



Kellerberrin Receiving Facility Expansion

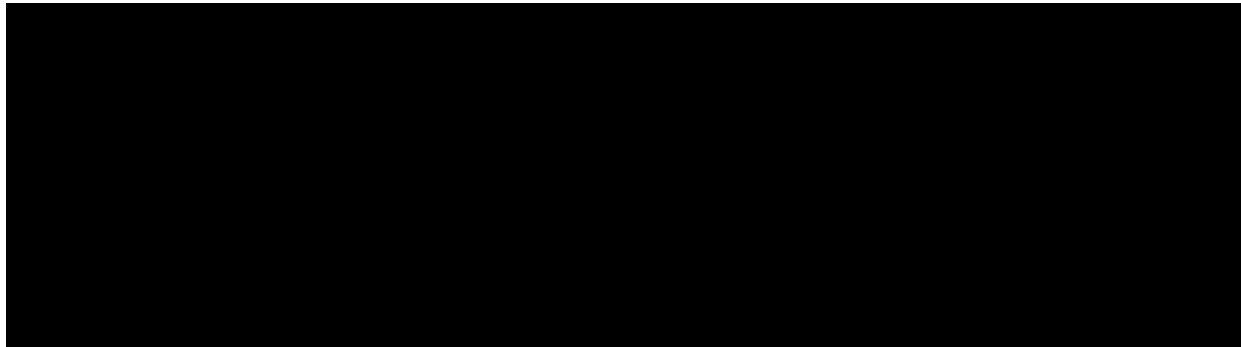
Spring Biological Survey

Prepared for

Cooperative Bulk Handling (CBH Group)

March 2022

● people ● planet ● professional



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Executive Summary

Cooperative Bulk Handling (CBH Group) commissioned 360 Environmental Pty Ltd part of SLR Group (360 Environmental) to undertake a reconnaissance flora, fauna, and Black Cockatoo habitat survey for the proposed Kellerberrin Receiving Facility Expansion (the Survey Area). The Survey Area is located within the town of Kellerberrin, in the Avon Wheatbelt bioregion of Western Australia, and encompasses approximately 28 ha. The proposed development footprint within the Survey Area includes existing roads and infrastructure.

The purpose of the assessment was to identify key biological values within the Survey Area to support the Environmental Impact Assessment (EIA) process and approvals applications to develop the Project. This report presents results of the survey undertaken.

Flora and Vegetation

The flora desktop assessment identified 74 conservation significant species occurring within 25 km of the Survey Area. A pre-survey likelihood of occurrence assessment was undertaken and determined 16 species as having a high likelihood of occurrence, 24 species as having a medium likelihood of occurrence, 30 species as having a low likelihood of occurrence and four species of unknown likelihood of occurrence.

The reconnaissance flora and vegetation survey recorded the floristic composition and vegetation types from two flora sites (both relevés), mapping notes and opportunistic observations. A total of 34 taxa were recorded from 19 genera across 12 families.

No Threatened flora species pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* and/or gazetted as Threatened/Declared Rare Flora pursuant to the *Biodiversity and Conservation Act 2016* were recorded during the survey. One Priority flora taxon (*Eucalyptus brockwayi* (P3)) was recorded within the Survey Area, however, represents a planted individual approximately 380 km west of its natural range.

Nine introduced species were recorded during the survey. One species, **Echium plantagineum*, is listed as a Declared Pest by the State Department of Primary Industries and Regional Development.

Ten vegetation types were described and mapped across one landform within the Survey Area. Vegetation in the Survey Area was representative of existing broad scale vegetation, and soil and land system mapping for the area.

Vegetation condition within the Survey Area ranged from Degraded to Completely Degraded with the majority considered to be in Completely Degraded condition. Evidence of disturbance included weeds, infrastructure, clearing, litter, and vehicle tracks.

Vertebrate Fauna

The vertebrate fauna desktop assessment identified eight conservation significant species occurring within 25 km of the Survey Area. An assessment of the likelihood of occurrence within the Survey Area was undertaken and identified that of the potential conservation significant fauna, one had a high likelihood of occurrence, one had a medium likelihood of occurrence, and six had a low likelihood of occurrence.

Fauna habitat mapping was based on a combination of field observations and fauna habitat assessment data. Nine fauna habitats were mapped within the Survey Area; several habitats were combined as one representative habitat with the most value to conservation significant fauna and overall fauna assemblages.

The reconnaissance terrestrial vertebrate fauna survey recorded the fauna assemblage using a variety of detection methods including opportunistic observations and active searches. A total of 21 fauna species from 14 families were recorded; each of these were avian species. No conservation significant species were recorded during the fauna survey, and one introduced species (domestic pigeon, *Columba livia*) was recorded during the survey.

Black Cockatoo Habitat Assessment

The Black Cockatoo habitat assessment identified 67 Black Cockatoo potential breeding trees containing a diameter at breast height (DBH) ≥ 500 mm and ≥ 300 mm (for Salmon Gums). The trees identified consisted of *Eucalyptus camaldulensis* (25 trees), *E. salmonophloia*, (21 trees), *E. kondininensis* (5 trees), *E. rudis* subsp. *rudis* (3 trees), *E. loxophleba* subsp. *loxophleba* (3 trees), *E. salubris* (1 tree), other introduced Eucalypts (2 trees), and stags (7 trees). A total of 15 of the identified potential breeding trees contained hollows, and 10 of these trees contained potentially suitable hollows with an estimated opening diameter equal or greater than 100 mm.

The results of the Black Cockatoo foraging assessment classified a total of 6.6 ha of Black Cockatoo Foraging Habitat, comprising:

- 1.74 hectares of low-moderate (BCE score of 3) quality foraging habitat representing open woodland of *E. salmonophloia* and *E. loxophleba* subsp. *loxophleba*, utilised for seeds and flowers/nectar by Carnaby's Black Cockatoos.
- 2.27 hectares of low-quality (BCE score of 2) foraging habitat consisting of isolated trees and patches of York and Salmon Gum, and open woodland of mixed endemic and non-endemic Eucalypts which may be utilised by Carnaby's Black Cockatoos for flowers and fruits
- 2.57 hectares of negligible-low (BCE score of 1) quality foraging habitat consisting of scattered foraging trees, a mix of cultivated garden and non-endemic trees and shrubs, isolated and roadside non-endemic Eucalypt trees (e.g., *E. camaldulensis*) and mallees which may offer forage to Carnaby's Black Cockatoo in the form of small fruits and/or flowers.

The remaining 21.33 ha of the Survey Area was cleared or dominated by introduced grasses and offered no foraging value to Carnaby's Black Cockatoo (BCE score of 0).

No evidence of Black Cockatoo breeding, foraging, or roosting was observed within the Survey Area.

Abbreviations

Abbreviations used through the report are described below in Table 1.

Table 1: Abbreviations

Abbreviation	Description
360	360 Environmental Pty Ltd
BAM Act	Biosecurity and Agriculture Management Act 2007
BC Act	Biodiversity Conservation Act 2016
BCE	Bamford Consulting Ecologists
BoM	Bureau of Meteorology
°C	Degree Celsius
CD	Conservation Dependent Fauna
CR	Critically Endangered
DAWE	Department of Agriculture, Water, and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DoE	Department of Environment
DP	Declared Pest
DWER	Department of Water and Environmental Regulation
EIA	Environmental Impact Assessment
EN	Endangered
EP Act	Environmental Protection Act 1986
EPA	Environmental Protection Authority
EPBC Act	Environment Protection Biodiversity and Conservation Act 1999
ESA	Environmentally Sensitive Area
GIS	Geographic Information System
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
IBSA	Index of Biodiversity Surveys for Assessments
km	Kilometres
m	Metres
mm	Millimetres
MA	Marine
MI	Migratory

Abbreviation	Description
MNES	Matters of National Environmental Significance
NVIS	National Vegetation Information System
OS	Other Specially Protected Fauna
P	Priority
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
Stag	Standing dead tree
Study Area	The database search area (varied according to each parameter)
Survey Area	The Kellerberrin Survey Area is approximately 28 ha, including public and private infrastructure
T	Threatened
TEC	Threatened Ecological Community
TPFL	Threatened and Priority Flora Database
TPFRF	Threatened and Priority Flora Report Forms
VU	Vulnerable
WA	Western Australia
WAH	Western Australian Herbarium
WAM	Western Australian Museum
WoNS	Weeds of National Significance

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1 Introduction

1.1 The Project

Cooperative Bulk Handling (CBH) commissioned 360 Environmental Pty Ltd part of SLR Group (360 Environmental) to undertake a reconnaissance flora and vegetation survey, basic vertebrate fauna survey and Black Cockatoo Habitat assessment for the proposed CBH Kellerberrin Receiving Facility Expansion (the Survey Area).

The Survey Area is located within the town of Kellerberrin in the Avon Wheatbelt bioregion of Western Australia, covering approximately 28 ha (Figure 1). The proposed development includes upgrades to existing roads, and public and private infrastructure.

1.2 Objectives and Scope

The purpose of the survey was to delineate key flora and fauna values within the Survey Area and identify potential environmental sensitivities that may impact the Project.

The scope of works includes:

- Undertake a desktop assessment including relevant database searches and a literature review to compile and summarise existing records of flora, vegetation, and fauna (including conservation significant species and communities) in the vicinity of the Survey Area
- Undertake a reconnaissance flora and vegetation survey using relevés and mapping notes to identify and describe the vegetation and flora occurring within the Survey Area
- Undertake targeted searching for flora of conservation significance within the Survey Area
- Undertake basic terrestrial vertebrate fauna survey using fauna detection methods including looking for scats, skeletal material, feathers, tracks, and diggings)
- Post Survey Debrief Email
- Biological Report
- Supply a geospatial data package prepared in accordance with IBSA requirements.

This report presents the results of the survey undertaken to support the above objectives.

2 Background

2.1 Protection of Flora, Vegetation and Fauna

Western Australian flora and fauna is protected formally and informally by legislative and non-legislative measures:

Legislative measures:

- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *WA Biodiversity Conservation Act 2016* (BC Act)
- *WA Environmental Protection Act 1986* (EP Act)
- *WA Biosecurity and Agriculture Management Act 2007* (BAM Act).

Non-legislative measures:

- WA Department of Biodiversity Conservation and Attractions (DBCA) Priority lists for fauna, flora, and ecological communities
- Weeds of National Significance (WoNS)
- Recognition of locally significant populations by DBCA.

These protection mechanisms are supported by guidance documents published by the Environmental Protection Authority (EPA) and Department of Agriculture, Water, and the Environment (DAWE):

- Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (Environmental Protection Authority, 2016)
- Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (Environmental Protection Authority, 2020)
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan (Department of Parks and Wildlife, 2013)
- Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (Department of the Environment, 2013)
- Survey Guidelines for Australia's Threatened Mammals (Department of Sustainability Environment Population and Communities, 1999)
- Survey Guidelines for Australia's Threatened Reptiles (Department of Sustainability Environment Water Population and Communities, 2011)
- Survey Guidelines for Australia's Threatened Birds Under the Environment Protection And Biodiversity Conservation Act 1999 (Department of the Environment Water Heritage and the Arts, 2010)
- EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (Department of Sustainability Environment Water Population and Communities, 2012a).

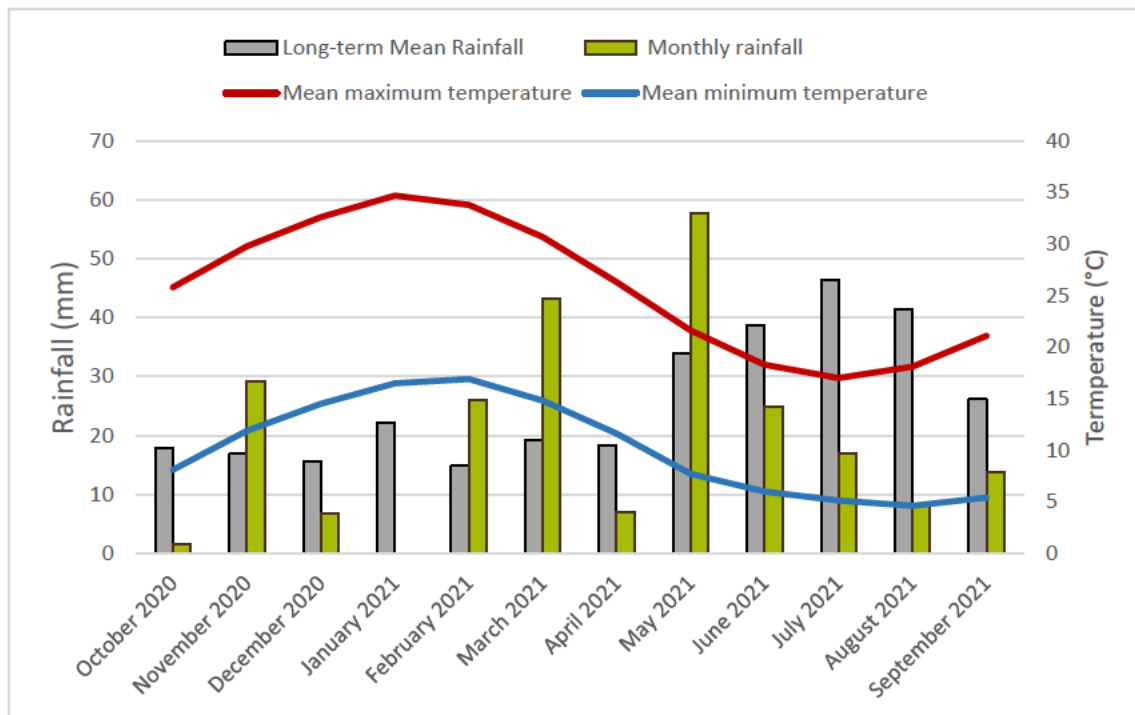
2.2 Existing Environment

2.2.1 Climate

The closest long-term Bureau of Meteorology weather station with a complete dataset is the Kellerberrin Weather Station (Station 0073), located approximately 1.7 km north of the Survey Area. Climate statistics were calculated utilising data from the most current climate normal, which is defined as a 30 year interval (Bureau of Meteorology, 2007), where possible. A climate normal is a period long enough to include year-to-year variations while avoiding the influence of longer-term changes in climate (Bureau of Meteorology, 2007).

The long-term mean minimum temperature for Station 0073 ranges from 4.6°C (August) to 16.9°C (February) (1991 to 2020) and the long-term mean maximum temperature ranges from 17.0°C (July) to 34.7°C (January) (Graph 1) (Bureau of Meteorology, 2021).

The Kellerberrin weather station recorded 245.1 mm of rainfall in the 12 months prior to the survey (October 2020 to September 2021), which is 65.7 mm below the 30 year average of 310.8 mm (Bureau of Meteorology, 2021). In the three months prior to the survey (July 2021 to September 2021), 37.2 mm of rainfall was recorded, which is 76.9 mm below the 30 year average of 114.1 mm for the same time period (Bureau of Meteorology, 2021).



Graph 1: Long term and Monthly Total Rainfall, Maximum and Minimum temperatures for Kellerberrin (0073) (Bureau of Meteorology, 2021).

2.2.2 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into 89 bioregions based on major biological, geographical, and geological attributes. These bioregions are subdivided into 419 subregions as part of a refinement of the IBRA framework (Department of the Environment and Energy, 2016). The Survey Area occurs within the Avon Wheatbelt bioregion and the Merredin (AVW01) subregion (Figure 2).

The Avon Wheatbelt (AW1) region is characterised by a gently undulating landscape of low relief and salt lakes on residual lateritic uplands and sandplains (Beecham, 2001). The Merredin subregion is represented by Proteaceous scrub-heaths, mixed eucalypt, *Allocasuarina huegeliana* and Jam-York woodlands on Quaternary alluvial and eluvial soils (Beecham, 2001).

2.2.3 Soil Landscapes and Land Systems

Soil landscapes and land system mapping of Western Australia describes broad soil and landscape characteristics from regional to local scales, ranging from 1:20,000 to 1:250,000 (Department of Primary Industries and Regional Development, 2018). The Survey Area occurs within one land system (Figure 3). The Kellerberrin System (258Kb) is described as having alkaline red shallow loamy duplex, alkaline grey sandy duplexes mainly in branch valleys, calcareous loamy earth, and hard cracking clays.

2.2.4 Hydrography

No major hydrographic features intersect the Survey Area. Several minor drains and watercourses are present within a 5 km radius of the Survey Area, predominately to the south-east.

2.2.5 Broad Vegetation Types

Mapping of pre-European vegetation in Western Australia was completed on a broad scale (1:1,000,000) by Beard (1976). These vegetation types were later refined by Shepherd et al. (2002) resulting in 819 vegetation types.

One broad vegetation system association is mapped over the Survey Area (Figure 4), the Mt Caroline (1049) association, which consists of “Medium woodland; Wandoo, York Gum, Salmon Gum, Morrel and Gimlet” Representation of the system associations at a local, regional, and state level is shown in Table 2.

Table 2: Broad Vegetation Types within the Survey Area and their Representation at the State, Regional and Local Levels (Government of Western Australia, 2019)

System and Vegetation Association	Extent			
	Pre-European (ha)	Current (ha)	Remaining (%)	Managed in DBCA Lands (%)*
Representation across Western Australia				
Mt Caroline 1049	833,384.77	56,618.34	6.79	5.96
Representation across the Avon Wheatbelt Bioregion				
Mt Caroline 1049	833,384.77	56,618.34	6.79	5.96
Representation across the Merredin Subregion				
Mt Caroline 1049	577,982.14	36,045.59	6.24	8.30
Representation across the Shire of Kellerberrin				
Mt Caroline 1049	108,872.43	8,427.11	7.74	14.94

*as a portion of the current extent

2.2.6 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are declared by the Department of Water and Environmental Regulation (DWER) to prevent the degradation of important environmental values such as Threatened flora, Threatened Ecological Communities (TECs) or significant wetlands.

The Survey Area does not occur within a mapped ESA (Figure 5). The nearest ESA is the Mount Caroline Nature Reserve 18 km to the southwest of the Survey Area.

2.2.7 Conservation Areas

The Survey Area is not identified within a conservation area (Figure 5) (Department of Biodiversity Conservation and Attractions, 2021a). The nearest conservation area is the Mount Caroline Nature Reserve located 18 km to the south west of the Survey Area, which is vested under the Conservation and Parks Commission of DBCA (Conservation and Parks Commission, 2019).

3 Methods

3.1 Requirements for Flora and Fauna Surveys

The biological surveys documented by this report were undertaken in accordance with relevant EPA and DAWE guidelines (see section 2.1).

3.2 Desktop Assessment

3.2.1 Literature Review

Background information on the Survey Area and surrounds was compiled prior to the field survey (see Section 2). Historical vegetation mapping (Beard, 1976; Shepherd, Beeston and Hopkins, 2002), land systems mapping (Department of Primary Industries and Regional Development, 2018), and the IBRA classification system (Beecham, 2001) were consulted to provide broad contextual knowledge of the vegetation units and habitat likely to be encountered within the Survey Area.

The literature review also considered biological reports detailing assessments undertaken in the region, that were either publicly available or provided by CBH:

- Cunderdin-Wyalkatchem Road Survey Report – Flora and Vegetation Survey (Copeland, 2020) located approximately 55 km NW of the Survey Area
- GAR 2019/2020 Operational Banding Program Ecological Surveys (Ecoscape [Australia] Pty Ltd, 2020).

3.2.2 Database Searches

Database searches were undertaken to compile a list of potential flora and fauna and identify potential conservation significant flora, fauna, and ecological communities within or surrounding the Survey Areas (Table 3). In addition, an EPBC Protected Matters Search (PMST) was undertaken to identify the potential for Matters of National Environmental Significance (MNES) to occur within or surrounding the Survey Area (Department of Agriculture Water and the Environment, 2020).

The search area for each parameter was varied to reflect distances recommended by DBCA. The search areas are herein referred to collectively as the Study Area.

Table 3: Database Searches of the Survey Area

Database Name	Date Received	Search Target	Search Area
Threatened and Priority Ecological Communities database search (Department of Biodiversity Conservation and Attractions, 2021b)	29 October 2021	TECs and PECs	20 km buffer around the Survey Area
Threatened and Priority Flora (TPFL) database search (Department of Biodiversity Conservation and Attractions, 2020b)	21 October 2021	Threatened and Priority Flora	25 km buffer around the Survey Area
Western Australian Herbarium flora database search (Department of Biodiversity Conservation and Attractions, 2021d)	21 October 2021		25 km buffer around the Survey Area
DBCA Threatened and Priority Fauna database search (Department of Biodiversity Conservation and Attractions, 2021c)	03 November 2021	Threatened and Priority Fauna	25 km (fauna) and 20 km (black cockatoo) buffer around the Survey Area
NatureMap (Department of Biodiversity Conservation and Attractions, 2020a)	15 October 2021	Threatened and Priority flora and fauna, and inventory of potential flora and fauna	20 km buffer around the Survey Area
Protected Matters Search Tool (Department of Agriculture Water and the Environment, 2021a)	15 October 2021	Commonwealth listed Threatened flora and fauna and TECs	20 km buffer around the Survey Area

3.2.3 Likelihood of Occurrence

Conservation significant flora and fauna species identified from the desktop assessment were assessed to determine the likelihood of their occurrence within the Survey Area, both prior to and post field survey. The assessment was completed based on the likelihood of occurrence criteria presented in Table 4.

Only species either recorded within the Survey Area or considered as having a high or medium likelihood of occurrence will be discussed in detail. Species classified as having a low likelihood of occurrence based on the above criteria will not be discussed unless a justification for this classification is required.

For fauna, species listed as Marine under the EPBC Act were not included as conservation significant as the Marine listing only applies within Commonwealth marine areas.

Table 4: Likelihood of Occurrence Criteria

Rank	Criteria
Previously Recorded	The species has been previously recorded in the Survey Area

Rank	Criteria
High (Likely to occur)	<ul style="list-style-type: none"> There are existing records of the species in close proximity to the Survey Area (within 10 km), and for fauna has been recorded within 25 km of the Survey Area and suitable habitat is present The species is strongly linked to a specific habitat, which is present in the Survey Area; or The species has more general habitat preferences, and suitable habitat is present.
Medium (May occur)	<ul style="list-style-type: none"> There are existing records of the species from the locality between 10 and 20 km, however: <ul style="list-style-type: none"> The species is strongly linked to a specific habitat, of which only a small amount is present in the Survey Area; or The species has more general habitat preferences, but only some suitable habitat is present. There is suitable habitat in the Survey Area, but the species is recorded infrequently in the locality.
Low (Unlikely to occur)	<ul style="list-style-type: none"> The species is linked to a specific habitat, which is absent from the Survey Area; or Suitable habitat is present, however there are no existing records of the species from the locality despite reasonable previous search effort in suitable habitat; or There is some suitable habitat in the Survey Area, however the species is very infrequently recorded in the locality.

3.3 Field Surveys

The reconnaissance flora, vegetation and basic terrestrial vertebrate fauna survey was undertaken by Principal Zoologist Dr Michael Lohr and Ecologist Grant Buller (Flora Licence FB62000321) on the 27-28th October 2021. The Survey effort is demonstrated in Figure 6.

3.4 Flora and Vegetation

3.4.1 Field Survey

Relevés comprised unbounded sites of approximately 10 x 10 m. A comprehensive record of the flora present at the time of sampling was recorded.

Flora site location was recorded using a handheld Garmin GPS unit, with points recorded at the start and finish point of linear relevés, and the central point of circular relevés. At each flora site, the following was recorded using a Fulcrum mobile data collection device:

- Site code
- Date and personnel
- Landform and soil description
- Relevant site descriptors including, slope, aspect, litter cover, bare ground cover and fire history
- Inventory of vascular flora including the approximate average height and percentage foliar cover for each taxon recorded
- Vegetation description in accordance with the National Vegetation Information System (NVIS), Level 5 'association', whereby the dominant growth form, height, cover, and

species (three species) for the three traditional strata (upper, mid, and ground) are described

- Vegetation condition in accordance with the South West and Interzone Botanical Province vegetation condition scale (Environmental Protection Authority, 2016), and evidence of disturbance (for example clearing, rubbish, feral animals, weed incursion and evidence of feral animals and dieback) where present
- Photograph of the vegetation occurring within the site.

A total of two relevés were established within the Survey Area as well as additional mapping notes to aid vegetation mapping delineation. Vegetation condition notes, opportunistic flora collections, and targeted searching for conservation significant flora were also completed. The relevé locations are shown in Figure 6.

3.4.2 Opportunistic Flora

Additional flora taxa observed opportunistically around flora sites or while traversing on foot within the Survey Area were also recorded. Where populations of conservation significant flora taxa, Declared Pests (DPs), or WoNS were encountered, a GPS location and a count of the individuals present was recorded.

3.4.3 Targeted Searching

Prior to the survey conservation significant flora with the likelihood or potential to occur within the Survey Area was compiled (see section 3.1.3). Field personnel familiarised themselves with photographs, reference samples and descriptions of these taxa before conducting the survey.

Personnel actively searched for conservation significant flora species in and around flora sites, while traversing on foot within the Survey Area and in known locations or preferred habitat encountered in the Survey Area.

Where Threatened or Priority flora were encountered in the field a GPS location was taken and a count of individuals was recorded, followed by a search in the local vicinity to determine if any other individuals were present nearby and delineate population boundaries where relevant. Specimens of any potential conservation significant flora that could not be identified in the field were collected for identification and lodgement at the Western Australian Herbarium (WAH).

3.4.4 Taxonomy and Nomenclature

Where field identification of plant taxa was not possible, specimens were collected for identification using resources of the WAH. Identification of flora collections was completed by experienced Taxonomist Frank Obbens at the WAH.

The finalised species list was checked against FloraBase (Western Australian Herbarium, 2021) to determine the conservation status and known distribution of each taxon. Introduced species were compared against the current BAM Act Declared Plants list the WoNS list to determine their control status (Department of Agriculture Water and the Environment, 2021b; Department of Primary Industries and Regional Development, 2021).

Any conservation significant flora taxa, including potential Threatened and Priority species, range extensions and potential new taxa were submitted to the WAH for verification and

lodgement. Where relevant, Threatened and Priority Flora Report Forms (TPFRFs) were submitted to DBCA.

3.4.5 Threatened and Priority Ecological Community Assessments

Any potential TECs/PECs encountered within the Survey Area were assessed against relevant guidance and descriptions.

In particular, any potential instance of the EPBC-listed *Eucalypt woodlands of the Western Australian Wheatbelt* (Wheatbelt Woodlands) TEC was assessed against the diagnostic criteria for the Commonwealth TEC (Department of the Environment, 2015). This included occurrences previously identified by DBCA database searches to ensure currency.

3.4.6 Vegetation Unit and Condition Mapping

Broad vegetation and condition mapping was conducted in the field, with boundaries delineated over aerial photography, at a scale of 1:3,000. Broad vegetation units were refined based on taxonomic identification of flora collections and analysis of data collected from the relevés and mapping notes. Vegetation condition mapping was refined based on site data and mapping notes. Finalised polygons were digitized and produced as electronic mapping data using GIS software.

3.5 Vertebrate Fauna

3.5.1 Daily Survey Conditions

Survey conditions for the detailed fauna survey are presented in Table 5. Daily temperature and rainfall data is from the Kellerberrin Weather Station (Station 0073) (Bureau of Meteorology, 2021). This information is important for potential detection of species diversity during a survey.

Table 5: Detailed Fauna Survey Weather Conditions

Date	Temperature (°C)		Rainfall (mm)
	Min	Max	
27/10/2021	12	No data	7.0
28/10/2021	No data	No data	1.0

3.5.2 Fauna Habitat Assessment

Fauna habitat assessments were undertaken throughout the Survey Area to identify fauna habitat values. Habitat assessment locations are shown in Figure 6. The following information was collected at each site using Fulcrum, a mobile data collection app:

- Site photo
- Landform
- Soil type and colour
- Rock types, surface stone cover and size classes
- Key habitat and microhabitat features including leaf litter, logs, burrows, rocky outcrops, rock crevices, hollows, water sources
- Habitat quality, fire history and evidence of disturbance

- General description of vegetation structure.

Fauna habitat mapping was based on a combination of field observations, fauna habitat assessment data and vegetation mapping undertaken by 360 Environmental.

3.5.3 Opportunistic Observations and Active Searches

Opportunistic observations of fauna were recorded throughout the Survey Area. Observations of primary evidence (direct sightings, calls) and secondary evidence (tracks, scats, feathers, diggings etc.) were recorded. Active searches were undertaken in microhabitats likely to contain fauna. They primarily involved raking leaf litter, peeling bark, and splitting dead wood.

3.5.4 Identification and Taxonomy

All terrestrial vertebrate fauna taxa were identified in the field.

Where there was doubt on a species name (through subsequent name changes or taxonomic reviews), an effort was made to determine the current scientific name for each taxon. Taxonomy and nomenclature in this report follows the WA Museum checklist 2020 (Western Australian Museum, 2021) where relevant.

3.6 Black Cockatoos

3.6.1 Field Survey

The Black Cockatoo habitat assessment was undertaken alongside the vertebrate fauna survey and involved traversing the Survey Area by foot. The survey was conducted in accordance with the *EPBC Act Referral Guidelines for three threatened Black Cockatoo Species: Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo* (Department of Sustainability Environment Water Population and Communities, 2012), and with consideration for the Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (Endangered) *Calyptorhynchus Latirostris* Baudin's Cockatoo (Vulnerable) *Calyptorhynchus baudinii* Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso* (Department of the Environment and Energy, 2017).

All habitat assessments herein are applicable only to Carnaby's Black Cockatoo as the Survey Area falls outside of the current distribution for the Baudin's Black Cockatoo and Forest Red Tailed Black Cockatoo (Department of the Environment and Energy, 2017).

3.6.2 Foraging Habitat

Foraging habitat was assessed based on the presence of tree and shrub species known to be important dietary items as outlined within the referral guidelines. If observed, any evidence of foraging such as chewed cones, seed and nut material, or direct observations of Carnaby's Black Cockatoos foraging, was recorded.

Any habitat for Carnaby's Black Cockatoo that occurred within the Survey Area and contained suitable foraging plant species was recorded as foraging habitat, regardless of whether evidence of foraging was identified.

The quality of foraging habitat was assessed using the criteria outlined in the BCE classing system (Bamford, 2015). The assessment criteria consider factors such as plant species present, type of woodland (e.g., Eucalypt woodland, foliage cover, fruit size of Eucalypts, vegetation, and tree

condition, and weed invasions. As the Survey Area was within the Merredin subregion of the Avon Wheatbelt, the assessment was applicable only to Wheatbelt vegetation (i.e., coastal/Swan Coastal Plain species such as Marri were not relevant). The assessment takes into account any known foraging species for Carnaby's Black Cockatoos (Valentine and Stock, 2008); Groom, 2011) recorded in the Survey Area.

3.6.3 Breeding Habitat

Any vegetation meeting the following criteria for potential breeding of Carnaby's Black Cockatoos were recorded using the Fulcrum mobile data-collection application:

- Tree species with the potential to form suitable hollows, including Eucalypt species endemic to southwest Western Australia (e.g., Jarrah, Tuart, Marri, Wandoo and Salmon Gum); consideration was also provided for introduced Eucalypt species
- Diameter at breast height (DBH) of greater than 500 mm (greater than 300 mm for Wandoo and Salmon Gum) regardless of the presence or absence of hollows (DBH is measured approximately 1.3 metres from the ground) (Department of the Environment and Energy, 2017)
- Any trees containing hollows (observed from the ground), which were then categorized as:
 - Hollows that are unsuitable for black cockatoo breeding (i.e., hollows with an estimated opening diameter of less than 100 mm, downwards-facing hollows)
 - Hollows that are potentially suitable for black cockatoo breeding [i.e., upwards or horizontal-facing hollows with an estimated opening diameter of greater than 100 mm]).

Trees with multiple stems, swellings or forking/branching at breast height were measured separately. In these instances, the diameter was measured just above breast height to gain a more accurate measurement of diameter.

3.6.4 Roosting Habitat

While undertaking the assessment, any evidence of roosting or areas identified as having high roosting potential were identified and recorded.

4 Results

4.1 Limitations

Limitations and constraints of the flora, vegetation, and fauna survey are detailed below in Table 6. Despite the limitations identified the assessment is suitable to support approvals applications for the proposed actions within the Survey Area.

Table 6: Limitations and Constraints Associated with the Survey

Variable	Degree of Limitation	Potential Constraints on Survey Outcomes
Survey Scope	No limitation	<p>The reconnaissance flora and vegetation survey was undertaken in accordance with the EPA (Environmental Protection Authority, 2016) and was considered appropriate to support approvals applications.</p> <p>A single phase basic terrestrial vertebrate fauna and Black Cockatoo habitat survey was undertaken in line with the scope.</p>
Availability of Data	No limitation	All data required to complete the scope of works including regional and local contextual information was available.
Site Access	No limitation	The Survey Area was able to be accessed by vehicle and on foot.
Survey Intensity and Resources	No limitation	<p>Two relevés were sampled in the Survey Area. A series mapping notes were undertaken to aid vegetation mapping and delineation.</p> <p>The entire Survey Area was not systematically searched, however, given the small size of the Survey Area and the fragmented vegetation within it, the level of survey effort was adequate to assess the flora and vegetation values of the Survey Area and provide information required to support approvals applications. It is unlikely additional survey effort would have resulted in records of conservation significant flora species.</p> <p>Sufficient time was allocated to the flora and vegetation survey, given the size and complexity of the Survey Area, and the expected level of survey intensity.</p> <p>A total of nine fauna habitat assessments were completed throughout the Survey Area. All hollows potentially suitable for use by black cockatoos were inspected. Fauna survey effort was appropriate for the size of the survey area and the habitat present.</p>
Experience	No limitation	<p>The flora and vegetation survey was undertaken by Ecologist Grant Buller who has one year experience at 360 Environmental conducting surveys of similar scope throughout Western Australia, and 5 years' experience in a previous vegetation monitoring role.</p> <p>Identification of flora collections was completed by experienced taxonomist Frank Obbens at the WAH. Relevant WAH specialists were consulted for difficult specimens, and any specimens with novel characteristics were submitted to the WAH for formal identification.</p> <p>The fauna and black cockatoo survey was undertaken by Principal Zoologist Dr Michael Lohr who has 18 years' experience conducting fauna surveys with 9 years' experience specifically within Western Australia and the bioregion.</p>

Variable	Degree of Limitation	Potential Constraints on Survey Outcomes
Timing, weather, season	No limitation	<p>The recommended primary survey period for the region as per the EPA Technical Guidance is in spring (September – November), in which this survey was undertaken. In the three months prior to the survey, rainfall in the area was 80 mm below the long-term average for the same period, however given flora in the Survey Area has been greatly fragmented by infrastructure and urbanisation, this low rainfall is not considered a limitation.</p> <p>Survey timing was within the seasons recommended by EPA Technical Guidance for all terrestrial vertebrates in the Southern Climatic Region with the exception of autumn-winter breeding frogs, which would not be expected within the survey area due to lack of suitable habitat.</p> <p>The timing was not a limitation for surveying black cockatoo breeding habitat.</p>
Life Forms Sampled	No limitation	<p>The Survey Area was traversed by vehicle and on foot and representative sites of all remnant vegetation was sampled. All flora species encountered within the Survey Area were recorded.</p> <p>A total of 31 vascular flora taxa were recorded from the Survey Area, comprising 48.4% native flora taxa and 51.6% introduced flora taxa.</p> <p>Of the 31 flora taxa recorded, three taxa (5%), could not be identified to species level because they were sterile at the time of the survey.</p> <p>None of the unknown flora species were analogous to Threatened or Priority flora taxa identified by the database searches as likely to occur within the Survey Area, nor were they representative of flora of other significance.</p> <p>The basic vertebrate fauna and black cockatoo surveys used a range of detection techniques as per the scope to detect fauna taxa within the Survey Area. All vertebrate fauna species were readily identified in the field.</p>
Mapping Reliability	No limitation	<p>Vegetation types were described and mapped based on relevé data and additional mapping notes taken during the field survey.</p> <p>The greatest effort was expended ground truthing vegetation boundaries within the proposed development footprint.</p>
Disturbances (fire, flood etc.)	No limitation	<p>No disturbances occurred during any of the surveys.</p> <p>Areas of disturbance associated with human access, railways, and weeds were recorded but were not a constraint on the results of the survey.</p>
Completeness	No limitation	<p>The survey was considered complete for a reconnaissance flora and vegetation survey, and all vegetation types were surveyed and delineated within the Survey Area.</p> <p>The survey was considered complete for a basic terrestrial vertebrate survey and targeted black cockatoo survey.</p>

4.2 Flora and Vegetation

4.2.1 Literature Review

The key findings of the flora and vegetation reports reviewed are summarised in Appendix A.

4.2.2 Database Searches

Database search results identified 74 conservation significant flora species occurring within 25 km of the Survey Area (Figure 7, Appendix B), comprising:

- 20 Threatened species
- 7 Priority 1 species
- 10 Priority 2 species
- 28 Priority 3 species
- 9 Priority 4 species.

No additional conservation significant flora species were identified by the literature review.

One Commonwealth listed Threatened Ecological Community, the *Eucalypt woodlands of the Western Australian Wheatbelt* (Wheatbelt Woodlands) was identified by DBCA database searches as occurring within 20 km of the Survey Area. This TEC is critically endangered and is regarded as a high priority for conservation value and retention. In total, 1393 instances of the community were identified by the database as occurring within 20 km of the Survey Area, with many occurring in highly restricted patches.

The Wheatbelt Woodlands community is composed of eucalypt woodlands that formerly were the most common type of vegetation across the wheatbelt landscape of south-western Western Australia (WA). The woodlands are dominated by a complex mosaic of several eucalypt species with a tree or mallet form over an understorey that is highly variable in structure and composition (Department of the Environment and Energy, 2016)

The database searches identified four State-listed PECs and their buffers within 20 kms of the Survey Area (Department of Biodiversity Conservation and Attractions, 2021b) (Figure 8):

- Red Morrel Woodlands (Priority 1) – 15.5 km ENE of the Survey Area
- York Gum Woodlands (Priority 3) – 17 km SW and 12-15 km N of the Survey Area
- Salmon Gum Woodlands (Priority 3) – 6.5 km WNW, 10 km NNW and 15.5 km N of the Survey Area
- Gimlet Woodlands (Priority 3) – 11.5 km ENE and 12.5 km NE of the Survey Area.

4.2.3 Pre-Survey Likelihood of Occurrence

The pre-survey likelihood of occurrence assessment identified that of the 74 conservation significant flora species identified by the desktop assessment:

- 15 were considered to have a high likelihood of occurrence:
 - 6 of these had previously been recorded within the Survey Area.
- 25 were considered to have a medium likelihood of occurrence
- 30 were considered to have a low likelihood of occurrence
- 4 species had insufficient information to classify.

The likelihood of occurrence assessment is provided in Appendix C.

4.2.4 Flora Composition

The survey recorded a total of 34 taxa from 19 genera across 12 families (Appendix D). The dominant families were Myrtaceae (15 species) and Poaceae (4 species). The most dominant genus was *Eucalyptus* (14 species).

4.2.5 Flora of Conservation Significance

4.2.5.1 Threatened or Priority Flora

No Threatened flora species pursuant to the EPBC Act 1999 and/or gazetted as Threatened pursuant to the BC Act 2016 were recorded during the survey.

No locally endemic Priority species as listed by DBCA were recorded within the Survey Area. One species, *Eucalyptus brockwayi* (Dundas Mahogany) (P3) was recorded in the Survey Area. However, this individual occurs approximately 380 km west of the known natural range and is considered to be planted. This individual is therefore not considered to be conservation significant for the purpose of this report.

4.2.5.2 Flora of Other Conservation Significance

Flora may be considered of other conservation significance if it represents a range extension, novel taxon, species that play a keystone role in a community, has relic status, is locally endemic, or represents the extent of a species range. No taxa recorded from the Survey Area were considered flora of other conservation significance.

4.2.6 Introduced Flora

A total of nine introduced (weed) species were recorded within the Survey Area, representing approximately 24 % of the total taxa recorded (Table 7). One species (**Echium plantagineum*) is listed as a Declared Pest under the BAM Act (Department of Primary Industries and Regional Development, 2021); this species was recorded in several locations within the Survey Area (Figure 10). No species are listed as a WoNS (Department of Agriculture Water and the Environment, 2021b).

As the Survey Area sits within the urbanised Kellerberrin township, a large portion of the vegetation in the Survey Area was comprised of gardens and planted WA and eastern states species. This included eight *Eucalyptus* species that are not considered to be 'weeds', however, these are not endemic to the Merredin subregion area (Table 8).

Table 7: Introduced Flora Species within the Survey Area

Species	Common Name	Status under BAM Act	WONS
* <i>Avena</i> sp.	Wild Oat	Permitted – s11	No
* <i>Echium plantagineum</i>	Paterson’s Curse	Declared Pest – s22	No
* <i>Ehrharta longiflora</i>	Annual Veldt Grass	Permitted – s11	No
* <i>Ficus</i> sp.	Fig	Permitted – s11	No
* <i>Lolium rigidum</i>	Rye Grass	Permitted – s11	No
* <i>Oncosiphon piliferum</i>	Globe Chamomile	Permitted – s11	No
* <i>Raphanus raphanistrum</i>	Wild Radish	Permitted – s11	No
* <i>Schinus molle</i>	Peppercorn Tree	Permitted – s11	No
* <i>Sonchus asper</i>	Rough Sowthistle	Permitted – s11	No

Table 8: Non-endemic Eucalypt Species within the Survey Area

Species	Common name
<i>Eucalyptus aspratilis</i>	Inland Mallee-yate
<i>Eucalyptus brockwayi</i> (P3)	Dundas Mahogany
<i>Eucalyptus camaldulensis</i> subsp. <i>obtus</i>	Blunt-budded River Red Gum
<i>Eucalyptus ?cladocalyx</i> subsp. <i>cladocalyx</i>	Sugar Gum
<i>Eucalyptus kondininensis</i>	Kondinin Blackbutt
<i>Eucalyptus rudis</i> subsp. <i>rudis</i>	Flooded Gum
<i>Eucalyptus</i> sp. Sullivan Soak (D. Nicolle and M. French DN 5503)	
<i>Eucalyptus torquata</i>	Coral Gum

4.2.7 Unconfirmed Flora

Nine specimens (26.5 % of the taxa recorded) could not be confidently identified to species level (Appendix D). This was due to the taxa either being sterile at the time of the survey or lacked additional information to assist with identification. Eight have been assigned a confirmed genus and two have been tentatively identified to species level.

None of the unconfirmed flora taxa were analogous to Priority flora taxa identified by the database searches.

4.2.8 Vegetation Types

Ten vegetation types were described and mapped across one broad landform within the Survey Area (Table 9, Figure 9).

Detailed site sheets for each relevé are provided in Appendix E.

4.2.9 Vegetation Condition

The condition of vegetation within the Survey Area was either Degraded or Completely Degraded (Figure 10), comprising:

- 3.67 ha (13.1 %) of Degraded condition
- 4.68 ha (16.8 %) of Completely Degraded condition.

The remaining 19.56 ha (70.1%) of the Survey Area was devoid of vegetation and was Completely Degraded.

Evidence of disturbance included weeds, litter, and historical clearing for local infrastructure.

Table 9: Vegetation Types Occurring within the Survey Area

Vegetation Unit		Sites	Total Area (ha)
Code	Description		
EIEs	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i> low isolated trees over <i>Acacia leptopetala</i> , <i>A. hemiteles</i> , and <i>Rhagodia drummondii</i> low isolated shrubs over * <i>Avena</i> sp., * <i>Lolium rigidum</i> , and <i>Rytidosperma caespitosum</i> low sparse grassland over * <i>Echium plantagineum</i> low isolated herbs	KELR02	1.74
Es	Isolated <i>Eucalyptus salmonophloia</i>	Map Note	0.12
EI	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	Map Note	0.06
eE	endemic Eucalypts	Map Note	0.13
<i>Allocasuarina</i> sp.	Isolated <i>Allocasuarina</i>	Map Note	0.03
NeE	Non-endemic Eucalypts	Map Note	1.41
Mixed weeds	Mixed weeds e.g., <i>Lolium rigidum</i> , <i>Avena</i> sp. herbs	Map Note	1.77
Garden/Ne/NeE	Mixed cultivated and irrigated gardens of non-endemic Eucalypts and other non-endemic trees and shrubs	Map Note	1.42
Cleared	Cleared	Map Note	19.56
Ne	Non-endemic trees	Map Note	0.07
Mixed endemic and non-endemic Eucalypts	Low open woodland of <i>Eucalyptus arachnaea</i> subsp. <i>arachnaea</i> , * <i>Eucalyptus campaspe</i> and <i>Eucalyptus aspratilis</i> over isolated <i>Sclerolaena</i> sp. and mixed grasses	KELR01	1.59

4.2.10 Vegetation of Conservation Significance

4.2.10.1 Threatened and Priority Ecological Communities

One TEC the *Eucalypt Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)* was considered relevant to the survey. This TEC is listed as Threatened (Critically Endangered) at the Commonwealth level, and Priority 3 at the State level. Any vegetation considered potentially analogous to the TEC was assessed against the diagnostic characteristics provided in the Draft Conservation Advice for Eucalypt Woodlands of the Western Australian Wheatbelt (Department of the Environment and Energy, 2015).

Wheatbelt Woodlands TEC

DBCA database searches identified 16 known patches of the Wheatbelt Woodlands TEC (and their 200 m buffers) which intersected the Survey Area. Of these, six patches are mapped as potentially occurring within the Survey Area. The remaining areas mapped as the Wheatbelt Woodland TEC by DBCA that intersect the Survey Area comprises the buffers of known TEC occurrences, or vegetation that has been cleared or is too degraded to be considered the TEC. Vegetation within previously identified patches of the Wheatbelt Woodland TEC was re-assessed to determine currency of data.

Three patches within the Survey Area were considered potentially analogous to the Wheatbelt Woodland TEC (Table 10; Figure 9) and were assessed against the diagnostic characteristics for the TEC as outlined in the approved conservation advice for the *Eucalypt Woodlands of the Western Australian Wheatbelt* (Department of the Environment, 2015). Table 11 provides a summary of the diagnostic criteria, whilst Table 12 describes the assessment of each patch against the diagnostic criteria. Following the assessment all three patches were considered to not be analogous to the TEC (Table 12).

Some of the vegetation types described and mapped within the Survey Area shared similarities with the Wheatbelt Woodlands TEC but were not assessed against the diagnostic criteria. This is because it was immediately evident the diagnostic criteria could not be met due to some of the defining characteristics such vegetation structure, condition or patch size being inadequate.

Table 10: Potential Patches of the Wheatbelt Woodland TEC within the Survey Area

Patch	Location and details
1	A patch of continuous <i>Eucalyptus</i> -dominated vegetation (which includes both endemic and non-endemic Eucalypts) is present at the western end of the Survey Area between the railway line and Leake Street.
2	This patch occurs along Great Eastern Highway, approximately 750 m east of East Crossing Road.
3	This patch occurs at the eastern end of the Survey Area and is divided into 3 smaller patches: two between the railway line and Mather Road, and the other between the railway and Great Eastern Highway. The majority of this patch was identified as the TEC by the DBCA database searches.

Table 11: Diagnostic Characteristics of the Wheatbelt Woodland TEC

Criteria	Diagnostic Characteristics of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC (Department of the Environment, 2015)
1	Be located within the Avon Wheatbelt (subregions AVW01 or AVW02), the Western Mallee subregion or Jarrah Forest – outlying patches in the eastern parts of the JAH01 Northern Jarrah forests and JAH02 Jarrah forests adjacent to the Avon Wheatbelt.
2	For those in the Jarrah Forest IBRA region they must be off the Darling Scarp and receive less than 600 mm mean annual rainfall, associated with the Yilgarn Craton geology, and are generally heavily cleared.
3	The structure of the Ecological community is a woodland in which crown cover of the tree canopy in a mature woodland is 10% – 40%.
4	Key species of the tree canopy is <i>Eucalyptus</i> [of which at least one is a key indicator species listed in the conservation advice, such as York gum (<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>), Salmon gum (<i>Eucalyptus salmonophloia</i>), Wandoo (<i>Eucalyptus wandoo</i>) or Kondinin Blackbutt (<i>Eucalyptus kondininensis</i>)].
5a	<p>The vegetation type meets one of the following condition thresholds (non-roadside patches only):</p> <ul style="list-style-type: none"> Category A: An intact area of woodland in Very Good/Excellent/Pristine condition is 2 ha or more in size Category B: An intact area of woodland in Good condition (retaining important habitat features) but has less than five trees per 0.05 ha present and/or is 5 ha or more in size Category C: An intact area of woodland in Good condition but has less than least 5 trees per 0.05 ha and/or is 2 ha or more in size.
5b	<p>Condition thresholds (area relates to roadside patches)</p> <p>The vegetation type meets one of the following condition thresholds:</p> <ul style="list-style-type: none"> Category A (High Quality): ≤ 30% of the total understorey vegetation cover comprises exotic plant species with a native understorey of 5 or more metres in width consisting of six or more native plant species in the understorey Category B (Good Quality): ≤ 50% of the total understorey vegetation cover comprises exotic plant species with a native understorey of 5 or more metres in width consisting of six or more native plant species in the understorey Category C (Moderate Quality AND presence of mature trees in verge): ≤ 70% of the total understorey vegetation cover comprises exotic plant species with a native understorey of 5 or more metres in width consisting of six or more native plant species in the understorey.

Table 12: Patches Assessed Against the Wheatbelt Woodland TEC Diagnostic Criteria

Criteria	Patch		
	Patch 1 (non-roadside vegetation)	Patch 2 (roadside vegetation)	Patch 3 (roadside vegetation)
1	Yes, AW1	Yes, AW1	Yes, AW1
2	NA	NA	NA
3	Yes	Yes	Yes
4	Yes, <i>E. loxophleba</i> subsp. <i>loxophleba</i>	Yes, <i>E. kondininensis</i>	Yes, <i>E. salmonophloia</i> and <i>E. loxophleba</i> subsp. <i>loxophleba</i>
5a	NA (does not meet an assigned Category) Degraded quality and under 5 ha (1.6 ha)	NA	NA
5b	NA	Category C <70% introduced species Understorey >5m width <6 native understorey species present	Category C <70% introduced species Understorey >5m width <6 native understorey species present
Vegetation considered analogous to the TEC	No	No	No

4.2.11 Vegetation of Other Conservation Significance

Vegetation may be of significance for a range of reasons, other than a listing as a TEC or a PEC, including (Environmental Protection Authority, 2016):

- Vegetation extent being below a threshold level
- Scarcity
- Unusual species
- Novel combinations of species
- A role as a refuge
- A role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species
- Being representative of the range of a unit (particularly a good local and/or regional example of a unit in 'prime' habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range); and/or
- A restricted distribution.

One vegetation type in the Survey Area (NeE) supports a Priority flora species, *Eucalyptus brockwayi* (P3), that has not previously been recorded in the local area. This species, however, is not endemic to the Merredin subregion and, as per several other Eucalypts in the Survey Area, appears to have been planted for landscape aesthetic purposes. Therefore, the vegetation type NeE is not considered locally significant.

4.2.12 Groundwater Dependent Ecosystems

Most vegetation in the Survey Area comprised of xerophytic species that have little to no reliance on groundwater. One facultative phreatophyte, *Eucalyptus camaldulensis* subsp. *obtusata*, was recorded scattered throughout the Survey Area, however this species is not endemic to the area and was likely planted; as such, the presence of this species does not indicate the presence of a Groundwater Dependent Ecosystem (GDE).

4.2.13 Survey Adequacy

Due to the highly fragmented and small areas of vegetation within the Survey Area, two relevés and a series of mapping notes was deemed to be sufficient coverage across the Survey Area.

4.3 Vertebrate Fauna

4.3.1 Desktop Assessment

Database searches identified 34 conservation significant terrestrial vertebrate fauna species potentially occurring within the Survey Area, comprising:

- 13 bird species
- Six mammal species
- Four reptile species.

The results of the DBCA Threatened and Priority Fauna database search are mapped in Figure 11. Key findings of the literature review are summarised in Appendix A2, and database searches are displayed in their entirety in Appendix B2.

4.3.2 Conservation Significant Fauna Likelihood of Occurrence

The likelihood of occurrence assessment within the Survey Area for conservation significant fauna species identified by the databases searches found that:

- One species had a high likelihood of occurrence:
 - Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) – Endangered under the BC Act and EPBC Act.
- One species had a medium likelihood of occurrence:
 - Peregrine Falcon (*Falco peregrinus*) – Other Specially Protected Fauna under the BC Act.
- Six species had a low likelihood of occurrence.

The results of the likelihood of occurrence assessment are presented in Appendix F.

4.3.3 Fauna Habitat

Three broad fauna habitats (excluding cleared areas) were identified and mapped within the Survey Area (Figure 12). Habitat condition throughout the Survey Area was not consistent, with some areas of habitat being heavily fragmented from clearing vegetation for public and private infrastructure.

A description, extent within the Survey Area and a representative photo is provided for each fauna habitat in Table 13. Small discrepancies in fauna habitat extents (i.e., not adding up to the exact area extent of the Survey Area) are due to rounding. Fauna habitat mapping is presented in Figure 12 and site sheets for each habitat assessment are shown in Appendix G.

4.3.4 Fauna Assemblage

The terrestrial vertebrate fauna survey recorded a total of 21 fauna species from 14 families, where all species were avian). The most recorded species was the Little Crow (*Corvus bennetti*) followed by the Tree Martin (*Petrochelidon nigricans*) and the Yellow-throated Miner (*Manorina flavigula*). The most speciose avifauna families were Columbidae (3 taxa) and Meliphagidae (3 taxa). One introduced species was recorded during the survey, the Domestic Pigeon (*Columba livia*)

No mammals, reptiles, or amphibians were recorded in the Survey Area.


A full inventory of fauna species recorded during the field survey is provided in Appendix H.



4.3.5 Conservation Significant Fauna

No fauna species of conservation significance (Threatened or Priority), or evidence of these species such as tracks, scats, nest, diggings, burrows, or direct sightings were recorded within or directly surrounding the Survey Area.

The post-survey results identified one conservation significant species, Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) as having a high likelihood of occurrence within the Survey Area, and one species, the Peregrine Falcon (*Falco peregrinus*), as having a medium likelihood of occurrence.

Table 13: Fauna Habitat Type Descriptions with the Survey Area

Fauna Habitat	Total Area, Proportion of the Survey Area	Sites	Habitat Description	Representative Photo
Mixed endemic and non-endemic Eucalypt woodland	4.74 ha, 17%	HAB01, HAB02, HAB03, HAB04, HAB06	Open woodland of <i>Eucalyptus loxophleba</i> , <i>E. salmonophloia</i> (photo 1) and <i>E. camaldulensis</i> (photo 2) over sparse tussock grassland. Existing hollows in native Eucalypts, and potential future hollows in <i>E. camaldulensis</i> , offer breeding habitat for black cockatoos and other hollow-nesting birds. Mixed Eucalypt species also offer foraging habitat for a range of native birds.	 

Fauna Habitat	Total Area, Proportion of the Survey Area	Sites	Habitat Description	Representative Photo
Garden, landscaping	1.77 ha, 7%	HAB05, HAB07	Open woodland (introduced Eucalypts) over cultivated and landscaped shrubland and heathland over low sparse rushland and/or sedgeland. Potential breeding and foraging habitat for some reptiles and nectar-feeding birds.	
Open weedy grassland	1.77 ha, 6%	HAB08, HAB09	Open tussock grassland and forbland. This habitat is highly disturbed with minimal habitat value for most native vertebrate fauna.	

4.4 Black Cockatoos

4.4.1 Foraging Habitat

Foraging habitat was assessed based on Carnaby's Black Cockatoo foraging species outlined in Groom (2011) and Valentine and Stock (2008) and the BCE scoring tool (Bamford, 2015). A total of approximately 6.6 ha of foraging habitat was recorded, containing primarily endemic and non-endemic *Eucalyptus* spp. And scattered non-endemic/introduced trees and garden shrubs (Figure 13). The results of the foraging habitat quality assessment are summarised in Table 14.

No evidence of Carnaby's Black Cockatoo foraging (direct or indirect) was observed within the Survey Area.

Table 14: Carnaby's Black Cockatoo Foraging Habitat Quality

Foraging Score	Foraging Quality	Area (ha)	Species and justification for foraging score
0	No foraging value	21.33	Bare ground, infrastructure and introduced grasses provide no foraging resources.
1	Negligible-Low	2.57	Urban areas with scattered foraging trees. Includes a mix of cultivated garden and non-endemic trees and shrubs, isolated and roadside non-endemic Eucalypt trees (e.g., <i>E. camaldulensis</i>) and mallees which may offer forage in the form of small fruits and/or flowers.
2	Low	2.27	Isolated trees/patches of known foraging species (Salmon Gum and York Gum) and open woodland of mixed endemic and introduced (e.g., <i>E. camaldulensis</i>) Eucalypt trees and mallees which may offer forage in the form of flowers and small fruits.
3	Low-Moderate	1.74	Primarily open woodland of known foraging species <i>Eucalyptus salmonophloia</i> (Salmon Gum) and <i>E. loxophleba</i> (York Gum). Small fruits and flowers offer low-moderate foraging value.

4.4.2 Breeding Habitat

The survey identified 67 trees within the Survey Area with a DBH of adequate size to support black cockatoo breeding (Figure 13, Appendix I). Fifty-five trees recorded a DBH of ≥ 500 mm, the majority of which consisted of planted introduced Eucalypts, particularly *E. camaldulensis* subsp. *obtusata*. Several *E. rudis*, *E. loxophleba* subsp. *loxophleba*, *E. salmonophloia*, *E. kondininensis*, and stags (species unknown) were also categorised as being suitable breeding trees. Eleven *E. salmonophloia* (Salmon Gum) were under 500 mm DBH but met the 300 mm DBH threshold required for this species. One stag with a DBH below 500 mm was also included because it contained an obvious hollow over 100 mm diameter. A total of ten trees bore hollows that were potentially suitable to accommodate Carnaby's Black Cockatoo breeding (Table 16).

Table 15. Potential Black Cockatoo Breeding Trees Bearing Suitable Hollows (hollows ≥100 mm) within Survey Area

Taxa	DBH (mm)	Easting	Northing
Salmon Gum (<i>Eucalyptus salmonophloia</i>)	793	-31.631	117.738
Salmon Gum (<i>Eucalyptus salmonophloia</i>)	929	-31.6304	117.7437
Salmon Gum (<i>Eucalyptus salmonophloia</i>)	1155	-31.6303	117.7445
Salmon Gum (<i>Eucalyptus salmonophloia</i>)	1528	-31.6302	117.7454
Salmon Gum (<i>Eucalyptus salmonophloia</i>)	312	-31.6306	117.7466
Salmon Gum (<i>Eucalyptus salmonophloia</i>)	1502	-31.63	117.7467
York Gum (<i>Eucalyptus loxophleba</i>)	726	-31.6307	117.7409
Stag	745	-31.6308	117.7394
Stag	487	-31.6304	117.7431
Stag	1012	-31.6304	117.7441

4.4.3 Roosting Habitat

A number of mature *Eucalyptus camaldulensis* (River Red Gum) trees with the potential to offer suitable¹ Black Cockatoo roosting habitat were recorded scattered throughout the Survey Area. Most of these trees were located at the western end of the survey area and adjacent to the CBH Group Headquarters at the centre of the Survey Area.

¹ Suitable roosting trees for Carnaby's Black Cockatoos must meet several criteria for height, structure and proximity to water sources and known roosting sites in the area.

5 Discussion

5.1 Flora and Vegetation

5.1.1 Flora Composition

The suite of flora taxa recorded during the survey is considered typical for disturbed areas in the Wheatbelt (Beard, 1976) and aligns with the database search results obtained.

Where vegetation occurred, its structure was predominantly degraded, and largely comprised of isolated Eucalypts or patches of remnant or planted Eucalypts. Structure of the vegetation communities present were predominantly open Eucalypt woodlands with lacking mid-storey vegetation and an understorey largely dominated by weedy grasses. This lack of natural vegetation structure is typical of areas that are highly disturbed with fragmented vegetation and close to major infrastructure.

5.1.2 Survey Adequacy

The flora and vegetation survey effort was in accordance with the scope of works and the EPA Technical Guidance (2016, 202). All native vegetation within the Survey Area was identified and distinguished from non-native vegetation to provide sufficient information on where to avoid impacts to vegetation. The inventory of vascular flora and records of conservation significant flora and weed species was compiled using site data and opportunistic observations made while traversing between sites.

5.1.3 Flora of Conservation Significance

No Threatened flora species pursuant to the EPBC Act 1999 and/or gazetted as Threatened Flora pursuant to the BC Act 2016 were identified by the database searches or recorded within the Survey Area.

One Priority species, *Eucalyptus brockwayi* (P3), was recorded in the survey area, however as this species is endemic to the Eastern Mallee subregion and has likely been planted, it is not regarded as conservation significant flora in the context of this survey. Of the Priority flora identified by the desktop assessment, one species, *Acacia cowaniana* (P2), had been previously recorded within the Survey Area, however this was a historic record (recorded in 1897), and the species was not recorded during the survey. Furthermore, historical imagery sourced from (Landgate, 2022) shows that much of the Survey Area has been previously cleared, including the location of the previous record of *Acacia cowaniana* (P3).

No other flora of conservation significance were recorded from the Survey Area.

5.1.4 Introduced Flora

Weed species were particularly prevalent through the eastern three quarters of the Survey Area, notably grasses **Avena* sp. and **Lolium rigidum*. This high weed cover is likely associated with the open, cleared areas adjacent to the railway infrastructure. The declared pest in **Echium plantagineum* was recorded at several locations in the eastern section of the Survey Area.

****Echium plantagineum* (Paterson's Curse) - DP s22(2)** is an erect annual herb to 1.5 m, with alternate bristly leaves and purple flowers (Department of Primary Industries and Regional Development, 2020). **E. plantagineum* is most common in paddocks, and roadsides and in

disturbed areas, from Geraldton to the Swan and Avon Valleys, but also occurs further south down the coast and eastward to the Goldfields (Department of Primary Industries and Regional Development, 2022).

All remaining weed species recorded had a legal status of Permitted – s11, and do not have an assigned control category according to the BAM Act 2016.

5.1.5 Vegetation Types

Mapping reliability was considered adequate as flora sites and mapping notes were completed within the Survey Area, which could be entirely accessed and traversed.

One broad landform (plains) was recorded within the Survey Area. Vegetation within the Survey Area was representative of existing broad scale vegetation and soil and land system mapping for the area.

The Survey Area was assessed as predominantly being Completely Degraded, and comprised of cleared areas, gardens, introduced Eucalypts, and large open areas of mixed weeds and grasses. Only small pockets contained native vegetation that resembled the native vegetation of the area (i.e., remnant York Gum and Salmon Gum woodlands), however these areas were still in Degraded condition due to the lack of community structure and highly fragmented surrounding landscape.

5.1.6 Vegetation of Conservation Significance

No vegetation representative of any TECs or PECs was recorded in the Survey Area. DBCA database searches showed several historical records of TECs as existing within the Survey Area, however when assessed against the Wheatbelt Woodlands TEC criteria, these patches did not meet the criteria due to their small size and the lack of any lower or mid stratum native vegetation layers.

None of the vegetation types within the Survey Area are likely to represent A GDE despite the presence of the facultative phreatophyte, *E. camaldulensis* subsp. *obtusa* throughout the Survey Area. This species is well outside of its natural range (Western Australian Herbarium, 2022) and these trees have most likely been planted.

5.2 Vertebrate Fauna

5.2.1 Fauna Habitat

The fauna habitats identified within the Survey Area have been heavily disturbed and altered by a combination of clearing, weeds, litter, and infrastructure. Areas of remnant and planted open Eucalypt and mallee woodland and isolated Eucalypts, despite being fragmented and in Degraded to Completely Degraded condition, still offered suitable foraging, nesting and roosting habitat to a range of birds and small reptiles. These areas were most prevalent at the western and eastern ends of the Survey Area. The eastern portion of the survey area also contained several trees with hollows of suitable size for a range of birds (HAB 02). Some areas within the Mixed endemic and non-endemic Eucalypt woodland habitat (HAB01 and HAB02) offered woody debris that may be utilised by small reptiles.

5.2.2 Fauna Assemblage

The inventory of fauna taxa recorded during the field survey mostly comprised common and cosmopolitan avian species that would be expected to occur in the Wheatbelt. The basic fauna survey was not intensive and sampled opportunistic records of fauna based on calls, sightings, remains and other evidence (e.g., feathers).

Several bird species – Australian Ringneck Parrot (*Barnardius zonarius*), Nankeen Kestrel (*Falco cenchroides*), and Western-long billed Corella (*Cacatua pastinator*) – were recorded utilising hollows in habitat trees at the eastern end of the survey area. These species are common throughout the Wheatbelt and across the South-West of the State.

Due to urbanization and landscape fragmentation, the fauna assemblage recorded during the survey is less species-rich than would be expected in less-disturbed bushland in the surrounding region.

5.2.3 Conservation Significant Fauna

No conservation significant fauna species were detected within the Survey Area, but Carnaby's Black Cockatoo and Peregrine Falcon retained high and medium post-survey likelihood of occurrence designations, respectively.

5.2.3.1 Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) – Endangered under the BC Act and EPBC Act

The Survey Area falls within the modelled breeding range of Carnaby's Black Cockatoo. The relative value of foraging, breeding, and roosting habitat are discussed below (5.3).

5.2.3.2 Peregrine Falcon (*Falco peregrinus*) – Other Specially Protected Fauna under the BC Act

The Peregrine Falcon is an uncommon but wide-ranging bird across Australia (Barrett et al., 2003). It occurs mainly along rivers and ranges as well as wooded watercourses and lakes. It nests primarily on cliffs, granite outcrops and quarries, although is also known to occupy existing raptor and corvid stick nests (Menkhorst et al., 2017). The diet of the Peregrine Falcon has been well studied and primarily includes flocking species such as parrots, pigeons and on the east coast, European Starlings (Olsen and Fuentes, 2008).

The Peregrine Falcon typically nests on cliff ledges or in refurbished nests built by other raptors or corvids (Pizzey and Knight, 2013), but it can also exploit ledges on man-made structures such

as tall buildings and may therefore use some of the infrastructure adjacent to the Survey Area for breeding. All habitats within the Survey Area may be used for hunting. Domestic Pigeons were observed to be abundant within the Survey Area and are likely to be attracted by spilled grain associated with CBH operations. These Domestic Pigeons may provide an attractive food resource for Peregrine Falcons.

5.3 Black Cockatoo Habitat Assessment

5.3.1 Foraging Habitat

Foraging habitat primarily consisted of mature trees of *Eucalyptus salmonophloia* and *E. loxophleba*, both known dietary species for Black Cockatoos (Groom, 2011; Valentine and Stock, 2008). Whilst some of the literature (Groom, 2011) does not include food sources that have been included in the total foraging quality area assessment (e.g., *Eucalyptus kondininensis*, *E. camaldulensis*), all Eucalypts present in the survey have been included in the foraging assessment as offering low and low-moderate foraging value for Carnaby's Black Cockatoos. Carnaby's Black Cockatoos are known to be adaptable to a wide variety of endemic and non-endemic plants, including the flowers of small-fruited Eucalypts. They have been recorded foraging on insect larvae and insects (including weevils) from under bark, from wood of live and dead trees and shrubs, from galls and from flowers and flower stems, of *Acacia* spp. including *A. saligna*, *Banksia* spp., and *Eucalyptus* spp. (Johnstone and Kirkby, 2011).

The foraging value of remnant *Eucalyptus* spp. woodland and planted introduced Eucalypts throughout the Survey Area was assessed as low to low-moderate, based solely on the criteria in Bamford (2015). However, additional factors not explicitly stated in the foraging assessment criteria can affect the qualitative value of potential foraging habitat for Carnaby's Black Cockatoos. In particular, no known roost sites were identified by the DBCA as occurring within 25 km of the Survey Area; while Carnaby's Black Cockatoos do migrate long distances, a distance of 12 kms or greater between potential foraging habitat and known roost sites reduces the functionality of the potential foraging habitat (Department of the Environment and Energy, 2017). Furthermore, there are no known breeding sites within 25 km of the Survey Area, which also reduces the value and functionality of the potential foraging habitat. These factors would be more pronounced in the highly fragmented landscape of the Wheatbelt.

During the survey no Carnaby's Black Cockatoos were observed directly utilising the Survey Area or flying over the site, and no direct or indirect foraging evidence was recorded during the survey.

5.3.2 Breeding Habitat

Carnaby's Black Cockatoos nest in the hollows of several Wheatbelt Eucalypt trees, with a preference for smooth barked trees such as Salmon Gum (*E. salmonophloia*) and Wandoo (*E. wandoo*), but also rough barked Eucalyptus and *Corymbia* trees such as York Gum (*E. loxophleba*) and Red Morrell (*E. longicornis*) (Johnstone and Storr, 1998). Large, hollow-bearing trees, generally in woodlands or forests, offer the best breeding habitat for Carnaby's Black Cockatoos (Johnstone, Kirkby and Sarti, 2013), however trees of suitable size in the urban landscape can also offer breeding habitat, as has been demonstrated on the Swan Coastal Plain.

The size of the tree can be a useful indication of the hollow-bearing potential of the tree. Trees of suitable DBH are potentially important for supporting breeding in the long-term, through maintaining the integrity of the habitat and allowing trees to provide future nest hollows. Maintaining the long-term supply of trees of a size to provide suitable nest hollows is particularly important in woodland stands that are known to support Black Cockatoo breeding (Department of Sustainability Environment Water Population and Communities, 2012a).

The Black Cockatoo assessment revealed that the Survey Area contains *E. salmonophloia*, *E. loxophleba* subsp. *loxophleba*, *E. rudis*, *E. camaldulensis*, *E. kondininensis* and *E. salubris* trees, all of which have reached a size that are considered to be potential future hollow bearing trees. Most Eucalypts must reach ≥ 500 mm DBH to be considered potential breeding habitat, while *E. salmonophloia* must reach ≥ 300 mm to be considered potential breeding habitat according to the EPBC Act Black Cockatoo referral guidelines (Department of Sustainability Environment Water Population and Communities, 2012b).

Trees with potentially suitable hollows within the Survey Area consisted primarily of Salmon Gums (*Eucalyptus salmonophloia*), York Gums (*E. loxophleba* subsp. *loxophleba*) and stags. These trees were present along Mather Road, at the eastern end of the Survey Area. While these trees bore hollows large enough to support black cockatoo breeding, there was no evidence (e.g., fresh chew marks) that they were being used or had been used recently. It is unlikely that Carnaby's Black Cockatoos currently use or have recently used the potential breeding habitat identified during the survey, however considering the adaptability of the species, there remains the potential for these trees to support future breeding.

5.3.3 Roosting Habitat

The field survey recorded a number of endemic and non-endemic Eucalypt trees that met the basic requirements to be considered potential roosting trees. However, for such trees to be suitable roosts, they must also meet several criteria (Department of the Environment and Energy, 2017):

- Within 2 km of good access to water
- Within 20 km of foraging resources
- Within 12 km of breeding sites resources.

Aerial imagery suggests that access to water is within the ideal 2 km range, however DBCA search results showed that there are no known roost or breeding sites recorded within 25 km of the Survey Area. While this likely reduces the potential for the suitably sized Eucalypts within the Survey Area to be utilised by Carnaby's Black Cockatoos, it does not preclude them from future use.

6 Conclusion

Flora and Vegetation

- No Threatened flora species pursuant to the EPBC Act 1999 and/or gazetted as Threatened/Declared Rare Flora pursuant to the BC Act 2016 were recorded during the survey.
- One DBCA listed Priority flora (*Eucalyptus brockwayi* (P3)) was recorded however this species is not endemic to the area and in the context of the survey is not considered conservation significant flora. As such, the presence of these species is unlikely to form a statutory constraint for the Survey Area.
- Nine introduced species were recorded during the survey. One species, *Echium plantagineum*, which is listed as a Declared Pest under the BAM Act by the Department of Primary Industries and Regional Development, was recorded at several locations in the eastern portion of the Survey Area.
- Ten vegetation types were mapped within the Survey Area. Intact natural vegetation was largely isolated and limited to the eastern and western ends of the Survey Area; the remainder of the Survey Area largely consisted of isolated non-endemic Eucalypts, introduced grasses, and cleared areas devoid of vegetation.
- Three patches of intact natural vegetation were assessed against the criteria for the Wheatbelt Woodlands TEC. Due to their small size and lack of vegetation structure, these patches did not meet the criteria to be classed the TEC.

Vertebrate Fauna

- Three main fauna habitats were mapped. 'Mixed endemic and non-endemic Eucalypt woodland' held the most value to conservation significant fauna and overall fauna assemblages, with the *Eucalyptus* spp. canopy layer offering foraging and nesting habitat for a range of birds. This included potential breeding habitat for the endangered Carnaby's Black Cockatoo, of which several potential habitat trees were recorded and mapped.
- No conservation significant fauna species were recorded during the fauna surveys and no evidence of conservation significant fauna within the Survey Area was recorded. The Carnaby's Black Cockatoo retained a high post-survey likelihood of occurrence, while the Peregrine Falcon had a medium post-survey likelihood of occurrence.
- One introduced species was recorded during the survey, the Domestic Pigeon (*Columba livia*).

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Figures



Legend

- Survey
- Cadastral Lines

NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

- LOCALITY MAP SOURCED LANDGATE 2022
- OTHER DATA SOURCED LANDGATE 2022
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SLIP ENABLER

360
environmental

10 Bermondsey St, West Leederville, 6007 WA
t (08) 9388 8360
f (08) 9381 2360
w www.360environmental.com.au

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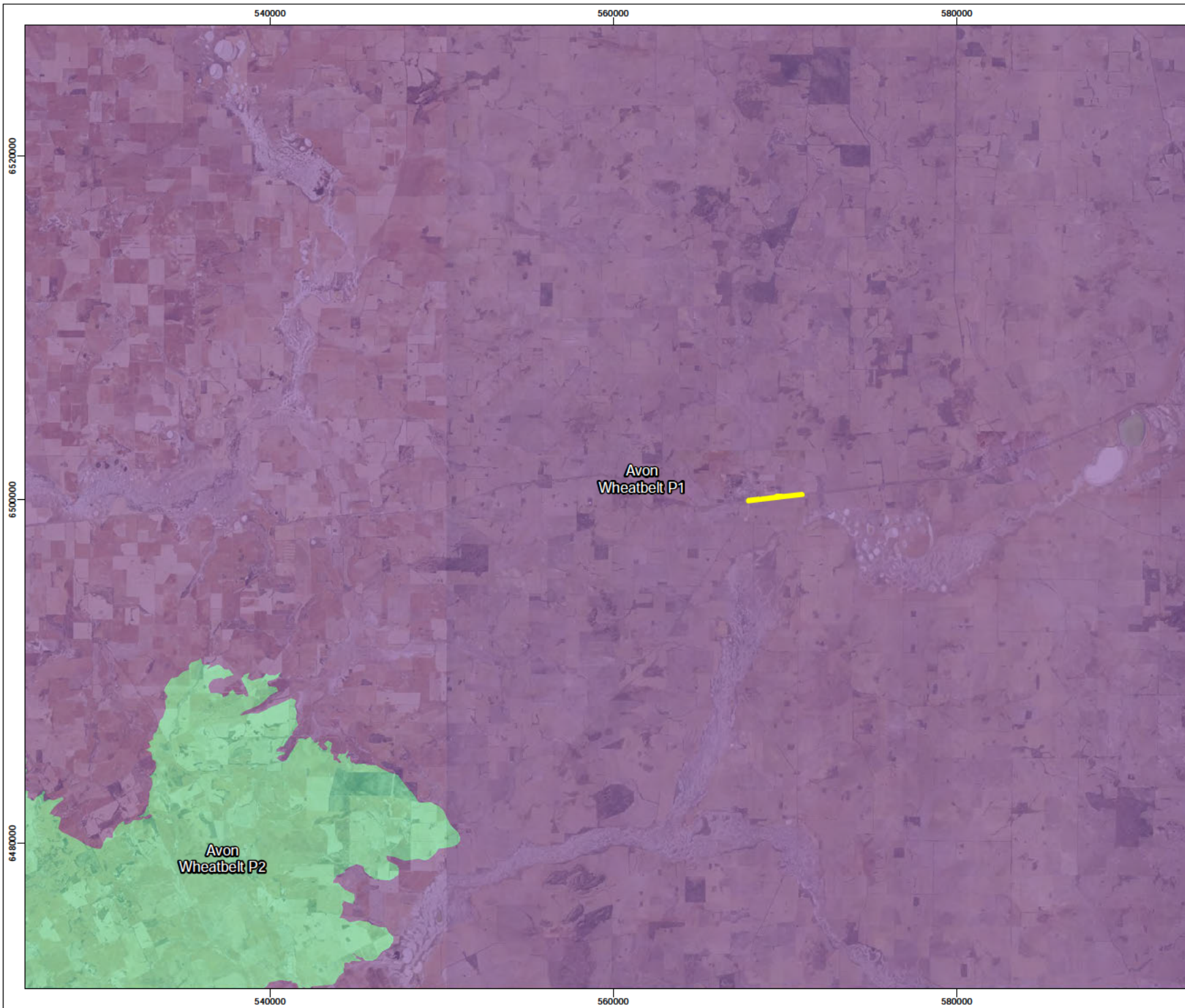
LOCALITY MAP

PROJECT ID 4921		DATE 28/01/2022	
HORIZONTAL DATUM AND PROJECTION GDA 1994 MGA Zone 50			
CREATED CL	CHECKED GB	APPROVED GB	REVISION 0

Cooperative Bulk Handling
Kellerberrin

**Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys**

Figure 1
Survey Area



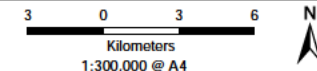
Legend

- Survey Area
- IBRA Subregions
 - Avon Wheatbelt P1
 - Avon Wheatbelt P2

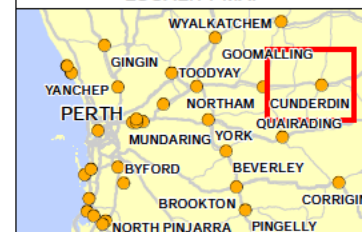
- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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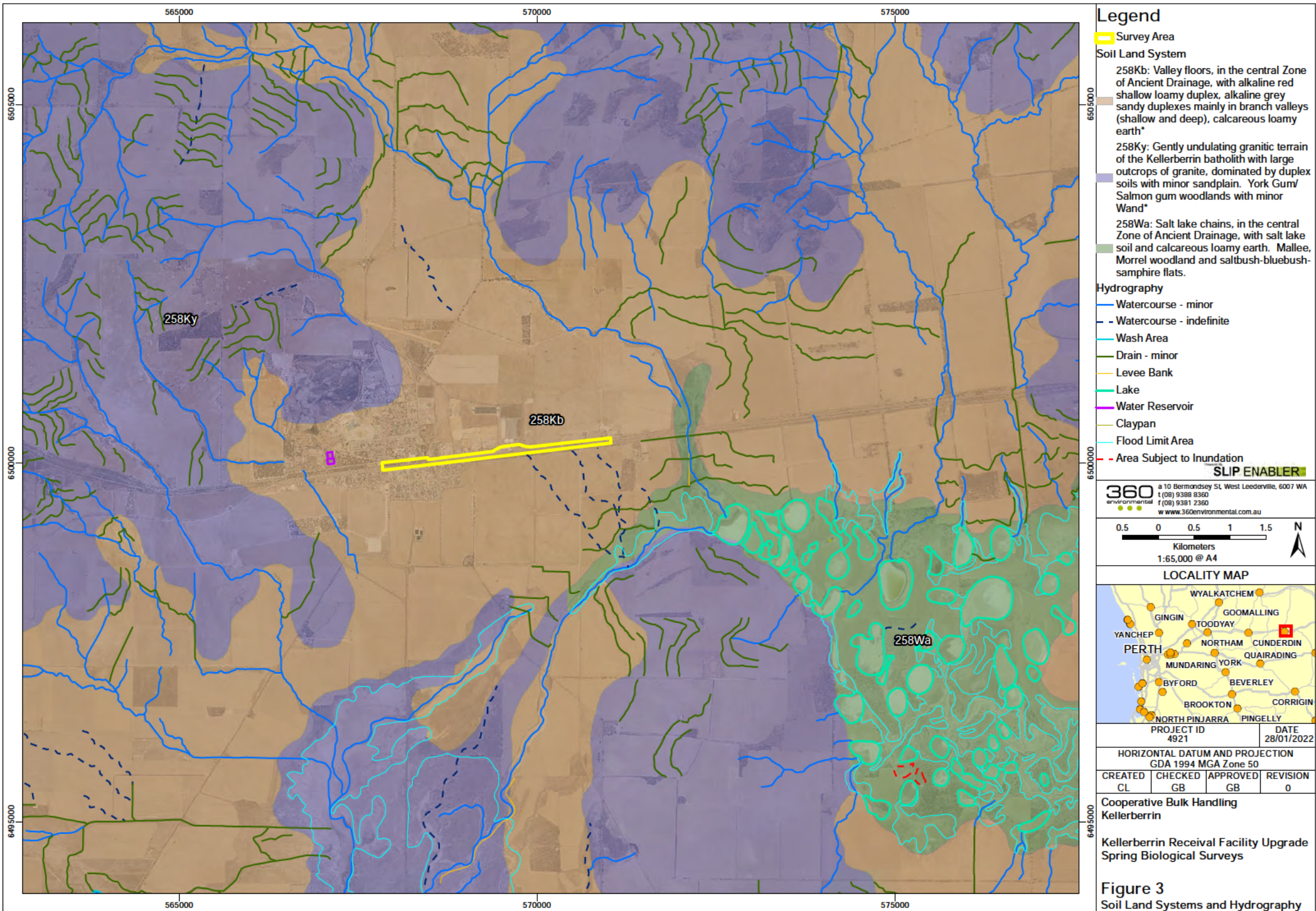


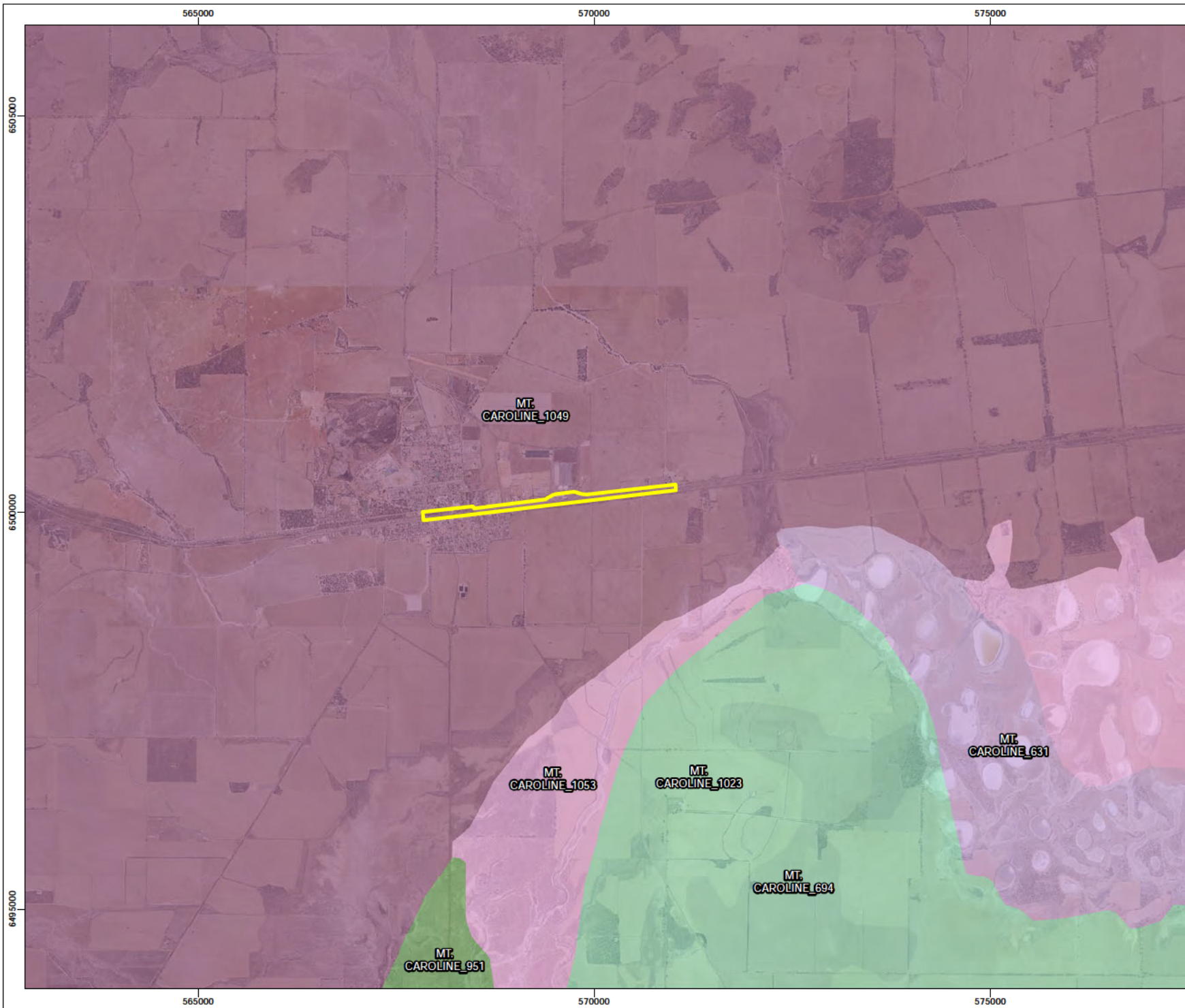
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	HORIZONTAL DATUM AND PROJECTION GDA 1994 MGA Zone 50			
	CREATED CL	CHECKED GB	APPROVED GB	REVISION 0

Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 2
IBRA Subregions





Legend

Survey Area

Broad Vegetation Types

- MT. CAROLINE_1023
- MT. CAROLINE_1049
- MT. CAROLINE_1053
- MT. CAROLINE_631
- MT. CAROLINE_694
- MT. CAROLINE_951

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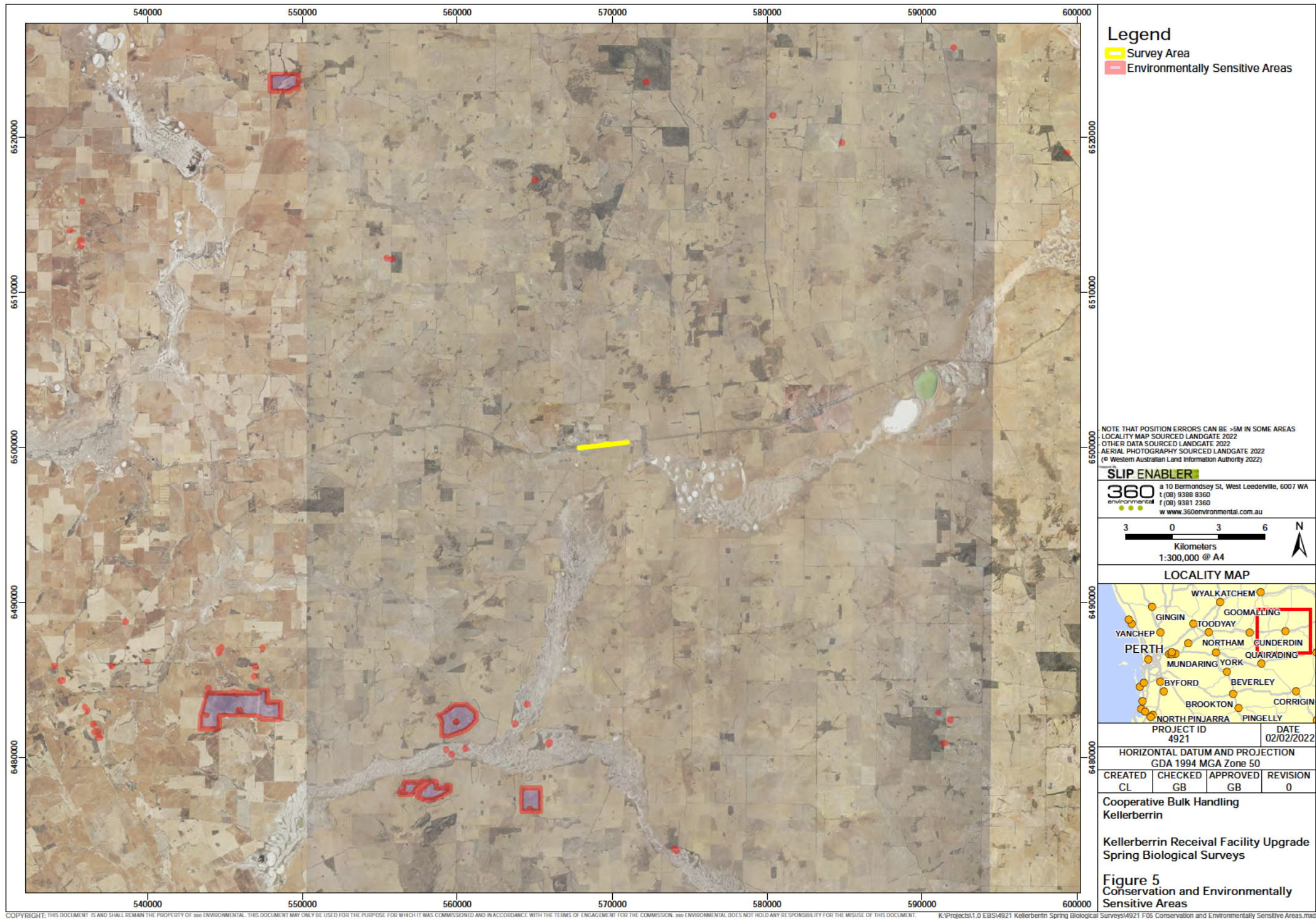
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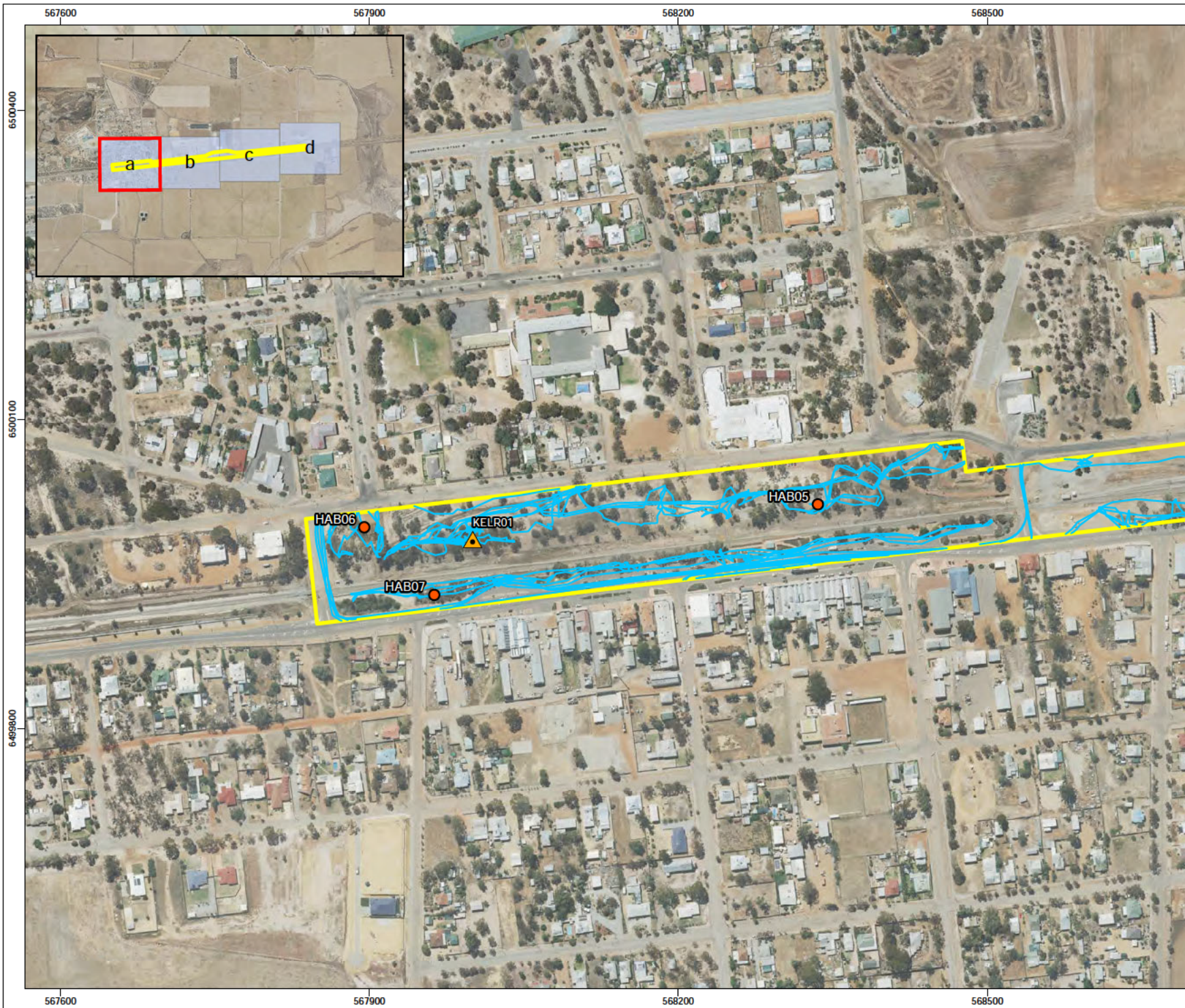
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Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 4
Broad Vegetation Types





Legend

- ▬ Survey
- ▬ GPS Tracks
- ▲ Relevé
- Fauna Habitat Assessments

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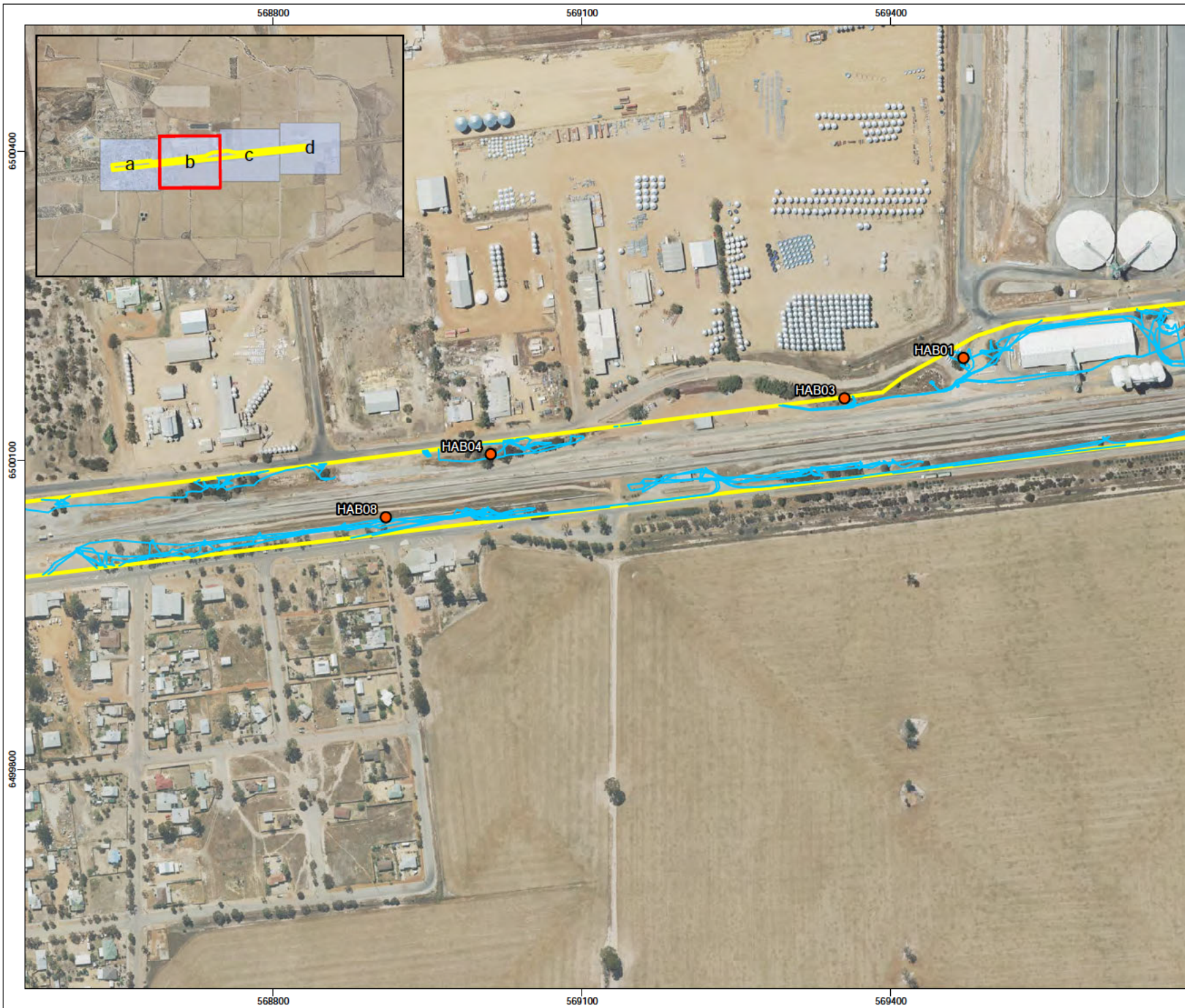
LOCALITY MAP

PROJECT ID 4921		DATE 02/02/2022	
HORIZONTAL DATUM AND PROJECTION GDA 1994 MGA Zone 50			
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Cooperative Bulk Handling
 Kellerberrin

Kellerberrin Receiving Facility Upgrade
 Spring Biological Surveys

Figure 6a
 Survey Effort



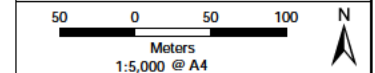
Legend

- Survey
- GPS Tracks
- Relevé
- Fauna Habitat Assessments

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LOCALITY MAP



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HORIZONTAL DATUM AND PROJECTION			
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CL	GB	GB	0

Cooperative Bulk Handling
 Kellerberrin

Kellerberrin Receiving Facility Upgrade
 Spring Biological Surveys

Figure 6b
 Survey Effort



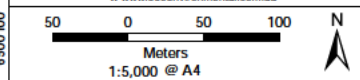
Legend

- Survey
- GPS Tracks
- ▲ Relevé
- Fauna Habitat Assessments

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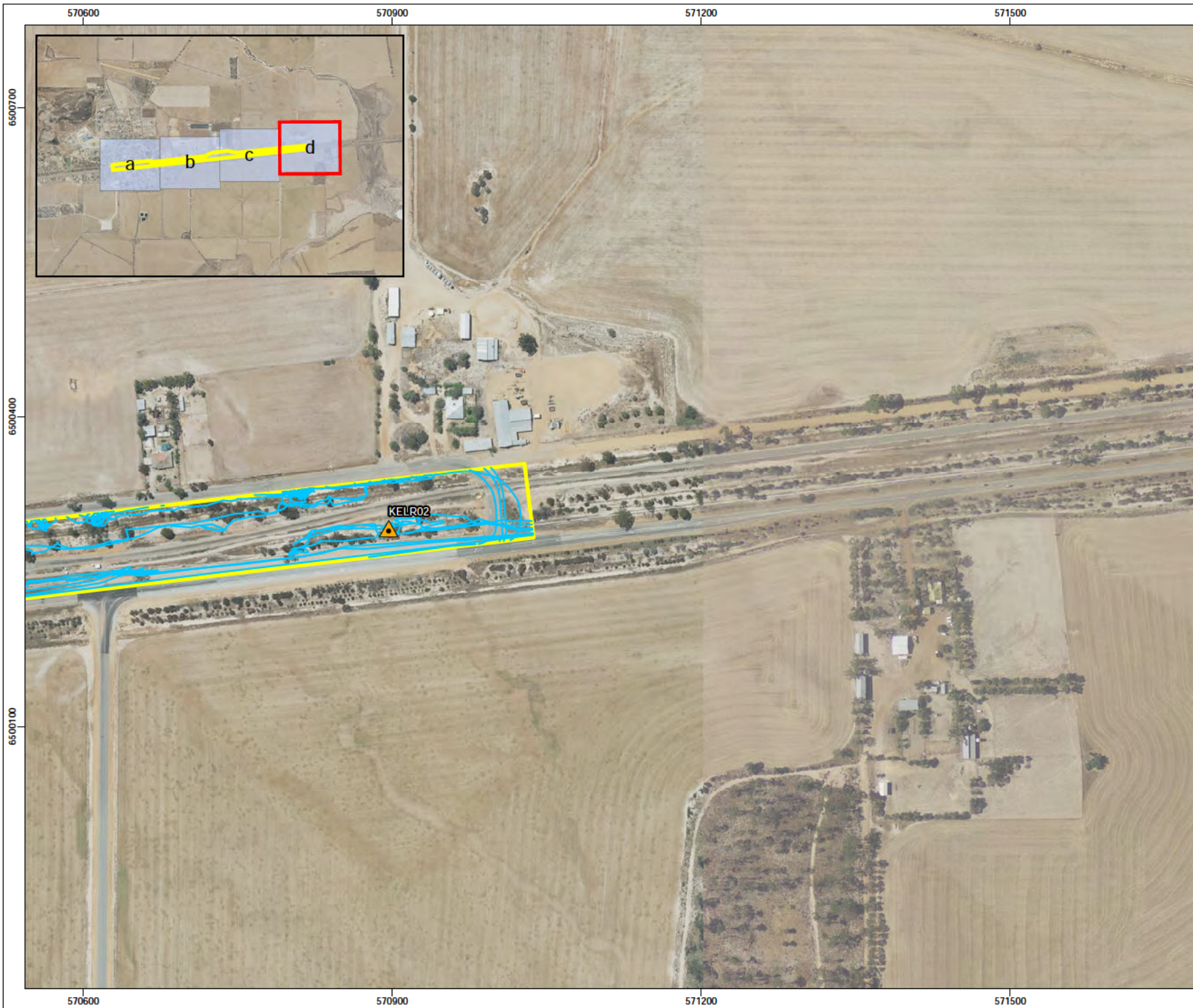


PROJECT ID 4921			DATE 02/02/2022
HORIZONTAL DATUM AND PROJECTION GDA 1994 MGA Zone 50			
CREATED CL	CHECKED GB	APPROVED GB	REVISION 0

Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 6c
Survey Effort



Legend

- ▬ Survey
- ▬ GPS Tracks
- ▲ Relevé
- Fauna Habitat Assessments

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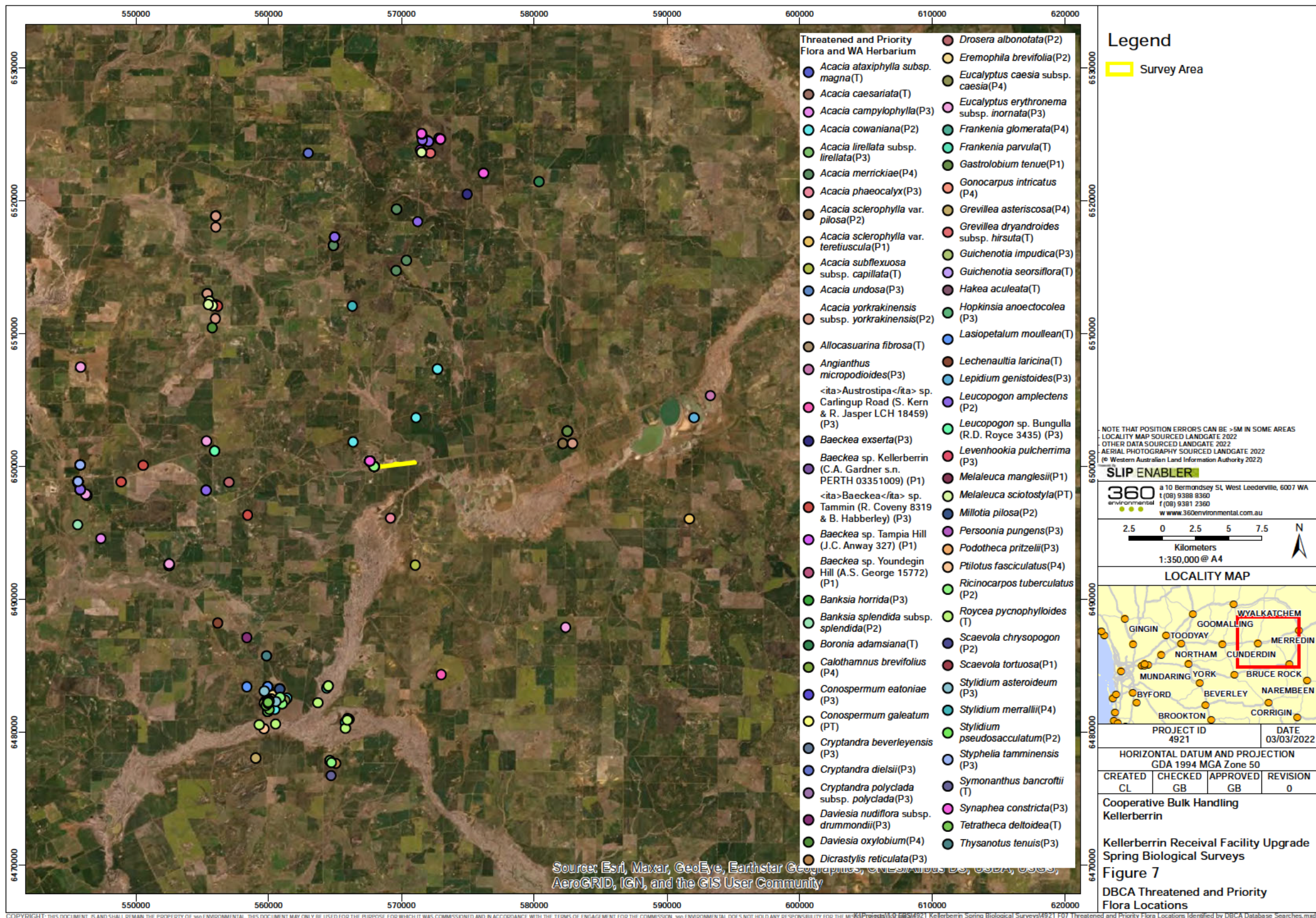
LOCALITY MAP

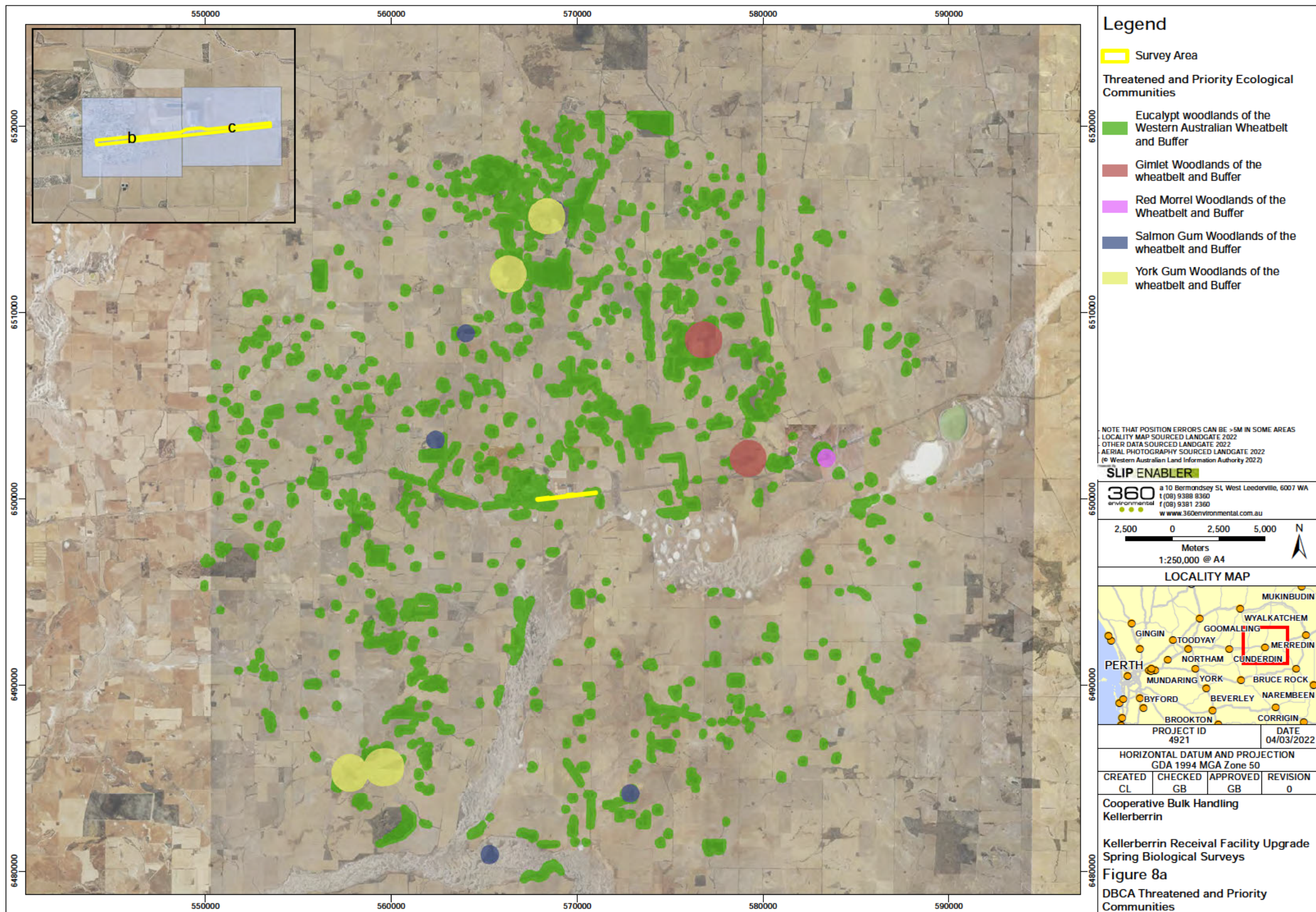
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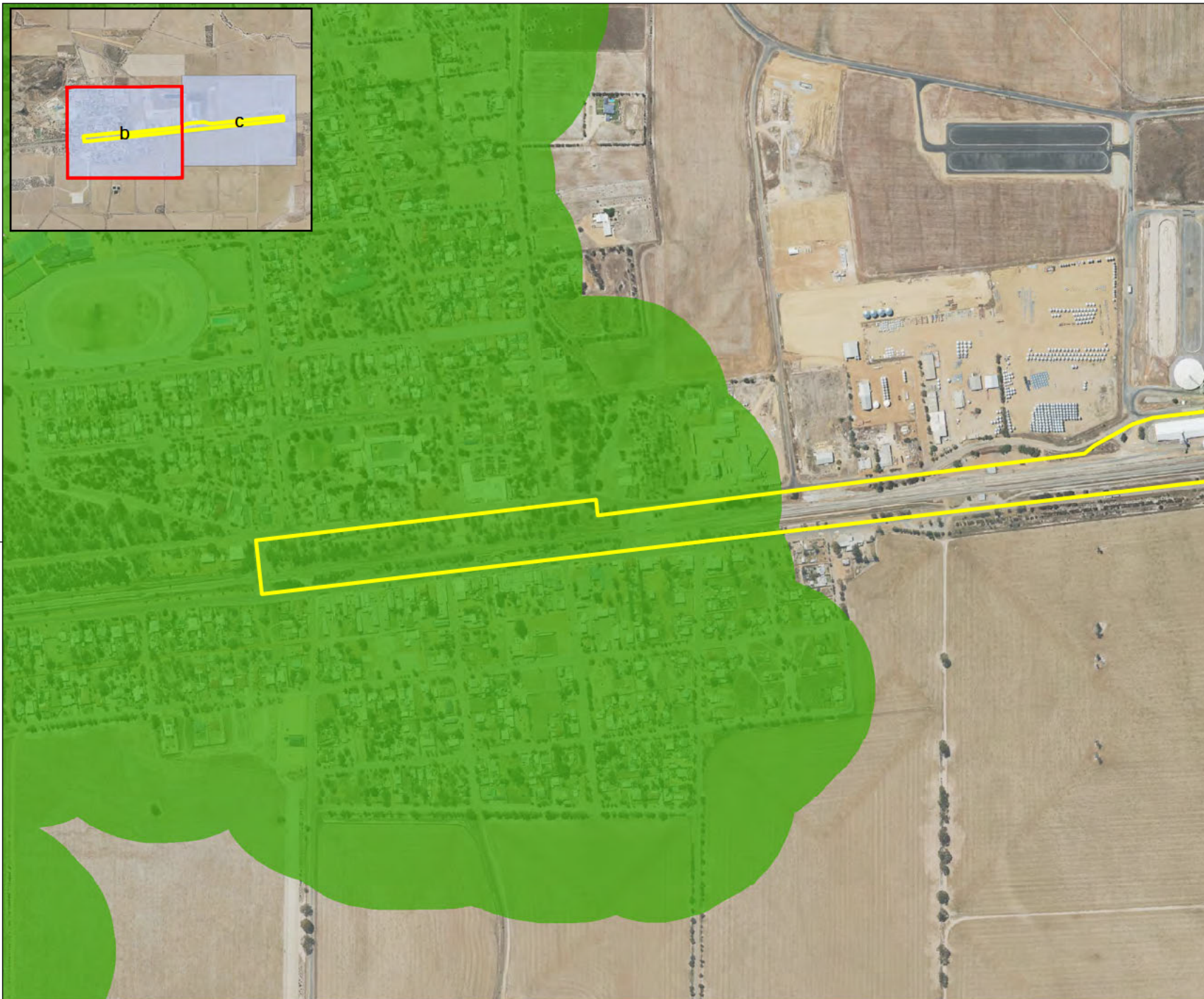
Cooperative Bulk Handling
 Kellerberrin

Kellerberrin Receiving Facility Upgrade
 Spring Biological Surveys

Figure 6d
 Survey Effort







Legend

Survey Area

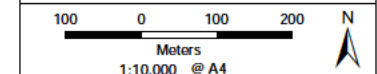
Threatened and Priority Ecological Communities

Eucalypt woodlands of the Western Australian Wheatbelt and Buffer

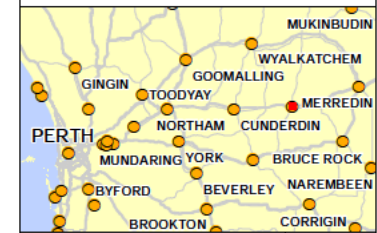
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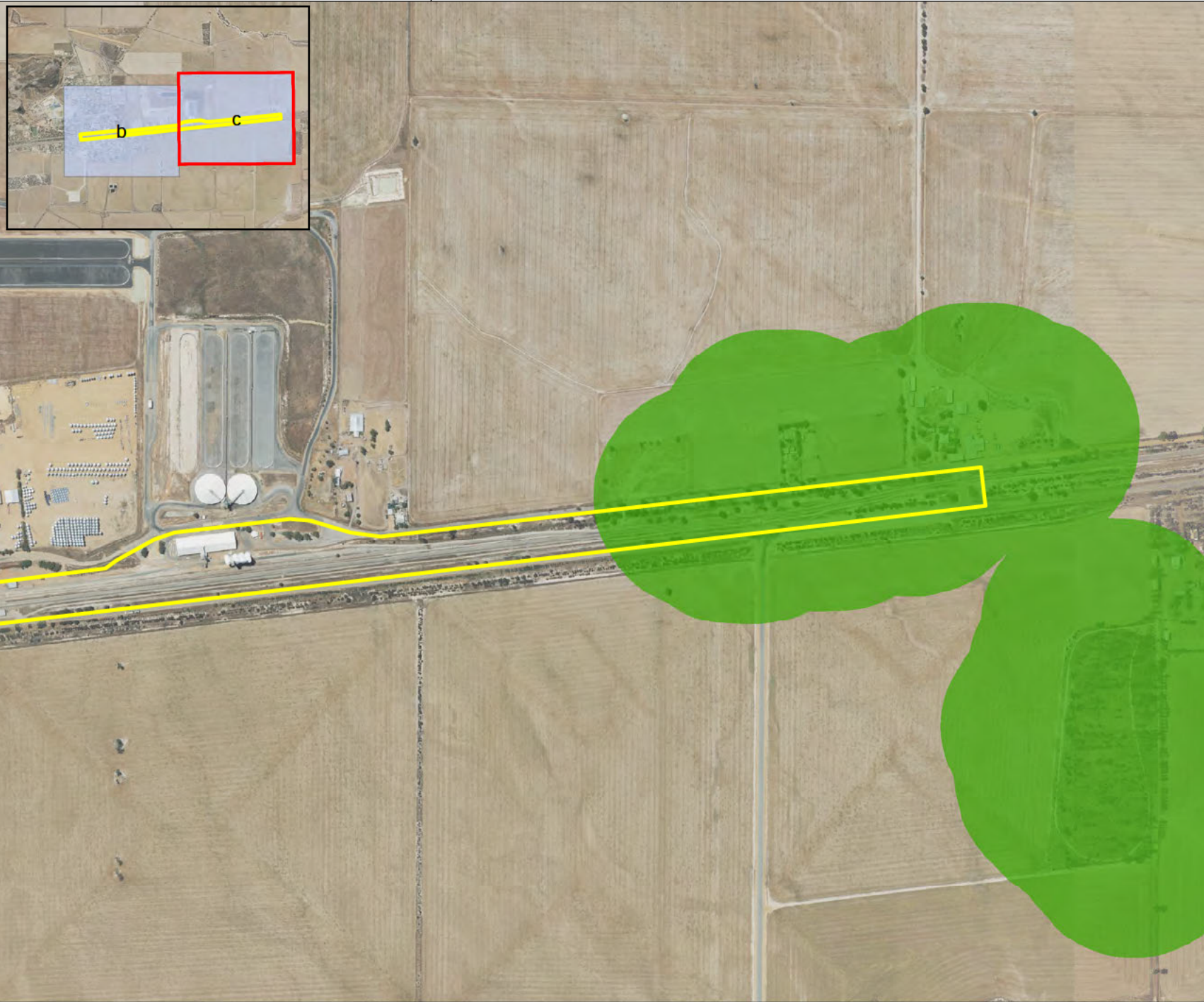
Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 8b

DBCAs Threatened and Priority
Communities

570000



Legend

Survey Area

Threatened and Priority Ecological Communities

Eucalypt woodlands of the Western Australian Wheatbelt and Buffer

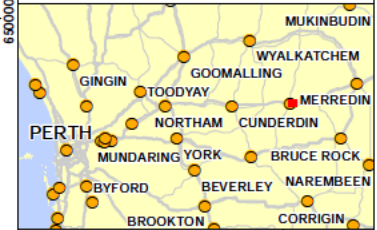
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LOCALITY MAP



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HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CL	GB	GB	0

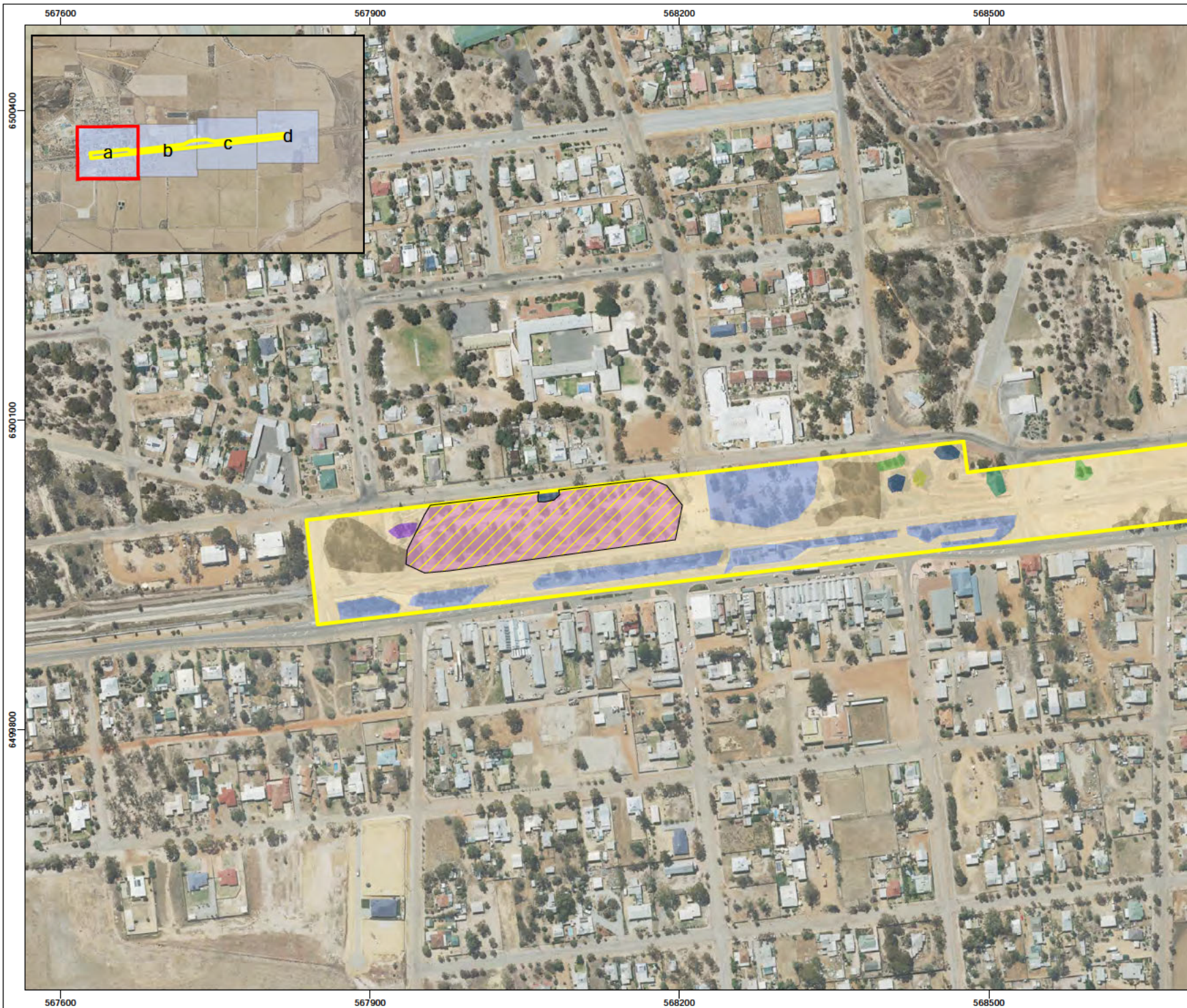
Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 8c

DBCA Threatened and Priority
Communities

6500000



Legend

 Survey Area

vegetation types

 Allocasuarina sp.

 EI

 Es

 Garden/Ne/NeE

 Mixed endemic and non-endemic
Eucalypts

 Ne

 NeE

 eE

 Cleared

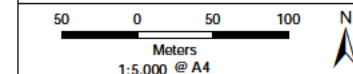
Potential TEC Locations (Wheatbelt
woodlands)

 Patch 1

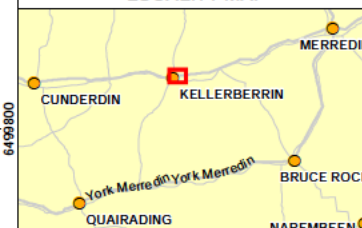
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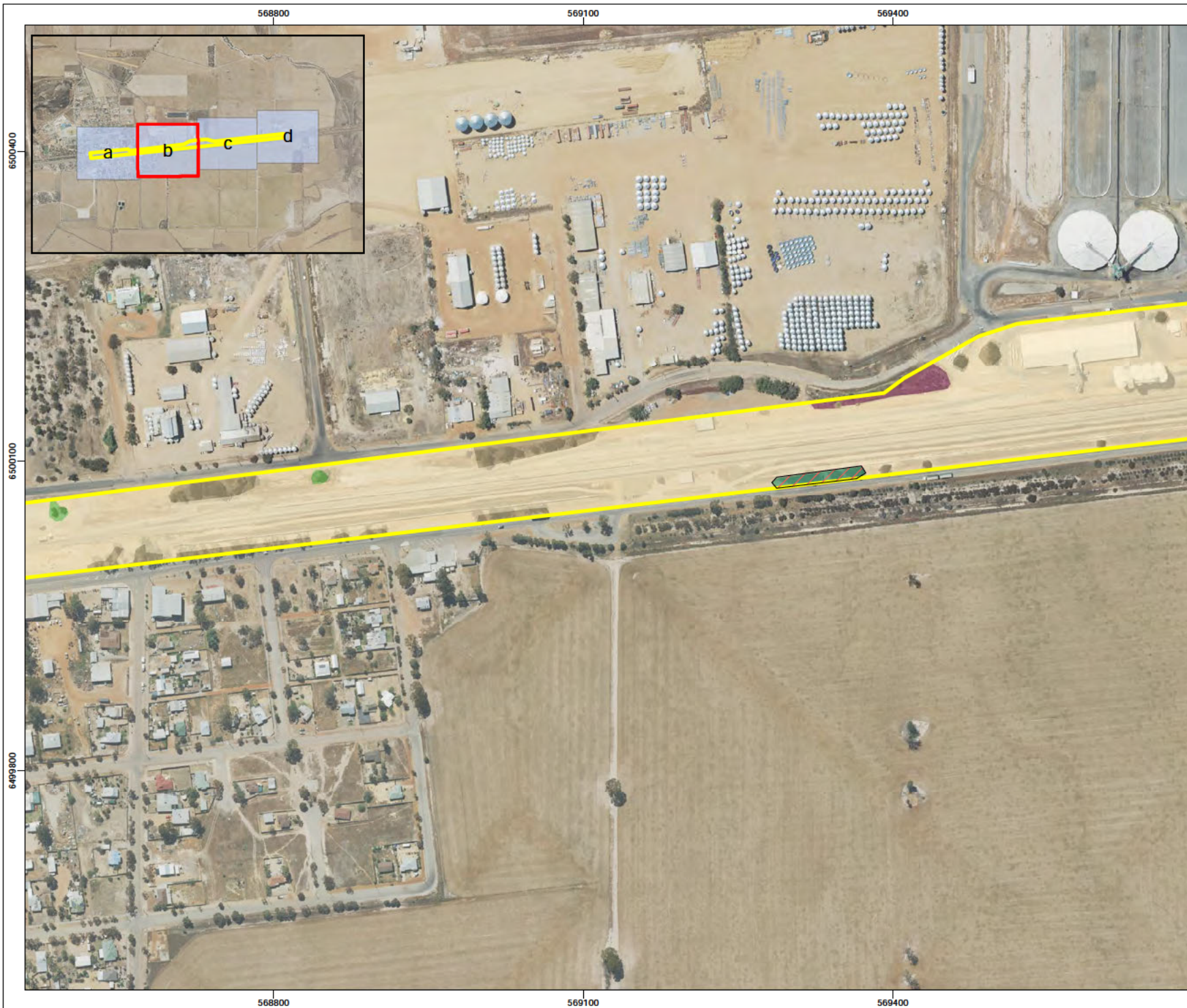
HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED CL	CHECKED GB	APPROVED GB	REVISION 0
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Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 9a
Vegetation Types



Legend

 Survey Area

vegetation types

Es

Mixed weeds

NeE

eE

Cleared

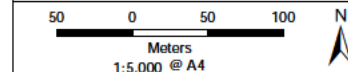
Potential TEC Locations (Wheatbelt woodlands)

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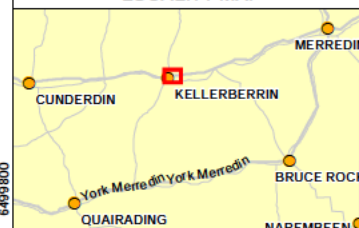
NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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GDA 1994 MGA Zone 50

CREATED CL	CHECKED GB	APPROVED GB	REVISION 0
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Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 9b
Vegetation Types



Legend

 Survey Area

vegetation types

EI

EIEs

Es

Mixed weeds

NeE

Cleared

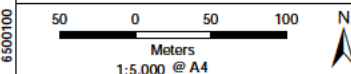
Potential TEC Locations (Wheatbelt woodlands)

Patch 3

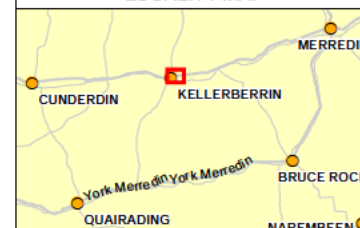
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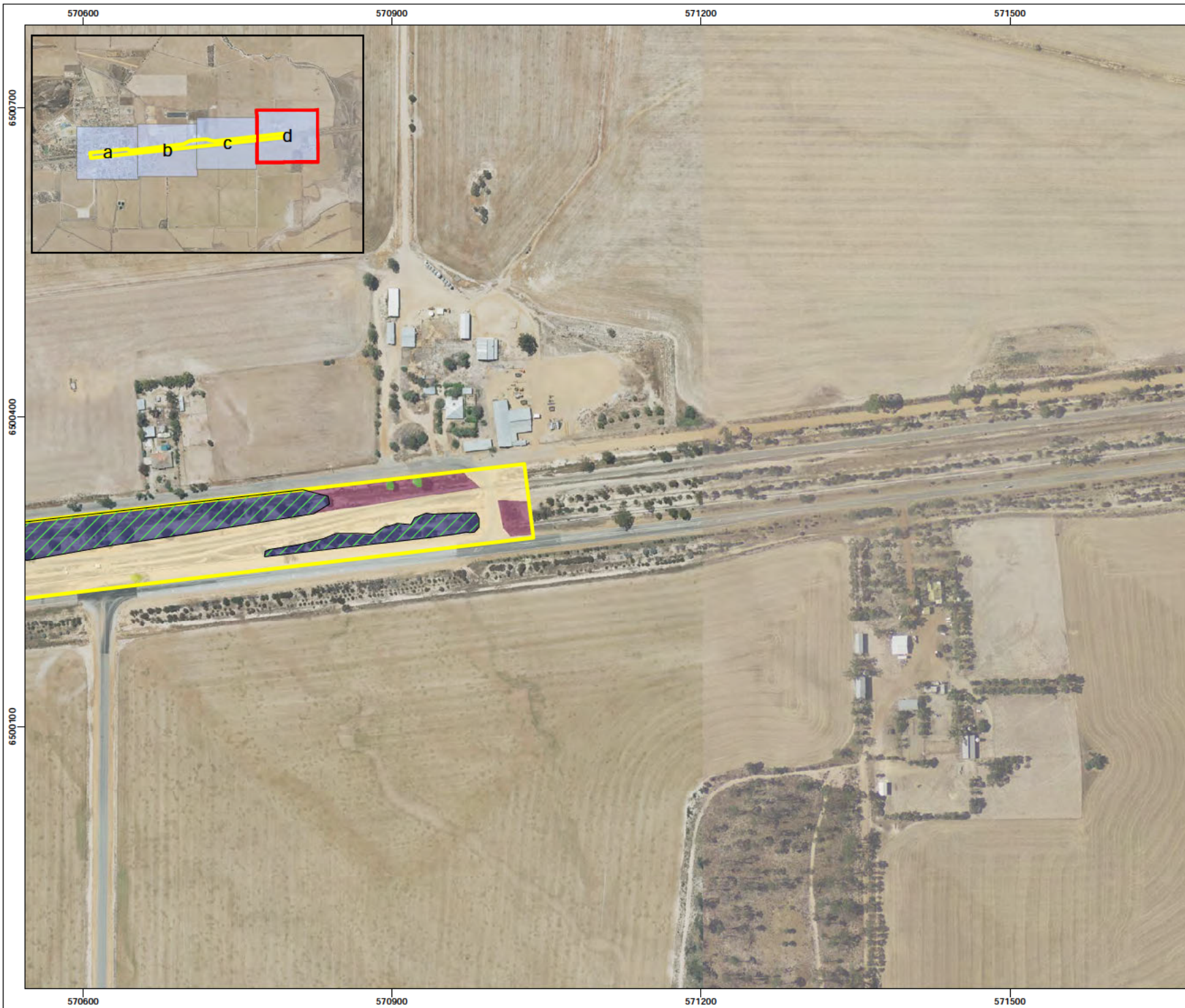
HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED CL	CHECKED GB	APPROVED GB	REVISION 0
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Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 9c
Vegetation Types



Legend

Survey Area

vegetation types

- EI
- EIEs
- Es
- Mixed weeds
- Cleared

Potential TEC Locations (Wheatbelt woodlands)

- Patch 3

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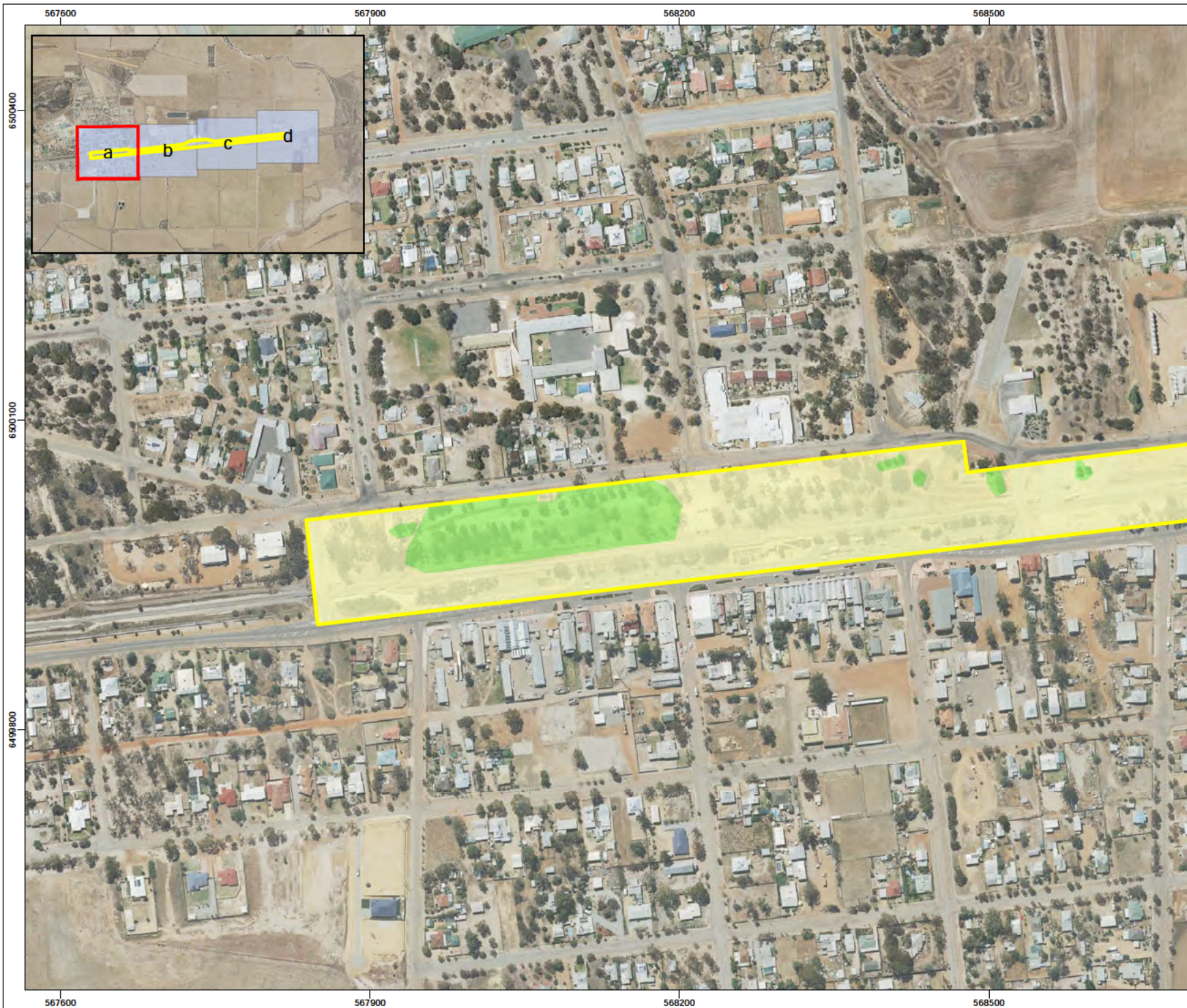
LOCALITY MAP

PROJECT ID 4921		DATE 04/03/2022	
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CREATED CL	CHECKED GB	APPROVED GB	REVISION 0

Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 9d Vegetation Types



Legend

 Survey Area

Vegetation Condition

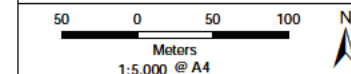
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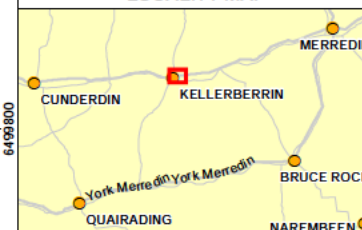
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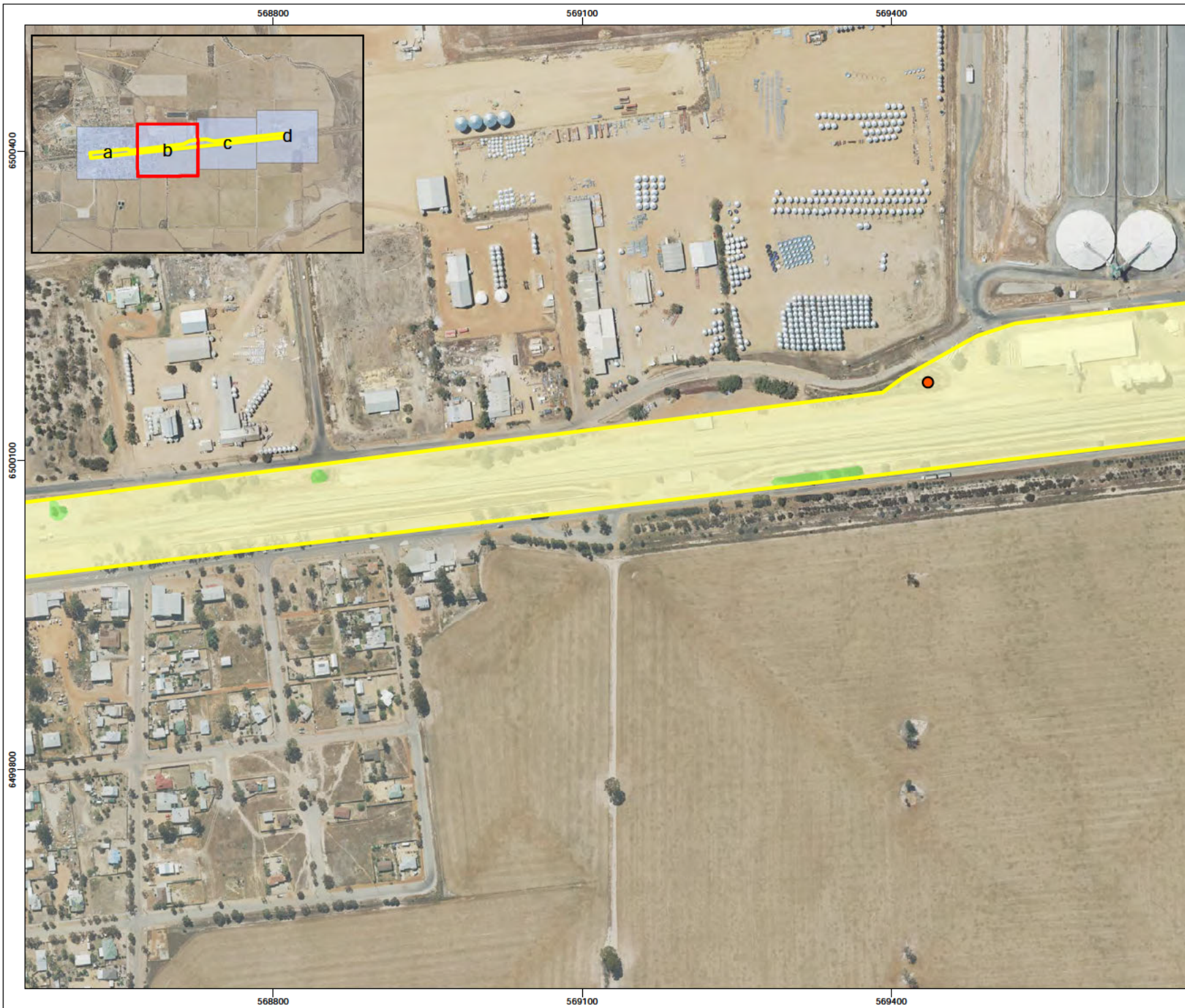
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Cooperative Bulk Handling
 Kellerberrin

Kellerberrin Receiving Facility Upgrade
 Spring Biological Surveys

Figure 10a
 Vegetation Condition



Legend

 Survey Area

Declared Weeds

● *Echium plantagineum*

Vegetation Condition

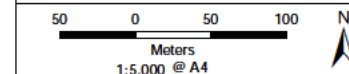
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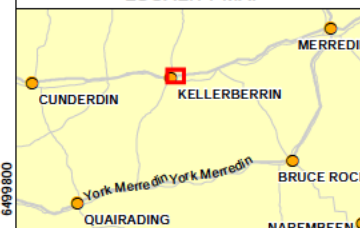
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Cooperative Bulk Handling
 Kellerberrin

Kellerberrin Receiving Facility Upgrade
 Spring Biological Surveys

Figure 10b
 Vegetation Condition



Legend

Survey Area

Declared Weeds

● *Echium plantagineum*

Vegetation Condition

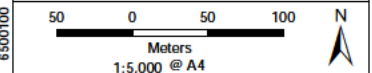
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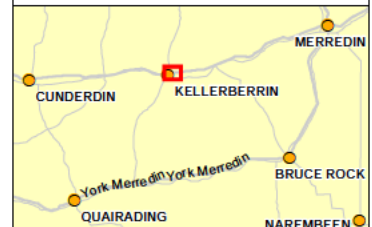
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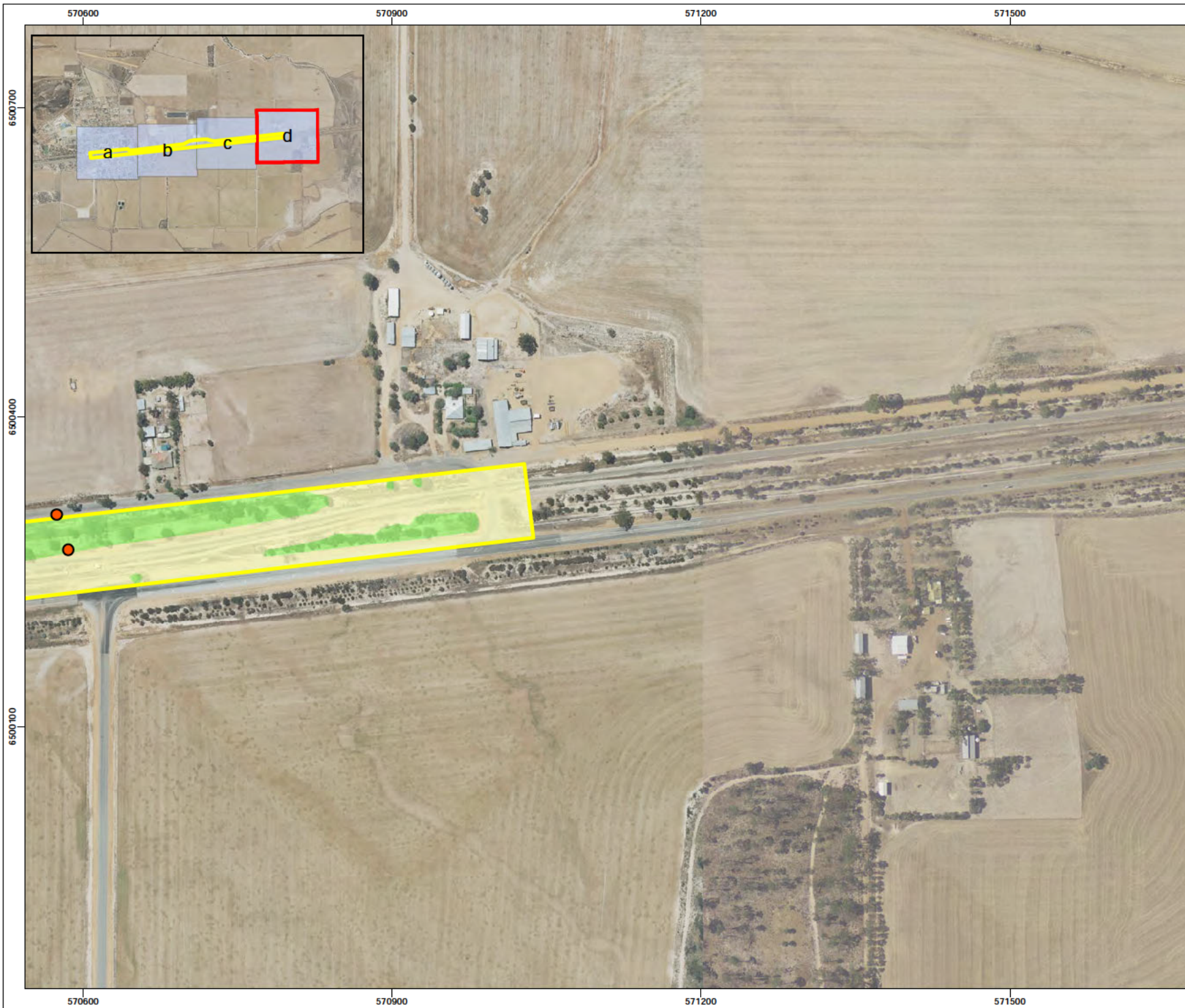
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CREATED	CHECKED	APPROVED	REVISION
CL	GB	GB	0

Cooperative Bulk Handling
 Kellerberrin

Kellerberrin Receiving Facility Upgrade
 Spring Biological Surveys

Figure 10c
 Vegetation Condition



Legend

Survey Area

Declared Weeds

● *Echium plantagineum*

Vegetation Condition

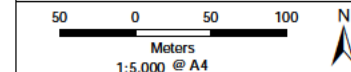
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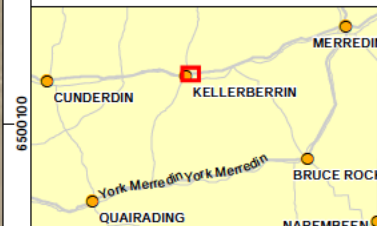
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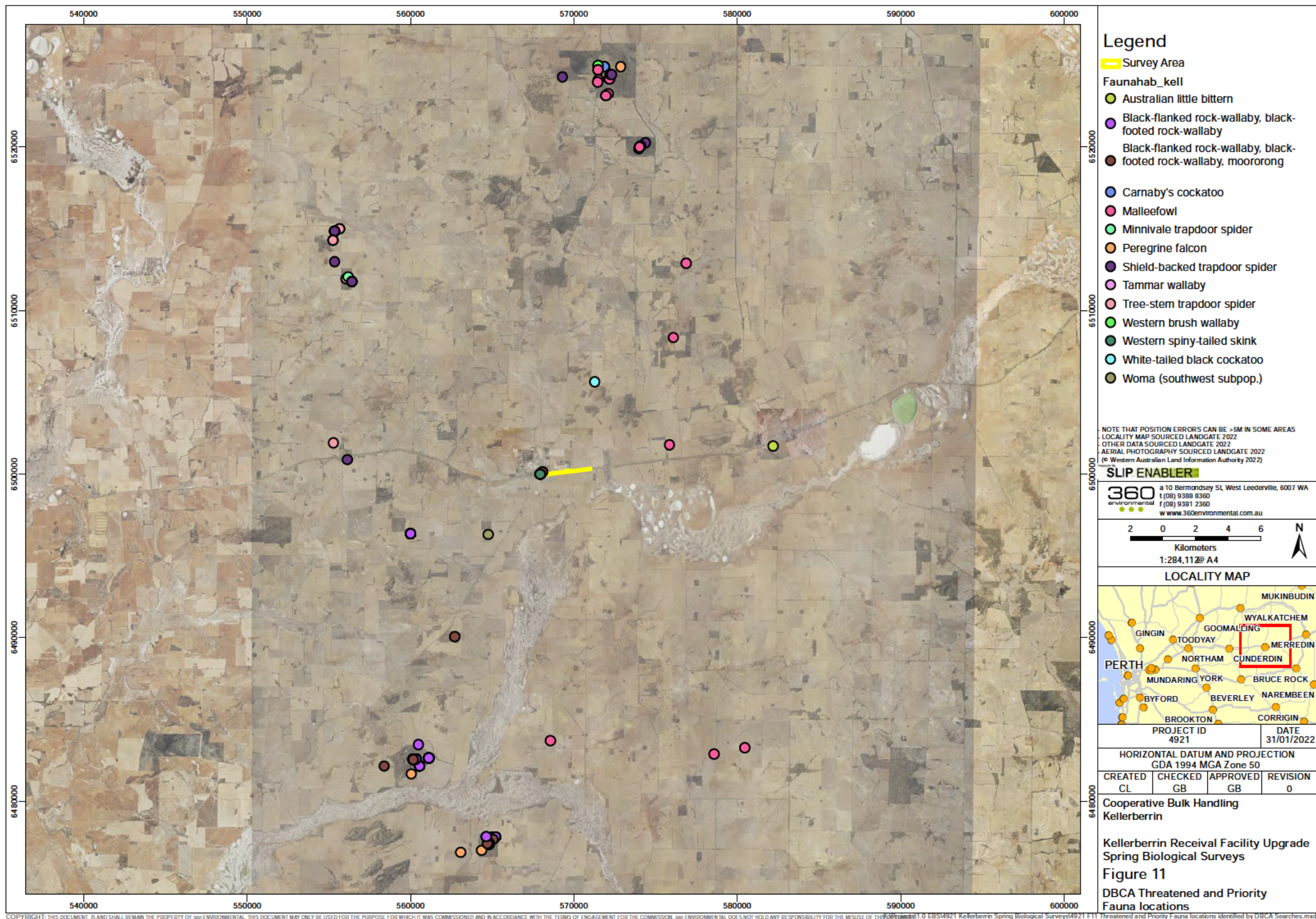
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GDA 1994 MGA Zone 50

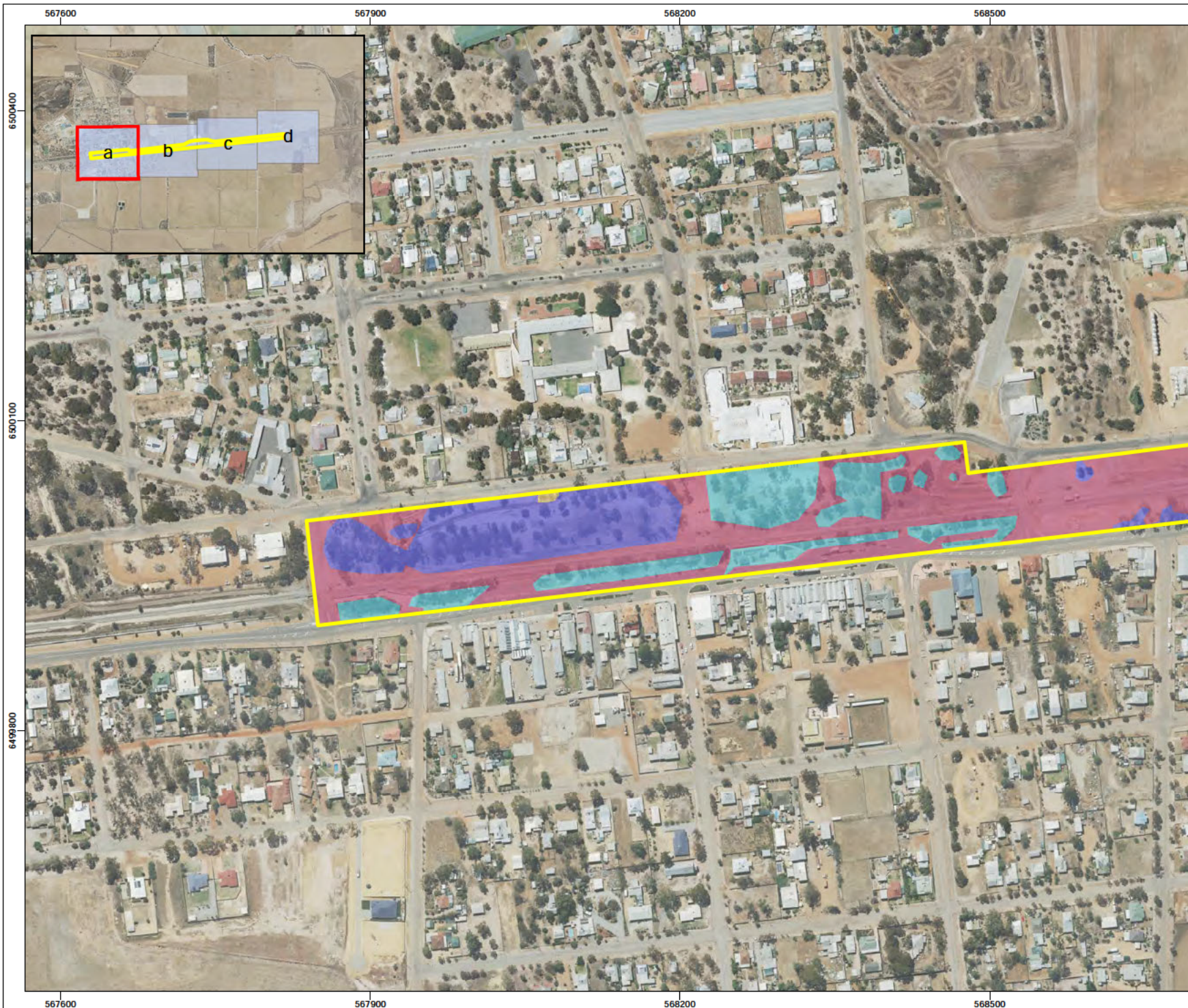
CREATED CL	CHECKED GB	APPROVED GB	REVISION 0
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Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 10d
Vegetation Condition





Legend

 Survey Area

Fauna Habitat

 Garden/landscaped

 Garden/non-endemic trees

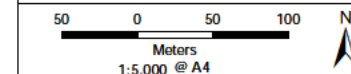
 Mixed endemic and non-endemic Eucalypts

 Cleared

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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- OTHER DATA SOURCED LANDGATE 2022
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LOCALITY MAP



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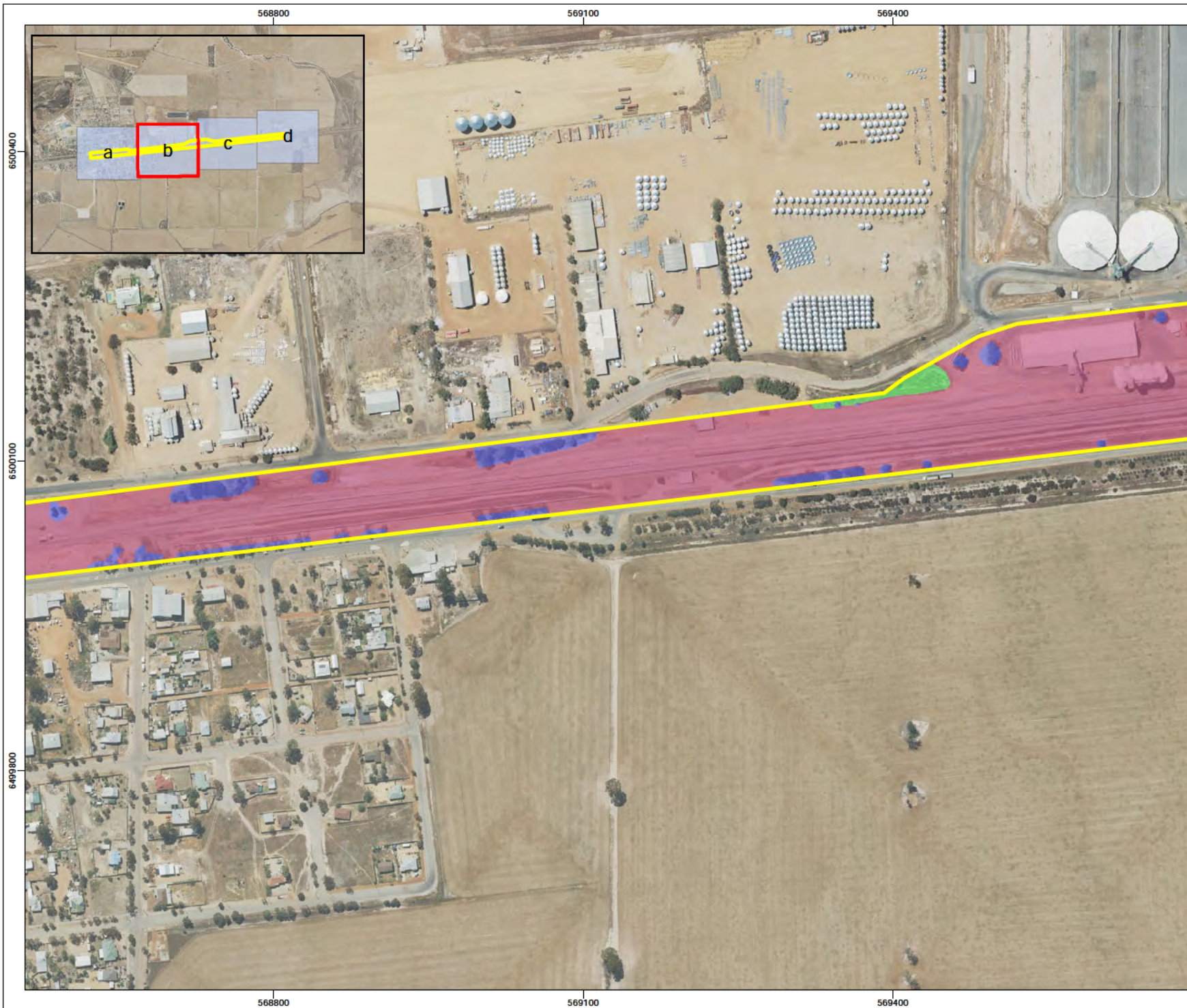
HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED CL	CHECKED GB	APPROVED GB	REVISION 0
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Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 12a
Fauna Habitat



Legend

Survey Area

Fauna Habitat

Mixed endemic and non-endemic Eucalypts

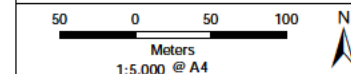
Weedy grassland

Cleared

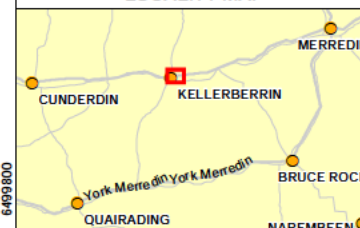
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LOCALITY MAP



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HORIZONTAL DATUM AND PROJECTION
 GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CL	GB	GB	0

Cooperative Bulk Handling
 Kellerberrin

Kellerberrin Receiving Facility Upgrade
 Spring Biological Surveys

Figure 12b
 Fauna Habitat



Legend

Survey Area

Fauna Habitat

Mixed endemic and non-endemic Eucalypts

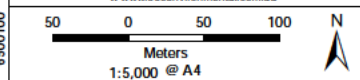
Weedy grassland

Cleared

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4921	04/03/2022

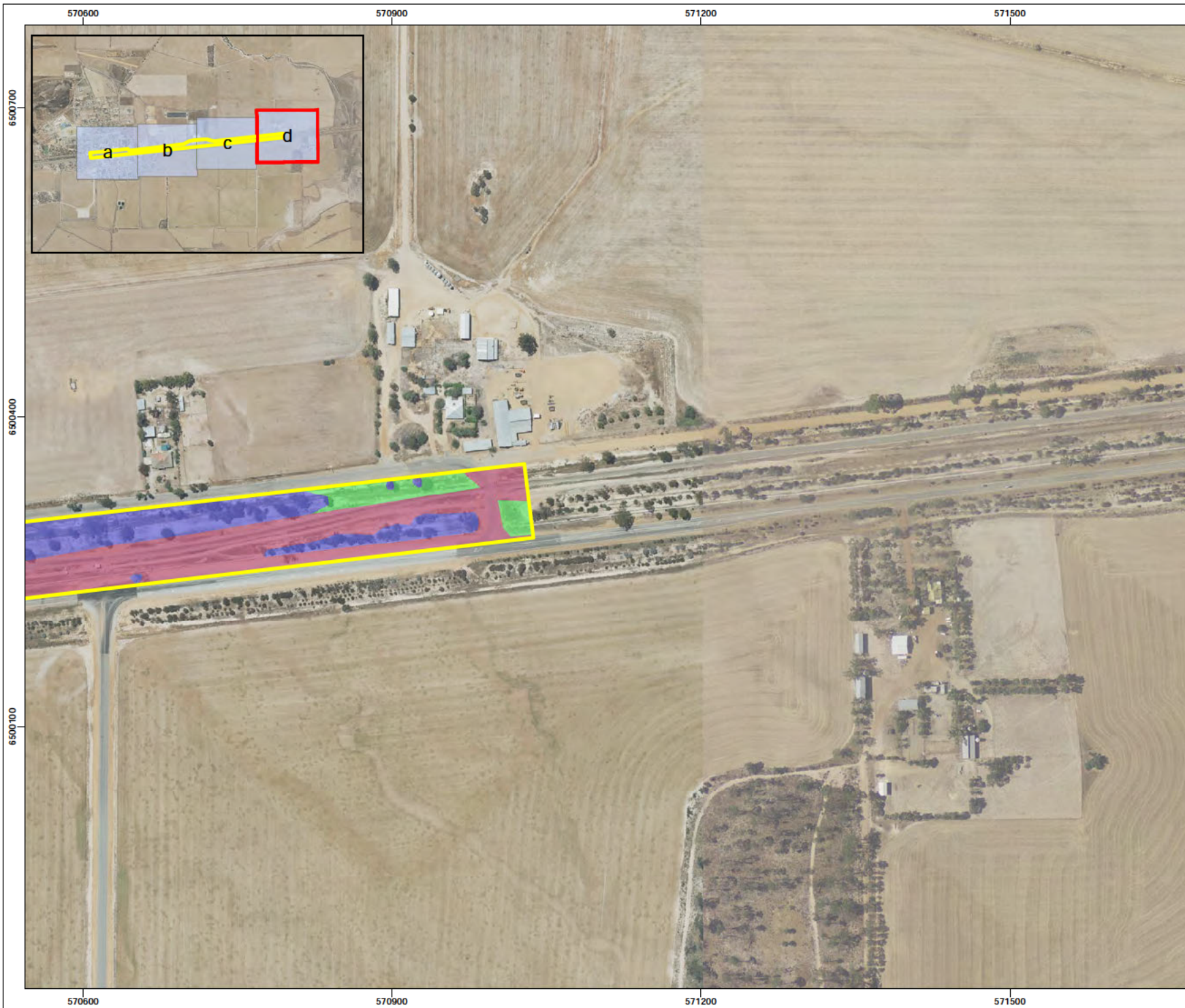
HORIZONTAL DATUM AND PROJECTION

CREATED	CHECKED	APPROVED	REVISION
CL	GB	GB	0

Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 12c
Fauna Habitat



Legend

Survey Area

Fauna Habitat

Mixed endemic and non-endemic Eucalypts

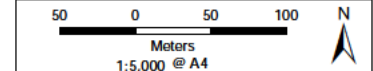
Weedy grassland

Cleared

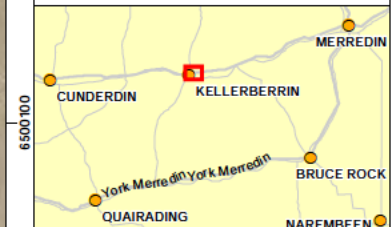
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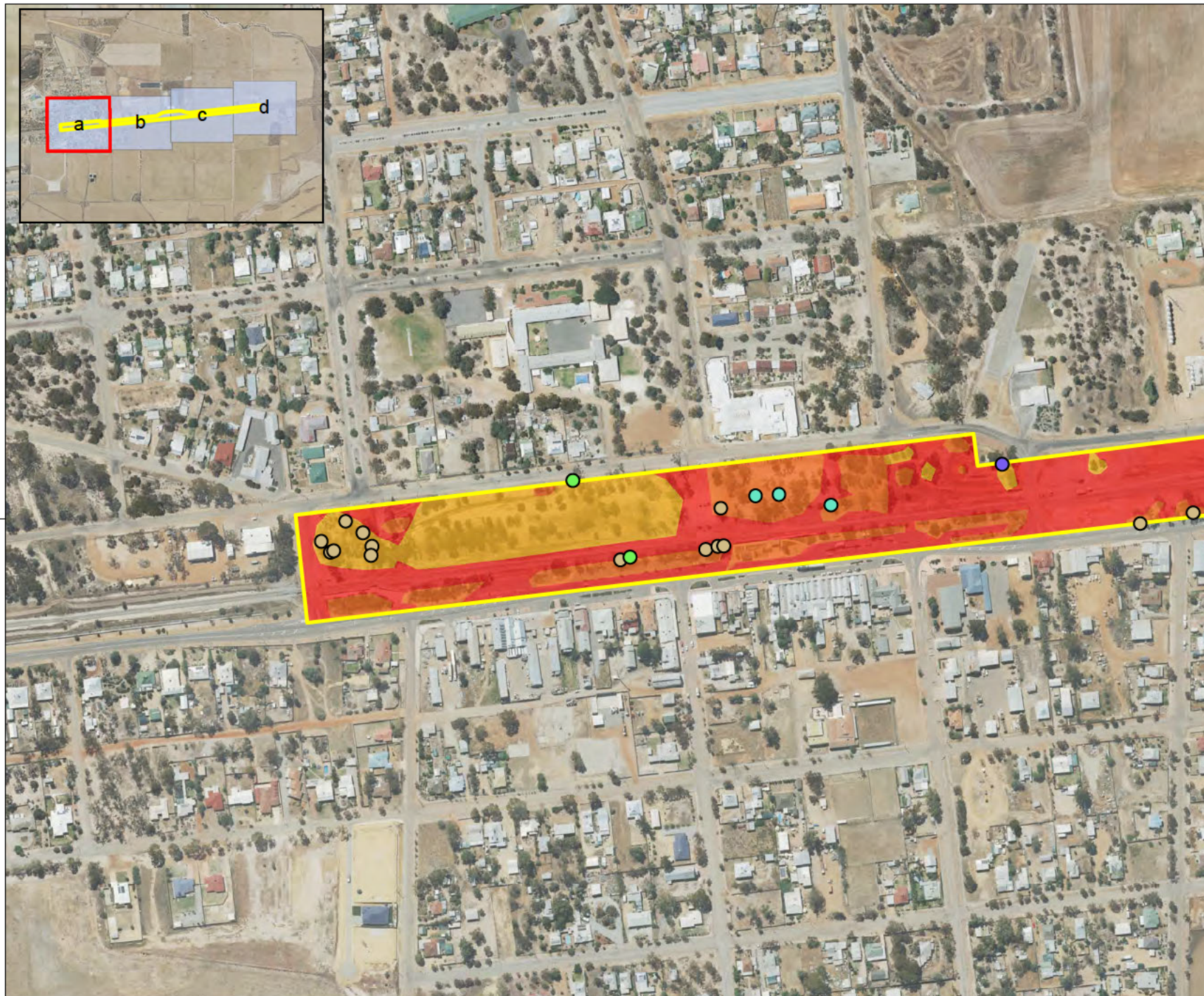
HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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CL	GB	GB	0

Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 12d
Fauna Habitat



Legend

 Survey Area

Potential Black Cockatoo Breeding Trees (DBH>500 mm)

● *Eucalyptus camaldulensis*

● *Eucalyptus rudis* subsp. *rudis*

● *Eucalyptus salubris*

● Other introduced Eucalypt

Foraging Value

■ 0 - No Foraging Value

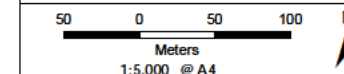
■ 1 - Negligible to Low Foraging Value

■ 2 - Low Foraging Value

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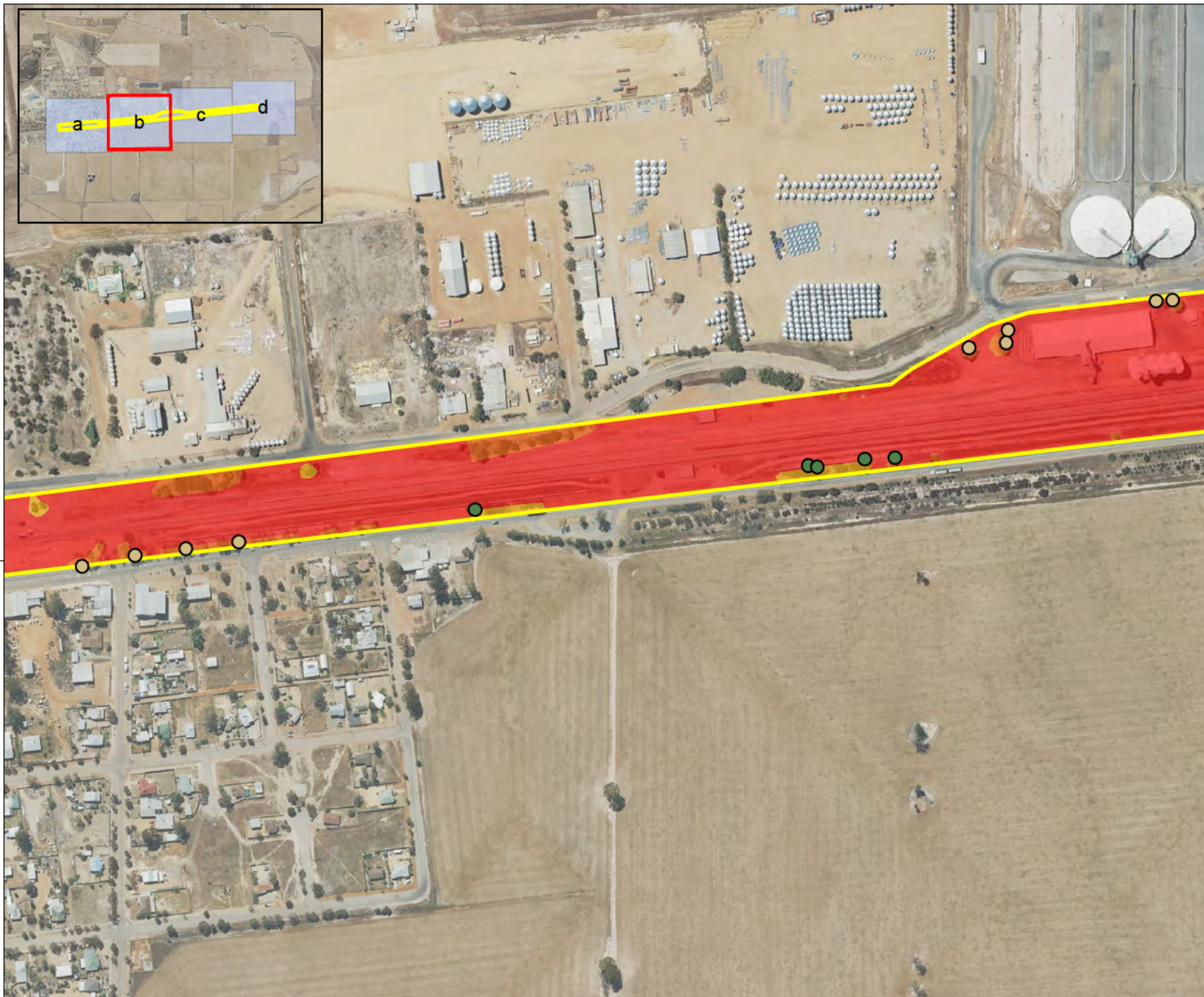
Cooperative Bulk Handling
 Kellerberrin

Kellerberrin Receiving Facility Upgrade
 Spring Biological Surveys

Figure 12a

Black Cockatoo Breeding Habitat

6500000



Legend

 Survey Area

Potential Black Cockatoo Breeding Trees (DBH > 500 mm)

● *Eucalyptus camaldulensis*

● *Eucalyptus kondininensis*

Foraging Value

0 - No Foraging Value

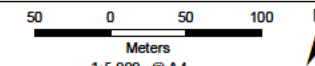
1 - Negligible to Low Foraging Value

2 - Low Foraging Value

NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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HORIZONTAL DATUM AND PROJECTION GDA 1994 MGA Zone 50			
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CREATED CL	CHECKED GB	APPROVED GB	REVISION 0
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Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 12b

Black Cockatoo Breeding Habitat

570000



6500000

570000

Legend

 Survey Area

Potential Black Cockatoo Breeding Trees (DBH > 500 mm)

● *Eucalyptus camaldulensis*

● Salmon gum (*Eucalyptus salmonophloia*)

● Stag

● York Gum (*Eucalyptus loxophleba*)

● Potential Black Cockatoo Breeding Hollows (> 100 mm)

Foraging Value

■ 0 - No Foraging Value

■ 1 - Negligible to Low Foraging Value

■ 2 - Low Foraging Value

■ 3 - Low to Moderate Foraging Value

NOTE THAT POSITION ERRORS CAN BE > 5M IN SOME AREAS

LOCALITY MAP SOURCED LANDGATE 2022

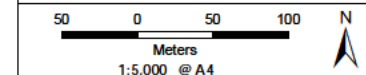
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AERIAL PHOTOGRAPHY SOURCED LANDGATE 2022

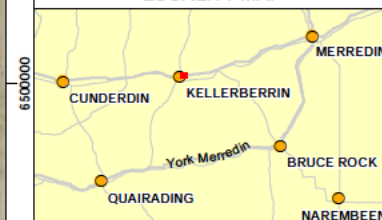
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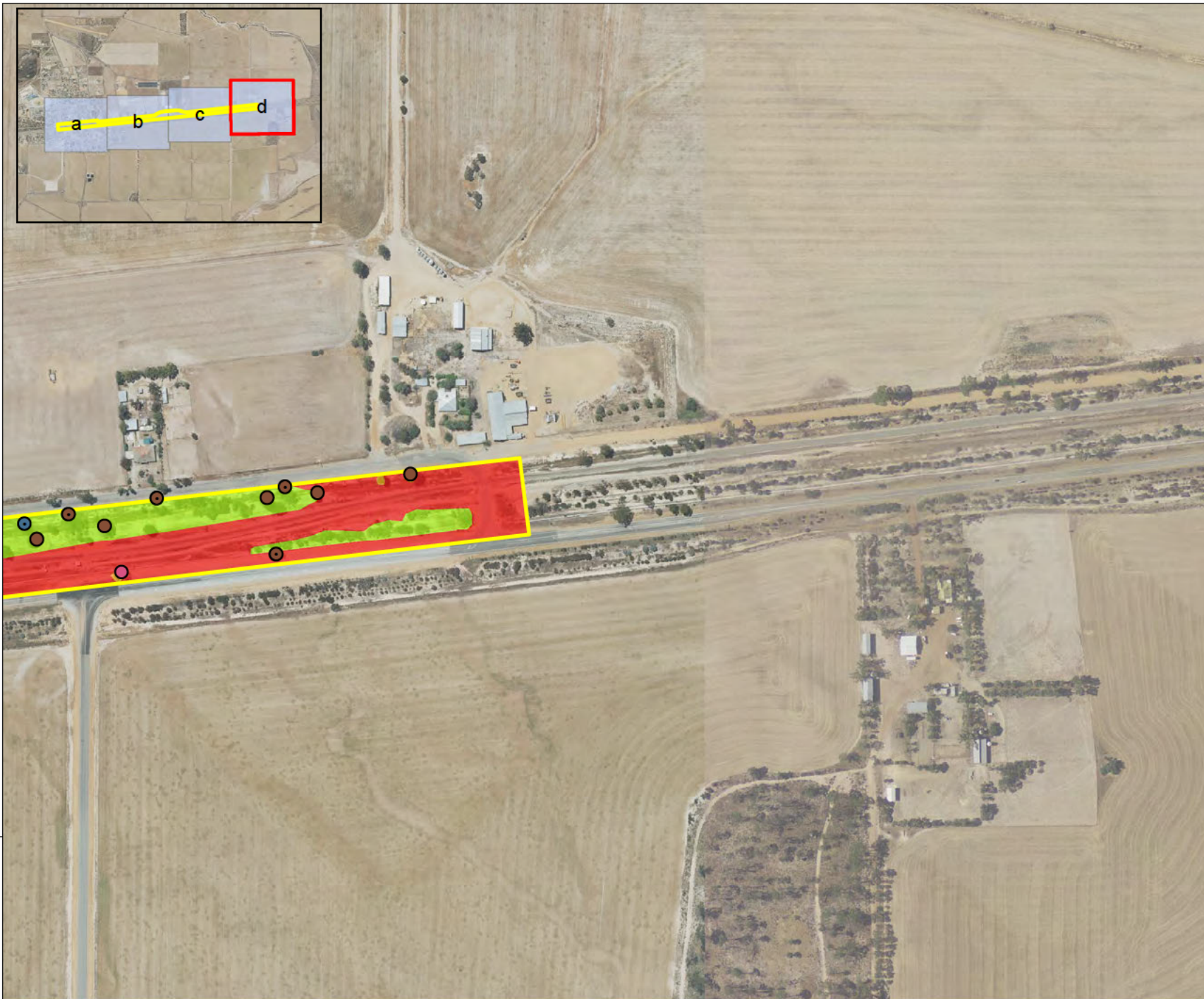
CREATED CL	CHECKED GB	APPROVED GB	REVISION 0
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Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 12c

Black Cockatoo Breeding Habitat



Legend

Survey Area

Potential Black Cockatoo Breeding Trees (DBH>500 mm)

Salmon gum (*Eucalyptus salmonophloia*)

Stag

York Gum (*Eucalyptus loxophleba*)

Potential Black Cockatoo Breeding Hollows (>100mm)

Foraging Value

0 - No Foraging Value

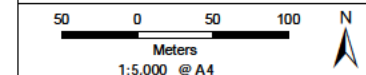
2 - Low Foraging Value

3 - Low to Moderate Foraging Value

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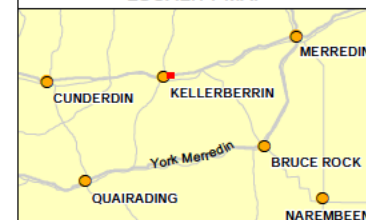
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LOCALITY MAP



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Cooperative Bulk Handling
Kellerberrin

Kellerberrin Receiving Facility Upgrade
Spring Biological Surveys

Figure 12d

Black Cockatoo Breeding Habitat

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Appendices

Appendix A

Flora Literature Review

Appendix A: Flora Literature Review

Report	Project Area	Survey Timing	Survey Effort	Conservation Significant Ecological Communities	Conservation Significant Flora	Introduced Flora
Cunderdin-Wyalkatchem Road Survey Report – Flora and Vegetation Survey (Wheatbelt Revegetation and Carbon, 2020)	Approximately 55 km NW of the Survey Area.	October 2020	Reconnaissance flora and vegetation assessment	None recorded.	None recorded.	Weeds recorded but none specified
GAR 2019/2020 Operational Banding Program Ecological Surveys (Ecoscape, 2020)	Immediately north and south of Kellerberrin.	Oct-Nov 2019	Target searches, ground truthing.	Wheatbelt Woodlands	Relevant to the Kellerberrin vicinity: <ul style="list-style-type: none"> • <i>Leucopogon amplexans</i> (P2) • <i>Scaevola chrysopogon</i> (P2) • <i>Acacia phaeocalyx</i> (P3) • <i>Daviesia nudiflora</i> subsp. <i>drummondii</i> (P3) • <i>Eucalyptus erythronema</i> subsp. <i>inornata</i> (P3) • <i>Synaphea constricta</i> (P3) • <i>Acacia merrickiae</i> (P4) 	Weeds recorded but none specified near Kellerberrin

Appendix A: Fauna Literature Review

Report	Project Area	Survey Timing	Survey Effort	Conservation Significant Fauna Habitat	Conservation Significant Fauna	Introduced Fauna
GAR 2019/2020 Operational Banding Program Ecological Surveys (Ecoscape, 2020)	Immediately north and south of Kellerberrin.	Oct-Nov 2019	Surrogate fauna habitat assessment using vegetation condition assessments.	Black Cockatoo foraging habitat (e.g., Proteaceous species). Black Cockatoo breeding trees not specified.	None recorded	None recorded.

Appendix A2

Fauna Literature Review

Appendix A2: Fauna Literature Review

Report	Project Area	Survey Timing	Survey Effort	Conservation Significant Fauna Habitat	Conservation Significant Fauna	Introduced Fauna
GAR 2019/2020 Operational Banding Program Ecological Surveys (Ecoscape, 2020)	Immediately north and south of Kellerberrin.	Oct-Nov 2019	Surrogate fauna habitat assessment using vegetation condition assessments.	Black Cockatoo foraging habitat (e.g., Proteaceous species). Black Cockatoo breeding trees not specified.	None recorded	None recorded.

Appendix B

Threatened and Priority Flora Database Search Results

Threatened and Priority Flora Database Searches inclusive of DBCA, Western Australia Herbarium and NatureMap results

CR = Listed as Critically Endangered under the EPBC Act, EN = Listed as Endangered under the EPBC Act, VU = Vulnerable under the BC Act, P = Priority Listed, Ranked and Listed by the DBCA

Species	Conservation Status		Source				Flowering Period	Preferred Habitat
	DBCA	EPBC	NM	PMST	TPFL	WAH		
<i>Acacia ataxiphylla</i> subsp. <i>magna</i>	T	EN	-	-	X	X	Jun - Jul	Sandy soils. Lateritic ironstone rises, flats. ²
<i>Acacia caesariata</i>	T	-	X	-	X	X	Aug - Sep	Gritty loam and clay. ²
<i>Acacia campylophylla</i>	P3	-	-	-	-	X	Jul - Aug	Lateritic gravelly soils. ²
<i>Acacia cochlocarpa</i> subsp. <i>velutinos</i> a	T	CR	-	X	-	-	Jul - Nov	Sandy clay or laterite. ²
<i>Acacia cowaniana</i>	P2	-	X	-	X	X	Apr - Jul	Soil pockets on granite outcrops. ²
<i>Acacia lirellata</i> subsp. <i>lirellata</i>	P3	-	-	-	-	X	Jun - Aug	Sandy and loamy soils. ²
<i>Acacia merrickiae</i>	P4	-	X	-	X	X	Apr - Jun	Sandy loam, clay, yellow sand. ²
<i>Acacia phaeocalyx</i>	P3	-	X	-	X	X	Apr - Jun	Yellow or white sand, often over laterite. Flats, hillsides. ²
<i>Acacia sclerophylla</i> var. <i>pilosa</i>	P2	-	X	-	X	X	Aug - Oct	Sandy loam or clay. ²
<i>Acacia sclerophylla</i> var. <i>teretiuscula</i>	P1	-	-	-	X	X	Sep - Oct	Clay and loamy soils. ²
<i>Acacia subflexuosa</i> subsp. <i>capillata</i>	T	EN	X	-	-	X	n/a	Laterite. ²
<i>Acacia undosa</i>	P3	-	-	-	-	X	Jul - Sep	Sandy clay loam, clayey sand. Undulating plains, low-lying areas. ²
<i>Acacia volubilis</i>	T	EN	-	X	-	-	Jun	Gravelly sand, sandy clay. ²
<i>Acacia yorkkrakenensis</i> subsp. <i>yorkkrakenensis</i>	P2	-	X	-	-	X	Jul - Sep or Dec	Yelow or red sand, sandy clay. Sandplains. ²
<i>Allocasuarina fibrosa</i>	T	VU	-	-	-	X	Jul - Aug	Sand over laterite. Low ridges, quartz outcrops. ²
<i>Angianthus micropodioides</i>	P3	-	-	-	-	X	Nov - Dec or Jan - Feb	Saline sandy soils. River edges, saline depressions, claypans. ²
<i>Austrostipa</i> sp. Carlingup Road (S. Kern & R. Jasper LCH 18459)	P3	-	-	-	-	X	n/a	
<i>Baeckea exserta</i>	P3	-	-	-	-	X	Aug - Nov	Sandy clay. ²
<i>Baeckea</i> sp. Kellerberrin (C.A. Gardner s.n. PERTH 03351009)	P1	-	X	-	-	X	n/a	
<i>Baeckea</i> sp. Tammin (R. Coveny 8319 & B. Habberley)	P3	-	X	-	-	X	Aug - Oct	Light brown sandy clay or loam, silty yellow-grey sand, orange brown sand or loam, gravel. Gentle slopes, breakaways, disturbed ground. ²
<i>Baeckea</i> sp. Tampia Hill (J.C. Anway 327)	P1	-	-	-	-	X	n/a	
<i>Baeckea</i> sp. Younegin Hill (A.S. George 15772)	P1	-	-	-	-	X	Sep - Oct	Yellow sand, red sandy clay, laterite. Along road verges. ²
<i>Banksia horrida</i>	P3	-	-	-	-	X	Apr - Jun or Aug	Sand, sometimes with gravel. ²
<i>Banksia splendida</i> subsp. <i>splendida</i>	P2	-	-	-	X	X	Jul - Sep	Sandy and loamy soils with lateritic gravel. ²
<i>Boronia adamsiana</i>	T	VU	-	X	X	X	Jul - Oct	Yellow sand/loam over laterite. Flats, roadverges. ²
<i>Calothamnus brevifolius</i>	P4	-	-	-	-	X	Jan - Feb or Apr	White/grey or yellow sand. ²
<i>Conospermum eatoniae</i>	P3	-	X	-	-	X	Aug - Oct	Deep white sand, sandy clay loam. ²
<i>Conospermum galeatum</i>	T	CR	X	X	-	X	Aug - Sep	Yellow sand. ²
<i>Cryptandra beverleyensis</i>	P3	-	X	-	-	X	Aug - Sep	Clay soils with sand, laterite gravel, undulating landscape, plains. ²
<i>Cryptandra dielsii</i>	P3	-	-	-	X	X	Jul - Sep	Sand, often over laterite. Sandplains. ²
<i>Cryptandra polyclada</i> subsp. <i>polyclada</i>	P3	-	-	-	-	X	Jan - May or Aug	Sand. Sandplains. ²
<i>Daviesia nudiflora</i> subsp. <i>drummondii</i>	P3	-	X	-	-	X	Jul - Aug	White or grey sand. Undulating low rises. ²
<i>Daviesia oxylobium</i>	P4	-	X	-	X	X	Jul - Aug	Sandy lateritic soils. Undulating plains. ²
<i>Dicrastylis reticulata</i>	P3	-	X	-	-	X	Sep - Dec	Sandy soils, often over granite. Amongst granite rock, hills, flats. ²
<i>Drosera albonotata</i>	P2	-	X	-	-	X	Sep - Oct	Mid-slope. Rocky, grey-brown lateritic clay loam. ²
<i>Eremophila brevifolia</i>	P2	-	X	-	X	X	Jul - Sep	Slopes with grey light clay over quartz and loose rock. Well drained soil. Granite outcrops. Loam. Red/brown gravelly clay/loam. ²
<i>Eremophila resinosa</i>	T	EN	-	X	-	-	April or Oct-Nov	Clay loam, gravelly sandy clay. Road verges. ²
<i>Eremophila viscida</i>	T	EN	-	X	-	-	Sep - Nov	Preferred habitat is brown, sandy-loam or red brown clay-loam soils, in open woodland Associated with Eucalyptus loxophleba (York Gum) and scrub vegetation. ¹
<i>Eucalyptus caesia</i> subsp. <i>caesia</i>	P4	-	X	-	-	X	May - Sep	Loam, granite outcrops. ²
<i>Eucalyptus erythronema</i> subsp. <i>inornata</i>	P3	-	X	-	-	X	Aug - Dec	Flat, white sand. Gravelly, grey-brown sandy loam. ²
<i>Frankenia glomerata</i>	P4	-	X	-	X	X	Nov	White sand. ²
<i>Frankenia parvula</i>	T	EN	X	X	X	X	Oct - Nov or Feb	Salt lake. Moist wet sand, sandy clay. ²
<i>Gastrolobium tenue</i>	P1	-	X	-	-	X	Sep - Oct	Yellow sand or sandy clay. Undulating dunes, stony outcrops. ²
<i>Gonocarpus intricatus</i>	P4	-	-	-	-	X	Oct or Jan	Sand. Granite outcrops and hills. ²
<i>Grevillea asteriscosa</i>	P4	-	-	-	-	X	May or Jul - Nov	Gravelly or granitic soils. Gravel rises, granite outcrops. ²
<i>Grevillea dryandroides</i> subsp. <i>hirsuta</i>	T	EN	-	X	X	-	May or Sep - Nov	White or yellow sand, laterite. ²
<i>Guichenotia impudica</i>	P3	-	X	-	-	X	Aug - Oct	Laterite. ²
<i>Guichenotia seorsiflora</i>	T	CR	X	X	X	X	Jul - Sep	Sandy clay with lateritic gravel. Breakaways. ²
<i>Hakea aculeata</i>	T	VU	-	-	-	X	Oct	Sand, loam or clay. Road verges. ²
<i>Hopkinsia anoectocolea</i>	P3	-	-	-	-	X	Sep - Dec	White or grey sand, often saline. Winter-wet depressions, floodplains, salt lakes. ²

<i>Lasiopetalum moullean</i>	T	CR	X	X	X	X	Jul or Sep - Dec	Base of granite outcrops. Wet brown sand/loam. ²
<i>Lechenaultia laricina</i>	T	EN	X	-	-	X	Sep - Dec or Jan	Sand, gravelly loam. ²
<i>Lepidium genistoides</i>	P3	-	-	-	X	X	Sep - Oct	Sandy loam. ²
<i>Leucopogon amplexans</i>	P3	-	X	-	X	X	Apr - Jul	Sandy soils. ²
<i>Leucopogon</i> sp. Bungulla (R.D. Royce 3435)	P3	-	X	-	-	X	Apr - Jun	White-yellow sand, brown-yellow loam over clay, laterite. Hills, plains, summits, disturbed sites. ²
<i>Levenhookia pulcherrima</i>	P3	-	X	-	-	X	Oct - Nov	Sand. ²
<i>Melaleuca manglesii</i>	P1	-	X	-	-	X	Sep	White sand. ²
<i>Melaleuca sciotostyla</i>	T	EN	X	X	X	X	Aug	Orange clayey sand with lateritic pebbles. Scree slopes. ²
<i>Millotia pilosa</i>	P2	-	X	-	-	X	Aug - Sep	Granite rocks. ²
<i>Persoonia pungens</i>	P3	-	X	-	-	X	Sep - Dec	White or yellow sand, often over laterite. ²
<i>Podotheca pritzelii</i>	P3	-	-	-	X	X	Sep - Oct	Sand. Sand ridges in salt flats. ²
<i>Ptilotus fasciculatus</i>	P4	-	X	-	X	X	Oct - Dec	Flat, sandy brown/grey well-drained moist loam. ²
<i>Ricinocarpus tuberculatus</i>	P2	-	X	-	-	X	Sep - Oct	White/grey sand. Coastal dunes. ²
<i>Roycea pycnophylloides</i>	T	EN	X	X	X	X	Sep	Sandy soils, clay. Saline flats. ²
<i>Scaevola chrysopogon</i>	P2	-	-	-	-	X	Aug - Oct	Red/brown sand. Sandplains. ²
<i>Scaevola tortuosa</i>	P1	-	X	-	-	X	Oct	Sandy clay. Margins of salt lakes. ²
<i>Stylidium asteroideum</i>	P3	-	X	-	-	X	Sep - Oct	Wandoo open woodland, Winter-wet flat; brown loam, granite. ²
<i>Stylidium merrallii</i>	P4	-	X	-	X	X	Oct - Nov or Feb	Sandy loam. Granite outcrops. ²
<i>Stylidium pseudosacculatum</i>	P2	-	-	-	-	X	Oct - Nov	Sand over laterite. Gentle hillslopes. Allocasuarina heath. ²
<i>Styphelia tamminensis</i>	P3	-	-	-	-	X	Oct - Dec or Mar	Bare. Dry, white/yellow loamy sand over laterite/gravel. ²
<i>Symonanthus bancroftii</i>	T	EN	-	X	X	-	Jul - Sep	Moist, grey clay over granite. Mid-lower slope, edges of ephemeral wetland. Disturbed areas. ²
<i>Synaphea constricta</i>	P3	-	X	-	X	X	Jun - Sep	Sand or sandy clay-loam over laterite. ²
<i>Tetralthea deltoidea</i>	T	EN	-	X	X	X	Sep - Oct	Loamy soils. Granite outcrops. ²
<i>Thysanotus tenuis</i>	P3	-	X	-	X	X	Sep - Oct	Clay, sandy clay, sand. ²

Appendix B2

Threatened and Priority Fauna Database Search Results

Appendix B2: DBCA Threatened and Priority Fauna

[illegible]

Appendix B2: DBCA Threatened and Priority Fauna

[illegible]

Appendix B2: DBCA Threatened and Priority Fauna

[illegible]

Appendix B2: DBCA Threatened and Priority Fauna

[illegible]

Appendix C

Flora Likelihood of Occurrence

Appendix C: Assessment of the Likelihood of Occurrence of Threatened and Priority Flora as per Desktop Assessment Database Searches surrounding the Survey Area

Distance to Nearest Record from the Survey Area is based on a distance analysis undertaken against 2020 DBCA database. High = Suitable habitat present and records less than 10 km from the Survey Area, Medium = Suitable habitat present and records between 10 km and 20 km from the Survey Area, and Low = No suitable habitat present and/or records greater than 20 km from the Survey Area, Unknown = Insufficient information available to classify . CR= Listed as Critically Endangered under the EPBC Act, EN = Listed as Endangered under the EBPC Act, VU = listed as Vulnerable under the EBPC Act. T = Threatened under the BC Act, P = Priority Listed, Ranked and Listed by the DBCA. Likelihoods are assessed both pre and post survey based on knowledge of the Survey Area, nearest known records, known flowering period of flora taxa and knowledge gained from the survey effort during ground truthing. 1: Department of the Environment (2021). SPRAT EPBC Threatened Flora in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. 2: Department of Biodiversity, Conservation and Attractions (2021). FloraBase - TheWestern Australian Flora. <https://florabase.dpaw.wa.gov.au/>

Species	Conservation Status		Source			Distance to Nearest Record (km)	Flowering Period	Prefered Habitat	Habitat occurs within the Survey Area	Pre-Survey Likelihood of Occurrence	Post-Survey Likelihood of Occurrence
	DBCA	EPBC	NatureMap	PMST	DBCA						
<i>Acacia ataxiphylla</i> subsp. <i>magna</i>	T	EN			x	22.21	Jun - Jul	Sandy soils. Lateritic ironstone rises, flats. ²	No	Low	Low
<i>Acacia caesariata</i>	T		x		x	16.68	Aug - Sep	Gritty loam and clay. ²	Yes	Medium	Low
<i>Acacia campylophylla</i>	P3				x	21.17	Jul - Aug	Lateritic gravelly soils. ²	No	Low	Low
<i>Acacia cochlocarpa</i> subsp. <i>velutinosa</i>	T	CR		x		49.39	Jul - Nov	Sandy clay or laterite. ²	Yes	Low	Low
<i>Acacia cowaniana</i>	P2		x		x	Within the Survey Area	Apr - Jul	Soil pockets on granite outcrops. ²	No	Medium	Low
<i>Acacia lirellata</i> subsp. <i>lirellata</i>	P3				x	22.21	Jun - Aug	Sandy and loamy soils. ²	Yes	Low	Low
<i>Acacia merrickiae</i>	P4		x		x	Within the Survey Area	Apr - Jun	Sandy loam, clay, yellow sand. ²	Yes	High	Low
<i>Acacia phaeocalyx</i>	P3		x		x	3.95	Apr - Jun	Yellow or white sand, often over laterite. Flats, hillsides. ²	Yes	High	Low
<i>Acacia sclerophylla</i> var. <i>pilosa</i>	P2		x		x	11.26	Aug - Oct	Sandy loam or clay. ²	Yes	Medium	Low
<i>Acacia sclerophylla</i> var. <i>teretiuscula</i>	P1				x	21.13	Sep - Oct	Clay and loamy soils. ²	Yes	Low	Low
<i>Acacia subflexuosa</i> subsp. <i>capillata</i>	T	EN	x		x	7.67		Laterite. ²	No	Low	Low
<i>Acacia undosa</i>	P3				x	22.09	Jul - Sep	Sandy clay loam, clayey sand. Undulating plains, low-lying areas. ²	Yes	Low	Low
<i>Acacia volubilis</i>	T	EN		x		33.46	Jun	Gravelly sand, sandy clay. ²	Yes	Low	Low
<i>Acacia yorkkrakensis</i> subsp. <i>yorkkrakensis</i>	P2		x		x	11.97	Jul - Sep or Dec	Yellow or red sand, sandy clay. Sandplains. ²	Yes	Medium	Low
<i>Allocasuarina fibrosa</i>	T	VU			x	22.01	Jul - Aug	Sand over laterite. Low ridges, quartz outcrops. ²	No	Low	Low
<i>Angianthus micropodioides</i>	P3				x	22.83	Nov - Dec or Jun	Saline sandy soils. River edges, saline depressions, claypans. ²	No	Low	Low
<i>Austrostipa</i> sp. <i>Carlingup Road (S. Kern & R. Jasper LCH 18459)</i>	P3				x	16.09				Unknown	Low
<i>Baeckea exserta</i>	P3				x	20.56	Aug - Nov	Sandy clay. ²	Yes	Low	Low
<i>Baeckea</i> sp. <i>Kellerberrin (C.A. Gardner s.n. PERTH 03351009)</i>	P1		x		x	0.44				Unknown	Low
<i>Baeckea</i> sp. <i>Tammin (R. Coveny 8319 & B. Habberley)</i>	P3		x		x	0.44	Aug - Oct	Light brown sandy clay or loam, silty yellow-grey sand, orange brown sand or loam, gravel. Gentle slopes, breakaways, disturbed ground. ²	Yes	High	Low
<i>Baeckea</i> sp. <i>Tampia Hill (J.C. Anway 327)</i>	P1				x	23.49				Unknown	Low
<i>Baeckea</i> sp. <i>Youndegin Hill (A.S. George 15772)</i>	P1				x	22.09	Sep - Oct	Yellow sand, red sandy clay, laterite. Along road verges. ²	Yes	Low	Low
<i>Banksia horrida</i>	P3				x	22.21	Apr - Jun or Aug	Sand, sometimes with gravel. ²	Yes	Low	Low
<i>Banksia splendida</i> subsp. <i>splendida</i>	P2				x	20.83	Jul - Sep	Sandy and loamy soils with lateritic gravel. ²	Yes	Low	Low
<i>Boronia adamsiana</i>	T	VU		x	x	23.09	Jul - Oct	Yellow sand/loam over laterite. Flats, roadverges. ²	Yes	Low	Low
<i>Calothamnus brevifolius</i>	P4				x	22.09	Jan - Feb or Apr	White/grey or yellow sand. ²	Yes	Low	Low
<i>Conospermum eatoniae</i>	P3		x		x	Within the Survey Area	Aug - Oct	Deep white sand, sandy clay loam. ²	Yes	High	Low
<i>Conospermum galeatum</i>	T	CR	x	x	x	Within the Survey Area	Aug - Sep	Yellow sand. ²	Yes	High	Low
<i>Cryptandra beverleyensis</i>	P3		x		x	0.44	Aug - Sep	Clay soils with sand, laterite gravel, undulating landscape, plains. ²	Yes	High	Low
<i>Cryptandra dielsii</i>	P3				x	22.21	Jul - Sep	Sand, often over laterite. Sandplains. ²	Yes	Low	Low
<i>Cryptandra polyclada</i> subsp. <i>polyclada</i>	P3				x	22.01	Jan - May or Aug	Sand. Sandplains. ²	Yes	Low	Low
<i>Daviesia nudiflora</i> subsp. <i>drummondii</i>	P3		x		x	0.05	Jul - Aug	White or grey sand. Undulating low rises. ²	Yes	High	Low
<i>Daviesia oxylobium</i>	P4		x		x	15.97	Jul - Aug	Sandy lateritic soils. Undulating plains. ²	No	Medium	Low
<i>Dicrastylis reticulata</i>	P3		x		x	0.44	Sep - Dec	Sandy soils, often over granite. Amongst granite rock, hills, flats. ²	No	High	Low
<i>Drosera albonotata</i>	P2		x		x	10.89	Sep - Oct	Mid-slope. Rocky, grey-brown lateritic clay loam. ²	No	Medium	Low
<i>Eremophila brevifolia</i>	P2		x		x	18.71	Jul - Sep	Slopes with grey light clay over quartz and loose rock. Well drained soil. Granite outcrops. Loam. Red/brown gravelly clay/loam. ²	No	Medium	Low
<i>Eremophila resinosa</i>	T	EN		x		71.37	April or Oct-Nov	Clay loam, gravelly sandy clay. Road verges. ²	Yes	Low	Low
<i>Eremophila viscida</i>	T	EN		x		24.02	Sep - Nov	Preferred habitat is brown, sandy-loam or red brown clay-loam soils, in open woodland Associated with <i>Eucalyptus loxophleba</i> (York Gum) and scrub	Yes	Low	Low
<i>Eucalyptus caesia</i> subsp. <i>caesia</i>	P4		x		x	18.71	May - Sep	Loam, granite outcrops. ²	No	Medium	Low
<i>Eucalyptus erythronema</i> subsp. <i>inornata</i>	P3		x		x	11.95	Aug - Dec	Flat, white sand. Gravelly, grey-brown sandy loam. ²	Yes	Medium	Low

<i>Frankenia glomerata</i>	P4		x		x	19.03	Nov	White sand. ²	Yes	Medium	Low
<i>Frankenia parvula</i>	T	EN	x	x	x	16.93	Oct - Nov or F	Salt lake. Moist wet sand, sandy clay. ²	No	Medium	Low
<i>Gastrolobium tenue</i>	P1		x		x	11.73	Sep - Oct	Yellow sand or sandy clay. Undulating dunes, stony outcrops. ²	No	Medium	Low
<i>Gonocarpus intricatus</i>	P4				x	19.29	Oct or Jan	Sand. Granite outcrops and hills. ²	No	Medium	Low
<i>Grevillea asteriscosa</i>	P4				x	23.58	May or Jul - N	Gravelly or granitic soils. Gravel rises, granite outcrops. ²	No	Low	Low
<i>Grevillea dryandroides subsp. hirsuta</i>	T	EN		x	x	23.28	May or Sep - N	White or yellow sand, laterite. ²	Yes	Low	Low
<i>Guichenotia impudica</i>	P3		x		x	0.44	Aug - Oct	Laterite. ²	No	High	Low
<i>Guichenotia seorsiflora</i>	T	CR	x	x	x	17.51	Jul - Sep	Sandy clay with lateritic gravel. Breakaways. ²	No	Medium	Low
<i>Hakea aculeata</i>	T	VU			x	22.01	Oct	Sand, loam or clay. Road verges. ²	Yes	Low	Low
<i>Hopkinsia anoetocolea</i>	P3				x	22.21	Sep - Dec	White or grey sand, often saline. Winter-wet depressions, floodplains, salt lakes. ²	No	Low	Low
<i>Lasiopetalum mouleian</i>	T	CR	x	x	x	18.30	Jul or Sep - D	Base of granite outcrops. Wet brown sand/loam. ²	No	Medium	Low
<i>Lechenaultia laricina</i>	T	EN	x		x	16.50	Sep - Dec or J	Sand, gravelly loam. ²	Yes	Medium	Low
<i>Lepidium genistoides</i>	P3				x	21.29	Sep - Oct	Sandy loam. ²	Yes	Low	Low
<i>Leucopogon amplexens</i>	P3		x		x	Within the Survey Area	Apr - Jul	Sandy soils. ²	Yes	High	Low
<i>Leucopogon sp. Bungulla (R.D. Royce 3435)</i>	P3		x		x	0.44	Apr - Jun	White-yellow sand, brown-yellow loam over clay, laterite. Hills, plains, summits, disturbed sites. ²	No	High	Low
<i>Levenhookia pulcherrima</i>	P3		x		x	18.07	Oct - Nov	Sand. ²	Yes	Medium	Low
<i>Melaleuca manglesii</i>	P1		x		x	0.44	Sep	White sand. ²	Yes	High	Low
<i>Melaleuca sciotostyla</i>	T	EN	x	x	x	17.08	Aug	Orange clayey sand with lateritic pebbles. Scree slopes. ²	No	Medium	Low
<i>Millotia pilosa</i>	P2		x		x	18.10	Aug - Sep	Granite rocks. ²	No	Medium	Low
<i>Persoonia pungens</i>	P3		x		x	0.44	Sep - Dec	White or yellow sand, often over laterite. ²	No	High	Low
<i>Podotheca pritzelii</i>	P3				x	21.13	Sep - Oct	Sand. Sand ridges in salt flats. ²	No	Low	Low
<i>Ptilotus fasciculatus</i>	P4		x		x	16.77	Oct - Dec	Flat, sandy brown/grey well-drained moist loam. ²	Yes	Medium	Low
<i>Ricinocarpos tuberculatus</i>	P2		x		x	Within the Survey Area	Sep - Oct	White/grey sand. Coastal dunes. ²	Yes	High	Low
<i>Roycea pycnophylloides</i>	T	EN	x	x	x	16.77	Sep	Sandy soils, clay. Saline flats. ²	No	Medium	Low
<i>Scaevola chrysopogon</i>	P2				x	24.71	Aug - Oct	Red/brown sand. Sandplains. ²	No	Low	Low
<i>Scaevola tortuosa</i>	P1		x		x	0.44	Oct	Sandy clay. Margins of salt lakes. ²	No	High	Low
<i>Stylidium asteroideum</i>	P3		x		x	16.26	Sep - Oct	Wandoo open woodland, Winter-wet flat; brown loam, granite. ²	No	Medium	Low
<i>Stylidium merrallii</i>	P4		x		x	12.16	Oct - Nov or F	Sandy loam. Granite outcrops. ²	No	Medium	Low
<i>Stylidium pseudosacculatum</i>	P2				x	22.01	Oct - Nov	Sand over laterite. Gentle hillslopes. Allocasuarina heath. ²	No	Low	Low
<i>Styphelia tamminensis</i>	P3				x	22.01	Oct - Dec or M	Bare. Dry, white/yellow loamy sand over laterite/gravel. ²	Yes	Low	Low
<i>Symonanthus bancroftii</i>	T	EN		x	x	23.40	Jul - Sep	Moist, grey clay over granite. Mid-lower slope, edges of ephemeral wetland. Disturbed areas. ²	No	Low	Low
<i>Synaphea constricta</i>	P3		x		x	0.44	Jun - Sep	Sand or sandy clay-loam over laterite. ²	Yes	High	Low
<i>Tetratheca deltoidea</i>	T	EN		x	x	19.15	Sep - Oct	Loamy soils. Granite outcrops. ²	No	Medium	Low
<i>Thysanotus tenuis</i>	P3		x		x	16.26	Sep - Oct	Clay, sandy clay, sand. ²	Yes	Medium	Low

Appendix D Flora Inventory

Family	Species	Common name	Introduced
Amaranthaceae	<i>Ptilotus polystachyus</i>	Prince of Wales Feather	
Anacardiaceae	<i>Schinus molle</i>	Peppercorn Tree	*
Asteraceae	<i>Oncosiphon piluliferum</i>	Globe Chamomile	*
	<i>Sonchus asper</i>	Rough Sowthistle	*
Boraginaceae	<i>Echium plantagineum</i>	Paterson's Curse	*
Brassicaceae	<i>Raphanus raphanistrum</i>	Wild Radish	*
Casuarinaceae	<i>Allocasuarina</i> sp.	Sheoak	
Chenopodiaceae	<i>Chenopodiaceae</i> sp.		
	<i>Rhagodia drummondii</i>	Lake Fringe Rhagodia	
	<i>Sclerolaena</i> sp.		
Fabaceae	<i>Acacia hemiteles</i>		
	<i>Acacia leptopetala</i>		
Malvaceae	<i>Seringia velutina</i>		
Moraceae	<i>Ficus</i> sp.		
Myrtaceae	<i>Callistemon</i> sp.	Bottlebrush	
	<i>Eucalyptus aspratilis</i>	Inland mallee-yate	*
	<i>Eucalyptus arachnaea</i> subsp. <i>arachnaea</i>		
	<i>Eucalyptus brockwayi</i>	Dundas Mahogany	*
	<i>Eucalyptus camaldulensis</i> subsp. <i>obtus</i> (planted)	Blunt-budded River Red Gum	*
	<i>Eucalyptus campaspe</i>		
	<i>Eucalyptus ?capillosa</i>		
	<i>Eucalyptus ?cladocalyx</i> subsp. <i>cladocalyx</i>	Sugar Gum	*
	<i>Eucalyptus kondininensis</i>	Kondinin Blackbutt	*
	<i>Eucalyptus salmonophloia</i>	Salmon Gum	
	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	York Gum	
	<i>Eucalyptus rudis</i> subsp. <i>rudis</i>	Flooded Gum	*
	<i>Eucalyptus salubris</i>	Gimlet	
	<i>Eucalyptus</i> sp. Sullivan Soak (D. Nicolle & M. French DN 5503)		*
	<i>Eucalyptus torquata</i>	Coral Gum	*
	<i>Melaleuca hamulosa</i>		
Poaceae	<i>Avena</i> sp.	Oat grass	*
	<i>Ehrharta longiflora</i>	Annual Veldt Grass	*
	<i>Lolium rigidum</i>	Wimmera Rye grass	*
	<i>Rytidosperma caespitosum</i>	Wallaby Grass	

Appendix E

Flora Site Sheets

FLORA SITE SHEET

Project Name

Site:

Location

Kellerberrin Spring Biological Surveys

KELR01

MGA 50568000 mE6499984 mN

Described by:

Date:

Type:

GB

28/10/2021

Releve

Landform:

Slope:

Rock Type:

Soil Type:

Soil Colour:


Plain

Flat

None

Clay, loam, sand

Black



Vegetation:

Condition:

Fire Age:

Mixed Eucalyptus (E. arachnaea subsp. arachnaea, *E. campaspe, *E. aspratilis) low open woodland over low isolated grasses and Chenopodiaceae shrubs.

Degraded

Unknown

Disturbance:

Historical Clearing, infrastructure, weeds

SPECIES LIST

Taxon	Height (cm)	Cover (%)	Notes
*Eucalyptus aspratilis	300	20	
*Eucalyptus campaspe	600	9	
Chenopodiaceae sp.	60	5	
Eucalyptus arachnaea subsp. arachnaea	500	50	

FLORA SITE SHEET

Project Name

Site:

Location

Kellerberrin Spring Biological Surveys

KELR02

MGA 50570897 mE6500292 mN

Described by:

Date:

Type:

GB

28/10/2021

Releve

Landform:

Slope:

Rock Type:

Soil Type:

Soil Colour:

Plain

Flat

Limestone

Soft clay

White, Yellow



Vegetation:

Condition:

Fire Age:

Eucalyptus salmonophloia and *E. loxophleba* subsp. *loxophleba* low isolated trees over *Avena* sp. low sparse grasses and mixed low sparse mixed chenopod shrubs

Degraded

Unknown

Disturbance:

Historical Clearing, infrastructure, weeds

SPECIES LIST

Taxon	Height (cm)	Cover (%)	Notes
* <i>Avena</i> sp.	65	11	
* <i>Lolium rigidum</i>	50	15	
<i>Acacia leptopetala</i>	40	25	
<i>Chenopodiaceae</i> sp.	50	25	
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	300	0.1	
<i>Eucalyptus salmonophloia</i>	800	25	
<i>Rhagodia drummondii</i>	50	21	
<i>Sclerolaena</i> sp.	35	0.5	

Appendix F

Fauna Likelihood of Occurrence

Conservation Status: State - Listed under Biodiversity Conservation Act 2016 or Department of Biodiversity, Conservation and Attractions Conservation, Federal - Listed under Environmental Protection and Biodiversity Conservation Act 1999.
CR - Critically Endangered, EN - Endangered, VU - Vulnerable, IA/MI - Migratory, CD - Conservation Dependent fauna, OS - Other Specially Protected fauna, MA - Marine, P - Listed as Priority by DBCA.

Source: NM - NatureMap, PMST - EPBC Protected Matters Search Tool, DBCA - DBCA Threatened and Priority Fauna database search, Field - Recorded during the current field survey. Due to the some ALA records in Western Australia being Sensitive, the locations are generalised to 10km by WA DEC.

Family	Scientific Name	Common Name	Conservation Status		Source			Field Survey	Likelihood of Occurrence	Justification
			State	Federal	NM	PMST	DBCA			
AVIAN										
Megapodiidae	Leipoa ocellata	Malleefowl	VU	VU	X	X	X		Low	21 DBCA records within 25 km of the Survey Area, including 23 km N in 2011 (Department of Biodiversity Conservation and Attractions, 2021). No suitable habitat present in the Survey Area (unburned mallee and woodland with abundant litter and low scrub).(Morcombe, 2003)
Cacatuidae	Calyptrorhynchus latirostris	Carnaby's Cockatoo	EN	EN	X	X	X		High	3 DBCA records within 25 km of the Survey Area, including within the survey area in 1975 and 5 km N in 1979 (Department of Biodiversity Conservation and Attractions, 2021). Potentially suitable habitat in the form of Salmon Gum and York Gum present in the Survey Area (forests, woodlands, heathlands, farms; feeds on banksias hakeas, dryandras, pine plantations).(Morcombe, 2003)
Falconidae	Falco peregrinus	Peregrine Falcon	OS				X		Medium	5 DBCA records within 25 km of the Survey Area, including 20 km SSW in 2015 (Department of Biodiversity Conservation and Attractions, 2021). Potentially suitable nesting habitat in the form of infrastructure present in the Survey Area (most environments with suitable nest sites: cliff faces preferred, including man-made ones, commonly uses stick nests built by other species).(Menkhorst et al., 2017) May use the Survey Area for hunting.
Ardeidae	Ixobrychus dubius	Australian Little Bittern (Black-backed Bittern)	P4				X		Low	1 vouchered DBCA specimen 11 km E of the Survey Area (Department of Biodiversity Conservation and Attractions, 2021). No suitable habitat present in the Survey Area (freshwater swamps, lakes and rivers with dense beds of Baumea, Typha and other tall rushes).(Johnstone & Storr, 1998)
Macropodidae	Petrogale lateralis lateralis	Black-footed Rock-wallaby	EN		X		X		Low	264 DBCA records within 25 km of the Survey Area, including 8.6 km SW in 2007 (Department of Biodiversity Conservation and Attractions, 2021) No suitable habitat present in the Survey Area due to fragmentation. (never ventures far from rock shelter. Shelters in crevices and caves, feeds on grasses and forbs.?)
Macropodidae	Notamacropus irma	Western Brush Wallaby	P4				X		Low	2 DBCA records within 25 km of the Survey Area, including 20 km N in 1978 (Department of Biodiversity Conservation and Attractions, 2021). No suitable habitat present in the Survey Area due to fragmentation (open forest and woodland, open seasonally wet flats).(Van Dyck and Strahan, 2008)
Macropodidae	Notamacropus eugenii derbianus	Tammar Wallaby	P4				X		Low	1 DBCA record 20 km SW of the Survey Area in 1962 (Department of Biodiversity Conservation and Attractions, 2021). No suitable habitat present in the Survey Area due to fragmentation (likes coastal scrub, heath, dry sclerophyll forest and thickets in mallee and woodland*)
Scincidae	Egernia stokesii badia	Western Spiny-tailed Skink	VU	EN	X		X		Low	2 DBCA records within the Survey Area in 1963 (Department of Biodiversity Conservation and Attractions, 2021) No suitable habitat present in the Survey Area (occupies rock crevices and hollow timber in SW interior of WA and on Dirk Hartog Is., Shark Bay ³)

Appendix G

Fauna Habitat Assessments

HAB01

Project:	Kellerberrin Flora, Fauna and Black Cockatoo Survey		
Date	27/10/2021	Personnel	ML
Zone	50	Easting	569471
		Northing	6500199
Landform and soil		Rock	
Landform	Plain	Rock type/s	None
Soil type	Sandy loam	Surface stone cover	0 - 5%
Soil colour	Brown	Surface stone size classes present	
Condition		Habitat Features	
Quality	Highly degraded	Water Source	Absent
Fire History	Little or no fire evidence (>5 years)	Microhabitats	Leaf litter, Peeling bark, Woody debris
Disturbance	Clearing,Infrastructure,Vehicle tracks,Weeds		
Introduced fauna	None observed		
Vegetation			
Upper stratum	Mid (10-30 m)	Open woodland (0.25-20%)	<i>Introduced Eucalypts, possibly E camaldulensis</i>
Mid stratum	Absent		
Ground stratum	Low (>0.5 m)	Sparse tussock grassland (0.25-20%)	<i>Tussock grasses and dead Sonchus oleraceus</i>



Fulcrum photo ID 09d6ea02-d735-4b8a-9ae4-71920cbc7d1f,b1a10fdf-adea-4772-882f-

HAB02

Project:	Kellerberrin Flora, Fauna and Black Cockatoo Survey		
Date	27/10/2021	Personnel	ML
Zone	50	Easting	570276
		Northing	6500259
Landform and soil		Rock	
Landform	Plain	Rock type/s	Calcrete
Soil type	Sandy loam	Surface stone cover	0 - 5%
Soil colour	White	Surface stone size classes present	Small Stones (0.6 - 2 cm),Stones (2 - 6 cm)
Condition		Habitat Features	
Quality	Highly degraded	Water Source	Present
Fire History	Little or no fire evidence (>5 years)	Microhabitats	Leaf litter, Peeling bark, Woody debris
Disturbance	Clearing,Infrastructure,Litter,Vehicle tracks,Weeds		
Introduced fauna	None observed		
Vegetation			
Upper stratum	Mid (10-30 m)	Open woodland (0.25-20%)	<i>York Gum and Salmon Gum</i>
Mid stratum	Mid (1-2 m)	Sparse shrubland and/or heathland (0.25-20%)	<i>Acacia sp.</i>
Ground stratum	Mid (0.5-1 m)	Sparse tussock grassland (0.25-20%)	<i>Avena, Rytidosperma, low saltbushes</i>



Fulcrum photo ID c73d0c15-785e-4db5-893d-d2f8b59d3d0c,909aa87c-e567-4588-

HAB03

Project:	Kellerberrin Flora, Fauna and Black Cockatoo Survey		
Date	27/10/2021	Personnel	ML
Zone	50	Easting	569355
		Northing	6500160
Landform and soil		Rock	
Landform	Plain	Rock type/s	None
Soil type	Sandy loam	Surface stone cover	
Soil colour	Brown	Surface stone size classes present	
Condition		Habitat Features	
Quality	Highly degraded	Water Source	Present
Fire History	Little or no fire evidence (>5 years)	Microhabitats	Hollows - logs, Leaf litter, Logs > 10 cm, Peeling bark, Woody debris
Disturbance	Clearing,Infrastructure,Litter,Vehicle tracks,Weeds		
Introduced fauna	None observed		
Vegetation			
Upper stratum	Low (<10 m)	Open woodland (0.25-20%)	<i>Introduced eucalypts</i>
Mid stratum	Absent		
Ground stratum	Mid (0.5-1 m)	Open tussock grassland (20-50%)	<i>Avena and saltbush</i>



Fulcrum photo ID 8263525a-f8c0-417f-9de7-e73ec53e64fe,89300f21-3f12-4167-bf7e-

HAB04

Project:	Kellerberrin Flora, Fauna and Black Cockatoo Survey		
Date	27/10/2021	Personnel	ML
Zone	50	Easting	569011
		Northing	6500106
Landform and soil		Rock	
Landform	Plain	Rock type/s	None
Soil type	Sandy loam	Surface stone cover	
Soil colour	Grey	Surface stone size classes present	
Condition		Habitat Features	
Quality	Highly degraded	Water Source	Absent
Fire History	Little or no fire evidence (>5 years)	Microhabitats	Leaf litter, Peeling bark, Woody debris
Disturbance	Clearing,Infrastructure,Litter,Weeds		
Introduced fauna	None observed		
Vegetation			
Upper stratum	Low (<10 m)	Open woodland (0.25-20%)	<i>Introduced eucalypts</i>
Mid stratum	Absent		
Ground stratum	Mid (0.5-1 m)	Open tussock grassland (20-50%)	<i>Avena and saltbush</i>



Fulcrum photo ID ba3fedb5-38cc-46c1-a7d1-f05480180b26,753eb505-082d-4107-

HAB05

Project:		Kellerberrin Flora, Fauna and Black Cockatoo Survey				
Date		27/10/2021		Personnel	ML	
Zone	50	Easting	568336		Northing	6500018
Landform and soil			Rock			
Landform	Plain		Rock type/s			
Soil type	Sandy loam		Surface stone cover			
Soil colour	Brown,Grey		Surface stone size classes present			
Condition			Habitat Features			
Quality	Highly degraded					
Fire History	Little or no fire evidence (>5 years)		Water Source	Present		
Disturbance	Clearing,Infrastructure,Weeds		Microhabitats	Leaf litter, Woody debris		
Introduced fauna	None observed					
Vegetation						
Upper stratum	Mid (10-30 m)	Open woodland (0.25-20%)		Introduced eucalypts		
Mid stratum	Tall (>2 m)	Isolated shrubs and/or heath shrubs (<0.25%)		Melaleuca and bottle brush		
Ground stratum	Low (>0.5 m)	Isolated tussock grasses (<0.25%)		Tussock grasses and weedy forbs		



Fulcrum photo ID	ef2c23ff-6823-456d-a544-0c3d05aa62f2,bcb965ec-618d-4996-9645-
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HAB06

Project:		Kellerberrin Flora, Fauna and Black Cockatoo Survey			
Date		28/10/2021		Personnel	ML
Zone	50	Easting	567895	Northing	6499995
Landform and soil			Rock		
Landform	Plain		Rock type/s	None	
Soil type	Sandy loam		Surface stone cover		
Soil colour	Brown		Surface stone size classes present		
Condition			Habitat Features		
Quality	Highly degraded				
Fire History	Little or no fire evidence (>5 years)		Water Source	Present	
Disturbance	Clearing,Infrastructure,Litter,Vehicle tracks,Weeds		Microhabitats	Leaf litter, Peeling bark, Woody debris, xanthorea shirts	
Introduced fauna	None observed				
Vegetation					
Upper stratum	Mid (10-30 m)	Woodland (20-50%)	Eucalyptus camaldulensis		
Mid stratum	Absent				
Ground stratum	Low (>0.5 m)	Isolated tussock grasses (<0.25%)	Small tussock grasses		



Fulcrum photo ID	3eafb44b-7ada-45c4-9298-e269ea5c145a,51e0e31d-5eb2-4752-
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HAB07

Project:	Kellerberrin Flora, Fauna and Black Cockatoo Survey		
Date	28/10/2021	Personnel	ML
Zone	50	Easting	567963
		Northing	6499930
Landform and soil		Rock	
Landform	Plain	Rock type/s	None
Soil type	Sandy loam	Surface stone cover	
Soil colour	Brown	Surface stone size classes present	
Condition		Habitat Features	
Quality	Highly degraded	Water Source	Absent
Fire History	Little or no fire evidence (>5 years)	Microhabitats	Leaf litter, Logs > 10 cm, Peeling bark, Woody debris
Disturbance	Clearing,Infrastructure,Litter,Weeds		
Introduced fauna	None observed		
Vegetation			
Upper stratum		Open woodland (0.25-20%)	<i>Introduced eucalypts</i>
Mid stratum	Tall (>2 m)	Shrubland and/or heathland (50-80%)	<i>Cultivated shrubs</i>
Ground stratum	Low (>0.5 m)	Sparse rushland and/or sedgeland (0.25-20%)	<i>Cultivated sedges</i>



Fulcrum photo ID	70ebd55d-c426-4291-9259-a8ca573c672e,43982302-734e-480d-
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HAB08

Project:	Kellerberrin Flora, Fauna and Black Cockatoo Survey		
Date	28/10/2021	Personnel	ML
Zone	50	Easting	568910
		Northing	6500045
Landform and soil		Rock	
Landform	Plain	Rock type/s	None
Soil type	Sandy loam	Surface stone cover	
Soil colour	Brown,Grey	Surface stone size classes present	
Condition		Habitat Features	
Quality	Highly degraded	Water Source	Absent
Fire History	Little or no fire evidence (>5 years)	Microhabitats	Leaf litter, Peeling bark, Woody debris, grasses
Disturbance	Clearing,Infrastructure,Vehicle tracks,Weeds		
Introduced fauna	None observed		
Vegetation			
Upper stratum	Mid (10-30 m)	Open woodland (0.25-20%)	<i>Eucalyptus camaldulensis</i>
Mid stratum	Absent		
Ground stratum	Low (>0.5 m)	Open tussock grassland (20-50%)	<i>Tussock grasses</i>



Fulcrum photo ID	8688e195-02fe-4ab9-ae16-62d1a0e31b93,fa4c4628-0892-4d0e-
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HAB09

Project:		Kellerberrin Flora, Fauna and Black Cockatoo Survey					
Date		28/10/2021		Personnel		ML	
Zone	50	Easting	570469		Northing	6500229	
Landform and soil				Rock			
Landform		Plain		Rock type/s		None	
Soil type		Sandy loam		Surface stone cover			
Soil colour		Brown		Surface stone size classes present			
Condition				Habitat Features			
Quality		Highly degraded		Water Source		Absent	
Fire History		Little or no fire evidence (>5 years)		Microhabitats		Leaf litter, Peeling bark, Woody debris	
Disturbance		Clearing,Infrastructure,Vehicle tracks,Weeds					
Introduced fauna		None observed					
Vegetation							
Upper stratum		Mid (10-30 m)		Isolated trees (<0.25%)		Salmon Gums and York Gums	
Mid stratum		Absent					
Ground stratum		Mid (0.5-1 m)		Tussock grassland (50-80%)		Weedy grasses and forbs	

Fulcrum photo ID

e424e81e-6697-4d31-ae84-4ec0263f2a8a,167988a6-1965-472b-

Appendix H Fauna Inventory

Conservation Status: State - Listed under Biodiversity Conservation Act 2016 or Department of Biodiversity, Conservation and Attractions Conservation, Federal - Listed under Environmental Protection and Biodiversity Conservation Act 1999. VU - Vulnerable, MA - Marine. * - Introduced species.

Family	Scientific Name	Common Name	Conservation Status		Method						
			State	Federal	Sighting	Call	Capture	Remains	Foraging evidence	Scat	Feather
Aves											
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle			1						
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck			1						
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah						1			
	<i>Cacatua pastinator</i>	Western Long-billed Corella			2						
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike		MA	1						
Columbidae	<i>Columba livia</i>	Domestic Pigeon (Rock Dove)						1			
	<i>Spilopelia senegalensis</i>	Laughing Turtle Dove			1						
	<i>Ocyphaps lophotes</i>	Crested Pigeon									1
Corvidae	<i>Corvus bennetti</i>	Little Crow			5						
	<i>Corvus coronoides</i>	Australian Raven			1						
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird			1						
Falconidae	<i>Falco cenchroides</i>	Australian Kestrel (Nankeen Kestrel)		MA	1						
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow		MA	2						
	<i>Petrochelidon nigricans</i>	Tree Martin		MA	3						
Meliphagidae	<i>Lichmera indistincta</i>	Brown Honeyeater				2					
	<i>Anthochaera carunculata</i>	Red Wattlebird				2					
	<i>Manorina flavigula</i>	Yellow-throated Miner			3						
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark		MA		1					
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote				1					
Psittaculidae	<i>Barnardius zonarius</i>	Australian Ringneck			1						
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail			1						

Appendix I

Black Cockatoo Breeding Trees

Appendix I - Potential Black Cockatoo Breeding Trees in Survey Area

Latitude	Longitude	Species	DBH (mm)	Height (m)	No. Hollows	No. Hollows >100 mm	No. Hollows with Bees	Comments
-31.633	117.716	<i>Eucalyptus camaldulensis</i>	503	11			0	
-31.631	117.735	<i>Eucalyptus camaldulensis</i>	512	16			0	
-31.631	117.736	<i>Eucalyptus camaldulensis</i>	516	14			0	
-31.633	117.719	<i>Eucalyptus camaldulensis</i>	516	10			0	
-31.633	117.720	<i>Eucalyptus camaldulensis</i>	535	11			0	
-31.631	117.733	<i>Eucalyptus camaldulensis</i>	547	14			0	
-31.633	117.716	<i>Eucalyptus camaldulensis</i>	547	13			0	
-31.633	117.716	<i>Eucalyptus camaldulensis</i>	554	16			0	
-31.631	117.734	<i>Eucalyptus camaldulensis</i>	560	14			0	
-31.631	117.735	<i>Eucalyptus camaldulensis</i>	560	16			0	
-31.633	117.716	<i>Eucalyptus camaldulensis</i>	560	10			0	
-31.633	117.720	<i>Eucalyptus camaldulensis</i>	567	10			0	
-31.631	117.735	<i>Eucalyptus camaldulensis</i>	573	16			0	
-31.633	117.725	<i>Eucalyptus camaldulensis</i>	592	9			0	
-31.634	117.719	<i>Eucalyptus camaldulensis</i>	611	9			0	
-31.631	117.733	<i>Eucalyptus camaldulensis</i>	643	14			0	
-31.633	117.725	<i>Eucalyptus camaldulensis</i>	646	10			0	
-31.633	117.720	<i>Eucalyptus camaldulensis</i>	649	13			0	
-31.631	117.733	<i>Eucalyptus camaldulensis</i>	653	12			0	
-31.633	117.724	<i>Eucalyptus camaldulensis</i>	656	12			0	
-31.631	117.736	<i>Eucalyptus camaldulensis</i>	665	14			0	
-31.633	117.716	<i>Eucalyptus camaldulensis</i>	713	16			0	Two stems.
-31.633	117.724	<i>Eucalyptus camaldulensis</i>	754	16			0	
-31.633	117.716	<i>Eucalyptus camaldulensis</i>	796	15			0	
-31.633	117.716	<i>Eucalyptus camaldulensis</i>	901	18			0	
-31.632	117.732	<i>Eucalyptus kondininensis</i>	560	10			0	
-31.632	117.731	<i>Eucalyptus kondininensis</i>	589	10			0	
-31.633	117.728	<i>Eucalyptus kondininensis</i>	653	8			0	
-31.632	117.731	<i>Eucalyptus kondininensis</i>	729	12			0	
-31.632	117.731	<i>Eucalyptus kondininensis</i>	748	11			0	
-31.633	117.720	<i>Eucalyptus rudis</i> subsp. <i>rudis</i>	503	11			0	
-31.633	117.720	<i>Eucalyptus rudis</i> subsp. <i>rudis</i>	662	8			0	
-31.633	117.721	<i>Eucalyptus rudis</i> subsp. <i>rudis</i>	697	11			0	
-31.633	117.722	<i>Eucalyptus salubris</i>	786	7	3	no	0	
-31.633	117.719	Other introduced Eucalypt	506	10			0	

Appendix I - Potential Black Cockatoo Breeding Trees in Survey Area

Latitude	Longitude	Species	DBH (mm)	Height (m)	No. Hollows	No. Hollows >100 mm	No. Hollows with Bees	Comments
-31.633	117.718	Other introduced Eucalypt	805	7			0	
-31.631	117.739	Salmon gum (<i>Eucalyptus salmonophloia</i>)	246	19	1	no	0	
-31.630	117.745	Salmon gum (<i>Eucalyptus salmonophloia</i>)	1155	15	7	yes	0	Rock Pigeons in one large hollow. Other 3 checked and not occupied.
-31.631	117.742	Salmon gum (<i>Eucalyptus salmonophloia</i>)	1483	13	2	no	0	
-31.630	117.747	Salmon gum (<i>Eucalyptus salmonophloia</i>)	1502	19	6	yes	0	Hollows checked. Not occupied.
-31.630	117.745	Salmon gum (<i>Eucalyptus salmonophloia</i>)	1528	21	6	yes	0	One hollow occupied by Rock Pigeons.
-31.631	117.742	Salmon gum (<i>Eucalyptus salmonophloia</i>)	302	7			0	
-31.631	117.747	Salmon gum (<i>Eucalyptus salmonophloia</i>)	312	7	1	yes	0	Hollow less than 2 m off the ground with spider webs across entrance
-31.630	117.747	Salmon gum (<i>Eucalyptus salmonophloia</i>)	325	10			0	
-31.631	117.743	Salmon gum (<i>Eucalyptus salmonophloia</i>)	360	11			0	Multiple stems
-31.631	117.744	Salmon gum (<i>Eucalyptus salmonophloia</i>)	369	8			0	
-31.631	117.739	Salmon gum (<i>Eucalyptus salmonophloia</i>)	392	10			0	
-31.631	117.739	Salmon gum (<i>Eucalyptus salmonophloia</i>)	414	11			0	2 stems
-31.632	117.740	Salmon gum (<i>Eucalyptus salmonophloia</i>)	417	10			0	
-31.631	117.742	Salmon gum (<i>Eucalyptus salmonophloia</i>)	439	9			0	
-31.631	117.742	Salmon gum (<i>Eucalyptus salmonophloia</i>)	458	9			0	
-31.631	117.742	Salmon gum (<i>Eucalyptus salmonophloia</i>)	458	10			0	
-31.630	117.745	Salmon gum (<i>Eucalyptus salmonophloia</i>)	567	1			0	
-31.631	117.742	Salmon gum (<i>Eucalyptus salmonophloia</i>)	576	10			0	
-31.630	117.748	Salmon gum (<i>Eucalyptus salmonophloia</i>)	662	12			0	
-31.630	117.746	Salmon gum (<i>Eucalyptus salmonophloia</i>)	713	11			0	
-31.631	117.738	Salmon gum (<i>Eucalyptus salmonophloia</i>)	793	18	2	yes	0	Hollow occupied by Western Corellas
-31.630	117.744	Salmon gum (<i>Eucalyptus salmonophloia</i>)	929	17	8	yes	0	Hollows checked but not occupied.
-31.630	117.744	Stag	1012	18	6	yes	0	One large hollow occupied by Feral Pigeons, one occupied by Nankeen Kestrels, one checked with camera but not occupied.

Appendix I - Potential Black Cockatoo Breeding Trees in Survey Area

Latitude	Longitude	Species	DBH (mm)	Height (m)	No. Hollows	No. Hollows >100 mm	No. Hollows with Bees	Comments
-31.630	117.743	Stag	487	0	2	yes	0	Australian Ringneck flew out of large hollow
-31.631	117.740	Stag	512	9			0	2 stems
-31.631	117.740	Stag	532	8			0	Small area at base still alive. York Gum
-31.631	117.739	Stag	579	13	5	no	0	
-31.631	117.739	Stag	672	13	1	no	0	
-31.631	117.739	Stag	745	16	5	yes	0	Large hollow occupied by Australian Ringnecks. Checked anyway.
-31.631	117.741	York Gum (<i>Eucalyptus loxophleba</i>)	605	7	2	no	0	
-31.631	117.745	York Gum (<i>Eucalyptus loxophleba</i>)	611	11			0	
-31.631	117.741	York Gum (<i>Eucalyptus loxophleba</i>)	726	11	1	yes	0	Phone video of hollow taken.



10 Bermondsey Street West Leederville WA 6007 **t** (+618) 9388 8360 **f** (+618) 9381 2360
PO BOX 14, West Perth WA 6872
w 360environmental.com.au **e** admin@360environmental.com.au

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