for MNES)
sp.	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
subsp.	Subspecies (infrataxon)
TEC	Threatened Ecological Community
TF	Threatened Flora (formerly termed Declared Rare Flora, DRF, in Western Australia)
var.	Variety (infrataxon)
VU	Vulnerable (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
WAH	Western Australian Herbarium
WAOL	Western Australian Organism List
WONS	Weeds of National Significance
*	Introduced flora species (i.e. weed)

1 INTRODUCTION

1.1 BACKGROUND

Infinite Green Energy (IGE, previously known as Infinite Blue Energy; IBE) is proposing to develop a green hydrogen plant at Arrowsmith in the Midwest of Western Australia, south of Dongara. This plant will be powered by wind turbines and a photovoltaic array and use groundwater available on-site. The resulting hydrogen is proposed for both local use and export.

The Arrowsmith Hydrogen Plant is proposed to be developed in stages and will ultimately include an export facility. The location of the proposed plant is currently a combination of cleared farmland and grazed and ungrazed bushland. The wider site includes shallow freshwater lakes and a limestone karst system including two known caves (Arramall Cave and River Cave). IGE is not proposing developing the area including the freshwater lakes, and is intending to keep this portion of the site as conservation lands.

In 2020 IBE appointed Ecoscape to undertake a Reconnaissance-level flora and vegetation survey and a Basic-level fauna survey of its Arrowsmith site. The resulting report (summarised in **Section 2.2**) was provided to the Western Australian Environmental Protection Authority (EPA) as part of the environmental review process required prior to commencing development. The EPA review (dated 8 August 2022) identified a number of survey constraints including lack of information on a significant proportion of the site due to inaccessibility as a result of impenetrable vegetation, and the level of detail of the survey, particularly the flora and vegetation component (Reconnaissance rather than Detailed flora and vegetation). These constraints were identified during the field survey. As a result, the EPA informed IGE that further information was required (**Appendix One**).

In 2022 IGE appointed Ecoscape to conduct investigations to meet the EPA requirements in regard to the flora and vegetation survey and terrestrial fauna, particularly for Carnaby's Cockatoo, components. This report represents the flora and vegetation requirements and aspects of the Carnaby's Cockatoo requirements that require field survey to address. A separate literature review was also undertaken to identify the potential significant impacts of wind turbines on avifauna (birds and bats).

1.2 SURVEY AREA

The IGE project area, known as the 'survey area' in this report, is located within the Shire of Irwin in the Midwest region of Western Australia, approximately 320 km north from Perth and 30 km south of Dongara (**Figure 1**). The survey area, which consists of areas proposed to be cleared (240.37 ha) with an applied 50 m buffer, as required by the EPA, occupied 768.95 ha overall.

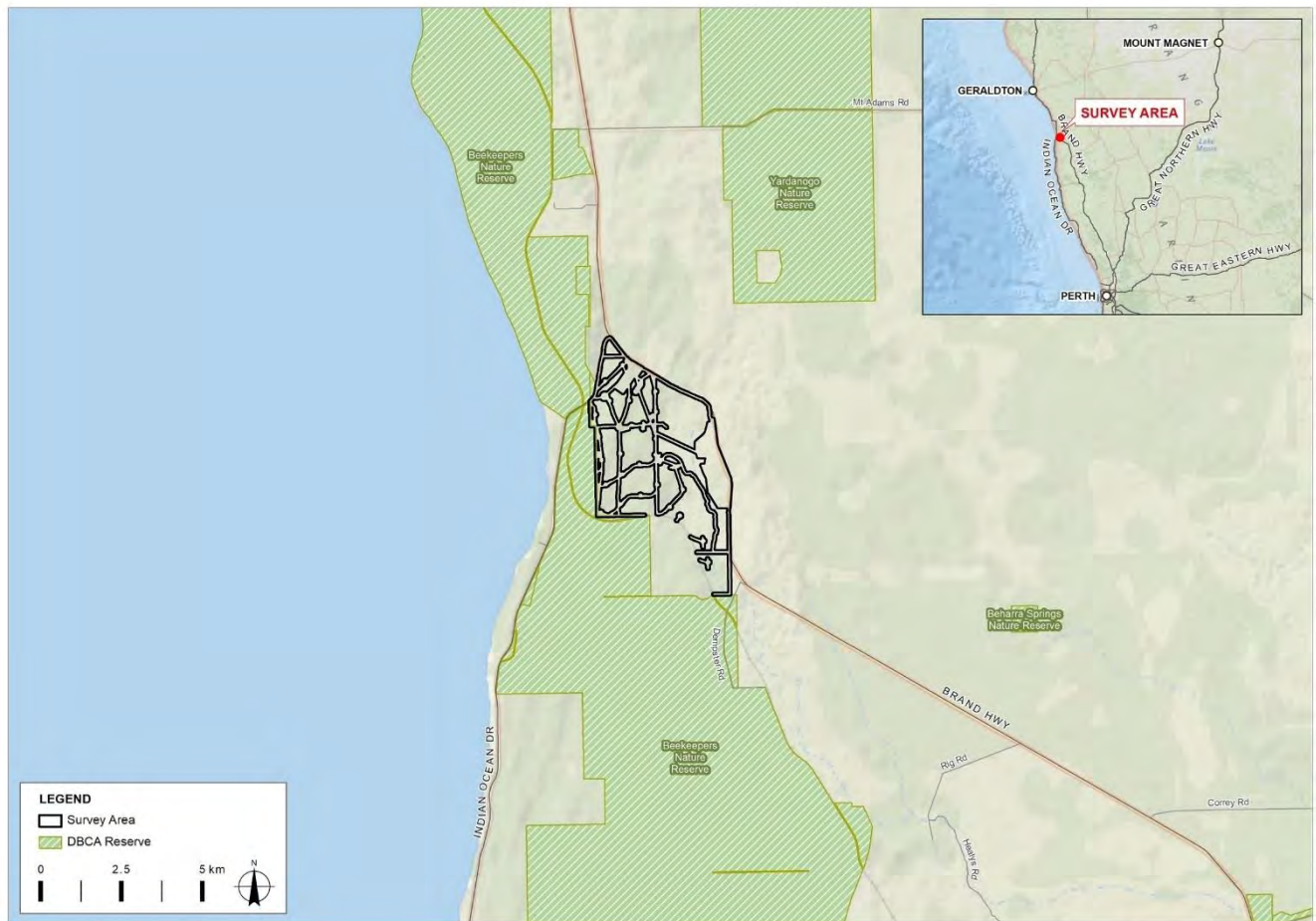


Figure 1: Survey area location

1.3 SURVEY REQUIREMENTS

The requirements of the survey were to:

- supplement the results of the Reconnaissance flora and vegetation survey by conducting a Detailed survey of the disturbance footprint and at least another 50 m
- quantify the Carnaby's Cockatoo foraging habitat, delineating the extent of vegetation with *Banksia sessilis* and *Banksia prionotes*.

1.4 COMPLIANCE

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Western Australian *Biodiversity Conservation Regulations 2018*
- Department of Environment, Water, Heritage and the Arts (DEWHA 2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999*
- Department of Agriculture Water and the Environment (DAWE 2022) *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black-cockatoo.*

Summaries of the main Acts under which this assessment was conducted, and related criteria and definitions, are available in **Appendix Two**.

As well as those listed above, the assessment complied with EPA requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2016a) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, known herein as the Flora and Vegetation Technical Guidance
- EPA (2016b) *Environmental Factor Guideline – Flora and Vegetation*
- EPA (2021) *Statement of environmental principles, factors, objectives and aims of EIA*.

Additional details (definitions and criteria) relevant to these works are available in **Appendix Two**.

2 DESKTOP ASSESSMENT AND PREVIOUS SURVEY

2.1 DESKTOP ASSESSMENT

The current survey area is located within the same physical footprint as the previous survey therefore the previous desktop assessment remains applicable, with modifications as follows.

The desktop assessment identifying physical and biological factors intersecting the survey area is available in Ecoscape (2021) *Arrowsmith Hydrogen Project Environmental Survey*, prepared for Infinite Blue Energy (now Infinite Green Energy).

2.2 PREVIOUS SURVEY SUMMARY

The summary of relevant information contained in the above report is as follows, noting that the 2020 survey (Ecoscape 2021) was conducted over a larger area, including the portion of the site to be retained as conservation lands. Corrections to the following summary are outlined in **Section 2.2.1** below.

The desktop assessment identified the following significant features of the survey area:

- it is located immediately adjacent to Beekeepers Nature Reserve
- the nearest Threatened or Priority Ecological Community is approximately 25 km from the survey area
- 83 conservation-listed flora have been recorded within 25 km of the site, including eight Threatened Flora (TF) and a further six TF (or their habitat) are likely to or may occur
- 12 Priority-listed flora (PF) have a high desktop likelihood of occurring or (for one P4 species; *Eucalyptus zopherophloia*) are known to occur within the survey area
- 27 conservation-listed fauna species have been recorded from within 30 km of the survey area (DBCAs and *NatureMap* search results) and a further 25 EPBC-listed species or their habitat are known to or could occur within the survey area; two were considered to have a High desktop likelihood of occurring: Malleefowl and Carnaby's Cockatoo, both listed as Threatened under both Commonwealth and Western Australian legislation. The survey area is not within the mapped breeding range of Carnaby's Cockatoo.

The flora and vegetation field survey, conducted during October 2020 as a Reconnaissance survey in accordance with the requirements of the Environmental Protection Authority (EPA) 2016 Flora and Vegetation Technical Guidance, and subsequent review, identified:

- 191 vascular flora species recorded from five floristic quadrats, 15 detailed relevés and during targeted conservation-listed flora searches and traverses of the site, including:
 - three Priority-listed flora (*Anthocercis intricata*, P3; *Beyeria cinerea* subsp. *cinerea*, P3; *Eucalyptus zopherophloia*, P4)
 - no TF or P1 species were assessed as having a High post-survey likelihood of occurring
 - two P2 (*Acacia vittata* and *Scholtzia calcicola*), two P3 (*Haloragis foliosa* and *Thryptomene* sp. Lancelin (M.E. Trudgen 14000) and one P4 (*Stawellia dimorphantha*) had a High post-survey likelihood of occurring. Impacts on clearing (if present) are unlikely to be significant for these, except possibly *Scholtzia calcicola* that is a poorly known and poorly collected species, and it is not possible to determine impacts on its population.
 - 39 introduced flora (weeds) including one Declared Pest species (**Echium plantagineum*, Patterson's Curse) and one Weed of National Significance (**Lycium ferocissimum*, African Boxthorn). There are no management requirements as a result of these species' presence.
 - two species are considered to have minor significance as a small range extension (*Melaleuca strobophylla*) and range infill (*Pelargonium littorale*)
- eight broad structural vegetation types:

- **ArLOF**; *Acacia rostellifera* low open forest and **As1As2TOS**; *Acacia saligna* and *Acacia scirpifolia* tall open shrubland largely on disturbed uplands; neither are considered locally or regionally significant
- **ArMrTS**; *Acacia rostellifera* and *Melaleuca raphiophylla* tall shrubland on karst limestone; this vegetation type is locally and regionally significant due the presence of the phreatophytic species *Eucalyptus camaldulensis* (indicative of a Groundwater Dependent Ecosystem; GDE) and its role maintaining the ecological integrity of a significant ecological community (the karst system), however, was in Degraded-Completely Degraded condition
- **EcArMW**; *Eucalyptus camaldulensis* subsp. *obtusata* and *Acacia rostellifera* mid woodland in riparian areas and floodplains; considered locally and regionally significant due the presence of the phreatophytic species *Eucalyptus camaldulensis* (indicative of a GDE), however, was in Degraded-Completely Degraded condition
- **EeLW**; *Eucalyptus erythrocorys* low woodland and **McArGaTS**; *Melaleuca cardiophylla*, *Acacia rostellifera* and *Grevillea argyrophylla* tall shrubland on limestone uplands, neither of which are considered locally or regionally significant
- **LcBsJhMOS**; *Labichea cassioides*, *Banksia sessilis* var. *cygnorum* and *Jacksonia hakeoides* mid open shrubland on sandplain with limestone pavement; this vegetation type incorporated small areas of *Banksia prionotes* woodland, and is not considered locally or regionally significant
- **MsCoMrMOW**; *Melaleuca strobophylla*, *Casuarina obesa* and *Melaleuca raphiophylla* mid open woodland associated with ephemeral lakes and floodplain areas; this vegetation type is locally and regionally significant for a number of reasons. These include its small extent, association with a restricted landform, degree of historical impact from grazing, importance for fauna as wetland fringing vegetation, and presence of the phreatophytic species *Eucalyptus camaldulensis* that is indicative of a GDE and important in maintaining the ecological integrity of a significant ecosystem (karst system). However, it was in Degraded-Completely Degraded condition.
- the vegetation condition ranged from Excellent (mostly on the sandplain in vegetation type **LcBsJhMOS**) to Completely Degraded.

The fauna and fauna habitat survey, conducted as a Basic survey in accordance with the EPA's 2020 Fauna Survey Technical Guidance identified the following significant attributes:

- 57 vertebrate fauna species including:
 - one Threatened bird species: *Calyptorhynchus latirostris* (Carnaby's Cockatoo), listed as Endangered under both the EPBC Act and BC Act
 - one Migratory bird species: *Calidris acuminata* (Sharp-tailed Sandpiper), listed under the EPBC Act
 - one Marine bird species: *Merops ornatus* (Rainbow Bee-eater) listed under the EPBC Act, although not considered threatened
- the post-survey likelihood assessment identified a further Migratory bird as having a High likelihood of occurring in the survey area; *Actitis hypoleucos* (Common Sandpiper)
- two microbat species recorded during the survey (*Austronomus australis* and *Vespadelus baverstocki*) are significant as range extensions, and one mammal, *Sminthopsis dolichura* (Little Long-tailed Dunnart), represents a range infill; none of these are conservation-listed
- eight fauna habitat types are present in the survey area (Heath, Mallee Woodland, Pastoral, Riparian, Shrubland, Waterbody (seasonal), Wetland and Woodland), of which the Waterbody and Wetland habitats are considered important for conservation-listed migratory wading birds
- the Pastoral and Wetland habitats are considered significant for Carnaby's Cockatoo, noting that Heath and Shrubland may also represent foraging habitat, particularly areas with *Banksia prionotes* trees that are considered as a premium food source.

2.2.1 CORRECTIONS AND CHANGES IDENTIFIED SINCE THE PREVIOUS SURVEY

The following corrections, identified since the previous (Ecoscape 2021) report was prepared, should be applied to the previous data and above summary.

Anthocercis intricata (P3)

Anthocercis intricata (P3) was identified during the previous survey (Ecoscape 2021), however, the collected representative specimen from the 2022 survey was identified as *Anthocercis genistoides* which is not conservation-listed.

It is likely that the 2020 identification was incorrect, however, it remains possible that *Anthocercis intricata* may occur on occasion.

Melaleuca raphiophylla

Melaleuca raphiophylla was misattributed in the data to occur within vegetation type **ArMrTS**; it should have been *Melaleuca lanceolata* and the vegetation type code should therefore have been ArMITS. This error has been corrected in this document.

Melaleuca raphiophylla was collected from the Arrowsmith River in 2020 thus it remains valid as a species associated with riparian areas (drainage lines, lake).

DBCA Threatened and Priority Flora Database Search

An updated DBCA database search was not commissioned prior to the field survey. However, *Eucalyptus foecunda* subsp. *aeolica* (P2), common name Beekeepers Mallee, was formally described in 2021 (Nicolle & French 2021) and would have, if a search had been commissioned, been added to the survey targets. The species was collected as an opportunistic observation without a recorded location during the 2020 survey but was not, at that time, described to infrataxon level or conservation-listed.

Taxonomy

Subtaxa discrepancies have been reconciled between the two surveys. Taxonomic changes of note are described below.

Leucopogon insularis and *Styphelia insularis* are nomenclatural synonyms; the former name was used in the 2020 report (Ecoscape 2021) whereas the latter name is the current taxonomy according to *FloraBase* (WAH 1998-2023).

Lysiandra calycina and *Lysiandra scaber* are the more recent taxonomic names of *Phyllanthus calycinus* and *Phyllanthus scaber* respectively (WAH 1998-2023).

These taxa are not conservation-listed and have no other significance.

Carnaby's Cockatoo

The Commonwealth and Western Australian governments have both accepted updates to the taxonomy of Black Cockatoo species (DAWE 2022; Western Australian Museum 2022). *Calyptorhynchus latirostris* (Carnaby's Cockatoo) is now known as *Zanda latirostris*.

2.3 REVISED LITERATURE REVIEW

The following documents were identified as having relevance to the survey area (documents identified after the Ecoscape 2020 survey (Ecoscape 2021) are indicated with the author in bold font):

- Ecoscape (2010) *Dongara to Cape Burney Coastal Vegetation Survey*, detailing the results of a coastal vegetation survey for Northern Agricultural Catchment Council, the southern terminus of which is approximately 25 km to the north of the survey area
- **Mattiske Consulting** (2021) *Flora and Vegetation Assessment Arrowsmith North Survey Area*. The Mattiske survey area is located approximately 2.8 km to the east of the IGE survey area. A total of 113 survey sites were established, resulting in the recording of 221 vascular plant taxa (no TF; nine PF) and eight vegetation communities, none of which were considered as significant. Overall, the vegetation was low heath and shrubland on sandplain, and mostly not significantly floristically similar to the sandplain vegetation of the IGE site. Of note, *Banksia sessilis* was not recorded by Mattiske although *Banksia prionotes* was, along with six other species in the genus.

- **Astron Environmental Services** (2020) *Reconnaissance Flora, Vegetation and Basic Fauna Survey Facility Extension*, describing the survey results from Jingemina, approximately 14 km to the north. Three vegetation types were recorded that are structurally and moderately floristically similar to that of the IGE site, including a vegetation type characterised by *Eucalyptus oraria* but not considered to be representative of the *Coastal sands dominated by Acacia rostellifera, Eucalyptus oraria and Eucalyptus obtusiflora* (Geraldton area) PEC as *Acacia rostellifera* was not present in the vegetation type. No conservation-listed flora were recorded.
- **PGV Environmental** (2020) *Dongara Lime Sands M70/311, M70/917, P70/1735, E70/355, E70/5041, M70/642 Flora and Vegetation Survey*, detailing surveys of two areas, one located approximately 14 km north of the IGE survey area and the other approximately 18 km north. The closest PGV survey area was occupied by vegetation (upper stratum only) described as *Melaleuca huegelii/M. cardiophylla* Tall Open Scrub; the other PGV survey area was occupied by 16 vegetation types characterised by various combinations of the two previously listed *Melaleuca* species and *Melaleuca lanceolata, Acacia rostellifera, Myoporum insulare, Allocasuarina lehmanniana, Spyridium globulosum* and *Tecticornia halocnemoides*. The latter four species have not been recorded from the current IGE survey area (noting they occur closer to the coast than the IGE survey area), however, the westernmost, more coastal shrubland vegetation within the IGE survey area is characterised by the three listed *Melaleuca* species and *Acacia rostellifera*. PGV did not record any *Grevillea argyrophylla* or *Acacia xanthina* that characterise the westernmost more coastal shrublands at Arrowsmith. PGV also did not record any mallee species or vegetation in its survey areas. Overall, despite some floristic differences, the PGV vegetation types in a similar landform (i.e. not including the taller coastal dunes and dune swales that are not present in the IGE site) is structurally very similar to that at Arrowsmith.
- **Mattiske Consulting** (2018) *Flora survey for the Beharra Springs Clearing Permit (CPS 4607)*, describing a targeted survey area from approximately 9 km to the east of the IGE survey area. The survey recorded three Priority-listed species: *Hemiandra* sp. Eneabba (H. Demarz 3687) – P3, and two P4 species; *Banksia elegans* and *Schoenus griffinianus*. The vegetation of the Mattiske survey area was described as *Banksia attenuata, Banksia hookeriana* and *Banksia menziesii* open woodland; no similar vegetation occurs on the IGE site.
- GHD (2015) *Mid West Coastal Nodes Biological Survey Report*, detailing a biological assessment of three coastal areas: Halfway Bay/Lucky Bay in the Shire of Northampton, Little Anchorage in the Shire of Coorow and Sandy Cape in the Shire of Dandaragan. Overall the vegetation recorded from the GHD survey areas was more coastal than the IGE site and therefore had little similarity.
- **Woodman Environmental Consulting** (2012) *Summary report of flora and vegetation studies 2001-2011*. This report summarises flora and vegetation survey findings from a number of surveys conducted in areas of interest for future mining by Iluka Resources. In total 425 floristic quadrats were assessed, identifying 1,012 vascular plant taxa including 11 TF and 79 PF. Floristic analysis identified 42 floristic community types, most of which within the Iluka study area were considered to have high conservation significance due to high species richness and endemism.
- Bamford Consulting Ecologists (2012) *Fauna Assessment of Tiwest's Dongara Project*, detailing a fauna survey from approximately 10 km east of the survey area. The survey recorded six conservation-listed fauna species: Black-striped Snake, Carnaby's Cockatoo, Rainbow Bee-eater (no longer considered as significant), Rufous Fieldwren (western wheatbelt) (not currently conservation-listed), Crested Bellbird (not currently conservation-listed) and White-breasted Robin (not currently conservation-listed), and a further 15 conservation-listed species as likely to occur.
- Brett Lane & Associates (2008) *Proposed Badgingarra Wind Farm Flora and Fauna Assessment*, detailing a primarily fauna survey of an area approximately 80 km to the south. Carnaby's Cockatoo was the only significant fauna species recorded, with the report's author suggesting that this species is unlikely to be collide with wind turbines, although roosting and foraging habitat may be impacted by proposed wind turbines.
- Susac (2007) *A Literature Review & Report of Karst Biodiversity, Palaeontology & Hydrology in the Northern Agricultural Region, Western Australia*. This literature review documents information relating to karst areas

in the Eneabba, Jurien, South Hill, East Moore and Moora karst area zones, including E-22 Arramall Cave and E-23 River Cave, both of which located within the survey area. Arramall Cave is reported as having evidence of bats (guano piles), including *Macroderma gigas* (Ghost Bat) that is now extinct from the region and now replaced by *Chalinolobus morio* (Chocolate Wattled Bat), nesting in the cave entrance by *Hirundo neoxena* (Welcome Swallow), *Litoria moorei* (Motorbike Frog) and a large array of invertebrate troglofauna residents and arthropods washed into the cave. River Cave has greater surface connectivity and more vertebrate fauna including snakes, geckos and frogs, and an array of invertebrate troglofauna although it is noted that the cave dries out significantly in summer and autumn.

- Hart, Simpson and Associates Pty Ltd (2003) *Flora & Fauna Investigation Report*. This report details a survey for Origin Energy, with the study located approximately 2.5 km north of this survey area. The survey identified a shrub mallee vegetation type as being significant (dominated by *Eucalyptus obtusifolia* subsp. *dongarraensis*); this is now recognised as a P1 PEC, three conservation-listed flora (*Anthocercis intricata*, P3; *Haloragis foliosa*; P3, and *Eucalyptus zopherophloia*; P4) and three conservation-listed fauna species (Carnaby's Cockatoo, Malleefowl, Peregrine Falcon).

2.4 SEASONAL CONDITIONS

The closest Bureau of Meteorology (BoM) station with long term rainfall records is Green Grove (BoM 2023a station 8057, operating since 1951) which is located approximately 6 km from the survey area. The mean annual rainfall is 403.6 mm falling predominantly during May-August. The rainfall during the 6-month period prior to the field survey was 96.23% of the long-term average for this period.

The closest Bureau of Meteorology (BoM) station with long term temperate records is Jurien Bay (BoM 2023a station 9131, operating since 1968) located approximately 85 km south of the survey area. February is the hottest month with a mean maximum temperature of 30.8°C and minimum of 18°C. July is the coldest month with a mean maximum of 19.6°C and minimum of 9.4°C.

Figure 2 shows the average rainfall and temperatures of the survey area, with rainfall for the year preceding the field survey.

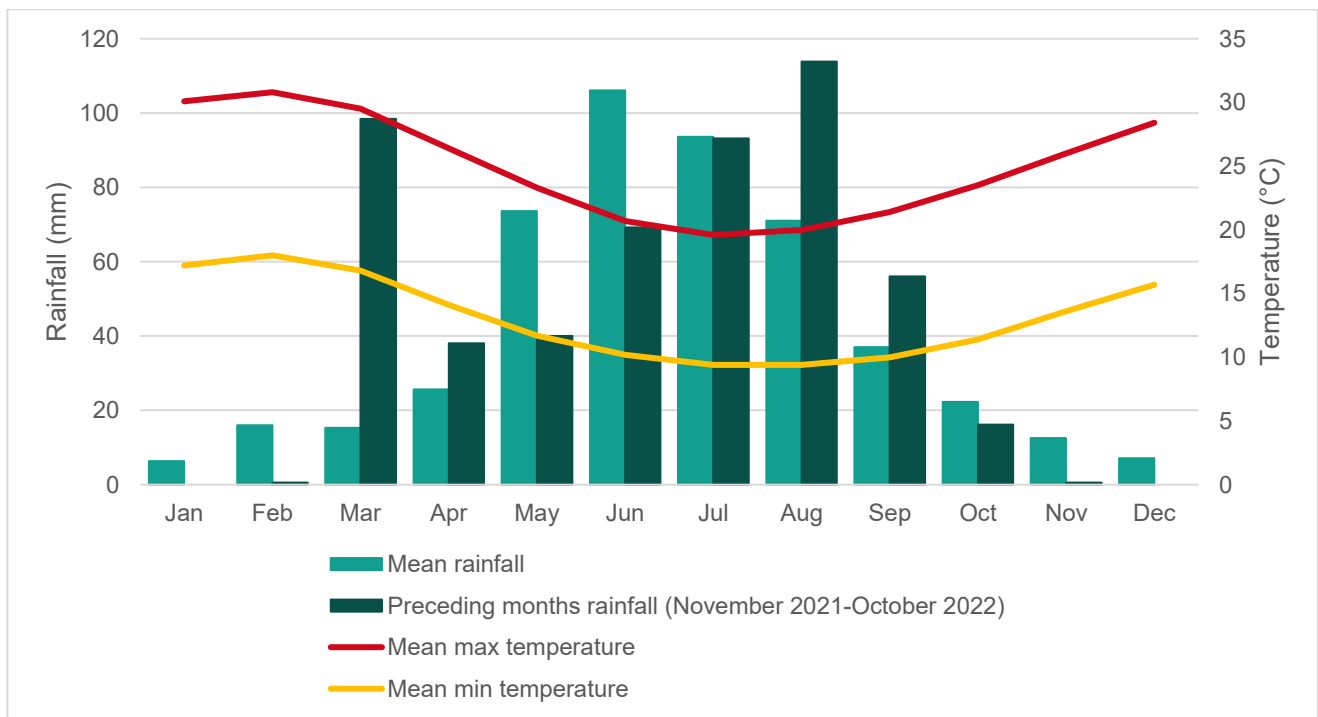


Figure 2: Rainfall and temperature data for the survey area (BoM 2023a)

3 METHODS

3.1 SURVEY AIMS

The aims of the Detailed flora and vegetation survey were to:

- conduct a Detailed flora and vegetation survey, supplementing the results of the Ecoscape (2021) Reconnaissance-level survey, of the current disturbance footprint and at least 50 m surrounding
- conduct a Carnaby's Cockatoo foraging habitat assessment, particularly to determine the extent and quality of *Banksia prionotes* and *Banksia sessilis* in the disturbance footprint.

The Detailed flora and vegetation survey is in response to the EPA's Notice Requiring Information for Assessment (**Appendix One**).

3.2 GUIDING PRINCIPLES

The flora and vegetation survey was conducted as a Detailed survey according to the Flora and Vegetation Technical Guidance (EPA 2016a). The EPA considers that a Detailed survey requires:

- a comprehensive survey design, including giving consideration to the survey timing that should be conducted during the primary season of survey for the bioregion and disturbance events, and the potential requirement for supplementary surveys
- a minimum of three quadrats (in proportion to the extent of the vegetation unit), located throughout each preliminary vegetation types sampled throughout its geographic range, with additional quadrats and rescoring during supplementary surveys to clarify vegetation unit boundaries
- regional surveys if there is insufficient information available (identified during the desktop assessment) to provide local and regional context
- the survey may include a number of sampling techniques including quadrats, relevés, transects and traverses, as well as opportunistic observations
- the flora inventory should be comprised of data collected from quadrats and relevés, supplemented by opportunistic observations, systematic surveys and targeted inspections of various habitat areas
- it may be appropriate to increase survey effort in areas of unusual habitat
- sampling sites that are placed at representative locations throughout the survey area considering landform, geology, elevation, slope, aspect, surface or groundwater expression and soil type, as well as vegetation structure, composition and condition.

Targeted searches were also conducted in areas of habitat suitable for TF and PF identified during the desktop assessment and previous surveys as having potential to occur.

3.3 FLORA AND VEGETATION FIELD SURVEY

3.3.1 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Flora and Vegetation Technical Guidance (EPA 2016a), conducted as a single phase Detailed survey.

Table 9, **Table 10** and **Table 11** in **Appendix Two** outline the conservation criteria used in the assessment.

Survey method details are outlined below.

3.3.1.1 Floristic Quadrats

Floristic quadrat ('quadrat') locations were selected using aerial photography, environmental values and field observations to represent the vegetation values existing at the site. The unmarked quadrats were 10 m x 10 m in dimension, as required according to the Flora and Vegetation Technical Guidance (EPA 2016a). Where the vegetation consisted of a narrow linear corridor, quadrats were linear but of the same overall size i.e. 100 m².

The following information was collected from within each quadrat:

- observer
- date
- quadrat/site number
- GPS location (GDA94) of the northwest corner
- digital photograph (spatially referenced with a reference number), taken from the northwest corner, looking diagonally across the quadrat
- broad soil type and colour
- topography
- list of flora species recorded with the average height and total cover within the quadrat for each species
- vegetation description (as per below)
- vegetation condition.

At least three quadrats per vegetation type were recorded for the Detailed survey where there was sufficient extent; this total incorporates quadrats recorded during the 2020 (Ecoscape 2021) survey although these may not be within the current survey area but are still relevant to describe the flora and vegetation of the area. On occasions the quadrats recorded during the current 2022 survey are slightly outside the survey area, however, the data is valid for within the survey area.

Quadrat locations are displayed on the **Map 1** series.

Supplementary relevés (unmeasured areas of approximately the same extent as quadrats) were recorded in areas of Degraded or Completely Degraded condition vegetation or where there were physical limitations on measuring the precise extent. Despite being unmeasured a similar level of detail was recorded as for quadrats.

Descriptive relevés wherein only the dominant species were noted were also recorded during the field survey. The role of these relevés was to assist with vegetation type mapping.

3.3.1.2 Targeted Searches

Threatened and Priority Flora identified during the desktop analysis and previous surveys as known or having potential to occur were targeted for searches in areas of potential habitat. Where accessible, particularly in areas proposed for tracks, wind turbines and wind turbine construction laydown areas, the sites were traversed at approximately 50 m intervals.

The locations of all targeted taxa collected were recorded using a handheld GPS with the following data recorded:

- observer, date and time
- local abundance/population size and/or population boundary, including outside the development envelopes where possible
- landform
- brief vegetation community description
- representative photos of each species and habitat
- collection of representative specimens.

3.3.1.3 Introduced Species

Introduced species (weeds) were recorded during the collection of the overall flora inventory.

3.3.1.4 Vegetation Description and Classification

Vegetation was described from each of the quadrats using the height and estimated cover of dominant and characteristic species of each stratum based on the National Vegetation Information System, recorded at Level V (NVIS Technical Working Group & DotEE 2017) (**Table 12** and **Table 13** in **Appendix Three**). Up to three species per stratum from each stratum (upper, mid and ground) were used to formulate vegetation descriptions for each quadrat and each vegetation type.

Vegetation type descriptions were created by combining quadrat descriptions and modifying, where necessary, based on the wider vegetation. Vegetation codes for these were formulated using the characteristic species of the highest stratum within the vegetation type that had >2% cover (i.e. not scattered) if present, with the first series of letter codes referring to the component species (upper case first letter referring to the genus, lower case one or two letters referring to the species, with the upper case letters at the end referring to the stratum structure e.g. **AspBsBIMS** refers to *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland. **Asp** (*Acacia spathulifolia*) requires three letters as *Acacia saligna* is also a dominant species.

3.3.1.5 Vegetation Condition Assessment

Vegetation condition was assessed broadly and continuously throughout the survey area and at each quadrat using the Vegetation Condition Scale for the Southwest Botanical Province (EPA 2016a) (**Table 14** in **Appendix Three**). As quadrats are located in the best condition parts of a vegetation type, the condition rating of the quadrat may not match that of the broader vegetation type due to the scale of mapping.

3.3.1.6 Vegetation Interpretation

Not all areas could be or were accessible or accessed during the 2020 (Ecoscape 2021) or current 2022 surveys. Vegetation type interpretation methods were as follows:

- where not accessed during 2022 but accessed during 2020 – 2020 vegetation type boundaries and attributions (taking into consideration refinements to vegetation types) were used, noting that the quality of available aerial imagery has improved and boundaries could be more accurately applied
- where not accessed during either 2022 or 2020 surveys – aerial imagery or IGE-supplied drone footage has been used to interpret boundaries and vegetation types based on imagery signatures of nearby known areas.

Vegetation condition interpretation was based on the condition of nearby areas of the same vegetation type, using surveyor experience of the site. In general, the eastern side of the survey area has been previously grazed by livestock and is in poorer condition than the western side. The western side is generally weedy but has more intact vegetation structure; it may have been historically grazed by livestock and is currently grazed by a significant amount of feral goats that were regularly seen or heard during the 2022 survey, and also potentially by feral pigs that have been reported by IGE. Goats were observed during the 2020 survey, however, the western side of the survey area was largely inaccessible during 2020 thus there were less observations.

Vegetation types and condition outside the IGE boundary and immediately adjacent road reserve (i.e. on the opposite side of Brand Highway and Indian Ocean Drive) were not assessed or interpreted.

3.3.1.7 Field Survey Timing

The field survey was conducted during 17-21 October 2022 which is within the optimal period for a primary survey within the bioregion according to the Flora and Vegetation Technical Guidance (EPA 2016a).

3.3.2 STATISTICAL ANALYSIS

3.3.2.1 Post-survey Likelihood Assessment

Following the field survey, a post-survey likelihood assessment was conducted to identify conservation-listed species that have potential to occur on site. This assessment was based on survey results, survey effort and habitat identified within in the survey area.

3.3.2.2 Floristic Analysis

PATN© software (Blatant Fabrications Pty Ltd 2013) was used to undertake statistical analysis to generate floristic groups using the data collected from the quadrats and relevés, in order to better understand local significance of floristic units. PATN analysis has been used for several local floristic analyses including Gibson *et al.* (1994) for the Swan Coastal Plain.

PATN is a multivariate analysis tool that generates estimates of association (resemblance, affinity, distance) between sets of objects described by a suite of variables (attributes) and classifies the objects into groups and condenses the information and displays the patterns in the data graphically. It offers a choice of data transformations prior to multivariate analysis.

Floristic groups, identified using a dendrogram output of the analysis, are used as a tool to inform vegetation type groups at various levels and scales.

For this project a variety of analyses were run. The most informative analysis used the Bray Curtis similarity coefficient for rows (species) and columns (sites) as this provides a good estimation of association for ecological applications (Blatant Fabrications Pty Ltd 2013). For this analysis we used presence/absence data.

Interpretation of these purely floristic groups into recognisable and mappable on-ground units is a tool used to identify broad vegetation types. Generally, quadrats that are closely floristically related on the dendrogram form identifiable vegetation units, however, interpretation is frequently required for imperfect results. Vegetation types are therefore determined as a combination of floristic analysis and on-ground interpretation using dominant and characteristic species.

3.3.2.3 Adequacy of Sampling

In order to demonstrate adequacy of sampling, a species accumulation curve was generated by the software Species Diversity and Richness IV (Pisces Conservation Ltd 2010) using five random selections of sample order, using quadrat data only.

4 FIELD SURVEY RESULTS

The Detailed flora and vegetation survey was conducted by Lyn Atkins (Principal Ecologist, Flora Collecting Permit FB62000003; Threatened Flora Collecting Permit TFL 73-1920) and Sandra Ng during 17-21 October 2022.

The results of the 2020 Reconnaissance-level flora and vegetation survey (Ecoscape 2021) is also incorporated into these results. The 2020 survey was conducted over the wider IGE holdings, of which the 2022 survey area is a subset identified as requiring a Detailed flora and vegetation survey by the EPA *Notice Requiring Information for Assessment*, reproduced in **Appendix One**.

4.1 FLORA

4.1.1 FLORA INVENTORY

Fourteen floristic quadrats and detailed relevés were recorded from within the survey area during the 2022 field assessment, along with an additional 13 descriptive relevés wherein only dominant species were recorded. Twenty quadrats and relevés from 2020 survey (Ecoscape 2021) are also included in the following results.

A total of 234 vascular flora were recorded from 157 genera and 63 families from the quadrats, relevés, opportunistic observations and searches for conservation-listed flora. Of these, 44 were introduced (18.80%) and 17 (7.26%) could not be identified to species level due to insufficient diagnostic reproductive material. Some of these may represent duplicate taxa (nine; 3.84%), however, the others (eight; 3.42%) are unique taxa not represented elsewhere in the inventory.

The most commonly represented families were Fabaceae (27 taxa), Myrtaceae (23) and Poaceae (22). The most commonly represented genera were *Melaleuca* with eight taxa, *Acacias* (seven definitely defined) and *Eucalyptus* (six).

The number of species per quadrat or detailed relevé (excluding descriptive relevés) ranged from seven in relevé D20R01 to 39 in quadrat D20Q05, with an average species diversity per quadrat of 20.79. The most commonly recorded species were *Acacia rostellifera* and **Ehrharta longiflora* recorded from 16 quadrats/detailed relevés, *Austrostipa flavescens*, **Brassica tournefortii* and *Melaleuca cardiophylla* (15 quadrats/detailed relevés) and **Bromus diandrus* and **Lysimachia arvensis* (14 quadrats/detailed relevés).

The combined flora inventory is presented in **Table 16** in **Appendix Five**. Quadrat data is presented in **Appendix Six**.

4.1.2 CONSERVATION-LISTED FLORA

Threatened Flora

No Commonwealth EPBC Act or Western Australian BC Act-listed TF were recorded during the field surveys. None of the taxa that could not be identified with certainty resembled any currently described TF.


Priority Flora

Five PF were recorded during the field surveys:

- *Eucalyptus foecunda* subsp. *aeolica* (P2)
- *Scholtzia calcicola* (P2)
- *Beyeria cinerea* subsp. *cinerea* (P3)
- *Dampiera tephrea* (P3)
- *Eucalyptus zopherophloia* (P4).

Locations of PF are indicated on **Map 1** and described in more detail in **Table 2**.

Table 2: Priority Flora

<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i> (P2)	
<p>Description: According to Nicolle & French (2021), <i>Eucalyptus foecunda</i> subsp. <i>aeolica</i> is a mallee usually to 5 m high with rough bark in the lower part of the trunk becoming ribbony or flaky above, and ultimately smooth grey above. Leaves are glossy. It grows on coastal sands over limestone or on limestone dunes between Cliff Head and Leeman.</p> <p>Within the survey area this species was observed to meet the overall description or, on occasion, to not have the rough bark at the base.</p> 	<p>Habitat: Coastal dunes; lower slope. Vegetation types EobEorEzMOMF and mosaic (intergrade) of EeLOW and AspBsBIMS.</p> <p>Location: Western side of survey area in mallee vegetation and western central area on the edge of sandplain.</p> <p>Survey results: Two records in survey area although more would occur as the taxon wasn't targeted for survey.</p> <p>Populations: The two records are technically from separate populations, however, are likely to be within a single population. Numbers of individual plants were not recorded but is likely to be in low hundreds of plants.</p> <p>Known records and distribution: According to <i>FloraBase</i> (WAH 1998-2023, 2023) there are 25 records of this species from the Geraldton Sandplains and Swan Coastal Plain bioregions, with an overall distribution of approximately 80 km (north-south) and up to approximately 15 km from the coast. The survey area at the northern extent of the nominal distribution of this species.</p>

Scholtzia calcicola* (P2)*Description:**

According to Rye (2019) *Scholtzia calcicola* is an erect, dense shrub to 2 m high with tiny pale pink flowers.

Within the survey area this species recorded as an opportunistic observation with vegetation type AspBsBIMS.



Habitat: Sandplain.

Location: Not recorded but near the southern edge of the survey area, towards the western side.

Survey results: One record in survey area.

Populations: Not counted during the survey as the species was identified from an opportunistic collection. Likely sparsely scattered individuals or small clumps but within a single population.

Known records and distribution: According to *Atlas of Living Australia* (ALA 2023) there are eight records of this species from the Geraldton Sandplains and Swan Coastal Plain bioregions, with an overall distribution of approximately 115 km (north-south) and up to 20 km inland, from the Irwin river to near Jurien Bay. The survey area is in the northern portion of the species' distribution.

Beyeria cinerea* subsp. *cinerea* (P3)*Description:**

According to *FloraBase* (WAH 1998-2023, 2023), *Beyeria cinerea* subsp. *cinerea* is a low upright or spreading shrub usually 30-40 cm high but up to 1.3 m high.

Within the survey area this species was observed as an erect small shrub to 40 cm high.



Habitat: Mallee vegetation in swales of coastal dunes in vegetation type **EobEorEzMOMF**; occasionally in adjacent areas in vegetation type **McAxGaTDS**.

Location: Western portion of the survey area.

Survey results: 26 records from 2022 and a single record from 2020 (noting it was observed 'everywhere') in the survey area. In total 2,250 plants were recorded, however, this likely represents only a small proportion (estimated 10-20%) of the total population on site.

Populations: Likely a single population.

Known records and distribution: According to ALA (2023) there are 62 records of this species from the Geraldton Sandplains and Swan Coastal Plain bioregions, with an overall distribution of approximately 490 km (north-south) and up to 20 km inland, plus a historical outlier record in the Murchison region (note: this record is not incorporated into the WAH data).

Dampiera tephrea* (P3)*Description:**

According to *FloraBase* (WAH 1998-2023, 2023), *Dampiera tephrea* is an erect or ascending perennial herb to 60 cm high.

Within the survey area this species was observed to be a small (to 20 cm high) herb with grey felted leaves (underside) growing in open areas with exposed limestone (as per photo below). It was not recorded in more densely vegetated areas and may be a disturbance opportunist.



Habitat: Open, exposed areas with sand between exposed limestone, generally on the edge of cleared areas but not within denser vegetation. Most frequently in a mosaic of vegetation types **ArMcMhTS / McAxGaTDS** but also recorded in vegetation types **AspBsBIMS** and **EobEorEzMOMF**.

Location: Mostly along the north-south fence through the middle of the IGE holdings.

Survey results: 11 records in survey area totalling 197 counted individuals. This is estimated to represent 20-50% of the potential population on site, although the majority are unlikely to occur in areas proposed for clearing.

Populations: 1-2 populations

Known records and distribution: According to ALA (2023) there are 37 records of this species from the Geraldton Sandplains and Swan Coastal Plain bioregions, with an overall distribution of approximately 250 km (north-south) by 40-50 km (east-west) occurring in coastal areas at its northern extremity north of Dongara to approximately 40 km inland (but not coastal) near Gingin.

Eucalyptus zopherophloia* (P4)*Description:**

According to *FloraBase* (WAH 1998-2023, 2023), *Eucalyptus zopherophloia* is a rough barked spreading mallee to 6 m high (but generally to 4 m high). It grows in coastal areas on grey/white sand with limestone.

Within the survey area this species was observed to confirm to the description and habitat that is typical for the species.



Habitat: Most frequently in swales in coastal dunes, occasionally on slopes and crests of dunes, occurring in mallee vegetation (**EobEorEzMOMF**), woodland (**EeLOW**) and as scattered individuals or small groups in *Acacia* / *Melaleuca* shrublands (vegetation types **ArLOF**, **ArMcMhTS**, **ArMIMhTS**, **McAxGaTDS**).

Location: Western portion of the survey area.

Survey results: 66 records (2022) and seven records (2020) in overall survey area. Overall 639 individuals were counted during the 2022 survey.

Populations: Likely representing a single population with scattered individuals or groups.

Known records and distribution: According to ALA (2023) there are 174 records of this species from the Carnarvon, Geraldton Sandplains, Swan Coastal Plain and Yalgoo bioregions, with an overall distribution of approximately 490 km (north-south and up to 60 km from the coast). *Eucalyptus zopherophloia* occurs in disjunct populations from Leeman Lagoon north to Shark Bay (north of Denham).

4.1.3 OTHER SIGNIFICANT FLORA

According to the criteria outlined in the Flora and Vegetation Technical Guidance (EPA 2016a), the following taxa are considered to be significant:

- *Hardenbergia comptoniana* as a range edge record and potentially a very minor range extension of the species as a naturally occurring individual
- *Minuartia mediterranea* as an approximately 200 km northwards range extension and new record for the bioregion
- *Silene nocturna* as a range infill.

4.1.4 FLORA OF TAXONOMIC INTEREST

No flora of taxonomic interest were recorded during the field survey.

4.1.5 INTRODUCED FLORA

Forty-four introduced flora species (weeds) were recorded during the field survey, representing 18.80% of the overall flora inventory.

Five of the eight most commonly occurring species were introduced. In particular, these species (**Brassica tournefortii*, Wild Turnip; **Bromus diandrus*, Great Brome; **Ehrharta longiflora*, Annual Veldt Grass; **Lysimachia arvensis*, Pimpernel; and **Vulpia myuros*, Rat's Tail Fescue/Silver Grass) were significant factors that affected the vegetation condition ratings of quadrats and overall survey area.

**Echium plantagineum* (Patterson's Curse), which is a Declared Pest plant, was recorded from a single location during the 2020 field survey (Ecoscape 2021). However, it was not observed at all during 2022 and the site of the 2020 record is not within the 2022 survey area/proposed development footprint. As an annual species it may occur sporadically in different parts of the site, however, even if present it is in the Exempt category and has no management requirements in response to its presence.

**Lycium ferocissimum* (African Boxthorn), which is a WoNS species, was recorded from a single location during the 2020 field survey (Ecoscape 2021) but not observed during 2022. The location of the 2020 record is not within the 2022 survey area/proposed development footprint.

There are no management requirements in regard to the listing of this species as a WoNS.

4.2 VEGETATION

4.2.1 VEGETATION TYPES

Eleven vegetation types were recorded from within the overall IGE site (**Table 4, Map 1** series) based on a combination of structural vegetation type as identified in the field, floristic analysis (see **Section 4.4**) and subsequent desktop review. Ten of these intersected the current survey area.

The 10 vegetation types within the survey area, grouped broadly based on landform types, were:

- near-coastal dunes and swales:
 - **ArMcMhTS**; *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
 - **ArMIMhTS**; *Acacia rostellifera*, *Melaleuca lanceolata* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
 - **EobEorEzMOMF**; *Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland
 - **McAxGaTDS**; *Melaleuca cardiophylla*, *Acacia xanthina* and *Grevillea argyrophylla* tall dense shrubland
- exposed limestone/cap:
 - **EeLOW**; *Eucalyptus erythrocorys* low open woodland
- sandplain/lower slopes:
 - **AspBsBIMS**; *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland
 - **BpLW**; *Banksia prionotes* low woodland
- sandy slopes/disturbed areas:
 - **ArLOF**; *Acacia rostellifera* low open forest
 - **AsaAscTOS**; *Acacia saligna* and *Acacia scirpifolia* tall open shrubland
- riparian and low-lying areas:
 - **EcArMW**; *Eucalyptus camaldulensis* subsp. *obtusa* and *Acacia rostellifera* mid woodland.

A further vegetation type was recorded during 2020 survey (Ecoscape 2021) but is not within the current survey area. It occurred in wetland and on low-lying floodplain:

- **MsCoMrMOW**; *Melaleuca strobophylla*, *Casuarina obesa* and *Melaleuca raphiophylla* mid open woodland.

Table 4 details the vegetation types within the survey area, including mosaic combinations wherein the vegetation either intergrades between the two types or occurs in patches that are too small to delineate accurately at the scale of mapping.

Vegetation types within the overall IGE site but not intersecting the current survey area are detailed in **Table 5**.



Vegetation types were delineated in more detail during the current survey in comparison with the 2020 Reconnaissance-level survey (Ecoscape 2021). As a result of the increased coverage due to improved access, additional recording sites (quadrats, relevés, descriptive relevés) and more detailed aerial imagery that permits more accurate interpretation of areas that were not accessed or accessible, and taking into consideration floristic analysis, some of the 202 vegetation types have been further refined as per **Table 3**.



Table 3: Vegetation type equivalents



Mapping unit	2020 equivalent	Details and notes
ArLOF	ArLOF	Disturbed sites (previously grazed and/or cleared and naturally regenerated). No change to mapping; no additional quadrats or relevés recorded in 2022.
ArMcMhTS	McArGaTS	Refined from 2020 vegetation type. This is the main equivalent. Occurs in mosaics with AspBsBIMS , McAxGaTDS and EobEorEzMOMF .
ArMIMhTS	McArGaTS	Refined from 2020 vegetation type; generally occurs on exposed limestone, potentially in association with karst landforms.
AsaAscTOS	As₁As₂TOS	No change to mapping.
AspBsBIMS	LcBsJhMOS	Refined from 2020 vegetation type. This is the main equivalent. Occurs in mosaics with ArMcMhTS and McAxGaTDS .
BpLW	LcBsJhMOS	Refined from 2020 vegetation type where <i>Banksia prionotes</i> is present as an upper stratum.
EcArMW	EcArMW	No change to mapping. No additional quadrats/relevés recorded from this vegetation type in 2022.
EeLOW	EeLW	Refined from 2020 vegetation type. Frequently intergrades with AspBsBIMS and occurs in a mosaic with McAxGaTDS .
EobEorEzMOMF	McArGaTS	Refined from 2020 vegetation type; occurs in a mosaic within ArMcMhTS .
McAxGaTDS	McArGaTS	Refined from 2020 vegetation type where <i>Acacia xanthina</i> is dominant rather than <i>Acacia rostellifera</i> . Tends to be more coastal and have more exposed limestone than ArMcMhTS . Occurs in mosaics with ArMcMhTS , AspBsBIMS and EeLOW .
MsCoMrMOW	MsCoMrMOW	No change to mapping. Does not intercept 2022 survey area.



Table 4: Vegetation types in the survey area



Bold font indicates site of representative photo; *italic font* indicates recording site is not within current (2022) survey area.

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Sandy slopes (disturbed)	ArLOF	<p><i>Acacia rostellifera</i> low open forest over *<i>Hordeum leporinum</i>, *<i>Ehrharta longiflora</i> and *<i>Bromus diandrus</i> low closed grassland</p> <p>NVIS: U+ ^<i>Acacia rostellifera</i>^tree\6;c;G ^<i>Hordeum leporinum</i>,^<i>Ehrharta longiflora</i>,<i>Bromus diandrus</i>^other grass\1\1d</p> <p>Degraded-Completely Degraded condition as a result of grazing.</p>	D20R02		<p>*<i>Arctotheca calendula</i> <i>Austrostipa elegantissima</i> *<i>Ehrharta brevifolia</i> *<i>Hypochoeris glabra</i> *<i>Reichardia tingitana</i></p>	<p>29.00 ha 3.77%</p> <p>In disturbance footprint 15.07 ha 6.27%</p>
Slopes and valleys	ArMcMhTS	<p><i>Acacia rostellifera</i>, <i>Melaleuca cardiophylla</i> and <i>Melaleuca huegelii</i> subsp. <i>huegelii</i> tall shrubland over *<i>Vulpia myuros</i> forma <i>myuros</i>, <i>Guichenotia ledifolia</i> and <i>Conostylis prolifera</i> low grassland/shrubland/forbland</p> <p>NVIS: M+ ^^<i>Acacia rostellifera</i>,<i>Melaleuca cardiophylla</i>,<i>Melaleuca huegelii</i> subsp. <i>huegelii</i>^shrub\4;c;G ^^<i>Vulpia myuros</i> forma <i>myuros</i>,<i>Guichenotia ledifolia</i>,<i>Conostylis prolifera</i>^other grass,shrub,forb\1\1c</p>	A22O10 D20Q02 D20R14		<p><i>Austrostipa flavescens</i> *<i>Avellinia michelii</i> <i>Commersonia borealis</i> <i>Desmodium asper</i> *<i>Erodium botrys</i> <i>Grevillea argyrophylla</i> <i>Scholtzia umbellifera</i> <i>Trachymene pilosa</i></p>	<p>109.84 ha 14.28%</p> <p>In disturbance footprint 16.96 ha 7.06%</p>

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Slopes (sand and exposed limestone)	ArMIMhTS	<p><i>Acacia rostellifera</i>, <i>Melaleuca lanceolata</i> and <i>Melaleuca huegelii</i> subsp. <i>huegelii</i> tall shrubland over <i>*Ehrharta longiflora</i>, <i>*Bromus diandrus</i> and <i>*Reichardia tingitana</i> low grassland/forbland</p> <p>NVIS: M+ ^^<i>Acacia rostellifera</i>,<i>Melaleuca lanceolata</i>,<i>Melaleuca huegelii</i> subsp. <i>huegelii</i>\^shrub\4\c;G ^<i>Ehrharta longiflora</i>,^<i>Bromus diandrus</i>,<i>Reichardia tingitana</i>\^other grass,forb\1\c</p> <p>May correlate with karst system</p>	A2201 A2206 A2208 A22002		<p><i>Acanthocarpus canaliculatus</i> <i>Commersonia borealis</i> <i>Diplolaena leemaniana</i> <i>Eucalyptus zopherophloia</i> (P4) <i>Hordeum leporinum</i> <i>Melaleuca cardiophylla</i> <i>Rhagodia preissii</i> subsp. <i>obovata</i></p>	23.99 ha 3.12% In disturbance footprint 1.22 ha 0.51%
Sandy slopes (disturbed)	AsaAscTOS	<p><i>Acacia saligna</i> and <i>Acacia scirpifolia</i> tall open shrubland over <i>*Vulpia myuros</i>, <i>*Pentameris airoides</i> and <i>*Hypochaeris glabra</i> low closed grassland/forbland</p> <p>NVIS: M+ ^<i>Acacia saligna</i>,^<i>Acacia scirpifolia</i>\^shrub\4\i;G ^^<i>Vulpia myuros</i>,<i>Pentameris airoides</i>,<i>Hypochaeris glabra</i>\^other grass,forb\1\d</p>	D20R03		<p><i>Acacia rostellifera</i> <i>Amyema preissii</i> <i>*Arctotheca calendula</i> <i>*Brassica tournefortii</i> <i>*Bromus diandrus</i> <i>Crassula</i> sp. <i>*Ehrharta longiflora</i> <i>*Petrohragia dubia</i> <i>*Trifolium arvense</i></p>	2.95 ha 0.38% In disturbance footprint 0.01 ha 0.004%

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Lower slopes (sand with limestone)	AspBsBIMS	<p><i>Acacia spathulifolia</i>, <i>Banksia sessilis</i> var. <i>cygnorum</i> and <i>Banksia leptophylla</i> var. <i>melletica</i> mid shrubland over <i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>, <i>Scholtzia umbellifera</i> and <i>Desmoclados asper</i> low shrubland/rushland</p> <p>NVIS: M+ ^^<i>Acacia spathulifolia</i>,<i>Banksia sessilis</i> var. <i>cygnorum</i>,<i>Banksia leptophylla</i> var. <i>melletica</i>^\shrub\3\c;G ^^<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>,<i>Desmoclados asper</i>^\shrub,rush\2\c</p>	A2207 A2210 A2213 A22O04 A22O09 A22O12 D20Q03 D20Q05 D20R06		<p><i>Acacia scirpifolia</i> <i>Acanthocarpus canaliculatus</i> <i>Austrostipa flavescens</i> <i>Austrostipa macalpinei</i> <i>Bossiaea eriocarpa</i> <i>Callitris pyramidalis</i> <i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i> <i>Conostylis candicans</i> subsp. <i>calvicola</i> <i>Conostylis prolifera</i> <i>Eucalyptus erythrocorys</i> <i>Grevillea preissii</i> <i>Guichenotia ledifolia</i> <i>Hibbertia subvaginata</i> <i>Labichea cassioides</i> <i>Melaleuca cardiophylla</i> <i>Melaleuca leuropoma</i> <i>Mesomelaena pseudostygia</i> <i>Scholtzia laxiflora</i> <i>Stenanthemum notiale</i> <i>Styphelia insularis</i> <i>Trachymene pilosa</i> *<i>Vulpia myuros</i> forma <i>myuros</i> <i>Waitzia suaveolens</i> var. <i>suaveolens</i></p>	93.17ha 12.12% In disturbance footprint 11.86 ha 4.93%
Lower slopes (sand)	BpLW	<p><i>Banksia prionotes</i> low woodland over <i>Banksia leptophylla</i> var. <i>melletica</i>, <i>Jacksonia calcicola</i> and <i>Banksia sessilis</i> var. <i>cygnorum</i> mid open shrubland over <i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>, <i>Ecdeiocolea monostachya</i> and <i>Stenanthemum notiale</i> low shrubland/rushland</p> <p>NVIS: U+ ^<i>Banksia prionotes</i>^\tree\6\i;M ^^<i>Banksia leptophylla</i> var. <i>melletica</i>,<i>Jacksonia calcicola</i>,<i>Banksia sessilis</i> var. <i>cygnorum</i>^\shrub\3\i;G ^^<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>,<i>Ecdeiocolea monostachya</i>,<i>Stenanthemum notiale</i>^\shrub,rush\1\c</p>	A2211 A2214 A22O13 D20Q04 D20R10		<p><i>Acacia saligna</i> <i>Acacia scirpifolia</i> <i>Acacia spathulifolia</i> <i>Callitris pyramidalis</i> <i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i> <i>Desmoclados asper</i> <i>Eucalyptus erythrocorys</i> <i>Eucalyptus obtusiflora</i> <i>Hakea trifurcata</i> <i>Jacksonia hakeoides</i> <i>Lepidobolus chaetocephalus</i> <i>Melaleuca carrii</i> <i>Melaleuca leuropoma</i> <i>Mesomelaena pseudostygia</i> <i>Scaevola ?sericophylla</i></p>	5.59 ha 0.73% In disturbance footprint 2.73 ha 1.14%

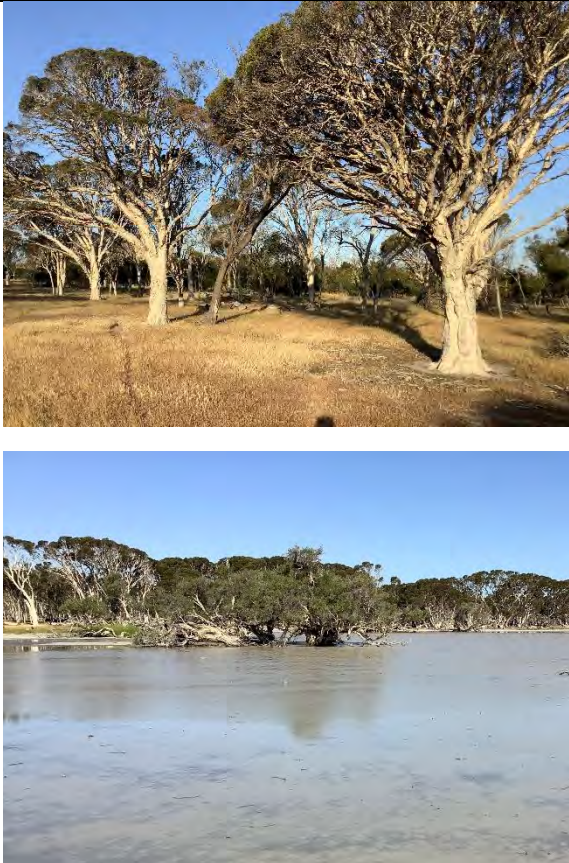
Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Riparian and low-lying areas	EcArMW	<p><i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i> and <i>Acacia rostellifera</i> mid woodland over <i>Acacia scirpifolia</i> and <i>Rhagodia preissii</i> subsp. <i>obovata</i> tall shrubland/chenopod shrubland over <i>Ehrharta longiflora</i>, <i>Avena barbata</i> and <i>Lysimachia arvensis</i> low open grassland/forbland</p> <p>NVIS: U+ ^<i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i>,<i>Acacia rostellifera</i>^tree\7i;M ^^<i>Acacia scirpifolia</i>,<i>Rhagodia preissii</i> subsp. <i>obovata</i>^shrub,chenopod shrub\4c;G ^^<i>Ehrharta longiflora</i>,<i>Avena barbata</i>,<i>Lysimachia arvensis</i>^other grass,forb\1i</p>	D20R01 D20R07 D20R08 D20R09 D20R11		<p>*<i>Arctotheca calendula</i> *<i>Brassica tournefortii</i> *<i>Bromus diandrus</i> <i>Crassula</i> sp. *<i>Hordeum leporinum</i> *<i>Hypochaeris glabra</i> *<i>Lolium multiflorum</i> <i>Melaleuca raphiophylla</i> <i>Muehlenbeckia adpressa</i> *<i>Petrohragia dubia</i> <i>Rytidosperma setaceum</i> <i>Trachymene pilosa</i> *<i>Trifolium campestre</i> *<i>Ursinia anthemoides</i> *<i>Vulpia myuros</i> forma <i>myuros</i></p>	30.56 ha 3.97% In disturbance footprint 1.52 ha 0.63%
Exposed limestone	EeLOW	<p><i>Eucalyptus erythrocorys</i> low open woodland over <i>Melaleuca cardiophylla</i>, <i>Diplolaena leemaniana</i> tall shrubland over <i>Bossiaea eriocarpa</i>, <i>Ehrharta longiflora</i> and <i>Brassica tournefortii</i> low open shrubland\grassland</p> <p>NVIS: U+ ^<i>Eucalyptus erythrocorys</i>^tree\6r;M+ ^<i>Melaleuca cardiophylla</i>,<i>Diplolaena leemaniana</i>^shrub\4c;G ^^<i>Bossiaea eriocarpa</i>,<i>Ehrharta longiflora</i>,<i>Brassica tournefortii</i>^forb,other grass\2i</p>	A22O03 A22O08 D20R04 D20R12 D20R13 D20R15+ *now cleared		<p><i>Acacia rostellifera</i> <i>Acacia saligna</i> <i>Acanthocarpus canaliculatus</i> <i>Austrostipa elegantissima</i> <i>Avena barbata</i> <i>Banksia sessilis</i> var. <i>cygnorum</i> <i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i> <i>Dioscorea hastifolia</i> <i>Hibbertia subvaginata</i> <i>Hordeum leporinum</i> <i>Hypochaeris glabra</i> <i>Lysimachia arvensis</i> <i>Olearia axillaris</i> <i>Petrohragia dubia</i> <i>Rhagodia preissii</i> subsp. <i>obovata</i> <i>Styphelia insularis</i></p>	88.82 ha 11.55% In disturbance footprint 43.3 ha 18.02%

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Dune swales (shallow sand over limestone)	EobEorEzMOMF	<p><i>Eucalyptus obtusiflora</i>, <i>Eucalyptus oraria</i> and <i>Eucalyptus zopherophloia</i> mid open mallee forest/mallee shrubland over <i>Melaleuca cardiophylla</i>, <i>Acacia rostellifera</i> and <i>Olearia axillaris</i> mid open shrubland over <i>Beyeria cinerea</i> subsp. <i>cinerea</i>, <i>Acanthocarpus canaliculatus</i> and <i>Diplolaena leemaniana</i> low open shrubland</p> <p>NVIS: U+ ^<i>Eucalyptus obtusiflora</i>, ^<i>Eucalyptus oraria</i>, ^<i>Eucalyptus zopherophloia</i> ^tree mallee, ^mallee shrub\6c;M ^^<i>Melaleuca cardiophylla</i>, <i>Acacia rostellifera</i>, <i>Olearia axillaris</i> ^shrub\3i;G ^^<i>Beyeria cinerea</i> subsp. <i>cinerea</i>, <i>Acanthocarpus canaliculatus</i>, <i>Diplolaena leemaniana</i> ^shrub\2i</p>	<p>A2205 A2212 A22001 D20Q01</p>		<p><i>Acacia idiomorpha</i> <i>Alyogyne hakeifolia</i> <i>Austrostipa flavescens</i> <i>Commersonia borealis</i> <i>Conostylis prolifera</i> <i>Cryptandra pungens</i> <i>Dodonaea aptera</i> <i>Eucalyptus erythrocorys</i> <i>Eucalyptus foecunda</i> subsp. <i>aeolica</i> (P2) <i>Guichenotia ledifolia</i> <i>Hibbertia subvaginata</i> <i>Lasiopetalum angustifolium</i> <i>Lysiandra scabra</i> <i>Rhagodia preissii</i> subsp. <i>obovata</i> <i>Templetonia retusa</i></p>	<p>40.60 ha 5.28%</p> <p>In disturbance footprint 6.96 ha 2.89%</p>
Slopes; usually with limestone rocks	McAxGaTDS	<p><i>Melaleuca cardiophylla</i>, <i>Acacia xanthina</i> and <i>Grevillea argyrophylla</i> tall dense shrubland over <i>Lasiopetalum angustifolium</i>, <i>Guichenotia ledifolia</i> and <i>Dodonaea aptera</i> low open shrubland</p> <p>NVIS: M+ ^^<i>Melaleuca cardiophylla</i>, <i>Acacia xanthina</i>, <i>Grevillea argyrophylla</i> ^shrub\4d;G ^<i>Lasiopetalum angustifolium</i>, ^<i>Guichenotia ledifolia</i>, <i>Dodonaea aptera</i> ^shrub\2i</p>	<p>A2202 A2203 A2204 A2209 A22006 A22011</p>		<p>*<i>Avena barbata</i> *<i>Bossiaea eriocarpa</i> *<i>Bromus diandrus</i> <i>Cryptandra pungens</i> *<i>Ehrharta longiflora</i> *<i>Petrorhagia dubia</i> *<i>Reichardia tingitana</i> <i>Styphelia insularis</i></p>	<p>140.18 ha 18.23%</p> <p>In disturbance footprint 34.03 ha 14.16%</p>

FIELD SURVEY RESULTS

Mapping unit	Vegetation type (abbreviation)	Area (ha) and extent (%)	In disturbance footprint: area (ha), extent (%)
ArMcMhTS / EobEorEzMOMF	Mosaic of ArMcMhTS and EobEorEzMOMF	1.41 ha, 0.18%	-
ArMcMhTS / McAxGaTDS	Mosaic of ArMcMhTS and McAxGaTDS	5.65 ha, 0.74%	0.68 ha, 0.28%
AspBsBIMS / ArMcMhTS	Mosaic of AspBsBIMS and ArMcMhTS	3.95 ha, 0.51%	0.91 ha, 0.38%
AspBsBIMS / McAxGaTDS	Mosaic of AspBsBIMS and McAxGaTDS	6.03 ha, 0.78%	0.05 ha, 0.02%
EeLOW / McAxGaTDS	Mosaic of EeLOW and McAxGaTDS	7.24 ha, 0.94%	0.93 ha, 0.39%
McAxGaTDS / EobEorEzMOMF	Mosaic of McAxGaTDS and EobEorEzMOMF	11.37 ha, 1.48%	1.09 ha, 0.45%
Not native vegetation (cleared, including tracks)		168.59 ha, 21.93%	103.03 ha, 42.86%
TOTAL EXTENT		768.95 ha	240.37 ha

Table 5: Vegetation types within the overall IGE site but not within the current survey area

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Riparian areas and floodplain	MsCoMrMOW	<p><i>Melaleuca strobophylla</i>, <i>Casuarina obesa</i> and <i>Melaleuca raphiophylla</i> mid open woodland over <i>*Vulpia myuros</i> forma <i>myuros</i>, <i>*Plantago coronopus</i> and <i>*Hordeum leporinum</i> low dense grassland/forbland</p> <p>NVIS: U+ ^<i>Melaleuca strobophylla</i>,^<i>Casuarina obesa</i>,<i>Melaleuca raphiophylla</i>\^tree\7r;G ^^<i>Vulpia myuros</i> forma <i>myuros</i>,<i>Plantago coronopus</i>,<i>Hordeum leporinum</i>\^other grass,forb\1d</p>	<p>D20R05</p> <p>lower photo Arramall Lake in 2020</p>		<p><i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i> *<i>Hordeum leporinum</i> *<i>Lolium multiflorum</i> *<i>Mesembryanthemum nodiflorum</i> *<i>Petrorhagia dubia</i> <i>Rhodanthe oppositifolia</i> subsp. <i>oppositifolia</i> *<i>Trifolium arvense</i></p>	0

4.3 VEGETATION SIGNIFICANCE

4.3.1 TECS AND PECS

No vegetation recorded from the survey area was assessed as being representative of any currently described TEC.

The 2020 DBCA database search identified the P1 *Coastal sands dominated by Acacia rostellifera, Eucalyptus oraria and Eucalyptus obtusiflora (Geraldton area)* PEC as having been recorded within 2 km of the survey area. This PEC is described as:

Floristically, this community is similar to other Acacia rostellifera communities but is differentiated on structure, being dominated by mallee eucalypts. The community occurs on limestone ridges, in some swales in the coastal dunes between Cape Burney and Dongara, on the Greenough Alluvial Flats on limestone soil and near Tarcoola Beach. Some very small occurrences have also been recorded on the limestone scarp north of the Buller River (Species and Communities Program DBCA 2022).

Based on the information available at the time of the 2020 survey (Ecoscape 2021), this PEC was not considered to occur within the survey area. However, with the increased information available from a Detailed survey, vegetation type **EobEorEzMOMF** substantially meets the descriptive requirement of being dominated by mallee Eucalypts, including the dominant species (*Eucalyptus obtusiflora* and *Eucalyptus oraria*), has *Acacia rostellifera* as a subdominant mid-stratum species and occurs in the characteristic landforms of the PEC as described. Therefore, it is possible that vegetation type **EobEorEzMOMF** is representative of the PEC. It occupied 40.60 ha, representing 5.28% of the survey area, and also occurred in mosaics with other vegetation types, in the western portion of the survey area.

4.3.2 OTHER SIGNIFICANT VEGETATION

According to the criteria outlined in the Flora and Vegetation Technical Guidance (EPA 2016a), vegetation type **EcArMW** may be significant due to its characteristic species *Eucalyptus camaldulensis* subsp. *obtusiflora* being groundwater dependent and therefore a significant species required to maintain the ecological integrity of the ecosystem. However, this vegetation type is in Degraded-Completely Degraded condition and therefore likely provides little in the way of ecological functioning.

4.4 STATISTICAL ANALYSIS

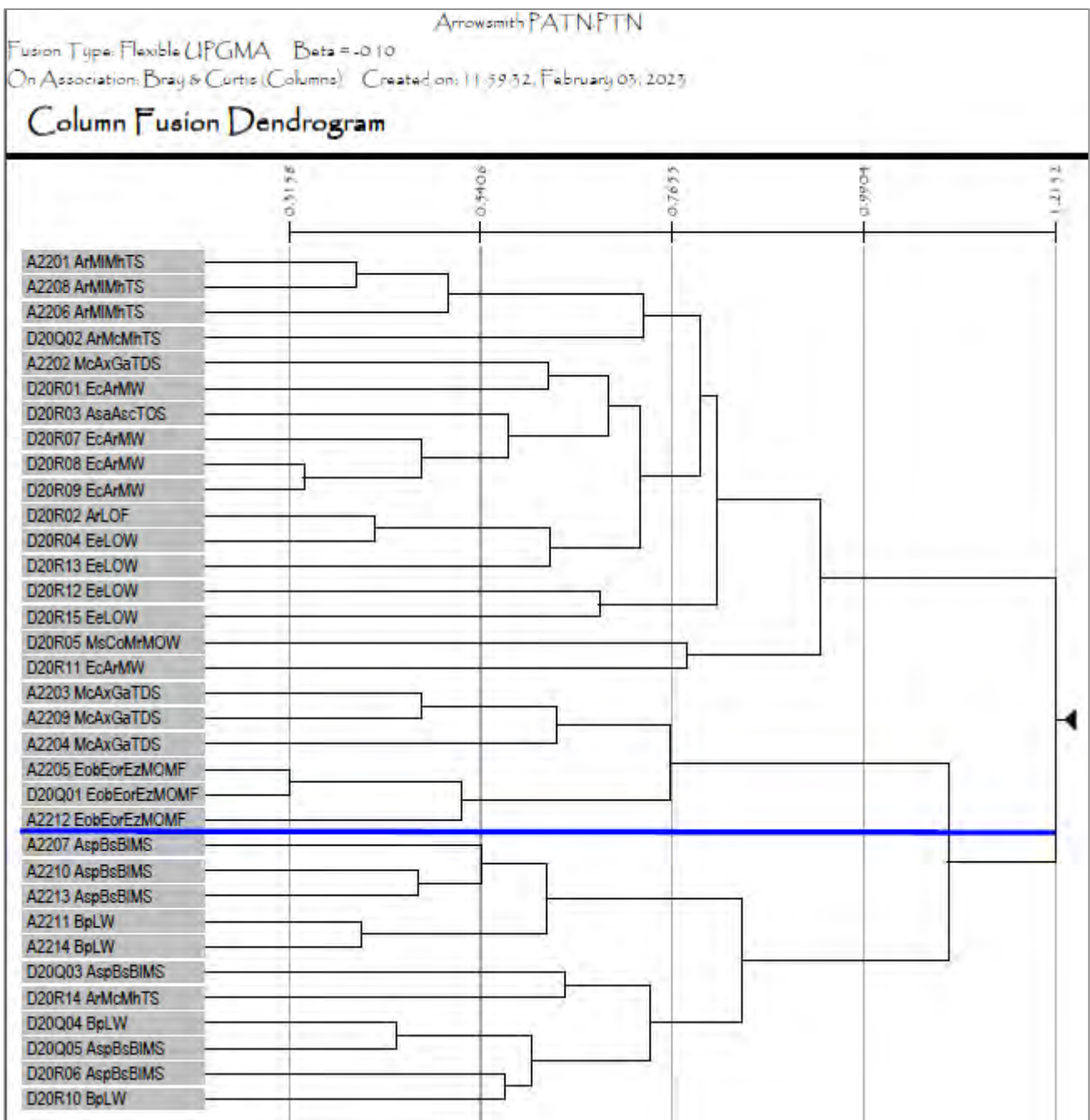
4.4.1 FLORISTIC ANALYSIS

The floristic analysis dendrogram (**Figure 3**) indicates a clear floristic differentiation (with only one exception) between the vegetation types occurring on sandplain formations (vegetation types **AspBsBIMS** and **BpLW**) and other vegetation types (under the blue line in **Figure 3**). These two vegetation types do not form separate groups within this broader floristic group supporting the field observation that they intergrade between the two types and differentiate based on the presence of *Banksia prionotes* as an upper stratum.

Most other vegetation types cluster together suggesting that the structural vegetation types as identified in the field have a floristic basis.

Descriptive relevés not used in this analysis.

Figure 3: Floristic analysis dendrogram



4.4.2 ADEQUACY OF SURVEY

Adequacy of survey can be demonstrated using a species accumulation curve; if the curve has reached (or almost reached) an asymptote it is considered that most species are likely to have been recorded from the survey area.

A species accumulation curve was generated using quadrat data (Figure 4). Opportunistic observations and descriptive relevés, which increase the number of species recorded, are not included in the analysis.

The species accumulation curve suggests the majority of the floral component of the survey area would have been recorded during the survey. The Bootstrap estimate of species richness is 236 which, when taking opportunistic records into account, is very close to the recorded 234 taxa, further confirming that the majority of species likely to be present were recorded during the two survey periods.

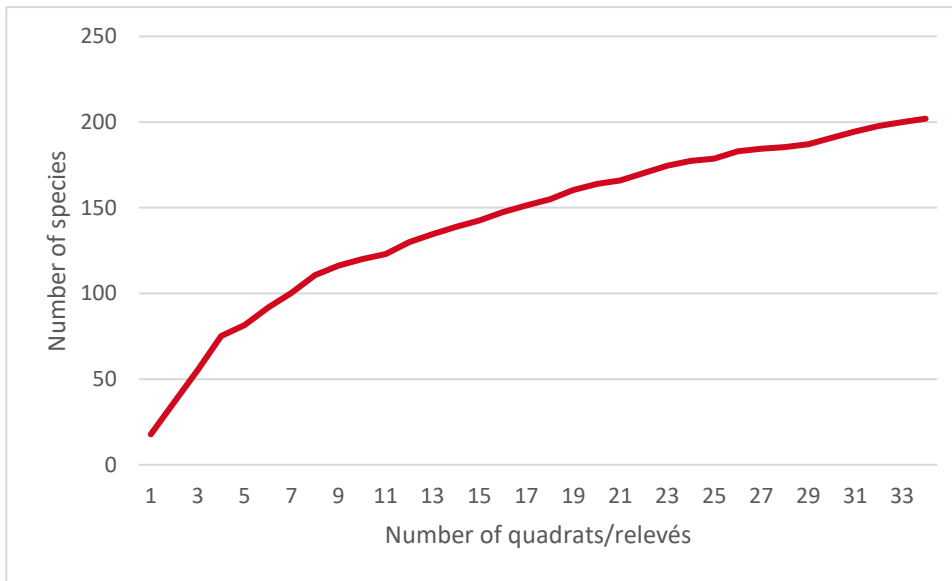


Figure 4: Species accumulation curve

4.5 VEGETATION CONDITION

The vegetation condition within the survey area ranged from Completely Degraded to Excellent condition (Table 6, Map 2 series). Approximately one quarter of the survey area was in Very Good condition and approximately one fifth was not vegetated, consisting largely of cleared (former) paddock on the eastern portion of the survey area and tracks or localised areas cleared for proposed infrastructure throughout the site.

The main factor affecting vegetation condition in areas of native vegetation was weediness due to long-term grazing by livestock or by feral animals that introduced weed seeds to the broader area. Changes to vegetation structure in the eastern portion of the survey area, also a result of long-term grazing, contributed to the vegetation condition rating within the survey area.

The vegetation condition in areas that were not accessed or accessible was attributed with a rating based on the surrounding area and surveyor experience within the wider survey area.

Table 6: Vegetation condition within the survey area

Vegetation condition	Extent (ha)	Proportion (%)
Pristine	-	-
Excellent	107.39	13.97
Very Good	184.84	24.04
Good	123.35	16.04
Degraded	96.77	12.58
Completely Degraded	88.02	11.45
Not vegetated	168.59	21.93

4.6 BOTANICAL LIMITATIONS

Survey design and type: Two-phase Detailed quadrat-based flora and vegetation survey with extensive traverses searching for conservation-listed flora conducted in 2022 and (as a Reconnaissance-level survey) in 2020.

Type of vegetation classification system: Vegetation classified at NVIS Level V (NVIS Technical Working Group & DotEE 2017) using largely structural vegetation types defined using dominant and characteristic species and vegetation structure as recorded during the field surveys. Floristic analysis was used to identify major floristic groups and outlier groups of floristic interest.

A full summary of botanical limitations is presented in **Table 7**. However, the constraints do not necessarily apply to areas where IGE's proposed locations for wind turbines have changed.

Table 7: Botanical limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of contextual information at a regional and local scale	Yes: negligible	Although Ecoscape is aware that a number of surveys have been conducted nearby their results are not publicly available thus cannot provide regional context.
Competence/experience of the team conducting the survey, including experience in the bioregion surveyed	No	The lead Botanist conducting the field survey has over 30 years experience conducting flora and vegetation surveys in Western Australia, including the Geraldton Sandplains bioregion.
Proportion of the flora recorded and/or collected, and any identification issues	No	234 vascular flora taxa were recorded during the field surveys of which 7.26% could not be identified with certainty to species level due to the lack of diagnostic reproductive material. This is considered to not represent a constraint as none are similar to any currently described conservation-listed flora from the region.

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
<p>Was the appropriate area fully surveyed (effort and extent)</p>	<p>Yes: Negligible on eastern side of survey area (otherwise no constraint).</p>	<p>The majority of the survey area (western side) has been sufficiently surveyed to identify the biological attributes that are present, either through direct access (physical flora and vegetation survey) or aerial interpretation to define vegetation types and their extents.</p> <p>The eastern side of the survey area was surveyed during 2020, however, was not accessed during the 2022 survey. This portion of the survey area is in generally poor condition (Degraded-Completely Degraded vegetation) and therefore not accessing the area is only a negligible constraint. Aerial imagery interpretation was used to refine vegetation types and their boundaries.</p> <p>Not all of the vegetation types had a minimum of three quadrats recorded. Explanations follow:</p> <ul style="list-style-type: none"> • ArLOF – degraded (Degraded-Completely Degraded condition) vegetation type as a result of grazing. Not considered to represent extant native vegetation (one detailed relevé in 2020). • AsaAscTOS – degraded (Degraded-Completely Degraded condition) vegetation types as a result of clearing and/or grazing. Not considered to represent extant native vegetation (one detailed relevé in 2020). • MsCoMrMOW – not in 2022 survey area (one detailed relevé in 2020). <p>There is not anticipated to be any constraint as a result of the low number of recording sites for these vegetation types.</p>

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Access restrictions within the survey area	Yes: negligible	<p>The majority of the western portion of the survey area was accessible due to the recent clearing of tracks that permitted access to previously inaccessible areas. Where not accessible, recent detailed aerial imagery and drone footage was used to refine vegetation type boundaries. There is not likely to be a constraint to the survey as a result in this portion of the survey area.</p> <p>The eastern side of the survey area was accessible but not accessed due to time constraints as the newly installed tracks were very rough and travel was very slow. However, the eastern portion of the survey area was fully accessed during 2020 and was therefore well understood in 2022, therefore was only a negligible constraint to the 2022 survey.</p>
Survey timing, rainfall, season of survey	No	<p>The field surveys were conducted during October which is within the optimal season of survey in the bioregion.</p> <p>The rainfall in the 6 months prior to the field survey was approximately the mean for this period (Figure 5). This represents no constraints to identifying the flora present in the survey area.</p>
Disturbance that may have affected the results of the survey e.g. fire, flood, clearing	No	<p>Aside from recently installed tracks there were no recent disturbances that would have affected the results of the survey.</p> <p>None of the survey area had been recently burnt.</p>

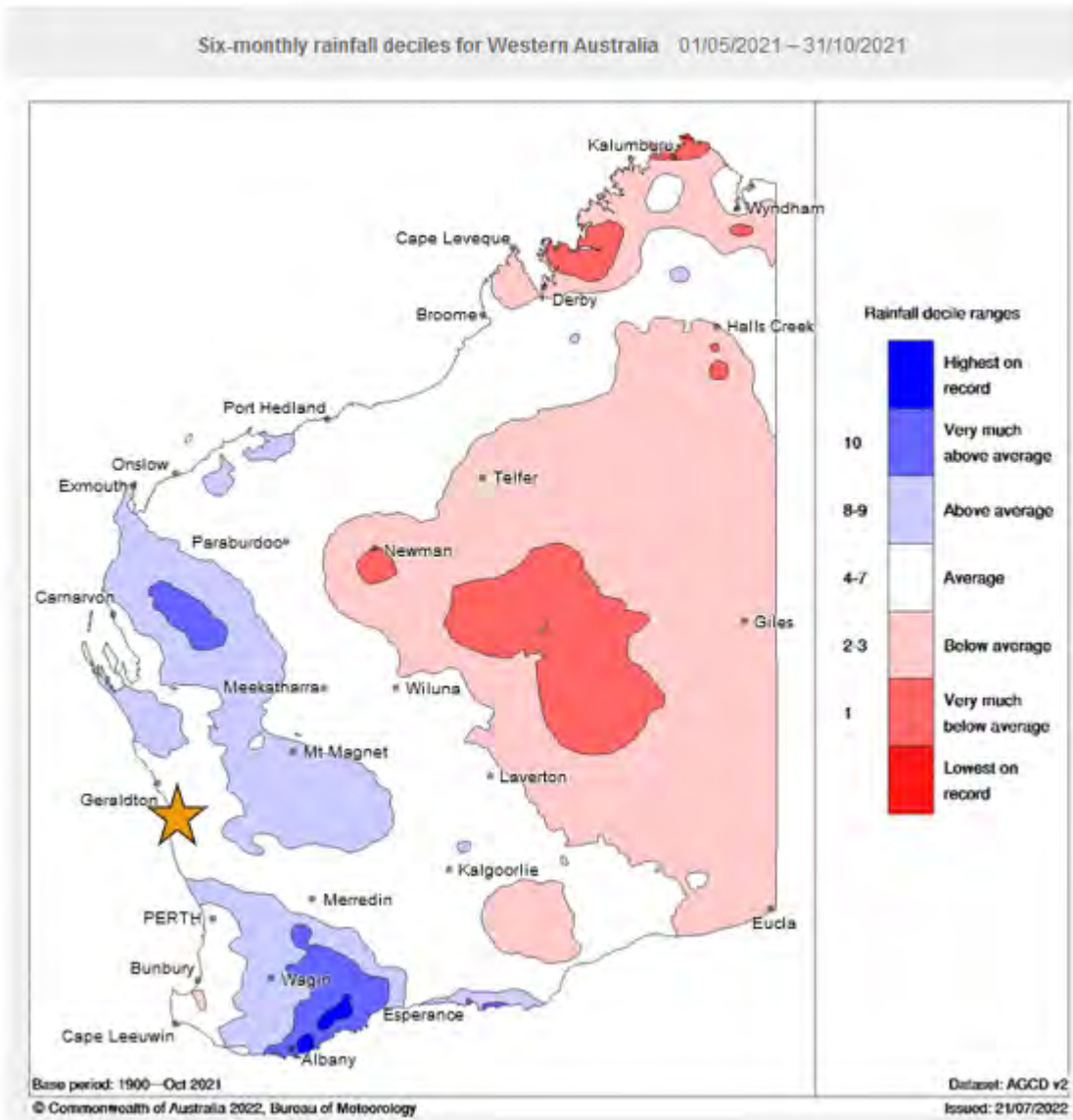


Figure 5: Rainfall deciles for the 6 months prior to the field survey (BoM 2023b)

The star in **Figure 5** indicates the approximate location of the survey area.

5 DISCUSSION

5.1 FLORA SIGNIFICANCE

A total of 234 vascular flora species were recorded from 34 floristic quadrats and detailed relevés (14 recorded in 2022 and 20 recorded in 2020), opportunistic observations, including during searches for conservation-listed flora, and from 13 descriptive relevés wherein only the dominant species were recorded in 2022.

Almost one fifth of the total flora inventory (44 species; 18.80%) were introduced reflecting the level of disturbance in the survey area from previous livestock and feral animal, including goats, grazing.

5.1.1 CONSERVATION-LISTED FLORA

5.1.1.1 Threatened Flora

No TF species listed for protection under the Commonwealth EPBC Act or Western Australian BC Act were recorded.

None of the unidentified taxa resemble any currently described TF.

5.1.1.2 Priority Flora

Five PF species were recorded, as follows.

None of the unidentified taxa resemble any currently described PF taxa.

Eucalyptus foecunda subsp. *aeolica* (P2)

The nearest record of this species as shown on *FloraBase* (WAH 2023) is located approximately 7 km to the south of the closest record from this survey. This WAH record (from two identical entries considered to represent duplicates – PERTH 08839980 and PERTH 08840016) is from *Eucalyptus erythrocorys* vegetation in dune swales, which is descriptively the equivalent of vegetation type **EeLOW** although, within the survey area this vegetation type occurred on limestone capping not in swales. Only fifteen plants are noted in the WAH record, suggesting patchy distribution.

According to *FloraBase* map and specimen data (WAH 1998-2023, 2023) *Eucalyptus foecunda* subsp. *aeolica* has an overall distribution of approximately 80 km north-south and has been recorded from up to approximately 15 km from the coast. The survey area is at the northern edge of this nominal distribution based on WAH specimen records and its taxonomic description (Nicolle & French 2021). There are 25 records of this taxon listed on *FloraBase* (WAH 2023), noting that this is likely to be exaggerated based on duplication of records.

ALA (2023) mapping has not yet adopted the updated taxonomy that recognises two subspecies (Nicolle & French 2021). The ALA website shows records of the species *sens. lat.* from further north and northeast. As the subspecies are defined partly in terms of geographic distribution (that correlates with seedling morphology differences (Nicolle & French 2021)), and no other subtaxa have been defined from the northern part of the overall species (*sens. lat.*) distribution, it is possible that these more northern records would extend the range of *Eucalyptus foecunda* subsp. *aeolica* if accurate. The taxon's range, estimated from *FloraBase* (WAH 1998-2023) records and using the measuring tool on the ALA (2023) website, is approximately 80 km north-south. If the ALA records to the north attributed to the species *sens. lat.* are referring to the subspecies, the north-south distribution of *Eucalyptus foecunda* subsp. *aeolica* would be extended by a further approximately 200 km and inland by approximately 140 km.

This taxon was recorded from two separate locations, however, it was not targeted for survey and is likely to be more common.

Based on the species habitat, particularly in quadrat A2205 in vegetation type **EobEorEzMOMF** where it was the dominant species, and taking into consideration that it was not recorded in quadrats in similar vegetation elsewhere, it is likely to occur patchily in the survey area in mallee vegetation in dune swales and uncommonly

in vegetation type **EeLOW** that only infrequently had other Eucalypt species present. It is anticipated to occur only rarely in other vegetation types.

At most it is estimated that there may be 100-200 individuals of this species within the survey area, noting that the EPA requested a survey area that incorporated 50 m buffers beyond the proposed works footprint (**Appendix One**). Therefore, only a small proportion of these would be within the proposed works footprint and any impact on the species population at local and regional scales is likely to be negligible.

Scholtzia calcicola (P2)

Scholtzia calcicola has an overall distribution range of approximately 115 km north-south and up to 20 km inland, with the survey area being towards the northern end of the distribution (ALA 2023). *FloraBase* (WAH 1998-2023) lists only seven records of this species with the nearest specimens from 'Arrowsmith' having been recorded in vegetation similar to **AspBsBIMS**. As a relatively recently described species (Rye 2019), and being amongst a taxonomic group known colloquially as 'small-flowered Myrtaceae' that are notoriously difficult to differentiate, it is likely that this species is under-collected and more common than the low number of records suggest, although only likely to occur commonly in small patches of perhaps up to 50 or so individuals per patch or sparsely distributed individuals.

This species was collected as an opportunistic record without a recorded location or population count, however, based on collecting sequence it is likely that it was recorded in vegetation type **AspBsBIMS**. It was not recorded in any of the six quadrats and detailed relevés from this vegetation type, or as a dominant species in any of the three descriptive relevés, nor in any other vegetation type including the similar **BpLW**. It is therefore likely to occur as scattered individuals or small clumps within the sandplain vegetation types.

Whilst not possible to accurately estimate the number of individuals occurring in the survey area, nor population extent (although presumed to be restricted to these vegetation types), it is likely to be at most 50-100 individuals in the overall survey area with only a small proportion of these within the proposed works footprint due to the 50 m buffer applied (to the works footprint) by the EPA (**Appendix One**).

Due to the likely small number of plants occurring within the development footprint, the potential impact on local and regional populations of the proposed clearing is likely to be negligible at a regional scale and also most likely negligible at a local scale as most of IGE's proposed works area on the western side of the IGE site has already been cleared for tracks and will only require widening for construction, turbine footings and firebreaks.

The area of vegetation types **AspBsBIMS** and **BpLW** intersecting the proposed solar farm on the eastern side of the IGE site have been previously grazed, and as such there is a lower likelihood of *Scholtzia calcicola* occurring. The likelihood of impacting the local or regional population is therefore correspondingly lower and would be negligible at worst and more likely to be of no impact (i.e. species not present).

Beyeria cinerea subsp. *cinerea* (P3)

Beyeria cinerea subsp. *cinerea* has a wide distribution occurring over an approximate 490 km north-south distribution and up to 20 km inland, with the main distribution between Mandurah and the Menai Hills north of Horrocks (ALA 2023). ALA lists 62 records for this taxon, the WAH (2023, 1998-2023) lists 53 records. Most of the WAH records indicate that the associated vegetation is tall shrubland or low heath with similar species to those present within the survey area (i.e. *Melaleuca cardiophylla* and *Acacia*-dominated shrublands), and only one record indicating it to be associated with mallee. The nearest DBCA record indicated by the database search is approximately 100 m from the survey area.

Within the survey area this taxon was recorded in vegetation type **EobEorEzMOMF** (mallee) as the dominant ground stratum species in most occurrences of the vegetation type, and occasionally in adjacent areas in vegetation type **McAxGaTDS**. Over 1,700 individuals were counted during 2022 and, whilst not counted during 2020 (Ecoscape 2021), was a dominant understorey species and described as being commonly occurring. The plant counts during the current (2022) survey are only from areas in close proximity to targeted search tracks and are only representative of perhaps 10% of the total population.

Due to the wide distribution of *Beyeria cinerea* subsp. *cinerea* and large number of individuals within the survey area, and that the survey area includes a 50 m buffer on the proposed works area applied by the EPA (**Appendix One**), any impact of clearing in the proposed works area is anticipated to have a negligible impact on the taxon at both regional and local scales.

Dampiera tephrea (P3)

Dampiera tephrea has a distribution range of approximately 250 km north-south by approximately 40-50 km east west, from north of Dongara to near Gingin (ALA 2023). The nearest record in the WAH (2023) is from the road reserve adjacent to the survey area along Brand Highway (record PERTH 09505555), recorded as being a limestone ridge and described as 'locally frequent' but without a count or population estimate. This record is approximately 2.5 km from the majority of the records of this species recorded during this survey.

Within the survey area, almost 200 plants were recorded, most from within one general locality, in a mosaic vegetation type (**ArMcMhTS / McAxGaTDS**) towards the centre of the survey area. *Dampiera tephrea*, in this location, occurred on the edge of bushland, but not within it, in areas of disturbed bare soil and exposed limestone. It is likely to occur in similar areas and be more common than recorded in the survey area.

Most of the WAH (2023) records are from roadsides suggesting that it is at least tolerant of disturbance and may be favoured by disturbance i.e. is a disturbance opportunist. Given the wide distribution of this species and its association with disturbance, impacts of clearing at both regional and local scales are likely to be negligible.

Eucalyptus zopherophloia (P4)

Eucalyptus zopherophloia has an approximate distribution of 490 km north-south by 60 km inland (ALA 2023) and was known to occur within the survey area prior to the Ecoscape surveys (DBCA records).

Eucalyptus zopherophloia is a subdominant species in vegetation type **EobEorEzMOMF** with 639 individuals counted during the 2022 survey. Whilst being most common in this vegetation type it has also been recorded from five other vegetation types (**EeLOW**, **ArLOF**, **ArMcMhTS**, **ArMIMhTS**, **AcAxGaTDS**) and within mosaics of these.

Given that the survey area consisted of the proposed development footprint and a 50 m buffer applied by the EPA, and that most tracks had already been cleared and would only require widening at tower locations and for construction, clearing would only intersect a small proportion of the total number of plants present. Therefore, given the species' overall distribution any impacts on its population would be likely to be insignificant at both local and regional scales.

5.1.2 POST-SURVEY LIKELIHOOD ASSESSMENT

The likelihood of conservation significant flora occurring in the survey area was revised following the field survey. This revised likelihood, that took into account vegetation condition, grazing and other disturbances, actual habitat availability and search effort, is included in **Table 15** in **Appendix Four**.

No TF species were assessed as having a high likelihood of occurring in the survey area. Eight PF species, as follows, were considered a high likelihood of occurring prior to the survey.

Acacia vittata (P2)

Acacia vittata is a dense rounded shrub to 4 m high (WAH 1998-2023).

FloraBase (*ibid.*) describes the habitat of *Acacia vittata* as grey sand, sandy clay and from the margins of seasonal lakes. Sandy soil, including grey sand which occurred in shallow basins in otherwise rocky limestone areas, and yellow sand in the sandplain areas, are present in the survey area. DBCA records indicate that it has not previously been recorded from within the survey area, however, there are three records from within approximately 250 m of the survey area, all to the south. All of these records are from the 1980s and 1990s and their indicated locations are unlikely to be accurate (noting that two of these records have the same location description but are positioned approximately 680 m apart). It has also been recorded from

approximately 1 km to the east (DBCA records), also during the 1980s, however, there are no records that are more recent of this species from the vicinity of the survey area.

Acacia vittata has an overall distribution of approximately 50 km north-south by 35 km east-west, with an outlier record approximately 300 km to the southeast (ALA 2023) with the survey area located at the northern end of the species' range.

As the habitat indicated for *Acacia vittata* in *FloraBase* (*ibid.*) and in WAH specimen records (WAH 2023) is present in the survey area it must be assumed that the species has potential to occur, particularly as neither of the surveys corresponded with its listed flowering period of August (WAH 1998-2023) when it would have been more visible. It has been re-evaluated as being Unlikely to occur based on survey effort as it is a large shrub that is unlikely to have been overlooked for collection if observed. If it does occur, it is likely to be sparsely or as small groups in areas not accessed during the field surveys and therefore unlikely to intercept the development footprint.

***Comesperma griffinii* (P2)**

Comesperma griffinii is a small herb to 15 cm high growing in sandy soils in sandplain (WAH 1998-2023). Potentially suitable habitat occurs in the southern portion of the IGE survey area, however, the nearest DBCA record is from approximately 16 km to the east and none of the *FloraBase* (*ibid.*) or ALA (2023) records indicated the species occurs closer than 14 km from coast.

Comesperma griffinii has an overall distribution of approximately 850 km north-south by a band of approximately 250 km east-west (*ibid.*) with the survey area located towards the northern end of the species' range.

Regardless of this species' known local distribution being to the east, due to its small size that may have led to it being overlooked during the Ecoscape surveys and others in the vicinity, and that suitable habitat exists it may occur within the survey area. If it does occur it is likely to be only a few individuals as WAH (2023) records at most indicate small numbers of plants (maximum 10) per record.

***Schoenus* sp. Eneabba (F. Obbens & C. Godden I154) (P2)**

Schoenus sp. Eneabba is described as being an erect, clumped rhizomatous perennial sedge to 75 cm high, recorded in sandplain habitat (WAH 1998-2023). The nearest DBCA record is from approximately 9 km to the east of the survey area, in habitat similar to that found near the far southern extremity of current IGE survey area.

Schoenus sp. Eneabba has an overall distribution of approximately 75 km north-south by 5 km east-west (estimated from WAH 1998-2023 records) with the survey area located towards the northern end of the species' range.

Based on survey effort that did not record any similar large sedges and its known distribution being confined to a narrow band to the east of the survey area, it has been re-evaluated as being Unlikely to occur.

***Anthocercis intricata* (P3)**

Anthocercis intricata is vegetatively very similar to *Anthocercis genistoides* (unlisted) that was recorded during the survey (identified by the WAH); both are dense spinescent shrubs to 3 m high with white flowers (WAH 1998-2023). The habitat within the survey area is suitable for both species.

Anthocercis intricata has an overall distribution of approximately 420 km north-south and up to 20 km from the coast for most records (ALA 2023), with the survey area located at the southern end of the species' known range.

Due to the two *Anthocercis* species being so vegetatively similar it must be considered possible that *Anthocercis intricata* individuals could occur and as such it retains its pre-survey (desktop assessment) likelihood (Likely to occur).

Haloragis foliosa (P3)

Haloragis foliosa is a perennial herb or shrub to 50 cm high growing in sand over limestone (WAH 1998-2023). The habitat within the survey area is only broadly similar to that described in Hart Simpson and Associates (2003) from north of the survey area, with most records from disturbed areas (WAH 2023).

Haloragis foliosa has an overall distribution of approximately 180 km north-south by up to 10 km from the coast excluding one outlier record (ALA 2023), with the survey area located towards the northern end of the species' known range.

Although not recorded it retains its pre-survey (desktop assessment) assessment of being Likely to occur as it may have been overlooked or occur in disturbed areas not accessed during the survey. As a possible disturbance opportunist it is possible that any groundworks could favour the species and it may occur during or shortly after disturbance for construction.

Thryptomene sp. Lancelin (M.E. Trudgen 14000) (P3)

Thryptomene sp. Lancelin is a pink-flowering shrub to approximately 50 cm high growing in calcareous sands (WAH 1998-2023). It has been recorded from coastal heath or shrubland vegetation with *Acacia rostellifera* and *Acacia xanthina* (WAH 2023).

Thryptomene sp. Lancelin has an overall distribution of approximately 200 km north-south and up to approximately 20 km from the coast (ALA 2023) with the survey area located near the northern end of the species' known range.

As potentially suitable habitat occurs and a number of similar-looking pink-flowering myrtaceous shrubs are present in the survey area (in the sandplain vegetation types) it remains possible that *Thryptomene* sp. Lancelin could occur in the survey area. Its post-survey likelihood remains high i.e. it is Likely to occur. If present it is most likely to occur in the southwest corner of the survey area.

Banksia elegans (P4)

Banksia elegans is a woody shrub to 4 m high growing on sand in sandplain and on consolidated dunes (WAH 1998-2023). It has been reported that it rarely reproduces from seed as it has a fire-tolerant rootstock that suckers dunes (ALA 2023; WAH 1998-2023).

Banksia elegans has an overall distribution of approximately 110 km north-south by 25 km east-west (ALA 2023) with the survey area located near the centre of the species' known range.

No similar-looking shrubs have been observed during either the 2020 (Ecoscape 2021) or 2022 surveys, however, isolated plants may occur in vegetation types **AspBsBIMS** and **BpLW**.

Stawellia dimorphantha (P4)

Stawellia dimorphantha is a fine stilt-rooted perennial herb to 20 cm high growing in sandy soils (WAH 1998-2023). Its habitat is similar to that of vegetation type **AspBsBIMS** (WAH 2023).

Stawellia dimorphantha has an overall distribution of approximately 80 km north-south by 20 km east-west, with an outlier record a further 80 km to the south (ALA 2023) with the survey area located towards the centre of the species' known range.

As a small and insignificant plant it is possible that this species has been overlooked during the field surveys and it therefore retains its pre-survey (desktop) assessment that it is Likely to occur.

5.1.3 OTHER SIGNIFICANT FLORA

No species having any other significance according to the Flora and Vegetation Technical Guidance (EPA 2016a) was recorded (excluding introduced species), nor any flora of taxonomic interest.

5.1.4 INTRODUCED FLORA

Forty-four introduced species were recorded during the field survey, representing 18.80% of the overall flora inventory. Most were commonly-occurring agricultural weeds that have spread through the site due to grazing by livestock or feral animals including goats and rabbits.

Two of the recorded introduced species were of significance: *Echium plantagineum* (Patterson's Curse) is a Declared Pest plant (Exempt category) that was recorded in 2020 (Ecoscape 2021) in a portion of the IGE site not within the current survey area although it is considered highly likely that it occurs as scattered individuals in the eastern portion of the survey area. *Lycium ferocissimum* (African Boxthorn) is a WoNS species that was similarly recorded in 2020 but not 2022. As such isolated individuals may occur elsewhere.

However, there are no management requirements resulting from these species presence.

5.1.5 LOCAL AND REGIONAL SIGNIFICANCE OF FLORA

Five Priority-listed flora were recorded from the survey area; all are considered to have local and regional significance noting that *Scholtzia calcicola* is perhaps the most significant as it is poorly collected with only seven records listed on *FloraBase* (WAH 2023) and ALA (ALA 2023).

Aside from the recorded PF, none of the recorded flora are considered likely to have any local or regional significance.

5.2 VEGETATION SIGNIFICANCE

Ten vegetation types were recorded from the survey area:

- near-coastal dunes and swales:
 - **ArMcMhTS**; *Acacia rostelifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland, occupying 14.28% of the survey area plus additional representation in mosaics with other vegetation types
 - **ArMIMhTS**; *Acacia rostelifera*, *Melaleuca lanceolata* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland, occupying 3.12% of the survey area
 - **EobEorEzMOMF**; *Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland, occupying 5.28% of the survey area plus additional representation in mosaics with other vegetation types
 - **McAxGaTDS**; *Melaleuca cardiophylla*, *Acacia xanthina* and *Grevillea argyrophylla* tall dense shrubland, occupying 18.23% of the survey area plus additional representation in mosaics with other vegetation types
- exposed limestone/cap:
 - **EeLOW**; *Eucalyptus erythrocorys* low open woodland, occupying 11.55% of the survey area plus additional representation in mosaics with other vegetation types
- sandplain/lower slopes:
 - **AspBsBIMS**; *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland, occupying 12.12% of the survey area plus additional representation in mosaics with other vegetation types
 - **BpLW**; *Banksia prionotes* low woodland, occupying 0.73% of the survey area
- sandy slopes/disturbed areas:
 - **ArLOF**; *Acacia rostelifera* low open forest, occupying 3.77% of the survey area plus additional representation in mosaics with other vegetation types
 - **AsaAscTOS**; *Acacia saligna* and *Acacia scirpifolia* tall open shrubland, occupying 0.38% of the survey area
- riparian and low-lying areas:
 - **EcArMW**; *Eucalyptus camaldulensis* subsp. *obtusata* and *Acacia rostelifera* mid woodland, occupying 3.97% of the survey area plus additional representation in mosaics with other vegetation types.

The majority of the vegetation types appear similar to vegetation observed in adjacent and nearby areas, particularly the vegetation types recorded on near coastal dunes and swales and exposed limestone caps.

5.2.1 THREATENED ECOLOGICAL COMMUNITIES

No TECs have been recorded from within 25 km of the survey area (Ecoscape 2021). None of the vegetation resembles any currently described TECs (DBCA 2018).

5.2.2 PRIORITY ECOLOGICAL COMMUNITIES

The 2020 DBCA database search identified the P1 *Coastal sands dominated by Acacia rostellifera, Eucalyptus oraria and Eucalyptus obtusiflora (Geraldton area)* PEC as having been recorded within 2 km of the survey area.

The Reconnaissance-level flora and vegetation survey conducted by Ecoscape during 2020 (Ecoscape 2021) did not identify this ecological community as present based on the level of detail recorded at the time as *Eucalyptus obtusiflora*, being one of the required characteristic species to meet the descriptive criteria of the PEC, was not recorded.

However, information from additional quadrats recorded during the 2022 Detailed survey identified this species was characteristic of the mallee vegetation in dune swales. The other species definitive of the PEC (*Acacia rostellifera*, but not in the upper stratum, and *Eucalyptus oraria*) were also present in vegetation type **EobEorEzMOMF**. It is concluded, therefore, that vegetation type **EobEorEzMOMF** is likely to be representative of the above-named PEC. Within the survey area it occupied 40.60 ha (5.28% of the total area), and it also occurred in fine-scale mosaics with vegetation types **ArMcMhTS** (part of 1.41 ha) and **McAxGaTDS** (part of 1.48 ha).

5.2.2.1 The Coastal sands dominated by *Acacia rostellifera, Eucalyptus oraria* and *Eucalyptus obtusiflora (Geraldton area)* PEC distribution and extent

Extents and distributions of PECs are not publicly available, therefore, it is not possible to adequately discuss how significant a locally occurring PEC is in relation to the PEC as currently understood.

As a bare minimum (based on 'Geraldton area' forming part of the PEC description), this PEC must be assumed to occur from at least Geraldton to the survey area – a distance of approximately 85 km. Limestone ridge plant community 11 in the *Geraldton Regional Flora and Vegetation Survey* (GRFVS; Department of Planning [DoP] & Ecoscape 2010) includes mallee vegetation characterised by *Eucalyptus obtusiflora*, *E. oraria* and on occasion *E. zopherophloia* (i.e. essentially the same characteristic species composition as vegetation type **EobEorEzMOMF**), and was recorded as far north as Oakajee, extending the potential northwards distribution by a further 25 km (total 110 km north-south). No similar vegetation was recorded further north (as far as the Menai Hills near the Hutt River; Ecoscape 2011), although survey further north was not conducted to confirm that Oakajee was the northern limit of this mallee vegetation. Taking into consideration the area where the distribution of the defining species intersect, and given that the distribution of *Eucalyptus oraria* extends only approximately 20 km south of the survey area (excluding outlier populations; ALA 2023), it must be concluded that the potential north-south range of the PEC is approximately 125 km.

The GRFVS Limestone ridge plant community 11 occupied 0.32% of the GRFVS survey area (DoP & Ecoscape 2010); similar vegetation (community 12; *Eucalyptus oraria*, *E. obtusiflora* Mallee (Limestone)) occupied 0.52% of the *Dongara to Cape Burney Coastal Vegetation Survey* area (DCBCVS; Ecoscape 2010), not including within mosaics. These small extents and overall small proportion of the native vegetation are likely to have justified the listing of these vegetation units as a PEC, which occurred after these surveys.

Within the IGE survey area, vegetation type **EobEorEzMOMF** occupied a small proportion of the survey area (5.28% not including mosaics noting that mosaics did not occur within the proposed development footprint, or 6.76% of the survey area if not including cleared lands), although it was at least ten times more common than in either the GRFVS (DoP & Ecoscape 2010) or DCBCVS (Ecoscape 2010) survey areas.

This PEC, or vegetation very similar to it:

- has an estimated north-south distribution of approximately 125 km although the east-west (distance from the coast) is not definable
- appears to have become more common towards the southern part of its potential distribution:
 - it occupies a larger proportion of the native vegetation in the survey area (compared with in the GRFVS and DCBVS areas)
 - there are large extents of the PEC indicated in the DBCA data to the west of Mt Adams (including occurrence 127118) and within 2 km north of the survey area (including occurrence 127112)
- the bulk of the mapped occurrences (DBCA data) are further to the east than the original mapped occurrences recorded during the coastal vegetation surveys (DoP & Ecoscape 2010; Ecoscape 2010) where such vegetation occupied only a small proportion of the native vegetation and appear to define the PEC.

5.2.2.2 Local and Regional Impacts

As only a small proportion of the IGE survey area is proposed for clearing (as the EPA requested a 50 m buffer around the proposed development footprint) it is unlikely that this clearing would have a significant impact on the overall ecological community at a local scale, and even less impact on a regional scale.

The overall viability of the ecological community, which occurs in discrete patches rather than as a continuous whole, would not be affected by partial clearing in one or more of its occurrences.

5.2.3 LOCAL AND REGIONAL SIGNIFICANCE OF VEGETATION

Vegetation type **EobEorEzMOMF** is considered likely to represent the *Coastal sands dominated by Acacia rostellifera, Eucalyptus oraria and Eucalyptus obtusiflora (Geraldton area)* PEC. Its significance is discussed above in **Section 5.2.2**.

Two of the recorded vegetation types occupy only a small proportion of the survey area (<1%); these may be considered as significant for this reason, and are discussed below:

- **AsaAscTOS** occupies 2.95 ha (0.0.38% of the survey area). This vegetation type is entirely in Degraded-Completely Degraded condition as a result of disturbance (grazing). As such it is not considered to represent an extant vegetation type and the vegetation type and its small extent is not significant. Clearing in this vegetation type is not considered as significant.
- **BpLW** occupies 5.59 ha (0.73% of the survey area). This vegetation type is likely to be significant, particularly at a local scale, in terms of its small extent and as Carnaby's Cockatoo foraging habitat (see **Section 5.3.1.1** below).

Two vegetation types are considered as significant as they represent foraging habitat for the endangered Carnaby's Cockatoo (vegetation types **AspBsBIMS** and **BpLW**), discussed below in **Section 5.3.1.1**.

Vegetation type **EcArMW** may be significant as it is defined by *Eucalyptus camaldulensis* which is considered indicative of a groundwater dependent ecosystem (see **Appendix Two**). **EcArMW** largely corresponds with the streamline of the Arrowsmith River and floodplain associated with Arramall Lake (which is outside the survey area) and is in Degraded-Completely Degraded condition due to livestock grazing. As such it is not considered as an extant native vegetation type, however, its role as the only vegetation type with large trees that provide habitat for fauna may be significant.

Clearing in **EcArMW** may be locally significant if trees are removed, however, is unlikely to have any regional significance. Clearing for access tracks may be possible without tree removal; due to the Degraded-Completely Degraded condition of the vegetation type tracks are unlikely to further significantly degrade the vegetation as the trees are the significant feature, not the ground vegetation which is largely not native (weedy).

None of the other vegetation types are considered to have any specific local or regional significance as they are considered to be widespread within the local and, broadly, regional area.

5.2.4 VEGETATION CONDITION

The vegetation condition within the IGE survey area varied from Excellent to Completely Degraded, with a relatively even proportion distributed between the condition ratings. However, overall, more vegetation was in the better ratings (Excellent-Good) – overall 415.57 ha or 54.04% of the total.

The majority of the Excellent condition vegetation was in the west or southern portions of the survey area.

The eastern portion of the survey area was previously part of an operating farm and was grazed by livestock (sheep) resulting in less structural and floristic diversity and increased weed cover. However, the entire site has a significant feral goat population and weeds are common through most of the survey area. The goats were not observed, nor was there significant evidence of their presence, in sandplain vegetation, particularly in vegetation type **AspBsBIMS**.

5.3 CARNABY'S COCKATOO FORAGING HABITAT

5.3.1 SITE SIGNIFICANCE

The survey area is within the mapped non-breeding range of the endangered EPBC- and BC Act-listed Carnaby's Cockatoo (*Zanda latirostris*). The mapped edge of the breeding range is to the east, approximately 18 km from the IGE site (DAWE 2022), reproduced in **Figure 6** with the approximate location of the survey area indicated by a yellow star.

Map 3 Modelled distribution for Carnaby's Cockatoo (*Zanda latirostris*)

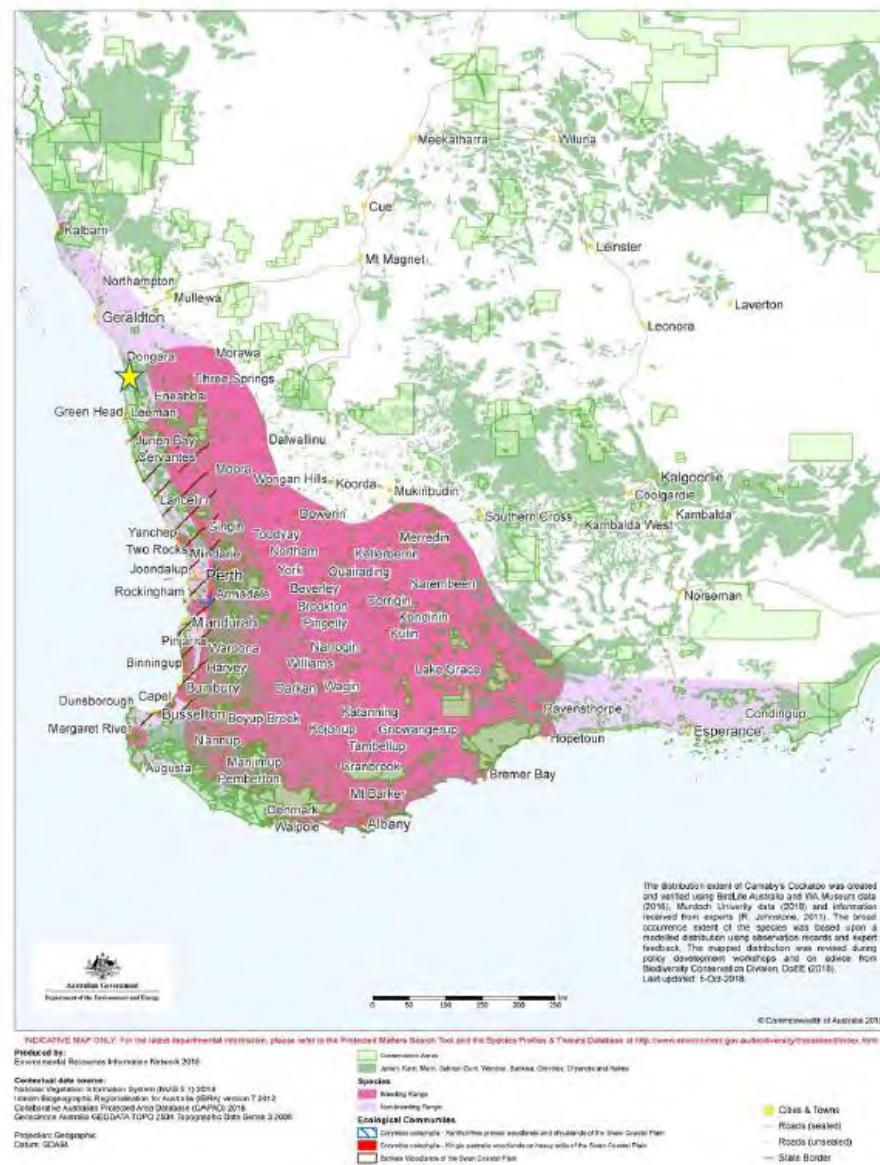


Figure 6: Carnaby's Cockatoo modelled distribution (DAWE 2022) with survey area indicated by a yellow star

The survey area is considered to be important to Carnaby's Cockatoo as it is within a foraging area of the Koobabbie population (Williams *et al.* 2017); **Figure 7**. According to the flight route indicated in **Figure 7** Carnaby's Cockatoo is likely to access the IGE site from the east and forage in suitable habitat largely to the south of the survey area, including in Beekeepers Nature Reserve. This species is considered 'scarce and patchily distributed' near Arrowsmith Lake (Johnstone & Johnstone 2010).

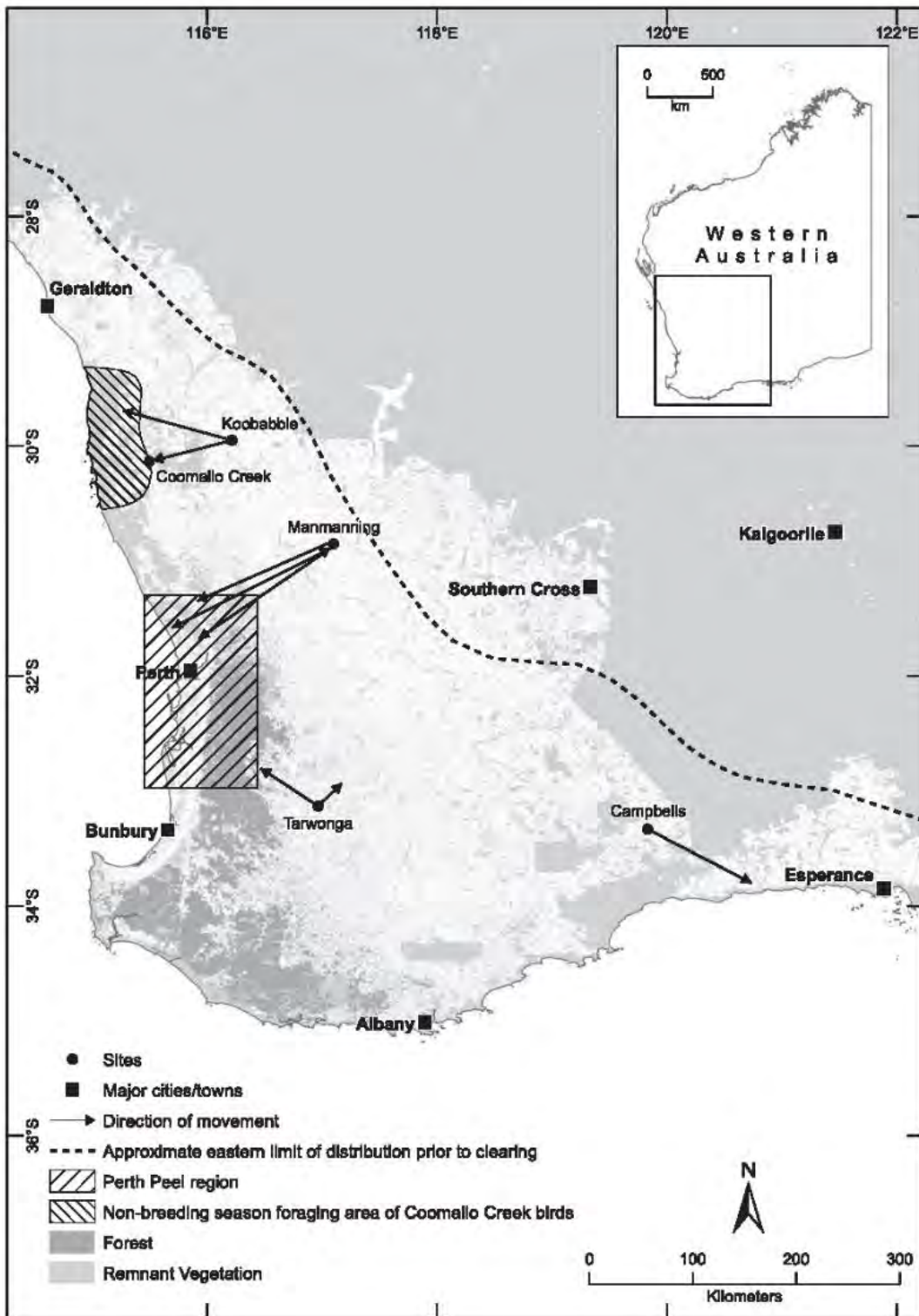


Figure 7: Known seasonal migration patterns of Carnaby's Cockatoo (Williams *et al.* 2017)

However, another reference (Johnstone & Kirkby 2019) cites the approximate location of the survey area as having a semi-resident flock (upper green oval in **Figure 8**). There is no indication in this reference if the semi-resident flock consists of non-breeding-age (old and/or young) birds or what the timing of 'semi' refers to i.e. seasonality.

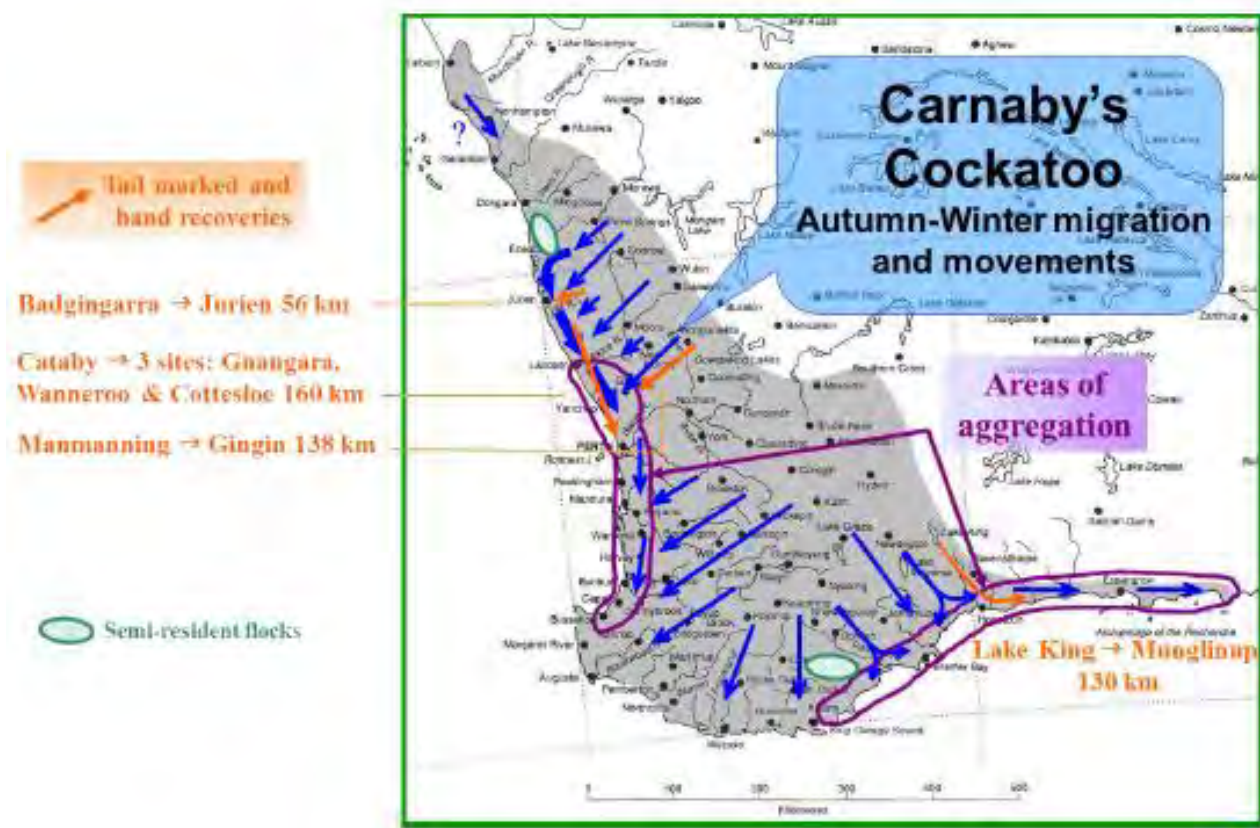


Figure 8: Migration and movement of Carnaby's Cockatoo (Johnstone & Kirkby 2019)

Ecoscape has conducted two field surveys of the overall IGE site in 2020 and 2022, both over 5 days in October (15 person days due to team separation).

Carnaby's Cockatoos were observed near Arramall Lake during October 2020 (**Image 1**), either feeding on or resting in large *Melaleuca* trees, and to the east of the IGE site along Brand Highway, foraging on *Banksia attenuata* shrubs on the (eastern) road reserve on at least three of the 10 person days of the 2020 survey. None of the observed locations are within the 2022 survey area or proposed development footprint.

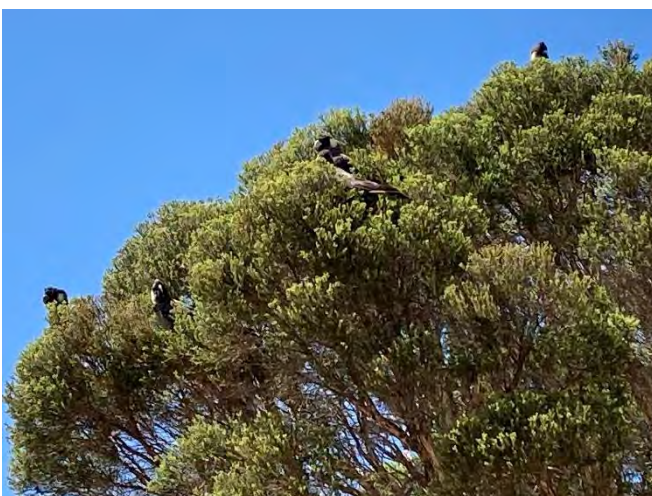


Image 1: Carnaby's Cockatoo in *Melaleuca strobophylla* (October 2020)

Carnaby's Cockatoo was not sighted or heard during the 2022 survey period (5 person days), noting that this survey concentrated on the western side of the IGE survey area and did not access the site of the 2020

observations. No evidence of foraging activity was observed in vegetation types **AspBsBIMS** and **BpLW**, noting that there is no established method to define this.

Although the combined survey effort amounts to only the equivalent of 15 person days of observation it would be expected that if the *Banksia*-dominated vegetation types (**AspBsBIMS** and **BpLW**) within the survey area were significant for foraging during October that Carnaby's Cockatoo would have been observed or heard in the vicinity of them during either or both of the survey periods.

5.3.1.1 Carnaby's Cockatoo Foraging Habitat

According to DAWE (2022), Carnaby's Cockatoo forage on *native shrubland, kwongan heathland or woodland, dominated by proteaceous plant species such as Banksia spp. (including Dryandra spp.), Hakea spp. and Grevillea spp., as well as native eucalypt woodland and forest that contains foraging species.*

Within the survey area vegetation types **AspBsBIMS** (*Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland) and **BpLW** (*Banksia prionotes* low woodland) are considered suitable for foraging as they have significant populations of *Banksia* species which are favoured for foraging, and (for **AspBsBIMS**) a lesser number of other Proteaceous species including small amounts of *Hakea* or *Grevillea* species.

Foraging Species Present

Carnaby's Cockatoo were not observed in these two vegetation types (**AspBsBIMS** and **BpLW**, in combination referred to as 'sandplain vegetation types') on either occasion, despite *Banksia sessilis* (being the most common foraging species) having flowers present during both years (**Image 2**). The flowering period of *Banksia sessilis* var. *cygnorum* is listed as being between July and October (WAH 1998-2023).

The flowering period of *Banksia prionotes* is listed as being between February and August (*ibid.*). No flowers were observed during either survey period.

Banksia leptophylla var. *melletica* (**Image 3**), characteristic of vegetation type **AspBsBIMS**, had largely finished flowering during the 2022 survey. Its flowering period is listed as March-August (*ibid.*). However, it is listed as having low foraging value by Groom (Groom 2011).



Image 2: *Banksia sessilis* subsp. *cygnorum* flower (October 2022)



Image 3: *Banksia leptophylla* var. *melletica* old flowers (October 2022)

Other proteaceous species (see **Table 16** in **Appendix Five**), the majority of which were only sparsely distributed had also largely finished flowering by October. The exceptions were *Grevillea argyrophylla* which is characteristic in vegetation type **McAxGaTDS** on coastal limestone, the foraging value of which is unknown, however, it is not likely to be significant due to the small flower size, and *Grevillea leucoptervis* which occurred

in patches in **AspBsBIMS** and has large flowers from July to up to December although as these are on tall, narrow stalks they may be less favourable.

The majority of references detailing foraging species for Carnaby's Cockatoo are from the Swan Coastal Plain (Groom 2011; Shah & Birds Australia WA 2006; Valentine & Stock 2008), although two (Johnstone & Johnstone 2010; Johnstone, Johnstone & Kirkby 2007) provide some information from the Geraldton Sandplains region. Information from recorded (in the IGE survey area) foraging species listed in these publications are summarised in **Table 8**. Of note, *Eucalyptus erythrocorys* which occurs commonly in the survey area (dominant in vegetation type **EeLOW** and occasionally in **AspBsBIMS**) is not listed as a foraging species despite being extensively planted in the Perth area and is therefore assumed not to be significantly utilised by this species at Arrowsmith (noting that the DAWE (2022) referral guidelines specifically list *Eucalyptus erythrocorys* as foraging for Forest Red-tailed Black Cockatoo in the Perth area).

Based on available information foraging is likely to occur most commonly during the flowering period of favoured species as the flowers are nectarous and therefore energy-rich, have visiting insects which add to the protein content, and are more visible. However, the main source of sustenance is from the seed, which is present in an immature form during flowering but in a larger and more mature form following flowering, although (for proteaceous species including Banksias) potentially becoming more unpalatable and requiring more time and energy to extract seeds when cones are dry and hard. Therefore, Carnaby's Cockatoo may forage on proteaceous (and other seed and food sources) at any time of year but are more likely during flowering or early fruiting of favoured species.

Table 8: Carnaby's Cockatoo foraging species data

Species	Foraging value (Groom 2011)	Plant parts utilised (Shah & Birds Australia WA 2006; Valentine & Stock 2008)	Plant parts utilised (Johnstone & Johnstone 2010; Johnstone, Johnstone & Kirkby 2007)	Commonly occurring (i.e. recorded in quadrats)	Occasional (i.e. opportunistic observations only)
<i>Acacia saligna</i>	Low	fresh bark	insect larvae	x	
<i>Banksia attenuata</i>	High	seeds, seeds (old fruit), grubs	seeds, flowers		x
<i>Banksia dallanneyi</i>	High (as <i>B. nivea</i>)			x	
<i>Banksia leptophylla</i> var. <i>melletica</i>	Low				x
<i>Banksia prionotes</i>	High	seeds (old fruit)	seeds	x	
<i>Banksia sessilis</i> var. <i>cygnorum</i>	High	late flowers/mature seed	seeds, flowers	x	
<i>Banksia</i> species			insect larvae	x	
<i>Erodium botrys</i>	Low		seeds	x	
<i>Eucalyptus camaldulensis</i>	Low			x	
<i>Eucalyptus</i> species			insect larvae	x	
<i>Hakea lissocarpha</i>	Medium		seeds	x	
<i>Hakea trifurcata</i>	High		seeds		x
<i>Jacksonia</i> species			insect larvae	x	
<i>Melaleuca leuropoma</i>	Medium			x	
<i>Mesomelaena pseudostygia</i>	Medium		seeds	x	
<i>Xanthorrhoea</i> sp.	Medium (as <i>X. preissii</i>)		insect larvae	x	

5.3.1.2 Roosting Habitat and Likely Carnaby's Cockatoo Movement

Carnaby's Cockatoo require tall trees greater than 8 m high for night roosts (Kabat, Barrett & Kabat 2012) located preferably within 6 km radius of a water source (Le Roux 2017). Trees of this height occur only within vegetation types **EcArMW** (mainly *Eucalyptus camaldulensis*) and rarely in other vegetation types (primarily *Melaleuca* species e.g. in vegetation type **ArMIMhTS**).

However, there are no tall trees within sandplain vegetation types (**AspBsBIMS** and **BpLW** – *Banksia prionotes* is usually less than 8 m high) that would be suitable as night roosts. This suggests that Carnaby's Cockatoo would be moving around the landscape between daytime foraging sites (assumed to be these vegetation types) and night roost sites, the location of which are unknown. They are also likely to move through the landscape to and from water sources that would seasonally include Arramall Lake and some smaller waterbodies on the northeast of the overall IGE site (which are not within the survey area as this portion of the site is being set aside for conservation). Arramall Lake is seasonal and not known to hold water through summer and autumn, only refilling after significant rainfall. Other, smaller but deeper water bodies present on the IGE site may hold water for longer periods, however, this is unverified.

If water is not available Carnaby's Cockatoo will likely not occur within the IGE site over summer and potentially also autumn or, if present, will approach the site from the direction of the water source being utilised i.e. from the south.

5.3.1.3 Carnaby's Cockatoo Summary

The survey area is not within the breeding distribution of Carnaby's Cockatoo (DAWE 2022). On this information alone it would be anticipated that the site would only be visited seasonally for foraging during the non-breeding period.

As the site is within the suggested semi-resident population extent (Johnstone & Kirkby 2019) it could be used for foraging and roosting throughout the year. This is in part confirmed as the sightings of Black Cockatoo within the overall IGE site during October 2020 (Ecoscape 2021) were within the species' breeding period.

However, if drinking water is not available at the site Carnaby's Cockatoo are unlikely to be present as they require a drinking source within 6 km of roosting sites (Le Roux 2017). Therefore, they would likely move to areas closer to a source of drinking water like Lake Logue (Department of Environment and Conservation 2009; Johnstone, Johnstone & Kirkby 2007) or Lake Indoon, approximately 40 km to the south, both of which appear to be within the extent indicated in this reference (Johnstone & Kirkby 2019). It is unknown if there are sources of drinking water closer than these lakes.

In summary, it is clear that Carnaby's Cockatoo utilise the overall survey area as they have been observed to be present in at least close proximity and would, as a minimum, overfly it on between traverses for foraging and for roosting and water sources. However, the suitable foraging habitat with *Banksia* species (vegetation types **AspBsBIMS** and **BpLW**) is potentially only visited on occasion, particularly taking into consideration that these vegetation types form the northern edge of a much larger area of similar vegetation to the south in Beekeepers Nature Reserve.

It is concluded that Carnaby's Cockatoo would only visit the foraging habitat on infrequent occasions, however, specific Carnaby's Cockatoo surveys or observation records from site workers would be required to confirm foraging habitat use.

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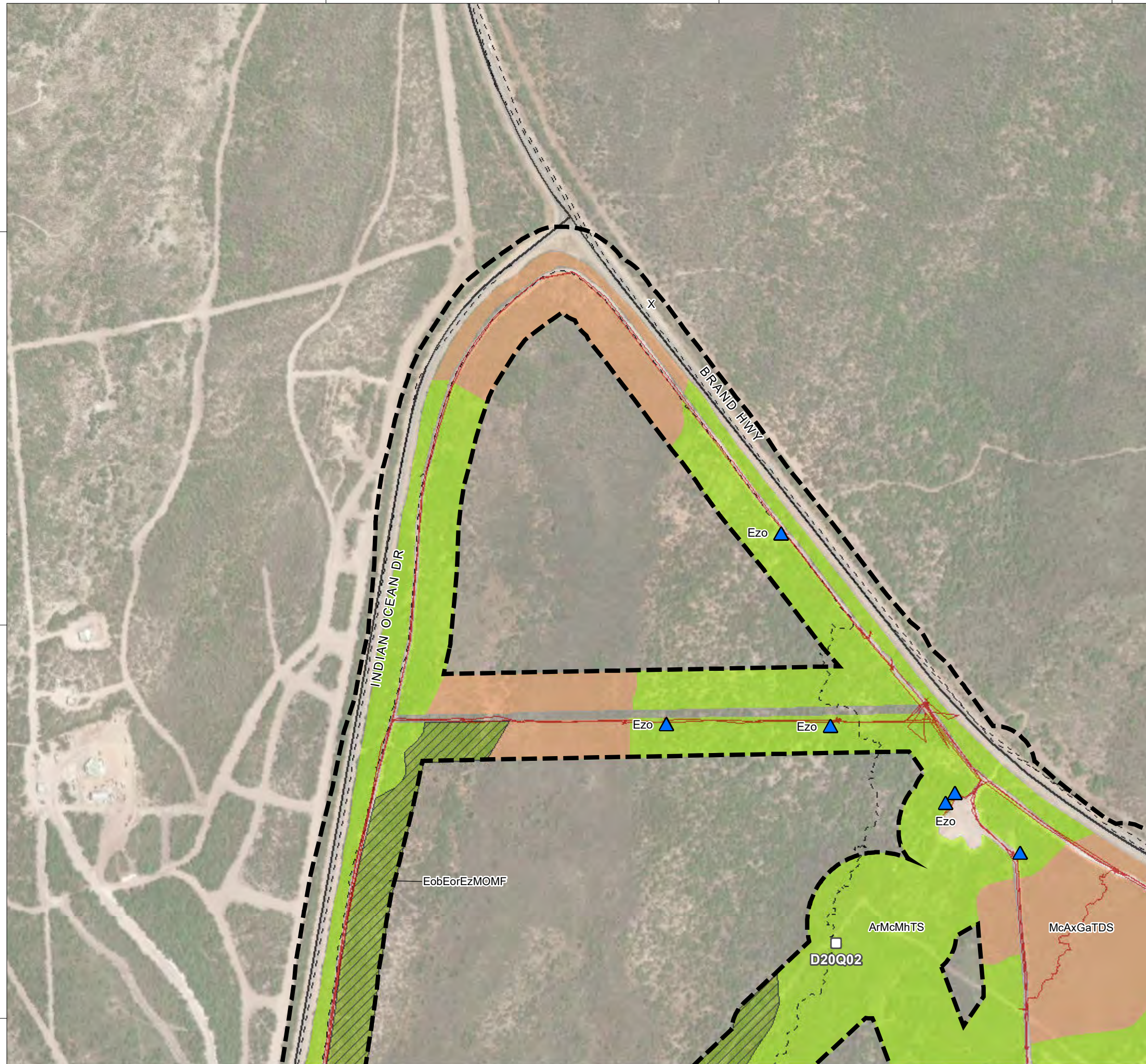
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MAPS

Please note that taxa names in vegetation type mosaics have been truncated due to field size limitations in the GIS data. Subspecies (subsp.) and varieties (var.) are as per indicated in the vegetation type name.

307500 308000 308500



307500 308000 308500

6738500

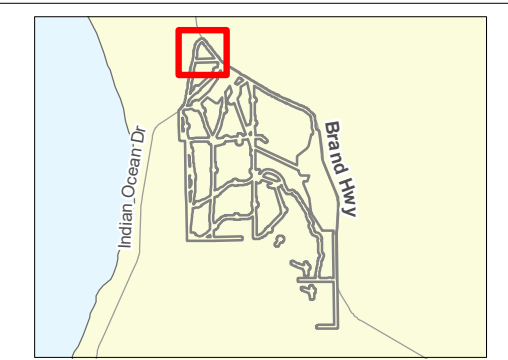
6738000

6737500

LEGEND

- Survey
- Quadrat (2020)
- Survey Track
- Survey Track (2020)
- Road
- Conservation-listed Flora**
- Priority 4
- Vegetation Survey Area**
- ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- EobEorEzMOMF: *Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland
- McAxGaTDS: *Melaleuca cardiophylla*, *Acacia xanthina* and *Grevillea argyrophylla* tall dense shrubland
- X: Not native/cleared
- Coastal sands dominated by *Acacia rostellifera*, *Eucalyptus oraria* and *Eucalyptus obtusiflora* (Geraldton area) PEC

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
 SOURCE DATA: QUADRATS AND CONSERVATION LISTED FLORA (ECOSCAPE 2020 AND 2022) AND VEGETATION DATA (ECOSCAPE 2022)
 AERIAL: ESRI BASEMAP (2021)
 BASEMAP: GEOSCIENCE AUSTRALIA
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



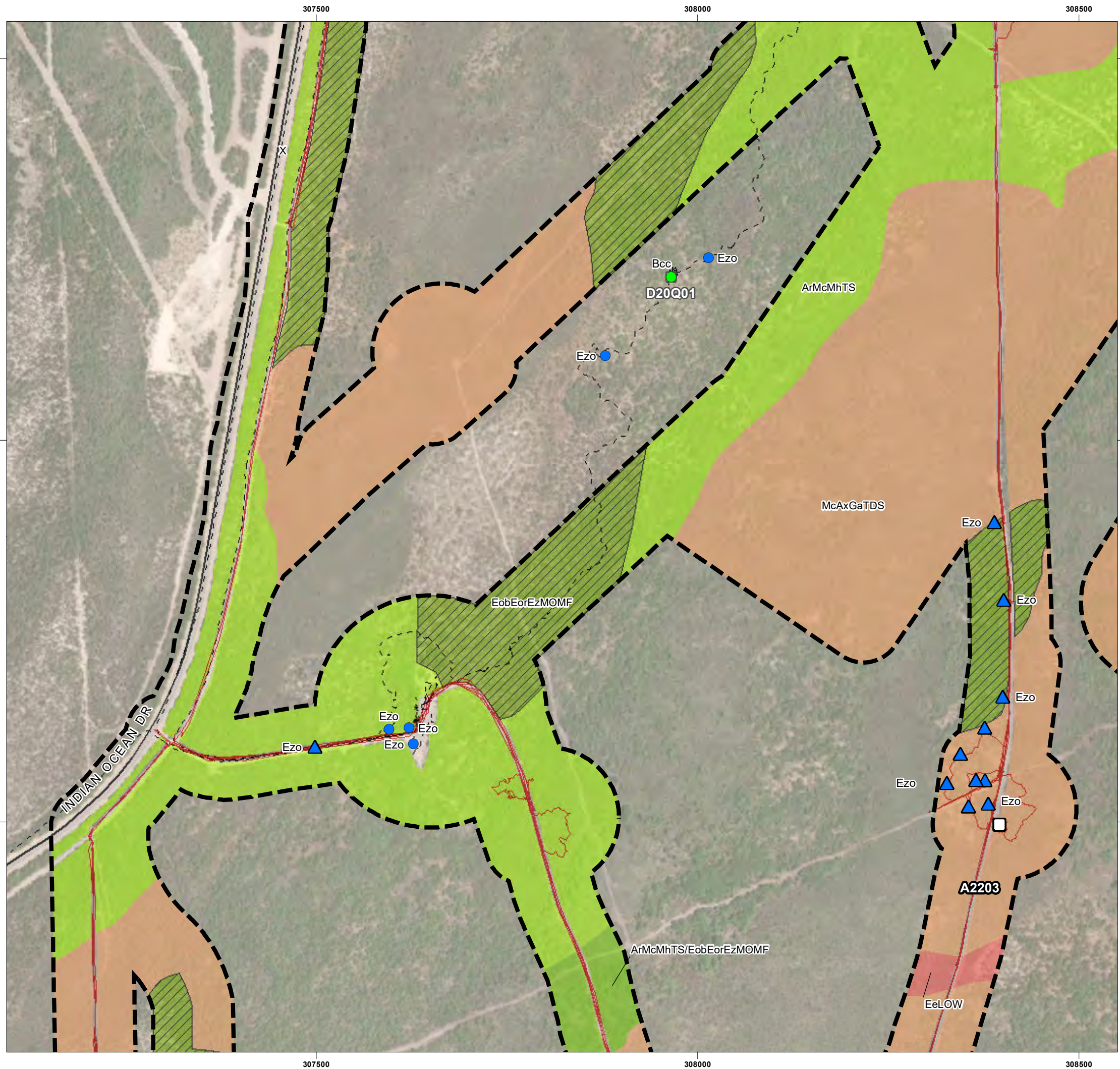
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
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MAP
1-1



LEGEND

- Survey Area
- Quadrat
- Quadrat (2020)
- Survey Track
- Survey Track (2020)
- Road

Conservation-listed Flora

- Priority 4

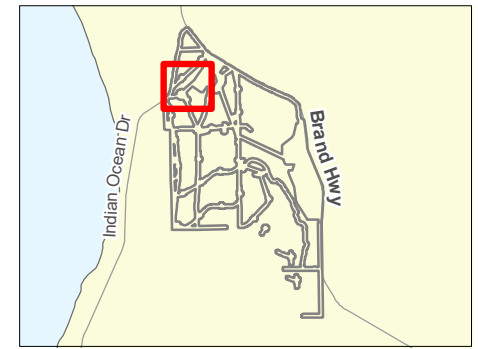
Conservation-listed Flora (2020)

- Beyeria cinerea* subsp. *cinerea* (Priority 3)
- Eucalyptus zopherophloia* (Priority 4)

Vegetation Survey Area

- ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- ArMcMhTS/EobEorEzMOMF: *A. rostellifera*, *M. cardiophylla* and *M. huegelii* tall shrubland / *E. obtusiflora*, *E. oraria* and *E. zopherophloia* mid open mallee forest/mallee shrubland
- EeLOW: *Eucalyptus erythrocorys* low open woodland
- EobEorEzMOMF: *Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland
- McAxGaTDS: *Melaleuca cardiophylla*, *Acacia xanthina* and *Grevillea argyrophylla* tall dense shrubland
- X: Not native/cleared
- Coastal sands dominated by *Acacia rostellifera*, *Eucalyptus oraria* and *Eucalyptus obtusiflora* (Geraldton area) PEC

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS
ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



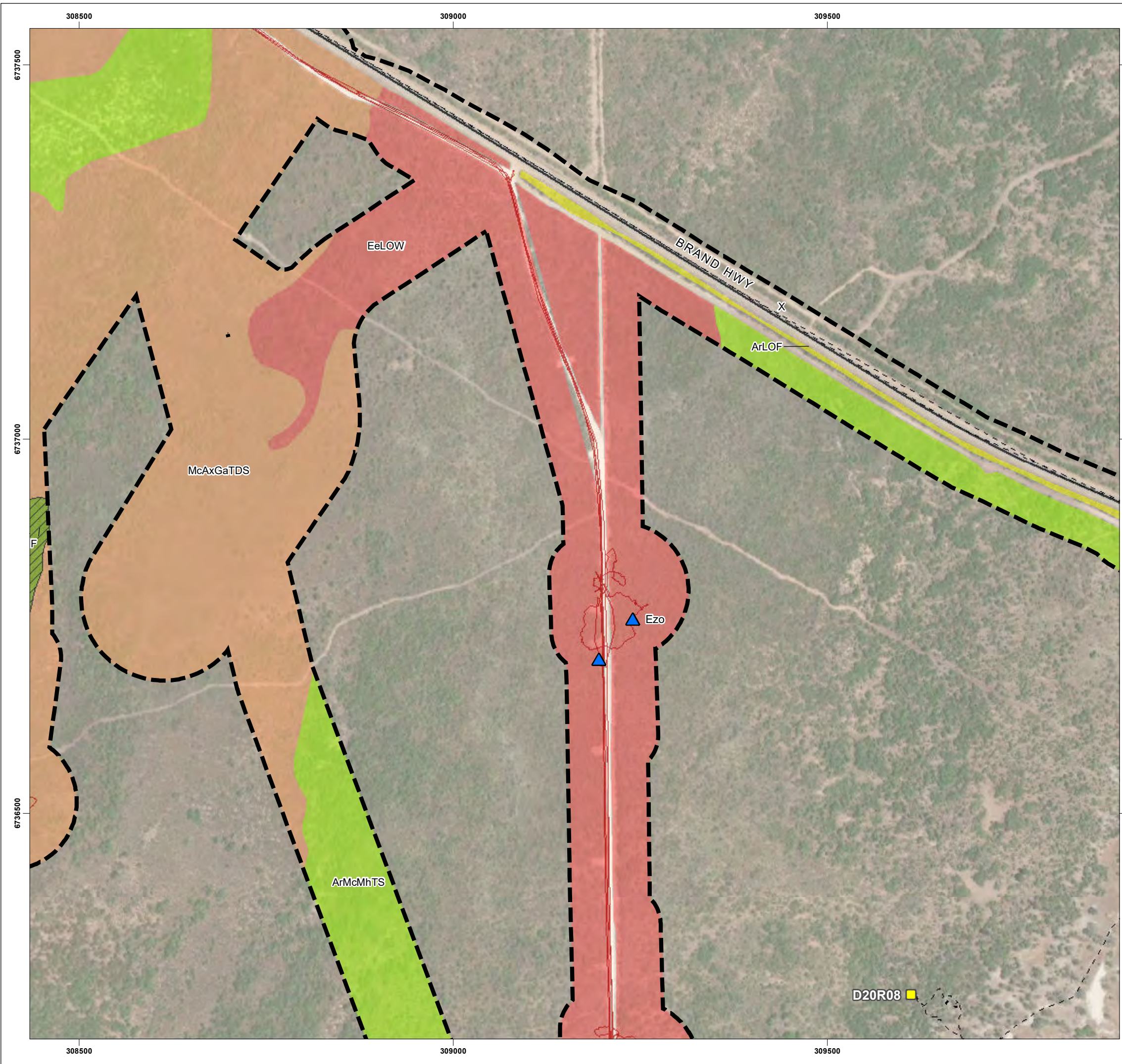
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	06/04/2023

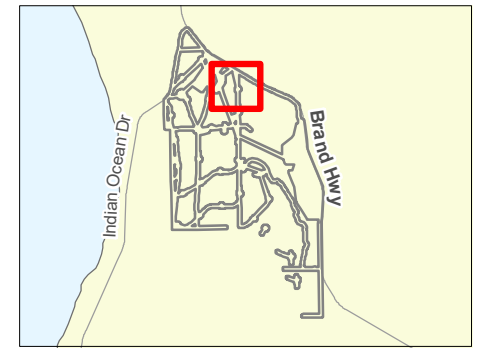
MAP
1-2



LEGEND

- Survey Area
- Relevé (2020)
- Survey Track
- Survey Track (2020)
- Road
- Conservation-listed Flora**
- Priority 4
- Vegetation Survey Area**
- ArLOF: *Acacia rostellifera* low open forest
- ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- EeLOW: *Eucalyptus erythrocorys* low open woodland
- EobEorEzMoMF: *Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland
- McAxGaTDS: *Melaleuca cardiophylla*, *Acacia xanthina* and *Grevillea argyrophylla* tall dense shrubland
- X: Not native/cleared
- Coastal sands dominated by *Acacia rostellifera*, *Eucalyptus oraria* and *Eucalyptus obtusiflora* (Geraldton area) PEC

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4755-22

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MAP
1-3



LEGEND

- Survey Area
- Survey Track (2020)
- Road

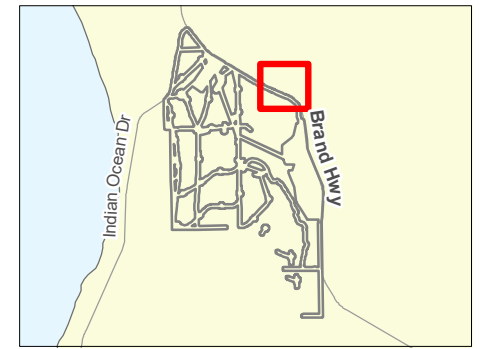
Conservation-listed Flora (2020)

- Eucalyptus zopherophloia* (Priority 4)

Vegetation Survey Area

- ArLOF: *Acacia rostellifera* low open forest
- ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- EcArMW: *Eucalyptus camaldulensis* subsp. *obtusata* and *Acacia rostellifera* mid woodland
- X: Not native/cleared

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS
ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



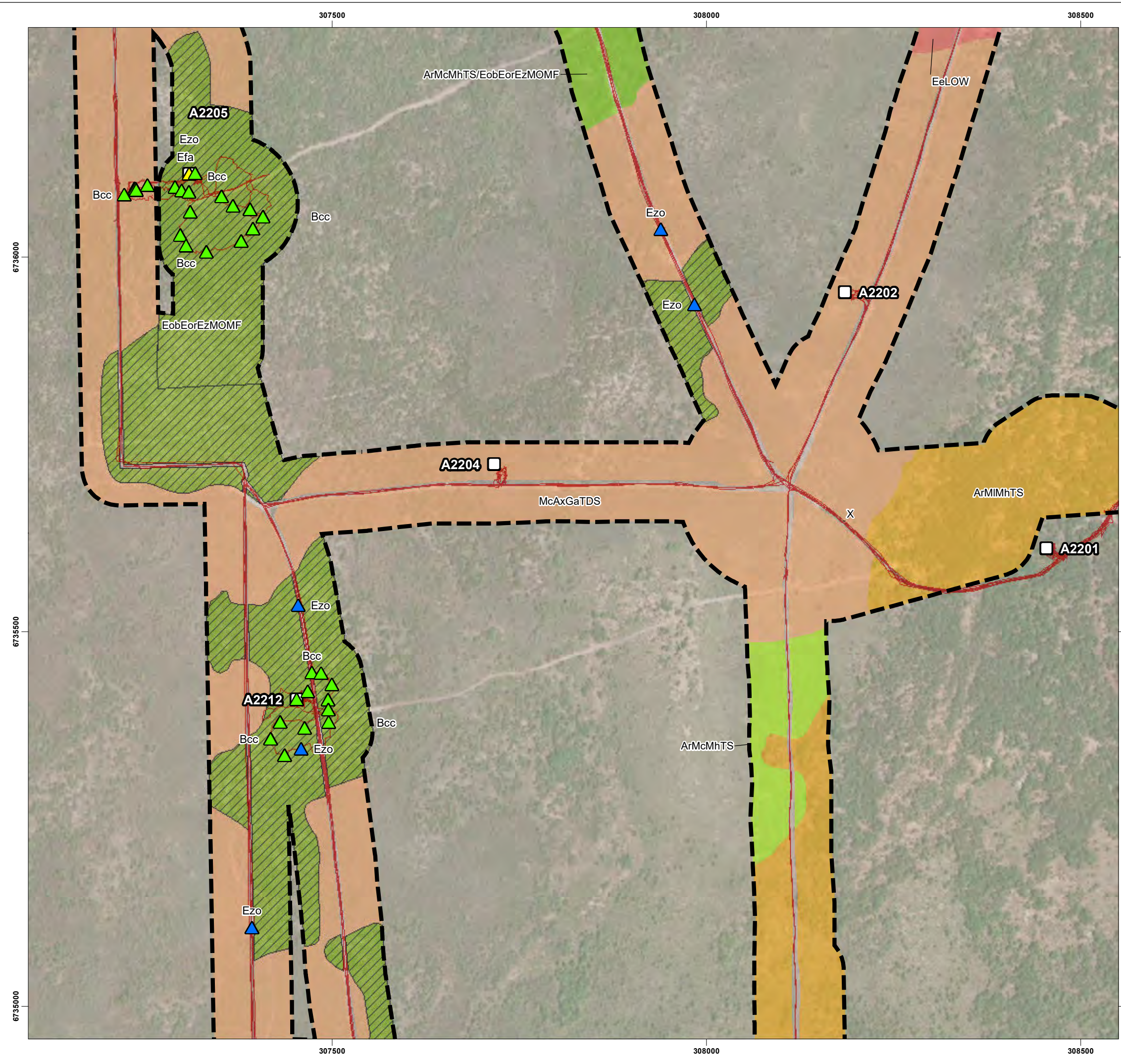
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 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
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MAP
1-4



LEGEND

- Survey
- Quadrat
- Survey Track
- Survey Track (2020)

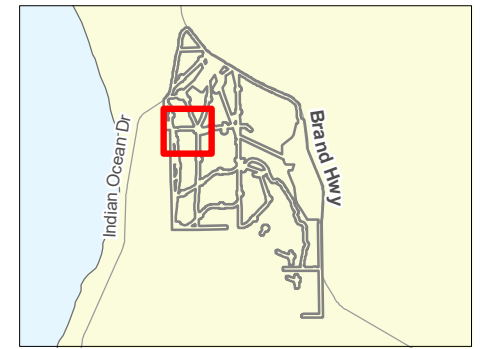
Conservation-listed Flora

- Priority 2
- Priority 3
- Priority 4

Vegetation Survey Area

- ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- ArMcMhTS/EobEorEzMOMF: *A. rostellifera*, *M. cardiophylla* and *M. huegelii* tall shrubland / *E. obtusiflora*, *E. oraria* and *E. zopherophloia* mid open mallee forest/mallee shrubland
- ArMIMhTS: *Acacia rostellifera*, *Melaleuca lanceolata* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- EeLOW: *Eucalyptus erythrocorys* low open
- EobEorEzMOMF: *Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland
- McAxGaTDS: *Melaleuca cardiophylla*, *Acacia xanthina* and *Grevillea argyrophylla* tall dense shrubland
- X: Not native/cleared
- Coastal sands dominated by *Acacia rostellifera*, *Eucalyptus oraria* and *Eucalyptus obtusiflora* (Geraldton area) PEC

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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 BASEMAP: GEOSCIENCE AUSTRALIA
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



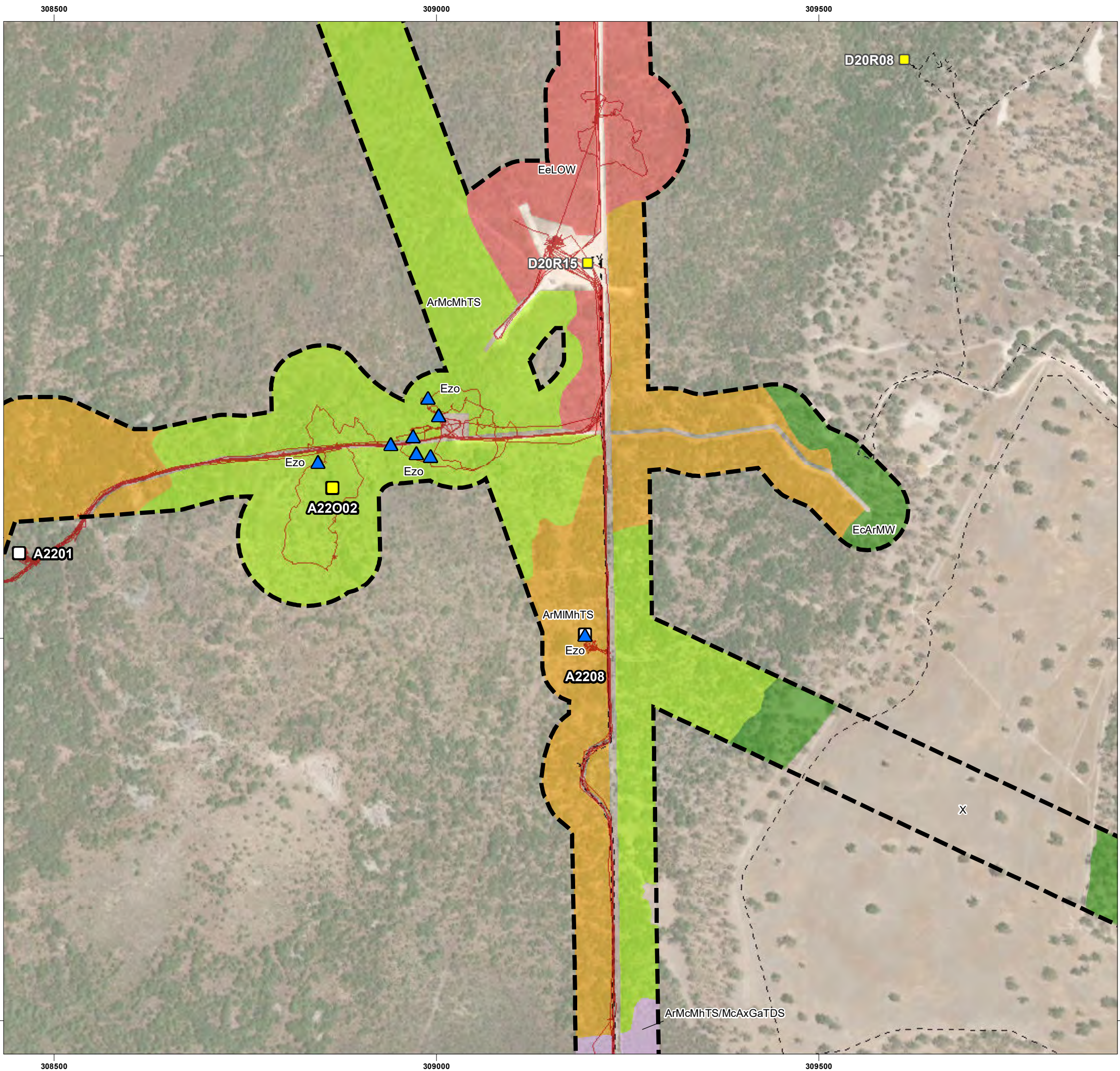
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	06/04/2023

MAP 1-5



LEGEND

- Survey Area
- Quadrat
- Relevé
- Relevé (2020)
- Survey Track
- Survey Track (2020)

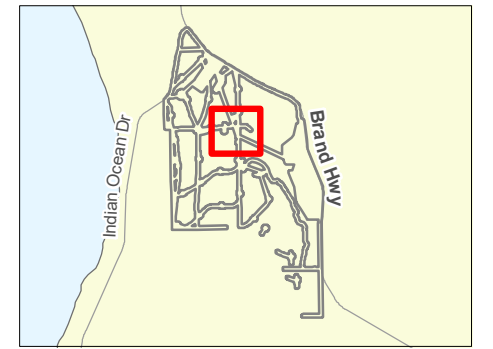
Conservation-listed Flora

- Priority 4

Vegetation Survey Area

- ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- ArMcMhTS/McAxGaTDS: *A. rostellifera*, *M. cardiophylla* and *M. huegelii* tall shrubland / *M. cardiophylla*, *A. xanthina* and *G. argyrophylla* tall dense shrubland
- ArMIMhTS: *Acacia rostellifera*, *Melaleuca lanceolata* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- EcArMW: *Eucalyptus camaldulensis* subsp. *obtusa* and *Acacia rostellifera* mid woodland
- EeLOW: *Eucalyptus erythrocorys* low open woodland
- X: Not native/cleared

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
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 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



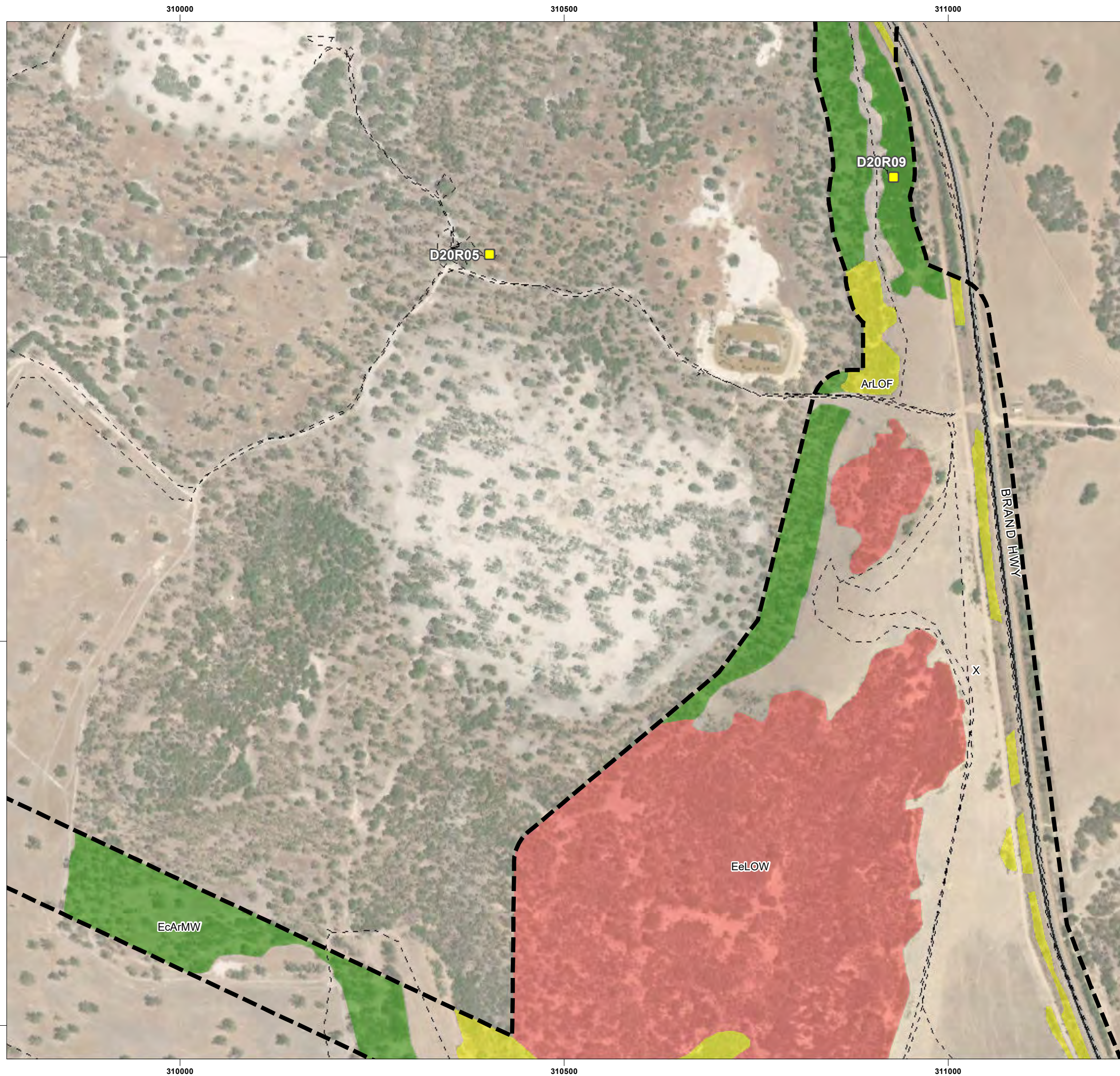
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	06/04/2023

MAP
1-6



LEGEND

- Survey Area
- Relevé (2020)
- Survey Track (2020)
- Road
- Vegetation Survey Area**
- ArLOF: *Acacia rostellifera* low open forest
- EcArMW: *Eucalyptus camaldulensis* subsp. *obtusa* and *Acacia rostellifera* mid woodland
- EeLOW: *Eucalyptus erythrocorys* low open woodland
- X: Not native/cleared

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aelica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



REV	AUTHOR	APPROVED	DATE
00	NW	LA	06/04/2023

MAP
1-7



LEGEND

- Survey Area
- Quadrat
- Relevé
- Survey Track
- Survey Track (2020)

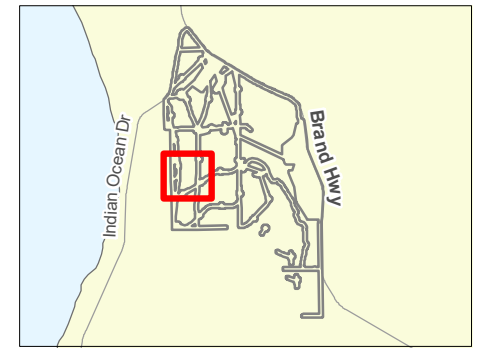
Conservation-listed Flora

- Priority 3
- Priority 4

Vegetation Survey Area

- ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- ArMIMhTS: *Acacia rostellifera*, *Melaleuca lanceolata* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- AspBsBIMS/McAxGaTDS: *A. spathulifolia*, *B. sessilis* and *B. leptophylla* mid shrubland / *M. cardiophylla*, *A. xanthina* and *G. argyrophylla* tall dense shrubland
- EeLOW/McAxGaTDS: *E. erythrocorys* low open woodland / *M. cardiophylla*, *A. xanthina* and *G. argyrophylla* tall dense shrubland
- EobEorEzMOMF: *Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland
- McAxGaTDS: *Melaleuca cardiophylla*, *Acacia xanthina* and *Grevillea argyrophylla* tall dense shrubland
- McAxGaTDS/EobEorEzMOMF: *M. cardiophylla*, *A. xanthina* and *G. argyrophylla* tall dense shrubland / *E. obtusiflora*, *E. oraria* and *E. zopherophloia* mid open mallee forest/mallee shrubland
- X: Not native/cleared
- Coastal sands dominated by *Acacia rostellifera*, *Eucalyptus oraria* and *Eucalyptus obtusiflora* (Geraldton area) PEC

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



ecoscape

VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



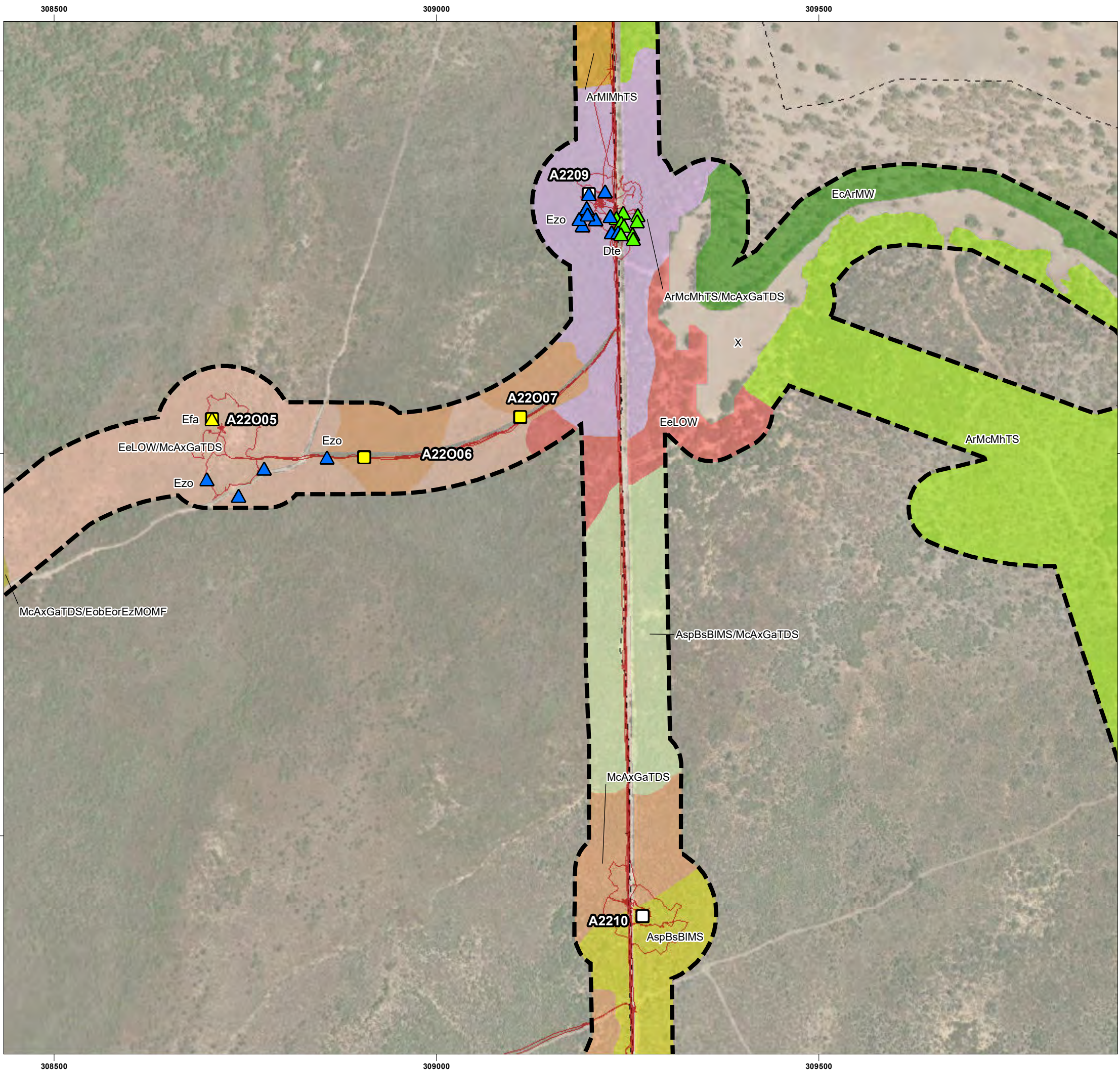
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	06/04/2023

MAP
1-8



LEGEND

- Survey Area
- Quadrat
- Relevé
- Survey Track
- Survey Track (2020)

Conservation-listed Flora

- Priority 2
- Priority 3
- Priority 4

Vegetation Survey Area

- ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- ArMcMhTS/McAxGaTDS: *A. rostellifera*, *M. cardiophylla* and *M. huegelii* tall shrubland / *M. cardiophylla*, *A. xanthina* and *G. argyrophylla* tall dense shrubland
- ArMIMhTS: *Acacia rostellifera*, *Melaleuca lanceolata* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- AspBsBIMS: *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland
- AspBsBIMS/McAxGaTDS: *A. spathulifolia*, *B. sessilis* and *B. leptophylla* mid shrubland / *M. cardiophylla*, *A. xanthina* and *G. argyrophylla* tall dense shrubland
- EcArMW: *Eucalyptus camaldulensis* subsp. *obtusata* and *Acacia rostellifera* mid woodland
- EeLOW: *Eucalyptus erythrocorys* low open woodland
- EeLOW/McAxGaTDS: *E. erythrocorys* low open woodland / *M. cardiophylla*, *A. xanthina* and *G. argyrophylla* tall dense shrubland
- McAxGaTDS: *Melaleuca cardiophylla*, *Acacia xanthina* and *Grevillea argyrophylla* tall dense shrubland
- McAxGaTDS/EobEorEzMOMF: *M. cardiophylla*, *A. xanthina* and *G. argyrophylla* tall dense shrubland / *E. obtusiflora*, *E. oraria* and *E. zopherophloia* mid open mallee forest/mallee shrubland
- X: Not native/cleared

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



ecoscape

VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS
ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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 BASEMAP: GEOSCIENCE AUSTRALIA
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



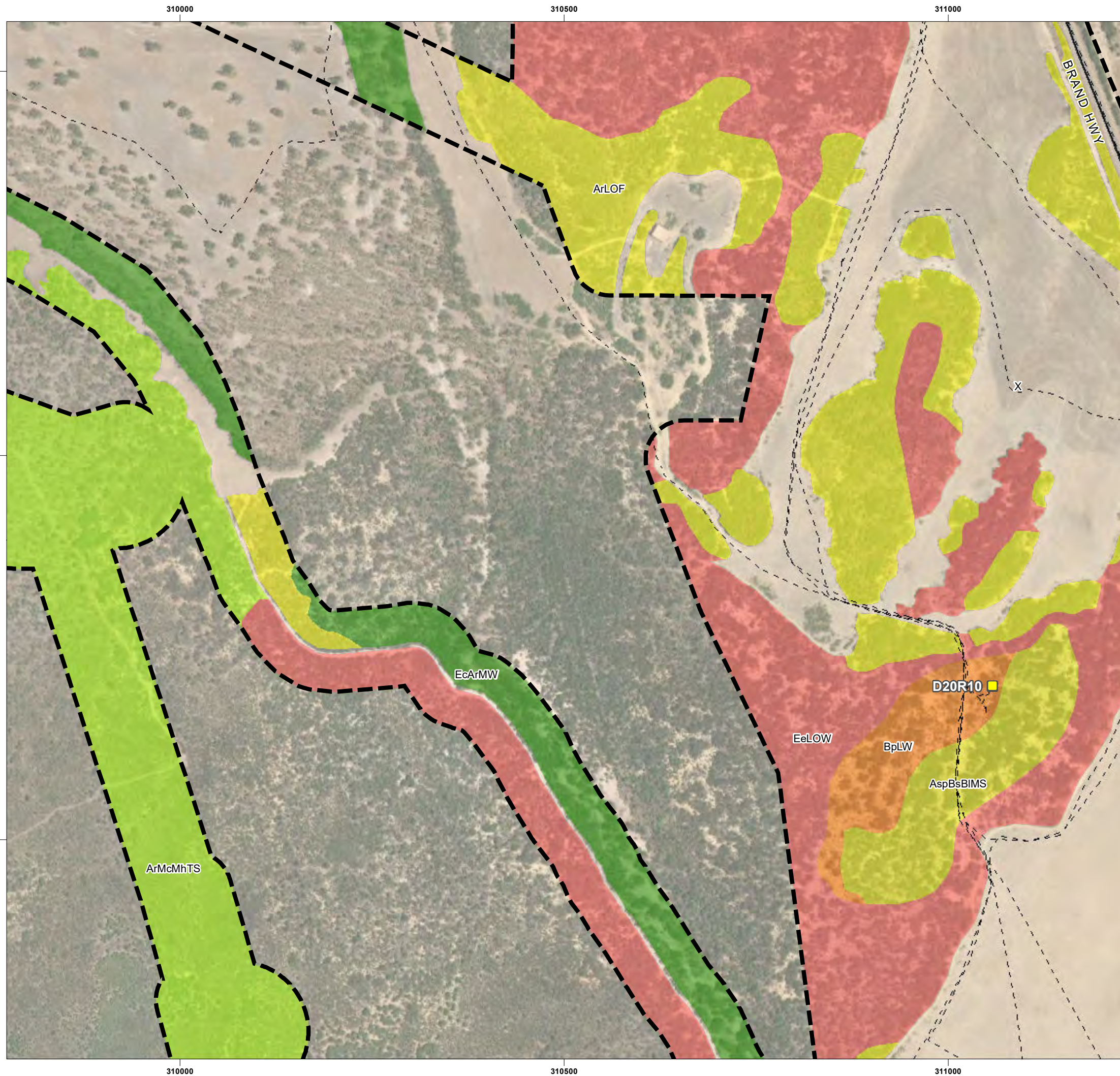
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	06/04/2023

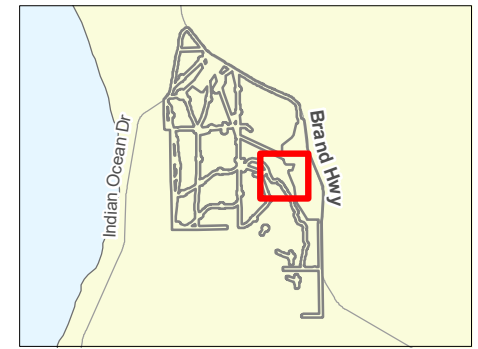
MAP
1-9



LEGEND

- Survey Area
 - Relevé (2020)
 - Survey Track (2020)
 - Road
- Vegetation Survey Area**
- ArLOF: *Acacia rostellifera* low open forest
 - ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
 - AspBsBIMS: *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland
 - BpLW: *Banksia prionotes* low woodland
 - EcArMW: *Eucalyptus camaldulensis* subsp. *obtusata* and *Acacia rostellifera* mid woodland
 - EeLOW: *Eucalyptus erythrocorys* low open woodland
 - X: Not native/cleared

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
 SOURCE DATA: QUADRATS AND CONSERVATION LISTED FLORA (ECOSCAPE 2020 AND 2022) AND VEGETATION DATA (ECOSCAPE 2022)
 AERIAL: ESRI BASEMAP (2021)
 BASEMAP: GEOSCIENCE AUSTRALIA
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

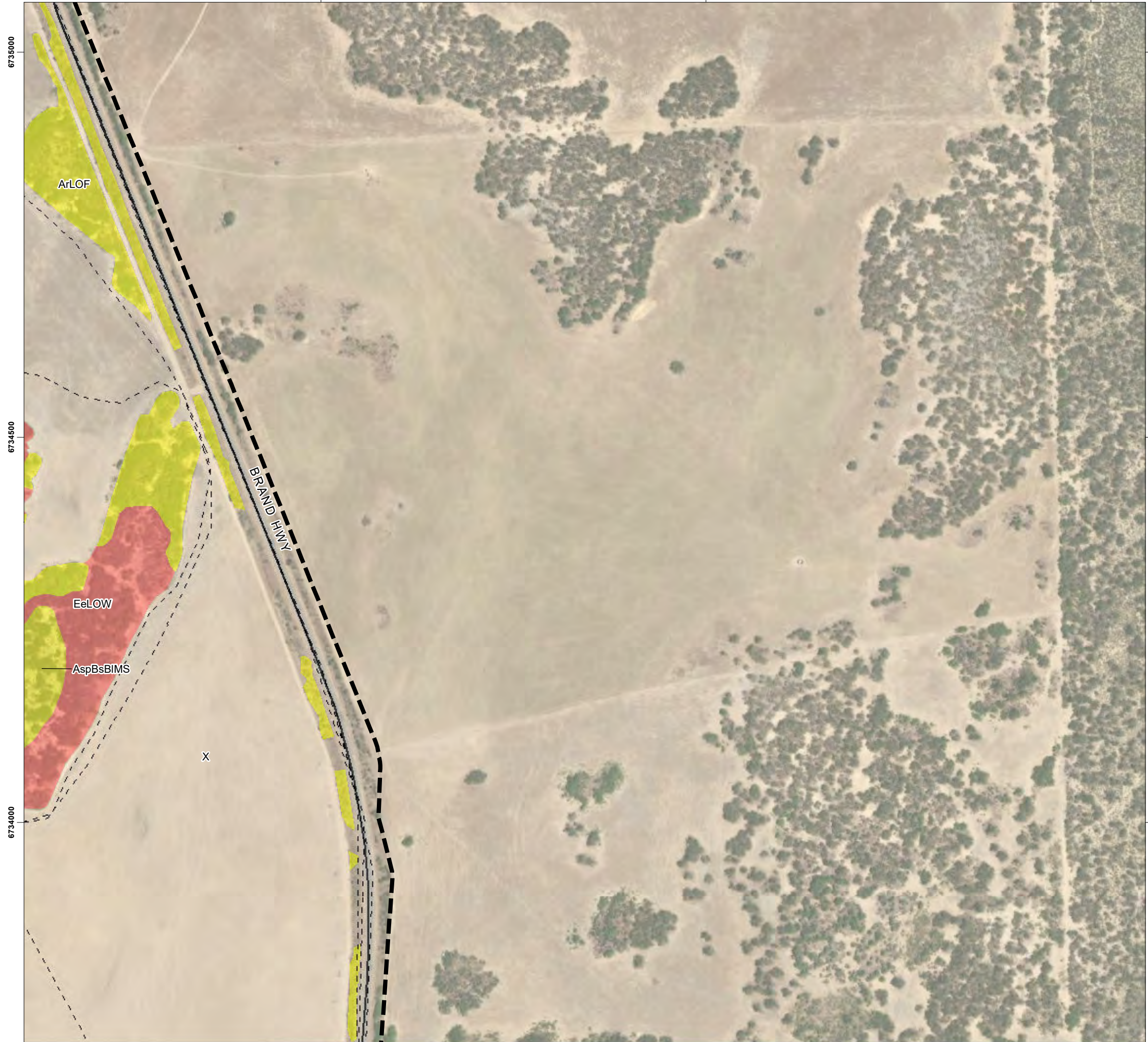


PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	06/04/2023

MAP
1-10

311500 312000 312500



6735000

6734500








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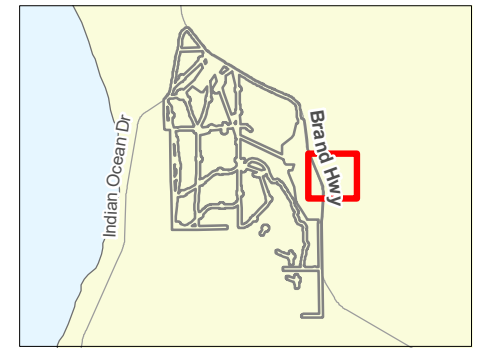
6734500

6734000

LEGEND

-  Survey Area
-  Survey Track (2020)
-  Road
- Vegetation Survey Area**
-  ArLOF: *Acacia rostellifera* low open forest
-  AspBsBIMS: *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland
-  EeLOW: *Eucalyptus erythrocorys* low open woodland
-  X: Not native/cleared

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
 SOURCE DATA: QUADRATS AND CONSERVATION LISTED FLORA (ECOSCAPE 2020 AND 2022) AND VEGETATION DATA (ECOSCAPE 2022)
 AERIAL: ESRI BASEMAP (2021)
 BASEMAP: GEOSCIENCE AUSTRALIA
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

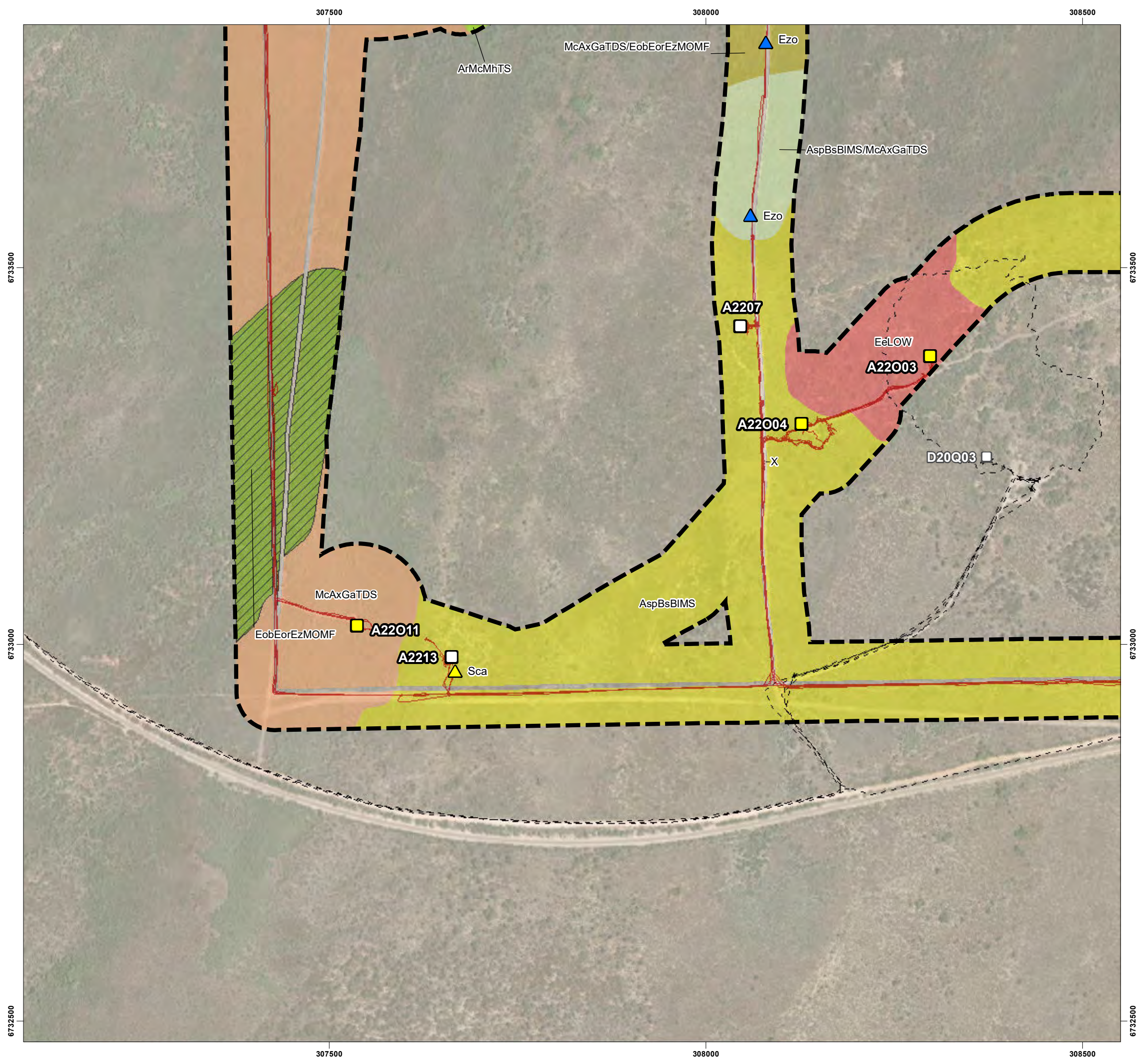


PROJECT NO: 4755-22

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MAP
1-11

311500 312000 312500



LEGEND

- Survey Area
- Quadrat
- Relevé
- Quadrat (2020)
- Survey Track
- Survey Track (2020)

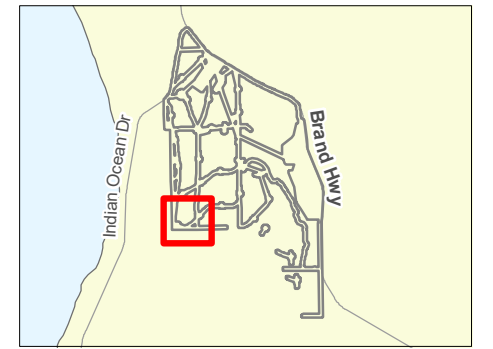
Conservation-listed Flora

- Priority 2
- Priority 4

Vegetation Survey Area

- ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- AspBsBIMS: *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland
- AspBsBIMS/McAxGaTDS: *A. spathulifolia*, *B. sessilis* and *B. leptophylla* mid shrubland / *M. cardiophylla*, *A. xanthina* and *G. argyrophylla* tall dense shrubland
- EeLOW: *Eucalyptus erythrocorys* low open woodland
- EobEorEzMOMF: *Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland
- McAxGaTDS: *Melaleuca cardiophylla*, *Acacia xanthina* and *Grevillea argyrophylla* tall dense shrubland
- McAxGaTDS/EobEorEzMOMF: *M. cardiophylla*, *A. xanthina* and *G. argyrophylla* tall dense shrubland / *E. obtusiflora*, *E. oraria* and *E. zopherophloia* mid open mallee forest/mallee shrubland
- X: Not native/cleared
- Coastal sands dominated by *Acacia rostellifera*, *Eucalyptus oraria* and *Eucalyptus obtusiflora* (Geraldton area) PEC

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



ecoscape

VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
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 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



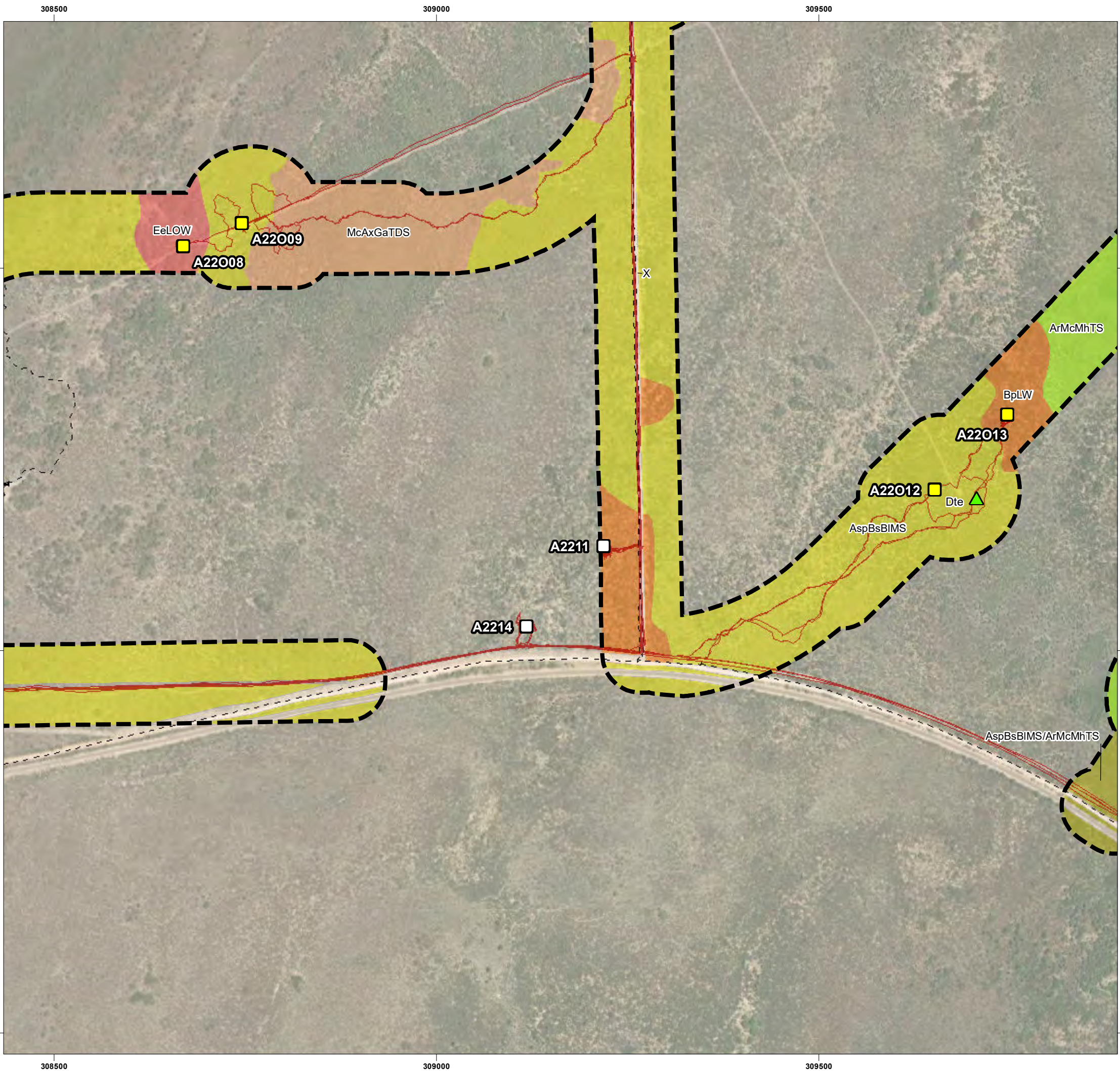
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4755-22

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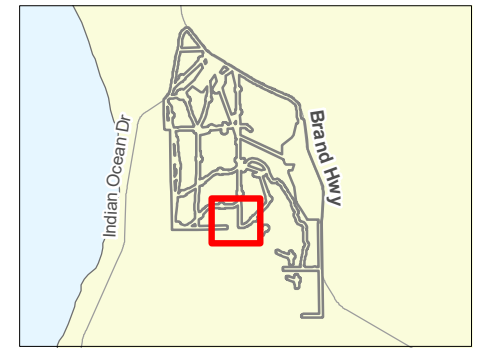
MAP
1-12



LEGEND

- Survey Area
- Quadrat
- Relevé
- Survey Track
- Survey Track (2020)
- Conservation-listed Flora**
- Priority 3
- Vegetation Survey Area**
- ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- AspBsBIMS: *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland
- BpLW: *Banksia prionotes* low woodland
- EeLOW: *Eucalyptus erythrocorys* low open woodland
- McAxGaTDS: *Melaleuca cardiophylla*, *Acacia xanthina* and *Grevillea argyrophylla* tall dense shrubland
- X: Not native/cleared

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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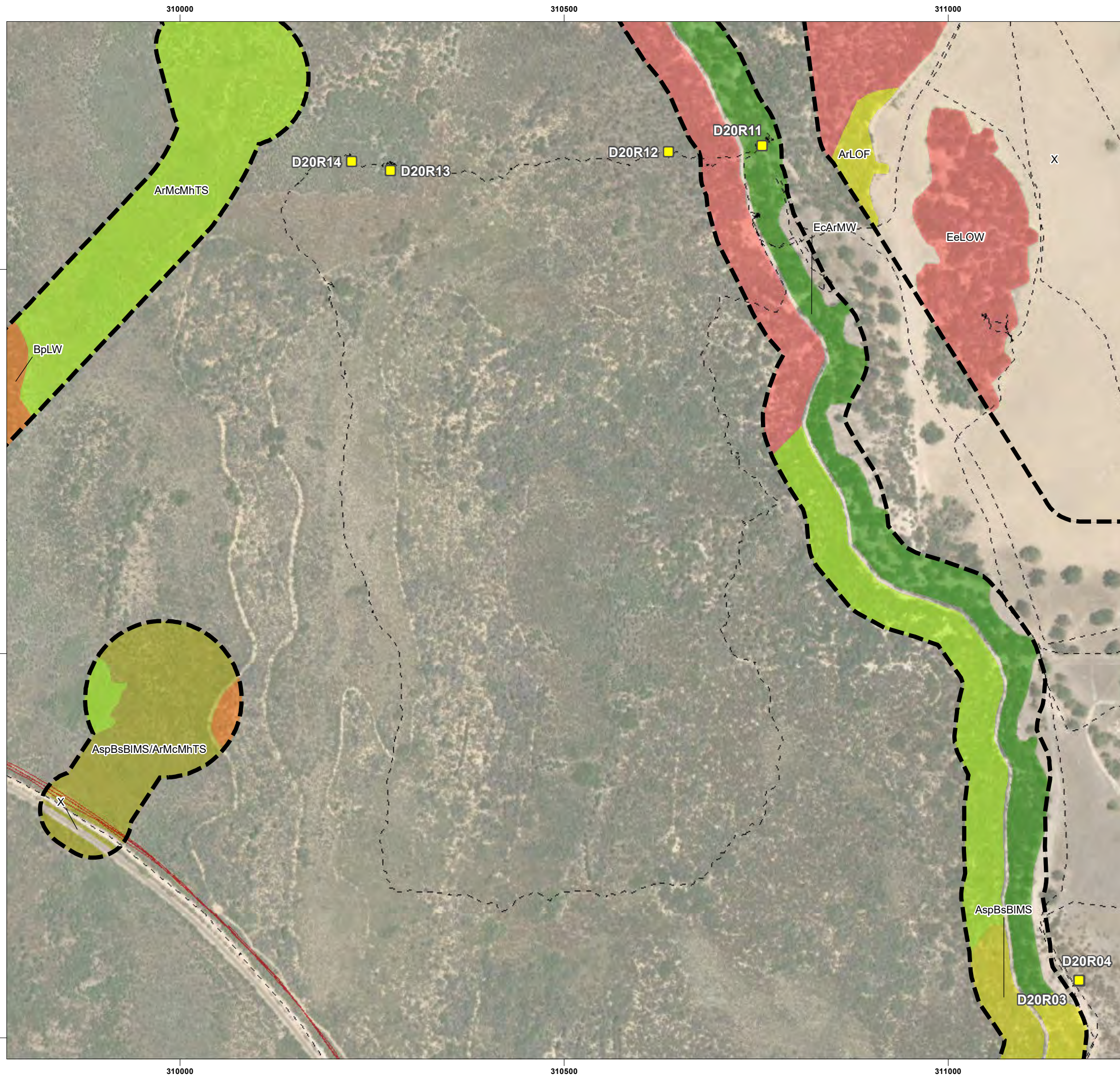


COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



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MAP
1-13



LEGEND

- Survey Area
- Relevé (2020)
- Survey Track
- Survey Track (2020)
- Vegetation Survey Area**
- ArLOF: *Acacia rostellifera* low open forest
- ArMcMhTS: *Acacia rostellifera*, *Melaleuca cardiophylla* and *Melaleuca huegelii* subsp. *huegelii* tall shrubland
- AspBsBIMS: *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland
- AspBsBIMS/ArMcMhTS: *A. spathulifolia*, *B. sessilis* and *B. leptophylla* mid shrubland / *A. rostellifera*, *M. cardiophylla* and *M. huegelii* tall shrubland
- BpLW: *Banksia prionotes* low woodland
- EcArMW: *Eucalyptus camaldulensis* subsp. *obtusa* and *Acacia rostellifera* mid woodland
- EeLOW: *Eucalyptus erythrocorys* low open woodland
- X: Not native/cleared

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



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VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS
ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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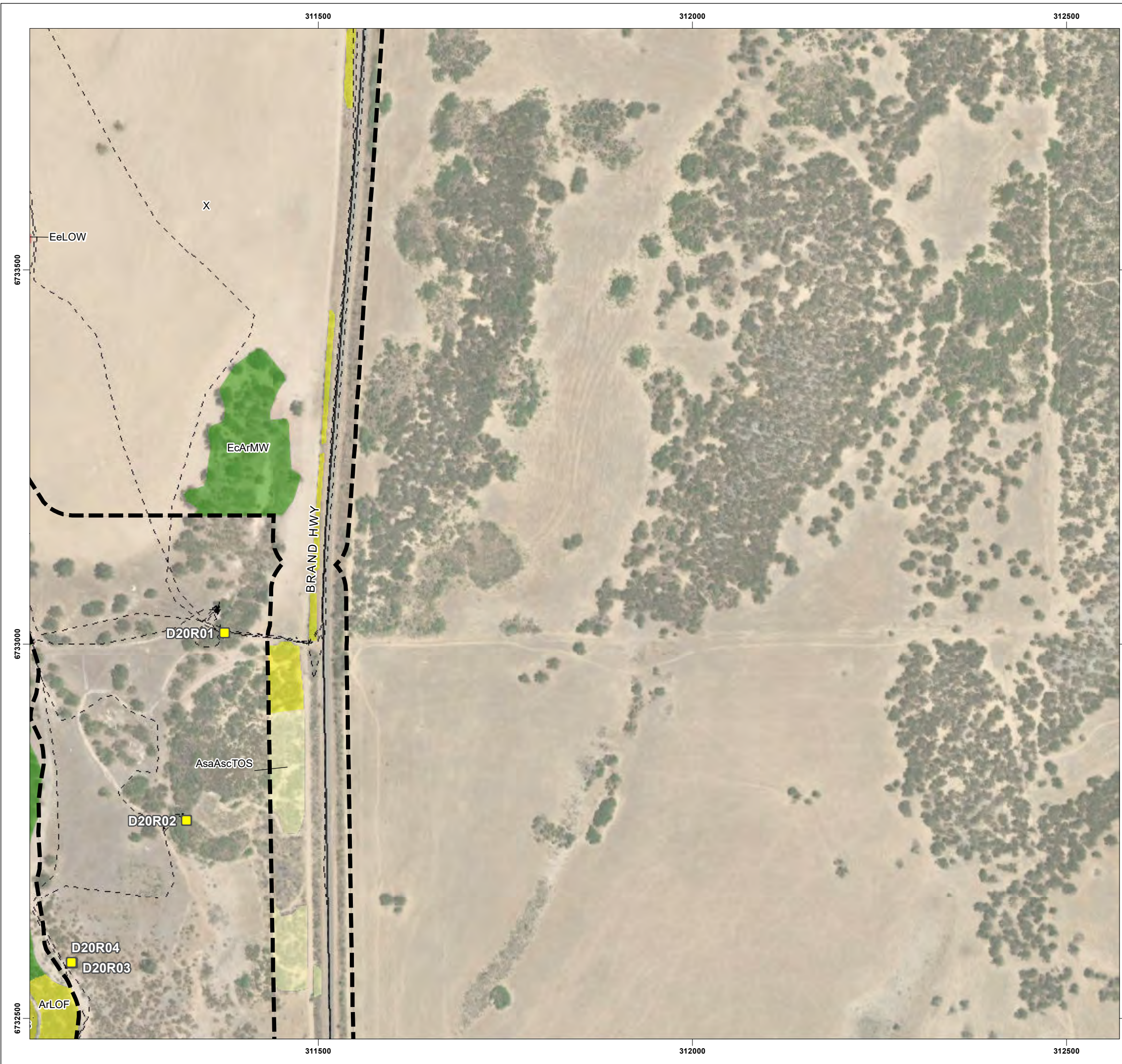
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
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PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
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MAP
1-14



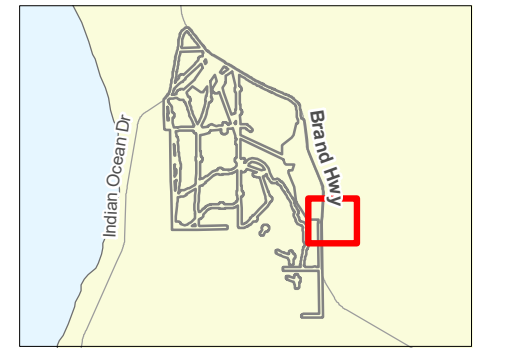
LEGEND

- Survey Area
- Relevé (2020)
- Survey Track (2020)
- Road

Vegetation Survey Area

- ArLOF: *Acacia rostellifera* low open forest
- AsaAscTOS: *Acacia saligna* and *Acacia scirpifolia* tall open shrubland
- AspBsBIMS: *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland
- EcArMW: *Eucalyptus camaldulensis* subsp. *obtusata* and *Acacia rostellifera* mid woodland
- EeLOW: *Eucalyptus erythrocorys* low open woodland
- X: Not native/cleared

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	06/04/2023

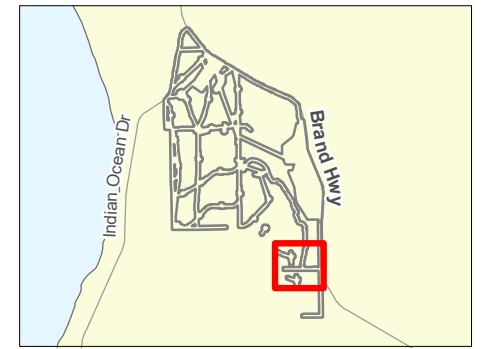
MAP
1-15



LEGEND

- Survey
 - Quadrat (2020)
 - Relevé (2020)
 - Survey Track
 - Survey Track (2020)
 - Road
- Vegetation Survey Area**
- ArLOF: *Acacia rostellifera* low open forest
 - AsaAscTOS: *Acacia saligna* and *Acacia scirpifolia* tall open shrubland
 - AspBsBIMS: *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland
 - EcArMW: *Eucalyptus camaldulensis* subsp. *obtusata* and *Acacia rostellifera* mid woodland
 - EeLOW: *Eucalyptus erythrocorys* low open woodland
 - X: Not native/cleared

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
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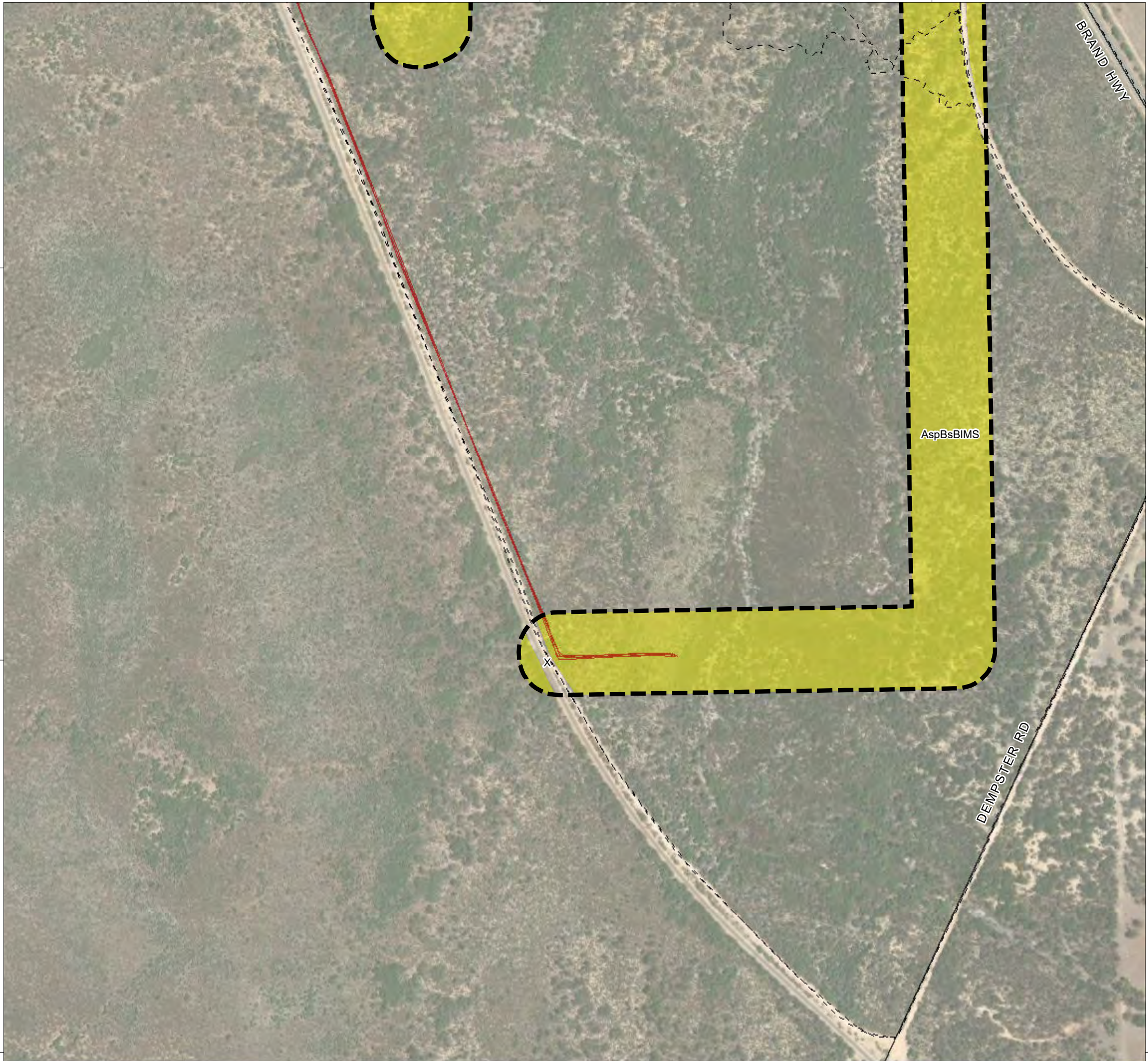


COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
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MAP
1-16



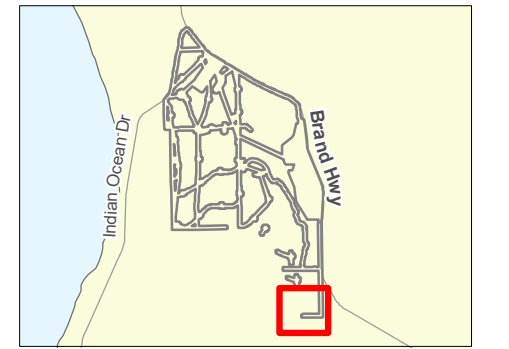
LEGEND

- Survey Area
- Survey Track
- Survey Track (2020)
- Road

Vegetation Survey Area

- AspBsBIMS: *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland
- X: Not native/cleared

Code	Taxon	Cons. Code
Efa	<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P2
Sca	<i>Scholtzia calcicola</i>	P2
Bcc	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3
Dte	<i>Dampiera tephrea</i>	P3
Ezo	<i>Eucalyptus zopherophloia</i>	P4



VEGETATION TYPES, QUADRATS AND CONSERVATION FLORA LOCATIONS

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

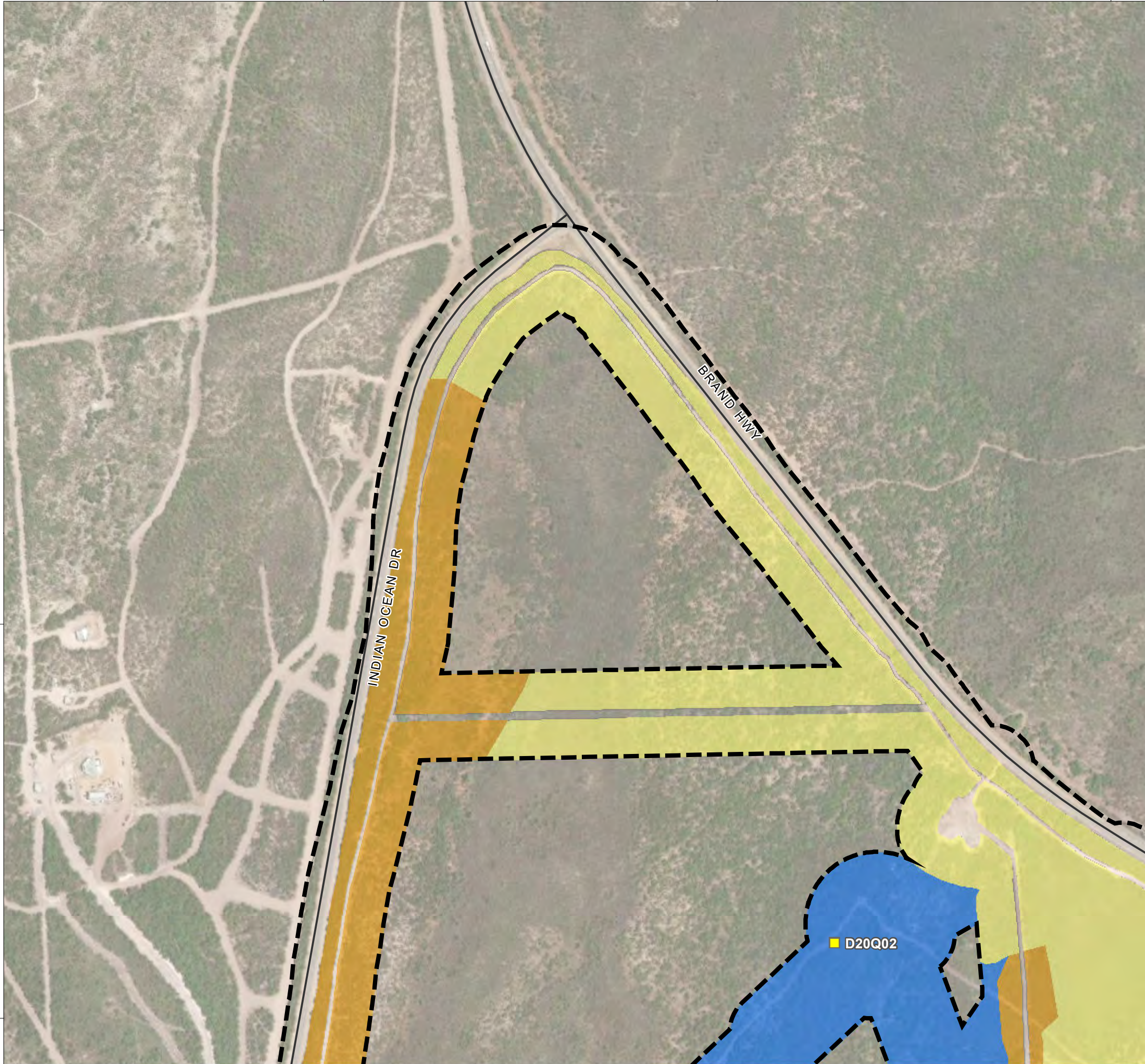


PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	06/04/2023

MAP
1-17

307500 308000 308500



6738500

6738500

6738000

6738000

6737500

6737500

307500 308000 308500

LEGEND

Survey Area

Road

Quadrat Condition (2020)

Good

Vegetation Condition

Very Good

Good

Degraded

N/A



VEGETATION CONDITION

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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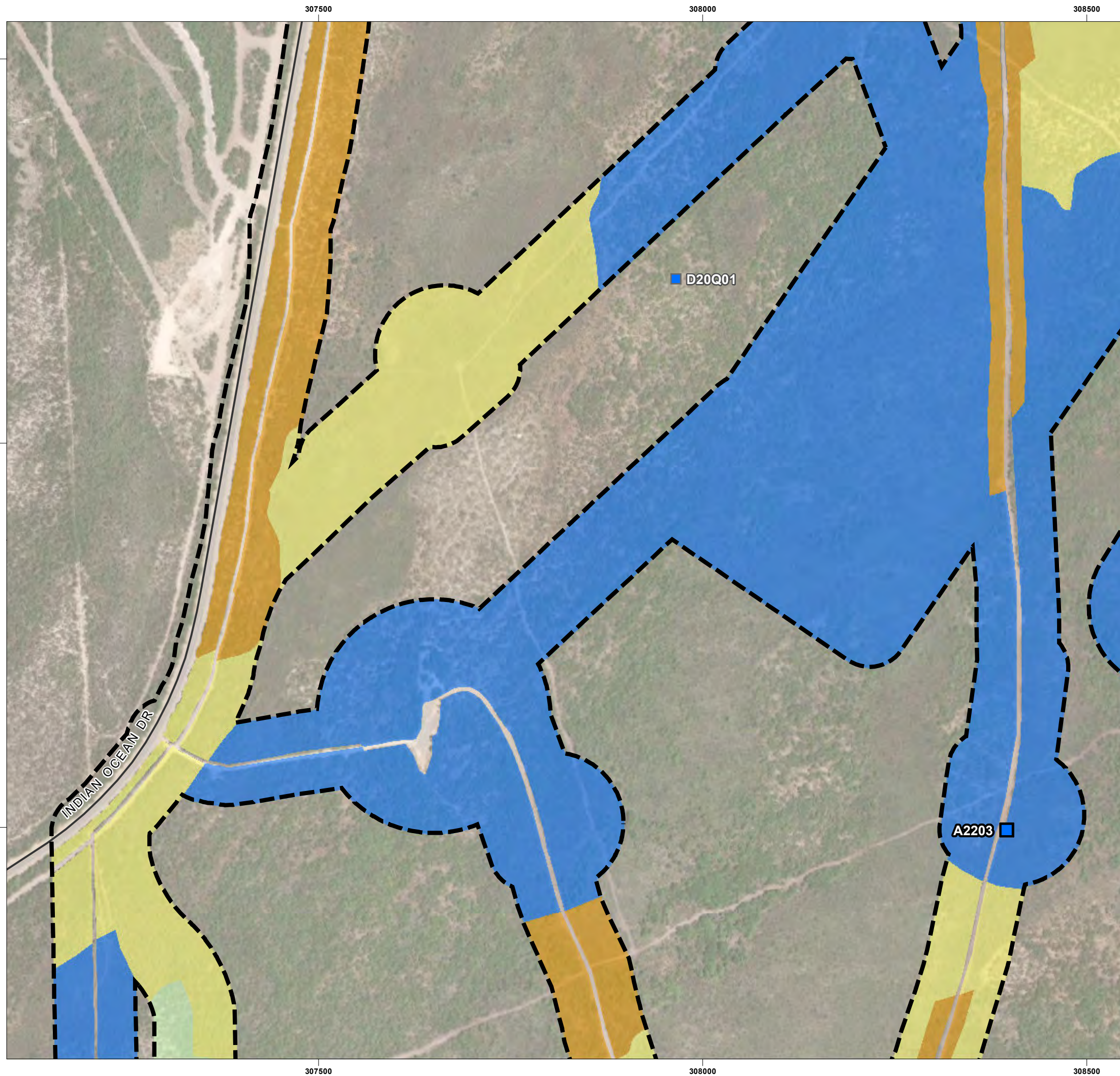


COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
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 DATUM: GDA 1994
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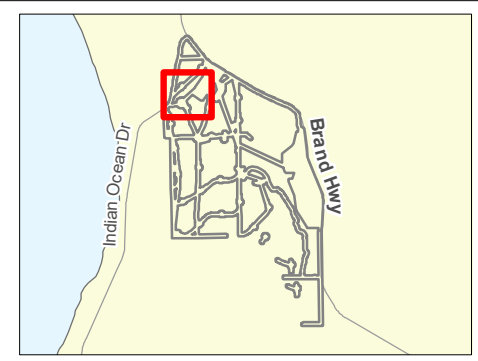
REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP 2-1



LEGEND

- Survey Area
- Road
- Quadrat Condition**
- Very Good
- Quadrat Condition (2020)**
- Very Good
- Vegetation Condition**
- Excellent
- Very Good
- Good
- Degraded
- N/A



VEGETATION CONDITION
ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
 SOURCE DATA: QUADRATS (ECOSCAPE 2020 AND 2022) AND VEGETATION DATA (ECOSCAPE 2022)
 AERIAL: ESRI BASEMAP (2021)
 BASEMAP: GEOSCIENCE AUSTRALIA
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

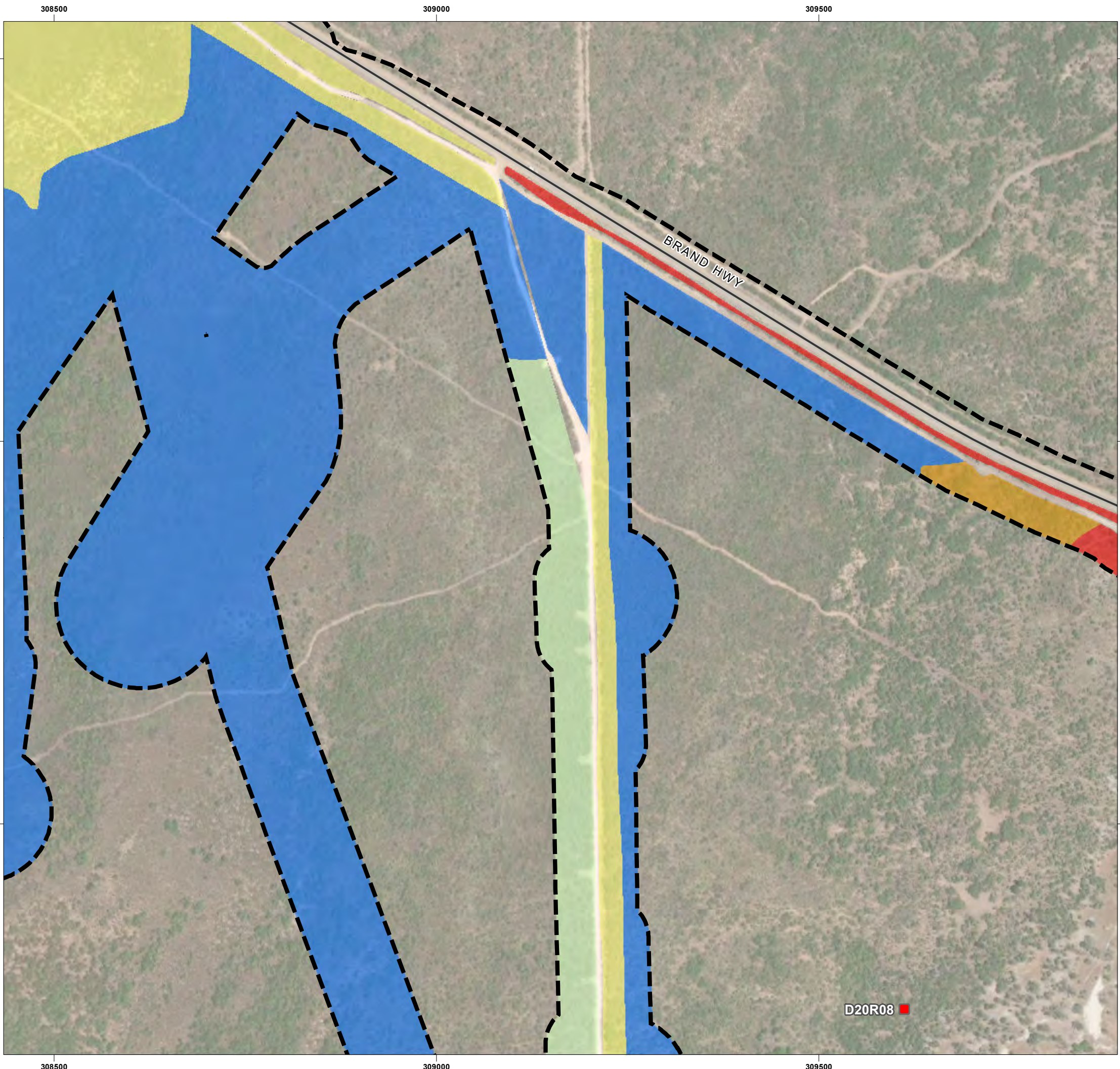


COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
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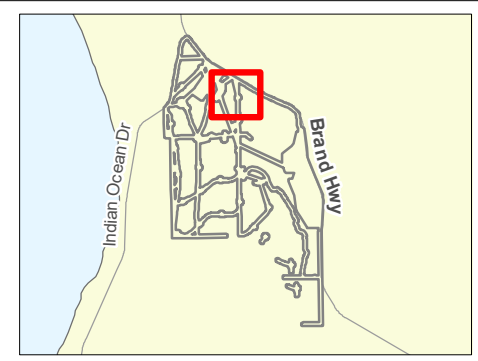


REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP
2-2



- LEGEND**
- Survey Area
 - Road
 - Quadrat Condition (2020)**
 - Completely Degraded
 - Vegetation Condition**
 - Excellent
 - Very Good
 - Good
 - Degraded
 - Completely Degraded
 - N/A



VEGETATION CONDITION
ARROWSMITH HYDROGEN DETAILED
FLORA AND VEGETATION SURVEY

DATA SOURCES:
 SOURCE DATA: QUADRATS (ECOSCAPE 2020 AND 2022)
 AND VEGETATION DATA (ECOSCAPE 2022)
 AERIAL: ESRI BASEMAP (2021)
 BASEMAP: GEOSCIENCE AUSTRALIA
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR
 GEOGRAPHICS, AND THE GIS USER COMMUNITY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

D20R08

MAP
2-3

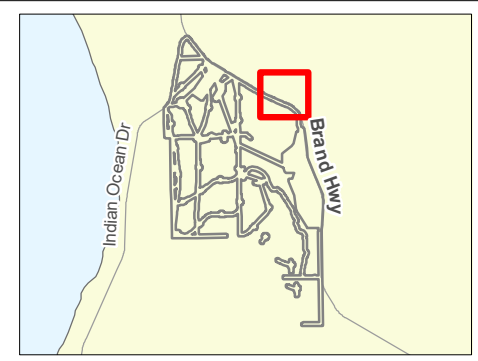


LEGEND

- Survey Area
- Road

Vegetation Condition

- Degraded
- Completely Degraded
- N/A



VEGETATION CONDITION
ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
 SOURCE DATA: QUADRATS (ECOSCAPE 2020 AND 2022) AND VEGETATION DATA (ECOSCAPE 2022)
 AERIAL: ESRI BASEMAP (2021)
 BASEMAP: GEOSCIENCE AUSTRALIA
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



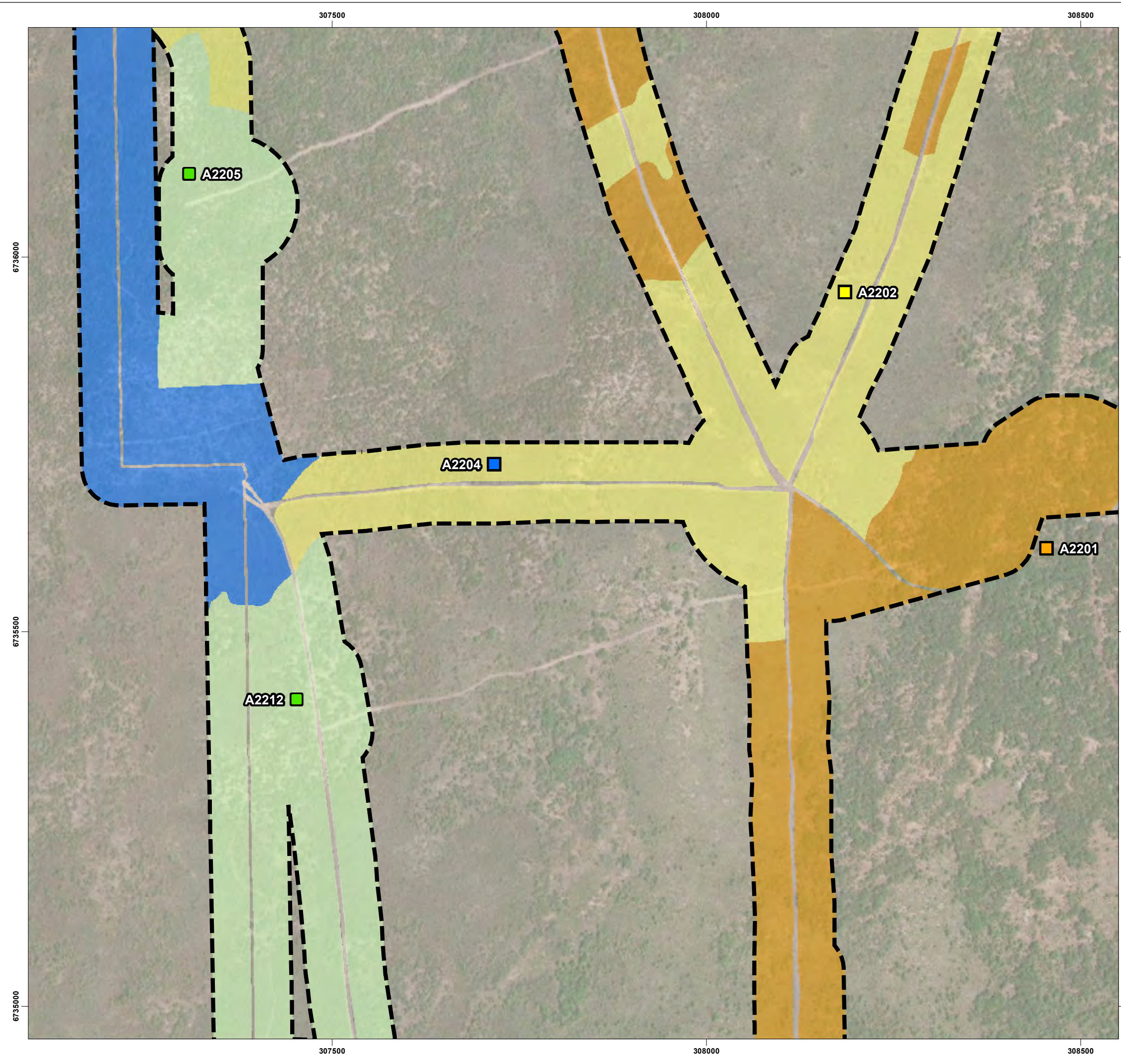
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP
2-4



LEGEND

Survey

Quadrat Condition

- Excellent
- Very Good
- Good
- Degraded

Vegetation Condition

- Excellent
- Very Good
- Good
- Degraded
- N/A



ecoscape

VEGETATION CONDITION

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
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 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

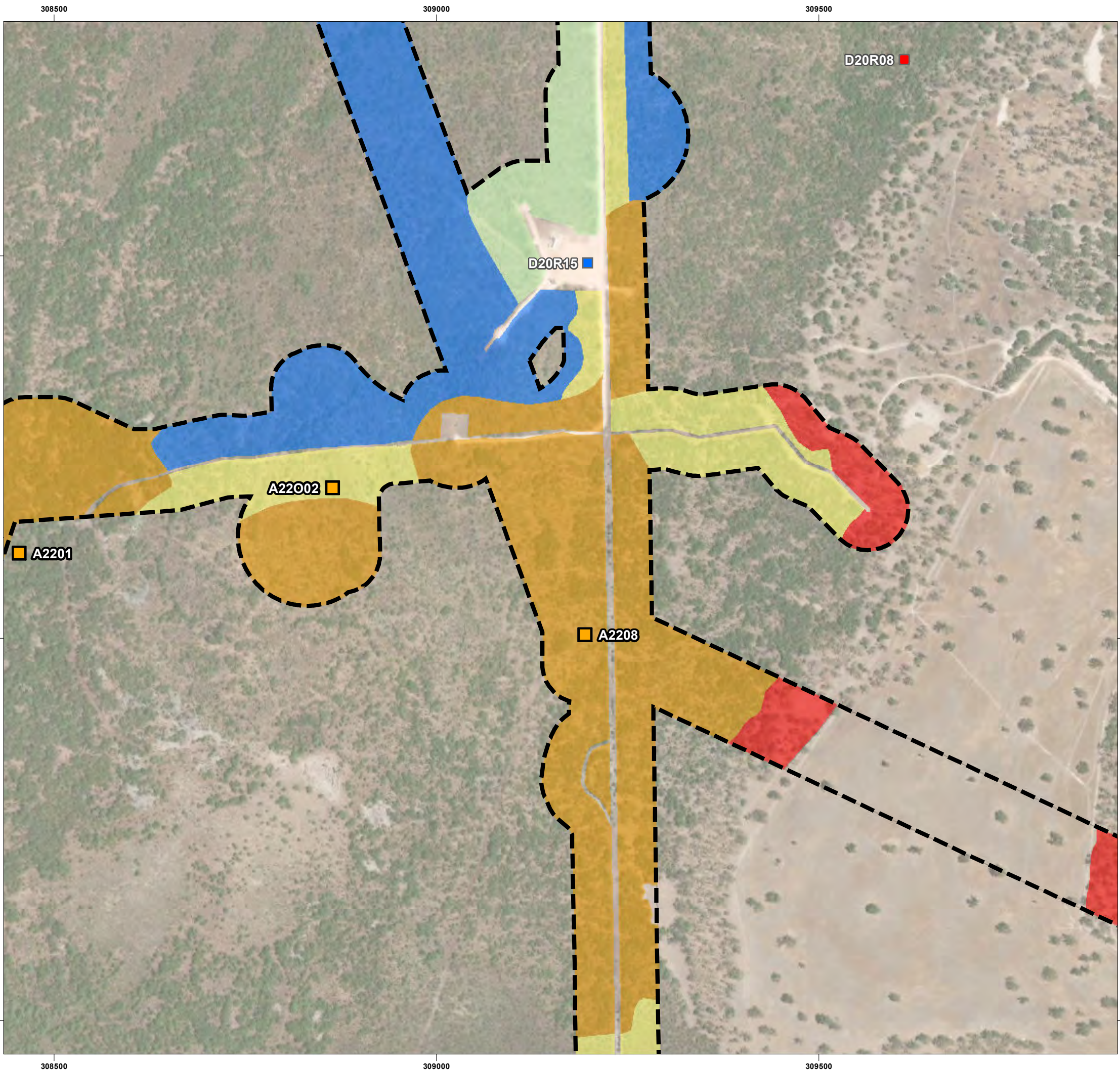


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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



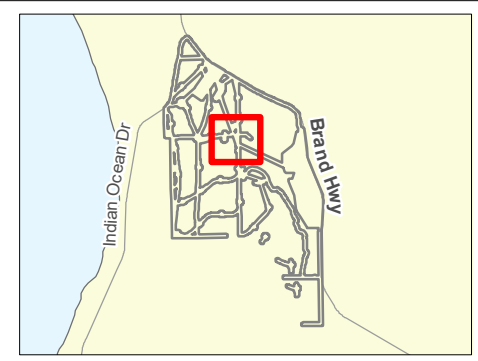
REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP
2-5



LEGEND

- Survey Area
- Quadrat Condition**
- Degraded
- Quadrat Condition (2020)**
- Very Good
- Completely Degraded
- Vegetation Condition**
- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- N/A




VEGETATION CONDITION
ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
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COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

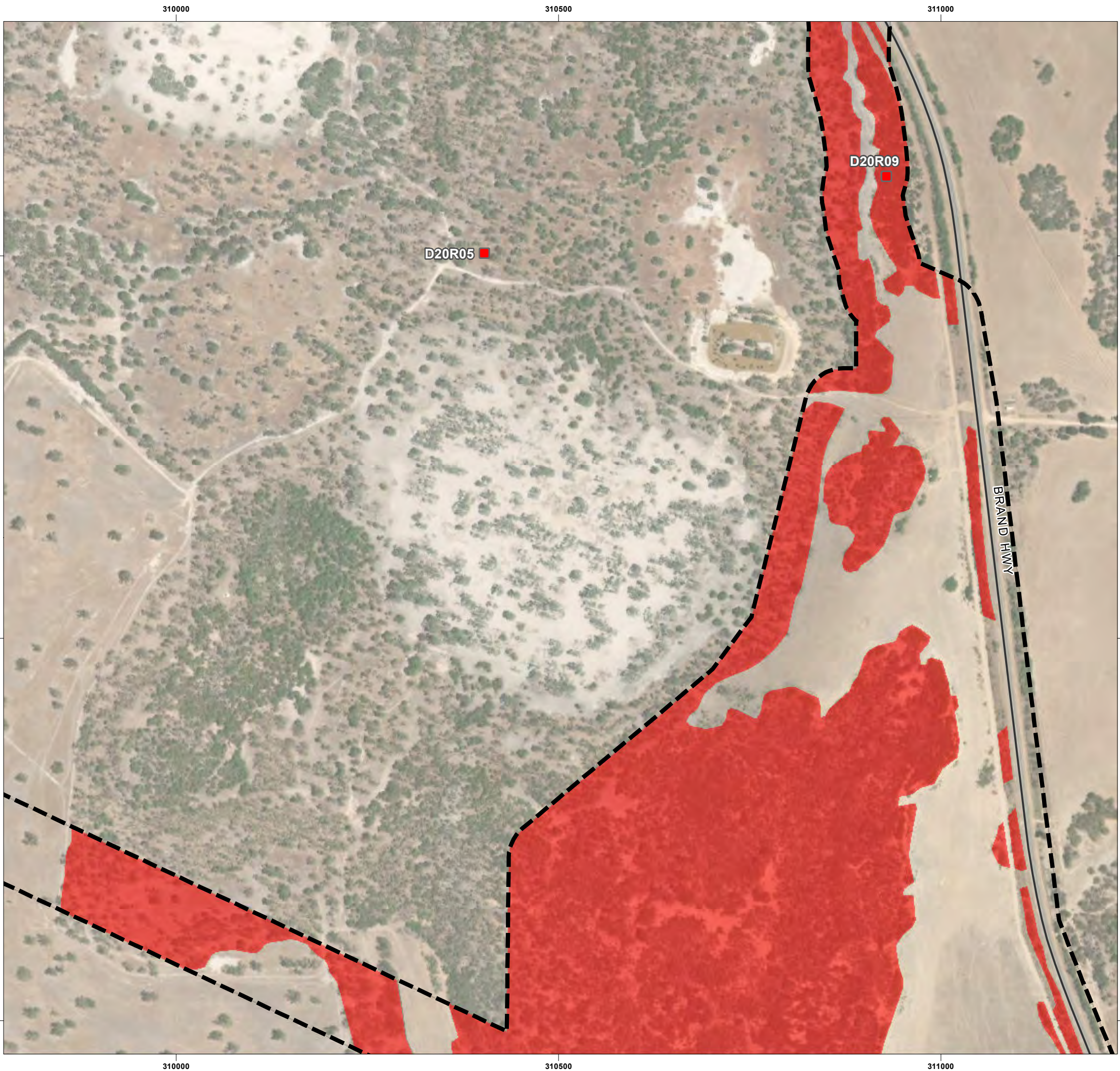
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PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP 2-6



LEGEND

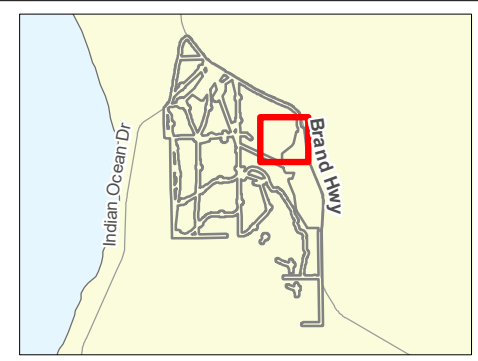
- Survey Area
- Road

Quadrat Condition (2020)

- Completely Degraded

Vegetation Condition

- Completely Degraded
- N/A



VEGETATION CONDITION

**ARROWSMITH HYDROGEN DETAILED
FLORA AND VEGETATION SURVEY**

DATA SOURCES:
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 AERIAL: ESRI BASEMAP (2021)
 BASEMAP: GEOSCIENCE AUSTRALIA
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

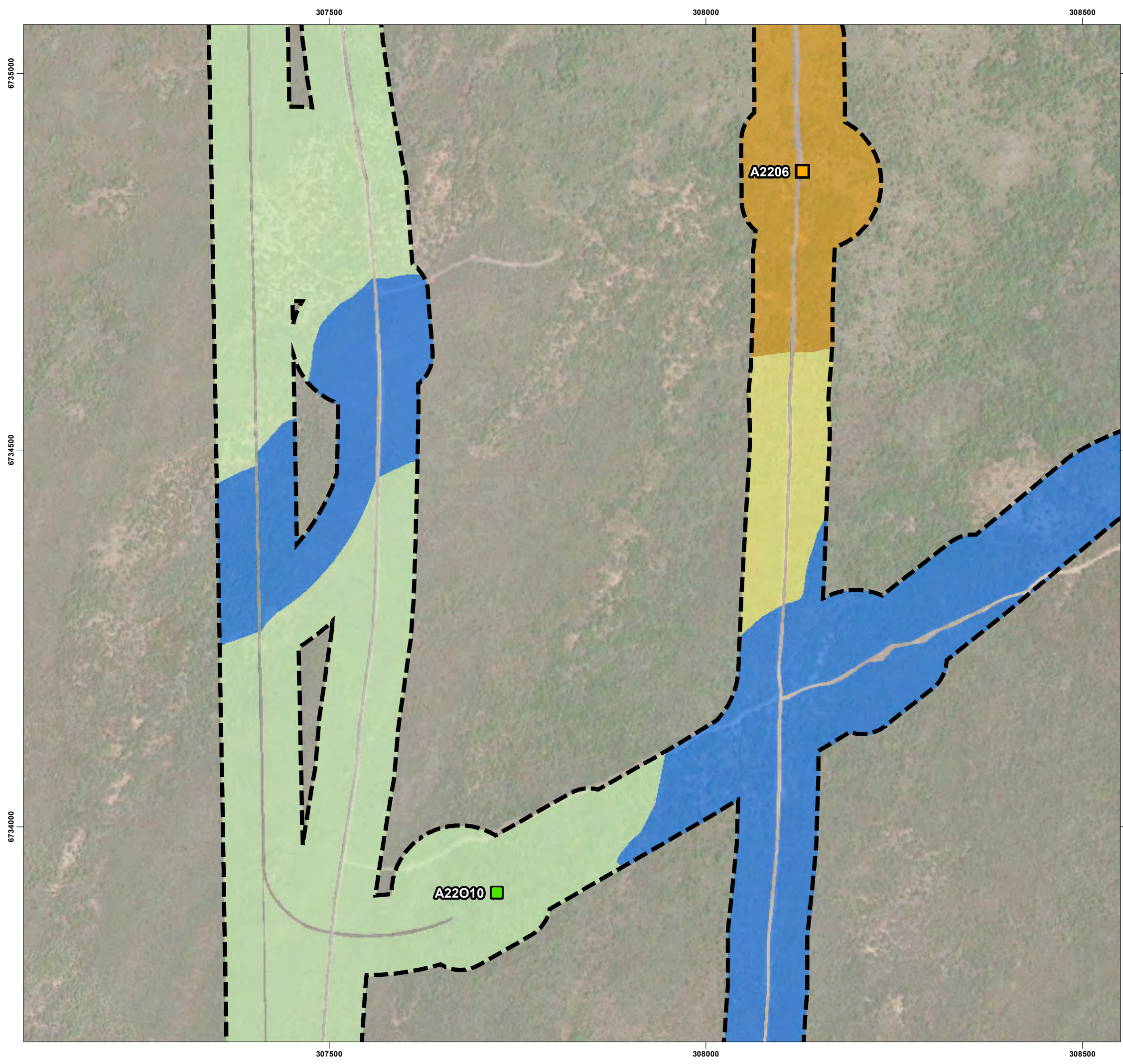


COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



REV	AUTHOR	APPROVED	DATE
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MAP
2-7



LEGEND

Survey Area

Quadrat Condition

- Excellent
- Degraded

Vegetation Condition

- Excellent
- Very Good
- Good
- Degraded
- N/A



VEGETATION CONDITION

**ARROWSMITH HYDROGEN DETAILED
FLORA AND VEGETATION SURVEY**

DATA SOURCES:
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 AND VEGETATION DATA (ECOSCAPE 2022)
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 GEOGRAPHICS, AND THE GIS USER COMMUNITY



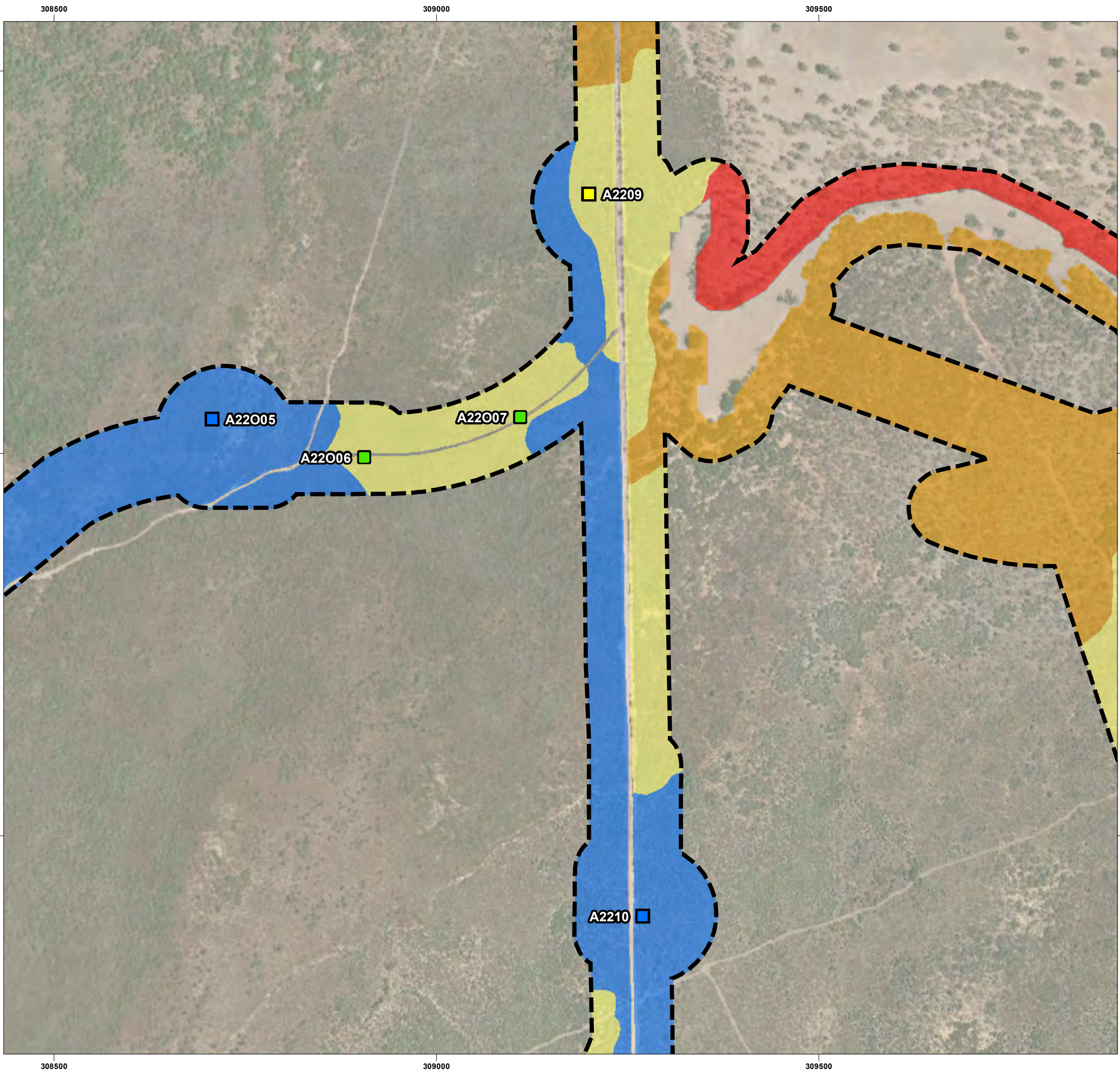
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 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:5,000 @ A3

0 100 200 m

REV	AUTHOR	APPROVED	DATE
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**MAP
2-8**



LEGEND

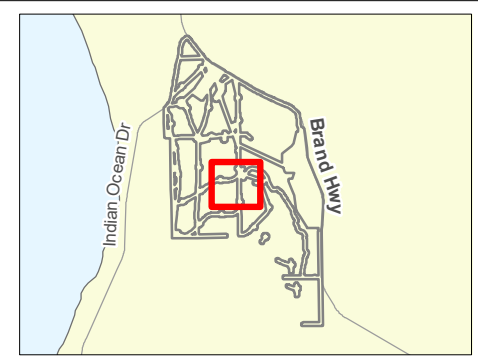
Survey Area

Quadrat Condition

- Excellent
- Very Good
- Good

Vegetation Condition

- Very Good
- Good
- Degraded
- Completely Degraded
- N/A



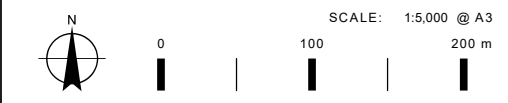
VEGETATION CONDITION

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
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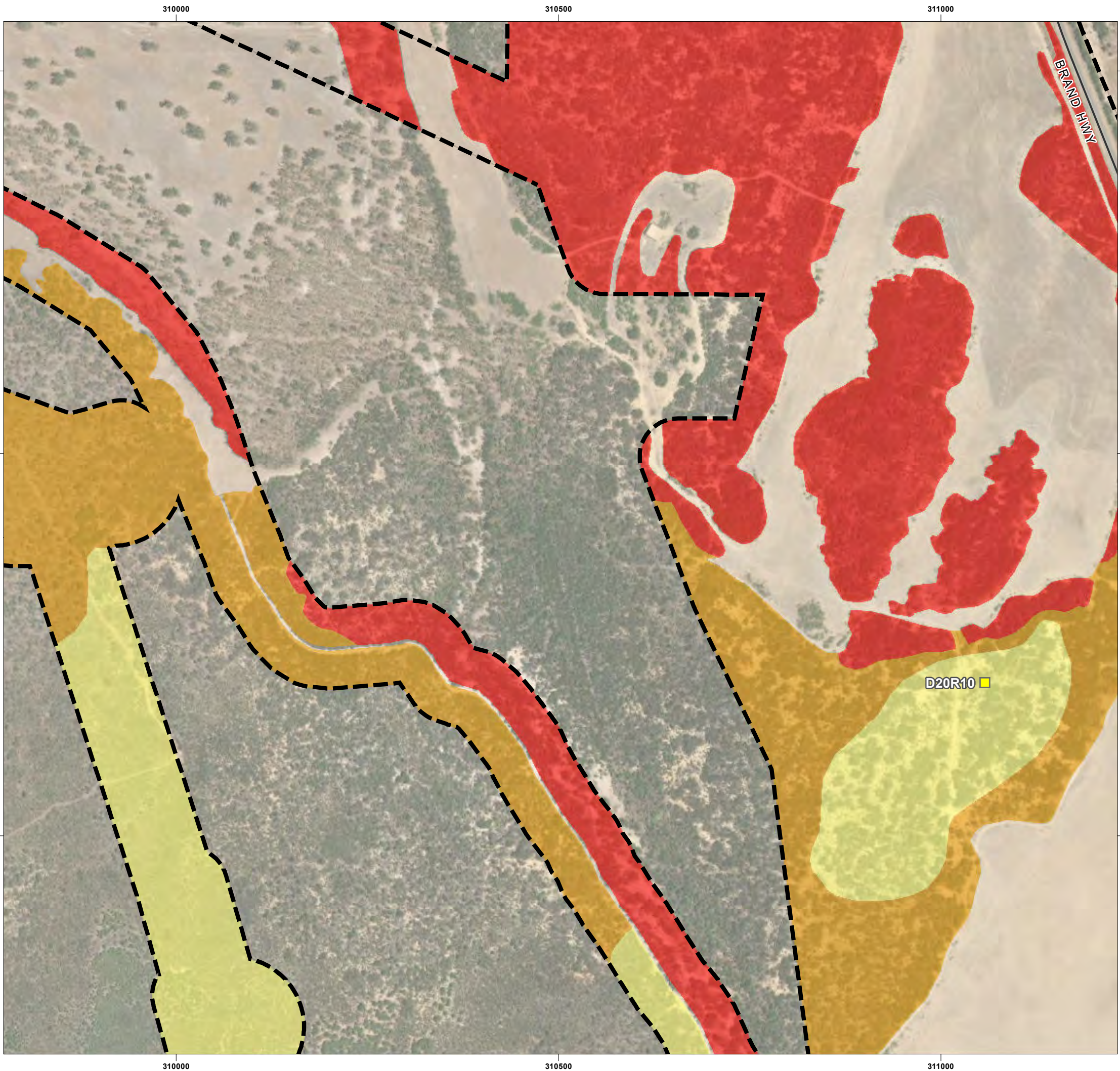


COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP
2-9



LEGEND

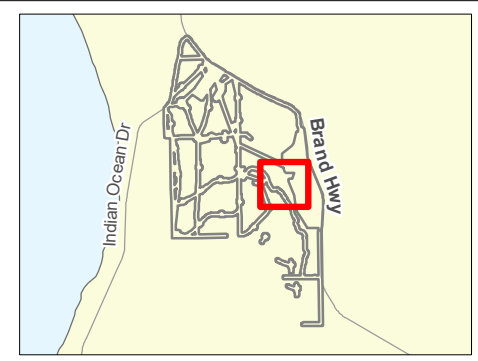
- Survey Area
- Road

Quadrat Condition (2020)

- Good

Vegetation Condition

- Good
- Degraded
- Completely Degraded
- N/A



VEGETATION CONDITION
ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
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COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP
2-10

311500

312000

312500

6735000

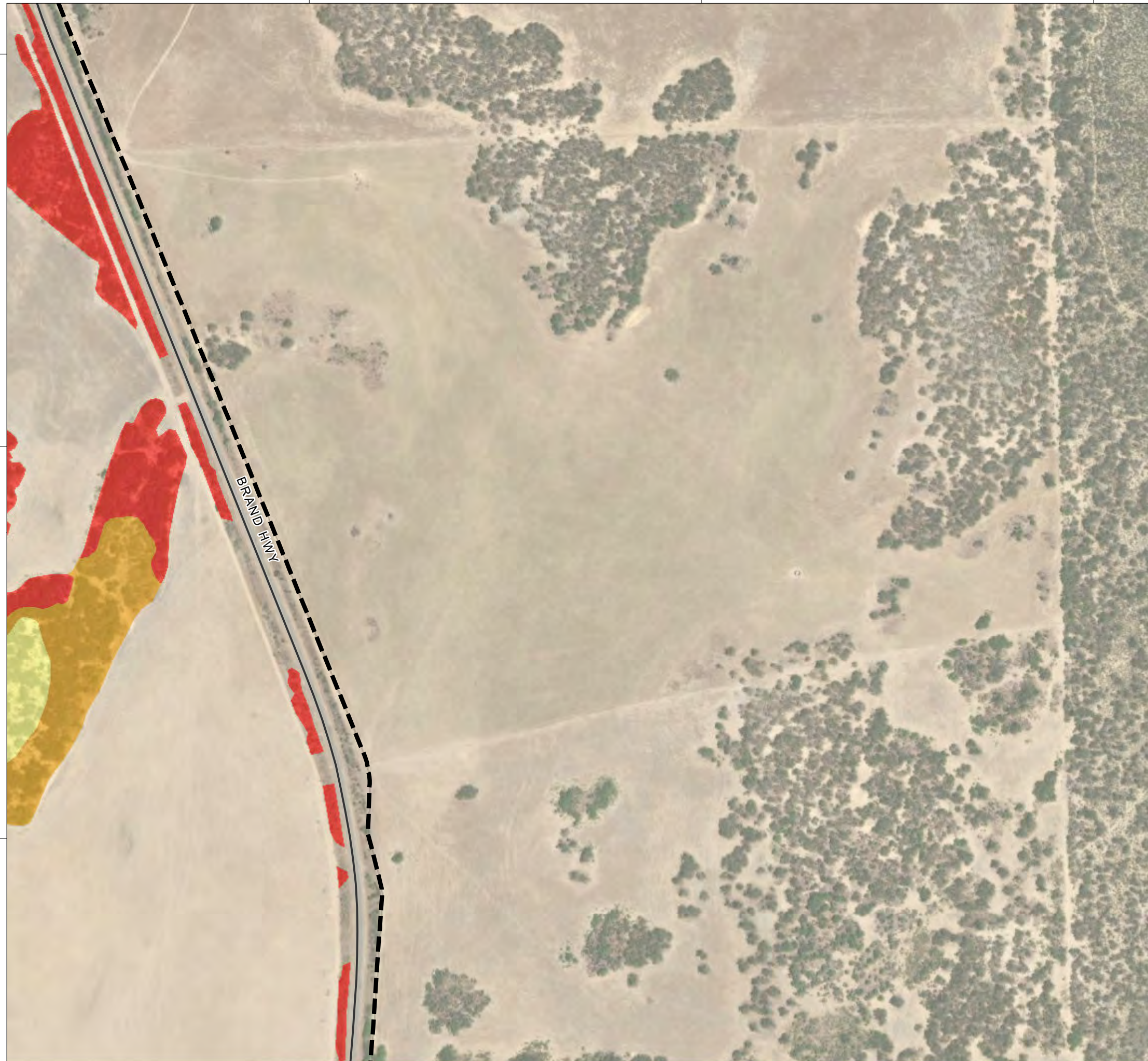
6735000

6734500

6734500

6734000

6734000



LEGEND

Survey Area

Road

Vegetation Condition

Good

Degraded

Completely Degraded

N/A



ecoscape

VEGETATION CONDITION

**ARROWSMITH HYDROGEN DETAILED
FLORA AND VEGETATION SURVEY**

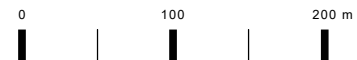
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SOURCE DATA: QUADRATS (ECOSCAPE 2020 AND 2022)
AND VEGETATION DATA (ECOSCAPE 2022)
AERIAL: ESRI BASEMAP (2021)
BASEMAP: GEOSCIENCE AUSTRALIA
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COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



SCALE: 1:5,000 @ A3



PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

**MAP
2-11**

311500

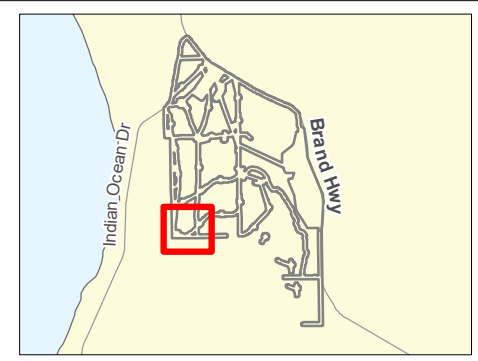
312000

312500



LEGEND

- Survey Area
- Quadrat Condition**
 - Excellent
 - Good
- Quadrat Condition (2020)**
 - Excellent
- Vegetation Condition**
 - Excellent
 - Very Good
 - Good
 - N/A



VEGETATION CONDITION

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
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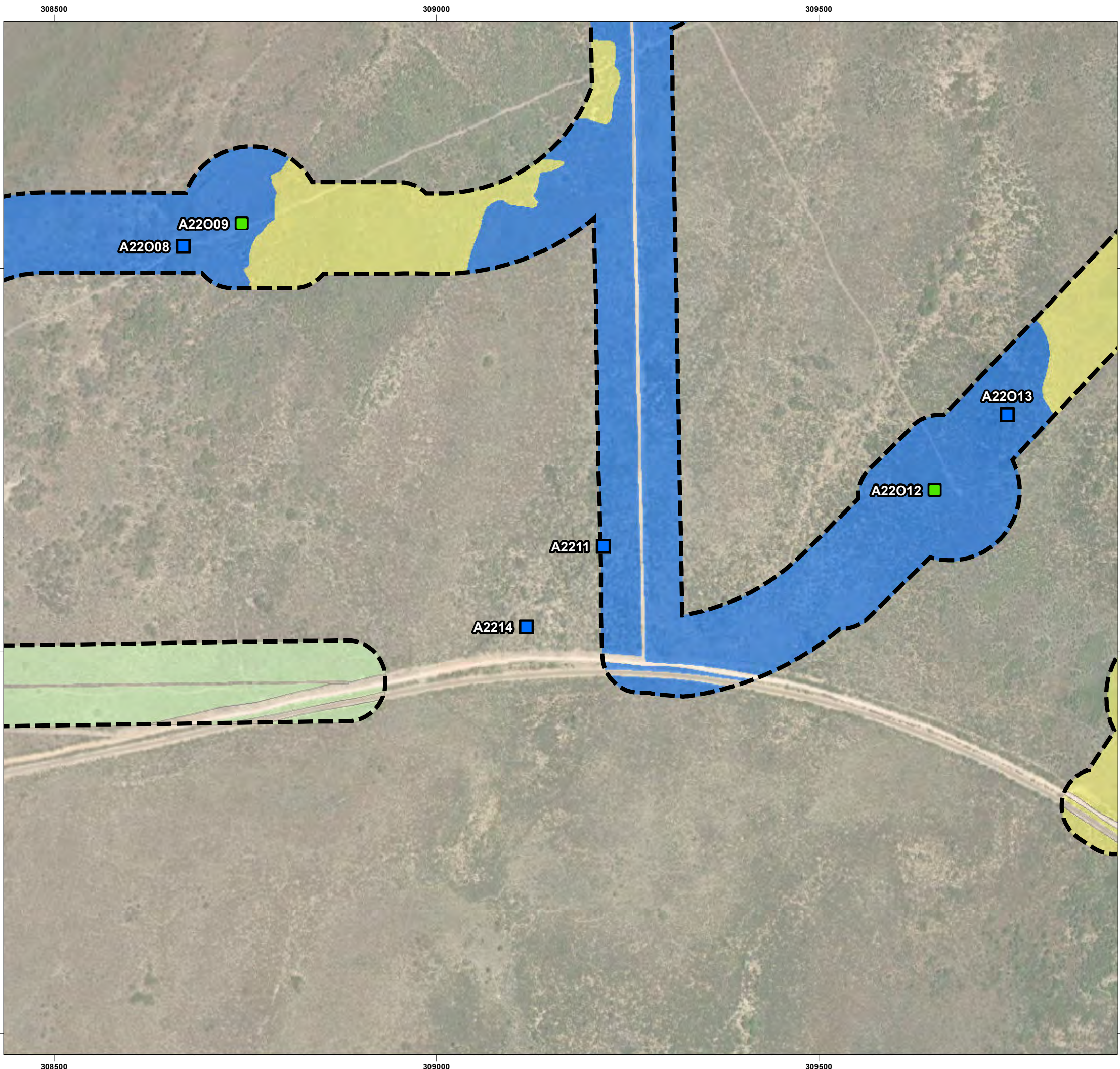
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER



PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP
2-12



LEGEND

Survey Area

Quadrat Condition

Excellent

Very Good

Vegetation Condition

Excellent

Very Good

Good

N/A



ecoscape

VEGETATION CONDITION

ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
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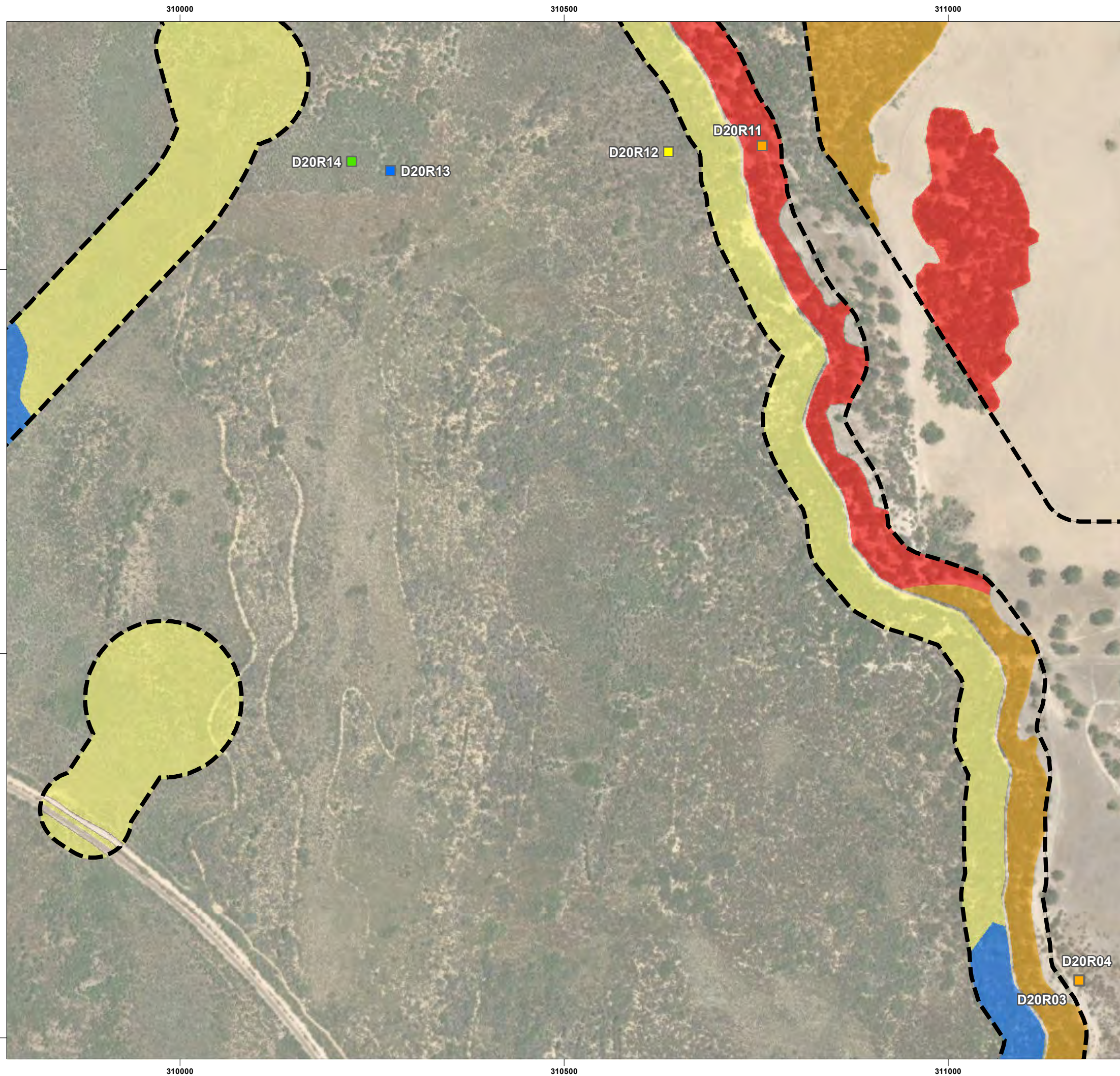
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:5,000 @ A3

PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP 2-13



LEGEND

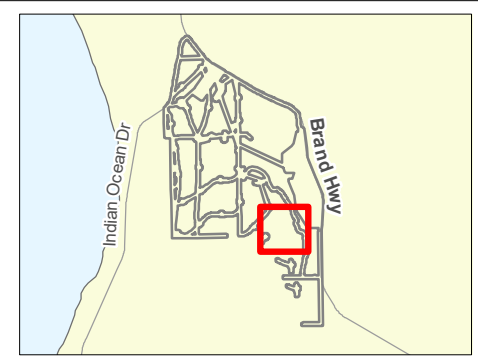
Survey Area

Quadrat Condition (2020)

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded

Vegetation Condition

- Very Good
- Good
- Degraded
- Completely Degraded
- N/A



VEGETATION CONDITION

**ARROWSMITH HYDROGEN DETAILED
FLORA AND VEGETATION SURVEY**

DATA SOURCES:
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COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
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 DATUM: GDA 1994
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REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP
2-14



LEGEND

-  Survey Area
-  Road
- Quadrat Condition (2020)**
-  Degraded
-  Completely Degraded
- Vegetation Condition**
-  Very Good
-  Degraded
-  Completely Degraded
-  N/A



ecoscape

VEGETATION CONDITION
ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

DATA SOURCES:
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 PROJECTION: TRANSVERSE MERCATOR
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 UNITS: METER



PROJECT NO: 4755-22

REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP
2-15



LEGEND

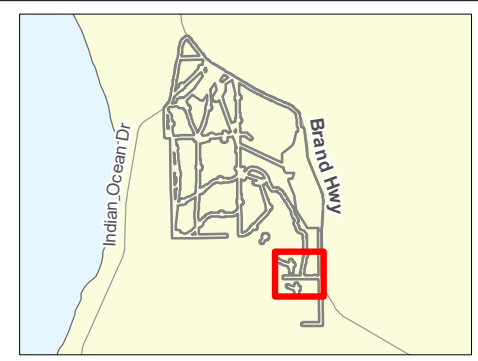
- Survey Area
- Road

Quadrat Condition (2020)

- Very Good
- Good
- Degraded
- Completely Degraded

Vegetation Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- N/A




VEGETATION CONDITION
ARROWSMITH HYDROGEN DETAILED FLORA AND VEGETATION SURVEY

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COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
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REV	AUTHOR	APPROVED	DATE
00	NW	LA	24/03/2023

MAP
2-16

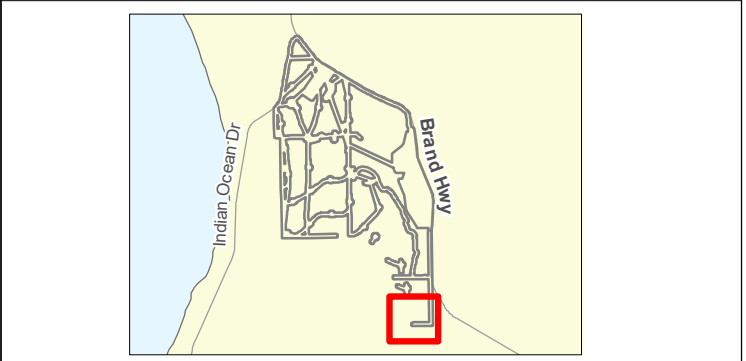


LEGEND

- Survey Area
- Road

Vegetation Condition

- Excellent
- Very Good
- N/A



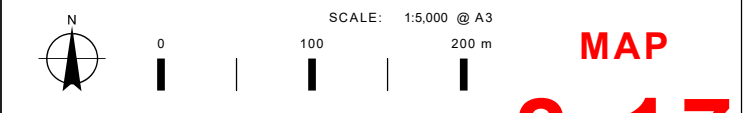
VEGETATION CONDITION

**ARROWSMITH HYDROGEN DETAILED
FLORA AND VEGETATION SURVEY**

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00	NW	LA	24/03/2023

MAP
2-17

APPENDIX ONE

**EPA NOTICE REQUIRING INFORMATION
FOR ASSESSMENT**

Environmental Protection Act 1986

Section 40(2)(a)

NOTICE REQUIRING INFORMATION FOR ASSESSMENT

PERSON TO WHOM THIS NOTICE IS GIVEN

Stephen Gauld, Managing Director
Infinite Green Energy Limited (ACN: 628 842 464)
Level 13, 99 St Georges Terrace
PERTH WA 6000

PROPOSAL TO WHICH THIS NOTICE RELATES:

Arrowsmith Hydrogen Project

Pursuant to section 40(2)(a) of the *Environmental Protection Act 1986*, I, as a delegate of the Environmental Protection Authority (EPA), require that you provide the EPA with the following information for its assessment. The requirements for each of the items listed below are provided as Attachment 1.

1. Flora and vegetation

- Additional survey information to determine the potential impact to significant flora and vegetation.
- Evidence of consultation with the Department of Biodiversity, Conservation and Attractions (DBCA) regarding potential indirect impact to Beekeepers Nature Reserve.

2. Terrestrial fauna

- Additional black cockatoo habitat assessment to determine the extent and quality of foraging habitat for Carnaby's cockatoo (*Calyptorhynchus latirostris*).
- Identification of adequate mitigation measures during wind turbine operation (such as wind curtailment).

3. Inland waters

- Further clarification of the proposed groundwater extraction strategy and whether the potential environmental impacts of the chosen strategy have been assessed.
- Further surface water assessment based on the site layout as referred, and clarification of management measures to determine impact to surface water.

4. Social surroundings

- Further information to clarify the extent and effort of the Aboriginal heritage survey, including further discussion on potential impacts to ethnographic aspects, and confirmation that all recommendations set out in the survey report will be addressed.

5. Other environmental factors

- Further information and clarification of proposed management and mitigation measures to determine that the EPA's objective for landforms is met.
- Evidence of consultation with the Western Australian Speleological Group (WASG) regarding potential impact to karst formation and cave systems.

6. Environmental management plans

- Any management plans intended to be considered during the assessment should follow the framework as outlined in the EPA's guidance for developing EMPs <https://www.epa.wa.gov.au/forms-templates/instructions-part-iv-environmental-management-plans>. Alternatively, all relevant mitigation and management measures specified in the management plans should be included in the revised supporting document for each relevant environmental factor.

7. Cumulative and holistic impact assessment

- A holistic impact assessment, providing a summary of the environmental effect of the proposal on the environment as a whole is required.
- A cumulative impact assessment of the proposal for each environmental factor is required.

It is recommended that the Referral Information documentation be amended and updated to include and address the requested additional information, including appending any revised environmental management plans. Any additional biological survey work requires an accompanying Index of Biodiversity Surveys for Assessments (IBSA) data package. All IBSA data packages must meet the [IBSA data package requirements](#).

Your response should be sent by email to registrar@dwer.wa.gov.au marked for the attention of the person cited in the covering letter, or by post to the Environmental Protection Authority, Locked Bag 10, Joondalup DC, Perth WA 6919. Please quote the case number CMS18197 on any further correspondence.

The EPA will not proceed with its assessment of the proposal until you have provided the requested information and it is considered to be adequate, or if you advise the EPA that the further information is not available and/or cannot be obtained.

Yours sincerely



Prof. Matthew Tonts
CHAIR

8 August 2022

Attachment 1: Detail of further information required for assessment

ATTACHMENT 1: DETAIL OF FURTHER INFORMATION REQUIRED FOR ASSESSMENT

Item	Comments	Proponent response
1. Flora and vegetation	<ul style="list-style-type: none"> • To supplement the results of the reconnaissance flora survey undertaken by Ecoscape, undertake a detailed flora survey of the disturbance footprint and an area of at least 50 meters surrounding the disturbance footprint. The detailed flora survey is to be undertaken in accordance with the EPA's technical guidance on Flora and Vegetation Surveys for Environmental Impact Assessment (December 2016). • Update the referral information and mapping using results of the detailed flora survey and include an assessment of the potential impact to significant flora and vegetation. The assessment should quantify the potential impacts (direct, indirect, and cumulative). • Provide evidence of consultation with the Department of Biodiversity, Conservation and Attractions (DBCA) regarding potential indirect impact to Beekeepers Nature Reserve. Evidence must include a summary of the discussion and outcomes (including any concerns raised, resolutions, and agreement to mitigation and management actions). • Provide Index of Biodiversity Surveys for Assessments (IBSA) data packages for any additional survey work that is undertaken. All IBSA data packages must meet the IBSA data package requirements. 	
2. Terrestrial Fauna	<ul style="list-style-type: none"> • The black cockatoo habitat assessment undertaken by Bamford Consulting concludes that moderate to high quality foraging habitat extends beyond the areas identified by Ecoscape, and <i>Banksia sessilis</i> could occur elsewhere in the development envelope. To supplement the results of the black cockatoo habitat assessment, undertake a further black cockatoo habitat assessment to determine the extent of <i>Banksia sessilis</i> and <i>Banksia prionotes</i> in the development envelope, and the 	

Item	Comments	Proponent response
	<p>quality of foraging habitat for Carnaby's cockatoo (<i>Calyptorhynchus latirostris</i>).</p> <ul style="list-style-type: none"> • Update the referral information and mapping accordingly and include an assessment of the potential impacts to Carnaby's cockatoo. The assessment should quantify the potential impacts (direct, indirect, and cumulative). • It is acknowledged that a suite of construction and operational management and mitigation measures have been specified in the Fauna Management Plan. Identification of adequate mitigation measures during wind turbine operation (such as wind curtailment), to minimise impact to avifauna and bats is required to demonstrate that the EPA's objective can be met. • Provide Index of Biodiversity Surveys for Assessments (IBSA) data packages for any additional biological survey work that is undertaken for Flora and Vegetation and Terrestrial Fauna to meet the IBSA data package requirements. 	
3. Inland waters	<ul style="list-style-type: none"> • Update referral information to clarify the proposed groundwater extraction strategy (i.e. extraction from Yarragadee and remove any references to potential extraction from the Superficial Aquifer), and include an updated assessment of the impacts to groundwater resources, including groundwater dependent ecosystems, based on the confirmed strategy. • Undertake a surface water assessment that is relevant to the site layout as referred and update the referral information and mapping accordingly. • Update the assessment of impacts to surface water, including impact to drainage/water lines and wetlands, including the ephemeral waterbody. Update any surface water management strategies as required. 	

Item	Comments	Proponent response
4. Social surroundings	<ul style="list-style-type: none"> • Provide evidence that meaningful engagement with the Yamatji people is ongoing and that there is Yamatji Southern Regional Corporation support for the project. • Provide the spatial data to accompany the Aboriginal heritage survey report to confirm the extent of the survey effort. The spatial data can be provided as a confidential attachment if it contains sensitive cultural information. • Update the referral information to address all of the recommendations set out in the Aboriginal heritage survey report, including in relation to the potential for further research on the caves, mounds (potential archaeological deposits) and stone arrangements referred to in the Aboriginal heritage survey report. • The Aboriginal heritage survey report has a strong focus on the archaeology of the surveyed area, with little discussion on ethnographic aspects or findings. The EPA will need to understand the ethnographic importance of the area to Traditional Owners and relevant Knowledge Holders. Provide a discussion on the results of the ethnographic survey. In particular, the importance of any identified sites to women's cultural practice should be considered given the survey appears to only have been undertaken by Yamatji men. 	
5. Other environmental factors	<ul style="list-style-type: none"> • Update Table 27 (other environmental factors and proposed management) in the referral supporting documentation to clarify and elaborate on the proposed management and mitigation measures to meet the EPA's objective for landforms. • Provide evidence of consultation with the Western Australian Speleological Group (WASG) regarding potential impact to karst formation and cave systems. Evidence must include a summary of the discussion and outcomes (including any concerns raised, resolutions, and agreement to mitigation and management actions). 	

Item	Comments	Proponent response
6. Environmental Management Plans	<ul style="list-style-type: none"> • If management plans are intended to be considered during the assessment, then the layout and content should follow the framework as outlined in the EPA's guidance for developing EMPs https://www.epa.wa.gov.au/forms-templates/instructions-part-iv-environmental-management-plans. • If management plans are not intended to be considered for the purposes of the assessment, then any relevant mitigation and management measures specified in the management plans that are not included in the supporting document are to be included in a revised supporting document for each relevant environmental factor. 	
7. Cumulative and holistic impact assessment	<ul style="list-style-type: none"> • The holistic impact assessment in section 10 of the referral supporting document provides a summary of each individual environmental factor and does not provide a summary of the environmental effect of the proposal on the environment as a whole. Update the referral information to include a holistic impact assessment of the proposal. • The referral supporting document acknowledges that there is potential for cumulative impacts to preliminary key environmental factors in the region. However, an assessment is not provided. Provide a cumulative impact assessment of the proposal for each environmental factor. • Guidance on cumulative and holistic impact assessment can be found in the EPA's guidance for preparing an Environmental Review Document https://www.epa.wa.gov.au/forms-templates/instructions-how-prepare-environmental-review-document. 	

APPENDIX TWO

LEGISLATIVE CONTEXT, DEFINITIONS AND CRITERIA

COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is a legal framework to protect and manage matters of national environmental significance (MNES) including important flora, fauna, ecological communities and heritage areas listed under the Act.

Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species and ecological communities that have been assessed as meeting the criteria to be listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild, as detailed in **Table 9**.

Threatened Ecological Communities protected under the EPBC Act are categorised as Critically Endangered, Endangered or Vulnerable, also detailed in this table.

Migratory species subject to international agreements are also protected under the EPBC Act. The definition of a migratory species under the Act follows that prescribed by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (DCCEEW 2023a). The list of migratory species established under section 209 of the EPBC Act comprises:

- migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II);
- migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and
- native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Table 9: EPBC Act categories for flora, fauna and ecological communities

Category	Threatened species	Threatened Ecological Communities
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	n/a
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.	n/a
Critically Endangered (CR)	A native species is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria
Endangered (EN)	A native species is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.

Category	Threatened species	Threatened Ecological Communities
Vulnerable (VU)	A native species is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.	n/a

WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian EP Act was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 10**; these categories align with those of the EPBC Act. Some State-listed threatened species and ecological communities are provided with additional protection as they are also listed under the Commonwealth EPBC Act (see **Table 9** for conservation status category descriptions).

The most recent Western Australian flora and fauna listings were published in the Government Gazette on 30 September 2022 (Government of Western Australia 2022).

PRIORITY-LISTED FLORA AND FAUNA

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed in the BC Act, some may qualify as being of special conservation interest and thereby have a greater level of protection than unlisted species.

There are three categories covering Western Australian-listed TF and four categories covering PF species which are outlined in **Table 10**. PF for Western Australia are regularly reviewed by the DBCA whenever new information becomes available, with species status altered or removed from the list when data indicates that they no longer meet these requirements.

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in **Table 10**.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, have a restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as ‘specially protected species’ in the BC Act.

Table 10: Conservation codes for Western Australian flora and fauna (DBCA 2020)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora ¹ are species ² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.	
The <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> and the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> have been transitioned under regulations 170, 171 and 172 of the <i>Biodiversity Conservation Regulations 2018</i> to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the <i>Biodiversity Conservation Act 2016</i> .	
Categories of Threatened, Extinct and Specially Protected fauna and flora are:	
T	<p>Threatened species Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the <i>Biodiversity Conservation Act 2016</i> (BC Act).</p> <p>Threatened fauna is the species of fauna that are listed as critically endangered, endangered or vulnerable threatened species.</p> <p>Threatened flora is the species of flora that are listed as critically endangered, endangered or vulnerable threatened species.</p> <p>The assessment of the conservation status of threatened species is in accordance with the BC Act listing criteria and the requirements of Ministerial Guideline (Number 1) and Ministerial Guideline (Number 2) that adopts the use of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species Categories and Criteria⁴, and is based on the national distribution of the species</p>

Conservation Codes for Western Australian Flora and Fauna	
CR	<p>Critically endangered species</p> <p>Threatened species considered to be “<i>facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines</i>”.</p> <p>Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.</p>
EN	<p>Endangered species</p> <p>Threatened species considered to be “<i>facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines</i>”.</p> <p>Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines.</p>
VU	<p>Vulnerable species</p> <p>Threatened species considered to be “<i>facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines</i>”.</p> <p>Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines.</p>
<p>Extinct species</p> <p>Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.</p>	
EX	<p>Extinct species</p> <p>Species where “<i>there is no reasonable doubt that the last member of the species has died</i>”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).</p>
EW	<p>Extinct in the wild species</p> <p>Species that “<i>is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form</i>”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).</p>
<p>Specially protected species</p> <p>Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.</p> <p>Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.</p>	
MI	<p>Migratory species</p> <p>Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).</p> <p>Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the <i>Convention on the Conservation of Migratory Species of Wild Animals</i> (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.</p>
CD	<p>Species of special conservation interest (conservation dependent)</p> <p>Species of special conservation need that are dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act)</p>
OS	<p>Other specially protected species</p> <p>Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).</p>
P	<p>Priority species</p> <p>Priority is not a listing category under the BC Act.</p> <p>All fauna and flora are protected in WA following the provisions in Part 10 of the BC Act. The protection applies even when a species is not listed as threatened or specially protected, and regardless of land tenure (State managed land (Crown land), private land, or Commonwealth land).</p> <p>Species that may possibly be threatened species that do not meet the criteria for listing under the BC Act because of insufficient survey or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of prioritisation for survey and evaluation of conservation status so that consideration can be given to potential listing as threatened.</p> <p>Species that are adequately known, meet criteria for near threatened, or are rare but not threatened, or that have been recently removed from the threatened species list or conservation dependent or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.</p> <p>Assessment of priority status is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.</p>

Conservation Codes for Western Australian Flora and Fauna	
1	<p>Priority 1: Poorly-known species – known from few locations, none on conservation lands</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, for example, agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation</p> <p>Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. These species are in urgent need of further survey.</p>
2	<p>Priority 2: Poorly-known species – known from few locations, some on conservation lands</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, for example, national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation.</p> <p>Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements for threatened listing and appear to be under threat from known threatening processes. These species are in urgent need of further survey.</p>
3	<p>Priority 3: Poorly-known species – known from several locations</p> <p>Species that are known from several locations and the species does not appear to be under imminent threat or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat.</p> <p>Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. These species need further survey.</p>
4	<p>Priority 4: Rare, Near Threatened and other species in need of monitoring</p> <p>(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
<p>¹ The definition of flora includes algae, fungi and lichens.</p> <p>² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).</p>	

THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Western Australian TECs are protected under the BC Act and are categorised much like those of the EPBC Act. Western Australian definitions and criteria for TECs are shown in **Table 11**.

Currently described TECs are listed on the DBCA website, with the most recent list endorsed by the Minister for Environment in June 2018 (DBCA 2018).

DBCA also maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined. They are not protected under legislation but are taken into consideration as part of the environmental approvals process.

Currently described PECs are listed on the DBCA website, with the most recent list dated 21 December 2022 (Species and Communities Program, DBCA 2022). Definitions and criteria for PECs are shown in **Table 11**.

Table 11: DBCA definitions and criteria for TECs and PECs (DEC 2013)

Criteria	Definition
Threatened Ecological Communities	
Presumed Totally Destroyed (PD)	<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <ul style="list-style-type: none"> A. Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or B. All occurrences recorded within the last 50 years have since been destroyed
Critically Endangered (CR)	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <ul style="list-style-type: none"> A. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): <ul style="list-style-type: none"> i. geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii. modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): <ul style="list-style-type: none"> i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).
Endangered (EN)	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):</p> <ul style="list-style-type: none"> A. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): <ul style="list-style-type: none"> i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii. modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): <ul style="list-style-type: none"> i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii. there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii. there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. <p>The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).</p>

Criteria	Definition
Vulnerable (VU)	<p>An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):</p> <ul style="list-style-type: none"> A. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.
Priority ecological communities	
Priority One	<p><i>Poorly known ecological communities</i></p> <p>Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
Priority Two	<p><i>Poorly known ecological communities</i></p> <p>Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.</p>
Priority Three	<p><i>Poorly known ecological communities</i></p> <ul style="list-style-type: none"> i. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or; ii. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; iii. Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. <p>Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.</p>
Priority Four	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <ul style="list-style-type: none"> i. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. iii. Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five	<p><i>Conservation Dependent Ecological Communities</i></p> <p>Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

FLORA CRITERIA

OTHER SIGNIFICANT FLORA

According to the Flora and Vegetation Technical Guidance (EPA 2016a) other than being listed as Threatened or Priority Flora, a species can be considered as significant if it is considered to be:

- locally endemic or association with a restricted habitat type (e.g. Groundwater Dependent Ecosystems, Sheet Flow Dependent Vegetation)
- a new species or has anomalous features that indicate a potential new species
- at the extremes of range, recently discovered range extensions (generally considered greater than 100 km or in a different bioregion), or isolated outliers of the main range)
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

INTRODUCED FLORA

Introduced plant species, known as weeds, are plants that are not indigenous to an area and have been introduced either directly or indirectly (unintentionally) through human activity. Species are regarded as introduced if they are listed as 'alien' on *FloraBase* (Western Australian Herbarium [WAH] 1998-2023) and are designated with an asterisk (*) in this document.

Weeds of National Significance

At a national level there are 32 weed species listed as Weeds of National Significance (WoNS) (Weeds Australia & Centre for Invasive Species Solutions 2021). The Commonwealth *Australian Weeds Strategy 2017-2027* (Invasive Plants and Animals Committee 2016) describes broad goals and objectives to manage these species.

Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, Declared Pests are listed as one of the three categories, or exempt:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage
- exempt (no category).

VEGETATION CRITERIA

OTHER SIGNIFICANT VEGETATION

According to the Flora and Vegetation Technical Guidance (EPA 2016a) other than being listed as a TEC or PEC, vegetation can be considered as significant if it is considered to have:

- restricted distribution
- a degree of historical impact from threatening processes
- a role as a refuge
- provides an important function required to maintain ecological integrity of a significant ecosystem.

Groundwater Dependent vegetation may be considered as significant and are described below.

Groundwater Dependent Vegetation

Groundwater Definition

Groundwater is water that is found in the saturated zone of the soil, where all soil pores are filled with water. The water table is the upper surface of the saturated zone in an unconfined aquifer. Groundwater may also occur as a perched aquifer located above unsaturated rock formations as a result of a discontinuous permeable layer or held under pressure in a confined aquifer (Goulburn-Murray Water 2010).

Groundwater Dependent Ecosystems Definition

Groundwater Dependent Ecosystems (GDEs) have been defined as ecosystems that are dependent on groundwater for their survival at some stage or stages of their lifecycle, however groundwater use cannot be equated with groundwater dependence (Eamus 2009). In some contexts (including that of a flora and vegetation assessment), GDEs are also known as Groundwater Dependent Vegetation (GDV).

Hatton and Evans (1998) identified four types of GDEs based on their geographic setting: terrestrial vegetation (vegetation communities and dependent fauna that have seasonal or episodic dependence on groundwater), river base flow systems (aquatic and riparian ecosystems that exist in or adjacent to streams that are fed by groundwater base flow), aquifer and cave ecosystems, and wetlands.

Eamus *et al.* (2006) identified three primary classes based on type of groundwater reliance:

1. Aquifer and cave ecosystems.
2. All ecosystems dependent on the surface expression of groundwater:
 - a) river base flows
 - b) wetlands, swamplands
 - c) seagrass beds in estuaries
 - d) floodplains
 - e) mound springs
 - f) riparian vegetation
 - g) saline discharge to lakes
 - h) low lying forests.
3. All ecosystems dependent on the subsurface presence of groundwater, often accessed via the capillary fringe (non-saturated zone above the water table) when roots penetrate this zone:
 - a) River Red Gum (*Eucalyptus camaldulensis*) forests
 - b) Banksia woodlands
 - c) Riparian vegetation in the wet/dry tropics.

GDEs associated with the subsurface presence of groundwater (Eamus *et al.* 2006 class 3) includes riparian vegetation characterised by the phreatophytic species described below.

Direct impacts on GDEs (clearing), and indirect impacts, including from dewatering and reinjection, frequently feature as being a significant environmental impact in mining approvals documents e.g. Office of the Appeals Convenor (2016a, 2016b), Rio Tinto (2016).

Phreatophytic Species

Phreatophytic species rely on groundwater sources for water intake (Maunsell Australia Pty Ltd 2006) essentially the water requirements of phreatophytes are greater than can be provided from the surface soil profile (e.g. riparian vegetation) or they are dependent on free water availability (e.g. wetland species). They frequently show low tolerance to extended water stress due to a lack of physiological and/or morphological adaptation to drought and respond to significant water deficit by a decline in health and eventual death (*ibid.*).

Obligate phreatophytes are dependent on free access to water (i.e. they are wetland species) whereas facultative phreatophytes can switch their water source between the soil surface profile in times of rain, to groundwater in times of drought when the soil surface profile (vadosphere) is depleted (Grierson 2010).

Vegetation containing *Eucalyptus camaldulensis sens. lat.* is generally considered to represent a GDE.

ENVIRONMENTALLY SENSITIVE AREAS

There are a number of areas within Western Australia identified as being of environmental significance within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs), and are declared under section 51B of the EP Act and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice*.

CONSERVATION ESTATE

The National Reserve System is a network of protected areas managed for conservation under international guidelines. The objective of placing areas of bushland into the Conservation Estate is to achieve and maintain a comprehensive, adequate and representative reserve system for Western Australia. The Conservation and Parks Commission is the vesting body for conservation lands, forest and marine reserves that are managed by DBCA (Government of Western Australia 2018).

APPENDIX THREE FIELD SURVEY CRITERIA

Table 12: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group & DotEE 2017)

Cover characteristics								
	Foliage cover *	70-100	30-70	10-30	<10	» 0 (scattered)	0-5 (clumped)	unknown
	Cover code	d	c	i	r	bi	bc	unknown
Growth Form	Height Ranges (m)	Structural Formation Classes						
tree, palm	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	tree, palm
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	tree mallee
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrub, cycad, grass-tree, tree-fern
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrub
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrub
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrub
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrub
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grass
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grass
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grass
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedge
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rush
forb	<0.5,>0.5	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forb
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	fern
bryophyte	<0.5	closed bryophyte-land	bryophyte-land	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophyte
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichen
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vine

Table 13: NVIS height classes (NVIS Technical Working Group & DotEE 2017)

Height		Growth form				
Height Class	Height Range (m)	Tree, vine (M & U), palm (single-stemmed)	Shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed)	Tree mallee, mallee shrub	Tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G)	Bryophyte, lichen, seagrass, aquatic
8	>30	tall	NA	NA	NA	NA
7	10-30	mid	NA	tall	NA	NA
6	<10	low	NA	mid	NA	NA
5	<3	NA	NA	low	NA	NA
4	>2	NA	tall	NA	tall	NA
3	1-2	NA	mid	NA	tall	NA
2	0.5-1	NA	low	NA	mid	tall
1	<0.5	NA	low	NA	low	low

Source: (based on Walker & Hopkins 1990)

Table 14: Vegetation condition scale for the South West and Interzone Botanical Provinces (EPA 2016a)

Condition rating	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

APPENDIX FOUR LIKELIHOOD ASSESSMENT (REVISED)

Table 15: Flora database search results, habitat and likelihood assessment (updated)

Blue shading indicates high likelihood; dark blue indicates species is known (recorded) from the survey area.

The updated (since the 2020 survey; Ecoscape (2021)) likelihood takes into consideration IGE's wetland conservation area. As a result, wetland habitat is not present in the current survey area/proposed development footprint and buffer. The PMST database search was updated on 24 January 2023 (DCCEE 2023b) using a 20 km buffer around IGE's site.

DBCA*	PMST**	Species name	Habitat from:	Flowering	Likelihood of occurrence	
			<ul style="list-style-type: none"> FloraBase (WAH 1998-2022) (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH, DBCA & Shire of Dalwallinu 2022) 		Desktop (including 2020 results)	Post-survey (2022)
		Threatened Flora***				
	May	<i>Andersonia gracilis</i>	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Sep-Nov	Highly unlikely	Highly unlikely
	May	<i>Caladenia hoffmanii</i>	Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies.	Aug-Oct	Highly unlikely	Highly unlikely
WAH, TP	Known	<i>Caleana dixonii</i> (formerly <i>Paracaleana dixonii</i>)	Grey sand over granite.	Oct-Jan	Unlikely	Unlikely
	Likely	<i>Conostylis dielsii</i> subsp. <i>teres</i>	White, grey or yellow sand, gravel. Low open woodland.	Jul-Aug	Unlikely	Unlikely
	May	<i>Conostylis micrantha</i>	White or grey sand. Sandplains.	Jul-Aug	Unlikely	Unlikely
WAH	Likely	<i>Daviesia speciosa</i>	Gravelly lateritic soils. Undulating plains, rises.	Apr-May	Highly unlikely	Highly unlikely
TP		<i>Eleocharis keigheryi</i>	Clay, sandy loam. Emergent in freshwater: creeks, claypans.	Aug-Nov	Highly unlikely	Highly unlikely
WAH		<i>Eremophila glabra</i> subsp. <i>chlorella</i>	Sandy clay. Winter-wet depressions.	Jul-Nov	Highly unlikely	Highly unlikely
TP	May	<i>Eucalyptus crispata</i>	Sand, loam with lateritic gravel. Lateritic breakaways.	Mar-Jun	Unlikely	Unlikely
	May	<i>Eucalyptus impensa</i>	Yellow sand. Lateritic hills.	Jun-Jul	Unlikely	Unlikely
WAH, TP	Likely	<i>Eucalyptus leprophloia</i>	White or grey sand over laterite. Valley slopes.	Aug-Oct	Unlikely	Unlikely
	May	<i>Hemiandra gardneri</i>	Grey or yellow sand, clayey sand. Sandplains.	Aug-Oct	Unlikely	Unlikely
	May	<i>Styphelia marginata</i> (known as <i>Leucopogon marginatus</i> under the EPBC Act)	Shrublands or low heath. Sand over laterite.	May-Aug	Highly unlikely	Highly unlikely
TP	Likely	<i>Styphelia obtecta</i> ***	Grey-white or yellow sand. Gently undulating slope or plain.	Oct-Nov	May occur	May occur
	May	<i>Tetradlea nephelioides</i>	White-grey sand, yellow-brown clayey sand, gravel laterite. Outcrops, undulating hills, ridges.	Sep	Unlikely	Unlikely
WAH, TP	Likely	<i>Thelymitra stellata</i>	Sand, gravel, lateritic loam.	Oct-Nov	May occur	Unlikely
	May	<i>Wurmbea tubulosa</i>	Clay, loam. River-banks, seasonally-wet places.	Jun-Aug	Highly unlikely	Highly unlikely
		DBCA Priority 1				
WAH		<i>Caladenia denticulata</i> subsp. <i>albicans</i>	Riverbanks, wet flats, depressions. Clay or sandy soil.	Aug	Highly unlikely	Highly unlikely
WAH		<i>Drosera pedicellaris</i>	Deep sand.	Oct-Nov	May occur	May occur
WAH		<i>Korthalsella arthroclada</i>	White, sandy clay around lake edges.	Dec	Highly unlikely	Highly unlikely
WAH, TP		<i>Lasiopetalum ogilvieanum</i>	White/grey or yellow sand, stony loam. Undulating plains, lateritic rises.	Jul-Oct	May occur	Unlikely
WAH, TP		<i>Micromyrtus rogeri</i>	Yellow-brown sandy soils, gravel, laterite. Breakaways.	Jul - Oct	Highly unlikely	Highly unlikely
WAH		<i>Poranthera asybosca</i>	White sand.	Oct	Unlikely	Unlikely

DBCA*	PMST**	Species name	Habitat from:	Flowering	Likelihood of occurrence	
			<ul style="list-style-type: none"> • FloraBase (WAH 1998-2022) • (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH, DBCA & Shire of Dalwallinu 2022) 		Desktop (including 2020 results)	Post-survey (2022)
WAH		<i>Stylidium carnosum</i> subsp. <i>Narrow leaves</i> (J.A. Wege 490)	Slopes on low hills, low plains. White/grey sand with laterite.	Oct	Unlikely	Unlikely
WAH		<i>Verticordia dasystylis</i> subsp. <i>oestopioia</i>	Gritty soils over granite. Outcrops.	Oct	Highly unlikely	Highly unlikely
WAH, TP		<i>Verticordia luteola</i> var. <i>rosea</i>	White sand. Flats.	Dec-Jan	May occur	May occur
		DBCA Priority 2				
WAH, TP		<i>Acacia vittata</i>	Grey sand, sandy clay. Margins of seasonal lakes.	Aug	Likely	Unlikely
WAH		<i>Calectasia palustris</i>	White or grey sand. Seasonally inundated swamplands.	Jul-Oct	Unlikely	Highly unlikely
WAH		<i>Comesperma griffinii</i>	Yellow or grey sand. Plains.	Oct	Likely	May occur
WAH		<i>Dampiera tephrea</i>	Sand, gravelly loam.	Jul	May occur	Known
		<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	White, yellowish or pale brown coastal sands overlying limestone, often on limestone dunes, in mallee shrubland or low open woodland		-	Known
WAH, TP		<i>Guichenotia quasicalva</i>	Drainage lines. Sandy clay over laterite.	Sep-Oct	Unlikely	Unlikely
WAH		<i>Schoenus badius</i>	Grey sand. Moist areas.	Sep - Oct	Highly unlikely	Highly unlikely
WAH		<i>Schoenus</i> sp. <i>Eneabba</i> (F. Obbens & C. Godden 1154)	Grey, yellow or white sand. Undulating sandplains, mid slopes, tops of rises.	Dec	Likely	Unlikely
WAH		<i>Scholtzia calcicola</i>	Yellow/grey sand, over limestone. Slopes.	Oct	Likely	Known
WAH		<i>Stylidium pseudocaespitosum</i>	White, grey or yellow sand over laterite. Breakaways and hillslopes.	Sep-Nov	Unlikely	Unlikely
WAH		<i>Stylidium</i> sp. <i>Three Springs</i> (J.A. Wege & C. Wilkins JAW 600)	Upper slopes, ironstone breakaways, flats. Yellow-brown clayey sand over laterite, red rocky soil.	Sep	Unlikely	Unlikely
TP		<i>Synaphea sparsiflora</i>	Sandy loam over laterite.	Aug – Sep	Unlikely	Unlikely
WAH		<i>Tricoryne</i> sp. <i>Wongan Hills</i> (B.H. Smith 794)	Yellow to grey sand, gravelly clay quartz, laterite, limestone. Mid-slopes and uplands.		May occur	May occur
WAH		<i>Verticordia argentea</i>	White, grey or yellow sand. Sand ridges, undulating plains.	Nov-Apr	May occur	May occur
		DBCA Priority 3				
WAH		<i>Acacia latipes</i> subsp. <i>licina</i>	White sand, granitic soils. Limestone hills, sandplains.	Jun-Sep	May occur	May occur
WAH		<i>Acacia lanceolata</i>	Lateritic hills & breakaways.		Unlikely	Unlikely
WAH		<i>Acacia telmica</i>	Sand, loam or loamy clay. Low-lying seasonally moist areas.	Jul-Sep	Highly unlikely	Highly unlikely
WAH		<i>Anthocercis intricata</i>	Sand or loam over limestone. Consolidated sand dunes.	Jun-Sep	Likely	Likely
WAH		<i>Austrostipa</i> sp. <i>Cairn Hill</i> (M.E. Trudgen 21176)	Slopes. Grey clayey or yellow brown sandy soil.		Unlikely	Unlikely
WAH		<i>Baeckea</i> sp. <i>Walkaway</i> (A.S. George 11249)	Yellow/brown or white sand. Undulating plains, hillslopes.	Dec-Jan	May occur	May occur
WAH		<i>Banksia cypholoba</i>	Sand & gravelly loam.	Aug	Unlikely	Unlikely
WAH		<i>Banksia fraseri</i> var. <i>crebra</i>	Shallow valley, sandplains, slopes, laterite hills. Yellow-brown sand, gravelly clay loam.	Jul-Aug	May occur	May occur
WAH, TP		<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	Depressions, limestone ridges, hill tops. Brown or grey sand, sand over limestone.	Jul-Aug	Likely	Known
WAH		<i>Beyeria gardneri</i>	Yellow sand.	Aug-Sep	May occur	May occur

DBCA*	PMST**	Species name	Habitat from:	Flowering	Likelihood of occurrence	
			<ul style="list-style-type: none"> • FloraBase (WAH 1998-2022) • (for <i>Acacia</i> species) World Wide Wattle (WAH, DBCA & Shire of Dalwallinu 2022) 		Desktop (including 2020 results)	Post-survey (2022)
WAH		<i>Blackallia nudiflora</i>	Clay or sandy clay with granite. On hills or breakaways, plains.		Unlikely	Unlikely
WAH		<i>Centrolepis milleri</i>	Sandplains.		May occur	May occur
WAH		<i>Comesperma rhadinocarpum</i>	Sandy soils, sand over laterite. Hill slopes, undulating plains.	Oct-Nov	May occur	May occur
WAH, TP		<i>Eucalyptus macrocarpa x pyriformis</i>	Sand, lateritic sandy soils. Hills, rocky ironstone ridges, sandplains.	Aug-Oct	Unlikely	Unlikely
WAH		<i>Grevillea erinacea</i>	White, grey or yellow sand, often with lateritic gravel.	Jul-Dec	May occur	Unlikely
WAH		<i>Guichenotia alba</i>	Sandy & gravelly soils. Low-lying flats, depressions.	Jul-Aug	Unlikely	Unlikely
WAH		<i>Haloragis foliosa</i>	White/grey sand over limestone.	Dec	Likely	Likely
WAH		<i>Hemiandra</i> sp. Eneabba (H. Demarz 3687)	Sand over laterite, sandplains. Disturbed sites.	Nov	May occur	Unlikely
WAH		<i>Hemigenia saligna</i>	Lateritic and sandy soils.	Jul-Oct	May occur	Unlikely
WAH		<i>Hopkinsia anoectocolea</i>	White or grey sand, often saline. Winter-wet depressions, floodplains, salt lakes.	Sep-Dec	Highly unlikely	Highly unlikely
WAH		<i>Hypocalymma gardneri</i>	Grey-brown sand, laterite. Sandplains, upper slopes, heathland.	Aug-Sep	Unlikely	Unlikely
WAH		<i>Hypocalymma tetrapterum</i>	Grey sand, loam, lateritic gravel. Riverbanks, breakaways.	Aug	Unlikely	Unlikely
WAH		<i>Mesomelaena stygia</i> subsp. <i>deflexa</i>	White, grey or lateritic sand, clay, gravel.	Mar-Oct	Unlikely	Unlikely
WAH		<i>Persoonia chapmaniana</i>	White sandy clay, yellow sand. Vicinity of salt lakes.	Sep-Nov	Highly unlikely	Highly unlikely
WAH		<i>Persoonia filiformis</i>	Yellow or white sand over laterite.	Nov-Dec	Unlikely	Unlikely
WAH, TP		<i>Persoonia rudis</i>	White, grey or yellow sand, often over laterite.	Sep-Jan	May occur	Unlikely
WAH		<i>Stylidium drummondianum</i>	Sand or clayey sand over laterite. Upper hillslopes, breakaways. Low heath, mallee shrubland.	Aug-Oct	Unlikely	Unlikely
WAH, TP		<i>Stylidium maritimum</i>	Sand over limestone. Dune slopes and flats. Coastal heath and shrubland, open Banksia woodland.	Sep-Nov	May occur	May occur
WAH		<i>Stylidium torticarpum</i>	Sandy clay and clay loam over laterite. Adjacent to creek lines, depressions and beneath breakaways.	Sep-Nov	Highly unlikely	Highly unlikely
WAH		<i>Styphelia filifolia</i>	Yellow/brown sand. Flats or slopes.	Feb-Apr	May occur	May occur
WAH		<i>Synaphea oulopha</i>	Lateritic breakaways and rises. Grey sand, gravelly loam, clay.	Jul-Oct	Unlikely	Unlikely
WAH		<i>Thryptomene</i> sp. Lancelin (M.E. Trudgen 14000)	Calcareous sand.	Sep	Likely	Likely
WAH		<i>Triglochin protuberans</i>	Red loam, grey mud over clay. Winter-wet sites, claypans, near salt lakes, margins of pools.	Oct	Highly unlikely	Highly unlikely
WAH		<i>Verticordia densiflora</i> var. <i>roseostella</i>	Sandy gravelly soils.	Sep-Dec	May occur	May occur
WAH, TP		<i>Verticordia fragrans</i>	White, grey or yellow sand, clay loam. Low-lying areas, sandplains.	Sep-Nov	Highly unlikely	Highly unlikely
WAH, TP		<i>Verticordia luteola</i> var. <i>luteola</i>	Grey sand over gravel. Flats.	Nov-Dec	Unlikely	Unlikely
		DBCA Priority 4				
WAH		<i>Banksia elegans</i>	Yellow, white or red sand. Sandplains, low consolidated dunes.	Oct-Nov	Likely	May occur
WAH		<i>Banksia scabrella</i>	White, grey or yellow sand, sometimes with lateritic gravel. Sandplains, lateritic ridges.	Sep-Jan	Unlikely	Unlikely
WAH, TP		<i>Calytrix chrysantha</i>	White, grey or yellow/brown sand. Flats.	Dec-Feb	May occur	May occur
WAH, TP		<i>Calytrix eneabensis</i>	White, grey or yellow sand over laterite. Sandplains.	Jul-Oct	Unlikely	Unlikely

DBCA*	PMST**	Species name	Habitat from:	Flowering	Likelihood of occurrence	
			<ul style="list-style-type: none"> • <i>FloraBase</i> (WAH 1998-2022) • (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH, DBCA & Shire of Dalwallinu 2022) 		Desktop (including 2020 results)	Post-survey (2022)
WAH		<i>Calytrix superba</i>	Sand over laterite. Flats.	Dec-Feb	Unlikely	Unlikely
WAH		<i>Eucalyptus ebbanoensis</i> subsp. <i>photina</i>	Sandy clay, red sand. Lateritic breakaways, sandplains.	Sep - Dec or Jan - Mar	Unlikely	Unlikely
WAH, TP		<i>Eucalyptus macrocarpa</i> subsp. <i>elachantha</i>	White or grey sand over laterite. Hillslopes, ridges, sandplains.	Aug-Dec	Unlikely	Unlikely
WAH, TP		<i>Eucalyptus zopherophloia</i>	Grey/white sand with limestone rubble. Coastal areas.	Oct-Jan	Recorded	Recorded
WAH		<i>Grevillea olivacea</i>	Coastal dunes, limestone rocks.	Jun-Sep	May occur	May occur
WAH		<i>Hydrocotyle lemnoides</i>	Swamps.	Aug-Oct	May occur	May occur
WAH		<i>Liparophyllum congestiflorum</i>	Grey sand/loam over laterite. Flats, seasonally wet areas.	Sep - Oct	Highly unlikely	Highly unlikely
WAH		<i>Pityrodia viscida</i>	Lateritic sand.	Sep - Dec or Jan - Feb	Highly unlikely	Highly unlikely
WAH		<i>Scaevola kallophylla</i>	Sandy soils over limestone. Coastal plain.	May or Aug-Dec	Unlikely	Unlikely
WAH		<i>Schoenus griffinianus</i>	White sand.	Sep-Oct	May occur	May occur
WAH, TP		<i>Stawellia dimorphantha</i>	White, grey, yellow sand.	Jun-Nov	Likely	Likely
WAH		<i>Stylidium longitubum</i>	Sandy clay, clay. Seasonal wetlands.	Oct-Dec	Highly unlikely	Highly unlikely
TP		<i>Thysanotus glaucus</i>	White, grey or yellow sand, sandy gravel.	Oct-Mar	Unlikely	Unlikely

* WAH = herbarium record (vouchered specimen)

TP = Threatened and Priority Flora Report Form record; may be unconfirmed i.e. without vouchered specimen

** PMST likelihood of occurrence or likelihood of habitat occurring

*** Commonwealth EPBC Act and Western Australian BC Act conservation status

APPENDIX FIVE FIELD SURVEY RESULTS

Table 16: Flora inventory (site x species matrix)

APPENDIX SIX FLORISTIC QUADRAT DATA

The 2020 floristic quadrat and relevé data sheets (Ecoscape 2021) are appended after the current data sheets. The 2020 data has not been altered; note the corrections to species identifications listed in **Section 2.2.1**.

D20Q01

Staff LJA **Date** 13/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith wind and solar farm
MGA Zone 50 307965 mE 6737214 mN **Lat.** -29.4799 **Long.** 115.0194
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type None
Loose Rock 0 % cover **Litter** 30 % cover ; <1 cm in depth
Bare ground 60 % cover **Weeds** 0 % cover
Vegetation U+ ^*Eucalyptus oraria*^mallee shrub\6\c;G ^^*Beyeria cinerea* subsp. *cinerea*,*Acanthocarpus canaliculatus*,*Diplolaena leemaniana*^shrub\2\i
Veg. Condition Very Good
Disturbance Fire or perhaps rolled
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		2	1	
<i>Acanthocarpus canaliculatus</i>		0.3	2	
<i>Alyogyne hakeifolia</i>		0.3	<1	
<i>Anthocercis intricata</i>	P 3	1	<1	
<i>Austrostipa flavescens</i>		0.3	<1	

<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P 3	0.3	5
<i>Comesperma confertum</i>		0.5	<1
<i>Commersonia borealis</i>		0.5	<1
<i>Cryptandra pungens</i>		0.3	<1
<i>Diplolaena leemaniana</i>		0.5	2
<i>Dodonaea aptera</i>		0.7	<1
<i>Eucalyptus oraria</i>		3	40
<i>Exocarpos sparteus</i>		1.3	<1
<i>Guichenotia ledifolia</i>		0.4	<1
<i>Lasiopetalum angustifolium</i>		0.7	<1
<i>Melaleuca cardiophylla</i>		1	<1
<i>Olearia axillaris</i>		0.7	<1
<i>Phyllanthus scaber</i>		0.3	<1
<i>Rhagodia preissii</i> subsp. <i>obovata</i>		0.6	<1

D20Q02

Staff LJA **Date** 13/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith wind and solar farm
MGA Zone 50 308149 mE 6737596 mN **Lat.** -29.4764 **Long.** 115.0213
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type Limestone
Loose Rock 20-50 % cover **Litter** 50 % cover ; <1 cm in depth
Bare ground 20 % cover **Weeds** 40 % cover
Vegetation M+ *Acacia rostellifera*, *Grevillea argyrophylla*, *Melaleuca cardiophylla* shrub; *Vulpia myuros*, *Avellinia michelii*, *Erodium botrys* other grass, forb
Veg. Condition Good
Disturbance Possibly grazed
Fire Age >10 years
Notes Quadrat not measured



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		4	25	
<i>Acanthocarpus canaliculatus</i>		0.3	<1	
<i>Alyogyne hakeifolia</i>		2	<1	
<i>Anthocercis intricata</i>	P 3	0.5	<1	
* <i>Avellinia michelii</i>		0.1	5	

<i>*Avena barbata</i>	0.5	<1
<i>*Brassica tournefortii</i>	0,3	<1
<i>Calandrinia</i> sp. Shark Bay (A. Markey 1405)	0.1	<1
<i>Cassutha melantha</i>	2	<1
<i>Cassutha</i> sp.	1.5	<1
<i>Commersonia borealis</i>	0.5	<1
<i>*Erodium botrys</i>	0.1	5
<i>Grevillea argyrophylla</i>	2	10
<i>Guichenotia ledifolia</i>	1	<1
<i>*Hordeum leporinum</i>	0.2	<1
<i>Lobelia heterophylla</i>	0.4	<1
<i>Melaleuca cardiophylla</i>	2	10
<i>Melaleuca huegelii</i>	2.5	<1
<i>Pelargonium littorale</i>	0.1	<1
<i>Ptilotus gaudichaudii</i>	0.2	<1
<i>*Reichardia tingitana</i>	0.3	<1
<i>Thysanotus patersonii</i>	1	<1
<i>Trachymene pilosa</i>	0.1	<1
<i>*Vulpia myuros</i>	0.1	20
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.3	2

D20Q03

Staff LJA **Date** 13/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith wind and solar farm
MGA Zone 50 308373 mE 6733249 mN **Lat.** -29.5157 **Long.** 115.0229
Habitat Lower-Slope
Aspect W **Slope** Very Gentle
Soil Type Grey sand
Rock Type Limestone
Loose Rock 2-10 % cover; 200 mm in size **Litter** 40 % cover ; <1 cm in depth
Bare ground 30 % cover **Weeds** 1 % cover
Vegetation U ^*Eucalyptus erythrocorys*\^tree\6\r;M+ ^^*Labichea cassioides*,*Banksia sessilis* var. *cygnorum*,
Guichenotia ledifolia\^shrub\3\c;G ^*Desmocladius asper*,^*Acanthocarpus canaliculatus*\^rush,
forb\1\r
Veg. Condition Excellent
Disturbance Old bore in quadrat but little evidence of other disturbances
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acanthocarpus canaliculatus</i>		0.3	2	
<i>Austrostipa elegantissima</i>		0.5	<1	
<i>Austrostipa flavescens</i>		1	<1	
<i>Austrostipa macalpinei</i>		0.3	<1	

<i>Banksia sessilis</i> var. <i>cygnorum</i>	2	8
<i>Beaufortia aestiva</i>	1	<1
<i>Bossiaea eriocarpa</i>	0.5	2
<i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i>	1.6	<1
<i>Cassytha melantha</i>	0.5	<1
<i>Comesperma integerrimum</i>	1.2	<1
<i>Conostylis candicans</i> subsp. <i>calcicola</i>	0.1	<1
<i>Desmocladius asper</i>	0.2	3
<i>Dioscorea hastifolia</i>	.3	<1
<i>Eucalyptus erythrocorys</i>	7	5
<i>Guichenotia ledifolia</i>	1.4	8
<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>	0.3	<1
<i>Hibbertia subvaginata</i>	0.6	<1
<i>Hyalosperma cotula</i>	0.1	<1
<i>Isotoma hypocrateriformis</i>	0.3	<1
<i>Jacksonia hakeoides</i>	0.5	<1
<i>Labichea cassioides</i>	1.3	20
<i>Leucopogon insularis</i>	0.6	<1
<i>Lomandra</i> sp. indet.	0.3	<1
* <i>Lysimachia arvensis</i>	0.2	<1
<i>Melaleuca carrii</i>	0.3	<1
<i>Melaleuca systema</i>	1	<1
<i>Opercularia spermacocea</i>	0.3	<1
<i>Petrophile axillaris</i>	0.5	<1
<i>Phyllanthus scaber</i>	0.3	<1
<i>Thysanotus manglesianus</i>	0.6	<1
<i>Trachymene pilosa</i>	0.1	<1
* <i>Vulpia myuros</i>	0.1	<1

D20Q04

Staff LJA **Date** 14/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith wind and solar farm
MGA Zone 50 311273 mE 6732269 mN **Lat.** -29.5250 **Long.** 115.0526
Habitat Upper-Slope
Aspect W **Slope** Gentle
Soil Type Yellow grey sand
Rock Type Limestone
Loose Rock <2 % cover; 60-200 mm in size **Litter** 5 % cover ; <1 cm in depth
Bare ground 50 % cover **Weeds** 2 % cover
Vegetation M+ ^{^^}Melaleuca carrii, Acacia scirpifolia, Banksia sessilis var. cygnorum^{^^}heath shrub, shrub\3\i; G^{^^}Hibbertia hypericoides subsp. septentrionalis, Ecdeiocolea monostachya, Desmocladius asper^{^^}shrub, rush\1\c
Veg. Condition Good
Disturbance Grazed
Fire Age >10 years
Notes Banksia prionotes scattered in vicinity but none in quadrat



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		1.3	1	
<i>Acacia scirpifolia</i>		1.5	2	
<i>Acanthocarpus canaliculatus</i>		0.3	<1	
<i>Austrostipa macalpinei</i>		0.2	<1	

<i>Banksia prionotes</i>	0.1	<1
<i>Banksia sessilis</i> var. <i>cygnorum</i>	1.5	2
<i>Desmocladius asper</i>	0.2	3
<i>Dianella revoluta</i>	0.3	<1
<i>Ecdeiocolea monostachya</i>	0.5	8
<i>Grevillea leucopteris</i>	3.5	2
<i>Hakea lissocarpa</i>	0.6	<1
<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>	0.4	10
<i>Hyalosperma cotula</i>	0.1	<1
* <i>Hypochaeris glabra</i>	0.2	<1
<i>Lomandra</i> sp. indet.	0.4	<1
<i>Lyginia barbata</i>	0.4	<1
<i>Melaleuca carrii</i>	1.5	15
<i>Muehlenbeckia adpressa</i>	0.4	<1
<i>Neurachne alopecuroidea</i>	0.1	<1
<i>Scholtzia umbellifera</i>	1.3	5
<i>Stenanthemum notiale</i>	0.1	<1
<i>Thysanotus manglesianus</i>	0.4	<1
<i>Trachymene pilosa</i>	0.	<1
<i>Tricoryne elatior</i>	0.3	<1
* <i>Ursinia anthemoides</i>	0.2	<1
* <i>Vulpia myuros</i>	0.2	<1
<i>Wahlenbergia gracilenta</i>	0.3	<1
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.3	<1
<i>Xanthorrhoea</i> sp.	0.3	<1

D20Q05

Staff LJA **Date** 14/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith wind and solar farm
MGA Zone 50 311226 mE 6731357 mN **Lat.** -29.5332 **Long.** 115.0520
Habitat Upper-Slope
Aspect S **Slope** Very Gentle
Soil Type Yellow grey sand
Rock Type Limestone
Loose Rock <2 % cover; 20-60 mm in size **Litter** 35 % cover ; <1 cm in depth
Bare ground 60 % cover **Weeds** 2 % cover
Vegetation U+ ^*Eucalyptus erythrocorys*^tree\6\r;M ^*Acacia spathulifolia*,^*Acacia scirpifolia*,*Guichenotia ledifolia*^shrub\3\i;G ^^*Hibbertia hypericoides* subsp. *septentrionalis*,*Desmocladius asper*,
Conostylis candicans subsp. *callicola*^shrub,rush,forb\2\i
Veg. Condition Very Good
Disturbance Burnt
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		1	<1	
<i>Acacia scirpifolia</i>		2	6	
<i>Acacia spathulifolia</i>		2	10	
<i>Acanthocarpus canaliculatus</i>		0.2	1	

<i>Anthobolus foveolatus</i>	.4	<1
<i>Austrostipa flavescens</i>	1	<1
<i>Austrostipa macalpinei</i>	0.3	<1
<i>Banksia dallanneyi</i>	0.2	<1
<i>Banksia sessilis</i> var. <i>cygnorum</i>	1.6	1
<i>Billardiera fraseri</i>	2	<1
* <i>Brassica tournefortii</i>	0.3	<1
<i>Calandrinia</i> sp.	0.3	<1
<i>Conostylis candicans</i> subsp. <i>calcicola</i>	0.3	3
<i>Desmocladus asper</i>	0.2	5
<i>Eucalyptus erythrocorys</i>	8	3
<i>Guichenotia ledifolia</i>	2	2
<i>Hakea lissocarpa</i>	0.7	
<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>	0.6	15
<i>Hibbertia subvaginata</i>	0.5	1
<i>Hybanthus floribundus</i> subsp. <i>floribundus</i>	0.3	<1
<i>Isotoma hypocrateriformis</i>	0.3	<1
<i>Laxmannia sessiliflora</i> subsp. <i>drummondii</i>	0.1	<1
<i>Macrozamia fraseri</i>	1.2	1
<i>Melaleuca carrii</i>	0.8	<1
<i>Muehlenbeckia adpressa</i>	1	<1
<i>Neurachne alopecuroidea</i>	0.2	<1
<i>Petrophile brevifolia</i>	0.5	1
<i>Phyllanthus calycinus</i>	0.6	<1
<i>Poa drummondiana</i>	0.6	<1
<i>Ptilotus stirlingii</i> subsp. <i>stirlingii</i>	0.3	<1
<i>Stackhousia monogyna</i>	0.4	<1
<i>Stenanthemum notiale</i>	0.	<1
<i>Thysanotus manglesianus</i>	0.5	<1
<i>Trachymene pilosa</i>	0.	<1
<i>Tricoryne elatior</i>	0.4	<1
* <i>Ursinia anthemoides</i>	0.2	<1
* <i>Vulpia myuros</i>	0.2	<1
<i>Wahlenbergia gracilentia</i>	0.3	<1
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.2	<1

D20R01

Staff LJA **Date** 12/10/2020 **Season** A
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 311375 mE 6733015 mN **Lat.** -29.5183 **Long.** 115.0538
Habitat Lower-Slope
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type None
Loose Rock 0 % cover **Litter** 100 % cover
Bare ground 2 % cover **Weeds** 95 % cover
Vegetation U+ ^*Eucalyptus camaldulensis* subsp. *obtusa*\^tree\7;c;G ^*Hordeum leporinum*,*Ehrharta longiflora*,*Lolium multiflorum*\^other grass\1d
Veg. Condition Completely Degraded
Disturbance Grazed; parkland cleared
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
* <i>Brassica tournefortii</i>		0.3	1	
* <i>Bromus diandrus</i>		0.3	<1	
* <i>Echium plantagineum</i>		0.3	<1	
* <i>Ehrharta longiflora</i>		0.6	5	
<i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i>		22	50	

**Hordeum leporinum*

0.2

80

**Lolium multiflorum*

0.3

5

<i>*Ehrharta longiflora</i>	0.4	25
<i>*Hordeum leporinum</i>	0.2	30
<i>*Hypochaeris glabra</i>	0.2	<1
<i>*Reichardia tingitana</i>	0.4	<1

D20R03

Staff LJA **Date** 12/10/2020 **Season** A
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 311171 mE 6732574 mN **Lat.** -29.5222 **Long.** 115.0516
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type None
Loose Rock 0 % cover **Litter** 40 % cover
Bare ground 20 % cover **Weeds** 80 % cover
Vegetation M+ ^*Acacia saligna*, ^*Acacia scirpifolia* ^shrub\4i;G ^^*Vulpia myuros*, *Pentameris airoides*, *Hypochaeris glabra* ^other grass, forb\1\d
Veg. Condition Completely Degraded
Disturbance Grazed; probably regen following clearing
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia saligna</i>		3.5	20	
<i>Acacia scirpifolia</i>		2	5	
<i>Amyema preissii</i>		1.5	<1	
* <i>Arctotheca calendula</i>		0.1	<1	
* <i>Brassica tournefortii</i>		0.3	<1	

<i>*Bromus diandrus</i>	0.4	<1
<i>Crassula</i> sp.	0.1	<1
<i>*Ehrharta longiflora</i>	0.4	<1
<i>*Hypochaeris glabra</i>	0.3	5
<i>*Pentameris airoides</i>	0.1	10
<i>*Petrohragia dubia</i>	0.3	<1
<i>*Trifolium arvense</i>	0.2	<1
<i>*Vulpia myuros</i>	0.2	30

D20R04

Staff LJA **Date** 12/10/2020 **Season** A
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 311170 mE 6732575 mN **Lat.** -29.5222 **Long.** 115.0516
Habitat Crest
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type Limestone
Loose Rock <2 % cover **Litter** 50 % cover
Bare ground 20 % cover **Weeds** 30 % cover
Vegetation U+ ^*Eucalyptus erythrocorys*,^*Acacia saligna*^tree mallee,tree\6\c;G ^^*Hordeum leporinum*,
Brassica tournefortii,*Ehrharta longiflora*^other grass,forb\1\c
Veg. Condition Degraded
Disturbance Grazed
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia saligna</i>		3	10	
<i>Austrostipa elegantissima</i>		1.3	<1	
<i>Austrostipa</i> sp.		0.6	<1	
* <i>Brassica tournefortii</i>		0.4	5	
* <i>Bromus diandrus</i>		0.3	<1	

<i>Desmocladus asper</i>	0.2	<1
* <i>Ehrharta brevifolia</i>	0.4	<1
* <i>Ehrharta longiflora</i>	0.4	2
<i>Eucalyptus erythrocorys</i>	8	35
* <i>Hordeum leporinum</i>	0.2	20
* <i>Hypochaeris glabra</i>	0.2	<1
* <i>Lysimachia arvensis</i>	0.2	<1
* <i>Reichardia tingitana</i>	0.2	<1
<i>Rhagodia preissii</i> subsp. <i>obovata</i>	1	<1
<i>Trachymene pilosa</i>	0.1	<1

D20R05

Staff LJA **Date** 12/10/2020 **Season** A
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 310403 mE 6736004 mN **Lat.** -29.4912 **Long.** 115.0443
Habitat Open Depression
Aspect N/A **Slope** Very Gentle
Soil Type Grey clay
Rock Type None
Loose Rock 0 % cover **Litter** 30 % cover
Bare ground 5 % cover **Weeds** 95 % cover
Vegetation U+ ^*Melaleuca strobophylla*,^*Casuarina obesa*^tree\7r;G ^^*Vulpia myuros*,*Plantago coronopus*,
Hordeum leporinum^other grass,forb\1d
Veg. Condition Completely Degraded
Disturbance Grazed
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Casuarina obesa</i>		12	2	
* <i>Hordeum leporinum</i>		0.2	10	
* <i>Lolium multiflorum</i>		0.3	5	
<i>Melaleuca strobophylla</i>		12	5	
* <i>Mesembryanthemum nodiflorum</i>		0.1	<1	

* <i>Petrorhagia dubia</i>	0.3	<1
* <i>Plantago coronopus</i>	0.1	35
<i>Rhodanthe oppositifolia</i> subsp. <i>oppositifolia</i>	0.2	<1
* <i>Trifolium arvense</i>	0.1	<1
* <i>Vulpia myuros</i>	0.2	50

D20R06

Staff LJA **Date** 14/10/2020 **Season** A
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 311182 mE 6731883 mN **Lat.** -29.5284 **Long.** 115.0516
Habitat Upper-Slope
Aspect W **Slope** Gentle
Soil Type Grey sand
Rock Type None
Loose Rock 0 % cover **Litter** 70 % cover
Bare ground 20 % cover **Weeds** 25 % cover
Vegetation U ^*Eucalyptus erythrocorys*\^tree\6\bi;M+ ^*Acacia scirpifolia*,^*Scholtzia laxiflora*\^shrub\4\c;G
^*Vulpia myuros*,*Trachymene pilosa*,*Waitzia suaveolens* var. *suaveolens*\^other grass,forb\1\i
Veg. Condition Degraded
Disturbance Grazed; potentially cleared and regenerated
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		1	1	
<i>Acacia scirpifolia</i>		3	60	
<i>Austrostipa elegantissima</i>		1	<1	
<i>Austrostipa flavescens</i>		0.8	<1	
<i>Austrostipa macalpinei</i>		0.3	<1	

<i>*Brassica tournefortii</i>	0.3	<1
<i>Calandrinia</i> sp. Shark Bay (A. Markey 1405)	0.1	<1
<i>Conostylis candicans</i> subsp. <i>calcicola</i>	0.3	<1
<i>Desmocladus asper</i>	0.1	<1
<i>Drosera erythrorhiza</i>	0.1	<1
<i>*Ehrharta longiflora</i>	0.3	<1
<i>Eucalyptus erythrocorys</i>	7	1
<i>Gnephosis angianthoides</i>	0.1	<1
<i>Grevillea leucopteris</i>	3	
<i>Hybanthus floribundus</i> subsp. <i>floribundus</i>	0.3	<1
<i>Jacksonia nutans</i>	0.3	<1
<i>Macrozamia fraseri</i>	0.6	<1
<i>*Pentameris airoides</i>	0.1	<1
<i>Scholtzia laxiflora</i>	3.5	5
<i>Thysanotus manglesianus</i>		<1
<i>Trachymene pilosa</i>	0.1	2
<i>Trymalium ledifolium</i>	0.4	<1
<i>*Ursinia anthemoides</i>	0.2	<1
<i>*Vulpia myuros</i>	0.2	10
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.3	2

D20R07

Staff LJA **Date** 14/10/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location Arrowsmith wind and solar farm
MGA Zone 50 311226 mE 6731357 mN **Lat.** -29.5332 **Long.** 115.0520
Habitat River
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type None
Loose Rock 0 % cover **Litter** 100 % cover
Bare ground 0 % cover **Weeds** 20 % cover
Vegetation U+ *Eucalyptus camaldulensis* subsp. *obtusa*^tree\7i;M *Acacia scirpifolia*,*Acacia rostellifera*,
Rhagodia preissii subsp. *obovata*^shrub,chenopod shrub\4c;G *Ehrharta longiflora*,*Avena barbata*,*Lysimachia arvensis*^other grass,forb\1i
Veg. Condition Degraded
Disturbance Probably grazed

Fire Age**Notes**

Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		4	10	
<i>Acacia saligna</i>		2	2	
<i>Acacia scirpifolia</i>		2.5	20	
* <i>Arctotheca calendula</i>		0.1	1	

<i>*Avena barbata</i>	0.4	5
<i>*Brassica tournefortii</i>	0.5	<1
<i>*Bromus diandrus</i>	0.3	<1
<i>Clematicissus angustissima</i>	0.2	<1
<i>Comesperma ?integerrimum</i>	0.3	<1
<i>Comesperma integerrimum</i>	2	<1
<i>Crassula sp.</i>	0.	<1
<i>*Ehrharta longiflora</i>	0.4	10
<i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i>	2	20
<i>Exocarpos sparteus</i>	5	2
<i>*Hypochaeris glabra</i>	0.2	1
<i>*Lysimachia arvensis</i>	0,2	2
<i>Melaleuca raphiophylla</i>	2	2
<i>Muehlenbeckia adpressa</i>	1	<1
<i>*Petrohragia dubia</i>	0.3	<1
<i>*Reichardia tingitana</i>	0.4	<1
<i>Rhagodia preissii</i> subsp. <i>obovata</i>	2	5
<i>*Silene gallica</i>	0.3	<1
<i>Stylobasium australe</i>	1.5	3
<i>Trachymene pilosa</i>	0.	<1
<i>*Trifolium campestre</i>	0.1	<1

D20R08

Staff LJA **Date** 15/10/2020 **Season** A
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 309612 mE 6736257 mN **Lat.** -29.4887 **Long.** 115.0362
Habitat Upper-Slope
Aspect N **Slope** Very Gentle
Soil Type Black sand
Rock Type Limestone
Loose Rock 2-10 % cover **Litter** 80 % cover
Bare ground 0 % cover **Weeds** 100 % cover
Vegetation U ^*Eucalyptus camaldulensis* subsp. *obtusata*^tree\7\bi;M+ ^*Acacia rostellifera*,^*Melaleuca raphiophylla*^shrub\4\c;G ^*Bromus diandrus*,*Brassica tournefortii*,*Hordeum leporinum*^other grass,forb\1\d
Veg. Condition Completely Degraded
Disturbance Grazed

Fire Age**Notes**

Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		3	20	
* <i>Brassica tournefortii</i>		0.5	20	
* <i>Bromus diandrus</i>		0.3	50	
<i>Crassula</i> sp.		0.1	<1	

<i>*Ehrharta longiflora</i>	0.2	5
<i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i>	20	
<i>*Hordeum leporinum</i>	0.2	20
<i>*Lycium ferocissimum</i>		<1
<i>*Lysimachia arvensis</i>	0.1	5
<i>Melaleuca raphiophylla</i>	3	10
<i>*Petrorhagia dubia</i>	0.4	<1
<i>Rhagodia preissii</i> subsp. <i>obovata</i>	1	<1

D20R09

Staff LJA **Date** 15/10/2020 **Season** A
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 310929 mE 6736104 mN **Lat.** -29.4903 **Long.** 115.0497
Habitat Mid-Slope
Aspect W **Slope** Very Gentle
Soil Type Grey sand
Rock Type None
Loose Rock 0 % cover **Litter** 10 % cover
Bare ground 60 % cover **Weeds** 30 % cover
Vegetation U ^*Eucalyptus camaldulensis* subsp. *obtusa*^tree\6\bi;M+ ^*Chamelaucium uncinatum*,^*Acacia rostellifera*^shrub\4\c;G ^^*Brassica tournefortii*,*Ehrharta longiflora*,*Bromus diandrus*^forb,other grass\1\i
Veg. Condition Completely Degraded
Disturbance Grazed

Fire Age**Notes**

Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		4	10	
* <i>Avena barbata</i>		1	<1	
* <i>Brassica tournefortii</i>		0.5	5	
* <i>Bromus diandrus</i>		0.3	2	

<i>Chamelaucium uncinatum</i>	2	20
<i>Crassula</i> sp.	0.	<1
* <i>Ehrharta longiflora</i>	0.3	5
<i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i>	6	<1
* <i>Hypochaeris glabra</i>	0.2	<1
* <i>Lysimachia arvensis</i>	0.1	<1
* <i>Petrorhagia dubia</i>	0.3	<1
* <i>Sonchus oleraceus</i>	0.3	<1

D20R10

Staff LJA **Date** 15/10/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location Arrowsmith wind and solar farm
MGA Zone 50 311058 mE 6734200 mN **Lat.** -29.5075 **Long.** 115.0507
Habitat Lower-Slope
Aspect W **Slope** Very Gentle
Soil Type Yellow grey sand
Rock Type None
Loose Rock 0 % cover **Litter** 30 % cover
Bare ground 60 % cover **Weeds** 2 % cover
Vegetation U+ ^*Eucalyptus erythrocorys*\^tree\6\i;M ^*Jacksonia hakeoides*,^*Hibbertia hypericoides* subsp. *septentrionalis*\^shrub\3\i;G ^^*Ecdeiocolea monostachya*,*Lepidobolus chaetocephalus*, *Mesomelaena pseudostygia*\^rush,sedge\2\i
Veg. Condition Good
Disturbance Grazed
Fire Age
Notes Banksia prionotes sparse but not in releve



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia ?rostellifera</i>		2.5	<1	
<i>Acanthocarpus canaliculatus</i>		0.3	<1	
<i>Anigozanthos humilis</i>		0.1	<1	
<i>Austrostipa flavescens</i>		0.7	<1	

<i>Austrostipa macalpinei</i>	0.3	<1
<i>Brachyscome iberidifolia</i>	0.2	<1
<i>Conostylis candicans</i> subsp. <i>calcicola</i>	0.2	<1
<i>Desmocladus asper</i>	0.1	1
<i>Ecdeiocolea monostachya</i>	0.8	3
* <i>Ehrharta longiflora</i>	0.3	<1
<i>Eucalyptus erythrocorys</i>	8	10
<i>Goodenia berardiana</i>	0.2	<1
<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>	1	5
<i>Hybanthus floribundus</i> subsp. <i>floribundus</i>	0.3	<1
<i>Jacksonia hakeoides</i>	1.8	4
<i>Laxmannia sessiliflora</i> subsp. <i>drummondii</i>	0.1	<1
<i>Lepidobolus chaetocephalus</i>	0.4	2
<i>Mesomelaena pseudostygia</i>	0.3	2
<i>Neurachne alopecuroidea</i>	0.3	<1
<i>Poa drummondiana</i>	0.6	<1
<i>Podotheca gnaphalioides</i>	0.3	<1
<i>Trachymene pilosa</i>	0.1	<1
* <i>Ursinia anthemoides</i>	0.2	<1
* <i>Vulpia myuros</i>	0.2	<1
* <i>Wahlenbergia capensis</i>	0.2	<1
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.3	<1

D20R11

Staff LJA **Date** 15/10/2020 **Season** A
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 310758 mE 6733662 mN **Lat.** -29.5123 **Long.** 115.0476
Habitat River
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type None
Loose Rock 0 % cover **Litter** 20 % cover
Bare ground 10 % cover **Weeds** 40 % cover
Vegetation U+ *Eucalyptus camaldulensis* subsp. *obtusa*, *Acacia rostellifera*, *Melaleuca raphiophylla* tree; M *Rhagodia preissii* subsp. *obovata* chenopod shrub; G *Vulpia myuros*, *Rytidosperma setaceum*, *Hordeum leporinum* other grass, tussock grass
Veg. Condition Degraded
Disturbance Grazed
Fire Age
Notes Riverbed. Three species of mistletoes!



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		4	10	
<i>Amyema miquelii</i>		2-4	<1	
* <i>Arctotheca calendula</i>		0.	<1	
* <i>Briza minor</i>			<1	

<i>*Bromus diandrus</i>	0.2	<1
<i>*Bromus hordeaceus</i>	0.2	<1
<i>*Bromus rubens</i>	0.1	<1
<i>Crassula colorata</i> var. <i>acuminata</i>		<1
<i>Crassula colorata</i> var. <i>colorata</i>	0.1	<1
<i>Eryngium pinnatifidum</i>	0.2	1
<i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i>	10	15
<i>*Hordeum leporinum</i>	0.2	5
<i>*Hypochaeris glabra</i>	0.2	<1
<i>*Juncus bufonius</i>	0.	<1
<i>*Lolium multiflorum</i>	0.3	<1
<i>*Lysimachia arvensis</i>	0.2	2
<i>Melaleuca raphiophylla</i>	3	5
<i>Myriocephalus appendiculatus</i>	0.1	<1
<i>*Plantago coronopus</i>	0.1	<1
<i>Rhagodia preissii</i> subsp. <i>obovata</i>	2	5
<i>Rytidosperma setaceum</i>	0.3	5
<i>Santalum acuminatum</i>	4	<1
<i>Siloxerus multiflorus</i>	0.1	1
<i>*Trifolium campestre</i>	0.1	<1
<i>Triglochin</i> sp. A Flora of Australia (G.J. Keighery 2477)	0.1	<1
<i>*Ursinia anthemoides</i>	0.2	<1
<i>*Vulpia myuros</i>	0.2	25

D20R12

Staff LJA **Date** 15/10/2020 **Season** A
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 310636 mE 6733654 mN **Lat.** -29.5124 **Long.** 115.0463
Habitat Mid-Slope
Aspect E **Slope** Gentle
Soil Type Pink sand
Rock Type Limestone
Loose Rock 10-20 % cover **Litter** 25 % cover
Bare ground 40 % cover **Weeds** 15 % cover
Vegetation U+ ^*Eucalyptus erythrocorys*^tree\6\i;M ^^*Acanthocarpus canaliculatus*,*Diplolaena leemaniana*,
Rhagodia preissii subsp. *obovata*^shrub,chenopod shrub\3\i;G ^^*Vulpia myuros*,*Petrorhagia dubia*,*Brassica tournefortii*^other grass,forb\1\i
Veg. Condition Good
Disturbance Probably grazed

Fire Age**Notes**

Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acanthocarpus canaliculatus</i>		1.3	10	
<i>Austrostipa elegantissima</i>		1	<1	
<i>Austrostipa</i> sp.		0.3	<1	
* <i>Avena barbata</i>		0.4	<1	

<i>*Brassica tournefortii</i>	0.4	2
<i>Calandrinia</i> sp. Shark Bay (A. Markey 1405)	0.3	<1
<i>Conostylis prolifera</i>	0.1	<1
<i>Diplolaena leemaniana</i>	1.2	5
<i>Eucalyptus erythrocorys</i>	8	10
<i>Goodenia berardiana</i>	0.2	<1
<i>*Hypochaeris glabra</i>	0.	<1
<i>*Lysimachia arvensis</i>	0.1	<1
<i>Muehlenbeckia adpressa</i>	1	<1
<i>*Petrohragia dubia</i>	0.3	2
<i>Podotheca gnaphalioides</i>	0.2	<1
<i>Rhagodia preissii</i> subsp. <i>obovata</i>	1.5	5
<i>*Sonchus oleraceus</i>	0.8	<1
<i>Trymalium ledifolium</i>	1	<1
<i>*Vulpia myuros</i>	0.2	5

D20R13

Staff LJA **Date** 15/10/2020 **Season**
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 310274 mE 6733629 mN **Lat.** -29.5126 **Long.** 115.0426
Habitat Upper-Slope
Aspect E **Slope** Gentle
Soil Type Dark grey sand
Rock Type Limestone
Loose Rock 20-50 % cover **Litter** 60 % cover
Bare ground 35 % cover **Weeds** 30 % cover
Vegetation U ^*Eucalyptus erythrocorys*\^tree\6\bi;M+ ^*Melaleuca cardiophylla*\^shrub\4\c;G ^^*Lysimachia arvensis*,*Ehrharta longiflora*,*Hypochaeris glabra*\^forb,other grass\1\c
Veg. Condition Very Good
Disturbance Possibly grazed
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Austrostipa elegantissima</i>		1	<1	
<i>Calandrinia</i> sp. Shark Bay (A. Markey 1405)		0.1	<1	
<i>Dioscorea hastifolia</i>		0.2	<1	
* <i>Ehrharta longiflora</i>		0.2	5	
<i>Eucalyptus erythrocorys</i>		6	<1	

<i>*Hypochaeris glabra</i>	0.2	2
<i>*Lysimachia arvensis</i>	0.2	10
<i>Melaleuca cardiophylla</i>	4	40
<i>Melaleuca trichophylla</i>	0.4	<1
<i>Millotia tenuifolia</i>		<1
<i>*Reichardia tingitana</i>	0.3	<1
<i>*Sonchus oleraceus</i>	0.3	<1
<i>*Trifolium campestre</i>	0.2	<1

D20R14

Staff LJA **Date** 15/10/2020 **Season**
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 310223 mE 6733641 mN **Lat.** -29.5124 **Long.** 115.0420
Habitat Upper-Slope
Aspect S **Slope** Gentle
Soil Type Orange sand
Rock Type Limestone
Loose Rock 2-10 % cover **Litter** 5 % cover
Bare ground 60 % cover **Weeds** 2 % cover
Vegetation M+ ^Melaleuca cardiophylla,Melaleuca huegelii,Labichea cassioides\^shrub\4\c;G
^Desmocladius asper,Conostylis prolifera,Scholtzia umbellifera\^rush,forb,heath shrub\1\c
Veg. Condition Excellent
Disturbance Fire
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Austrostipa flavescens</i>		0.7	<1	
<i>Conostylis prolifera</i>		0.2	5	
<i>Desmocladius asper</i>		0.1	20	
<i>Dioscorea hastifolia</i>		0.2	<1	
<i>Gompholobium tomentosum</i>		0.3	<1	

<i>Grevillea preissii</i> subsp. <i>glabrilimba</i>	0.5	<1
<i>Hakea lissocarpha</i>	0.5	<1
<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>	0.3	<1
<i>Labichea cassioides</i>	1.5	2
<i>Leucopogon insularis</i>	1	<1
* <i>Lysimachia arvensis</i>	0.1	<1
<i>Macrozamia fraseri</i>	0.3	<1
<i>Melaleuca cardiophylla</i>	2.5	25
<i>Melaleuca huegelii</i>	2.5	5
<i>Melaleuca trichophylla</i>	0.6	<1
<i>Scholtzia umbellifera</i>	0.4	2
<i>Trachymene pilosa</i>	0.1	<1
* <i>Vulpia myuros</i>	0.1	

D20R15

Staff LJA **Date** 16/10/2020 **Season** A
Revisit
Type R
Location Arrowsmith wind and solar farm
MGA Zone 50 309198 mE 6735991 mN **Lat.** -29.4911 **Long.** 115.0319
Habitat Upper-Slope
Aspect N/A **Slope** N/A
Soil Type Grey pink sand
Rock Type Limestone
Loose Rock <2 % cover **Litter** 40 % cover
Bare ground 30 % cover **Weeds** 30 % cover
Vegetation U+ ^*Eucalyptus erythrocorys*,^*Acacia rostellifera*\^tree\6\i;M ^^*Olearia axillaris*,*Diplolaena leemaniana*,*Hibbertia subvaginata*\^shrub\4\c;G ^^*Avena barbata*,*Brassica tournefortii*,*Ehrharta longiflora*\^other grass,forb\1\i
Veg. Condition Very Good
Disturbance Weedy but doesn't seem to have been cleared or deliberately grazed

Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		4	8	
<i>Alyogyne huegelii</i>		0.5	<1	
* <i>Avena barbata</i>		0.5	2	
* <i>Brassica tournefortii</i>		0.5	2	

* <i>Briza maxima</i>	0.2	<1
* <i>Bromus diandrus</i>	0.2	<1
<i>Clematicissus angustissima</i>	0.3	<1
<i>Commersonia borealis</i>	0.5	<1
<i>Conostylis prolifera</i>	0.1	1
<i>Crassula colorata</i> var. <i>colorata</i>	0.1	<1
* <i>Cuscuta planiflora</i>	0.1	<1
<i>Diplolaena leemaniana</i>	1.3	8
* <i>Ehrharta longiflora</i>	0.3	2
<i>Eucalyptus erythrocorys</i>	5	10
<i>Hibbertia subvaginata</i>	1	8
* <i>Hypochaeris glabra</i>	0.2	<1
<i>Melaleuca cardiophylla</i>	1.3	<1
<i>Melaleuca trichophylla</i>	0.5	<1
<i>Olearia axillaris</i>	2.5	8
<i>Opercularia spermacocea</i>	0.1	<1
* <i>Petrorhagia dubia</i>	0.2	2
<i>Phyllanthus calycinus</i>	0.6	<1
<i>Quoya loxocarpa</i>	0.7	<1
* <i>Silene gallica</i>	0.2	<1
* <i>Stellaria media</i>	0.1	<1
<i>Stylidium elongatum</i>	0.4	<1
* <i>Trifolium arvense</i>	0.1	<1
* <i>Trifolium campestre</i>	0.1	<1
<i>Trymalium ledifolium</i>	0.8	<1
* <i>Ursinia anthemoides</i>	0.2	<1
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.2	<1

A2201

Staff LJA **Date** 18/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 308454 mE 6735611 mN **Lat.** -29.4944 **Long.** 115.0241
Habitat Upper-Slope
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type Limestone
Loose Rock 2-10 % cover; 20-60 mm in size **Litter** 80 % cover ; <1 cm in depth
Bare ground 5 % cover **Weeds** 40 % cover
Vegetation M+ ^Acacia rostellifera,Melaleuca lanceolata,Melaleuca huegelii subsp. huegelii^shrub\4\d;G
^Ehrharta longiflora,Reichardia tingitana,Bromus diandrus^other grass,forb\1\c
Veg. Condition Degraded
Disturbance Grazed (feral goats)
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		5	55	
<i>Alyogyne huegelii</i>		0.8	<1	
* <i>Brassica tournefortii</i>		0.3	<1	
* <i>Bromus diandrus</i>		0.3	2	
<i>Cassutha ?glabella</i>		2	<1	

<i>*Ehrharta longiflora</i>	0.4	50
<i>*Hordeum leporinum</i>	0.3	<1
<i>Melaleuca cardiophylla</i>	2	<1
<i>Melaleuca huegelii</i> subsp. <i>huegelii</i>	2	2
<i>Melaleuca lanceolata</i>	3	20
<i>*Petrohragia dubia</i>	0.3	<1
<i>*Polycarpon tetraphyllum</i>	0.1	<1
<i>*Reichardia tingitana</i>	0.3	10
<i>Rhagodia preissii</i> subsp. <i>obovata</i>	0.8	1
<i>*Silene nocturna</i>	0.3	<1
<i>*Sonchus oleraceus</i>	0.3	<1

A2202

Staff LJA **Date** 18/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 308185 mE 6735953 mN **Lat.** -29.4913 **Long.** 115.0214
Habitat Crest
Aspect SE **Slope** Very Gentle
Soil Type Grey sand
Rock Type Limestone
Loose Rock 20-50 % cover; 6-20 mm in size **Litter** 35 % cover ; <1 cm in depth
Bare ground 50 % cover **Weeds** 30 % cover
Vegetation M+ ^{^^}Melaleuca cardiophylla,Acacia xanthina,Lasiopetalum angustifolium[^]\shrub\4\;G
^{^^}Reichardia tingitana,Avena barbata,Bromus diandrus[^]\forb,other grass\1\i
Veg. Condition Good
Disturbance Grazed (feral goats)
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia xanthina</i>		2.5	10	
* <i>Avena barbata</i>		0.5	5	
* <i>Brassica tournefortii</i>		0.3	<1	
* <i>Bromus diandrus</i>		0.3	5	
<i>Calandrinia calyptрата</i>		0.1	<1	

<i>Dioscorea hastifolia</i>	1.5	2
* <i>Ehrharta longiflora</i>	0.3	2
* <i>Hordeum leporinum</i>	0.3	<1
<i>Lasiopetalum angustifolium</i>	1	10
* <i>Lysimachia arvensis</i>	0.2	<1
<i>Melaleuca cardiophylla</i>	1.8	65
* <i>Melilotus indicus</i>	0.5	<1
<i>Ptilotus gaudichaudii</i>	0.3	<1
* <i>Reichardia tingitana</i>	0.3	15

A2203

Staff LJA **Date** 18/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 308396 mE 6736496 mN **Lat.** -29.4864 **Long.** 115.0237
Habitat Crest
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type Limestone
Loose Rock 10-20 % cover; 20-60 mm in size **Litter** 65 % cover ; <1 cm in depth
Bare ground 30 % cover **Weeds** 5 % cover
Vegetation M+ *Grevillea argyrophylla*, *Melaleuca cardiophylla*, *Acacia xanthina* \shrub\4\c; G *Guichenotia ledifolia*, *Cryptandra pungens* \shrub\2\i
Veg. Condition Very Good
Disturbance Grazed (feral goats)
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia xanthina</i>		2.3	10	
<i>Alyogyne hakeifolia</i>		0.6	<1	
<i>Austrostipa flavescens</i>		1	<1	
* <i>Brassica tournefortii</i>		0.3	<1	
<i>Calandrinia calyptрата</i>		0.1	<1	

<i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i>	0.8	<1
<i>Conostylis prolifera</i>	0.1	1
<i>Crassula colorata</i>	0.1	<1
<i>Cryptandra pungens</i>	0.4	5
<i>Dioscorea hastifolia</i>	1	<1
<i>Diplolaena leemaniana</i>	0.8	<1
<i>Eremaea ?violacea</i>	0.2	<1
<i>Grevillea argyrophylla</i>	1.8	40
<i>Guichenotia ledifolia</i>	0.8	15
<i>Hibbertia subvaginata</i>	0.5	<1
<i>Lysiandra scabra</i>	0.4	<1
* <i>Lysimachia arvensis</i>	0.2	<1
<i>Melaleuca cardiophylla</i>	1.8	20
<i>Quoya loxocarpa</i>	0.5	<1
<i>Thysanotus manglesianus</i>	1	<1
<i>Trachymene cyanopetala</i>	0.1	<1
<i>Wahlenbergia gracilentia</i>	0.1	<1
<i>Waitzia suaveolens</i>	0.3	<1

A2204

Staff LJA **Date** 18/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 307716 mE 6735724 mN **Lat.** -29.4933 **Long.** 115.0165
Habitat Upper-Slope
Aspect W **Slope** Very Gentle
Soil Type Grey sand
Rock Type Limestone
Loose Rock 10-20 % cover; 60-200 mm in size **Litter** 90 % cover ; <1 cm in depth
Bare ground 10 % cover **Weeds** 0 % cover
Vegetation M+ *Acacia xanthina*, *Dodonaea aptera*, *Melaleuca cardiophylla* \shrub\4\; *Guichenotia ledifolia* \shrub\2\i
Veg. Condition Very Good
Disturbance None obvious
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia xanthina</i>		2.5	35	
<i>Conostylis prolifera</i>		0.1	<1	
<i>Dodonaea aptera</i>		1.7	25	
<i>Grevillea argyrophylla</i>		1.8	5	
<i>Guichenotia ledifolia</i>		1	20	

<i>Lysiandra scabra</i>	0.4	<1
<i>Melaleuca cardiophylla</i>	1.8	20
<i>Thysanotus manglesianus</i>	1	<1

A2205

Staff LJA **Date** 18/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 307309 mE 6736112 mN **Lat.** -29.4897 **Long.** 115.0124
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type None
Loose Rock 0 % cover **Litter** 30 % cover ; <1 cm in depth
Bare ground 55 % cover **Weeds** 0 % cover
Vegetation U+ ^*Eucalyptus foecunda* subsp. *aeolica*, ^*Eucalyptus zopherophloia* ^mallee shrub\6\c;M
^^*Acacia rostelifera*, *Melaleuca cardiophylla*, *Olearia axillaris* ^shrub\4\i; G ^*Beyeria cinerea* subsp.
cinerea, ^*Acacia idiomorpha* ^shrub\2\i
Veg. Condition Excellent
Disturbance None evident
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia idiomorpha</i>		0.5	2	
<i>Acacia rostelifera</i>		4	6	
<i>Alyogyne hakeifolia</i>		1.5	<1	
<i>Austrostipa flavescens</i>		0.5	<1	

<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P 3	0.5	10
<i>Comesperma integerrimum</i>		1	<1
<i>Commersonia borealis</i>		0.3	<1
<i>Cryptandra pungens</i>		0.5	<1
<i>Dodonaea aptera</i>		1	<1
<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P 2	3.5	30
<i>Eucalyptus zopherophloia</i>	P 4	3	3
<i>Guichenotia ledifolia</i>		0.4	<1
<i>Gyrostemon ramulosus</i>		2.5	1
<i>Lasiopetalum angustifolium</i>		0.8	<1
<i>Lysiandra scabra</i>		0.3	<1
<i>Melaleuca cardiophylla</i>		2	2
<i>Olearia axillaris</i>		1.5	2
<i>Rhagodia preissii</i> subsp. <i>obovata</i>		0.6	<1
<i>Templetonia retusa</i>		0.3	<1

A2206

Staff LJA **Date** 19/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 308128 mE 6734870 mN **Lat.** -29.5010 **Long.** 115.0206
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type Limestone
Loose Rock 2-10 % cover; 20-60 mm in size **Litter** 90 % cover ; <1 cm in depth
Bare ground 5 % cover **Weeds** 80 % cover
Vegetation M+ ^{^^}*Acacia rostellifera*, *Melaleuca huegelii* subsp. *huegelii*, *Commersonia borealis* [^]shrub\4\d;G
^{^^}*Ehrharta longiflora*, *Vulpia myuros* forma *myuros*, *Reichardia tingitana* [^]other grass, forb\2\d
Veg. Condition Degraded
Disturbance Grazed; feral goat camp
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		4	40	
<i>Alyogyne huegelii</i>		3	<1	
<i>Austrostipa flavescens</i>		0.6	<1	
* <i>Bromus diandrus</i>		0.3	<1	
<i>Calandrinia calyptрата</i>		0.1	<1	

<i>Commersonia borealis</i>	1.5	5
* <i>Ehrharta longiflora</i>	0.3	40
<i>Grevillea argyrophylla</i>	2	2
<i>Lasiopetalum angustifolium</i>	1.5	2
<i>Melaleuca cardiophylla</i>	2	1
<i>Melaleuca huegelii</i> subsp. <i>huegelii</i>	4	35
<i>Pimelea microcephala</i>	1.8	3
* <i>Polycarpon tetraphyllum</i>	0.1	2
* <i>Reichardia tingitana</i>	0.3	2
* <i>Vulpia myuros</i> forma <i>myuros</i>	0.1	30

A2207

Staff LJA **Date** 19/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 308046 mE 6733422 mN **Lat.** -29.5141 **Long.** 115.0195
Habitat Lower-Slope
Aspect SW **Slope** Very Gentle
Soil Type Yellow grey sand
Rock Type Limestone
Loose Rock 2-10 % cover; 60-200 mm in size **Litter** 65 % cover ; <1 cm in depth
Bare ground 10 % cover **Weeds** 0 % cover
Vegetation M+ *Banksia leptophylla* var. *melletica*, *Banksia sessilis* var. *cygnorum*, *Hakea trifurcata* \^shrub\3\i; G *Melaleuca leuropoma*, *Scholtzia umbellifera*, *Mesomelaena pseudostygia* \^shrub, sedge\2\c
Veg. Condition Excellent
Disturbance None obvious
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>		0.2	<1	
<i>Acacia spathulifolia</i>		1.2	2	
<i>Allocasuarina humilis</i>		0.7	1	
<i>Austrostipa flavescens</i>		0.6	<1	

<i>Austrostipa macalpinei</i>	0.3	<1
<i>Banksia leptophylla</i> var. <i>melletica</i>	1.5	8
<i>Banksia sessilis</i> var. <i>cygnorum</i>	1.8	5
<i>Bossiaea eriocarpa</i>	0.5	3
<i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i>	0.6	1
<i>Cassytha ?glabella</i>	0.4	<1
<i>Cyperaceae</i> sp.	0.2	<1
<i>Daviesia pedunculata</i>	0.2	<1
<i>Desmocladus asper</i>	0.1	1
<i>Eremaea beaufortioides</i> var. <i>microphylla</i>	1.3	4
<i>Gastrolobium oxylobioides</i>	0.7	<1
<i>Hakea trifurcata</i>	1.7	3
<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>	0.3	2
<i>Jacksonia calcicola</i>	1.5	<1
<i>Labichea cassioides</i>	0.4	4
<i>Lepidobolus chaetocephalus</i>	0.4	1
<i>Lepidosperma calcicola</i>	0.4	3
<i>Leucopogon inflexus</i>	0.6	1
<i>Melaleuca leuropoma</i>	0.6	10
<i>Mesomelaena pseudostygia</i>	0.4	4
<i>Petrophile axillaris</i>	0.3	<1
<i>Scholtzia umbellifera</i>	0.5	6
<i>Stenanthemum notiale</i>	0.1	2
<i>Synaphea spinulosa</i> subsp. <i>spinulosa</i>	0.3	<1

A2208

Staff LJA **Date** 20/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 309194 mE 6735505 mN **Lat.** -29.4955 **Long.** 115.0318
Habitat Upper-Slope
Aspect **Slope** Very Gentle
Soil Type Grey sand
Rock Type Limestone
Loose Rock ; 20-60 mm in size **Litter** 90 % cover ; <1 cm in depth
Bare ground 2 % cover **Weeds** 95 % cover
Vegetation M+ ^Acacia rostellifera, Commersonia borealis, Melaleuca lanceolata\^shrub\4\c;G ^Ehrharta longiflora, ^Bromus diandrus, Acanthocarpus canaliculatus\^other grass, forb\1\d
Veg. Condition Degraded
Disturbance Historically grazed, probably cleared
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		5	25	
<i>Acanthocarpus canaliculatus</i>		0.3	2	
* <i>Arctotheca calendula</i>		0.1	2	
<i>Austrostipa flavescens</i>		0.5	1	
* <i>Brassica tournefortii</i>		0.3	<1	

<i>*Bromus diandrus</i>		0.3	10	
<i>Clematicissus angustissima</i>		0.2	<1	
<i>Commersonia borealis</i>		1.5	20	
<i>*Ehrharta longiflora</i>		0.3	80	
<i>Eucalyptus zopherophloia</i>	P 4	2	<1	1
<i>*Lolium multiflorum</i>		0.2	<1	
<i>Melaleuca huegelii</i> subsp. <i>huegelii</i>		1	<1	
<i>Melaleuca lanceolata</i>		4	3	
<i>*Petrohragia dubia</i>		0.3	<1	
<i>*Polycarpon tetraphyllum</i>		0.1	<1	
<i>*Reichardia tingitana</i>		0.3	<1	
<i>*Sonchus oleraceus</i>		0.3	<1	

A2209

Staff LJA **Date** 20/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 309199 mE 6734839 mN **Lat.** -29.5015 **Long.** 115.0317
Habitat Upper-Slope
Aspect S **Slope**
Soil Type Grey sand
Rock Type Limestone
Loose Rock 10-20 % cover; 60-200 mm in size **Litter** 70 % cover ; <1 cm in depth
Bare ground 40 % cover **Weeds** 20 % cover
Vegetation M+ ^Melaleuca cardiophylla,^Acacia xanthina\^shrub\4\c;G ^^Ehrharta longiflora,Guichenotia ledifolia,Petrorhagia dubia\^other grass,shrub,forb\2\r
Veg. Condition Good
Disturbance Grazed (feral goats)
Fire Age 5-10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia xanthina</i>		4	20	
<i>Acanthocarpus canaliculatus</i>		0.3	1	
<i>Alyogyne hakeifolia</i>		1.5	<1	
<i>Austrostipa flavescens</i>		0.5	<1	
<i>Bossiaea eriocarpa</i>		0.3	1	

<i>*Bromus diandrus</i>		0.3	1	
<i>Calandrinia calyptata</i>		0.1	<1	
<i>Commersonia borealis</i>		1	1	
<i>Conostylis prolifera</i>		0.1	1	
<i>Diplolaena leemaniana</i>		1	2	
<i>*Ehrharta longiflora</i>		0.3	5	
<i>Eucalyptus zopherophloia</i>	P 4	1	1	8
<i>Grevillea argyrophylla</i>		1	<1	
<i>Guichenotia ledifolia</i>		1	3	
<i>Hibbertia subvaginata</i>		1	1	
<i>*Hypochaeris glabra</i>		0.2	<1	
<i>Lasiopetalum angustifolium</i>		1	<1	
<i>Lysiandra scabra</i>		0.3	<1	
<i>*Lysimachia arvensis</i>		0.3	2	
<i>*Medicago truncatula</i>		0.2	<1	
<i>Melaleuca cardiophylla</i>		1.5	60	
<i>*Minuartia mediterranea</i>		0.3	<1	
<i>*Petrohragia dubia</i>		0.3	2	
<i>Ptilotus gaudichaudii</i>		0.3	<1	
<i>*Reichardia tingitana</i>		0.3	<1	
<i>Styphelia insularis</i>		0.5	<1	
<i>Trachymene cyanopetala</i>		0.1	<1	
<i>*Trifolium fragiferum</i>		0.3	<1	
<i>*Vulpia myuros forma myuros</i>		0.2	2	
<i>Waitzia suaveolens</i>		0.2	<1	

A2210

Staff LJA **Date** 20/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 309270 mE 6733895 mN **Lat.** -29.5100 **Long.** 115.0322
Habitat Crest
Aspect N/A **Slope** N/A
Soil Type Yellow grey sand
Rock Type Limestone
Loose Rock 2-10 % cover; 60-200 mm in size **Litter** 10 % cover ; <1 cm in depth
Bare ground 60 % cover **Weeds** <1 % cover
Vegetation M+ *Melaleuca cardiophylla*, *Banksia sessilis* var. *cygnorum*, *Melaleuca systema* ^{shrub}; *G*
Hibbertia subvaginata, *Scholtzia umbellifera*, *Hibbertia hypericoides* subsp.
septentrionalis ^{shrub}

Veg. Condition Very Good
Disturbance Likely historically grazed
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia spathulifolia</i>		1.8	2	
<i>Acacia xanthina</i>		2	1	
<i>Austrostipa flavescens</i>		0.4	<1	
<i>Austrostipa macalpinei</i>		0.3	<1	

<i>Banksia sessilis</i> var. <i>cygnorum</i>	2	4
<i>Bossiaea eriocarpa</i>	0.6	2
<i>Cassutha aurea</i>	2	<1
<i>Comesperma integerrimum</i>	1.4	<1
<i>Conostylis prolifera</i>	0.1	1
<i>Desmocladius asper</i>	0.1	3
<i>Gompholobium tomentosum</i>	0.4	<1
<i>Guichenotia ledifolia</i>	0.8	<1
<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>	0.6	4
<i>Hibbertia subvaginata</i>	0.8	5
* <i>Hypochaeris glabra</i>	0.3	<1
<i>Labichea cassioides</i>	0.6	3
<i>Lepidosperma calcicola</i>	0.3	<1
<i>Lysiandra calycina</i>	1.2	<1
* <i>Lysimachia arvensis</i>	0.2	<1
<i>Melaleuca cardiophylla</i>	3.5	20
<i>Melaleuca leuropoma</i>	0.6	2
<i>Melaleuca systema</i>	1.5	4
<i>Rhagodia preissii</i> subsp. <i>obovata</i>	0.5	<1
<i>Scholtzia umbellifera</i>	1	4
<i>Stenanthemum notiale</i>	0.2	<1
<i>Styphelia insularis</i>	0.5	<1
* <i>Ursinia anthemoides</i>	0.2	<1
* <i>Wahlenbergia capensis</i>	0.3	<1
<i>Waitzia suaveolens</i>	0.3	<1

A2211

Staff LJA **Date** 20/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 309219 mE 6733137 mN **Lat.** -29.5168 **Long.** 115.0316
Habitat Lower-Slope
Aspect SW **Slope** Very Gentle
Soil Type Yellow sand
Rock Type None
Loose Rock **Litter** 70 % cover ; 1-2 cm in depth
Bare ground 20 % cover **Weeds** <1 % cover
Vegetation U+ *Banksia prionotes* tree; *Banksia leptophylla* var. *melletica*, *Acacia saligna* shrub; *Stenanthemum notiale*, *Hibbertia hypericoides* subsp. *septentrionalis*, *Jacksonia calcicola* shrub
Veg. Condition Very Good
Disturbance None obvious
Fire Age >10 years
Notes Lots of seedlings including *Banksia* and *Jacksonia*



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia saligna</i>		2.5	4	
<i>Acacia spathulifolia</i>			4	
<i>Austrostipa elegantissima</i>		1	<1	
<i>Austrostipa macalpinei</i>		0.3	<1	

<i>Banksia leptophylla</i> var. <i>melletica</i>	1.8	10
<i>Banksia prionotes</i>	3	10
<i>Banksia sessilis</i> var. <i>cygnorum</i>	2	4
<i>Beaufortia aestiva</i>	0.8	1
<i>Bossiaea eriocarpa</i>	1.2	2
<i>Desmocladius asper</i>	0.1	<1
<i>Drosera humilis</i>	0.05	<1
<i>Guichenotia ledifolia</i>	1.3	<1
<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>	0.4	5
<i>Jacksonia calcicola</i>	0.5	4
<i>Lepidobolus chaetocephalus</i>	0.3	<1
<i>Lepidosperma calcicola</i>	0.3	<1
<i>Levenhookia octomaculata</i>	0.02	<1
<i>Melaleuca leuropoma</i>	0.6	3
<i>Neurachne alopecuroidea</i>	0.4	<1
<i>Opercularia spermacocea</i>	0.3	<1
<i>Poranthera microphylla</i>	0.02	<1
<i>Scaevola lanceolata</i>	0.2	<1
<i>Schoenus nanus</i>	0.03	<1
<i>Stenanthemum notiale</i>	0.1	8
<i>Styphelia insularis</i>	1.2	1
<i>Thysanotus manglesianus</i>	0.4	<1
<i>Thysanotus triandrus</i>	0.03	<1
<i>Trachymene cyanopetala</i>	0.1	<1

A2212

Staff LJA **Date** 21/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 307452 mE 6735410 mN **Lat.** -29.4961 **Long.** 115.0138
Habitat Lower-Slope
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type Limestone
Loose Rock 0 % cover **Litter** 40 % cover ; <1 cm in depth
Bare ground 30 % cover **Weeds** 0 % cover
Vegetation U+ ^*Eucalyptus obtusiflora*^tree mallee\6\c;M ^*Melaleuca cardiophylla*,^*Dodonaea aptera*^shrub\3\r;G ^*Acanthocarpus canaliculatus*,^*Beyeria cinerea* subsp. *cinerea*^forb,shrub\1\i
Veg. Condition Excellent
Disturbance Likely burnt, some clearing for old tracks
Fire Age 5-10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia idiomorpha</i>		0.4	<1	
<i>Acacia xanthina</i>		0.8	<1	
<i>Acanthocarpus canaliculatus</i>		0.4	6	
<i>Austrostipa flavescens</i>		0.6	<1	
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P 3	0.4	5	65

<i>Dodonaea aptera</i>	1	1
<i>Eucalyptus obtusiflora</i>	4	70
<i>Guichenotia ledifolia</i>	0.5	<1
<i>Melaleuca cardiophylla</i>	1.2	2
<i>Rhagodia preissii</i> subsp. <i>obovata</i>	0.3	<1
<i>Templetonia retusa</i>	0.3	<1

A2213

Staff LJA **Date** 21/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 307662 mE 6732984 mN **Lat.** -29.5180 **Long.** 115.0155
Habitat Lower-Slope
Aspect E **Slope** Very Gentle
Soil Type Yellow sand
Rock Type None
Loose Rock 0 % cover **Litter** 60 % cover ; <1 cm in depth
Bare ground 30 % cover **Weeds** <1 % cover
Vegetation M+ *Acacia spathulifolia*, *Banksia leptophylla* var. *melletica*, *Banksia sessilis* var. *cygnorum* \^shrub\3\c; G *Hibbertia hypericoides* subsp. *septentrionalis*, *Desmocladius asper*, *Labichea cassioides* \^shrub, sedge\2\c
Veg. Condition Excellent
Disturbance None obvious
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia spathulifolia</i>		2	5	
<i>Austrostipa macalpinei</i>		0.3	<1	
<i>Banksia leptophylla</i> var. <i>melletica</i>		1.5	5	
<i>Banksia sessilis</i> var. <i>cygnorum</i>		2	4	

<i>Beaufortia aestiva</i>	1	<1
<i>Bossiaea eriocarpa</i>	0.8	2
<i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i>	1.2	2
<i>Calytrix strigosa</i>		<1
<i>Conostylis prolifera</i>	0.2	1
<i>Desmocladius asper</i>	0.2	10
<i>Dianella revoluta</i>	0.5	<1
<i>Ecdeiocolea monostachya</i>	1	1
<i>Guichenotia ledifolia</i>	1.2	2
<i>Hakea lissocarpa</i>	1	<1
<i>Hakea trifurcata</i>	1.2	2
<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>	0.5	10
<i>Isotoma hypocrateriformis</i>	0.2	<1
<i>Jacksonia calcicola</i>	1.2	2
<i>Labichea cassioides</i>	0.7	4
<i>Lepidosperma calcicola</i>	0.3	1
<i>Melaleuca cardiophylla</i>	1.4	<1
<i>Melaleuca huegelii</i> subsp. <i>huegelii</i>	1.3	<1
<i>Melaleuca leuropoma</i>	0.3	<1
<i>Melaleuca systema</i>	1.3	2
<i>Neurachne alopecuroidea</i>	0.1	<1
<i>Scholtzia umbellifera</i>	0.4	<1
<i>Sphaerolobium gracile</i>	0.1	<1
<i>Stenanthemum notiale</i>	0.1	2
<i>Styphelia insularis</i>	1	2
<i>Thysanotus triandrus</i>	0.02	<1
<i>Xanthorrhoea ?drummondii</i>	1.5	1

A2214

Staff LJA **Date** 21/10/2022 **Season** A
Revisit
Type Q 10 m x 10 m
Location Arrowsmith
MGA Zone 50 309118 mE 6733031 mN **Lat.** -29.5178 **Long.** 115.0305
Habitat Lower-Slope
Aspect S **Slope** Very Gentle
Soil Type Yellow sand
Rock Type None
Loose Rock 0 % cover **Litter** 25 % cover ; 1-5 cm in depth
Bare ground 35 % cover **Weeds** <1 % cover
Vegetation U ^*Banksia prionotes*^tree\6\r;M+ ^^*Banksia leptophylla* var. *melletica*,*Hakea trifurcata*,*Jacksonia calcicola*^shrub\3\c;G ^^*Scaevola ?sericophylla*,*Stenanthemum notiale*,*Desmocladus asper*^shrub,sedge\1\c
Veg. Condition Very Good
Disturbance Unknown
Fire Age >10 years
Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		1	<1	
<i>Austrostipa elegantissima</i>		0.6	<1	
<i>Austrostipa flavescens</i>		0.5	<1	
<i>Austrostipa macalpinei</i>		0.3	<1	

<i>Banksia leptophylla</i> var. <i>melletica</i>	1.8	20
<i>Banksia prionotes</i>	3	6
<i>Calytrix strigosa</i>	0.2	2
<i>Conospermum stoechadis</i>	1.3	2
<i>Conostylis candicans</i> subsp. <i>calcicola</i>	0.4	1
<i>Desmocladius asper</i>	0.1	2
<i>Dianella revoluta</i>	0.4	<1
<i>Drosera humilis</i>	0.03	<1
<i>Hakea costata</i>	0.8	1
<i>Hakea trifurcata</i>	1.5	3
<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>	0.3	<1
* <i>Hypochaeris glabra</i>	0.1	<1
<i>Jacksonia calcicola</i>	1.2	2
<i>Lepidobolus chaetocephalus</i>	0.3	2
<i>Lepidosperma calcicola</i>	0.3	1
<i>Levenhookia octomaculata</i>	0.03	<1
* <i>Lysimachia arvensis</i>	0.1	<1
<i>Melaleuca leuropoma</i>	0.3	<1
<i>Mesomelaena pseudostygia</i>	0.5	<1
<i>Neurachne alopecuroidea</i>	0.3	<1
<i>Petrophile axillaris</i>	1	<1
<i>Poranthera microphylla</i>	0.03	<1
<i>Scaevola ?sericophylla</i>	0.5	5
<i>Scaevola lanceolata</i>	0.2	<1
<i>Stenanthemum notiale</i>	0.1	5
<i>Thysanotus triandrus</i>	0.03	1
<i>Trachymene cyanopetala</i>	0.1	<1
<i>Wahlenbergia gracilentia</i>	0.2	<1

A22001

Staff LJA **Date** 17/10/2022 **Season**
Revisit
Type V
Location
MGA Zone mE mN **Lat.** **Long.**
Habitat
Aspect **Slope**
Soil Type
Rock Type
Loose Rock **Litter**
Bare ground **Weeds**
Vegetation U+ ^*Eucalyptus zopherophloia*,^*Eucalyptus erythrocorys*\^mallee shrub,tree mallee\6\i;M
^*Olearia axillaris*,*Melaleuca cardiophylla*,*Acacia rostellifera*\^shrub\3\i;G ^^*Hibbertia subvaginata*,
Diplolaena leemaniana,*Conostylis prolifera*\^shrub,forb\2\c
Veg. Condition Good
Disturbance
Fire Age
Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		2	2	
<i>Conostylis prolifera</i>		0.3	15	
<i>Diplolaena leemaniana</i>		0.7	15	
<i>Eucalyptus erythrocorys</i>		4	4	

<i>Eucalyptus zopherophloia</i>	P 4	3.5	10
<i>Hibbertia subvaginata</i>		0.6	20
<i>Melaleuca cardiophylla</i>		2	2
<i>Olearia axillaris</i>		2	10

Melaleuca lanceolata

2

2

A22003

Staff LJA **Date** 19/10/2022 **Season** A
Revisit
Type V
Location
MGA Zone 50 308297 mE 6733383 mN **Lat.** -29.5145 **Long.** 115.0221
Habitat
Aspect **Slope**
Soil Type
Rock Type
Loose Rock **Litter**
Bare ground **Weeds**
Vegetation U ^*Eucalyptus erythrocorys*\^tree\6\r;M+ ^*Melaleuca cardiophylla*\^shrub\4\c;G ^*Bossiaea eriocarpa*,^*Styphelia insularis*\^shrub\2\i

Veg. Condition Good

Disturbance

Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Bossiaea eriocarpa</i>		0.6	7	
<i>Eucalyptus erythrocorys</i>		4	3	
<i>Melaleuca cardiophylla</i>		5	60	
<i>Styphelia insularis</i>		0.5	4	

A22004

Staff LJA **Date** 19/10/2022 **Season** A
Revisit
Type V
Location
MGA Zone 50 308127 mE 6733293 mN **Lat.** -29.5153 **Long.** 115.0204
Habitat
Aspect **Slope**
Soil Type
Rock Type
Loose Rock **Litter**
Bare ground **Weeds**
Vegetation M+ ^{^^}Melaleuca cardiophylla, Acacia spathulifolia, Banksia sessilis var. cygnorum[^]shrub\3\c;G
^{^^}Grevillea preissii, Guichenotia ledifolia, Styphelia insularis[^]shrub\2\c
Veg. Condition Excellent
Disturbance
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia spathulifolia</i>		1.4	20	
<i>Banksia sessilis</i> var. <i>cygnorum</i>		2	2	
<i>Grevillea preissii</i>		0.6	10	
<i>Guichenotia ledifolia</i>		0.5	5	
<i>Melaleuca cardiophylla</i>		2	20	

Styphelia insularis

0.5

5

A22005

Staff LJA **Date** 20/10/2022 **Season** A
Revisit
Type V
Location
MGA Zone 50 308706 mE 6734545 mN **Lat.** -29.5041 **Long.** 115.0266
Habitat
Aspect **Slope**
Soil Type
Rock Type
Loose Rock **Litter**
Bare ground **Weeds**
Vegetation U+ ^*Eucalyptus erythrocorys*,^*Eucalyptus foecunda* subsp. *aeolica*^tree,mallee shrub\6\r;M
^*Acacia spathulifolia*^shrub\3\c;G ^*Bossiaea eriocarpa*^shrub\2\c
Veg. Condition Very Good
Disturbance
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia spathulifolia</i>		1.8	30	
<i>Bossiaea eriocarpa</i>		0.6	40	
<i>Eucalyptus erythrocorys</i>		6	5	
<i>Eucalyptus foecunda</i> subsp. <i>aeolica</i>	P 2	3	2	

A22008

Staff LJA **Date** 20/10/2022 **Season**
Revisit
Type V
Location
MGA Zone 50 308669 mE 6733529 mN **Lat.** -29.5132 **Long.** 115.0260
Habitat
Aspect **Slope**
Soil Type
Rock Type
Loose Rock **Litter**
Bare ground **Weeds**
Vegetation U+ ^*Eucalyptus erythrocorys*^tree\6\r;M ^^*Melaleuca cardiophylla*,*Calothamnus quadrifidus*
 subsp. *angustifolius*,*Banksia sessilis* var. *cygnorum*^shrub\4\c;G ^*Bossiaea eriocarpa*,^*Dioscorea*
hastifolia^shrub,vine\2\i
Veg. Condition Very Good

Disturbance**Fire Age****Notes**

Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Banksia sessilis</i> var. <i>cygnorum</i>		2	3	
<i>Bossiaea eriocarpa</i>		0.5	5	
<i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i>		2	5	
<i>Dioscorea hastifolia</i>		1	2	

<i>Eucalyptus erythrocorys</i>	5	8
<i>Melaleuca cardiophylla</i>	3.5	30

A22009

Staff LJA **Date** 20/10/2022 **Season**
Revisit
Type V
Location
MGA Zone 50 308745 mE 6733559 mN **Lat.** -29.5129 **Long.** 115.0268
Habitat
Aspect **Slope**
Soil Type
Rock Type
Loose Rock **Litter**
Bare ground **Weeds**
Vegetation M+ [^]*Banksia sessilis* var. *cygnorum*, *Acacia spathulifolia*, *Styphelia insularis* [^]shrub\3\c;G
[^]*Hibbertia hypericoides* subsp. *septentrionalis*, *Desmocladius asper*, *Conostylis prolifera* [^]shrub,
sedge, forb\2\i
Veg. Condition Excellent
Disturbance
Fire Age
Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia spathulifolia</i>		1.5	8	
<i>Banksia sessilis</i> var. <i>cygnorum</i>		2	15	
<i>Conostylis prolifera</i>		0.3	4	
<i>Desmocladius asper</i>		0.3	5	

<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>	0.6	10
<i>Styphelia insularis</i>	1.4	6

A22010

Staff LJA **Date** 21/10/2022 **Season**
Revisit
Type V
Location
MGA Zone 50 307723 mE 6733913 mN **Lat.** -29.5096 **Long.** 115.0163
Habitat
Aspect **Slope**
Soil Type
Rock Type
Loose Rock **Litter**
Bare ground **Weeds**
Vegetation M+ ^Acacia rostellifera,Melaleuca cardiophylla,Melaleuca huegelii subsp. huegelii^shrub\4\;G
^Guichenotia ledifolia^shrub\2\r
Veg. Condition Excellent
Disturbance
Fire Age
Notes Occasional mallee clumps



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia rostellifera</i>		4	20	
<i>Guichenotia ledifolia</i>		0.6	2	
<i>Melaleuca cardiophylla</i>		2	25	
<i>Melaleuca huegelii</i> subsp. <i>huegelii</i>		2	35	

A22011

Staff LJA **Date** 21/10/2022 **Season** A
Revisit
Type V
Location
MGA Zone 50 307537 mE 6733025 mN **Lat.** -29.5176 **Long.** 115.0142
Habitat
Aspect **Slope**
Soil Type
Rock Type
Loose Rock **Litter**
Bare ground **Weeds**
Vegetation U ^*Eucalyptus erythrocorys*\^tree\6\bi;M+ ^*Melaleuca cardiophylla*,^*Dodonaea aptera*\^shrub\4\i;
G ^*Lasiopetalum angustifolium*,^*Bossiaea eriocarpa*,*Styphelia insularis*\^shrub\2\i
Veg. Condition Excellent
Disturbance
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Bossiaea eriocarpa</i>		0.6	2	
<i>Dodonaea aptera</i>		1.8	2	
<i>Eucalyptus erythrocorys</i>		4	<1	
<i>Lasiopetalum angustifolium</i>		1	10	
<i>Melaleuca cardiophylla</i>		4	70	

Styphelia insularis

0.5

2

A22012

Staff LJA **Date** 21/10/2022 **Season**
Revisit
Type V
Location
MGA Zone 50 309652 mE 6733211 mN **Lat.** -29.5162 **Long.** 115.0361
Habitat
Aspect **Slope**
Soil Type
Rock Type
Loose Rock **Litter**
Bare ground **Weeds**
Vegetation M+ *Callitris pyramidalis*, *Acacia spathulifolia*, *Calothamnus quadrifidus* subsp. *angustifolius* \^shrub\4i; G *Scholtzia umbellifera*, *Melaleuca leuropoma*, *Hibbertia hypericoides* subsp. *septentrionalis* \^shrub\2i
Veg. Condition Excellent
Disturbance
Fire Age
Notes Sparse *Banksia sessilis*; decreasing *Banksia leptophylla* along access to west



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia spathulifolia</i>		1.5	6	
<i>Callitris pyramidalis</i>		2.5	12	
<i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i>		1.4	2	
<i>Hibbertia hypericoides</i> subsp. <i>septentrionalis</i>		0.5	2	

<i>Melaleuca leuropoma</i>	1	3
<i>Scholtzia umbellifera</i>	0.6	6

A22013

Staff LJA **Date** 21/10/2022 **Season**
Revisit
Type V
Location
MGA Zone 50 309746 mE 6733309 mN **Lat.** -29.5154 **Long.** 115.0371
Habitat
Aspect **Slope**
Soil Type
Rock Type
Loose Rock **Litter**
Bare ground **Weeds**
Vegetation U+ ^*Banksia prionotes*,^*Eucalyptus obtusiflora*^tree,tree mallee\6\r;M ^^*Callitris pyramidalis*,
Banksia leptophylla var. *melletica*,*Calothamnus quadrifidus* subsp. *angustifolius*^shrub\4\r;G
^*Melaleuca leuropoma*^shrub\2\r
Veg. Condition Very Good
Disturbance
Fire Age
Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Banksia leptophylla</i> var. <i>melletica</i>		2	4	
<i>Banksia prionotes</i>		5	5	
<i>Callitris pyramidalis</i>		4	12	
<i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i>		1.5	2	

Eucalyptus obtusiflora

6

4

Melaleuca leuropoma

0.5

5

APPENDIX SEVEN DBCA REPORT FORMS



Threatened and Priority Flora Report Form

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants

TAXON: <u>Beyeria cinerea subsp. cinerea</u>		TPFL Pop. No.: _____
OBSERVATION DATE: <u>18/10/2022</u>	CONSERVATION STATUS: <u>P3</u>	New population <input type="checkbox"/>
OBSERVER/S: <u>Lyn Atkins</u>	PHONE <u>94308955</u>	
ROLE: <u>Principal Ecologist</u>	ORGANISATION: <u>Ecoscape</u>	
EMAIL: <u>lyna@ecoscape.com.au</u>		

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
Infinite Green Energy site; cnr Brand Highway and Indian Ocean Drive, Arrowsmith
Approximately 28 km south of Dongara

DBC DISTRICT: <u>Midwest Region</u>		LGA: <u>Irwin</u>	Reserve No.: _____	Land manager present: <input type="checkbox"/>
DATUM:	COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:	
GDA94 / MGA94 <input checked="" type="checkbox"/>	DecDegrees x	DegMinSec <input type="checkbox"/>	UTMs <input type="checkbox"/>	GPS x
AGD84 / AMG84 <input type="checkbox"/>	Lat / Northing: <u>6736111.6</u>			Differential GPS <input type="checkbox"/>
WGS84 <input type="checkbox"/>	Long / Easting: <u>307309.005</u>			Map <input type="checkbox"/>
Unknown <input type="checkbox"/>	ZONE: <u>50</u>			No. satellites: _____
				Map used: _____
				Boundary polygon captured: <input type="checkbox"/>
				Map scale: _____
LAND TENURE:				
Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property x	Rail reserve <input type="checkbox"/>	Shire road reserve <input type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input type="checkbox"/>	MRWA road reserve <input type="checkbox"/>	Other Crown reserve <input type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/>	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey Partial survey x Full survey Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual Extrapolation Estimate x Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants x Clumps Clonal stems

TOTAL POP'N STRUCTURE:	Mature:	Juveniles:	Seedlings:	Totals:	Area of pop (m ²): _____ Note: Pls record count as numbers (not percentages) for database.
	Alive	2,250			
Dead					

QUADRATS PRESENT: No. _____ Size _____ Data attached Total area of quadrats (m²): _____

Summary Quad. Totals: Alive

REPRODUCTIVE STATE:	Clonal <input type="checkbox"/>	Vegetative <input type="checkbox"/>	Flowerbud <input type="checkbox"/>	Flower <input type="checkbox"/>
	Immature fruit <input type="checkbox"/>	Fruit <input type="checkbox"/>	Dehisced fruit <input type="checkbox"/>	Percentage in flower: _____ %

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
•	_____	_____	_____
•	_____	_____	_____
•	_____	_____	_____



Threatened and Priority Flora Report Form

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand x	Red <input type="checkbox"/>	Well drained x
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown x	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% x	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone x	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey x	
Flat <input type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression x	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					

Specific **Landform** Element: Dune swale
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry x Moist Waterlogged Inundated

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
2. Open shrubland (Hibbertia sp., Acacia spp.);
3. Isolated clumps of sedges (M.tetragona)

1. *Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland
2. *Melaleuca cardiophylla*, *Acacia rostelifera* and *Olearia axillaris* mid open shrubland
3. *Beyeria cinerea* subsp. *cinerea*, *Acanthocarpus canaliculatus* and *Diplolaena leemaniana* low open shrubland
- 4.

ASSOCIATED SPECIES:

Other (non-dominant) spp

Acacia idiomorpha, *Alyogyne hakeifolia*, *Austrostipa flavescens*, *Commersonia borealis*, *Conostylis prolifera*, *Cryptandra pungens*, *Dodonaea aptera*, *Eucalyptus erythrocorys*, *Eucalyptus foecunda* subsp. *aeolica* (P2), *Guichenotia ledifolia*, *Hibbertia subvaginata*, *Lasiopetalum angustifolium*, *Lysiandra scabra*, *Rhagodia preissii* subsp. *obovata*, *Templetonia retusa*

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent x Very good x Good Degraded Completely degraded

COMMENT: Characteristic species in some patches of dune swale mallee vegetation. Not present in all mallee patches.

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire x

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Estimated 10-20% of total population included in count. Not all records included in table below.

Locations:

Number of plants	Easting	Northing	Date
not counted	307309.005	6736111.6	18/10/2022
65	307452.22	6735409.933	21/10/2022
3	307221.989	6736083.838	18/10/2022
20	307235.333	6736091.938	18/10/2022
5	307237.181	6736091.637	18/10/2022
10	307238.088	6736089.657	18/10/2022
2	307253.105	6736096.343	18/10/2022
4	307289.912	6736093.646	18/10/2022
10	307298.717	6736089.251	18/10/2022
50	307308.351	6736087.42	18/10/2022
30	307310.07	6736060.62	18/10/2022
30	307297.015	6736029.909	18/10/2022
50	307304.534	6736015.624	18/10/2022
40	307331.834	6736007.332	18/10/2022
20	307378.24	6736021.872	18/10/2022
30	307393.868	6736038.215	18/10/2022

Please return completed form to **Species And Communities Program DBCA,**

Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Program.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

40	307407.361	6736054.632	18/10/2022
100	307390.125	6736064.315	18/10/2022
30	307367.157	6736068.801	18/10/2022
30	307352.003	6736081.514	18/10/2022
50	307316.65	6736112.618	18/10/2022
300	307436.326	6735335.381	21/10/2022
200	307417.816	6735357.238	21/10/2022
300	307430.426	6735379.849	21/10/2022
40	307462.763	6735371.864	21/10/2022
300	307494.934	6735379.287	21/10/2022

Photo:



FLORA AUTHORISATION / LICENCE No: FB62000003-2 Note if only observing plants (i.e. no specimens or plant material is taken) then no authorisation/licence is required. For further information on authorisation and licencing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under authorisations/licences should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: WA Herb. Regional Herb. District Herb. Other: _____

LODGEMENT: WA Herb Lodgement No: _____ Known population: specimen lodgement not needed

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Lyn Atkins Role: Principal Ecologist Signed: _____ Date: 14/04/2023

Please return completed form to **Species And Communities Program DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Program.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

Version 1.4 March 2021

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants

TAXON: <u>Dampiera tephrea</u>		TPFL Pop. No.: _____	
OBSERVATION DATE: <u>18/10/2022</u>		CONSERVATION STATUS: <u>P3</u>	
OBSERVER/S: <u>Lyn Atkins</u>		PHONE <u>94308955</u>	
ROLE: <u>Principal Ecologist</u>		ORGANISATION: <u>Ecoscape</u>	
EMAIL: <u>lyna@ecoscape.com.au</u>			

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
Infinite Green Energy site; cnr Brand Highway and Indian Ocean Drive, Arrowsmith
Approximately 28 km south of Dongara

DBC DISTRICT: <u>Midwest Region</u>		LGA: <u>Irwin</u>		Reserve No.: _____		Land manager present: <input type="checkbox"/>	
DATUM:		COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:			
GDA94 / MGA94 <input checked="" type="checkbox"/>		DecDegrees x DegMinSec <input type="checkbox"/> UTM <input type="checkbox"/>		GPS <input checked="" type="checkbox"/>		Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>	
AGD84 / AMG84 <input type="checkbox"/>		Lat / Northing: <u>6734811.44</u>		No. satellites: _____		Map used: _____	
WGS84 <input type="checkbox"/>		Long / Easting: <u>309263.238</u>		Boundary polygon captured: <input type="checkbox"/>		Map scale: _____	
Unknown <input type="checkbox"/>		ZONE: <u>50</u>					
LAND TENURE:							
Nature reserve <input type="checkbox"/>		Timber reserve <input type="checkbox"/>		Private property <input checked="" type="checkbox"/>		Rail reserve <input type="checkbox"/>	
National park <input type="checkbox"/>		State forest <input type="checkbox"/>		Pastoral lease <input type="checkbox"/>		MRWA road reserve <input type="checkbox"/>	
Conservation park <input type="checkbox"/>		Water reserve <input type="checkbox"/>		UCL <input type="checkbox"/>		SLK/Pole _____ to _____	
						Shire road reserve <input type="checkbox"/>	
						Other Crown reserve <input type="checkbox"/>	
						Specify other: _____	

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input checked="" type="checkbox"/> Full survey <input type="checkbox"/>		Area observed (m ²): _____	
EFFORT: Time spent surveying (minutes): _____		No. of minutes spent / 100 m ² : _____	
POP'N COUNT ACCURACY: Actual <input type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input checked="" type="checkbox"/>		Count method: _____	
(Refer to field manual for list)			
WHAT COUNTED:		Plants <input checked="" type="checkbox"/> Clumps <input type="checkbox"/> Clonal stems <input type="checkbox"/>	
TOTAL POP'N STRUCTURE:			
		Mature: Juveniles: Seedlings: Totals:	
Alive		<u>197</u>	
Dead			
QUADRATS PRESENT:		No. _____ Size _____ Data attached <input type="checkbox"/> Total area of quadrats (m ²): _____	
Summary Quad. Totals: Alive			
REPRODUCTIVE STATE:		Clonal <input type="checkbox"/> Vegetative <input checked="" type="checkbox"/> Flowerbud <input type="checkbox"/> Flower <input type="checkbox"/>	
Immature fruit <input type="checkbox"/> Fruit <input checked="" type="checkbox"/> Dehisced fruit <input type="checkbox"/> Percentage in flower: _____ %			

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
•	_____	_____	_____
•	_____	_____	_____
•	_____	_____	_____



Threatened and Priority Flora Report Form

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input checked="" type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input checked="" type="checkbox"/>	Red <input type="checkbox"/>	Well drained <input checked="" type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown <input checked="" type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input checked="" type="checkbox"/>	Limestone <input checked="" type="checkbox"/>	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input checked="" type="checkbox"/>	
Flat <input type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
CONDITION OF SOIL:	Dry <input checked="" type="checkbox"/>	Moist <input type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
2. Open shrubland (Hibbertia sp., Acacia spp.);
3. Isolated clumps of sedges (M.tetragona)

1. Acacia rostelifera, Melaleuca cardiophylla and Melaleuca huegelii subsp. huegelii tall shrubland
2. *Vulpia myuros forma myuros, Guichenotia ledifolia and Conostylis prolifera low grassland/shrubland/forbland
- 3.
- 4.

ASSOCIATED SPECIES:

Austrostipa flavescens, *Avellinia michelii, Commersonia borealis, Desmocladius asper, *Erodium botrys, Grevillea argyrophylla, Scholtzia umbellifera, Trachymene pilosa

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 Australian Soil and Land Survey Field Handbook guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent Very good Good Degraded Completely degraded

COMMENT: Mostly along a fenceline in previously cleared areas or adjacent but few or none within uncleared vegetation

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Locations:

Number of plants	Easting	Northing	Date
7	309263.238	6734811.44	20/10/2022
3	309262.501	6734803.445	20/10/2022
3	309256.773	6734786.607	20/10/2022
5	309257.359	6734780.631	20/10/2022
8	309244.464	6734814.781	20/10/2022
8	309235.66	6734807.758	20/10/2022
10	309241.78	6734801.431	20/10/2022
70	309245.433	6734797.613	20/10/2022
80	309241.545	6734786.682	20/10/2022
2	307496.785	6734793.722	21/10/2022
1	309706.512	6733199.633	21/10/2022

Photo:

Please return completed form to **Species And Communities Program DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Program.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form



FLORA AUTHORISATION / LICENCE No: FB62000003-2 Note if only observing plants (i.e. no specimens or plant material is taken) then no authorisation/licence is required. For further information on authorisation and licencing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under authorisations/licences should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: 4755-22- WA Herb. Regional Herb. District Herb. Other: _____
FI-80

LODGEMENT: WA Herb Lodgement No: TBA

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Lyn Atkins Role: Principal Ecologist Signed: _____ Date: 13/04/2023

Please return completed form to **Species And Communities Program DBCA,**
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Program.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants

TAXON: <u>Eucalyptus foecunda subsp. aeolica</u>		TPFL Pop. No.: _____
OBSERVATION DATE: <u>18/10/2022</u>	CONSERVATION STATUS: <u>P2</u>	New population x
OBSERVER/S: <u>Lyn Atkins</u>	PHONE <u>94308955</u>	
ROLE: <u>Principal Ecologist</u>	ORGANISATION: <u>Ecoscape</u>	
EMAIL: <u>lyna@ecoscape.com.au</u>		

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
Infinite Green Energy site; cnr Brand Highway and Indian Ocean Drive, Arrowsmith
Approximately 28 km south of Dongara

DBC DISTRICT: <u>Midwest Region</u>		LGA: <u>Irwin</u>	Reserve No.: _____	Land manager present: <input type="checkbox"/>
DATUM:	COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:	
GDA94 / MGA94 x	DecDegrees x	DegMinSec <input type="checkbox"/>	UTMs <input type="checkbox"/>	GPS x
AGD84 / AMG84 <input type="checkbox"/>	Lat / Northing: <u>6736111.6</u>			Differential GPS <input type="checkbox"/>
WGS84 <input type="checkbox"/>	Long / Easting: <u>307309.005</u>			Map <input type="checkbox"/>
Unknown <input type="checkbox"/>	ZONE: <u>50</u>			No. satellites: _____
				Map used: _____
				Boundary polygon captured: <input type="checkbox"/>
				Map scale: _____
LAND TENURE:				
Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property x	Rail reserve <input type="checkbox"/>	Shire road reserve <input type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input type="checkbox"/>	MRWA road reserve <input type="checkbox"/>	Other Crown reserve <input type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/>	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey Partial survey x Full survey Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual Extrapolation Estimate Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants Clumps Clonal stems

TOTAL POP'N STRUCTURE:	Mature:	Juveniles:	Seedlings:	Totals:	Area of pop (m ²): _____ Note: Pls record count as numbers (not percentages) for database.
	Alive	Not recorded			
Dead					

QUADRATS PRESENT: No. _____ Size _____ Data attached Total area of quadrats (m²): _____

Summary Quad. Totals: Alive

REPRODUCTIVE STATE:	Clonal <input type="checkbox"/>	Vegetative <input type="checkbox"/>	Flowerbud <input type="checkbox"/>	Flower <input type="checkbox"/>
	Immature fruit <input type="checkbox"/>	Fruit <input type="checkbox"/>	Dehisced fruit <input type="checkbox"/>	Percentage in flower: _____ %

CONDITION OF PLANTS: Healthy x Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
•	_____	_____	_____
•	_____	_____	_____
•	_____	_____	_____



Threatened and Priority Flora Report Form

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand x	Red <input type="checkbox"/>	Well drained x
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown x	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone x	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey x	
Flat <input type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression x	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					

Specific **Landform** Element: Dune swale
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry x Moist Waterlogged Inundated

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
2. Open shrubland (Hibbertia sp., Acacia spp.);
3. Isolated clumps of sedges (M.tetragona)

1. *Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland
2. *Melaleuca cardiophylla*, *Acacia rostelifera* and *Olearia axillaris* mid open shrubland
3. *Beyeria cinerea* subsp. *cinerea*, *Acanthocarpus canaliculatus* and *Diplolaena leemaniana* low open shrubland
- 4.

ASSOCIATED SPECIES:

Other (non-dominant) spp

Acacia idiomorpha, *Alyogyne hakeifolia*, *Austrostipa flavescens*, *Commersonia borealis*, *Conostylis prolifera*, *Cryptandra pungens*, *Dodonaea aptera*, *Eucalyptus erythrocorys*, *Eucalyptus foecunda* subsp. *aolica* (P2), *Guichenotia ledifolia*, *Hibbertia subvaginata*, *Lasiopetalum angustifolium*, *Lysiandra scabra*, *Rhagodia preissii* subsp. *obovata*, *Templetonia retusa*

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent x Very good x Good x Degraded Completely degraded

COMMENT: _____

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire x

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.) _____

Locations

Easting	Northing	Date
307309.005	6736111.6	18/10/2022
308706.421	6734544.908	20/10/2022

Specimen scan: _____

Please return completed form to **Species And Communities Program DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Program.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form



FLORA AUTHORISATION / LICENCE No: FB62000003-2 Note if only observing plants (i.e. no specimens or plant material is taken) then no authorisation/licence is required. For further information on authorisation and licencing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under authorisations/licences should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: A2205-1 WA Herb. Regional Herb. District Herb. Other: _____

LODGE MENT: WA Herb Lodgement No: TBA

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Lyn Atkins Role: Principal Ecologist Signed: _____ Date: 14/04/2023

Please return completed form to **Species And Communities Program DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Program.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants

TAXON: <u>Eucalyptus zopherophloia</u>		TPFL Pop. No.: _____
OBSERVATION DATE: <u>17/10/2022</u>	CONSERVATION STATUS: <u>P4</u>	New population <input type="checkbox"/>
OBSERVER/S: <u>Lyn Atkins</u>	PHONE <u>94308955</u>	
ROLE: <u>Principal Ecologist</u>	ORGANISATION: <u>Ecoscape</u>	
EMAIL: <u>lyna@ecoscape.com.au</u>		

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
Infinite Green Energy site; cnr Brand Highway and Indian Ocean Drive, Arrowsmith
Approximately 28 km south of Dongara

DBC DISTRICT: <u>Midwest Region</u>	LGA: <u>Irwin</u>	Reserve No.: _____	Land manager present: <input type="checkbox"/>
DATUM:	COORDINATES: (If UTM coords provided, Zone is also required)	METHOD USED:	
GDA94 / MGA94 <input checked="" type="checkbox"/>	DecDegrees x DegMinSec <input type="checkbox"/> UTM <input type="checkbox"/>	GPS <input checked="" type="checkbox"/>	Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>
AGD84 / AMG84 <input type="checkbox"/>	Lat / Northing: <u>6735791.738</u>	No. satellites: _____	Map used: _____
WGS84 <input type="checkbox"/>	Long / Easting: <u>309002.818</u>	Boundary polygon captured: <input type="checkbox"/>	Map scale: _____
Unknown <input type="checkbox"/>	ZONE: <u>50</u>		
LAND TENURE:			
Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property <input checked="" type="checkbox"/>	Rail reserve <input type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input type="checkbox"/>	MRWA road reserve <input type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/> SLK/Pole _____ to _____	Shire road reserve <input type="checkbox"/>
			Other Crown reserve <input type="checkbox"/>
			Specify other: _____

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input checked="" type="checkbox"/> Full survey <input type="checkbox"/>	Area observed (m ²): _____
EFFORT: Time spent surveying (minutes): _____	No. of minutes spent / 100 m ² : _____
POP'N COUNT ACCURACY: Actual <input type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input type="checkbox"/>	Count method: _____
	(Refer to field manual for list)
WHAT COUNTED:	Plants <input checked="" type="checkbox"/> Clumps <input type="checkbox"/> Clonal stems <input type="checkbox"/>
TOTAL POP'N STRUCTURE:	Mature: Juveniles: Seedlings: Totals:
Alive	<u>639</u> _____ _____ _____
Dead	_____ _____ _____
QUADRATS PRESENT:	No. _____ Size _____ Data attached <input type="checkbox"/> Total area of quadrats (m ²): _____
Summary Quad. Totals: Alive	_____
REPRODUCTIVE STATE:	Clonal <input type="checkbox"/> Vegetative <input type="checkbox"/> Flowerbud <input type="checkbox"/> Flower <input type="checkbox"/>
	Immature fruit <input type="checkbox"/> Fruit <input type="checkbox"/> Dehisced fruit <input type="checkbox"/> Percentage in flower: _____ %

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
•	_____	_____	_____
•	_____	_____	_____
•	_____	_____	_____



Threatened and Priority Flora Report Form

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand x	Red <input type="checkbox"/>	Well drained x
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown x	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone x	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey x	
Flat <input type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression x	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					

Specific **Landform** Element: Dune swale
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry x Moist Waterlogged Inundated

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
2. Open shrubland (Hibbertia sp., Acacia spp.);
3. Isolated clumps of sedges (M.tetragona)

- Eucalyptus obtusiflora*, *Eucalyptus oraria* and *Eucalyptus zopherophloia* mid open mallee forest/mallee shrubland
- Melaleuca cardiophylla*, *Acacia rostelifera* and *Olearia axillaris* mid open shrubland
- Beyeria cinerea* subsp. *cinerea*, *Acanthocarpus canaliculatus* and *Diplolaena leemaniana* low open shrubland
-

ASSOCIATED SPECIES:

Other (non-dominant) spp

Acacia idiomorpha, *Alyogyne hakeifolia*, *Austrostipa flavescens*, *Commersonia borealis*, *Conostylis prolifera*, *Cryptandra pungens*, *Dodonaea aptera*, *Eucalyptus erythrocorys*, *Eucalyptus foecunda* subsp. *aeolica* (P2), *Guichenotia ledifolia*, *Hibbertia subvaginata*, *Lasiopetalum angustifolium*, *Lysiandra scabra*, *Rhagodia preissii* subsp. *obovata*, *Templetonia retusa*

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent x Very good x Good Degraded Completely degraded

COMMENT: Characteristic species in dune swale mallee vegetation

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire x

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Locations:

Number of plants	Easting	Northing	Date
Not counted	307309.005	6736111.6	18/10/2022
1	309194.48	6735504.737	20/10/2022
8	309199.342	6734839.184	20/10/2022
12	309002.818	6735791.738	17/10/2022
35	308989.14	6735814.788	17/10/2022
8	308992.469	6735738.458	17/10/2022
35	308973.882	6735742.134	17/10/2022
50	308969.428	6735764.565	17/10/2022
3	308845.169	6735730.973	17/10/2022
4	308380.979	6736523.879	18/10/2022
1	308376.87	6736554.519	18/10/2022
20	308364.933	6736554.871	18/10/2022
20	308355.144	6736520.115	18/10/2022
35	308326.971	6736551.233	18/10/2022
50	308344.56	6736589.337	18/10/2022
30	308376.475	6736623.471	18/10/2022
5	308399.937	6736664.114	18/10/2022

Please return completed form to **Species And Communities Program DBCA**,

Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Program.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

20	308401.366	6736791.301	18/10/2022
10	308389.066	6736892.978	18/10/2022
30	308383.032	6737711.063	18/10/2022
10	308288.346	6737774.201	18/10/2022
20	308300.26	6737786.709	18/10/2022
12	308141.853	6737871.712	18/10/2022
5	307932.848	6737874.366	18/10/2022
50	307497.89	6736598.425	18/10/2022
5	307938.893	6736037.642	18/10/2022
3	307983.865	6735937.076	18/10/2022
3	309194.815	6736706.189	19/10/2022
1	309240.175	6736759.949	19/10/2022
5	308690.319	6737570.156	19/10/2022
5	308090.564	6734250.068	19/10/2022
4	308169.578	6734200.193	19/10/2022
2	308273.216	6734247.744	19/10/2022
2	308328.719	6734285.828	19/10/2022
3	308287.319	6734245.323	19/10/2022
1	308157.854	6734153.984	19/10/2022
4	308127.558	6734162.005	19/10/2022
2	308118.172	6734126.59	19/10/2022
10	308094.982	6734132.958	19/10/2022
2	308105.185	6734165.948	19/10/2022

Photo:



FLORA AUTHORISATION / LICENCE No: FB62000003-2 Note if only observing plants (i.e. no specimens or plant material is taken) then no authorisation/licence is required. For further information on authorisation and licensing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under authorisations/licences should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: WA Herb. Regional Herb. District Herb. Other: _____

LODGEMENT: WA Herb Not necessary: known
Lodgement No: population

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Lyn Atkins Role: Principal Ecologist Signed: _____ Date: 13/04/2023

Please return completed form to **Species And Communities Program DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Program.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants

TAXON: Scholtzia calcicola		TPFL Pop. No.: _____	
OBSERVATION DATE: 21/10/2022		CONSERVATION STATUS: P2	
OBSERVER/S: Lyn Atkins		PHONE: 94308955	
ROLE: Principal Ecologist		ORGANISATION: Ecoscape	
EMAIL: lyna@ecoscape.com.au			

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
 Infinite Green Energy site; cnr Brand Highway and Indian Ocean Drive, Arrowsmith
 Approximately 28 km south of Dongara

DBC DISTRICT: Midwest Region		LGA: Irwin		Reserve No.: _____	
DATUM:		COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:	
GDA94 / MGA94 <input type="checkbox"/> AGD84 / AMG84 <input type="checkbox"/> WGS84 <input type="checkbox"/> Unknown <input type="checkbox"/>		DecDegrees <input type="checkbox"/> DegMinSec <input type="checkbox"/> UTM <input type="checkbox"/> Lat / Northing: Approximately 6732965.00 Long / Easting: Approximately 307667.00 ZONE: 50		GPS <input type="checkbox"/> Differential GPS <input type="checkbox"/> Map x No. satellites: _____ Map used: _____ Boundary polygon captured: <input type="checkbox"/> Map scale: _____	
LAND TENURE:					
Nature reserve <input type="checkbox"/>		Timber reserve <input type="checkbox"/>		Private property x	
National park <input type="checkbox"/>		State forest <input type="checkbox"/>		Pastoral lease <input type="checkbox"/>	
Conservation park <input type="checkbox"/>		Water reserve <input type="checkbox"/>		UCL <input type="checkbox"/> SLK/Pole _____ to _____	
				Rail reserve <input type="checkbox"/> Shire road reserve <input type="checkbox"/>	
				MRWA road reserve <input type="checkbox"/> Other Crown reserve <input type="checkbox"/>	
				Specify other: _____	

AREA ASSESSMENT: Edge survey Partial survey Full survey Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual Extrapolation Estimate Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants Clumps Clonal stems

TOTAL POP'N STRUCTURE:	Mature:	Juveniles:	Seedlings:	Totals:	Area of pop (m ²): _____ <small>Note: Pls record count as numbers (not percentages) for database.</small>
	Not counted				
Alive					
Dead					

QUADRATS PRESENT: No. _____ Size _____ Data attached Total area of quadrats (m²): _____

Summary Quad. Totals: Alive

Clonal <input type="checkbox"/>	Vegetative <input type="checkbox"/>	Flowerbud <input type="checkbox"/>	Flower <input type="checkbox"/>
Immature fruit <input type="checkbox"/>	Fruit <input type="checkbox"/>	Dehisced fruit <input type="checkbox"/>	Percentage in flower: _____ %

CONDITION OF PLANTS: Healthy x Moderate Poor Senescent

COMMENT: Opportunistic collection. Location approximate. No population count or estimate.

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
•	_____	_____	_____
•	_____	_____	_____
•	_____	_____	_____



Threatened and Priority Flora Report Form

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand x	Red <input type="checkbox"/>	Well drained x
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown <input type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow x	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope x	Limestone x	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input type="checkbox"/>	
Flat <input type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					

Specific Landform Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry x Moist Waterlogged Inundated

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
2. Open shrubland (Hibbertia sp., Acacia spp.);
3. Isolated clumps of sedges (M.tetragona)

1. *Acacia spathulifolia*, *Banksia sessilis* var. *cygnorum* and *Banksia leptophylla* var. *melletica* mid shrubland
2. *Hibbertia hypericoides* subsp. *septentrionalis*, *Scholtzia umbellifera* and *Desmocladius asper* low shrubland/rushland
- 3.
- 4.

ASSOCIATED SPECIES:

Other (non-dominant) spp

Acacia scirpifolia, *Acanthocarpus canaliculatus*, *Austrostipa flavescens*, *Austrostipa macalpinei*, *Bossiaea eriocarpa*, *Callitris pyramidalis*, *Calothamnus quadrifidus* subsp. *angustifolius*, *Conostylis candicans* subsp. *calicicola*, *Conostylis prolifera*, *Eucalyptus erythrocorys*, *Grevillea preissii*, *Guichenotia ledifolia*, *Hibbertia subvaginata*, *Labichea cassioides*, *Melaleuca cardiophylla*, *Melaleuca leuropoma*, *Mesomelaena pseudostygia*, *Scholtzia laxiflora*, *Stenanthemum notiale*, *Styphelia insularis*, *Trachymene pilosa*, **Vulpia myuros* forma *myuros*, *Waitzia suaveolens* var. *suaveolens*

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent x Very good x Good Degraded Completely degraded

COMMENT: _____

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire x

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Specimen scan: _____

Please return completed form to **Species And Communities Program DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Program.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form



FLORA AUTHORISATION / LICENCE No: FB62000003-2 Note if only observing plants (i.e. no specimens or plant material is taken) then no authorisation/licence is required. For further information on authorisation and licencing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under authorisations/licences should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: A22099s-14 WA Herb. Regional Herb. District Herb. Other: _____

LODGE MENT: WA Herb Lodgement No: TBA

ATTACHED: Map Mudmap Photo GIS data Field notes Other: scan

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Lyn Atkins Role: Principal Ecologist Signed: _____ Date: 13/04/2023

Please return completed form to **Species And Communities Program DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Program.

Record entered by: _____ Sheet No.: _____ Record Entered in Database