



Great Northern Highway Muecha to Wubin Upgrade - Stage 2

MAIN ROADS WESTERN AUSTRALIA

EPBC 2017/8035 Bindoon Bypass Artificial Hollow Management Plan

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Issue summary

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1	19-10-2020	Draft	Cross Discipline Review / Technical Review / PAG Review
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Glossary

Abbreviation	Description
AHMP	Artificial Hollow Management Plan
ASJV	Arup Jacobs Joint Venture
BCE	Bamford Consulting Ecologists
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attraction
DBH	Diameter at Breast Height
DPaW	Department of Parks and Wildlife
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GNH	Great Northern Highway
GPS	Global Positioning System
ha	Hectare
km	Kilometre
Landcare SJ	Landcare Serpentine-Jarrahdale Inc.
mm	Millimetre
M2W	Muchea to Wubin
Main Roads	Main Roads Western Australia
PAG	Project Advisory Group
WA	Western Australia

1. Summary

Main Roads Western Australia (Main Roads) is proposing to construct a bypass around Bindoon town and Bindoon Hill (hereafter referred to as the Bindoon Bypass), deviating from the existing Great Northern Highway (GNH) at Chittering Roadhouse and re-joining the highway at Calingiri Road. This Artificial Hollow Management Plan (AHMP) has been prepared to:

- provide guidance to Main Roads and their contractors in relation to the requirement for, installation and management of artificial hollows for Black Cockatoos, specifically the Forest Red-tailed Black Cockatoo and Carnaby’s Black Cockatoo.
- support the environmental assessment of the Bindoon Bypass under both the Commonwealth *Environment Protection and Biodiversity Act 1999* (EPBC Act) and Western Australian (WA) *Environmental Protection Act 1986* (EP Act).

Table 1-1 details the environmental management targets to measure achievement of the environmental objectives that must be met through implementation of this AHMP.

Table 1-1: Artificial Hollow Management Plan Summary

Item	Description
Project	Bindoon Bypass
Assessment Number	<ul style="list-style-type: none"> • EPBC 2017/8035 • Environmental Protection Authority (EPA) Assessment No. 2135
Proponent	Main Roads Western Australia
Purpose of the AHMP	<p>Provide guidance to Main Roads and their contractors to manage, mitigate and offset potential impacts to Black Cockatoos resulting from the clearing of hollow bearing trees.</p> <p>Support the environmental assessment of the Bindoon Bypass</p>
Environmental Objective	Minimise potential impacts to breeding success of Black Cockatoos as a result of clearing of natural hollows during construction of the Bindoon Bypass
Management Targets	<ul style="list-style-type: none"> • Three artificial hollows installed for each hollow showing evidence of use cleared • Artificial hollows installed prior to start of breeding season following clearing • Location/s for installation of artificial hollows verified by a suitably qualified person
Completion/Success Criteria	A minimum of ten artificial hollows have shown evidence of use by Black Cockatoos for three consecutive years

2. Scope, Context and Rationale

2.1 Description of the Action

The GNH is a critical freight link between the Perth metropolitan area, and the towns and mining centres of the Midwest and Pilbara regions of WA. The GNH forms part of Highway 1, a network of highways that connect all mainland state capitals. In order to improve freight efficiency and road safety, Main Roads is proposing to construct a bypass around Bindoon town and Bindoon Hill (hereafter referred to as the Bindoon Bypass or the Action), located within the Shire of Chittering approximately 70 km north east of Perth and approximately 13 km north of Muchea. The Bindoon Bypass will divert from the existing GNH at the Chittering Roadhouse, running to the west of Bindoon and re-joining the GNH north of Calingiri Road (**Figure 1**). This will involve the construction of approximately 47 km of new highway.

The Bindoon Bypass will be constructed in stages based on the expected traffic volumes. The initial stage (Interim Stage) will consist of single carriageway (two lanes) with a number of overtaking lanes for both north-bound and south-bound traffic, as well as stopping facilities. The second stage (Ultimate Stage) will build on the work done in the Interim Stage to accommodate higher numbers of road users, and comprises an upgrade to dual carriageway (four lanes) between Chittering Roadhouse and Bindoon-Moora Road. Upgrades to local roads, rail crossings and intersections may also be required, as well as relocation of services, fencing of the road reserve and construction of driveway accesses for landowners.

2.2 Purpose of this Management Plan

This AHMP has been prepared specifically in relation to the use of artificial hollows to manage, mitigate and offset potential impacts to Black Cockatoos resulting from construction of the Bindoon Bypass. This plan:

- provides guidance on the installation of artificial hollows for Black Cockatoos;
- details management targets to determine success of the artificial hollows;
- outlines monitoring and maintenance requirements;
- recommends adaptive management approaches should targets be at risk of not being met; and
- describes the record keeping, review and reporting requirements for this plan.

2.3 Black Cockatoo Values of the Bindoon Bypass

The Bindoon Bypass is within the mapped distribution of Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*). Fauna surveys across the Development Envelope for the Action and surrounds were undertaken by Bamford Consulting Ecologists (BCE) between October and December 2016, April and November 2017, February and November 2018, and March and May 2019. These surveys included targeted searches for Black Cockatoos.

The surveys undertaken by BCE (2017, 2018, 2019) identified 11,554 Black Cockatoo potential breeding trees, those trees with a diameter at breast height (DBH) greater than 500 mm. Of these, approximately 90% did not have hollows suitable for Black Cockatoos. A total of 1,352 tree hollows were recorded that are suitable for use by Black Cockatoos (BCE 2018), with a further 83 identified with evidence of chew marks around hollow entrances, indicating these are likely to be used for breeding (**Figure 2**). During the 2017 survey, three active nests were recorded outside of the Development Envelope.

Three roost sites for the Forest Red-tailed Black Cockatoo were identified by BCE (2018). None of these roosts are within the Development Envelope. No roost sites for Carnaby's Black Cockatoo were recorded (BCE 2018).

Foraging habitat for both Carnaby's Black Cockatoo and the Forest Red-tailed Black Cockatoo was recorded across the study area during the surveys by BCE (2017, 2018, 2019). The value of the foraging habitat ranged from Negligible to High for both species (**Table 2-1**). For the Forest Red-tailed Black Cockatoo, 68.5% of the survey area was determined to consist of habitat with Low or Negligible foraging value while for Carnaby's Black

Cockatoo 60% of the survey area was recorded as Low or Negligible (BCE 2018). Only 2.7% and 6.2% of the foraging habitat was recorded as High value for the Forest Red-tailed Black Cockatoo and Carnaby’s Black Cockatoo, respectively. In general, the Development Envelope provides Moderate value foraging habitat for both species of Black Cockatoo (BCE 2019).

Table 2-1: Black Cockatoo Foraging Habitat Value within the Study Area

Habitat Value	Forest Red-tailed Black Cockatoo		Carnaby’s Black Cockatoo	
	Area (ha)	%	Area (ha)	%
6: High	106.5	2.7	243.3	6.2
5: Moderate to High	202.1	5.2	383.7	9.8
4: Moderate	365.1	9.4	664.4	17.0
3: Low to Moderate	555.2	14.2	313.3	8.0
2: Low	1,362.0	34.9	1,452.0	37.1
1: Negligible	1,308.5	33.6	855.4	21.9
0: Nil	0.0	0.0	0.0	0.0

2.4 Potential Effects of the Action

Construction of the Bindoon Bypass will require clearing of Black Cockatoo habitat. Implementation of the Action will result in clearing of:

- 10 trees with hollows showing evidence of use by Black Cockatoos; and
- 117 trees with hollows suitable for use by Black Cockatoos.

3. Management Measures

3.1 Rationale for Choice of Management Measures

This AHMP has been informed by the results of baseline surveys, the recovery plans for each species (BCE 2017, 2018, 2019; Department of Parks and Wildlife 2013; Chapman 2008) and current scientific knowledge on the use and effectiveness of artificial hollows for Black Cockatoos (Johnstone R.E. 1997; BirdLife Australia 2017; Groom 2010; Johnstone *et al* 2010). The management approach has further been informed by current best practice and recent experience on similar road projects in WA.

The installation of artificial hollows has been selected as a key management and offset measure for the following reasons:

- Loss of breeding habitat and competition for nesting hollows have been identified as key threats to Black Cockatoos (Department of Parks and Wildlife 2013; Chapman 2008).
- Evidence of nesting by Black Cockatoos as recorded adjacent to the Development Envelope with evidence of potential nesting, in the form of chew marks at hollow entrances, also recorded within the Development Envelope (BCE 2017, 2018, 2019).

Throughout the planning and environmental assessment phase of the Bindoon Bypass, a hierarchical approach was taken to impact mitigation. The primary focus was on avoiding Black Cockatoo habitat and nesting trees through, for example, route selection and design refinement. Where avoidance was not possible, the use of artificial hollows is proposed to minimise the duration, intensity and/or extent of impacts on Black Cockatoos due to the clearing of potential nesting hollows.

3.2 Management Objectives, Actions and Targets

The objective of this AHMP is to minimise potential impacts to breeding success of Black Cockatoos as a result of clearing of natural hollows during construction of the Bindoon Bypass. Main Roads aims to achieve this objective through the installation of 30 artificial hollows to replace the 10 trees with hollows showing evidence of use that will be cleared for construction of the Bindoon Bypass. **Table 3-1** details the management actions required to meet the objective.

Table 3-1: Management Actions, Performance Targets and Timing

Management Actions	Performance Target	Timing
Location/s for installation of artificial hollows verified by a suitably qualified person with experience in Black Cockatoos	All artificial hollow locations signed off by a suitably qualified person	Prior to commencement of clearing
Artificial hollows installed prior to start of breeding season ¹ following clearing	Required number of artificial hollows for each hollow showing evidence of use cleared installed prior to breeding season following clearing	Artificial hollows installed by 31 March
Three artificial hollows installed for each hollow showing evidence of use cleared	At least 30 artificial hollows installed	Completion of clearing activities and prior to 31 March

Notes: ¹ Breeding season for Carnaby's Black Cockatoo is July to February with peak breeding occurring between September and December. Breeding season for the Forest Red-tailed Black Cockatoo is April to June and August to October.

3.3 Installation of Artificial Hollows

Artificial hollows will be installed prior to the breeding season that follows the clearing, in order to maximise the number of hollows available at the commencement of the breeding season. As no active nests will be cleared, this timing is considered appropriate to avoid any additional impacts on the species.

A suitably qualified person with experience in Black Cockatoos will be engaged to assist with the planning of artificial hollow installation, including location. Appropriate trees will be identified by taking into consideration the following parameters:

- trees should be within the road reserve, but not adjacent to the road, or within other Crown lands (e.g. DBCA-managed lands) to facilitate ease of access for monitoring and maintenance;
- located in proximity to impacted nesting hollow, or existing nesting hollow which will not be impacted;
- located within or adjacent to foraging habitat;
- located in proximity to water;
- trees should be mature and well shaded; and
- trees should be accessible with a cherry picker, without requiring additional disturbance, to allow installation of the artificial hollows.

Main Roads is intending to procure and install artificial hollows known as Cockatubes®. These are constructed by Landcare Serpentine-Jarrahdale Inc. (Landcare SJ), and the current design has been developed over a period of 10 years with the assistance of the Department of Biodiversity, Conservation and Attraction (DBCA) and the WA Museum. Cockatubes® have an expected lifespan of 50 years or more, provided they are regularly maintained (maintenance includes, for example, replacing the sacrificial wood chewing post as required). They are used extensively throughout the south west of WA, including a number of Cockatubes® that have been installed by Main Roads along the GNH in the Bindoon area. Recent monitoring of the artificial hollows show they have been used successfully for breeding (Johnstone *et al* 2010; Phoenix Environmental Sciences 2018).

3.4 Monitoring and Maintenance

3.4.1 Monitoring Surveys

Artificial hollows will be surveyed in September / October each year to coincide with the peak breeding season for both species. The first survey will occur during the breeding season following the installation of artificial hollows. Surveys will be undertaken by a suitably qualified person. Hollows should initially be inspected from the ground using binoculars to check for signs of use (chew marks or birds entering/exiting the hollow) or factors which may prohibit nesting by Carnaby's Black Cockatoo such as invasion of the hollow by feral bees. A drone or remotely operated camera on a pole of sufficient length may also be used to look directly into the hollow. Surveys will identify:

- if hollows are currently in use or show evidence of previous use;
- maintenance requirements for artificial hollows (such as replacement of the sacrificial wooden post or removal of feral bees); and
- if hollows are no longer able to be used by Carnaby's Black Cockatoo, for example they have been invaded by feral bees, the hollow has been damaged or the limb has fallen.

The results of monitoring surveys will be provided to DBCA in order to contribute to broader research into the species. This information will also be available to other research organisations and individuals upon request.

3.4.2 Artificial Hollow Maintenance

Maintenance of artificial hollows will be scheduled for March so as to occur outside of the breeding season. Maintenance may include:

- replacement of sacrificial chewing post;
- replacement/repair of attachment points;
- repairs to the base of hollows;
- repair of cracks in the artificial hollow. If crack form that are too large to be repaired the hollow may need to be replaced; and
- removal of pest species, such as feral bees.

3.5 Completion/Success Criteria

The use of artificial hollows to achieve the stated environmental objective will be determined to be successful when a minimum of ten artificial hollows have shown evidence of use by Black Cockatoos for three consecutive years. As Black Cockatoos are known to have a roster of hollows from which they choose a nesting hollow for any given year (*pers com.* Ron Johnstone), the ten artificial hollows that show evidence of use do not need to be the same hollows over the three-year period.

4. Adaptive Management

To confirm that the installation of artificial hollows will meet the stated objective and completion criteria achieved, Main Roads will implement an adaptive management approach. The aim of adaptive management will be to maximise the likelihood, and eventually prove, that the artificial hollows are being used by Black Cockatoos in line with the pre-impact usage of natural hollows. The adaptive management approach is outlined in **Diagram 4-1** and **Table 4-1**. It is proposed that this adaptive management approach will be used until such a time that monitoring shows breeding by Black Cockatoo is at least equivalent to that recorded during pre-impact surveys.

The offset will be deemed to be effective and adaptive management will cease when at least 10 artificial hollows are in use for three consecutive years post-impact. Hollows identified as used do not need to be the same from year to year.

Table 4-1: Adaptive Management Actions

Management Actions / Monitoring Parameter	Adaptive Management Trigger	Corrective Actions
Location/s for installation of artificial hollows verified by a suitably qualified person with experience in Black Cockatoos	Artificial hollow locations have not been signed off by a suitably qualified person	Review of locations and installation by suitably qualified person to confirm acceptability
Artificial hollows will be installed prior to start of breeding season following clearing	Artificial hollows not installed prior to breeding season following clearing	Undertake installation of artificial hollows as soon as practicable.
Three artificial hollows will be installed for each hollow showing evidence of use cleared	Less than 3 artificial hollows installed for each hollow showing evidence of use cleared	Undertake installation of additional artificial hollows as soon as practicable.
Installed artificial hollows are used by Black Cockatoos	<ul style="list-style-type: none"> Monitoring shows artificial hollows are not in use Trends from monitoring data suggest the completion criteria will not be achieved Monitoring shows a drop in use of artificial hollows 	<ul style="list-style-type: none"> Review/modify location selection parameters. Review artificial hollow location. Move artificial hollow to new location in line with revised parameters. Install additional artificial hollows to increase density. Review regional cockatoo numbers and active breeding sites to determine if results are part of a larger trend.

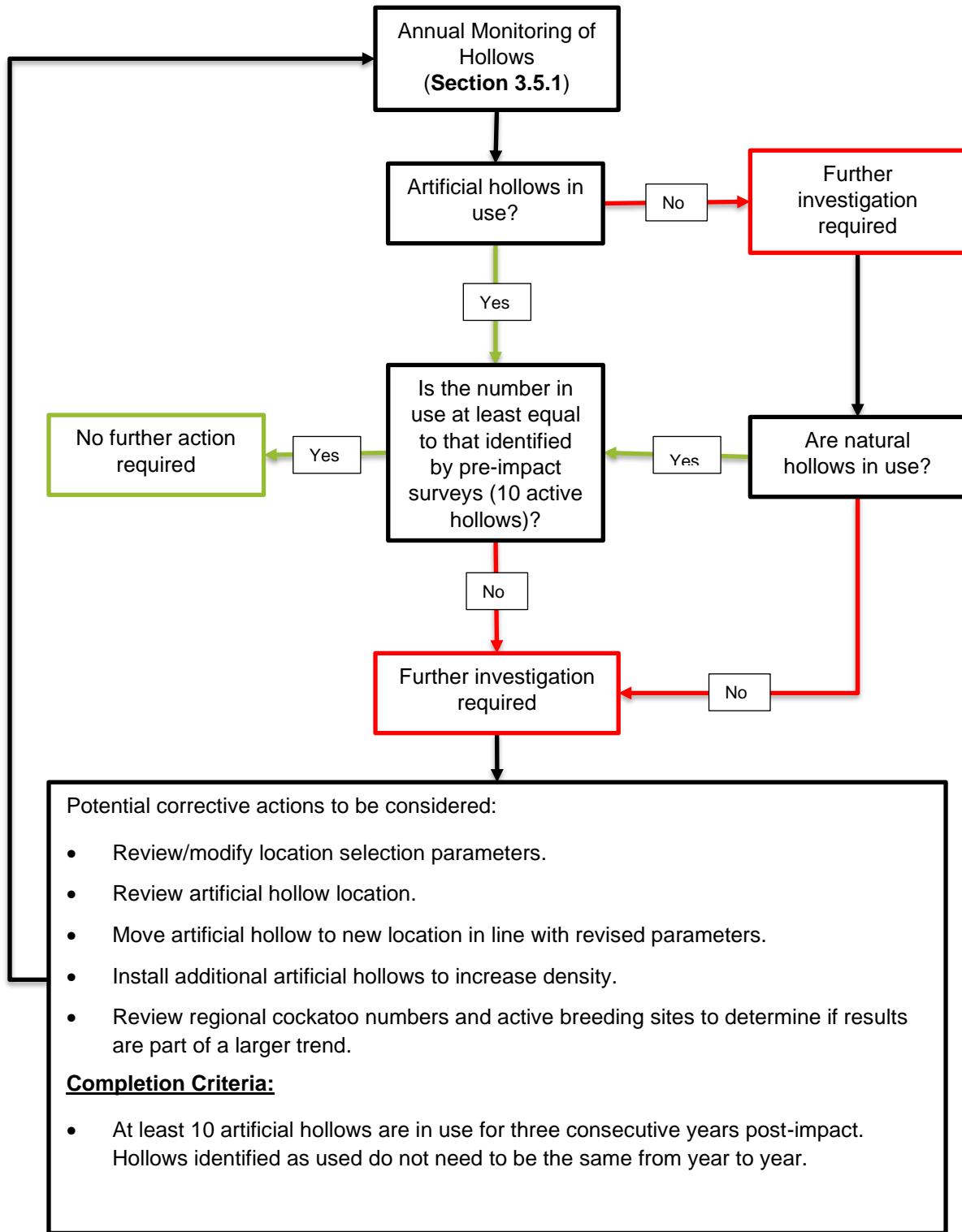


Diagram 4-1: Adaptive Management Decision Tree

5. Record Keeping, Reporting and Review

5.1 Record Keeping

The following information will be recorded and kept on file:

- each Cockatube® will be assigned a unique identifier;
- locations of installed Cockatubes® will be recorded using a GPS;
- date of installation for each Cockatube®;
- photographs of Cockatubes® following installation;
- results of annual monitoring including condition of the hollow, if the hollow is/has been in use and photographs;
- maintenance required and date undertaken; and
- outcomes of any investigations undertaken and additional actions put in place.

This information will be made available to other government organisations and third parties for research into the species.

5.2 Reporting

Compliance with this AHMP, results of monitoring and any investigations and/or corrective action undertaken will be reported to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) in the annual compliance report for the action.

Results of monitoring will be provided to DBCA on an annual basis.

5.3 Management Plan Review

This AHMP shall be reviewed annually during construction. Once construction is complete, reviews shall be undertaken in line with Main Roads standard environmental management requirements. Out of cycle reviews of the plan may be undertaken for the following reasons:

- new or revised information relating to Black Cockatoos becoming available;
- the recovery plans for the species are revised;
- changes in the design and/or management of artificial hollows; or
- adaptive management (corrective) actions are triggered.

6. References

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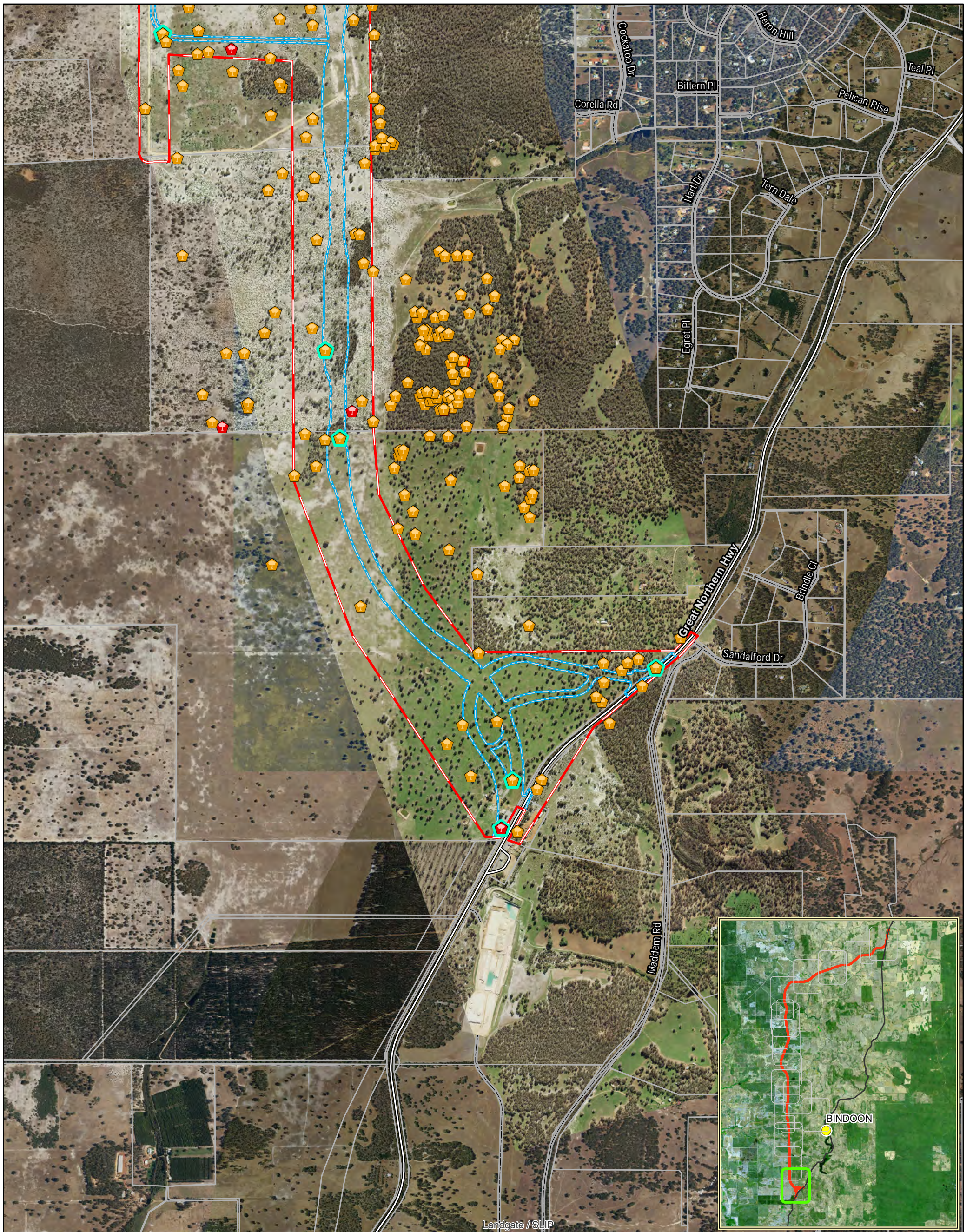
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Phoenix Environmental Sciences 2018, Muchea North Black Cockatoo breeding activity census, unpublished memorandum prepared for the GNH IPT, Phoenix Environmental Sciences Pty Ltd, Perth.

Figures

Figure 1: Location Plan

Figure 2: Hollows Suitable for or Used by Black Cockatoos



Landgate / SLP

Black Cockatoo Trees (FVC) - Outside Development Footprint

- Hollow currently in Use
- Hollow with Evidence of Use (Previously Used Hollow)
- Suitable Hollow

Black Cockatoo Trees (FVC) - Within Development Footprint

- Hollow with Evidence of Use (Previously Used Hollow)
- Suitable Hollow

- Development Envelope
- Development Footprint
- Highway
- Major Road
- Minor Road
- Cadastral Boundary



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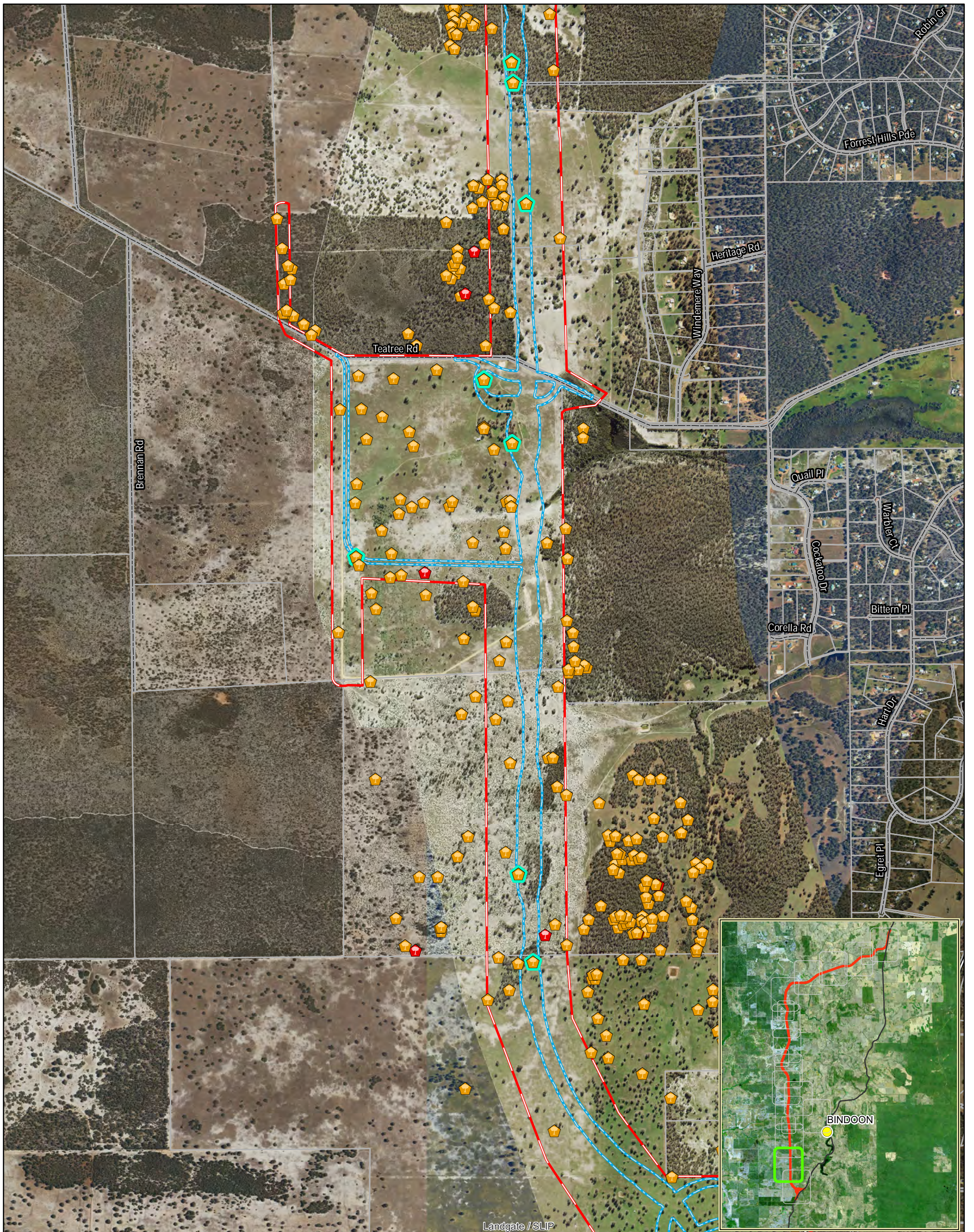
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Black Cockatoo Habitat – Trees
 with Suitable or Used Hollows
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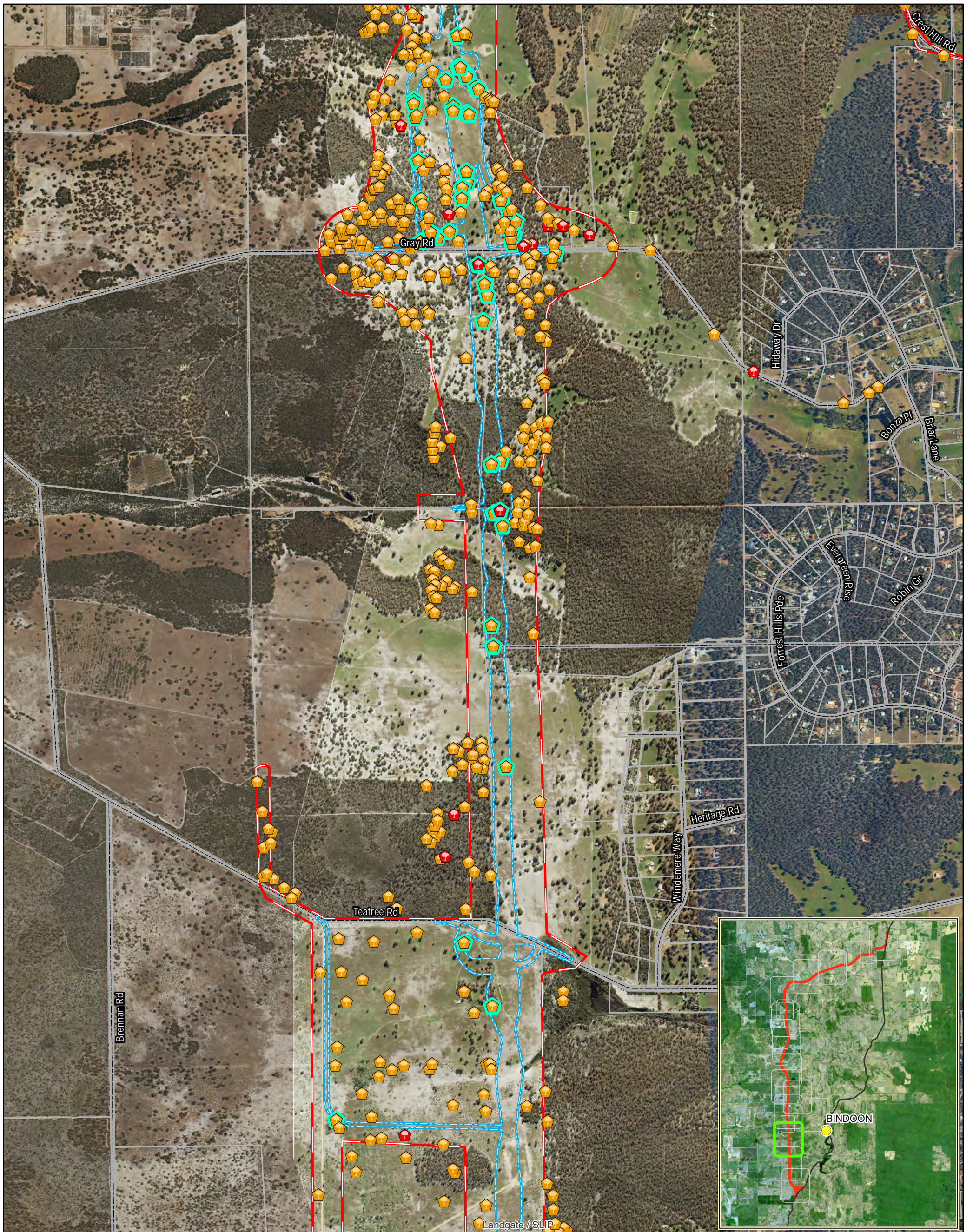
Black Cockatoo Habitat – Trees with Suitable or Used Hollows
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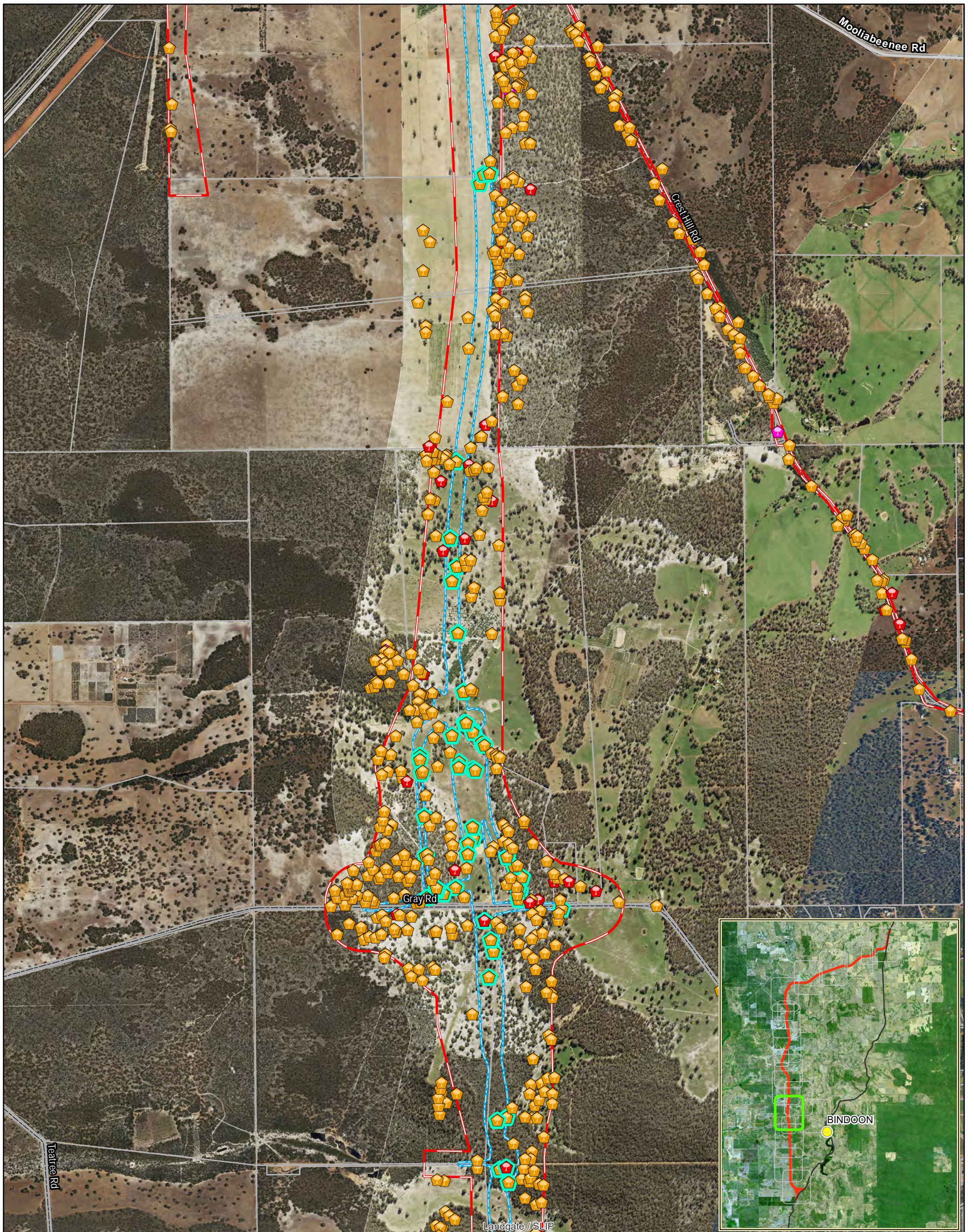
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**Black Cockatoo Habitat – Trees
with Suitable or Used Hollows**
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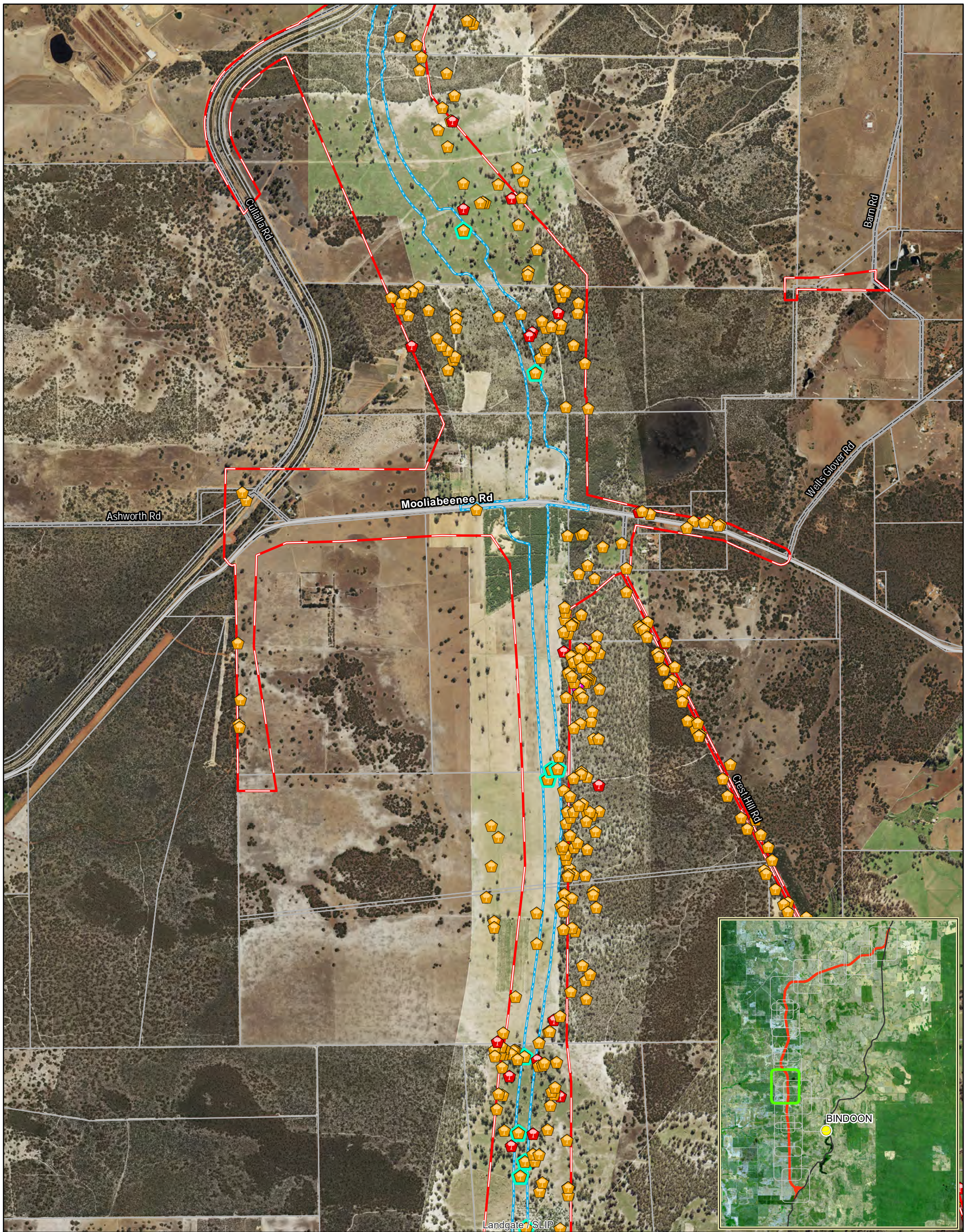
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**Black Cockatoo Habitat – Trees
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Black Cockatoo Habitat – Trees
 with Suitable or Used Hollows
 Figure: 2 Page 5 of 16

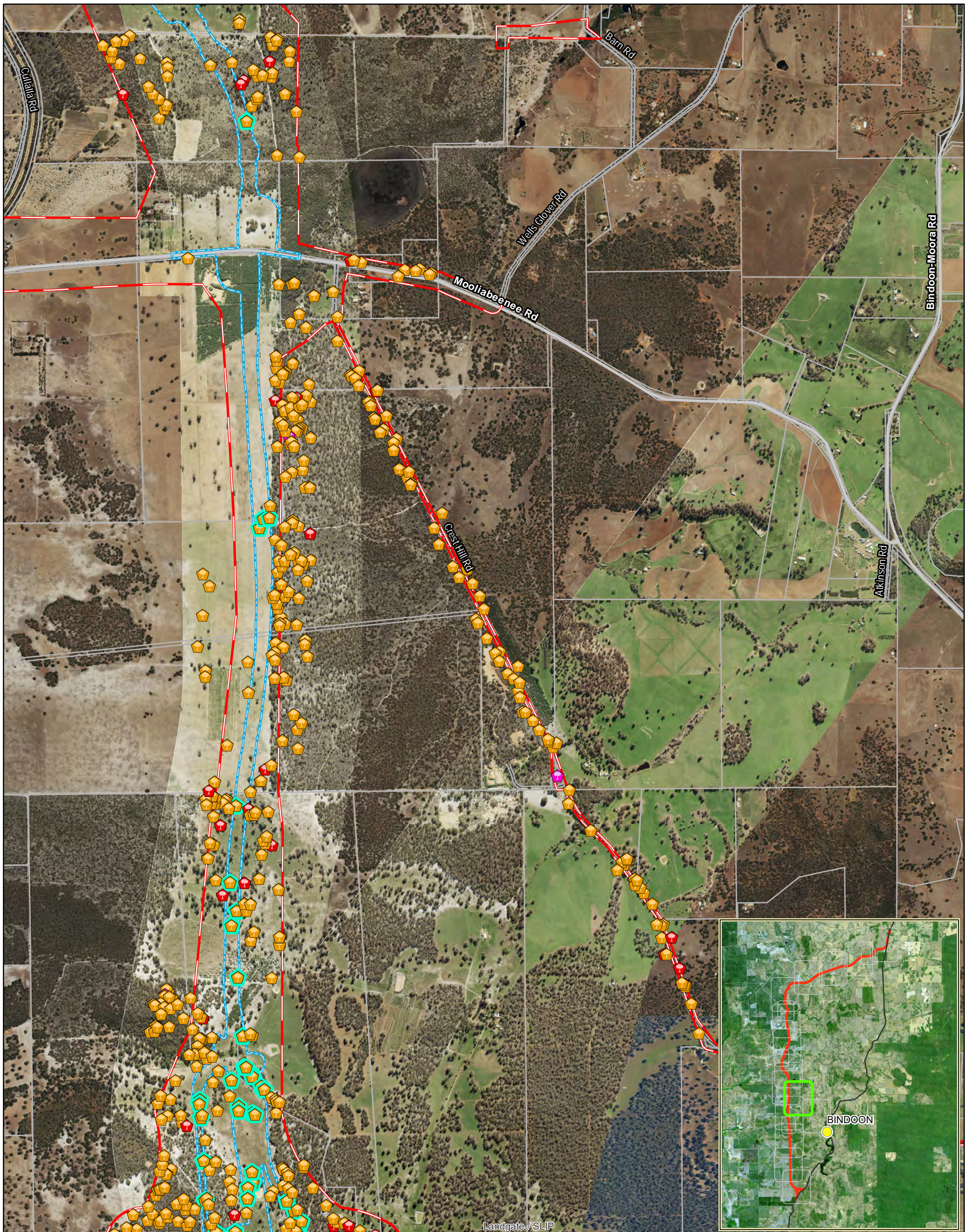
Drawing No
 GNH-CN12-EA-PER-00001
 - F4-13

Issue
 2

Task No
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Drawing Status / Other
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Date	By	Chkd	Appd
30/10/2020	JR	-	-



Landgate / SLIP

Black Cockatoo Trees (FVC) - Outside Development Footprint

- Hollow currently in Use
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- Suitable Hollow

Black Cockatoo Trees (FVC) - Within Development Footprint

- Hollow with Evidence of Use (Previously Used Hollow)
- Suitable Hollow

- Development Envelope
- Development Footprint
- Highway
- Major Road
- Minor Road
- Cadastral Boundary

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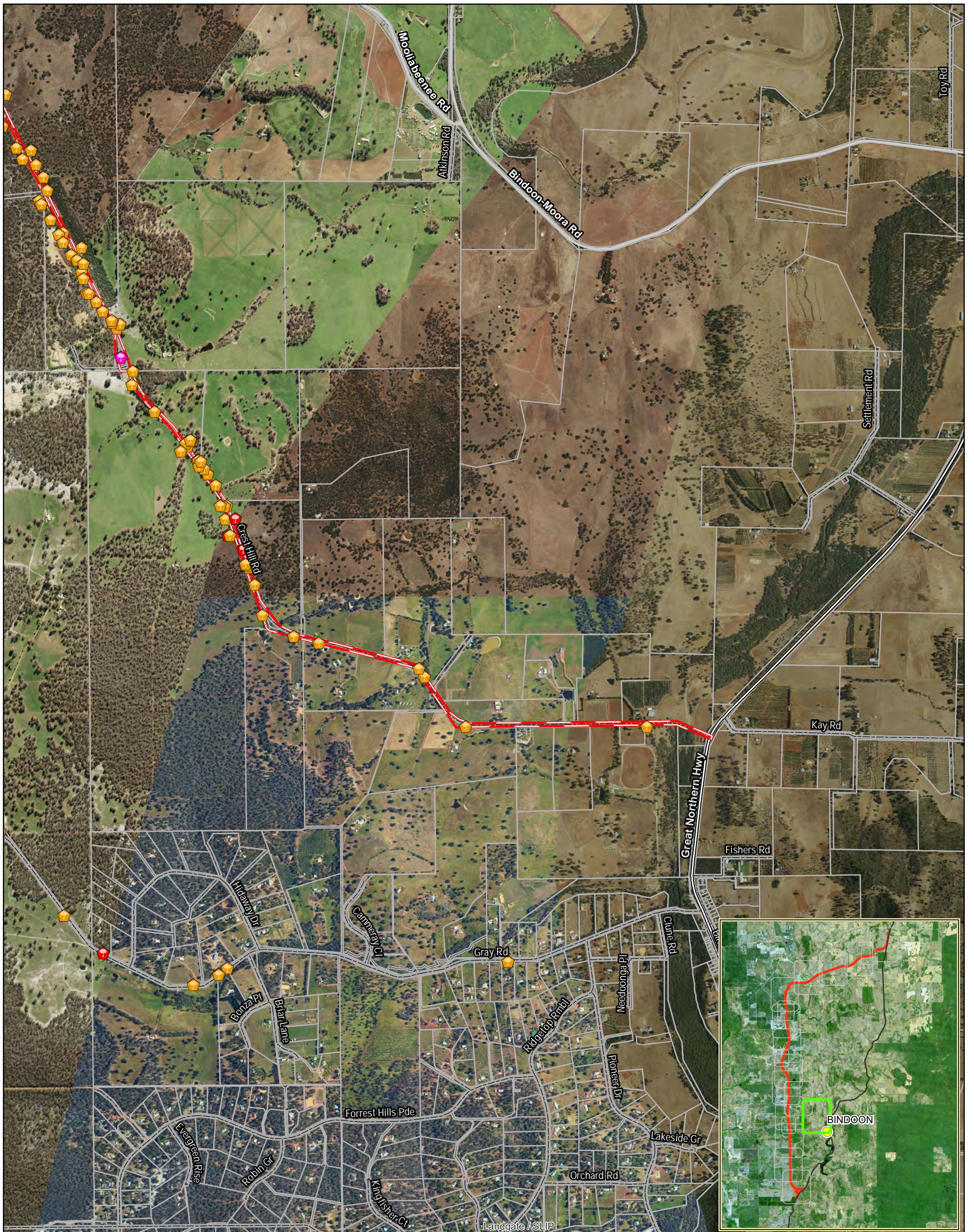
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Black Cockatoo Habitat – Trees with Suitable or Used Hollows

Figure: 2 Page 6 of 16

Drawing No GNH-CN12-EA-PER-00001 - F4-13	Issue 2		
Task No ERD	Drawing Status / Other Final		
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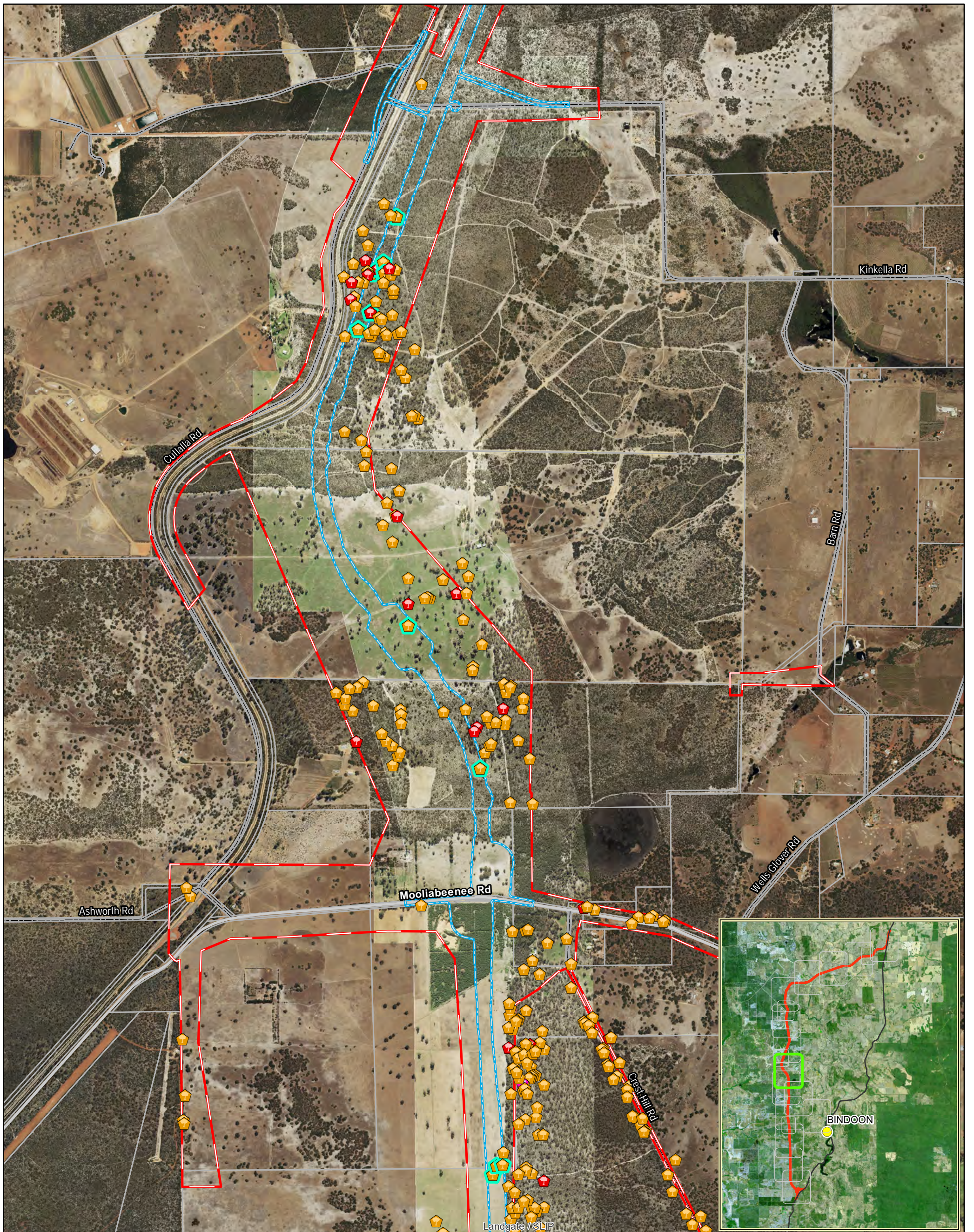
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Black Cockatoo Habitat – Trees
with Suitable or Used Hollows
Figure: 2 Page 7 of 16

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- F4-13 Issue
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Task No
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30/10/2020	JR	-	-



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Black Cockatoo Habitat – Trees
 with Suitable or Used Hollows
 Figure: 2 Page 8 of 16

Drawing No
 GNH-CN12-EA-PER-00001
 - F4-13

Issue
 2

Task No
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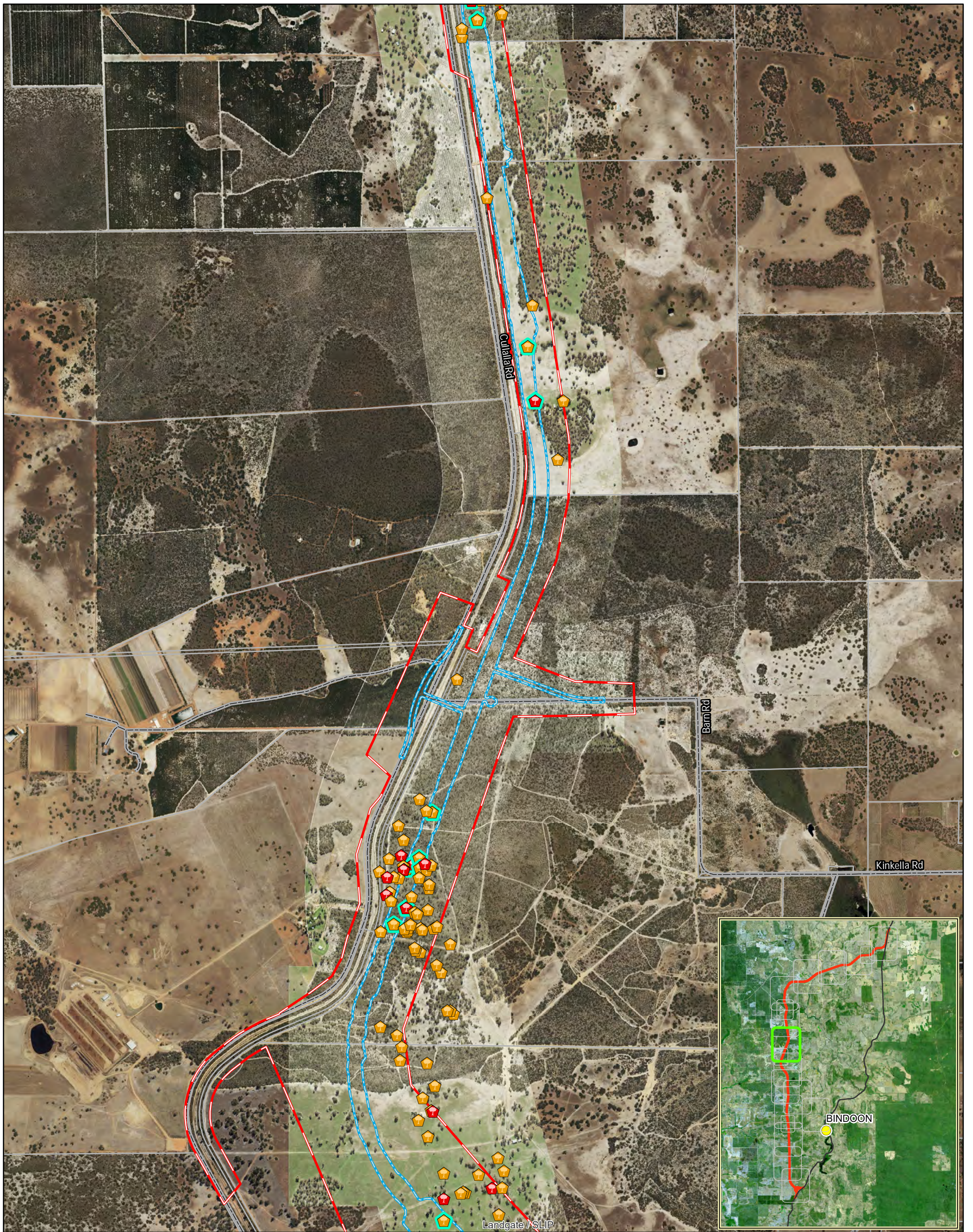
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Black Cockatoo Habitat – Trees
 with Suitable or Used Hollows
 Figure: 2 Page 9 of 16

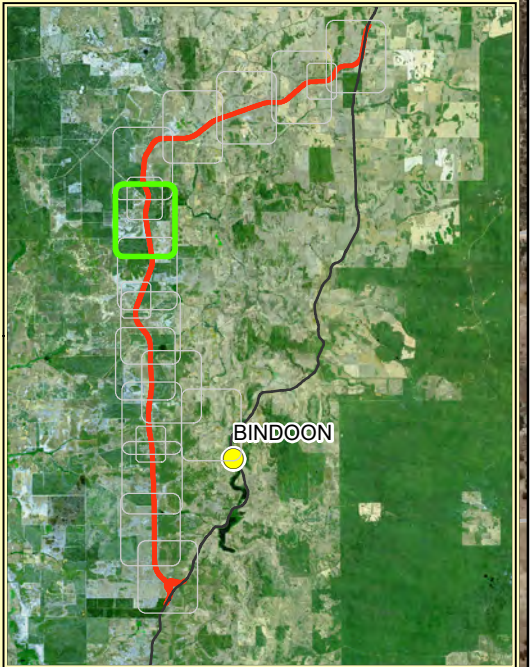
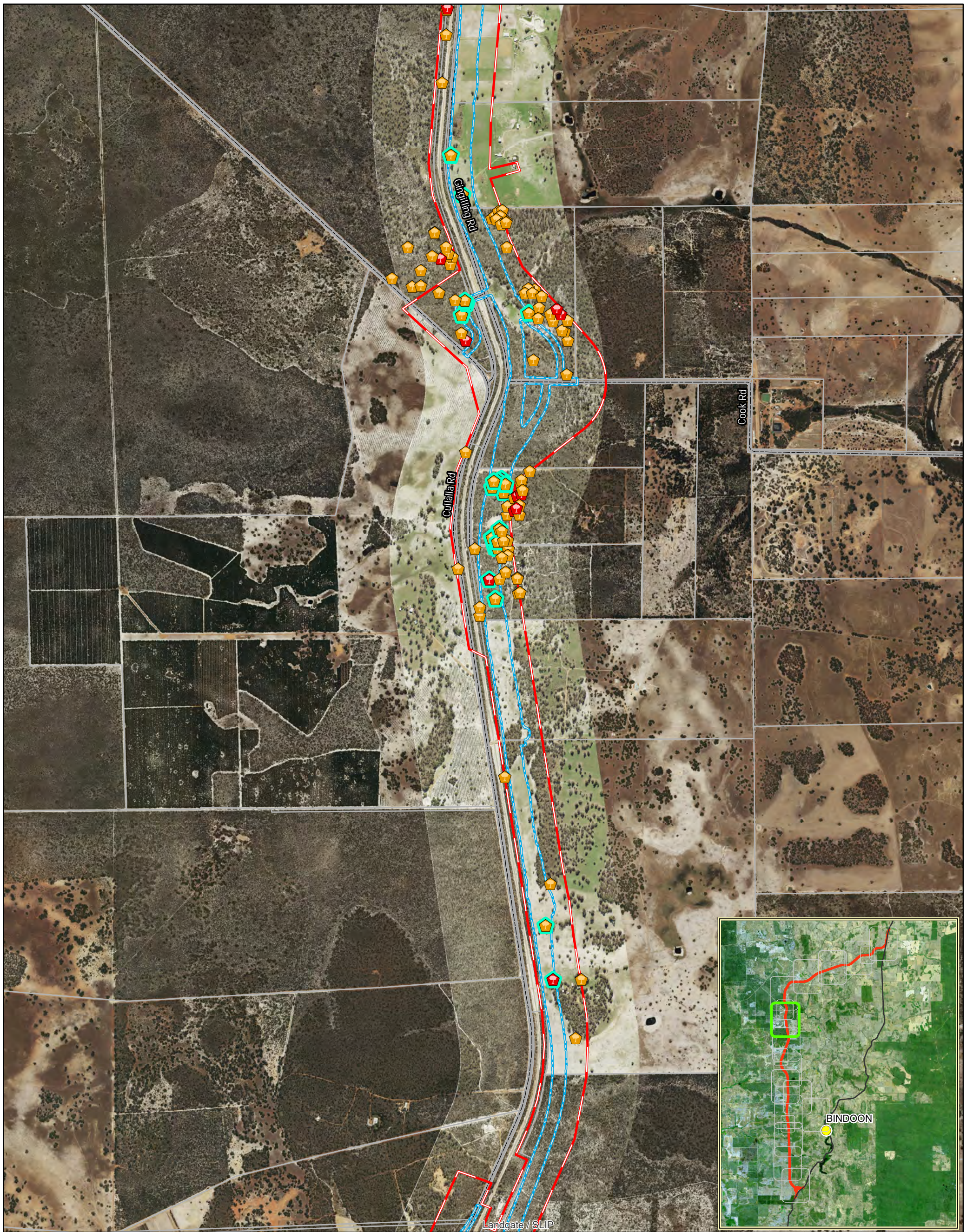
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Task No
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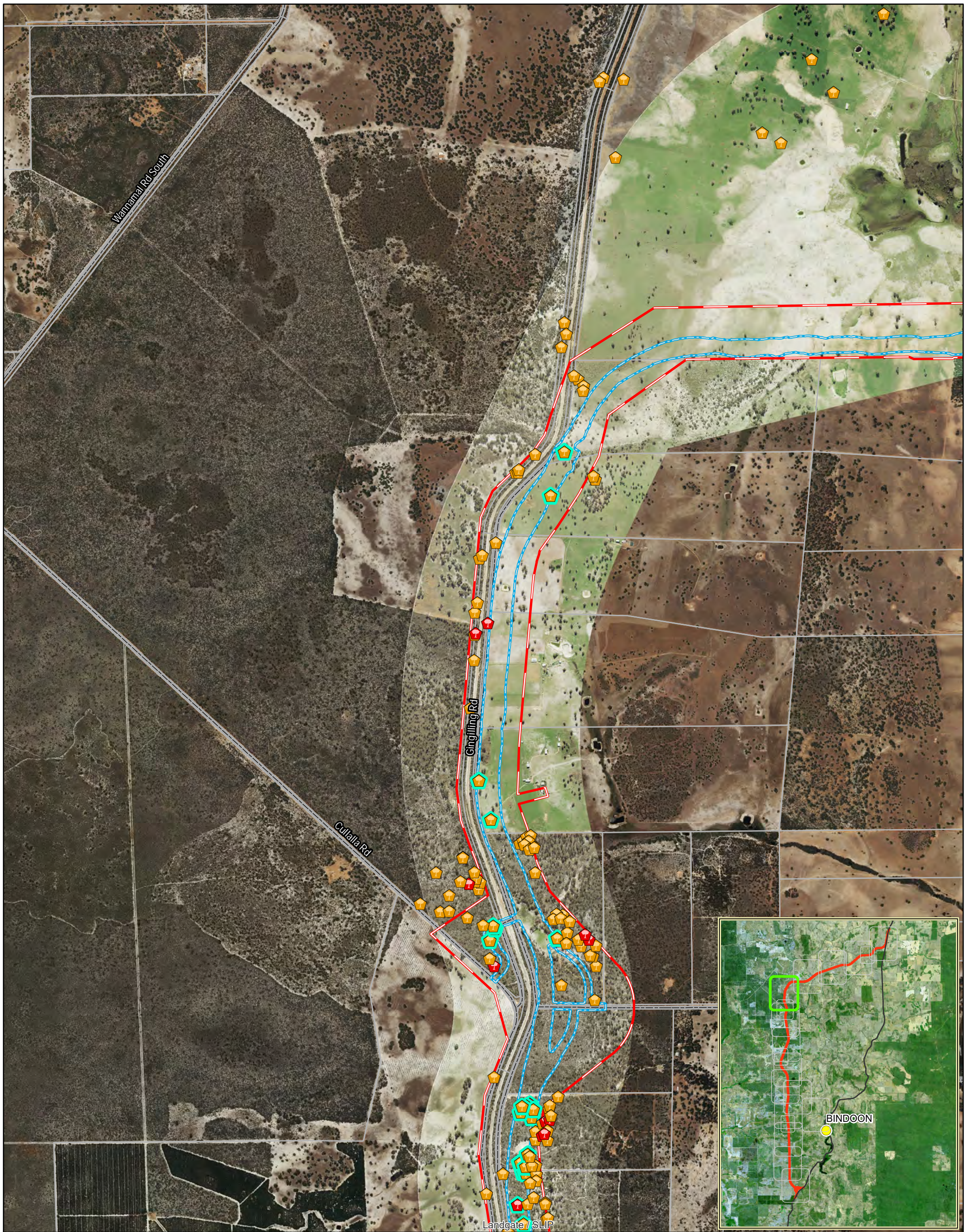
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**Black Cockatoo Habitat – Trees
with Suitable or Used Hollows**

Figure: 2 Page 10 of 16

Drawing No GNH-CN12-EA-PER-00001 - F4-13	Issue 2		
Task No ERD	Drawing Status / Other Final		
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Black Cockatoo Trees (FVC) - Outside Development Footprint

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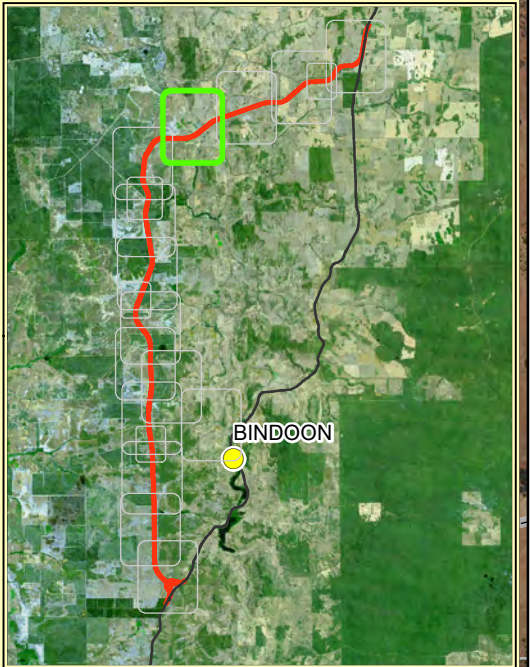
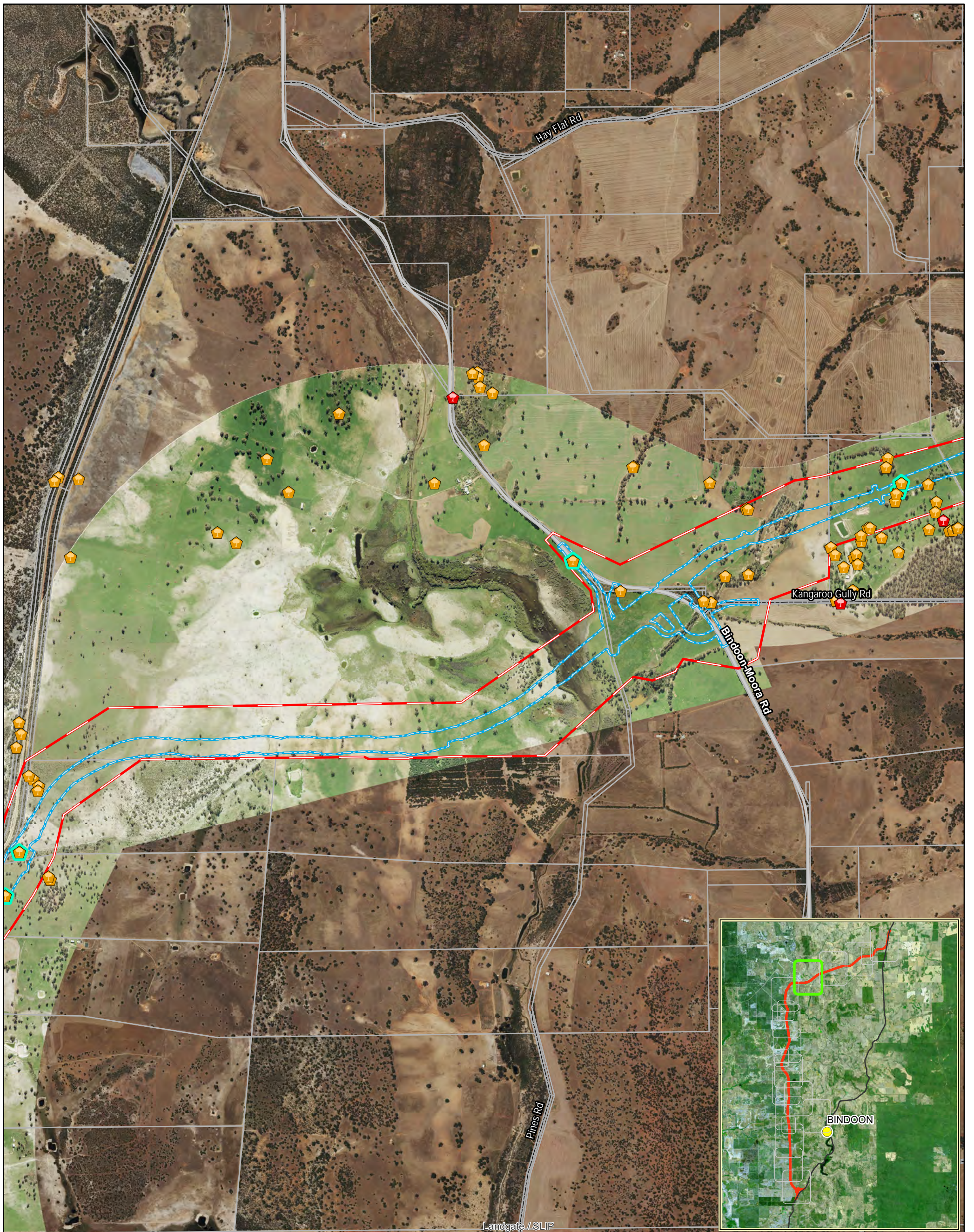
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Black Cockatoo Habitat – Trees with Suitable or Used Hollows
Figure: 2 Page 11 of 16

Drawing No: **GNH-CN12-EA-PER-00001 - F4-13** Issue: **2**

Task No: **ERD** Drawing Status / Other: **Final**

Date	By	Chkd	Appd
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- Black Cockatoo Trees (FVC) - Outside Development Footprint**
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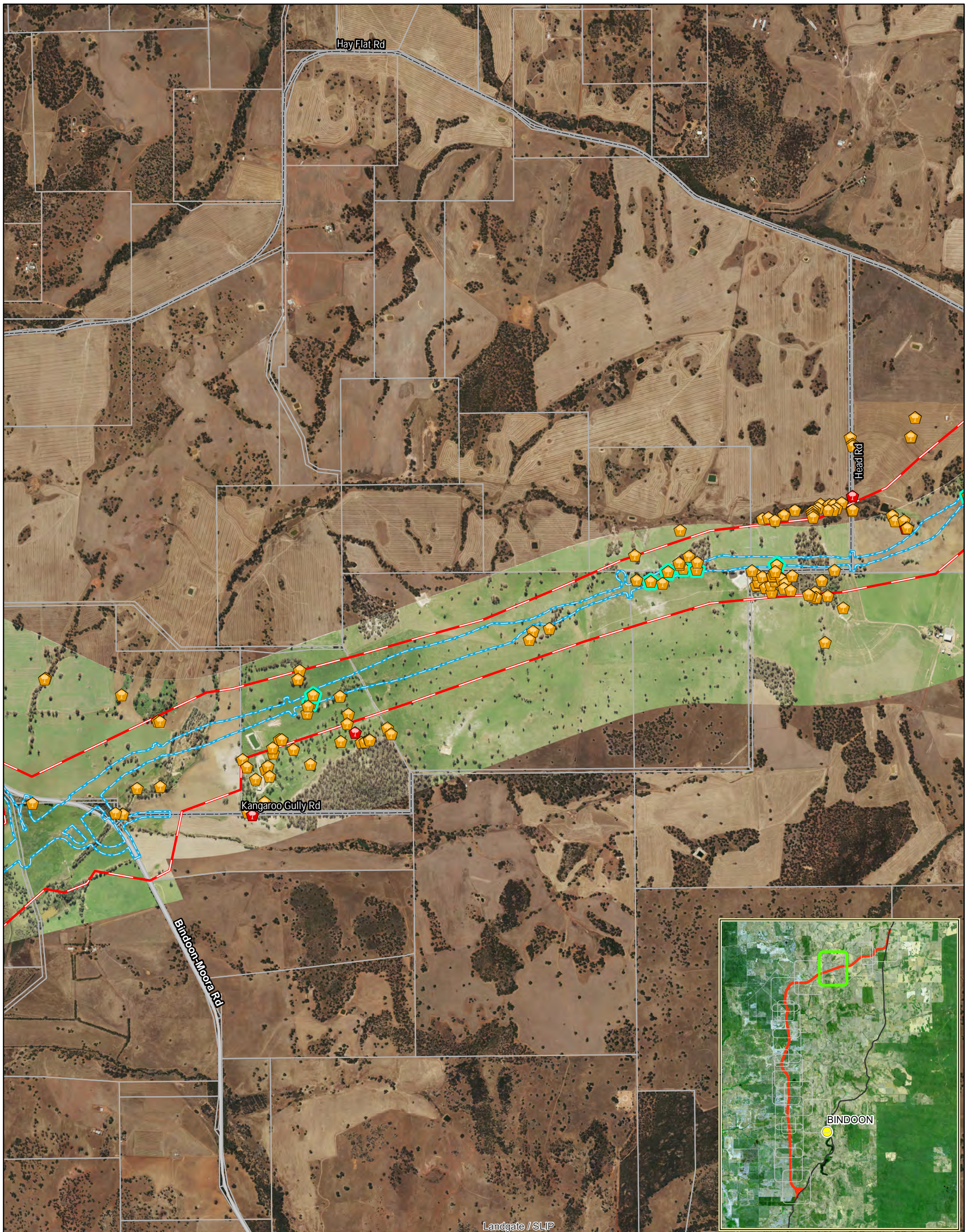
Black Cockatoo Habitat – Trees with Suitable or Used Hollows

Figure: 2 Page 12 of 16

Drawing No: GNH-CN12-EA-PER-00001 - F4-13 Issue: 2

Task No: ERD	Drawing Status / Other: Final		
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Landgate / SLIP

- Black Cockatoo Trees (FVC) - Outside Development Footprint**
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Black Cockatoo Habitat – Trees with Suitable or Used Hollows

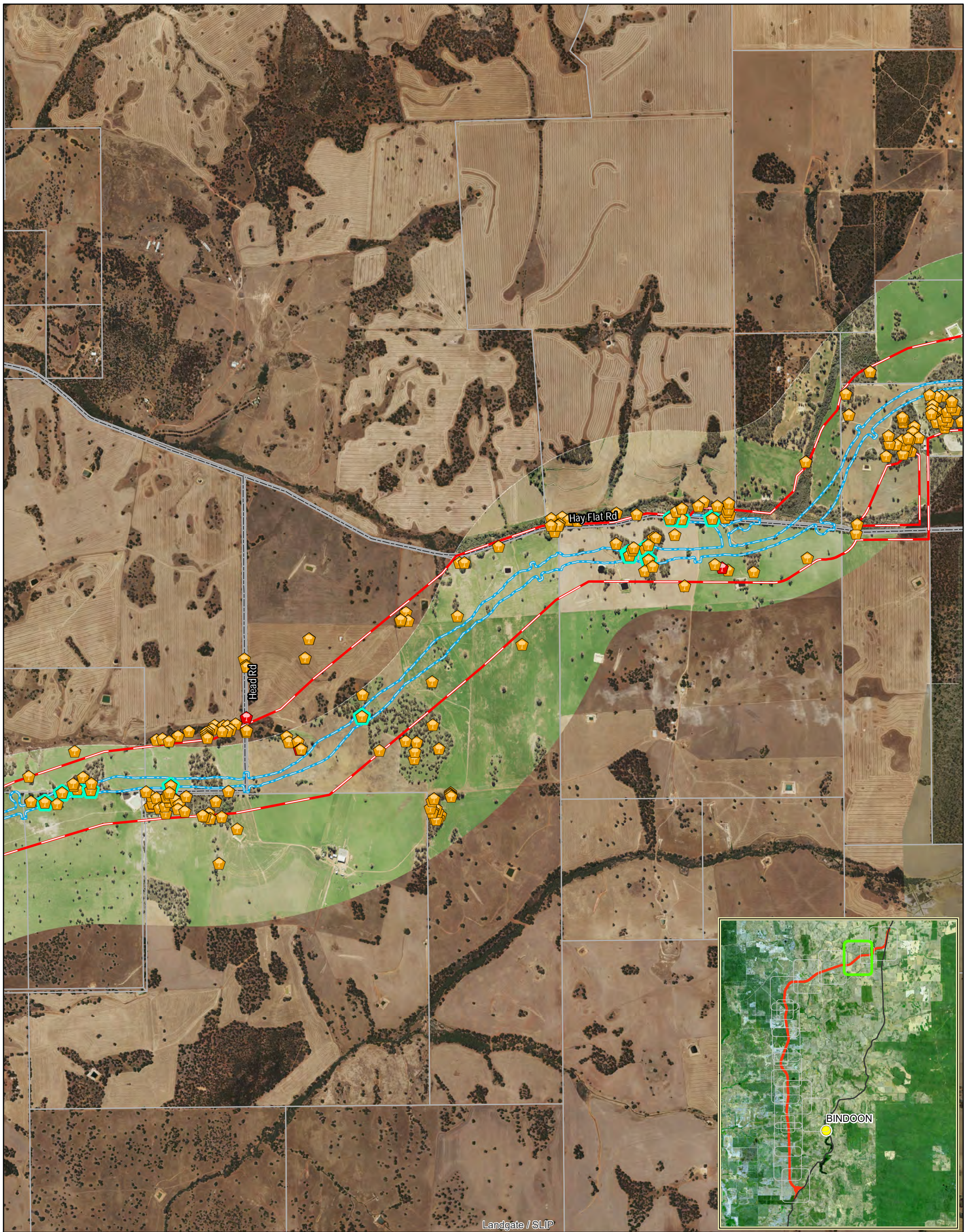
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Drawing No: **GNH-CN12-EA-PER-00001** Issue: **2**
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Task No	Drawing Status / Other
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Landgate / SLIP

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Black Cockatoo Habitat – Trees
 with Suitable or Used Hollows
 Figure: 2 Page 14 of 16

Drawing No
 GNH-CN12-EA-PER-00001
 - F4-13 Issue
 2

Task No
 ERD Drawing Status / Other
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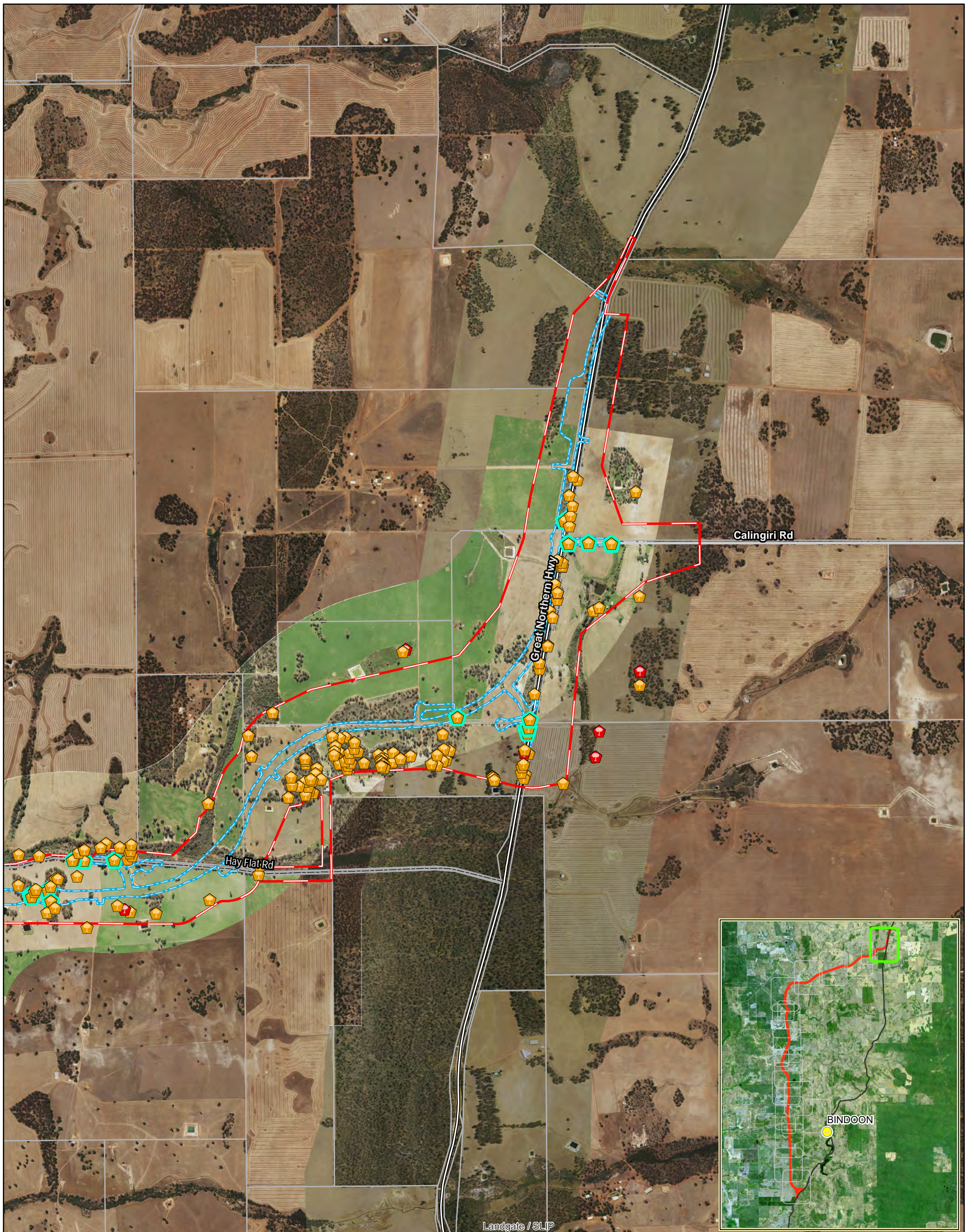
**Black Cockatoo Habitat – Trees
 with Suitable or Used Hollows**
 Figure: 2 Page 15 of 16

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**GNH-CN12-EA-PER-00001
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Landgate / SLP

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Black Cockatoo Habitat – Trees
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 Figure: 2 Page 16 of 16

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