



COPPERSTRING 2.0

CopperString 2.0

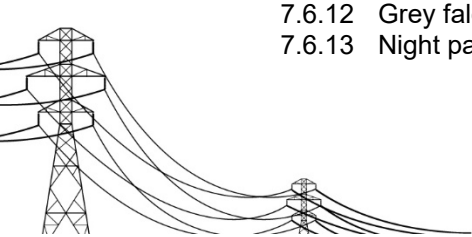
Flora and fauna

Volume 2 Chapter 7



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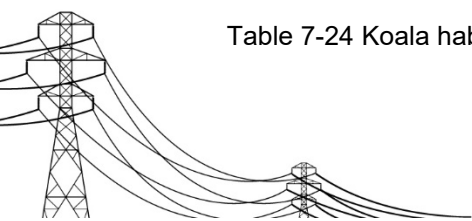


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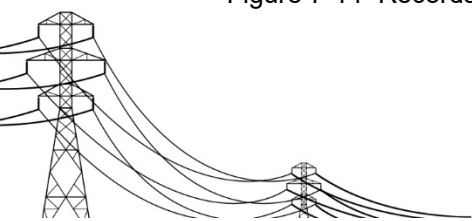
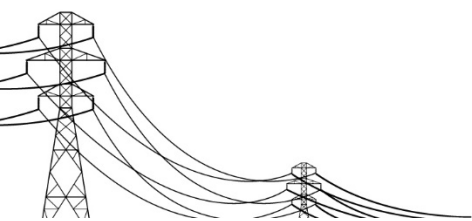


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7. Flora and fauna

7.1 Introduction

7.1.1 Project overview

The CopperString 2.0 Project (the Project) involves the construction and operation of approximately 1,060 km of extra high voltage overhead electricity transmission line that will extend from Mount Isa to the Powerlink transmission network, via a new connection point near Woodstock, south of Townsville.

The Project involves construction of seven new substations at Woodstock, Hughenden, Dajarra Road (Cloncurry), Mount Isa, Selwyn, Cannington Mine and Phosphate Hill Mine.

The CopperString transmission network is divided into the following eight sections as shown in Figure 7-1:

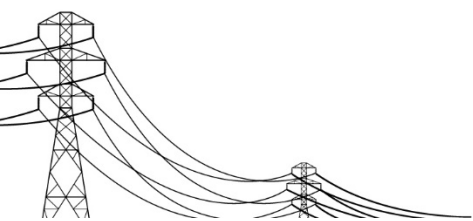
1. Woodstock Substation
2. Renewable Energy Hub
3. CopperString Core
4. Mount Isa Augmentation
5. Southern Connection
6. Cannington Connection
7. Phosphate Hill Connection
8. Kennedy Connection (option)

7.1.2 Purpose of chapter

The purpose of this Flora and Fauna Chapter is to summarise the existing terrestrial and aquatic environment in accordance with the Copperstring 2.0 Project EIS Terms of Reference and to assess the potential impacts to matters of national, state and local significance relating to flora, fauna and ecosystems. Recommended avoidance and mitigation measures have also been proposed.

The scope of this chapter includes the following specific elements from the Project TOR:

- (TOR 12.1) Identify and describe Matters of National Environmental Significance (MNES) protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), particularly threatened ecological communities (TECs) and conservation significant flora and fauna species including migratory species. While these matters have been addressed in a separate MNES Chapter, MNES ecological values are summarised and cross-referenced here.
- (TOR Section 12.15) Identify and describe MSES, State and regionally significant biodiversity and natural environmental values of the terrestrial and aquatic ecology likely to be impacted by the project. Where MSES have been addressed in the section on MNES, these have been cross referenced.
- (TOR 12.17) Map the location of fauna and flora of cultural, state and national environmental significance within the Project area and in surrounding areas, including their spatial relationship with habitat and connectivity in the surrounding landscape including:



- current regulated vegetation maps showing regional ecosystems, essential habitat, wetlands, watercourse and drainage features (over the project and adjoining areas)
- protected habitat
- wetlands of High Ecological Significance

This chapter provides a summary of the existing environment for ecology. For more information refer to Section 3 of Volume 3 Appendix P – Ecological Assessment.

7.1.3 Defined terms

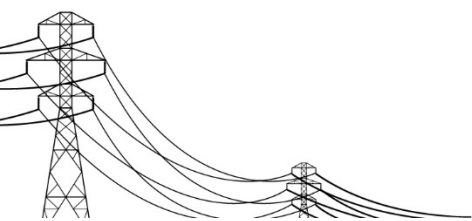
The following key terms are used throughout this chapter:

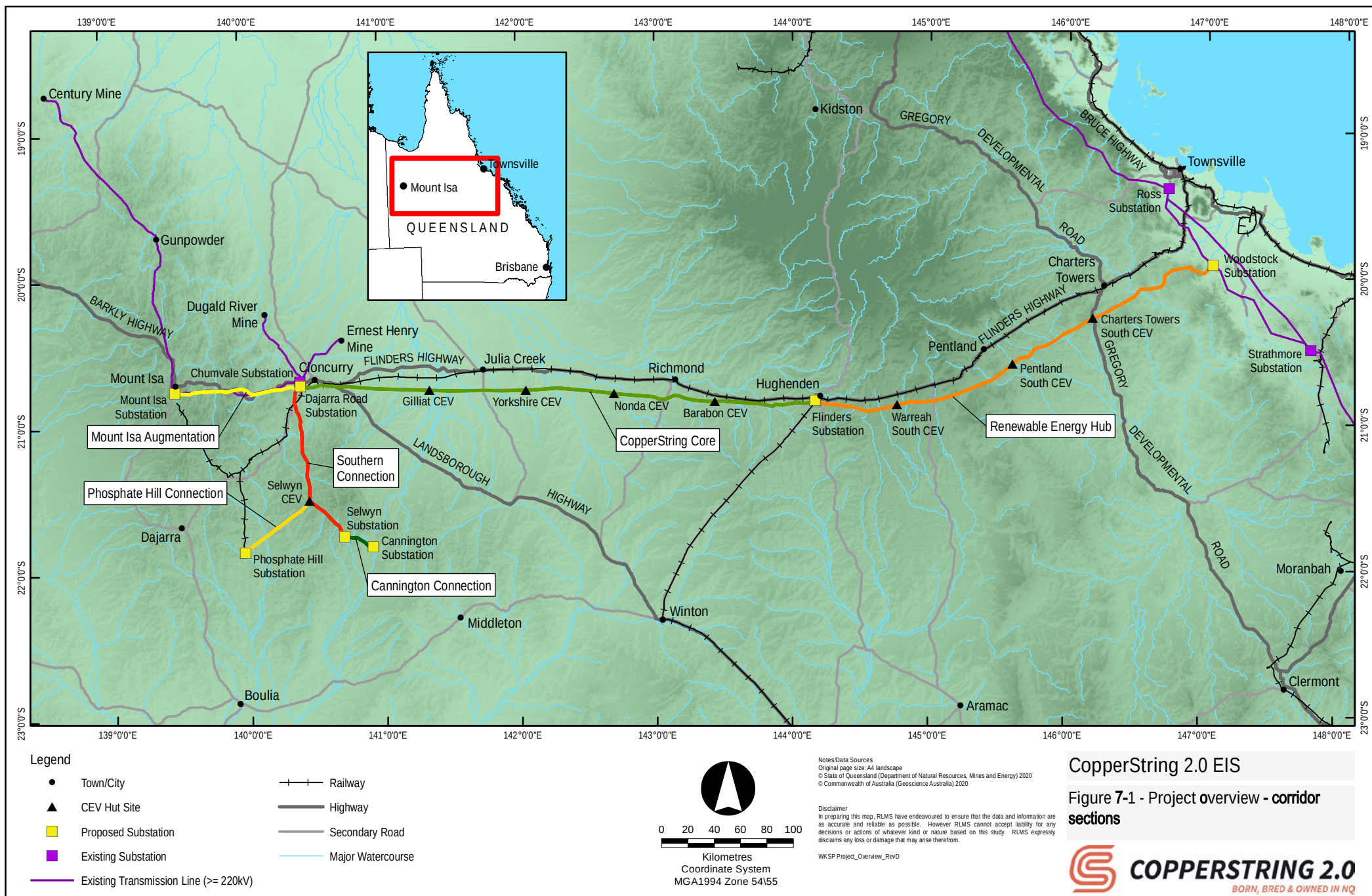
- ‘The Project’ – means the CopperString 2.0 EIS Project
- ‘CuString’ – means CuString Pty Ltd, the proponent
- ‘Corridor selection’ – means the baseline investigation corridor of the transmission line (a nominal 1,060 km long corridor). The corridor selection is 120 m wide from Woodstock to Dajarra Road, and 60 m wide from Dajarra Road to Mount Isa, Dajarra Road to Selwyn and Phosphate Hill, and Selwyn to Cannington. The 4 km long section of the corridor selection from Dajarra Road Substation to Chumvale Substation is 60 m wide and a 3 km long section from Dajarra Road Substation to the Dugald River 220 kV overhead line is 80 m wide.
- ‘Study area’ – means the study area defined specifically for this chapter of the EIS, included in Section 7.1.4.
- ‘Project area’ – means the 120 m, 80 m or 60 m wide easement and associated infrastructure including laydown areas, substations, CEV huts, access tracks, brake and winch sites, and construction camps (including components located off-easement).

7.1.4 Study area

The Project is located in northern Queensland and covers approximately 1,060 km, from south of Woodstock in the east to Mount Isa in the west and Cannington Mine and Phosphate Hill Mine in the south.

The study area refers to the 5 km corridor which was subject to the field and desktop assessments (up to 2.5 km either side of the corridor selection). An increased study area width was employed to allow for a greater assessment of the surrounding areas and to allow for identification of regional values, connected values, and potential constraints or realignment opportunities.





7.2 Methods

7.2.1 Approach

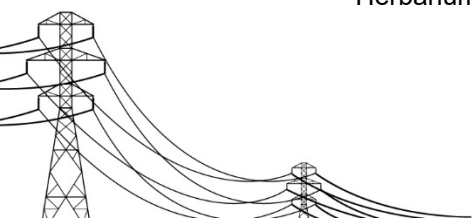
Given the Project has been subject to considerable survey effort for the original Environmental Impact Statement (EIS) and SEIS, the current assessment of ecological values has applied a combined approach, utilising:

- A desktop assessment of current ecological databases and mapping layers
- A review of previous ecological assessment reports prepared for the Project and
- Additional field surveys to validate current environmental conditions and target gaps that were not assessed in the original surveys due to constraints at the time.

7.2.2 Desktop assessment

In order to provide current information on the existing environment, a comprehensive desktop assessment was undertaken. Historical records from the area were also used to supplement findings from the field investigation. The desktop search extent included the final corridor selection plus a 30 km buffer. The desktop assessment involved searching a variety of literature and publicly available database sources for information on the terrestrial and aquatic ecological values of the study area. These sources included:

- **Protected Matters Search Tool** - the Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) was used to identify MNES protected under the EPBC Act that have the potential to occur within the vicinity of the study area.
- **Wildlife Online database** - the Department of Environment and Science (DES) Wildlife Online (WO) database was used to retrieve historical records of flora and fauna species previously recorded within the vicinity of the study area. The search extent encompassed the study area as point coordinates along the corridor selection (at 30 km intervals with a 30 km buffer to each point).
- **Atlas of Living Australia database** - the Atlas of Living Australia (ALA) database was searched to retrieve historical records of conservation significant flora and fauna species assessed as likely to occur within the study area.
- **Biomaps (Wildnet)** - this mapping tool was used to review specific locations, collection dates, confirmation attributes and details of species of conservation significance assessed as likely to occur within the study area.
- **Flora Survey Trigger Mapping** – the DES protected plants flora survey trigger mapping was viewed to determine if any high risk trigger areas for protected plants listed under the *Nature Conservation Act 1992* (NC Act) occur within the study area.
- **Regulated Vegetation Management Mapping** – The Department of Natural Resources, Mines and Energy (DNRME) Regulated Vegetation Management Map (version 3.07) and Vegetation Management Regional Ecosystem and Remnant Map spatial layer (version 11) was viewed to determine the extent and type of regulated vegetation categories and regional ecosystems (REs) mapped within the study area.
- **Regional Ecosystem Description Database (REDD)** – the REDD was viewed to obtain a description of REs within the study area including the Queensland *Vegetation Management Act 1999* (VM Act) status, biodiversity status and wetland classification (Queensland Herbarium 2019).

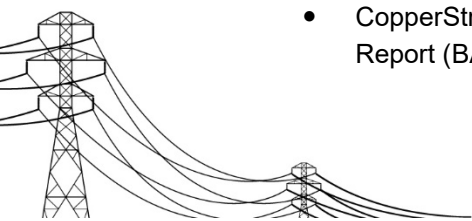


- **Broad Vegetation Group (BVG) mapping** – Mapping undertaken by the Queensland Herbarium (version 4.0) that amalgamates REs into broad vegetation communities of similar species, structure and/or landform was reviewed for habitat types and general landscape types for impact assessment purposes.
- **Essential Habitat Mapping** - the DES Essential Habitat Map spatial layer (version 7.2) was viewed to determine if vegetation within the study area has been identified as essential habitat for a conservation significant species of wildlife listed under provisions of the NC Act.
- **Directory of Important Wetlands in Australia** – this database was searched to determine if any nationally protected wetlands were present within the study area.
- **Queensland Wetlands Mapping** – the DES wetlands mapping data (version 5.0) was viewed to identify lacustrine (lake), riverine and palustrine (swamp) water bodies or REs through point features (e.g. rock holes too small to be depicted as areas), major and minor watercourses lines, and polygons of wetland waterbodies and wetland REs at 1:100,000 scale as at 2017 extent.
- **Queensland Groundwater Dependent Ecosystem (GDE) Mapping** – the DES mapping layer was viewed to identify different types of GDEs (surface expression, terrestrial, subterranean), and the Queensland Springs Dataset of active (permanent and intermittent) and inactive springs.
- **Map of Referable Wetlands** – the DES Map of Referable Wetlands was viewed to identify the extent of wetland protection areas and trigger areas, as well as wetlands and watercourses of general and high ecological significance.
- **Queensland Waterways for Waterway Barrier Works** – this Department of Agriculture and Fisheries (DAF) mapping layer was viewed to identify waterways with a risk of impact, which may require approvals under the *Fisheries Act 1994* where structures within the waterway are considered to restrict fish passage.
- **DNRME Watercourse mapping** – this mapping layer was viewed to identify watercourses (including rivers, creeks, streams and drainage features) that are defined under the *Water Act 2000*, and their hierarchy, hydrological regime and names where available.
- **Matter of State Environmental Significance (MSES)** – a report under the *State Planning Policy 2017* was obtained from DES to identify MSES in proximity to the study area. Spatial data was also reviewed to further interrogate MSES features within proximity to the study area.
- **Biodiversity and Conservation Values (BCV) Report** - This report produced by DES included a review of the Biodiversity Planning Assessment (BPA) and Aquatic Conservation Assessment (ACA) and information on Threatened and Priority Species to identify conservation values of riverine wetlands.

7.2.3 Review of past CuString ecological assessments

Extensive ecological surveys were previously undertaken as part of the original 2010 EIS and 2011 SEIS assessments. In order to capture the relevant ecological information from previous studies, the following documents were reviewed:

- CopperString Project EIS – specifically the Terrestrial Ecology and Impact Assessment Report (BAAM, 2010) and the Aquatic Ecology (frc environmental, 2010), prepared for BAAM Pty Ltd
- CopperString Project SEIS - specifically the Terrestrial Ecology and Impact Assessment Report (BAAM, 2011)



These were used to document past survey effort and identify locations where MNES and MSES including conservation significant species listed under the EPBC Act and/or NC Act were confirmed present or considered likely to occur. Past survey effort undertaken for the Project is summarised in Table 7-1.

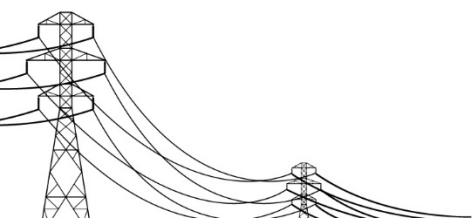
Table 7-1 Summary of past ecological surveys undertaken for the Project

Survey dates	Ecologists	Duration	Method and survey effort
Aquatic ecology surveys – frc environmental			
July 2010 / August – September 2010	Not specified	5 days / 10 days	Aquatic habitat assessments – 31 sites Water quality – 13 sites Aquatic flora assessment – 17 sites Macroinvertebrate sampling – 12 sites Electrofishing and trapping – 10 sites Turtle surveys and trapping – 4 sites
Targeted field surveys for MNES flora – BAAM			
July and August 2010	Not specified	Not specified	Quaternary vegetation assessments TEC verifications
Targeted field surveys for MNES reptiles - BAAM			
March-April 2011	4 fauna ecologists	10 days	Habitat suitability assessments Active searches
SEIS Terrestrial ecology surveys – BAAM, 3D Environmental			
April 2011	1 landscape ecologist 1 flora ecologist	12 days	Quaternary vegetation assessments Fauna habitat/rapid survey Trap and release surveys Regional ecosystem mapping
Targeted trapping survey for <i>Carpentarian Pseudantechinus</i> - BAAM			
May 2011	Not specified	4 x 5 days	Targeted trapping surveys Habitat suitability assessments
Targeted trapping surveys for Julia Creek Dunnart - BAAM			
May 2011	Not specified	2 x 5 days	Targeted trapping surveys Habitat suitability assessments
Targeted field surveys for MNES fauna – BAAM			
May / June 2011	4 fauna ecologists	10 days	Habitat suitability assessments Active searches

Regional Ecosystem mapping

Several sources of mapped data was used to provide the most accurate indication of the REs present within the study area, including:

- DNRME regulated vegetation management regional ecosystems (Version 11), covering the whole of the study area
- 3D Environmental field-verified mapping, covering the southern extent of the Southern Connection corridor section, the whole of the Cannington Connection corridor section, and parts of the Phosphate Hill Connection corridor section
- BAAM field-verified mapping, covering a 1 km wide corridor for the eastern-most 100 km of the 2010/2011 alignment (within the Renewable Energy Hub corridor section)



7.2.4 Field surveys

Overview

Targeted field surveys were undertaken during October and December 2-19. These surveys identified the characteristics and attributes of representative habitats and the diversity and abundance of terrestrial and aquatic flora and fauna species. This field data supplemented and verified information gathered during the desktop assessment outlined in Section 7.2.2.

7.2.5 Terrestrial flora assessment

Flora surveys involved a combination of vegetation community assessments and targeted surveys for conservation significant flora species. At each site, one or more of the following survey methods were applied:

Threatened Ecological Community (TEC) assessments – The structural and compositional characteristics of vegetation communities were compared with DAWE's descriptions of TECs to determine whether any vegetation communities met the thresholds necessary to constitute a TEC.

Regional Ecosystem (RE) verification – Quaternary level assessments were undertaken at each location in accordance with the survey method detailed in Neldner *et al.* (2019). The characteristics of each assessed vegetation community were compared to descriptions provided by the REDD (version 11.1) (Queensland Herbarium, 2019).

Targeted searches for conservation significant flora – Targeted searches for conservation significant flora species were undertaken in areas where previous records were documented or suitable habitat for a conservation significant flora species was identified. Species identified as being most likely to be recorded included *Eucalyptus raveretiana*, *Eucalyptus nudicaulis*, *Acacia armitii* and *Livistona lanuginosa*.

Recording of invasive species – Prohibited or restricted invasive species as defined under the *Biosecurity Act 2014* and listed as Weeds of National Significance were recorded and descriptions of densities and extent were documented.

Flora surveys were undertaken at 237 quaternary level survey sites. Targeted searches were undertaken opportunistically where suitable habitat for conservation significant flora species was observed. Random meanders (Cropper 1993) were also undertaken at many quaternary survey sites and involved random traverses of vegetation while searching for conservation significant species and other species of interest.

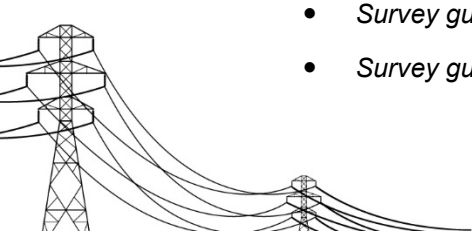
The locations of terrestrial flora assessment sites are displayed in Figure 7-2.

7.2.6 Terrestrial fauna assessment

An integrated suite of standard fauna detection methods formed the focus of the fieldwork, with no reliance upon a single methodology. This included habitat assessments, timed bird surveys, diurnal active searches, nocturnal surveys (spotlighting, call playback, nocturnal active searches, and microchiropteran bat call detection) and targeted searches for conservation significant species.

Targeted searches for conservation significant species were undertaken in areas of suitable habitat or sites of historic records. The methods employed were derived for Commonwealth and State best practice guidelines, including:

- *Survey guidelines for Australia's threatened birds* (DEWHA, 2010).
- *Survey guidelines for Australia's threatened mammals* (DEWHA, 2011).
- *Survey guidelines for Australia's threatened reptiles* (DEWHA, 2011).



- *Survey guidelines for Australia's threatened bats* (DEWHA, 2010).
- *Terrestrial vertebrate fauna survey guidelines for Queensland Version 3* (Eyre et al 2018).
- *Targeted species survey guidelines: painted honeyeater* (Rowland 2012).
- *Targeted species survey guidelines: purple necked rock-wallaby* (Rowland 2012).
- *Targeted species survey guidelines: common death adder* (Rowland 2012).
- *Targeted species survey guidelines: ornamental snake* (Rowland 2012)
- Spot Assessment Technique (Phillips and Callaghan 2011)

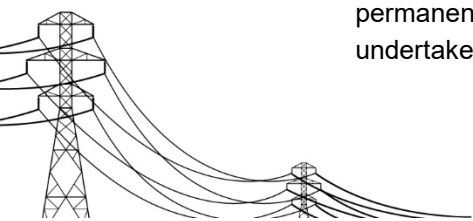
Terrestrial fauna surveys were undertaken at 191 sites within the study area, as shown in Figure 7-2. A summary of the terrestrial fauna survey effort is presented in Table 7-2.

Table 7-2 Summary of fauna survey effort

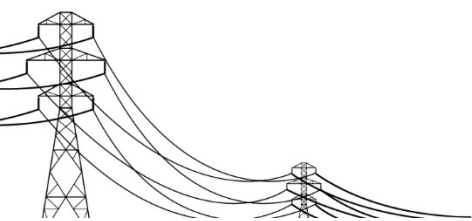
Survey method	Number of sites	Person hours
Terrestrial fauna habitat assessment	293	95
Standardised bird survey	293	63
SAT searches	140	31
Active searches for reptiles and frogs	293	63
Diurnal active search for wildlife traces	293	63
Driving / flushing surveys	750 km	37.5
Waterbody watches	>74	>74
Nocturnal Anabat sites	13	13
Remote surveillance cameras	13	13

A summary of the sites assessed for key conservation significant fauna is provided below (whilst a detailed analysis of the targeted surveys is presented in Section 2.5.3 of Volume 3 Appendix P Ecological Assessment):

- Koala – Targeted searches for koala faecal pellets were undertaken at 140 sites using the Spot Assessment Technique (SAT) (Phillips and Callaghan 2011). Targeted habitat assessments conducted at 134 sites.
- Black-throated finch – Waterbody watches and area searches for birds were undertaken within 600 m of permanent waterbodies at 74 sites. Targeted habitat assessments at three sites.
- Julia Creek dunnart – Deployment of remote cameras and collection of predator scats for content analysis were undertaken at 28 sites. Active searches undertaken at 62 sites. Targeted habitat assessments at 17 sites.
- Purple-necked rock wallaby – Searches for scats and signs (e.g. worn rock), habitat assessments and targeted observations of rock outcrops conducted at 93 sites, deployment of remote cameras (14 sites), and scat samples (14) collected for analysis.
- Night parrot – Habitat assessments undertaken at 84 sites. Targeted surveys completed at 37 sites. Song meters deployed at three locations. Remote cameras deployed at two locations.
- Squatter pigeon – Driving / flushing surveys over 770 km length, and area searches at permanent waterbodies, including in the vicinity of dams and cattle troughs, were undertaken at 90 sites.



- Plains death adder – Nocturnal driving transects and active searches were undertaken at 104 sites (over 25 evenings).
- Red goshawk – Active searches at 49 sites and targeted surveys at 23 sites.
- Grey falcon – Active searches undertaken at 293 sites.
- Australian painted snipe – Targeted stationary observations undertaken at 57 sites.
- Painted honeyeater – Active searches undertaken at 21 sites.
- Short-beaked echidna – Active searches undertaken at 293 sites.
- Vine-thicket fine-lined slider – Targeted surveys and active searches at eight sites.
- Ornamental snake – Active searches conducted at 25 sites. Targeted surveys conducted at 36 sites.
- Migratory birds – Bird census surveys at 293 sites. Waterbody watches at greater than 74 sites.

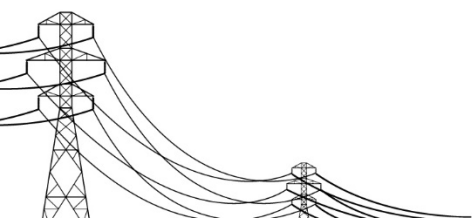


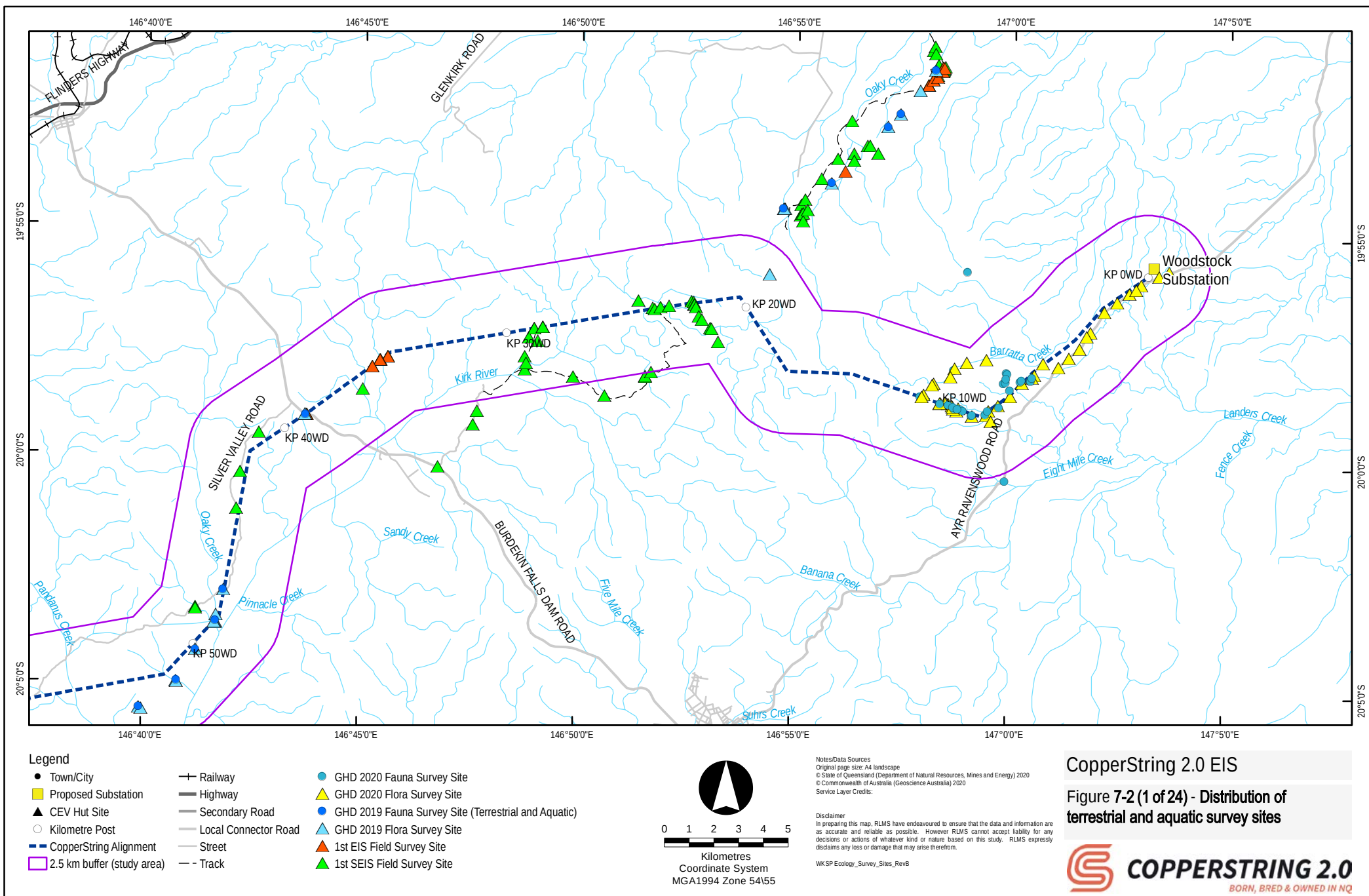
7.2.7 Aquatic ecology assessment

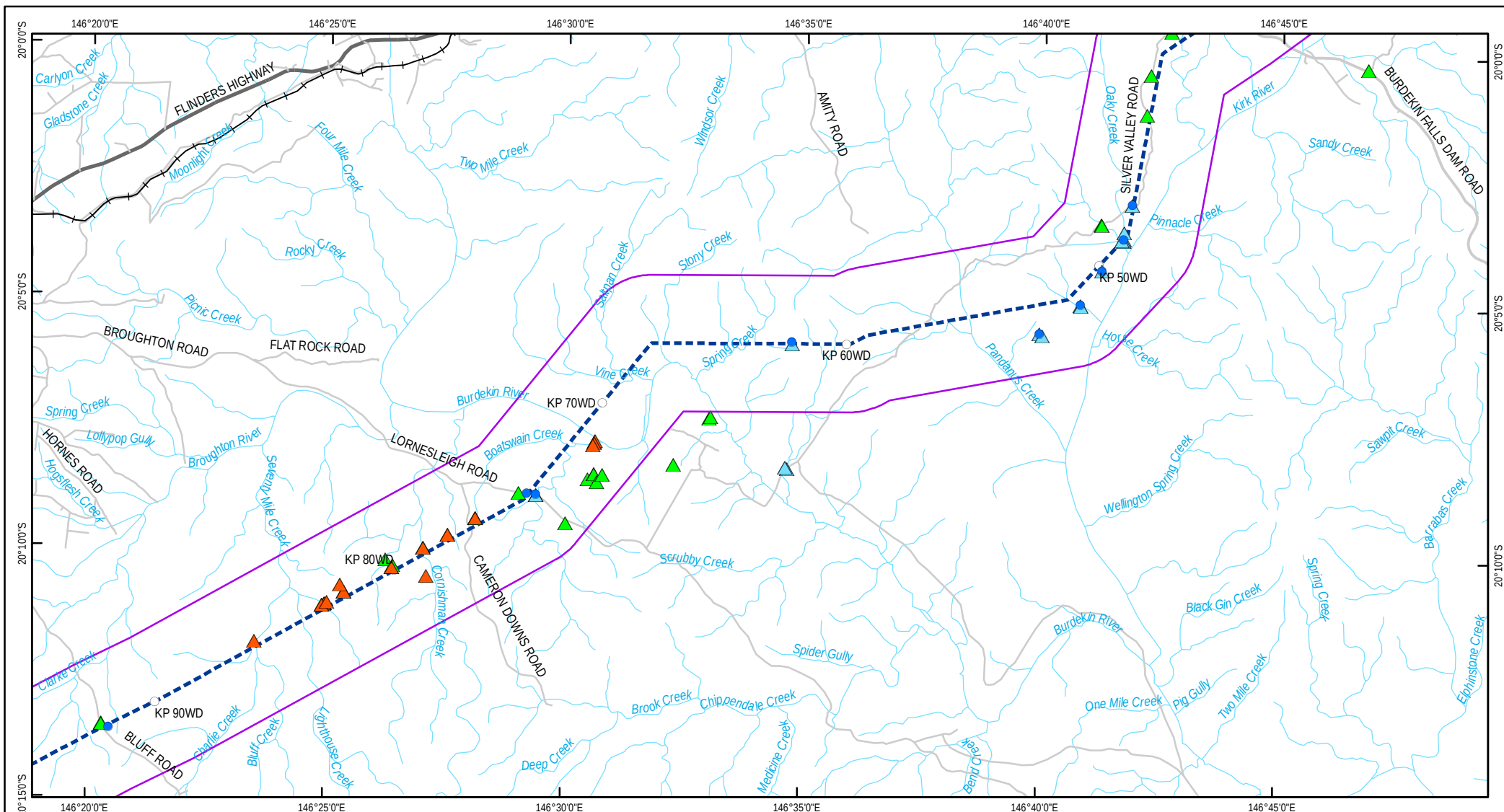
Extensive aquatic surveys were undertaken during fieldwork for the original EIS/SEIS. As the Project will predominantly span watercourses and aquatic habitats wherever possible, additional comprehensive assessments were considered unnecessary. Surveys targeted previously unassessed aquatic features, where they were accessible. As the majority of aquatic features were dry at the time of assessment, surveys were limited to visual assessments and habitat characterisations, including documenting the following:

- Morphology of stream bed and banks
- Diversity and abundance of instream macrophytes
- Diversity and abundance of fringing riparian vegetation
- Instream habitat complexity and resource availability for aquatic fauna
- Likely flow regime based on characteristics observed

The locations of aquatic habitat assessment sites are presented in Figure 7-2.

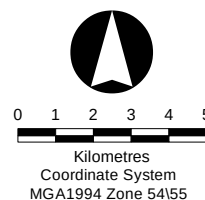






Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



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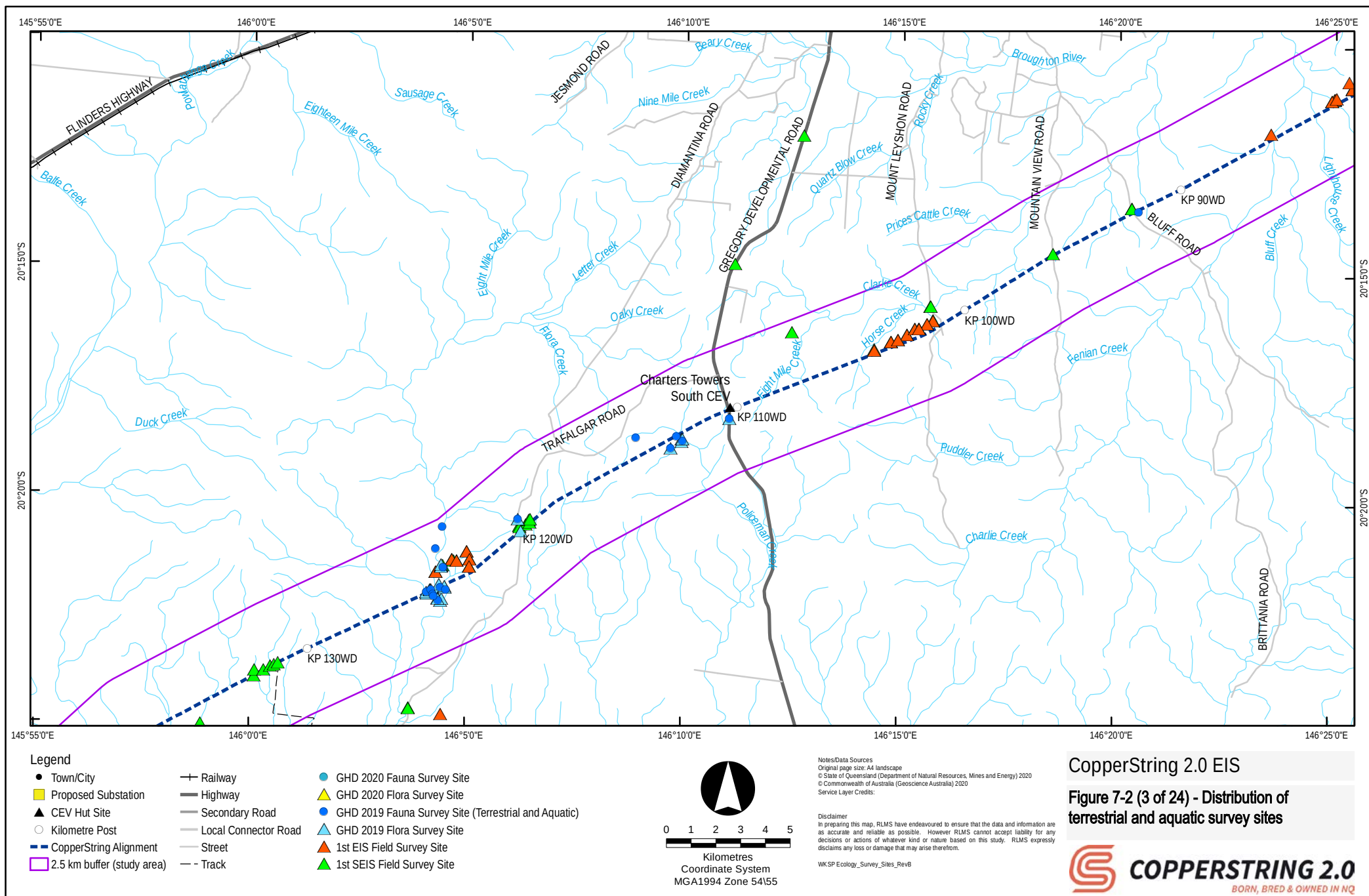
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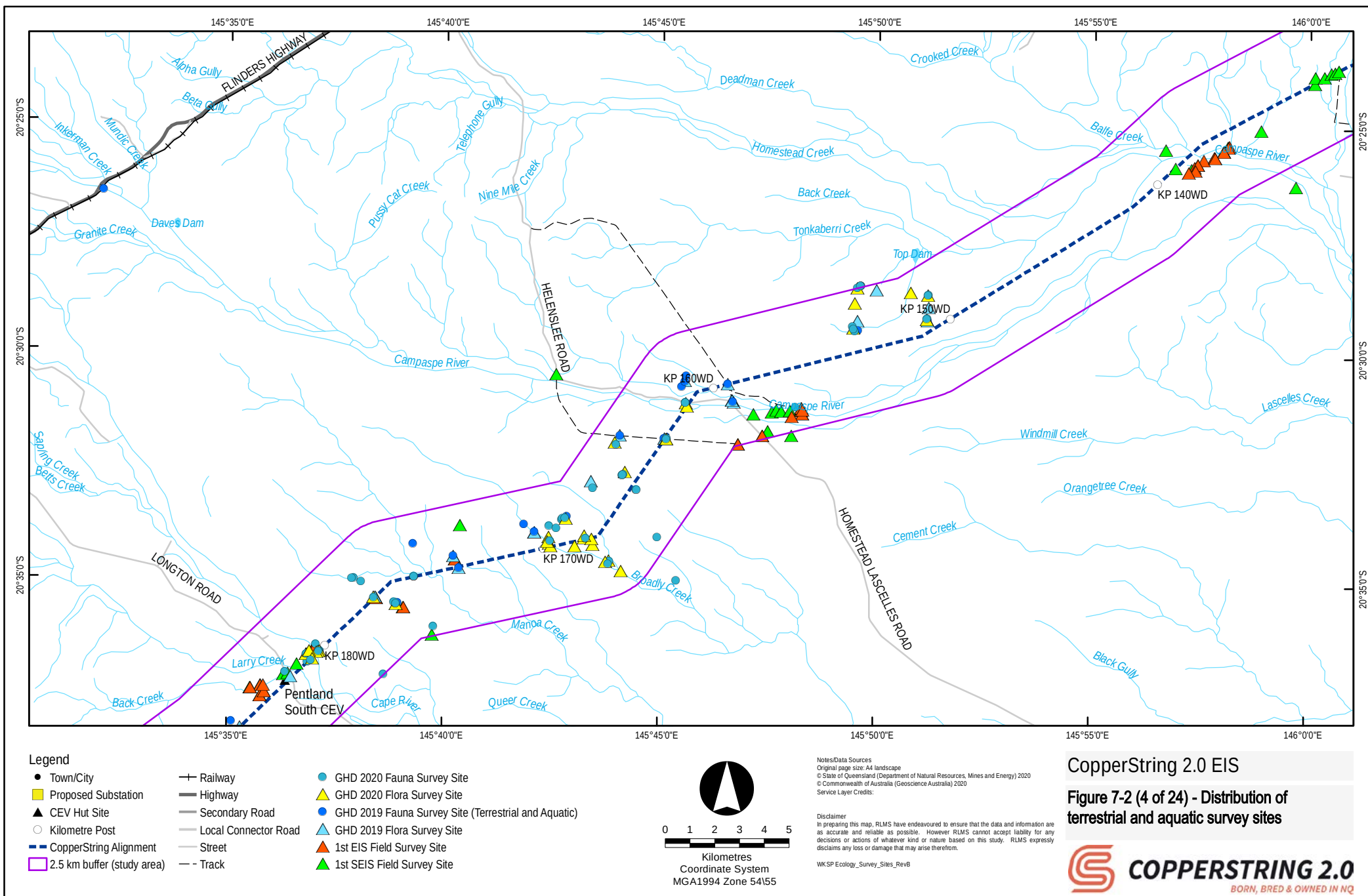
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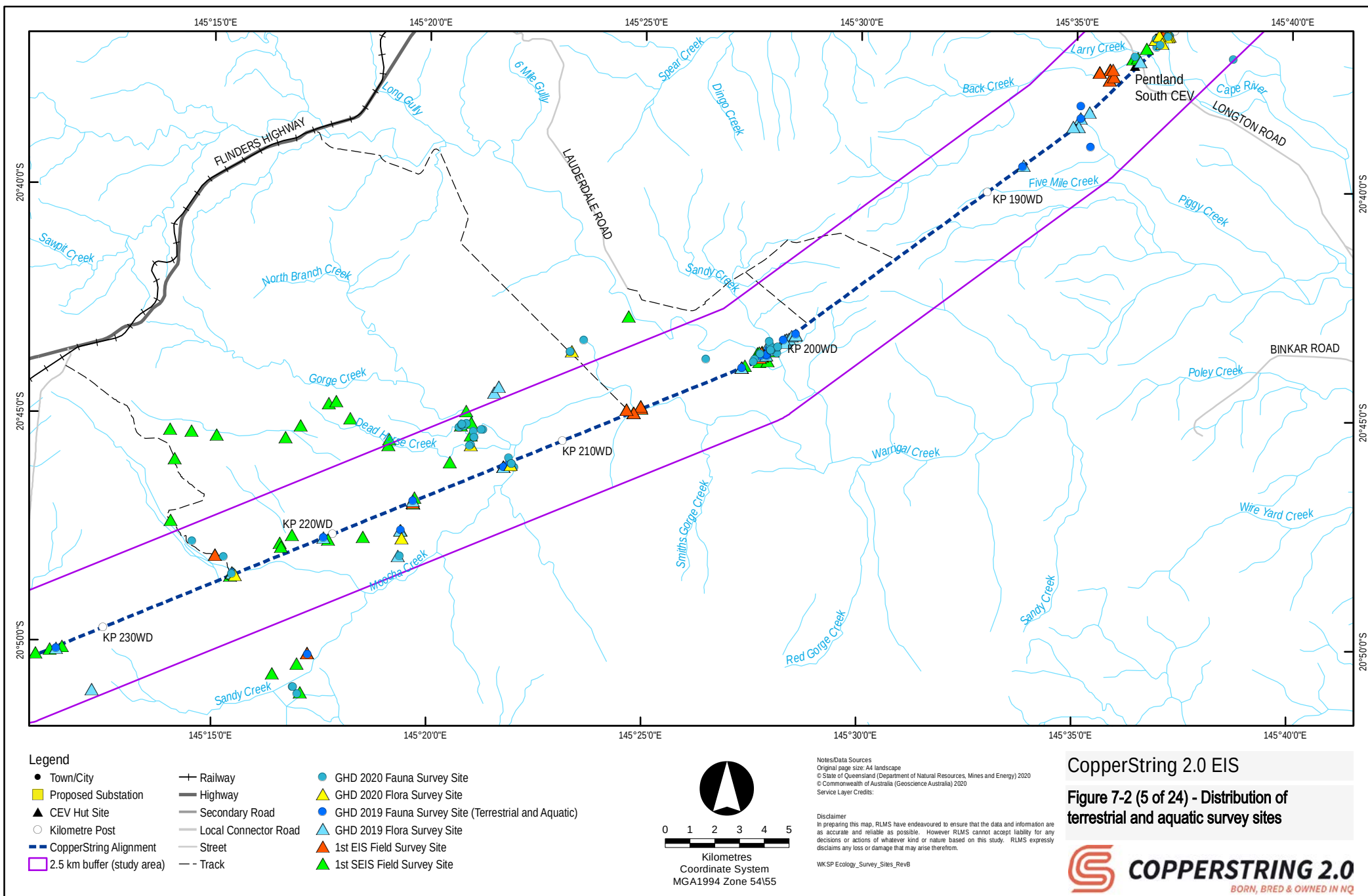
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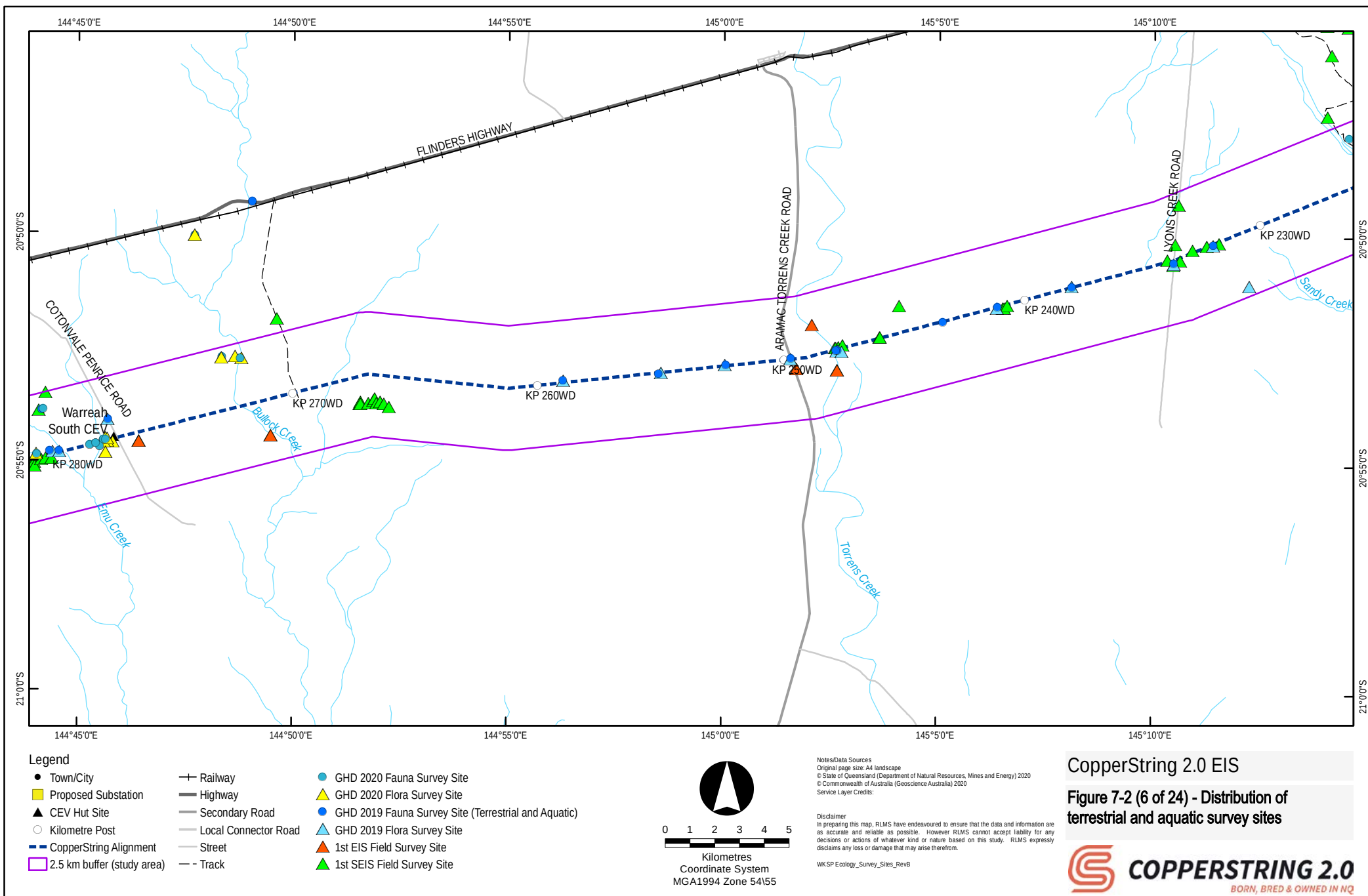
Figure 7-2 (2 of 24) - Distribution of terrestrial and aquatic survey sites

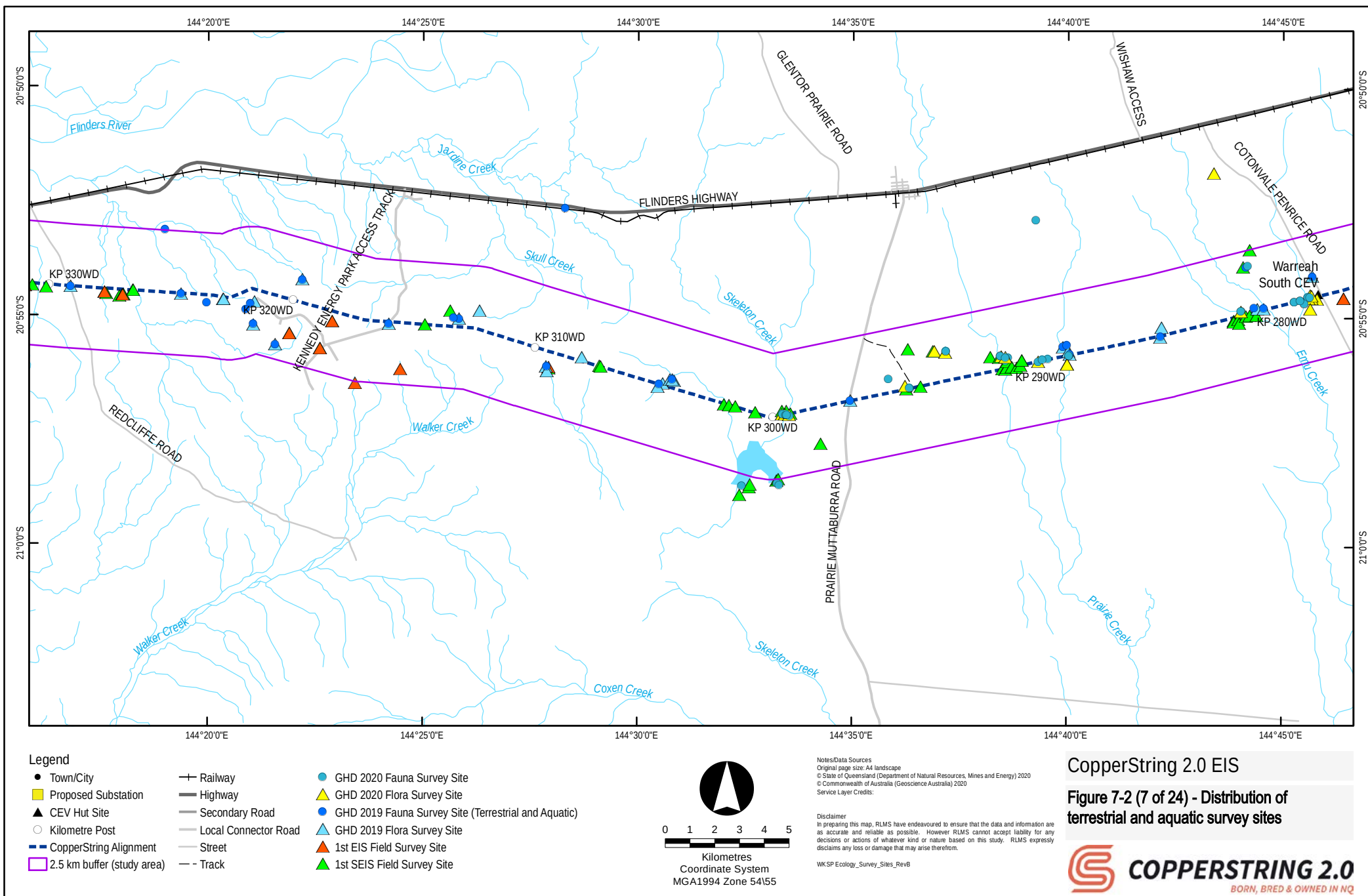


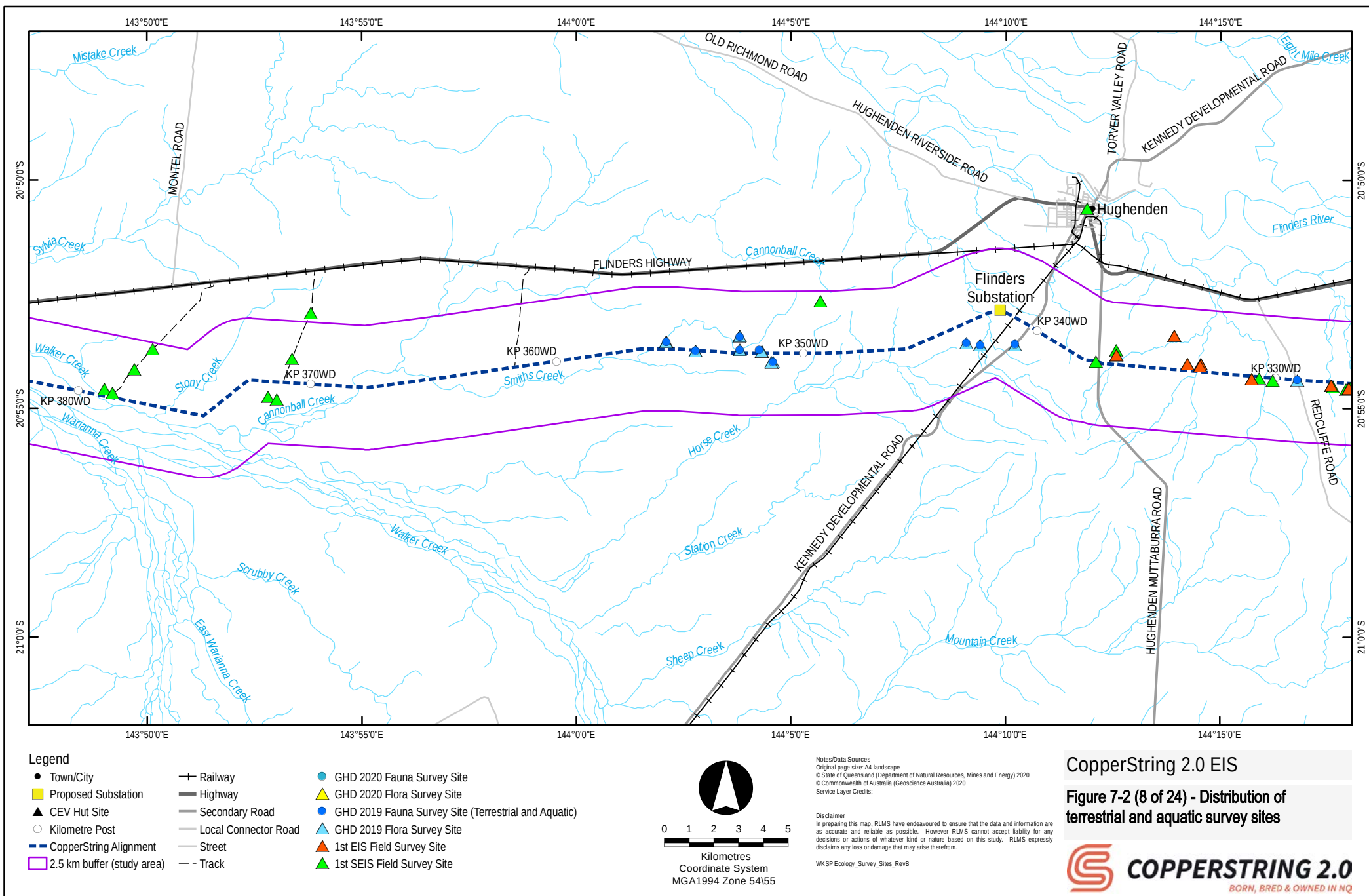


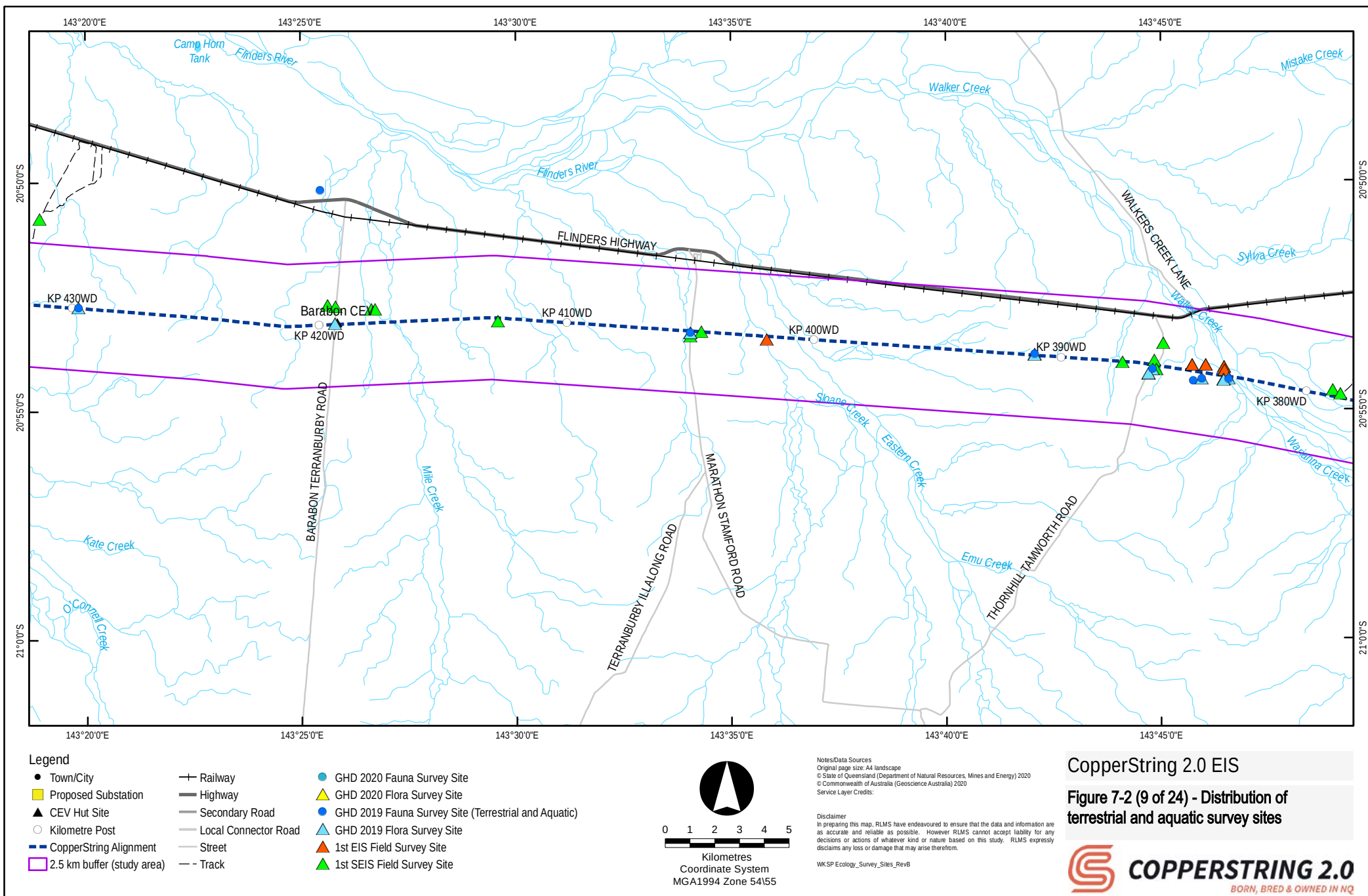


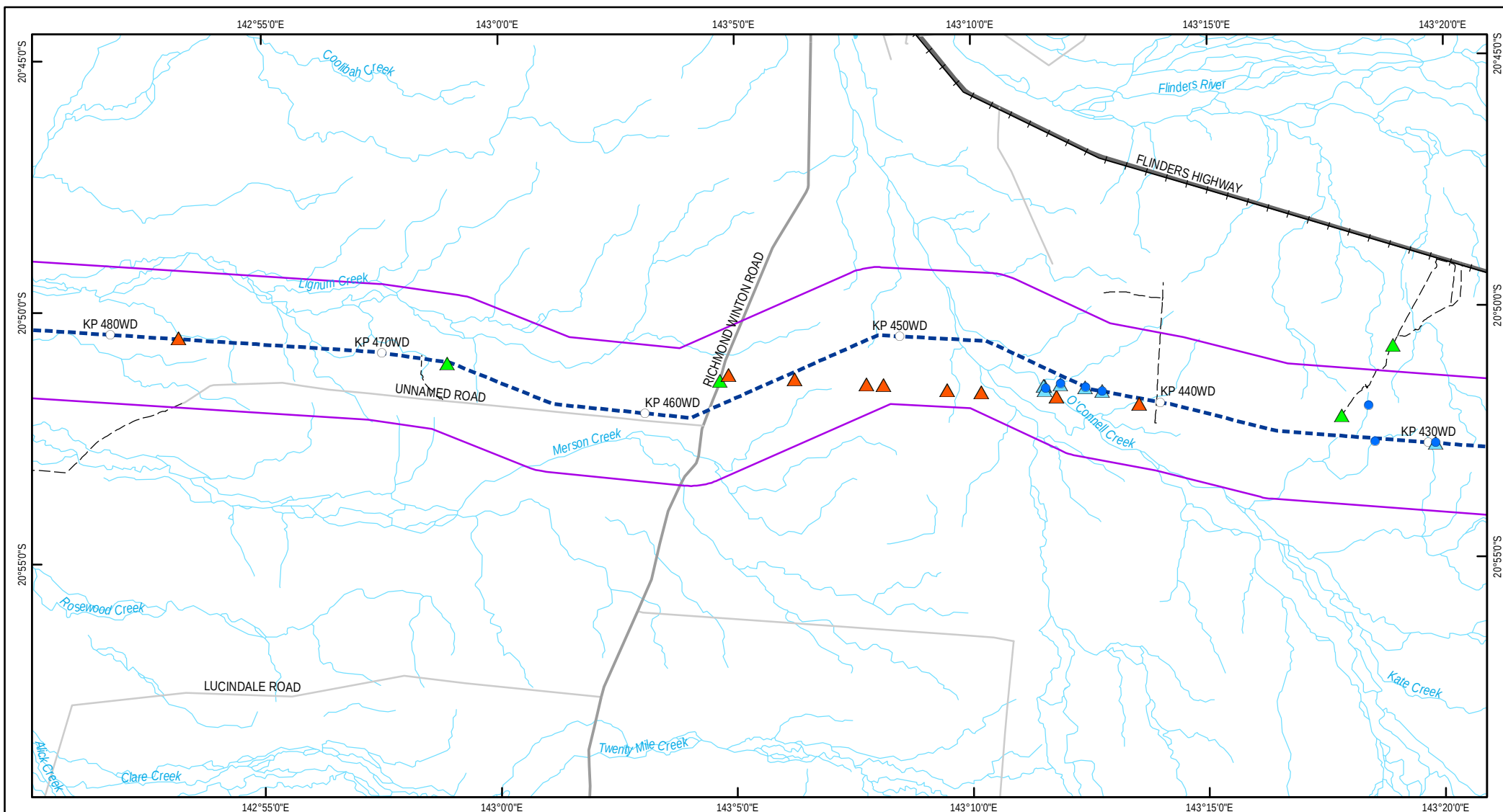






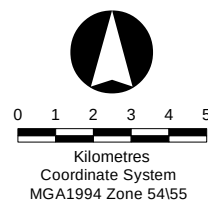






Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



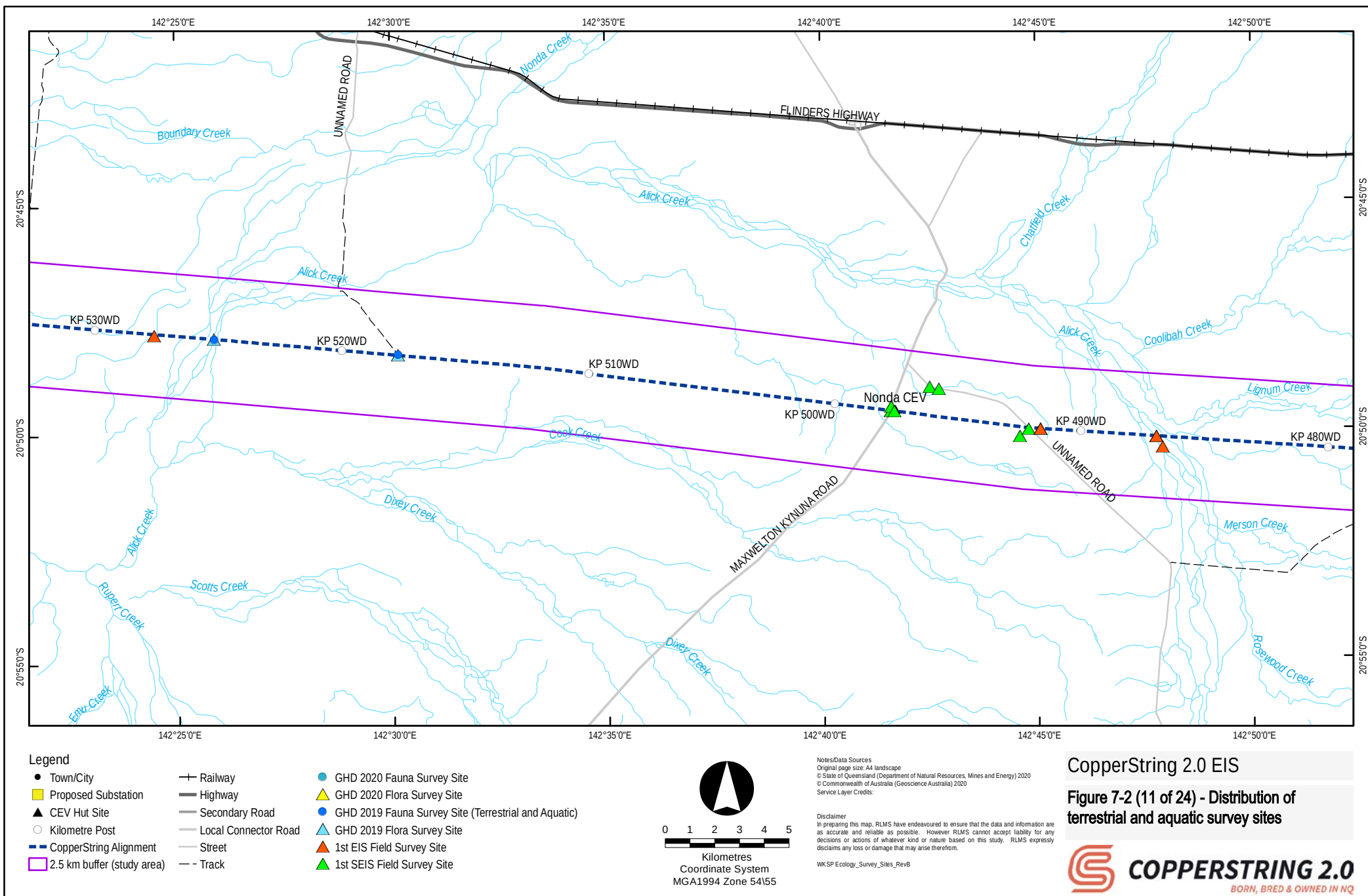
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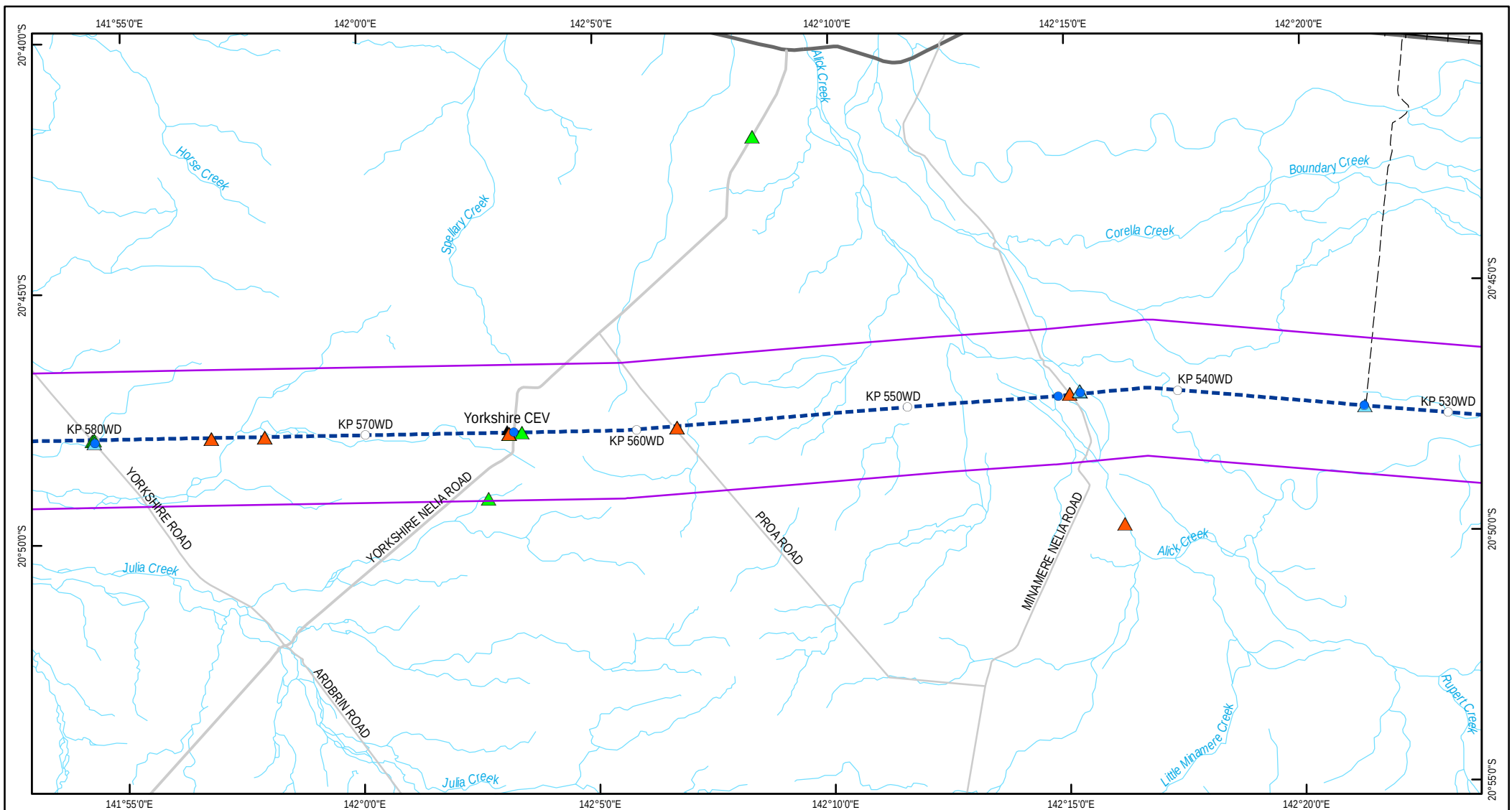
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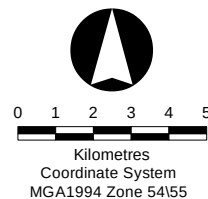
Figure 7-2 (10 of 24) - Distribution of terrestrial and aquatic survey sites





Legend

- | | | |
|------------------------------|------------------------|--|
| ● Town/City | ✚ Railway | ● GHD 2020 Fauna Survey Site |
| ■ Proposed Substation | — Highway | ▲ GHD 2020 Flora Survey Site |
| ▲ CEV Hut Site | — Secondary Road | ● GHD 2019 Fauna Survey Site (Terrestrial and Aquatic) |
| ○ Kilometre Post | — Local Connector Road | ▲ GHD 2019 Flora Survey Site |
| — CopperString Alignment | — Street | ▲ 1st EIS Field Survey Site |
| ■ 2.5 km buffer (study area) | — Track | ▲ 1st SEIS Field Survey Site |



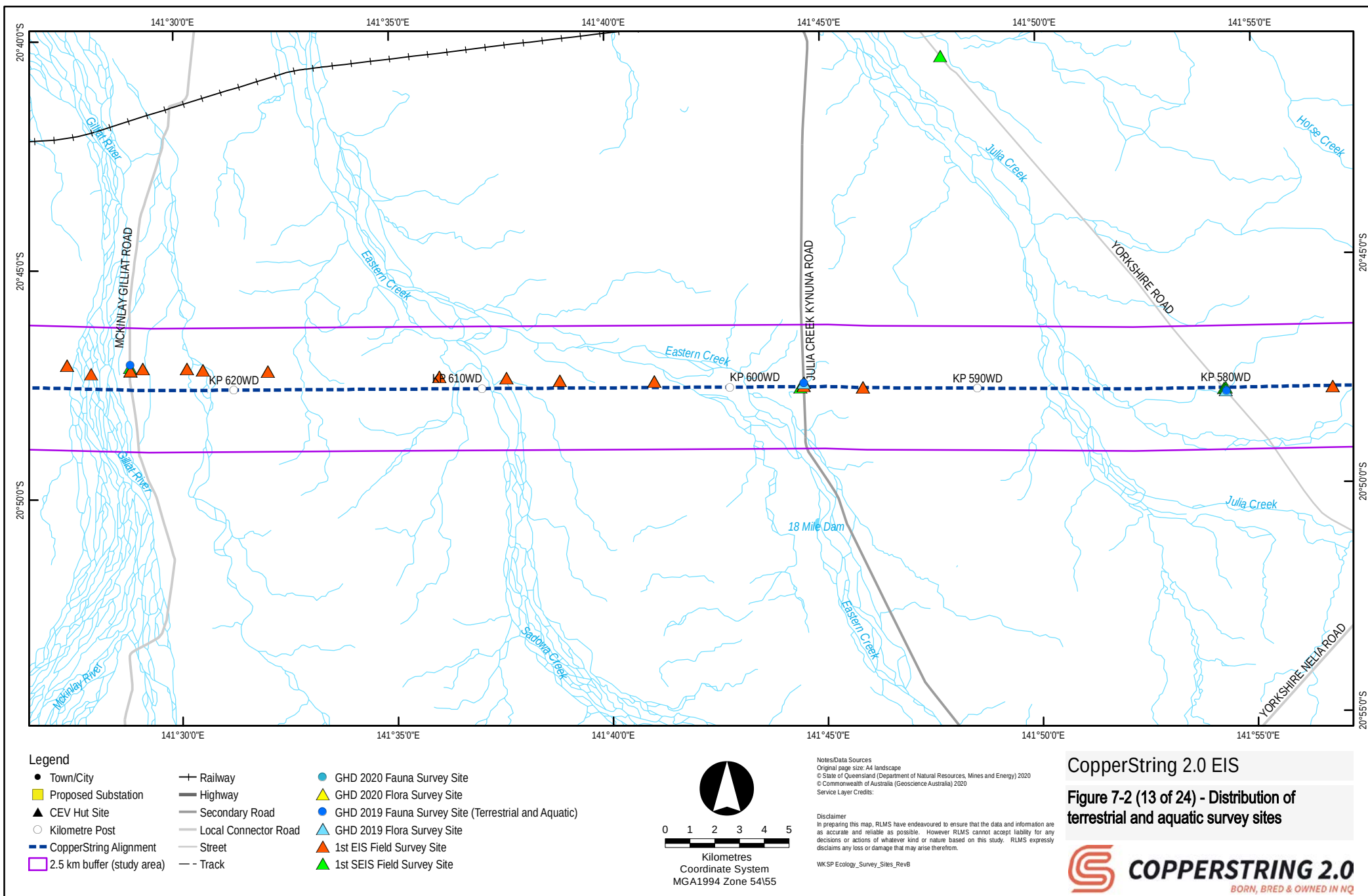
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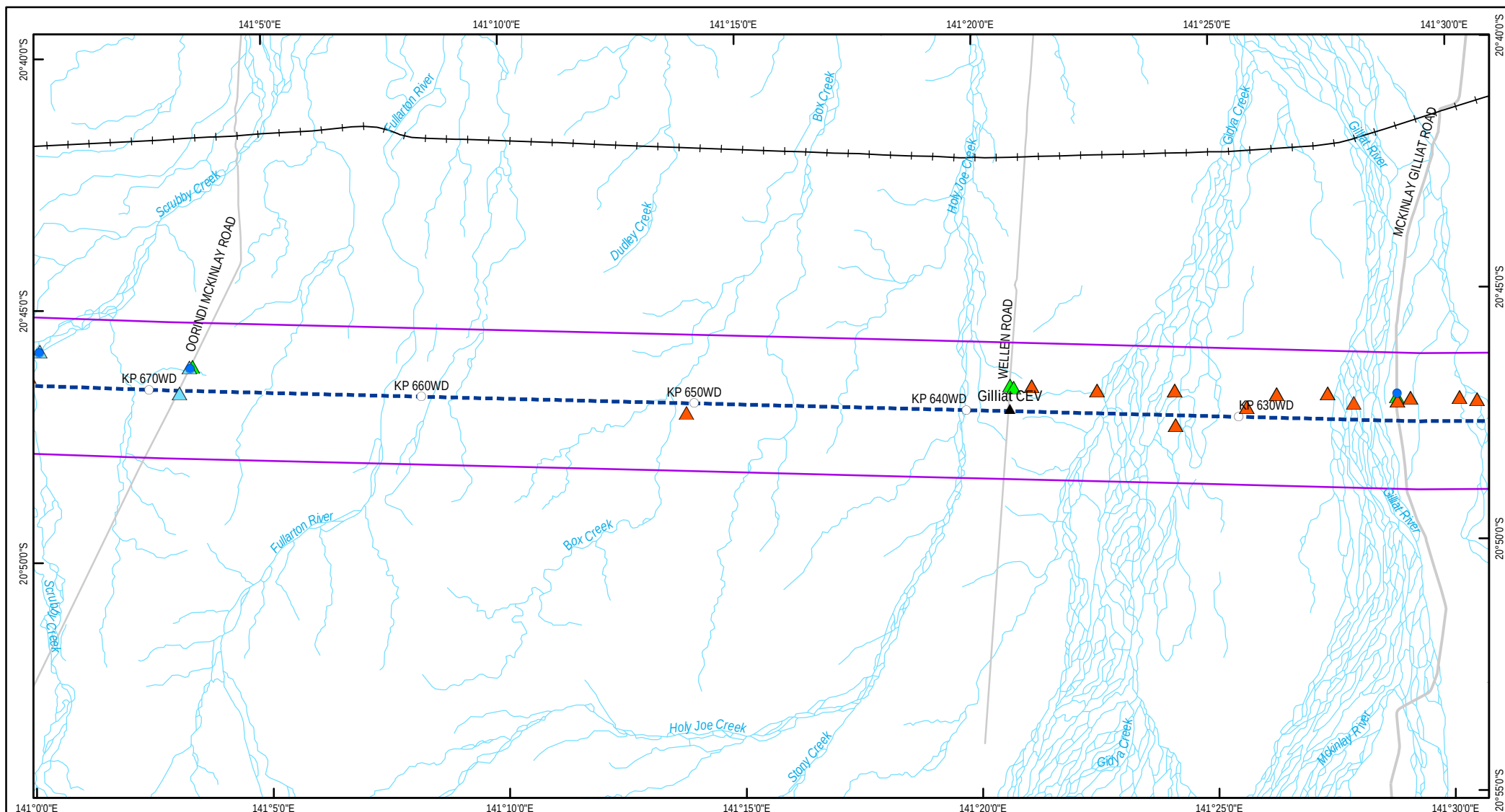
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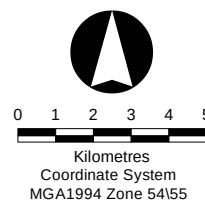
Figure 7-2 (12 of 24) - Distribution of terrestrial and aquatic survey sites





Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



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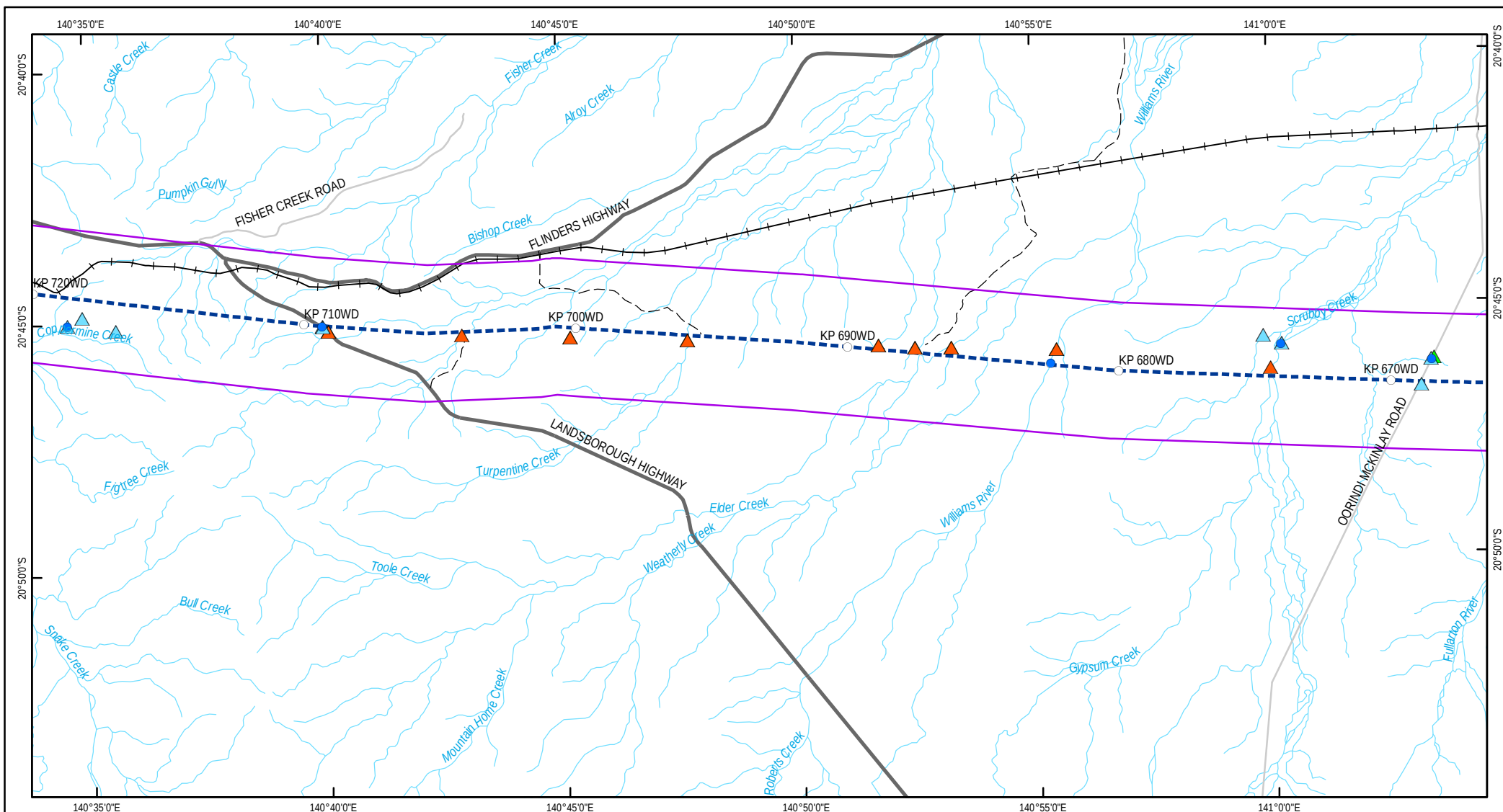
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CopperString 2.0 EIS

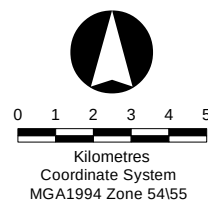
Figure 7-2 (14 of 24) - Distribution of terrestrial and aquatic survey sites





Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



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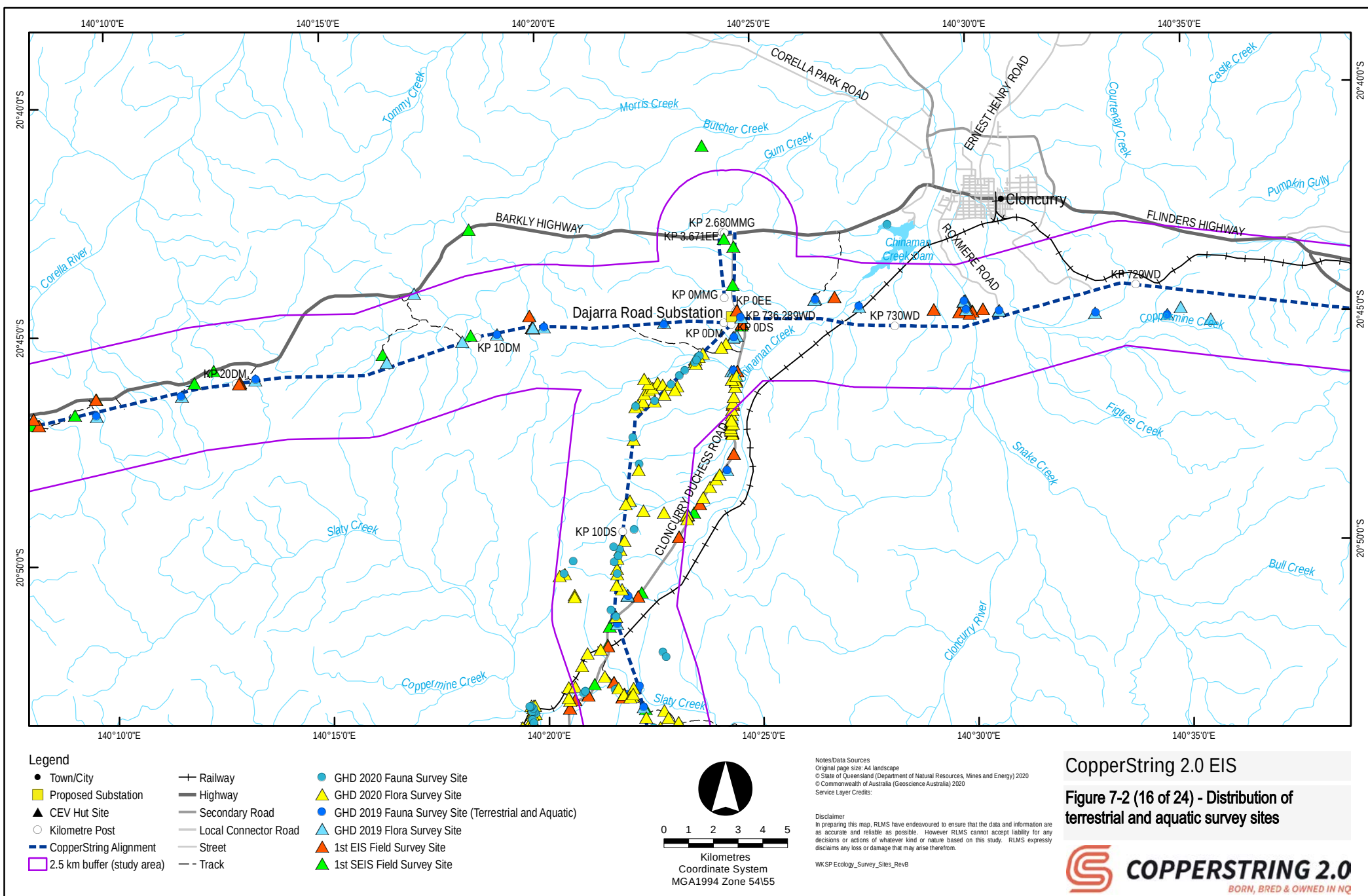
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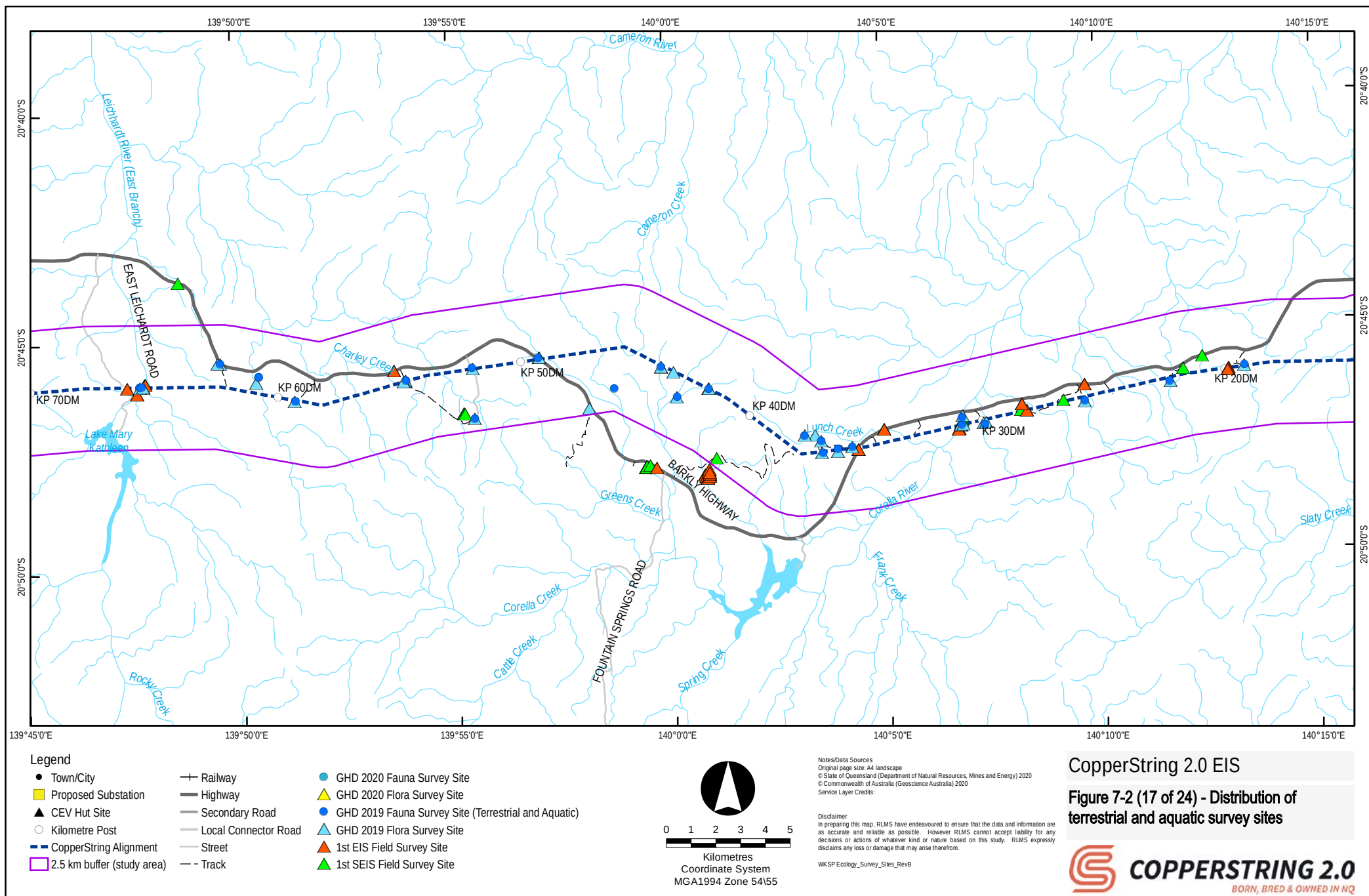
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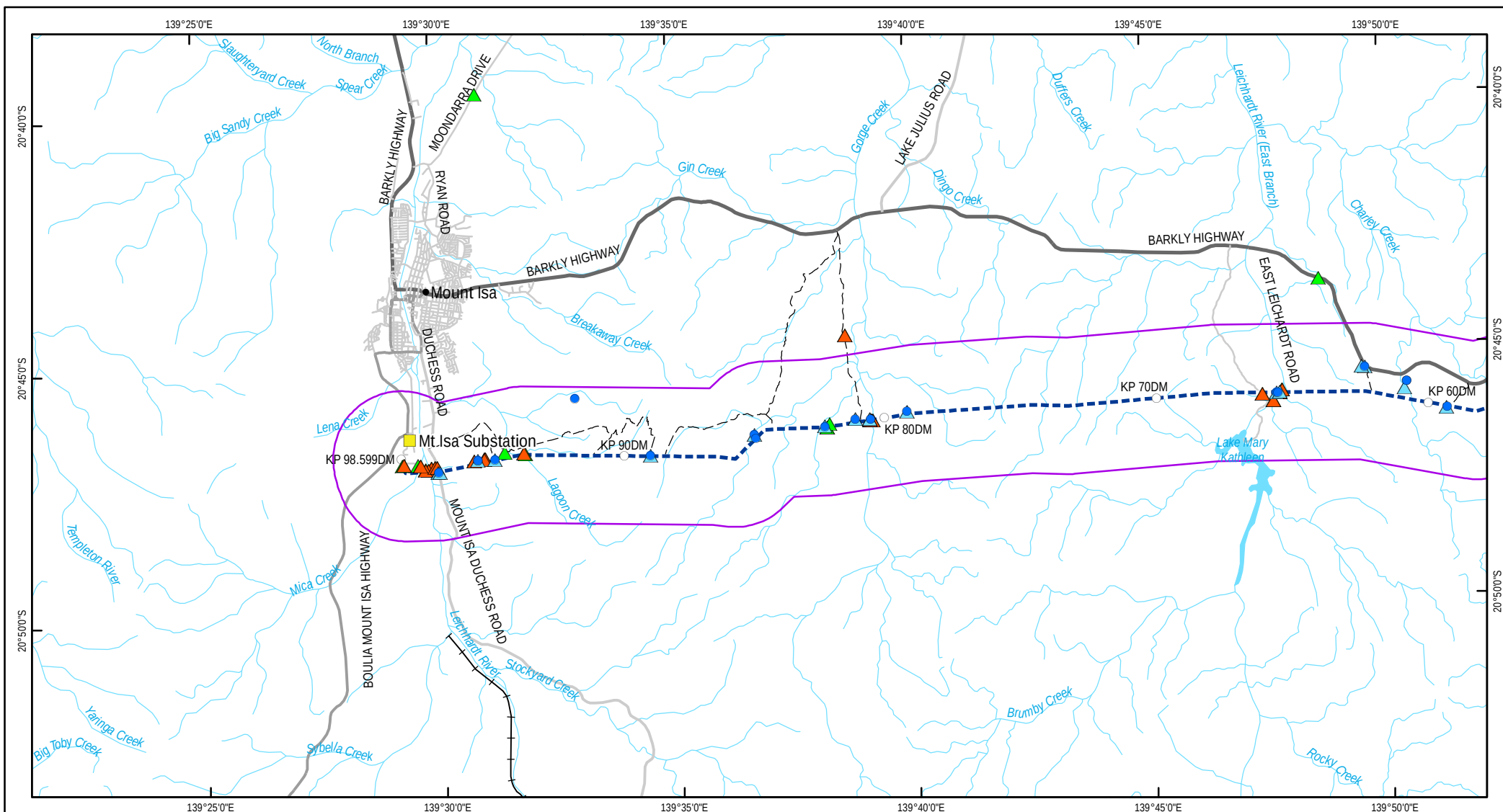
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Figure 7-2 (15 of 24) - Distribution of terrestrial and aquatic survey sites



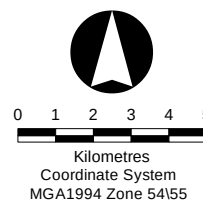






Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



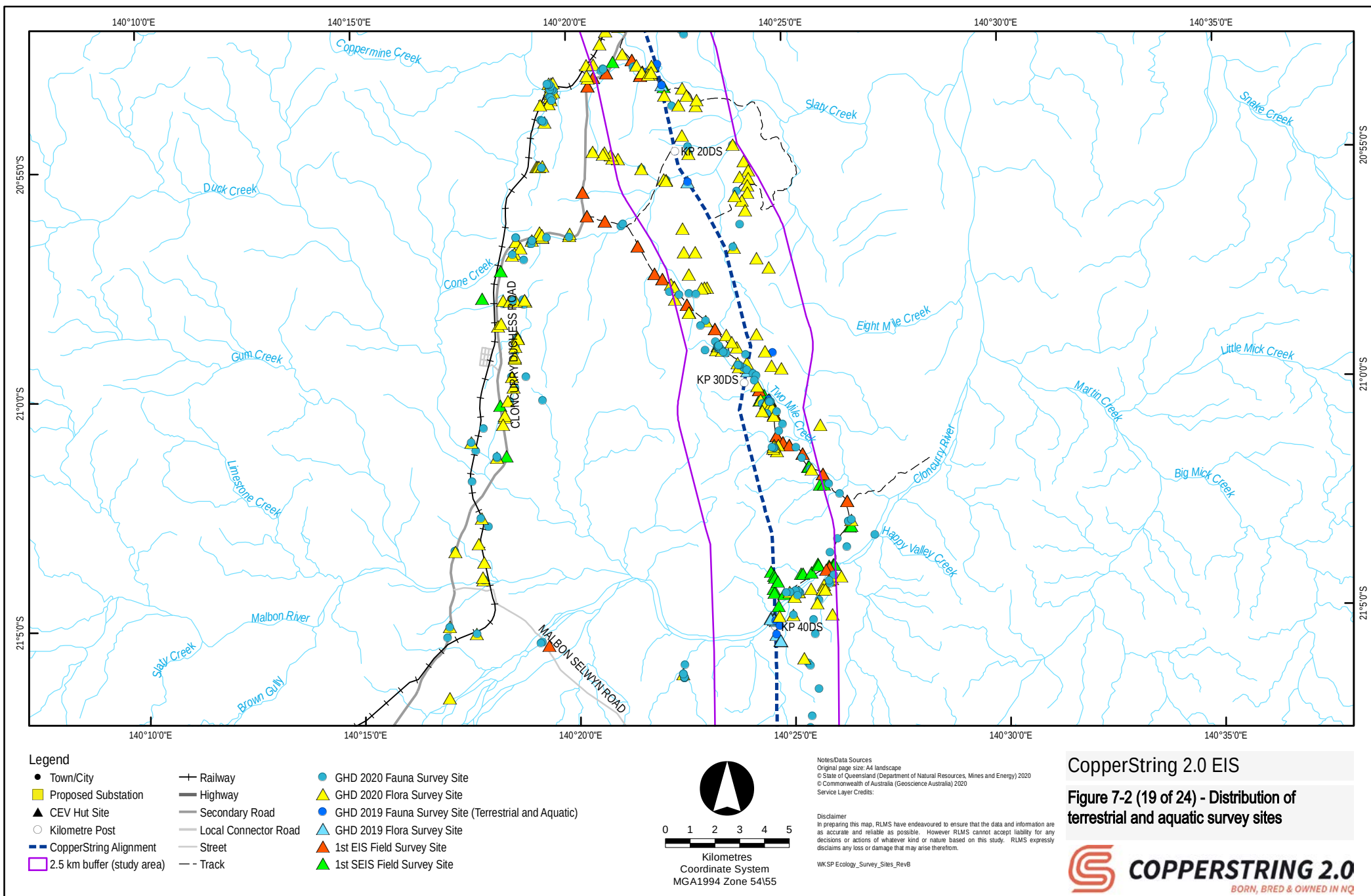
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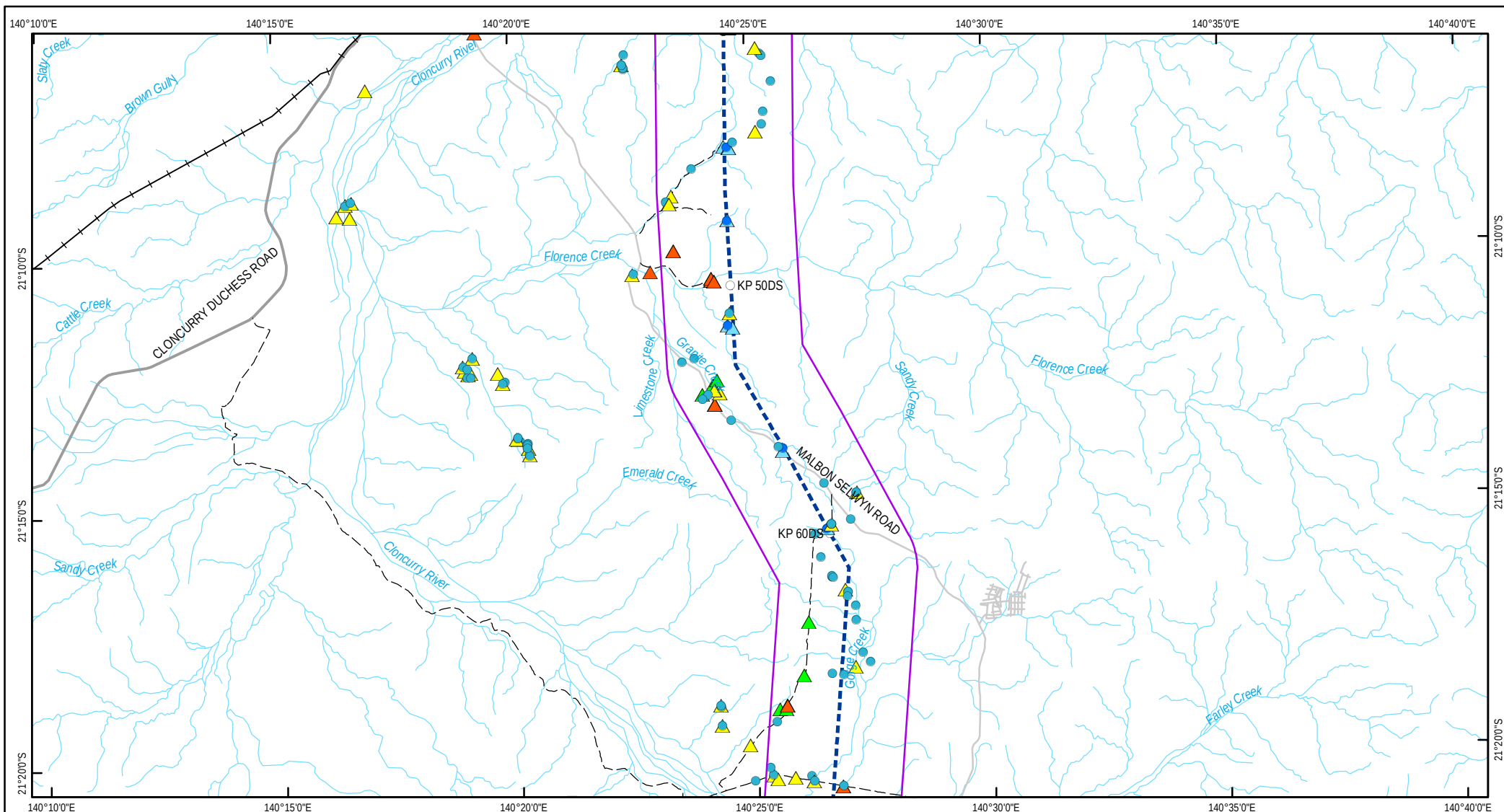
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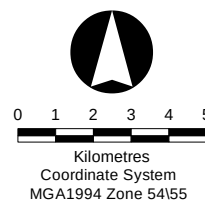
Figure 7-2 (18 of 24) - Distribution of terrestrial and aquatic survey sites





Legend

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|------------------------------|------------------------|--|
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| ■ Proposed Substation | — Highway | ▲ GHD 2020 Flora Survey Site |
| ▲ CEV Hut Site | — Secondary Road | ● GHD 2019 Fauna Survey Site (Terrestrial and Aquatic) |
| ○ Kilometre Post | — Local Connector Road | ▲ GHD 2019 Flora Survey Site |
| — CopperString Alignment | — Street | ▲ 1st EIS Field Survey Site |
| ■ 2.5 km buffer (study area) | — Track | ▲ 1st SEIS Field Survey Site |



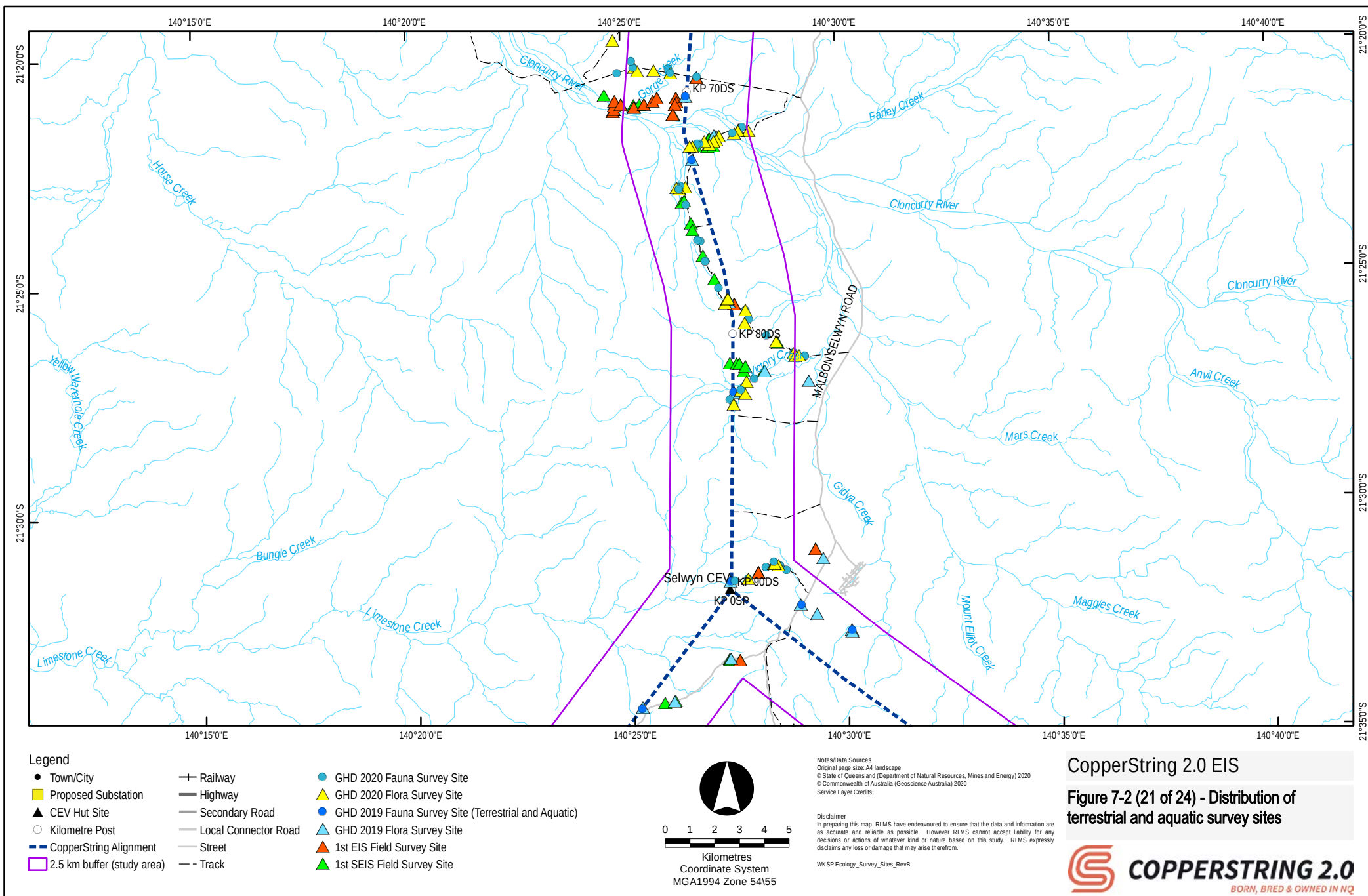
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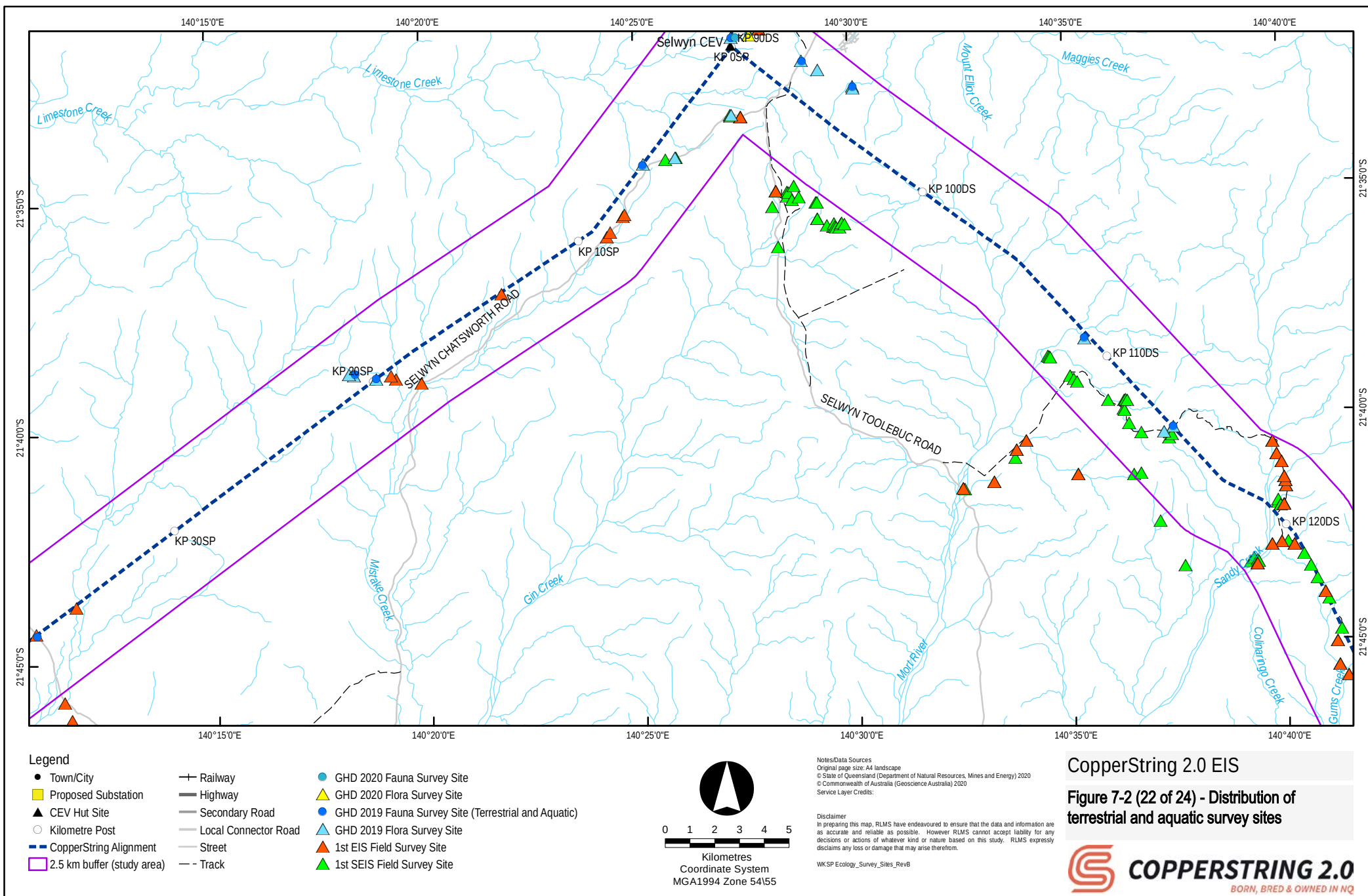
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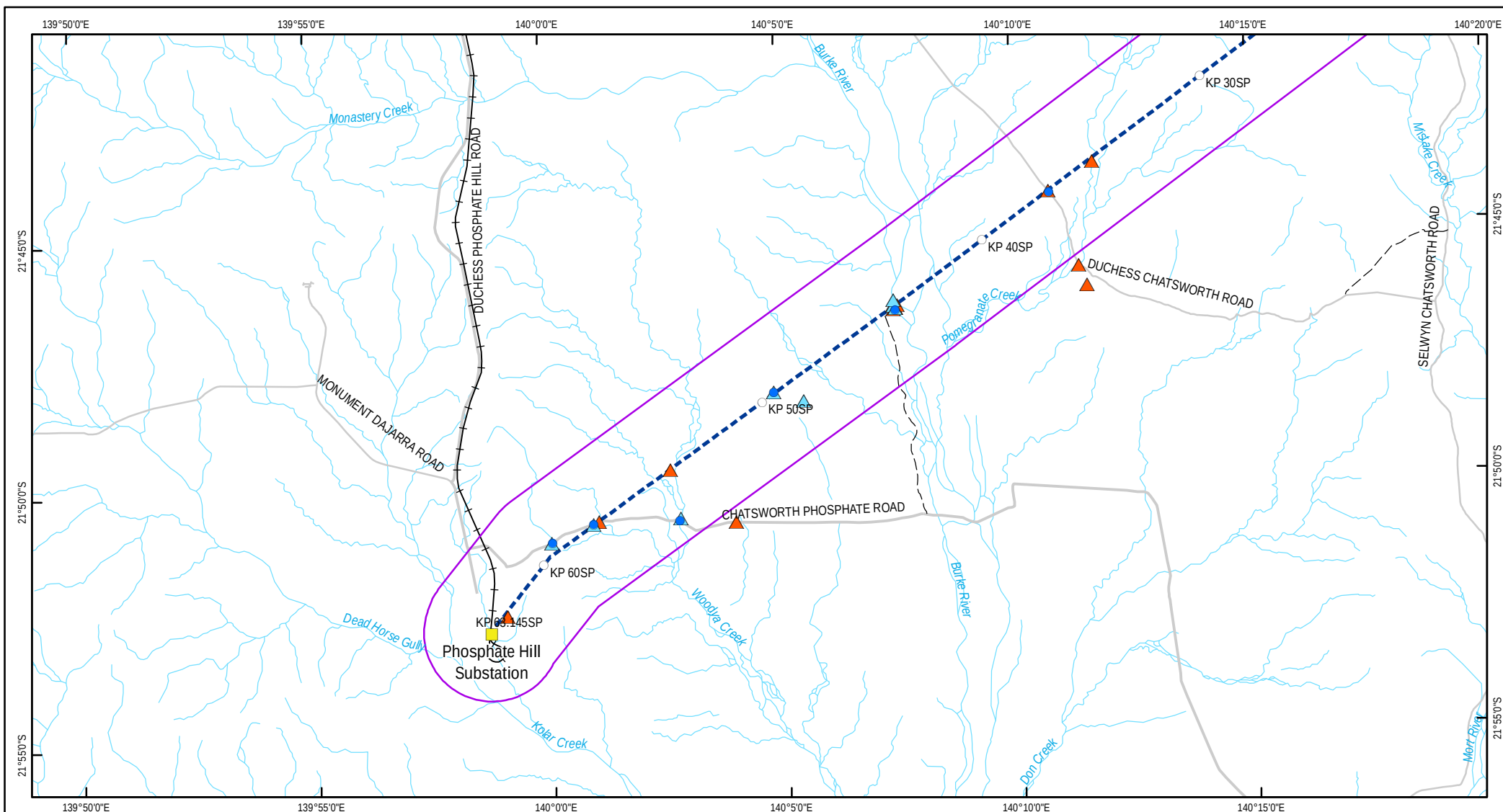
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Figure 7-2 (20 of 24) - Distribution of terrestrial and aquatic survey sites

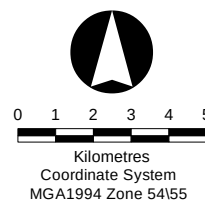






Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
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- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



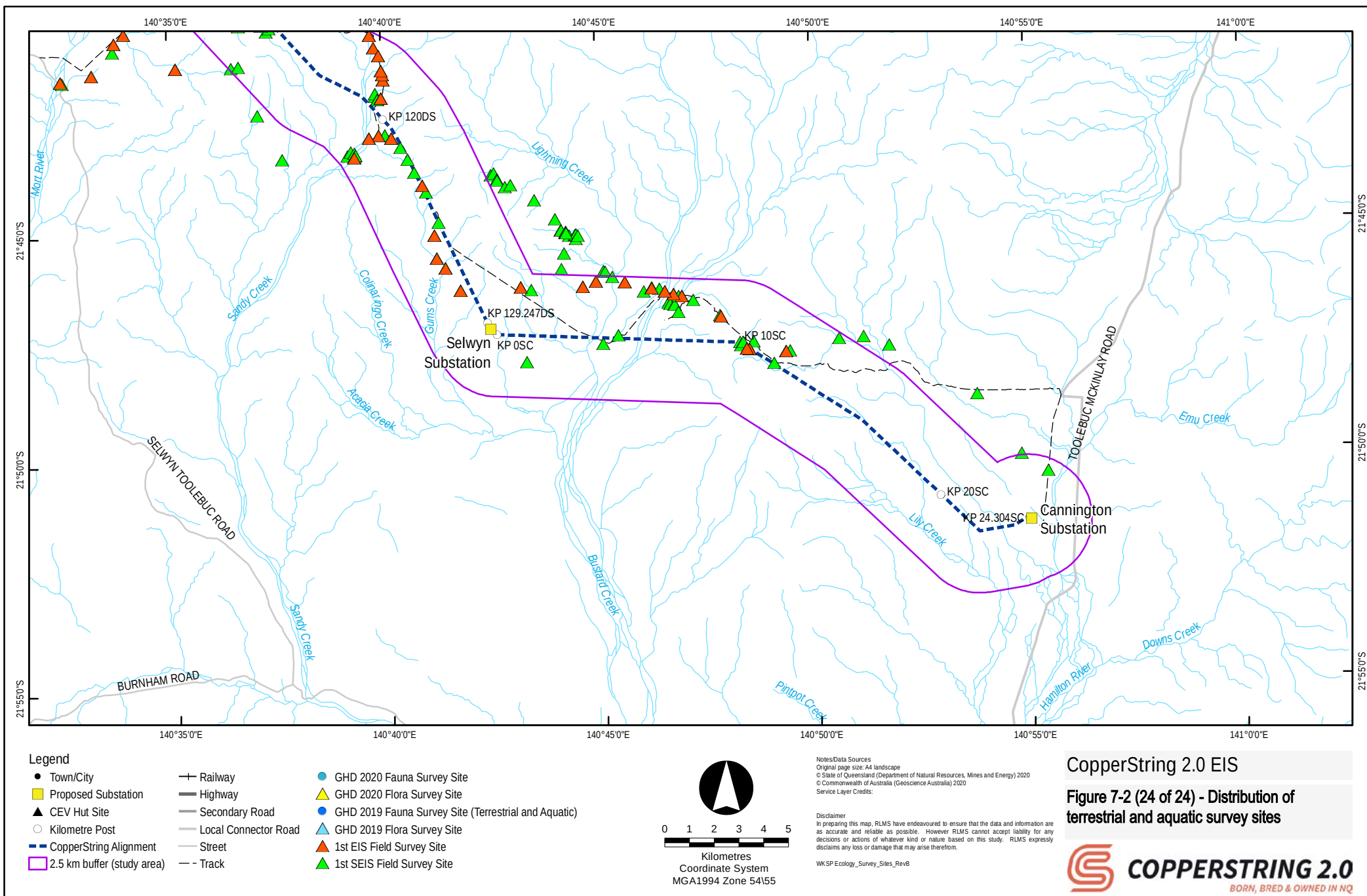
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Figure 7-2 (23 of 24) - Distribution of terrestrial and aquatic survey sites



7.2.1 Likelihood of occurrence assessment

A likelihood of occurrence assessment was undertaken for all conservation significant species listed under the EPBC Act or NC Act that were identified in desktop assessments. For each species, their likelihood of occurrence within the study area was assessed based on a review of species distributions, habitat requirements, historical records and the results of the field surveys. The likelihood of occurrence ranking was based on the following framework:

- **Confirmed present:** Species recorded during the field survey (GHD 2019 or BAAM 2010/2011).
- **Likely to occur:** Species has been recorded in the desktop search extent and suitable habitat is present in the study area.
- **May occur:** Species distribution incorporates the study area but only marginal habitat is present or the species has not been recorded in the desktop extent.
- **Unlikely to occur:** Species has not been previously recorded in the desktop search extent and/or current known distribution does not encompass study area and/or suitable habitat is generally lacking from the study area.

Species assigned to categories unlikely to occur or may occur are not specifically assessed in the impact assessment component of this chapter, since significant impacts to these species are unlikely and the objective of the assessment is to focus on key issues that need to be taken into account in decision making (EIANZ, 2010). The likelihood of occurrence assessment is provided in Appendix B of Volume 3 Appendix P Ecological Assessment

7.2.2 Predictive habitat mapping

Prior to undertaking field surveys, predictive habitat mapping was produced for all conservation significant species confirmed present or considered likely to occur in the original 2010 EIS and 2011 SEIS. Predictive mapping was based on essential habitat factors nominated for each species by DES, updated records and RE data, as well as the known, likely and/or potential habitat mapping produced in the 2010 EIS and 2011 SEIS. Predictive mapping informed the targeted selection of survey sites, as well as localised route selection changes to avoid areas of ecological significance.

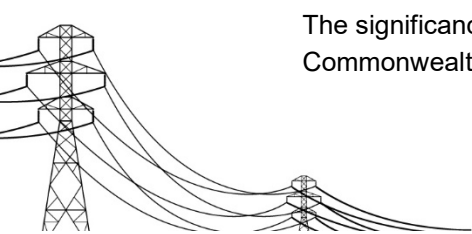
Following field surveys, predictive habitat mapping was refined based on information on habitat condition obtained from field surveys and additional species observations (or lack of observations for some flora species). The refined predictive habitat mapping was used to inform the impact assessment. For most species, predictive habitat mapping identified areas of suitable habitat. For species with clearly defined and known breeding habitat requirements, breeding habitat has also been identified. Criteria used to map suitable habitat for each species are described in Appendix C of Volume 3 Appendix P Ecological Assessment.

Predictive habitat mapping has been used to assess impacts on the species and to identify areas that require targeted pre-construction surveys to avoid and mitigate impact on key ecological values and resources.

7.2.3 Assessment of impacts

Construction and operation impacts on flora, fauna and aquatic values have been assessed using knowledge of the Project detailed in the Field Development Plan (Volume 3 Appendix R Field development plan) and footprint impacts calculated for individual mapped ecological values and predicted suitable habitat for conservation significant species.

The significance of impacts on MNES and MSES has been assessed against the Commonwealth Significant impact assessment guidelines 1.1 (DoE 2013) and the Queensland

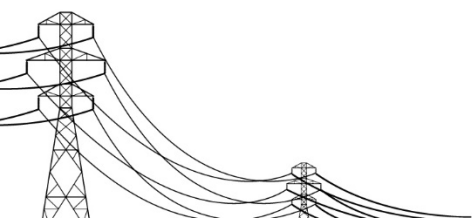


Significant residual impact guidelines (DEHP 2014), and species-specific guidelines as referenced.

7.2.4 Legislative context and standards

The flora and fauna baseline assessment has been undertaken with consideration to the following legislation:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is Commonwealth legislation protecting MNES including TECs, threatened flora and fauna species, migratory species, world heritage properties, national heritage places, wetlands of international importance, the Great Barrier Reef Marine Park, Commonwealth Marine Areas and Commonwealth lands. Administered and enforced by the Commonwealth DAWE.
- *Nature Conservation Act 1992* (NC Act) protects Queensland's ecological values including protected areas and protected native wildlife and wildlife habitats. The *Nature Conservation (Wildlife) Regulation 2006* (NC Regulation) is a piece of subordinate legislation to the NC Act. This protects breeding places for wildlife listed under the NC Act. The *Nature Conservation (Wildlife Management) Regulation 2006* (WM Regulation) regulates protected plants and associated high risk trigger areas under the NC Act. The Nature Conservation (Koala) Conservation Plan 2017 (Koala Plan) prescribes koala districts across Queensland and requires clearing of koala habitat to be undertaken in a certain manner. The NC Act and subordinate legislation are administered and enforced by the DES.
- *Vegetation Management Act 1999* (VM Act) regulates the clearing of native vegetation in Queensland in a way that conserves remnant vegetation i.e. regulated vegetation that is endangered, of concern or least concern regional ecosystem (RE), conserves vegetation in declared areas, ensures that vegetation clearing does not cause land degradation and prevents loss of biodiversity and maintains ecological processes. The VM Act is administered and enforced by the DNRME.
- *Fisheries Act 1994* (Fisheries Act) provides for the use, conservation and enhancement of the Queensland community's fisheries resources and fish habitats in a way that seeks to apply and balance the principles of ecologically sustainable development and promote ecologically sustainable development. This seeks to protect and maintain commercial and recreational fisheries and coastal areas that provide important fish habitat and marine plants. The Fisheries Act is administered by the Queensland DAF.
- *Biosecurity Act 2014* (Bs Act) provides a framework for effective biosecurity in Queensland and to manage risks associated with emerging, endemic and exotic pests and diseases that impact on industries, the environment, domestic animals, and infrastructure. The Biosecurity Act is administered and enforced by DAF.
- *Planning Act 2016* is a central piece of the Queensland planning legislation framework that manages the processes by which development occurs, and coordinates planning at local, regional and State levels.
- *Water Act 2000* (Water Act) provides for the sustainable management of Queensland's water resources. It aims to provide for ecologically sustainable development and to promote the efficient use and management of water resources. The Water Act defines what a watercourse is and regulates the taking of water, and development in and around watercourses. The Water Act is administered and enforced by the DNRME.



7.3 Existing environment

This chapter provides a summary of the existing ecological environment. For more information refer to Section 3 of Volume 3 Appendix P Ecological Assessment.

7.3.1 Regional context

The proposed corridor selection intersects six bioregions (generally from east to west): the Brigalow Belt (BRB), Einasleigh Uplands (EIU), Desert Uplands (DEU), Mitchell Grass Downs (MGD), Gulf Plains, (GUP) and Northwest Highlands (NWH) bioregions. The bioregions intersected by each corridor section are indicated in Table 7-3 and displayed in Figure 7-3.

Table 7-3 Bioregions intersected by the corridor sections

Corridor section	Bioregions					
	BRB	EIU	DEU	MGD	GUP	NWH
Renewable Energy Hub	✓	✓	✓	✓		
CopperString Core				✓	✓	✓
Mount Isa Augmentation						✓
Southern Connection						✓
Cannington Connection				✓		✓
Phosphate Hill Connection				✓		✓

Key to table: BRB = Brigalow Belt, EIU = Einasleigh Uplands, DEU = Desert Uplands, MGD = Mitchell Grass Downs, GUP = Gulf Plains, NWH = Northwest Highlands.

7.3.2 Landscape corridors and connectivity

Biodiversity Planning Assessment (BPA) mapping produced by the former Department of Environment and Heritage Protection (DEHP) identifies bioregional wildlife corridors that are important for wildlife movement and recognised to have State, regional or local significance. The proposed corridor selection intersects multiple State and regionally-significant terrestrial and riparian landscape corridors (as shown in Figure 7-4)

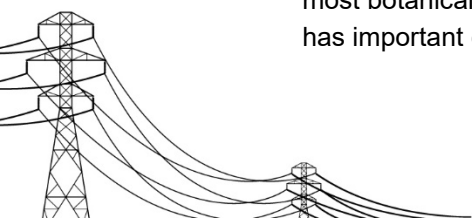
Within the study area, riparian corridors are generally associated with major rivers and their tributaries, including the Burdekin River, Kirk River, Campaspe River, Cape River, Reid River, Haughton River and Broughton River. A number of significant terrestrial corridors are also intersected by the Project, namely, the Great Artesian Basin Rim, the Gulf to Grasslands and the Wet Tropics – Einasleigh Uplands corridors.

7.3.3 Protected areas

Protected areas are shown in Figure 7-3.

National parks

The proposed corridor does not intersect any national parks. White Mountain National Park is located approximately 5 km north of the Project between Pentland and Torrens Creek at KP190WD-220WD is the nearest national park to the Project. The park contains the highest elevation areas of the Desert Uplands bioregion (450 – 780 m AHD) and is one of Queensland's most botanically diverse parks within 14 different ecosystems. White Mountains National Park has important catchment protection values as it conserves the headwaters of the Flinders River,



which flows north to the Gulf of Carpentaria, the Cape River, which flows into the Burdekin River catchment, and Torrens and Bullock creeks which flow west into Coopers Creek and Lake Eyre Basin. In addition, the park is also a recharge area for the Great Artisan Basin (Department of National Parks, Recreation, Sports and Racing, 2013). The park is known to support numerous conservation significant species (NRA Environmental Consultants, 2012).

Nature refuges – Ballara Nature Refuge

One nature refuge area is located within the Project area, namely the Ballara Nature Refuge. The Ballara Nature Refuge was established in January 2014 and encompasses parts of Lot 427 on SW505054 and Lot 2547 on SP255326. This refuge area covers 1,779.6 km² and is intersects the Southern Connection corridor section, between KP 22DS and 54DS. The entirety of the nature refuge is mapped as containing remnant vegetation. Essential habitat for NC Act listed conservation significant species is mapped for:

- Purple-necked rock wallaby around multiple previous records in the eastern areas of the nature refuge
- Night parrot in one patch outside of the nature refuge, approximately 9 km west of the study area
- *Eucalyptus nudicaulis* around two previous records in the western part of the nature refuge, near Fountain Springs (approximately 21 km south of the Mount Isa Augmentation corridor section).

Field survey results – Ballara Nature Refuge

Targeted ecology surveys were conducted within the Ballara Nature Refuge in October / November 2020. Field survey sites located within the Ballara Nature Refuge (KP 22-54.2DS) identified the following REs present within the corridor selection:

Of concern VM Status and no representation in reserves

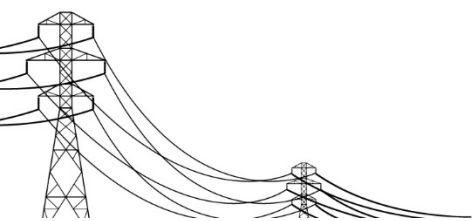
- RE 1.11.7 *Acacia cambagei* dominated areas on mid to lower slopes of metamorphic hills. This RE is only intersected at one area the corridor selection around KP 30DS with numerous other patches located adjacent to the corridor selection.

Endangered Biodiversity Status

- RE 1.3.7b comprising riparian fringing forest to 20 m height along the Cloncurry River dominated by *E. camaldulensis*

Low representation in reserves

- RE 1.3.4 *Acacia cambagei* low woodland, open forest and shrubland on alluvial flats associated with flood plains and drainage depressions
- RE 1.3.6a on sandy floodplains with *E. leucophylla*, *C. terminalis* and *C. aparrerinja*
- RE 1.3.13a *Eucalyptus leucophylla*, *Corymbia terminalis* dominated with *Acacia cambagei* patches, ground layer of tussock grasses and *Triodia* spp. on alluvial terraces
- RE 1.5.3 *Eucalyptus leucophloia* dominated with *Triodia* spp. dominated ground cover. Occurs on undulating plains typically elevated above alluvial if present nearby
- RE 1.5.4d comprising low open woodland dominated by *E. leucophloia* and *E. leucophylla*
- RE 1.11.2a including areas of flat terrain dominated by *Corymbia terminalis* and slopes of hills dominated by *Eucalyptus leucophloia*, with dense *Acacia* dominated shrub layers. Some areas are mapped by DNRME as containing Of Concern RE 1.11.7 as a minor



component, however this community was generally absent apart from small patches higher up on hill slopes that were not intersected by the corridor selection.

No representation in reserves

- RE 1.11.3a (NR) comprising low open woodland with *E. leucophylla*. One site featured recently burnt vegetation.
- RE 1.11.10 (NR) including *Corymbia terminalis*, *Atalaya hemiglauca*, *Eucalyptus leucophylla* dominated on hard metamorphic plains

These areas have been previously field verified by 3D Environmental for the 2011 SEIS (BAAM, 2011) with the resulting mapping updated and confirmed as being largely correct at the survey locations visited in 2019 and 2020. The REs identified as No Representation and Low Representation in reserves are abundant throughout the greater landscape and avoidance of these REs would not be achievable for this project.

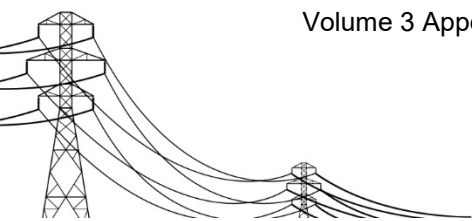
No conservation significant flora species were identified within the corridor selection at Ballara Nature refuge. Two species with a higher likelihood of occurring were identified, these species being *Ptilotus maconochiei* and *Eucalyptus nudicaulis*. Targeted searches were undertaken for these species on rocky slopes and gullies however, most of the geology present did not match that described in the species habitat. Additionally, where possible the corridor selection avoids hills and rocky gullies where these species may be found. The nearest records for these species occur 15 km (*Eucalyptus nudicaulis*) and 45 km (*Ptilotus maconochiei*) west of the corridor selection.

Terrestrial fauna habitats – Ballara Nature Refuge

Nine terrestrial habitat types are intersected by the Project within the Ballara Nature Refuge (note four fauna habitat types have been grouped into the eucalypt low open woodlands usually with a spinifex understorey and two have been grouped into low gidgee woodlands, for the purposes of mapping):

- Eucalypt low open woodlands usually with a spinifex understorey (mapped as BVG 6)
 - Rocky escarpments
 - Low shrubby woodland with spinifex ground layer
 - Low woodland on rocky rises with spinifex ground layer
 - Low woodland on rocky rises with grassy ground layer
- Open woodland with spinifex ground layer (mapped as BVG 14)
- Open woodland with grassy ground layer (mapped as BVG 3, 5, and 11)
- Low gidgee woodlands (mapped as BVG 6 and 10)
 - Gidgee on rocky flats
 - Gidgee on rocky hills
- Riparian woodlands on ephemeral watercourses (mapped as BVG 4)

Two of the habitat types (eucalypt low woodland on rocky rises and low gidgee woodlands) have been further refined into more specific habitat types only within Ballara Nature Refuge due to the increased level of survey effort and ecological value of the nature refuge. Eucalypt low woodland on rocky rises usually occurred with a spinifex understorey, and only occasionally with a grassy understorey within the nature refuge. Likewise, low gidgee woodlands usually occurred on rocky flats and only occasionally occurred on rocky hills. Descriptions of each habitat type, their ecological values and potential habitat for threatened species is described in detail in Volume 3 Appendix P Ecological Assessment.



Conservation significant fauna species with potential to occur within Ballara Nature Refuge include:

- Purple-necked rock-wallaby (likely to occur)
- Night parrot (likely to occur)
- Short-beaked echidna (likely to occur)

There are no known roosts sites for ghost bat, and the species has not been previously recorded within the study area. The abandoned town of Hightville is approximately 21 km south of the Mount Isa Augmentation corridor section. The listing advice for the species describes roosting habitat as deep caves or disused mines. There is potentially suitable roosting habitat in caves and rocky outcrops in escarpments, where they occur within the Ballara Nature Refuge. Any previous records are beyond the search extent for the study area, therefore the species has been considered as 'may occur' in the likelihood assessment. Anabats were deployed in potentially suitable cave and outcrop habitats within the study area, however this species was not recorded.

Purple-necked rock wallaby

No purple-necked rock wallaby individuals have been confirmed during GHD field surveys in 2019 and 2020 within the nature refuge. The purple-necked rock-wallaby was recorded at two other locations within the study area by GHD; one along Cloncurry Duchess Road approximately 10 km south west of Cloncurry, the other was recorded approximately 6 km west of the alignment near KP66DS, both within the Southern Connection section (north and south of Ballara Nature Refuge). Two carcasses were observed within the nature refuge in 2020 surveys, which were considered likely to be purple-necked rock wallaby. Scat was collected from numerous sites throughout Ballara Nature Refuge and surrounding areas that are awaiting formal identification, however are considered highly likely to be purple-necked rock wallaby (observed within the larger rocky outcrops and escarpments). Previous records were reported by BAAM in 2010/2011 field surveys within and adjacent to Ballara Nature Refuge.

Suitable habitat was observed throughout the study area, in escarpments and rocky outcrops or rises within the nature refuge (Plate 7-1). Escarpments containing caves were observed along ridgelines in the northern and eastern to central sections of the nature refuge. Caves with rock wallaby remains and abundant scats were frequently observed within the larger rocky outcrops and escarpments, which provide important refugia for this species (Plate 7-2). The nearby records and the abundance of suitable habitat suggests this species is likely to occur within the study area in Ballara Nature Refuge.

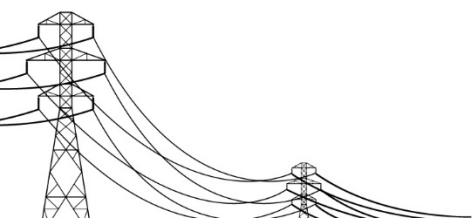




Plate 7-1 Suitable purple-necked rock wallaby habitat observed within Ballara Nature Refuge



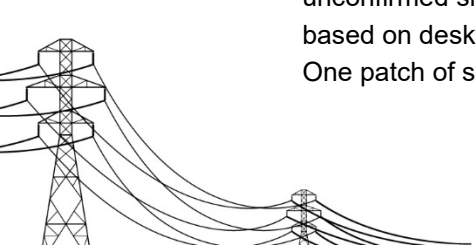
Plate 7-2 Suitable purple-necked rocky wallaby cave habitat within Ballara Nature Refuge

Night parrot

No night parrots were recorded during the field surveys or in past or recent sampling events within the nature refuge. Targeted assessments for the species were conducted at 27 sites within the Ballara Nature Refuge, with songmeters deployed at three locations. No known calls of the night parrot were recorded at these locations, and therefore these specific locations sampled are unlikely to support a long-term stable night parrot population.

Potential nesting and feeding habitat has been mapped through this area based on REs that are predominantly spinifex grassland for nesting habitat and grassland and forbland for feeding habitat. Known nesting and feeding habitat characteristics from Pullen Pullen Reserve (approximately 170 km south-east of the Project area) where the REs they occur in are better-documented. The desktop mapping was partially ground-truthed during field surveys of the nature refuge and surrounding areas in October 2020. Many of the mapped REs were considered to be too woody or too recently burnt to provide adequate habitat value for the night parrot. Further desktop mapping to refine these REs is currently being undertaken in consultation with members of the Night Parrot Recovery Team. Additional field survey will then be conducted to thoroughly ground-truth the potential nesting and feeding habitat areas, and to do targeted searches for night parrot individuals using songmeters and subsequent data analysis by the Night Parrot Recovery Team members.

Potentially suitable habitat was mapped south of Cloncurry, where there are several unconfirmed sightings from the 1990s (Garnett et al. 1993), and to the east and west in patches, based on desktop mapping of suitable REs (refer to mapped suitable habitat in Figure 7-19). One patch of spinifex (*Triodia longiceps*) grassland (RE 1.5.2) suitable for nesting habitat was



recorded 3.8 km west of the alignment from KP42 DS (beyond the study area) within Ballara Nature Refuge (Plate 7-3). No suitable feeding habitat for this species was observed within the nature refuge, predominantly because most mapped potential habitat was too densely wooded or shrubby. Patches of currently low value potential feeding habitat was observed approximately 10 km south of Ballara Nature Refuge. This habitat was limited due to lack of annual grasses observed during the survey and cattle disturbance (Plate 7-4).

While there is essential habitat mapped for this species in close proximity to the nature refuge, this is based on a generalised record. The accurate location of the records of night parrot are dated 1994 and are located approximately 20 km south-west of the nature refuge boundary, and 30 km south-west of the nearest section of the Project corridor selection.

Due to the proximity of the potential nesting habitat and feeding habitat (when annual grasses are present), it is considered likely that this species will occur within the study area within Ballara Nature Refuge. However there is a lack of recent knowledge about this species within the local region, with little known about any localised habitat requirements or its overall extent of occurrence if it is present.



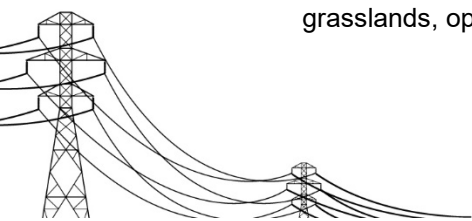
Plate 7-3 Suitable night parrot nesting habitat observed within Ballara Nature Refuge



Plate 7-4 Potentially suitable night parrot feeding habitat observed 10 km south of Ballara Nature Refuge

Short-beaked echidna

No short-beaked echidnas were observed during field surveys within Ballara Nature Refuge. This species is Australia's most widespread native mammal, with a broad distribution and habitat preference throughout most of Australia and Tasmania. Echidnas feed on mainly ants and termites and occur in all habitat types observed within the nature refuge including grasslands, open woodlands, shrub lands, cleared and grazing areas. Considering the wide



distribution, suitable habitat and abundance of termite nests, it is considered likely this species occurs within the project area in Ballara Nature Refuge.



Plate 7-5 Suitable short-beaked echidna habitat observed within Ballara Nature Refuge

A range of terrestrial fauna species were observed in field surveys undertaken within the Ballara Nature Refuge. Woodland birds including honeyeaters, treecreepers, wrens, robins, flycatchers, babblers, whistlers, parrots and kingfishers were abundant along watercourses. Low open woodlands supported a range of woodland birds in lower densities. Grasslands and woodlands with a shrubby understorey supported woodland and shrub thicket birds including wrens, finches, quails and honeyeaters in lower densities. Macropods including wallaroos, red kangaroos and eastern grey kangaroos were observed throughout the reserve in a range of habitat types. Reptiles including skinks, dragons and monitors were observed in low densities within spinifex hummock grasslands, gidgee woodlands and open woodlands amongst woody debris and discarded trash (metal sheeting etc) throughout the nature refuge.

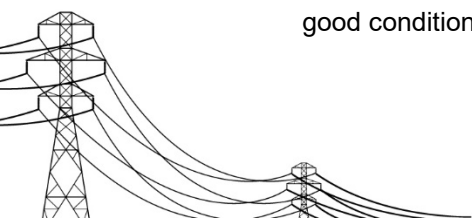
Disturbance and pests

The Ballara Nature Refuge supports cattle and some horse grazing at relatively low densities. The quality of ground-level habitats and microhabitats were generally high as the dominant groundcover within the nature refuge was spinifex, which generally excludes cattle from grazing within those habitats. However localised overgrazing and trampling by cattle was observed in habitats containing buffel. Tracks from cattle traversing through spinifex habitats was also observed throughout the nature reserve. Disturbance from cattle was more prominent around the artificial water sources within the nature refuge. Weed infestations were observed predominantly within dry watercourses beds, with minimal infestations observed elsewhere in the nature refuge and along banks. Feral animals observed included camels, dogs, pigs and cats.

Aquatic habitats – Ballara Nature Refuge

No aquatic conservation significant species were observed during surveys, mainly due to timing of surveys being within the dry season and a resulting lack of water.

The Cloncurry River is the only major watercourse the Project crosses within Ballara Nature Refuge. All remaining waterways crossed by the Project were minor, ephemeral tributaries. The Cloncurry River is a major, ephemeral river that has contained isolated, large pools supporting macrophytes. Within the nature refuge survey area, the Cloncurry River was dry during surveys and of good condition for a dry watercourse. The numerous minor ephemeral tributaries transacted by the Project were dry during surveys. The condition of these watercourses varied slightly which was predominantly due to cattle disturbance, however, they were generally of good condition.



7.3.4 Vegetation communities

Threatened Ecological Communities

No TECs were identified within the corridor selection during the recent field survey (GHD, 2020). One TEC, the *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* was recorded in the SEIS surveys (BAAM, 2011). However the corridor was realigned to avoid impact on the TEC. Assessment of TECs are discussed further in Chapter 17 – Matters of National Environmental Significance and Section 4.2.2 of Volume 3 Appendix P Ecological Assessment.

Regional Ecosystems

Most REs present within the study area are well represented in the respective bioregions and have a status of Least Concern under the VM Act. Nevertheless, six Of Concern RE polygons (as homogenous or mixed polygons) have been identified in the corridor selection. These cover an area of approximately 35.4 ha and represent 0.5 % of the area of mapped REs in the corridor selection. A description of vegetation communities of significance and their occurrence is provided in Table 7-4. The distribution of REs is mapped in Figure 7-5.

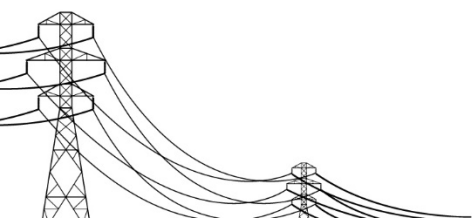


Table 7-4 Summary of conservation significant REs within the study area

DNRME RE description (VM status)	Occurrence	Field description/comments	Representative Photo
RE 1.11.7 (OC) - <i>Acacia cambagei</i> low woodland. Occurs on metamorphic hills and ranges	A total of five occurrences recorded in the corridor selection. Occurrence details as follows:	Low woodland with a sparse canopy dominated by <i>Acacia cambagei</i> , <i>Eucalyptus leucophloia</i> subsp. <i>euroa</i> and associated <i>Corymbia terminalis</i> , <i>C. aspera</i> and <i>Terminalia aridicola</i> (4-9 m tall) over a very sparse shrub layer of <i>Atalaya hemiglauca</i> , <i>Dodonaea stenophylla</i> , <i>Eucalyptus leucophloia</i> subsp. <i>euroa</i> , <i>Acacia acradenia</i> , <i>Carissa lanceolata</i> and <i>Santalum lanceolata</i> (0.3-2 m tall). Common species in the ground layer included <i>Heteropogon contortus</i> , <i>Eriachne mucronata</i> , <i>Triodia sp.</i> <i>Streptoglossa odora</i> , <i>Enneapogon lindleyanus</i> and <i>Ptilotus obovatus</i> . Found on metamorphic low hills and rocky outcrops.	 RE 1.11.7 at representative site (2.5km east of KP 9DS)

DNRME RE description (VM status)	Occurrence	Field description/comments	Representative Photo
RE 1.11.7 (OC) - <i>Acacia cambagei</i> low woodland. Occurs on metamorphic hills and ranges	Mount Isa Augmentation section (KP 95-96DM for a distance of 930 m) Mapped by DNRME as a minor component of heterogeneous polygon	At KP 95DM, the mapped mixed polygon of 1.11.2a/1.11.7 was confirmed to contain Least Concern RE 1.11.2a (<i>E. leucophloia</i> low open woodland), with potential for 1.11.7 to occur in patches within the polygon or as areas of integrated <i>Acacia cambagei</i> and other canopy species. No patches of 1.11.7 were found to occur within close proximity to the corridor selection.	 RE 1.11.2 recorded within the corridor selection (250 m east of KP 95DM)

DNRME RE description (VM status)	Occurrence	Field description/comments	Representative Photo
RE 1.11.7 (OC) - <i>Acacia cambagei</i> low woodland. Occurs on metamorphic hills and ranges	Southern Connection (KP 2-6DS for a distance of 2.3 km) Mapped by DNRME as a minor component of heterogeneous polygon	The mapped area of mixed RE at KP 2-6DS included a minor component of RE 1.11.7. It was found that this RE did not occur within the corridor selection at this point. The mapped RE located approximately 370 m east of the corridor selection was found to be accurate with 1.11.7 being the dominant (70 percent) RE and 1.11.2a making up the remainder.	 RE 1.11.3a recorded within the corridor selection (at KP 4DS)

DNRME RE description (VM status)	Occurrence	Field description/comments	Representative Photo
RE 1.11.7 (OC) - <i>Acacia cambagei</i> low woodland. Occurs on metamorphic hills and ranges	Southern Connection (KP 29.5-30DS for a distance of 300 m) Mapped by DNRME as a minor component of heterogeneous polygon	RE 1.11.7 was confirmed as occurring in small patches on the lower slopes of this section of the range. This RE was however only recorded on the south west slope at this point of the corridor selection in small batches or narrow bands.	 RE 1.11.7 confirmed in small patches on south west slope (250 m north of KP 30DS)
RE 1.11.7 (OC) - <i>Acacia cambagei</i> low woodland. Occurs on metamorphic hills and ranges	CopperString Core (KP 724-725WD for a distance of 330 m). Mapped by DNRME as a minor component of heterogeneous polygon	Access to this location was not possible. Based on aerial imagery interpretation, small patches that likely align with RE 1.11.7 (identified as darker-appearing and more dense patches of vegetation) are not within the corridor selection.	

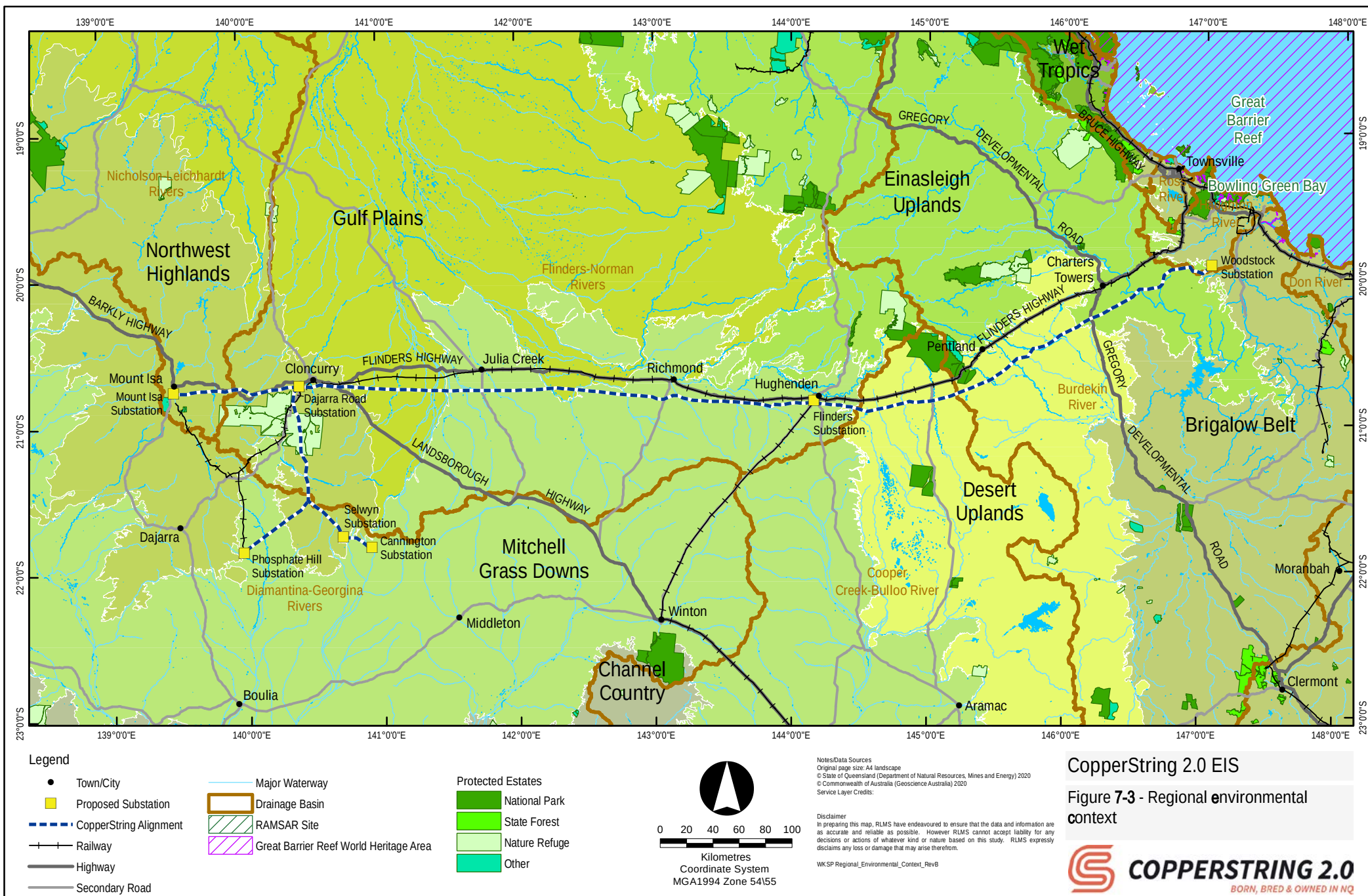
DNRME RE description (VM status)	Occurrence	Field description/comments	Representative Photo
RE 1.11.7 (OC) - <i>Acacia cambagei</i> low woodland. Occurs on metamorphic hills and ranges	Southern connection (KP 72-73 DS for a distance of 230 m)) Mapped by 3D Environmental as RE 1.11.2x2 (now RE 1.11.7) as a homogenous polygon	GHD identified this area as a possible mapping error due to its position within the landscape and revisited in 2020 to confirm the RE. It was confirmed that the RE aligned more closely with RE 1.3.4a: <i>Acacia cambagei</i> dominated with associate <i>Eucalyptus leucophylla</i> , <i>Grevillea striata</i> , <i>Eremophila mitchellii</i> over <i>Cenchrus ciliaris</i> on alluvial soils of brown loamy sand with a thin hard setting crust was recorded on site.	 RE 1.3.4a at KP 80DM (mapped as mixed polygon with 1.11.7)
RE 1.11.7 (OC) - <i>Acacia cambagei</i> low woodland. Occurs on metamorphic hills and ranges	Phosphate Hill Connection (KP 14-15SP for a distance of 180 m) Mapped by 3D Environmental as RE 1.11.2x2 (now RE 1.11.7) as a homogenous polygon	Not directly accessed in 2019/2020 surveys.	n/a

DNRME RE description (VM status)	Occurrence	Field description/comments	Representative Photo
Various Least Concern REs typically including 1.11.8, 1.11.2a and 1.11.11	Several small polygons between 0.3 and 6 ha were recorded outside of (more 100 m away) but close to Southern Connection corridor selection. at KP 0-1DS within area mapped by DNRME as Least Concern RE 1.11.11/1.11.3a. A series of small RE 1.11.7 polygons are also located adjacent but not within the corridor selection at KP 15DS and east of KP 31-32DS Not impacted by the corridor selection.	Strongly associated with the Jaspilite range that runs north south, however only ever recorded in small patches in the mid to lower slopes. Other patches of vegetation dominated by <i>Acacia cambagei</i> were recorded on the flats however these occurred within other Least Concern REs.	 RE 1.11.7 previously mapped as Least Concern REs

DNRME RE description (VM status)	Occurrence	Field description/comments	Representative Photo
1.11.14 (OC) - <i>Acacia cambagei</i> low open woodland on clay soils derived from metamorphic rocks	Mapped by DNRME as a minor component of the heterogeneous polygon RE 1.11.10/1.11.14/1.5.4 within the study area of the Phosphate Hill Connection at KP 22SP. Not impacted by the corridor selection.	3D Environmental mapped the portion of this heterogeneous polygon in the corridor selection as comprising the homogeneous polygons RE 4.5.8 and RE 4.7.2 rather than RE 1.11.10/1.11.14/1.5.4. These REs are described by DNRME as follows: 4.5.8 - <i>Triodia pungens</i> hummock grassland wooded with <i>Acacia</i> spp. +/- <i>Eucalyptus</i> spp. on Quaternary sand sheets. 4.7.2 - <i>Eucalyptus normantonensis</i> tall open shrubland with <i>Triodia</i> spp. on plateau margins. Quaternary data collected by GHD in 2019 (approximately 800 m from the easement but within the same polygon mapped by 3D Environmental as RE 4.5.8) supports the RE designation assigned by 3D Environmental, with <i>Triodia</i> sp on sands characterising the portion of the mapped polygon observed. <i>Acacia cambagei</i> was noted to be occasionally present but it was very sparse and was not observed growing on clays at this location. The RE 4.7.2 polygon was not verified during the 2019 survey but <i>Eucalyptus normantonensis</i> was recorded at other	

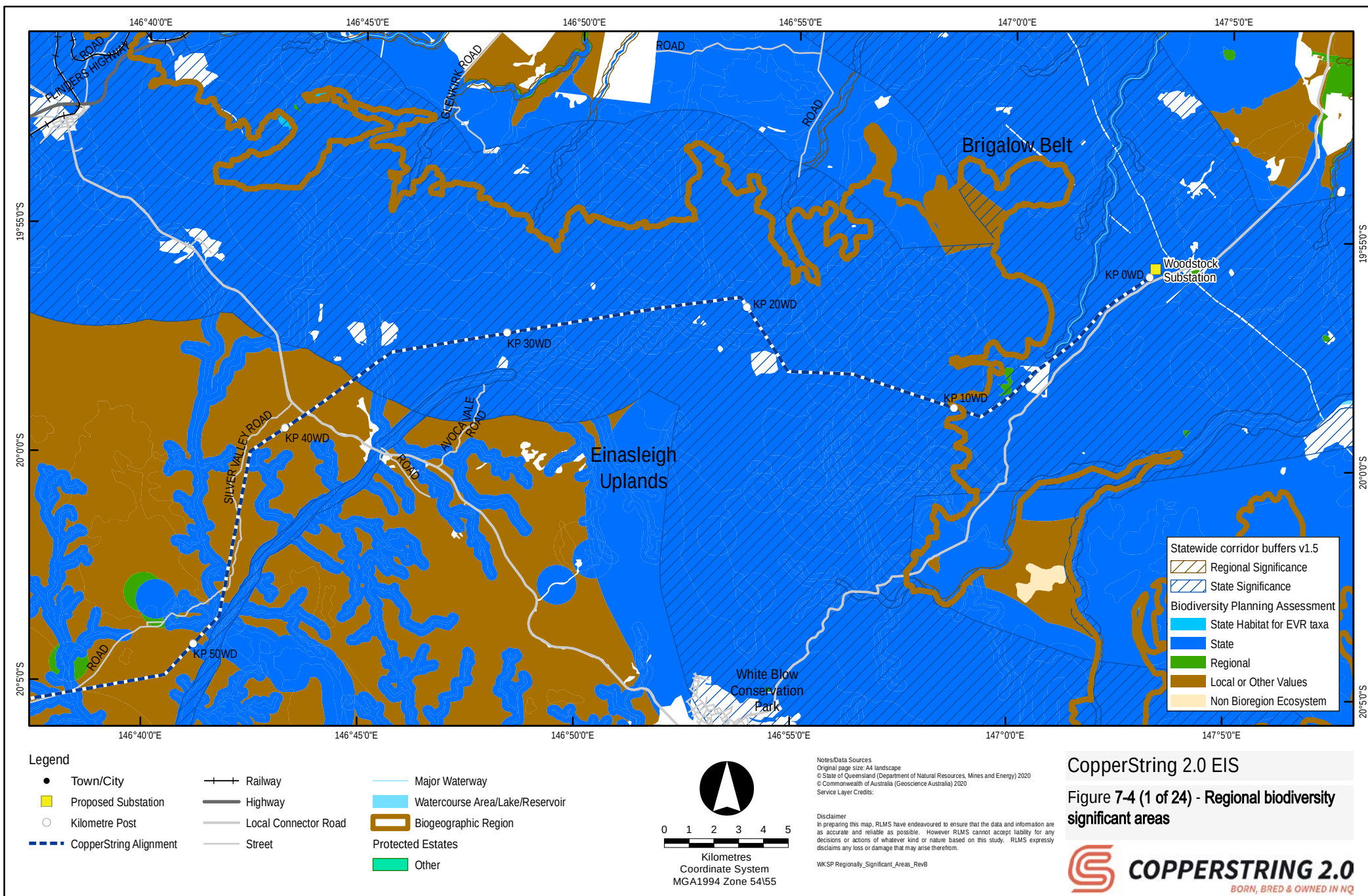
DNRME RE description (VM status)	Occurrence	Field description/comments	Representative Photo
		nearby polygons mapped by 3D Environmental as RE 4.7.2.	
2.3.43 (OC) - <i>Sporobolus mitchellii</i> +/- <i>Cyperus bifax</i> , <i>Astrebla elymoides</i> , <i>Chenopodium auricomum</i> tussock grassland on seasonally inundated alluvial plains and drainage depressions	Mapped by DNRME as a minor component of the heterogeneous polygon RE 2.3.17a/2.3.7a/2.3.3/2.3.43 within the corridor selection of the Copperstring Core corridor section at KP 624-626WD (Gilliat River) for a distance of up to 2.2 km.	GHD was unable to access the heterogeneous polygon within the corridor selection during the 2019 surveys. Observations of the same RE polygon were made approximately 16 km north of the corridor selection where the Gilliat River crosses the Flinders Highway (refer representative photo sourced from Google Map streetview). The vegetation type broadly consisted of a low mixed woodland over sparse shrubs over tussock grasses on a braided channel. Confirmation of the presence of RE 2.3.43 within the heterogeneous polygon was not possible during the 2019 survey due to depleted ground layer resulting from the prolonged dry conditions preceeding the survey. Nevertheless, the landform present was compatible with the description	

DNRME RE description (VM status)	Occurrence	Field description/comments	Representative Photo
		provided by DNRME for the RE (i.e. seasonally inundated alluvial plains). It is likely that the extent of the of concern heterogeneous polygon (RE 2.3.17a/2.3.7a/2.3.3/2.3.43) within the easement could be reduced if RE 2.3.43 was mapped separately as a homogenous polygon. This would need to be done following the wet season under more favourable conditions.	



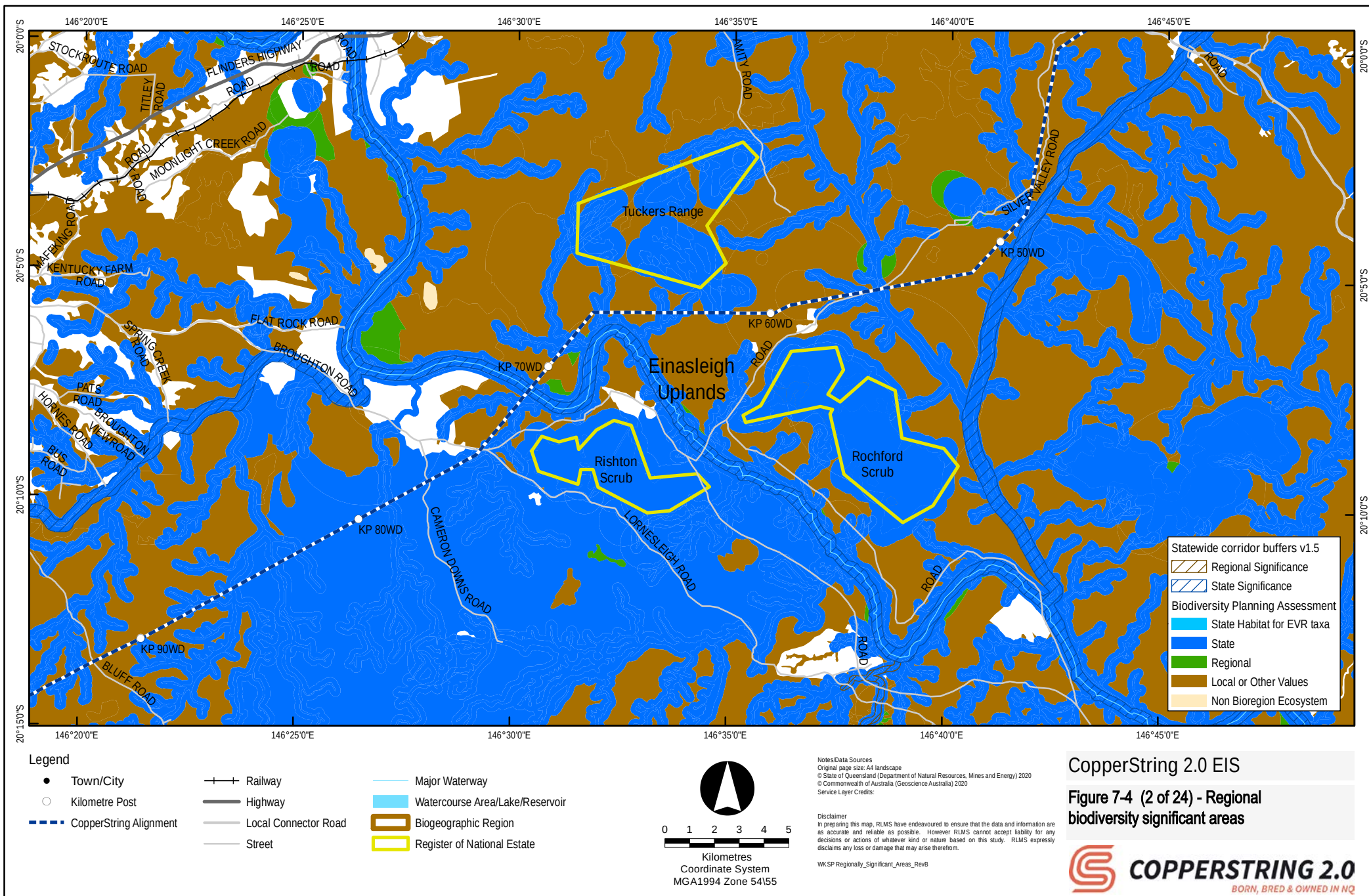
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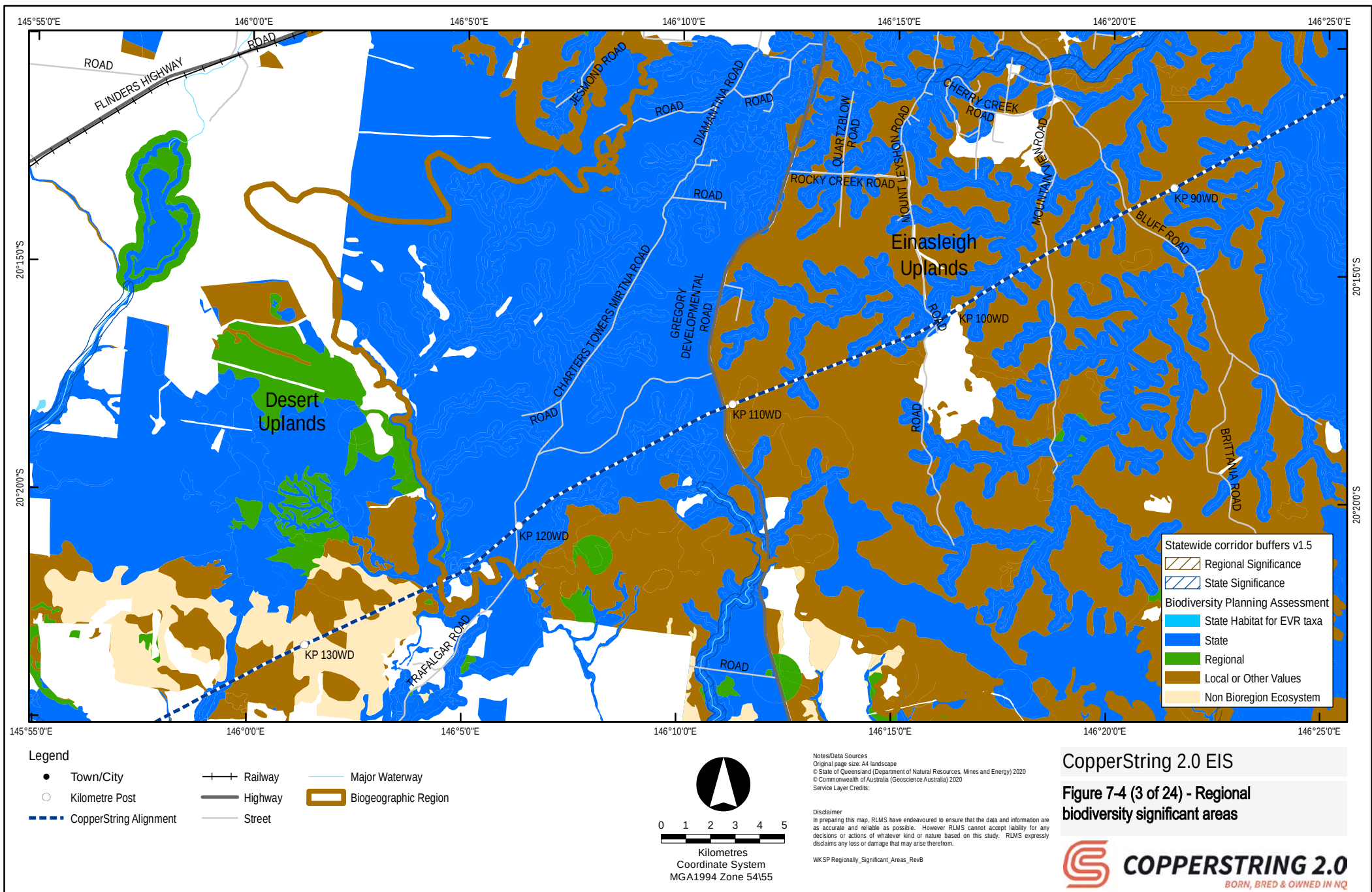
Figure 7-3 - Regional environmental context

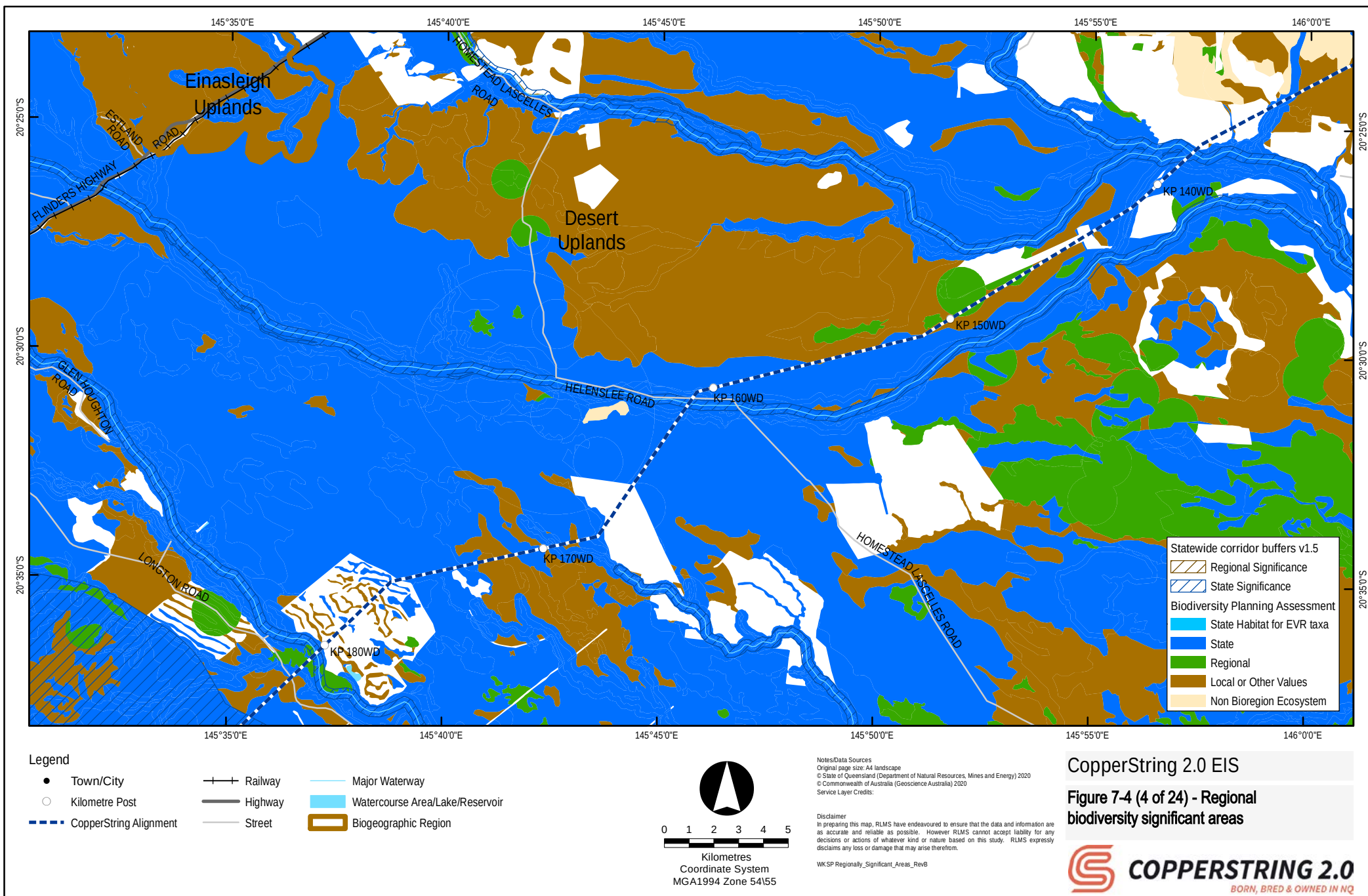


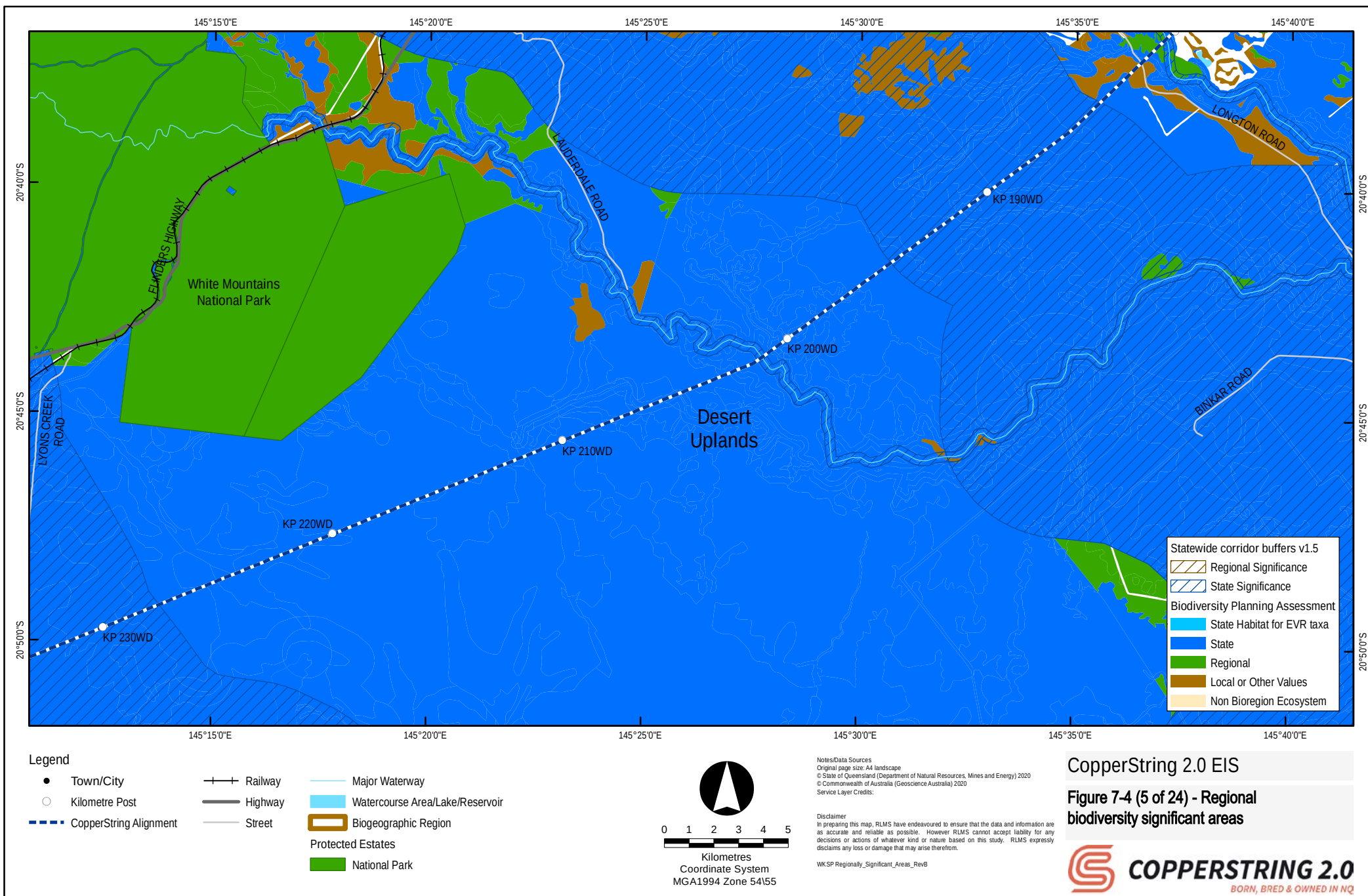
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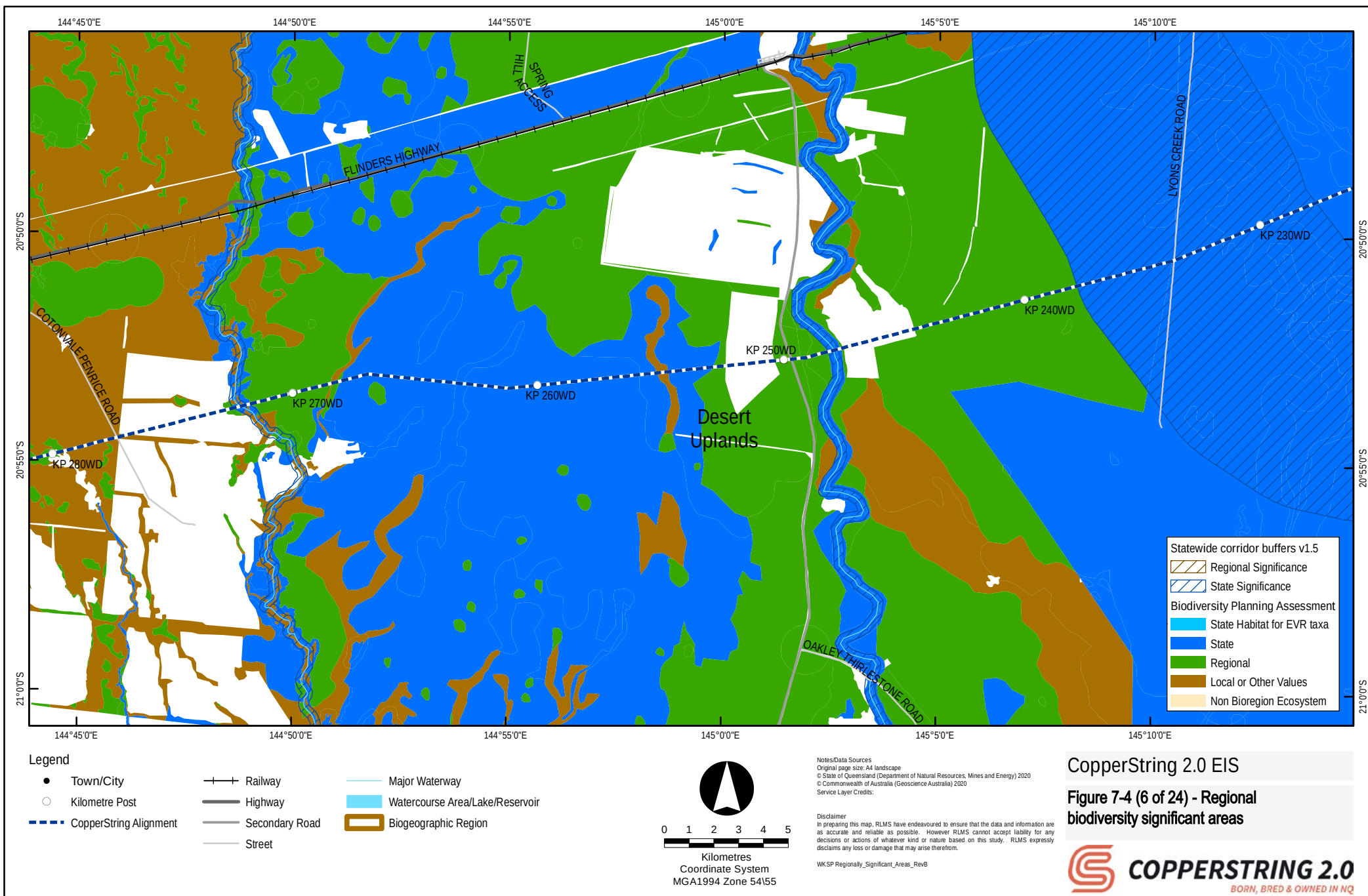
Figure 7-4 (1 of 24) - Regional biodiversity significant areas

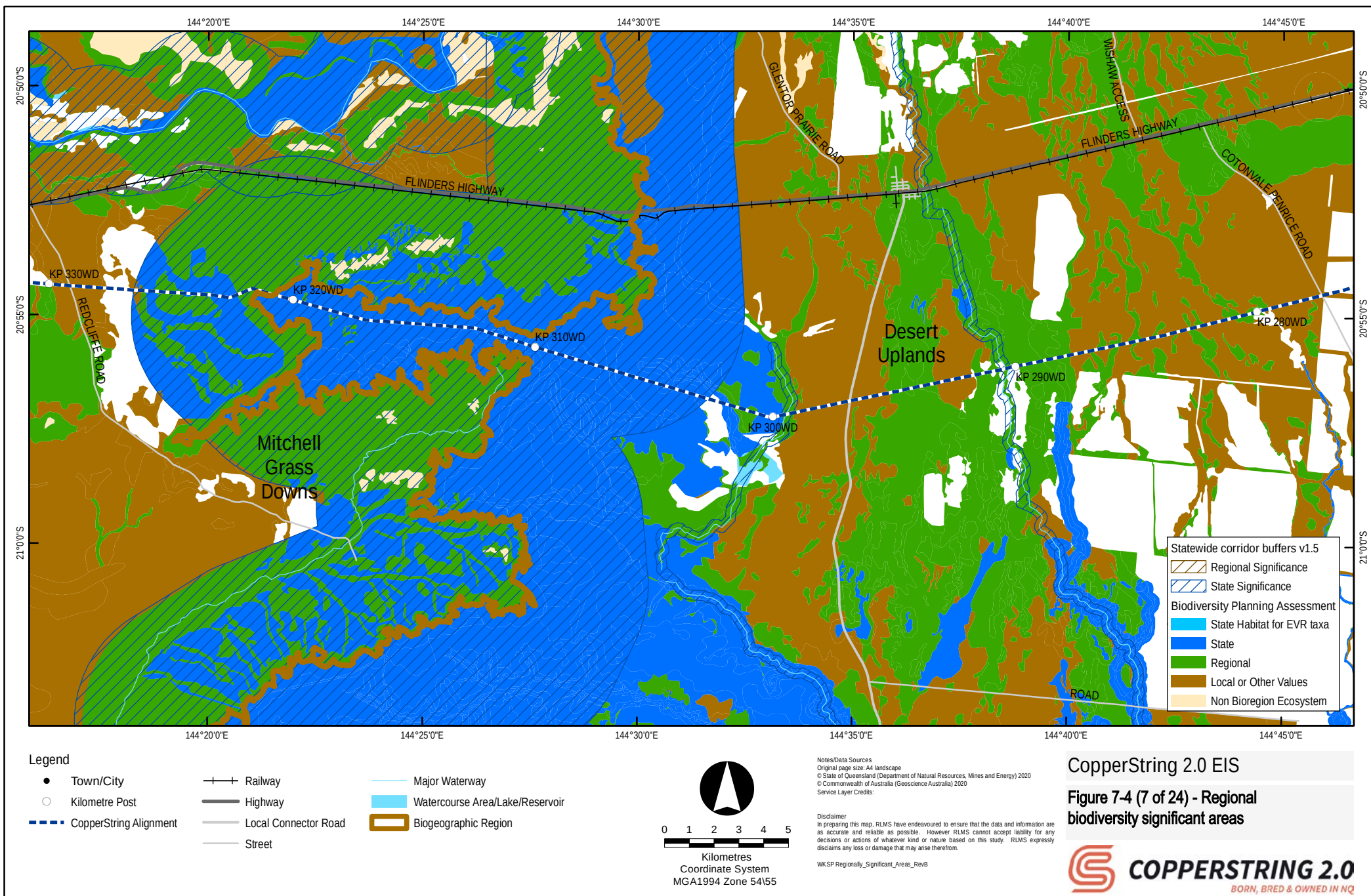


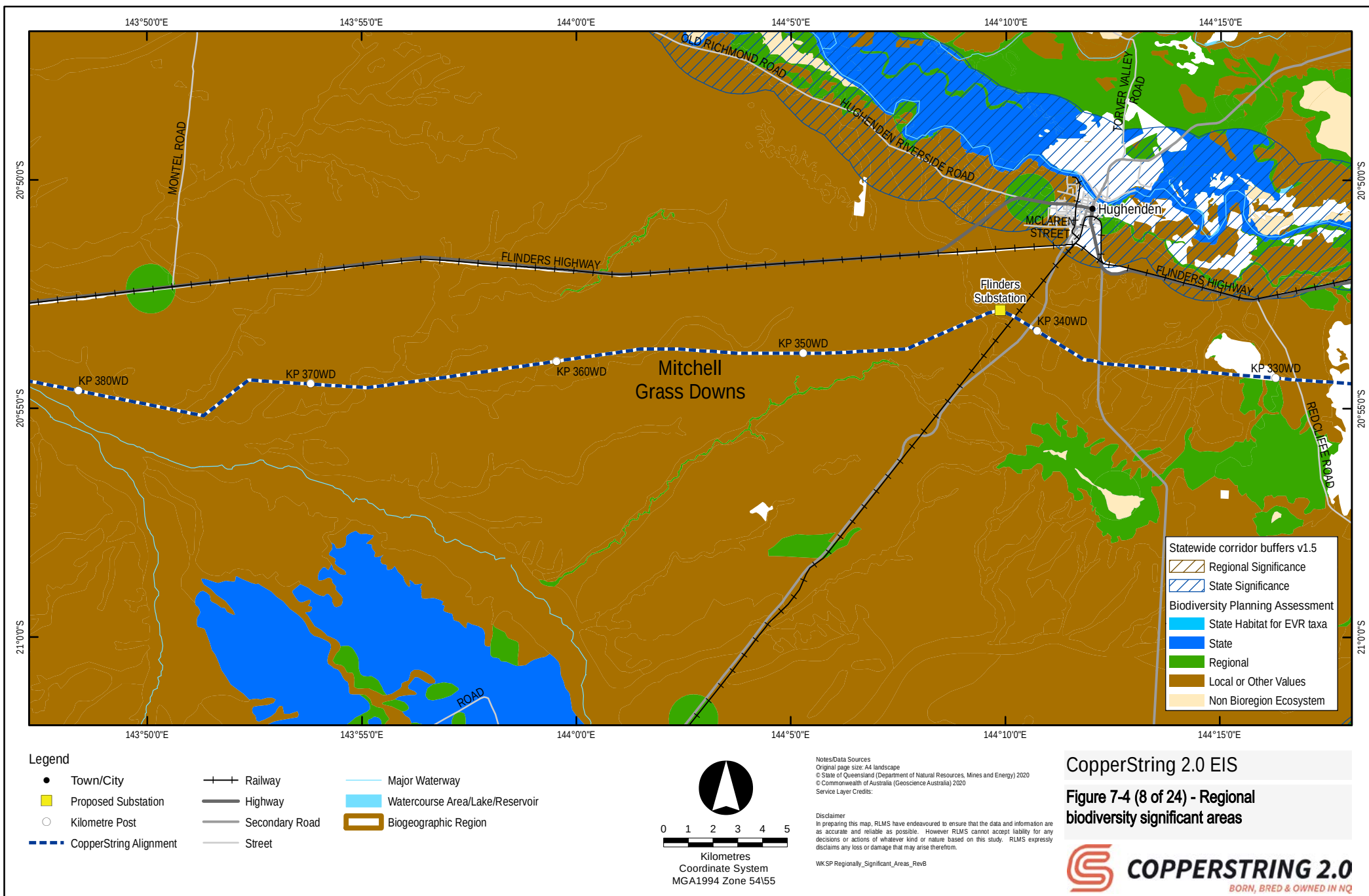


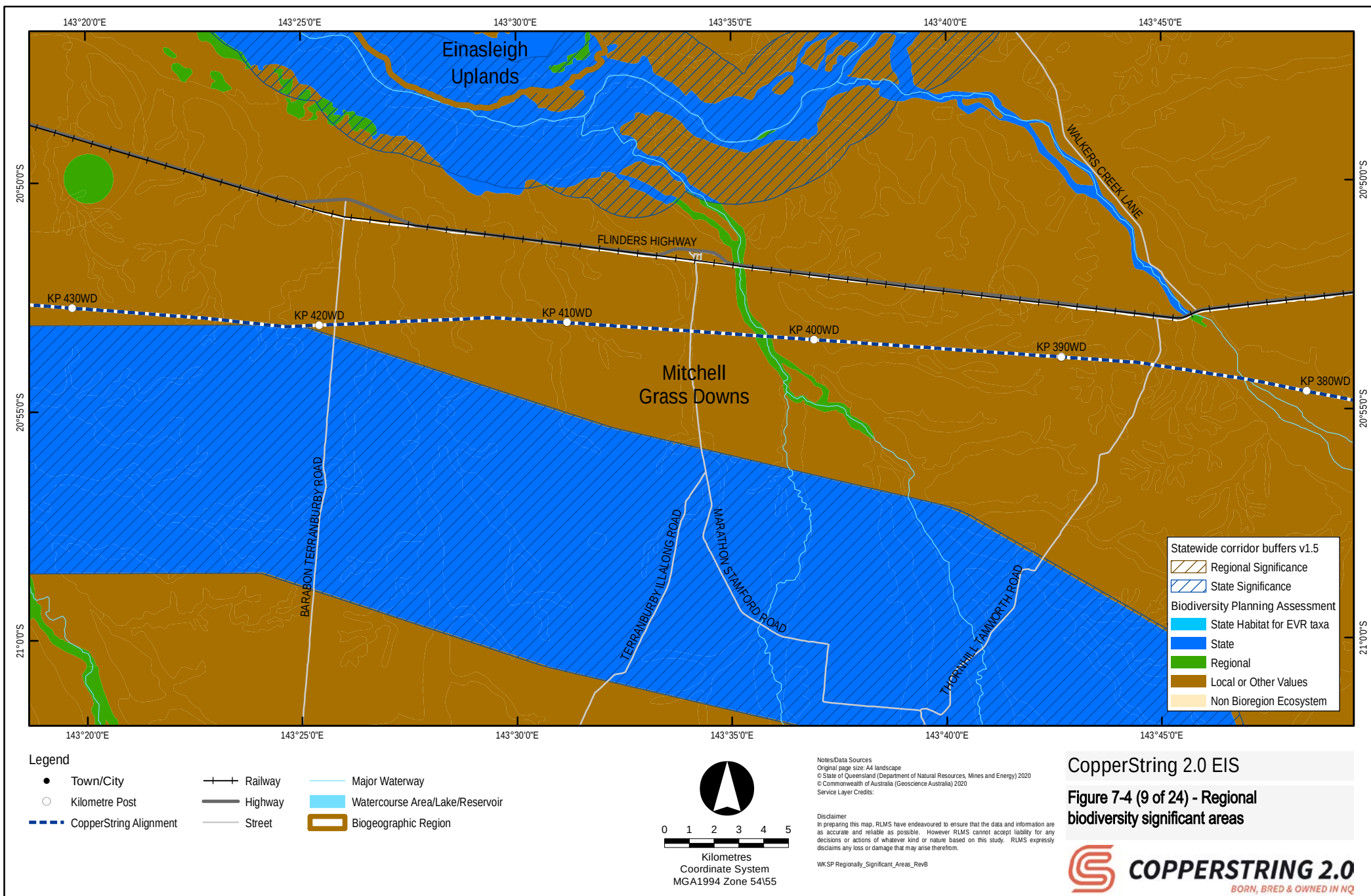


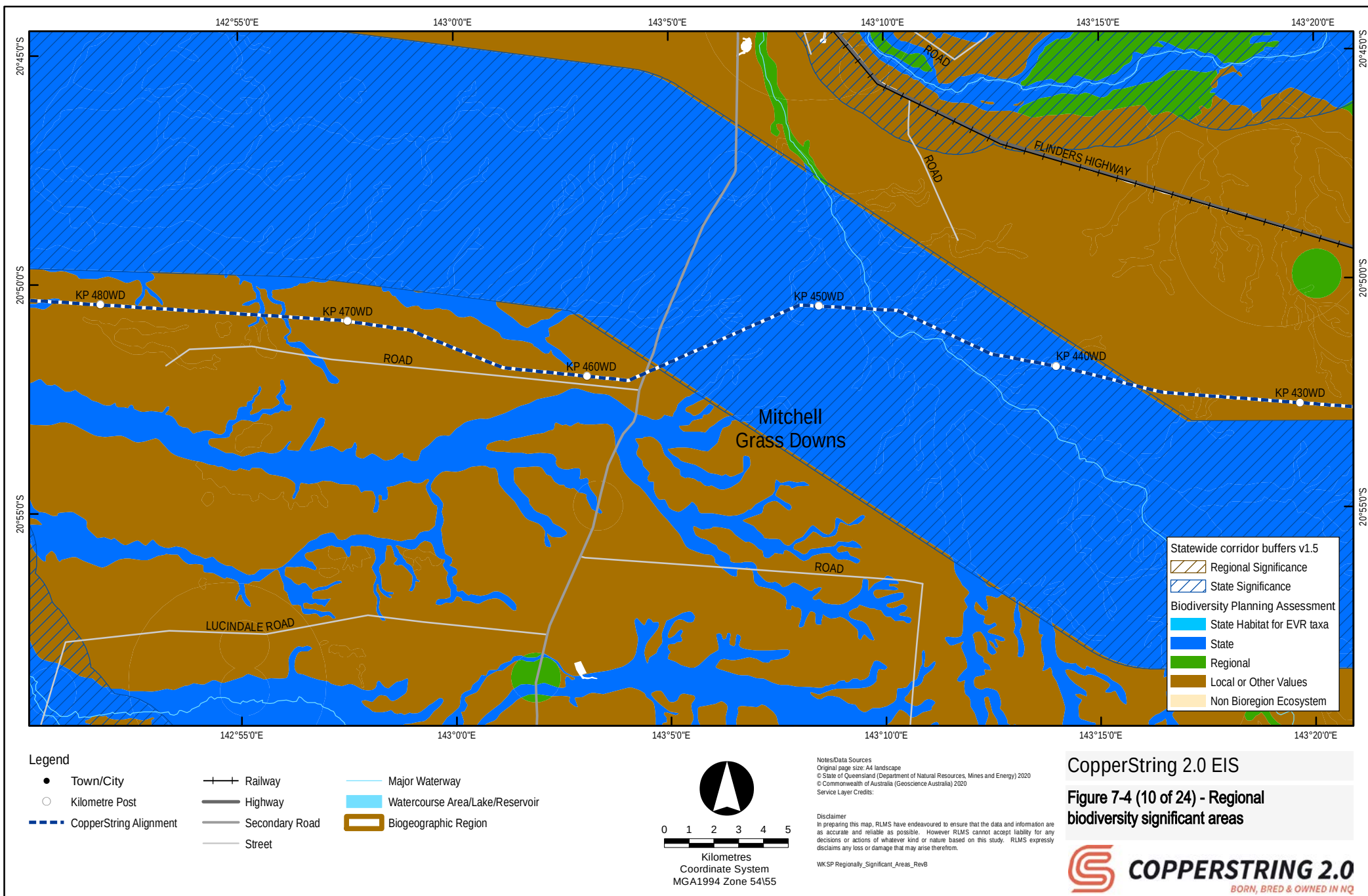


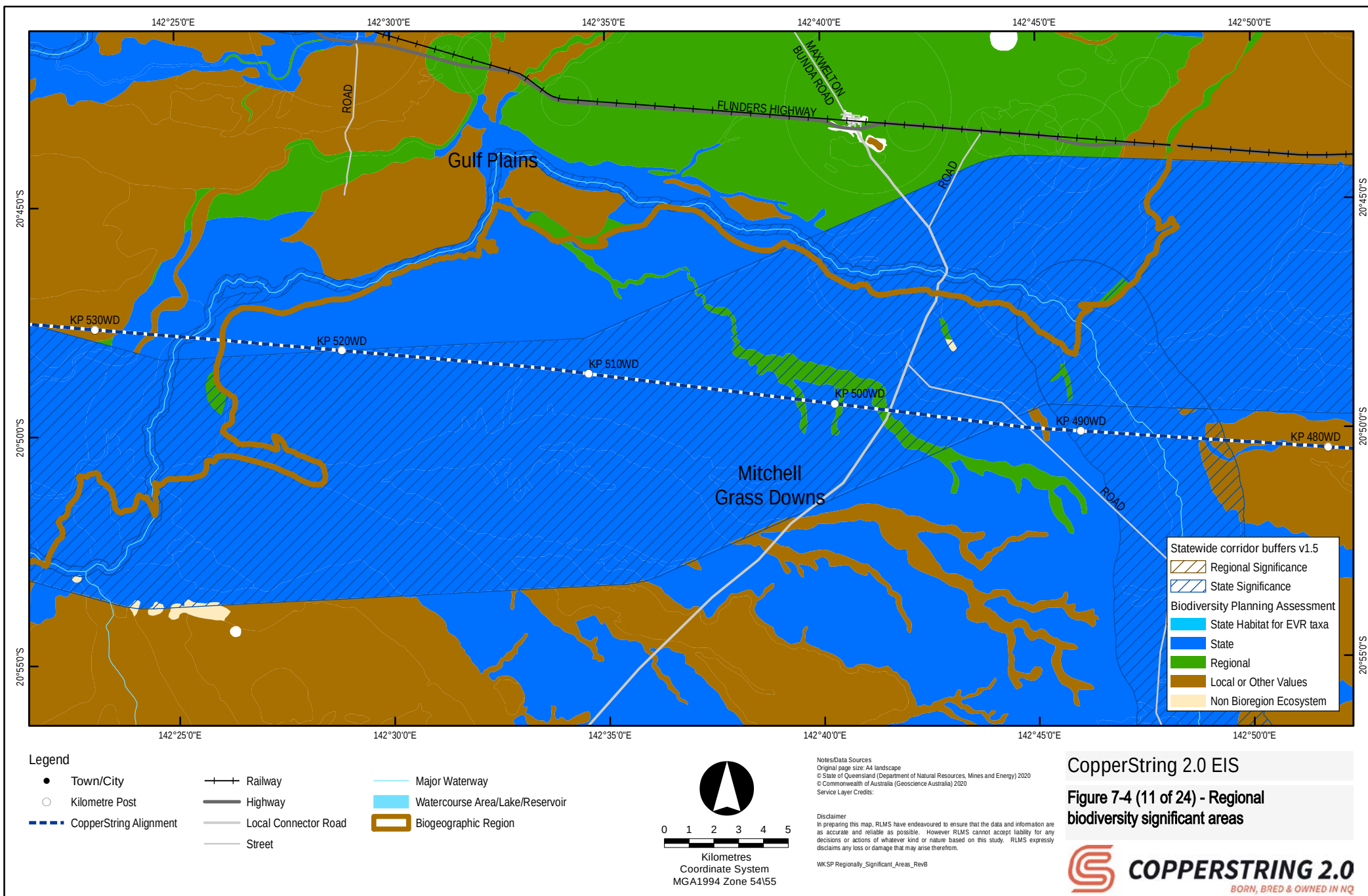


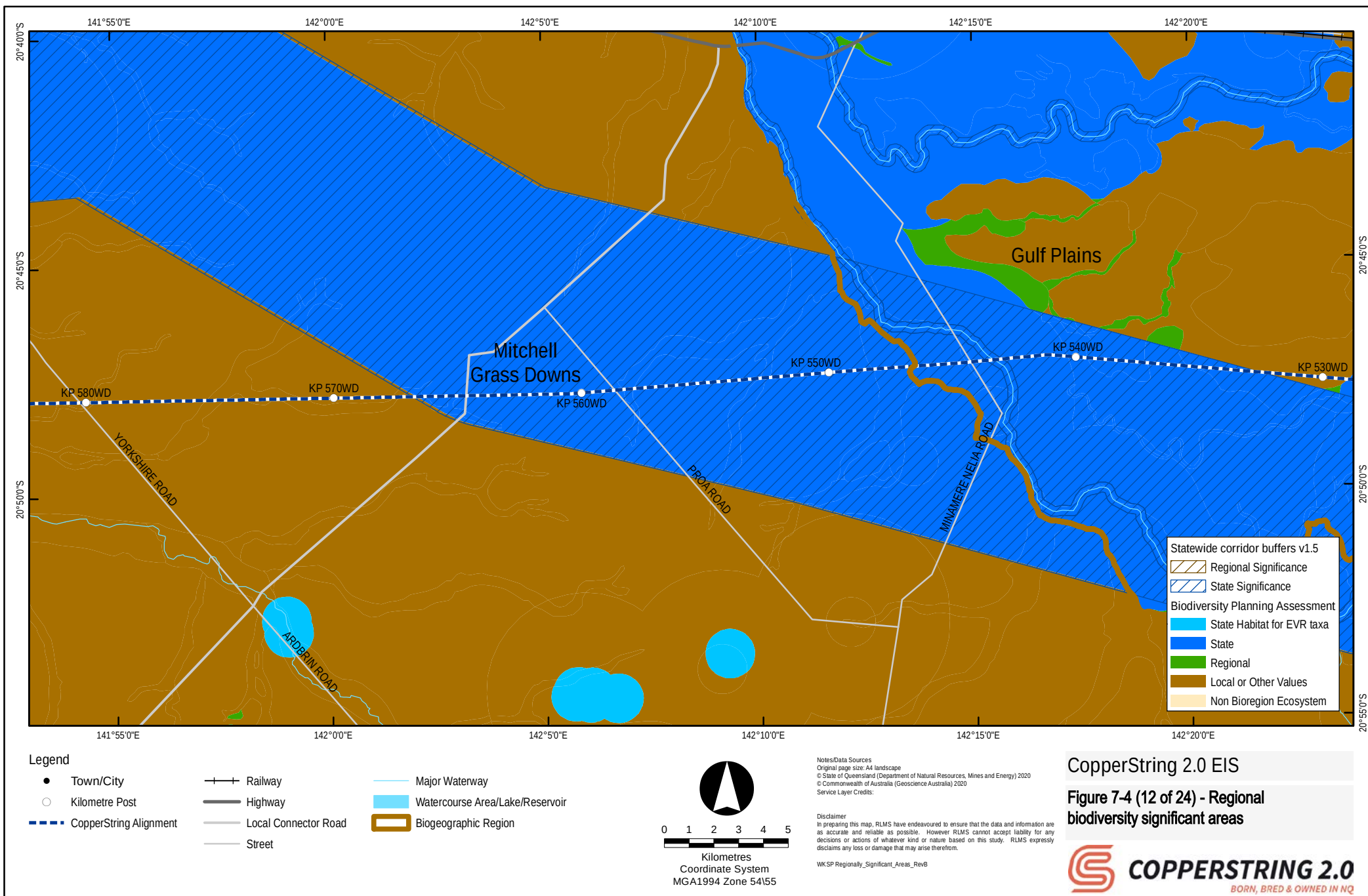


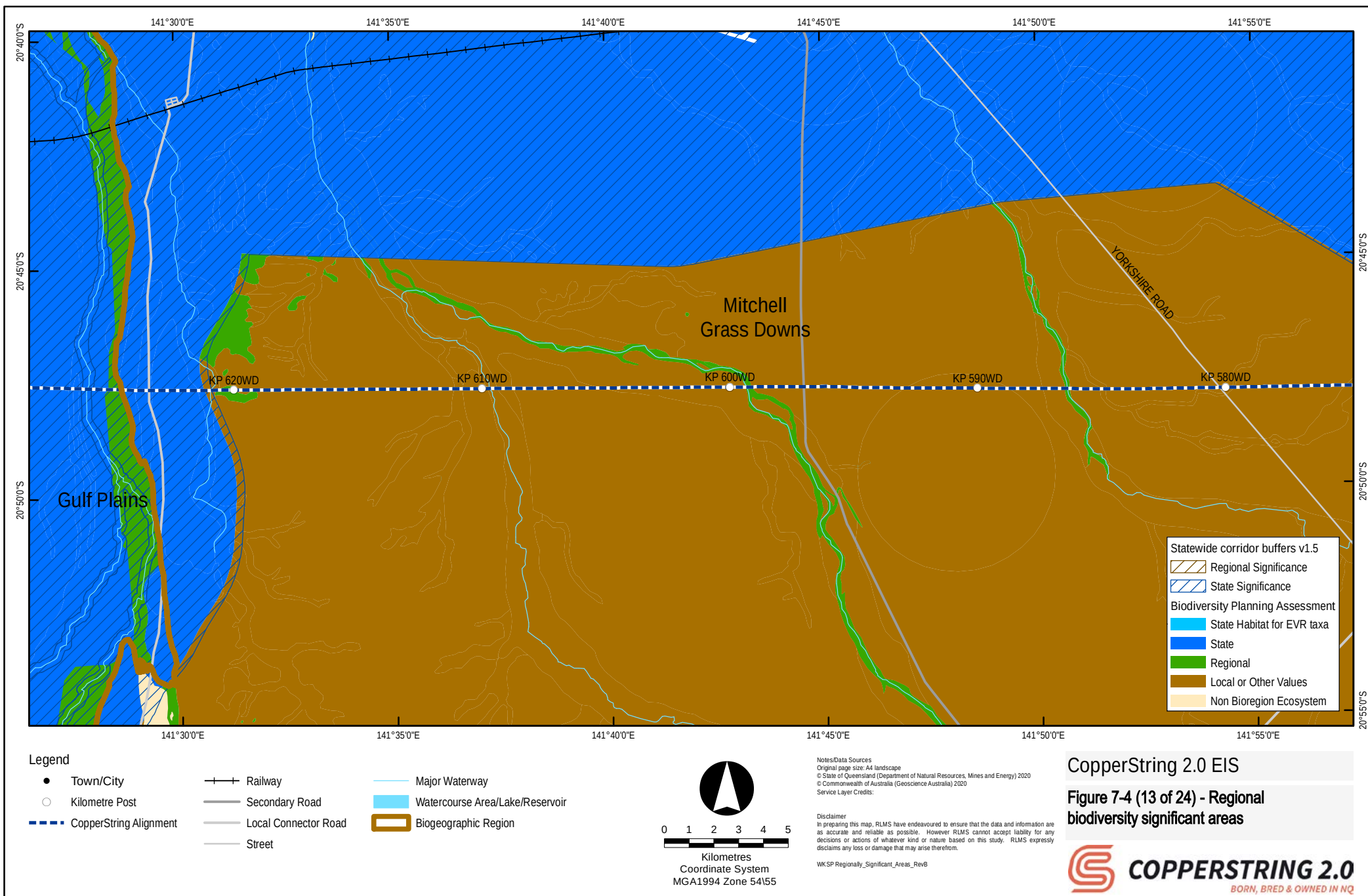


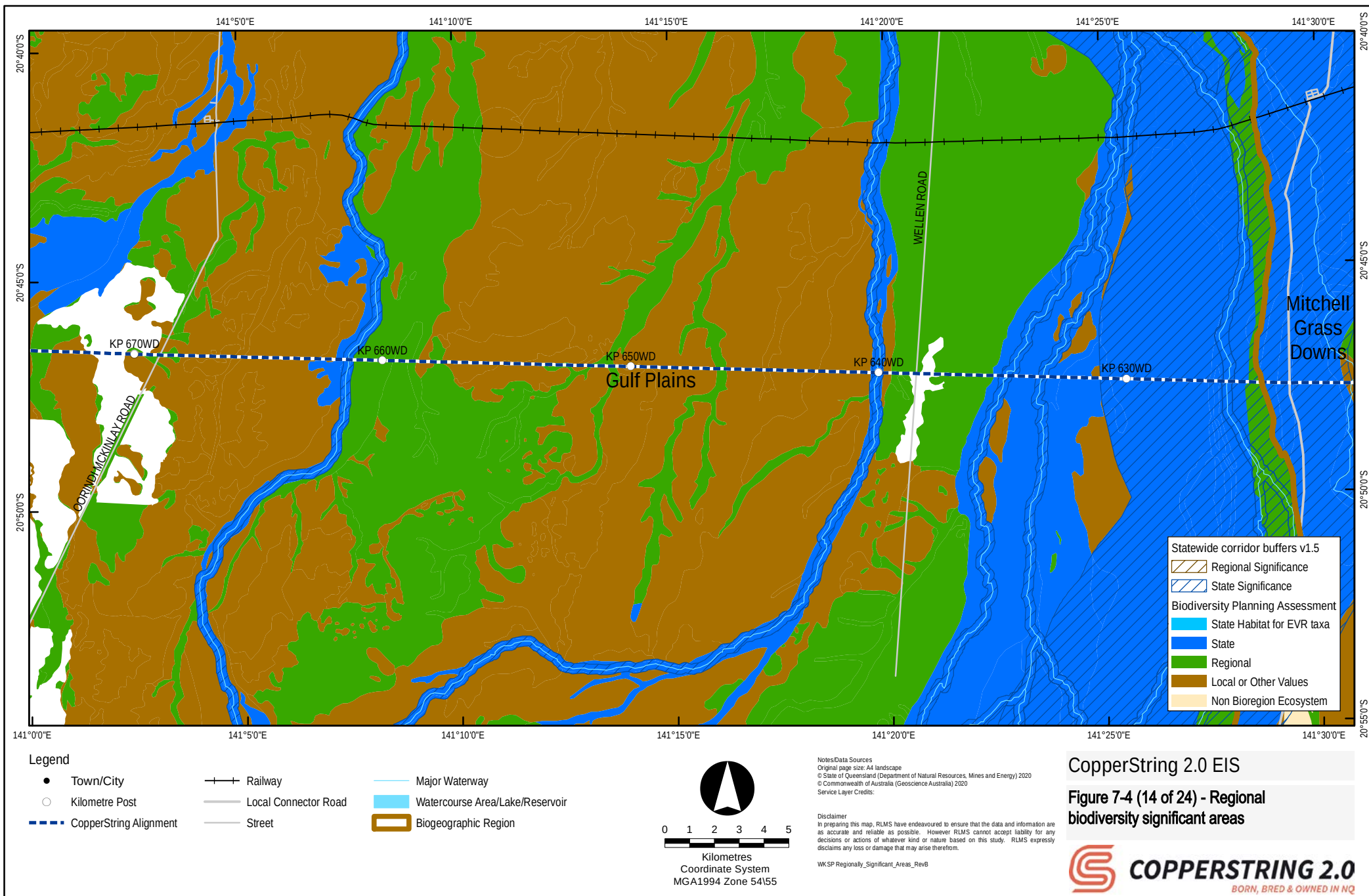


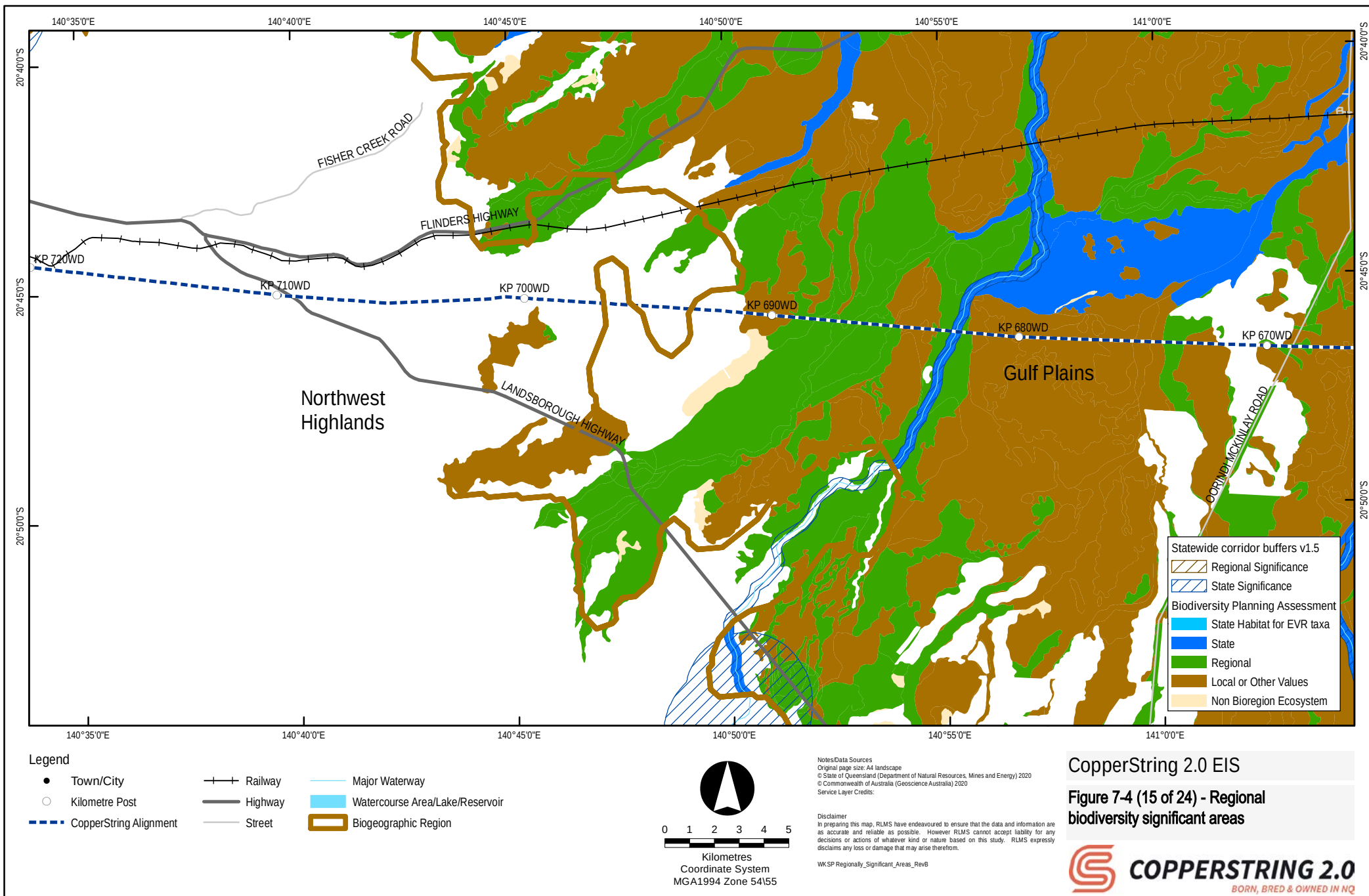


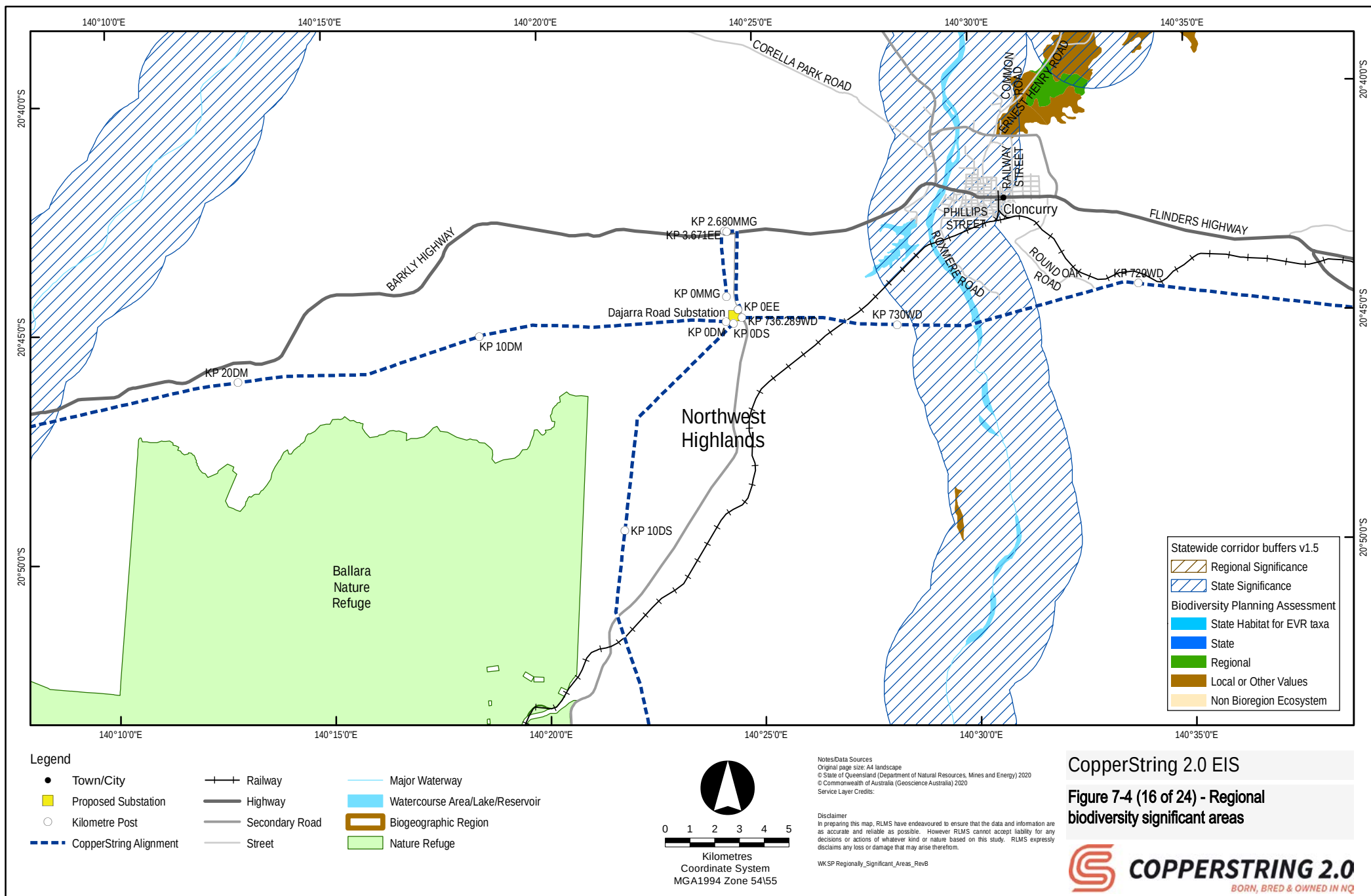


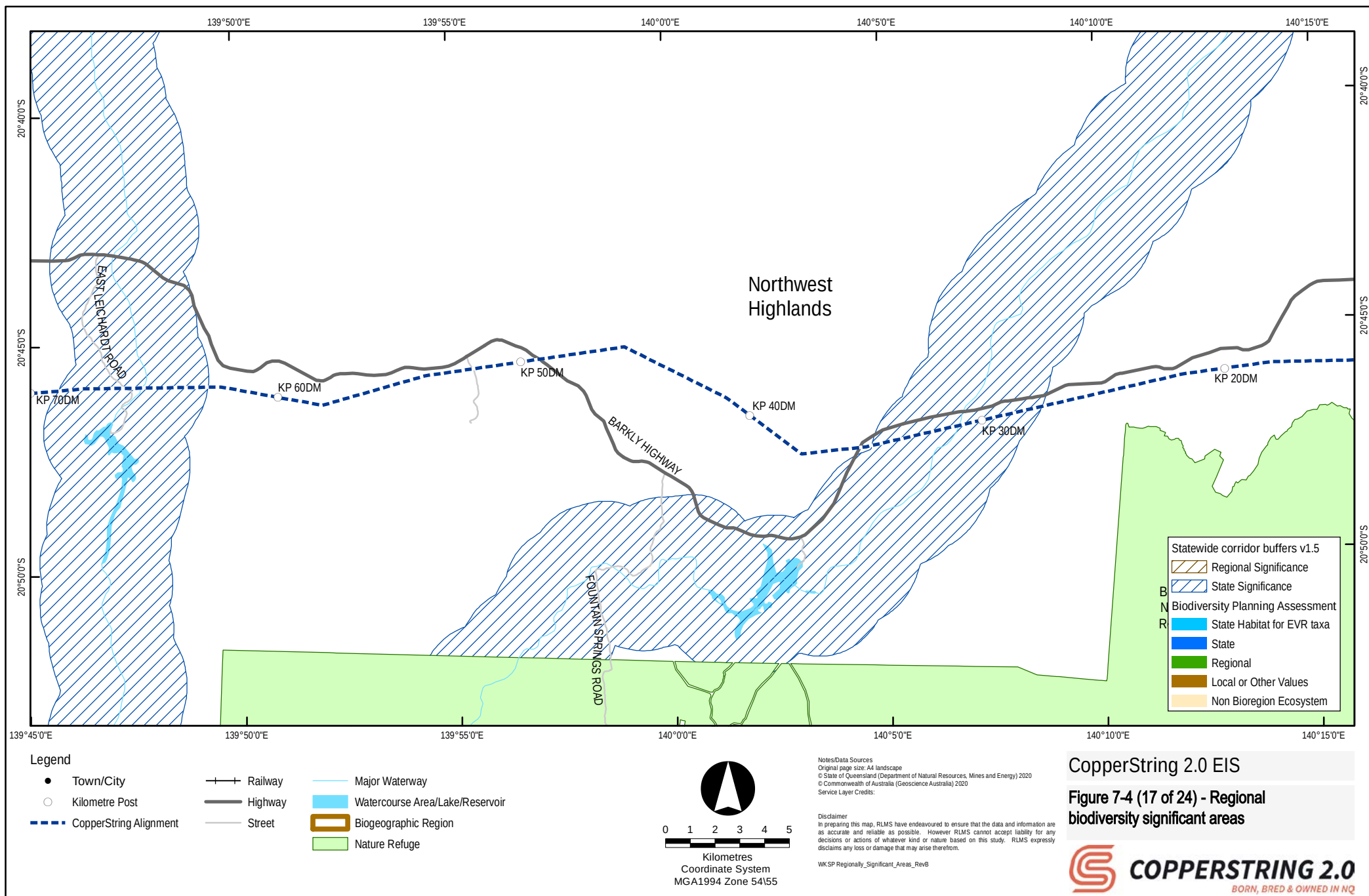


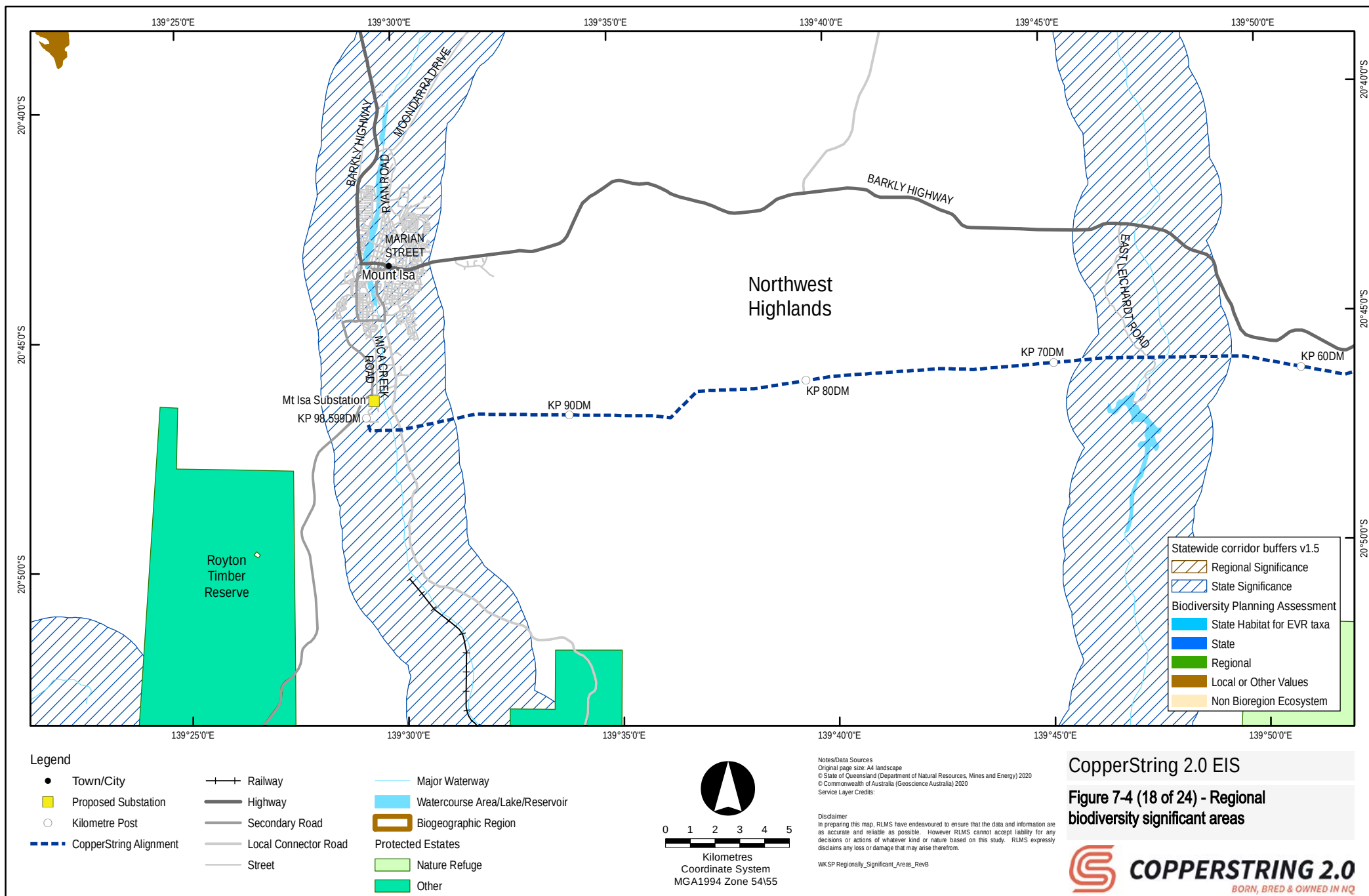


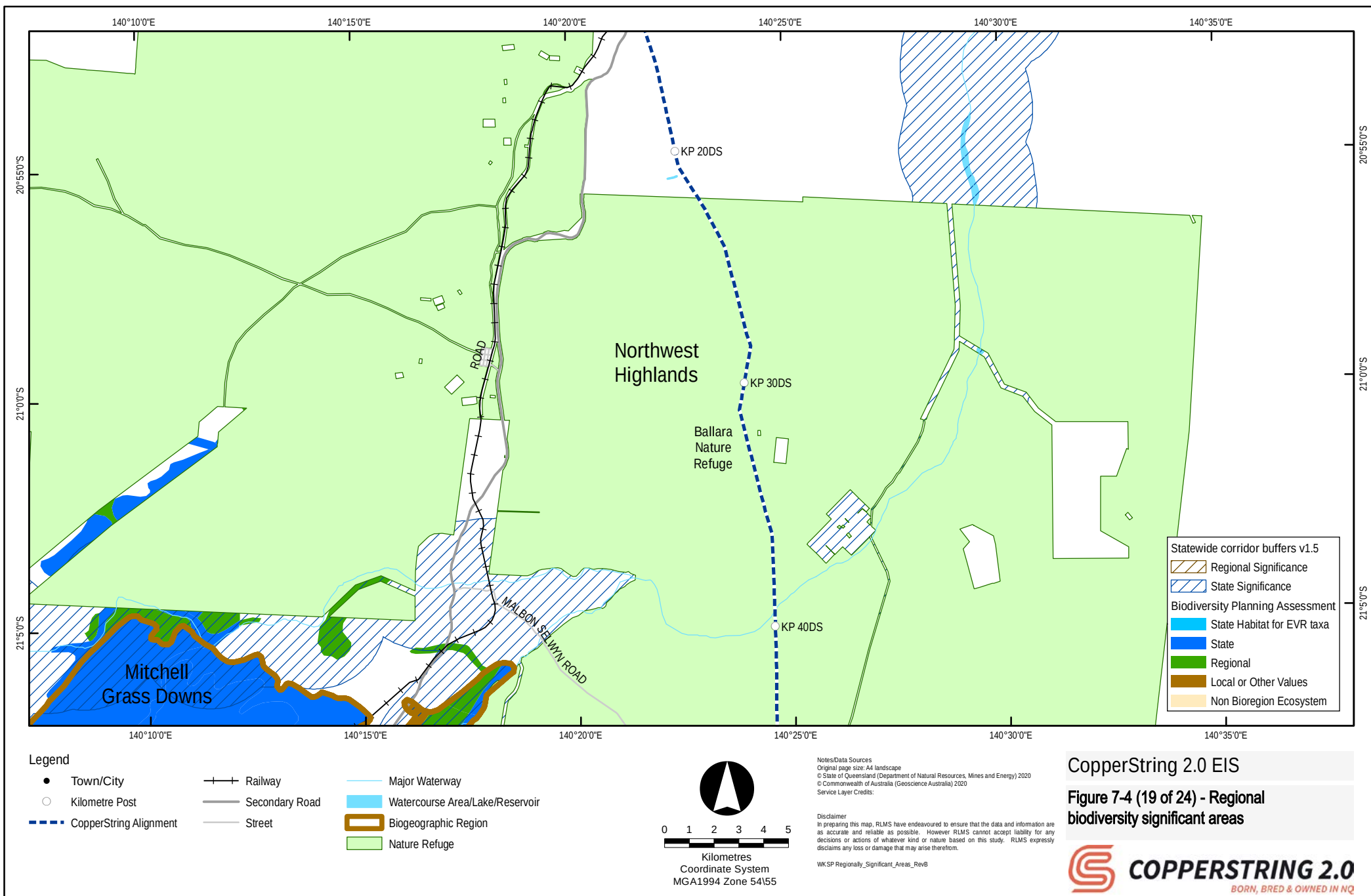


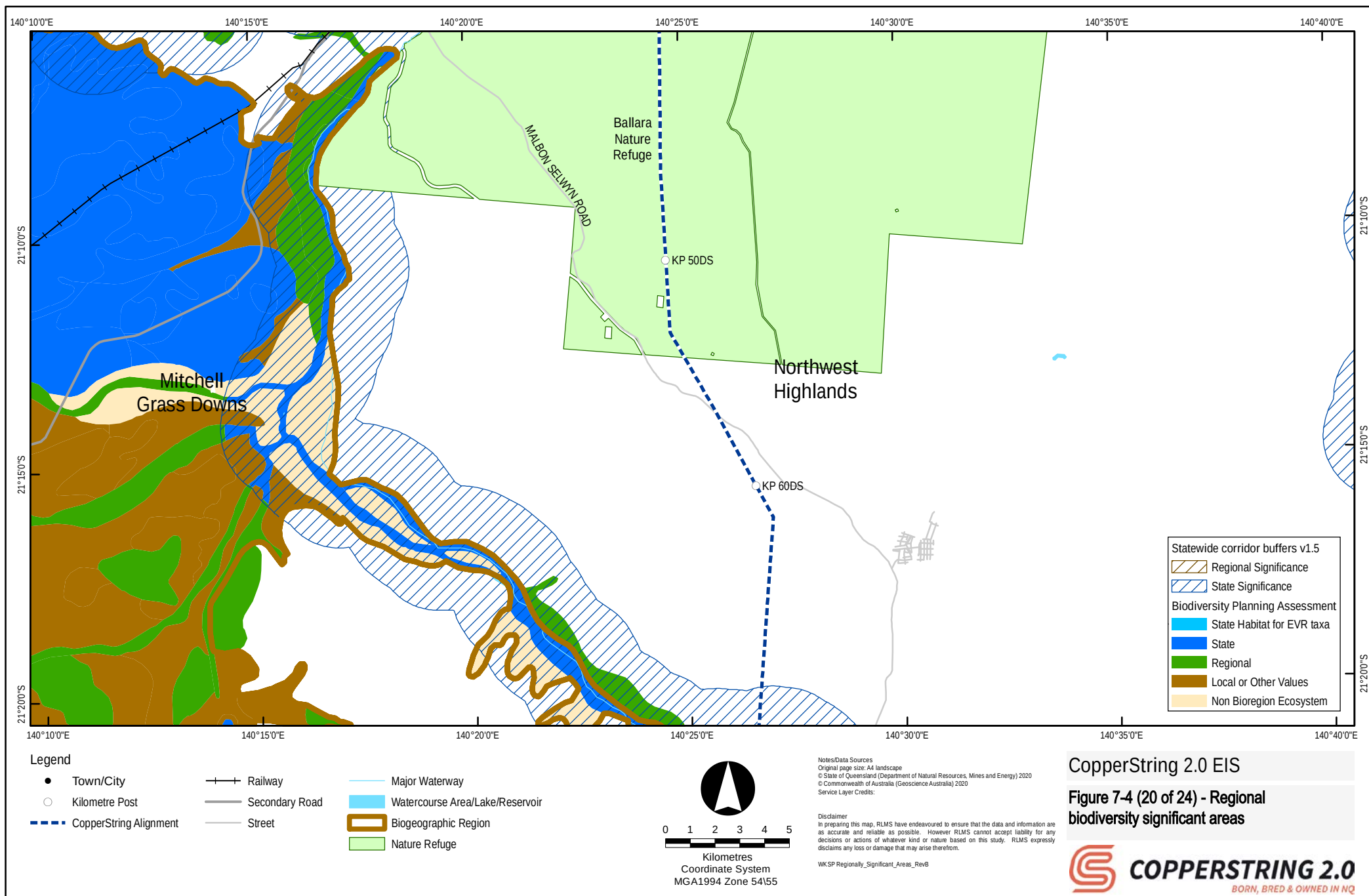


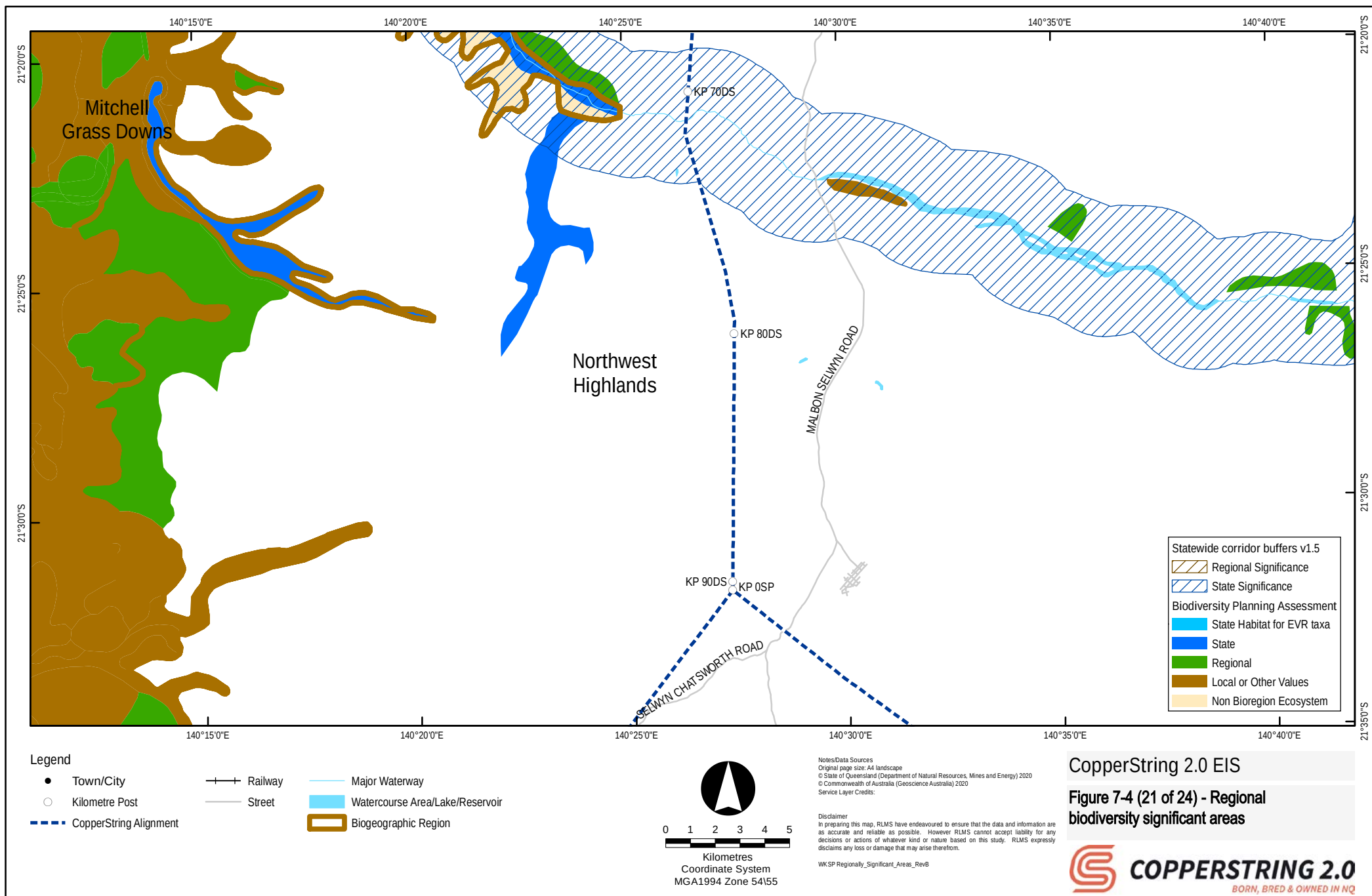


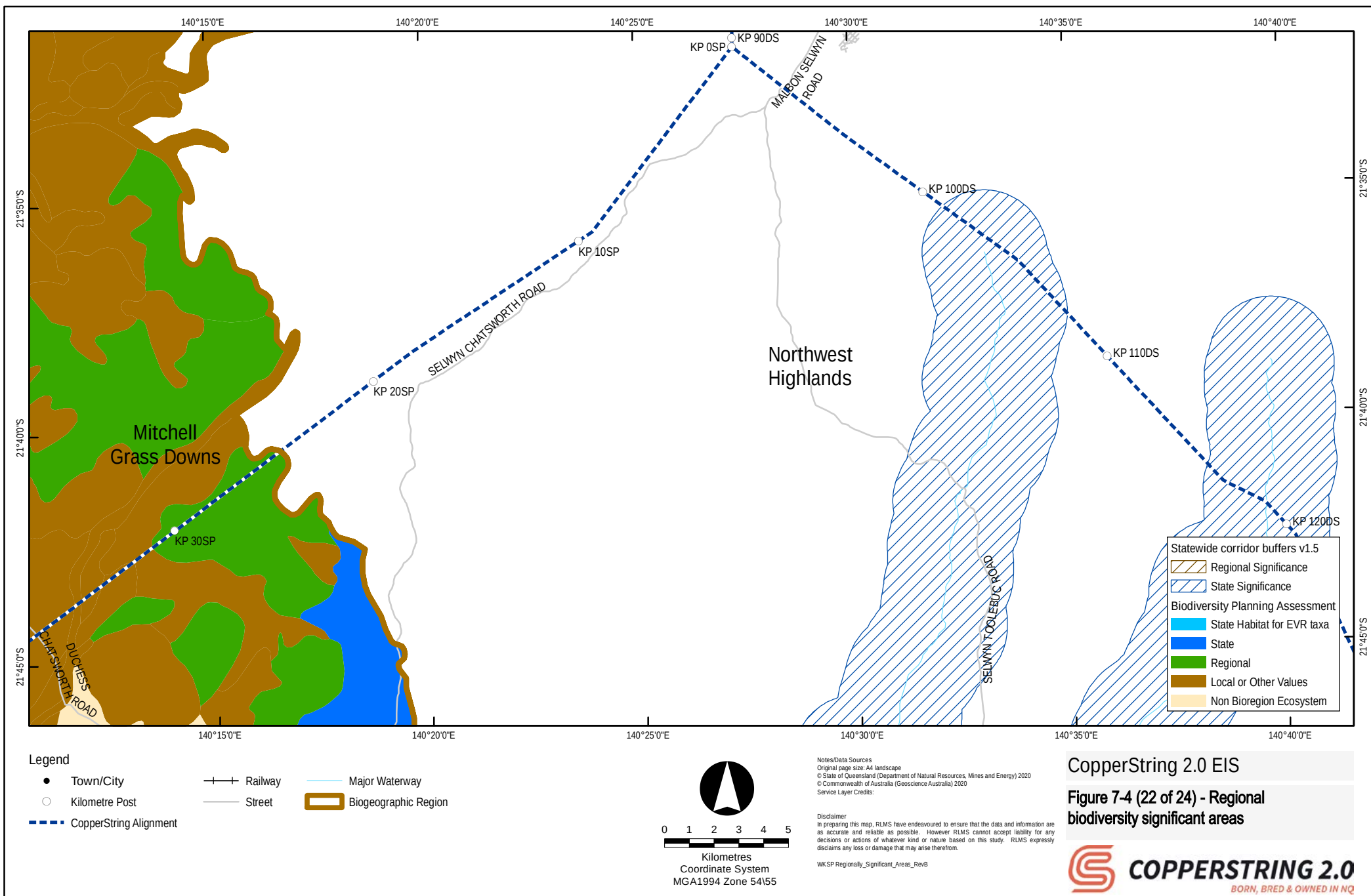


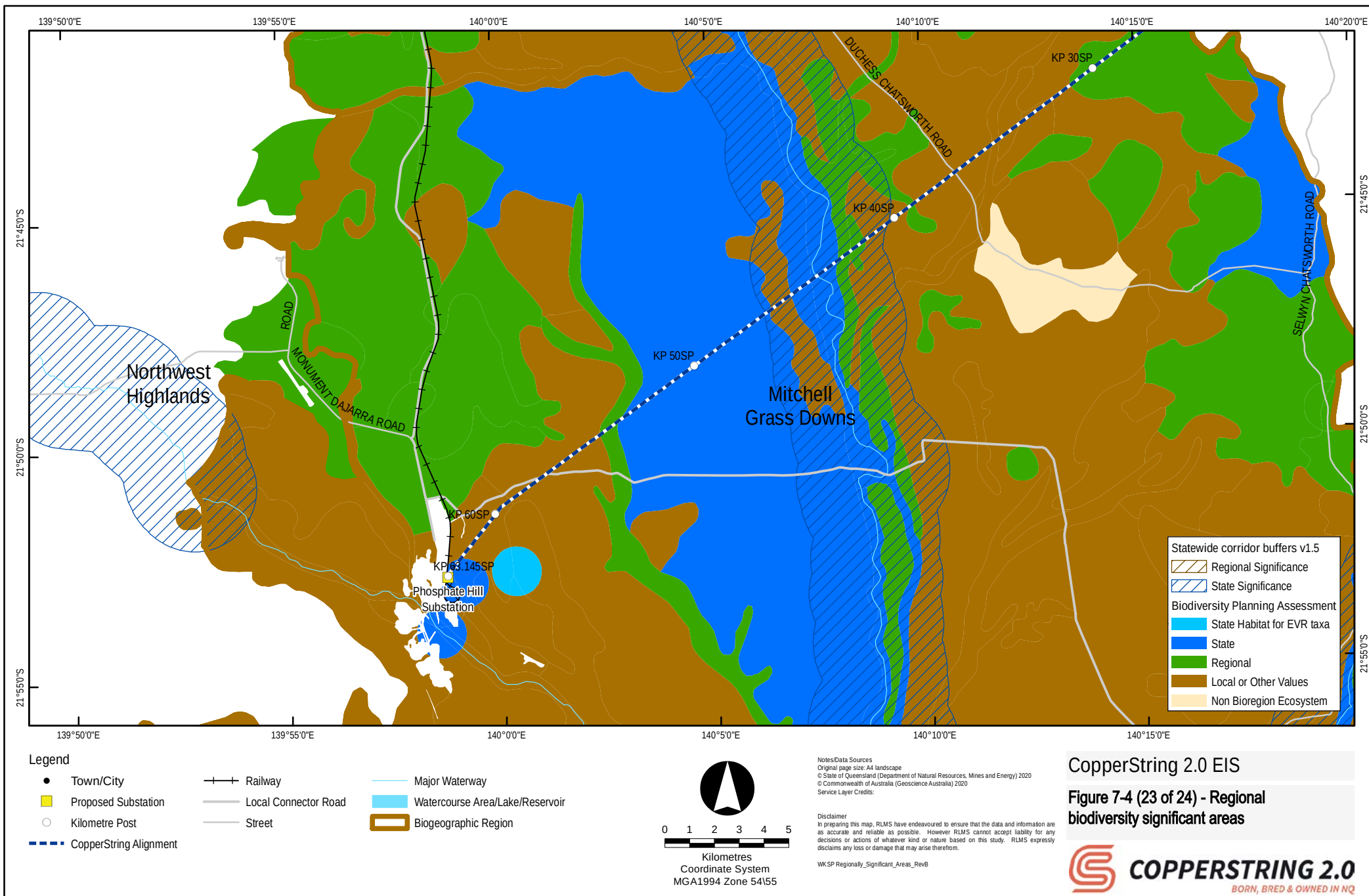






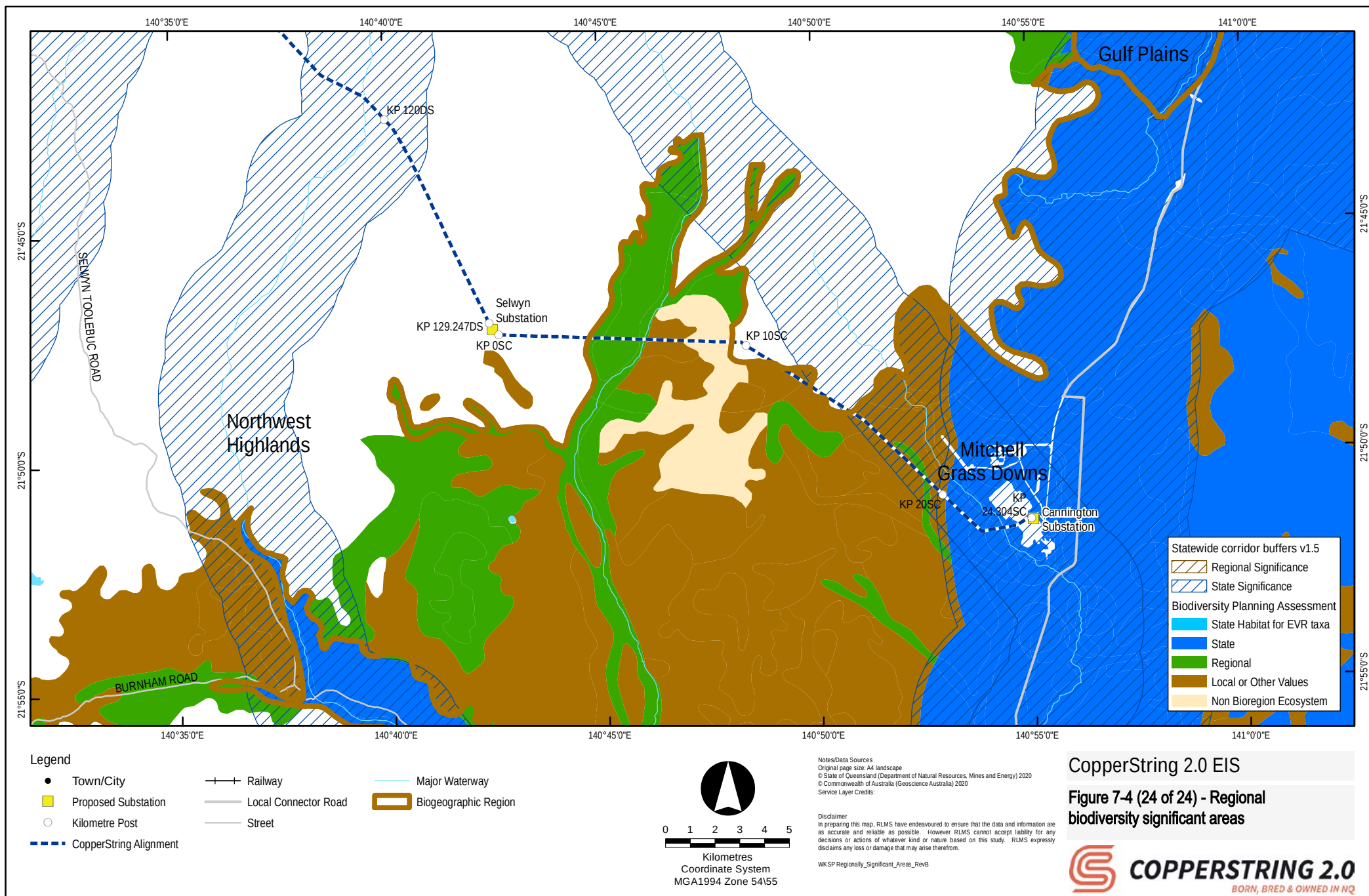


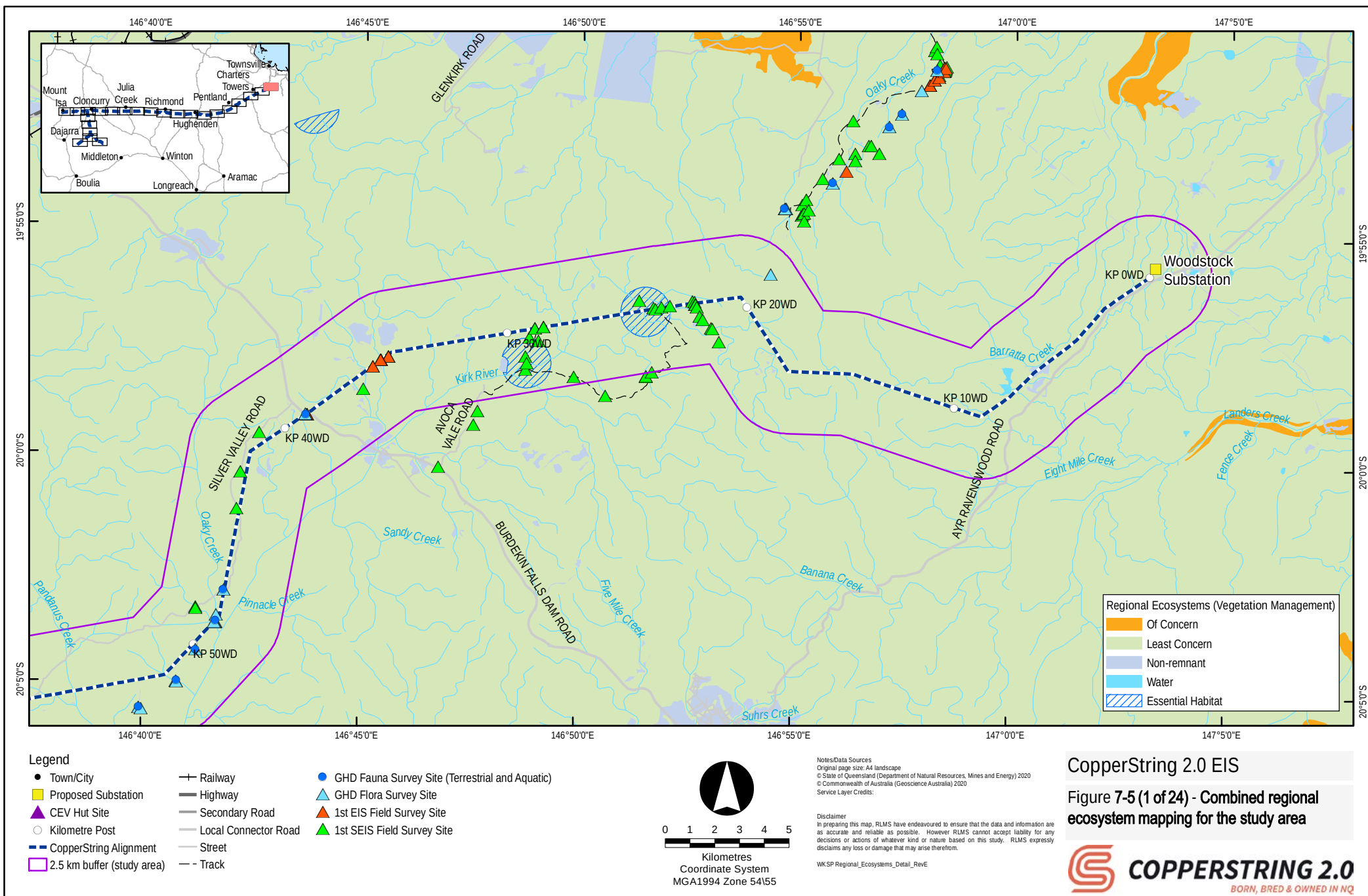


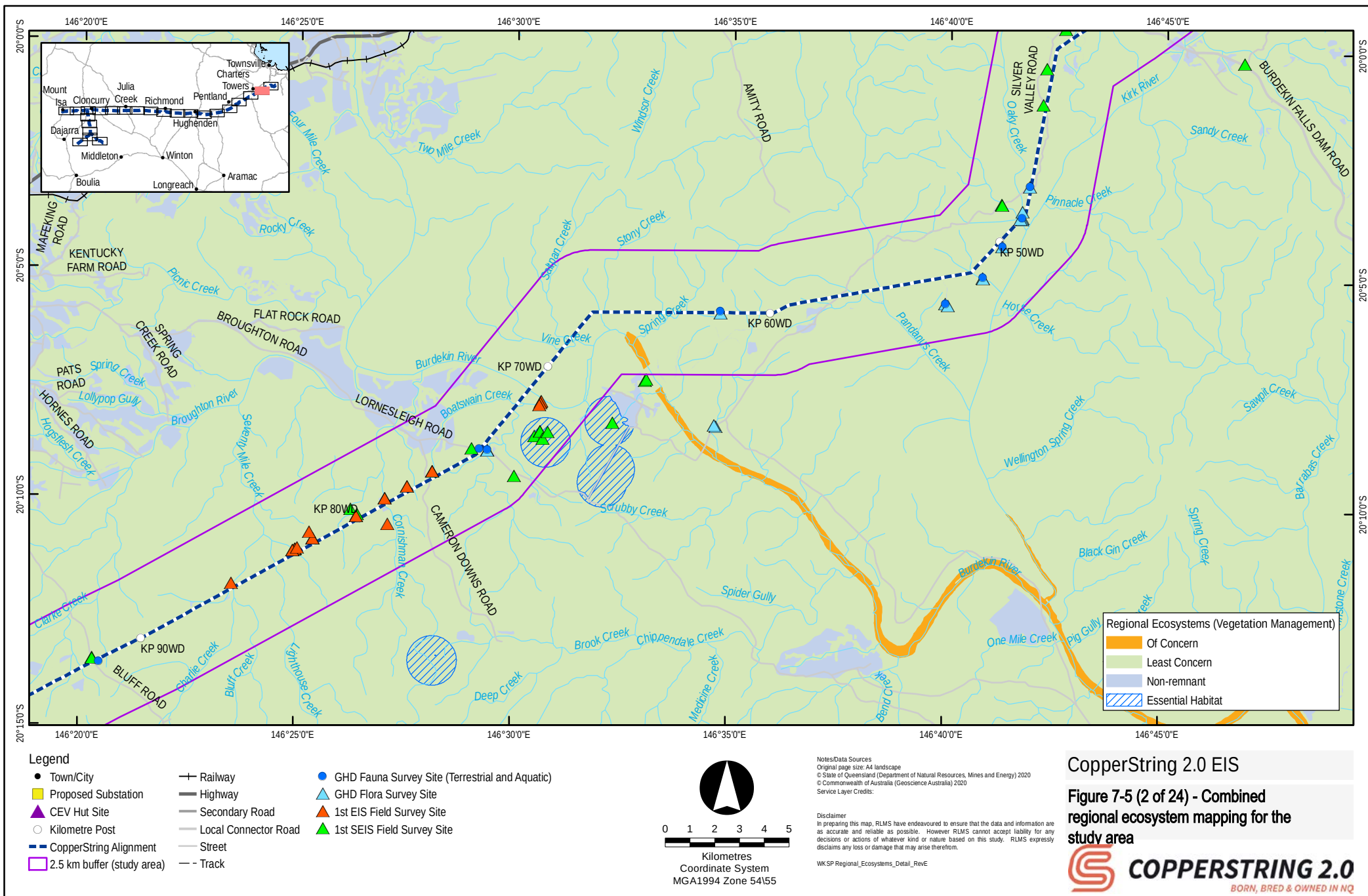


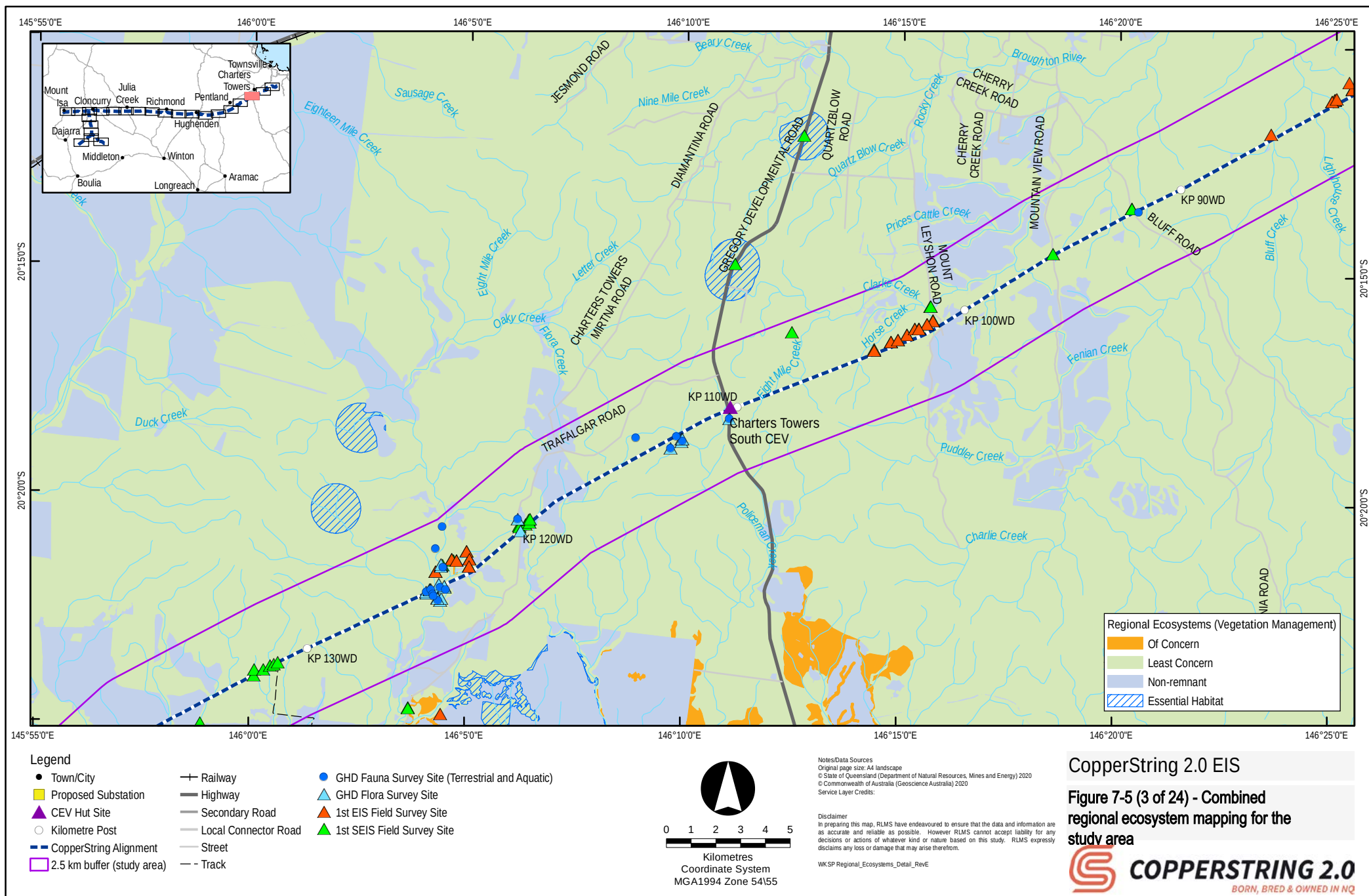
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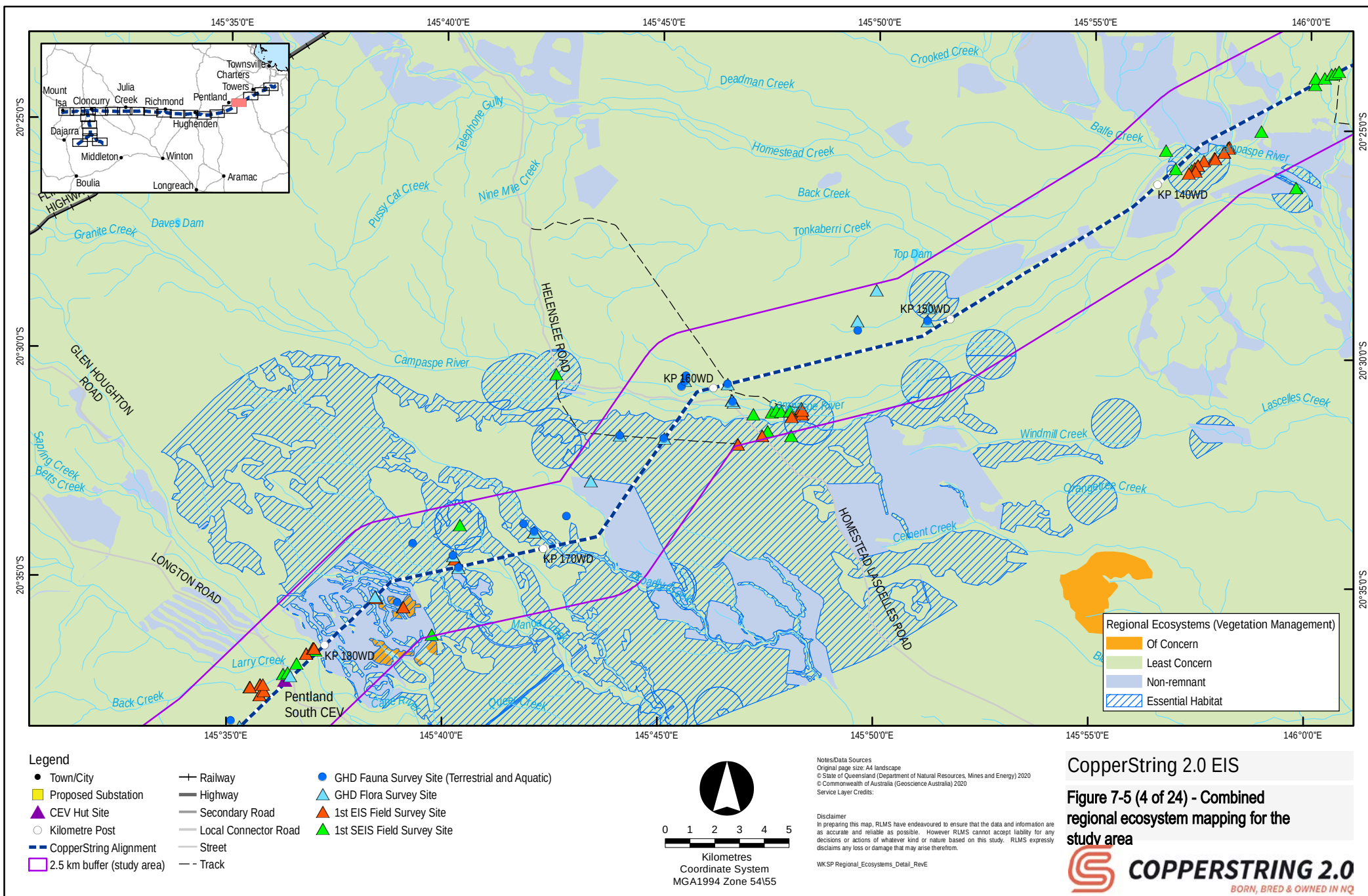
Figure 7-4 (23 of 24) - Regional biodiversity significant areas

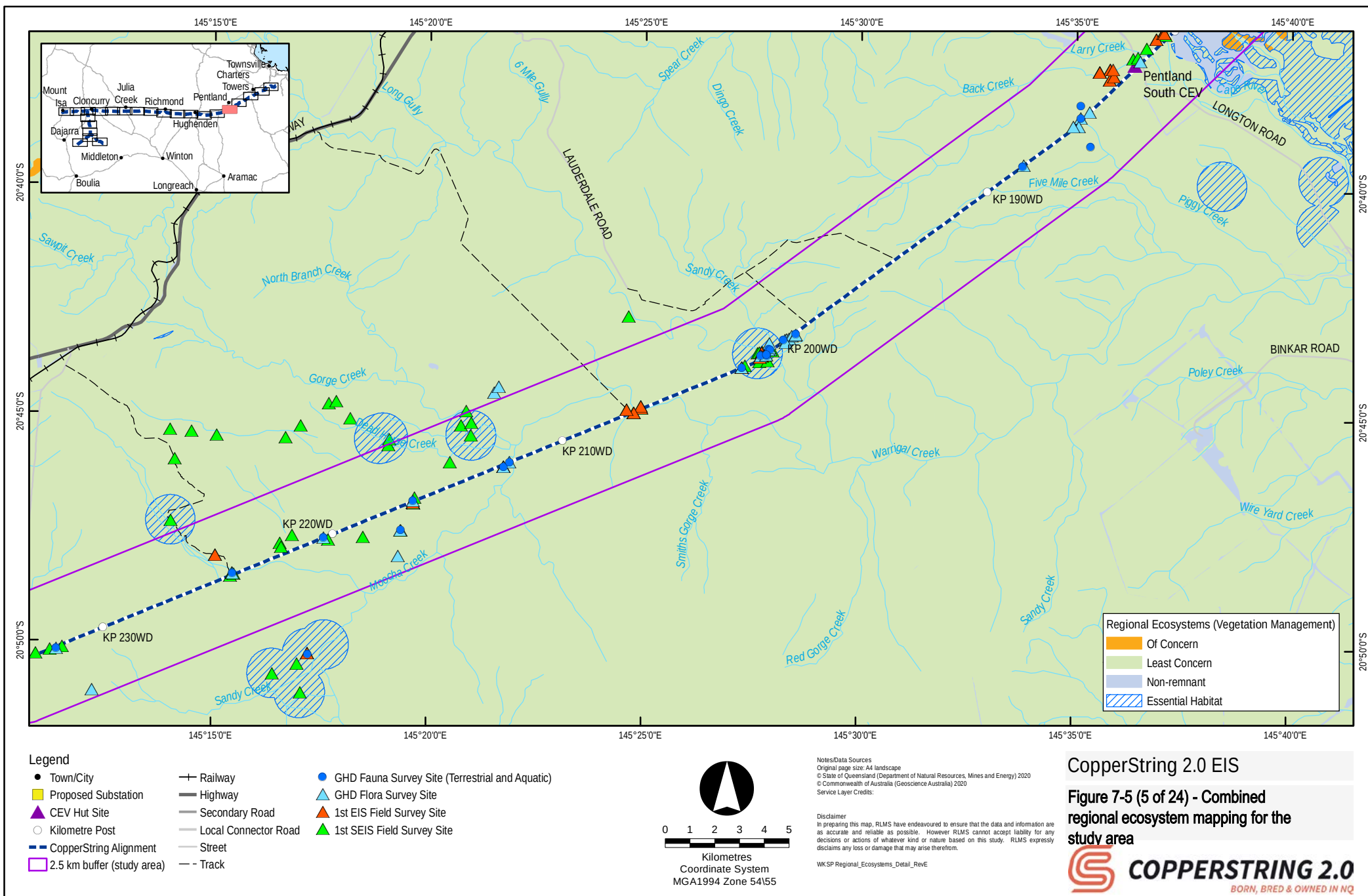


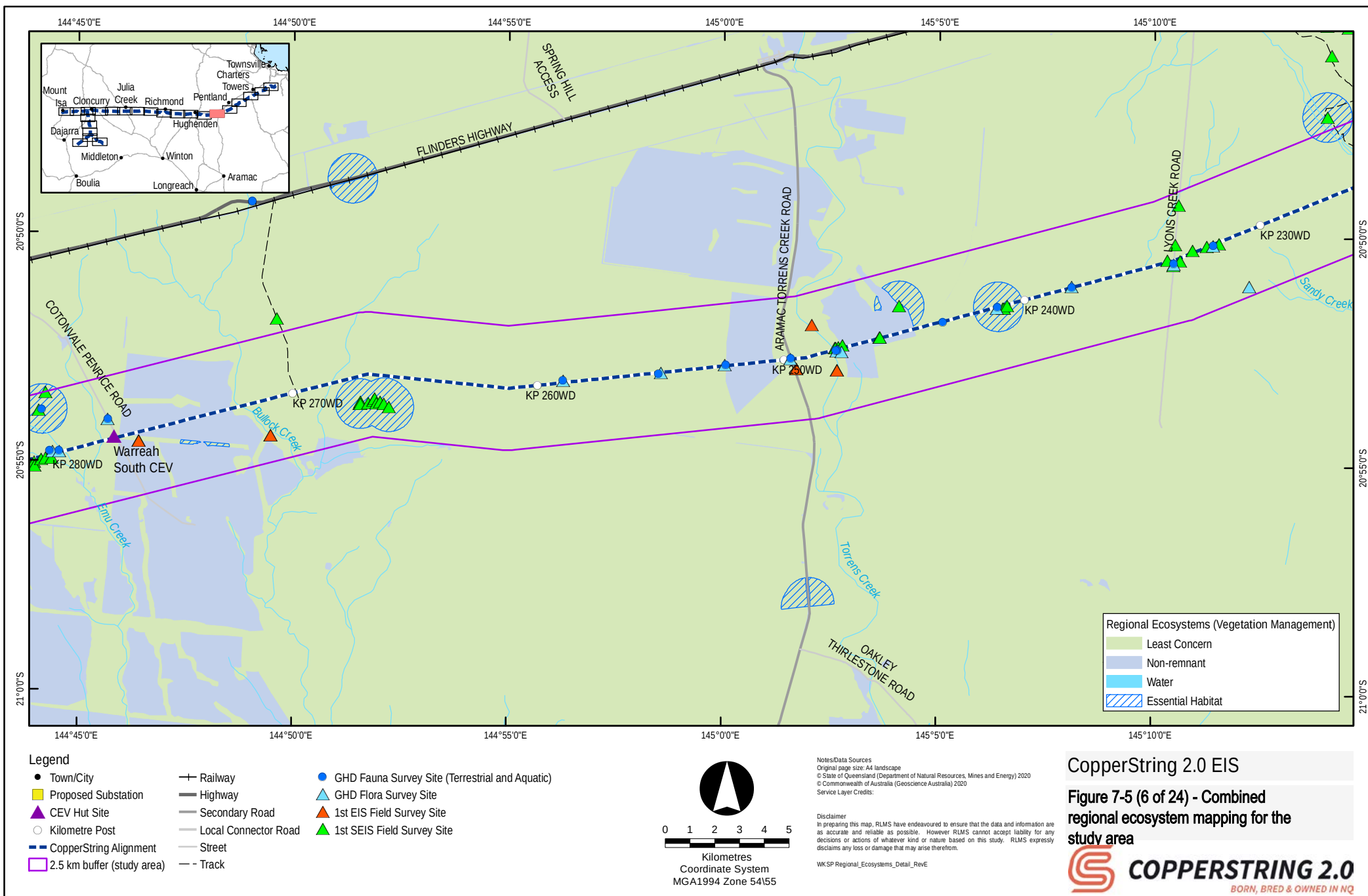


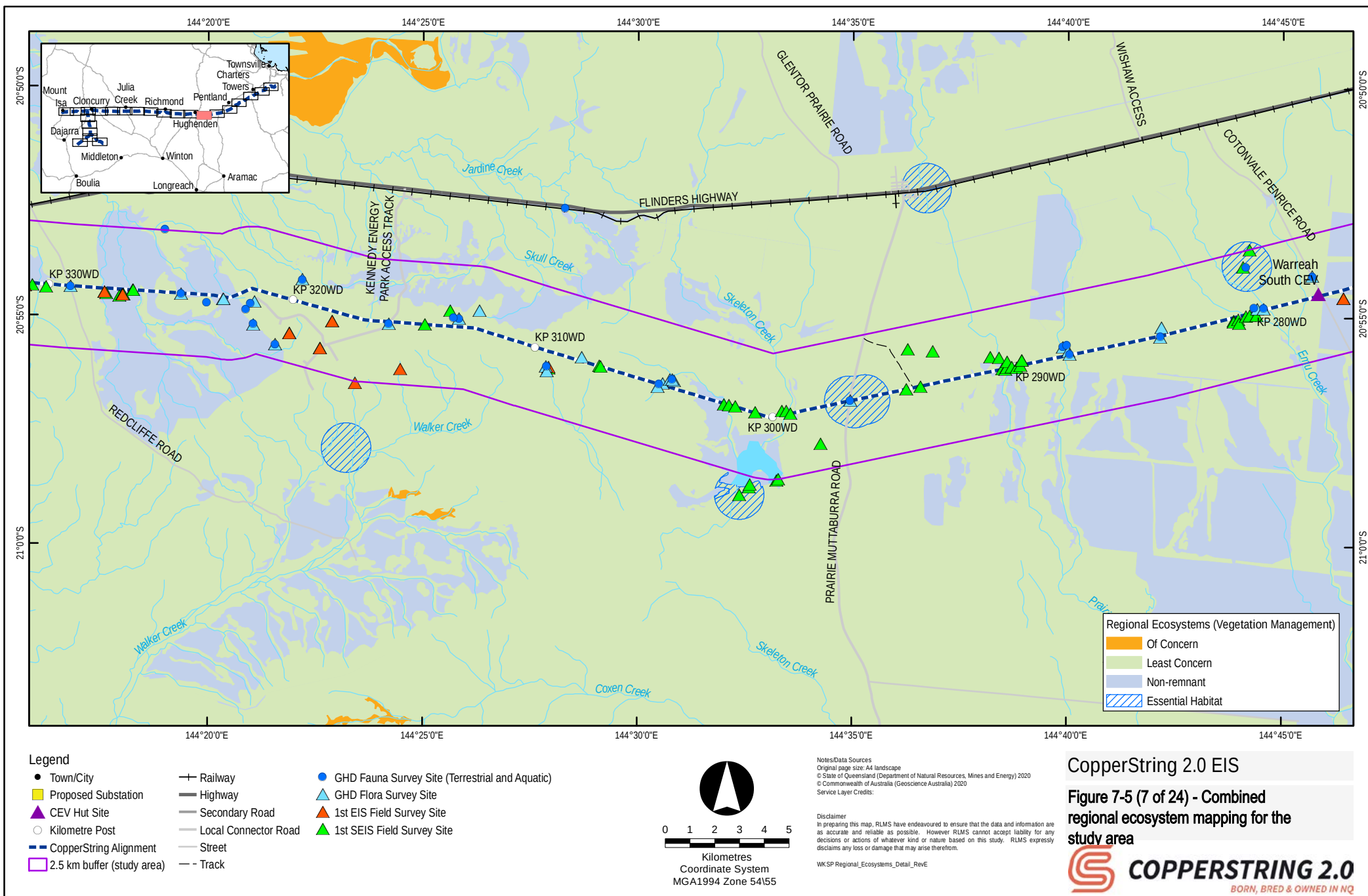


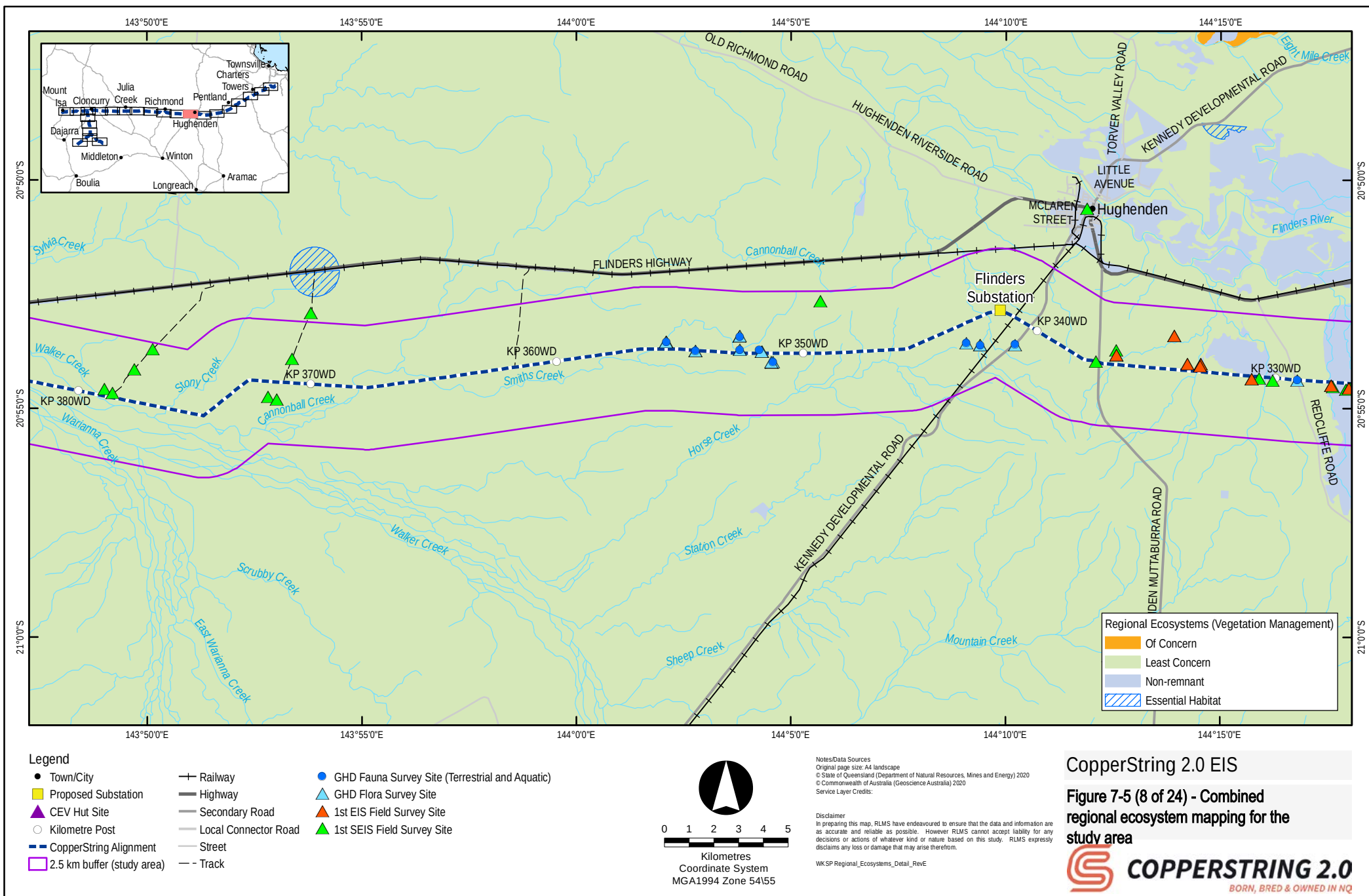


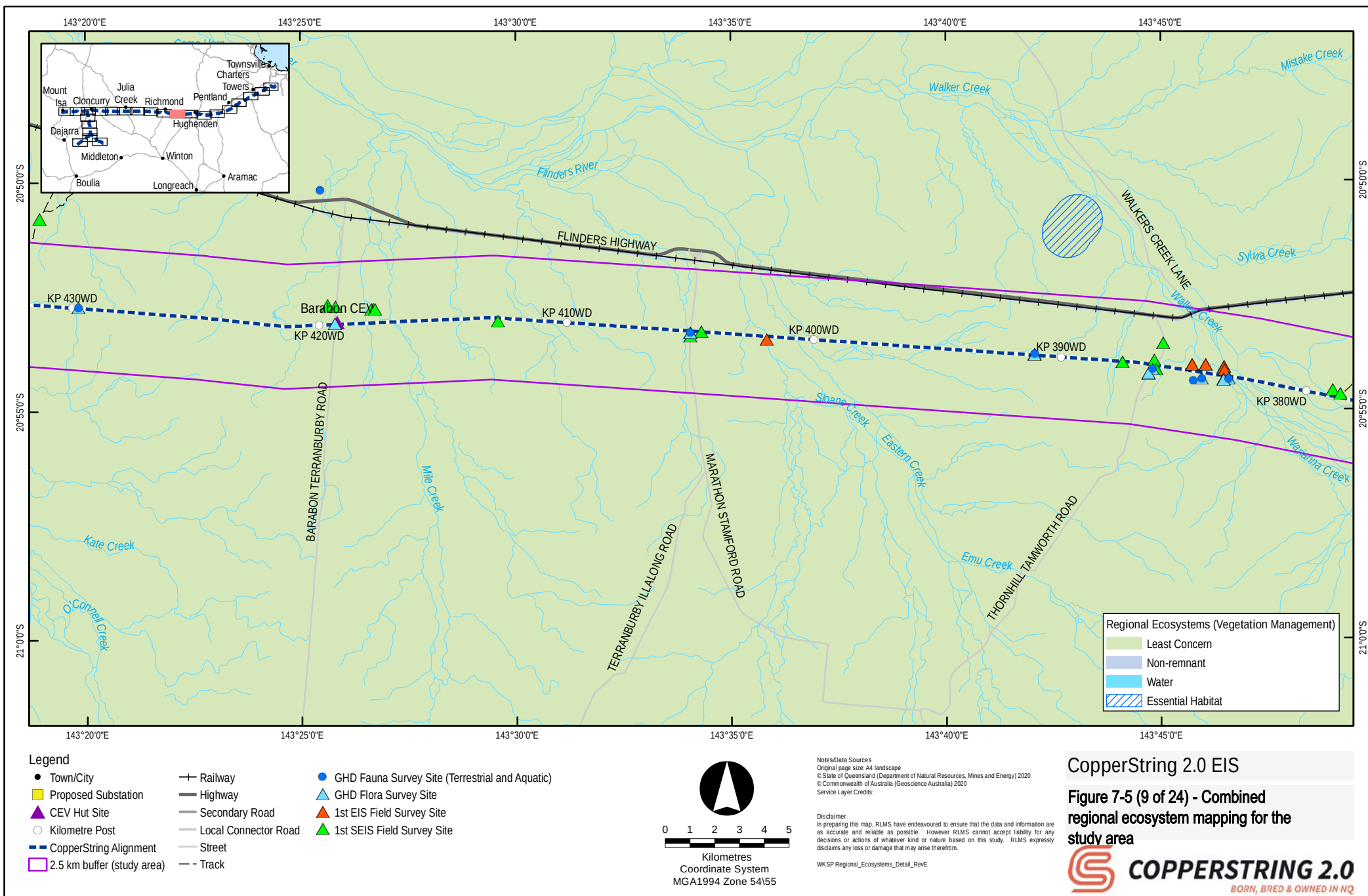


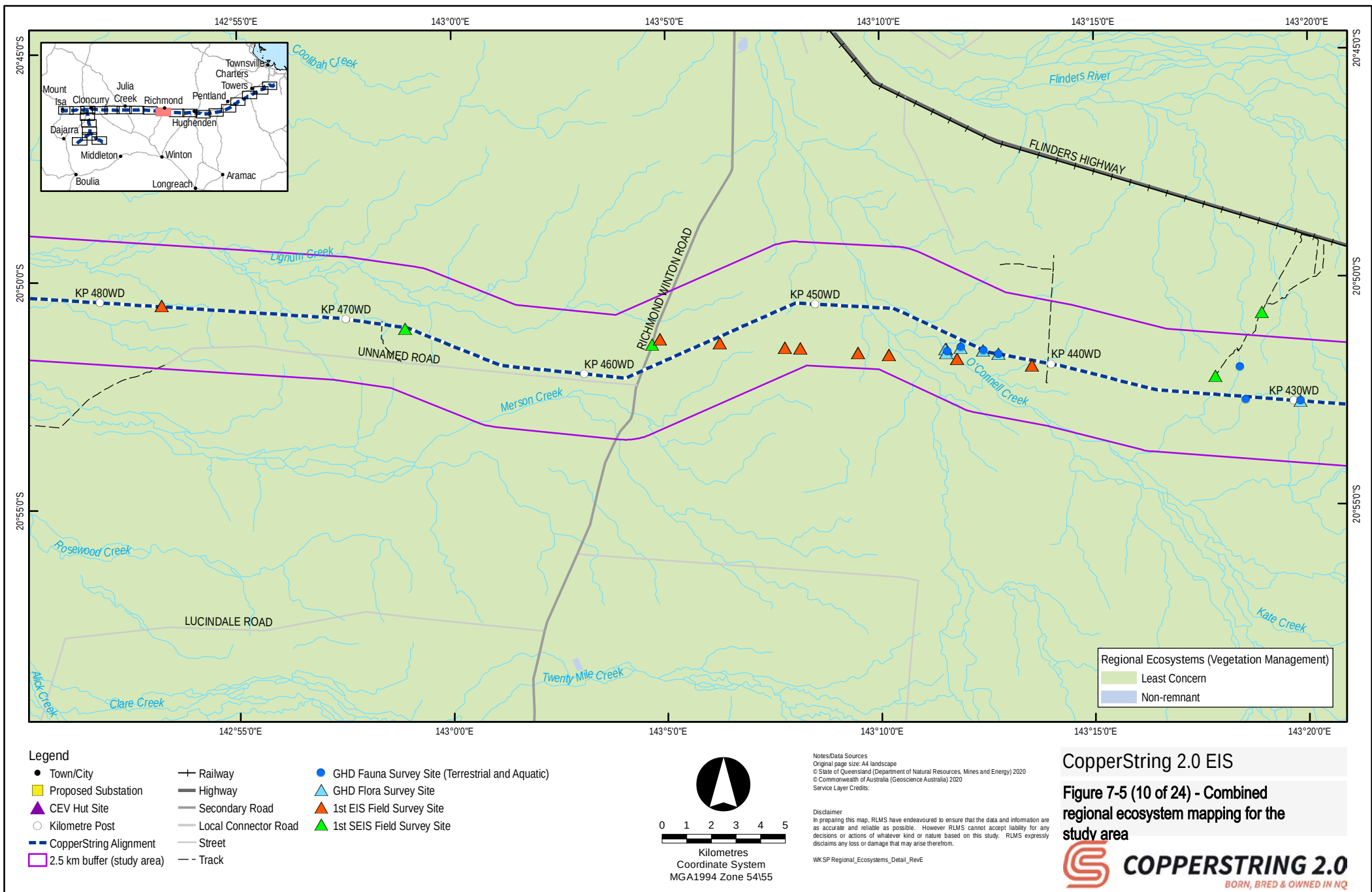


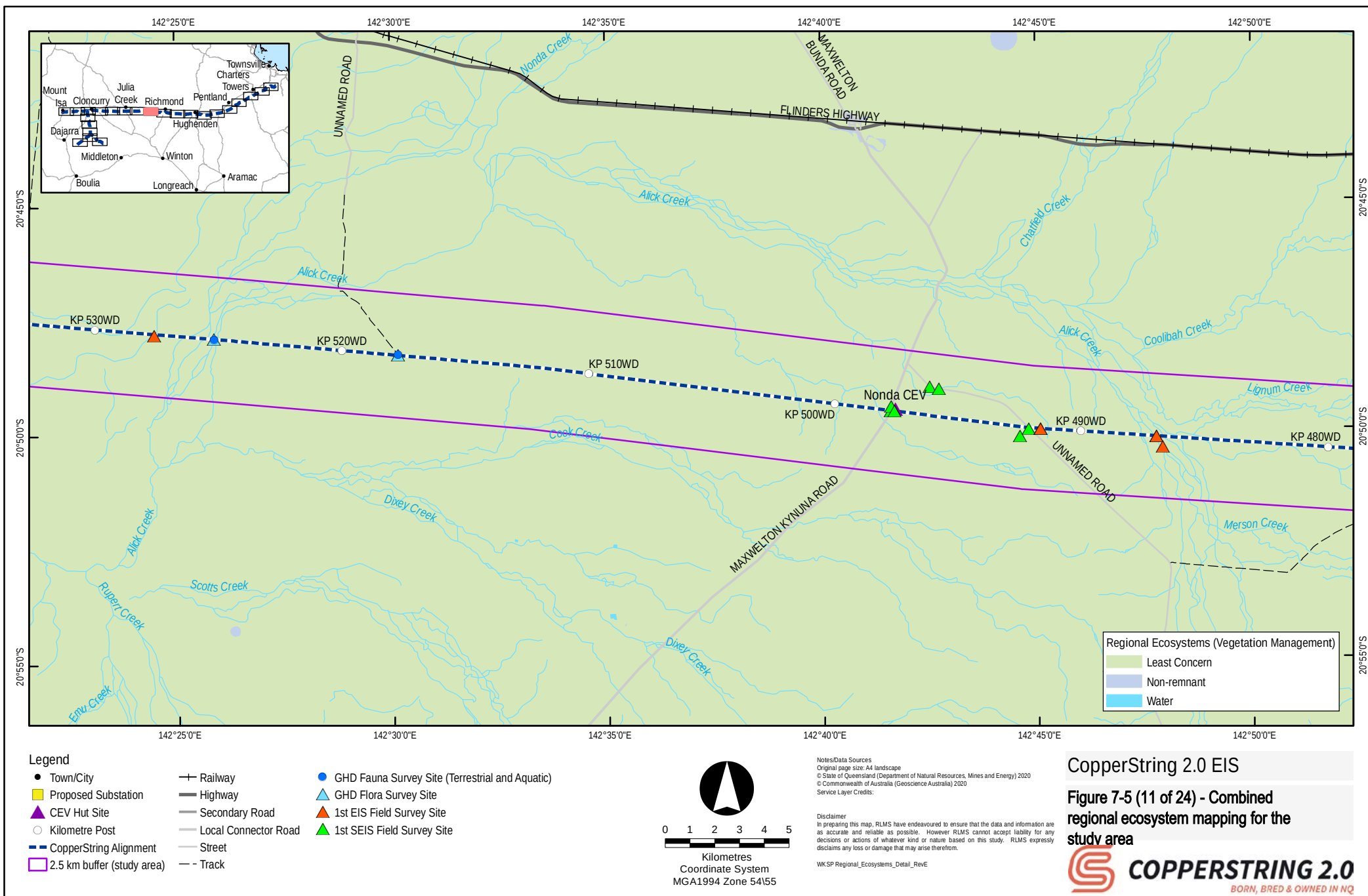


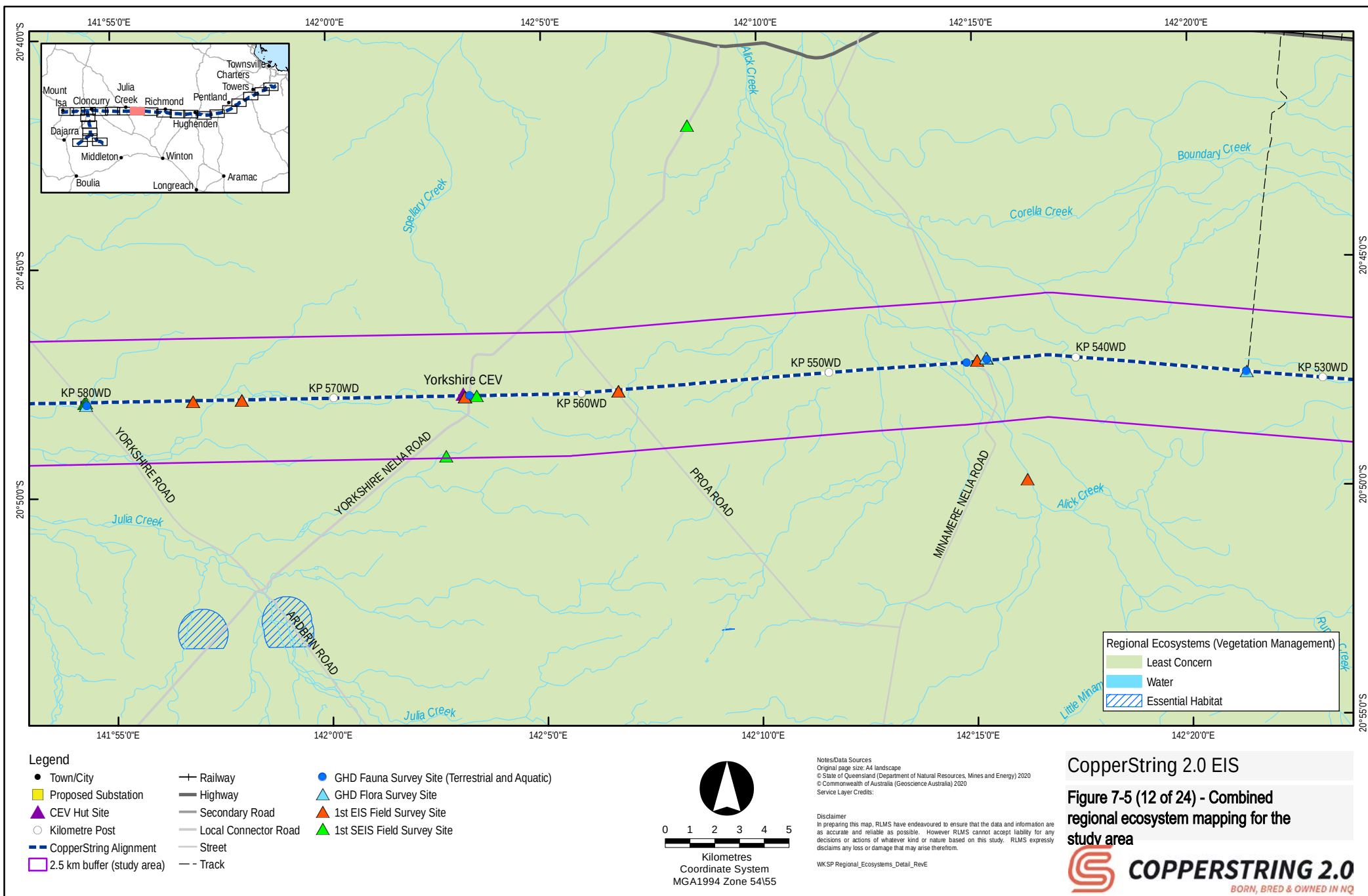


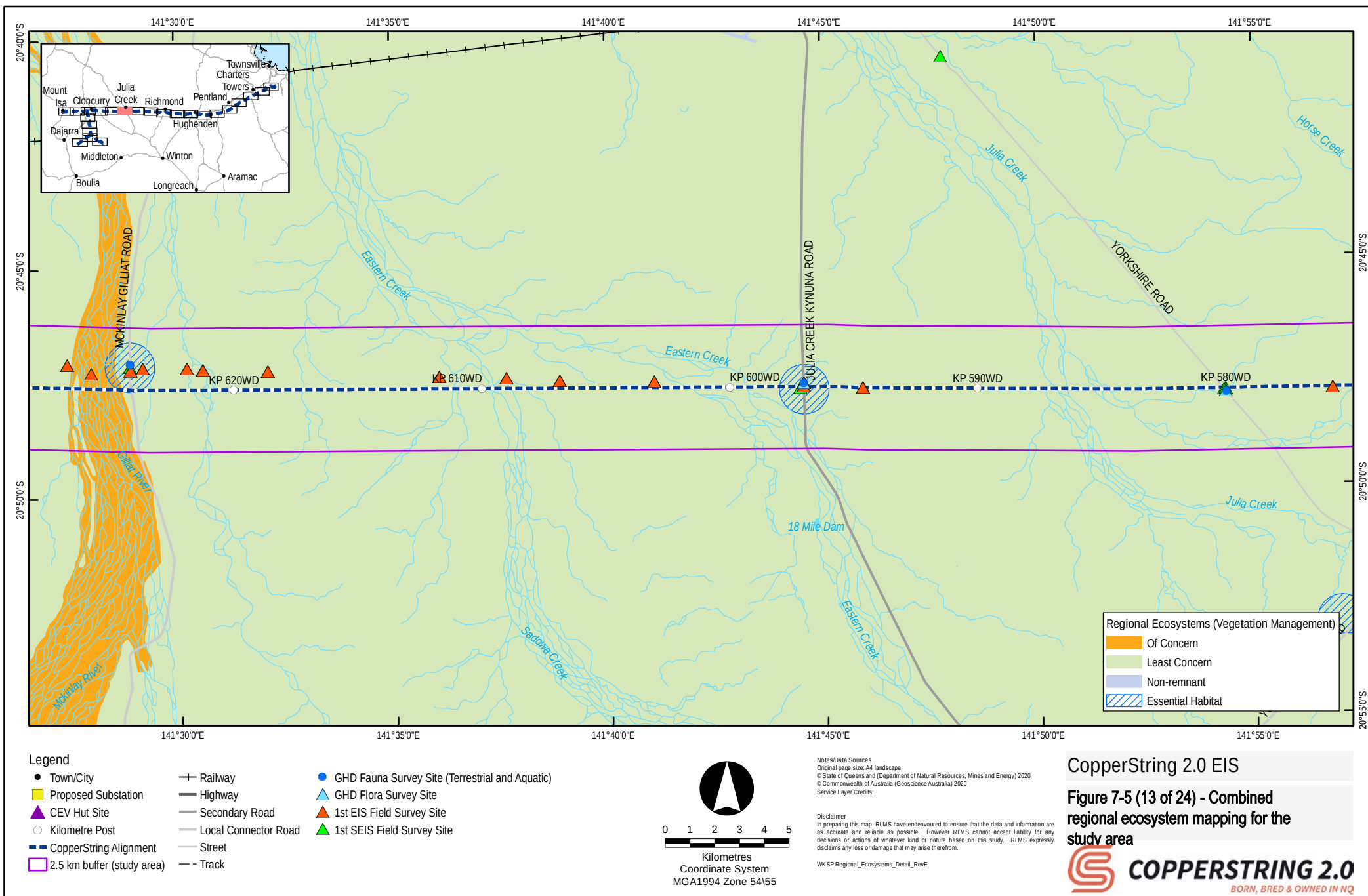


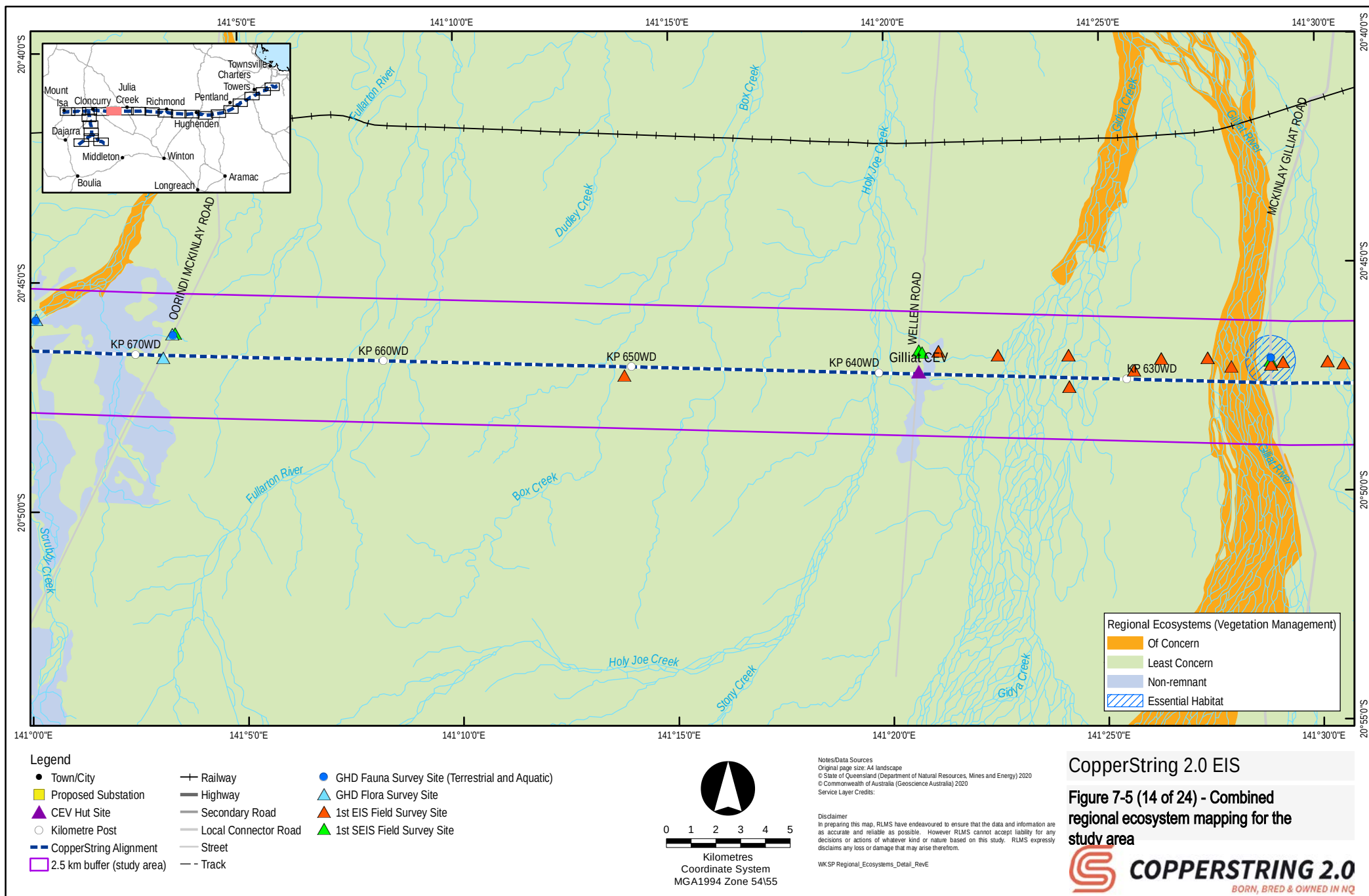


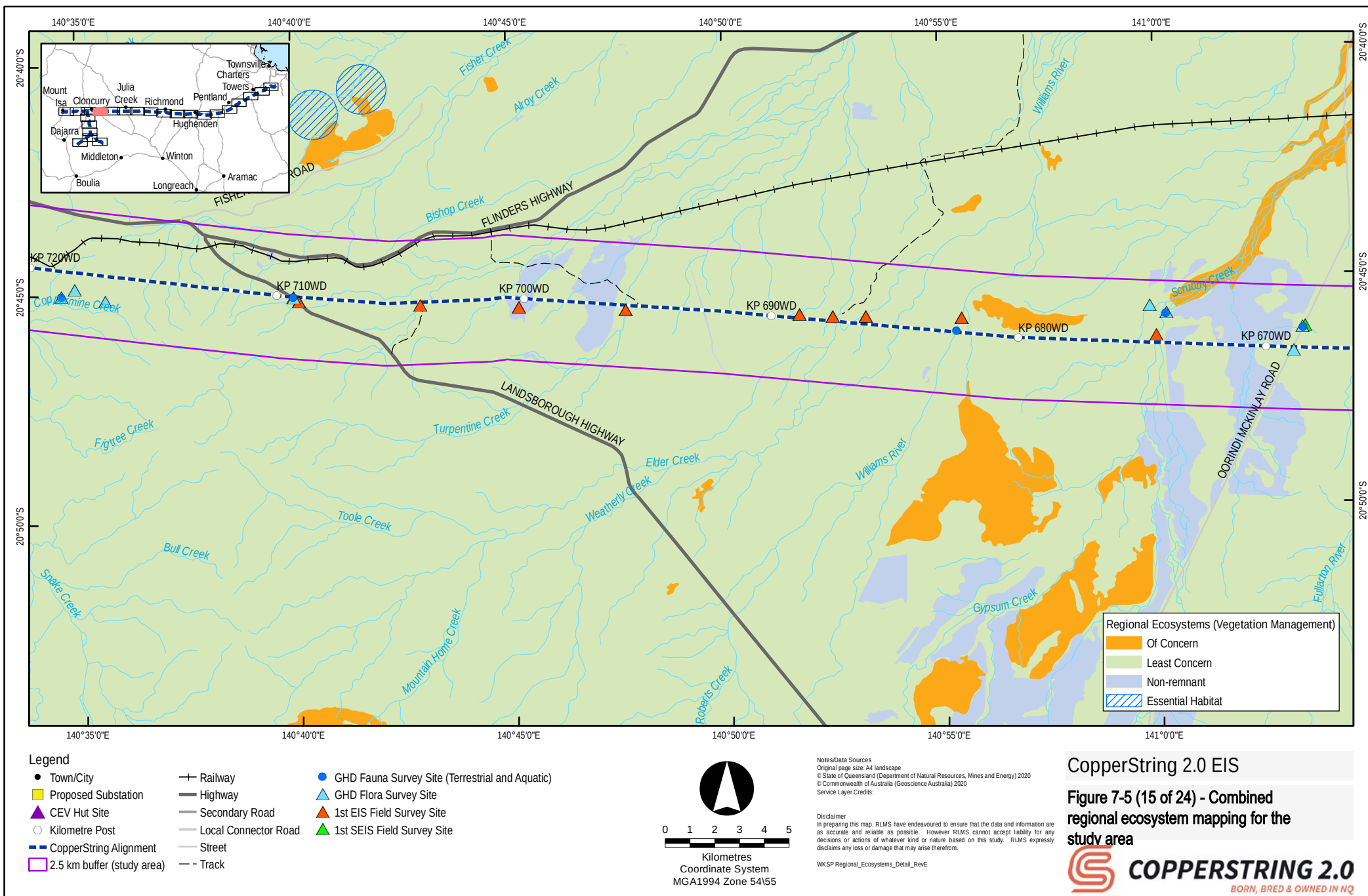


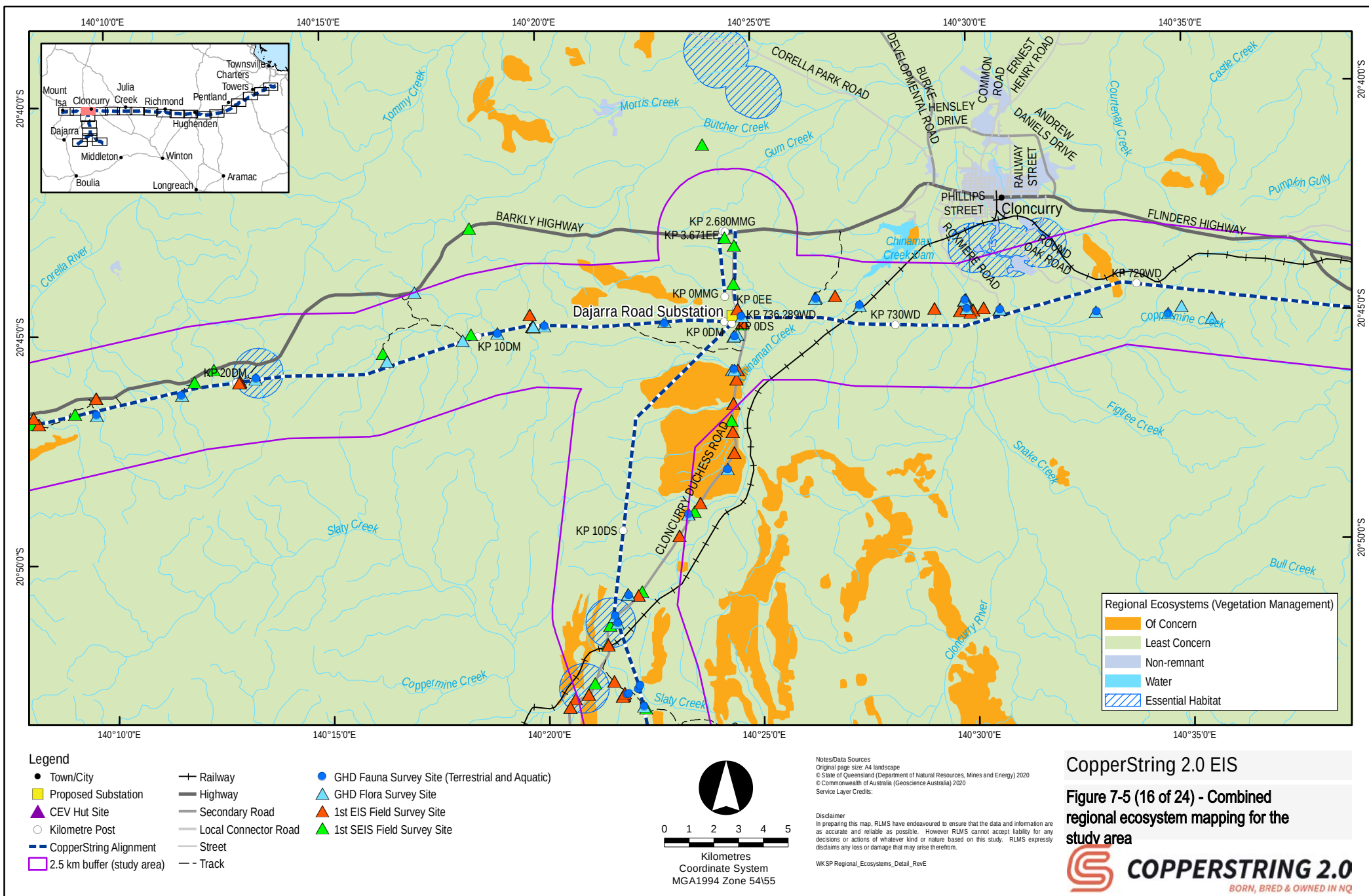


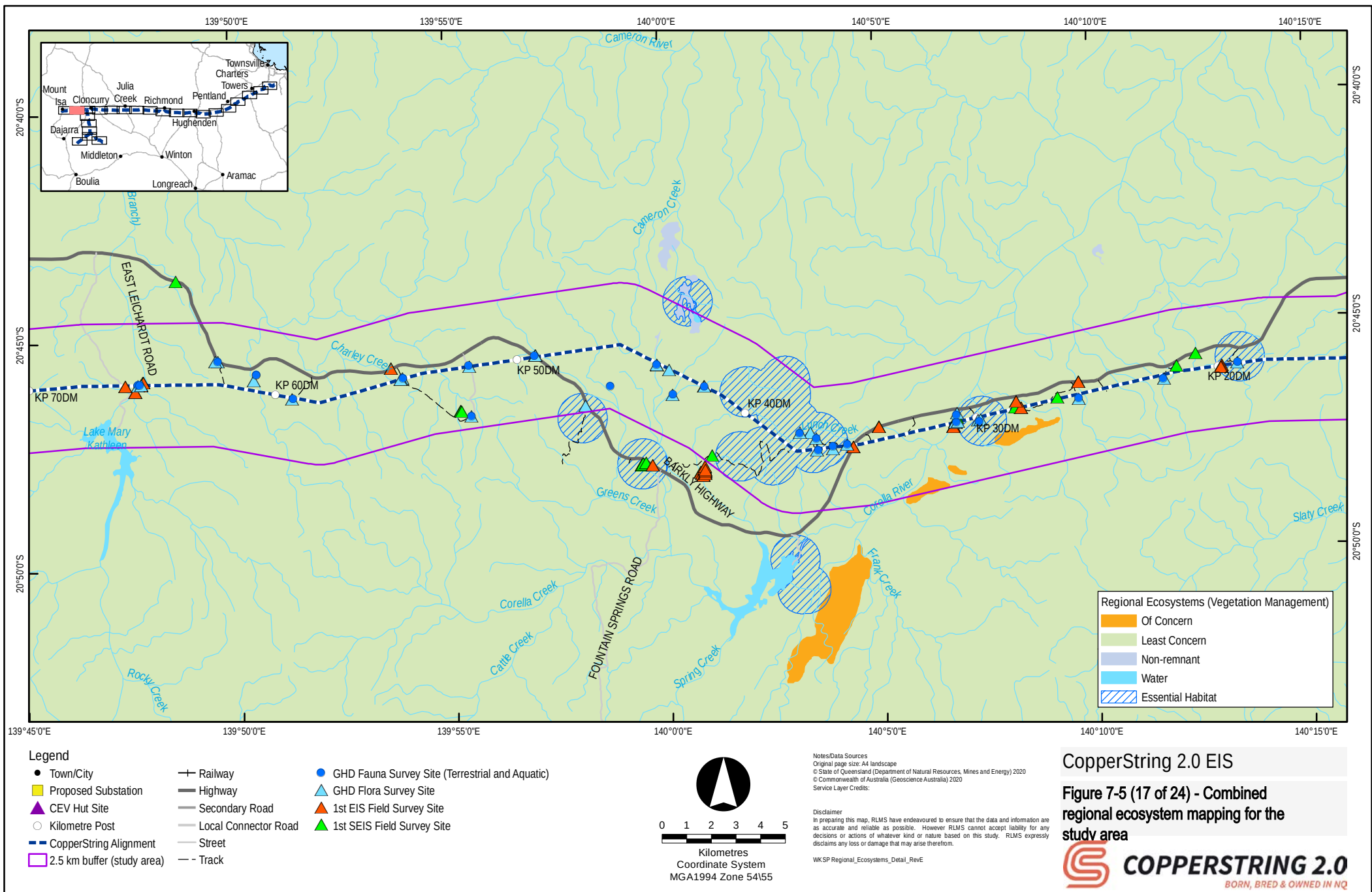


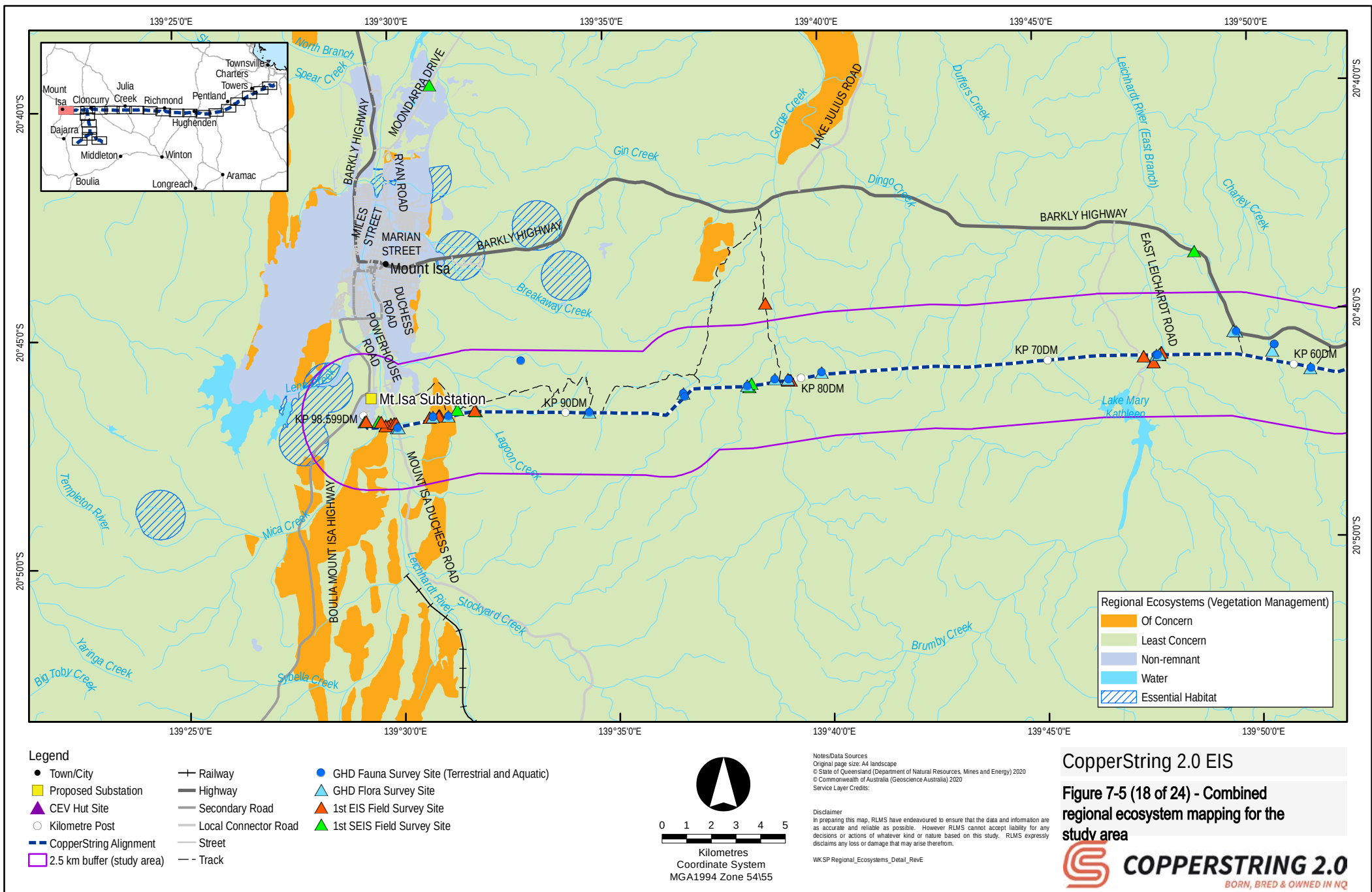


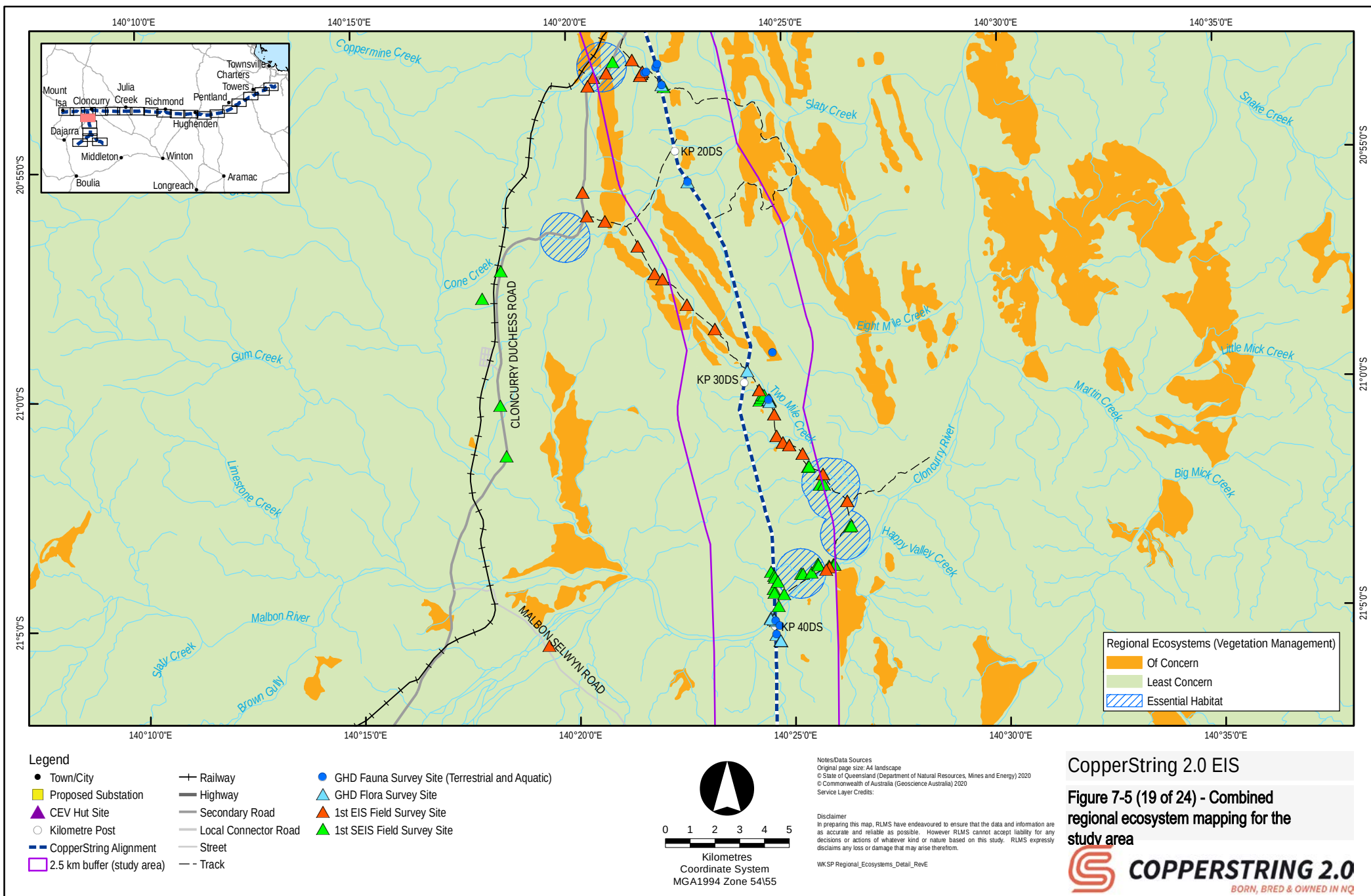


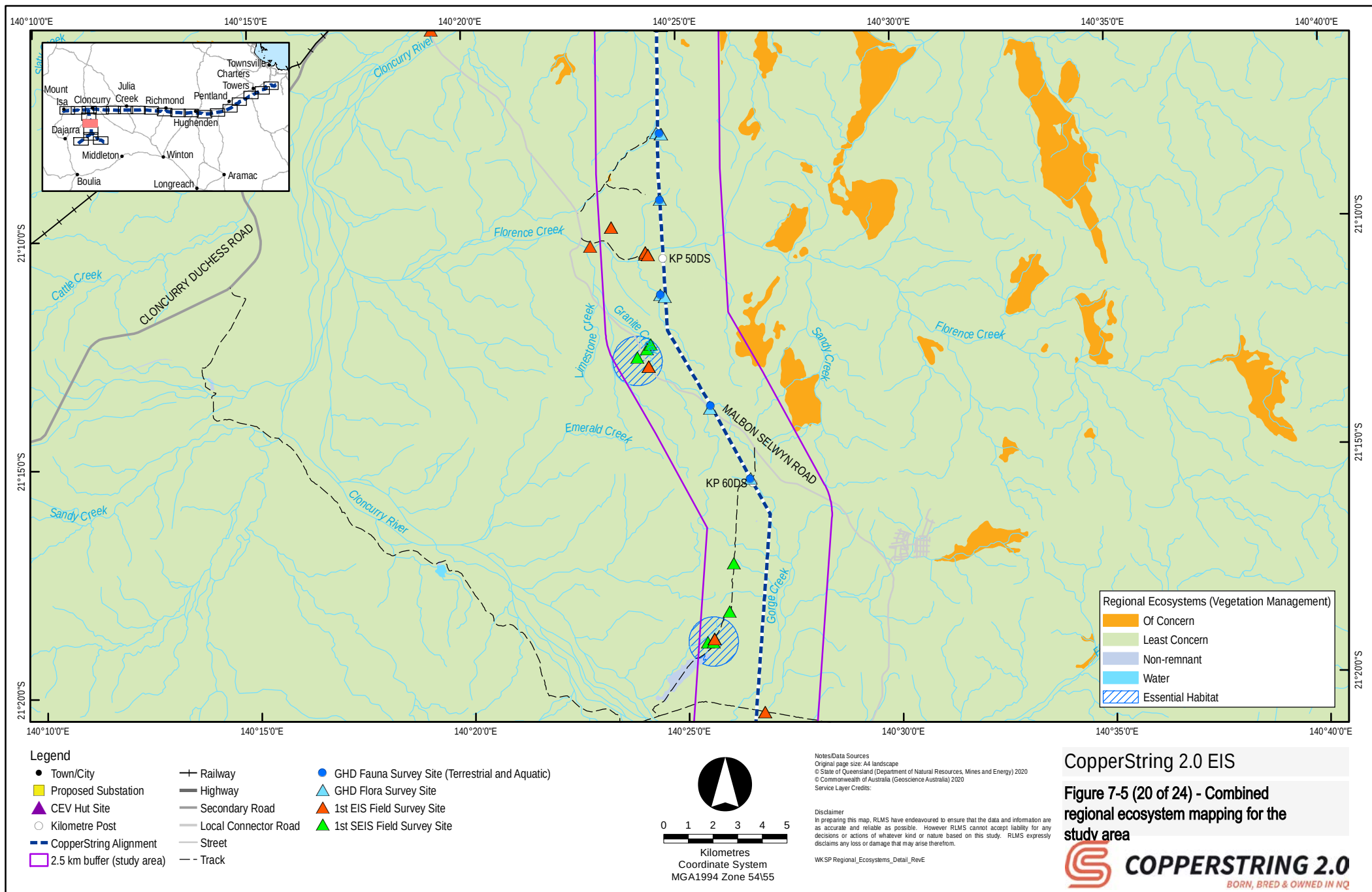


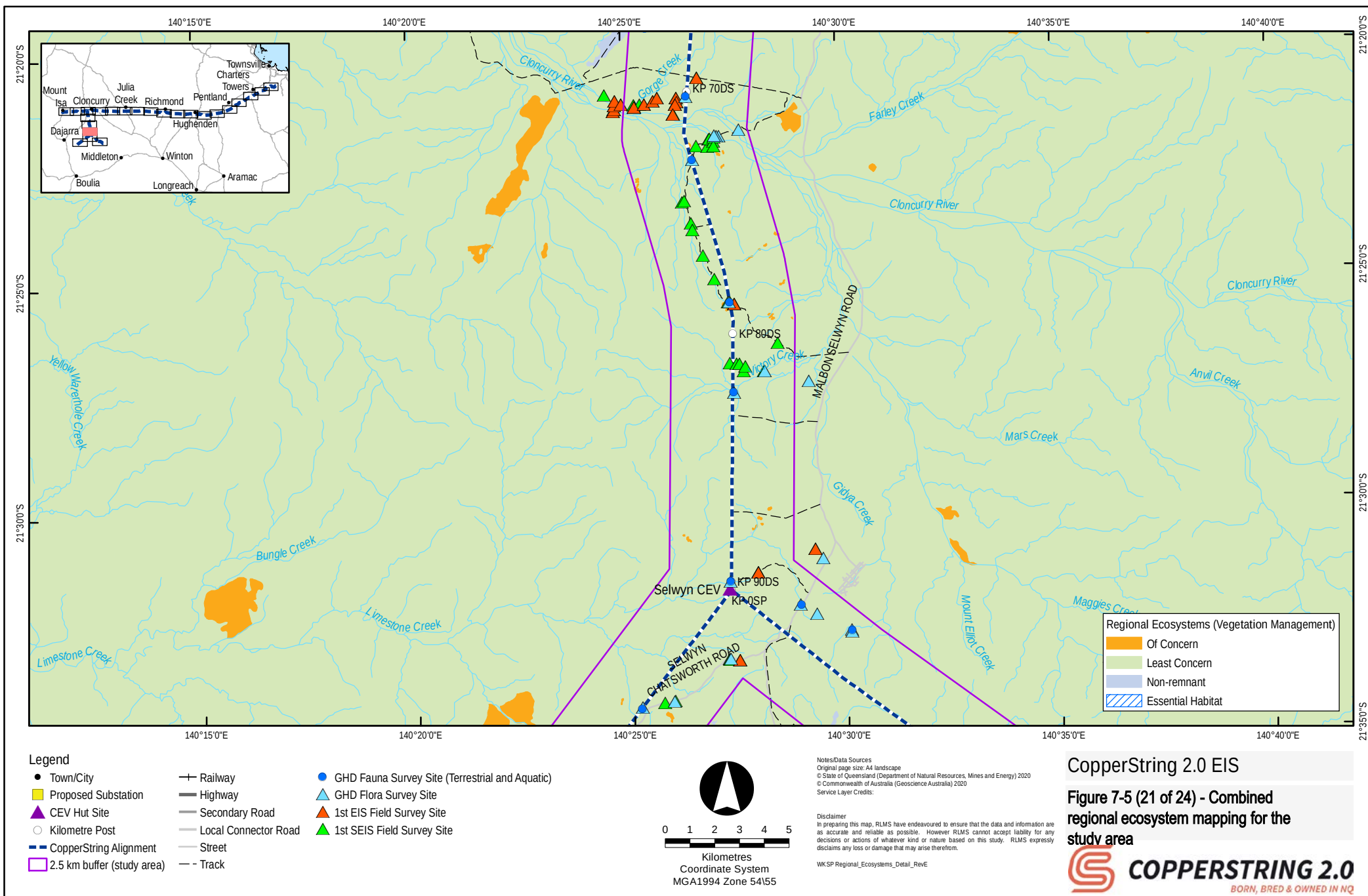


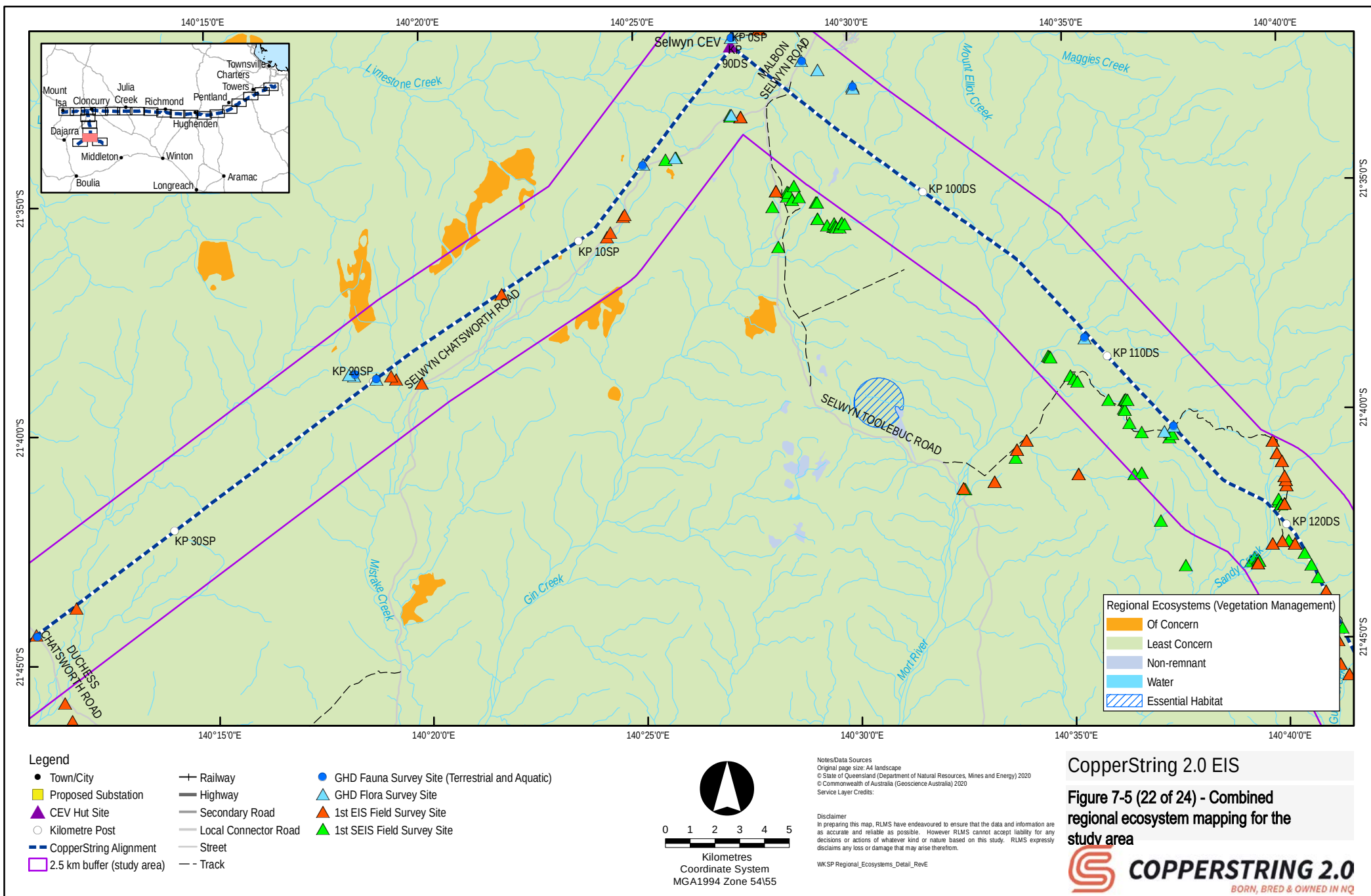


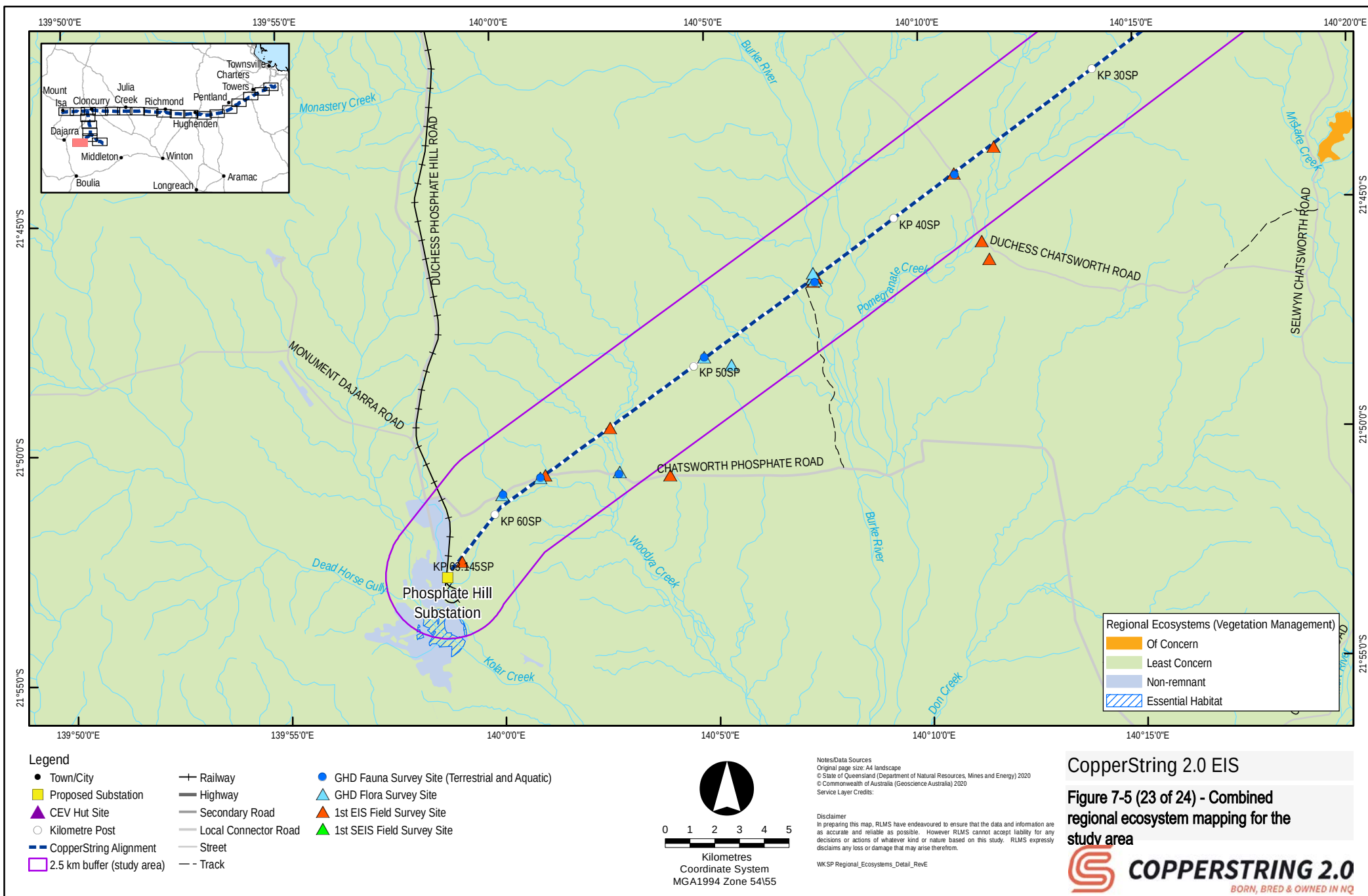


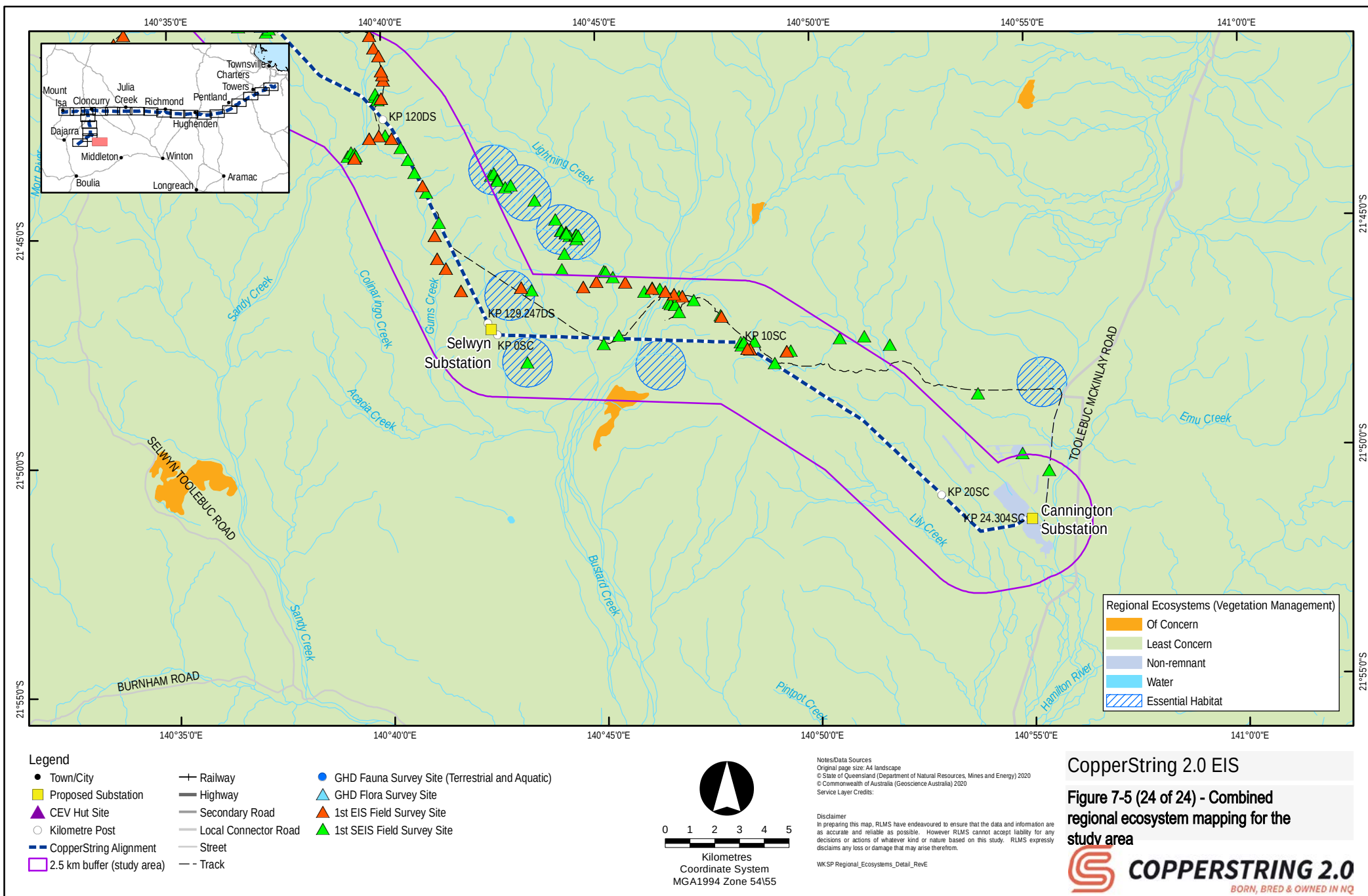












7.3.5 Flora species

Based on the likelihood of occurrence assessment, four conservation significant flora species have been confirmed present during field surveys for the Project:

- *Eucalyptus nudicaulis* (Vulnerable under the NC Act)
- *Eucalyptus raveretiana* (black ironbark) (Vulnerable under the EPBC Act)
- *Livistona lanuginosa* (waxy cabbage palm) (Vulnerable under the EPBC Act and NC Act)
- *Acacia armitii* (Near Threatened under the NC Act)

An additional conservation significant flora species was considered **likely to occur**:

- *Acacia crombiei* (pink gidgee) (Vulnerable under the EPBC Act and NC Act)

The habitat preferences of conservation significant flora species (under the NC Act) and their likelihood of occurrence are provided in Appendix B of Volume 3 Appendix P Ecological Assessment.

***Eucalyptus raveretiana* (Black ironbox)**

Eucalyptus raveretiana a tree to 30 m tall found along rivers and creeks from Rockhampton inland to the rivers north of Duaringa, and also inland from Sarina and Mackay north to Bowen and Townsville. This species was confirmed from two locations within the Renewable Energy Hub corridor section of the Project:

- Between KP 48-49WD along Oaky Creek (BAAM 2011 and GHD 2019)
- Along the Burdekin River south of the corridor selection (KP 65WD-66WD) (BAAM 2011).

The distribution of suitable habitat and records of *Eucalyptus raveretiana* is mapped in Figure 7-6.

***Livistona lanuginosa* (Waxy cabbage palm)**

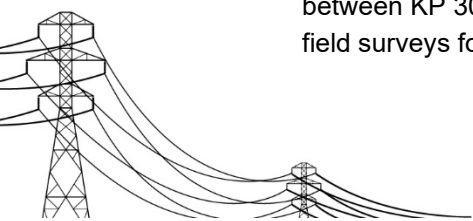
Livistona lanuginosa is endemic to the Burdekin-Ravenswood-Cape River area. The species typically occurs as scattered individuals along streams; with dense clusters being rare (Pettit and Dowe 2003). The species has been confirmed present within the study area from the following locations:

- Renewable Energy Hub corridor section at an eastern tributary of the Campaspe River (Oakey Creek) between KP 124-125WD. Ten individuals were recorded at this location, ranging from juveniles to 10 m tall between 115 m and 520 m from the corridor selection.
- On the Campaspe River, approximately 5 km north-west of KP 146WD
- At the proposed crossing of the Campaspe River at KP 137-139WD
- At the proposed crossing of a tributary (Oakey Creek) at KP 124WD

Suitable habitat has been mapped within the study area for RE polygons that contain the REs 9.3.1, 10.3.6, 10.3.13, 10.3.14, 10.3.31, 11.3.4, 11.3.25 (as mixed or single RE polygons), based on essential habitat factors and previously recorded habitats from the 2010 EIS and 2011 SEIS, where they occur along the 100 m buffer areas of watercourses. The distribution of potential habitat for *L. lanuginosa* is mapped in Figure 7-7.

Acacia crombiei

The known distribution of the species is centred on the Hughenden area north of the study area between KP 306-331WD. *Acacia crombiei* has not been recorded within the study area during field surveys for the Project. Targeted surveys were carried out for the 2010 EIS approximately



between KP 315-324WD (2011 alignment), 2011 SEIS between KP 298-328WD (2011 alignment), and GHD surveys in 2019, with no individuals observed. Suitable habitat has been mapped between KP 266WD and 435WD within RE polygons that are (or contain) RE 4.3.3, 4.3.4, 4.3.8, 4.3.14, 4.3.19, 4.3.20, 4.3.23, 4.9.1, 4.9.7, 4.9.8, 4.9.11, 9.8.5, 9.8.6, 9.8.7, 9.10.4, 9.12.18, 10.3.15, and 10.4.5. The distribution of potential habitat for *A. crombiei* is mapped in Figure 7-8.

Eucalyptus nudicaulis

Eucalyptus nudicaulis is a mallee with very restricted distribution, confined to some rocky gullies and steep hillsides in the Mount Isa – Cloncurry district of north-west Queensland. One individual was recorded during the 2019 surveys near KP 97.5 DM close to the corridor selection in very sparse low eucalypt woodland to 5 m dominated by *Corymbia capricornia* (with associated *Eucalyptus pruinosa* and *E. odontocarpa*), *Acacia spp.* dominated shrub layer to 2 m, and *Triodia sp.* and other grasses in the ground layer. Suitable habitat has been mapped at elevations above 400 m on quartz or quartzite (as per the mapped geology lithology summary), west of KP 5DM along the Mount Isa Augmentation corridor section. The distribution of potential habitat and the confirmed record of *E. nudicaulis* is mapped in Figure 7-9.

Acacia armitii

Acacia armitii was confirmed present from the following locations within the study area:

- 280 m north of (current) KP 181WD
- 125 m north-west between (current) KP 200-201WD - recorded as three multi-stemmed individuals on the margins of the ephemeral sandy drainage line within RE 10.3.13.
- 1.2 km north of (current) KP 214WD – scattered on margins of ephemeral drainage line in RE 10.3.13
- 2.5 km north of (current) KP 217WD – recorded as widely scattered mature individuals at a density of +/-3 plants per 50 m of creek bank, with saplings present, on margins of ephemeral drainage line dissecting sand plain with outcrops of sandstone on banks and bed in RE 10.3.13.

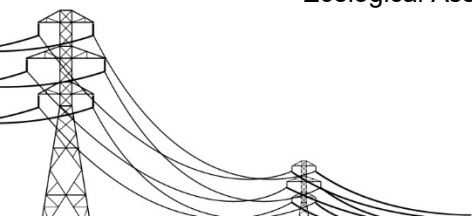
During the 2020 field surveys targeted searches were undertaken during the fruiting period for this species and confirmed present within the areas of predicted habitat. *Acacia armitii* was recorded as co-occurring with *A. torulosa*. Additional occurrences of *Acacia armitii* were recorded during the 2020 survey within the predicted area of occurrence.

The preferred habitat, with the most number of individuals recorded was located on watercourses with a stream order of one or two., this species was not found on watercourses with a stream order of five or larger.

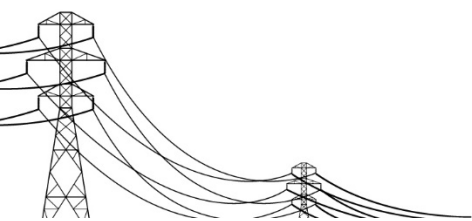
Suitable habitat has been mapped within a 20 m buffer of all watercourses with a stream order of four and below between KP 178WD and 223WD. The occurrence and mapped potential habitat for this species is shown in Figure 7-10.

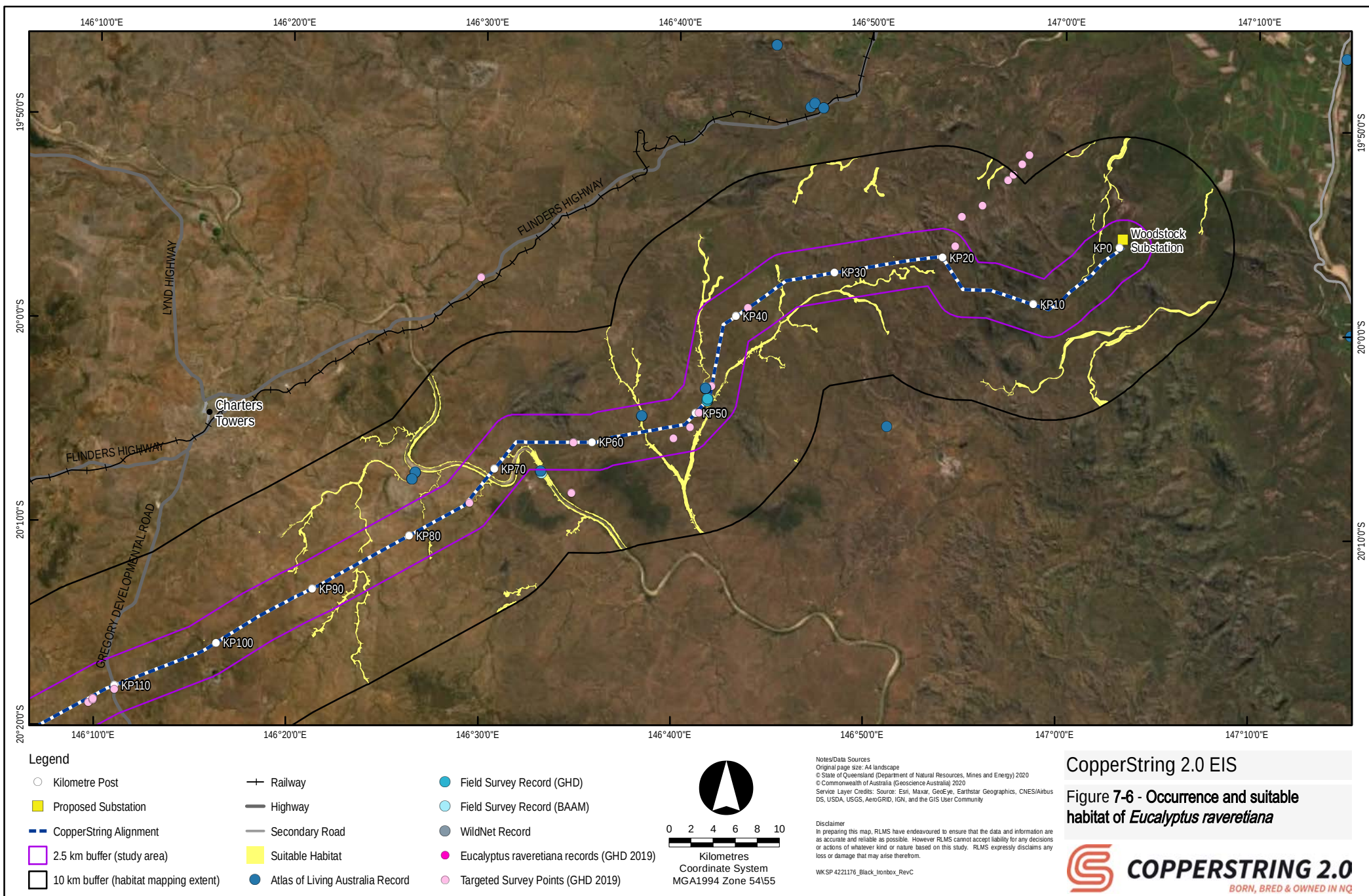
Weed species

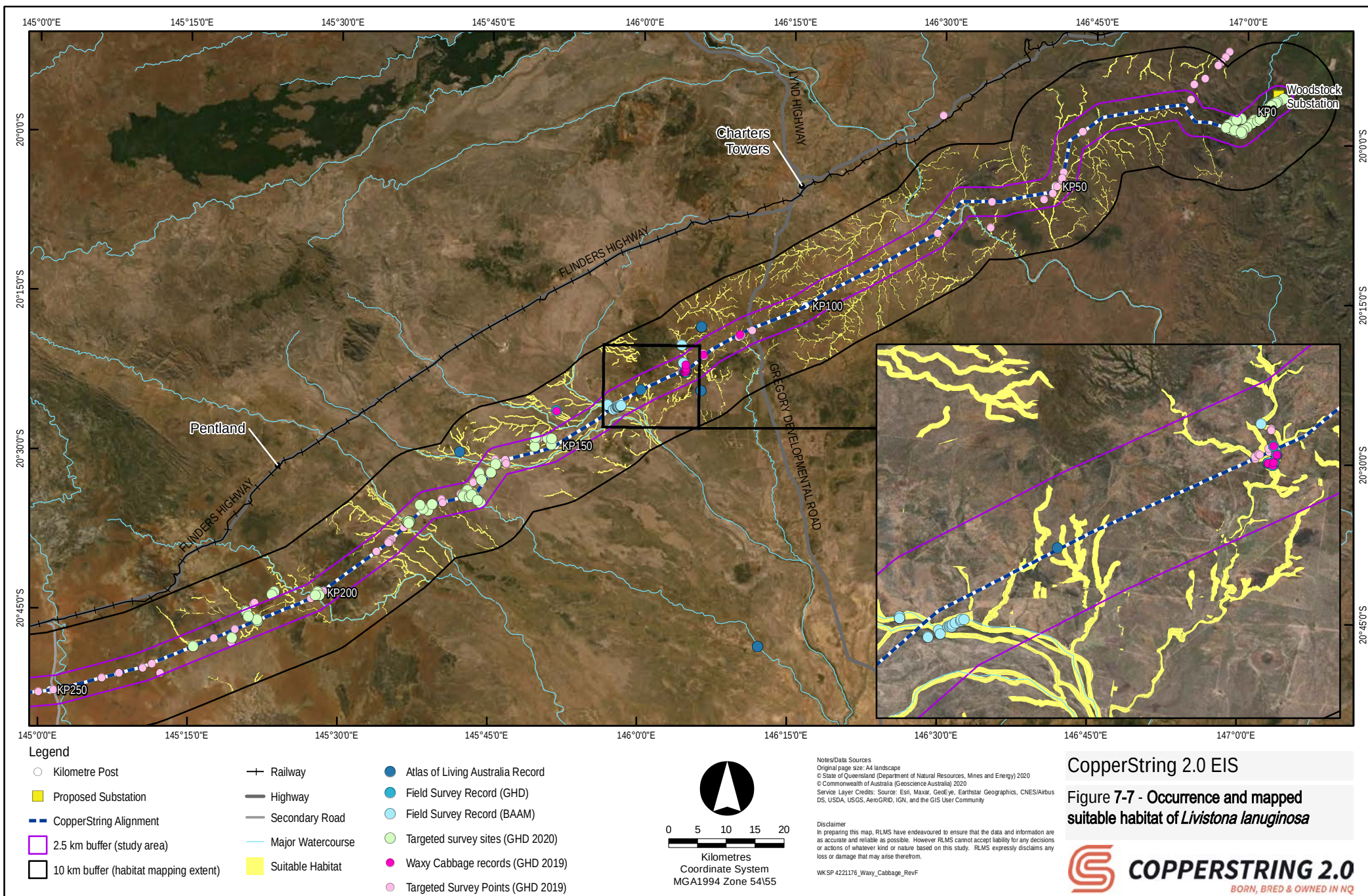
A total of 12 restricted invasive weed species were recorded during the field surveys. Past field surveys reported the presence of 43 exotic species within the study area, including five species listed as Weeds of National Significance (WoNS). The distribution and species recorded largely align with previous field surveys undertaken. For information on invasive weed species, refer to Volume 3 Appendix U Concept biosecurity plan or Section 4.5.1 of Volume 3 Appendix P Ecological Assessment.

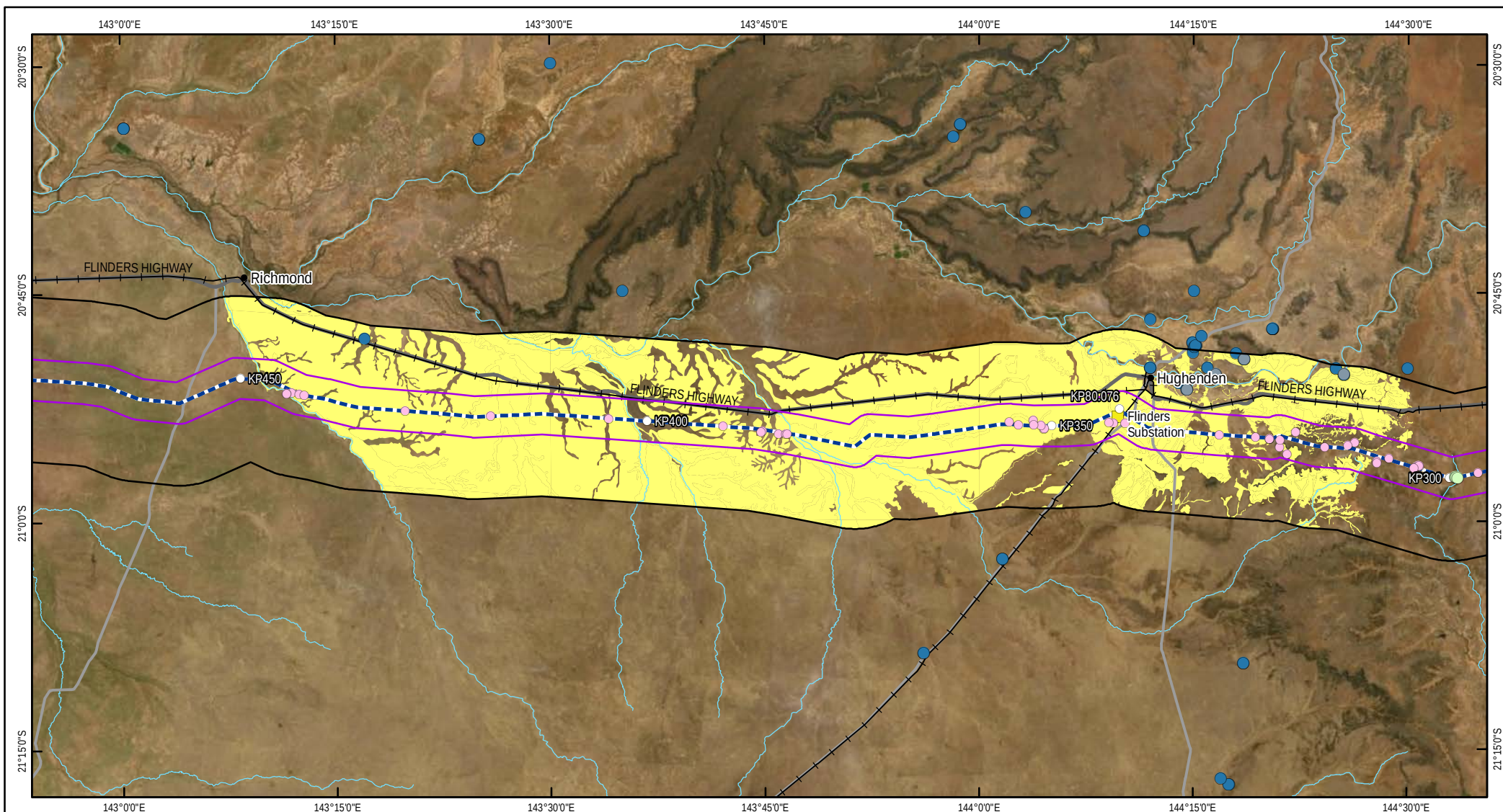


A comprehensive description of the mapped REs, regulated regrowth vegetation and essential habitat and restricted invasive species occurring within and adjacent to the preliminary investigation corridor is presented in Section 4.2.3 of Volume 3 Appendix P Ecological Assessment.



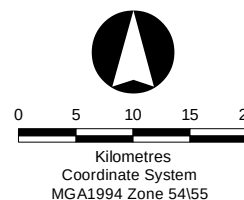






Legend

- Kilometre Post
- Proposed Substation
- - - CopperString Alignment
- 2.5 km buffer (study area)
- 10 km buffer (habitat mapping extent)
- + Railway
- Highway
- Secondary Road
- Major Watercourse
- Suitable Habitat
- Atlas of Living Australia Record
- WildNet Record
- Targeted survey sites (GHD 2020)
- Targeted Survey Points (GHD 2019)



Notes/Data Sources
Original page size: A4 landscape
© State of Queensland (Department of Natural Resources, Mines and Energy) 2020
© Commonwealth of Australia (Geoscience Australia) 2020
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

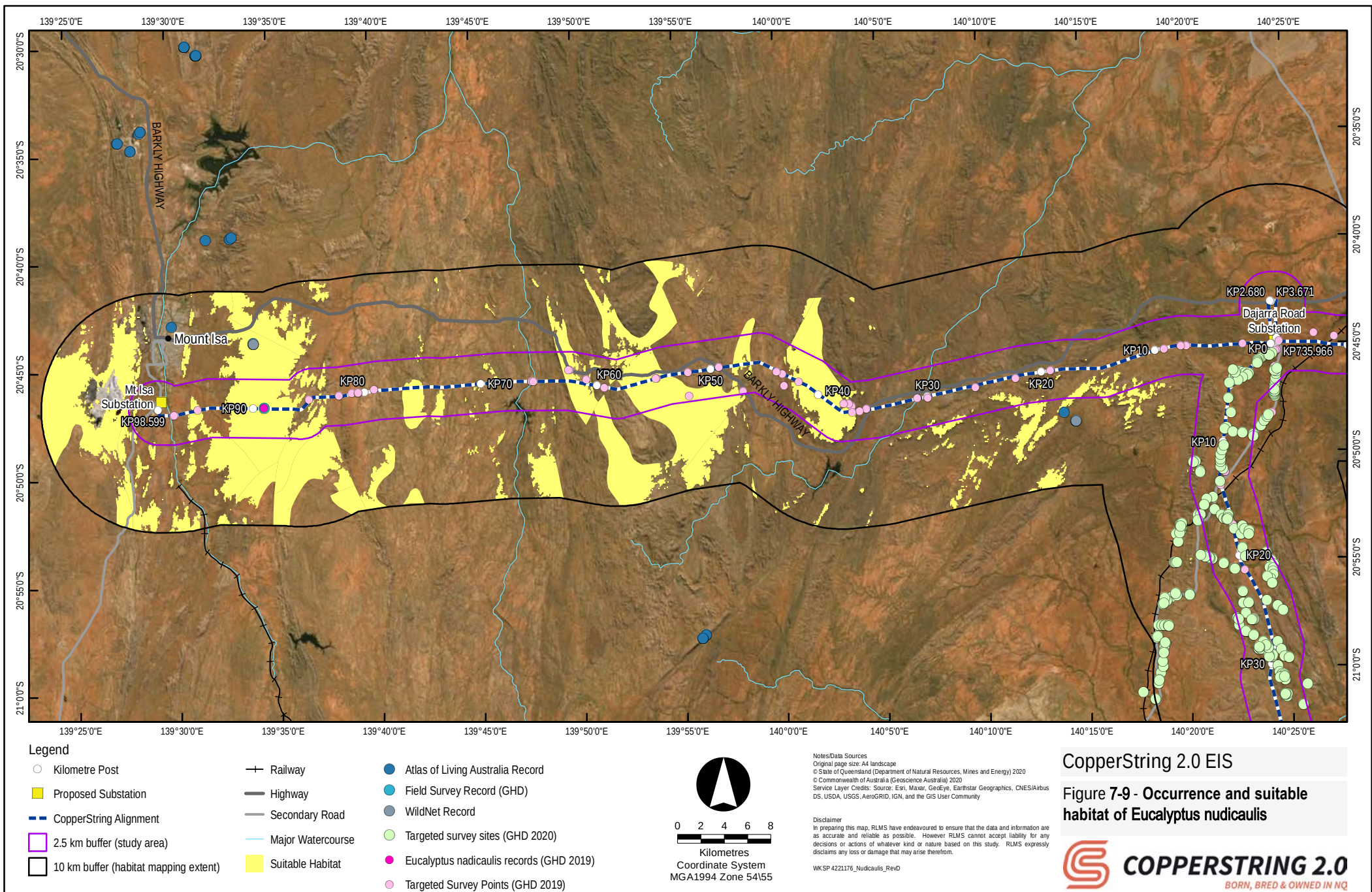
Disclaimer
In preparing this map, RLMS have endeavoured to ensure that the data and information are as accurate and reliable as possible. However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study. RLMS expressly disclaims any loss or damage that may arise therefrom.

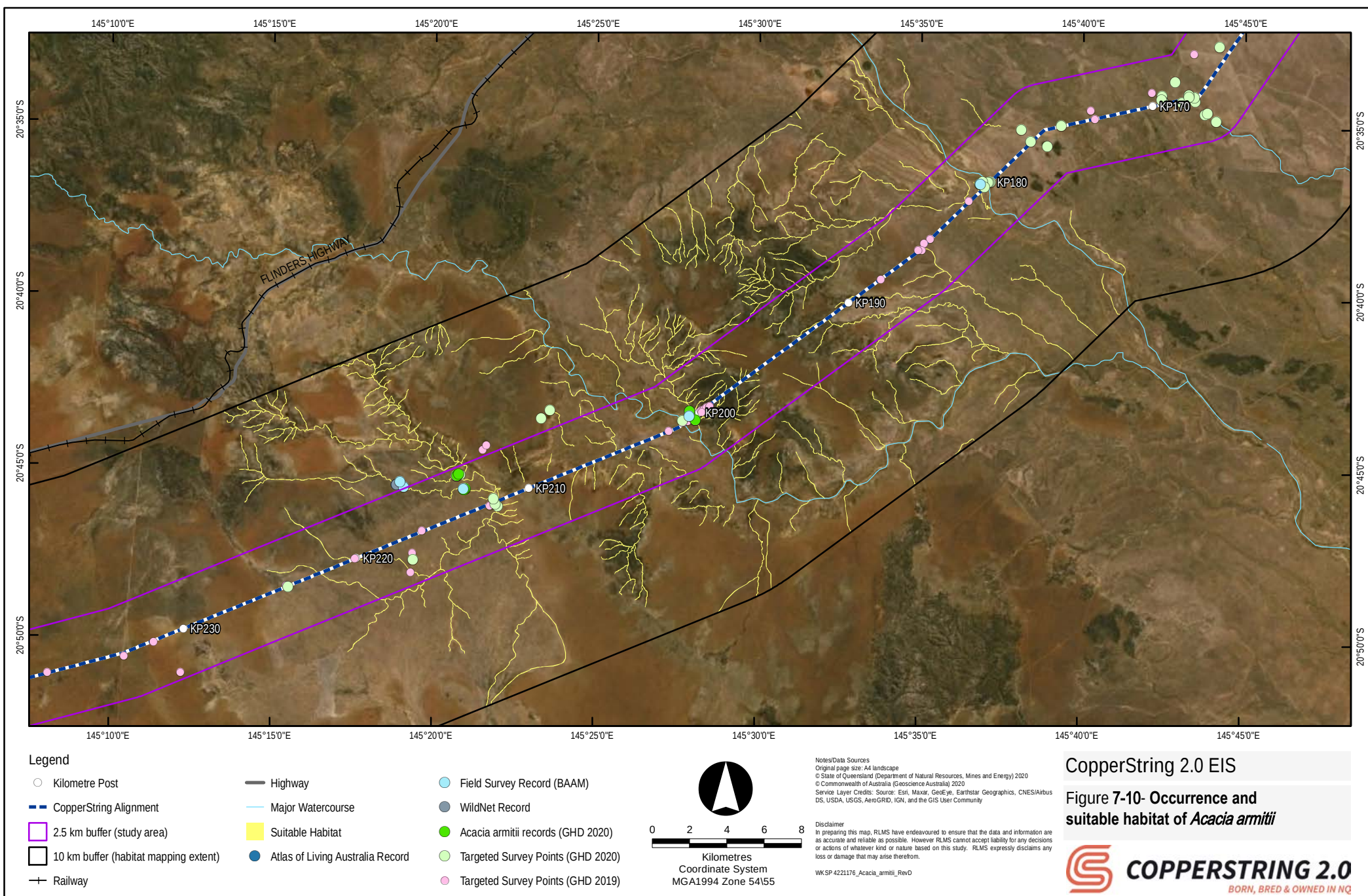
WK SP 4221176_Acacia_crombiei_RevE

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Figure 7-8 - Occurrence and suitable habitat of *Acacia crombiei*







7.3.6 Terrestrial fauna habitats

The Project grades from arid and semi-arid environments in the west and centre, to more coastally influenced sub-tropical environments in the east. Land form varies from rugged rocky ranges in the west, to broad grassy floodplains in the centre and more coastally influenced woodland habitats and grasslands in the east. Grazing intensity and fire history both play a substantial role in determining the diversity and structural complexity of the understorey and ground layers. While much of the Project area has been subject to generations of cattle grazing, this typically occurs at low to moderate densities, particularly to the west, where the ground layer is dominated by spinifex and therefore less conducive to intensive grazing. Twelve broad terrestrial fauna habitat types were observed within the Project area as detailed below and Table 7-5 (mapped in Figure 7-11 using the BVG 1:5 million scale mapping categories):

- Eucalypt low open woodlands usually with a spinifex understorey
 - Rocky escarpments (mapped as BVG 6)
 - Low shrubby woodland with spinifex ground layer (mapped as BVG 6)
 - Low woodland on rocky rises (mapped as BVG 6)
- Open woodland with spinifex ground layer (mapped as BVG 14)
- Mulga woodlands and shrublands (mapped as BVG 9)
- Open woodland with grassy ground layer (mapped as BVG 3, 5, and 11)
- Wetlands and swamps (mapped as BVG 15)
- Mitchell grassland on cracking clay plains (mapped as BVG 13)
- Low gidgee woodland on rocky flats (mapped as BVG 10)
- Riparian woodland on ephemeral watercourses (mapped as BVG 4)
- Melaleuca open woodlands (mapped as BVG 8)
- Semi evergreen vine thicket (mapped as BVG 1)
- Cleared land (mapped as non-remnant).

Rocky hillsides and fringing riparian vegetation represent the highest habitat values within the study area, providing important resources and microhabitats for a range of birds, reptiles, mammals and amphibians. Large amounts of fallen woody debris and timber at present across parts of the study area. These areas retain modified habitat values for a variety of mammals and reptiles. Dams have been constructed across the study area and natural waterholes occur within isolated sections of semi-permanent watercourses. These provide semi-permanent (to permanent) drinking sites that would be utilised by birds, mammals and provide breeding sites for amphibians fish and turtles.

Table 7-5 Terrestrial fauna habitat types observed within the study area

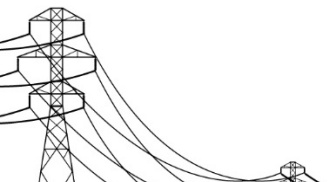
Habitat type	Characteristics	Ecological values
Rocky escarpments		
	• Very sparse, low canopy • Very patchy shrub layer • Patchy spinifex dominated ground layer • Steep rock, boulders and overhangs • Caves and hollows present • Complex ground level microhabitats	• Foraging and nesting habitat for finches, quails, wrens and • Foraging habitat for raptors • Microhabitats for skinks, dragons, geckos, snakes and other reptiles • Refuge and foraging habitat for macropods • Potential conservation significant species – purple-necked rock wallaby, night parrot, echidna
Low shrubby woodland with spinifex ground layer		
	• Low sparse canopy layer • Patchy shrub layer, dense in some areas. • Dense spinifex ground layer • Sandy and stony substrate • Presence of logs, woody debris, rocks or other complex ground-level microhabitats	• Foraging and nesting habitat for finches, quails, wrens and • Foraging habitat for raptors • Microhabitats for skinks, dragons, geckos, snakes and ground-dwelling mammals • Refuge and foraging habitat for macropods • Potential conservation significant species – purple-necked rock wallaby, night parrot, echidna.
Low woodland on rocky rises		
	• Sparse mature Eucalypt canopy layer • Patchy shrub layer • Ground layer dominated by tussocky native grasses • Sandy and stony substrate	• Nesting and foraging habitat for woodland and shrub-dwelling birds • Microhabitats for skinks, geckos, dragons, monitors and snakes • Foraging habitat for macropods and other ground-dwelling mammals • Potential conservation significant species – squatter pigeon, echidna.

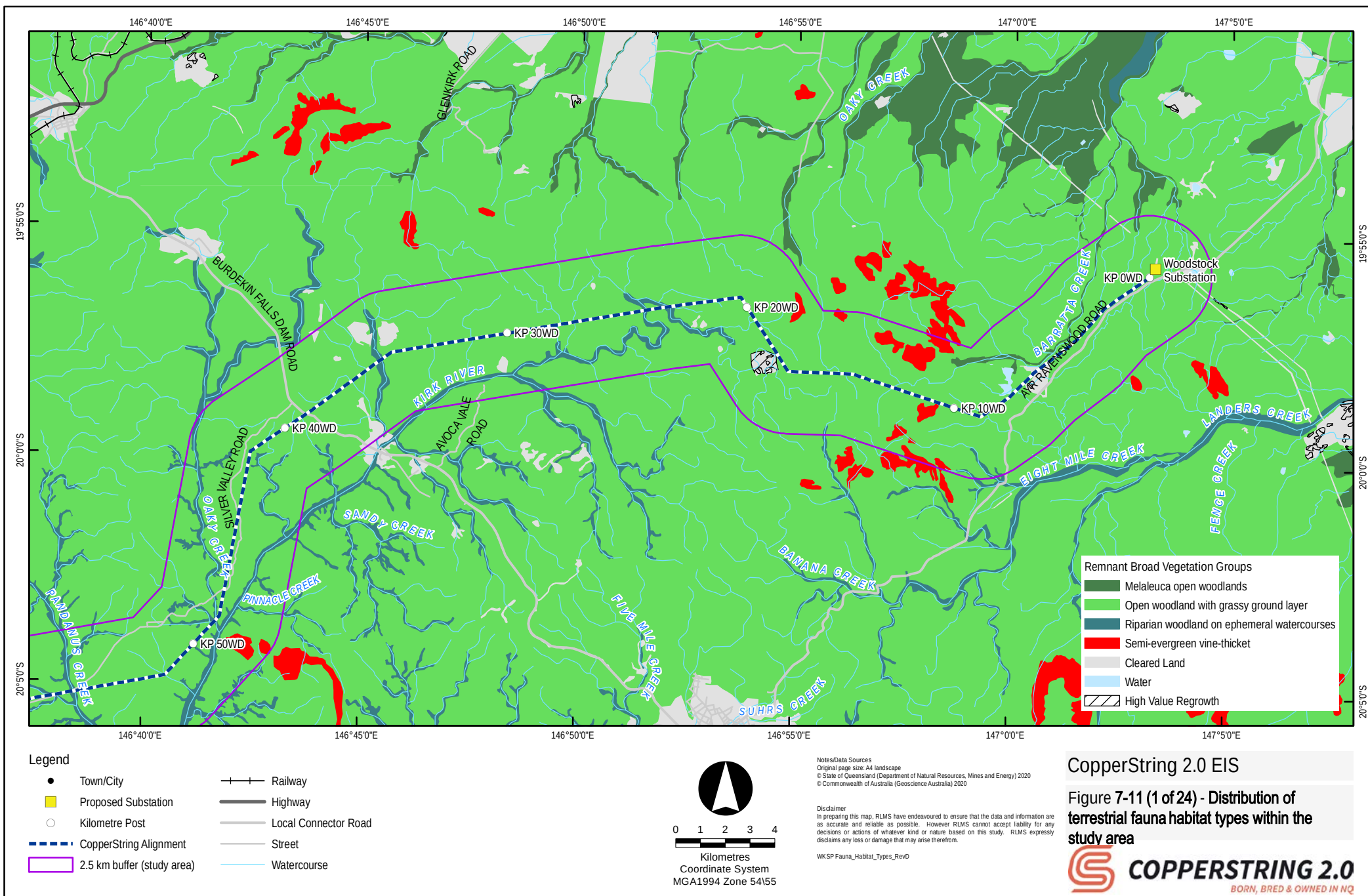
Habitat type	Characteristics	Ecological values
Open woodland with spinifex ground layer		
	• Mature Eucalypt canopy trees • Hollow trees present at low density • Shrub layer generally absent or patchy • Ground layer dominated by spinifex • Sandy and stony substrate	• Nesting and foraging habitat for canopy-dwelling birds • Denning habitat for arboreal mammals • Microhabitats for skinks, geckos and other reptiles • Foraging habitat for macropods, echidnas, dasyurids and other ground-dwelling mammals • Potential conservation significant species – squatter pigeon, echidna
Open woodland with grassy ground layer		
	• Mature Eucalypt canopy trees • Hollow trees present at low density • Shrub layer generally absent • Ground layer dominated by tussocky native grasses • Sandy substrate	• Nesting and foraging habitat for woodland birds • Denning habitat for arboreal mammals • Microhabitats for skinks, geckos, snakes and dragons • Foraging habitat for macropods, echidnas, dasyurids and other ground-dwelling mammals • Potential conservation significant species – squatter pigeon, echidna and koala (in east)
Mulga woodlands and shrublands		
	• Low sparse Acacia dominated canopy • Patchy ground layer dominated by native grasses and forbs • Localised woody debris and other ground structure • Sandy substrate	• Nesting and foraging habitat for a diversity of woodland birds • Burrowing habitat for mammals and fossorial reptiles • A diversity of microhabitats for snakes, dragons, skinks and other reptiles • Potential conservation significant species – echidna

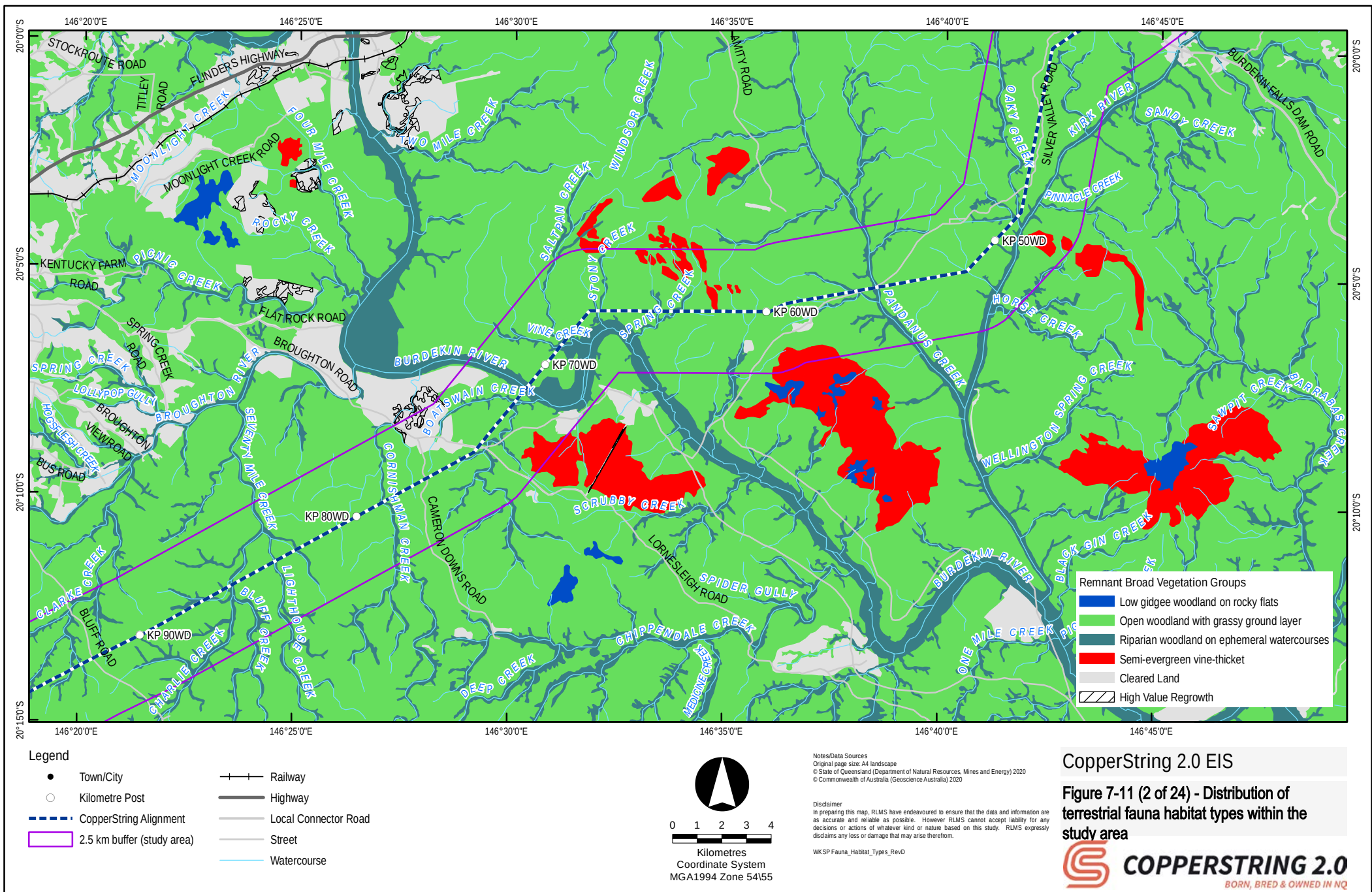
Habitat type	Characteristics	Ecological values
Wetlands and swamps		
	• Subject to seasonal inundation • Mature Eucalypt canopy at fringes • Abundance of hollows at fringes • Shrub layer generally absent • Grasses and sedges in ground-layer	• Seasonal habitat for wetland birds • Breeding habitat for frogs and snakes • Refugial habitat for possums, owls, parrots • Drinking sites for birds and mammals • Potential conservation significant species – black-throated finch (southern)
Mitchell grassland on cracking clay plains		
	• Canopy and shrub layers absent • Ground layer dominated by native grasses • Deep cracking clay soils • Subject to seasonal inundation • Presence of cattle at low densities	• Foraging habitat for pipits, quails and other grass dwelling birds • Foraging habitat for raptors • Microhabitats for skinks, dragons, monitors and snakes • Foraging habitat for rodents, dasyurids and macropods • Potential conservation significant species – Julia Creek dunnart, echidna, plains death adder
Low gidgee woodland on rocky flats		
	• Low canopy layer dominated by Acacias • Shrub layer generally absent • Patchy ground layer • Stony substrate • Abundance of fallen woody debris	• Nesting and foraging habitat for woodland birds • Microhabitats for skinks, geckos, dragons, monitors and snakes • Foraging habitat for macropods and other ground-dwelling mammals • Potential conservation significant species – squatter pigeon, echidna.

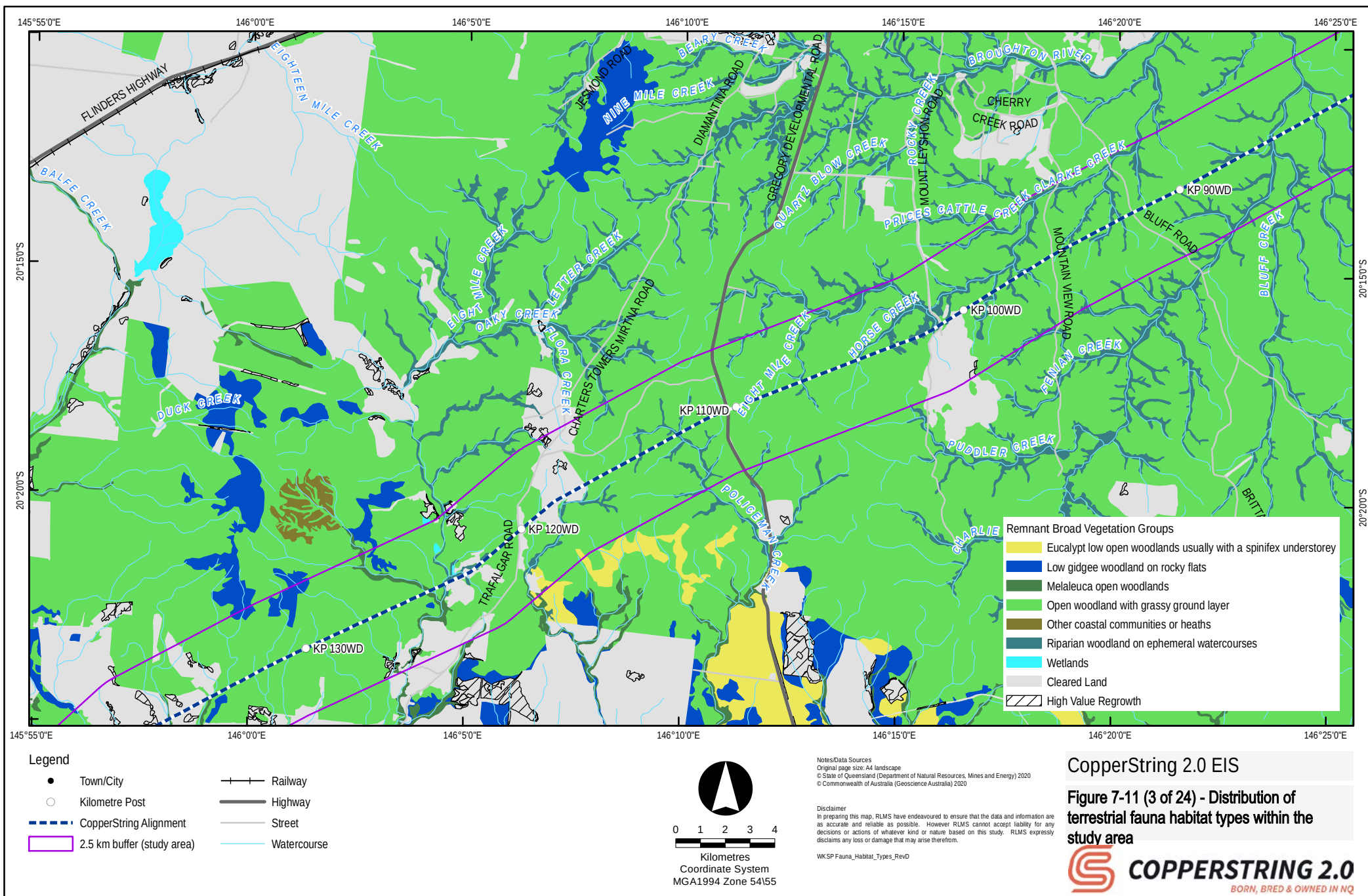
Habitat type	Characteristics	Ecological values
Riparian woodland on ephemeral watercourses		
	• Mature canopy trees • Hollow-bearing trees abundant • Patchy shrub layer • Ground layer dominated by native grasses and weeds • Subject to seasonal flow • High levels of weed infestation • High flood scour	• Nesting and foraging habitat for woodland and shrub-dwelling birds • Microhabitats for skinks, geckos, dragons, monitors and snakes • Foraging habitat for macropods and other ground-dwelling mammals • Important flyways and foraging habitat for microbat species. • Potential conservation significant species – squatter pigeon, koala, red goshawk
Melaleuca open woodlands		
	• Sparse canopy of Melaleucas and Eucalypts • Patchy shrub layer • Sparse grassy understorey • Subject to periodic inundation and localised flooding	• Foraging and nesting habitat for canopy and shrub-dwelling birds • Grazing and resting habitat for macropods • Foraging and roosting habitat for microbats and flying-foxes • Potential conservation significant species – koala
Semi evergreen vine thicket		
	• Tall canopy dominated by <i>Araucaria cunninghamii</i>. • Notably low abundance of hollow bearing trees • Generally occurring on south-facing cliff faces and steep escarpments • Geology consisting of granodiorite and rhyolite • Groundlayer mostly absent. • Shrub layer consisting of _____.	• Foraging and nesting habitat for canopy and shrub-dwelling birds • Microhabitats for skinks, geckos, dragons, monitors and snakes • Provide important fire refugia due to landscape location and lack of ground cover. • Potential conservation significant species – vine thicket fine lined slider.

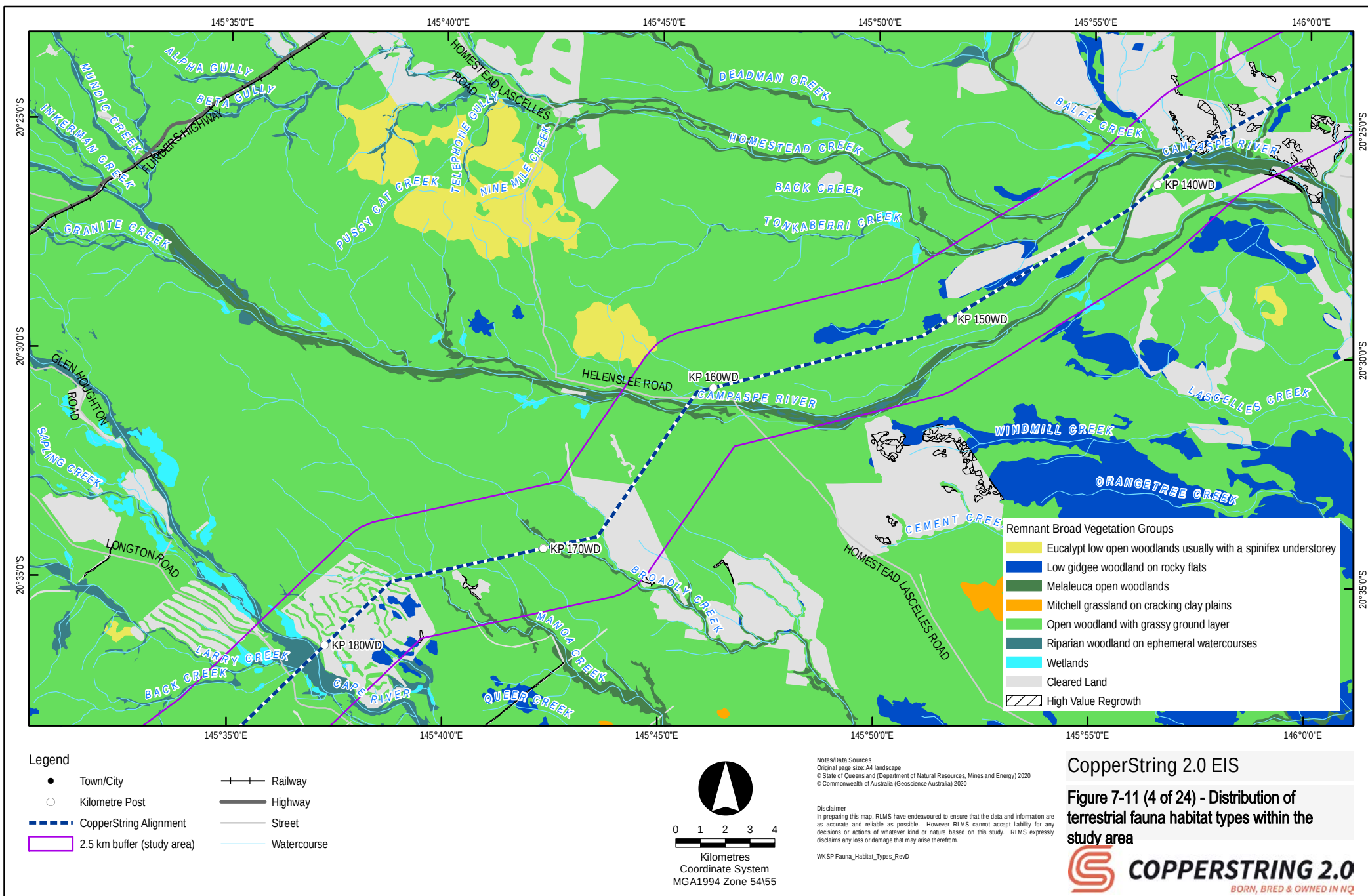
Habitat type	Characteristics	Ecological values
Cleared land		
	• Canopy cleared or naturally absent – restricted to isolated trees • Shrub layer cleared or naturally absent • Ground layer cleared and often sown with buffel and other exotic pasture grasses • Localised erosion and cattle grazing pressures • Abundance of weeds	• Foraging habitat for raptors and birds adapted to open landscapes (i.e. crows, miners, butcherbirds) • Some ground-dwelling birds such as pipits and quails • Grazing habitat for macropods • Potential conservation significant species - nil

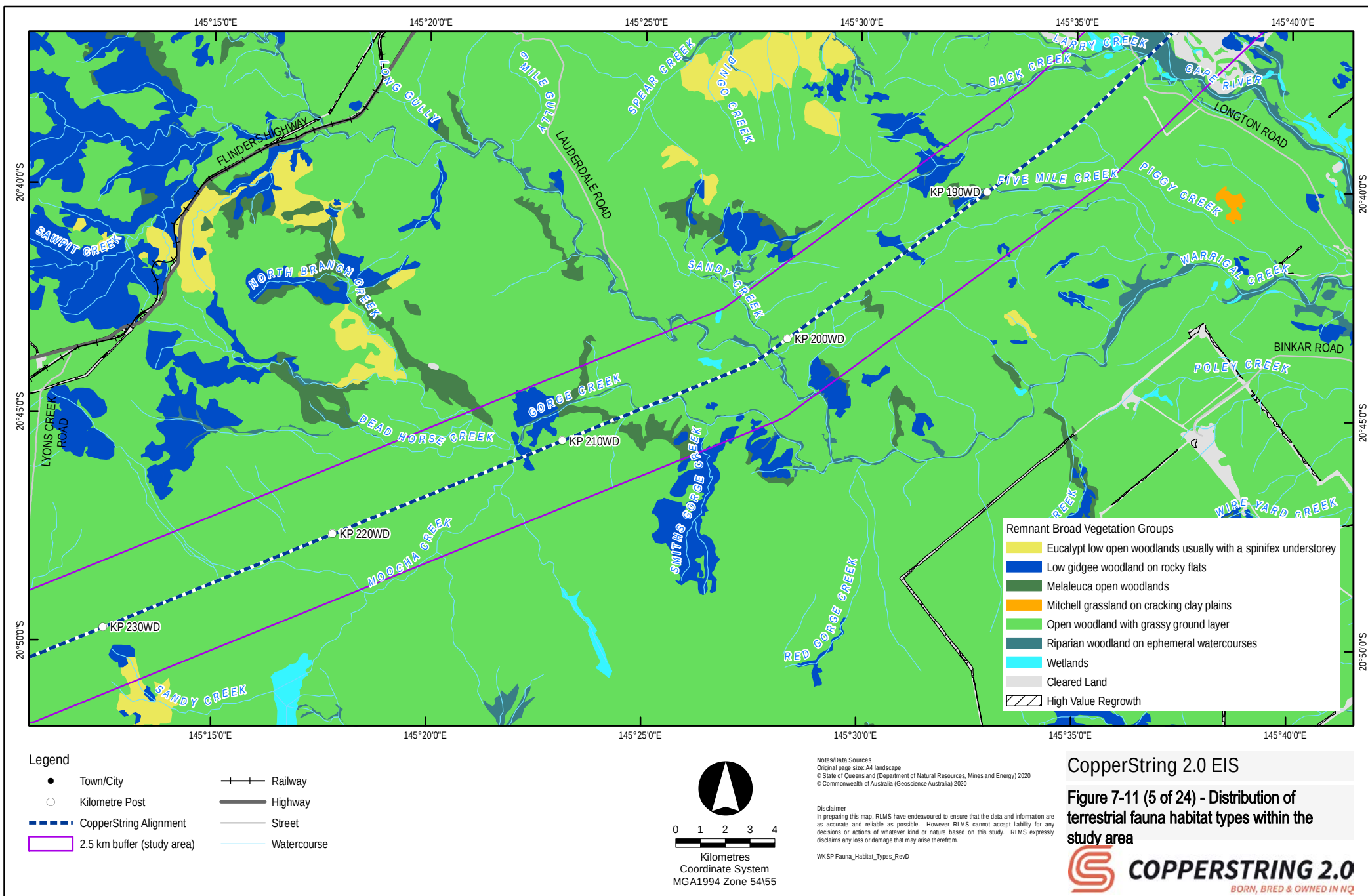


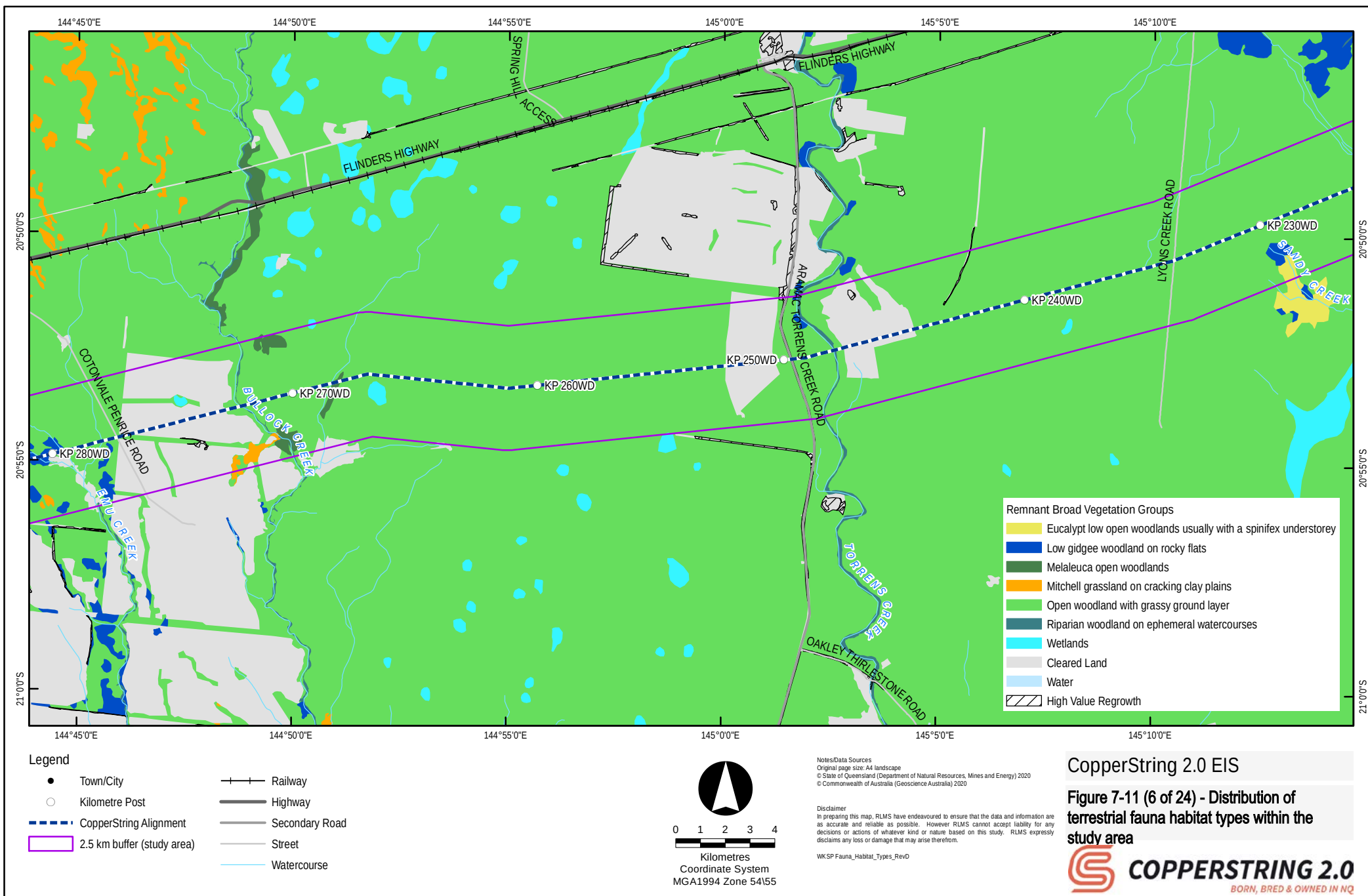


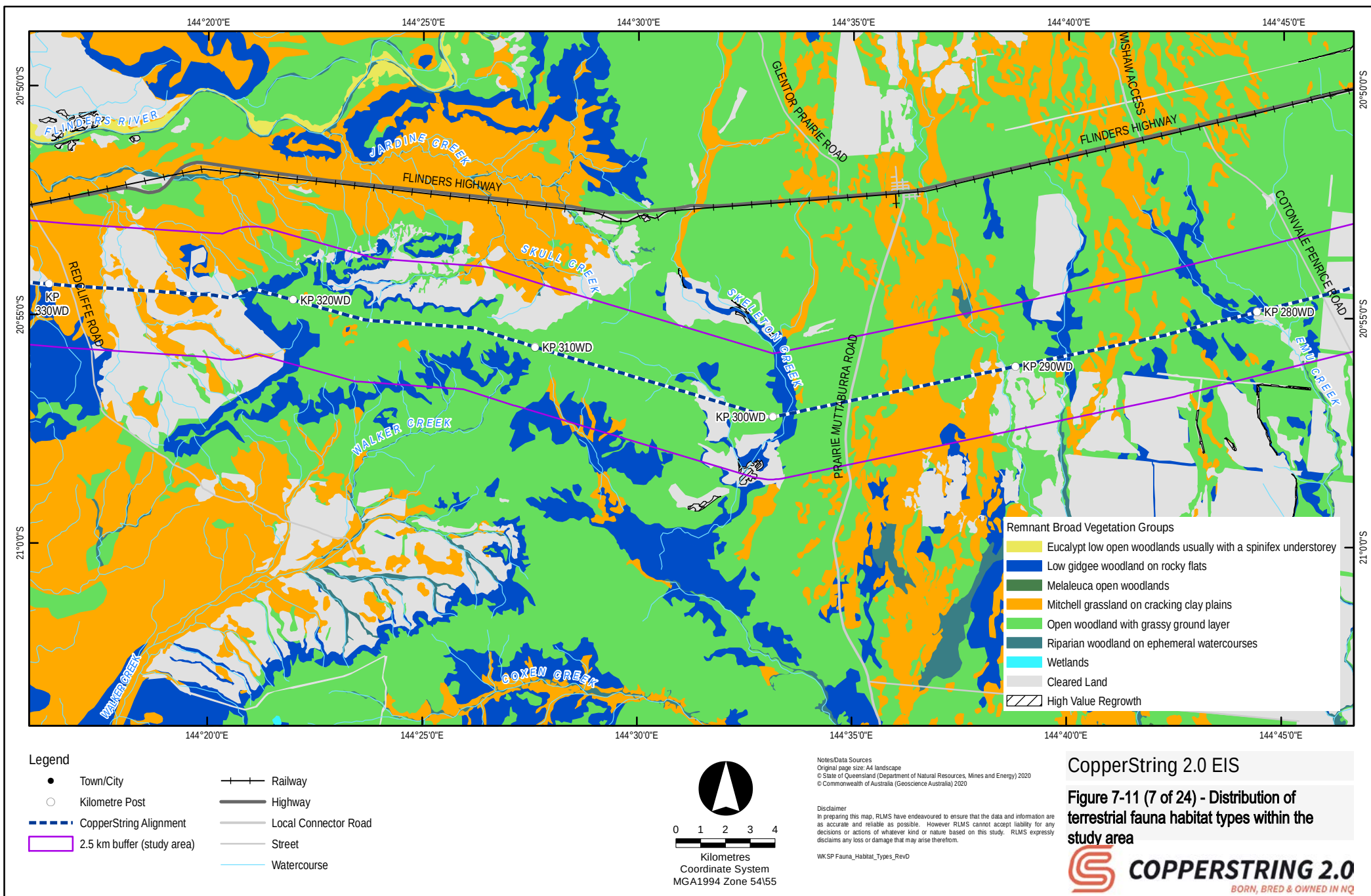


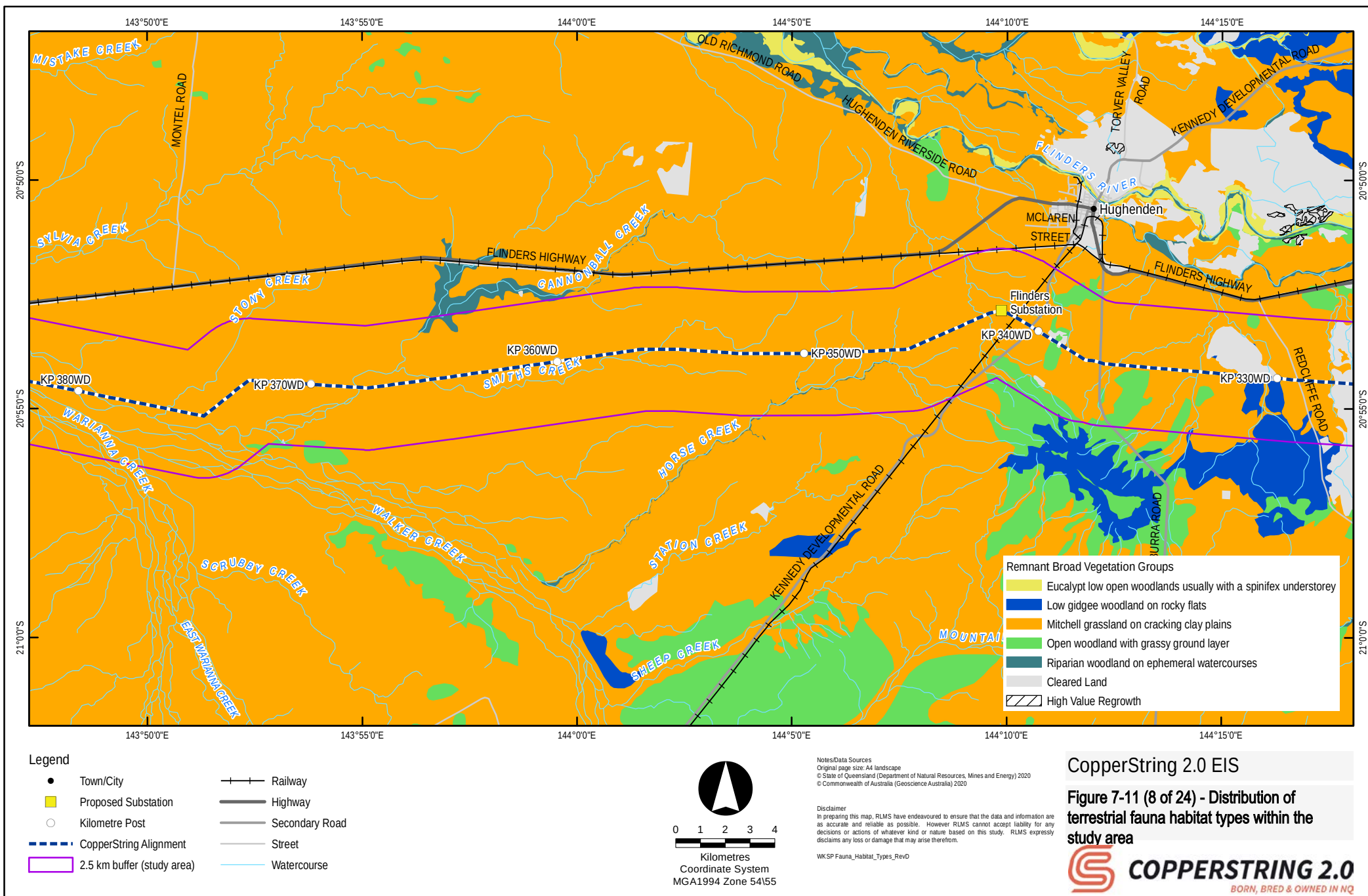


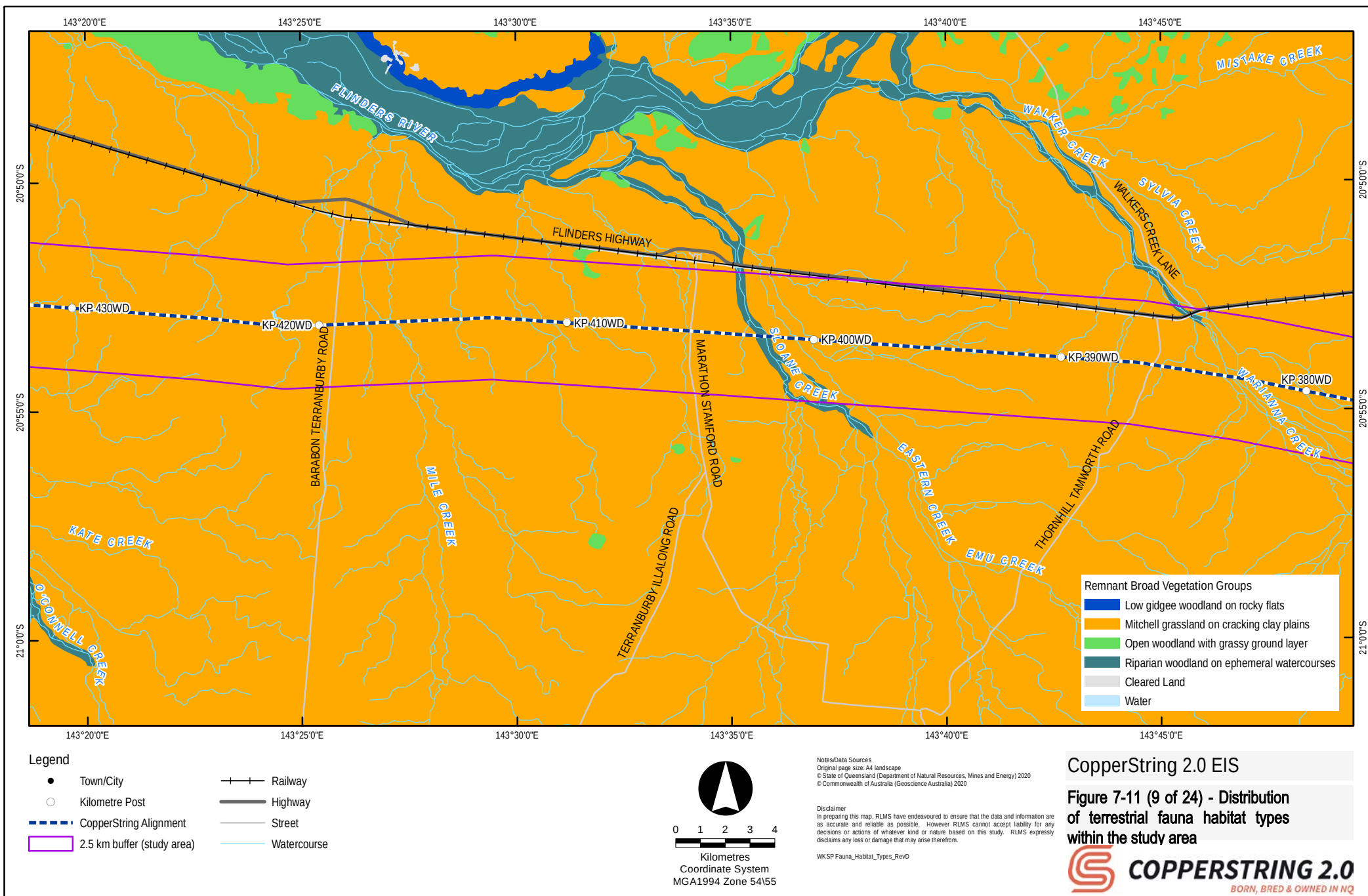


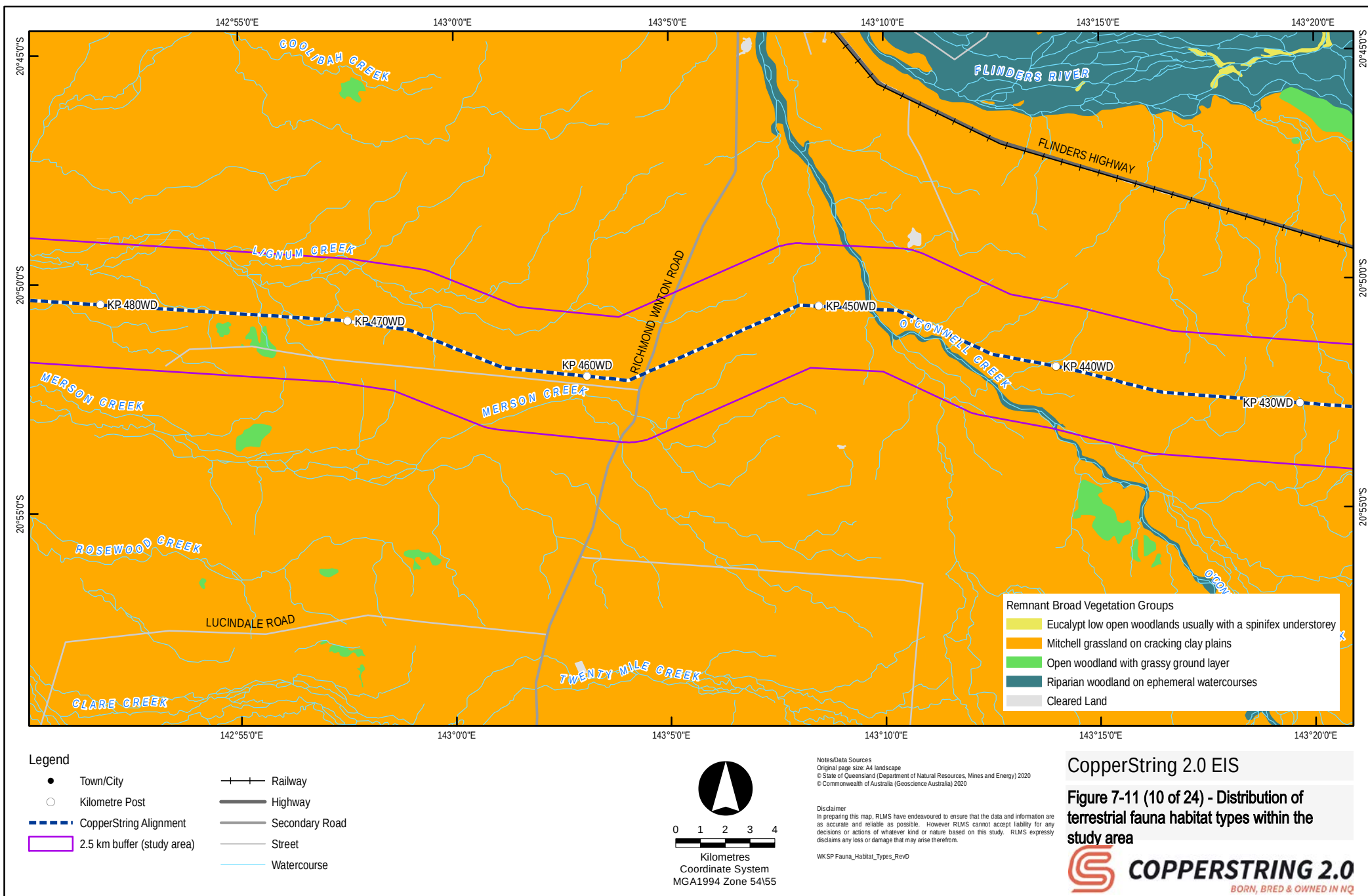


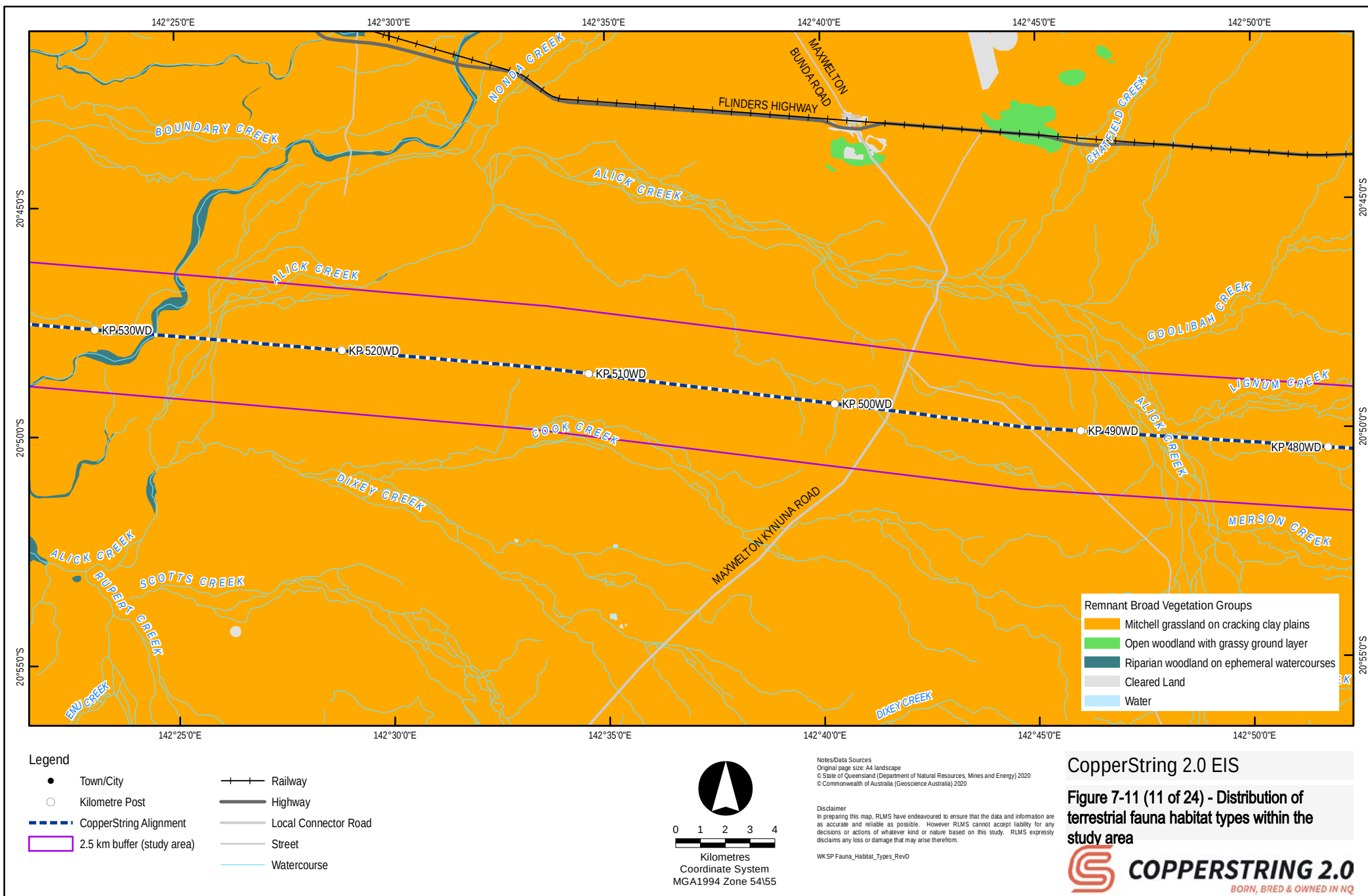


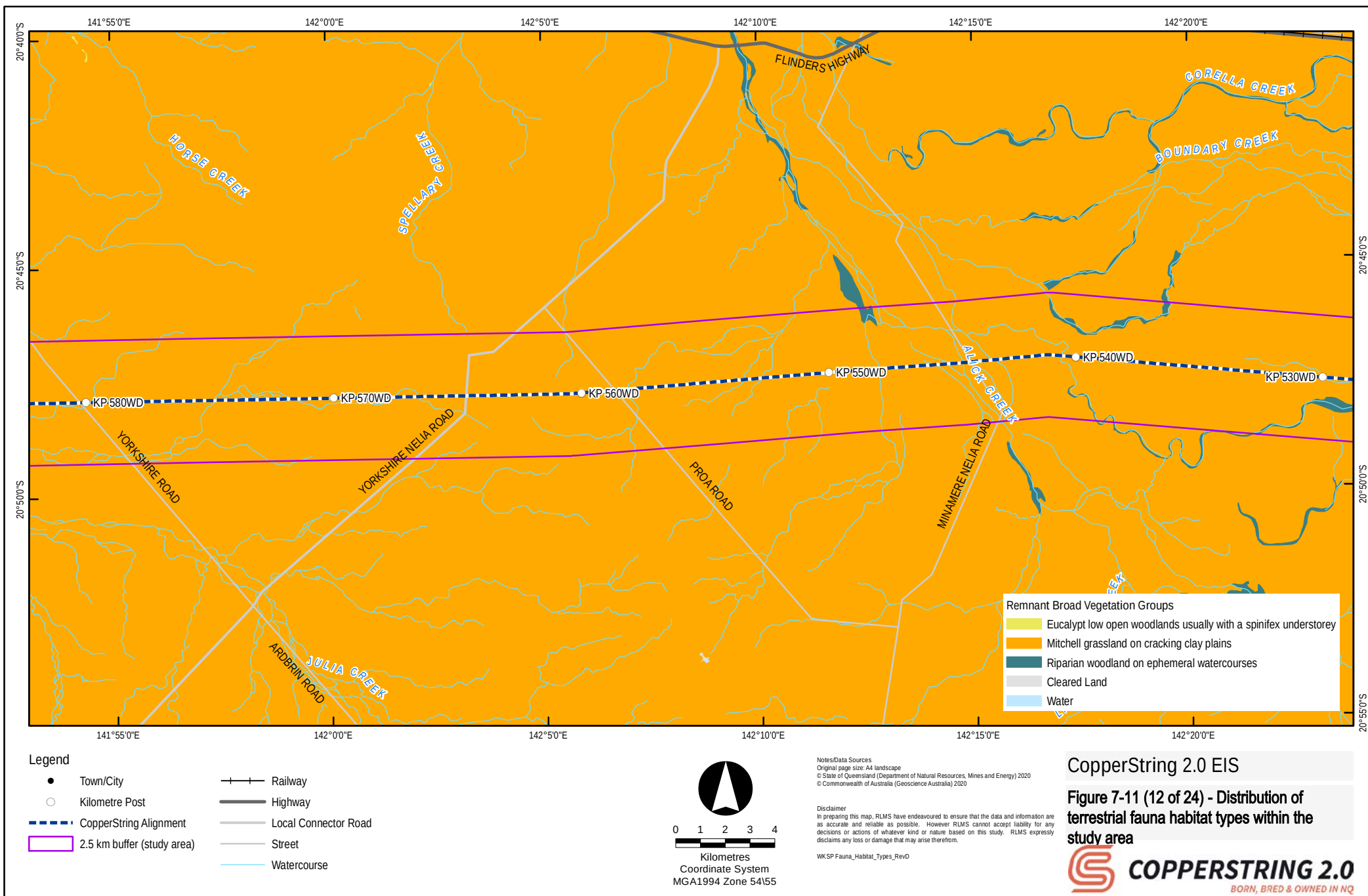


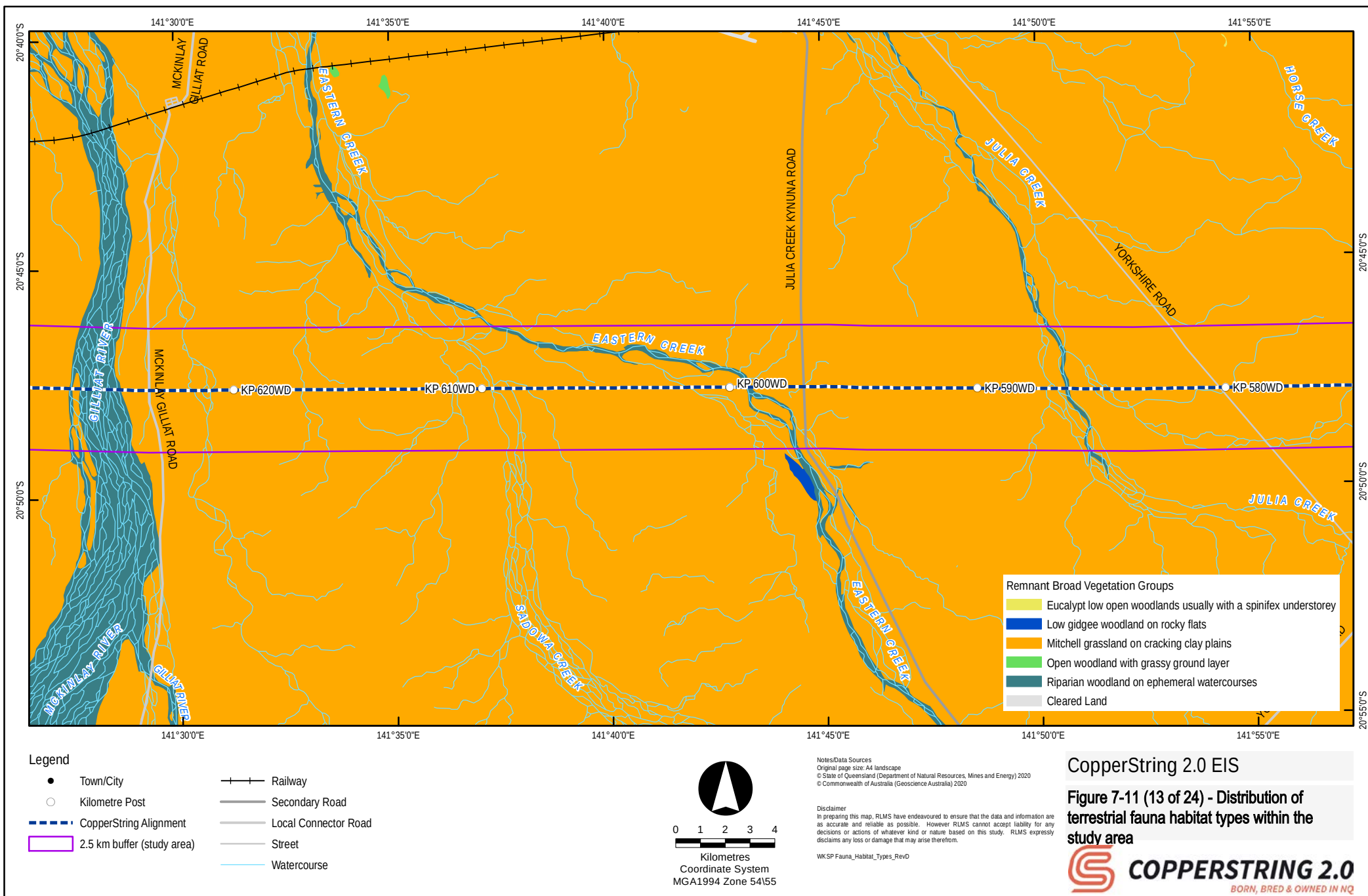


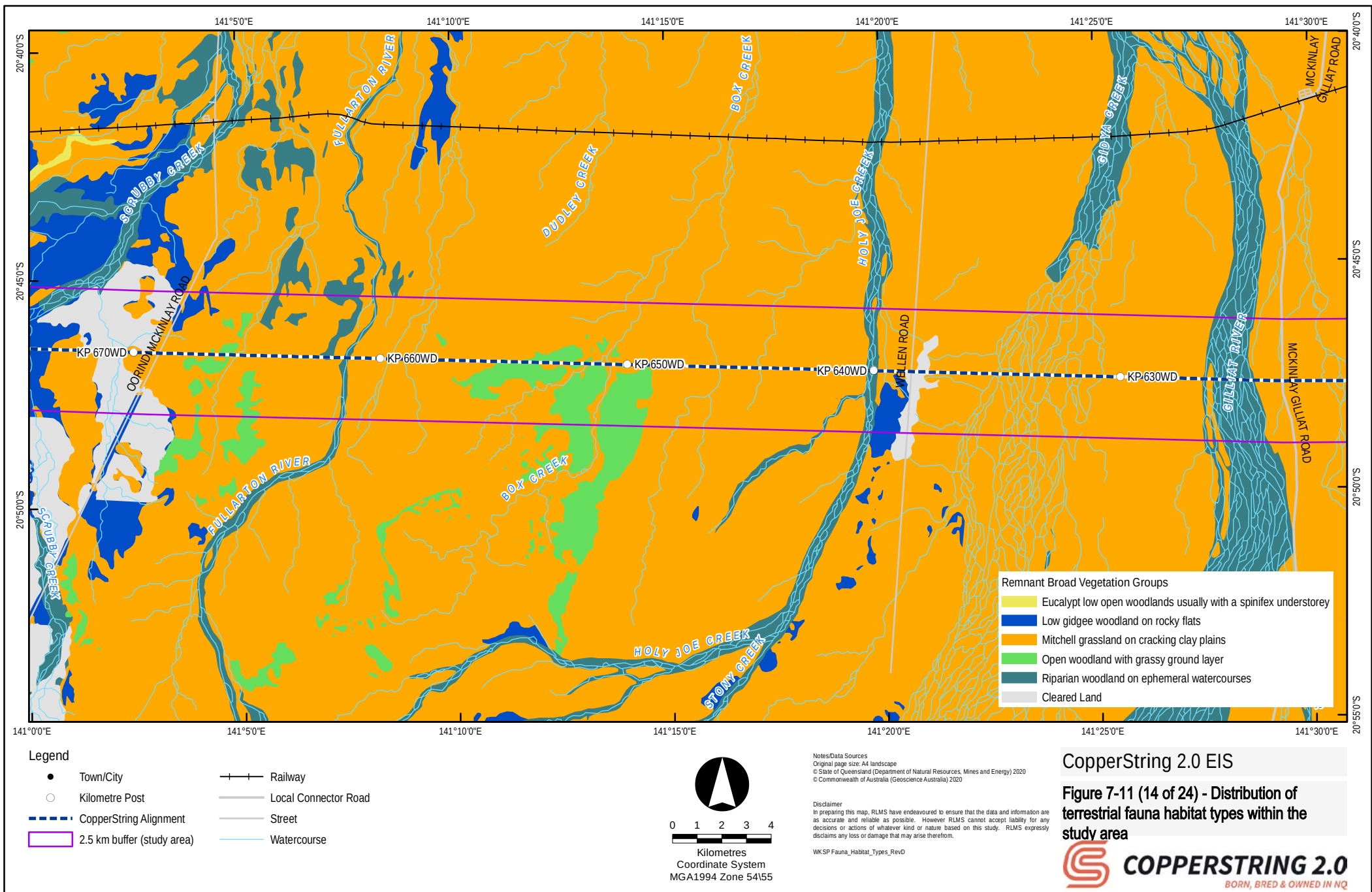


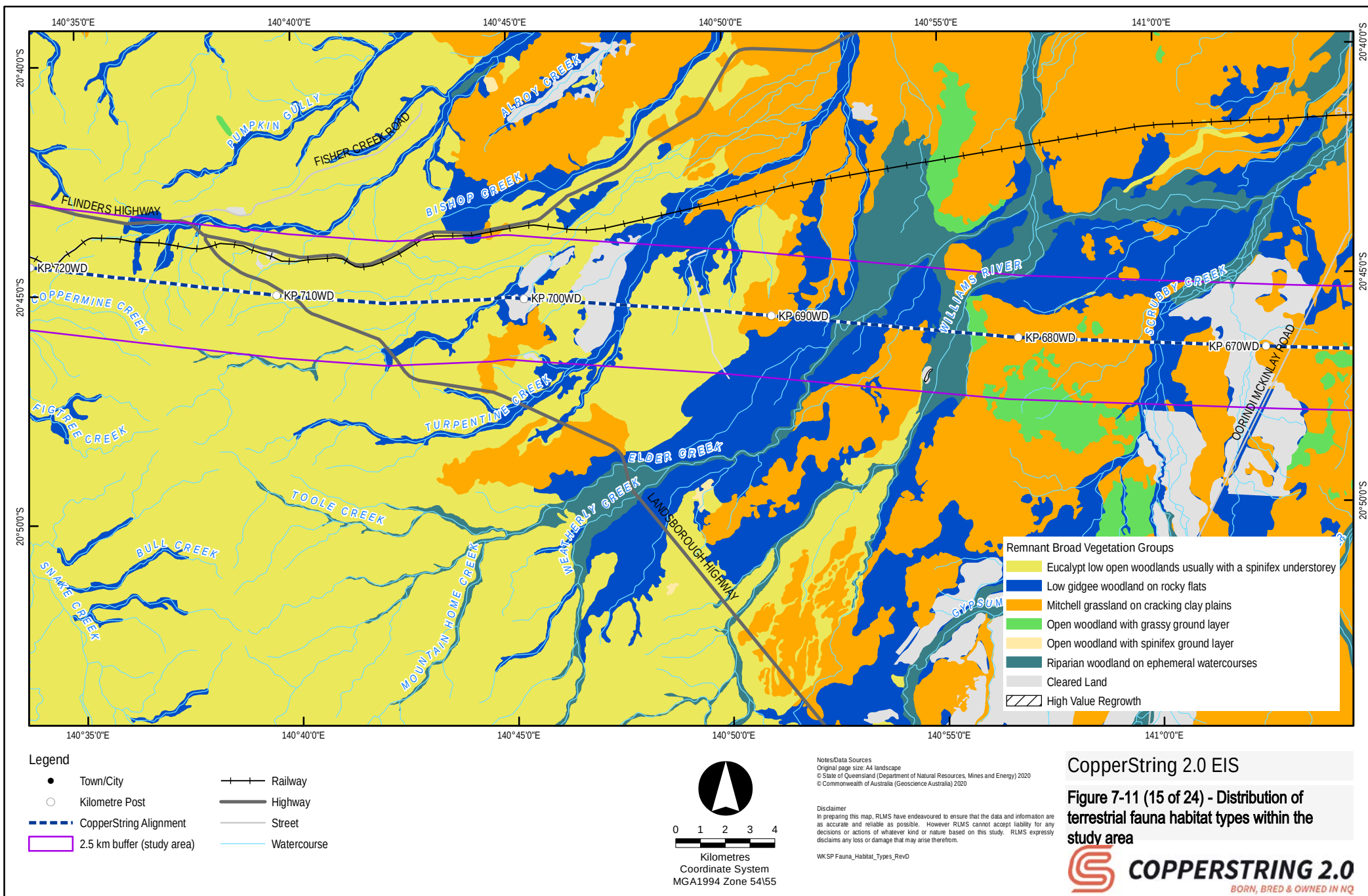


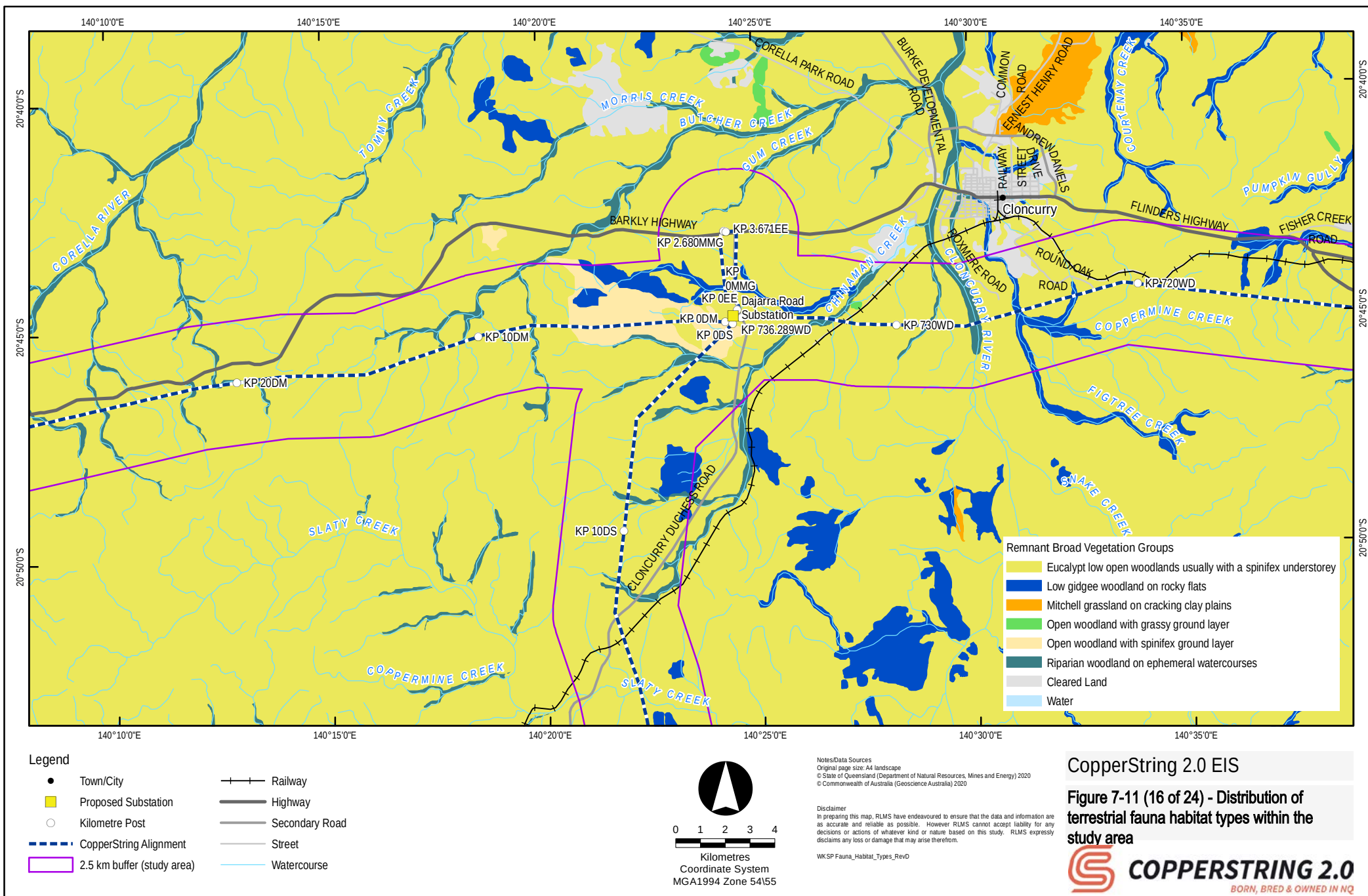


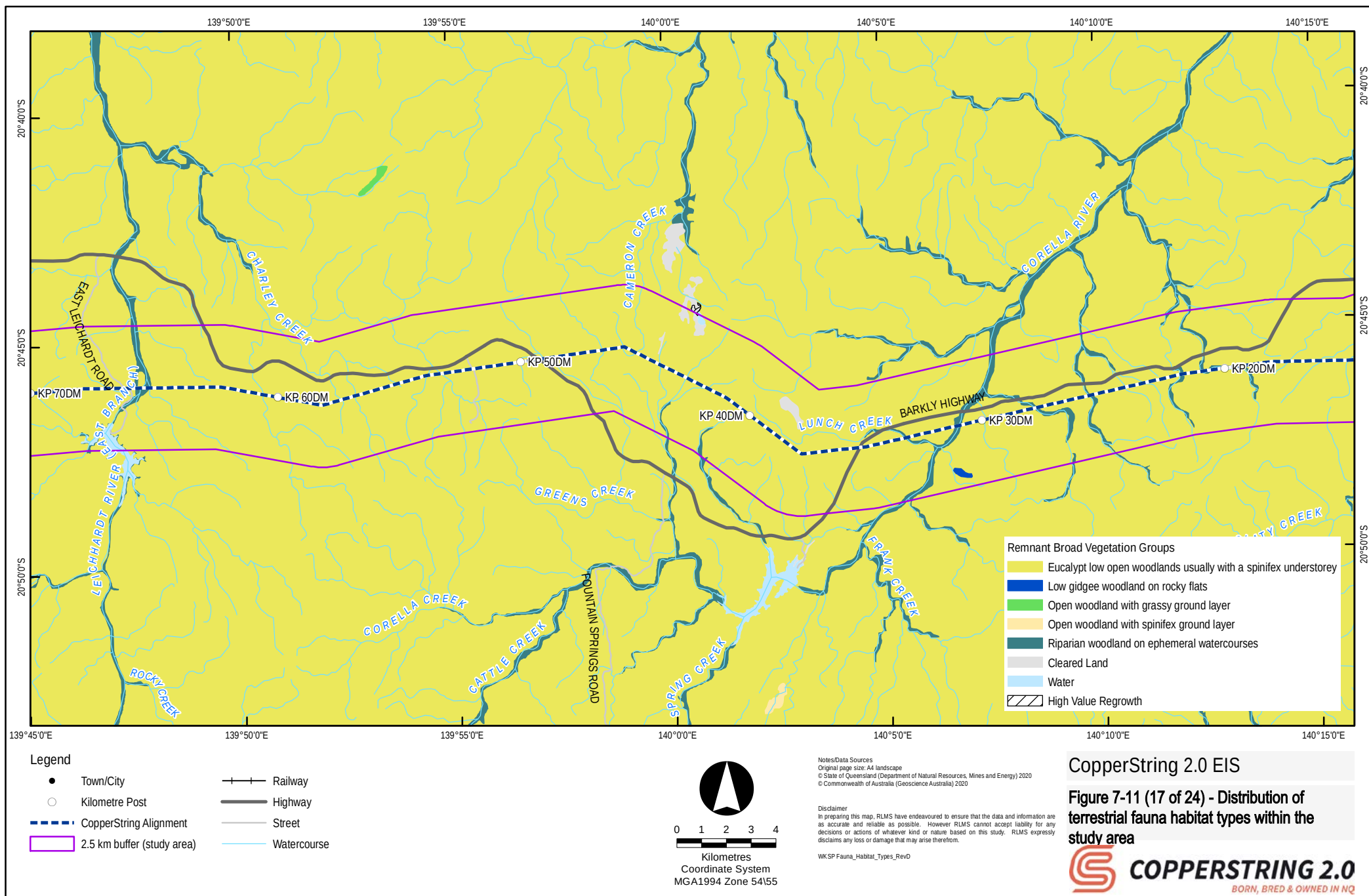


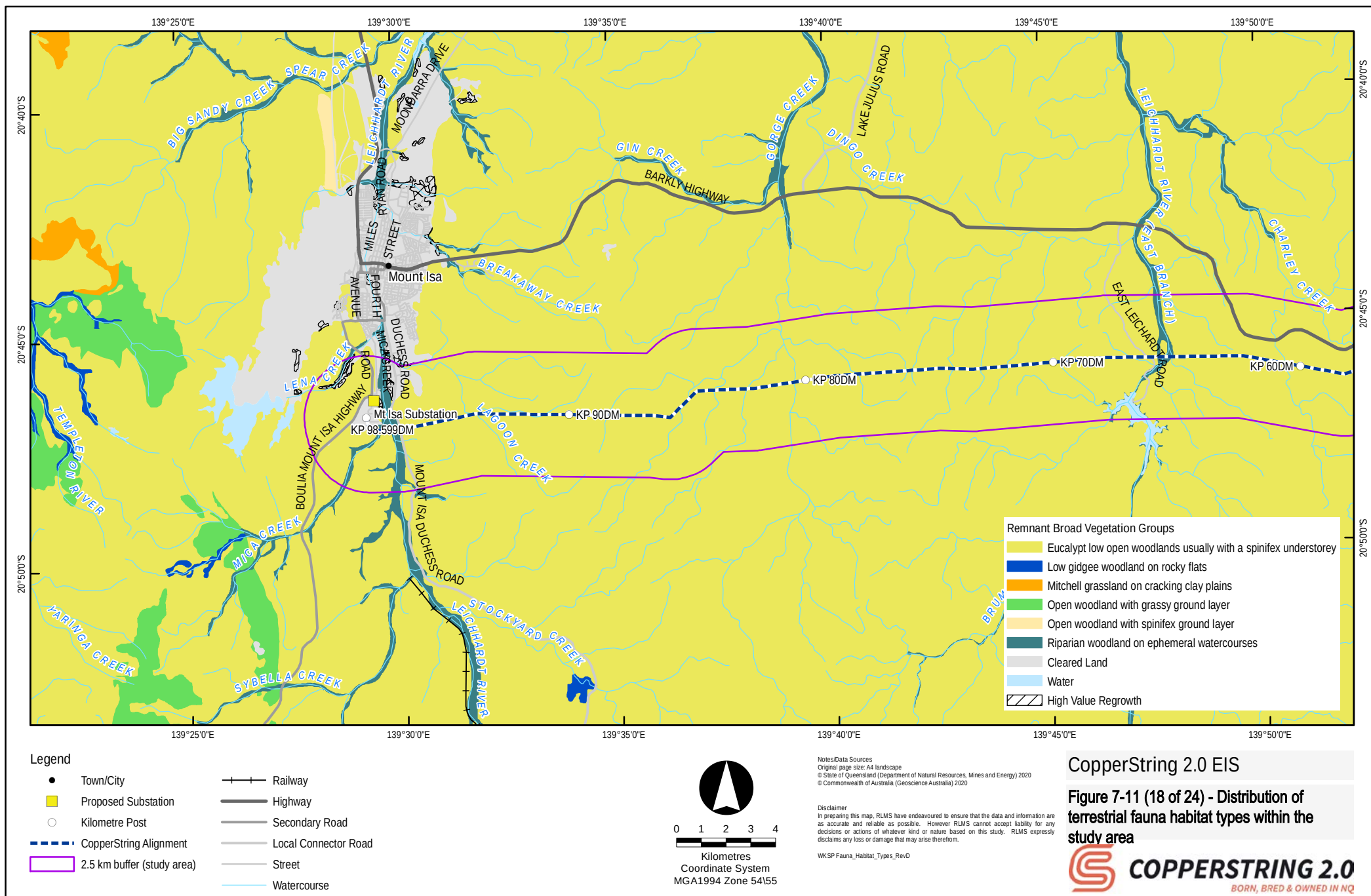


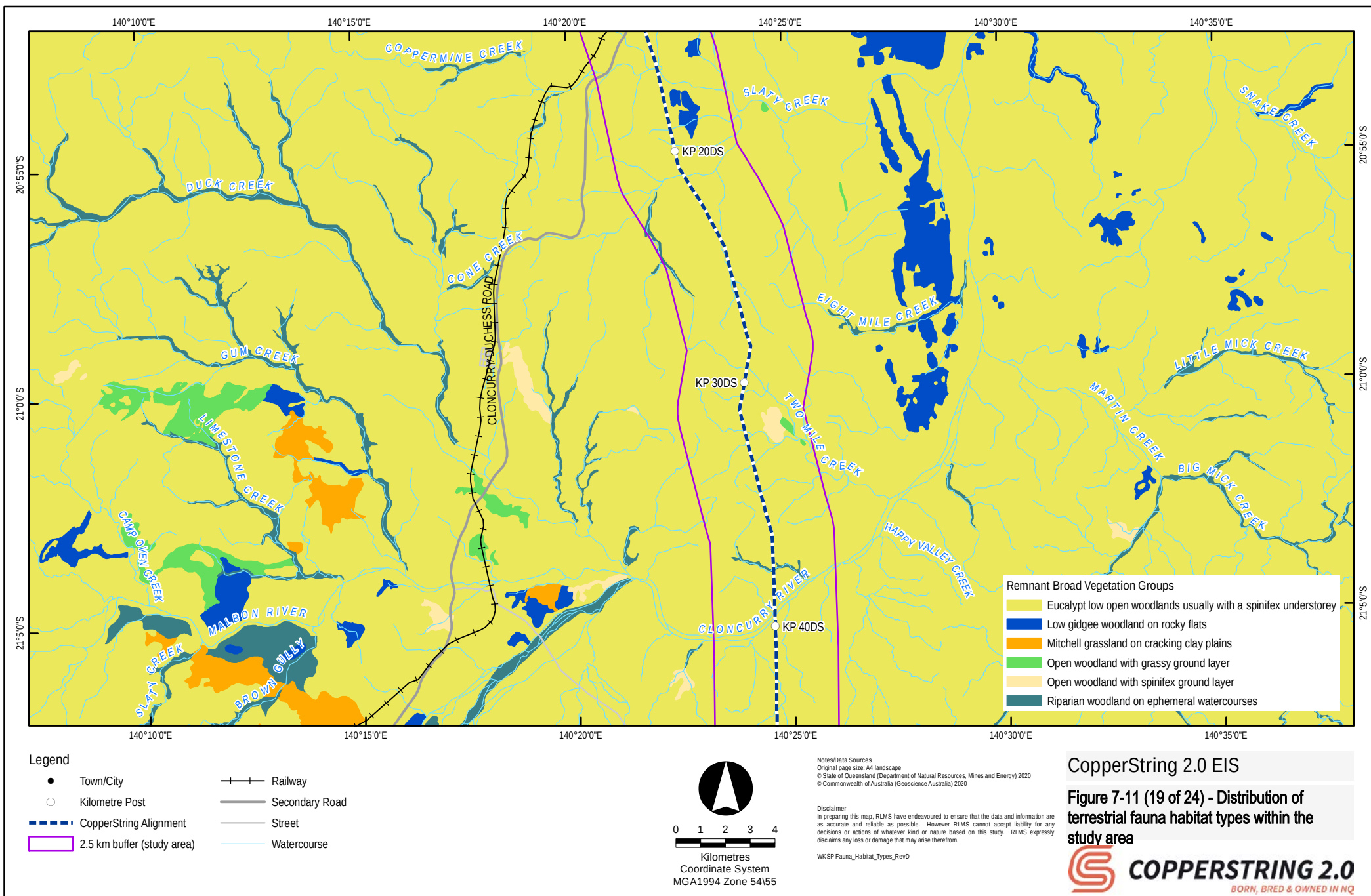


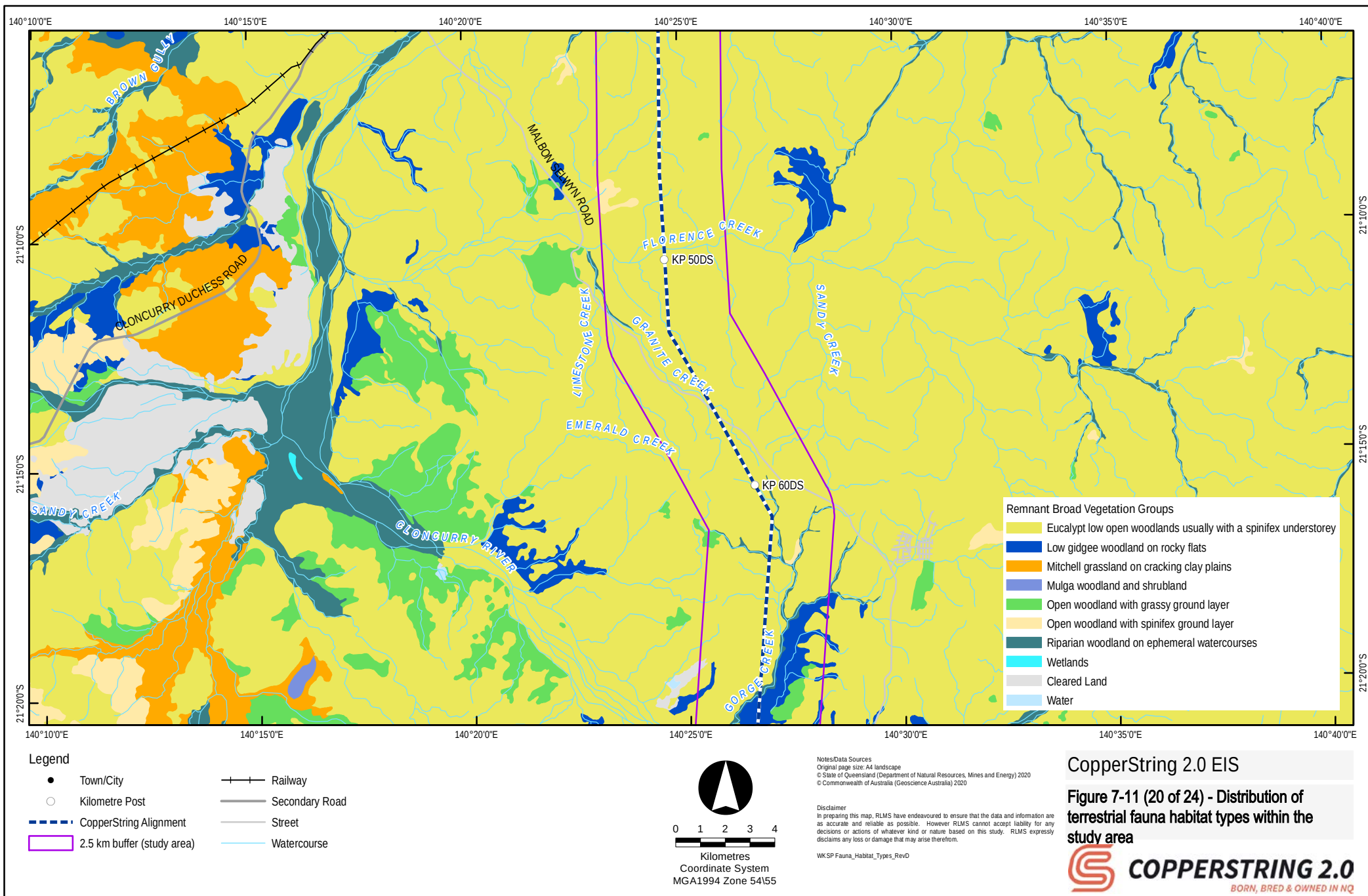


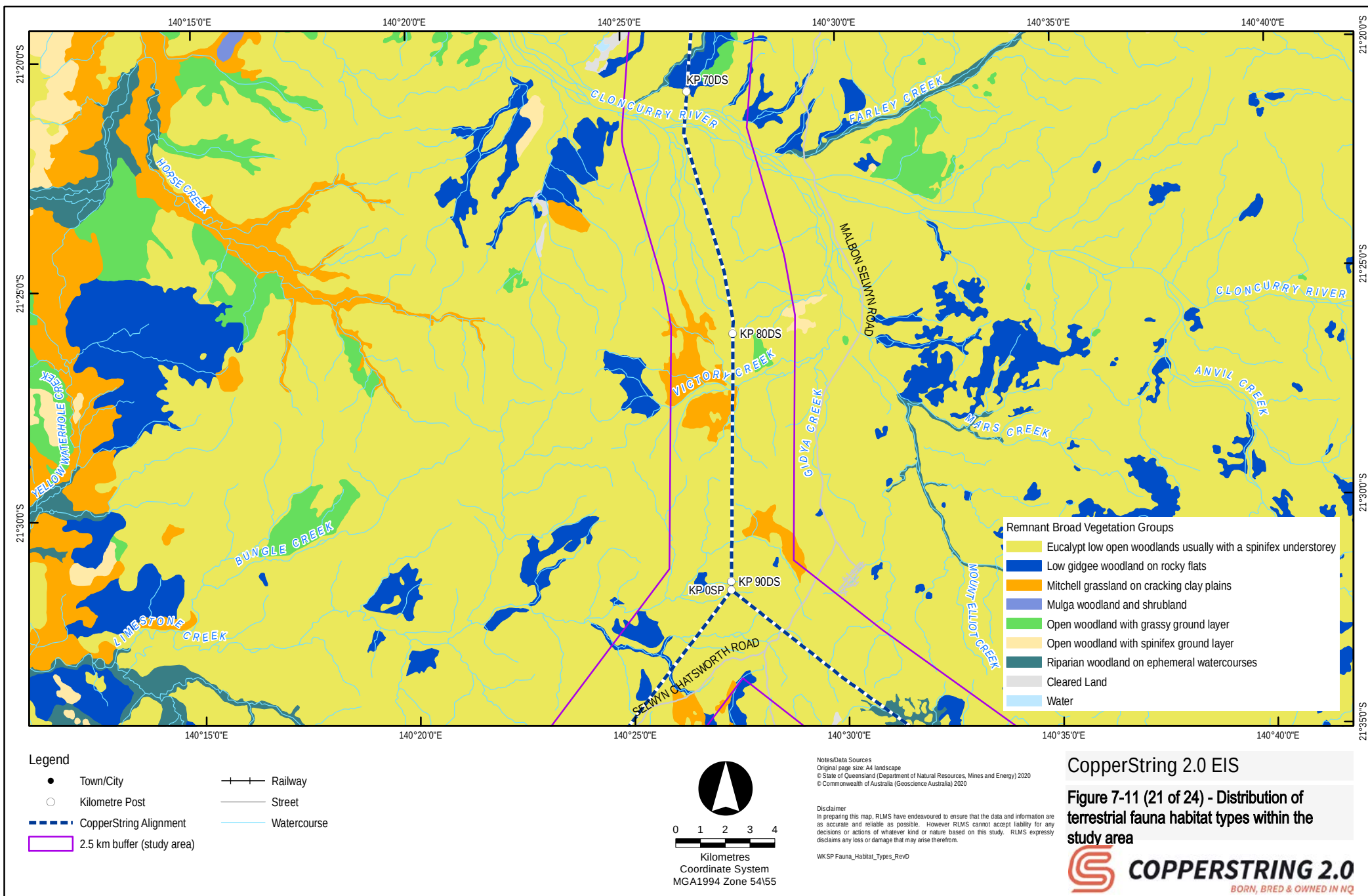


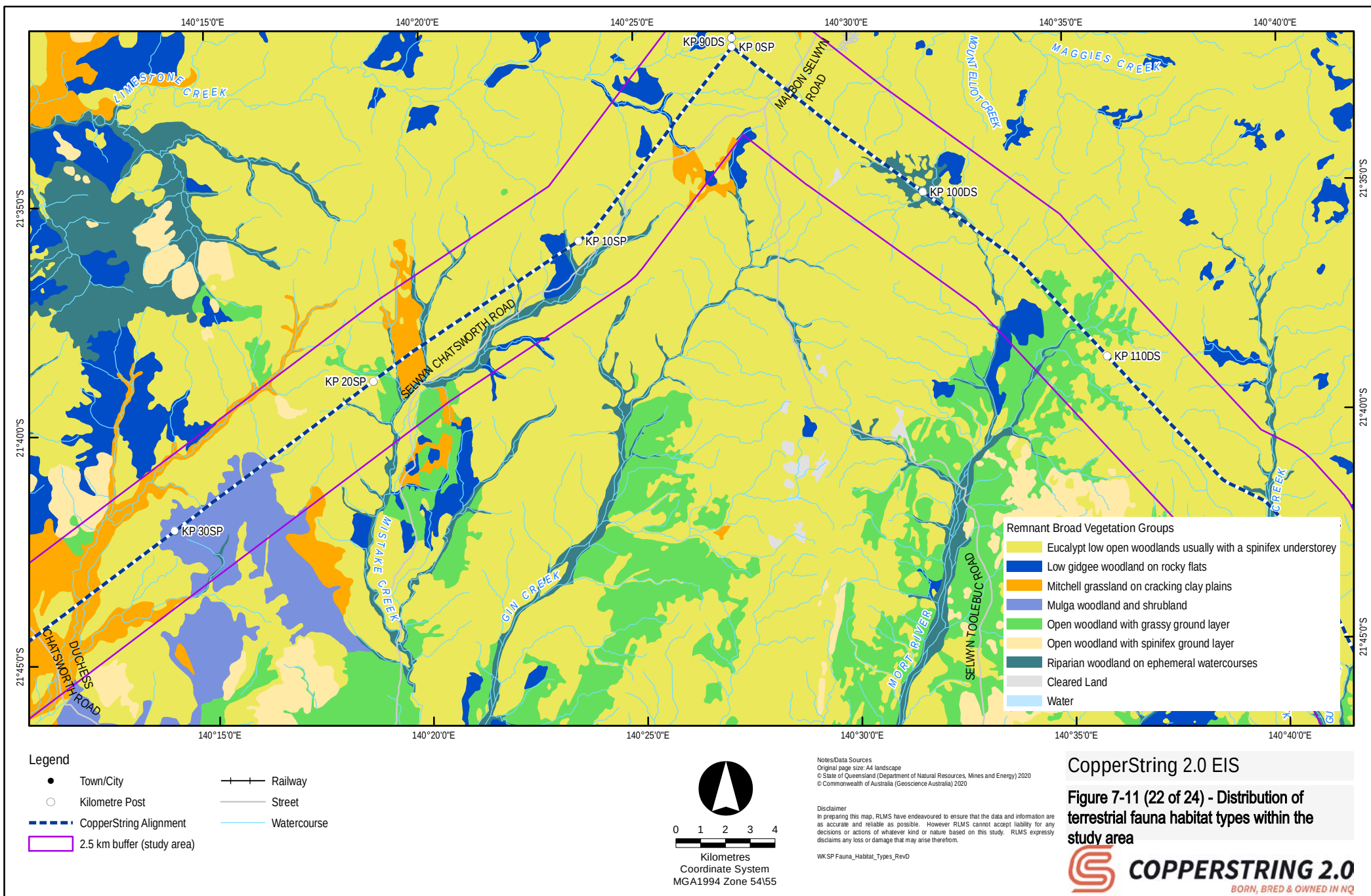


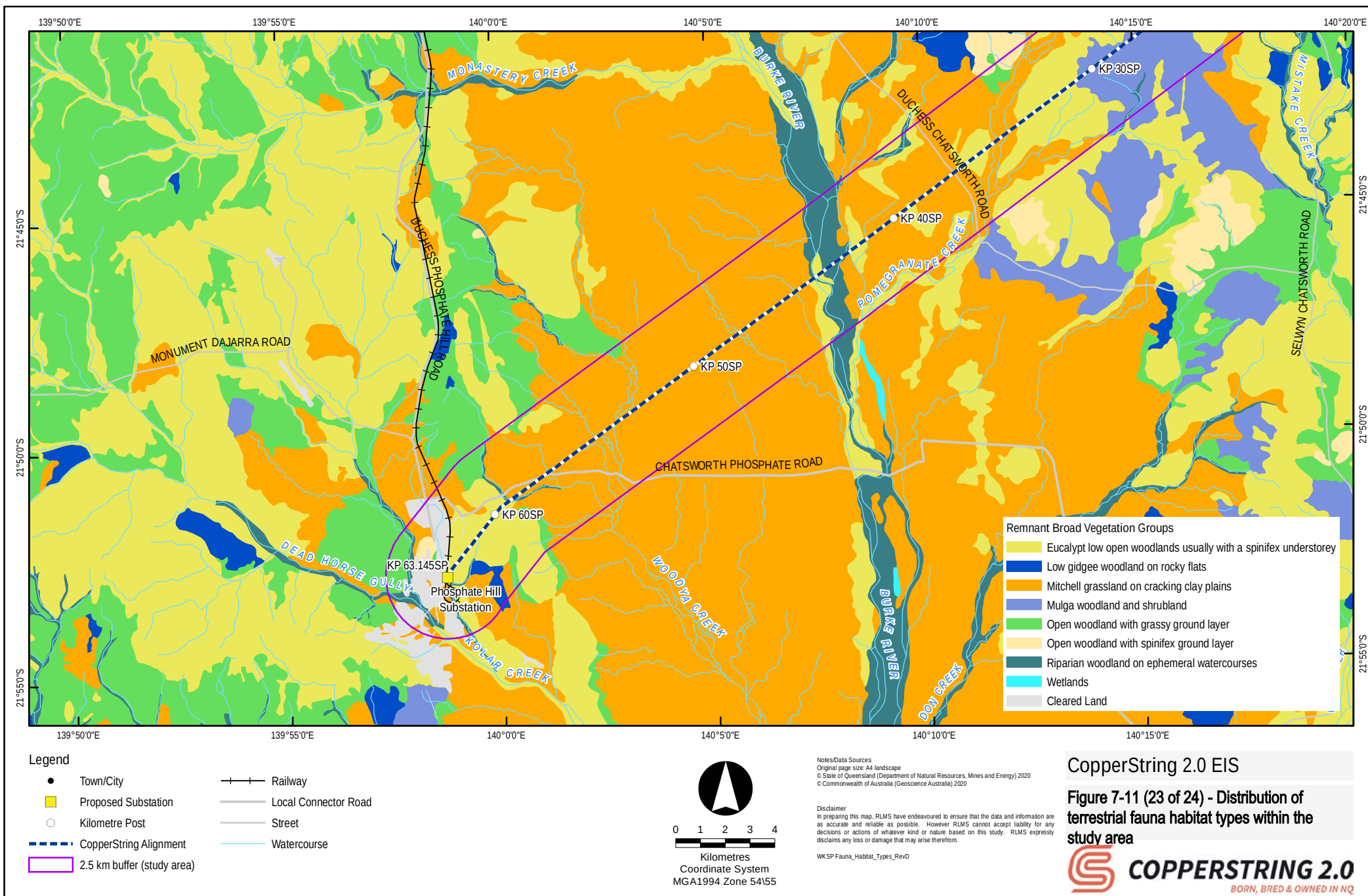


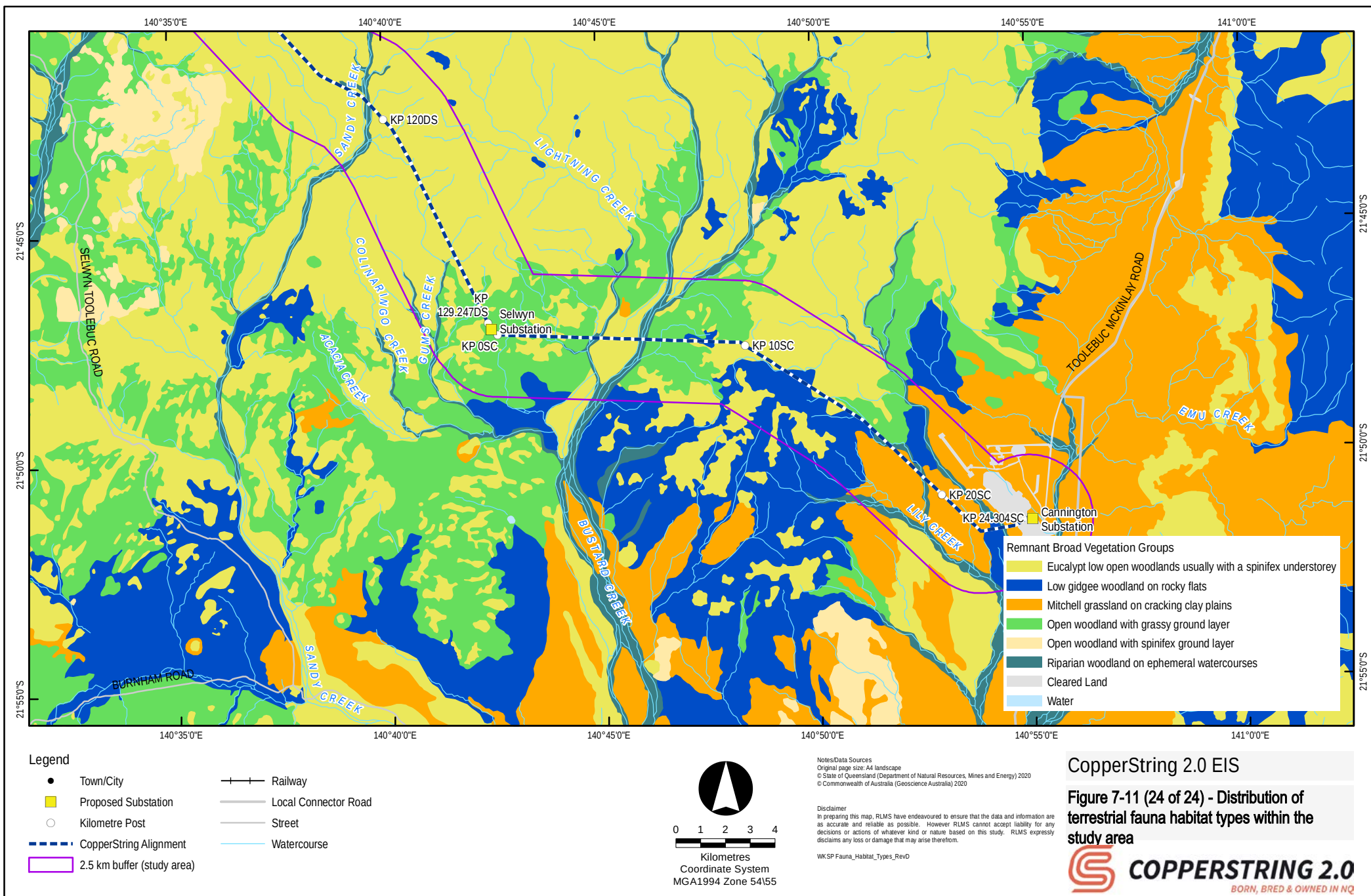












7.3.7 Terrestrial fauna species

A total of 223 terrestrial fauna species were recorded during the 2019 combined BAAM and GHD field surveys for the Project. This comprised 42 mammal species, 151 bird species, 26 reptile species and three amphibian species. A full list of the species recorded during the terrestrial fauna field surveys is provided in Appendix E of Volume 3 Appendix P Ecological Assessment.

Conservation significant terrestrial fauna species

Seven conservation significant fauna species were **confirmed present** in BAAM and GHD field surveys of the Project area, as shown in Table 7-6. An additional 11 conservation significant fauna species were considered **likely to occur** within the Project area and 14 species had a reduced likelihood of occurrence but **may occur** due to the presence of marginal habitat. The remaining 11 species identified in desktops are considered unlikely to occur. Table 7-6 presents a summary of all conservation significant species confirmed present, considered likely to occur and those that may occur within the Project area. The results of the likelihood of occurrence are presented in Appendix B of Volume 3 Appendix P Ecological Assessment. Summarised Information on the occurrence of each conservation significant species confirmed present or likely to occur within the Project area is provided below.

Table 7-6 Conservation significant fauna species that were confirmed present, likely to occur or may occur within the Project area

Species	Common name	EPBC Act	NC Act
Confirmed present			
<i>Geophaps scripta scripta</i>	Southern squatter pigeon	V	V
<i>Lerista cinerea</i>	Vine-thicket fine-lined slider	NL	V
<i>Petrogale purpureicollis</i>	Purple-necked rock wallaby	NL	V
<i>Phascolarctos cinereus</i>	Koala	V	V
<i>Poephila cincta cincta</i>	Southern black-throated finch	E	E
<i>Sminthopsis douglasi</i>	Julia Creek dunnart	V	E
<i>Tachyglossus aculeatus</i>	Short-beaked echidna	NL	SLC
Likely to occur			
<i>Acanthophis antarcticus</i>	Common death adder	NL	V
<i>Acanthophis hawkei</i>	Plains death adder	V	V
<i>Denisonia maculata</i>	Ornamental snake	V	V
<i>Erythrorhynchus radiatus</i>	Red goshawk	V	E
<i>Falco hypoleucos</i>	Grey falcon	V	V
<i>Grantiella picta</i>	Painted honeyeater	V	V
<i>Hipposideros semoni</i>	Northern leaf-nosed bat	NL	V
<i>Hirundapus caudacutus</i>	White-throated needletail	V	SLC
<i>Pezoporus occidentalis</i>	Night parrot	E	E
<i>Rostratula australis</i>	Australian painted snipe	E	V
May occur			
<i>Amytornis dorotheae</i>	Carpentarian grasswren	E	E
<i>Calidris ferruginea</i>	Curlew sandpiper	CE,Mig	E
<i>Crocodylus porosus</i>	Saltwater crocodile	Mig	V

Species	Common name	EPBC Act	NC Act
<i>Egernia rugosa</i>	Yakka skink	V	V
<i>Emydura subglobosa worrelli</i>	Diamond head turtle	NL	NT
<i>Epthianura crocea</i>	Yellow chat	NL	V
<i>Erythrura gouldiae</i>	Gouldian finch	E	E
<i>Hipposideros semoni</i>	Semon's leaf-nosed bat	V	E
<i>Lerista hobsoni</i>	Hobson's fine-lined slider	NL	V
<i>Macroderma gigas</i>	Ghost bat	V	E
<i>Numenius madagascariensis</i>	Eastern curlew	CE,Mig	E
<i>Petauroides volans</i>	Greater glider	V	V
<i>Pteropus conspicillatus</i>	Spectacled flying-fox	V	V
<i>Saccolaimus saccolaimus nudiclunatus</i>	Bare-rumped sheath-tail bat	V	E

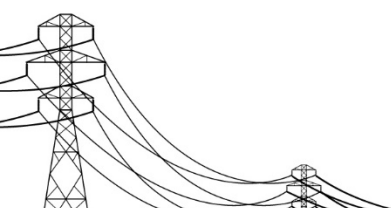
Information on the ecology, distribution and occurrence of conservation significant species confirmed present or likely to occur within the Project area is presented in Sections 4.2.5 and 4.2.6 of Volume 3 Appendix P Ecological Assessment. Additionally, a comprehensive assessment of the impacts and significance of impacts on conservation significant species confirmed present or likely to occur within the Project area is provided in Sections 6.4 and 6.5 of Volume 3 Appendix P Ecological Assessment.

Black-throated finch (southern) (*Poephila cincta cincta*)

The black-throated finch (southern) was confirmed present immediately north of KP162WD, south-east of Pentland in the 2020 surveys (Plate 7-6). A group of approximately 20 birds was observed foraging in ironbark open woodland with a mid-dense grassy ground layer. The species was also confirmed present within the Renewable Energy Hub during the initial EIS and SEIS surveys, where a group of up to 32 birds were observed south of Torrens Creek near KP264 -265WD. Historical records have also been confirmed 20 km north of this observation (DEWHA, 2009), from Trafalga Station (approximately 1 km from KP149WD) and 7 km south of KP146WD during a CSIRO study (2009). Two Birds Australia records are located at north of KP268WD and KP263WD. Potential habitat for the black-throated finch (southern) was identified within the Renewable Energy Hub, specifically between KP138WD – KP168WD and around KP268WD. The distribution of records and suitable habitat is mapped in Figure 7-12.



Plate 7-6 Black-throated finch and habitat observed within the study area



Julia Creek dunnart (*Sminthopsis douglasi*)

The species was not recorded during recent field surveys. However suitable habitat was observed and the species was recorded from two locations in the original EIS surveys, south of Julia Creek at KP615WD and KP588WD. There is also a further 646 Wildlife Online records and 3 Queensland Museum records within the CopperString Core section. Suitable habitat is located between KP616WD and KP579WD and within the CopperString Core section of the proposed corridor selection. Confirmed records and suitable habitat is mapped in Figure 7-13.

Koala (*Phascolarctos cinereus*)

The koala was confirmed present at 16 locations within the study area (refer to Figure 7-14). One koala was observed (Plate 7-7), and koala pellets were recorded from 15 other locations in riparian woodland near Woodstock, Pentland and Prairie. Koalas have also been historically recorded near Hughenden, Prairie, Pentland and Charters Towers as mapped in Figure 7-14. Eucalypt woodland habitats that represent suitable foraging habitat for koalas occurs in patches throughout the eastern extent of the study area. These are predominantly located along watercourses and in open woodland areas on alluvial soils.

Koala habitats have been mapped in Figure 7-14 using field verified RE mapping as a basis, differentiating areas into high, moderate, low and very low value by factors including koala food tree species composition, canopy tree density, soil fertility and proximity to drought refuge. The mapping criteria is detailed in full in Appendix C of the Volume 3 Appendix P Ecological Assessment and summarised in Table 7-7 below. All high, moderate and low value habitats represent habitat critical to the survival of the species. Very low value areas were not considered habitat critical to the survival of the species given their distance from drought refuge. To align with the Commonwealth koala habitat definitions in the Referral guidelines for the vulnerable koala (DoE 2014) separate criteria were applied for coastal (Brigalow Belt Bioregion), inland (Einasleigh Uplands Bioregion) and western inland (Desert Uplands and Mitchell Grass Plains Bioregions) areas.

Table 7-7 Criteria used to map koala habitat

Commonwealth criteria	Criteria used
Coastal koala habitat (Annual rainfall > 800 mm) – applied to Brigalow belt bioregion	
- Large, connected areas of native vegetation, including in forests and woodlands where logging has altered tree species composition; these areas may be remnant, regrowth or plantation vegetation - Small, isolated patches of native vegetation in rural, urban or peri-urban areas, windbreaks and narrow areas of native vegetation along riparian areas or linear infrastructure - Isolated food and/or shelter trees (i.e. on farm lands, in suburban streetscapes, parks and yards).	- High value: REs with primary and secondary food trees for region as named in National Koala Tree Planting List OR REs on alluvial soils within 300 m of watercourses (> stream order 2) - Moderate value: REs described as having moderately fertile soils with mid-dense to sparse tree densities of known koala food trees not specified as primary or secondary food trees in the National Koala Tree Planting List OR REs with low fertile soils and very sparse tree densities of primary or secondary koala food trees - Low value: REs described as having low fertility soils, very sparse tree densities of koala food trees not specified as primary or secondary tree species for the region OR Acacia-dominated REs with emergent

Commonwealth criteria	Criteria used
	koala food trees OR non-remnant areas with isolated trees within 200m of remnant vegetation
Inland koala habitat (Annual rainfall < 800 mm) – applied to Einasleigh uplands bioregion	
Eucalypt forests and woodlands, as well as Acacia woodlands (with emergent food trees) <i>in both riparian and non-riparian</i> environments - Woodlands and forests (where koala food trees have reliable access to soil moisture) - Box gum or red gum woodlands on heavier soils in remnant or regrowth vegetation patches particularly riparian zones - Small, patchy and sparsely distributed woodlands, shrublands and forest in highly modified, agricultural-grazing landscapes or in and around rural towns (although there are some large, connected areas of habitat also).	- High value: As for coastal - Moderate value: As for coastal - Low value: REs with low fertility soils, very sparse tree densities of koala food trees not specified as primary or secondary tree species for the region OR Acacia-dominated REs with emergent koala food trees - <i>all where these occur within 5 km of drought refuge</i> (i.e. high value habitat) - Very low value: Areas of low value habitat detailed above <i>where these occur more than 5 km from drought refuge</i>
Western inland koala habitat – applied to Desert Uplands and Mitchell Grass Plains bioregions	
Eucalypt (and related genera) forests and woodlands (<i>particularly in the vicinity of riparian environments</i> and Acacia-dominated forest, woodland and shrubland (with emergent food trees) - Woodlands and forests (where koala food trees have reliable access to soil moisture) - Box gum or red gum woodlands on heavier soils in remnant or regrowth vegetation patches particularly riparian zones - Small, patchy and sparsely distributed woodlands, shrublands and forest in highly modified, agricultural-grazing landscapes or in and around rural towns (although there are some large, connected areas of habitat also).	- High value: As for coastal - Moderate value: As for coastal - Low value: REs with low fertility soils, very sparse tree densities of koala food trees not specified as primary or secondary tree species for the region OR Acacia-dominated REs with emergent koala food trees - <i>all where these occur within 1 km of drought refuge</i> (i.e. high value habitat) - Very low value: Areas of low value habitat detailed above <i>where these occur more than 1 km from drought refuge</i>

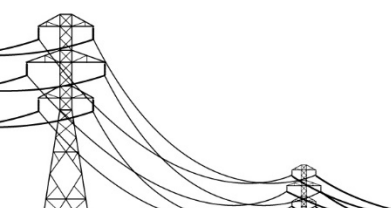




Plate 7-7 Koala and scratches recorded during 2019 / 2020 field surveys

Squatter pigeon (southern) (*Geophaps scripta scripta*)

The squatter pigeon (southern) (Plate 7-8) was recorded throughout the majority of the eastern extent of the proposed corridor selection, particularly around Pentland, Hughenden, Charters Towers and Ravenswood. The species was predominantly observed within highly disturbed environments where water was permanently available. Degraded cattle feeding areas recorded the highest abundance of squatter pigeons with some areas supporting flocks of over 30. Past studies have recorded this species within the Renewable Energy Hub at KP35WD, 135.5WD, 197.5WD and 270WD, and a 20 additional Birds Australia records and 4 Wildlife Online records are recorded within the Renewable Energy Hub and CopperString Core sections. Suitable habitat for the squatter pigeon was mapped throughout the majority of CopperString Core and Renewable Energy Hub sections, as shown in Figure 7-15.



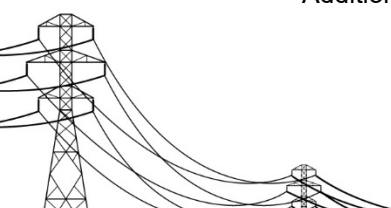
Plate 7-8 Squatter pigeon (southern) recorded during 2019 field surveys

White-throated needletail (*Hirundapus caudacutus*)

Although the white-throated needletail was not observed during field surveys, the species is likely to occur over all habitats within the eastern extent of the proposed corridor selection. In particular, between Hughenden and Woodstock where several historical records were reported within desktop study area. The potential local distribution of the species is mapped in Figure 7-16.

Red goshawk (*Erythrorchis radiatus*)

This species was not recorded during field surveys though suitable habitat was identified in the eastern and western sections of the corridor selection. The species was considered unlikely to occur throughout the central section of the Project due to the lack of woodland / forest habitats. Additionally, there are four Wildlife Online records for the species located within the study area



around the Mount Isa region. Suitable habitat for the red goshawk was mapped throughout the eastern and western extent of the proposed corridor selection as shown in Figure 7-17.

Vine-thicket fine-lined slider (*Lerista cinerea*)

Potential habitat for *Lerista cinerea* was identified within the Renewable Energy Hub during the 2011 SEIS field surveys. Vine thicket habitat was found on and in close proximity to the proposed alignment on the northern edge of Rishton Scrub near the Burdekin River between KP 68WD and 71WD, including a previously unmapped extent of vine thicket directly in the path of the previous alignment at KP 71WD. Within these areas, *L. cinerea* were reported as abundant in loose sand under fallen timber at several locations, indicating the species was locally common. The final corridor was realigned to avoid these areas, and is now approximately 1.5 km from the Rishton Scrub habitat, as mapped in Figure 7-18.

Night parrot (*Pezoporus occidentalis*)

This species was previously thought to be extinct, before two dead specimens were found in western Queensland in 1990 and 2006 (Cupitt and Cupitt 2008). The species' existence was later confirmed in 2013 (Dooley 2013). Preferred habitats for the species includes arid and semi-arid grasslands dominated by spinifex and with an absence of trees and shrubs. Run on areas and long unburnt habitats have also been identified as key habitat requirements for the species. The night parrot has not been recorded in surveys for the Project, however potentially suitable habitat was located around the Mount Isa and Cloncurry region. Essential habitat for the night parrot is mapped approximately 2 km west of the Project area within the Ballara Nature Refuge. Despite the potential to inhabit a large area of inland and arid Australia, the night parrot is a cryptic species only known from a number of locations. In order to protect the species, there is a high level of secrecy and restrictions on the release of information on the location of night parrot populations. As such, a conservative approach has been adopted for the Project and the species has been assessed as likely to occur to ensure it receives appropriate protection from any clearing impacts. Suitable habitat for the night parrot is presented in Figure 7-19.

Painted honeyeater (*Grantiella picta*)

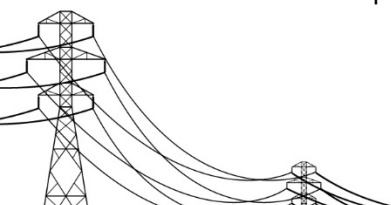
The painted honeyeater is a nomadic species, moving to northern parts of Queensland and Northern Territory each winter from breeding habitats in southern Queensland, New South Wales and Victoria. The species occurs in woodlands, feeding almost exclusively on mistletoe fruit and flowers (Oliver et al. 2003). No painted honeyeaters were recorded during field survey however suitable habitat was identified around within the central and western sections of the corridor selection. A high abundance of mistletoe was also recorded at KP 125 WD. Past surveys mapped potential habitat around sections KP26SC, KP30.5DS, KP 39DS, KP 53DS and KP71DS, as mapped in Figure 7-20.

Australian painted-snipe (*Rostratula australis*)

The Australian painted snipe has a relatively broad distribution, occurring at the fringes of a variety of permanent and / or temporary shallow, brackish and freshwater wetlands throughout mainland Australia. The Australian painted-snipe was not recorded during field surveys. However suitable habitat is patchily distributed across the study area as mapped in Figure 7-21.

Plains death adder (*Acanthophis hawkei*)

The plains death adder is a cryptic species, known to occupy the floodplains of the Adelaide, Mark and Alligator River, the Barkly Tablelands and Queensland's Mitchell Grass Downs bioregion and predicted to occur throughout most black soil floodplains of northern Australia. This species was not recorded during field surveys, however suitable habitat for the plains death



adder was intermittently mapped within the Mount Isa Augmentation, Southern Connection and Phosphate Hill Substation, as mapped in Figure 7-22.

Ornamental snake (*Denisonia maculata*)

The ornamental snake is known only from within the drainage system of the Fitzroy and Dawson Rivers in Queensland between Emerald and Inglewood (McDonald et al. 1991; Cogger et al. 1993). Important populations occur in remnant vegetation in close proximity to gilgai mounds and depressions (DSEWPac, 2012). The species occurs amongst woodlands and shrublands, preferably brigalow, in low lying areas where deep-cracking clays are abundant. The ornamental snake was not recorded during field studies, however suitable habitat was mapped at two separate locations; in the Renewable Energy Hub section between the Cape River and Campaspe River, approximately 24 km from the township of Homestead, and at two scattered locations between Prairie (KP288WD and KP284WD) and Torrens Creek (KP280WD) as mapped in Figure 7-23.

Grey falcon (*Falco hypoleucos*)

It inhabits a range of habitat types, including lightly timbered woodlands, Acacia shrublands and Triodia grasslands with annual rainfall under 500 mm (Marchant and Higgins, 1993). The species' core breeding habitat is restricted to Australia's hottest climatic regions (Schoenjahn, 2013). Consequently, there is a recognised lack of sampling of the species' breeding habitat. No grey falcons were recorded during field surveys, however the species is known to occur around Mount Isa and Cloncurry where it has been reported as an occasional, non-breeding, winter visitor. Potential habitat for the grey falcon is mapped in Figure 7-24.

Purple-necked rock wallaby (*Petrogale purpureicollis*)

The purple-necked rock-wallaby (Plate 7-9) was recorded at one location within the study area, specifically around along Cloncurry Duchess Road approximately 10 km south west of Cloncurry, within the Southern Connection section. This species was also observed approximately 8 km west of the alignment at KP66DS. During the 2020 field surveys, numerous scat samples were collected amongst rocky ranges and outcrops that are likely to belong to the species. This species are currently being analysed. Past surveys have also recorded this species at multiple sites within the western extent of the proposed corridor selection and multiple database searches support these results (DES 2020a; OZCAM, 2020; Atlas of Living Australia, 2020). Suitable habitat for the species is mapped in the western and central extent of the proposed corridor selection, from the Dajarra Road Substation to Mount Isa and south to the Phosphate Hill and Cannington Substations. The distribution of records and potential habitat for the purple-necked rock-wallaby is mapped in Figure 7-25.

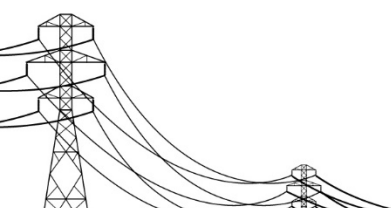


Plate 7-9 Purple-necked rock-wallaby and habitat observed in 2019 surveys**Short-beaked echidna**

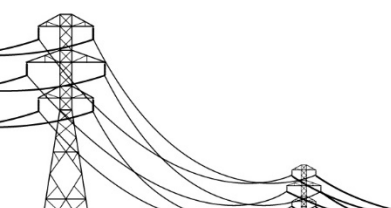
Evidence of the short-beaked echidna was recorded at two locations within the study area. Two individual diggings were observed near the Campaspe River, approximately 21 km south of Homestead. Suitable habitat for the short-beaked echidna was widely recorded throughout the study area as mapped in Figure 7-26.

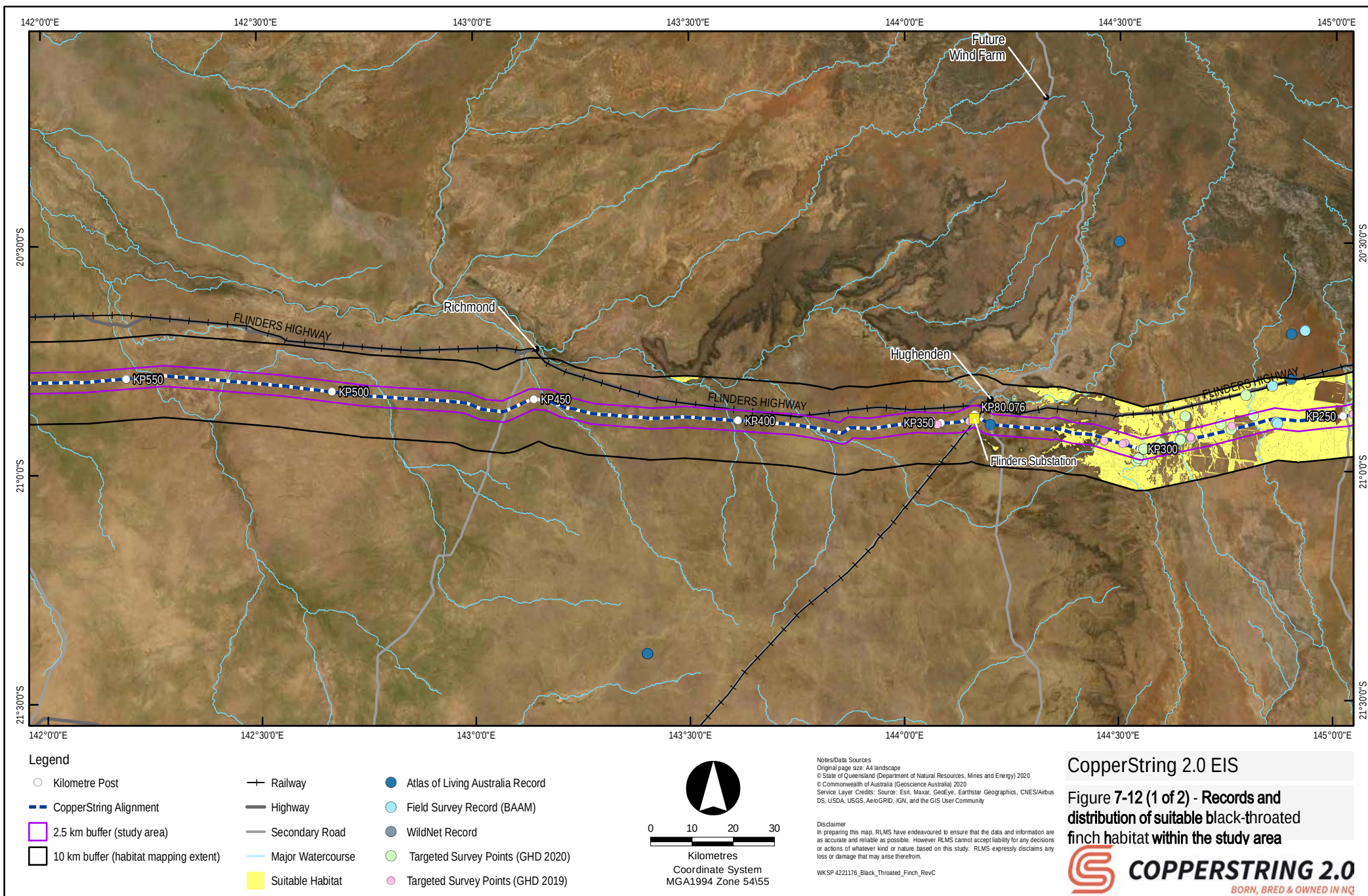
Northern leaf-nosed bat (*Hipposideros stenotis*)

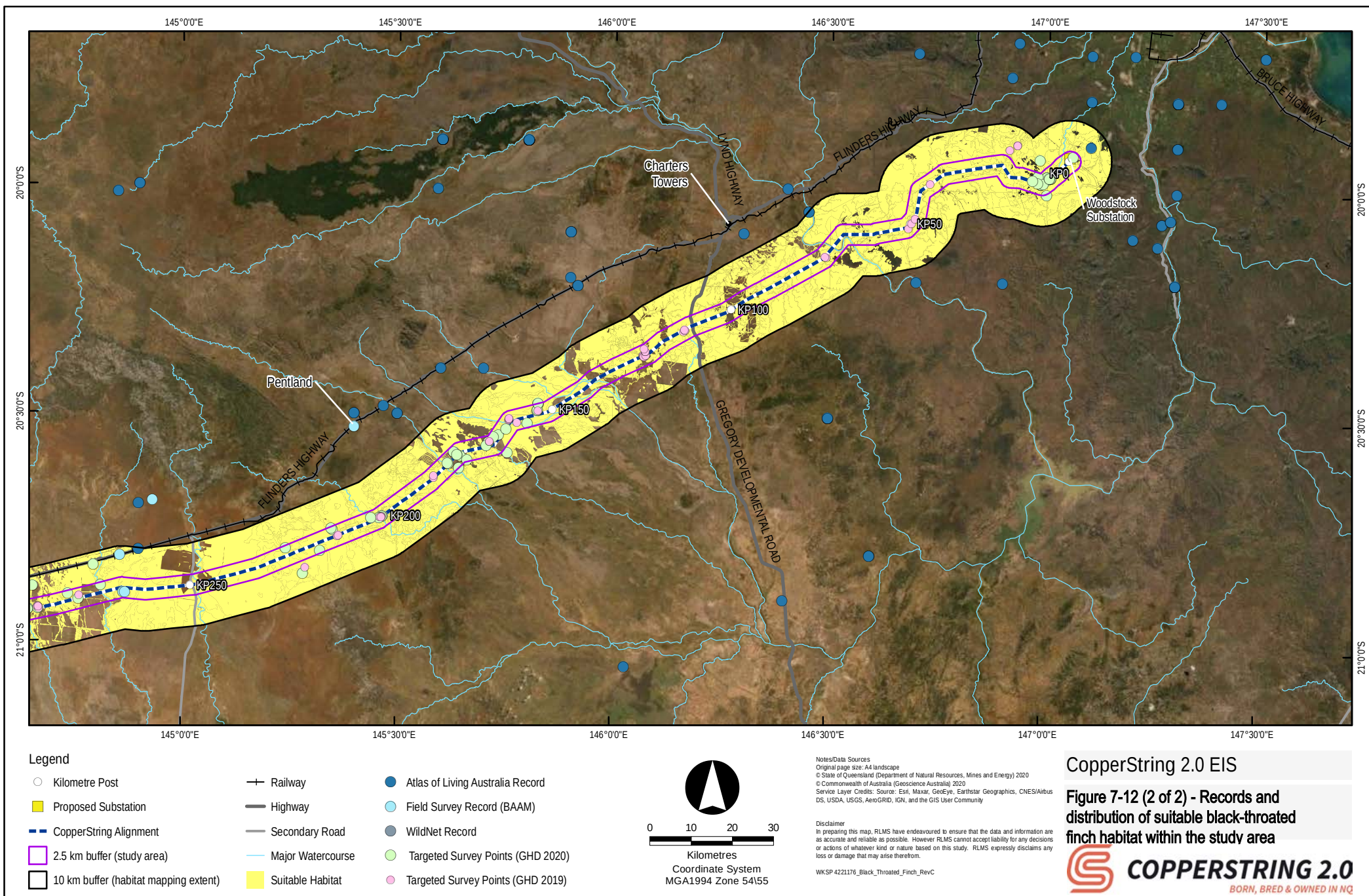
The species inhabits tall open eucalypts woodlands, floodplains and spinifex hills (Milne and Hall 2008) and roosts only in sandstone caves, boulder piles and disused mines. This species was not recorded during field studies however suitable habitat was identified within the Mount Isa Augmentation and Southern Connection sections of the final corridor selection, as mapped in Figure 7-27.

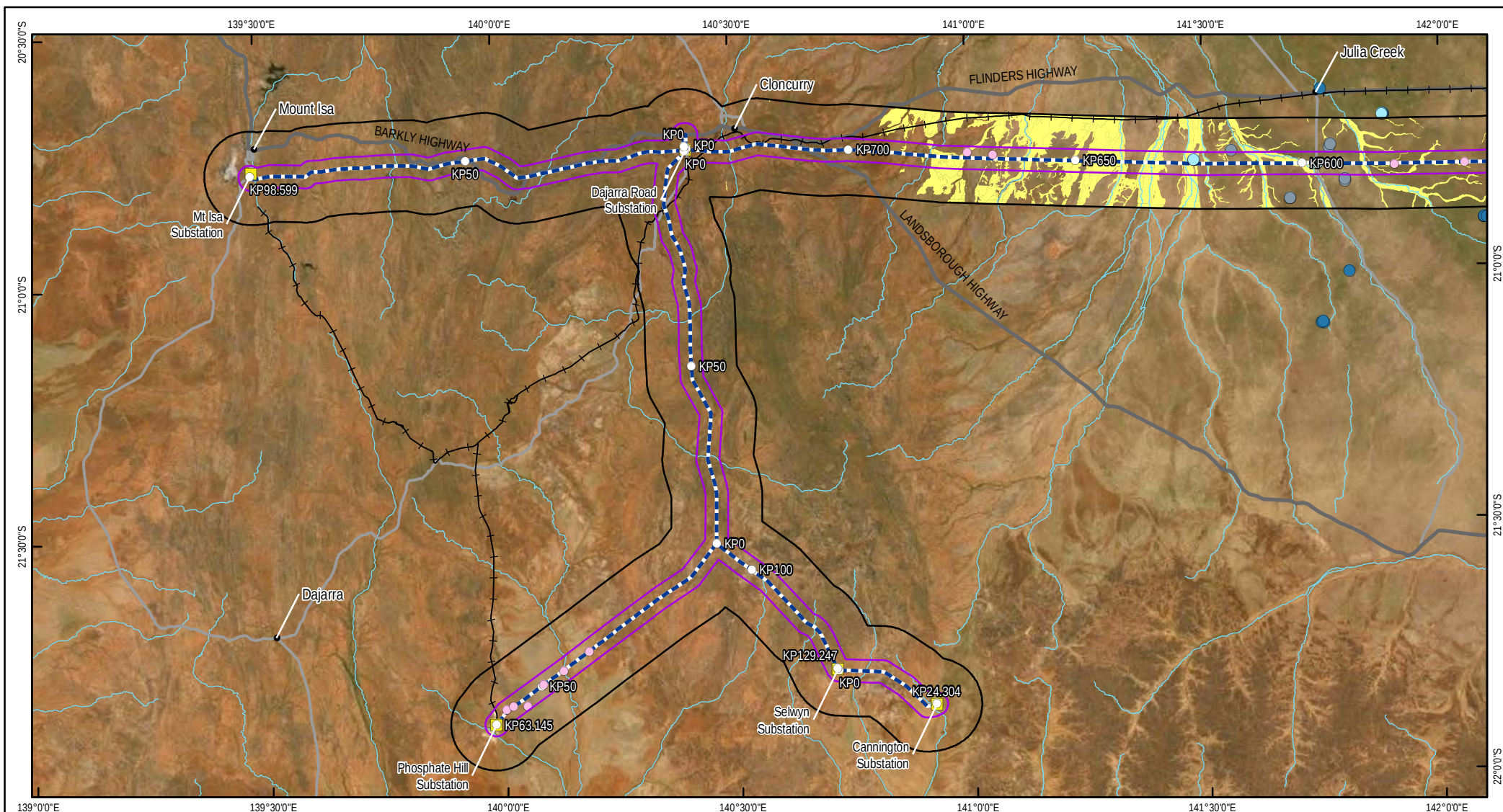
Common death adder (*Acanthophis antarcticus*)

The common death adder is found over a large part of Queensland with the majority of records from the south-east, and scattered records from elsewhere across its Queensland range (Covacevich and Couper 1991). Within its range *A. antarcticus* inhabits a broad range of habitat types, including wet and dry forests/woodlands, rainforests, grasslands, shrublands and coastal heaths. The species was not recorded during field surveys, however potential habitat was identified during the Renewable Energy Hub and the eastern areas of the CopperString Core section as mapped in Figure 7-28.









Legend

- Kilometre Post
- +— Railway
- Highway
- Secondary Road
- Major Watercourse
- Suitable Habitat
- CopperString Alignment
- 2.5 km buffer (study area)
- 10 km buffer (habitat mapping extent)
- Atlas of Living Australia Record
- Field Survey Record (BAAM)
- WildNet Record
- Targeted Survey Points (GHD 2019)



0 10 20 30
Kilometres
Coordinate System
MGA1994 Zone 54I55

Notes/Data Sources
Original page size: A4 landscape
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Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

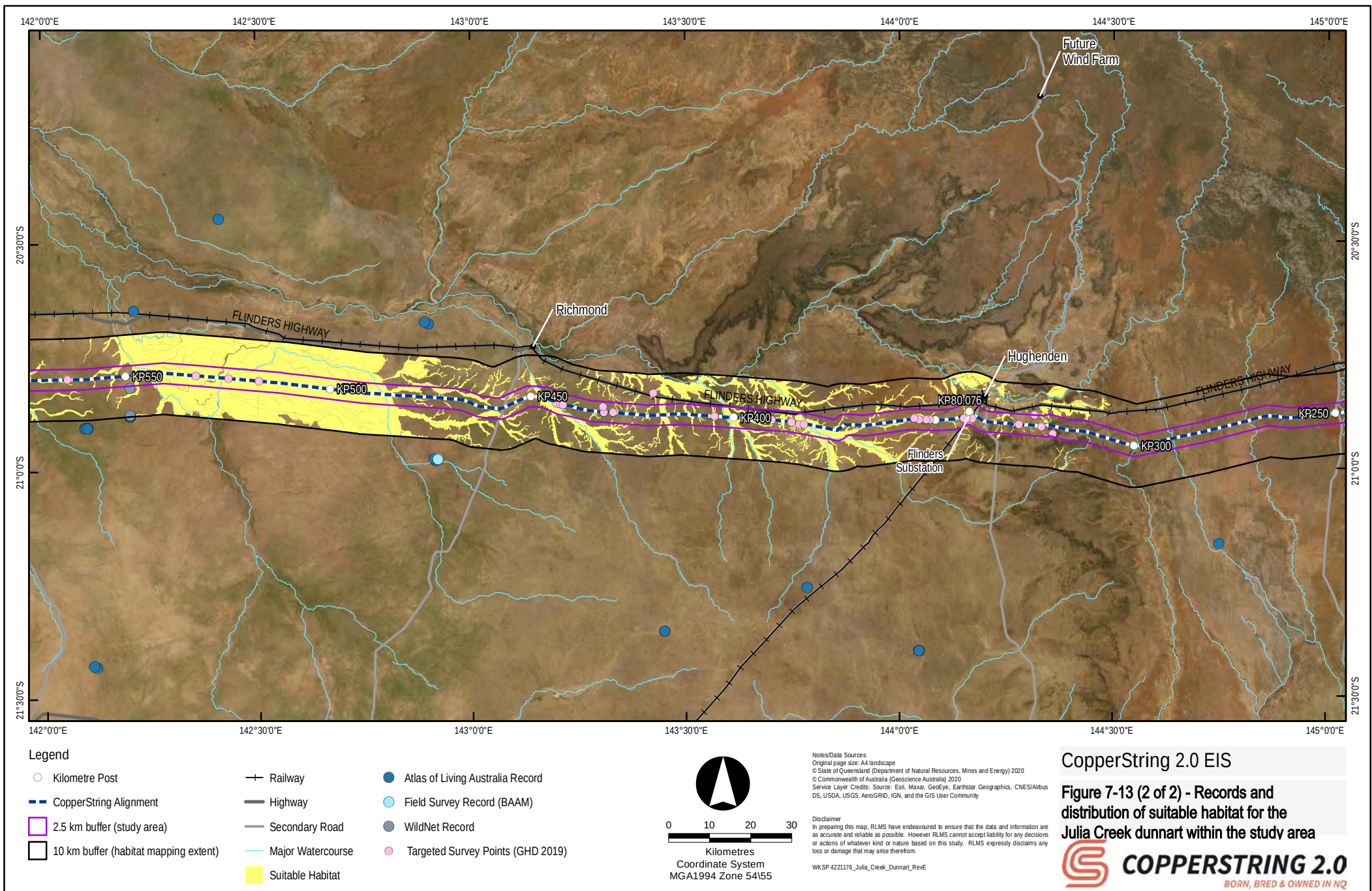
Disclaimer
In preparing this map, RLMS have endeavoured to ensure that the data and information are as accurate and reliable as possible. However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study. RLMS expressly disclaims any loss or damage that may arise therefrom.

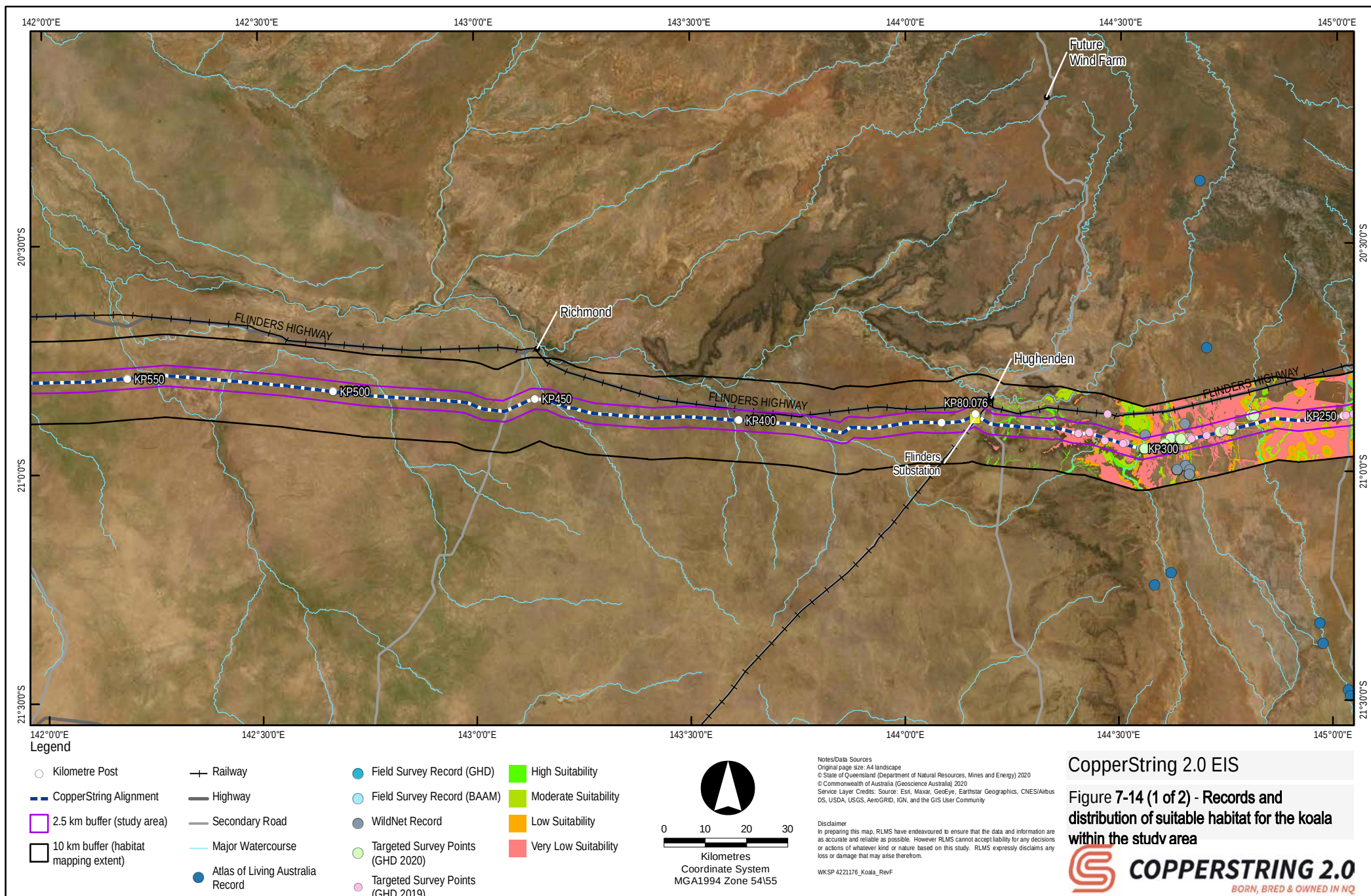
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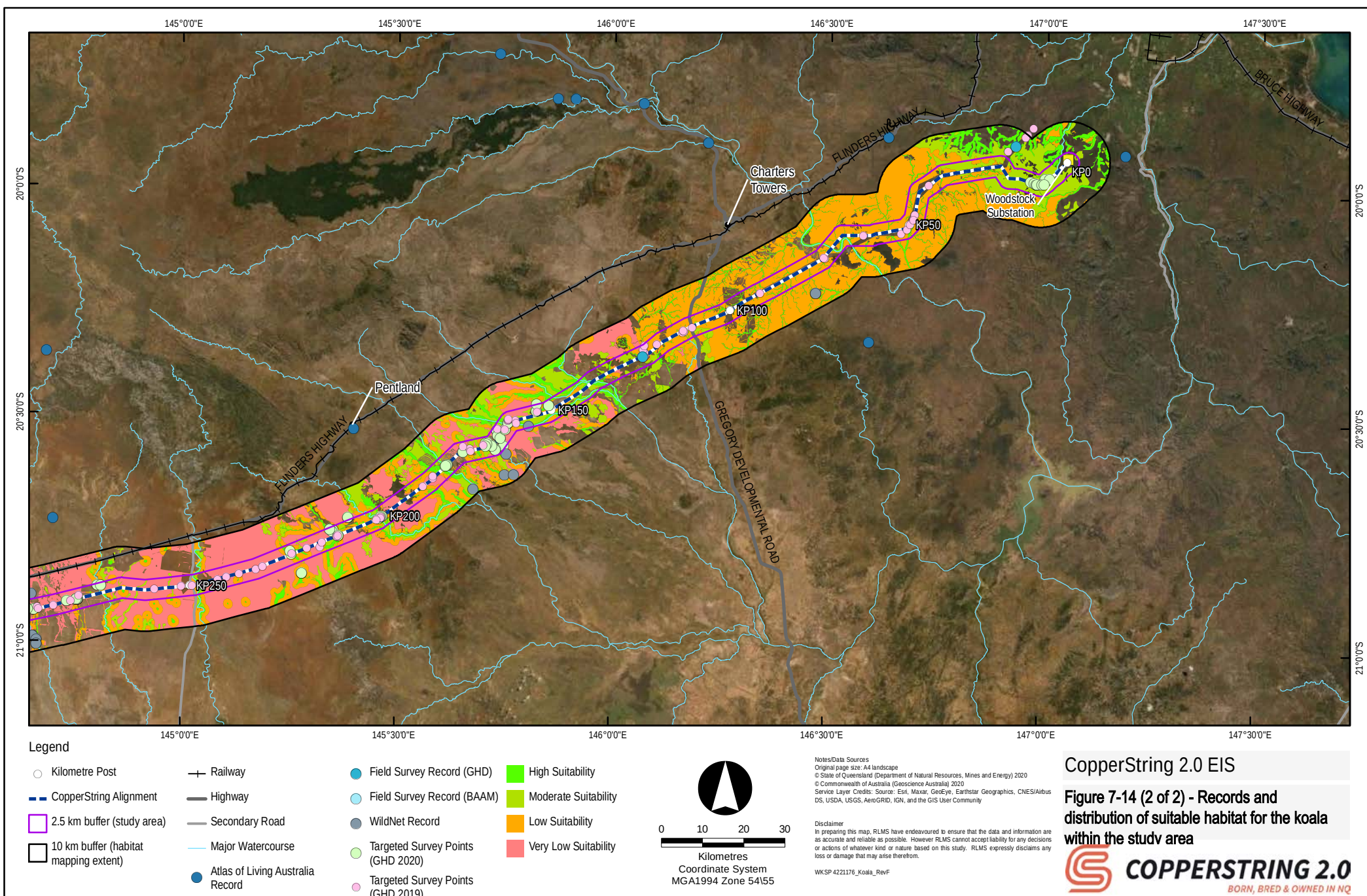
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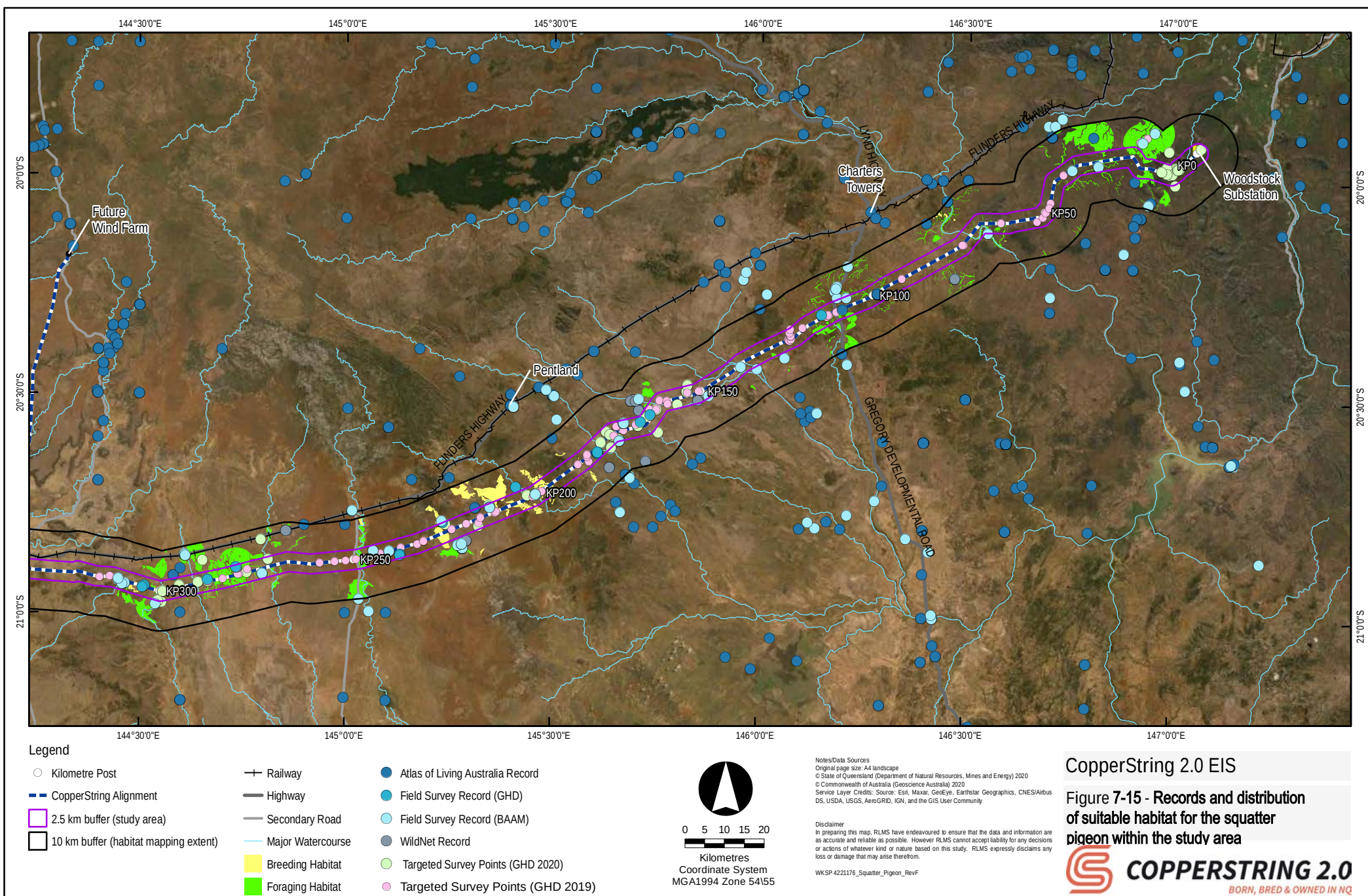
Figure 7-13 (1 of 2) - Records and distribution of suitable habitat for the Julia Creek dunnart within the study area

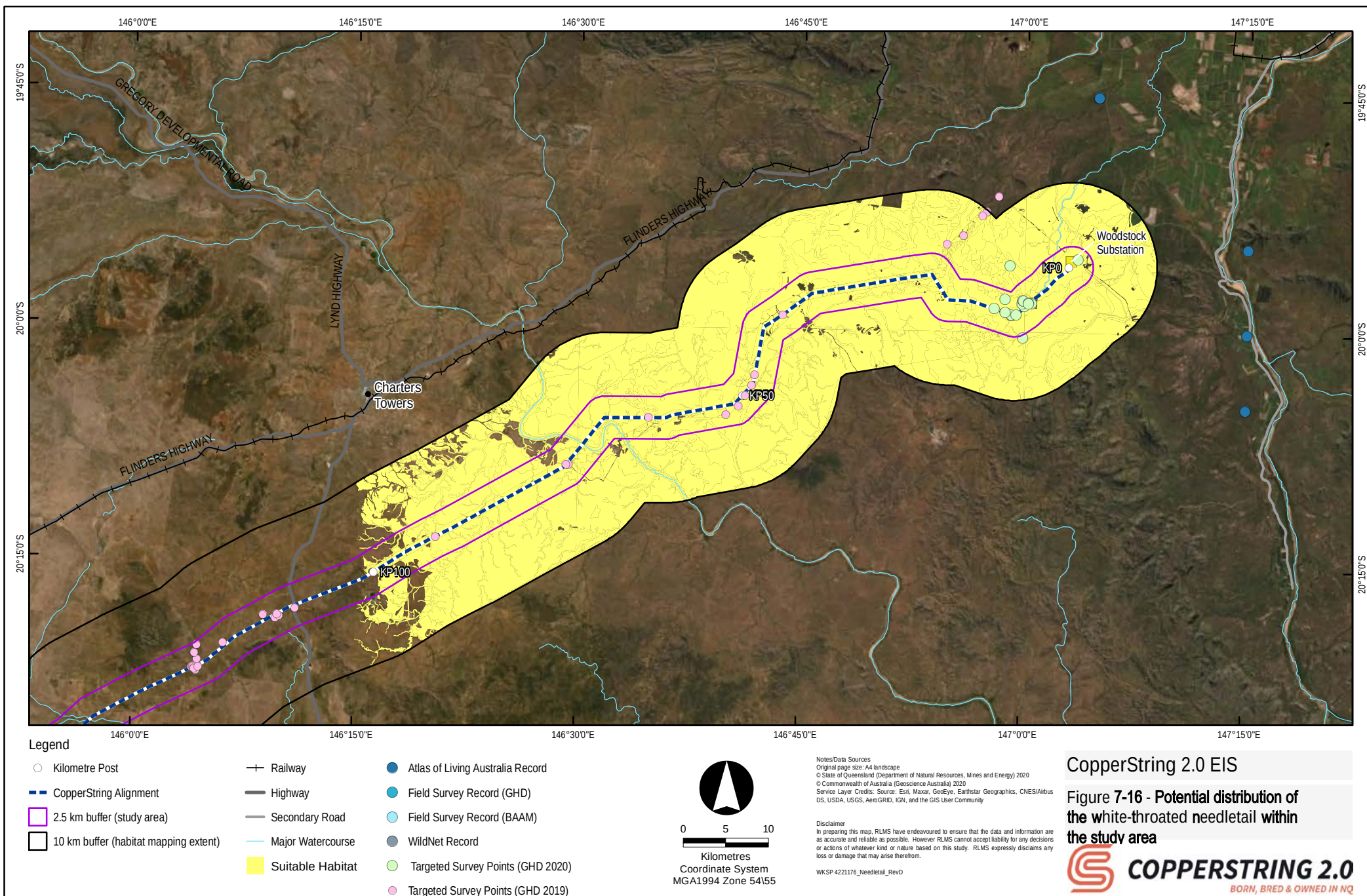


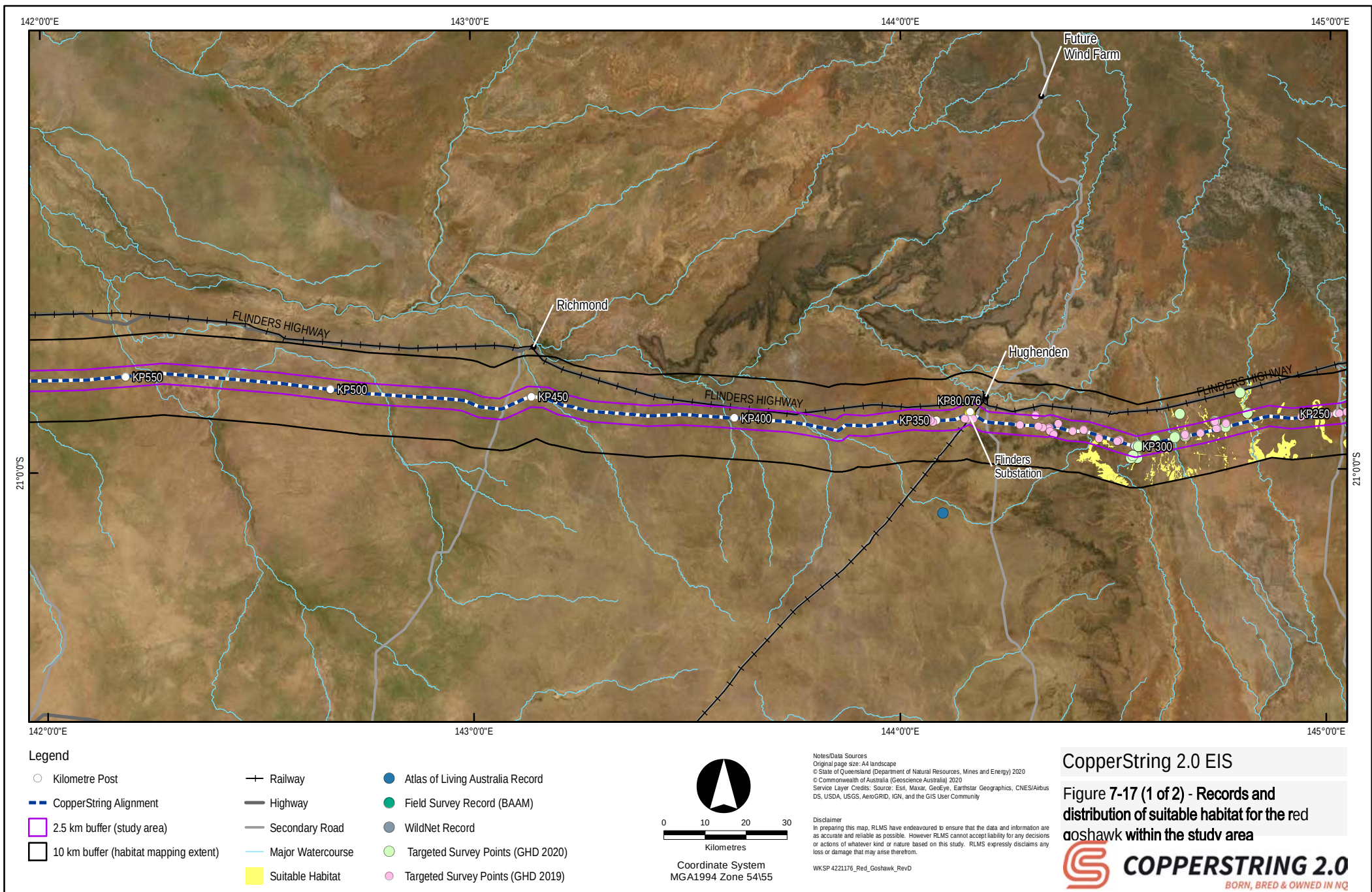


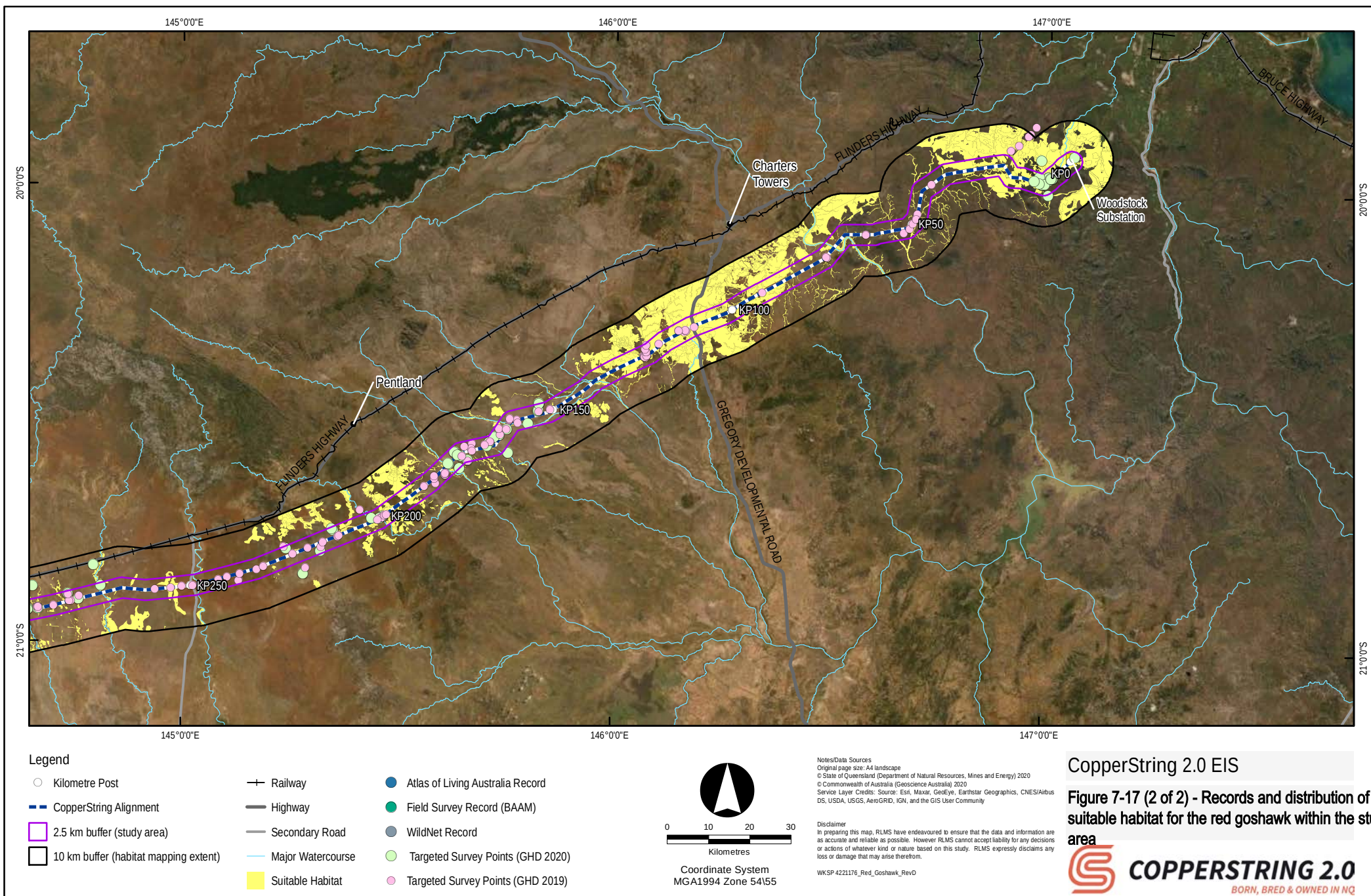


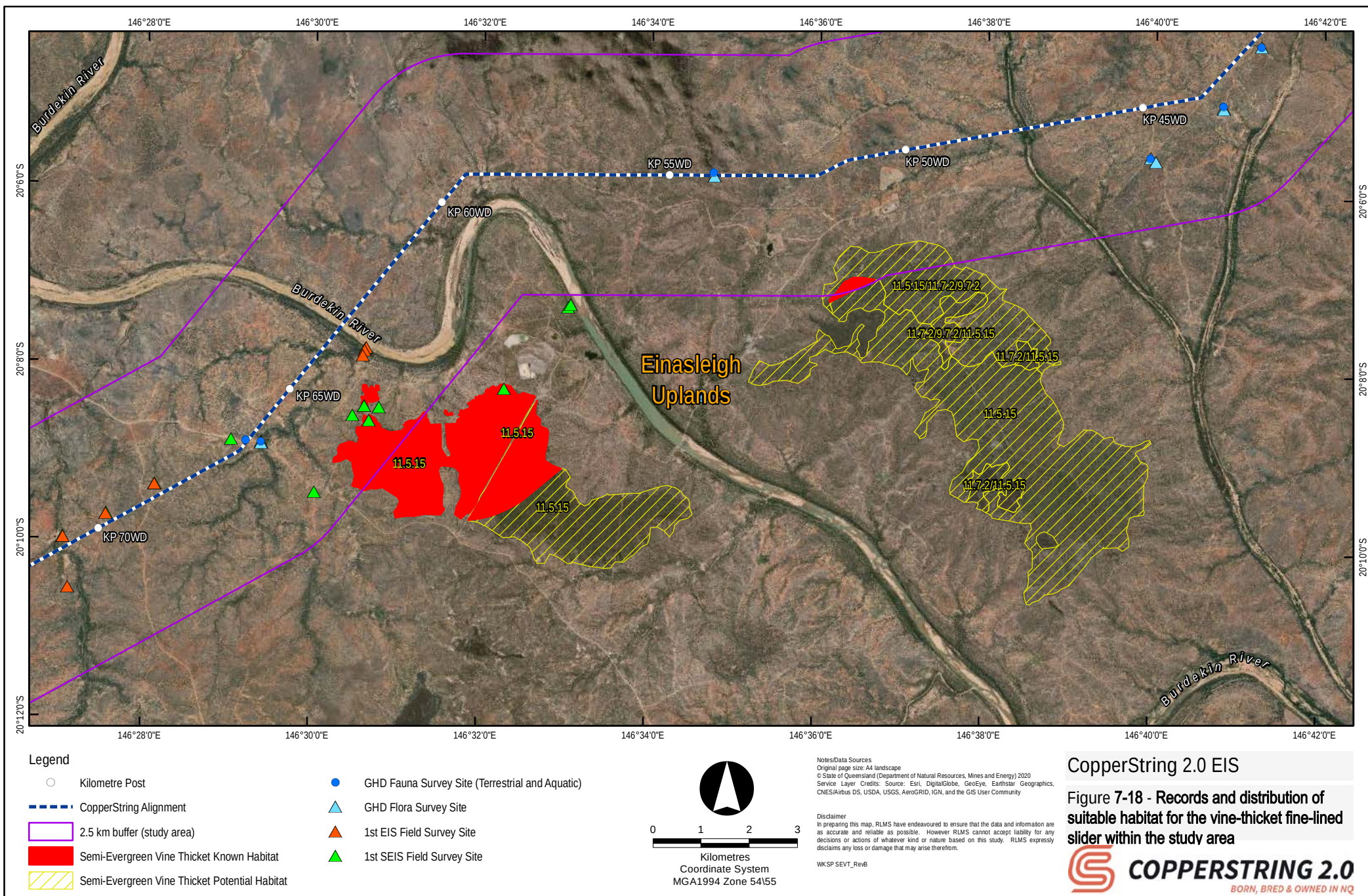


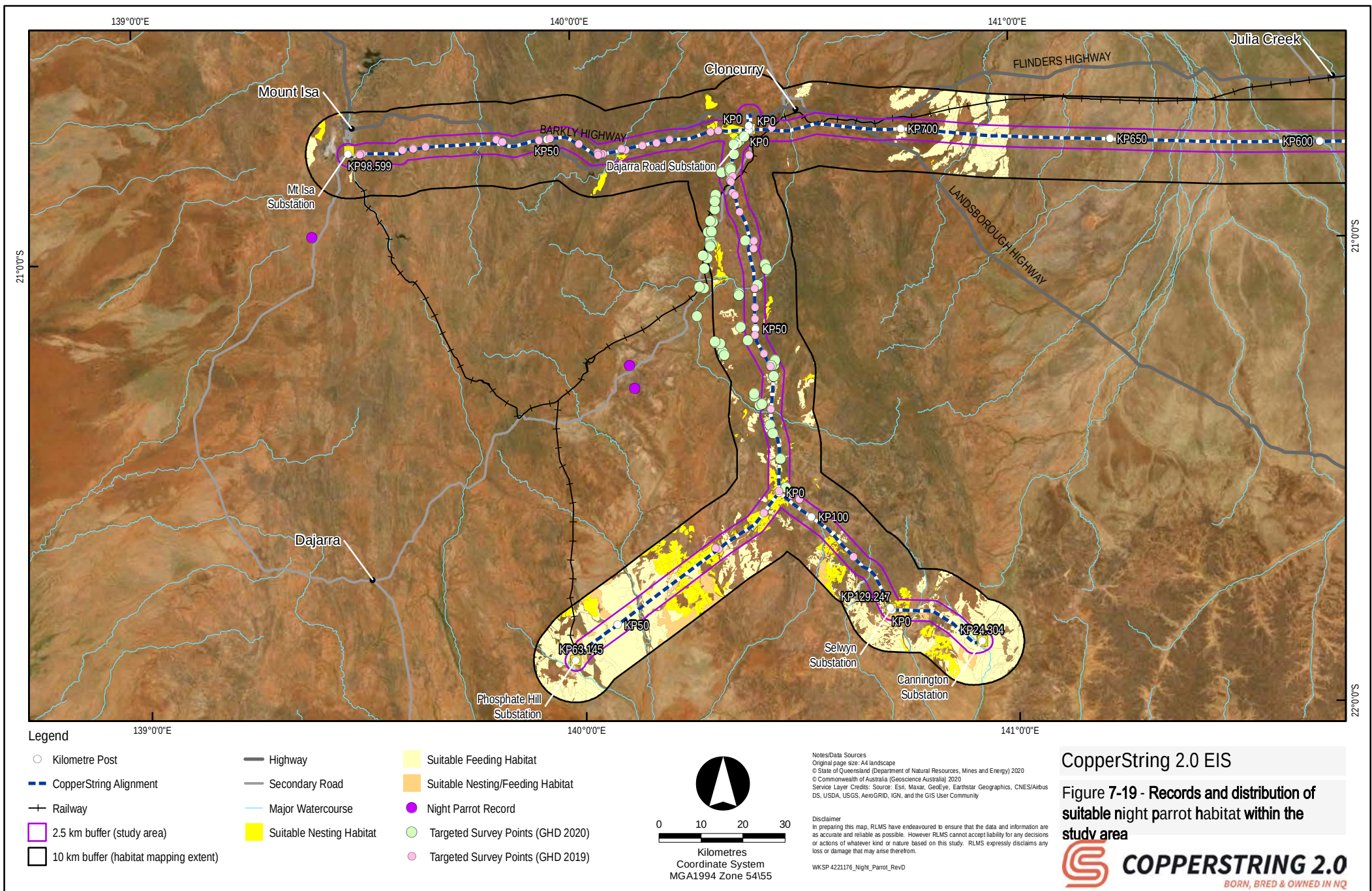


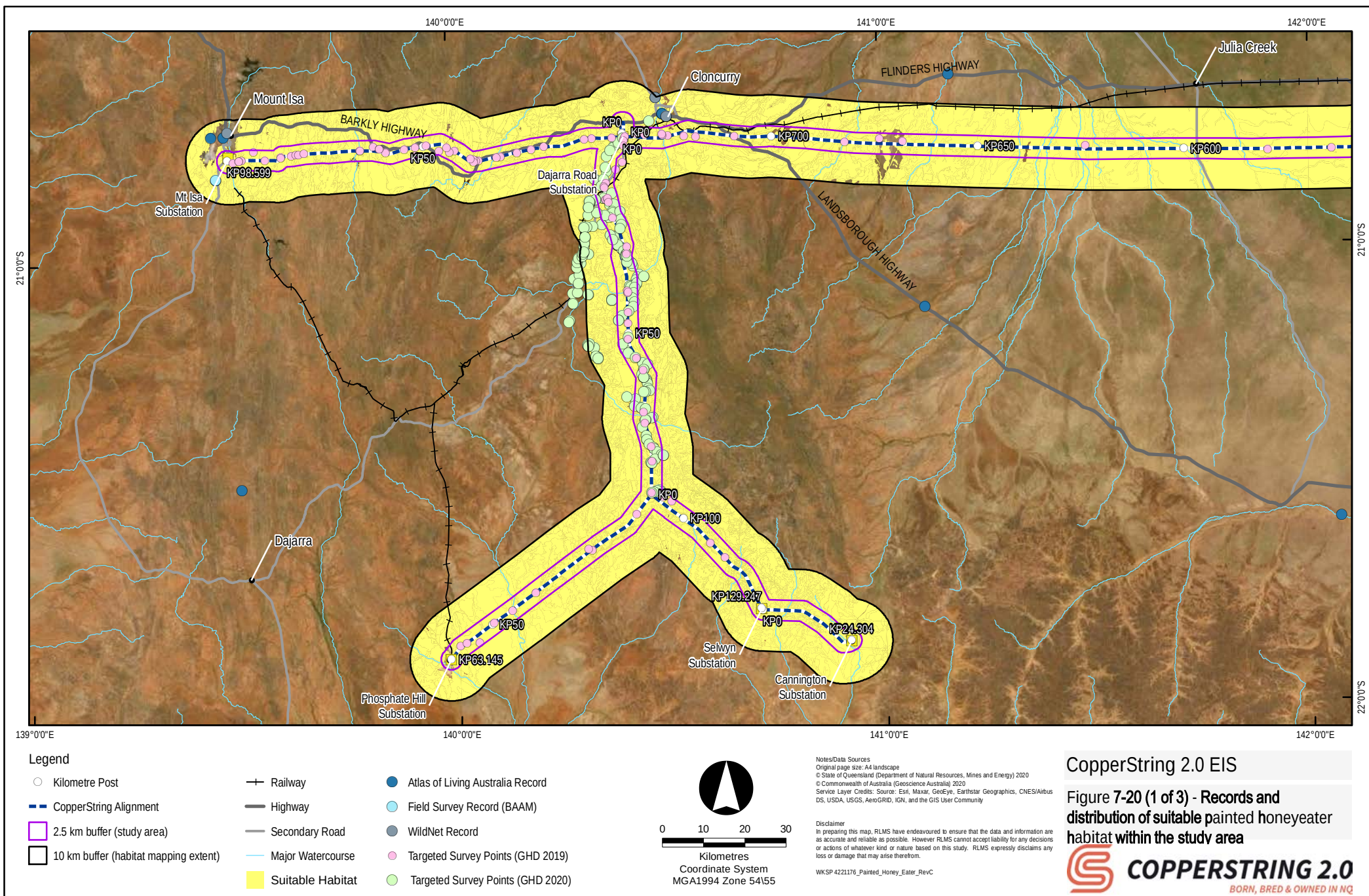


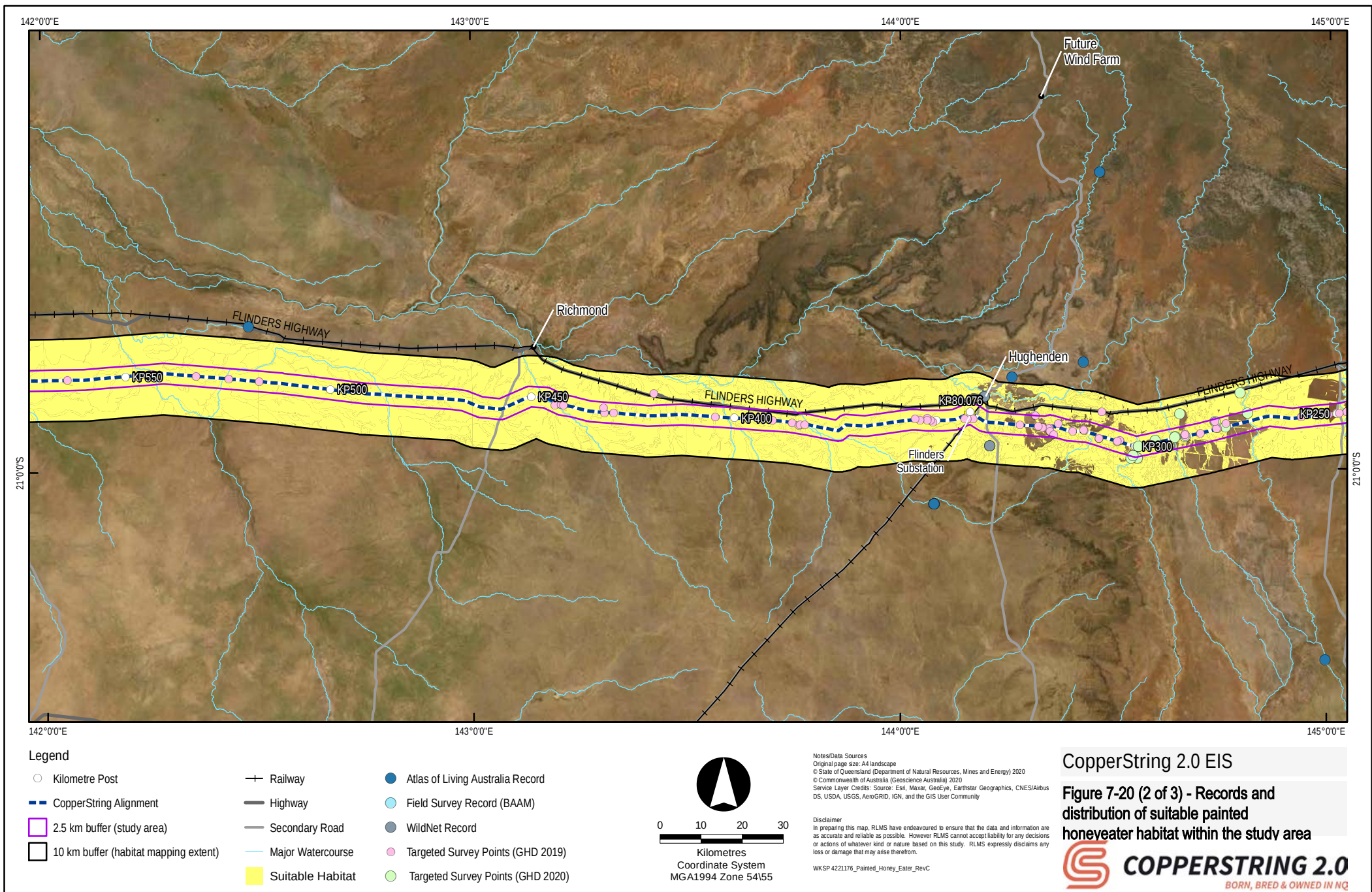


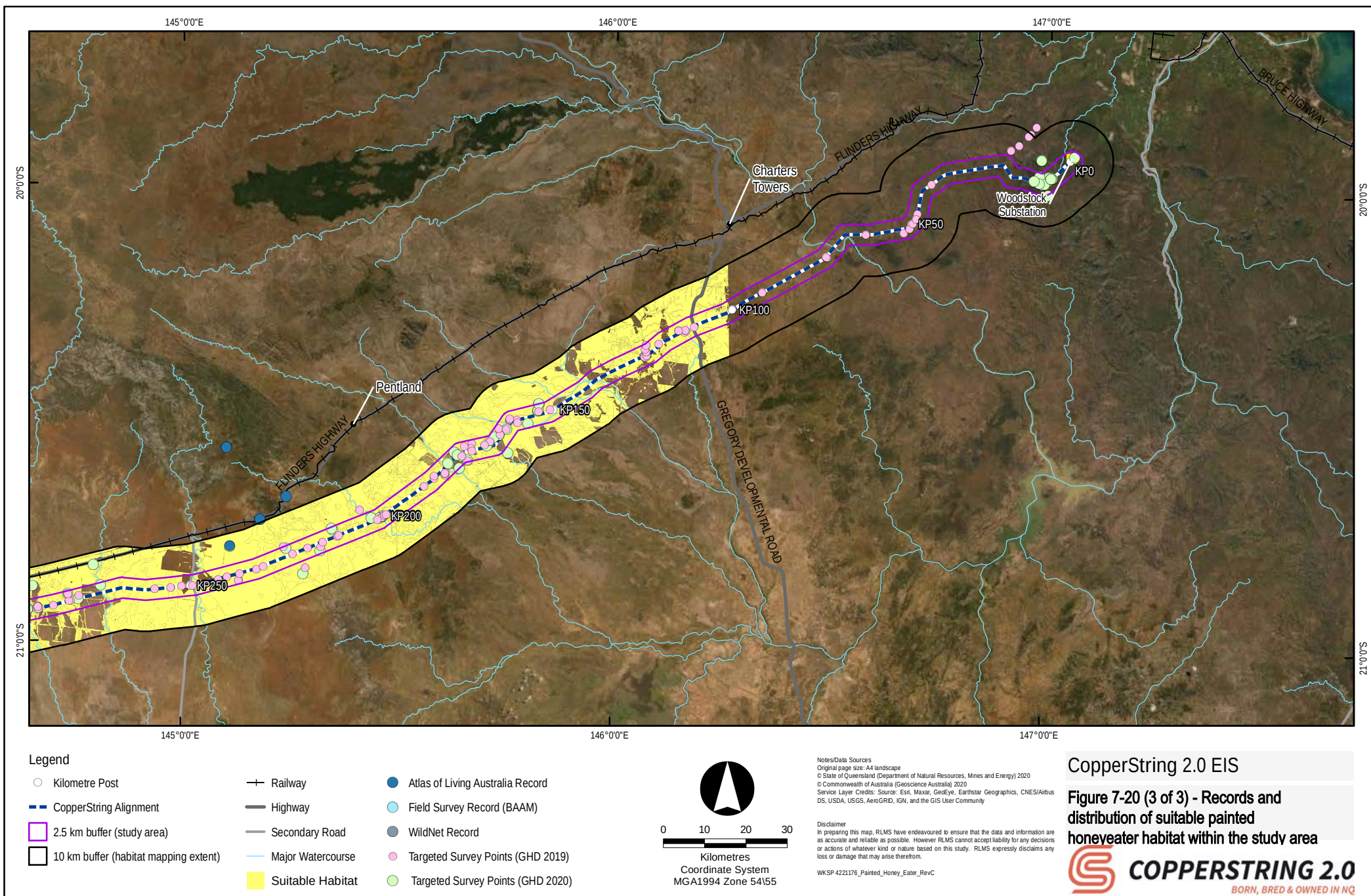


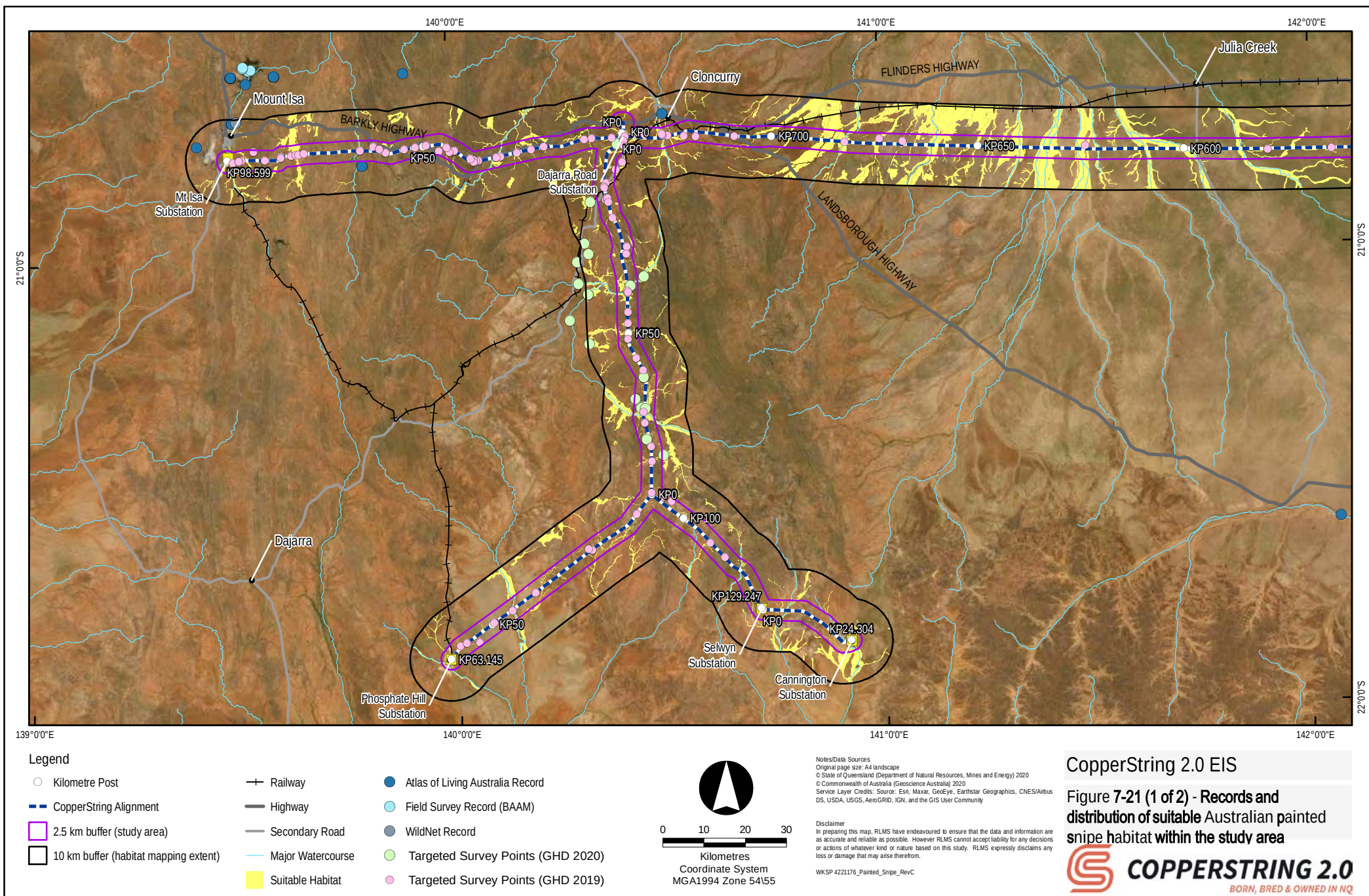


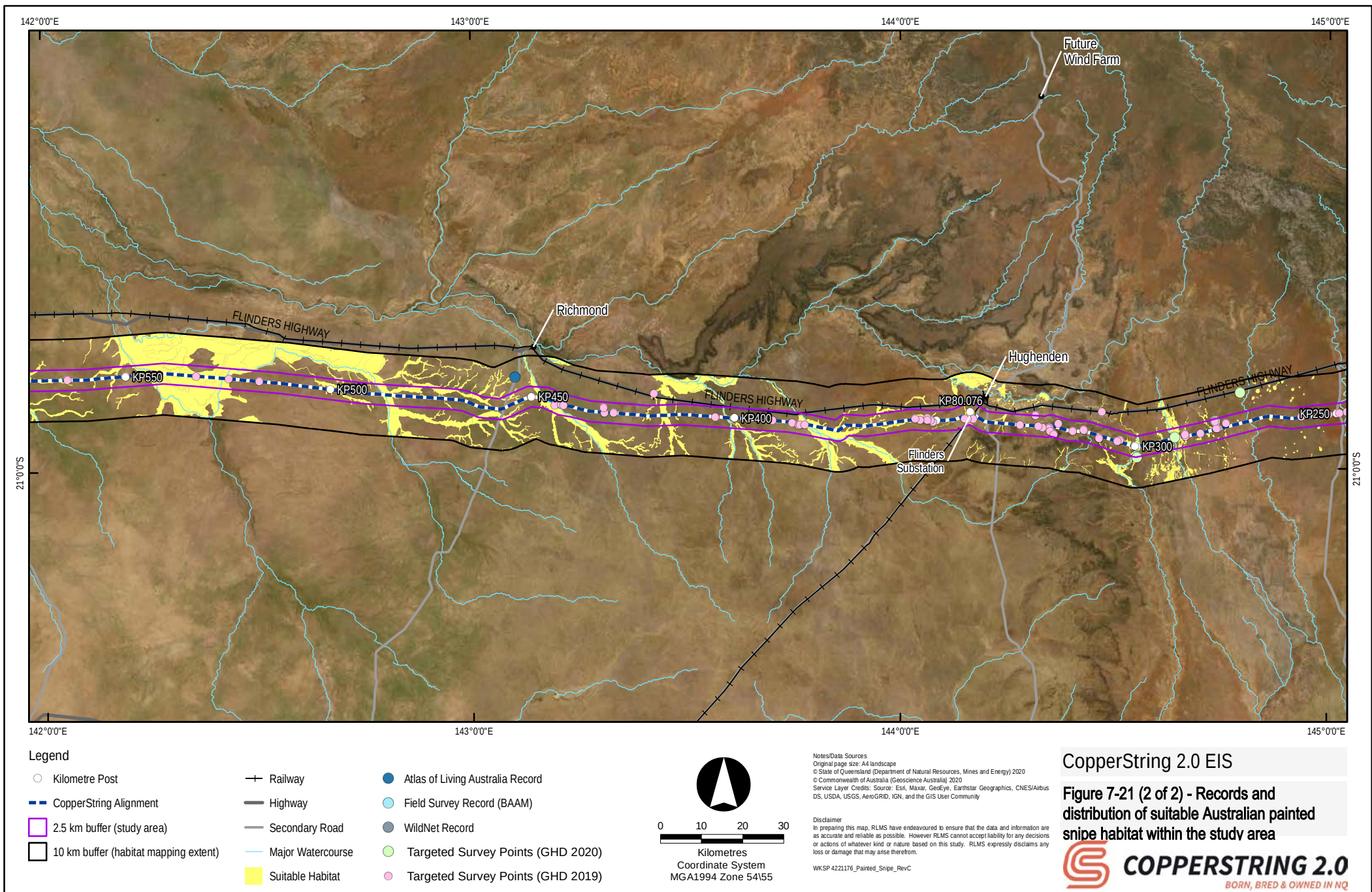


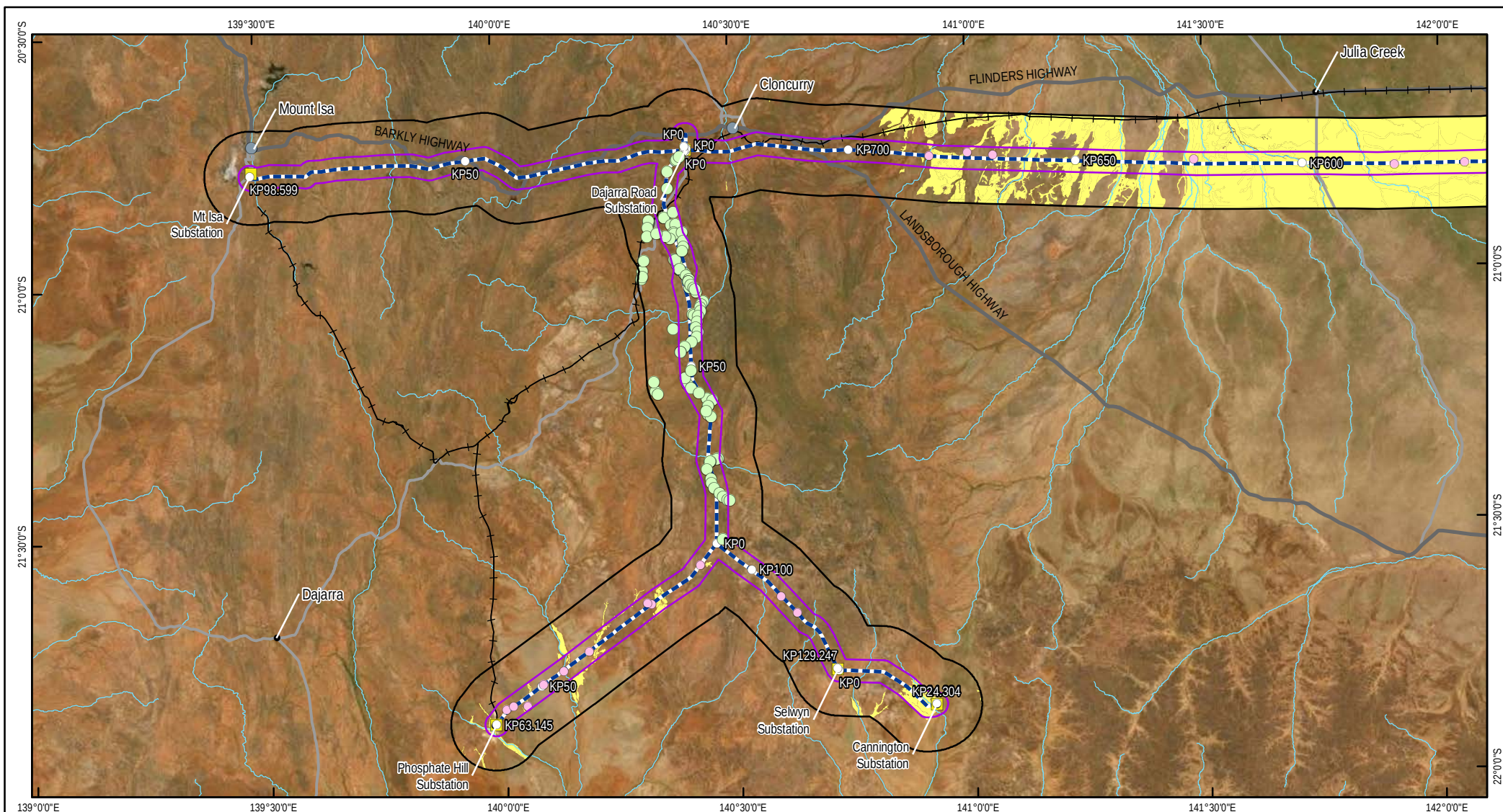






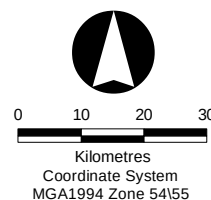






Legend

- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- 10 km buffer (habitat mapping extent)
- Railway
- Highway
- Secondary Road
- Major Watercourse
- Suitable Habitat
- Atlas of Living Australia Record
- Field Survey Record (BAAM)
- WildNet Record
- Targeted Survey Points (GHD 2020)
- Targeted Survey Points (GHD 2019)



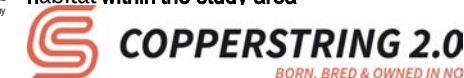
Notes/Data Sources
Original page size: A4 landscape
© State of Queensland (Department of Natural Resources, Mines and Energy) 2020
© Commonwealth of Australia (Geoscience Australia) 2020
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

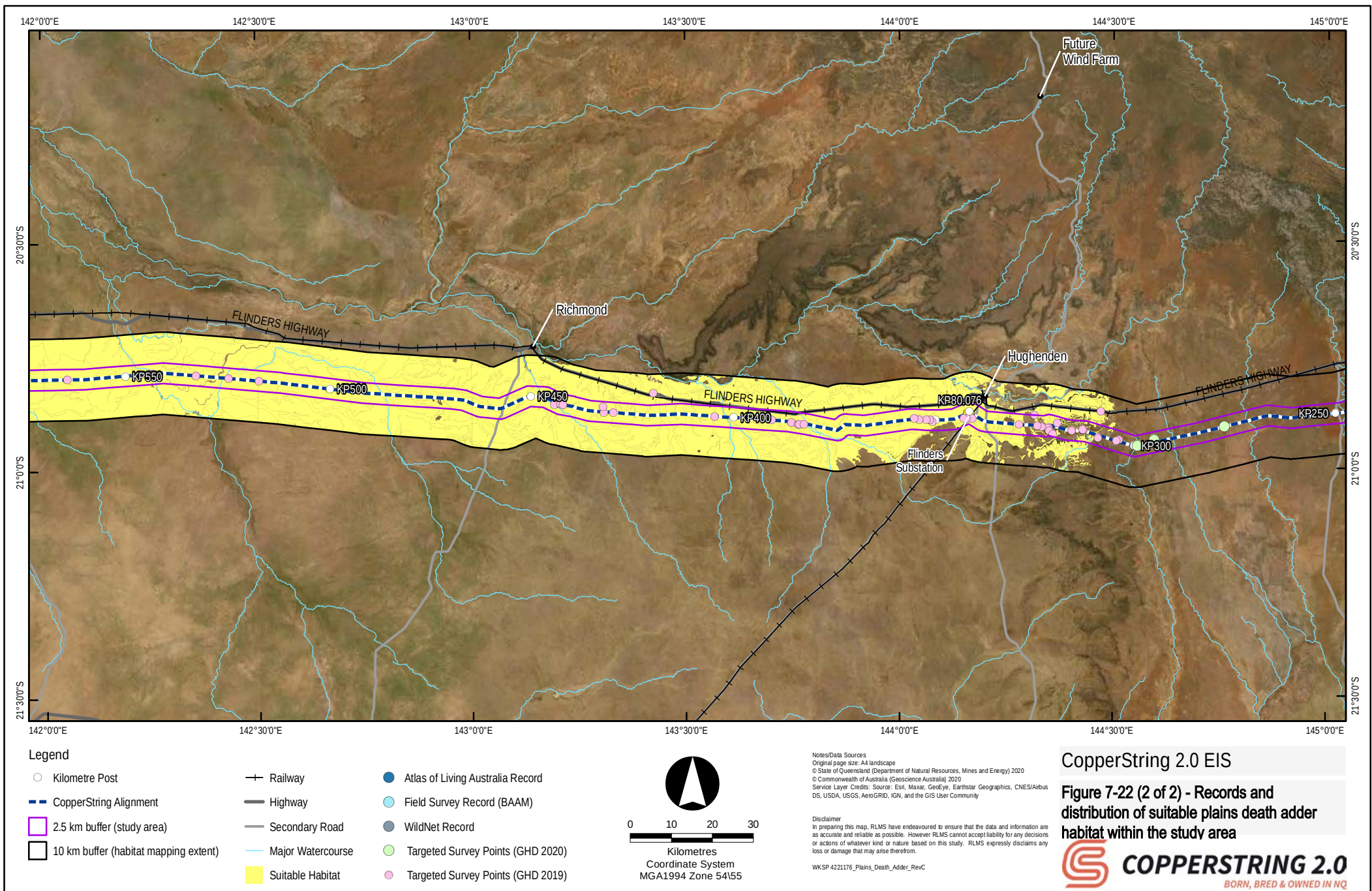
Disclaimer
In preparing this map, RLMS have endeavoured to ensure that the data and information are as accurate and reliable as possible. However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study. RLMS expressly disclaims any loss or damage that may arise therefrom.

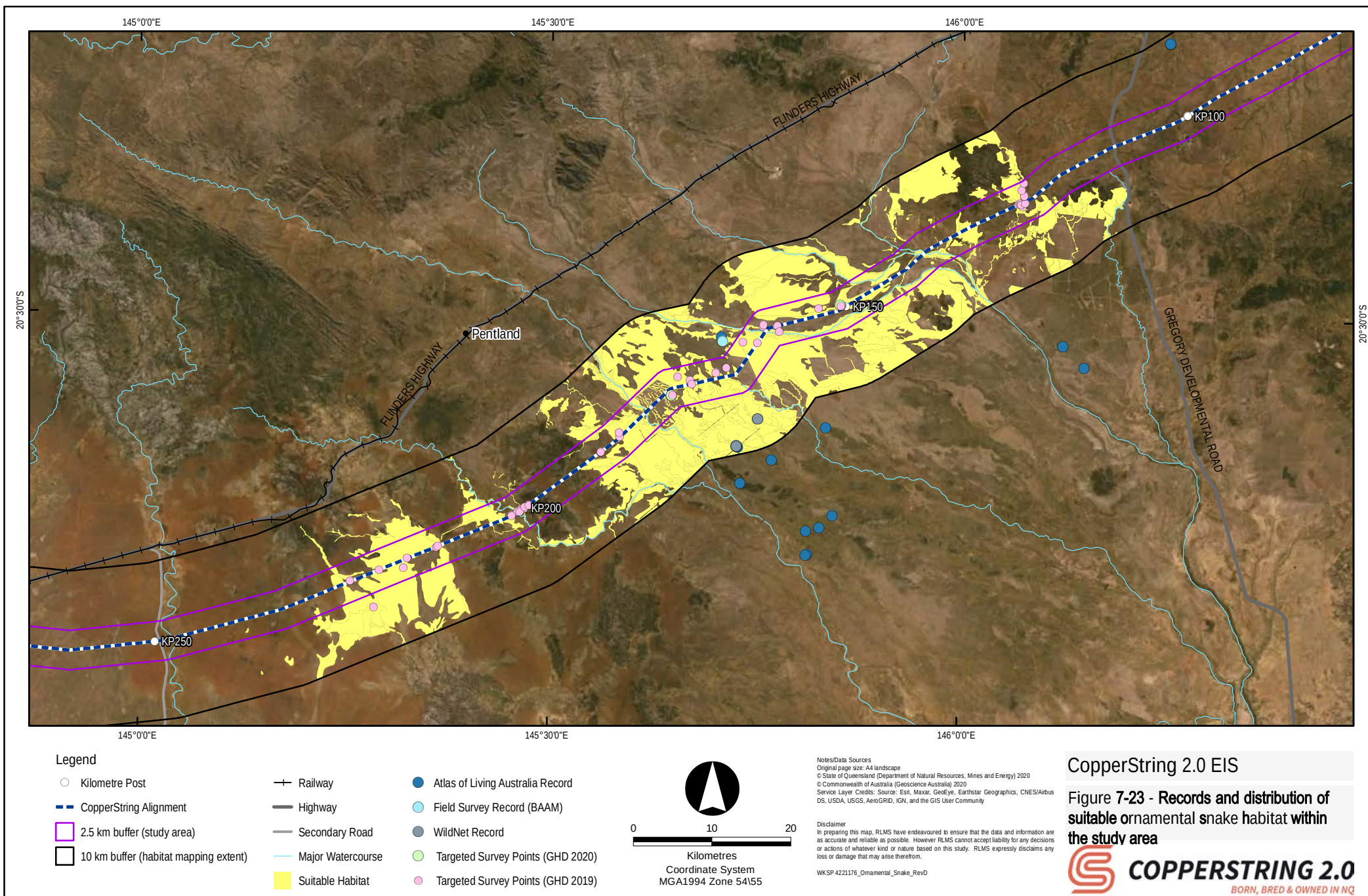
WKSP 4221176_Plains_Death_Adder_RevC

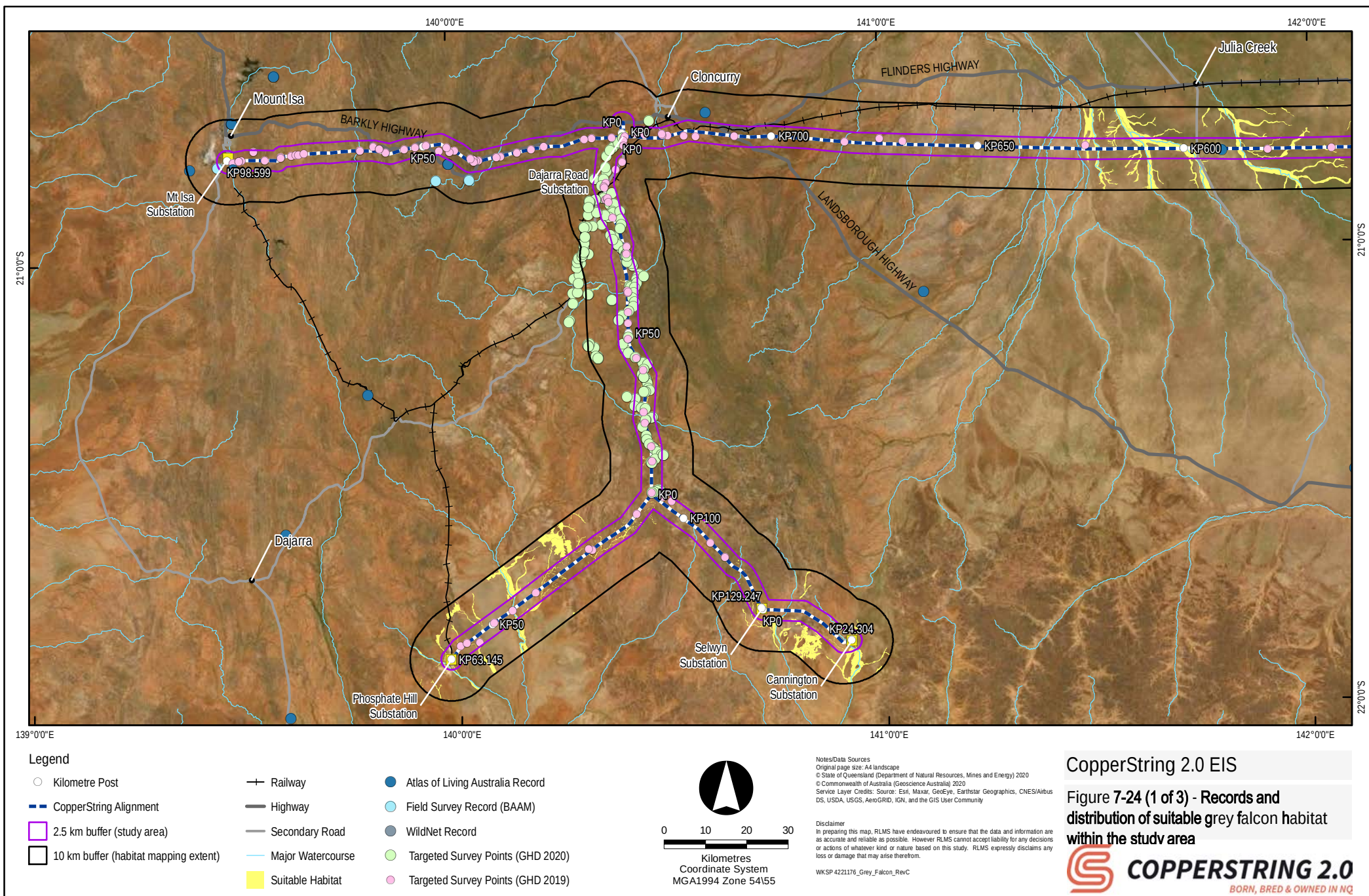
CopperString 2.0 EIS

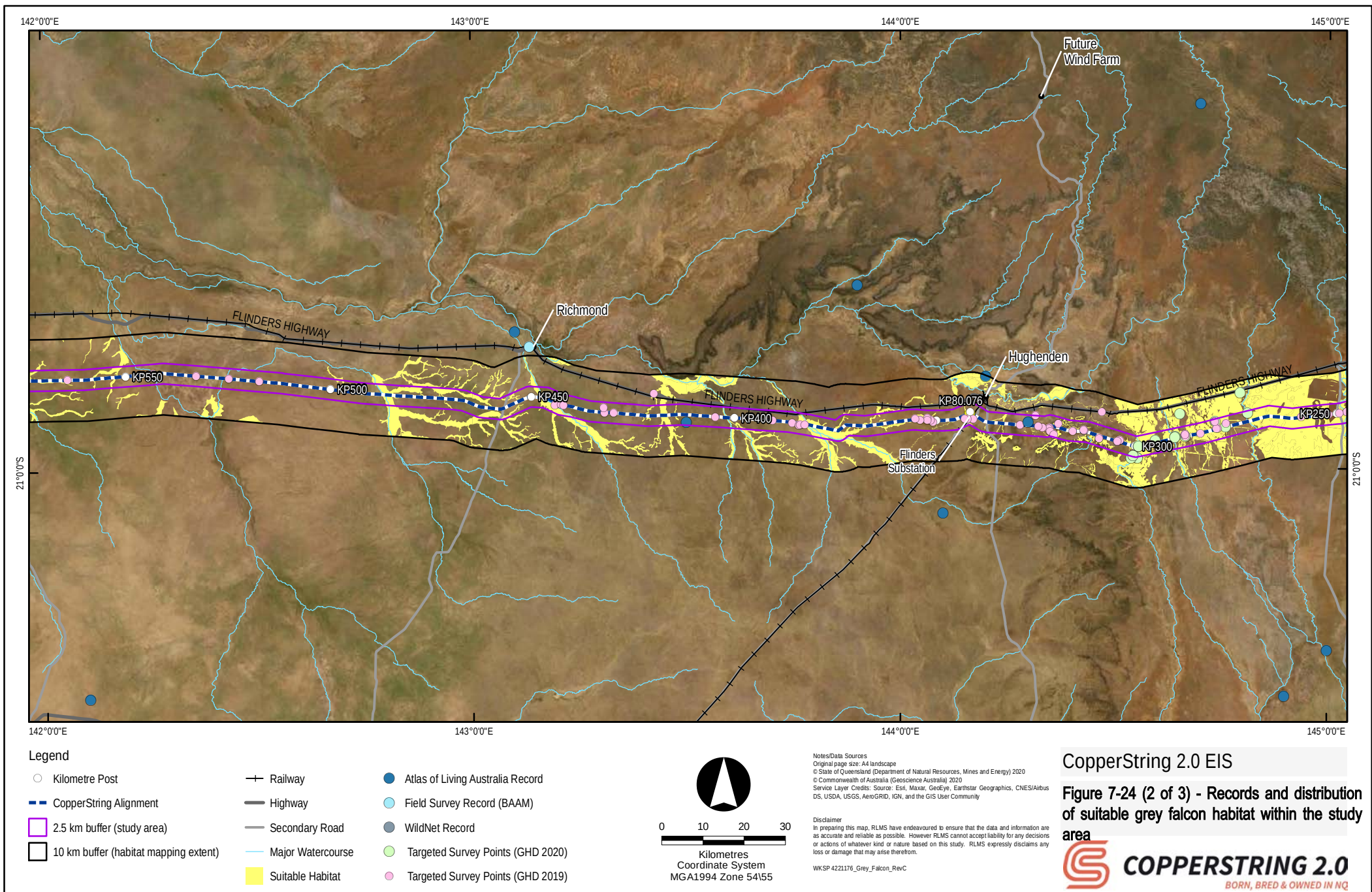
Figure 7-22 (1 of 2) - Records and distribution of suitable plains death adder habitat within the study area

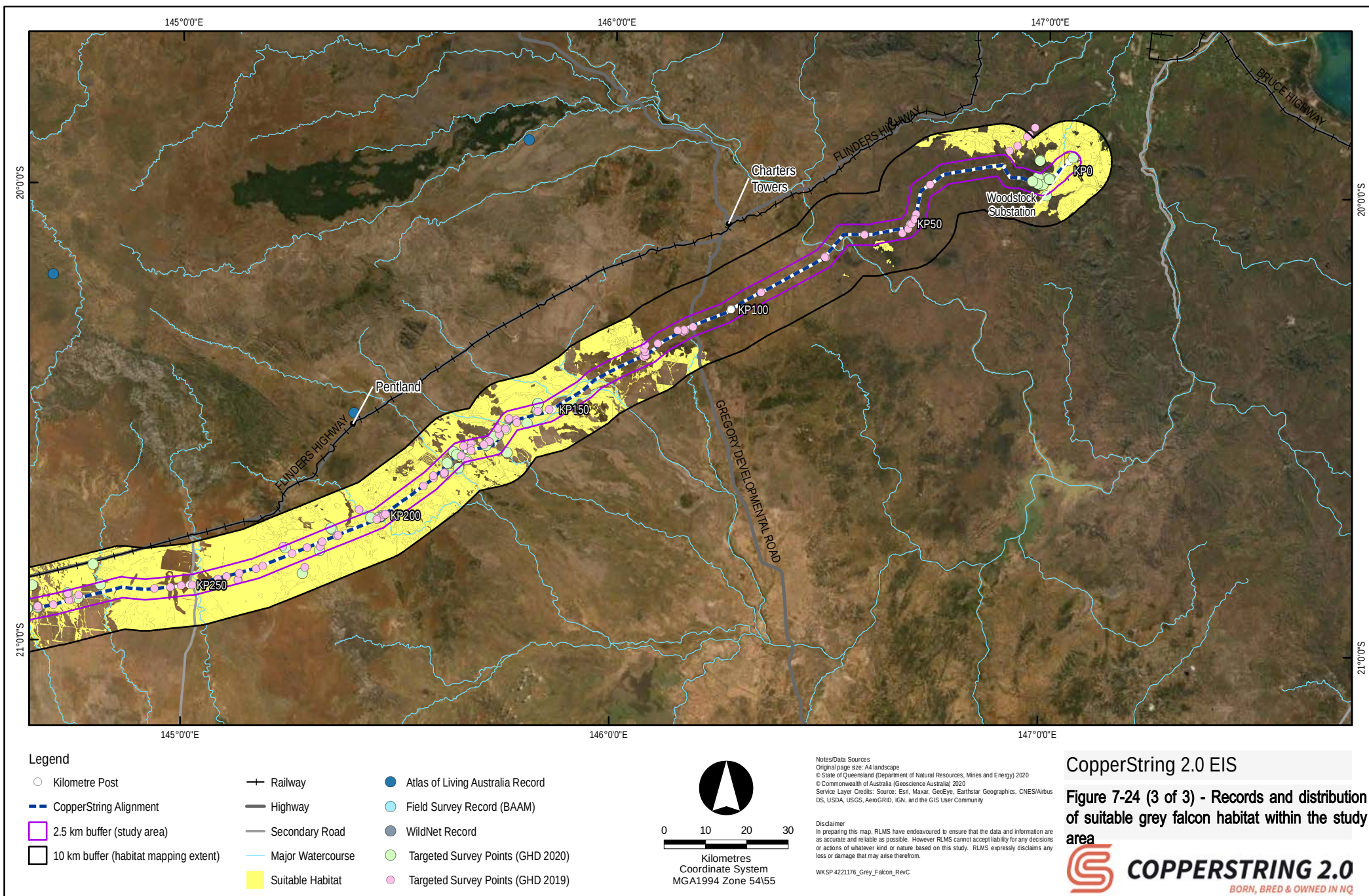


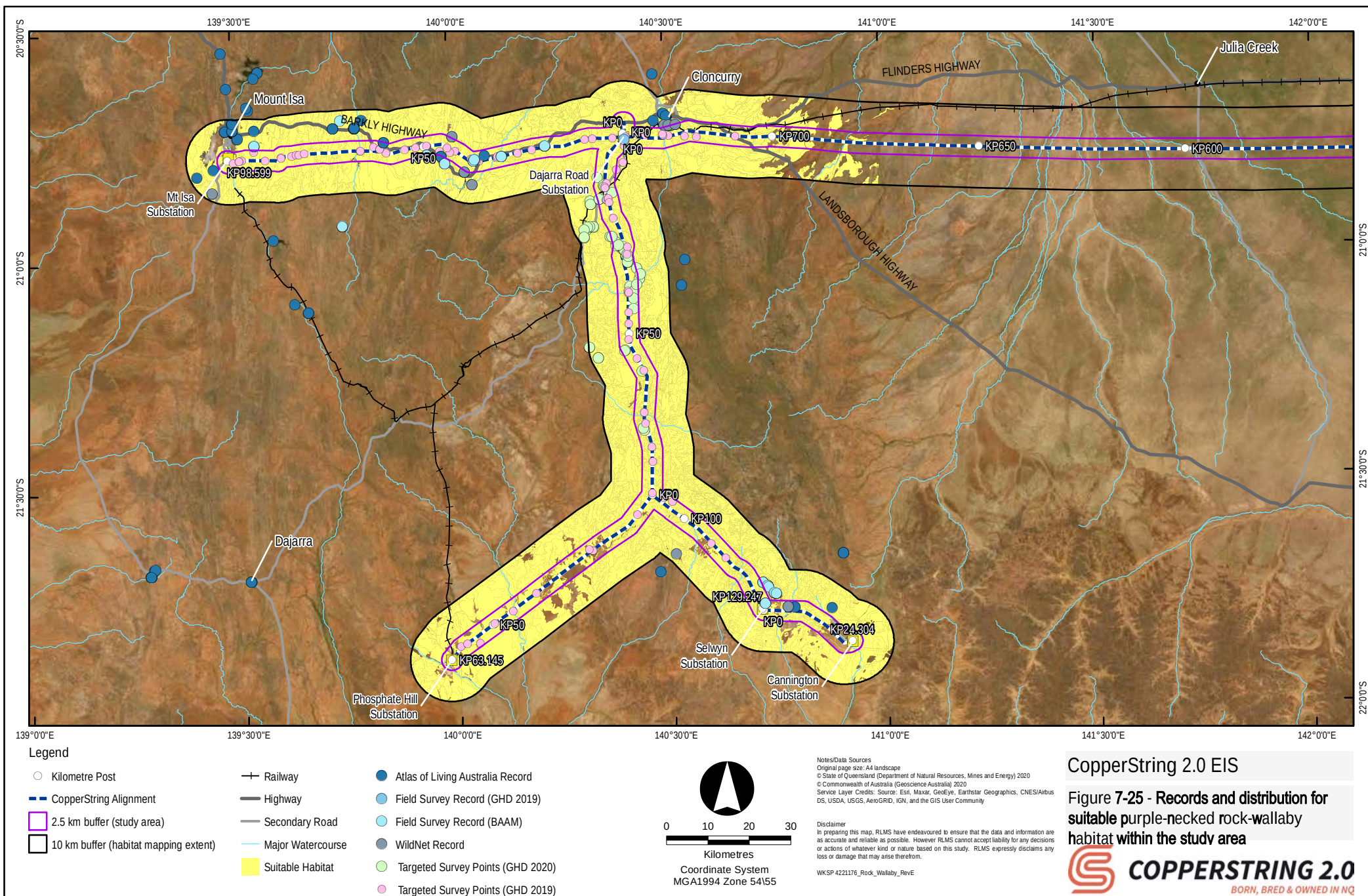


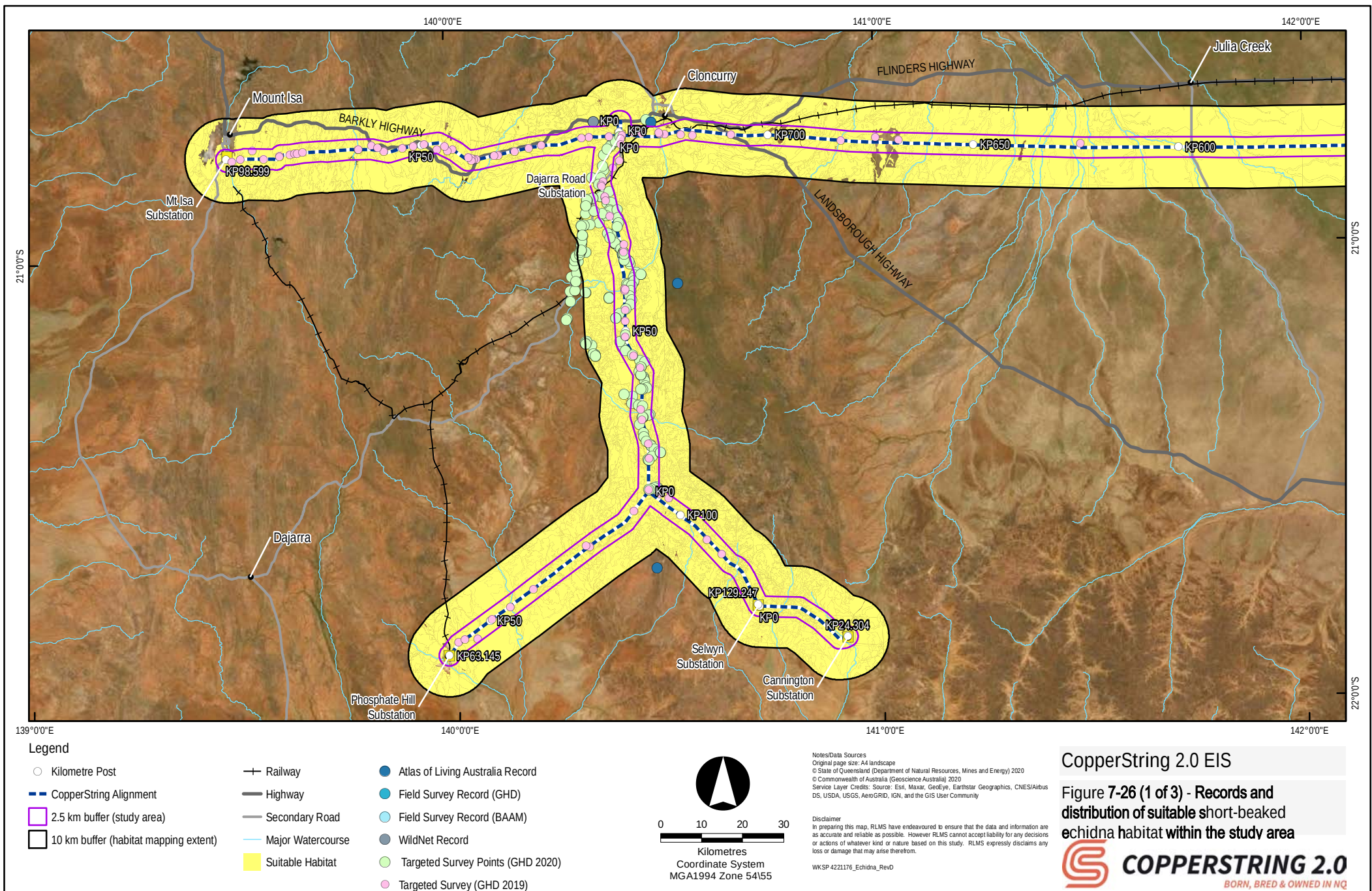


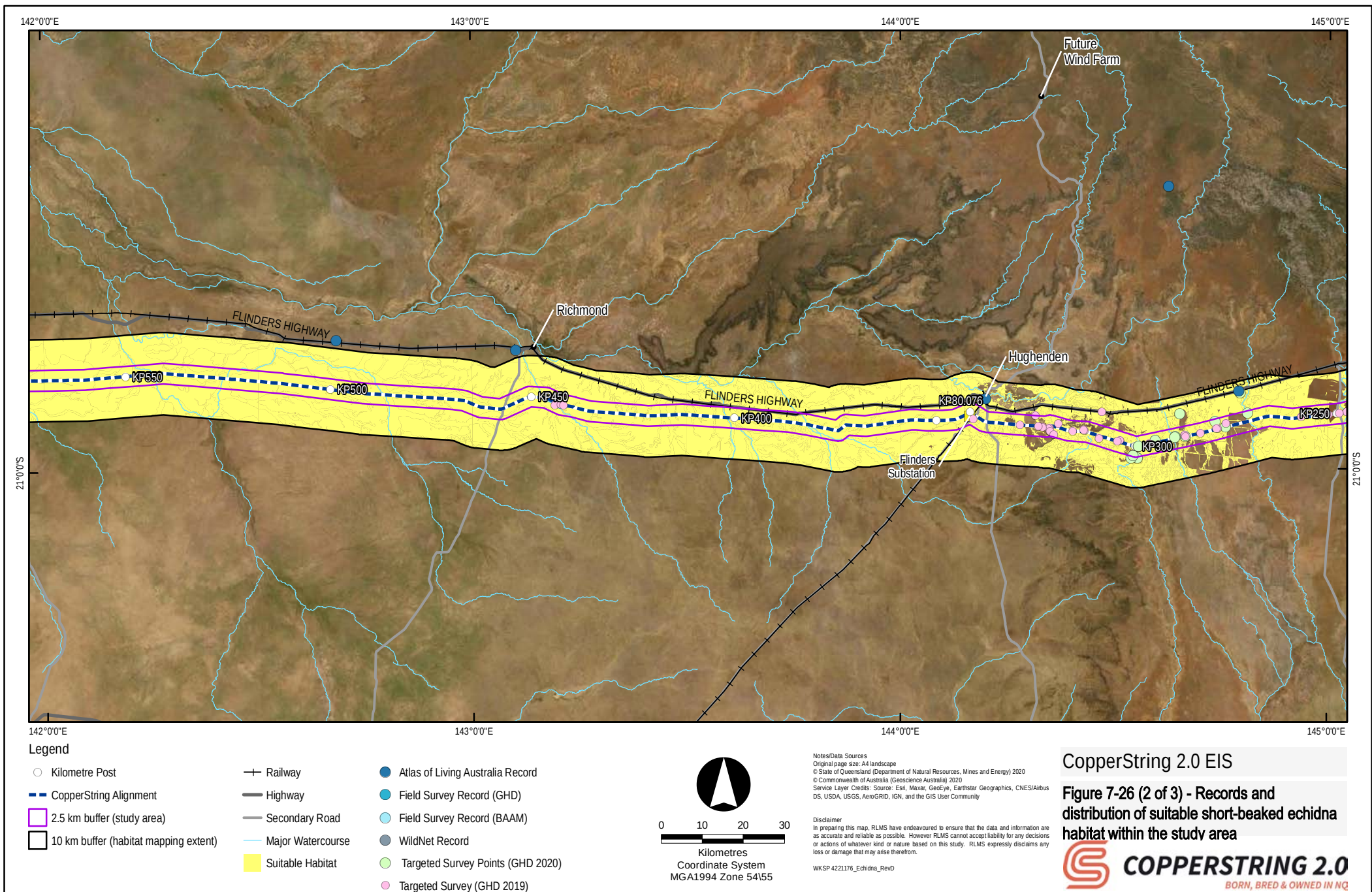


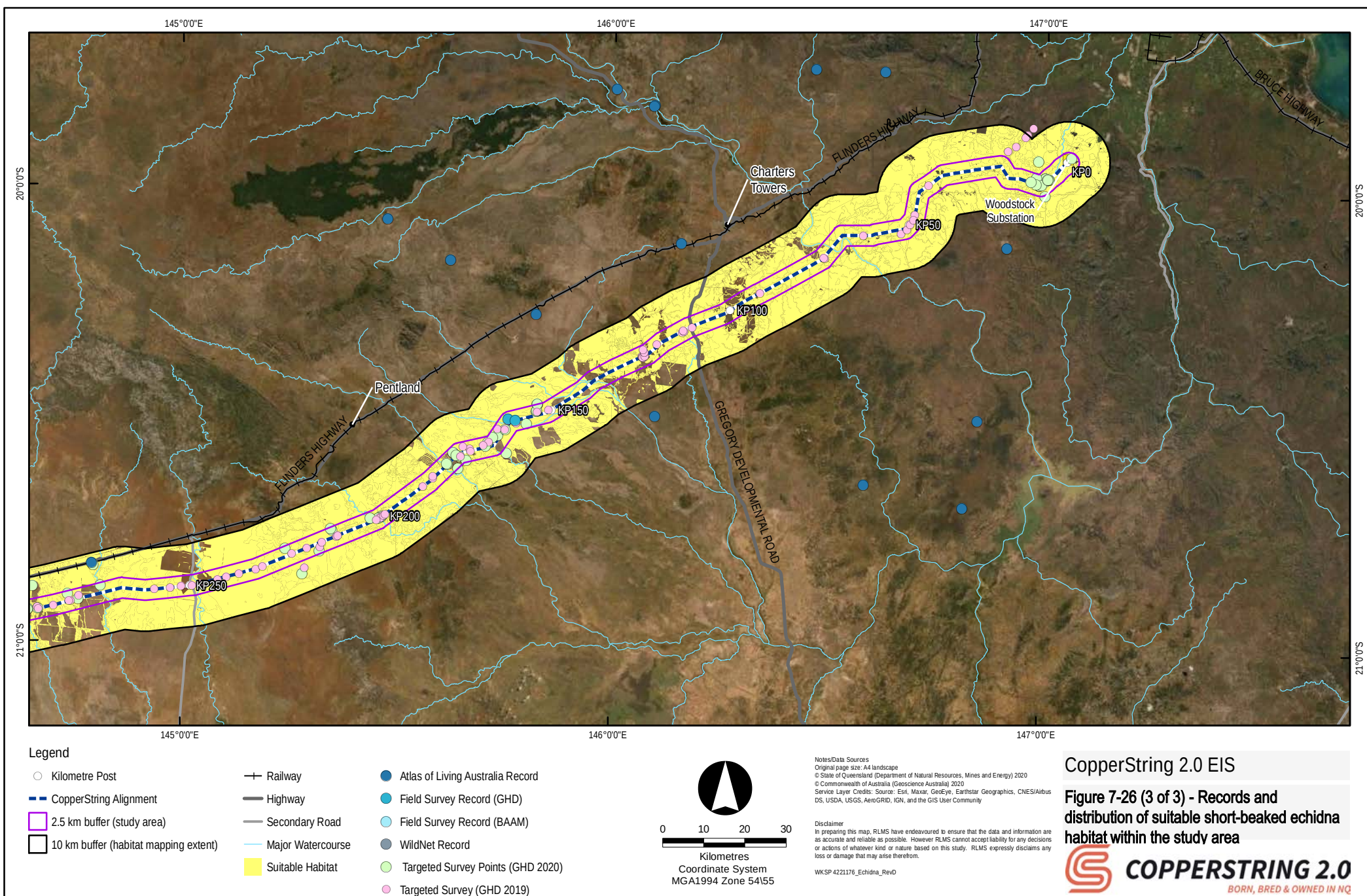


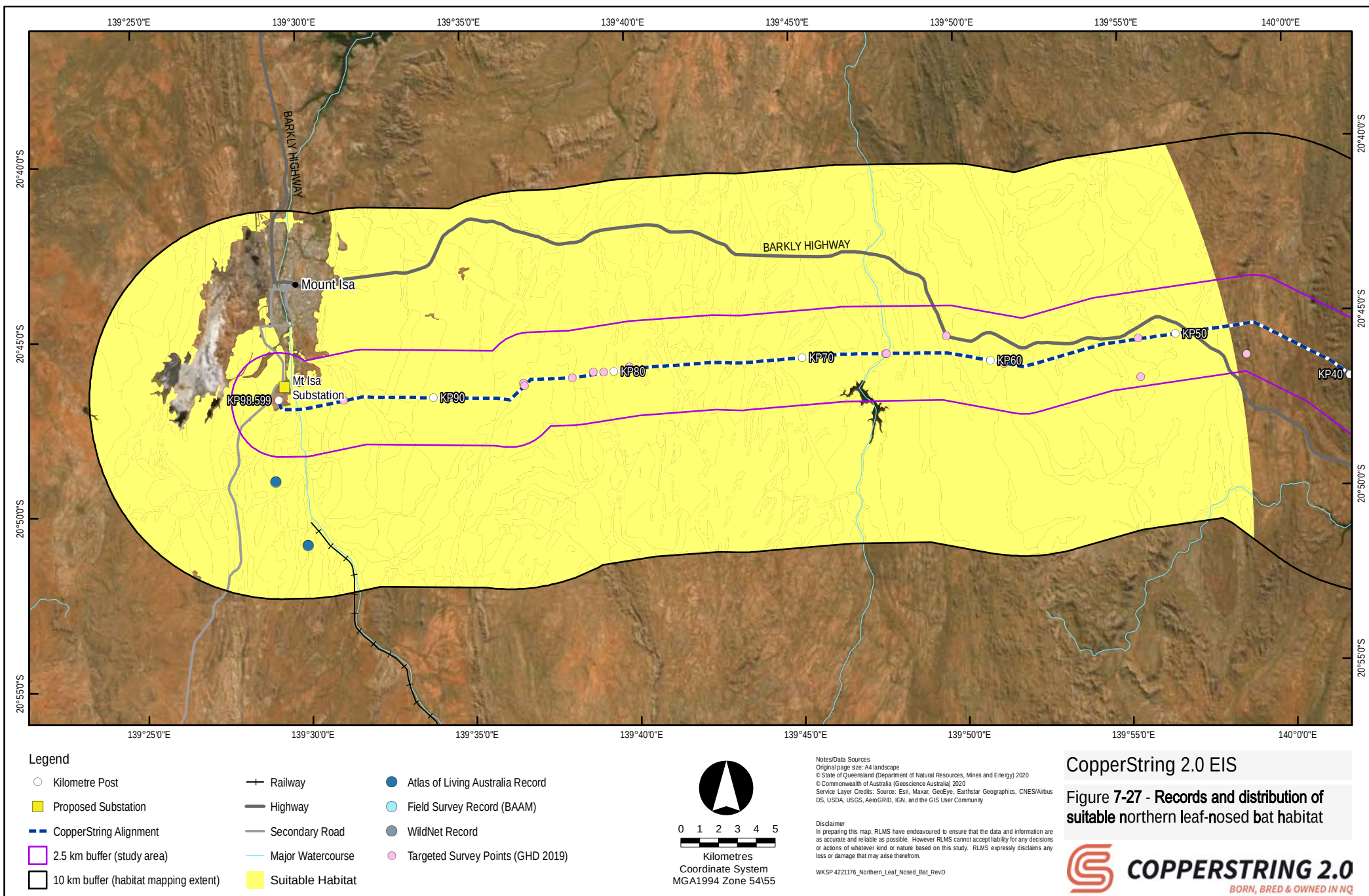


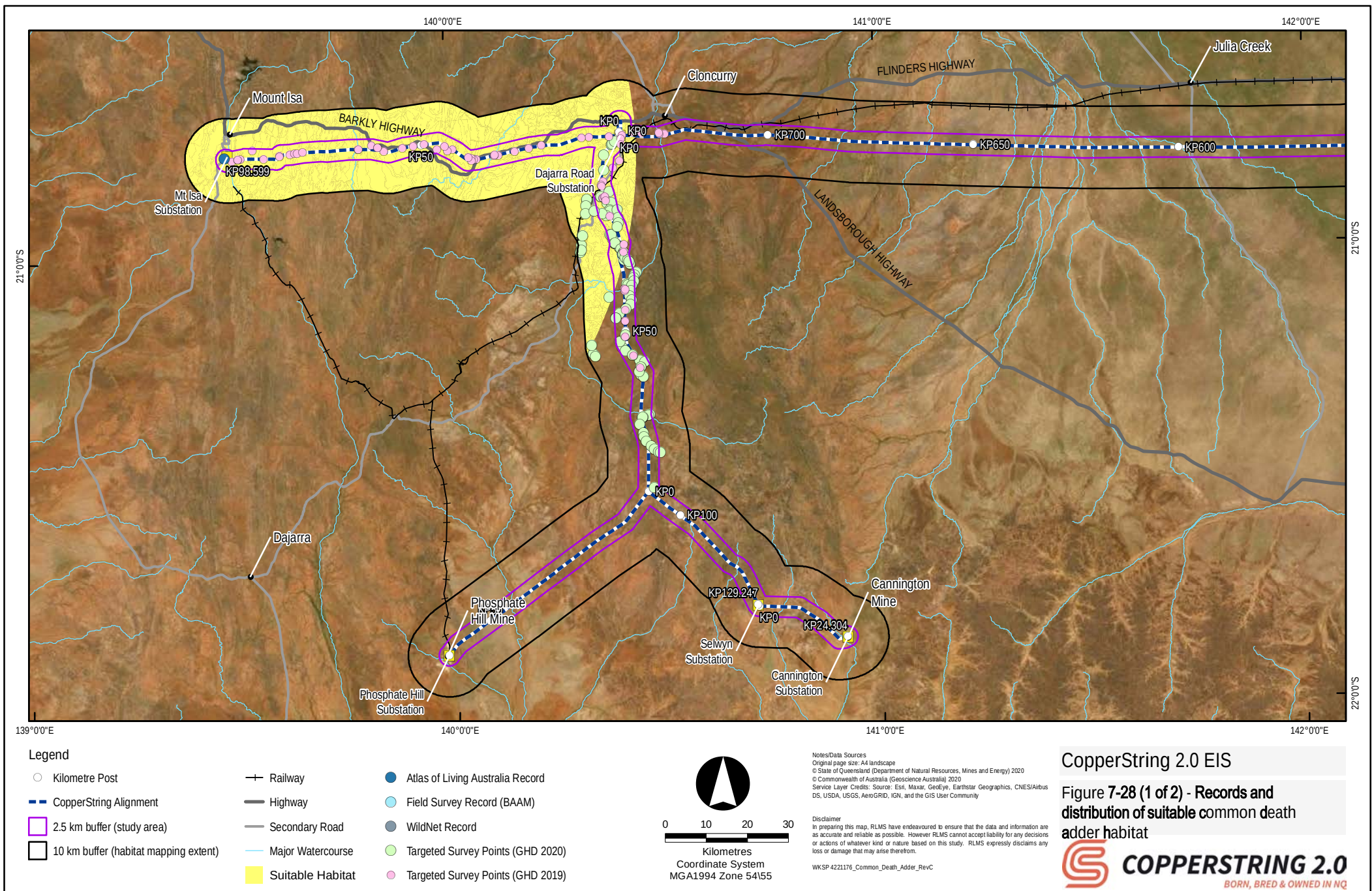


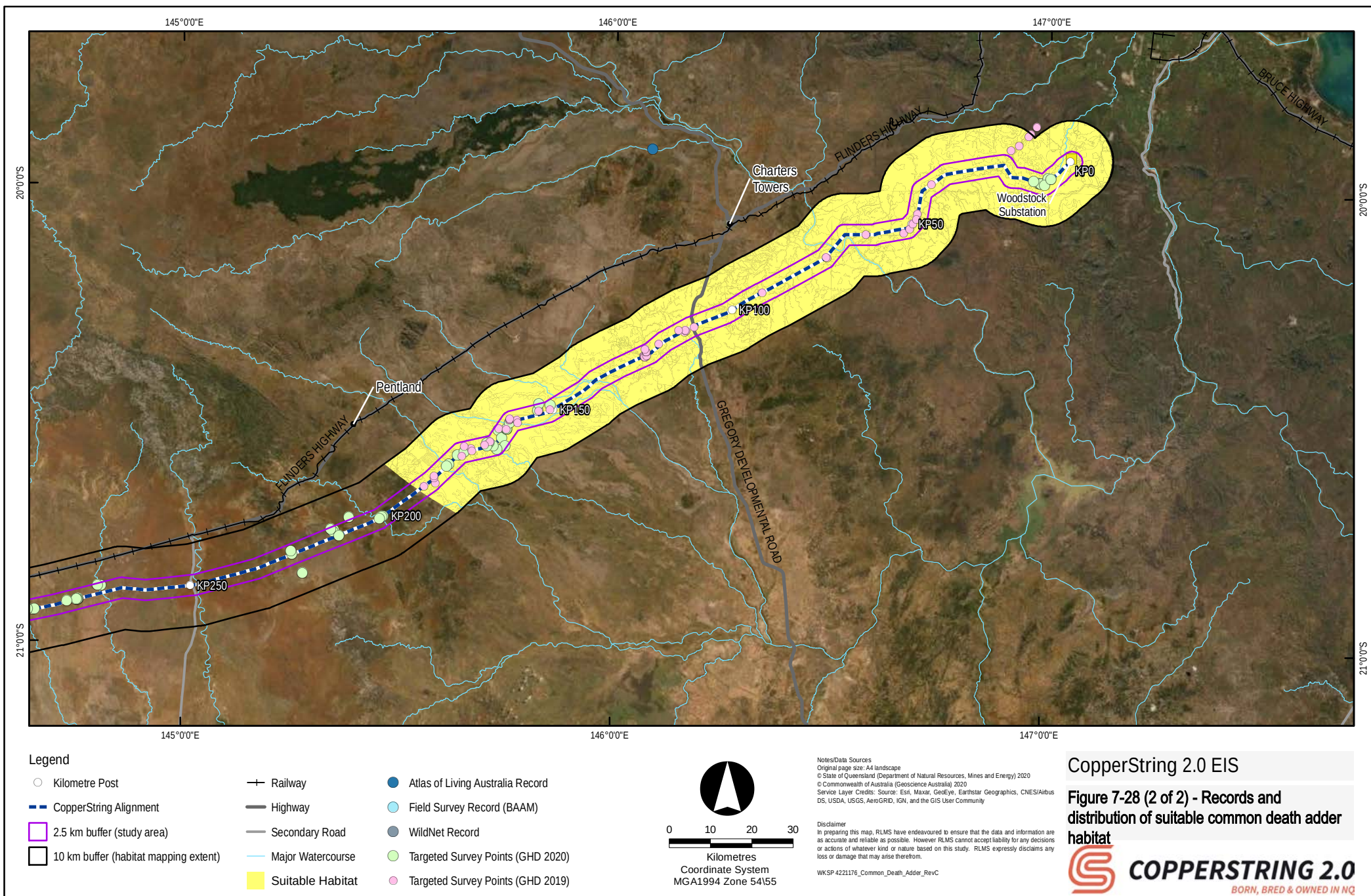












Migratory fauna species

Seven species of migratory bird were **confirmed present** during field surveys or considered **likely to occur**. The Mount Isa Augmentation, CopperString Core and Renewable Energy Hub sections of the corridor selection were identified as key areas containing habitat for migratory species, particularly around Mount Isa, Charters Towers and Pentland.

Species	Common name	EPBC Act	NC Act
Confirmed present			
<i>Plegadis falcinellus</i>	Glossy ibis	Mi, Ma	LC
<i>Hydroprogne caspia</i>	Caspian tern	Mi, Ma	LC
<i>Glareola maldivarum</i>	Oriental pratincole	Mi, Ma	LC
Likely to occur			
<i>Gallinago hardwickii</i>	Latham's snipe	Mi	LC
<i>Gelochelidon nilotica</i>	Gull-billed tern	Mi	LC
<i>Apus pacificus</i>	Fork-tailed swift	Mi	LC
<i>Hirundapus caudacutus</i>	White-throated needletail	Mi	LC

Glossy ibis (*Plegadis falcinellus*)

This species inhabits fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species core breeding area is within the Murray-Darling Basin in NSW and VIC, the Macquarie Marshes in NSW and southern QLD. It often moves north in autumn then returns south to the breeding areas in spring and summer (DoEE, 2019b).

This species was recorded in GHD 2019 field surveys for the project and has been historically recorded extensively throughout the entirety of the desktop search extent. Hotspots include around Mount Isa and Charters Towers. Suitable breeding or foraging habitat has been mapped for this species for lakes, dams and wetlands (refer to Figure 7-29).

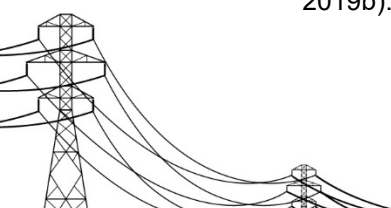
Caspian tern (*Hydroprogne caspia*)

In Queensland, the Caspian tern is widely distributed throughout coastal regions, from the southern Gulf of Carpentaria to Torres Strait, and along the eastern coastline. This species occurs mostly in sheltered coastal environments, particularly harbours, lagoons, estuaries and river deltas. They also occur in near-coastal or inland terrestrial wetlands (both fresh and saltwater), lakes, reservoirs, rivers and creeks.

The Caspian tern was confirmed present during the 2010 field surveys, where it was observed on the Burdekin River at KP 69WD, within the Renewable Energy Hub (BAAM 2010). There are also multiple historical records for the species reported within the desktop search extent, specifically within the Renewable Energy Hub, CopperString Core, Mount Isa Augmentation and Southern Connection sections. Suitable breeding habitat has been mapped for this species at Lake Moondarra, north of Mount Isa. Suitable foraging habitat has been mapped along watercourses, wetlands, lakes and dams (refer to Figure 7-29).

Gull-billed tern (*Gelochelidon nilotica*)

Gull-billed terns are widely distributed throughout Australia, and can occur throughout all of Queensland. This species inhabits freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grassland (DoEE 2019b). This species is known to migrate to New Guinea and Indonesia, but can also occur



throughout Australia, particularly north Australia, throughout the year (DoEE, 2019b). The gull-billed tern is known to occur on all continents except Antarctica.

Historical records of this species are widely recorded throughout the study area, especially around Mount Isa Richmond, and the eastern extent of the Renewable Energy Hub section. Suitable breeding or foraging habitat for this species has been mapped within wetland habitats in the study area (refer to Figure 7-29).

Latham's snipe (*Gallinago hardwickii*) – Likely to occur

Latham's snipe typically occurs in permanent and ephemeral wetlands with dense vegetation for cover. Distribution covers east and southeast Australia, and breeding occurs in Japan and eastern Russia (DoEE, 2019b). The species departs from breeding grounds from July through to November (Higgins and Davies, 1996). Birds commence the return journey in late February, passing over the QLD coast heading north (DoEE, 2019b).

This species has not been recorded during field surveys for the project. However the species has been historically recorded in the desktop search extent with concentrated sightings within the Mount Isa Augmentation and the Renewable Energy Hub section. Non-breeding habitat for this species has been mapped within wetland habitats in the study area (refer to Figure 7-30).

Fork-tailed swift (*Apus pacificus*) – Likely to occur

The fork-tailed swift is known to occur throughout all of mainland Australia (DoEE 2019b; Higgins 1999). In Queensland, the species is widespread throughout the State's south-east and areas west of the Great Dividing Range. This species is predominantly aerial and occurs across a range of environments between 1 m to over 300 m above sea level (DAWE 2020).

Although this species was not confirmed present during past field surveys, historical records are located throughout the majority of the study area, particularly within the Renewable Energy Hub, CopperString Core, Mount Isa Augmentation and Southern Connection sections. This species is likely to occur across the majority of the study area. Previous records for this species are shown on Figure 7-30).

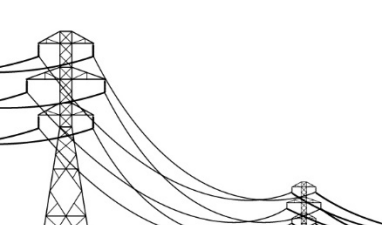
White-throated needletail (*Hirundapus caudacutus*) – Likely to occur

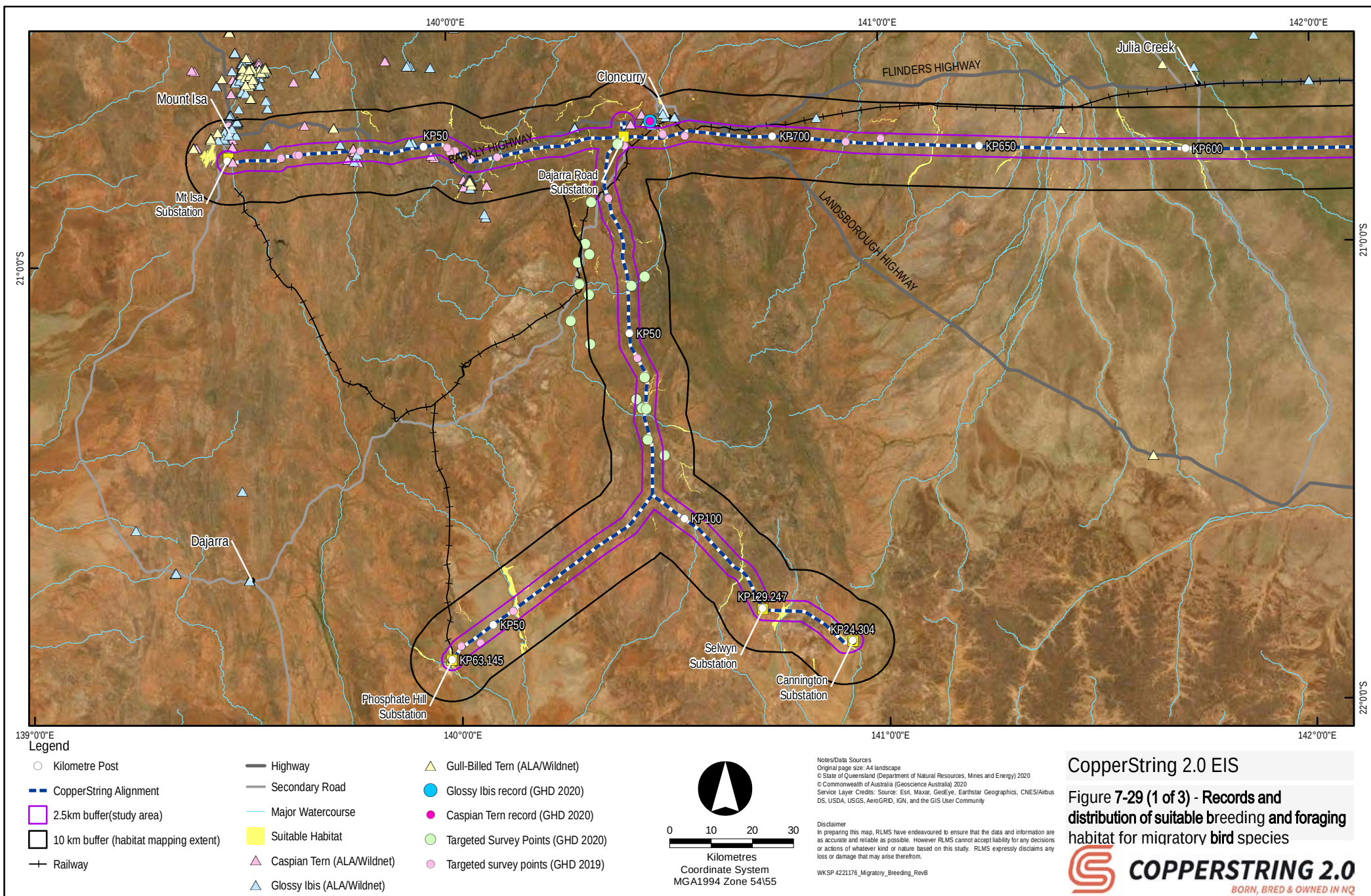
The white-throated needletail is exclusively aerial and has a broad distribution throughout eastern Australia. Although the white-throated needletail was not observed during field surveys, the species is likely to occur over all habitats at the eastern extent of the proposed corridor selection, particularly between Hughenden and Woodstock. Several historical records were reported within the desktop search extent in the Renewable Energy Hub. The species potential distribution is shown in Figure 7-30.

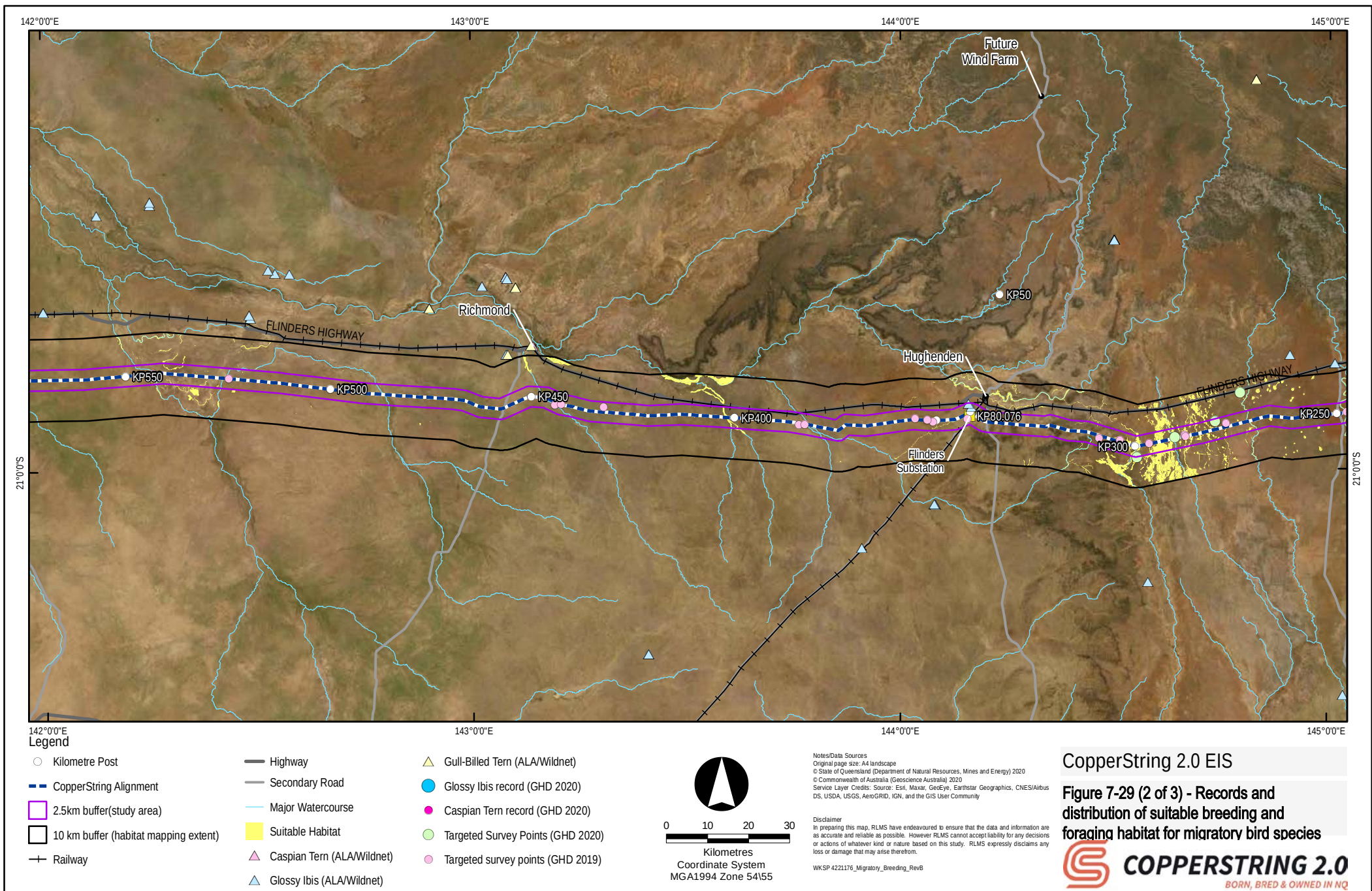
Oriental pratincole (*Glareola maldivarum*) – Confirmed present

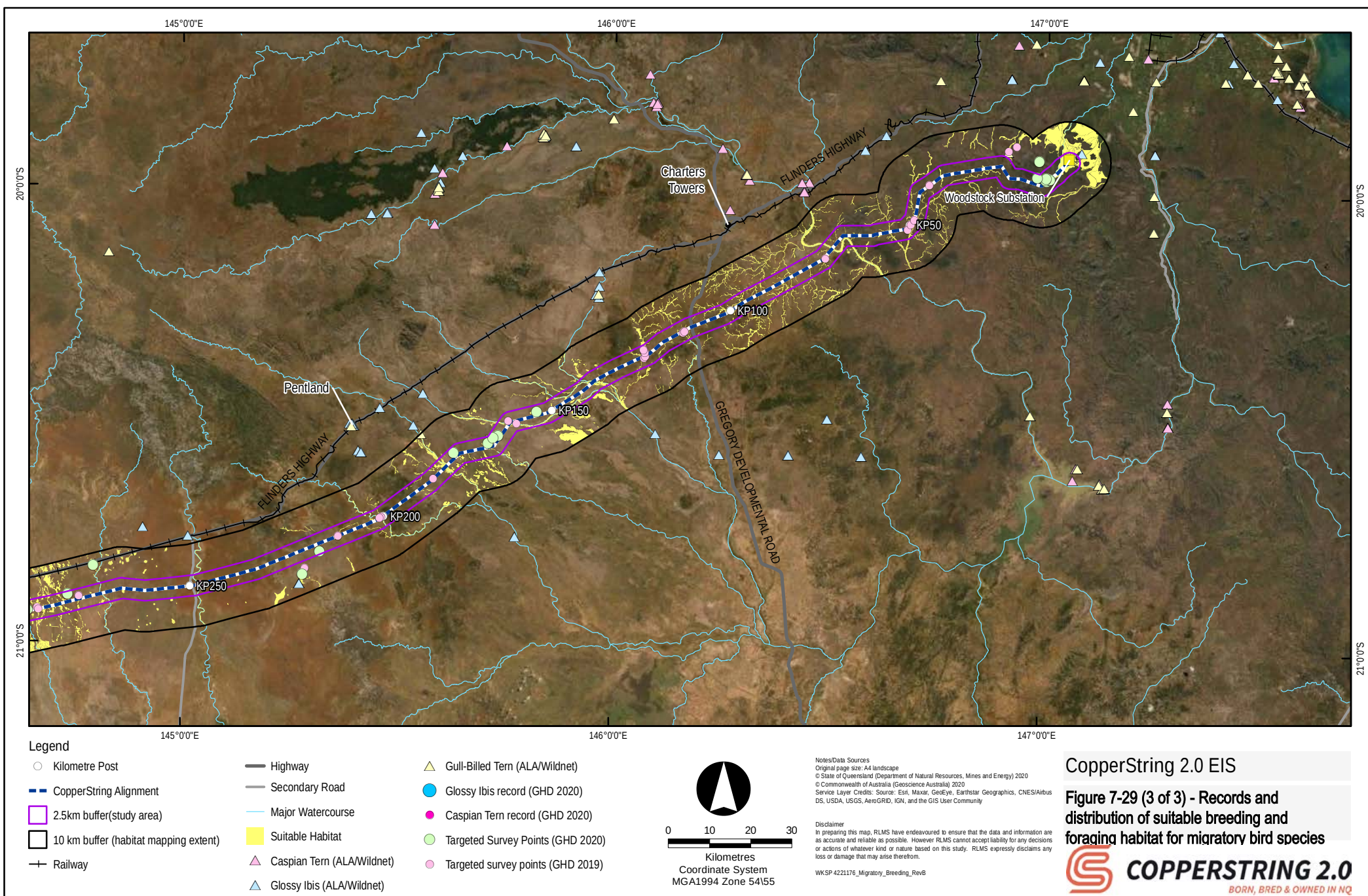
The species is widespread across northern Australia from the Pilbara region to part of the Gulf of Carpentaria with occasional records in southern Australia (DoEE, 2019b). Non-breeding habitat consists of open plains, floodplains or short grassland and the species often occurs near terrestrial wetlands. Oriental Pratincoles breed in southern, south-eastern and eastern Asia and migrates to Australia for the non-breeding season from late October until April (DoEE, 2019b).

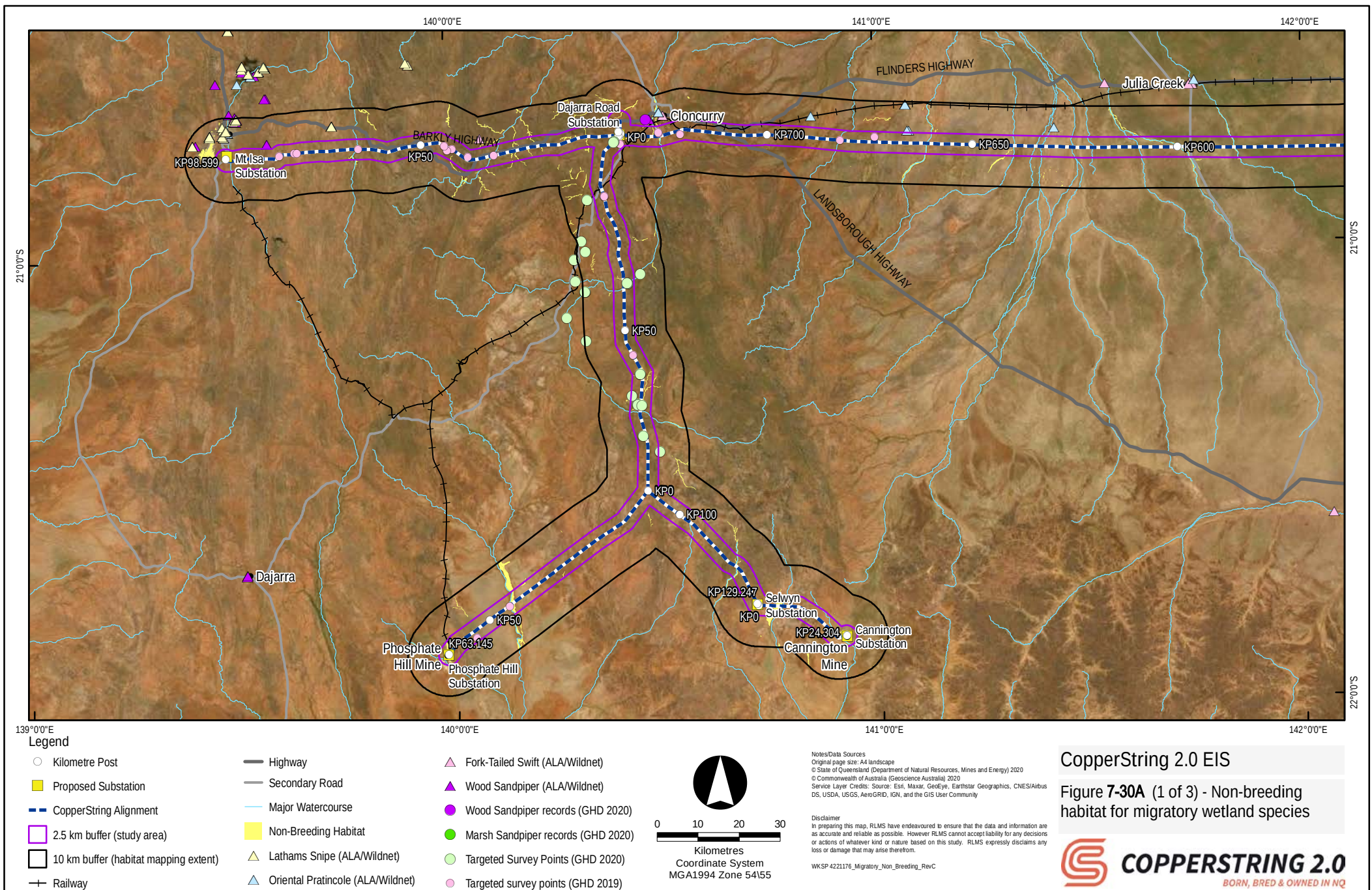
This species was confirmed present during field surveys, with the species recorded within the CopperString Core section of the final alignment, specifically, between Julia Creek and Richmond. Non-breeding habitat for this species has been mapped in wetland habitats within the study area (refer to Figure 7-30).

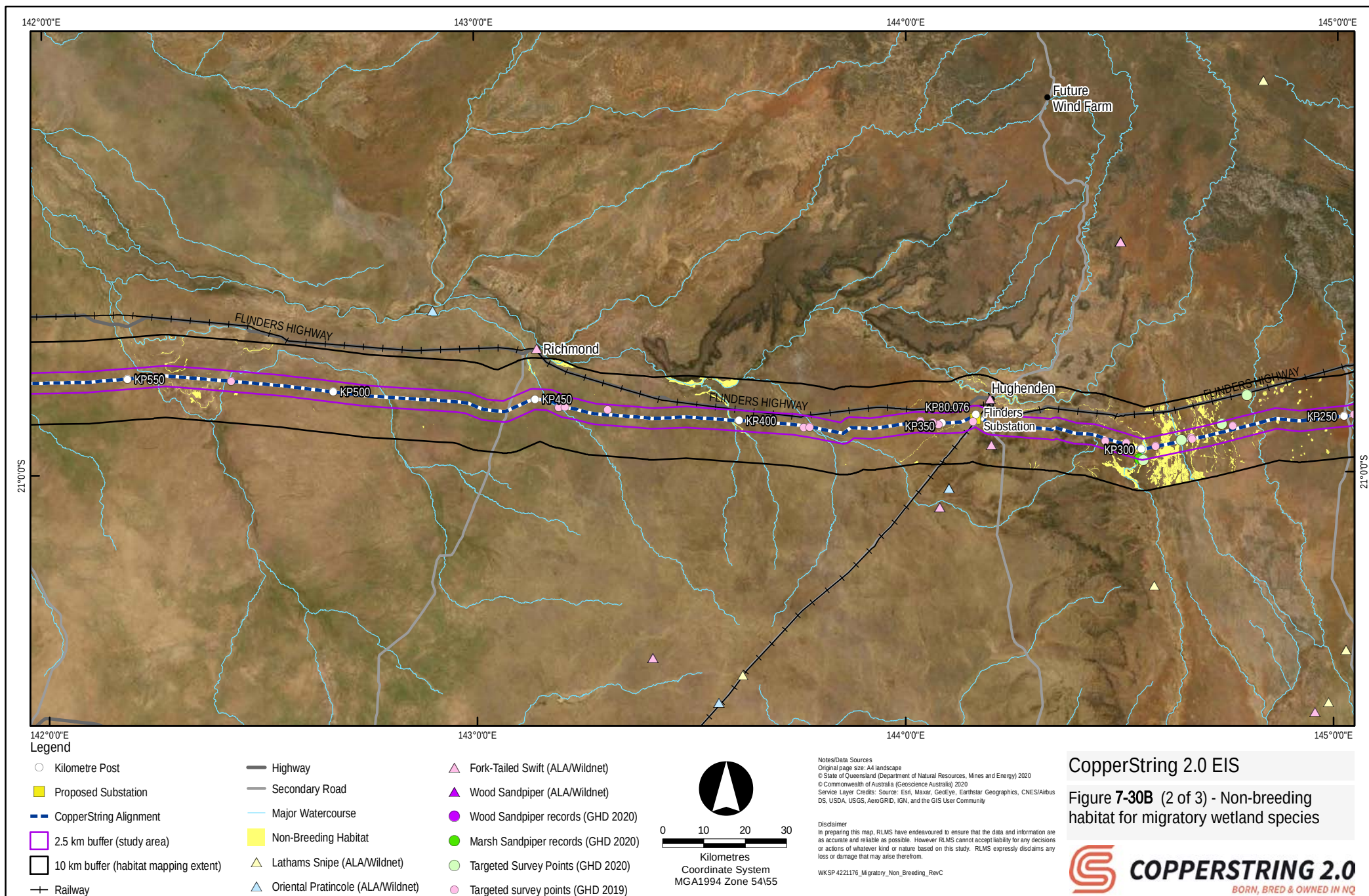


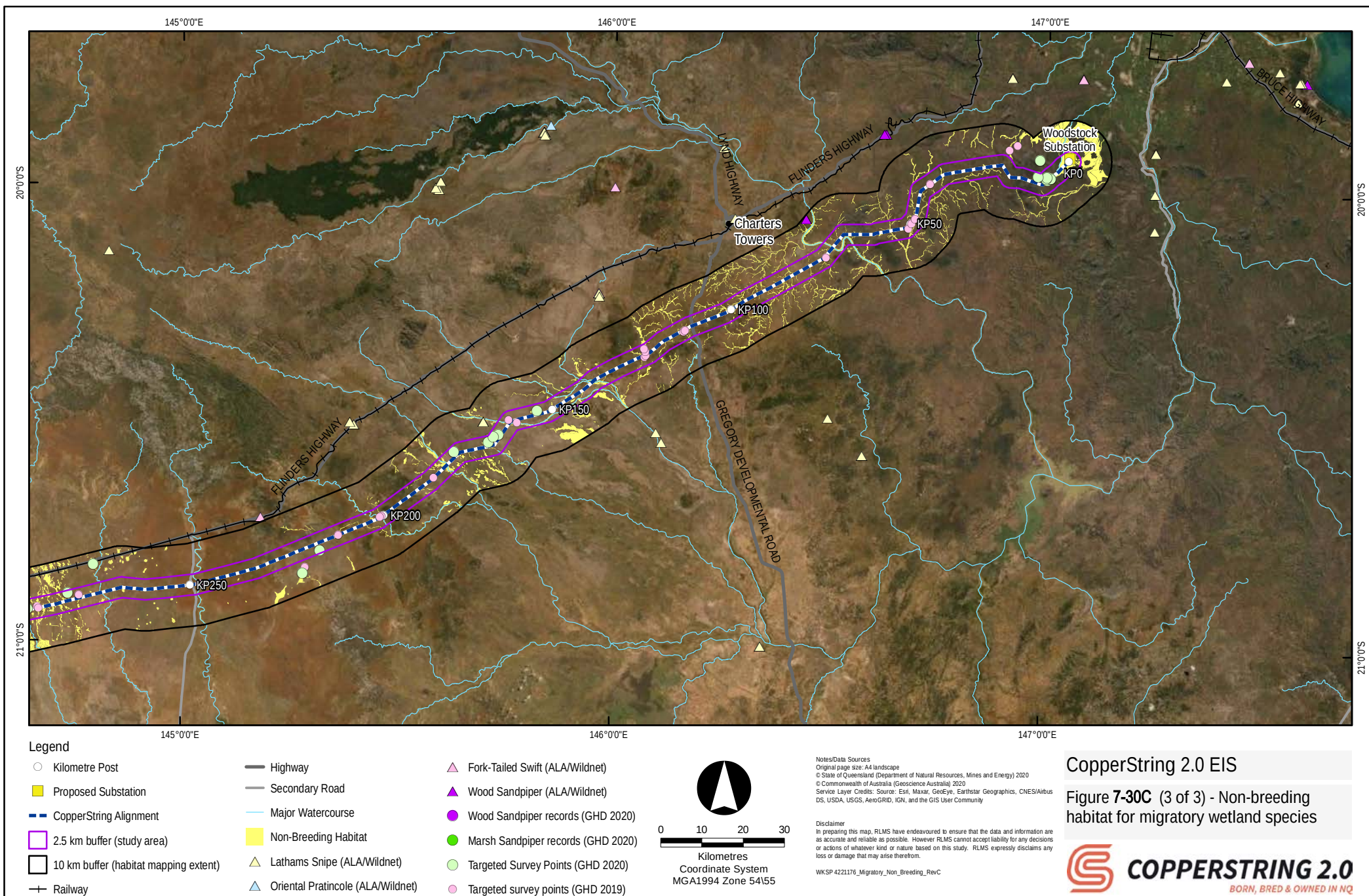












7.3.8 Aquatic habitats

The final corridor selection intersects an array of different aquatic habitat types. Ephemeral watercourse were frequently encountered and were widespread throughout all sections of the corridor selection. Such watercourses highly variable, and ranged in terms substrate composition, channel width, flow pattern and flow condition. Larger watercourses (e.g. the Cape and Campaspe River) consisted of sandy substrates, with low grassy banks and channel widths from 50 – 120 m. These watercourses were present as braided, meandering and striating flowing systems, with sandy bars and sediment deposition present in some areas. The riparian zone of these watercourses consisted of grassy woodlands with low – moderate levels of disturbance. Banks were generally low (< 2 m), though steep. In the west, ephemeral watercourses consisted mostly of narrow watercourses meandering through out rocky hills, gorges and undulating plains. The beds of these watercourses were comprised of a mix of sandy sediment or rocks, pebbles and cobblestone with low – moderate compaction. Root overhangs, undercut banks and fallen timber were abundant along the banks, which would provide habitat for aquatic species during times of flow.

Permanent watercourses were located within the Renewable Energy Hub, particularly the Burdekin River at KP 71WD. This waterway provides transport for spawning freshwater fish that migrate during the breeding season. As these watercourses contained permanent sources of water, they were capable of supporting complex, multi-trophic aquatic communities and were less dynamic than the smaller, ephemeral systems.

Isolated pools and billabong were present within sections of ephemeral waterways, predominantly within the Renewable Energy Hub and Mount Isa Augmentation sections. These ecosystems were characterised as no-flow, isolated waterbodies, often with root overhangs and fallen timber along the banks and provided high-quality habitat for turtles, aquatic reptiles, and freshwater eels. Dense macrophyte communities, including both emergent and submerged species, were abundant.

Natural springs were also recorded at one location within the study area, specifically within the rocky country of the Mount Isa Augmentation section. In such environments, springs provide an essential source of permanent water in a mostly arid landscape.

A summary of the aquatic habitat types intersect by the Project is provided in Table 7-8.

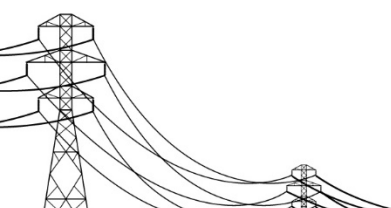
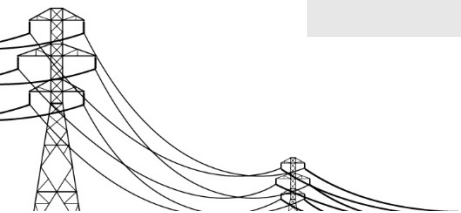


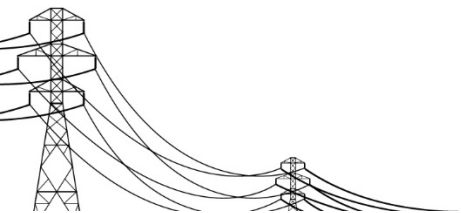
Table 7-8 Summary of aquatic habitat types

Aquatic habitat type	Features	Ecological value
Permanent watercourse		
	Often associated with major river systems. Generally uniform water quality in both the dry and wet seasons. Bars often present, with high flow deposits on inside river bends. Channel pattern generally meandering, irregular meandering or braided. Variety of potential substrates e.g. bedrock / sand. Contains mixed habitat features and variations in bank, substrate and flow characteristics.	Key dry season refugia for aquatic biota. Provides downstream transport of carbon and nutrient sources. High quality habitat for fish and aquatic reptiles. Breeding and foraging habitat for aquatic birds. Capable of supporting complex, multi-trophic aquatic ecosystems. Provides connected habitat y for dispersal and spawning migrations Transports macroinvertebrates downstream during the wet season.
Semi-permanent watercourse		
	Experiences flow post-wet season Higher turbidity than permanent watercourses. Retains water longer than smaller creeks. Habitat provided by roots overhangs, undercut banks and fallen timber along river banks. Potential for isolated pools to persist in deeper, shaded sections. Moderately sloped banks with erosion on lower levels.	Key dry season refugia for aquatic biota. Provides habitat connectivity for dispersal and spawning migrations during the wet season. Transports macroinvertebrates downstream during the wet season. Breeding and foraging habitat for aquatic birds. Downstream transport of carbon and nutrient sources during the period of creek flow. High-quality habitat for aquatic reptiles.

Aquatic habitat type	Features	Ecological value
Major ephemeral watercourse		
	Temporary sources of water, generally only after heavy rainfall. Low, convex banks fringed by grassy woodland vegetation. Roots overhangs and fallen timber common along river banks. Little deviation in channel width, normally occurring across alluvial plains. Bars and mid channel vegetation generally absent	Provide transient habitat for aquatic fauna during and immediately after flowing events Transports macroinvertebrates downstream during the wet season. Provides habitat connectivity for dispersal and spawning migrations during the wet season. Support amphibians and aquatic / semi-aquatic reptiles.
Lower order ephemeral creeklines		
	Creek bed comprised of gravel, pebbles or cobble stones with low – moderate compaction. Scattered bars present within channel, often supporting mid-channel vegetation. Generally fringed by mature woodland vegetation. Channel width variable in relation to landscape features and flow characteristics. Roots overhangs and fallen timber common along river banks	Fringing vegetation providing overhanging root structures and habitat. Diversity of flows, reflective of varying channel width / characteristics. Rocky substrate supports algae and macrophyte. Provide transient habitat for aquatic fauna during and immediately after flowing events
Artificial dams		
	Usually located amongst agricultural land, far from alternative water sources. Can provide permanent water, regardless of season. Water predominantly sourced from groundwater bores or rainfall. Potential for degradation of banks and water quality due to livestock.	Capable of supporting temporary wetland systems along banks. Provide habitat for aquatic and migratory birds. Habitat for freshwater eels, turtles and macroinvertebrates.



Aquatic habitat type	Features	Ecological value
Natural springs 	Occurs where water flows naturally to the earth's surface from underground. Located within gorges and low points within rocky landscapes. Unrelated to recent rainfall, though may fluctuate depending on seasonal conditions. Waters are generally alkaline with high levels of dissolved solids Support submerged and floating macrophytes, emergent mostly absent.	Potential seasonal refugia for aquatic biota. Important habitat for amphibians and aquatic reptiles. Essential sources of water for fauna within arid environments. Support spring-dependent flora and fauna.
Isolated pools and billabongs 	Generally intermittent, potentially drying out each year. Reduced to very shallow pools of poor water quality during the dry season. Often sandy, muddy substrate with a high composition of decomposing organic matter. Roots overhangs and fallen timber common along banks and within waterbody. Mostly stagnant and experiencing little to no flow.	Dense macrophytes colonising the shallow littoral zones. Potential dry season refugia for aquatic biota Support diverse macrophyte communities. Support wide array of amphibians and aquatic / semi-aquatic reptiles and macroinvertebrates. In-stream cover (fallen timber / roots) provide refuge and breeding habitat for freshwater fish. No flow allows organic matter to drop out of suspension, providing a food source for macroinvertebrates.



7.3.9 Significant wetlands

Wetlands of international importance

Two wetlands of international importance are predicted to occur in the vicinity of the study area:

- The Coongie Lakes Ramsar wetland, approximately 700-800 km downstream of the CopperString Core corridor section
- The Bowling Green Bay Ramsar wetland, approximately 40 km northeast and downstream of the Renewable Energy Hub corridor section

These Ramsar wetlands are not intersected by or in close proximity to the corridor selection. More information on these wetlands is located in Volume 3 Appendix P Ecological assessment.

Wetlands of National Importance

No listed wetlands from the Directory of Important Wetlands in Australia (DIWA) occur along the corridor selection. The closest DIWA listed wetland is the Barrattas Channels Aggregation which is located approximately 17 km northeast of the eastern end of the corridor selection.

Wetlands of High Ecological Significance

Two wetlands of high ecological significance (HES wetlands) are mapped within the study area in the Renewable Energy Hub corridor section. These wetlands are identified as MSES under the State Planning Policy (SPP). Wetland Protection Areas are buffer areas that protect HES wetlands within the Great Barrier Reef catchments. These HES wetlands occur within the Burdekin River catchment at:

- KP 177WD approximately 350 m southeast of the corridor selection. The corridor selection intersects the trigger area for the HES wetland (being the wetland protection area) for a distance of approximately 700 m.
- KP 180 WD approximately 1 km southeast of the corridor selection. The corridor selection does not intersect the Wetland Protection Area for this HES wetland.

Locations of MSES wetlands is mapped in Figure 7-31.

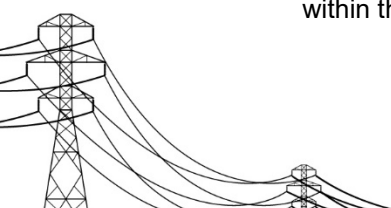
Wetland Protection Areas

HES wetlands within the Great Barrier Reef catchments are identified as Wetland Protection Areas (WPA). One WPA is mapped in the Renewable Energy Hub corridor section at KP 177WD, approximately 370 m south-east of the corridor selection. Vegetation within this WPA is mapped as RE 10.4.7 (*Casuarina cristata* open woodland on Cainozoic lake bed). This area was visited during the GHD 2019 survey and was confirmed to contain RE 10.4.7 featuring *C. cristata* (bulloak) open forest to woodland. However, the section of trigger area that is intersecting the corridor selection at this location contains regrowth *Acacia* habitat.

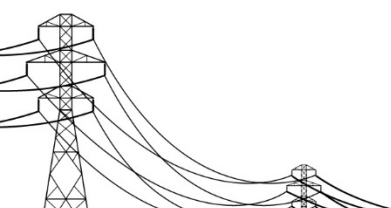
Wetlands of State or regional importance

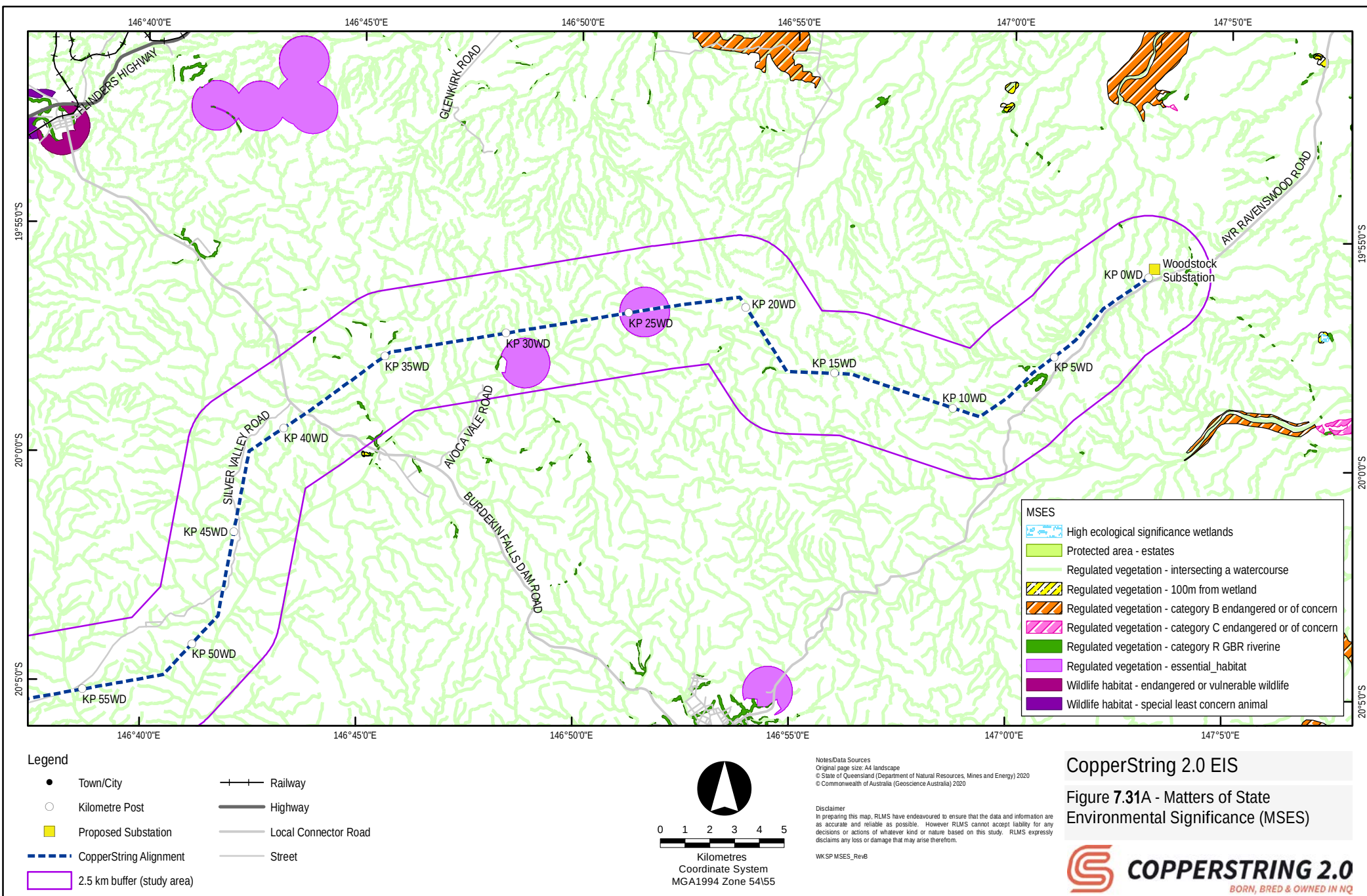
Three sections of the corridor selection contain MSES values that relate to wetlands, these being, the Renewable Energy Hub, CopperString Core and the Mount Isa Augmentation.

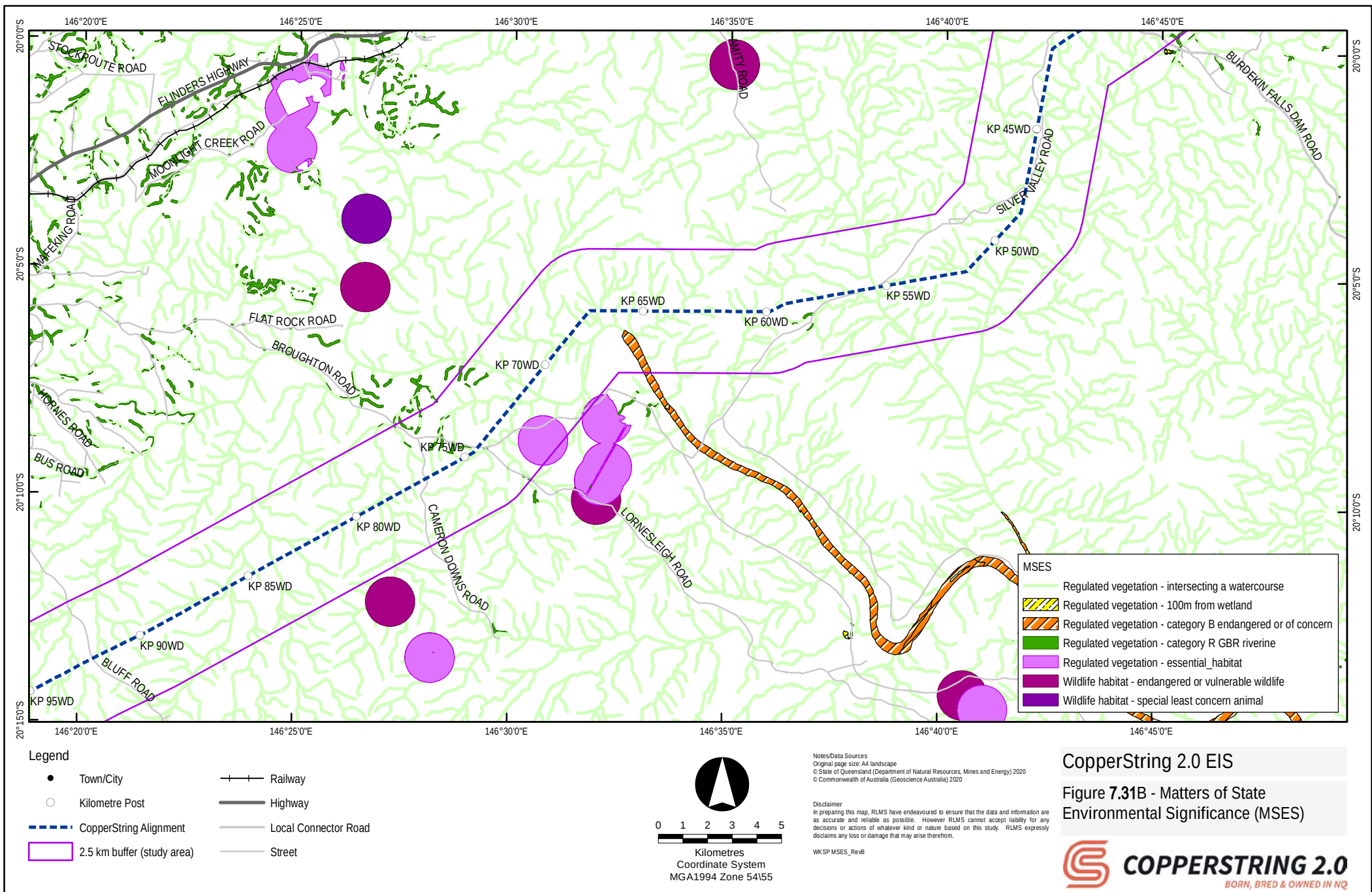
Three sections of the corridor selection contain Matters of State Environmental Significance (MSES) values that relate to wetlands, these being, the Renewable Energy Hub, CopperString Core and the Mount Isa Augmentation, including areas containing regulated vegetation within 100 m of a wetland and high ecological significance wetlands. The corridor selection intersects a trigger area for a MSES Wetland Protection Area (wetland of high ecological significance) within the Renewable Energy Hub at KP 185WD for a distance of approximately 700 m.

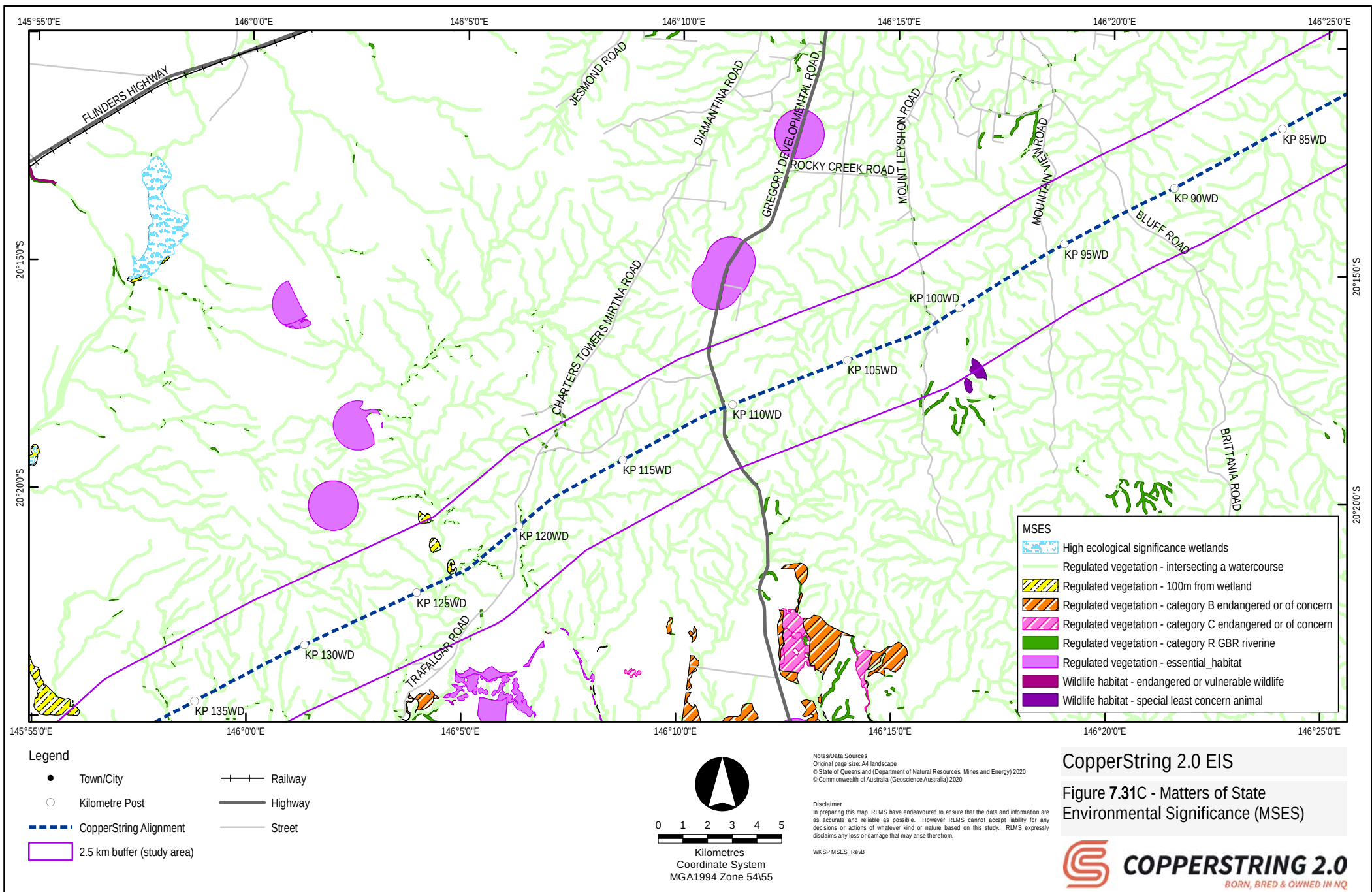


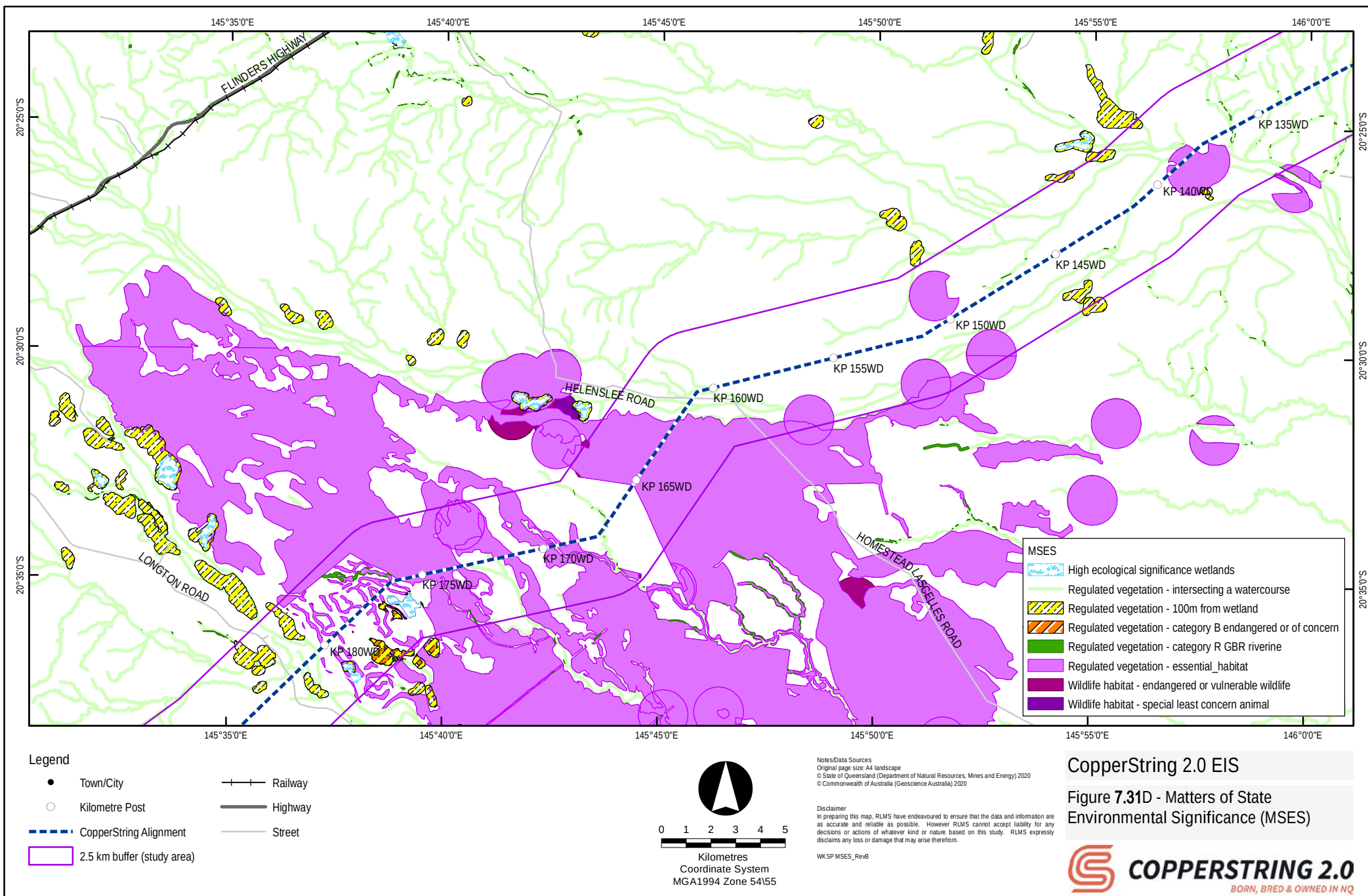
The location of wetlands of State or regional importance are presented in Figure 7-31. For a more comprehensive assessment of wetlands of State and regional importance, refer to Section 3.3.3 and 4.4.1 of Volume 3 Appendix P Ecological Assessment.

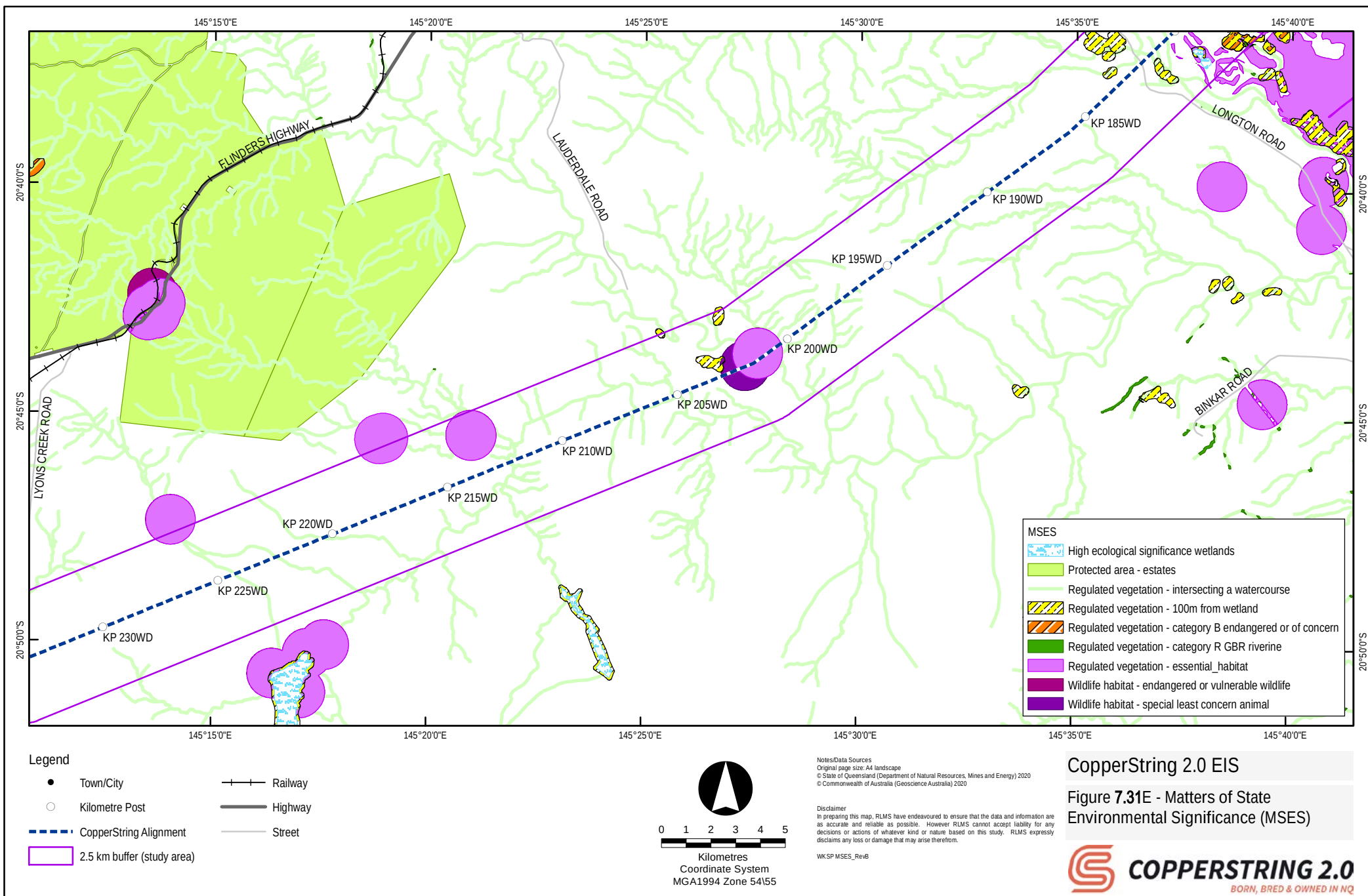


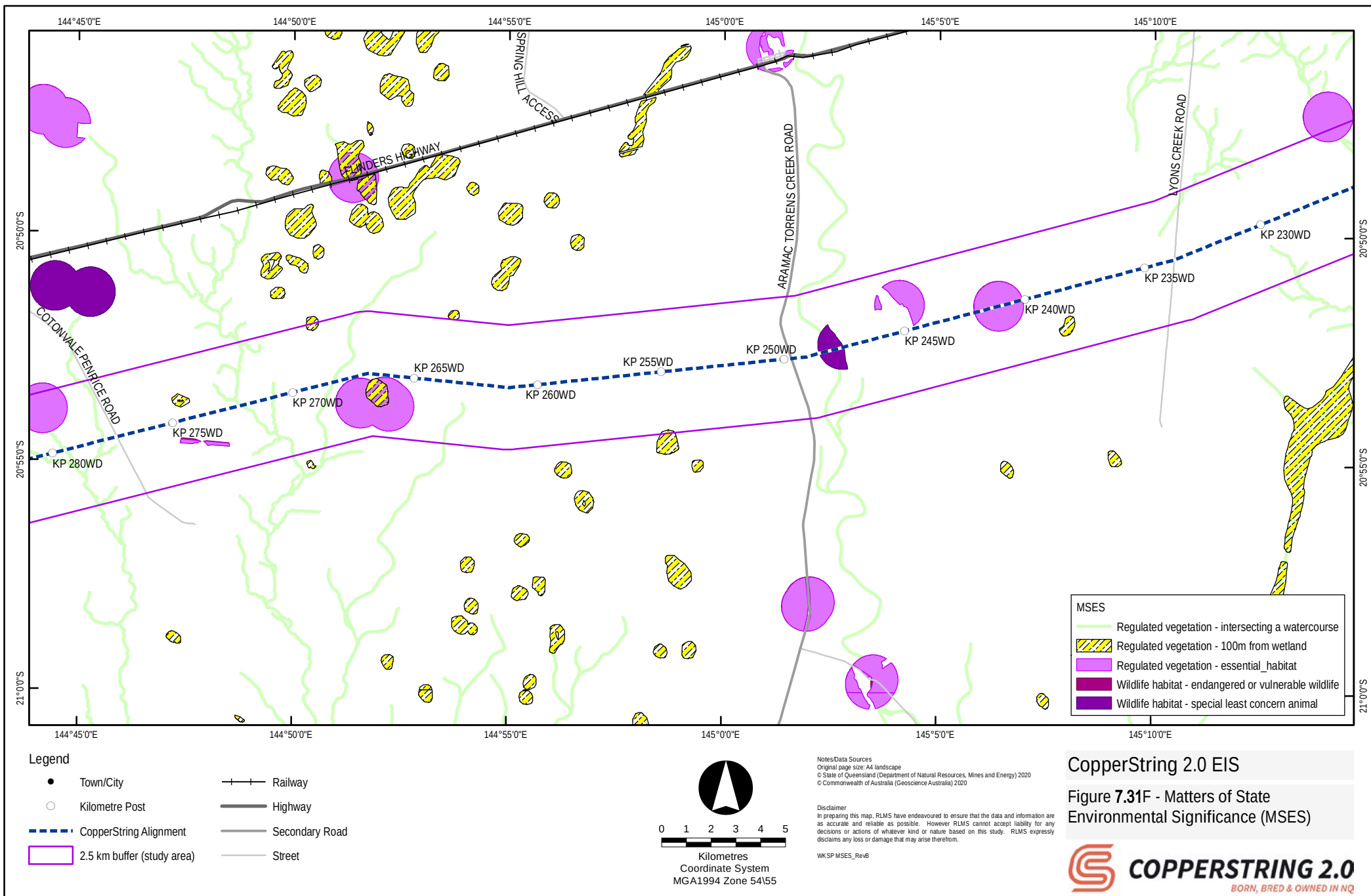


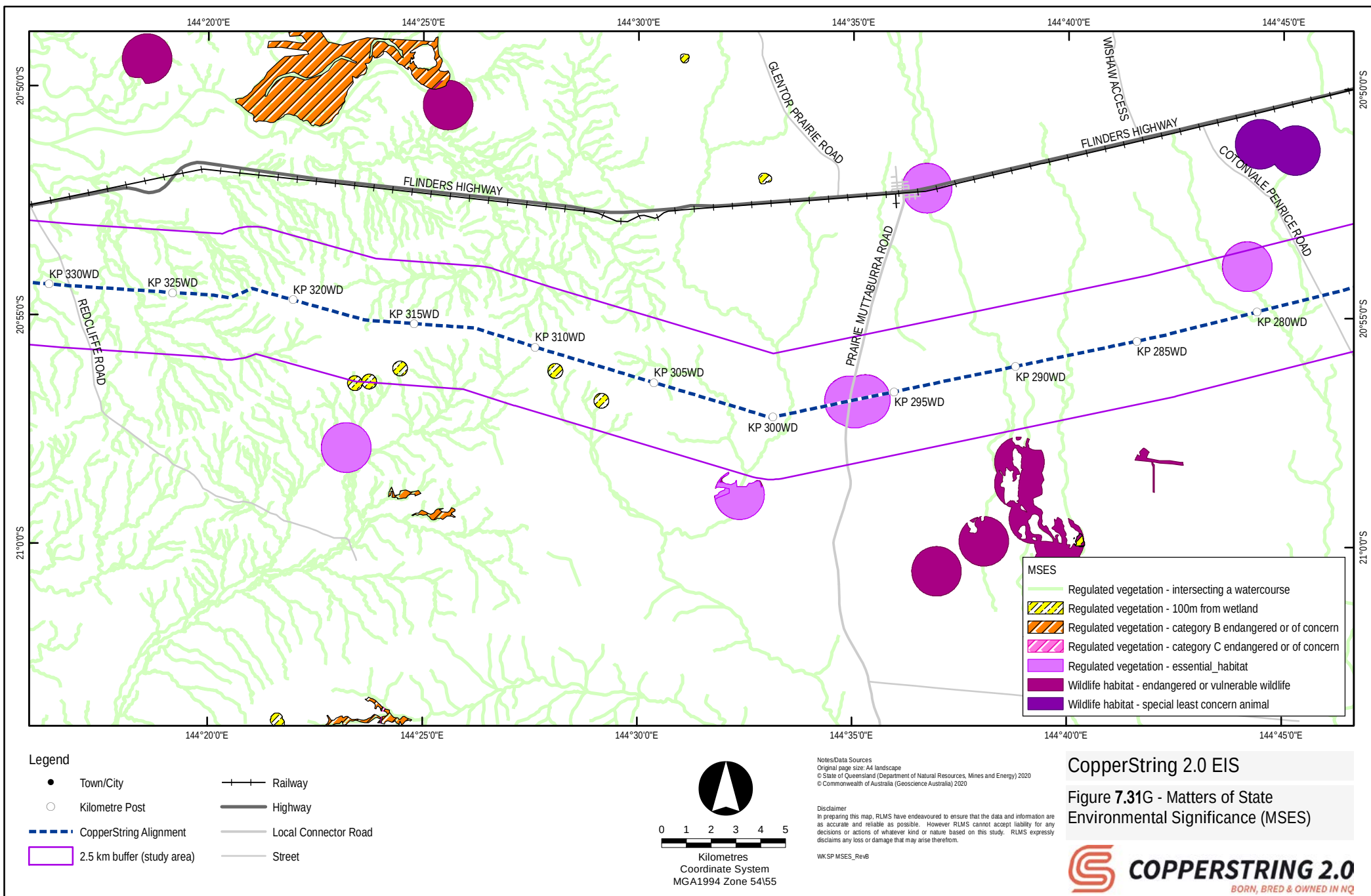


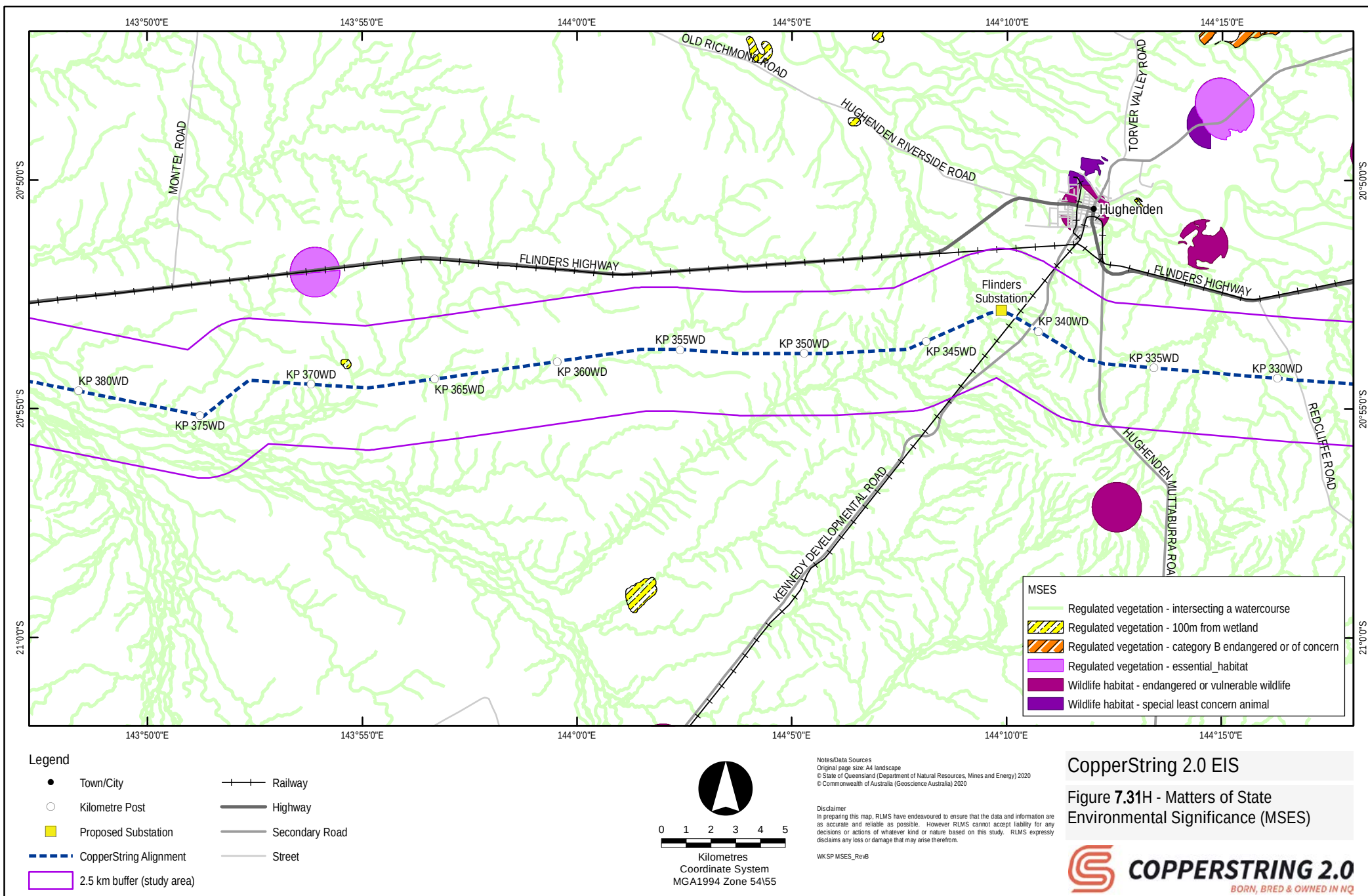


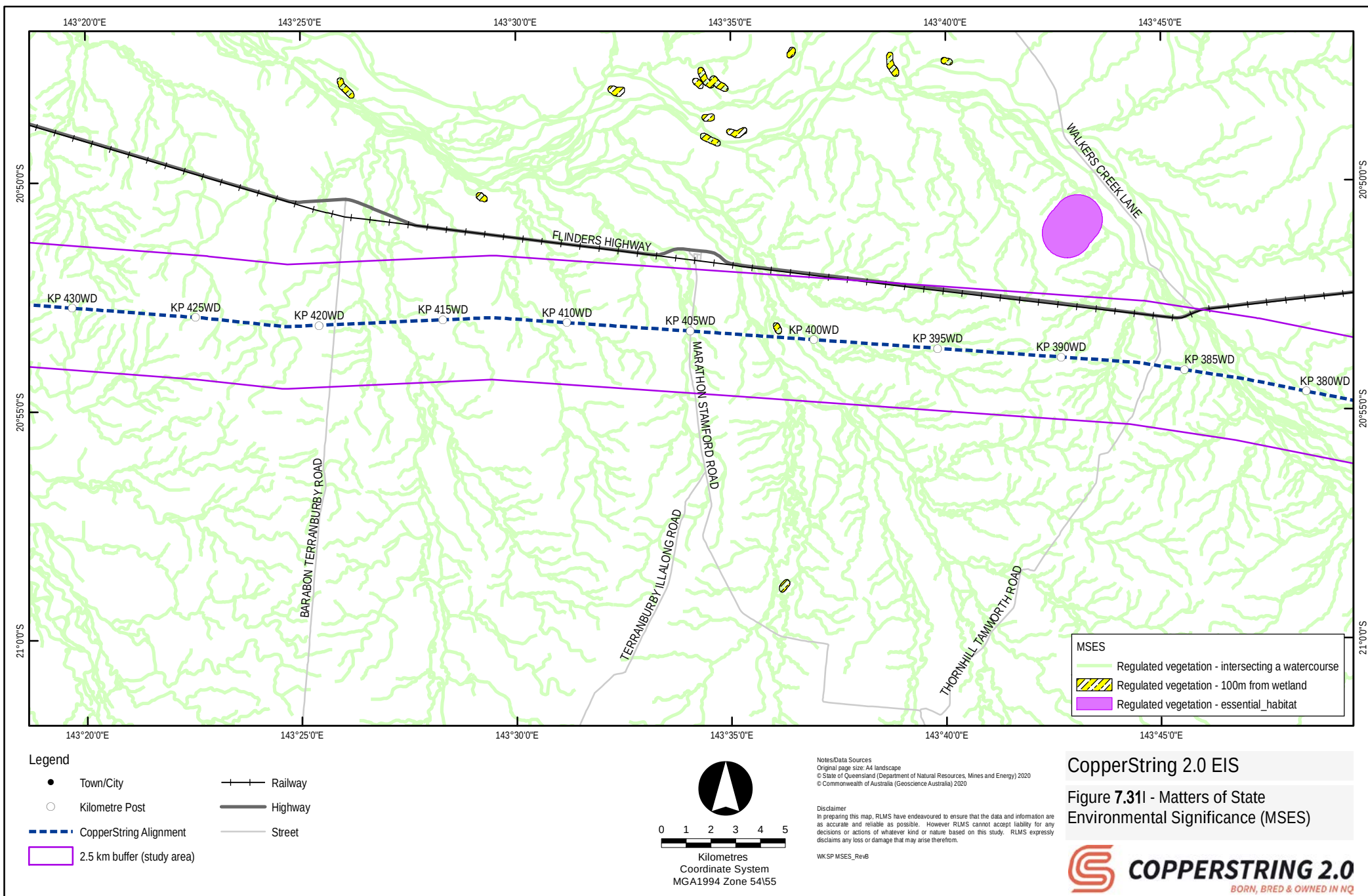


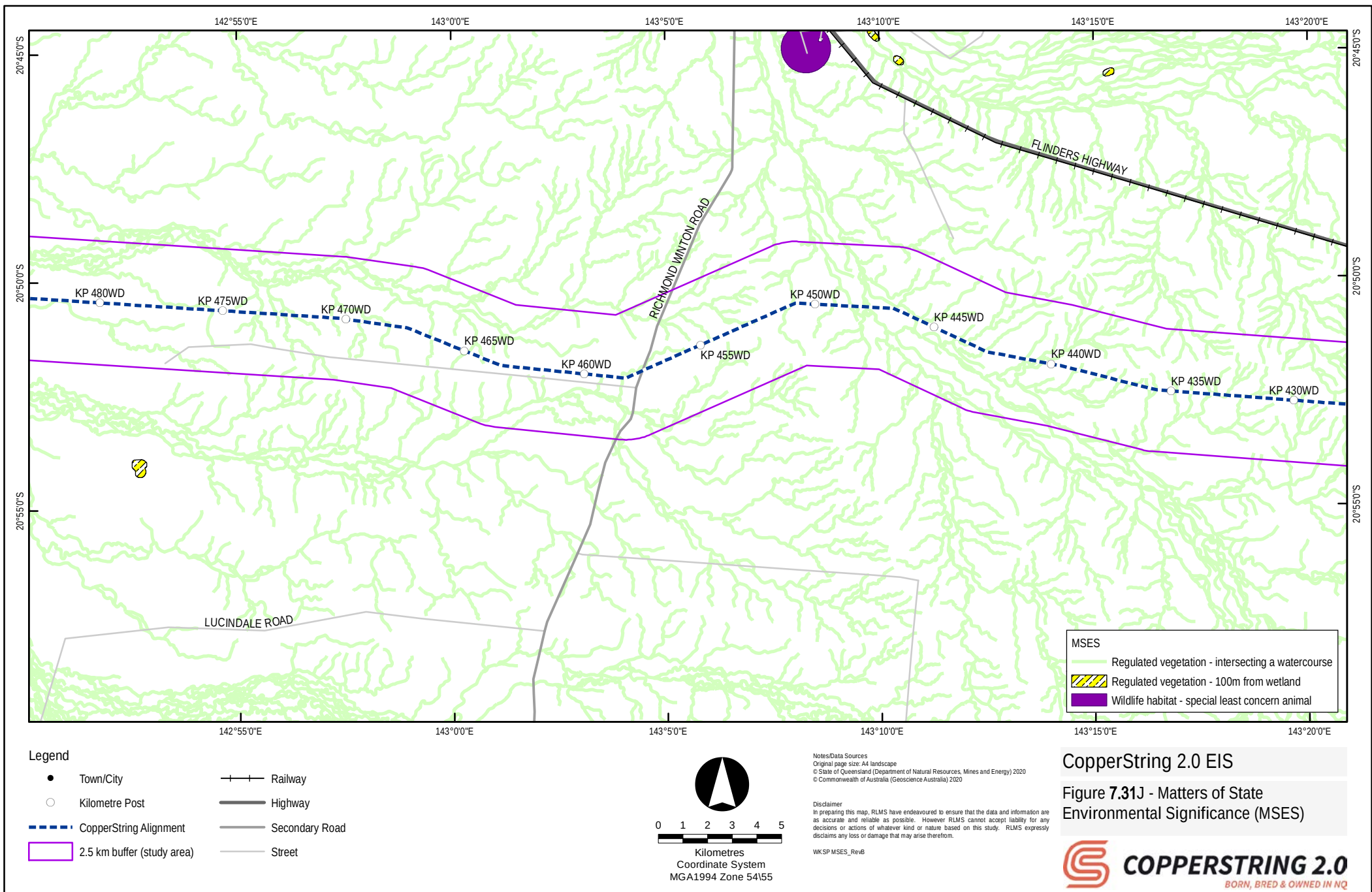


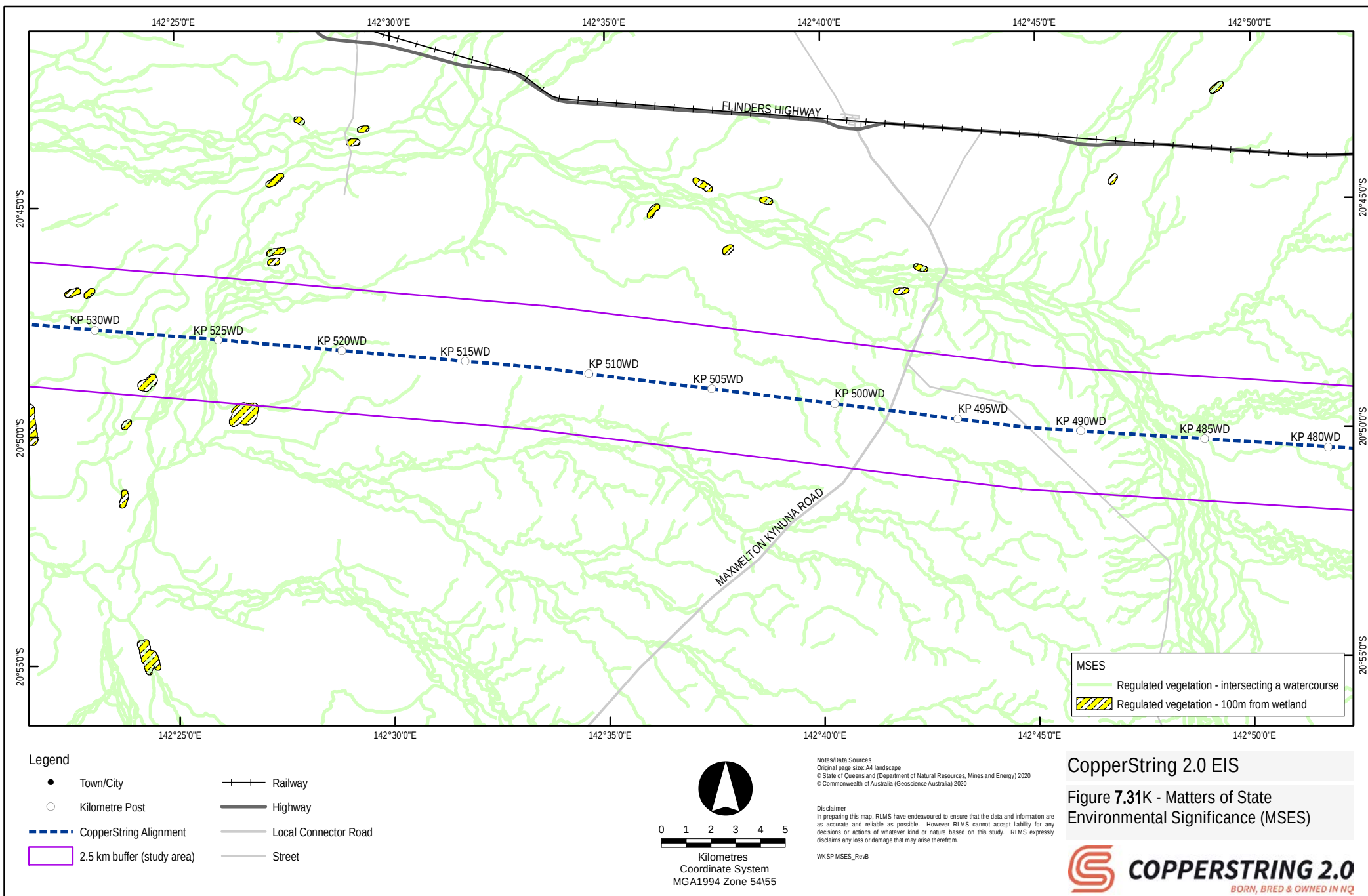


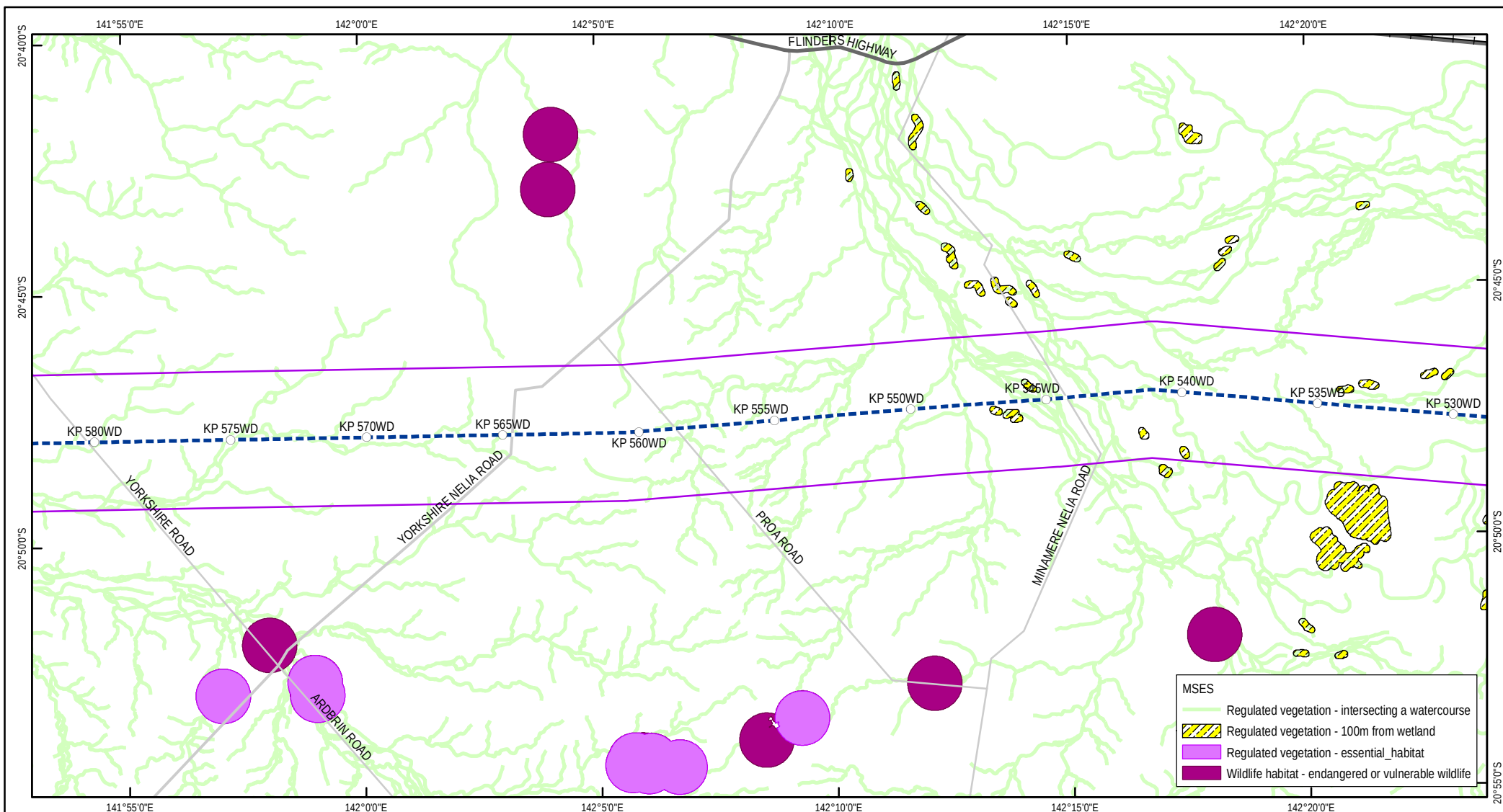






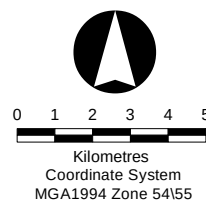






Legend

- Town/City
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- Railway
- Highway
- Local Connector Road
- Street



Notes/Data Sources
Original page size: A4 landscape
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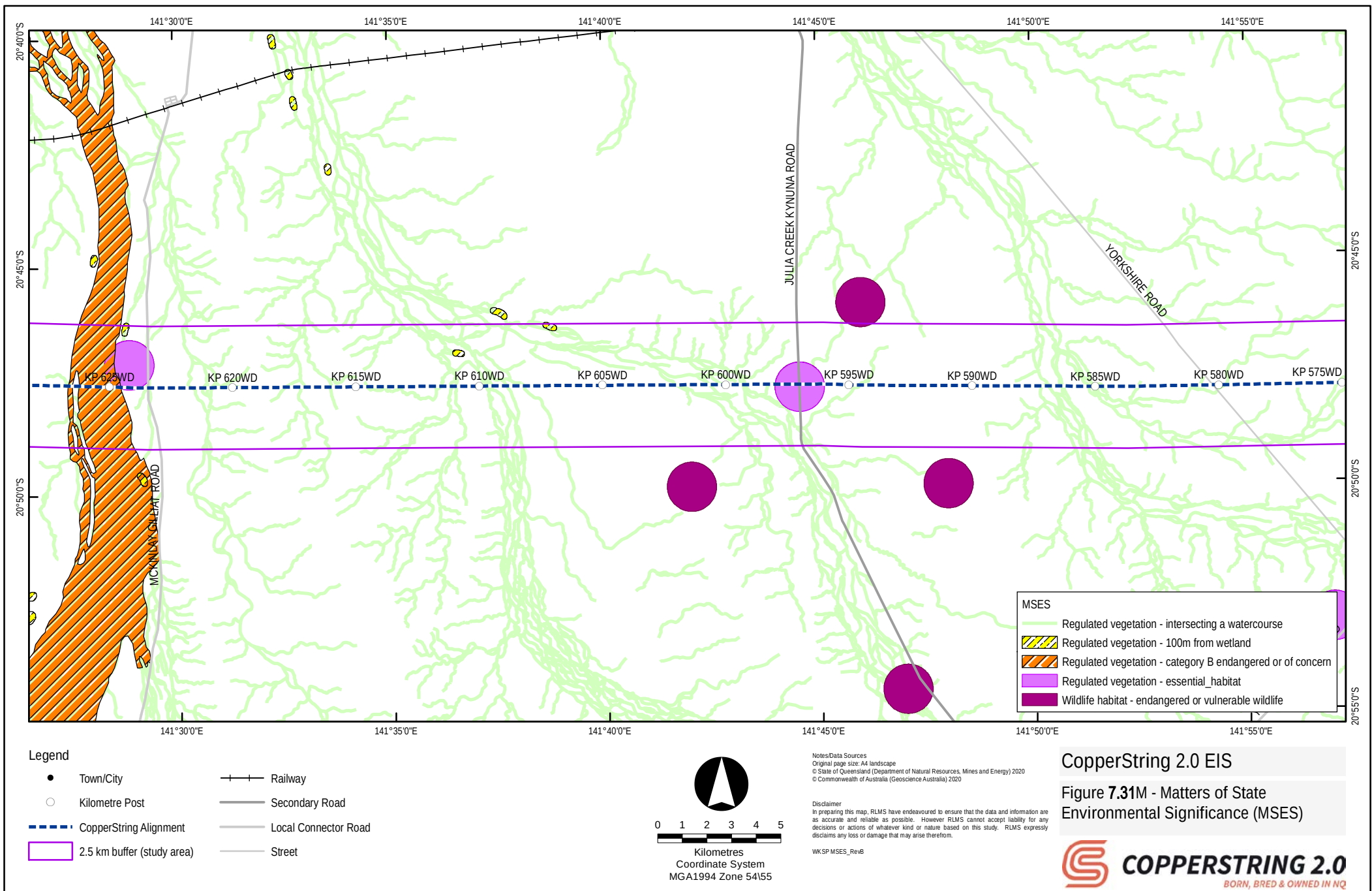
Disclaimer
In preparing this map, RLMS have endeavoured to ensure that the data and information are as accurate and reliable as possible. However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study. RLMS expressly disclaims any loss or damage that may arise therefrom.

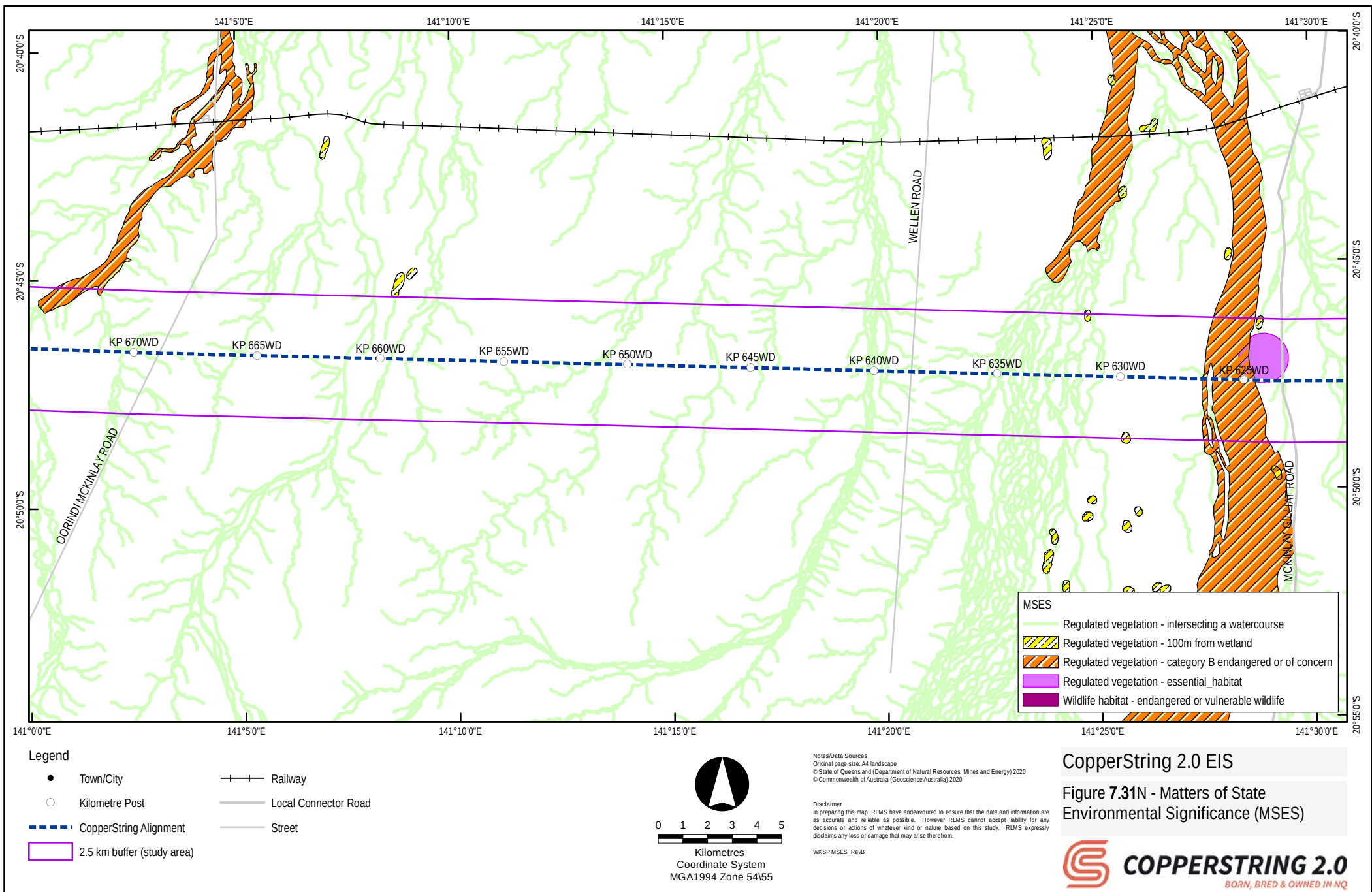
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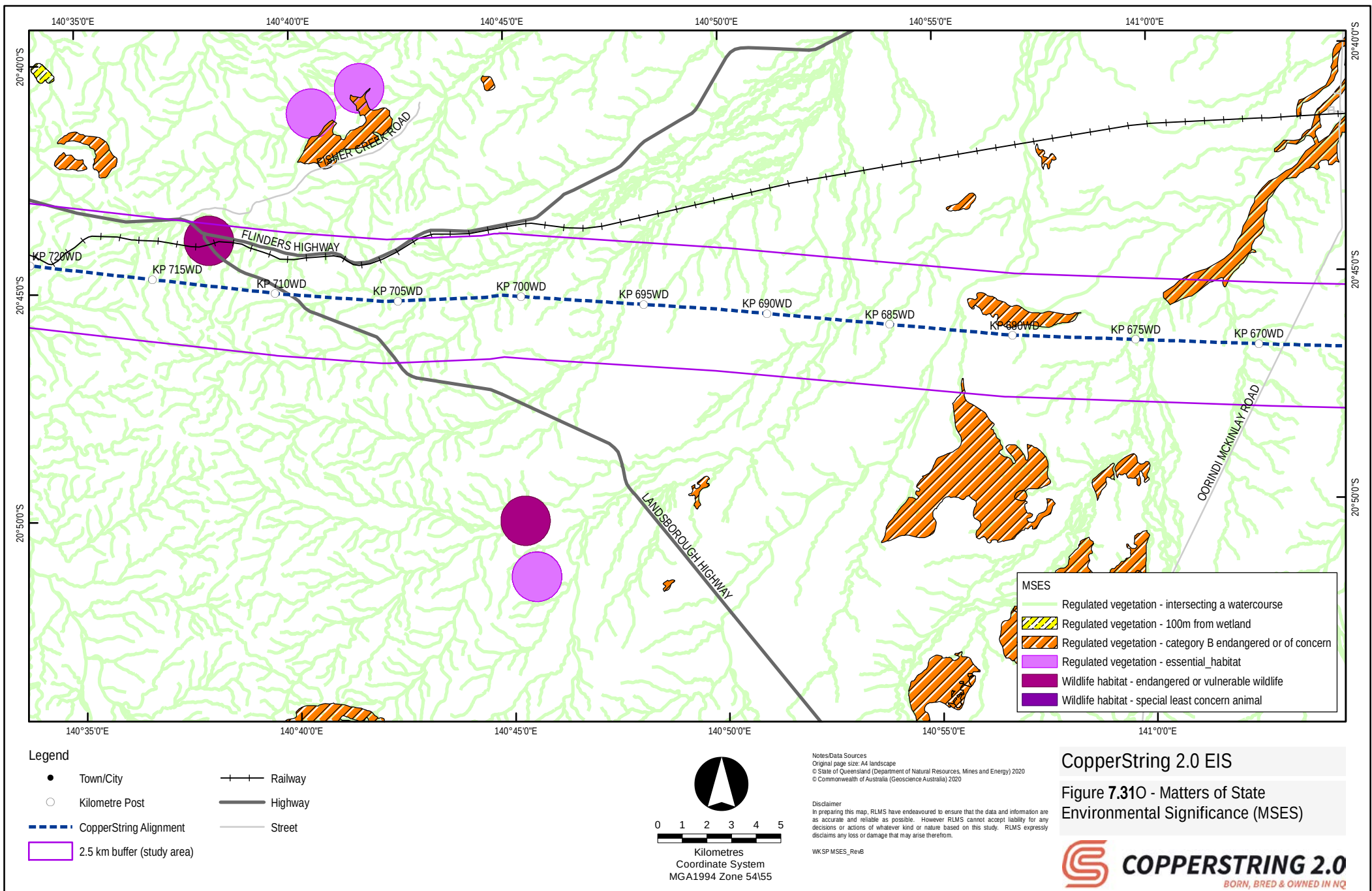
CopperString 2.0 EIS

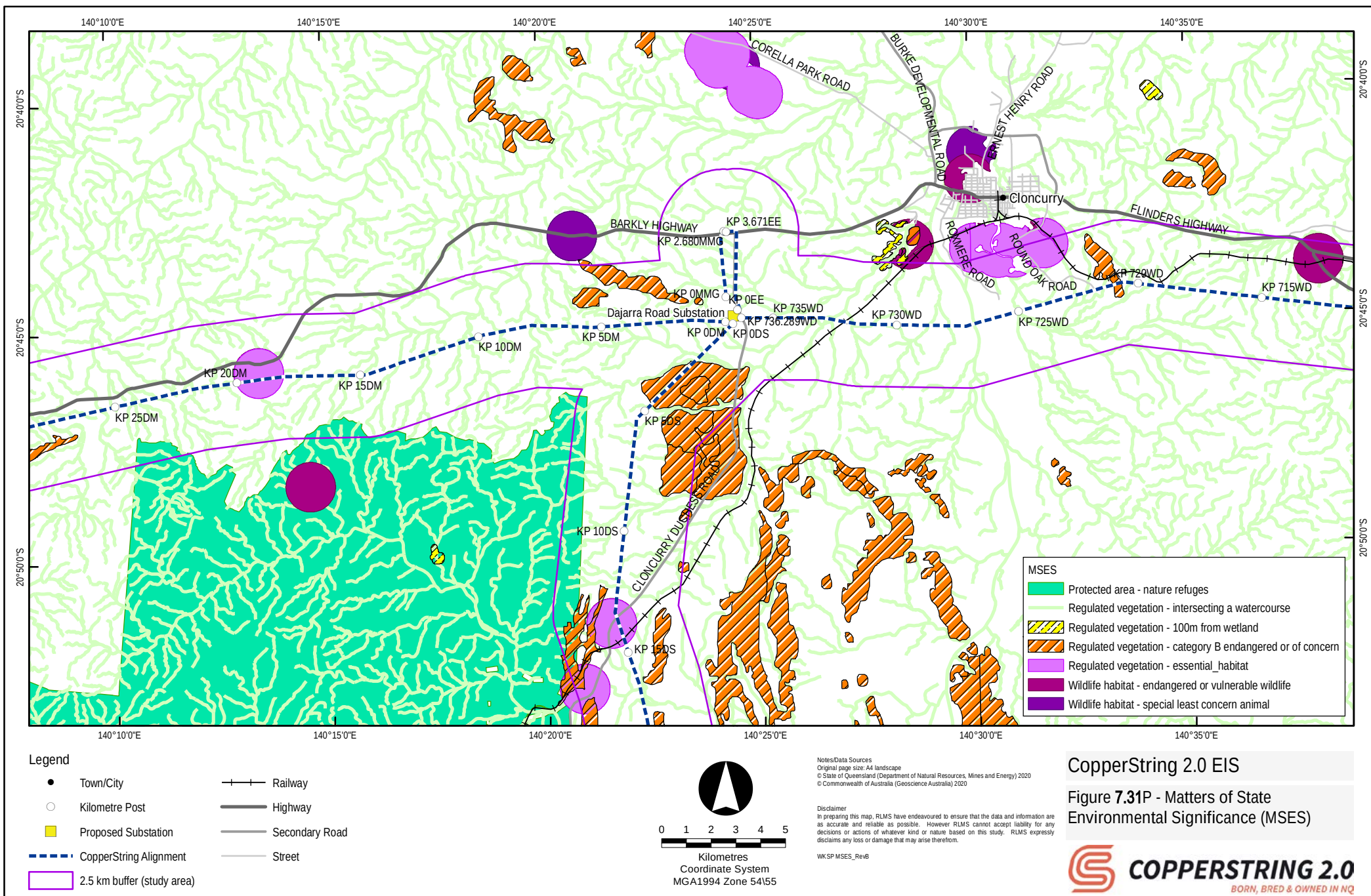
Figure 7.31L - Matters of State
Environmental Significance (MSES)

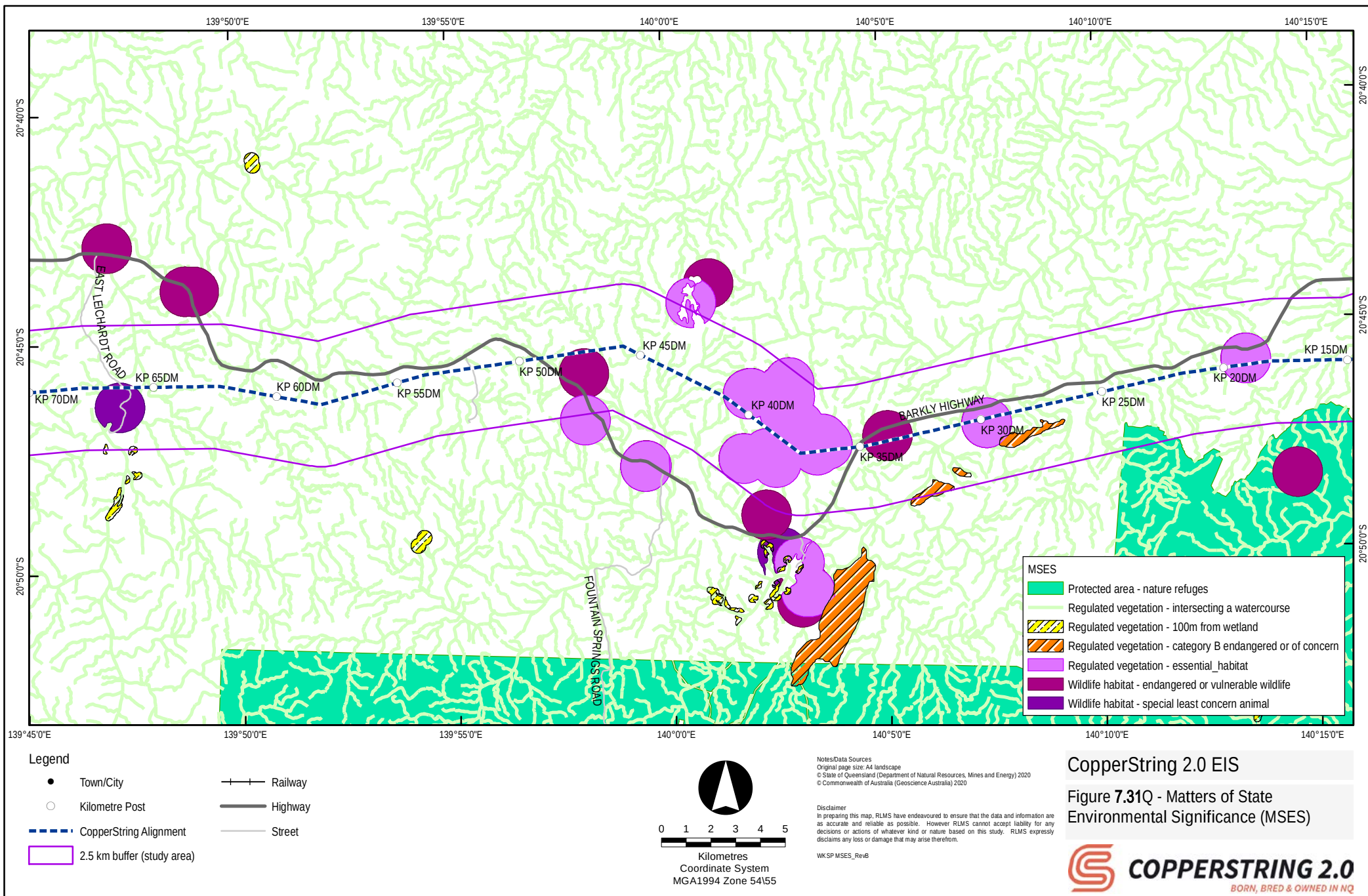


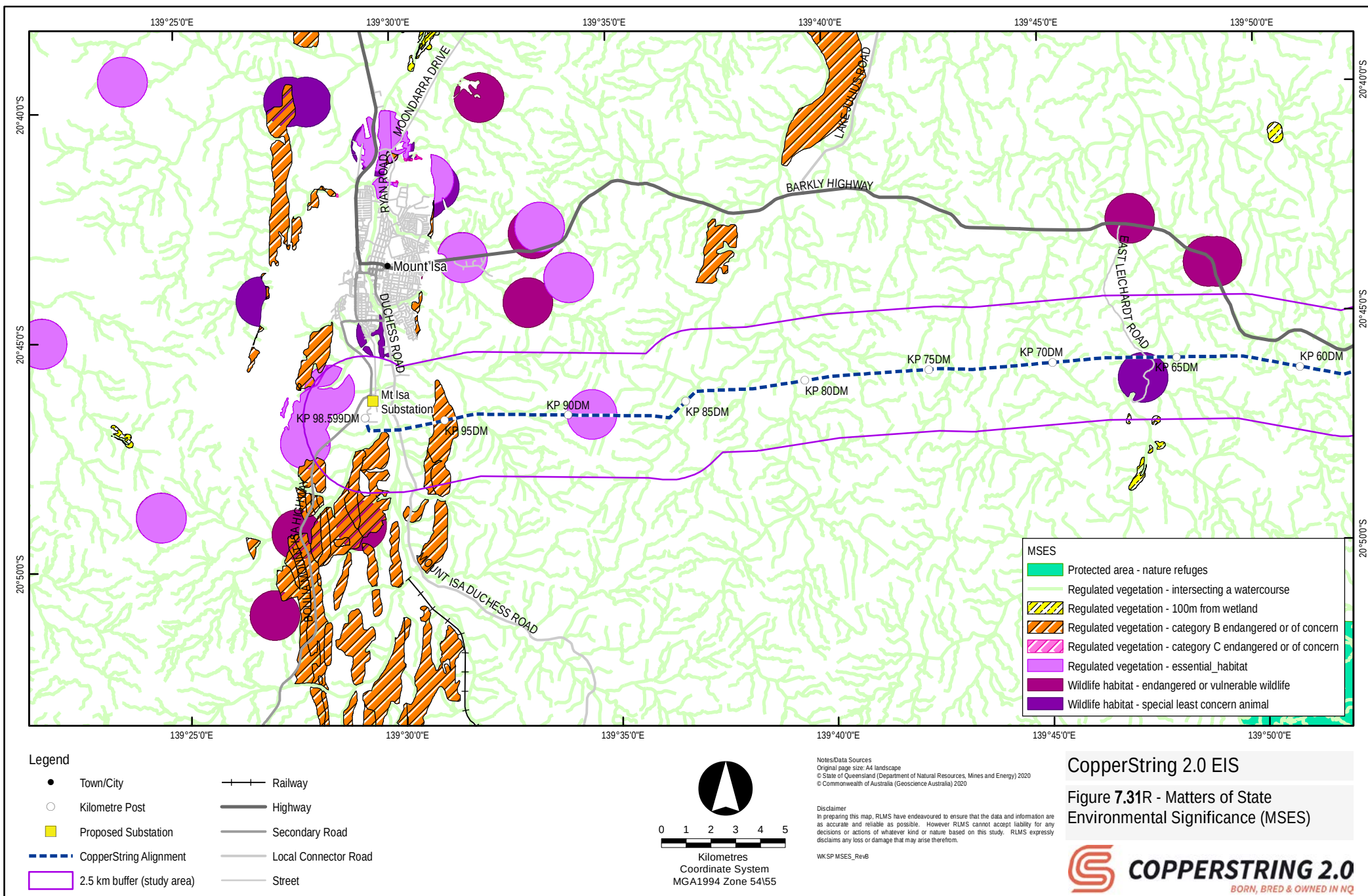




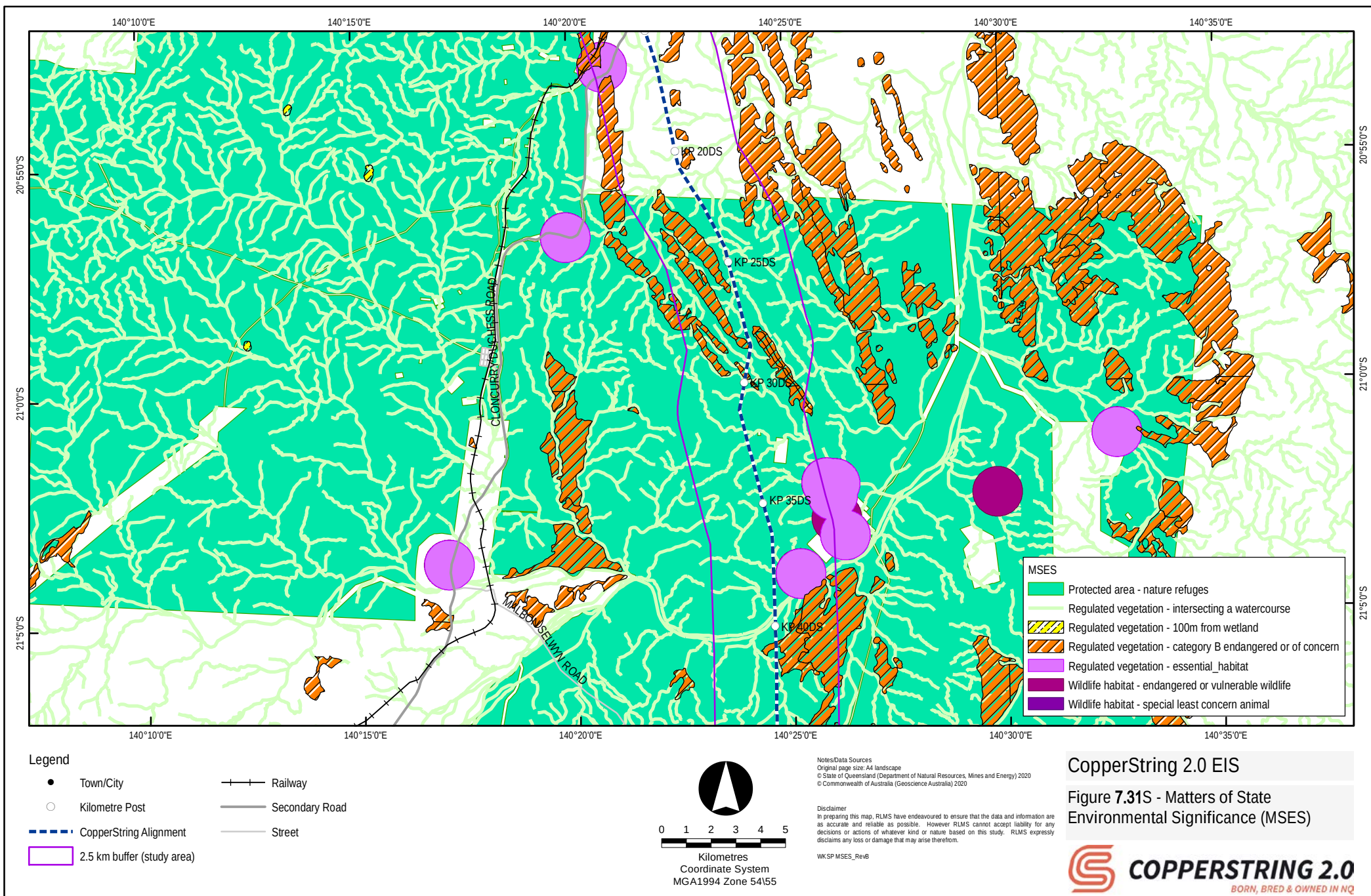


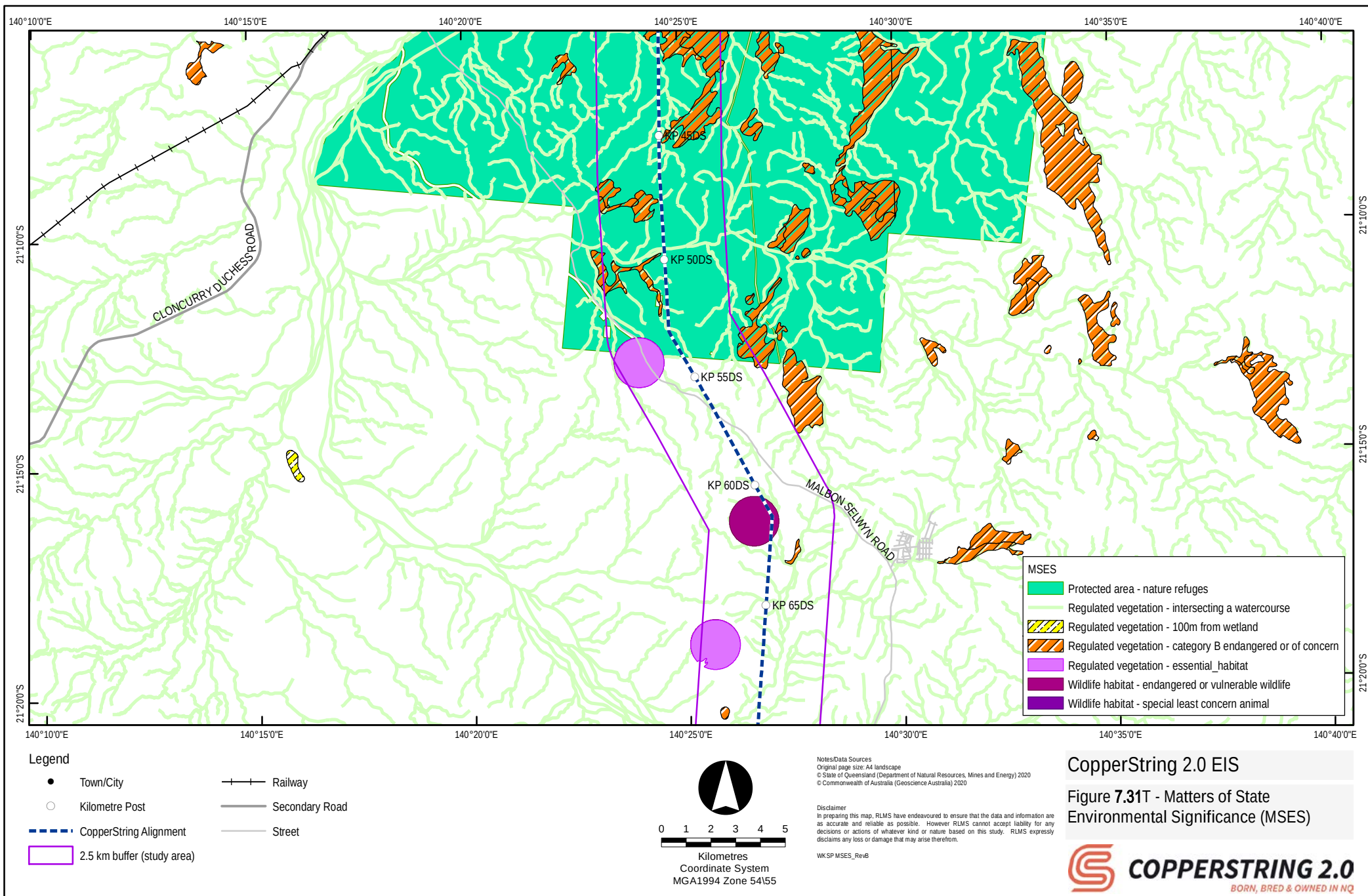


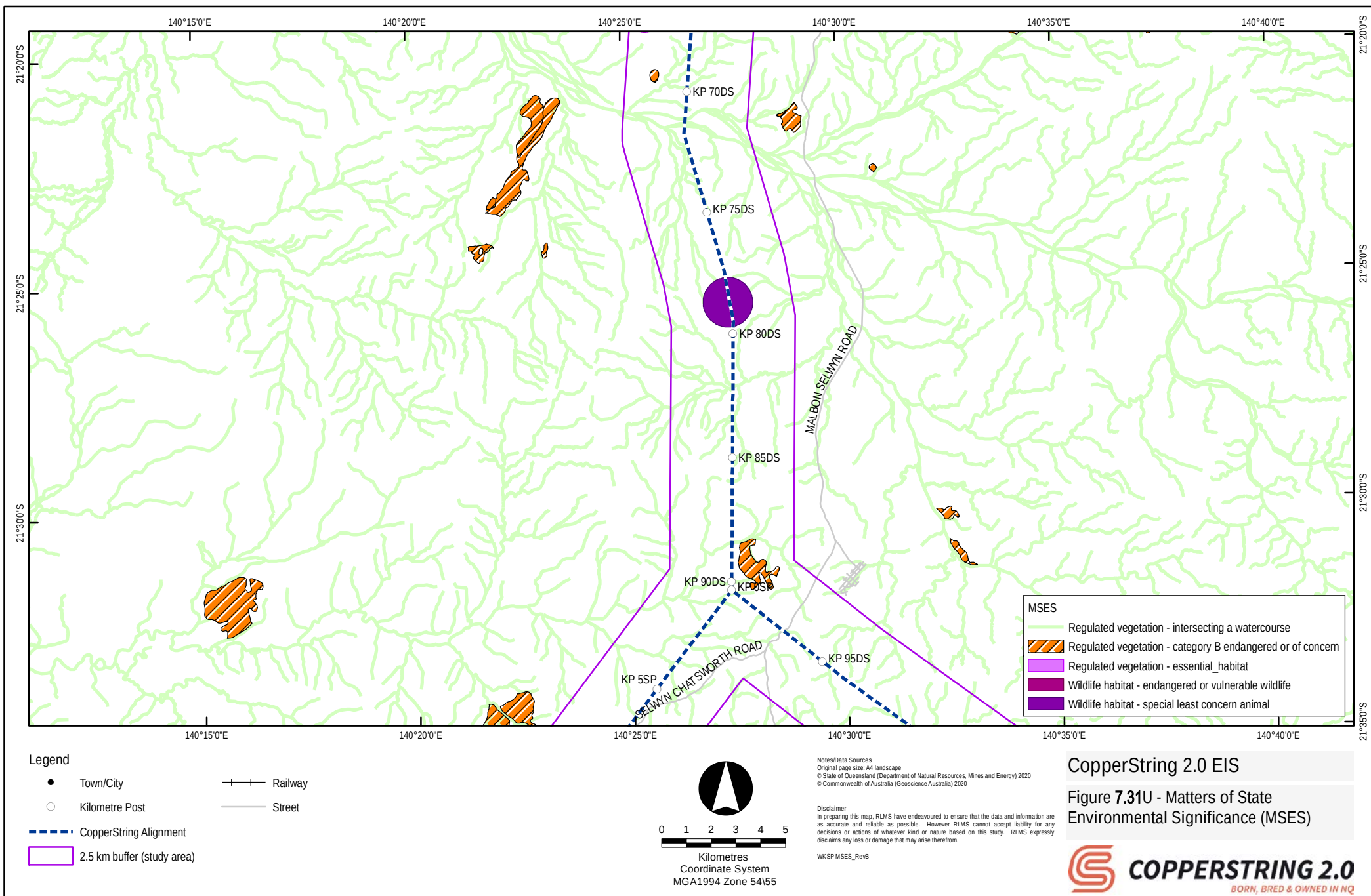


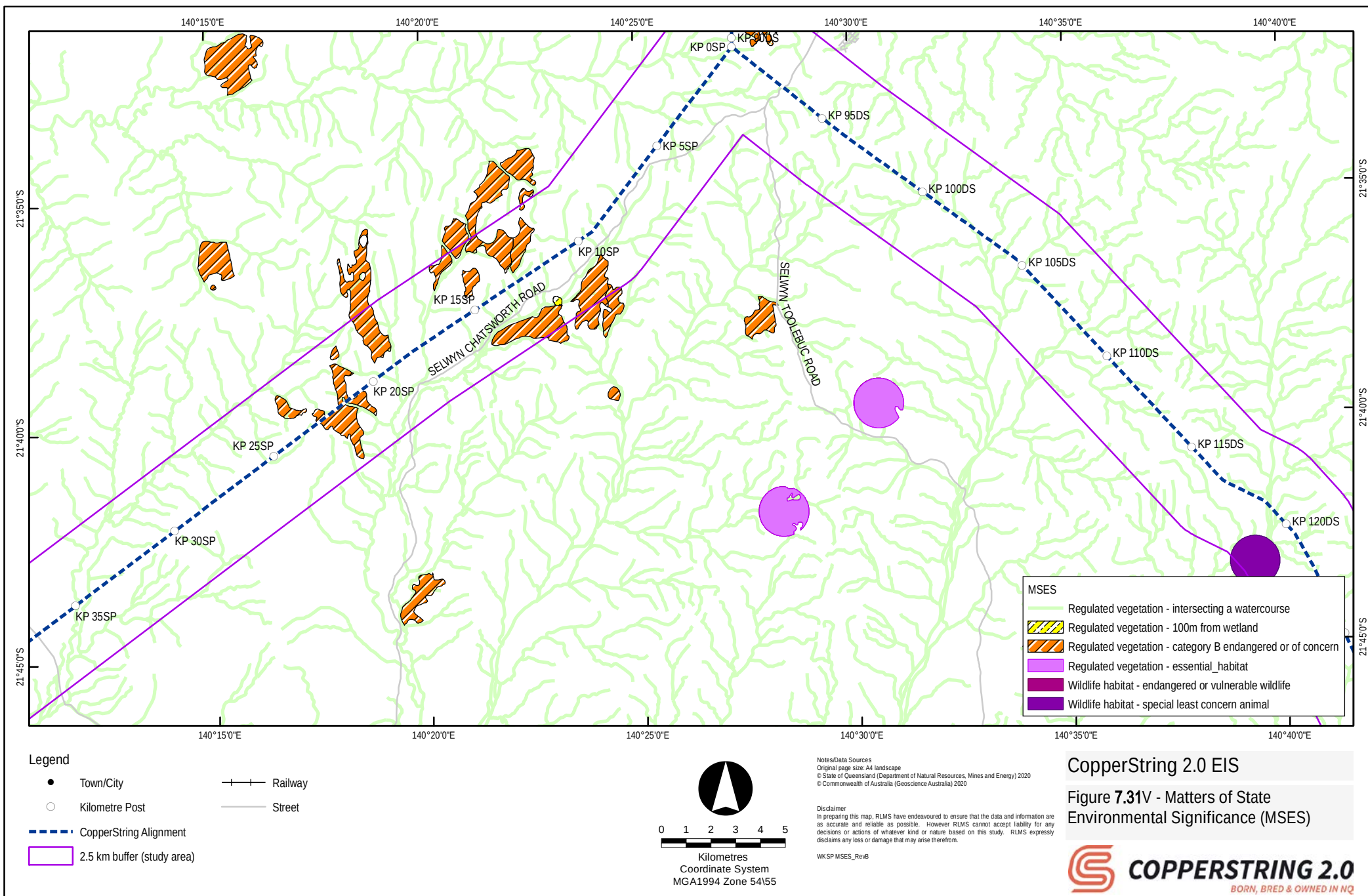


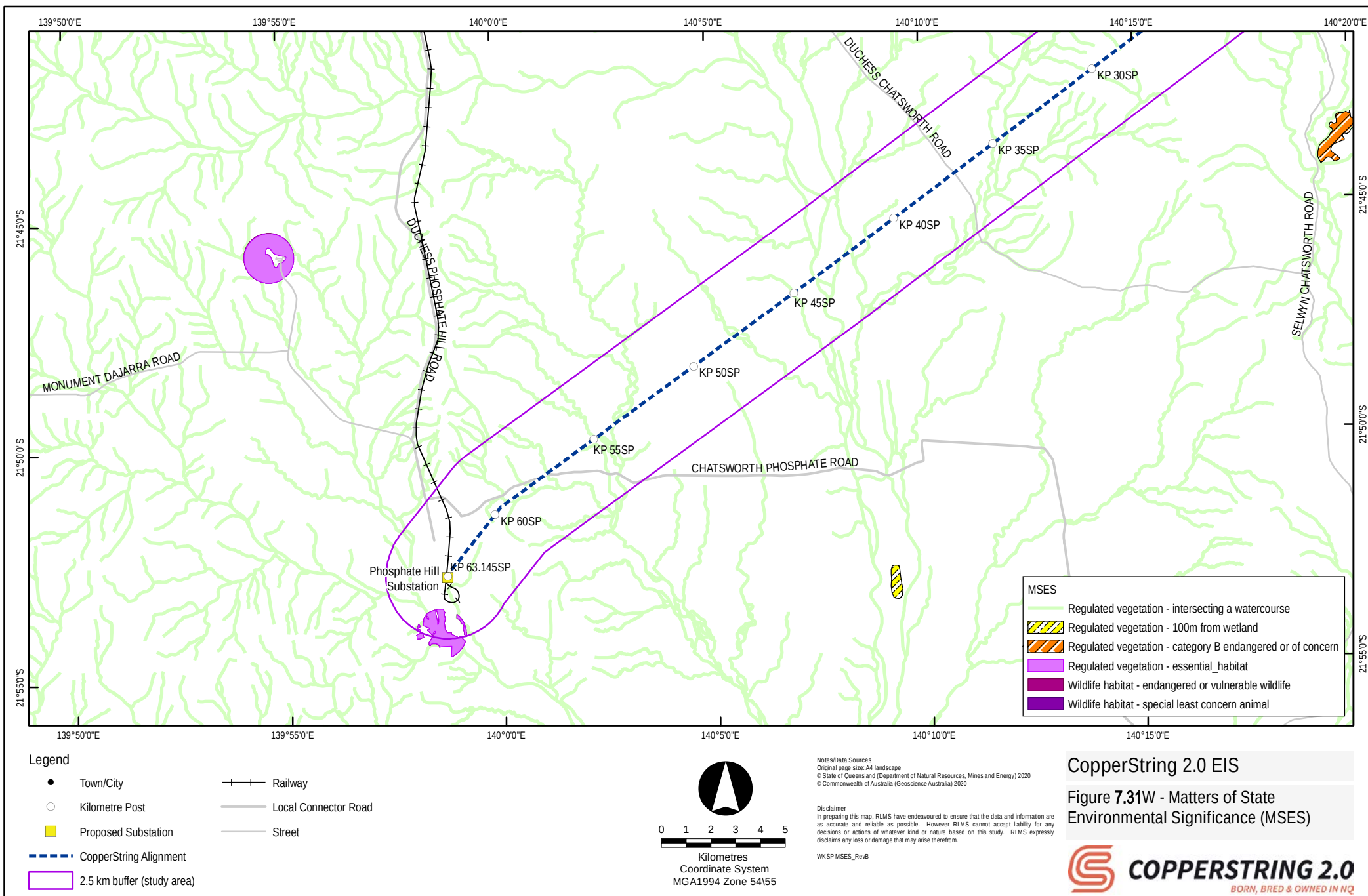
CopperString 2.0 EIS
Figure 7.31R - Matters of State
Environmental Significance (MSES)

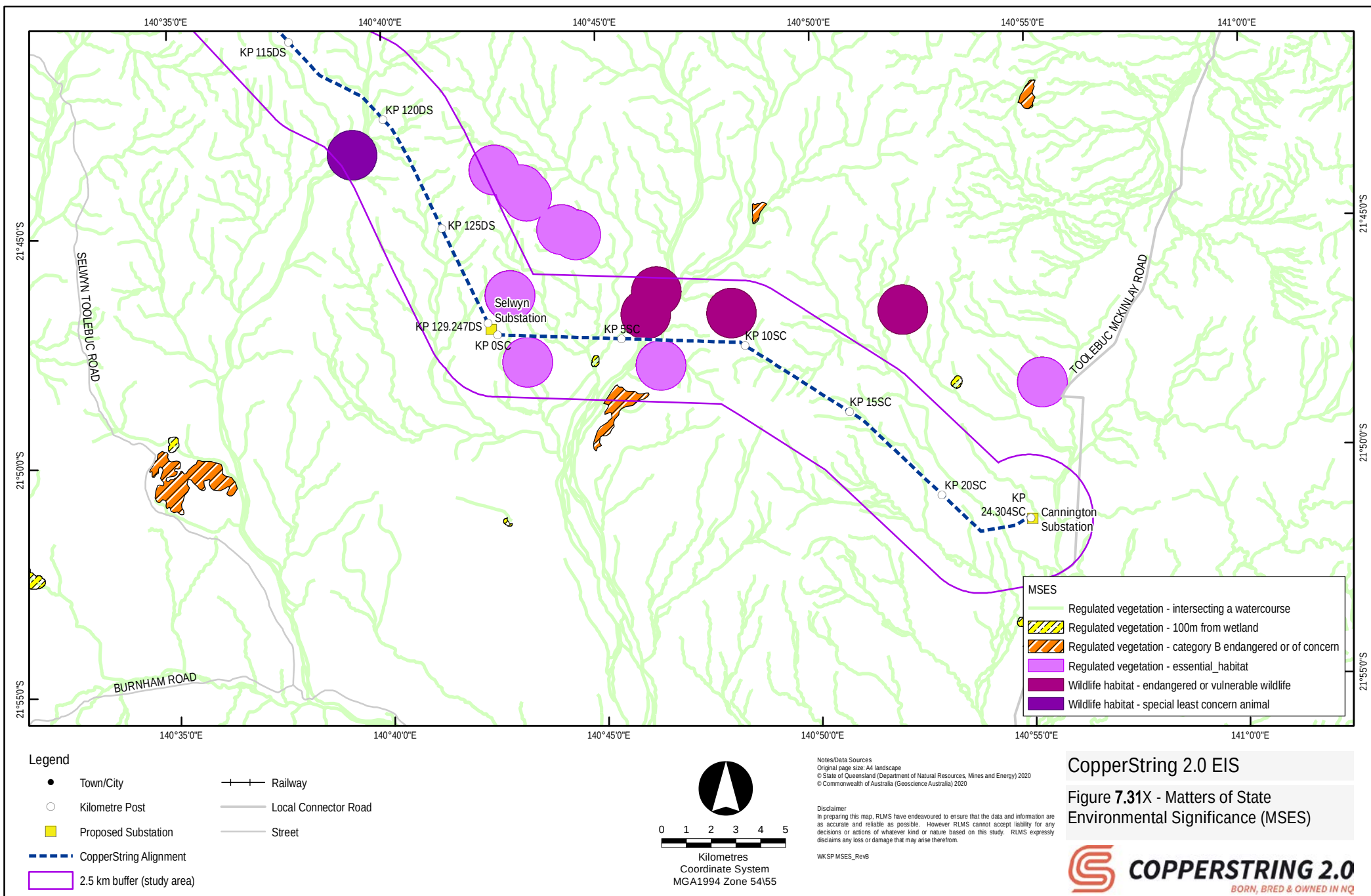








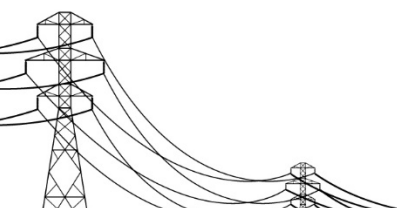




7.3.10 Existing threatening processes

The Biodiversity Planning Assessment framework identifies key threatening processes for each bioregion. Key threatening processes adversely impacting biodiversity in all bioregions intersected by the Project include:

- Habitat loss due to past and present agriculture, mining and dams
- Habitat degradation from weeds such as Parthenium, rubber vine and exotic pasture grasses (i.e. buffel grass)
- Predation by feral predators such as cats and foxes and grazing and habitat degradation by feral and domestic herbivores including cattle, horses, pigs and rabbits
- Landscape modification leading to increases in dominant species such as noisy miners and certain macropod species that impact on native flora and fauna.
- Soil erosion due to agricultural activities
- Climate change and associated restrictions on species distributions.
- Revegetation of all temporary construction and laydown areas following construction.
- Implementation of strict weed hygiene and pest management protocols during construction.



7.4 Impact Assessment

This section details anticipated impacts to terrestrial and aquatic ecological values during the Construction and Operation phases of the Project. A range of design measures have been used to minimise the Project's impact on the environment. These measures have been summarised in Section 7.4.1. Construction phase impacts are detailed in Section 7.4.2 and Operation phase impacts are detailed in Section 7.4.3.

7.4.1 Design Response

The Project design has been developed with consideration of the existing natural environment using the following mechanisms to avoid or minimise impact on areas of high ecological value:

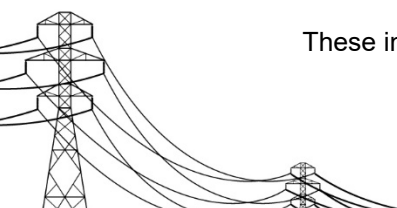
- Route-realignments were used via a preliminary constraints workshop, to avoid all impact on SEVT TEC and endangered REs and minimise impacts to watercourses, of concern REs and areas of mapped essential habitat for conservation significant species.
- A specific corridor selection process has been undertaken for proposed options through and adjacent to Ballara Nature Refuge, with consideration of areas of specific value under the nature refuge agreement, as well as other environmental values and constraints.
- Spanning over sensitive areas with taller masts to minimise non-essential clearing, leaving corridors of trees for connectivity. This will be undertaken to minimise impact to watercourses and habitat for koalas and other conservation significant species.
- In areas of importance for conservation significant species where high levels of fauna connectivity is unavoidably impacted, retention of remnant vegetation strips will be considered to maintain connectivity and reduce habitat fragmentation / isolation. This will be undertaken in areas where the vegetation strips will not impact the operational safety of the network infrastructure.
- Access to the corridor selection and along the easement will use existing tracks and locations of proposed tracks will be within previously disturbed areas, wherever possible, including for waterway crossings.
- Locating the layout of temporary and permanent structures and infrastructure in areas of non-remnant vegetation wherever possible to minimise clearing of vegetation (in particular of concern).
- Towers will be strategically located to allow the corridor to span across watercourses. This will also eliminate the need for waterway barriers.

7.4.2 Construction

The Project is anticipated to generate direct and / or indirect impacts on the existing environment within the Project area as detailed below:

- Loss and disturbance of vegetation and habitat
- Direct mortality and injury of wildlife
- Habitat fragmentation and reduced connectivity
- Wildlife disturbance through light, noise and vibration
- Habitat degradation through dust, erosion, run-off and sedimentation
- Introduction and spread of invasive flora and fauna
- Disturbance of surface waterways and GDEs

These impacts are discussed in detail below.



Disturbance footprints

The Field Development Plan (Volume 3 Appendix R) establishes a process for calculating habitat disturbance for the Project based on vegetation cover and potential Project clearing requirements. The approach forms the basis of calculating habitat disturbance along the Project area and therefore assessing impacts to individual species. The term “disturbance area” used in the below sections is calculated using the methodology specified within the Field Development Plan.

These calculations represent a worst-case scenario for habitat disturbance with important areas retaining potential for MNES and MSES to be highlighted. The design and construction management process will seek to avoid and minimise impacts through appropriate tower selection and siting, spanning of areas and consideration of vegetation clearing requirements.

An assessment of the Project area against the landscape types mapped using the 1:1 million broad vegetation groups demonstrates that a number of areas contain vegetation communities that feature low and/or very sparse canopy vegetation and therefore result in reduced clearing impacts. There is a requirement by the Project to clear all woody vegetation within the transmission line corridor that is, or may grow to be, over five metres in height, for the purposes of safety and future maintenance. In some landscapes this may require only trimming of taller branches, or only selective clearing of taller vegetation may be required while lower vegetation may remain. However, all vegetation within the standard impact footprint for towers, CEV huts and substations will be required to be cleared.

The landscape types that have been broadly mapped throughout the Project area and the percentage of disturbance per type within the corridor easement is estimated to be:

- Open forest to open woodland (eucalypt / melaleuca / belah dominated) on flat to undulating plains – 10.1% of the landscape type disturbed within the Renewable Energy Hub and CopperString Core corridor sections
- Riparian zone and fringing vegetation along ephemeral channels, watercourses and channelised floodplains – 0% of the landscape type disturbed due to the ability of infrastructure to span and avoid the riparian corridors
- Low open woodland to wooded spinifex grassland (eucalypt / acacia dominated) on slopes, crests and scarps – 0.2-3.9% of the landscape type disturbed, depending on the relevant corridor section
- Mixed low woodland with spinifex (gidgee / mulga / eucalypt dominated) on plains – 0-0.3% of the landscape type disturbed, depending on the relevant corridor section
- Tussock/hummock grassland – 0-0.4% of the landscape type disturbed, depending on the relevant corridor section
- Cleared grazing land with scattered trees – 0-0.1% of the landscape type disturbed within the Renewable Energy Hub, CopperString Core and Phosphate Hill Connection corridor sections

Disturbance within the easement includes temporary and permanent disturbance footprints. Temporary disturbance activities include the Brake and winch sites and the Tower construction footprints. Permanent disturbance includes clearing loss for the transmission line clearance to canopy, access tracks and towers. As described in Table 7-9, the permanent loss of vegetation across the corridor will vary depending on the corridor section. However the permanent loss in any section is not expected to exceed 15% of the total corridor.

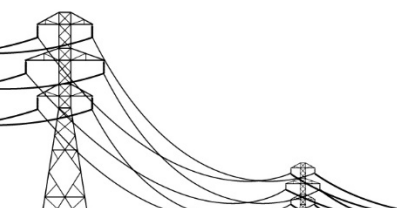


Table 7-9 Estimated clearing loss

Section	Length (km)	Width (km)	Area (ha)	Total Disturbance in easement (ha)	Temporary disturbance in easement (ha)	Permanent loss (% of easement)
Renewable Energy Hub	342	0.06	2052	426.53	144.89	13.73
CopperString Core	395	0.06	2370	430.87	162.85	11.31
Chumvale connections	7	0.06	42	14.76	9.61	12.27
Mount Isa Augmentation	99	0.06	594	68.30	45.83	3.78
Southern Connection	129	0.06	774	125.04	62.46	8.08
Cannington Connection	23	0.06	144	18.64	13.01	3.91
Phosphate Hill Connection	63	0.06	378	41.57	29.21	3.27

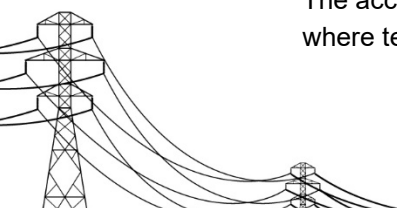
These percentages represent the likely clearing impacts within the different landscape types present in the Project area. These landscape types and clearing disturbance assumptions are further detailed in Volume 3 Appendix R Field Development Plan, including long-sections and cross-sections of the Project area through representative areas to show landscape types on aerial imagery as well as typical vegetation heights and infrastructure spans.

Tower siting plans have been produced for the Project area, in order to place towers, model tower heights and consider span lengths with regard to the canopy heights and ground elevations, as well as known ecological constraints, such as riparian corridors, significant wetland habitats, and known locations of conservation significant flora species.

Transmission towers will be designed to maintain a clearance of the transmission line above local terrain in compliance with Queensland legislation. Nominal transmission tower heights and distances between transmission towers are described in Table 2-3. Transmission tower heights will vary from location to location depending on the topography of each specific location, however will range from a minimum of 49-60 m to a maximum of 70-81 m depending on the corridor section. The distance between transmission towers will typically be in the range of 400–500 m. This may vary (and in special circumstances exceed 500 m) depending on the topography and conductor clearance required areas of the easement. Drawings showing indicative placement of transmission towers are included in Volume 3 Appendix H Tower siting plans.

The concept transmission tower sites have been selected after careful consideration of all physical constraints such as sensitive environmental areas, rock/soil types, significant waterways / watercourse infrastructure crossings, existing land use and amenity. The transmission towers will be sited to make the best use of available terrain providing both sound foundations whilst minimising impacts to the environment and adjacent land uses. Transmission towers and associated construction materials will be located outside of active watercourses and wetlands. Where the corridor selection crosses large braided ephemeral systems, some of which are more than 1 km wide, tower sites have been individually selected to avoid existing channels and the tower design will be sufficient to withstand seasonal flows or larger flooding events.

The access tracks will generally be contained within the transmission line easement however where terrain, environmentally or culturally sensitive areas and water crossings do not permit



this, the access track may be located outside of the easement, with spur tracks linking the main access track to each transmission tower site. In vegetated areas, existing cleared paths will be utilised where possible so that clearing by the Project is kept to a minimum. It is intended to utilise the existing road network and private access tracks, though some new tracks will be required to provide access for construction and maintenance teams. The access tracks for the Project will be constructed to a standard suitable for dry weather use for 4WDs at low speed. Where tracks are to be constructed as part of the Project, they will generally be unsealed tracks that follow the natural ground contours. Access constraints may require some landform re-shaping to construct a safe access track.

Loss and clearance of vegetation and habitat

During construction, the Project will require clearing of approximately 6620.87 ha of vegetation, of which approximately 6355.09 ha is mapped remnant vegetation (VM Act). The total area of expected impact on endangered, of concern and least concern REs is summarised in Table 7-10. Of concern REs are discussed individually in Table 7-11.

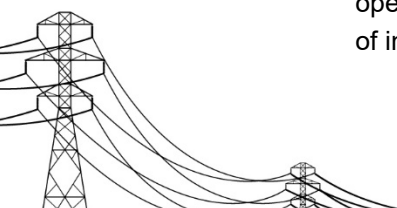
The Of Concern REs (representing approximately 0.5% of the total mapped REs) are mapped in the CopperString Core, Mount Isa Augmentation, Southern Connection and Phosphate Hill Connection corridor sections, with five homogenous or mixed polygons containing RE 1.11.7 and one mixed polygon that contains RE 2.3.43, described as follows:

- RE 1.11.7: *Acacia cambagei* low woodland on metamorphic hills
- RE 2.3.43: *Sporobolus mitchellii* +/- *Cyperus bifax*, *Astrebla elymoides*, *Chenopodium auricomum* tussock grassland on seasonally inundated alluvial plains and drainage depressions

The Of Concern RE 1.11.7 is a low, sparse woodland on hills and ranges, often comprising only minor components of heterogeneous polygons (representing only 5 or 10% of the heterogeneous polygon), and was found to typically occur in small patches on the side of low ridges. Due to the location of this RE type, on the side slopes, it is very rarely impacted by the Project as these landscape features have been typically avoided. Several smaller mapped polygons can be spanned across and avoid clearing of low canopy vegetation through appropriate tower placement, heights and span lengths.

As described below, it is unlikely that areas mapped as containing an Of Concern RE will impact any patches of Of Concern RE:

- The mapped area of mixed RE at KP2-6 DC (Southern Connection for a distance of 2.3 km) included a minor component of RE 1.11.7. It was found that this RE did not occur within the corridor selection through this polygon.
- At KP29.5-30 DC (Southern Connection, for a distance of 300 m) RE 1.11.7 was confirmed as occurring in small patches on the lower slopes of this section of the range; this RE was however only recorded on the south west slope at this point of the corridor selection in small batches or narrow bands. These small patches will be avoided by the Project activities.
- KP72-73 DC (Southern connection for a distance of 230 m). GHD identified this area as a possible mapping error due to its position within the landscape and revisited in 2020 to confirm the RE. It was confirmed that the RE aligned more closely with Least Concern RE 1.3.4a.
- At KP95 DM (Mount Isa Augmentation for a distance of 930 m), the mapped mixed polygon of 1.11.2a/1.11.7 was confirmed to contain Least Concern RE 1.11.2a (*E. leucophloia* low open woodland), with potential for 1.11.7 to occur in patches within the polygon or as areas of integrated *Acacia cambagei* and other canopy species. No patches of 1.11.7 were found



to occur within the close proximity to the corridor selection and will be spanned across by towers placed outside of patches if they are later identified.

- KP14-15 SP (Phosphate Hill Connection for a distance of 180 m). This area was mapped by 3D Environmental as RE 1.11.2x2 (now RE 1.11.7) as a homogenous polygon. However recent field surveys did not access this polygon. Towers placements will avoid this mapped area and be of a height so as to avoid clearing canopy vegetation.
- KP724-725 WD (CopperString Core for a distance of 330 m). Access to this location was not possible during field surveys. Based on aerial imagery interpretation, small patches that likely align with RE 1.11.7 identified as darker denser patches of vegetation are not within the corridor selection. Towers placements will avoid this mapped area and be of a height so as to avoid clearing canopy vegetation.

The Of Concern RE 2.3.43 is a grassland community on alluvial plains that occurs between KP624-626 WD within the CopperString Core corridor section at the Gilliat River crossing for a distance of up to 2.2 km. Access to the heterogeneous polygon RE 2.3.17a/2.3.7a/2.3.3/2.3.43 was not possible during 2019/2020 field surveys. It is likely that the extent of the heterogeneous polygon within the easement could be reduced if RE 2.3.43 was mapped separately as a homogenous polygon (this would need to be done following the wet season under more favourable conditions for identifying grassland species). Towers will be placed to avoid occurrences of the Of Concern RE 2.3.43 within the corridor, with very little clearing of vegetation required in order to construct the Project across this braided channel. Therefore it is likely that there will be minimal disturbance for tower footprints and access tracks only and the Of Concern RE can be avoided at this location (as a maximum, it would be 5% of the total mapped area intersected by the Project area, being 0.56 ha, as that is the mapped component of the Of Concern RE within the mixed polygon).

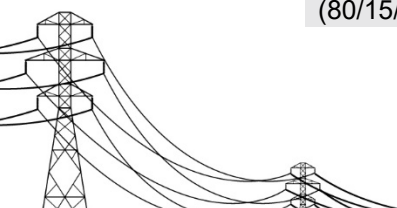
Three polygons of Least Concern HVR REs are mapped in the Renewable Energy Hub corridor section only. These areas will be avoided by the Project activities.

Table 7-10 Regional ecosystems intersected by Project area

RE status	Area within Project area (ha)
Endangered	0 ha
Of concern	35.39 ha
Least concern	6318.33 ha
High value regrowth (least concern)	1.37 ha
Non-remnant	265.78 ha
Total mapped	6620.87 ha

Table 7-11 Vegetation clearing impacts on high conservation status REs

RE*	Area within Project area (ha)
1.11.7 (100%)	2.35
1.11.2a/1.11.7 (95/5%)	5.55
2.3.17a/2.3.7a/2.3.3/2.3.43 (75/15/5/5%)	11.26
1.11.2a/1.11.3a/1.11.7 (70/20/10%)	1.92
1.11.3a/1.5.4d/1.11.7 (80/15/5%)	14.31



RE*	Area within Project area (ha)
Total mapped Of Concern	35.394
Of Concern within Project activity areas	0.56 ha

* Of Concern RE component shown in **bold**

Loss of terrestrial fauna habitat

A total of 223 terrestrial fauna species were recorded during the 2019 combined BAAM and GHD field surveys for the Project. This comprised 42 mammal species, 151 bird species, 26 reptile species and 3 amphibian species. A list of fauna species encountered during field surveys is provided in Appendix E of Volume 3 Appendix P Ecological Assessment.

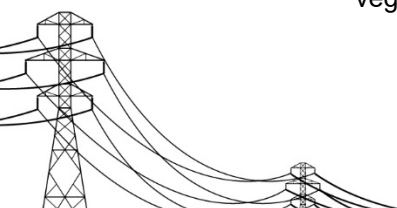
Vegetation clearing during construction of the Project will result in the direct loss of habitat for a variety of birds, reptiles, mammals and frogs. Direct loss of vegetation includes the removal of structural features (i.e. mature vegetation, hollow-bearing trees and hollow logs) that provide microhabitats and resources for fauna. Loss of these habitat features creates a loss of perching, foraging and den/nesting resources for native species. This is likely to reduce the number of individual animals that can be accommodated in a given area and will likely increase competition for resources such as food and shelter in remaining remnant habitats. Hollow-bearing trees are recognised as a limited resource in most grazing lands due to previous clearing and therefore the loss of these habitat features is considered to be a major threat to Australia's biodiversity (Gibbons and Lindenmayer 2002).

The types of fauna habitat and total area that would be cleared during construction within the final Project footprint will include:

- 1825.16 ha of eucalypt low open woodlands usually with a spinifex understorey (mapped as BVG 6)
- 40.96 ha of open woodland with spinifex ground layer (mapped as BVG 14)
- 1817 ha of open woodland with grassy ground layer (mapped as BVG 3, 5, and 11)
- 2321.16 ha of Mitchell grassland on cracking clay plains (mapped as BVG 13)
- 114.59 ha of low gidgee woodland on rocky flats (mapped as BVG 10)
- 201.51 ha of riparian woodland on ephemeral watercourses (mapped as BVG 4)
- 15.75 ha of *Melaleuca* open woodlands (mapped as BVG 8)
- 32.54 ha of mulga woodland and shrubland (mapped as BVG 9) 252.33 ha of cleared land (mapped as non-remnant vegetation)

The loss of terrestrial fauna habitat as a result of the Project will reduce localised resource availability for a range of fauna species, including:

- Amphibians – particularly suitable habitat types include: open woodland fringing watercourses and on flood plains; wetland vegetation; and mapped watercourses and cattle troughs
- Reptiles – particularly suitable habitat types include: brigalow shrubland to open forest; eucalypt open woodland; mixed species shrubland/low woodland; and open woodland fringing watercourses and on flood plains
- Birds – suitable habitat types include: native pastures or grasslands; vine thicket; brigalow shrubland to open forest; eucalypt open woodland; mixed species shrubland/low woodland; open woodland fringing watercourses and on flood plains; wetland vegetation; tidal vegetation; and open cleared land and regrowth



- Mammals – suitable habitat types include: native pastures or grasslands; vine thicket; brigalow shrubland to open forest; eucalypt open woodland; mixed species shrubland/low woodland; open woodland fringing watercourses and on flood plains; wetland vegetation; tidal vegetation; and open cleared land and regrowth.

The Project will result in the disturbance of mapped suitable habitat for 12 EPBC Act-listed conservation significant fauna species confirmed present or considered likely to occur within the preliminary investigation corridor (refer Table 7-13). The potential impacts on suitable habitat for these species is further discussed in Volume 3 Chapter 18 Matters of national environmental significance.

The Project will also result in the direct loss of potential habitat for 17 NC Act-listed threatened fauna species that were confirmed present or considered likely to occur within the preliminary investigation corridor. Species confirmed present included the results of the 2019 field surveys (GHD, 2020) and subsequent surveys conducted as part of the initial EIS / SEIS (BAMM, 2011). The area of Project activities to occur within suitable habitat for fauna species listed under the NC Act is summarised in Table 7-13.

Loss of habitat for terrestrial conservation significant species and communities

The EPBC Act listed TEC *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* is present within the study area, however this community is avoided by the corridor selection. A significance of impact assessment has been undertaken and considered that impacts are unlikely to occur to this TEC. No other TECs have been identified or are mapped within the corridor selection, therefore impacts to TECs are unlikely to occur as a result of the Project.

Approximately 204.7 ha of mapped essential habitat (for NC Act listed conservation significant species) is intersected by the Project area. Some of these areas contain value for the species they are mapped for; however, as they are a buffer of a previous record, some mapped areas will not contain values for the species they are mapped for. The permanent loss in any corridor section is not expected to exceed 15% of the total corridor (based on analysis described in Volume 3 Appendix P Ecological Assessment), therefore it is likely that the Project activity area within essential habitat mapped areas will be 15% of the total area, being 30.87 ha (as a maximum). The relevant corridor sections, areas and species are provided in Table 7-12.

Table 7-12 Mapped essential habitat within the Project area

Corridor Section	Species mapped	Area intersected (ha)
Renewable Energy Hub	Ornamental snake, squatter pigeon, waxy cabbage palm	110
CopperString Core	Julia Creek dunnart	16.42
Mount Isa Augmentation	Purple-necked rock wallaby	68.03
Southern Connection	Purple-necked rock wallaby	11.28
Cannington Connection	Purple-necked rock wallaby	0.068
Total		205.78
Essential habitat within Project activity areas		30.87

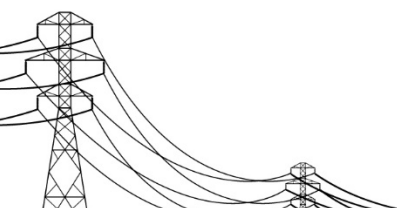
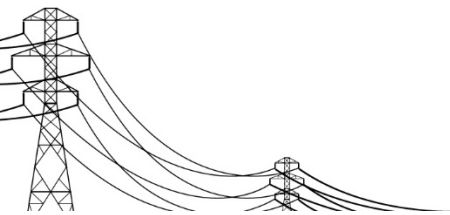


Table 7-13 Proportions of habitat within Project activity areas and the region for conservation significant species

Species	Total mapped habitat intersected by Project area (ha)	Total habitat within Project activities (ha)	Habitat within Project activities as a proportion of remaining local habitat (within a 2.5 km radius of Project centreline) (%)	Habitat within Project activities as a proportion of remaining regional habitat (within a 10 km radius of Project centreline) (%)
FLORA				
<i>Eucalyptus raveretiana</i>	7.23	0.002	<0.001	<0.001
<i>Livistona lanuginosa</i>	57.80	2.18	0.029	0.007
<i>Acacia crombiei</i>	660.08	105.46	0.19	0.05
<i>Eucalyptus nudicaulis</i>	141.85	5.37	0.03	0.009
<i>Acacia armitii</i>	8.06	0	-	-
FAUNA				
Squatter pigeon (southern)	38.23 (breeding)	5.25	0.14	0.05
	148.19 (foraging)	32.54	0.3	0.07
Koala	700.39	97.04	0.11	0.02
Black-throated finch	1711.48	290.99	0.2	0.05
Julia Creek dunnart	867.36	107.22	0.16	0.04
Red goshawk	398.99	88.87	0.23	0.05
Painted honeyeater	5646.19	661.09	0.14	0.04
Australia painted-snipe	884.26	138.63	0.4	0.19
Purple-necked rock wallaby	2118.49	196.63	0.11	0.03
Ornamental snake	248.58	34.66	0.14	0.04
Grey falcon	1215.18	216.2	0.5	0.22
Plains death adder	2069.2	261.47	0.15	0.04
Northern leaf-nosed bat	311.59	11.78	0.4	0.01
Vine thicket fine-lined slider	0	0	-	-
Common death adder	2083.28	281.9	0.17	0.04
Short-beaked echidna	6274.78	780.35	0.15	0.03
Migratory birds (non-breeding/ breeding)	244.54	65.15	0.36	0.07



Impacts to Ballara Nature Refuge

The Project area intersects approximately 192.0 ha of the Ballara Nature Refuge between KP22 and KP54.2 DS in the Southern Connection corridor section. Large sections of the corridor selection intersect areas of low open woodland on hills and ranges (i.e. RE 1.11.2) interspersed with areas of riparian communities and valley plains or terraces. A range of terrestrial fauna species were observed in field surveys undertaken within the Ballara Nature Refuge. Woodland birds including honeyeaters, treecreepers, wrens, robins, flycatchers, parrots and kingfishers were abundant along watercourses. Low open woodlands supported a range of woodland birds in lower densities. Macropods including wallaroos, red kangaroos and eastern grey kangaroos were observed. Feral animals observed included camels, dogs and pigs.

Conservation significant fauna species with potential to occur within Ballara Nature Refuge include:

- Purple-necked rock-wallaby (likely to occur)
- Night parrot (likely to occur)
- Short-beaked echidna (likely to occur)

The natural values that are listed in the conservation agreement for the nature refuge have been assessed for potential impacts from the Project.

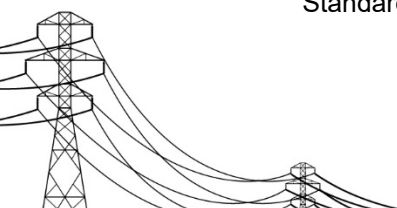
The corridor selection will avoid disturbance to mapped or field-verified REs listed as Of Concern or Endangered (VM Act status) within this protected area. There is one polygon within the nature refuge that is mapped as containing Of Concern (VM Act status) RE 1.11.7 that is intersected by the Project (being RE 1.11.2a/1.11.8/1.11.7 at KP29.5-30 DC for a distance of 300 m). The RE 1.11.7 was confirmed as occurring in small patches on the lower slopes of this section of the range; this RE was however only recorded on the south west slope at this point of the corridor selection in small batches or narrow bands. This Of Concern RE can be avoided by the Project. Some other areas mapped as containing RE 1.11.7 have been field-verified as not containing this RE, including in close proximity to the Project area.

The RE 1.3.7 that is Endangered (Biodiversity status) and Least Concern (VM Act status) occurs along the Cloncurry River within the nature refuge and the towers locations have been placed at the outer edges of this riparian corridor with towers heights to allow for spanning across the tallest vegetation.

The REs identified as No Representation and Low Representation in reserves are abundant throughout the greater landscape, however these are typically low open woodland communities that will be minimal clearing disturbance from the Project (largely limited to tower footprints and temporary disturbance for construction).

No areas of mapped essential habitat for conservation significant species are intersected by the corridor selection. Some records of purple-necked rock wallaby occur within the study area, with associated MSES mapping of essential habitat and wildlife habitat. There is an area of essential habitat mapped for the night parrot located west of the corridor selection and partially within a stock route area. The essential habitat is based on a historical record that has an accuracy of up to 11 km, and the actual records from 1994 are approximately 20 km away from the Project area and outside of Ballara Nature Refuge.

Disturbance to wetland and riparian vegetation will be avoided, or minimised where it cannot be avoided. Natural water flows and processes will not be impacted by the Project. Waterway crossings will use existing crossings through the nature refuge wherever possible, and will restrict the use of machinery or vehicles in the bed and banks of wetlands or watercourses. Standard fire management strategies have been applied for the construction and operation of



the Project, which take into account the potential fire hazard of the region. The introduction and spread of pest plants will be managed during construction and operation of the Project.

Fountain Springs and Trafalgar Springs are located approximately 22 km southwest of the Mount Isa Augmentation corridor section. No known springs are mapped within the vicinity of the Project area, therefore springs and their value as permanent water sources will not be impacted.

The Project will not impact suitable habitat for the ghost bat, or interrupt behavioural or movement patterns of the species.

The corridor selection does not intersect the areas to the west of Fountain Range and along White Range. No infrastructure is proposed to be built in such areas of extremely rugged terrain in near natural condition.

Direct mortality and injury of wildlife

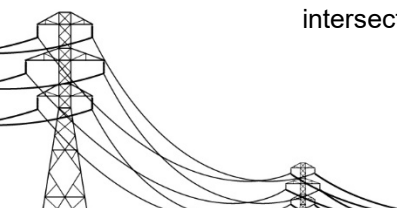
Vegetation clearance during construction of the transmission line will inevitably cause injury and mortality to local fauna sheltering in hollows, nests, ground habitat (logs, burrows, soil, leaf litter, beneath rocks). Species most at risk include nocturnal species that are likely to be sheltering during clearing activities and slow moving species or sedentary species that are unlikely to be able to flee the clearing zone (e.g. koala's, small ground-dwelling mammals, reptiles and frogs). Increased traffic during the construction phase may also increase local incidence of fauna injury and mortality. Species at increased risk of collision impacts include the squatter pigeon (southern) and ground-dwelling fauna such as macropods. Entrapment of wildlife within excavations poses an additional threat to wildlife. Most at risk wildlife includes wide-roaming fauna like macropods, snakes and echidnas.

Breeding places for conservation significant species including the Julia creek dunnart, southern black-throated finch, southern squatter pigeon and possibly the night parrot have the potential to be directly impacted during clearing of the Project footprint, causing a loss of critical ecological resources and the potential for injury and mortality of individual animals. Other conservation significant species with heightened risk of injury or mortality during construction include the koala (due to its local abundance and relatively slow movement), squatter pigeon (due to its sedentary nature and habitat of foraging on access tracks). Although turtles and platypus have the potential to burrow and nest along the banks of watercourses within the study area, these habitats will have minimal impact during construction of the Project. Access tracks may traverse smaller, ephemeral watercourses, however pre-clearance surveys for breeding places will identify any such burrows and nests and guide avoidance of such habitats during construction.

The potential incidence of direct mortality would be minimised during construction through the implementation of the mitigation measures outlined in Section 7.5.

Habitat fragmentation and reduced connectivity

Vegetation clearing during construction has the potential to result in localised fragmentation of habitats adjacent to the Project. This can restrict fauna movement, thereby increasing the isolation of wildlife populations. Species susceptible to habitat fragmentation typically become more reliant on local resources and more vulnerable to impact from local disturbances (e.g. fires or localised flooding) (Fridley et al. 2007; Gilpin and Soule 1986; Kneitel and Chase 2004). The nature and severity of habitat fragmentation impacts also tends to vary depending on the level of existing fragmentation within the landscape. The Project impacts an environment that is already highly fragmented by decades of broad-scale vegetation clearing for agriculture and mining. Within that context, habitat fragmentation resulting from the Project is unlikely to have a regional impact on fauna diversity. However, it is likely to cause localised impacts, by intersecting corridors that are important for local wildlife movement (e.g. along watercourses)



and isolating and reducing the size of individual habitat patches. The movement of koalas and other conservation significant species that are known to occur within the study area is unlikely to be limited by the gaps created. Nevertheless, the fragmentation of habitat is expected to have localised impacts on the composition of forest bird assemblages, reptile and small ground mammal species, by reducing the area of available habitat for edge-sensitive forest species that only occur in protected intact woodland remnants.

Disturbance of wildlife through light, noise and vibration

The operation of machinery and equipment during construction may disrupt local fauna behaviour, through increased exposure to light, noise and vibration. This can adversely impact native wildlife through the disruption of foraging, breeding and nesting behaviours (Longcore and Rich, 2004; Slabbekoorn et al. 2010; Popper and Hawkins, 2016). Increased light, noise and vibration can alter individual species' behaviours, and disrupt the balance of inter-species interactions. Such disruptions typically favour feral predators and generalist species that owe their success to broad ecological tolerances and possess the ability to tolerate or actively exploit disturbed environments. Construction-related disturbance will be transient and temporary in nature. The effects are therefore expected to be minimal and of relatively short duration.

Mitigation and management measures that would be implemented to minimise and avoid potential dust, light, noise and sedimentation impacts during construction of the Project are discussed in Section 7.5.

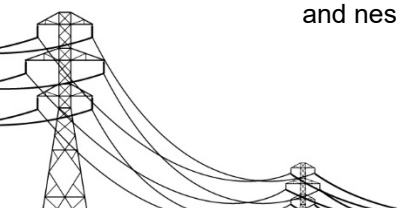
Indirect degradation of habitats by dust, run-off and sedimentation

Construction activities have the potential to indirectly degrade the quality of adjacent habitats and habitat edges through exposure to increased dust, noise and light. This can result in altered habitat composition (i.e. reduced flora diversity and simplified ecosystem structure) and quality (i.e. reduced availability of forage resources, increased predation pressure), thereby potentially modifying species diversity in the altered habitat. Where edge effects degrade or simplify habitats, it is possible the species diversity and habitat utilisation at habitat edges will be altered and native species diversity reduced. Indirect construction impacts on habitat quality will vary in their spatial extent. Dust and sedimentation impacts caused by road activity are generally limited to within 40 m of a road edge, while noise impacts can extend over 200 m from the road (Goosem 2007). Edge effects associated with runoff and sedimentation may extend further in circumstances where local topography increases the potential for run-off or where sediment has entered watercourses.

Introduction and spread of invasive flora species

Construction activities typically have the potential to introduce invasive species through the increased movement of people and machinery. Additionally, established weed populations may be further distributed throughout the easement Project personnel and work vehicles during construction, operation and decommissioning stage of the Project.

A total of 12 restricted invasive weed species were recorded during the field surveys. Past field surveys reported the presence of 43 exotic species within the study area, including five species listed as Weeds of National Significance (WoNS). Construction activities have the potential to introduce and spread weeds throughout the study area. This occurs predominantly via the movement of contaminated vehicles, fill and vegetative material. Additionally, surface water flow has the potential to distribute weed species from construction areas to nearby watercourses, resulting in weeds being distributed further downstream during the wet season. This can cause significant damage to Queensland's primary industries and undermine the ecological integrity of bushland remnants by competitively excluding native plant species that provide food, shelter and nesting resources for native wildlife. Given the Project is located within a predominantly



agricultural landscape, the risks of weed introductions carry heightened consequences. Strict vehicle hygiene and weed management protocols will be required to control risks of introducing or spreading weeds during construction. These are outlined in Section 7.5 and Volume 3 Appendix U Concept biosecurity plan).

Introduction and spread of introduced fauna

Construction activities have the potential to introduce and/or spread exotic pests throughout the construction area. This can result in substantial disruptions to natural ecosystem functioning by altering the balance of inter-species competition and predation. Inappropriate waste disposal and provision of water has the capacity to attract higher local concentrations of feral predators, increasing the predation pressures on local wildlife. Pest fauna species recorded within the study area included feral camels (*Camelus dromedarius*), feral pigs (*Sus scrofa*), dog (*Canis lupus*), cat (*Felis catus*) and fox (*Vulpes vulpes*). Access tracks created for the Project have the potential to facilitate movement of feral predators such as dogs and foxes, thereby increasing predation pressures on local wildlife. Although the study area is already exposed to relatively high levels of pest infestation, mitigation measures will be required to limit any spread of pest animals that could result from construction activities. Strict protocols will be needed to mitigate the risk of introducing or spreading pest fauna, as detailed in Section 7.5 and Volume 2 Chapter 8 Biosecurity, with proposed mitigation measures and outlined in in Volume 3 Appendix U Concept biosecurity plan.

Loss or disturbance to riparian or aquatic habitat

The proposed corridor selection has been sited to minimise the number of watercourse crossings and excavations are not anticipated to reach depths that will impact groundwater. Nevertheless, the Project intersects a number of mapped watercourses. The majority of aquatic habitats are already exposed to a number of existing disturbances, including:

- Erosion and scouring of stream banks due to vegetation clearing
- Cattle and pig disturbance within riparian habitat
- Farm activities such as tracks within the riparian habitat.
- Degradation by invasive weed species.

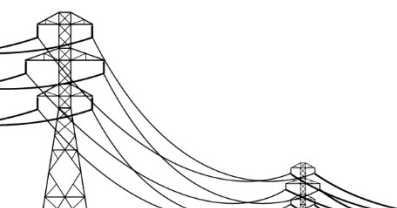
Nevertheless, the Project has the potential to exacerbate existing environmental disturbances to aquatic habitats.

Direct loss of aquatic habitat

In most instances, the transmission line will span watercourses and no loss of aquatic habitat will occur. Minor waterways may be temporary impacted during the construction period through construction of temporary access tracks and watercourse bed level crossings. These waterways are ephemeral and expected to be dry at all time during construction, excluding periods of rainfall. No aquatic habitat for conservation significant fauna species is anticipated to be impacted by the Project, however habitat for one conservation significant aquatic species, the diamond-head turtle (*Emydura subglobosa worrelli*) has the potential to occur within the study area.

Increased sedimentation and erosion

There is the potential for erosion once vegetation has been cleared and soil is exposed to the effects of wind or rain during the construction phase of the Project. Sediment laden runoff has the potential to degrade water quality within the Project area and at sites downstream.



A CEMP encompassing erosion and sediment control measures will be implemented to provide environmental management and mitigation procedures to minimise potential impact of construction activities on the environment. The CEMP shall provide effective erosion and sediment control practices to prevent the potential effects of construction on watercourses within the study area and adjacent landscape. The CEMP shall also provide effective management of stormwater run-off to prevent soil erosion and ensure that only uncontaminated water leaves the project site.

Degradation of aquatic habitats

While the Project will have minimal direct impact on watercourses, earthworks, vehicle movements and other construction activities have the potential to cause indirect degradation of aquatic habitats. Construction activities within and/or in the vicinity of watercourses have the potential to cause degradation of aquatic and riparian habitats through:

- Removal of riparian vegetation
- Run-off, sedimentation and erosion
- Point-source pollution (chemical and fuel spills)
- Establishing barriers to the movement of aquatic fauna
- Disturbance associated with noise, vibration and/or artificial lighting.

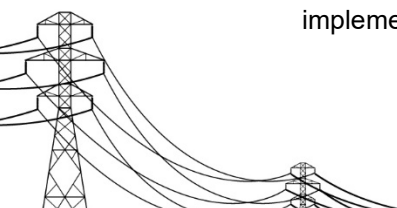
Release of sediments into aquatic habitats can result in altered water chemistry (e.g. increased turbidity, decreased oxygen levels, reduced light penetration), change in channel morphology and alteration of substrate composition (Wood and Armitage 1997; Wheeler et al. 2005). These impacts can affect aquatic fauna both directly and indirectly by reducing habitat value and altering trophic dynamics (particularly where substrate and macrophytes are smothered) and feeding behaviours. Use of construction machinery in and around aquatic habitat also has the potential to result in the introduction of contaminants, such as fuels and lubricants. Although aquatic ecosystems in ephemeral systems are likely to be adapted to peaks in high turbidity during some periods, an increase in the magnitude or the frequency of these peaks in turbidity due to construction activities has the potential to have a detrimental effect on aquatic habitats.

The Project intersects approximately 4.7 ha of the trigger area at the edge of a wetland protection area at KP 177WD, however does not intersect the HES wetland itself (the edge of the mapped wetland is approximately 350 m southeast of the corridor selection). The wetland area contains palustrine wetland RE 10.4.7 (*Casuarina cristata* open woodland on Cainozoic lake bed). The section of trigger area for the wetland protection area that is intersecting the corridor selection contains regrowth *Acacia* habitat. Due to the low impact earthworks likely to be required through this area and the distance to the wetland area, it is unlikely that direct or indirect degradation of the wetland would result.

Many surface and riverine associated GDEs will be avoided by the Project through the spanning of bed and banks of waterways by the transmission lines, and use of existing crossings and access routes. The nature of the Project is unlikely to have impacts on groundwater resources in general, therefore is also unlikely to affect subterranean GDEs.

The potential impacts of erosion and sedimentation on water quality and proposed mitigation and management practices is discussed in detail within Volume 2 Chapter 9 Water resources and water quality and Volume 3 Appendix S Concept erosion and sediment control plan.

Potential impacts on aquatic habitats would be minimised or mitigated through the implementation of the mitigation and management measures outlined in Section 7.5, with design recommendations presented in Section 7.3.8. Provided these recommendation are implemented, the impacts of the Project on aquatic habitat can be largely avoided.



7.4.3 Operation

The CopperString 2.0 Project is anticipated to be relatively benign in its ecological impacts during the operation phase, resulting in minor, localised disturbance. The disturbance is expected to be equivalent to existing impacts from operation of pastoral land within the surrounding landscape. Operation of the Project will have six direct and / or indirect impacts on the existing environment within the Project area:

- Injury and mortality of wildlife
- Disturbance of wildlife through light, noise and vibration
- Localised habitat degradation through dust, erosion and sedimentation
- Introduction and spread of invasive species
- Barrier effects and reduced fauna movement
- Altered fire regime on flora and fauna

These impacts are discussed in detail below.

Injury and mortality of wildlife by collision with vehicles, entanglement and entrapment

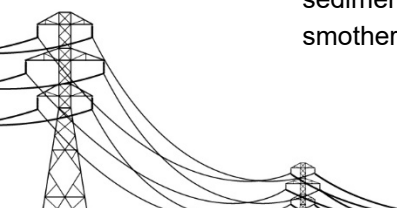
Transmission lines are known to cause periodic injury and mortality of birds and bats through direct collision with powerlines (Bernardino et al 2018). While some species are more susceptible to collision than others, it is difficult to determine the precise level of collision impact. For most species, collision with transmission lines is likely to result in a periodic loss of individuals that is unlikely to have significant impacts at a population level. The collision risks imposed by transmission lines are influenced by their spatial context in the landscape, with transmission lines crossing areas of connected woodland or near waterbird breeding sites typically causing greater collision rates than those located in open areas (Bernardino et al 2018). As the Project occurs in a landscape that is relatively open and does not contain any significant wetlands that would attract migratory birds, the Project is expected to have low level collision risks. Nevertheless, elevated risks are expected where the Project crosses watercourses and bioregional wildlife corridors. The incidence of collision is expected to be low. Operation of the Project will also involve occasional isolated vehicle movements by maintenance staff. This will cause low-level risk of injury and mortality of wildlife, comparable to the collision risks already experienced by wildlife within the existing pastoral landscape. Despite this, some species, notably the squatter pigeon (southern) are susceptible to vehicle collisions and may experience low-level impact. Given the impacts are expected to be irregular and minor, they are likely to cause negligible impact to local fauna populations.

Disturbance of wildlife through exposure to light, noise and vibration

The Project will have negligible impact on flora and fauna through light, noise and vibration. No lighting is proposed for the project during the operation phase. Noise levels associated with transmission lines are also negligible, resulting in low-level, constant noise unlikely to cause substantial behavioural disruption to local fauna.

Localised habitat degradation due to dust, erosion and sedimentation

The Project will create new unsealed roads with associated periodic low-level traffic of operational and maintenance staff. Although the temporary disturbance footprint for the transmission line and new buildings will be rehabilitated, the new unsealed roads will contribute to dust and sedimentation to the environment. Movements of maintenance vehicles have the potential to cause localised habitat degradation through exposure to dust, run-off and sedimentation. This can reduce the ecological value of surrounding habitats through physical smothering of vegetation (including aquatic macrophytes), changes in nutrient levels, increased



weed incursions and declines in species diversity. Dust impacts are typically localised in their extent, generally affecting areas within 10 m of unsealed access roads (Goosem 2007). Dust can reduce the photosynthetic capacity of the plants and impede plant growth. Given the frequency of vehicle movements will be low, the impacts are expected to be minimal and not inconsistent with those impacts in the surrounding pastoral landscape.

Introduction and spread of invasive species

As detailed in Section 4.4.1 of Volume 3 Appendix P Ecological Assessment, past field surveys reported the presence of 43 exotic species within the study area, including five species listed as Weeds of National Significance (WoNS) (BAAM 2010, 2011). Additionally, eight restricted invasive plants under the Biosecurity Act Biosecurity Act 2014 were recording within the study area during the 2019 field surveys; *O. tomentosa* and *O. stricta*. These species have the potential to cause damage to the ecological integrity of bushland remnants by excluding native plant species that provide food, shelter and nesting resources for native wildlife. Maintenance vehicles servicing the transmission line have the potential to spread weeds. Implementation of specific operational protocols can help limit the unintentional spread of weeds into and/or throughout the study area. This remains a persistent, low-level risk that does have the potential for significant environmental impact.

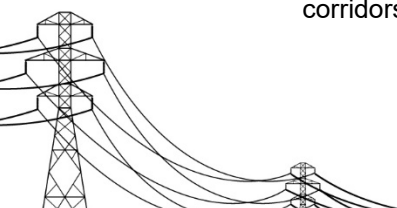
As detailed in section 4.6.2 of Volume 3 Appendix P Ecological Assessment, invasive fauna species are known to occur within the study area. Pest species that are likely to be relatively common and ubiquitous within the region include the cat (*Felis catus*), fox (*Vulpes vulpes*), dog (*Canis lupus familiaris*) and pig (*Sus scrofa*). The clearing and disturbance of remnant vegetation within the Project area has the potential to facilitate ongoing movement of feral animals, as these typically capable of better utilising heavily altered landscapes. There is potential for pest species to use the final corridor as a linear pathway for movement, leading to the introduction of pest species in previously pest-free habitats. An increase in the prevalence of these animals may adversely impact native fauna through:

- Increased competition for resources
- Increased predation (of native species by introduced animals)
- Habitat degradation (i.e. pig damage of riparian areas).

Impacts of weeds and pests are expected to be manageable, provided that the mitigation and management measures outlined in the Weed and Pest Management Plan are implemented (refer to Volume 3 Appendix U Concept biosecurity plan). More information on introduced flora and fauna is presented in Section 4.6 of Volume 3 Appendix P Ecological Assessment and Volume 2 Chapter 8 Biosecurity.

Barrier effects and reduced fauna movement

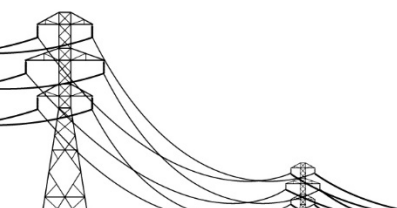
The Project will maintain a permanent linear clearing within the landscape. This will vary in width between 60 m and 120 m. Within the context of the surrounding landscape, where vegetation is typically sparse and contains an abundance of natural gaps, this is unlikely to significantly alter habitat connectivity. For most species, the easement will not pose a barrier to movement. Nevertheless, the persistence of a cleared easement to accommodate transmission line infrastructure will deter some fauna movement. Species more susceptible to barrier effects include smaller, ground-dwelling species with restricted movement capabilities and forest birds restricted to dense habitat types (e.g. riparian woodland) that can be reluctant to cross vegetation gaps. One conservation significant species that is likely to be susceptible to barrier effects resulting from the Project would be the koala.. This will be minimised by reducing the easement width to 60 m in areas of high risk, where the corridor selection intersects wildlife corridors, watercourses or areas of habitat for the koala or other species sensitive to



fragmentation effects. As the final corridor selection is located in a landscape that has been extensively fragmented by historical broad scale vegetation clearing the Project is likely to have minimal fragmentation or barrier effects.

Altered fire regime on flora and fauna

The Project is unlikely to have substantial impact on fire and is unlikely to cause any significant change in fire regime. The easement does have the potential to act as a fire break, restricting the local extent of natural fires. Given the increasing fire risks associated with climate change, the introduction of fire breaks in the landscape has the potential for positive impacts by limiting the capacity for fires to burn out entire areas of habitat. By restricting localised spread of fire, the easement has the potential to promote localised variation in fire consistent with small-scale mosaic burning. The Project has the potential for accidental fires where vegetation comes into contact with transmission lines or through inappropriate disposal of cigarettes by maintenance staff. The incidence of regulated management burns may also change in frequency. Accidental or uncontrolled fires have the potential to negatively impact upon vegetation (and habitat) within, and adjacent to, the final corridor in particular.



7.5 Mitigation Measures

7.5.1 Summary of mitigation and management measures

The mitigation and management measures in Table 7-14 will be implemented to minimise and avoid the potential impacts of the CopperString 2.0 Project on terrestrial and aquatic ecology. These mitigation and management measures will be implemented in combination with measures outlined in other chapters, including:

- Volume 2 Chapter 6 Geology and soil
- Volume 2 Chapter 8 Biosecurity
- Volume 2 Chapter 9 Water resources and water quality
- Volume 2 Chapter 10 Air and greenhouse gases
- Volume 2 Chapter 11 Noise and vibration
- Volume 2 Chapter 18 Matters of national environmental significance
- Volume 2 Chapter 19 Environmental management
- Volume 2 Chapter 21 Environmental offsets
- Volume 3 Appendix O Visual amenity
- Volume 3 Appendix Q Framework environmental management plan
- Volume 3 Appendix R Field development plan
- Volume 3 Appendix S Concept erosion and sediment control plan
- Volume 3 Appendix U Concept biosecurity plan.

The unmitigated and mitigated impacts on ecological values are summarised in Table 7-15 and Table 7-16.

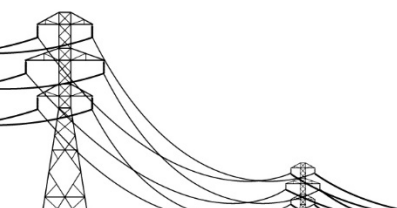
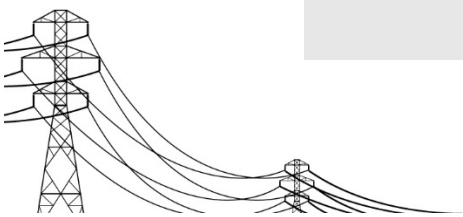
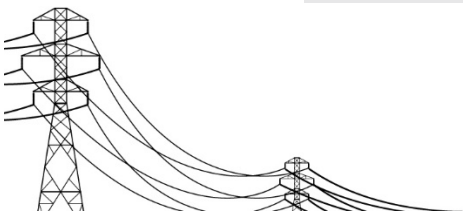


Table 7-14 Mitigation and management measures

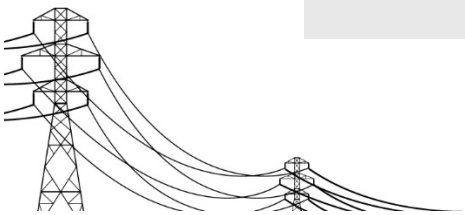
Timing	Mitigation and Management Measures
Pre-construction	The layout of temporary and permanent structures and infrastructure (including construction areas, site offices, stockpile, laydown areas, access tracks and construction camps) will be designed to minimise clearing of vegetation (in particular endangered, of concern and threshold REs).
Pre-construction	Habitat assessment and condition surveys will be undertaken in areas identified as potential habitat in the Draft EIS. These investigations will inform the Flora and Fauna Management Plan and refine the Offsets Strategy, if required. Further desktop mapping to refine potential nesting and feeding habitat for the night parrot is currently being undertaken in consultation with members of the Night Parrot Recovery Team. Additional field survey will then be conducted to thoroughly ground-truth the potential nesting and feeding habitat areas, and to do targeted searches for night parrot individuals using songmeters and subsequent data analysis by the Night Parrot Recovery Team members.
Pre-construction	A Flora and Fauna Management Plan will be developed prior to construction commencing. The Flora and Fauna Management Plan will include details relevant to the general management of flora and fauna impacts as well as Species Management Plans for identified conservation significant species that will be impacted. Where necessary, the Flora and Fauna Management Plan will incorporate flora and fauna monitoring activities. Specifically, ongoing monitoring and survey requirements necessary to assess the persistence and health of conservation significant populations will be outlined (i.e. EVNT flora and fauna species impacted by the Project). For more information on the flora and fauna management plan, refer to Volume 3 Appendix Q Environmental management plan.
Pre-construction	Species specific avoidance, mitigation and management measures will be incorporated within the Flora and Fauna Management Plan.
Pre-construction	Towers will be strategically located to allow the corridor to span across watercourses and riparian vegetation. This will also eliminate the need for waterway barriers and reduce the likelihood of impacts to aquatic environment.. No towers should be located within a watercourse or its riparian zone.
Pre-construction	The transmission line designed such that the corridor selection avoids erodible soils and sensitive reaches of watercourses. A 25 m buffer zone will be maintained around minor watercourse and 50 m buffer around major watercourses. Strict environmental management controls shall be applied when construction activities (like vehicle access) is within management buffers cannot be avoided.
Pre-construction	Where possible, the corridor selection should be located within cleared area to reduce to amount of clearing required. Similarly, access tracks will utilise pre-existing cleared areas.
Pre-construction	The final corridor selection should be designed to avoid sensitive areas (e.g. wetlands and semi-evergreen vine thicket) and areas with high canopies.
Pre-construction	A Decommissioning and Rehabilitation Plan for areas to be temporarily disturbed during construction will be developed prior to construction commencing with the overall aim of minimising the amount of land disturbed at any one time during the construction of the Project. After cleared areas are no longer required (i.e. temporary construction camps, laydown areas, quarries, borrows, turning circles and access tracks), rehabilitation will commence in accordance with the Rehabilitation Plan.



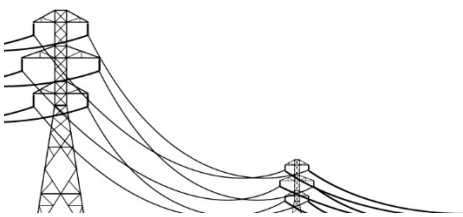
Timing	Mitigation and Management Measures
	Temporary construction infrastructure will be decommissioned and removed from site. The sites will then be rehabilitated to a state generally consistent with the natural environment. The Decommissioning and Rehabilitation Plan will include: • Removal of potentially hazardous stored substances • Remediation of any contaminated areas • Grading of disturbed surface landscapes to a state generally consistent with a natural environment (if required) and to ensure that permanent drainage lines are not compromised • Application of topsoil and revegetation with native species. Revegetation would use flora species of local provenance that were present prior to clearing commencing and species specific to the RE cleared at that site • A mechanism for rehabilitation strategies to be refined throughout the life of the Project to implement methods which have been most reliable and successful • Requirements and mechanisms for post construction monitoring and audit of rehabilitation success. Material cleared during construction is planned to be chipped, mulched and stockpiled for reuse during rehabilitation. Materials with special habitat value, such as hollow bearing logs or trees, will be selectively removed for reuse during rehabilitation, or placed in nearby bushland. Any watercourse areas crossed will be restored and rehabilitated with measures to improve connectivity and provide enhancements to suitable habitat, where referenced in the Flora and Fauna Management Plan. The Decommissioning and Rehabilitation Plan will also outline specific objectives and methodology for the following: • Seed collection • Flora regeneration • Landscape architecture (i.e. topography) • Creation of supplementary habitats (e.g. nesting boxes), if necessary.
Pre-construction	Weed mapping will be undertaken during the pre-construction phase. Weed mapping will cover the final corridor selection and ancillary infrastructure, with particular focus on high risk locations. This will allow for targeted weed management during construction and limit the likelihood of colonisation by invasive species post construction. Weed control will be undertaken in areas that are very heavily infested or where WoNS or Class 1, 2 or 3 weeds declared under the <i>Biosecurity Act 2014</i> (BS Act) are known to occur.
Pre-construction	A Weed and Pest Management Plan will be developed prior to construction commencing. The weed and pest management plan will include details relating to the monitoring, management and, where necessary, eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols.
Pre-construction	Light requirements identified during the detailed design will consider positioning security lighting at permanent facilities to minimise the potential for lighting impacts on fauna.
Construction	Vegetation clearing will be restricted to the minimal amount necessary for the construction of the Project footprint. Micro-siting of infrastructure, such as tower footprints, brake and winch sites, and assembly areas, will be undertaken during the detailed design phase to further reduce impacts and to ensure areas of high ecological significance are avoided.



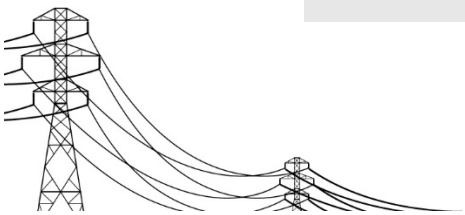
Timing	Mitigation and Management Measures
Construction	Vegetation will only be cleared or trimmed where it is within five metres of the transmission line at maximum sag. Clearing of all vegetation to ground level will be required to accommodate transmission line infrastructure including tower foundations, substations, laydown areas, etc, where it cannot be placed in cleared areas. Clearing may also be required for trees taller than five metres if they fall within the five metre safety buffer. Where safety will not be compromised, any trees taller than five metres within the easement or with overhanging branches that spread into the easement will be trimmed to a reduced height so as not to be within the five metre safety buffer.
Construction	Areas of high terrain will allow spanning of the majority of vegetated areas, particularly in habitats of low open woodlands that feature very sparse canopy trees of very low height. In such areas, clearing is likely to be limited to that required for tower footprints and access tracks. These tower and access locations will be determined during the detailed design phase.
Construction	Areas of grassland habitats feature very few and low trees or shrubs (frequently confined to drainage line corridors), therefore clearing of vegetation will be minimal in these areas and will span riparian corridors wherever possible. Ground disturbance will occur in these grassland habitats, which have value for ground-dwelling mammals and reptiles, however disturbance will be restricted to pre-determined areas and will be temporary apart from permanent infrastructure locations
Construction	Pre-clearance surveys will be undertaken during the detailed design phase within known and potential habitat areas of conservation significant species and within significant communities in order to plan infrastructure placement, tower heights, spans and resulting clearing to avoid known occurrences and habitat for species. Similar to such as Of Concern REs
Construction	Areas of high ecological significance will aim to be spanned across wherever possible using higher towers as appropriate to the ecological values and the terrain constraints. In areas of high ecological value this will enable vegetation below 20 m to be retained and mature trees over 20 m may be trimmed if necessary for safety and operational requirements
Construction	The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors
Construction	Where infrastructure must cross waterways, areas of existing disturbance (i.e. existing tracks or clearing) will be used. Where this is not safe to do so, the Project footprint will be minimised and large habitat trees retained. Waterway crossings in known habitat for conservation significant flora and fauna species will aim to avoid occurrences of flora species and span across the riparian habitat corridors wherever possible
Construction	Approximately 12.1 ha of protected plant high risk trigger area is intersected by the Project area mapped for <i>Livistona lanuginosa</i> in the Renewable Energy Hub corridor section. Clearing within 100 m of a protected plant within this area will require a compliant flora survey and clearing permit (under the NC Act) within this high risk trigger area. Removing a protected plant outside of a high risk trigger area will also require a clearing permit. This may apply to occurrences of <i>Livistona lanuginosa</i> , <i>Eucalyptus nudicaulis</i> or <i>Acacia armitii</i> that are confirmed during pre-clearance surveys. A Protected Plant Impact Management Plan is required as part of the clearing permit application. While the Project is considered to be able to avoid



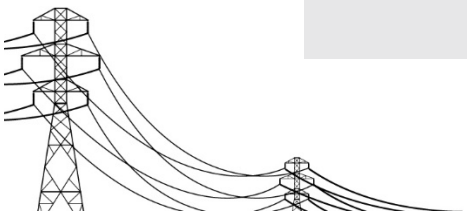
Timing	Mitigation and Management Measures
	occurrences of these individuals, there may be some trimming of mature trees required and individuals to be retained within the Project area that will require a clearing permit
Construction	All site offices, construction stockpiles and laydown/storage areas will be located within existing cleared or disturbed areas as a priority. This will effectively reduce the extent of impacts to remnant vegetation and fauna habitats.
Construction	Rehabilitation of temporary laydown areas, stockpiles, site offices and areas will be undertaken after these facilities are no longer required. Rehabilitation activities will include planting of native species, weed management practices and erosion control, if required.
Construction	A CEMP will be prepared and implemented for standards such as weed hygiene, erosion, fuels and hazardous substances, fire, etc.
Construction	All construction personnel shall attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance are to be clearly defined and detailed in site inductions
Construction	Habitat enhancement features (e.g. salvaged hollows and nesting boxes).will be established outside the clearing area within suitable habitat. The installation of habitat enhancement features will concentrated in areas of high quality habitat or within strategic environment areas (e.g. terrestrial corridors).
Construction	Pre-clearance surveys will be undertaken to mark and avoid the locations of potential breeding places for wildlife and the locations of any breeding places for conservation significant species. These will target areas with potential to support breeding habitat for the squatter pigeon, Julia Creek dunnart, southern black-throated finch and the night parrot. Findings from targeted pre-clearance surveys will be incorporated into high risk SMPs and the Environmental Management Plan.
Construction	Preparation of a high risk Species Management Program (SMP) will be undertaken in accordance with the requirements of Section 332 of the <i>Nature Conservation (Wildlife Management) Regulation 2006</i> . Key species likely to be targeted in the high risk SMP include the squatter pigeon (southern), black-throated finch (southern), Julia Creek dunnart, purple-necked rock wallaby and short-beaked echidna. SMPs will include information around the species' behaviour and ecology, along with specific mitigation measures to reduce to extent of impacts on conservation significant species and their habitat.
Construction	All clearing will be supervised by suitably qualified and experienced fauna spotter-catchers. This will involve searching and clearing all hollow trees and logs prior to clearing and relocating any resident fauna to the nearest suitable, safe habitat outside the clearing footprint.
Construction	Within the distribution of the koala, sequential clearing practices and the use of a suitably qualified koala spotters in accordance with guidelines will be employed to reduce the extent of impacts on koalas.
Construction	Temporary exclusion fencing will be established around cleared areas in locations of high ecological sensitivity to prevent wildlife from returning to works areas where deemed appropriate



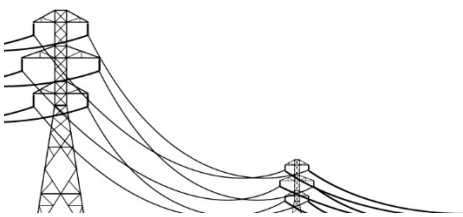
Timing	Mitigation and Management Measures
Construction	Areas of potential habitat for the squatter pigeon are to be flushed immediately prior to clearing (i.e. spotter-catcher to walk in front of clearing machinery).
Construction	Adverse incident response procedures will be developed to detail actions to be taken in the event of wildlife injury or mortality during clearing. Incident response procedures will include contact details for local wildlife carers and veterinary practices.
Construction	A Traffic Management Plan will be developed for the construction site with designated access routes, speed limits and sensitive ecological areas (i.e. particularly areas where squatter pigeons have the potential to occur on access roads). Speed limits and ecologically sensitive areas will be clearly identified using flagging tape and appropriate signage.
Construction	Establish 'go slow zones' (40 km/hr) for vehicles and machinery where non-gazetted roads or tracks are located adjacent to areas of woodland, wetlands, and rock outcrop/jump-up areas.
Construction	Given the specific susceptibility of the squatter pigeon to vehicle collision - warning signs will be erected on all tracks that intersect locations in which the squatter pigeon has been confirmed present. Squatter pigeon awareness will be included in all worker inductions and in the Traffic Management Plan. A register of squatter pigeon sightings will be maintained to identify areas that have a high risk of collision
Construction	The Construction EMP will include protocols to limit injury and mortality to fauna including management of risks associated with open excavations, trenching, waterbodies and responses and reporting for roadkill and adverse incident protocols
Construction	Access tracks and bed-level crossings will be restricted to areas that are already disturbed to reduce the extend of required clearing and remove unnecessary disturbances to the natural environmental.
Construction	Construction laydown areas and stockpiles will be limited to areas that have already been cleared to minimise unnecessary clearing.
Construction	The footprint needed for ancillary activities and hardstand areas will be minimised where possible without compromising the safety and integrity of structures
Construction	Where possible, temporary construction areas will be rehabilitated after the completion of construction works to reconnect fragmented habitats
Construction	During the detailed design phase, areas of high habitat connectivity that are intersected by the Project will be identified and measures investigated that would improve or restore connectivity across the corridor selection (e.g. placement of key habitat features within the corridor such as shelter or forage resources, or retention of vegetation between large remnant patches that hold significant habitat value).
Construction	Construction activities will be prioritised to daylight hours to reduce the need for lighting and resultant light spill into adjacent habitat and to reduce noise and vibration impacts on nocturnal fauna species
Construction	A Traffic Management Plan will be developed for the construction site to control vehicle movements and reduced the unnecessary generation of vehicular noise



Timing	Mitigation and Management Measures
Construction	All construction vehicles will comply with maintenance schedules and operational restrictions designed to limit noise impacts during construction
Construction	Erosion and sediment control measures will be developed as part of the CEMP for the Project. The requirement of erosion and sediment controls will be assessed at all watercourses and drainage lines intersect by the project. Erosion and sediment control measures will be installed where disturbance must be undertaken within or adjacent to wetted waterways. Erosion matting (e.g. Jute mesh) or sediment socks (e.g. Sand-filled UV-resistant fabric tubes) will be used for earthwork activities where there is a risk of gulling or sedimentation of watercourses.
Construction	Routine dust suppression and monitoring will be undertaken throughout construction and operation to reduce indirect impacts of flora and fauna habitats.
Construction	Construction traffic restricted to designated access tracks
Construction	Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events. Construction activities will cease during adverse weather conditions (e.g. high wind / high rainfall) that have the potential to distribute dust or increase run off and sedimentation
Construction	Duration of in-stream works will be minimised to reduce the potential for sedimentation
Construction	Waste management procedures will be prepared as part of the CEMP. These will detail the location and specifications for disposal and removal of waste from the construction site
Construction	Responsible waste management practices (e.g. not leaving out food waste and not feeding wildlife) will be implemented and followed by all construction personnel. All waste will be stored in secure temporary holding containers and transported off site.
Construction	Sightings or evidence of pest animals will be recorded during construction. If increased densities of pest animals are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers. Regular monitoring will be carried out along the easement and at substation sites. A feral animal management plan will be prepared and implemented in consultation with relevant stakeholders as appropriate.
Construction	Construction staff will not bring domestic animals to the Project area
Construction	All construction personnel shall attend environmental training as part of site inductions. As part of this training, all personnel will be instructed on their responsibilities related to avoiding and minimising the introduction/attraction to the construction site of feral animals
Construction	A CEMP should be prepared and implemented for standards such as weed hygiene, erosion, fuels and hazardous substances, fire, etc. The CEMP should include protocols to limit injury and mortality to fauna including management of risks associated with open excavations, trenching, waterbodies and responses and reporting for roadkill and adverse incident protocols
Construction	All construction vehicles / equipment travelling from declared weed areas will undertake a wash down and possess a current weed hygiene inspection certificate from an accredited inspection station that is required to carry as evidence of quarantine clearance



Timing	Mitigation and Management Measures
Construction	Resources sought from outside the study area (e.g. fill for access tracks) will be required to hold weed free declarations
Operation	All travel will be restricted to designated access tracks and roads
Operation	All vehicles and plant will adhere to site rules relating to speed limits. Speed limits will be clearly signposted to minimise the potential for road kill
Operation	All fencing used on the Project will use fencing without barbed wire on the top strand to minimise incidence of flying fox entanglement.
Operation	Warning signs will be placed where access tracks intersect areas where the risk of collision with squatter pigeons is high (i.e. confirmed squatter pigeon habitat).
Operation	Species management plans will be constructed for conservation significant species with predictable breeding habitat located within the study area. This includes the black-throated finch (southern), Julia Creek dunnart and the squatter pigeon (southern).
Operation	No artificial lighting will be used on transmission towers or supporting infrastructure
Operation	Work hours will be restricted to the hours of 7 am and 6 pm
Operation	Reduced vehicle speed limits to reduce dust dispersal in areas of exposed soil.
Operation	Minimising vehicle access to waterways and exposed surfaces by establishing designated watercourse crossings
Operation	Continued employment of sediment and erosion control measures and track maintenance to provide ongoing management of erosion prone areas (e.g. waterways).
Operation	Should additional clearing be required during operation, rehabilitation will take place in accordance with the Rehabilitation Plan
Operation	Continued implementation of responsible driving practices will reduce the amount of noise generated during construction
Operation	Ongoing maintenance of tracks to reduce dust and erosion that have the potential to exacerbate localised barrier effects for smaller ground-dwelling fauna species
Operation	Ongoing use and maintenance of designated waterway crossing points to minimise disruption to longitudinal movement of wildlife along watercourses
Operation	A large proportion of the footprint will be subject to temporary vegetation clearance only and rehabilitated after construction
Operation	Poles or planks will be placed in open excavation areas (e.g. pits and holes) to allow trapped fauna to escape

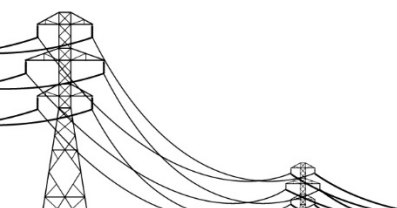


7.5.2 Construction phase

Construction phase impacts and their unmitigated and mitigated risk ratings is detailed in Table 7-15.

Table 7-15 Construction phase impact risks before and after mitigation

Activity	Associated Potential Impacts	Unmitigated Risk rating	Mitigated Risk rating
Vegetation clearing, earthworks, general construction activities	Loss and disturbance of vegetation and habitat including potential habitat for conservation significant species and vegetation communities	High	Moderate
	Injury and mortality of wildlife	High	Low
	Habitat fragmentation and reduced connectivity where clearing of canopy vegetation is required	Moderate	Low
	Disturbance of wildlife behaviours by increased light, noise and vibration	Moderate	Low
	Habitat degradation through increased dust, run-off and sedimentation	Moderate	Low
	Introduction and spread of invasive species	High	Low
Increased vehicle movements	Injury and mortality of wildlife	Moderate	Low
	Disturbance of wildlife behaviours	Moderate	Low
	Introduction and spread of invasive species	High	Low
	Habitat degradation through increased dust, run-off and sedimentation	Moderate	Low
Wastewater discharge from construction camps	Disturbance of surface waterways and waterbodies or GDEs	High	Low



7.5.3 Operation impacts

Operation phase impacts, their unmitigated and mitigated risk ratings are detailed in Table 7-16.

Table 7-16 Operation phase impact risks before and after mitigation

Activity	Associated Potential Impacts	Unmitigated Risk rating	Mitigated Risk rating
Presence of powerlines	Injury and mortality of wildlife by collision with powerlines	Moderate	Low
Presence of easement	Barrier effects and reduced fauna movement	Low	Low
	Altered fire regime on flora and fauna	Low	Low
Occasional vehicle movements	Injury and mortality of wildlife	Low	Low
	Disturbance of wildlife behaviour	Low	Low
	Localised habitat degradation through exposure to dust, erosion and sedimentation	Moderate	Low
	Introduction and spread of invasive species	Low	Low

7.5.4 Threatening processes, impacts and mitigation measures

An assessment of the proposed activities during construction and operation of the Project has been undertaken to identify potential impacts on the ecological values of the receiving environments (Table 7-17). Threatening processes cited in the respective Species Profile and Threats Database (DAWE 2020), together with potential impacts to existing ecological values have been described, as well as impacts specific to locations and/or species or faunal-groups, as relevant. Avoidance, mitigation and minimisation measures have been proposed to reduce the potential for impacts to species, their habitat and other ecological values, with an overall predicted effectiveness for those measures in mitigating potential impacts for each species.

Predicted effectiveness ratings are defined as follows:

- Very high effectiveness: complete avoidance of known occurrences and/or habitats
- High effectiveness: substantial avoidance of known occurrences and/or habitats
- Moderate effectiveness: areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods.
- Low effectiveness: mitigation of impacts only through implementation of EMP, spotter-catchers, pest fauna and weed control.
- Very low effectiveness: No mitigation strategies proposed.

An assessment of the likelihood and duration of residual impacts following proposed management measures has been included for key communities or species assessed.

A predicted reliability of assessments has been included, with species reliability index ratings provided as follows:

- 3 = species life history and distribution within Study Area well known
- 2a = species life history poorly known, distribution within Study Area well known
- 2b = species life history well known, distribution within Study Area poorly known
- 1 = species life history and distribution within Study Area poorly known

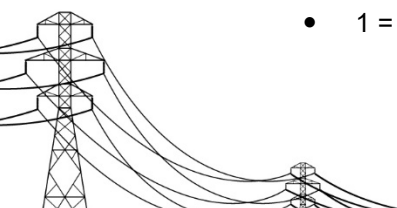


Table 7-17 Summary of impacts on conservation significant species

Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
Listed threatened flora						
<i>Eucalyptus raveretiana</i>	- Habitat disturbance and smothering by rubber vine (<i>Cryptostegia grandiflora</i>) - Disturbance of habitat during timber harvesting operations - Increased fire frequency from weeds and introduced grasses - Stream bank erosion	- Loss of potential habitat and individuals through vegetation clearing. - Decreased population viability through isolation. - Decreased habitat quality through edge effects, increased weed invasion, excessive dust, changed fire regimes, altered surface hydrology, increased riparian erosion, and altered drainage and nutrient dynamics.	- Pre-clearance surveys in suitable habitats to identify all individuals within corridor selection. - Utilising taller towers set back from the riparian zone to span occurrences and trimming taller trees rather than felling. - Retention of supporting riparian vegetation through set back of towers, spanning and trimming of taller vegetation. - Siting additional infrastructure, such as tracks and assembly areas outside of known and potential habitat for this species. - Construction and operation management practices, including weed control.	High effectiveness Substantial avoidance of known occurrences and/or habitats.	Any impacts likely to be minor and of short duration.	High
<i>Livistona lanuginosa</i>	- Fire - Trampling and grazing by stock - Clearing for agricultural development - Dams that affect water level and flow in the area of occurrence - Introduction of invasive weeds	- Loss of habitat and individuals through vegetation clearing and riparian degradation. - Decreased population viability through isolation. - Decreased habitat quality through edge effects, increased weed invasion (rubber vine and parkinsonia), excessive dust, changed fire regimes,	- Pre-clearance surveys in suitable habitats to identify all individuals potentially impacted - Avoiding or spanning occurrences - Retention of supporting riparian vegetation - Additional infrastructure, such as tracks and assembly areas, will avoid the known and potential habitat for this species.	High effectiveness Substantial avoidance of known occurrences and/or habitats.	Any impacts likely to be minor and of short duration.	Medium

Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
		altered surface hydrology, increased riparian erosion, altered nutrient dynamics.	• Construction and operation management practices, including weed control.			
<i>Acacia crombiei</i>	• Overgrazing • Habitat fragmentation and clearing	• Loss of potential habitat through vegetation clearing. • Decreased population viability through isolation. • Decreased habitat quality through edge effects. • Decreased habitat quality through edge effects, increased weed invasion, excessive dust, changed fire regimes, altered surface hydrology, increased riparian erosion, and altered drainage and nutrient dynamics.	• Proposed corridor has been selected to avoid known occurrences; however, pre-clearance surveys will be undertaken in suitable habitats to identify any undetected individuals. • Avoiding any individuals by micro-siting or spanning • Retention of supporting vegetation through micro-siting or spanning of infrastructure and trimming of taller supporting vegetation. • Construction and operation management practices, including weed control.	Very high effectiveness Complete avoidance of known occurrences and/or habitats.	Unlikely to be impacted. Any impacts likely to be minor and of short duration.	High
<i>Acacia armitii</i>	• Invasive species that occur in the region and in its habitat, such as parkinsonia and rubber vine • Degradation by high grazing pressure • Soil disturbance (e.g. by pigs or other factors) • Direct clearing • Excessive dust • Altered fire regimes • Altered hydrology (DES, 2012)	• Loss of potential habitat and individuals of a significant disjunct population through vegetation clearing. • Decreased population viability through isolation. • Decreased habitat quality through edge effects. • Decreased habitat quality through edge effects, increased weed invasion, excessive dust, changed fire regimes, altered surface hydrology, increased riparian erosion, and altered	• Proposed corridor has been selected to avoid known occurrences; however, pre-clearance surveys will be undertaken in suitable habitats to identify any undetected individuals. • Avoiding any individuals by micro-siting or spanning • Supporting vegetation will be retained through micro-siting or spanning of infrastructure and trimming of taller supporting vegetation.	High effectiveness Substantial avoidance of known occurrences and/or habitats.	Any impacts likely to be minor and of short duration.	Medium

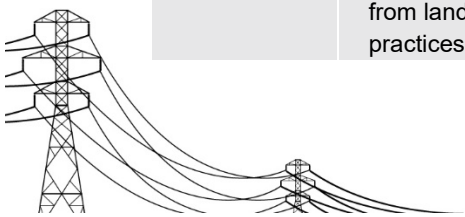
Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
		drainage and nutrient dynamics.	• Construction and operation management practices, including weed control.			
<i>Eucalyptus nudicaulis</i>	• Habitat disturbance and modification • Smothering by invasive species, particularly rubber vine. • Altered fire regimes	• Loss of potential habitat and individuals of a significant disjunct population through vegetation clearing. • Decreased population viability through isolation. • Decreased habitat quality through edge effects. • Decreased habitat quality through edge effects, increased weed invasion, excessive dust, changed fire regimes, altered surface hydrology, increased riparian erosion, and altered drainage and nutrient dynamics	• Pre-clearance surveys will be undertaken in suitable habitats to identify any undetected individuals. • Individuals and supporting vegetation will be avoided by micro-siting or spanning. • Construction and operation management practices, including weed control.	High effectiveness Substantial avoidance of known occurrences and/or habitats.	Any impacts likely to be minor and of short duration.	Medium
Listed threatened fauna						
Squatter pigeon (southern)	• Ongoing vegetation clearance and fragmentation • Loss of habitat through overgrazing by livestock and feral herbivores, such as rabbits, • Introduction of weeds • Inappropriate fire regimes • Thickening of understorey vegetation • Predation by feral cats and foxes	• Loss of foraging habitat • Injury and mortality from clearing and/or vehicle strikes • Habitat fragmentation and reduced connectivity • Disturbance from increased light, noise and vibration • Habitat degradation through increased dust, run-off and sedimentation	• Areas of potential habitat are to be flushed immediately prior to clearing. • Access to water sources and local on-ground connectivity between breeding and foraging habitat will be maintained during all stages of the Project. Tracks will be retained and managed as dusty, unsealed tracks to maintain opportunities for dispersal and local movement.	Moderate to high effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction	Impacts likely to be minor and of short duration, restricted to construction risks and minor localised loss of habitat.	3

Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
	• Trampling of nests by domestic stock • Illegal shooting.	• Introduction and spread of invasive fauna species • Introduction and spread of weed species • Disturbance of surface waterways and waterbodies	• Impacts to avoided by Project infrastructure • Critical drinking sources will be maintained to support the viability of local breeding habitats. • Pre-clearance surveys to microsite towers to avoid direct impacts on confirmed or potential nesting habitat. • Preparation of a high risk SMP will be undertaken in accordance with the requirements of Section 332 of the <i>Nature Conservation (Animals) Regulation 2020</i>. • Go-slow zones (40 km) and warning signs will be established for vehicles and machinery where non-gazetted access roads or tracks are located adjacent to areas of confirmed sightings. • Awareness information will be included in all worker inductions and in the Traffic Management Plan. • Use of trained and qualified spotter-catchers throughout clearing • Implementation of EMP, including fauna management, traffic management, weed control and erosion and sediment control.	methods. Habitat connectivity maintained.		
Koala	• Habitat loss, fragmentation and degradation • Mortality from vehicles strikes and dog attacks	• Loss of potential habitat, including food resources	• Identification and avoidance of areas of suitable habitat during design, including use of previously disturbed areas and spanning over	Moderate effectiveness	Minor, long-term loss of food trees, localised short	3

Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
	• Spread of disease • Drought impacts	• Injury and mortality during clearing and vehicle collisions • Habitat degradation by increased dust run-off and sedimentation • Introduction and spread of pest fauna species	• corridors of potential movement and connectivity to maximum span width. • Sequential clearing (outside of peak breeding season as a priority) and allowing koalas to self-disperse. • Use of trained and qualified spotter-catchers throughout clearing within suitable habitats • Implementation of vehicle speed limits on non-gazetted access roads and tracks. • Implementation of EMP, including environmental training, traffic management, erosion and sediment control, weed management and waste management. • Revegetation of riparian areas or potential connectivity areas (koala movement corridors) to restore and enhance habitat usage. • Feral animal control during construction • Natural regeneration of disturbed areas not required for operations	Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods.	duration impacts to habitat	
Black-throated finch (southern)	• Clearance and fragmentation of woodlands, riparian habitats and wattle shrublands • Degradation of habitat by domestic livestock and rabbits, including the alteration of fuel loads, vegetation structure and	• Loss of potential habitat, including nesting habitat through clearing of grassland and/or grassy woodland, earthworks or excavation and the construction of roads,	• Pre-clearance surveys in areas of suitable habitat to identify and avoid potential nesting sites. • Micrositing towers to avoid direct impacts on confirmed or potential nesting habitat. • Should clearing of nesting habitat be required, a high risk SMP will be	Moderate effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life	Impacts likely to be minor and of short duration.	3

Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
	the availability of food during the wet season • Alteration of habitat by changes in fire regimes • Invasion of habitat by exotic weeds, including exotic grasses • Illegal trapping • Predation by introduced predators • Hybridization with the northern subspecies.	structures and/or hard surfaces. • Increased likelihood of fires. • Increased access to habitat by feral predators and increased predation. • Disruption to breeding cycle • Degradation of downstream aquatic ecosystems through pollution and sedimentation in runoff from vehicle use of maintenance tracks.	prepared and implemented in accordance with the requirements of Section 332 of the <i>Nature Conservation (Animals) Regulation 2020</i>. • Maintenance of 'no go' buffer zones around nesting sites. • Use of trained and qualified spotter-catchers throughout clearing • Scheduling majority of clearing during the dry season, outside the species' usually breeding period • Implementation of EMP, including environmental training, pest animal, noise, weed, erosion and sediment control and fire management. • Natural regeneration of native grasses in disturbed areas not required for operations	cycles are minimised through design and construction methods.		
Julia Creek dunnart	• Cat (<i>Felis catus</i>) predation • Invasion of habitat by Prickly Acacia (<i>Vachellia nilotica</i>) • Heavy grazing • Potential threats may include: – inappropriate fire regimes, climatic factors and small population size	• Direct mortality from earthworks and other invasive construction activities • Mortality by maintenance vehicle collisions. • Compaction of soil cracks (reducing shelter sites) by maintenance vehicle activities. • Increased likelihood of weed invasion leading to choking of groundcover and	• Micrositing towers to avoid areas of high microhabitat value (i.e. areas with high densities of deep cracking clay) • Preparation of a high risk SMP will be undertaken in accordance with the requirements of Section 332 of the <i>Nature Conservation (Animals) Regulation 2020</i>. • Use of trained and qualified spotter-catchers throughout clearing • Scheduling majority of clearing during the dry season, outside the species' usually breeding period	Moderate effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods.	Impacts likely to be minor and of short duration.	2b

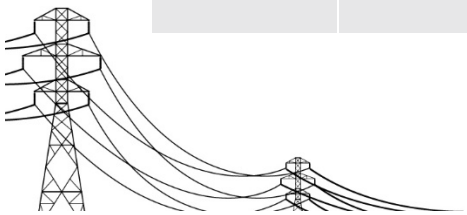
Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
		- reducing foraging opportunities. - Increased access to habitat by feral predators and possible increased predation.	- Minimise maintenance vehicle and machinery access and subsequent soil compaction beyond designated access tracks. - Implement vehicle speed limits on non-gazetted access roads and tracks. - Implementation of EMP, including environmental training, pest fauna, weed, traffic management and fire management. - Natural regeneration of ground cover within disturbed areas not required for operations			
White-throated needletail	- Use of insecticides and the loss of roosting sites - Loss of forest and woodland habitats may have also resulted in reduction in invertebrate prey - Logging of forests and hunting in breeding grounds of the northern hemisphere	Collision with transmission lines.	- No specific mitigation strategies are proposed for the species. - Insecticide use will not be required for the project.	Very low effectiveness No mitigation strategies proposed.	Negligible impacts anticipated.	3
Red goshawk	- Habitat loss and fragmentation - Forestry operations - Illegal egg collecting - Potential threats may include: - habitat alterations within a breeding pairs home range - application of persistent pesticides (outside Australia) - Reduce prey availability from land management practices	The removal of large trees will result in a more open vegetative structure for the communities within and adjacent to the easement. Because this species is an ambush predator that hunts within the midstorey, a more open canopy structure could reduce the species' ability to	- Proposed corridor has been selected to avoid key foraging areas such as ecotone boundaries, vegetated watercourses and wetland ecosystems in design phase. - Pre-clearance surveys in areas of suitable habitat to identify potential nesting sites (normally large trees within 1 km of permanent water).	Moderate to high effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and	Impacts likely to be minor and of short duration.	2b



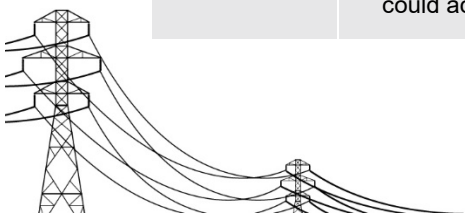
Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
	– fire and changed burning regimes – shooting of Red Goshawks – disease – catastrophic events, such as wildfire and tropical storms, which may exaggerate the impact of existing threats – possible genetic bottlenecks in the population – secondary poisoning – persistent disturbance by birdwatchers at know nests	• forage in the vicinity of the Project area. • Disturbance to foraging/ breeding by noise pollution/ vehicle movement. • Increased likelihood of fire leading to reduction or loss of shelter and foraging habitat. • Increased likelihood of weed invasion leading to increased fuel load.	• Micrositing towers to avoid direct impacts on confirmed or potential nesting habitat. • Minimisation of clearing to maintain canopy cover. • Use of trained and qualified spotter-catchers throughout clearing • Implementation of EMP, including environmental training, pest fauna, weed, chemical spills and storage and fire management.	construction methods. Habitat connectivity maintained.		
Night parrot	• There are no known threats to this species. Potential threats may include: – Predation by feral cats (<i>Felis catus</i>) and foxes (<i>Vulpes vulpes</i>) – Degradation of habitat around water points by livestock and feral herbivores – Competition for food by livestock or feral herbivores – Human-induced fire events and increased fire extent – Disease – Illegal collection of birds or eggs – Disturbance from bird watching activities	• Direct loss of suitable habitat • Mortality by maintenance vehicle collision. • Increased likelihood of fire leading to reduction or loss of shelter. • Increased likelihood of weed invasion leading to increased fuel load. • Increased access to habitat by feral predators and possible increased predation. • Degradation of downstream aquatic ecosystems through pollution and sedimentation in runoff from vehicle use of maintenance tracks.	• Proposed corridor has been selected to avoid water sources. • Targeted pre-clearance surveys prior to construction to minimise the potential for impact on breeding or nesting habitat. • Implement vehicle speed limits on non-gazetted access roads and tracks. • Implementation of EMP, including environmental training, pest fauna, weed, erosion and sediment control and fire management. • Implementation of the Department of Environment and Heritage (2006) hygiene and reporting protocols for psittacine beak and feather disease (PBFD).	Moderate effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods.	Impacts unlikely but any direct impact would have severe consequences.	1

Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
	– Fence collisions – Reduction in water availability through overuse of waterholes by camels or reduced waterhole maintenance		• Natural regeneration within disturbed areas not required for operations will be assisted to re-establish and maintain connectivity of ground-level habitats.			
Painted honeyeater	• Habitat loss • Grazing by livestock, native macropods and rabbits, as grazing inhibits recruitment through consumption of seedlings • Competition with the aggressive noisy miner • Predation by invasive species • Pasture improvement activities • Collision with road vehicles • Nest predation	• Direct loss of foraging habitat • Injury and mortality • Habitat fragmentation and reduced connectivity • Disturbance from increased light, noise and vibration • Habitat degradation through increased dust, run-off and sedimentation • Introduction and spread of invasive fauna species • Introduction and spread of weed species	• Implementation of EMP, including environmental training, pest fauna, weed, erosion and sediment control and fire management. • Implementation of the Department of Environment and Heritage (2006) hygiene and reporting protocols for psittacine beak and feather disease (PBFD). • Natural regeneration within disturbed areas not required for operations will be assisted to re-establish and maintain connectivity of ground-level habitats.	Low effectiveness Mitigation of impacts only through implementation of EMP (weed management).	Impacts likely to be minor and of short duration.	2b
Australian painted-snipe	• Loss and degradation of wetlands, principally from the drainage of wetlands and diversion of water to agriculture and reservoirs • Grazing and associated trampling of wetland vegetation by cattle and/or sheep • Potential threats may include: – Prolonged drought – Changed fire regimes – Replacement of endemic wetland vegetation	• Degradation of downstream aquatic ecosystems through pollution and sedimentation in runoff from vehicle use of maintenance tracks. • Increased access to habitat by feral predators and possible increased predation.	• Proposed corridor has been selected to avoid the majority of sensitive environmental areas (e.g. wetlands) which the species may utilise. • Where avoidance is not possible, such environments will be spanned. • Establishment and maintenance of 'no-go' zones around areas of suitable habitat. • Implementation of EMP, including environmental training, chemical management measures, pest fauna	Moderate to high effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods. Substantial	Impacts likely to be minor and of short duration.	3

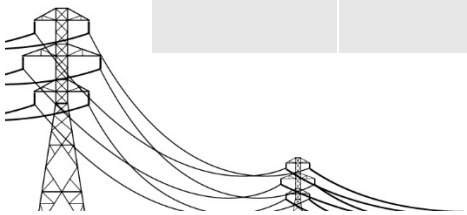
Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
	by invasive, noxious weeds may have a detrimental impact – Predation by feral animals		and weed control. A Sediment and Erosion Control Plan will also be implemented as part of the EMP.	avoidance of known habitats.		
Grey falcon	•Predation by cats •Increased temperatures in arid and semi-arid Australia •Small population size •Grazing by exotic herbivores •Nest shortage •Birdwatchers and photographers •Collision with traffic •Collision with fences and powerlines •Harvesting	•Loss of foraging habitat •Loss of nesting sites •Introduction / encroachment by invasive species •Disturbance to roosting by light and noise pollution. •Disturbance to foraging by noise pollution	•Targeted pre-clearance surveys prior to construction to minimise the potential for impact on nesting habitat. •Implementation of EMP, including environmental training, pest fauna and weed management and noise and light controls.	Moderate effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods.	Impacts likely to be minor and of short duration.	2b
Ornamental snake	•Habitat loss through clearing (roads, ploughing, railways, pipeline constructions) •Habitat fragmentation •Habitat degradation by overgrazing by stock, especially cattle, or grazing of gilgais during the wet season leads to soil compaction and compromising of soil structure •Alteration of landscape hydrology in and around gilgai environments	•Direct mortality and loss of habitat from earthworks and other invasive construction activities •Mortality by maintenance vehicle collisions. •Compaction of soil cracks (reducing shelter sites) by maintenance vehicle activities. •Sedimentation of habitat •Light spill disrupting nocturnal hunting •Increased likelihood of weed invasion leading to choking of groundcover and	•Localised risk of impact to individuals during clearing will be mitigated through the use of pre-clearance surveys by experienced spotter-catchers. •Pre-clearance surveys to identify areas of high micro-habitat value. Micro-siting towers to avoid such areas (i.e. areas with gilgais) •Should clearing of breeding habitat be required, a high risk SMP will be prepared and implemented in accordance with the requirements of Section 332 of the <i>Nature Conservation (Animals) Regulation 2020</i>.	Moderate effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods.	Minor, localised long-term loss of habitat	2b



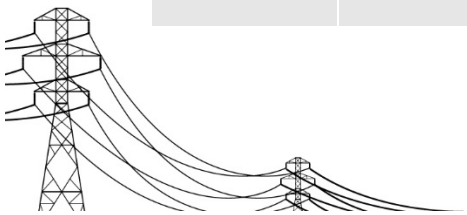
Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
	• Alteration of water quality through chemical and sediment pollution of wet areas • Contact with the Cane Toad • Predation by feral species • Invasive weeds	• reducing foraging opportunities. • Increased access to habitat by feral predators and possible increased predation.	• Use of trained and qualified spotter-catchers throughout clearing • Scheduling of works in the dry season months to avoid the species' peak period of breeding activity (i.e. the wet season). • Minimise maintenance vehicle and machinery access and subsequent soil compaction beyond designated access tracks. • Implement vehicle speed limits on non-gazetted access roads and tracks. • Implementation of EMP, including environmental training, pest fauna, weed, sediment and erosion control, light controls and traffic management. • Natural regeneration of ground cover within disturbed areas not required for operations			
Plains death adder	• Contact with the Cane Toad • Potential threats may include: – Habitat modification due to over-grazing by cattle and inappropriate fire regimes – Spreading water points to reduce grazing pressure which can result in an increase in total grazing pressure, reduced groundcover that could act as refugia and	• Loss of habitat. • Removal of groundcover that the species uses for shelter and a potential reduction in the species feed source (frogs and lizards) due to earthwork disturbances • Mortality during clearing activities. • Mortality by vehicle collision.	• Localised risk of impact to individuals during clearing will be mitigated through the use of pre-clearance surveys. • Use of trained and qualified spotter-catchers throughout clearing • Mitigation measures to reduce the impacts of Project on the species (e.g. vehicle strikes) have been designed and included within the Project EMP	Moderate to low effectiveness Mitigation of impacts only through implementation of EMP, spotter-catchers, pest fauna and weed control. Habitat connectivity maintained.	Negligible long-term loss of habitat	2b



Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
	increased spread of canetoads.	• Mortality by being trapped in excavations during construction. • Disruption of the breeding cycle of the species at a local level • Increase in edge effects. • Increased access to habitat by feral predators and possible increased predation. • Increased likelihood of trampling by livestock due to increased access to habitat. • Increased prevalence of cane toads and mortality from attempted predation. • Provision of shelter resources under stored equipment/ building materials resulting in possible subsequent mortality. • Increased likelihood of fire leading to direct mortality. • Increased likelihood of fire leading to reduction or loss of shelter. • Increased fuel load due to weed invasion. • Increased likelihood of weed invasion leading to choking of groundcover and	• Implementation of EMP, including environmental training, pest fauna and weed controls and traffic management. • Natural regeneration of ground cover within disturbed areas not required for operations			

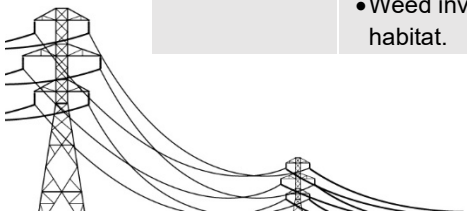


Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
		reducing foraging opportunities.				
Purple-necked rock wallaby	• Predation by feral cats • Predation by European foxes • Competition and habitat degradation by feral goats • High frequency fires resulting in the disruption of life cycle processes in plants • Land clearance / clearing of native vegetation • Habitat fragmentation • Inappropriate fire regimes. causing disruption to sustainable ecosystem processes and loss of biodiversity • Invasion of native vegetation by environmental weeds.	• Loss of foraging habitat • Disturbance by noise and light pollution. • Mortality by vehicle collision.	• Proposed corridor has been selected to avoid the majority of areas the species may utilise (i.e. boulder piles, rocky slopes, cliffs and gorges). • Establish go slow zones (40 km) for vehicles and machinery where non-gazetted access roads or tracks are located adjacent to rock outcrop/jump-up areas. • Implementation of EMP, including environmental training, pest fauna and weed controls and traffic management.	Moderate to high effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods. Substantial avoidance of known habitats.	Minor short-term disturbance during construction. Negligible permanent loss of habitat.	3
Short-beaked echidna	• Clearing of native habitat for grazing • Predation by feral predators e.g. cats and foxes.	• Loss of foraging and breeding habitat • Mortality by vehicle collision.	• Use of trained and qualified spotter-catchers throughout clearing • Should breeding habitat need to be cleared, a high risk SMP will be prepared and implemented in accordance with the requirements of Section 332 of the <i>Nature Conservation (Wildlife Management) Regulation 2006</i>. • Implementation of EMP, including environmental training, traffic management, pest fauna, weed and fire management.	Moderate to low effectiveness Mitigation of impacts only through implementation of EMP, SMP, spotter-catchers, pest fauna and weed control. Habitat connectivity maintained.	Impacts likely to be minor, localised and of short duration.	3

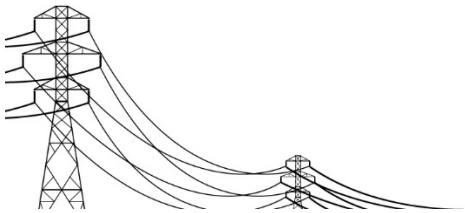


Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
Northern leaf-nosed bat	• Destruction and disturbance of roost sites. • Inappropriate fire regimes • Predation by feral cats	• Disturbance of roosting/breeding sites (rocky areas, caves, boulder piles, disused mines). • Disturbance by noise and light pollution. • Provision of shelter resources under stored equipment/building materials resulting in possible subsequent mortality.	• Proposed corridor has been selected to avoid the majority of roosting/breeding sites. • Localised risk of impact to individuals during clearing will be mitigated through the use of trained and qualified spotter-catchers when clearing suitable habitat • Limiting human access to roost sites to reduce the risk of introducing White Nose Syndrome • Implementation of EMP	Moderate to high effectiveness Substantial avoidance of known habitats. Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods.	Negligible long-term loss of habitat	1
Common death adder	• Inappropriate grazing and fire regimes which degrade the quality of habitat. • Poisoning by cane toads • Clearing of vegetation for development. Other identified threats include road-kill, removal of woody debris and habitat degradation by feral pigs.	• Loss of habitat. • Removal of groundcover that the species uses for shelter and a potential reduction in the species feed source (frogs and lizards) due to earthwork disturbances • Mortality during clearing activities. • Mortality by vehicle collision. • Mortality by being trapped in excavations during construction. • Disruption of the breeding cycle of the species at a local level • Increase in edge effects.	• Localised risk of impact to individuals during clearing will be mitigated through the use of trained and qualified spotter-catchers throughout clearing in suitable habitat. • Retain some felled timber to locate within adjacent habitat to increase sheltering opportunities for displaced animals. • Implementation of EMP, including environmental training, pest fauna and weed controls and traffic management. • Natural regeneration of ground cover within disturbed areas not required for operations	Moderate to low effectiveness Mitigation of impacts only through implementation of EMP, spotter-catchers, pest fauna and weed control. Habitat connectivity maintained.	Negligible long-term risk to the population. Negligible long-term loss of habitat	2b

Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
		• Increased access to habitat by feral predators and possible increased predation. • Increased likelihood of trampling by livestock due to increased access to habitat. • Increased prevalence of cane toads and mortality from attempted predation. • Provision of shelter resources under stored equipment/ building materials resulting in possible subsequent mortality. • Increased likelihood of fire leading to direct mortality. • Increased likelihood of fire leading to reduction or loss of shelter. • Increased fuel load due to weed invasion. • Increased likelihood of weed invasion leading to choking of groundcover and reducing foraging opportunities.				
Vine-thicket fine-lined slider	• Habitat loss from land clearing and thinning operations. • Inappropriate fire regimes • Weed invasions that degrade habitat.	• Loss of habitat. • Mortality during clearing activities. • Mortality by vehicle collision.	• Vine thicket (or other significant habitat) to be avoided and a 200m buffer to be maintained from clearing, construction and decommissioning activities.	High to very high effectiveness Substantial to complete	Impact unlikely due to avoidance of habitat	3



Species	Threatening processes	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Prediction Reliability Index
		• Barriers to movement created. • Mortality by being trapped in excavations during construction. • Indirect: Increase in edge effects. • Increased access to habitat by feral predators and possible increased predation. • Increased likelihood of fire. • Increased fuel load due to weed invasion. • Increased likelihood of weed invasion leading to choking of groundcover. • Provision of shelter resources under stored equipment/building materials resulting in possible subsequent mortality. • Permanent disturbance to friable upper soil profiles. • Disturbance to slightly embedded surface rocks. • Loss of native vegetation leading to permanent loss of natural litter profile.	• Access routes should be as far as possible from vine thickets, and never at points where they create barriers between vine thickets. • Cordon off vine thickets as 'No-go Zones' for all works and personnel, if any works proposed in the vicinity. • Fauna spotter/catcher to check excavations. • Implement pest animal, weed and fire management through the Environmental Management Plan for the Project. • Following the construction phase, cleared areas that are not required for on-going maintenance, access and/or fire safety obligations will be rehabilitated using locally native species which have a mature height of under 4m.	avoidance of known occurrences and/or habitats.		



7.6 Significance of impact assessment

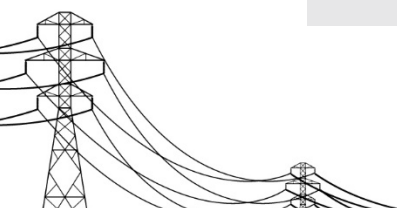
For each species confirmed present or considered likely to occur, the significance of the Projects impacts were assessed in accordance with the Commonwealth Significant impact guidelines 1.1 (DoE 2013) and Queensland Significant residual impact guidelines (DEHP 2014).

7.6.1 *Eucalyptus raveretiana*

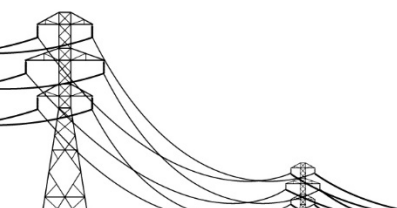
A significance of impact assessment of the Project on *Eucalyptus raveretiana* (Vulnerable under the EPBC Act only) is provided in Table 7-18.

Table 7-18 Significant impact assessment – *Eucalyptus raveretiana*

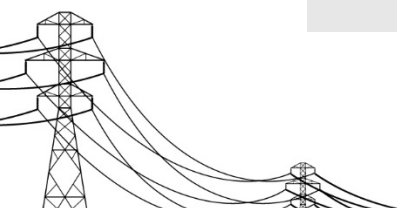
Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The total mapped suitable habitat for the species within Project activity areas is estimated as 0.002 ha. This represents a very small percentage (<0.001 %) of habitat available within a local (2.5 km) and region (10 km) buffer of the Project area and is unlikely to lead to long-term decrease in the size of the population. The occurrences of <i>E. raveretiana</i> within the corridor selection may be considered an important population due to their location near to the north-western limit of the species range. These individuals are potentially part of a sub-population that is within a larger overall population. The species is known from at least 23 sites and is considered to potentially have >100 sub-populations throughout its range (DoEE, 2019). Due to the concentrated location of this species within the riparian corridors of only a selection of waterways in the study area between KP48-49 WD and KP71-72 WD (Burdekin River to the south of the corridor selection), the Project corridor selection will be able to span the occurrences of recorded individuals. At the waterways that are known habitat, higher towers placed closer to the riparian areas will be designed so as to avoid needing to remove individuals present and their immediate supporting habitat. Trimming of the mature trees that are greater than 20 m tall may be required, depending on the final placement of towers, with periodical maintenance required during the operation of the Project. Trimming will only occur where it is within five metres of the transmission line at maximum sag. Pre-clearance surveys will be undertaken prior to final siting of towers and other infrastructure, to avoid individual occurrences or span across lower height trees or trees at the margins of the corridor selection. Additional infrastructure, such as tracks and assembly areas, will avoid the supporting habitat for this species. No alteration of hydrological regimes or groundwater interactions will results from the construction or operation of the Project. Construction and operation management practices, including weed control, will assist with reducing long-term effects on the habitat for this species. The Project is therefore unlikely to decrease the size of the <i>E. raveretiana</i> population.
Reduce the area of occupancy of an important population	Unlikely Due to the concentrated location of this species along the banks and within the riparian corridors of only a selection of waterways in the study area between KP48-49WD and south of KP71-72 WD, the Project corridor selection will be able to span the occurrences of individuals. At the waterways where the species is known to occur, higher towers



Significant impacts criteria	Assessment
	placed closer to the riparian areas will be used to avoid needing to remove individuals present. Trimming of the taller mature trees may be required depending on the final placement of towers, with periodical maintenance required during the operation of the Project. Therefore the Project is unlikely to reduce the area of occupancy of the <i>E. raveretiana</i> population.
Fragment an existing important population into two or more populations	Unlikely The Project intersects at least one known occurrence of individuals of <i>E. raveretiana</i> along Oakey Creek, and a likely occurrence along the Burdekin River, however the design will be able to avoid clearing individuals of this species and may only require trimming of trees greater than 20 m height, depending on the final placement of towers. Additional infrastructure, such as access tracks, will avoid clearing within supporting habitats along the riparian corridor. Existing crossings and clearings will be used where present. Therefore the riparian corridor will remain intact wherever possible at these locations of suitable habitat. Although the Project has potential to introduce weed species that can reduce habitat value, the implementation of a weed management plan will mitigate this risk. Increased weed management through the lifetime of the Project is expected to maintain the connectivity and extent of suitable habitat. Therefore, the Project is unlikely to fragment the population into two or more populations.
Adversely affect habitat critical to the survival of a species	Unlikely Due to the occurrences within the study area potentially being important populations of <i>E. raveretiana</i>, it is considered that the known occurrences can also be considered to be habitat critical to the survival of a species. Due to the concentrated location of this species along the banks and within the riparian corridors of only a selection of waterways in the study area between KP48-49 WD and south of KP71-72 WD, the Project corridor selection will be able to span the occurrences of individuals. Trimming of the taller mature trees may be required depending on the final placement of towers, with periodical maintenance required during the operation of the Project. Pre-clearance surveys will be undertaken prior to final siting of towers and other infrastructure, to avoid individual occurrences or span across lower height trees or trees at the margins of the corridor selection. Additional infrastructure, such as tracks and assembly areas, will avoid the supporting habitat for this species. It is not considered that the mapped suitable habitat areas are habitat critical to the survival of the species, due to the absence of records of individuals during previous and current field surveys. Wherever possible given construction and landholder constraints, areas of suitable habitat for <i>E. raveretiana</i> will be avoided by the Project (i.e. by spanning over corridors and placing associated infrastructure in pre-existing clearings and crossings). Due to the proposed avoidance of these habitat areas, the Project is unlikely to adversely affect any habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely The species flowers between December and January and fruits mature between March and April, with insects thought to be the primary pollinator (TSSC, 2012). This species does not vegetatively reproduce, although it does re-sprout after fire (TSSC, 2012). Due to the proposed retention of the existing populations of <i>E. raveretiana</i> and its supporting habitat, through the placement of higher



Significant impacts criteria	Assessment
	towers in a manner that avoids clearing of this species, pollination and seed dispersal is expected to continue without disruption. Any potentially required trimming of the taller trees will be undertaken outside of the summer-autumn flowering and fruiting period for the species. Therefore the Project is not expected to disrupt the reproductive cycle of the population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely The corridor selection has potential to disturb approximately 0.002 ha of mapped suitable habitat for <i>E. raveretiana</i>. This represents a small percentage (<0.001 %) of habitat available within a 10 km buffer of the Project and is unlikely to decrease the availability or quality of surrounding habitat. The Project proposes to avoid habitat for this species through designing the placement and heights of towers outside of and spanning across riparian corridors of higher order streams that are known or likely to have this species present. Other infrastructure, such as access tracks and assembly areas, will avoid clearing of any riparian corridors mapped as known or potential habitat for this species. No impacts from the Project will result in the altered hydrological regime of the waterways that are supporting habitat for this species. There is potential for impacts during the operation of this Project, such as through increased weed spread, however weed management will occur within those areas over the lifetime of the Project to mitigate such impacts. Access during construction and operation to or through riparian corridors that are suitable habitat will be avoided, using existing access and crossings where present. Therefore, the Project is unlikely to cause a decline in the local population.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely Known threats from invasive species include smothering by rubber vine (<i>Cryptostegia grandiflora</i>) (TSSC, 2012). The species is also threatened by exotic grasses that inhabit creek banks, such as <i>Panicum maximum</i>, and other weeds if they grow in large infestations, such as lantana, bellyache bush and chinee apple. Feral pigs and overgrazing can also be a threat to this species. The 2011 SEIS noted that the riparian habitat along Burdekin River was heavily degraded by the above weed species, and the habitat along Oakey Creek was in better condition however still impacted by rubber vine and chinee apple. The general presence of these species in the local area was confirmed during the 2019 surveys. Due to the avoidance measures (spanning across the riparian corridors and avoiding clearing within the riparian corridors) and mitigation measures (weed management protocols during construction and operation), it is considered unlikely that additional invasive species would be introduced or increase spread of existing weed species would result from the Project construction or operation. Weed management protocols will include weed hygiene protocols (e.g. washdowns) for vehicles and machinery between certain properties that have invasive species infestations and those areas that are weed free or have ecological significance, and restrictions to existing access tracks in the vicinity of the riparian habitats. Chemicals for weed control will be prohibited in proximity to known occurrences of <i>E. raveretiana</i>, however may be used appropriately in other areas of suitable habitat. Weed



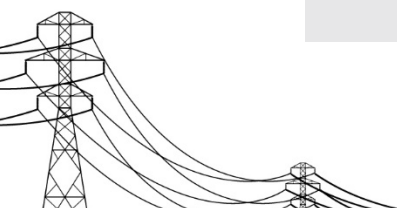
Significant impacts criteria	Assessment
	control will be undertaken during construction and operation of the Project. The Project is unlikely to result in increased feral animal or grazing stock abundance as the Project will not introduce any external food or water sources or changed grazing regimes. Feral animal management protocols will be implemented during the clearing, construction, operation and decommissioning phases with the intent to prevent negative impacts of invasive species as a result of the proposed action. Mitigation measures will be outlined further in the Project's Environmental Management Plan (EMP). Therefore the Project is considered unlikely to result in invasive species becoming established in the <i>E. raveretiana</i> habitat.
Introduce disease that may cause the species to decline	Unlikely No diseases or pathogens are identified among current known threats to <i>E. raveretiana</i>. The weed washdown and hygiene protocols that will be implemented through construction to manage the on-site spread or export of weeds will also act to reduce the potential for transmission of disease. The risks to this species associated with disease or pathogen introduction are therefore considered negligible.
Interfere substantially with the recovery of the species	Unlikely The corridor selection has potential to disturb approximately 0.002 ha of mapped suitable habitat for <i>E. raveretiana</i>. This represents a small percentage (<0.001 %) of habitat available within a 10 km buffer of the Project and is unlikely to interfere substantially with the recovery of the species. While the Project intersects areas where known occurrences of <i>E. raveretiana</i> occur, the Project will avoid clearing individual trees and adjacent supporting habitat within the corridor selection and for any additional temporary or permanent infrastructure or construction activity. Access during construction and operation to or through riparian corridors that are suitable habitat will be avoided, using existing access and crossings where present. If mature trees greater than 20 m tall are required to be trimmed along the corridor selection, this will be undertaken outside of the known summer-autumn flowering and fruiting period to avoid disrupting the species reproductive cycle. Therefore the Project is considered unlikely to interfere substantially with the potential recovery of the <i>E. raveretiana</i>.

7.6.2 *Livistona lanuginosa*

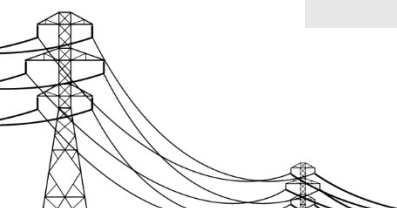
A significance of impact assessment of the Project on *Livistona lanuginosa* (Vulnerable under the EPBC Act and NC Act) is provided in Table 7-19.

Table 7-19 Significant impact assessment – *Livistona lanuginosa*

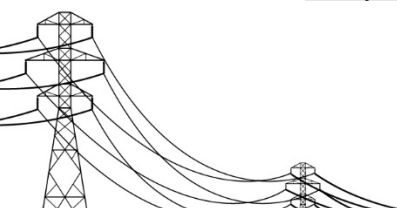
Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The total mapped suitable habitat for the species within Project activity areas is estimated as 2.18 ha. This represents a small percentage (0.007 %) of habitat available within a 10 km buffer of the Project and is unlikely to lead to a long-term decrease in the size of the population. The occurrences of <i>L. lanuginosa</i> within the corridor selection are considered to be part of an important population due to only seven distinct populations being recorded in Queensland and their location



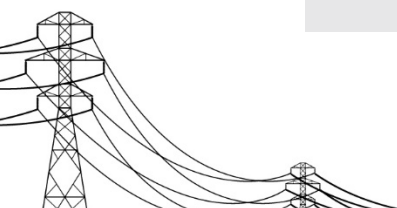
Significant impacts criteria	Assessment
	near to the north-western limit of the species range. There were 57 individuals recorded at the Campaspe River crossing (BAAM, 2011), with another individual observed further upstream at the edge of the study area. Another occurrence was recorded on an easterly tributary to the Campaspe River within the study area, with 11 individuals recorded in 2019. Due to the concentrated location of this species within the riparian corridors and adjacent alluvial plains of only a selection of waterways in the study area (recorded between KP123 WD and KP148 WD, the Project corridor selection will be designed to either avoid or span over the occurrences of individuals. At the waterways that have known occurrences, higher towers will be placed either side of the riparian habitats so as to avoid removing individuals present and additional disturbances in their supporting habitat. Pre-clearance surveys will be undertaken prior to final siting of towers and other infrastructure, to avoid individual occurrences and/or span across lower height trees or trees at the margins of the corridor selection. Locations of adult individuals can also be seen on high resolution aerial imagery, so towers can be placed to avoid prior to the pre-clearance surveys. There is a longer section of known habitat between KP 138-139 WD, being up to 750 m wide, which may require a tower to be placed in between braided channels in narrower sections of the waterway crossing. The <i>L. lanuginosa</i> trees are typically less than 20 m tall, therefore higher towers should be able to span across occurrences of this species, with no trimming or maintenance required. Additional infrastructure, such as tracks and assembly areas, will avoid the known occurrences and their supporting habitat for this species. Existing access and clearings will be used where present. No alteration of hydrological regimes or groundwater interactions will results from the construction or operation of the Project. Construction and operation management practices, including weed control, will assist with reducing long-term effects on the habitat for this species. The Project is therefore unlikely to decrease the size of the <i>L. lanuginosa</i> population.
Reduce the area of occupancy of an important population	Unlikely Due to the concentrated location of this species within the riparian corridors of only a selection of waterways in the study area between KP123 WD and KP148 WD, the Project corridor selection will be able to span the occurrences of individuals. At the waterways that have known occurrences, higher towers will be placed either side of the riparian habitats so as to avoid removing individuals present and additional disturbances in their supporting habitat. Pre-clearance surveys will be undertaken prior to final locating of towers and other infrastructure, to avoid individual occurrences or span across lower height trees or trees at the margins of the corridor selection. The trees are typically less than 20 m tall, therefore higher towers should be able to span across occurrences of this species, with no trimming or maintenance required. Therefore the Project is unlikely to reduce the area of occupancy of the <i>L. lanuginosa</i> population.
Fragment an existing important population into two or more populations	Unlikely The Project intersects at least two known occurrences of individuals of <i>L. lanuginosa</i> along Oakey Creek and Campaspe River, however the design will be able to avoid clearing individuals of this species, through the final placement of towers and increased tower heights. There is a longer section of known habitat between KP138-139 WD, being up to 750 m wide, which may require a tower to be placed in between braided channels in narrower sections of the waterway crossing. However the individuals occurring on different sides of the corridor selection will not



Significant impacts criteria	Assessment
	be fragmented into different populations because the Project will avoid clearing of individuals of the species, and the transmission line infrastructure will not have the effect of fragmenting habitat areas with the species maximum height being typically below 20 m (which is the maximum clearance for spans using higher towers (75 m). Additional infrastructure, such as access tracks and assembly areas, will avoid clearing within the riparian corridor through using existing accesses and crossings where present and finding alternative access routes if necessary. Therefore the riparian corridor will remain intact at these locations of known occurrences and supporting habitat. Although the Project has potential to introduce weed species that can reduce habitat value, the implementation of a weed management plan will mitigate this risk. Increased weed management through the lifetime of the Project is expected to maintain the connectivity and extent of suitable habitat. Therefore, the Project is unlikely to fragment the population into two or more populations.
Adversely affect habitat critical to the survival of a species	Unlikely Due to the occurrences within the study area being considered important populations of <i>L. lanuginosa</i>, it is considered that these known habitats can also be considered to be habitat critical to the survival of a species. Due to the proposed avoidance of these known occurrences, the Project is unlikely to adversely affect any habitat critical to the survival of the species. Pre-clearance surveys will be undertaken prior to final siting of towers and other infrastructure, to avoid individual occurrences or span across lower height trees or trees at the margins of the corridor selection. Additional infrastructure, such as tracks and assembly areas, will avoid the supporting habitat for this species. It is not considered that the mapped suitable habitat areas are habitat critical to the survival of the species, due to the limited occurrence of this species and absence of observations of individuals during previous and current field surveys. There is additional suitable habitat along the Campaspe and Cape Rivers and their tributaries, either side of the corridor selection. Wherever possible, given construction and landholder constraints, areas of suitable habitat for <i>L. lanuginosa</i> will be avoided by the Project (i.e. by spanning over corridors and placing associated infrastructure in pre-existing clearings and crossings).
Disrupt the breeding cycle of an important population	Unlikely The species flowers during spring and fruits in summer-autumn, with dispersal via flood water and along waterways (DoEE, 2019). Due to the proposed avoidance of the existing populations of <i>L. lanuginosa</i> and its known habitat, through the placement of higher towers in a manner that avoids clearing of this species. No trimming is will be required due to the higher towers (75 m tall) being able to span vegetation less than 20 m tall. No alteration of hydrological regimes or groundwater interactions will results from the construction or operation of the Project. Therefore the Project is not expected to disrupt the reproductive cycle of the population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely The Project will potentially approximately 2.18 ha of mapped suitable habitat. This represents a small percentage (0.007 %) of habitat available within a 10 km buffer of the Project and is unlikely to lead to a decrease in the availability or quality of habitat for <i>L. lanuginosa</i>. The Project proposes to avoid individual occurrences and surrounding supporting habitat for <i>L. lanuginosa</i> through siting of towers and other infrastructure and spanning across riparian corridors.



Significant impacts criteria	Assessment
	Additional infrastructure, such as tracks and assembly areas, will avoid the supporting habitat for this species. There is potential for impacts during the operation of this Project, such as through increased weed spread, however weed protocols and management will occur within those areas over the lifetime of the Project to mitigate such impacts. Therefore, the Project is unlikely to cause a decline in the local population.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely Known threats to the species include the introduction of invasive weed species. A number of weeds currently exist in the riparian habitats, such as parthenium and rubber vine. The species is also threatened by trampling by grazing stock. The 2011 SEIS noted that the riparian habitat along the Campaspe River was in good condition with scattered infestations of rubber vine and parkinsonia. Due to the avoidance measures (spanning across the riparian corridors and avoiding clearing within the riparian corridors) and mitigation measures (weed management protocols during construction and operation), it is considered unlikely that additional invasive species would be introduced, or increased spread of existing weed species would result, from the Project construction or operation. Weed management protocols will include weed hygiene measures (e.g. washdowns) for vehicles and machinery between certain properties that have invasive weed infestations and those areas that are weed free or have ecological significance, and restrictions to existing access tracks in the vicinity of the riparian habitats. Chemicals for weed control will be prohibited in proximity to known occurrences of <i>L. lanuginosa</i>, however may be used appropriately in other areas of suitable habitat. Weed control will be undertaken during construction and operation of the Project. The Project is unlikely to result in increased feral animal or grazing stock abundance as the Project will not introduce any external food or water sources or changed grazing regimes. Feral animal management protocols will be implemented during the clearing, construction, operation and decommissioning phases of this with the intent to prevent negative impacts of invasive species as a result of the proposed action. Mitigation measures will be outlined further in the Project's EMP. Therefore the Project is considered unlikely to result in invasive species becoming established in the <i>L. lanuginosa</i> habitat.
Introduce disease that may cause the species to decline	Unlikely No diseases or pathogens are identified among current known threats to <i>L. lanuginosa</i>. The weed washdown and hygiene protocols that will be implemented through construction to manage the on-site spread or export of weeds will also act to reduce the potential for transmission of disease. The risks to this species associated with disease or pathogen introduction are therefore considered negligible.
Interfere substantially with the recovery of the species	Unlikely While the Project intersects areas mapped as known or potential habitat for the species, the Project will avoid clearing in the known habitat of <i>L. lanuginosa</i> (and any potential habitat occurring further upstream and downstream and on associated tributaries) within the corridor selection and for any additional temporary or permanent infrastructure or other disturbance. Additional infrastructure, such as tracks and assembly areas, will avoid the supporting habitat for this species by using existing access and crossings where present. General construction access to the supporting habitats for this species will be minimised. No alteration of hydrological regimes or groundwater interactions will result from the construction or operation of the Project.



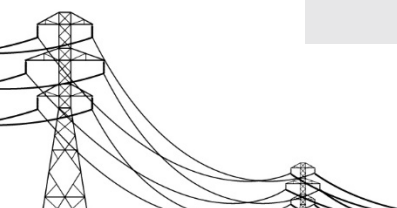
Significant impacts criteria	Assessment
	Therefore the Project is considered unlikely to interfere substantially with the potential recovery of the <i>L. lanuginosa</i> .

7.6.3 *Acacia crombiei*

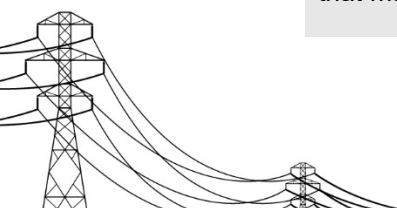
A significance of impact assessment of the Project on *Acacia crombiei* (Vulnerable under the EPBC Act and NC Act) is provided in Table 7-20.

Table 7-20 Significant impact assessment – *Acacia crombiei*

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely No individuals of <i>Acacia crombiei</i> have been recorded within the study area in the 2010 EIS, 2011 SEIS or 2019/2020 field surveys. The total mapped suitable habitat for the species within Project activity areas is estimated as 105.46 ha. This represents approximately 0.05% of the available habitat mapped at the regional scale (within a 10 km buffer of the Project). The species occurs outside the study area in areas to the north and south, in 15 subpopulations, and potentially comprising 76,000 plants (DoEE, 2019). It is unlikely that impacts to mapped potential habitat within the corridor selection will lead to a long-term decrease in the size of the population. Pre-clearance surveys will be undertaken in potential habitat prior to final siting of towers and other infrastructure, to avoid any potential individual occurrences. Should any individuals be identified, the transmission line can be designed to span over individuals as they are typically less than 10 m tall, and avoid impacting surrounding open woodland clearing by using taller towers and greater spans where safety will not be compromised. Construction and operation management practices, including weed control, will assist with reducing long-term effects on the potential habitat for this species. The Project is therefore unlikely to decrease the size of the <i>A. crombiei</i> population.
Reduce the area of occupancy of an important population	Unlikely No individuals of <i>A. crombiei</i> have been recorded within the study area in the 2010 EIS, 2011 SEIS or 2019/2020 field surveys. The area of occupancy is stated as 1,000 km² in the species profile (DoEE, 2019), and does not currently include the study area or Project area. Therefore the Project is unlikely to reduce the area of occupancy of the <i>A. crombiei</i> population.
Fragment an existing important population into two or more populations	Unlikely The current distribution is considered to consist of 15 subpopulations, which occur both north and south of the study area. No individuals are known to occur within the Project area. Pre-clearance surveys will be undertaken within suitable habitat to confirm that individuals of <i>A. crombiei</i> do not exist within areas to be cleared. If individuals are identified, the infrastructure will be placed to avoid clearing of occurrences and span across habitats using higher towers and/or greater span distances. The transmission line infrastructure will not have the effect of fragmenting an existing population or likely habitat areas. Although the Project has potential to introduce weed species that can reduce habitat value, the implementation of a weed management plan will mitigate this risk. Increased weed management through the lifetime



Significant impacts criteria	Assessment
	of the Project is expected to maintain the connectivity and extent of suitable habitat. Therefore, the Project is unlikely to fragment the population into two or more populations.
Adversely affect habitat critical to the survival of a species	Unlikely No occurrences of <i>A. crombiei</i> are known from within the study area. The mapped suitable habitat areas are not considered to be habitat critical to the survival of the species, due to the absence of observations of individuals during previous and current field surveys. There is suitable habitat mapped within the study area and in areas further north and south of the study area, outside of the corridor selection. The Project is unlikely to adversely affect any habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely There is limited information available in public databases regarding the reproductive cycle of this species. Considering the lack of recorded individuals in the study area and the availability of surrounding potential habitat, it is unlikely that the Project would disrupt the reproductive cycle of the population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely The Project has the potential to disturb 105.46 ha of mapped suitable habitat for <i>A. crombiei</i> . This represents approximately 0.05% of the available habitat mapped at the regional scale (within a 10 km buffer of the Project). These suitable habitat areas generally have existing disturbances due to grazing, clearing and weed invasion. There is potential for impacts to mapped suitable habitat during the construction and operation of this Project, such as through increased weed spread; however weed protocols and management will occur within those areas over the lifetime of the Project to mitigate such impacts. The Project is considered unlikely to cause a decline in the local population.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely A number of weed species have been recorded within the potential habitat areas mapped for <i>A. crombiei</i> , including prickly acacia, parkinsonia and pasture grasses such as buffel grass. The species is also threatened by overgrazing from domestic stock and occurs across land used for cattle grazing. Due to the mitigation measures (weed management protocols during construction and operation), it is considered unlikely that additional invasive species would be introduced, or increased spread of existing weed species would result, from the Project. Weed management measures will include weed hygiene protocols (e.g. washdowns) for vehicles and machinery between certain properties that have invasive weed infestations and those areas that are weed free or have ecological significance, and restrictions to existing access tracks in the vicinity of the ecologically significant habitats. The Project is unlikely to result in increased feral animal or grazing stock abundance as the Project will not introduce any external food or water sources or changed grazing regimes. Feral animal management protocols will be implemented during the clearing, construction, operation and decommissioning phases of this with the intent to prevent negative impacts of invasive species as a result of the proposed action. Mitigation measures will be outlined further in the Project's EMP. Therefore the Project is considered unlikely to result in invasive species becoming established in the <i>A. crombiei</i> habitat.
Introduce disease that may cause	Unlikely No diseases or pathogens are identified among current known threats to <i>A. crombiei</i> . The weed washdown and hygiene protocols that will be



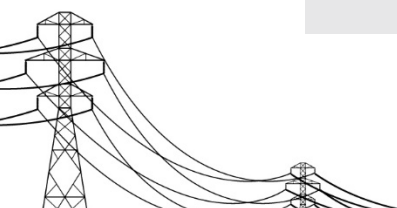
Significant impacts criteria	Assessment
the species to decline	implemented through construction to manage the on-site spread or export of weeds will also act to reduce the potential for transmission of disease. The risks to this species associated with disease or pathogen introduction are therefore considered negligible.
Interfere substantially with the recovery of the species	Unlikely While the Project intersects areas mapped as suitable habitat for the species, the Project will not impact any known occurrence or supporting habitat of <i>A. crombiei</i> within the corridor selection or for any additional temporary or permanent infrastructure or other disturbance. Therefore the Project is considered unlikely to interfere substantially with the potential recovery of the <i>A. crombiei</i> .

7.6.4 *Eucalyptus nudicaulis*

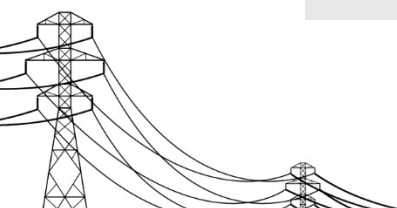
A significance of impact assessment of the Project on *Eucalyptus nudicaulis* (Vulnerable under the NC Act) is provided in Table 7-21.

Table 7-21 Significant residual impact assessment – *Eucalyptus nudicaulis*

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a local population.	Unlikely The Project is unlikely to lead to a long-term decrease in the size of the local population of <i>Eucalyptus nudicaulis</i> . The total mapped suitable habitat for the species within Project activity areas is estimated as 5.37 ha, occurring between Cloncurry and Mount Isa. This represents 0.009 % of the suitable habitat mapped at the regional scale (within 10 km of the Project). There is a recorded occurrence from the 2019 surveys within the proposed corridor selection. This record was near to the top of a rocky hill and clearing for the tower at the top of the hill will be able to avoid the need to disturb this individual. No other records were identified within a 200 m buffer of this occurrence. Pre-clearance surveys will be undertaken to inform tower placement and span lengths in areas of known and nearby mapped suitable habitat. Due to the undulating terrain and low sparse vegetation structure, minimal clearing is likely to be required through habitats for this species. Access will avoid known occurrences and their supporting habitats wherever possible. Whilst the construction phase of the Project may present risks to the occurrence (such as weed invasion), the mitigation measures outlined in Section 7.5 will effectively reduce the likelihood of impacts occurring. Therefore the Project is unlikely to lead to a long-term decrease in the size of a local population.
Reduce the extent of occurrence of the species.	Unlikely The extent of occurrence for <i>E. nudicaulis</i> includes approximately 70 km along the Mount Isa Augmentation corridor section. The Project activity area will intersect approximately 5.37 ha of mapped suitable habitat for this species. This habitat is typically rocky terrain at higher elevations and on slopes, therefore tower placement and longer spans will be effective in avoiding individual occurrences and minimising any clearing within supporting habitat for the <i>E. nudicaulis</i> .



Significant impacts criteria	Assessment
	Therefore the Project is considered unlikely to reduce the extent of occurrence of the species in that area.
Fragment an existing population.	Unlikely Although the Project may necessitate the clearing of some taller or higher elevation vegetation for tower placements, the locations of towers can be modified to avoid known occurrences of <i>E. nudicaulis</i>. Due to the terrain and vegetation community characteristics, areas of suitable habitat for this species intersected by the Project will remain largely intact. The Project will not result in prevention of pollination or dispersal of any existing populations. Therefore the Project is unlikely to fragment an existing population.
Result in genetically distinct populations forming as a result of habitat isolation.	Unlikely The Project will have the potential to identify and avoid direct clearing or disturbance of <i>E. nudicaulis</i>, and will not reduce the population size or isolate suitable habitat areas. The Project is not expected to impede pollinator interactions or wind dispersal of seed, thereby restricting gene flow. Retained vegetation in the Project area also provides extensive areas for colonisation of this species. Given that the Project is unlikely to impact any local occurrences or their supporting habitats and that opportunities for breeding and dispersal will continue in the landscape, the Project is not expected to result in the formation of genetically distinct populations of the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Unlikely The introduction of invasive weed species could threaten the habitat for <i>E. nudicaulis</i>. The Project has potential to introduce weed species that can reduce habitat value, however the implementation of a weed management plan with weed hygiene protocols will mitigate this risk. Increased weed management through the lifetime of the Project is expected to maintain the connectivity and extent of suitable habitat. The Project is unlikely to result in increased feral animal or grazing stock abundance as the Project will not introduce any external food or water sources or changed grazing regimes. Feral animal management protocols will be implemented during the clearing, construction, operation and decommissioning phases of this with the intent to prevent negative impacts of invasive species as a result of the proposed action. Mitigation measures will be outlined further in the Project's EMP. Therefore it is unlikely that the Project will result in harmful invasive species becoming established in the habitat.
Introduce disease that may cause the population to decline	Unlikely There are no known diseases that have been identified as a threat to the <i>E. nudicaulis</i>. It is considered unlikely that the Project will introduce a disease or pathogen that could cause the population to decline.
Interfere with the recovery of the species.	Unlikely While the Project intersects areas mapped as known or potential habitat for the species, the Project will avoid clearing or disturbing any occurrences of <i>E. nudicaulis</i> and will minimise any vegetation disturbance required in the known habitat areas.



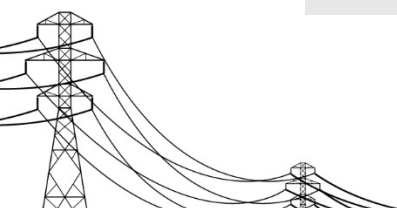
Significant impacts criteria	Assessment
	Access during construction and operation will be planned to avoid areas that are known or likely habitat for the species. Therefore the Project is considered unlikely to interfere substantially with the potential recovery of the <i>E. nudicaulis</i> .
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	Unlikely The Project will be designed to avoid known occurrences of <i>E. nudicaulis</i>, and will include a pre-clearance survey to identify any additional occurrences within proximity to previous records that are in supporting habitat for the species. Any individual of this species could be considered to be an ecologically significant location, depending on the positioning in the landscape and the health of the individual (influencing the likelihood of reaching maturity and achieving reproduction). Avoidance measures will be planned following pre-clearance surveys through tower siting and spanning individuals and associated patches of supporting habitat. Therefore the Project is considered unlikely to cause disruption to ecologically significant locations for the species.

7.6.5 *Acacia armitii*

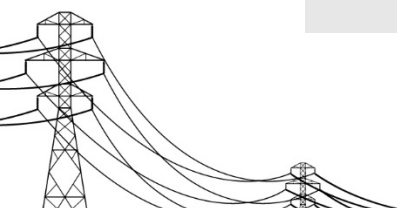
As a Near Threatened flora species listed under the NC Act, an assessment of residual impacts against the Significant Residual Impact Guideline for *Acacia armitii* is not required (unless for essential habitat of that species). However, the same criteria have been applied to assess potential impacts in order to demonstrate whether the species will be significantly impacted (refer to Table 7-22).

Table 7-22 Significant residual impact assessment – *Acacia armitii*

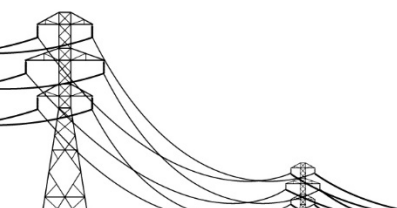
Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a local population.	Unlikely The Project is unlikely to lead to a long-term decrease in the size of the local population of <i>Acacia armitii</i>. The Project will avoid disturbance of the known occurrences along riparian corridors and will not disturb mapped suitable habitat within the study area. There are three known locations of the species occurring within the vicinity of the Project, along riparian corridors of ephemeral sandy drainage lines and sandstone outcrops. These recorded locations are outside of the current Project area, although the species has been recorded as scattered along the margins of ephemeral drainage lines and therefore there is potential for individuals to occur within the Project area. Due to the occurrence and typical habitat along riparian corridors on the margins of ephemeral drainage lines, and sparse vegetation structure 10-20 m tall, the Project is able to span known occurrences and supporting habitat for this species, using higher towers and appropriate spans to retain vegetation below 20 m height. Pre-clearance surveys will be undertaken to inform tower placement and span lengths in areas of known and nearby mapped potential habitat. Towers will be placed outside of known and potential habitat areas. Other infrastructure areas will avoid occurrences of this species, including for temporary and permanent access, laydown and assembly areas.



Significant impacts criteria	Assessment
	Whilst the construction phase of the Project may present risks to the species (such as weed invasion), the mitigation measures outlined in Section 7.5 will effectively reduce the likelihood of impacts occurring. Therefore the Project is unlikely to lead to a long-term decrease in the size of a local population.
Reduce the extent of occurrence of the species.	Unlikely The extent of occurrence for <i>A. armitii</i> includes approximately 40 km of the corridor selection of the Renewable Energy Hub corridor section. The Project will avoid disturbance of the known occurrences along riparian corridors and will not disturb mapped suitable habitat within the study area. This habitat is typically along the margins of ephemeral drainage lines between KP178 WD and KP238 WD. No clearing of individuals of this species is proposed to occur. The detailed design will include tower placement, higher towers and span lengths that will be effective in avoiding individual occurrences and minimising any clearing within potential habitat for the <i>A. armitii</i>. Other infrastructure areas will avoid occurrences of this species, including for temporary and permanent access, laydown and assembly areas. Therefore the Project is considered unlikely to reduce the extent of occurrence of the species in that area.
Fragment an existing population.	Unlikely The corridor selection traverses in close proximity (125 m and 280 m) to two known occurrences of <i>A. armitii</i>. Other recorded locations are further away from the corridor selection (1.2 km and 2.5 km). Although these occurrences recorded scattered locations along the margins of ephemeral drainage lines, it is unlikely that fragmentation of these populations would result from the corridor selection. The design will be able to avoid clearing individuals of this species and their supporting habitats, through pre-clearance surveys to determine the final placement of towers and populations to be spanned, if they are present within the Project area. Additional infrastructure (such as access tracks and assembly areas) will avoid clearing within the riparian corridor for known habitat locations. Therefore the riparian corridor will remain intact at these locations of known habitat. Although the Project has potential to introduce weed species that can reduce habitat value, the implementation of a weed management plan will mitigate this risk. Increased weed management through the lifetime of the Project is expected to maintain the connectivity and extent of suitable habitat. Therefore the Project is unlikely to fragment an existing population.
Result in genetically distinct populations forming as a result of habitat isolation.	Unlikely The Project will have the potential to identify and avoid direct clearing or disturbance of <i>A. armitii</i>, and will not reduce the population size or isolate suitable habitat areas. The Project is not expected to impede pollinator interactions or dispersal of seed, thereby restricting gene flow. Retained vegetation in the Project area also provides extensive areas for colonisation of this species. Given that the Project is unlikely to impact any known occurrences and that opportunities for breeding and dispersal will continue in the



Significant impacts criteria	Assessment
	landscape, the Project is not expected to result in the formation of genetically distinct populations of the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Unlikely The introduction of invasive weed species could threaten the habitat for <i>A. armitii</i>. The Project has potential to introduce weed species that can reduce habitat value; however the implementation of a weed management plan with weed hygiene protocols will mitigate this risk. Increased weed management through the lifetime of the Project is expected to maintain the connectivity and extent of suitable habitat. The Project is unlikely to result in increased feral animal or grazing stock abundance as the Project will not introduce any external food or water sources or changed grazing regimes. Feral animal management protocols will be implemented during the clearing, construction, operation and decommissioning phases of this with the intent to prevent negative impacts of invasive species as a result of the proposed action. Mitigation measures will be outlined further in the Project's Environmental Management Plan (EMP). Therefore it is unlikely that the Project will result in harmful invasive species becoming established in the habitat.
Introduce disease that may cause the population to decline	Unlikely There are no known diseases that have been identified as a threat to the <i>A. armitii</i>. The implementation of a weed management plan with weed hygiene protocols will assist to mitigate any risk of spread of disease or pathogens. It is considered unlikely that the Project will introduce a disease or pathogen that could cause the population to decline.
Interfere with the recovery of the species.	Unlikely While the Project intersects areas mapped as known or potential habitat for the species, the Project will avoid clearing or disturbing any occurrences of <i>A. armitii</i> and will minimise any vegetation disturbance required in the known habitat areas. Access during construction and operation will be planned to avoid areas that are known habitat for the species. Therefore the Project is considered unlikely to interfere with the potential recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	Unlikely The Project will be designed to avoid known occurrences of <i>A. armitii</i>, and will include a pre-clearance survey to identify any additional occurrences within areas of known or potential habitat for the species. Any individual of this species could be considered to be an ecologically significant location, depending on the positioning in the landscape and the health of the individual (influencing the likelihood of reaching maturity and achieving reproduction). Avoidance measures will be planned following pre-clearance surveys through tower placement and spanning individuals and patches of known habitat. Therefore the Project is considered unlikely to cause disruption to ecologically significant locations for the species.

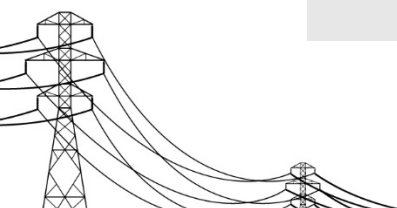


7.6.6 Squatter pigeon (southern)

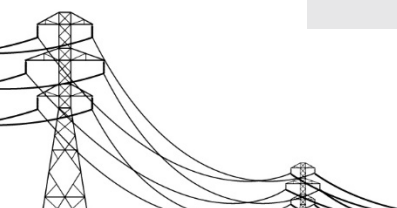
A significance of impact assessment of the Project on the squatter pigeon (southern) (Vulnerable under the EPBC Act and NC Act) is provided in Table 7-23.

Table 7-23 Significant impact assessment - squatter pigeon

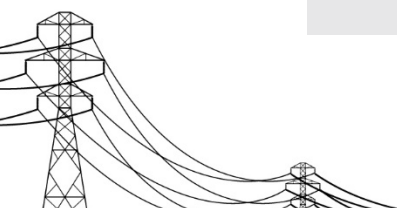
Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely Important populations of the squatter pigeon (southern) are listed as those small, isolated and sparsely distributed sub-populations at the southern extent of the sub-species current range. This includes areas south of the Carnarvon Range (Squatter Pigeon Workshop 2011). The local population is not among the important populations recognised by the Squatter Pigeon Workshop (2011). While the local population is at the northern extent of the sub-species range, squatter-pigeons are locally abundant and therefore unlikely to represent an important population. The total mapped suitable habitat for the species within Project activity areas is estimated as 32.54 ha of foraging habitat (representing 0.3% and 0.07% of foraging habitat within a 2.5 km and 10 km buffer of the Project respectively) and 5.25 ha of breeding habitat (representing 0.14% and 0.05% of breeding habitat within a 2.5 km and 10 km buffer of the Project respectively) is unlikely to lead to a long-term decline of an important population and is considered unlikely to lead to a significant decline in the local population. Construction of the Project has the potential to cause direct mortality and injury of squatter pigeons as result of clearing activities and / or vehicle strikes. This will be managed to minimise impact, but is not expected to be of sufficient scale to cause a drain on the local population, given that there will be no broad-scale land clearance. The Project is expected to be relatively benign in terms of its impact during the operational phase with negligible noise, lighting and vibration. Increased land management, particularly the potential for control of weeds has the potential to enhance the value of local habitats for the squatter pigeon. The Project is therefore unlikely to decrease the size of the local squatter pigeon population.
Reduce the area of occupancy of an important population	Unlikely As detailed above, the local population is unlikely to be considered an important population. The potential loss of 32.54 ha of foraging habitat will not lead to a reduction in the area of occupancy of the local population, as 99.8% of habitat will be retained within a 10 km buffer. The species is therefore likely to persist within the proposed corridor selection. Given the relatively benign nature of the Project in its operational phase, and the continued presence of suitable habitat within the local area, the Project is unlikely to reduce the area of occupancy of the local squatter pigeon (southern) population.
Fragment an existing important population into two or more populations	Unlikely Within the Project area, the squatter pigeon (southern) already utilises habitats that have been subject to a level of fragmentation, occurring in sparse, open woodland habitats impacted by cattle grazing, dams and local track networks. Clearing for the Project is expected to be linear with the rehabilitation of cleared areas not required for operation to significantly reduce the impacts of the Project. Habitat connectivity will



Significant impacts criteria	Assessment
	be maintained among areas of habitat both within the study area and adjacent to it by maintaining ground-level substrates and vegetation and by retaining existing unsealed tracks that provide pathways for local squatter pigeon movement. Although the Project has potential to introduce weed species that can reduce habitat value, this is not expected to be at a magnitude substantially greater than existing pastoral land use. The implementation of a weed management plan will mitigate this risk. Increased weed management through the lifetime of the Project is expected to maintain the connectivity and extent of suitable ground-level habitats and continue to facilitate ground-level movement of the squatter pigeon (southern). Given the loss of habitat represents only 0.6% of habitat locally available (i.e. within a 2.5 km buffer) and dispersal corridors along unsealed tracks will be increased, the Project is unlikely to fragment the population into two or more sub-populations.
Adversely affect habitat critical to the survival of a species	Unlikely Habitat critical to the survival of the species is not defined in the Commonwealth listing advice but is likely to include breeding habitat, particularly breeding habitat for important populations. The total mapped suitable habitat for the species within Project activity areas is estimated as 5.25 ha of breeding habitat. However, this loss is not likely to be considered significant in the context of the regional landscape, representing only 0.14% of that available locally (i.e. within a 2.5 km buffer) and 0.05% of that available regionally (i.e. within a 10 km buffer). Further reduction of impact on breeding habitat will be achieved through targeted surveys to identify and avoid nesting habitat by micro-siting towers, access tracks and other supporting infrastructure. Access to water sources and local on-ground connectivity between breeding and foraging habitat will be maintained during all stages of the Project. Tracks will be retained and managed as dusty, unsealed tracks to maintain opportunities for dispersal and local movement. While the Project will impact on habitat critical to the survival of the species, with a combination of habitat management and rehabilitation, the result of the Project is unlikely to adversely affect the local population.
Disrupt the breeding cycle of an important population	Unlikely As detailed above, the local population is not among those important populations identified in the Commonwealth listing advice for the species. Breeding habitat for the squatter pigeon (i.e. hills and rises with rocky, loamy and sandy soils) occur within the eastern extent of the study area. While approximately 5.25 ha of potential breeding habitat is mapped within Project activity areas, this represents only 0.14% of potential breeding habitat available locally (i.e. within 2.5 km of the Project) and 0.05% of that available regionally (i.e. within 10 km). Micro-siting of towers and other infrastructure will be undertaken to further minimise the impact on breeding habitat. Connectivity will be maintained with adjacent drinking sources (e.g. dams and water troughs) to support the viability of local breeding habitats. Construction activities have the potential to cause short-term disruption to breeding activities immediately adjacent to construction areas. Construction will be



Significant impacts criteria	Assessment
	prioritised to be undertaken during dry conditions to reduce the potential for indirect impacts to tracks and adjoining habitats from stormwater run-off from construction areas. While this coincides with the peak breeding season for the species, the impact will be temporary and is unlikely to result in a loss of an entire annual cohort as the species is expected to continue to breed in some areas that are located further from construction areas and the species is known to breed all year round (Squatter Pigeon Workshop 2011). The Project is therefore not expected to disrupt the breeding cycle of the population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely The Project will have only minimal impact on breeding habitat, resulting in a potential loss of 5.25 ha (as a maximum), representing 0.14% of that available within a 2.5 km buffer. The loss of 32.54 ha of foraging habitat is unlikely to represent a significant decrease in the availability of foraging habitat for the species at a population level, as it represents only 0.05% of the available foraging habitat within the surrounding 10 km buffer. Where towers or construction laydown areas are situated within squatter pigeon (southern) habitat, these areas of foraging habitat will still be available after construction. Given the small magnitude of the loss of habitat and the potential for ongoing use of these areas, the Project is unlikely to cause a decline in the local population.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely Known feral predators of the squatter pigeon (southern) (i.e. dogs, cats and foxes) have been confirmed present within the study area. The Project will not introduce any external food sources that could increase the local densities of feral predators. Feral animal management protocols will be implemented during the clearing, construction, operation and decommissioning phases of the Project with the intent to prevent negative impacts of invasive species. Mitigation measures will be outlined further in the Project's EMP. Unmitigated, the Project has the potential to reduce the extent and quality of local foraging habitat by facilitating the on-site spread of weeds. The inclusion of weed management controls (also contained in the Project EMP) has the potential to enhance the local foraging habitat values and result in positive outcome for the squatter pigeon (southern).
Introduce disease that may cause the species to decline	Unlikely No diseases or pathogens are identified among current known threats to the squatter pigeon (southern). The weed-washdown and hygiene protocols that will be implemented through construction to manage the on-site spread or export of weeds will also act to reduce the potential for transmission of disease. This risks to squatter pigeons associated with disease transmission are therefore considered negligible.
Interfere sustainably with the recovery of the species	Unlikely The Project is considered unlikely to adversely affect the potential recovery of the species. As previously mentioned, the loss of foraging habitat is unlikely to be significant at a local or regional scale. Implementation of a Weed Management Plan for the Project has the potential to increase the value of local habitats. Local noise disturbance and mortality threats associated with the Project are also expected to be



Significant impacts criteria	Assessment
	low and any removal, isolation or decrease in availability or quality of habitat for this species is unlikely to interfere with the recovery of the species.

7.6.7 Koala

The significance of the Project's impacts on the koala has been assessed in accordance with the EPBC Referral Guidelines for the vulnerable koala (DoE, 2014), specifically including:

- An assessment of the potential to impact 'habitat critical to the survival of the koala.
- An assessment of the potential to interference with the recovery of the species.

The significance of impacts are then summarised using the framework detailed in the Significant Impact Guidelines 1.1 (DoE, 2013) to provide consistency of approach with other conservation significant species listed under the EPBC Act.

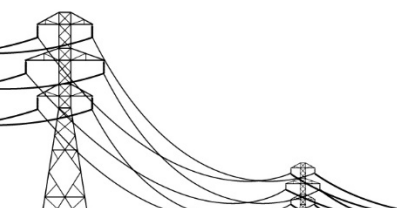
The Project is **unlikely** to have a significant impact on koala as detailed in Table 7-24. Justification for this assessment is provided below, and has been made with reference to the Referral guidelines to the vulnerable koala (DoE 2014).

Assessment of koala habitat value

The Referral guidelines for the vulnerable koala (DoE 2014) provide a framework for scoring koala habitat value. These suggest that one koala habitat value should be assigned to a project area. However, this may not be appropriate for a linear project that spans over 1060 km. To accurately reflect the value of habitats across the Project, habitat scores have been assigned for each habitat type (high, moderate and low) and section (coastal, inland and western inland) in Section 5 and 6 of the Volume 3 Appendix P Ecological Assessment. All high, moderate and low value habitat within the coastal area scored 5 or more and were considered habitat critical to the survival of the species. Potential habitat further than 5 km from drought refuge in inland areas and further than 1 km from drought refuge in western inland areas scored less than 5 and were not considered habitat critical to the survival of the species and rated as very low. The assessment of impact has been undertaken based on the magnitude of the loss of habitat critical to the survival of the species and consideration of the significance of impact due to interference with the recovery of the species.

Table 7-24 Koala habitat assessment

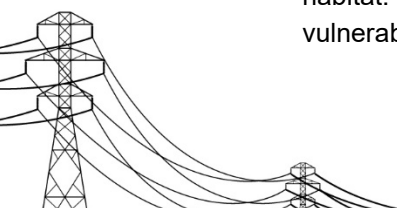
Attribute	Score	Description	Justification
Koala occurrence	+ 2 (high)	Evidence of one or more koalas within the last 5 years.	Evidence of the koala was recorded from two locations within the corridor selection.
Vegetative composition	+ 2 (high)	Has forest, woodland or shrublands with emerging trees with 2 or more known koala food tree species, OR 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata	Mixed eucalypt woodlands were recorded throughout much of the Renewable Energy Hub and areas in the east of the CopperString Core sections of the corridor selection.



Attribute	Score	Description	Justification
Habitat connectivity	+ 2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	The corridor selection intersects a landscape that contains patches of vegetation above 1000 ha.
Key existing threats	+ 1 (high)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence,	The corridor selection extends through areas that are relatively uncleared and separate from large road networks. In addition, the corridor selection is not in proximity to any urban areas, thereby reducing the likelihood of dog attack. However, local koala populations are known to be subject to periodic threats from drought.
Recovery value	+ 1 (high)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context,	The habitat within the corridor selection is likely to be important in achieving the interim recovery objectives for the species. These being: • Protect and conserve the quality and extent of habitat refuges for the persistence of the species during droughts and periods of extreme heat, especially in riparian environments and other areas with reliable soil moisture and fertility. • Maintain the quality, extent and connectivity of large areas of koala habitat surrounding habitat refuges
Total	8	Habitat is considered critical to the survival of the species.	

Significance of impact on habitat critical to the survival of the species

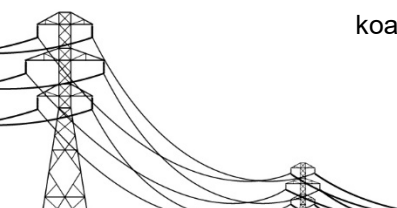
Within areas of mapped koala habitat, the Project is able to achieve substantial avoidance of impact on koala food trees. Much of the vegetation intersected is less than 15 m in height and can be spanned. Similarly, impact on taller riparian woodland vegetation has been avoided in most instances by elevating spanning heights at watercourse crossings (refer to mitigations in Section 7.5), thereby avoiding much of the high value habitats where koala utilisation is likely to focus. Formal access tracks do not need to be constructed and given the vegetation in most moderate and low value koala habitat areas is sparse to very sparse, construction vehicles can wind a path through open woodland to the tower locations without clearing vegetation. The total koala habitat areas (habitat critical to the survival of the koala) that have been mapped within Project activity areas is estimated in Section 7.6.7. Based on this, there is potential for the Project to disturb 97.04 ha of habitat critical to the survival of the koala. This represents 0.11% of koala habitat within a 2.5 km buffer and 0.02% of koala habitat within a 10 km buffer. While the magnitude of impact is not trivial, the loss of habitat is accumulated over a large geographic scale and will impact on koala populations that functionally isolated by large areas of unsuitable habitat. Population impacts will be limited to a local scale. The Referral guidelines for the vulnerable koala (DoE 2014) provide threshold limits above which a project may be likely to



have a significant impact. However, the guidelines suggest that these thresholds may not apply to all projects. The thresholds may not be appropriate to assess impacts on a linear project of this scale is, as the loss of habitat is likely to be impacting multiple isolated koala populations.

Under such circumstances, the guidelines suggest the significance of a project's impact on habitat critical to the survival of the koala can be assessed using the assessment criteria for 'Impacts uncertain' as specified in Figure 2 of the Referral guidelines for the vulnerable koala (DoE 2014). In accordance with the guideline, the significance of the Project's impact on habitat critical to the survival of the koala was assessed based on the following factors:

- **Koala habitat score:** Koala habitats within the Project area vary in quality across the extent of the Project ranging between scores of 4 and 8. High value habitats generally scored 8 - 9, moderate value habitats scored 7 - 8 and low value habitats scored 4 - 5. Koala scores have been factored into risk avoidance strategies. Areas of high value adjacent to watercourses will be spanned requiring only minimal clearance of vegetation. Lower value habitats have lower height and tree densities, allowing more opportunities for avoidance by spanning and micro-siting of towers.
- **Amount of habitat to be cleared:** There is potential for the Project to disturb 97.04 ha of habitat critical to the survival of the koala (ranging from low to high value habitat for koala). This represents 0.11% of koala habitat within a 2.5 km buffer and 0.02% of koala habitat within a 10 km buffer. While the cumulative area of habitat loss is substantial, the open woodland habitats impacted typically have sparse to very sparse tree densities. The physical loss of koala habitat trees per hectare is therefore substantially lower than it would be in areas of woodland. The loss of habitat is accumulated over a large spatial scale and is unlikely to result in a significant reduction in the proportion of habitat locally available to koala populations. Measures will be undertaken to reduce the magnitude of habitat loss by micro-siting access tracks and other infrastructures and spanning areas with increased local densities of koala food trees and potential movement corridors such as riparian vegetation.
- **Method of clearing:** The Project has the flexibility to refine tower positions at a localised scale to minimise direct loss of koala food trees. In areas of important koala habitat, surveys will be undertaken to identify the most appropriate tower locations. High value areas have been mapped to allow avoidance by spanning vegetation, particularly at watercourse crossings. Construction of the project does not require a formal cleared access track or the persistence of a permanent access track for maintenance. Clearing can be substantially minimised. Clearing will be required in some localised areas of sensitive koala habitat. Where this occurs, clearing will be directed by koala sensitive clearing protocols, selectively clearing individual koala trees in localised areas and sequentially clearing koala habitat in other areas. All clearing will be supervised by koala-specialist spotter-catchers and will allow koalas to disperse on their own accord.
- **Density and abundance at which koalas occur** Koalas are known to occur in low densities in inland regions of Queensland. The low number of records observed in field surveys for the Project supports this. Riparian woodlands represent areas of increased local importance, critical for foraging and movement of individuals. However, even in those areas, densities of individuals is typically low.
- **Level of fragmentation caused by the project:** The Project is unlikely to cause any substantial fragmentation of koala habitat as it impacts areas with very sparse natural tree densities in a landscape that has existing levels of fragmentation due to land clearing for pastoral activities. The Project will have a high span, no permanent access track or fencing. While the Project intersects numerous watercourses that provide important pathways for koala movement, impacts on these corridors has been avoided by elevating spans at



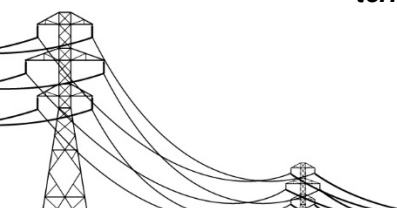
watercourse crossings. The Project is therefore unlikely to cause any substantial fragmentation of koala habitat or impose any barrier to koala movement.

While the Project will result in a relatively large magnitude of impact, this is spread over a very large geographic area as a linear footprint, and will result in only minor losses of habitat when considered at a local scale, equating to a loss of 0.11% within a 2.5 km buffer of the Project. Given the method of clearing, the lack of anticipated fragmentation and the low density at which koalas occur in the local landscape, the Project is considered unlikely to have a significant adverse impact on habitat critical to the survival of the species in the context of the existing receiving environment.

Significance of impact due to interference with the recovery of the species

The Project is unlikely to significantly interfere with the recovery of the species. The Project is anticipated to be relatively benign in terms of its likely impact on koalas. As detailed in the Referral guidelines for the vulnerable koala (DoE 2014), an assessment of the potential interference with the recovery of the species has been undertaken considering the following factors:

- ***Will the Project increase fatalities due to dog attacks to a level that is likely to result in multiple, ongoing fatalities?*** The Project is not expected to result in any change in the abundance of wild dogs. While the Project will result in the creation of new maintenance access tracks that will facilitate local movement of wild dogs, a large number of farm tracks exist in the landscape and are already utilised by wild dogs for movement. Accordingly, the introduction of additional access tracks is not expected to have a measurable impact on local dog numbers or the subsequent frequency of dog attacks on koalas. Wild dog control currently occurs throughout the region. Feral animal control will be undertaken through the construction and will reduce or at least maintain current risks of dog attacks for koalas.
- ***Will the Project increase koala fatalities due to vehicle strikes to a level that is likely to result in multiple ongoing fatalities?*** The Project will result in an increase in vehicle movements during the construction period. This carries a risk of increased vehicle strike however, this will be mitigated through standard controls such as speed limits and workforce awareness. During operation, the risks of ongoing mortality from vehicle strikes is low, given the Project will only result in very occasional movements of maintenance vehicles not dissimilar to that already experienced in the receiving environment.
- ***Will the Project facilitate the introduction or spread of pathogens such as Chlamydia or Phytophthora cinnamomi that are likely to significantly reduce the reproductive output or the carrying capacity of the habitat?*** The use of standard hygiene protocols in vehicle movements during construction means that the potential for introduction of Phytophthora is relatively limited. The Project is relatively benign during the operational phase and is unlikely to have any impact on levels of Chlamydia in the local koala population (DoE 2014a).
- ***Will the Project create a barrier to movement between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala?*** The Project is not expected to result in any substantial fragmentation of habitat. The Project in most cases, spans vegetation and does not require permanent access tracks or fencing. The Project is therefore unlikely to pose any barrier to koala movement or fragmentation of koala habitat.
- ***Will the Project change hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term?*** The Project will have no substantial impact on hydrology that could degrade the



quality of koala habitat. Watercourse crossings will have no impact on bed or banks that could alter hydrology.

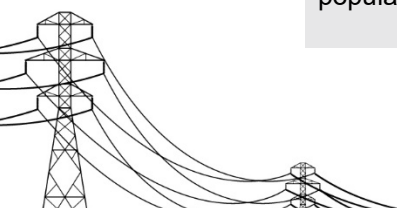
Based on these factors, the Project is considered unlikely to significantly interfere with the recovery of the species.

Significance of impact assessment

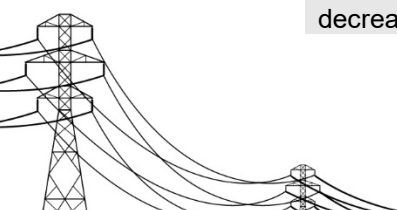
Using the information detailed above, the significance of the Projects' impact on the koala has been assessed in accordance with the Commonwealth Significant impact guidelines 1.1 (DoE 2014). Based on the justification in Table 7-25 below, the Project is considered unlikely to have a significant impact on the koala.

Table 7-25 Significant impact assessment - koala

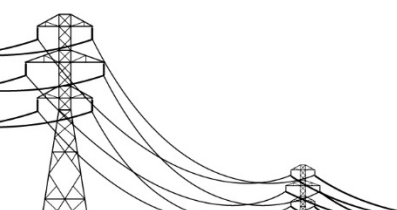
Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of a species	Unlikely The concept of 'important populations' has not been applied for koala, given a lack of sufficient information on the national population (DAWE 2020b) and the Project does not occur near the edge of the species' known range (for combined populations of Qld, NSW and the ACT). The suitable habitat identified during desktop assessments and field surveys occurs within the Renewable Energy Hub, with the potential for the Project activities to disturb up to 97.04 ha of suitable koala habitat (comprising high, moderate and low value koala habitats). This represents a small percentage (0.02 %) of habitat available within a 10 km buffer of the Project area and is unlikely to lead to long-term decrease in the size of the population. The use of sequential clearing practices and the employment of a fauna spotter catcher during clearing will further mitigate to risks to the species. Additionally, the likelihood of vehicle strikes can be mitigated by the implementation of safe driving practices.
Reduce the area of occupancy of an important population	Unlikely The Project is not expected to result in the disappearance of koalas from a 2 km x 2 km area that would result in a reduction in the area of occupancy of the species. While the Project will intersect 700.39 ha of mapped suitable koala habitat, substantial avoidance of koala habitat has been achieved to reduce the on-ground clearance of koala food trees. By micro-siting towers, elevating spans to avoid riparian woodland and selecting construction access routes that minimise the need to clear koala food trees, the loss of koala habitat has been reduced to 97.04 ha. . For example, by avoiding the high value riparian habitats, the area of disturbance was reduced by 13.52 ha. The loss of 97.04 ha of koala habitat is accumulated over a linear distance of approximately 350 km. The loss of 97.04 ha is dispersed over a broad area and represents only 0.02 % of foraging habitat within a 10 km buffer of the Project. As a consequence, the local impacts within any 2 km x 2 km area will be relatively minor. Once operational, the Project will have negligible impact on the species, forming no barrier to koala movement. Given these factors, no reduction in the area of occupancy of the species is anticipated.
Fragment an existing important population into	Unlikely The Project will cause an estimated loss of 97.04 ha of koala habitat. Koalas predominantly utilise riparian corridors for movement, particularly in the inland areas. Koala movement corridors have been protected from



Significant impacts criteria	Assessment
two or more populations	impact by elevating spans to avoid impact on riparian woodland. This will substantially reduce potential fragmentation that could otherwise have resulted from the Project. In more densely vegetated areas at the east of the Project, there will be a requirement to clear a 60 m-wide corridor. In the context of that landscape, the impact is not a substantial increase in fragmentation and not expected to pose a barrier to koala movement. No fencing or permanent access tracks will be required, further limiting the potential for barrier effects. Due to the high-set nature of the Project and the low density of woodland habitats along most of the project area, the Project will not cause a substantial fragmentation of koala habitat or impose restrictions to koala movement.
Adversely affect habitat critical to the survival of a species	Unlikely The Project is unlikely to have an adverse impact on habitat critical to the survival of the species. The Project will result in a loss of 97.04 ha of koala habitat scoring 8 in the Commonwealth habitat toolkit. While this exceeds the threshold given in the Referral guidelines for triggering a significant impact, the guidelines state that the thresholds may not be relevant to all projects. Given the impact is dispersed over a linear distance of 350 km and impacts multiple koala populations that are spatially isolated from one another, the localised impacts are considered substantially reduced. The anticipated loss of habitat represents only 0.11% and 0.02% of koala habitat within a 2.5 km and 10 km buffer of the Project respectively. Given the method of clearing, incorporating a mix of selective and sequential clearing under the direction of koala-specialist spotter-catchers, the lack of anticipated fragmentation (due to the very sparse density at which koala food trees occur in the surrounding landscape) and the low density at which koalas occur, the Project is considered unlikely to have a significant adverse impact on habitat critical to the survival of the species in the context of the existing receiving environment.
Disrupt the breeding cycle of an important population	Unlikely The Project is not expected to disrupt the breeding cycle of the population. The koala breeding season is generally between September and March, with females giving birth to a single young between October and May. During the breeding season, males actively seek females and koala movements are more extensive. Without mitigation, the Project could lead to an increased risk of vehicle strike. Traffic volume, speed and visibility influence the koala collision rate. Prevett <i>et al.</i> (1995) found that road kills occurred where vehicle speeds exceeded 80 km/hr and where wider habitat corridors or linear forests occurred on both sides of the road. Potential impacts will be mitigated through implementation of on-site speed limits and signage in koala habitat areas. Clearing within koala habitat areas will be planned to occur outside of peak breeding season (if possible) and standard best practice sequential clearing using koala spotters will be exercised.
Modify, destroy, remove, isolate or decrease the	Unlikely The Project activities are predicted to occur within 97.04 ha of mapped suitable koala habitat, which accounts for only 0.02% of koala habitat



Significant impacts criteria	Assessment
availability or quality of habitat to the extent that the species is likely to decline	within 10 km of the Project area. Although clearing will cause minor additional fragmentation of habitat and reduce the area of available habitat, the extent of linear habitat disturbance is not likely to decrease the availability or quality of habitat available to the local population to the extent that the species will decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely Invasive species including wild dogs already occur throughout the study area. Predatory species are attracted to prey opportunities presented by cleared linear corridors or prey moving away from disturbance areas. While new infrastructure has the potential to increase the risk of wild dog attack on koala by facilitating regional movement of dogs, these threats are already present within the receiving environment. Feral animal control measures will be implemented throughout the duration of the Project and have been designed to mitigate such risks. There is also potential for the spread of invasive weeds during the construction and operation phase. This potential will be addressed within a Weed Management Plan, and could provide the opportunity to enhance the quality of the environment utilised by the koala by providing mitigation measures to combat introduced species. The eradication of ground-covering weeds could enhance local koala movement. If mitigation measures are implemented correctly, the Project is unlikely to result in the introduction of invasive species that are harmful to the koala.
Introduce disease that may cause the species to decline	Unlikely The Project is not anticipated to introduce new diseases that may cause the species to decline. Stress may lead to an increase in the expression of chlamydia in koalas, however the implementation of mitigation measures such as sequential clearing, site speed limits, use of experienced spotter-catchers during clearing and the requirement to allow koalas to self-disperse will reduce disturbance-related stress and risk of disease. Additionally, the species is susceptible to <i>Phytophthora cinnamomi</i> due the soil fungus's ability to infect eucalypt species. Biosecurity requirements (e.g. weed and seed declarations) will be implemented for the Project, and thus, this risk has been assessed as low.
Interfere substantially with the recovery of the species	Unlikely Impacts will be relatively limited in spatial extent and will occur within a landscape in which koala habitat is relatively extensive and widespread. The Project is unlikely to substantially increase the mortality of koalas in the long term or lead to a substantial loss in habitat connectivity or barrier effects. All impacts are expected to be localised to within the Project area. Impacts along the transmission line are expected to be consistent with existing levels of impact from habitat fragmentation and exposure to road noise and traffic. The Project is unlikely to substantially interfere with the recovery of the species.

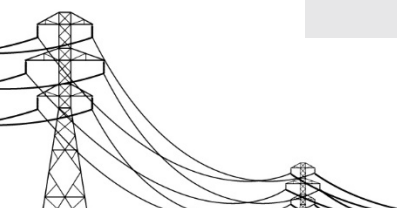


7.6.8 Black-throated finch (southern)

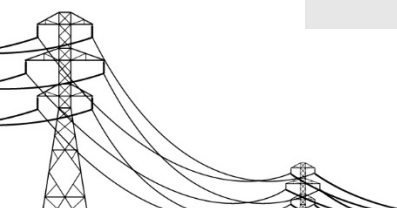
A significance of impact assessment of the Project on the black-throated finch (southern) (Endangered under the EPBC Act and NC Act) is provided in Table 7-26.

Table 7-26 Significant impact assessment – black-throated finch

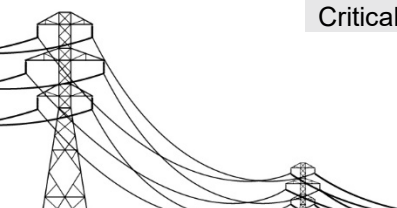
Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a population of the species	Unlikely In recent years, the range of the black-throated finch (southern) has undergone considerable contractions as a result of habitat clearing and fragmentation and the species is now locally common at only a few sites around Charters Towers / Townsville (NSW and Queensland Governments, 2004). Therefore, the local population may be considered important in the context of the whole species and any impacts to local populations may equate to a long-term decrease to the species. The area between Prairie and Torrens Creek is also recognised as an important area for the species in the Significant impact guidelines for the black-throated finch (southern) (DEWHA 2009). The Project has incorporated substantial measures to avoid impact on key habitats. Waterbodies that represent key drinking sites have been identified and avoided in the corridor selection process. The Project will result in no loss of drinking sites. Breeding habitats surrounding those waterbodies have also been largely avoided. While the corridor does intersect some areas of potential breeding habitat, these areas will be subject to targeted surveys to microsite towers and access routes to avoid direct impact on breeding habitat. As the Project does not require permanent access tracks and will form construction tracks through vehicle movements, the permanent impact on foraging habitat is also limited. While the Project intersects 290.99 ha of mapped black-throated finch (southern) suitable habitat, the footprint impacts within that area will be substantially reduced through avoidance and mitigation measures. The loss represents only 0.2% of local habitat (i.e. within a 2.5 km buffer) and 005% of regional habitat (10 km buffer). Given the avoidance measures implemented, the Project is unlikely to have an impact at a population level, that would result in a decrease in the size of the local population.
Reduce the area of occupancy of the species	Unlikely Permanent occupancy of an area by the black-throated finch is generally limited to areas where there are patch sizes of woodland vegetation in excess of 40 ha, proximity to permanent water (within 400 m) and a variety of perennial and annual grasses available all year round (NRA 2006). Where these factors are not met, black-throated finches can be locally nomadic, and will temporarily access available resources (e.g. perennial seeding native grasses) on an opportunistic basis. The Project intersects approximately 290.99 ha of potential habitat for the black-throated finch (southern). This is spread over a large geographic area and represents 0.2% of the habitat locally available within a 2.5 km buffer. Key breeding and drinking sites have been avoided in early corridor selections and will be further avoided by undertaking targeted surveys of potential breeding habitat to microsite towers and access tracks in areas of low habitat value. As a



Significant impacts criteria	Assessment
	consequence of these measures, the majority of impact is on foraging habitat in areas away from water points. Within land adjacent to the study area, there are adequate alternative foraging areas to sustain the species during construction should construction operations deter the species. Permanent access tracks will not be formed. The impacts imposed by construction vehicle movements, which will be restricted to a single dedicated route will be temporary in nature. Post construction, groundcover (in the form of grasses) will recolonise and provide continued resources for the local black-throated finch (southern) populations. Additionally, pest management practices have the potential to enhance the quality of existing habitat by reducing weed and pest abundance. Given the avoidance and mitigation measures implemented, the Project is not expected to result in the disappearance of the black-throated finch (southern) from any 2 km x 2 km area and is therefore unlikely to result in a reduction in the area of occupancy of the species.
Fragment an existing population into two or more populations	Unlikely Considering the species' nomadic nature, the easement is considered unlikely to fragment the species into two or more populations. As no physical barriers will be constructed and grasses will persist within the easement, the species is anticipated to continue to use the area without restriction. Given the high span of the Project and the avoidance measures that have been implemented to avoid impact on key drinking sites, the Project is not expected to represent a constraint to movement or fragment the existing population.
Adversely affect habitat critical to the survival of a species	Unlikely Habitat critical to the survival of the species is likely to include key breeding habitats associated with drinking sites and areas of high value foraging habitat. The majority of key drinking and breeding sites have been identified and avoided in the corridor selection process. Targeted surveys of potential breeding habitat will be undertaken in early 2021 to allow local micro-siting of towers and selection of temporary access routes to avoid key habitat areas. While the Project intersects 290.99 ha of foraging habitat, the impact on these areas will be substantially reduced, as the powerlines will in most cases, span vegetation with minimal requirement for permanent clearing. As no earthworks or grading will be undertaken for access, movement of construction vehicles will cause only temporary disturbance to foraging habitat. Areas of key foraging habitat will be rehabilitated after construction. Clearing for the Project is anticipated to be linear across a large geographic area and cleared areas within the easement are not required to remain clear during operations. Therefore, the majority of cleared black-throated finch (southern) habitat can be rehabilitated with native grasses after construction. Additionally, pest management practices have the capacity to enhance the quality of existing habitat by reducing weed abundance and feral pests within the study area. The employment of a fauna spotter catcher to ensure environmentally responsible clearing practices are employed and that no clearing is undertaken in 'no go' areas will further mitigate potentially adverse



Significant impacts criteria	Assessment
	impacts to the specie's habitat. Based on these considerations, the Project is unlikely to adversely affect the habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	Unlikely The majority of Project construction works are scheduled to occur during the dry season, outside the species' usually breeding period. The black-throated finch generally breeds during the wet season (February – May), though breeding can occur throughout the year under optimal conditions (Higgins et al. 2006; NRA 2007). Nests are usually made within 400 m of a perennial watercourse or waterbody. Key drinking and breeding sites have been identified and avoided through the corridor selection process. Some areas of breeding habitat surrounding waterpoints will be intersected. These areas will be subject to targeted surveys in 2021 to identify and avoid areas of confirmed and potential value as breeding and nesting sites. This can be achieved by micro-siting towers and temporary construction access routes. These measures will allow the Project to avoid impact on key breeding habitats. Increased noise, clearing of habitat and the construction of transmission lines and site offices have the potential to disrupt the species breeding cycle of the population. Strict measures will be outlined in the Project's EMP and implemented in these areas to minimise indirect impacts on breeding activities. This will involve scheduling construction in areas of black-throated finch breeding habitat outside the key breeding period (February – May). Given the avoidance measures achieved, the Project is unlikely to adversely affect the breeding cycle of a population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely As previously mentioned, potential drinking and breeding sites have been avoided through the corridor selection process. Targeted surveys will be undertaken in the few areas of potential breeding habitat that will still be intersected to micro-site construction access routes to avoid impact on breeding habitat. Despite the avoidance measures, some foraging habitat will be directly impacted. Clearing will occur in localised areas along a linear footprint. Disturbance for access tracks will be temporary, with no excavation or grading required. Grasses will not be cleared for construction access. Foraging habitat will persist within the easement. The Project does not align with any of the actions known to diminish habitat quality for the species, as outlined in the Significant Impact Guidelines for the species (DEWHA 2009). Clearing of grassy woodland, earthworks and excavation will only be required at localised areas, i.e. hardstands where stringing and pulling of lines is required during construction. These will be micro-sited to avoid areas of high habitat value. Given the avoidance measures implemented, the Project is not expected to modify, destroy or isolate habitat to the extent that populations will decline.
Result in invasive species that are harmful to a Critically	Unlikely The implementation of a weed control program, as part of the Project's EMP, will be designed to limit the introduction of invasive species during construction and rehabilitate areas of current weed infestations.



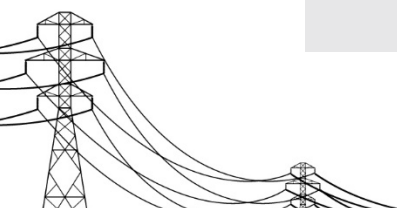
Significant impacts criteria	Assessment
Endangered or Endangered species becoming established in the Critically Endangered or Endangered species' habitat	This can increase the abundance of native grass species by reducing competition by exotic species, whilst also potentially reducing predation risks by pest species e.g. feral cats. This has the potential to not only preserve the current condition of the site. By introducing increased pest management investment in an area that is already subject to weed and pest infestations has the potential to enhance the quality of the habitat for black-throated finch (southern) within the study area.
Introduce disease that may cause the species to decline	Unlikely There are no known diseases affecting black-throated finches that could be introduced through the construction of the proposed works. There is a very rare chance that soil pathogens that affect the health of vegetation may be introduced via construction machinery although washdown procedures (designed to limit the spread of weeds) are considered adequate to remove foreign soil prior to entering site. In all cases, there would be no known introduced diseases that may cause the species to decline.
Interfere with the recovery of the species	Unlikely With the application of habitat management and weed management practices, it is expected that any modification, removal, fragmentation or decrease in availability or quality of habitat for this species would not be to an extent that is likely to interfere with the recovery of the species. Furthermore, the Project has the potential to increase the quality of habitat within the study area, which could support local recovery efforts for the species.

7.6.9 Julia Creek dunnart

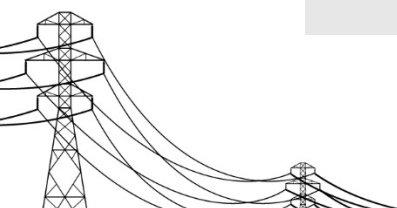
A significance of impact assessment of the Project on the Julia Creek dunnart (Vulnerable under the EPBC Act and Endangered under the NC Act) is provided in Table 7-27.

Table 7-27 Significant impact assessment – Julia Creek dunnart

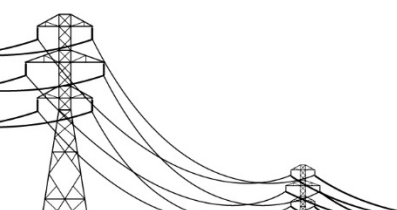
Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population	Unlikely The installation and construction of transmission towers has the potential to impact on the species directly if individuals are residing locally within the impact areas. Earthworks are expected to impact the integrity of the soil crack networks within the immediate vicinity of the construction areas. This could directly impact on the species foraging and breeding habitat. However, impacts are relatively localised and suitable foraging and breeding habitat is patchy and locally abundant where the species occurs. As such, towers can be micrositied to avoid areas of high microhabitat value (i.e. areas with high densities of deep cracking clay). Given the local prevalence of habitat, any local habitat loss is unlikely to have a significant impact on the local or regional availability of habitat. Furthermore, rehabilitation efforts following construction have the ability to restore the species' habitat and increase even increase



Significant impacts criteria	Assessment
	habitat quality following the implementation of weed and pest management techniques. Overall, the Project is considered unlikely to lead to a long-term decrease in the size of a population of the species.
Reduce the area of occupancy of an important population	Unlikely The Project activities will occur within an estimated 107.22 ha of mapped potentially suitable habitat for the species. This equates to only 0.16% of the potential habitat within a 2.5 km buffer and 0.04 with a 10 km buffer, as suitable habitat is locally abundant. Earthworks and other invasive construction activities have the potential to cause direct mortality of individuals. However this can be mitigated by micro-siting towers away from areas of high microhabitat value and through the use of suitably qualified fauna spotter-catchers. The Project is expected to be relatively benign during the operational phase. Provided the construction risks can be mitigated, the Project is unlikely to result in the disappearance of individuals from any 2 km x 2 km area (i.e. the scale at which area of occupancy is measured). As such, the Project is unlikely to result in a reduction in the area of occupancy of the species.
Fragment an existing important population into two or more populations	Unlikely As previously mentioned, the linear removal of 107.22 ha only represent a minor portion (0.2%) of the potential habitat available within the local landscape (i.e. within a 2.5 km buffer). Due to the linear nature of the required clearing and the distance (400 m) between sites of ground disturbance (tower locations) the Project is considered unlikely to fragment an existing population into two or more populations. No physical barriers will be constructed as part of the Project and the species will maintain the ability to move through the surrounding area. Following construction, groundcover is to be reinstated / rehabilitated which could further promote species' abundance in the area and reduce the likelihood of population fragmentation.
Adversely affect habitat critical to the survival of a species	Unlikely The Project is situated within a mosaic of moderate to high quality habitat. Within these areas, impacts are scattered and will not be applied across the entirety of the corridor selection. The mitigation measures outlined in the EMP (e.g. machinery restricted to previous roads, establishment of 'no go' zones) the Project are anticipated to reduce the effects of the Project on the habitat of the species. Considering that suitable habitat was locally abundant within the study area, and towers can be micro-sited to minimise local impact on high value microhabitats, the loss of habitat is not considered likely to be significant.
Disrupt the breeding cycle of an important population	Unlikely Construction is anticipated to be undertaken during the dry season (autumn/winter), outside of the species breeding season. Clearing footprints in areas of potential habitat for the Julia Creek dunnart will be reduced to areas required for construction of towers and other hard infrastructure. Towers will be micro-sited to avoid areas with high densities of cracking clay that may represent potentially suitable breeding habitat. Experienced spotter-catchers will direct all clearing



Significant impacts criteria	Assessment
	activities in areas of suitable habitat for the Julia Creek dunnart in accordance with the requirements of a High Risk SMP. Based on these factors, the Project is unlikely to significantly disrupt the breeding cycle of an important population of the Julia Creek dunnart.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely Although the Project will potentially result in the modification, destruction, removal or degradation of 107.22 ha of potential habitat, these impacts are considered unlikely to cause the species to decline. Potential habitat is abundant in areas adjacent to the Project area and considering that groundcover will be reinstated following construction, all impacts are considered temporary and unlikely to be of a magnitude that would cause the species to decline. The majority of construction impacts are anticipated to be mitigated by the employment of environmental management techniques outlined in the Project EMP.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely The Project area is currently used for cattle grazing, and exotic species are present within the Project area. The development of the Project area has the potential to result for a positive outcome by reducing the total of occupancy of weeds (notably prickly acacia) through weed management practices contained within the Project's EMP. Prickly acacia is a recognised threat to the Julia Creek dunnart (QPWS 2005) so any localised reduction in weed extent within areas of habitat will benefit local populations. While the Project has the potential to facilitate movement of feral animals such as cats, dogs and foxes, as these preferentially move along tracks, the magnitude of change is unlikely to represent a material difference to the existing landscape, where tracks are relatively abundant on adjacent pastoral properties.
Introduce disease that may cause the species to decline	Unlikely There are no known diseases affecting the Julia Creek dunnart that could be introduced through Project. There is a very rare chance that soil pathogens that affect the health of Mitchell grasslands habitat may be introduced via clearing machinery but there are no known introduced diseases that may cause the species to decline.
Interfere substantially with the recovery of the species	Unlikely Current recovery efforts are focused on known populations of the species. The Project is intersecting grasslands which surround Julia Creek and supports a known population of the Julia Creek dunnart. The National recovery plan for the Julia Creek dunnart (DERM 2009) outlines six specific objectives for the species' conservation, of which the Project has the potential to contribute to three, specifically: • Verifying the distribution of the species and map 'essential habitat'. • Reducing the impact of threatening processes on Julia Creek dunnart populations. • Promoting awareness of Julia Creek dunnart. Detailed surveys conducted as part of the Project have the potential to advance these specific recovery objections.



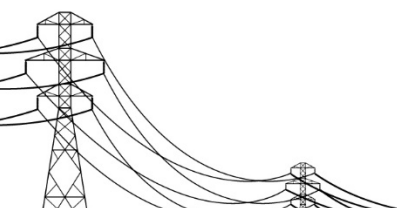
Significant impacts criteria	Assessment
	In relation to construction impacts, although the Project will require earthworks which could impact the species, the application of habitat rehabilitation techniques will aid in mitigating the impacts to the Project. Additionally, weed and pest management activities targeted at reducing exotic plant invasion and feral pest predation pressure will further advance recovery efforts for the species within the Project area.

7.6.10 White-throated needletail

A significance of impact assessment of the Project on the white-throated needletail (Vulnerable and listed migratory under the EPBC Act and Special Least Concern NC Act) is provided in Table 7-28.

Table 7-28 Significant impact assessment– white-throated needletail

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The white-throated needletail is regarded as a transient visitor to the study area, as the species moves through the region in response to climatic conditions (e.g. bushfires, wind fronts and storm fronts). The species is almost exclusively aerial and is therefore not reliant on terrestrial habitat types (Cramp 1985). Clearing and earthworks activities are unlikely to lead to a long-term decrease in the size of the population of the species as no habitats or resources critical to the species will be impacted. Construction based impacts (e.g. increased dust) are anticipated to be temporary.
Reduce the area of occupancy of an important population	Unlikely This nomadic species possesses no specialised habitat requirements, due to its exclusively aerial nature. Therefore, although clearing will be required for the Project, the Project will have negligible impact on habitat. The Project is likely to be relatively benign in its impact on the species during the operational phase. The species has some potential for collision with transmission lines. However the risks are considered low. Any impact would affect individuals and be unlikely to result in any change in the area of occupancy of the species.
Fragment an existing important population into two or more populations	Unlikely This species is highly nomadic and can form large, mixed-species feeding flocks. The exclusively aerial, migratory species is capable of long-distance flight. The species movements will not be restricted by the Project. As such, the Project will not fragment the population in any way.
Adversely affect habitat critical to the survival of a species	Unlikely As previously mentioned, the species is exclusively aerial and has no reliance on terrestrial habitats (Cramp 1985). The species is nomadic and known to fly above a range of habitats in response to climatic conditions and is widespread throughout coastal Queensland and on the western slopes of the Great Dividing Range. As a result, the



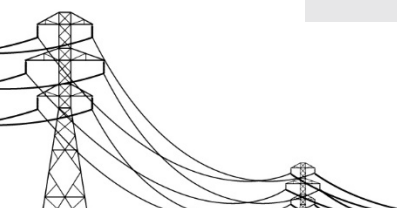
Significant impacts criteria	Assessment
	Project is unlikely to impact any habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely The species is a non-breeding visitor to Australia. The species breeds during October – May throughout Siberia, China, Japan and Mongolia (Chantler 1999; Orn. Soc. Japan, 2000). The Project is unlikely to impact on the breeding cycle of the population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely This species is truly ubiquitous, foraging over all habitat types throughout its distribution. As it is exclusively aerial the species has no typical association or reliance on terrestrial habitat types (Cramp 1985). The Project will not result in any loss of habitat for the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely The white-throated needletail is not known to be vulnerable to introduced predators such as the fox or cat. The Project is therefore expected to have negligible impact on the species due to the introduction of invasive species.
Introduce disease that may cause the species to decline	Unlikely There are no know diseases that could potentially introduced by the Project. Therefore, the risk of the Project introducing disease that may cause the species to decline is considered unlikely.
Interfere substantially with the recovery of the species	Unlikely The proposed works are considered unlikely to negative impact the species, let alone interfere with the recovery of the species.

7.6.11 Red goshawk

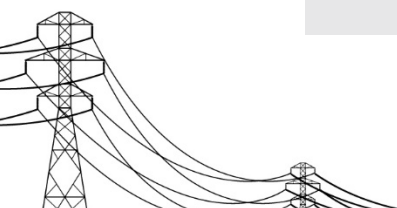
A significance of impact assessment of the Project on the red goshawk (Vulnerable under the EPBC Act and Endangered under the NC Act) is provided in Table 7-29.

Table 7-29 Significant impact assessment– Red goshawk

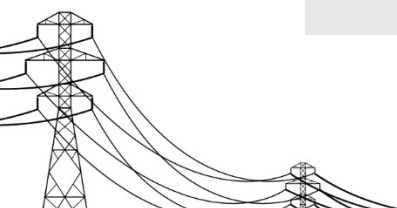
Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The Project activities will occur within an estimated 88.87 ha of mapped suitable habitat for the species. However, this loss of habitat will be accumulated over a large geographic range, with only minor loss of habitat at any local scale. The red goshawk has not been confirmed present within the greater survey area. Any impact on nest sites would have the potential to have an adverse impact at a population level by reducing breeding success, however targeted pre-



Significant impacts criteria	Assessment
	clearance surveys will be undertaken to identify and avoid any impact on nest sites. Although clearing will be required for the easement, the width is only 60 m, meaning the majority of the potential habitat for the species will remain intact. Considering this widely roaming species utilises a large home range (approx. 200 km ²), the removal of a 60 m linear easement is unlikely to have any impact on the availability of habitat within the broader landscape. The Project is therefore unlikely to have any impact at a population level.
Reduce the area of occupancy of an important population	Unlikely The Project activities will occur within an estimated 88.87 ha of mapped suitable habitat for the species, representing a 0.23% and 0.05% reduction of habitat for the species at a local (2.5 km buffer) and regional (10 km buffer) scale. Although the clearing of vegetation may result in edge effects (e.g. reduced cover) immediately adjacent to the easement, the red goshawk will still be capable of occupying the habitats either side of the easement and continued utilisation is anticipated. Additionally, considering this widely roaming species utilises a large home range (approx. 200 km ²), disturbance within a 60 m linear easement is unlikely to render the greater landscape uninhabitable to the point that species' area of occupancy is reduced.
Fragment an existing important population into two or more populations	Unlikely The red goshawk has a large home range (approx. 200 km ²) (Aumann and Baker-Gabb 1991) and a capacity to fly over areas of localised clearing. While the effects of fragmentation on the species are unknown (DAWE 2020b), they are expected to predominantly impact the species' use of habitat in coastal regions of Queensland where fragmentation has dramatically altered the nature of the landscape. The small, localised clearing extent that will result from this Project will not fragment the population.
Adversely affect habitat critical to the survival of a species	Unlikely Habitat critical to the survival of the species would include all known sites for nesting, food resources, water, shelter, essential travel routes, dispersal, buffer areas, and sites needed for the future recovery as defined by the EPBC Act (DERM 2012). While the Project will result in a loss of foraging habitat, the magnitude of loss is unlikely to have an adverse impact on the local population. The Project's most substantial potential impact would be on nesting sites. Unmitigated, the Project has the potential to have a significant impact on habitat critical to the survival of the species should a nest be directly impacted. However, measures will be implemented to negate this risk. No nesting sites have been recorded during field surveys and pre-clearance surveys will be undertaken in areas of potential habitat to identify and avoid impact on nesting sites prior to construction. Any confirmed nesting site identified during pre-clearance surveys will be avoided by micro-siting towers. The Project is therefore unlikely to have a significant impact on any habitat critical to the survival of the species.
Disrupt the breeding cycle of	Unlikely In North Queensland, the species breeds in vegetated mountain areas and rarely within fragmented native vegetation (Czechura 2001).



Significant impacts criteria	Assessment
an important population	Within the study area, the majority of potential habitat is mapped within patches of relatively fragmented remnant vegetation. Therefore, the likelihood of the Project impacting the species breeding cycles is considered unlikely due to limited breeding habitat within the Project area. The rarity and inconsistencies in recorded sightings further indicates that there is limited breeding habitat for the species within the study area. Regardless, employing a fauna spotter catcher prior to clearing to investigate the presence of nest sites (normally large tress within 1 km of water) will further reduce the likelihood of the Project impacting the species breeding cycle.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely Clearing will represent the greatest threat to the species as the removal of large trees will result in a more open vegetative structure for the communities within and adjacent to the easement. Because this species is an ambush predator that hunts within the midstorey, a more open canopy structure could reduce the species' ability to forage in the vicinity of the Project area. However, this is a localised impact that is unlikely to affect the local population, given its large home-range. Key foraging areas include ecotone boundaries, vegetated watercourses and wetland ecosystems (Czechura and Hobson, 2000). The proposed corridor selection has been designed to avoid / minimise impacts in the aforementioned ecosystems and mitigation measures contained in the EMP will be designed to further reduce the Projects potential impact. Furthermore, towers are anticipated to stretch approximately 400 m and of sufficient length to span the majority of watercourses. Considering the location of the corridor selection and the mitigation measures proposed, the Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely Feral animal management protocols will be implemented for the clearing, construction, operation and decommissioning phases of this Project. Inclusion of such measures into the EMP is expected to be sufficient to prevent negative impacts of invasive species as a result of the proposed action.
Introduce disease that may cause the species to decline	Unlikely There are no known disease affecting the species and no diseases or inflection that could be potentially introduced by the proposed works. Provided that the Project abides by the biosecurity measures contained in the EMP, the Project is considered unlikely to introduce foreign species / disease that may cause the species to decline.
Interfere substantially with the recovery of the species	Unlikely The Project activities will occur within an estimated 88.87 ha of mapped suitable habitat for the species. This represents 0.05% of the potential habitat within a 10 km buffer. Given the small magnitude, the loss of habitat is unlikely to reduce the foraging or breeding success of the species by altering resource availability. The Project will be



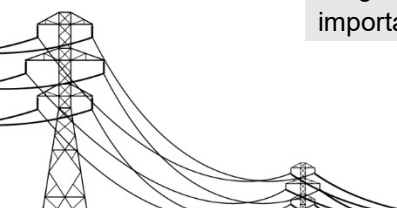
Significant impacts criteria	Assessment
	relatively benign during the operation phase. Given these factors, the Project is unlikely to interfere with the recovery of the species.

7.6.12 Grey falcon

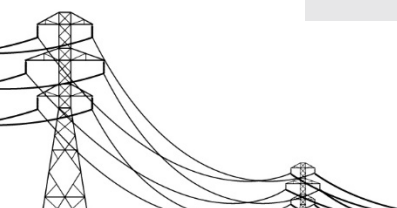
A significance of impact assessment for residual impacts of the Project on the grey falcon (Vulnerable under the EPBC Act and NC Act) is provided in Table 7-30.

Table 7-30 Significant impact assessment of residual impacts – grey falcon

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The Project is unlikely to lead to a long term decrease in the size of the population of the species. Potential impacts posed by the Project include a loss of foraging habitat, loss of nesting sites and the introduction / encroachment by invasive species. The Project activities will occur within an estimated 88.87 ha of mapped suitable habitat for the species. This represents only 0.5% and 0.22% of habitat within a 2.5 km and 10 km buffer of the Project area, respectively. Habitat loss will be experienced a largely linear, 60 m wide corridor. Although this may correspond to a reduction in foraging habitat, the presence of towers is anticipated to increase the abundance of potential nest sites (Schoenjahn, 2018). Grey falcons are known to utilise artificial structures for nesting (Schoenjahn, 2013) and the retention of power line towers has been reported as beneficial for the species ongoing conservation (Schoenjahn, 2018). Risk of increased predation pressure by introduced carnivores will be addressed by the inclusion of pest fauna management techniques in the Project EMP. These measures have been designed to suppress the abundance of feral cats and foxes within the study area. Overall, the proposed works are unlikely to lead to a long-term decrease in the size of a population of the species.
Reduce the area of occupancy of an important population	Unlikely The Project will require the clearing of a 60 m wide corridor for transmission lines and towers, however vegetation clearing is expected to have little impact on the species. The grey falcon has been observed hunting in treeless areas, tussock grasslands and open woodlands (Olsen and Olsen 1986). This implies that the species is well adapted to open areas, and therefore, the clearing of a narrow, linear corridor is unlikely to further reduce the area of occupancy for the species. In contrast, the Project could provide additional nesting habitat for the species. The grey falcon is known to nest in powerline towers (Schoenjahn, 2013), with recent studies reporting 40% of grey falcons nest being observed in artificial structures (Schoenjahn, 2018). Regardless, the species is considered highly mobile (Schoenjahn, 2019) and a narrow, linear loss of 585.8 ha of potential habitat is unlikely to reduce the area of occupancy for the species.
Fragment an existing important population	Unlikely



Significant impacts criteria	Assessment
into two or more populations	The grey falcon is nomadic, capable of long-distance movements throughout its range. The species occurs at low densities and often forages in open landscapes. The localised clearing that will be result from the Project has no capacity to restrict the movement of the grey falcon or fragment populations.
Adversely affect habitat critical to the survival of a species	Unlikely Habitat critical to the survival of the species has not been defined. However this is likely to include nesting habitat. Nest sites in particular are considered a limiting factor within the species breeding range. Breeding generally occurs in hot inland areas and is unlikely to occur within the Project area. The Project is therefore unlikely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely As detailed above, the grey falcon breeds in the hottest parts of Australia's arid zone, occurring in areas with less than 500 mm annual rainfall. While the species has been recorded within the centre and western end of the Project corridor, near Richmond and Mount Isa respectively, no breeding habitat is expected to occur within the vicinity of the Project. As such, the Project is unlikely to have an adverse impact on breeding. The species is known to nest on artificial structures provided by powerlines. This has the potential to increase potential nesting habitat.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely Although grey falcons have been recorded within the area, the species has been reported as a non-breeding, winter visitor. Although this implies that the grey falcon is not a resident species, parts of the Project may still be utilised for foraging and resting. Regardless, the Project poses little risks to the species as suitable habitat of similar quality is abundant within the surrounding landscape. <i>F. hypoleucos</i> is known to occupy large areas, the corridor selection is unlikely to be the only habitat utilised by the species. Furthermore, although the species has not been recorded breeding, the inclusion of transmission line towers will provide potential nesting sites and may contribute to greater regional utilisation by the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely Introduced carnivore species are known threats for the species (Schoenjahn, 2019). Feral cats and foxes have been confirmed within the Project area and pest fauna management techniques have been designed to reduce the likelihood of pest species becoming established within the Project area. Such measures will be contained within the Project EMP. Following appropriate implementation, the Project is unlikely to result in invasive species becoming established.
Introduce disease that may cause the species to decline	Unlikely There are no known diseases that could potentially introduced by the Project. The five most common disease in falcons are frounce, aspergillosis, coccidia, sour crop and bumblefoot. Frounce, coccidian and sour crop are transmitted by the consumption of infected prey and will not be influenced by the Project. Similarly, bumblefoot is a result of injuries to the species feet and as such is not relevant. Aspergillosis is caused by the fungus <i>Aspergillus fumigatus</i> , which is highly unlikely to be present within the Project area.



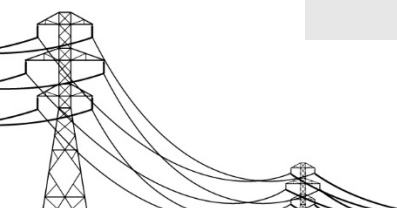
Significant impacts criteria	Assessment
	Normally, this fungus is encountered where there are wet or damp substances, or materials that promote the growth of fungus such as burlap, hay, or straw. Nevertheless, vehicle hygiene protocols implemented for weed management are likely to eliminate the risk of the fungus being introduced during construction.
Interfere substantially with the recovery of the species	Unlikely The Project is unlikely to interfere with the recovery of the species. In contrast, the Project could serve to counteract several threatening processes for the species within the Project area. A shortage in nest sites is a recognized threat for the species (Garnett et al. 2011) as a result of large-scale clearing and selective logging of larger trees. Considering the species' willingness to nest in power line towers (Schoenjahn, 2013; 2018) and the lack of large infrastructure in the area, the Project could serve to improve the species recovery by providing additional nest sites (Schoenjahn, 2018). This could also limit the effects of overgrazing, which has been identified as preventing the regeneration of suitable nesting sites (Garnett et al. 2011). The pressure of introduced predators (e.g. cats and foxes) has also addressed through the inclusion of pest fauna management controls within the Project EMP.

7.6.13 Night parrot

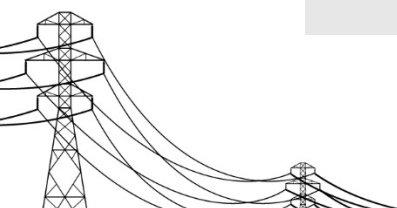
A significance of impact assessment of the Project on the night parrot (Endangered under the EPBC Act and NC Act) is provided in Table 7-31. For this species it should be noted that a relatively conservative approach has been applied given the cryptic nature of the species and the lack of publicly available information on its current locations. Further desktop mapping to refine the potential nesting and feeding habitat mapping is currently being undertaken in consultation with members of the Night Parrot Recovery Team. Additional field survey will then be conducted to thoroughly ground-truth the potential nesting and feeding habitat areas, and to do targeted searches for night parrot individuals using songmeters and subsequent data analysis by the Night Parrot Recovery Team members.

Table 7-31 Significant impact assessment – night parrot

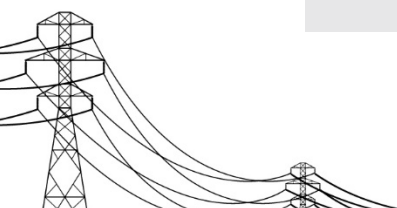
Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a population of the species	Unlikely Loss of suitable habitat for this species resulting from clearing for the proposed easement will largely be linear and considered to be minor considering the extent of habitat available in the surrounding landscape. Within the proposed corridor selection, areas cleared during construction that are not required to remain cleared during operation will be rehabilitated. As the species is dependent on ground-level vegetation and microhabitats and is located in areas with sparse tree densities, there will be substantial opportunities to minimise the on-ground clearing footprint by restricting clearing to the minimum amount necessary. This is likely to include selective removal of trees and clearing of a reduced footprint for access tracks and tower pads. Feral animal, weed and ecological fire management protocols will be implemented for the clearing, construction, operation and decommissioning phases of this



Significant impacts criteria	Assessment
	Project and have the potential to increase the quality of available habitat within and adjacent to the Project area. It is expected that any possible decrease in any possible local population would be minor and temporary.
Reduce the area of occupancy of the species	Unlikely The Project activities will occur within an estimated 62.57 ha of mapped suitable habitat for the species. Loss of suitable habitat for this species resulting from the proposed corridor selection will be linear and will likely be minor due to the nature of the rugged terrain where the majority of the species' habitat exists. Within areas of potential habitat, the clearing footprint will be minimised. Areas that are subject to temporary construction clearing will be rehabilitated to maximise the local habitat coverage. The area of habitat cleared represents only 0.14% of that available within a 2.5 km buffer. As such, the species is likely to persist locally and will not experience any loss in the area of occupancy of the species.
Fragment an existing population into two or more populations	Unlikely The associated linear clearing will not fragment any possible population for this mobile species. Within areas of suitable habitat, clearing widths will be minimised to reduce the potential impact. Local rehabilitation of the easement will be undertaken to maintain connectivity of ground-level habitats. Through these measures the Project is unlikely to fragment the population into two or more populations.
Adversely affect habitat critical to the survival of a species	Unlikely All habitat within the proximity of known records would be considered habitat critical to the survival of the species. While unconfirmed historical records are known from the Cloncurry region, as mapped in essential habitat within the Ballara Nature Refuge, the species has not been recorded with the Project area. Potential habitat is widespread and abundant in the area between Cloncurry and Mt Isa, however no high-quality habitat for the species has been identified during field surveys due to a combination of recent fire events and high abundance of wooded vegetation. Impacts will be localised and are therefore considered to have minimal impact in the context of the surrounding landscape. Cleared areas within the easement that are not required to remain cleared during operation will be rehabilitated after construction activities have concluded. Feral animal, weed and ecological fire management protocols will be implemented for the clearing, construction, operation and decommissioning phases of this Project. With the combination of habitat management and rehabilitation, the result of the proposed action is not expected to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	Unlikely There is a paucity of biological information known for this species and few occurrence records. There is no indication that there is habitat present that is critical to the breeding cycle of an important population. The Night Parrot Recovery Team will be consulted to assess risks to potential breeding and assist in recommending risk mitigation strategies for clearing and construction. The detection of breeding sites is difficult



Significant impacts criteria	Assessment
	as the species nests within clumps of dense vegetation, primarily old and large Spinifex clumps, but sometimes other vegetation types (Higgins 1999, Murphy 2017). Targeted pre-clearance surveys will be undertaken prior to construction to minimise the potential for impact on breeding or nesting habitat. Additionally, the inclusion of a combination of habitat management and rehabilitation activities, any disruption of the breeding cycle of a local population as a result of the proposed action is expected to be minor and temporary. Following these mitigation measures the Project is unlikely to disrupt the breeding cycle of the species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely As detailed above, potential habitat suitable for this species is widely distributed throughout a broad area between Cloncurry and Mt Isa. The loss of habitat will be localised and areas will be rehabilitated locally following construction. Although the proposed action may modify, destroy, remove, isolate or decrease the availability or quality of habitat, it is unlikely to be to the extent that the species is likely to decline. All impacted habitat will be rehabilitated following construction to minimise the temporal duration of any impacts. Additionally, the Project has the opportunity to increase the quality of habitat within the study area by implementing the pest fauna and flora management techniques contained in the Project EMP.
Result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Critically Endangered or Endangered species' habitat	Unlikely Predation by feral cats and foxes are highlighted as key threatening processes for the species (TSSC, 2016b). The implementation of actions directed at reducing invasive predator abundance are a priority of conservation advice for the species. The Project has the potential to exacerbate the feral predation threat by providing a dispersal corridor that may encourage movement of cats, dogs and other feral predators. Feral predators are an existing threat in the landscape and the area already contains many existing farm tracks that would be utilised by feral predators. As such the magnitude of change in exposure to feral predators is unlikely to be significant. Feral animal and weed management protocols will be implemented for the clearing, construction, operation and decommissioning phases of this Project. The Project will provide an impetus for increased feral animal control in a landscape that already exposed to feral threats. The inclusion of such measures in the EMP is expected to be sufficient to prevent any potential impacts of invasive species as a result of the proposed action.
Introduce disease that may cause the species to decline	Unlikely The Project is considered unlikely to introduce disease/s that may cause the species to decline. Regardless, the impacts of psittacine beak and feather disease (PBFD) have been considered. All endangered Australian psittacine bird species are susceptible to PBFD (Raidal <i>et al.</i> , 2015). Although the Department of Environment (2015) reports a low-level of concern for the species, following the Department of Environment and Heritage (2006) established hygiene and reporting protocols will further reduce the risk of the spread of PBFD into the Project area.



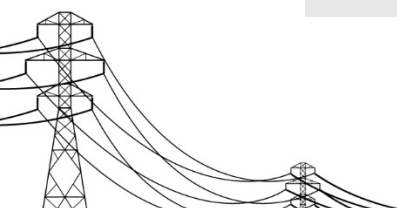
Significant impacts criteria	Assessment
Interfere with the recovery of the species	Unlikely If unmitigated, there is potential that the Project may interfere with the recovery of the species via direct impact on individual birds during construction. However, with the application of habitat management and rehabilitation, any impacts to the availability or quality of habitat for this species in the study area would be significantly reduced, and unlikely to interfere with the recovery of the species.

7.6.14 Painted honeyeater

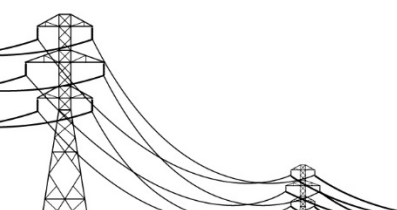
A significance of impact assessment of the Project on the painted honeyeater (Vulnerable under the EPBC Act and NC Act) is provided in Table 7-32.

Table 7-32 Significant impact assessment – painted honeyeater

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely Painted honeyeaters are dispersive, migrating across Qld, NSW, SA and NT in response to resource availability (mistletoe). The species is considered likely to occur within the Project and the Project activities will occur within an estimated 661.09 ha of the species' mapped suitable foraging habitat. This represents 0.14% and 0.04% of habitat available within a 2.5 km and 10 km buffer of the Project respectively. As the species has a broad distribution, the loss of 661.09 ha of potential foraging habitat is unlikely to lead to a long-term decrease in the size of a population of the species.
Reduce the area of occupancy of an important population	Unlikely The species is known to occur in a broad range of habitats, with distribution largely dictated by the presence of mistletoe (favoured feeding resource). The Project activities will occur in an estimated 661.09 ha of potential habitat for the species, however these areas are continuous within the surrounding landscape and are believed to represent similar habitat quality. Although the Project will result in a reduction in the area of occupancy to the species, the extent of impacts is minor and reduced area of occupancy is negligible when considering the extent of available habitat in adjacent areas.
Fragment an existing important population into two or more populations	Unlikely Due to the species dispersive nature, the species is considered to have a single population (Garnett et al. 2011). Considering the species is distributed across four states (NSW, Qld, SA and NT), the potential impacts within 661.09 ha of linear Project area is unlikely to fragment the population in two or more populations. Furthermore, as no physical barrier are being constructed and the clearing extent is only 60 m wide, the species is anticipated to continue to utilise the area once construction activities have concluded.
Adversely affect habitat critical to	Unlikely No habitat critical to the survival of the species is intersect by the proposed corridor selection. Additionally, no essential habitat polygons



Significant impacts criteria	Assessment
the survival of a species	are mapped within the greater study area. No breeding habitat will be impacted by the Project as the species is species generally breeds over 400 km south of the Project area (Higgins 1999). Although areas with increased mistletoe abundance may be present in the study area, mistletoe is actively dispersed by avian frugivores (e.g. mistletoe birds) and therefore, areas of high resource abundance areas is variable and not restricted a narrow geographical extent.
Disrupt the breeding cycle of an important population	Unlikely The species is a north – south migrant to the area, with movement dictated by resource (mistletoe) availability. Although the species is known to inhabit the region, almost all records of breeding come from south of 26°S, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland (Higgins et al., 2001). The Project is unlikely to disrupt the breeding cycles of the species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely Despite the Project area intersecting 661.09 ha of potential habitat, this impact is unlikely to be of the extent that the species is likely to decline. Similar habitats to that that are intersect by the corridor selection are present adjacent and surrounding the Project area and the impacts habitats represent only 0.14% available at a local scale (2.5 km buffer) and 0.04% at a regional scale (10 km buffer).
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely No increase in invasive species is anticipated as a result of the Project. Rather, the Project has the opportunity to reduce the abundance of invasive species by implementing pest flora and fauna management controls. Feral cats and European foxes are known predators contributing to the species' decline and implementing control measures could equate to a net benefit to the local painted honeyeater population.
Introduce disease that may cause the species to decline	Unlikely The Project is considered unlikely to introduce disease/s that may cause the species to decline. Regardless, the impacts of psittacine beak and feather disease (PBFD) have been considered. All endangered Australian psittacine bird species are susceptible to PBFD (Raidal et al. 2015). Although the Department of Environment (2015) reports a low-level of concern for the species, following the Department of Environment and Heritage (2006) established hygiene and reporting protocols will further reduce the risk of the spread of PBFD into the Project area.
Interfere substantially with the recovery of the species	Unlikely The Project is unlikely to interfere with the recovery of the species as the proposed works are not significant contributing to any of the species' threatening processes. Although the Project activities will occur within 661.09 ha of potential habitat, these impacts are anticipated to be minor and temporary and will be accompanied by management measures that could benefit the species.

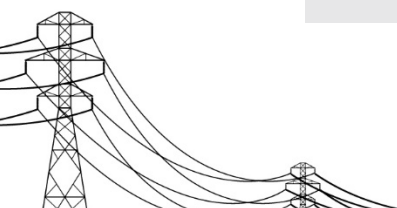


7.6.15 Australian painted snipe

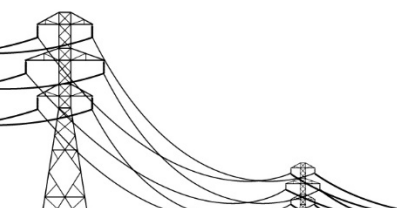
A significance of impact assessment of the Project on the Australian painted snipe (Endangered under the EPBC Act and Vulnerable under the NC Act) is provided in Table 7-33.

Table 7-33 Significant impact assessment – Australian painted snipe

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a population of the species	Unlikely The species utilises wetland habitats that will be avoided or spanned by the Project. All major wetlands and waterbodies that represent potential foraging habitat for the Australian painted snipe have been avoided through the corridor selection process. This identified and avoided key wetlands at KP308 WD, KP539 WD, KP38 DM and KP68 DM. A range of ephemeral watercourses provide potential foraging habitat for the species. The Project activities will occur within an estimated 138.63 ha of potentially suitable foraging habitat associated with ephemeral watercourses. However, in most cases the Project will span watercourses and can avoid impact on habitats within the riparian zone. Where the corridor selection crosses large braided ephemeral systems, some of which are more than 1km wide, tower sites have been individually selected to avoid existing channels. The Project will be relatively benign during the operational phase, unlikely to cause any ongoing disturbance or fragmentation of habitat. Considering these factors, the Project is unlikely to lead to a long-term decrease in the size of a population of the species.
Reduce the area of occupancy of the species	Unlikely The Australian painted snipe occurs in shallow freshwater wetlands, both ephemeral and permanent, such as lakes, swamps and inundated or waterlogged grassland/saltmarshes with good vegetative cover (Marchant and Higgins, 2003) and has been recorded at wetlands in all states and territories (Barrett <i>et al.</i> 2003; Blakers <i>et al.</i> 1984). The proposed corridor selection has been selected to avoid the wetland ecosystems due to the associated construction complications (e.g. waterlogged soils, difficult access for machinery). As such the Project will avoid or span most areas of potential habitat. While the Project activities will occur within an estimated 138.63 ha of suitable habitat, this represents only 0.4% and 0.19% of habitat within a 2.5 km and 10 km buffer of the Project area respectively. The magnitude of impact is considered negligible considering the species vast distribution in the surrounding area. Furthermore, Overall the Project is considered unlikely to reduce the area of occupancy of the species
Fragment an existing population into two or more populations	Unlikely The distribution of the Australian painted snipe within the Project area is non-uniform and concentrated around areas with adequate available water. As the corridor selection has been designed to avoid the majority of this areas it is unlikely to Project will fragment an existing population into two or more populations. Rather, local populations are expected to transition between a number of sites throughout northern Queensland.
Adversely affect habitat critical to	Unlikely All major wetlands that represent potential foraging habitat for the Australian painted snipe have been avoided. Direct impact on



Significant impacts criteria	Assessment
the survival of a species	ephemeral watercourses has also been avoided in most cases by elevating spans and placing towers outside the riparian zone. The Project has the potential to cause indirect degradation of ephemeral water bodies that may impact habitat for the Australian painted snipe. These impacts will be mitigated in the Sediment and Erosion Control Plan for the Project. Additionally, establishing and clearing identifying 'No Go' zones near suitable habitat will help to ensure these areas are not impacted during construction.
Disrupt the breeding cycle of a population	Unlikely The Australian painted snipe is considered to occur in a single, contiguous breeding population (Garnett and Crowley, 2000). Habitat in the Project area is not a known roosting site for the species and the extent of foraging habitat removal would not be of such a magnitude as to impact on the breeding success of the species. Regardless, implementing buffer zones around wetlands will significantly reduce the likelihood of disrupting the species breeding cycle.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely The Project activities will occur within an estimated 138.63 ha of potential habitat for the species. The extent of occurrence of the Australian painted snipe is estimated, with low reliability, to be 2000 km ² (Garnett et al. 2011). The loss of small areas of habitat is very unlikely to result in the further decline of the species.
Result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Critically Endangered or Endangered species' habitat	Unlikely The Project is unlikely to introduce an invasive species into the study area. Rather, the Project has the potential to reduce the abundance of pest species. The replacement of native wetland vegetation by weeds is a key threat to the species (Rogers et al. 2005). The implementation of weed management practices within the Project area could serve as a benefit for the species and help mitigate weed encroachment in the vicinity of the proposed works. Also, like many native birds, the Australian painted snipe is susceptible to predation by feral cats and European foxes. The employment of pest fauna control measures could in turn increase the quality of the habitat for this species by reducing predation pressure on local populations.
Introduce disease that may cause the species to decline	Unlikely This species is not known to be susceptible to any disease which may be transferred or introduced to the Project area as a result of the proposed action.
Interfere with the recovery of the species	Unlikely The proposed works are considered unlikely to interfere with the recovery of the species as the habitat impacted by the Project represents only 0.4% of habitat within a 2.5 km buffer. Furthermore, the Project's weed and pest management practices could generate a positive outcome for the species by reducing the impact of a key threatening process in the region.

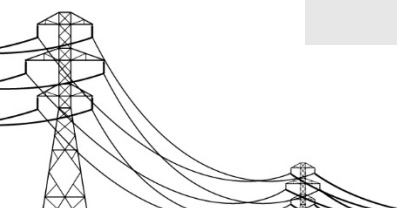


7.6.16 Plains death adder

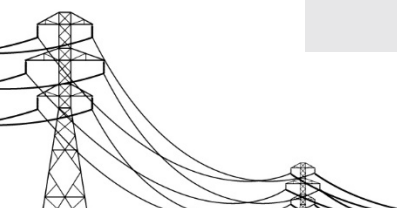
A significance of impact assessment of the Project on the plains death adder (Vulnerable under the EPBC Act and NC Act) is provided in Table 7-34.

Table 7-34 Significant impact assessment - plains death adder

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely Important populations of the plains death adder have not been defined in the Commonwealth listing advice. The Project is not unlikely to result in a long-term decrease in the species population. This species is an ambush predator, known to remain in a single spot for days at a time. Considering the sedentary nature of the species, pre-clear surveys by fauna spotter-catchers would be relatively effective in detecting and relocating individuals prior to Project works. The Project activities will occur within an estimated 261.47 ha of suitable habitat. This will occur over a large geographic area. Habitat is relatively uniform and widely available within the surrounding landscape. The potential impact represents only 0.15% and 0.04% of suitable habitat for the species within a 2.5 km and 10 km buffer of the Project respectively. Mitigation measures to reduce the impacts of Project on the species (e.g. vehicle strikes) have been designed and included within the Project EMP. Based on these factors the Project is unlikely to result in a long-term decrease in the size of the local population.
Reduce the area of occupancy of an important population	Unlikely The Project activities will occur within an estimated 261.47 ha of potential habitat for the species, which is entirely contained within the western extent of the Project. This represents only 0.15% and 0.04% of the potential habitat available within a 2.5 km and 10 km buffer of the Project, respectively. The loss of habitat is therefore not considered significant. The Project is expected to be relatively benign during the operational phase. The magnitude of habitat loss or impact on local populations is unlikely to result in the disappearance of individuals from any 2 km x 2 km area (i.e. the area at which area of occupancy is quantified).
Fragment an existing important population into two or more populations	Unlikely The proposed works are unlikely to fragment an existing population. Outside of breeding, the species is nomadic and can occur anywhere within the species distribution (Ward and Phillips 2012). As the proposed corridor width is only 60 m and will contain no barriers to movement, the Project is unlikely to restrict gene flow in the species. As a result the Project is unlikely to fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	Unlikely Habitat critical to the survival of the species has not been defined in the Commonwealth listing advice for the plains death adder. Although the proposed works will adversely affect habitats located within the easement, these habitats have not been identified as 'critical' to the survival of the species. The species utilises Mitchell grass plains habitat with cracking clay soils. These habitats are generally relatively uniform and locally abundant within the local landscape. As such, the habitats impacted by the Project are unlikely to represent



Significant impacts criteria	Assessment
	habitat critical to the survival of the species. The Project activities will occur within an estimated 261.47 ha of habitat from a relatively broad geographic area. This represents only 0.15% and 0.04% of potential habitat available within a 2.5 km and 10 km buffer of the Project, respectively. The magnitude of habitat loss is therefore unlikely to have a significant impact on the species.
Disrupt the breeding cycle of an important population	Unlikely The species generally breeds from October to November, with young born between February to March. Males will attempt to breed every year, but females will only breed every one–two years depending on prey availability. Seeing as the Project has the potential to influence the abundance of prey in the immediate proximity to the Project area, the Project has the potential to disrupt the breeding cycle of the species at a local level. However, in a broad landscape context, the likelihood of the Project disrupting the species' breeding cycle of an important population is unlikely.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely The proposed works have potential to modify, destroy, remove, isolate or decrease 261.47 ha of potential habitat for the species. This represents 0.15% of potential habitat within the surrounding 2.5 km buffer. No degradation of habitats is anticipated in areas outside of the 60 m easement that is required to the transmission line. These impacts are minor considering the availability of habitats nearby. Impacts can be further mitigated by the employment of a fauna spotter catcher to survey the Project area prior to clearing. This can allow for the success identification and relocation of 'resident' individuals. Furthermore, the implementation of pest and weed management practices could serve to improve the quality of habitats immediately adjacent to the Project area.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely Cane toads are a recognized threatening process for the species. In the NT, cane toad have resulted in an 89% decline in the abundance of the plains death adder and the species is known to die in large number when toads are introduced (Hagman et al. 2008; Phillips et al. 2010). Cane toads are predicted to occupy almost all of the species home range by 2030 (Phillips et al. 2003). The Project is unlikely to exacerbate the spread of cane toads.
Introduce disease that may cause the species to decline	Unlikely There are no known diseases that may be introduced to the species as a result of the Project.
Interfere substantially with the recovery of the species	Unlikely The exact distribution of the plains death adder is unclear. Areas of potential habitat are relatively uniform and locally widespread. The footprint impacts are therefore expected to result in minimal proportional loss of habitat. The Project activities will occur within an estimated 261.47 ha of suitable habitat, which represents only 0.15% and 0.04% of suitable habitat within a 2.5 km and 10 km buffer of the Project respectively. Greatest impacts are from the potential direct mortality of individuals. However, these risks will be minimised through the use of preclearance surveys by suitably qualified spotter-catchers. Additionally, the removal of grazing and the management of



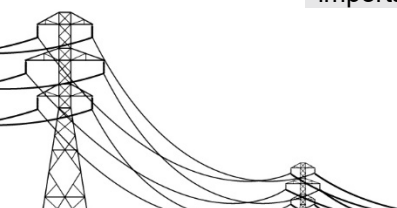
Significant impacts criteria	Assessment
	fire regimes could provide additional benefits for the species that offset the potential impacts of the Project.

7.6.17 Ornamental snake

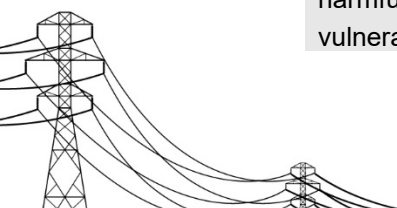
A significance of impact assessment for the ornamental snake (Vulnerable under the EPBC Act and NC Act) is provided in Table 7-35.

Table 7-35 Significant impact assessment – ornamental snake

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The occurrence of 'important habitat' has been adopted as a surrogate for an important population when assessing the impacts on the ornamental snake (DAWE, 2020b). Important habitat is considered to be any gilgais or mounds within areas of known habitat and connecting habitat that links gilgais (DSEWPaC 2011). The draft referral guidelines for the nationally listed brigalow belt reptiles (DSEWPaC 2011) indicates that a loss of more than 2 ha of important habitat risks a significant impact. The Project activities will occur within an estimated 34.66 ha of potential habitat, only a small proportion of that area would constitute gilgai areas or habitat linking gilgais. Gilgai areas have been actively avoided in the corridor selection process, to minimise disturbance to breeding habitat for the ornamental snake, but also to minimise the constructability issues that can be caused by gilgais given their dynamic and swampy nature. The majority of vegetated gilgai areas representing potential breeding habitat for the ornamental snake have been avoided. Areas of gilgai habitat that have not been avoided will be subject to targeted survey to microsite towers and access routes to avoid and minimise impact on gilgais. All clearing will be supervised by experienced fauna spotter-catcher to reduce the potential for injury or mortality. Given the avoidance measures implemented, the Project is unlikely
Reduce the area of occupancy of an important population	Unlikely The Project activities will occur within an estimated 34.66 ha of potential habitat for the ornamental snake. This represents 0.14% and 0.04% of the potential habitat within a 2.5 km and 10 km buffer of the Project area respectively. Habitat for the species is patchily distributed. Without mitigation, it is therefore possible that a small, localised impact could result in the disappearance of individuals from a 2 km by 2 km area and result in a reduction in the area of occupancy. However, targeted preclearance surveys will be undertaken to identify and avoid areas of high local value by microsite towers. The use of spotter-catchers during clearing will also mitigate the potential risks of localised mortality. These avoidance measures will mitigate the potential for a reduction in the area of occupancy.
Fragment an existing important population	Unlikely



Significant impacts criteria	Assessment
into two or more populations	If the species is present, it is anticipated to occupy scattered habitats with populations unlikely to be of an insufficient size for fragmentation to occur.
Adversely affect habitat critical to the survival of a species	Unlikely The ornamental snake is highly dependent on gilgais for shelter. The ornamental snake displays a high degree of habitat specificity, and is known to transition from highly abundant to absent over a few hundred metres (DAWE 2020b). As detailed above, gilgai areas have been largely avoided through the corridor selection process. Targeted surveys will be undertaken in all areas of potential breeding habitat still intersected to avoid impact on breeding areas by micro-siting towers and access routes away from areas of high microhabitat value. Construction activities have the potential to cause indirect impacts through sedimentation of adjacent foraging habitat or light spill that could disrupt the species nocturnal hunting behaviour. These temporary impacts can be mitigated through routine construction controls.
Disrupt the breeding cycle of an important population	Unlikely The Project is unlikely to disrupt the breeding cycle of an important population as suitable habitat for this species will largely be avoided by micro-siting towers away from areas of high habitat value. Due to the operational and logistic constraints associated with undertaking construction during the wet-season, works will take place in dry season months and therefore avoid the species' peak period of breeding activity (i.e. the wet season). Through spatial and temporal avoidance, the Project is expected to have minimal impact on breeding cycles of the ornamental snake.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely The Project activities will occur within an estimated 34.66 ha of potential habitat for the ornamental snake. This represents 0.14% of the potential habitat within the local landscape (2.5 km buffer) and 0.04% of potential habitat within the regional landscape (10 km buffer). As this species has specialised habitat requirements, it generally does not occur across broad regions, but has a patchy, localised distribution, with habitat found in distinct areas, particularly gilgais. This patchy distribution allows the opportunity to effectively avoid areas of habitat through local micro-siting of towers. While the Project has the potential to indirectly impact habitat through sedimentation and light spill, the impacts can be mitigated through routine construction controls. Maintaining connectivity between gilgais will be important. Pre-clearance surveys will be needed to identify areas important for movement between foraging areas. These areas will needed to be protected from impact as a priority and rehabilitated as after construction. Unmitigated the Project has the potential to cause direct and indirect impact on habitats. Provided the measures detailed above are undertaken the Project is not expected to result in any significant loss, modification, isolation or reduction in the quality of habitat.
Result in invasive species that are harmful to a vulnerable species	Unlikely As this species feeds almost exclusively on frogs, the ornamental snake is considered to be at risk from lethal ingestion of cane toads (Phillips et al. 2003). Cane toads are already known to occur within



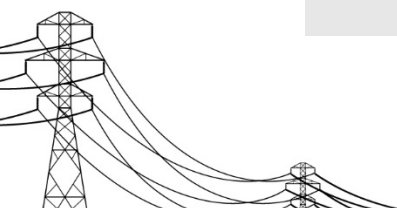
Significant impacts criteria	Assessment
becoming established in the vulnerable species' habitat	the Project area and the Project works are unlikely to exacerbate the risks. The Project is therefore expected to have negligible impact on the species due to the influence of cane toads or other pest species.
Introduce disease that may cause the species to decline	Unlikely There are no known diseases that could be introduced by the Project works.
Interfere substantially with the recovery of the species	Unlikely The Project activities will occur within an estimated 34.66 ha of potential habitat, representing 0.14% and 0.04% of suitable habitat for the species at a local scale (2.5 km buffer) and regional scale (10 km buffer) respectively. Considering that suitable habitat for this species has been largely avoided by the corridor selection, and localised impacts on habitat can be avoided by micro-siting towers away from areas of high value habitat the Project is unlikely to interfere with the recovery of the species.

7.6.18 Purple-necked rock wallaby

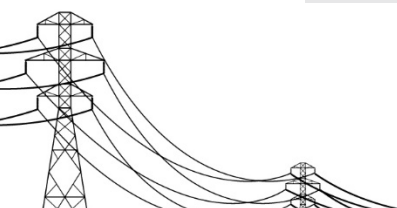
A significance of impact assessment for residual impacts of the Project on the purple-necked rock wallaby (Vulnerable under the NC Act only) is provided in Table 7-36.

Table 7-36 Significant impact assessment– purple-necked rock-wallaby

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a local population.	Unlikely The Project is unlikely to lead to a long-term decrease in the size of the local population. The Project activities will occur within an estimated 196.63 ha of potential habitat within the Project area. This represents only 0.11% and 0.03% of the habitat present within a 2.5 km and 10 km buffer of the Project area, respectively. Key habitats are associated with steep rocky outcrops. As these areas are generally logistically difficult to access and construct, they have been actively avoided through the Project corridor selection process. This has avoided 28 of 34 essential habitat polygons. Whilst the construction phase of the Project may present risks to the species (vehicle strikes), the mitigation measures outlined in Section 7.5 will effectively reduce the likelihood of impacts.
Reduce the extent of occurrence of the species.	Unlikely The corridor selection extends through the south-eastern area of the species known extent of occurrence. Within this region, the species inhabits boulder piles, rocky slopes, cliffs and gorges and the corridor selection has been designed with consideration of the preferred habitat for the species and ease of construction. These habitat types have been largely avoided. The Project activities will occur within an estimated 196.63 ha of potential habitat for the species, the impacts are extremely localised and unlikely to have any long-term impact on their persistence within the local area. While construction activities will undoubtedly cause some short-term disturbance, with individuals, individuals are likely to disperse to rock outcrops in surrounding



Significant impacts criteria	Assessment
	areas. Considering the Project will not clear large areas of potential habitat and is not located on the edge of the species' distribution, the proposed works are unlikely to reduce the extent of occurrence for the species.
Fragment an existing population.	Unlikely Areas of potential habitat intersected by the Project will remain largely intact. Although the Project may necessitate the clearing of vegetation, the rocky outcrops which the species inhabits are not anticipated to be impacted. Although foraging habitat may be impacted, it is not predicted to be of the extent that an existing population would become fragmented. Further, weed and pest management techniques have the potential to increase the quality of foraging habitat with the Project area. Reducing exotic groundcover could allow native grass species to become more abundant and increase the quality of habitat available for the purple-necked rock-wallabies within and adjacent to the corridor selection
Result in genetically distinct populations forming as a result of habitat isolation.	Unlikely Considering the small extent of clearing required for the 60 m easement and fact that the easement has been designed to avoid areas of key habitat, the Project is considered unlikely to result in the formation of a genetically distinct population. The location of the easement does not intersect habitat to the extent that it will create a barrier to movement.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Unlikely The introduction of invasive plant species could be harmful to the purple-necked rock-wallaby by outcompeting the native plant species that the species feeds on. Through the creation of access tracks, the Project has the potential to encourage dogs and foxes into the area and may inadvertently increase local predation pressures on the purple-necked rock-wallaby. However, the ecological impacts of this are considered relatively limited given the receiving environment already contains an abundance of property access tracks that would facilitate movement of dogs and other feral predators. The Project creates an impetus for increased feral pest management. This may have some value in controlling feral predators at least in the short-term. Considering the Project will impose mitigation measures to avoid the introduction or distribution of invasive plant species, the likelihood of the significant impact occurring has been assessed as unlikely. No fauna species are likely to be introduced to the Project area as a result of the Project.
Introduce disease that may cause the population to decline	Unlikely There are no known diseases that could potentially be introduced by the Project works.
Interfere with the recovery of the species.	Unlikely The Project is unlikely to interfere with the recovery of the species. Areas of key habitat have been predominantly avoided and the Project will be relatively benign during the operational phase, causing no barrier to movement or substantial increase in predation. While construction activities have the potential to cause minor disturbance to individuals, with rock-wallabies dispersing to surrounding areas



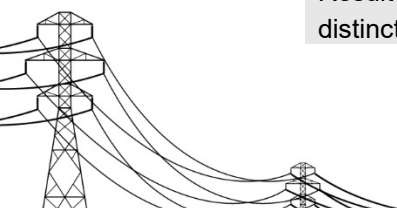
Significant impacts criteria	Assessment
	throughout construction the Project is unlikely to have any long-lasting effects that would interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	Unlikely As previously mentioned, the Project has undergone several realignments to avoid intersecting ecologically significant locations. In its current state, the Project corridor selection avoids the rough, rocky country that represents breeding habitat for the species. Although foraging habitat may be impacted, these impacts are short term and will not be sustained throughout the Projects lifespan. Clearing will be required during construction however these areas are expected to be rehabilitated during the operation phase. Furthermore, the inclusion of weed management measures could result in an increase in habitat quality due to higher native grass groundcover.

7.6.19 Short-beaked echidna

A significance of impact assessment for residual impacts of the Project on the short-beaked echidna (Special Least Concern under the NC Act) is provided in Table 7-37.

Table 7-37 Significant impact assessment of residual impacts - short-beaked echidna

Significant impacts criteria	Assessment
Result in a long-term decrease in the size of a local population.	Unlikely The Project activities will occur within an estimated 780.35 ha of potential habitat for the short-beaked echidna. Habitat for the species is widespread and abundant within the region. The total loss represents approximately 0.0.15% of habitat available locally (i.e. within a 2.5 km buffer) and 0.03% of habitat available regionally (i.e. within a 10 km buffer). The Project will pose minimal risk to individuals during construction and negligible risk to individuals during operation. While the short term increase in vehicle movements during construction may lead to an increase in roadkill mortality, this will be mitigated through the development of a Traffic Management Plan and measures contained in the EMP. Given these factors, the Project is unlikely to lead to a long-term decrease in the size of the local echidna population.
Result in a reduced extent of occurrence of the species.	Unlikely As detailed above, the Project will result in a relatively small-scale localised loss of habitat that will have limited bearing on the availability of local or regional habitat. As such, the Project is unlikely to reduce the extent of occurrence of the species.
Result in fragmentation of an existing population.	Unlikely The short-beaked echidna is capable of foraging widely over a broad range of environments including cleared grazing land. The localised clearing needed for proposed corridor selection is unlikely to present a barrier to echidna movement. As such the Project is unlikely to fragment the local echidna population.
Result in genetically distinct populations	Unlikely



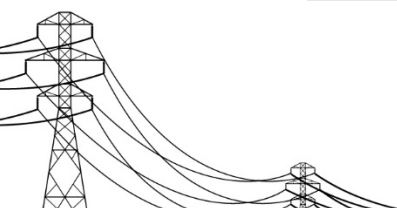
Significant impacts criteria	Assessment
forming as a result of habitat isolation.	As detailed above, the species capacity to move locally and regionally will not be limited by any localised land clearing necessary to construct the Project. As a result, the Project will not cause any loss of gene transfer that would cause genetically distinct populations to form.
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species.	Unlikely This species is Australia's most widely distributed native mammal, inhabiting a home range of approx. 192 ha (Abensperg-Traun 1991) and within multiple habitat types. Considering the species is likely to utilise the majority of land adjacent to the study area, the Project is unlikely to disrupt any ecological significant locations for the species. The species breeds between July – September (Griffiths 1978), which may coincide with construction activities. Despite this, no habitat within the study area is likely to represent an ecologically significant breeding location

7.6.20 Northern leaf-nosed bat

An assessment of the residual impacts on the northern leaf-nosed bat (Vulnerable under the NC Act) is presented in Table 7-38.

Table 7-38 Significant impacts assessment of residual impacts - northern leaf-nosed bat

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a local population.	Unlikely There is only one confirmed sighting of this species within Queensland (DSITIA 2012), located approximately 10 km south of the study area at Mount Isa (KP99.15 DM). Rocky outcrops with caves and boulder piles in the Mt Isa region represent potential roosting habitat for the species. However as these areas generally present a challenge to construction they have generally been avoided in the corridor selection process. The Project is therefore expected to result in minimal loss of habitat, even though the Project activities occurring within an estimated 11.78 ha of mapped habitat. This represents only 0.4% and 0.01% of habitat available to the species within a 2.5 km buffer and 10 km buffer of the Project area respectively.
Reduce the extent of occurrence of the species.	Unlikely This species is generally found across coastal Northern Territory and northern Western Australia. Within Queensland, the species has been recorded from only one location, approximately 10 km south of the study area. The species is closely associated with steep hills, rocky outcrops and escarpments (Milne et al. 2006; Churchill 2008; Milne and Hall 2008). Such areas provide logistical challenges for the Project and have been largely avoided. As a result the Project is unlikely to reduce the extent of occurrence of the species.
Fragment an existing population.	Unlikely The Project will result in a localised extent of clearing to a width of 60 m. This is unlikely to present a barrier to the movement of the northern leaf-



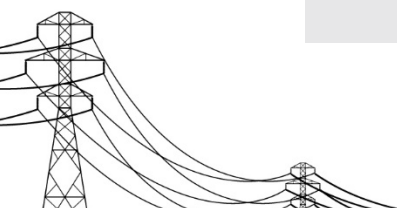
Significant impacts criteria	Assessment
	nosed bat. As such the Project is unlikely to fragment the existing population.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Unlikely There are no invasive species that are recognised as harmful to the species. Regardless, feral pest management techniques will be exercised throughout the entire life cycle of the Project.
Introduce disease that may cause the population to decline	Unlikely There are no known diseases threatening the northern leaf-nosed bat. However, as is relevant to all cave-roosting bat species in Australia, adherence to sanitary protocols is required to ensure that entry to cave roosts does not introduce the risk of White Nose Syndrome. This pathogen was recently considered as a major threat to environmental biosecurity. Currently, the risk of introduced diseases to the northern leaf-nosed bat is low, and can be controlled by limiting human access to roost sites.
Interfere with the recovery of the species.	Unlikely Considering the species is unlikely to roost within the study area, the removal of a narrow 60 m corridor is unlikely to interfere with the recovery of the species. In the majority of study area, habitat reflective of that impacted by the Project is widely recorded adjacent to the study area.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites).	Unlikely The Project is unlikely to cause disruption to any ecologically significant locations for the species. No roosting sites or potentially suitable roosting sites were encountered during field studies. This species is not migratory and is thought to occur as isolated populations across its range (Milne et al. 2006).

7.6.21 Common death adder

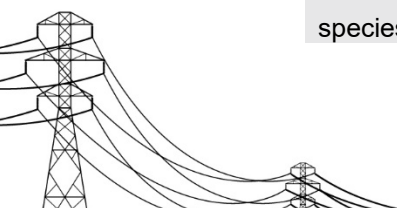
A significance of impact assessment for the common death adder (Vulnerable under the NC Act) is provided in Table 7-39.

Table 7-39 Significant impact assessment of residual impacts - common death adder

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a local population.	Unlikely This species was not recorded during field surveys, however historical records suggest the species is present within the wider region. Considering this species is an ambush predator, the removal of the understory will result in reduced foraging habitat for the species. However, the extent of habitat to be removed is relatively localised compared to the amount persisting adjacent to the study area. The Project activities will occur within an estimated 281.9 ha of potential



Significant impacts criteria	Assessment
	habitat. This represents only 0.17% and 0.04% of habitat within a 2.5 km and 10 km buffer of the Project area respectively. Additionally, the inclusion of pest animal controls are likely to positively impact the species by potentially feral pig abundance in the region.
Reduce the extent of occurrence of the species	Unlikely The Project activities will occur within an estimated 281.9 ha of potential habitat for the species, which is entirely contained within the CopperString Core and Renewable Energy Hub sections of the Project. Within these areas, the removal of a 60 m corridor could potentially reduce the extent of occurrence at a local scale, however, is unlikely to generate a significant impact. Post construction, the groundcover is anticipated to remain relatively undisturbed and the species could continue to utilise and move through the study area.
Fragment an existing population.	Unlikely The Project will result in localised impacts to mapped suitable habitat for the species. This represents only 0.04% of habitat available to the species within a 10 km buffer of the Project area. Pre-clearance surveys will be undertaken in areas of suitable habitat. All clearing will be supervised by suitably qualified fauna spotter-catchers. Where the species is found clearing widths will be minimised to reduce impact on the species. Temporary construction areas will be rehabilitated as soon as possible to minimise any barrier effects. Through these measures the Project is unlikely to fragment the population.
Result in genetically distinct populations forming as a result of habitat isolation.	Unlikely The common death adder has limited movement, typically remaining within a very small area for much of its life. The Project will result in direct clearance of habitat. However this is unlikely to limit the movement of the species, as the species is known to move on roads and other cleared areas. The Project is therefore unlikely to create any substantial barrier to movement of the species that could restrict gene flow.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat.	Unlikely Cane toads and feral pigs have been identified as threatening process for the common death adder. This species hunts using the tip of its tail as 'lure; attracting amphibians to within striking range. Cane toads are highly susceptible to this technique and are known to fatally poison death adders when ingested (Hagman et al. 2008). Habitat degradation by feral pigs has also been recognised as a threat to the species, as pigs often upturn and forage within the understorey that this species inhabits. Considering no artificial food or water sources will be installed by the Project and that feral pest management practices will be incorporated throughout the entirety of the Project lifecycle, the Project is unlikely to result in invasive species becoming established within the area.
Introduce disease that may cause the population to decline.	Unlikely The Project is unlikely to introduce diseases that would impact the common death adder.
Interfere with the recovery of the species.	Unlikely The exact distribution of the common death adder is unclear. Areas of potential habitat are relatively uniform and locally widespread. The



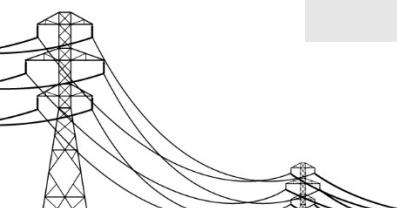
Significant impacts criteria	Assessment
	footprint impacts are therefore expected to result in minimal proportional loss of habitat. The estimated 281.9 ha of suitable habitat within the Project area represents only 0.17% and 0.04% of suitable habitat within a 2.5 km and 10 km buffer of the Project respectively. Greatest impacts are from the potential direct mortality of individuals during clearing. However, these risks will be minimised through the use of preclearance surveys by suitably qualified spotter-catchers. As such, any impacts to potential habitat could interfere with the species' recovery. The Project activities will occur within an estimated 281.9 ha of potential habitat, representing 0.04% of suitable habitat for the species with a 10 km buffer of the Project. Additionally, the removal of grazing and the management of fire regimes could provide additional benefits for the species that offset the potential impacts of the Project.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	Unlikely The Project has the potential to disrupt locations that the species uses for feeding, breeding and resting. However, whether these locations constitute 'ecologically significant locations' is unclear. This species is known to occur in similar habitats outside the study area, though was not recorded during field surveys. Additionally, such impacts are unlikely to be significant considering the nature of the Project (narrow, mostly linear corridor) and potential benefits (pest management) provided by the Project.

7.6.22 Vine thicket fine-lined slider

A significant impact assessment of residual impacts of the Project on the vine thicket fine-lined slider (Vulnerable under the NC Act) is provided in Table 7-40.

Table 7-40 Significant impact assessment of residual impacts - vine thicket fine-lined slider

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a local population	Unlikely The species has not been recorded within the Project area and previously identified habitats have been avoided by realignments in the final corridor. As such, the Project is unlikely to lead to a long-term decrease in the size of a local population.
Reduce the extent of occurrence of the species	Unlikely The species has not been recorded within the Project area. Previously confirmed habitats for the species have been the subject of a realignment for the final corridor. In its proposed alignment, the final corridor selection does not intersect any areas of vine-thicket habitat, and it therefore unlikely to reduce to area of occupancy for the species.
Fragment an existing population.	Unlikely This species has not been previously recorded within the Project area. Regardless, the possibility that the species inhabit the Project area will be addressed by having a fauna spotter catcher conduct preclear surveys of potential habitat to allow any potential populations to be relocated.



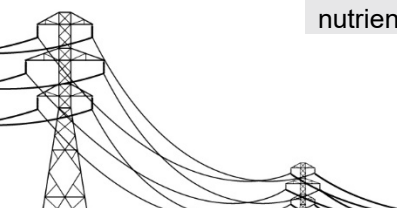
Significant impacts criteria	Assessment
	Should the species occur in the area, it not anticipated to be of sufficient size to be fragmented.
Result in genetically distinct populations forming as a result of habitat isolation.	Unlikely The species has not been recorded within the final corridor selection and potential habitat was not identified during field surveys. If the species is present, it is unlikely to be of a sufficient size that genetically distinct populations could form should the Project isolate the species' habitat.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat.	Unlikely Considering the vine-thicket fine-lined slider mostly inhabits groundcover habitats, invasive weeds pose a risk to the species. Weed free declarations will be required for all vehicles entering the Project site and already established populations will be disposed of in accordance with the Queensland Biosecurity Regulation 2016.
Introduce disease that may cause the population to decline.	Unlikely There are no known diseases that could be potentially introduced by the Project.
Interfere with the recovery of the species.	Unlikely The Project is unlikely to interfere with the recovery of the vine-thicket fine-lined slider. This species was not recorded during field surveys and no potential habitat (e.g. vine-thickets) occurs within the final corridor selection.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	Unlikely The final corridor selection has undergone a realignment to avoid areas of essential habitat for the species. At its closest point, the final corridor selection is 1.5 km from known habitat area for the vine-thicket fine-lined slider.

7.6.23 Migratory bird species

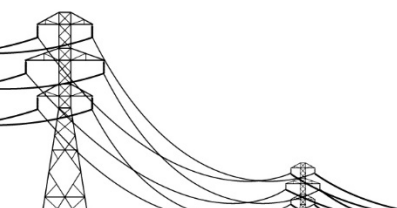
A significant impact assessment of the Project on eight of the confirmed present or likely to occur migratory bird species is provided in Table 7-41. The white-throated needletail is assessed separately in Section 7.6.10 as it is also a listed threatened species.

Table 7-41 Significant impact assessment of residual impacts – migratory bird species

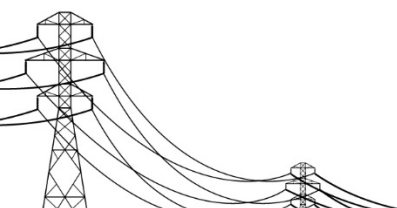
Significant impact criteria	Assessment
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or	Unlikely Mount Isa, particularly Lake Moondarra, may represent important habitat for a number of migratory species, with the oriental pranticole and Latham's snipe using the region as a resting place before continuing to migrate south or east. Lake Moondarra is



Significant impact criteria	Assessment
altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	recognised as an ecologically important wetland and water source for birds migratory across arid Australia (Porter et al. 2006). Within the Mount Isa Augmentation, the final corridor selection does not intersect or come in proximity to any wetland areas or water sources and is approximately 20 km south of Lake Moondarra. Although the Project activities will occur within an estimated 65.15 ha of non-breeding or breeding habitat for migratory bird species, this consists mostly of ephemeral waterbodies and watercourses that represent sub-optimal habitat and are distributed across a large geographic area. None of the mapped potential is likely to represent 'important habitat' as the species would likely be recorded as transient visitors. No single, large waterbody that represents a communal source of habitat will be directly or indirectly impacted. The final corridor selection has been designed with consideration of the ecological values present within the Project area and largely avoids wetland areas. Ephemeral watercourses are anticipated to be relatively unimpacted as transmission lines span a great distance (400 m) than the average width of the watercourses. Where watercourses or wetlands may be impact, mitigation measures will be included in the Project EMP to reduce the likelihood, extent and severity of impacts.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	Unlikely Feral cats and European foxes are known occur in the area. Both species represent invasive species that are harmful to migratory species and increase predation pressure of species resting within the Project area. Considering both species are already locally established, the Project is unlikely to introduce additional invasive fauna to the Project area. Invasive flora species poses a threat to migratory species through the degradation of habitat and potential impacts to foraging resources. The risk of invasive fauna species has been addressed by the requirement of weed and seed declaration for all Project vehicles on site. Additionally, weed management practiced implemented throughout the Project's lifespan will be targeted towards reducing weed abundance and encroachment into the area. This could benefit migratory species by increase the quality of habitat.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	Unlikely The Project area does not contain breeding habitat for any of the migratory species confirmed present or likely to occur, as discussed below. Glossy ibis – This species breeds in colonies in trees or shrubs growing in water throughout Australia. No habitat was identified during field surveys. Latham's snipe – The species breeds in Japan and eastern Russia between March and November (DoEE, 2019b; Higgins and Davies, 1996).



Significant impact criteria	Assessment
	Gull-billed tern – The breeding season of the Gull-billed Tern is flexible, however there are few breeding reports north of about 25°S. The Project is located between 20 - 21°S. Caspian tern – The species breeding habitat is dispersed throughout its' range. In Queensland, breeding habitat is associated with offshore islands including the Wellesley Islands, Bird Island, Three Isles and islands off Shoalwater Bay. Inland breeding has been recorded at Lake Brindegolly and Lake Moondarra (Higgins and Davies 1996). No suitable breeding habitat was observed within the study area or is expected to be impacted by the Project. Fork-tailed swift – The fork-tailed swift does not breed in Australia, with breeding activities restricted to Siberia between August and September (Higgins 1999). White-throated needletail – The white-throated needletail does not breed in Australia. Breeding occurs in Japan, Siberia and Pakistan (Higgins 1999). Oriental pratincole – Oriental pratincoles breed in southern, south-eastern and eastern Asia, from northern parts of the Indian subcontinent, east through Bangladesh, Burma, Thailand and Vietnam to southern, eastern and northern China, Mongolia and adjacent areas of south-eastern Siberia. Marsh sandpiper - The species breeds in eastern Europe and Siberia and occurs in Australia between September and March/April. Wood sandpiper - The species is a non-breeding visitor to Australia from August - and is known to broadly occur across northern Australia, particularly throughout the Kimberly and Mount Isa regions. The species breeds throughout northern Eurasia and occurs in Australia between August and April.



7.7 Conclusion

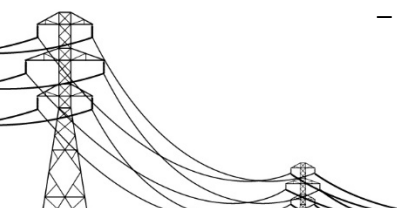
Desktop and field surveys were undertaken to assess the ecological values potentially impacted by construction and operation of the Project. The ecological assessment utilised field data obtained through the original EIS and SEIS undertaken for the Project in 2011.

A preliminary corridor selection workshop was undertaken in March 2019 to identify areas of high ecological value that could be avoided by the Project through a process of realignment of localised sections of the transmission line and corridor selection. Notably this minimised impact to watercourses and avoided any impact on the Semi-evergreen vine-thicket TEC, Of Concern RE, wetlands and habitats for conservation significant species.

The extensive size and linear nature of the Project means it intersects large areas of land, crossing six bioregions and six major catchments. While much of the land intersected by the Project is devoted to pastoral land uses and has been subject to varying levels of existing impact from grazing, weed and pest infestation, land clearance and erosion, areas of higher ecological value persist.

The Project identified one TEC and 23 conservation significant species listed under the EPBC Act and/or NC Act and 8 additional migratory bird species listed under the EPBC Act that were confirmed present or considered likely to occur:

- MNES conservation significant species:
 - *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* – confirmed present
 - *Eucalyptus raveretiana* – confirmed present
 - *Livistona lanuginosa* – confirmed present
 - *Acacia crombiei* – likely to occur
 - Squatter pigeon (southern) (*Geophaps scripta scripta*) – confirmed present
 - Koala (*Phascolarctos cinereus*) – confirmed present
 - Black throated-finch (*Poephila cincta cincta*) – confirmed present
 - Julia Creek dunnart (*Sminthopsis douglasi*) – confirmed present
 - White-throated needletail (*Hirundapus caudacutus*) – likely to occur
 - Red goshawk (*Erythrorhynchus radiatus*) – likely to occur
 - Night parrot (*Pezoporus occidentalis*) – likely to occur
 - Painted honeyeater (*Grantiella picta*) – likely to occur
 - Australian painted-snipe (*Rostratula australis*) – likely to occur
 - Ornamental snake (*Denisonia maculata*) – likely to occur
 - Plains death adder (*Acanthophis hawkei*) – likely to occur
 - Grey falcon (*Falco hypoleucos*) – likely to occur
- MNES migratory species:
 - Glossy ibis (*Plegadis falcinellus*) – confirmed present
 - Caspian tern (*Hydroprogne caspia*) – confirmed present
 - Oriental pratincole (*Glareola maldivarum*) – confirmed present
 - Marsh sandpiper (*Tringa stagnatilis*) – confirmed present
 - Wood sandpiper (*Tringa glareola*) – confirmed present
 - Latham's snipe (*Gallinago hardwickii*) – likely to occur
 - Gull-billed tern (*Gelochelidon nilotica*) – likely to occur



- Fork-tailed swift (*Apus pacificus*) – likely to occur
- White-throated needletail (*Hirundapus caudacutus*) – likely to occur
- MSES conservation significant species (only)
 - *Eucalyptus nudicaulis* – confirmed present
 - *Acacia armitii* – confirmed present
 - Purple-necked rock-wallaby (*Petrogale purpureicollis*) – confirmed present
 - Short-beaked echidna (*Tachyglossus aculeatus*) – confirmed present
 - Vine thicket fine-lined slider (*Lerista cinerea*) – confirmed present
 - Northern leaf-nosed bat (*Hipposideros stenotis*) – likely to occur
 - Common death adder (*Acanthophis antarcticus*) – likely to occur

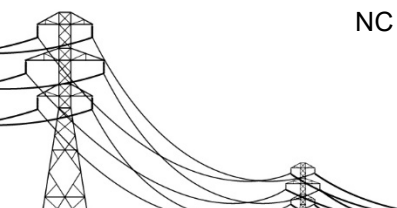
Impacts to these ecological values have been avoided by locating the proposed corridor in areas of cleared open land wherever possible. A range of other measures will be used to minimise the impact on habitat, by micro-siting towers away from areas of high resource value to avoid breeding/nesting habitat and wetlands. Impact to watercourses will also be avoided as a priority by positioning towers so that spans cross watercourses entirely without the need to locate infrastructure on the bed or banks.

Despite these measures, the Project will impact habitat for a range of conservation significant species. While the area of habitat estimated to be cleared is relatively large, this is spread over a large geographic area. The proportional loss of habitat in any local or regional area indicates that for these species, the loss of habitat is unlikely to have significant adverse ecological effects in terms of a loss of access to habitat and resources.

For two conservation significant species (koala and ornamental snake), the area of habitat anticipated to be cleared exceeds the threshold for which a significant impact is predicted in Commonwealth referral guidelines. However, the guidelines acknowledge that these thresholds may not apply to all projects. The impacts are accumulated over a substantial linear distance and impact populations that are effectively isolated from one another. Under these circumstances, population impacts should be considered at a local scale. For both species, the loss represents a small proportion of the habitat present within the local landscape. Substantial avoidance of habitat has been achieved via spanning areas of high value habitat and micro-siting towers and access tracks to avoid koala food trees and gilgais utilised by the ornamental snake. The total impact on the ornamental snake does not incorporate avoidance that can be achieved via micro-siting. The loss of habitat therefore represents a loss of potential foraging habitat. All breeding habitat likely to represent habitat critical to the survival of the species has been avoided through preliminary corridor selection process or will be avoided through pre-clearance surveys to micro-site towers and access tracks. As koala habitats within the Project area are typically located in open woodland with sparse tree densities, there is substantial opportunity to avoid direct loss of mature koala food trees via localised micro-siting of tracks, towers and other infrastructure. Given the relatively benign nature of the Project during the operation phase and the potential to avoid and reduce impact during construction, the Project is considered unlikely to have a significant impact on these species.

A range of mitigation measures are proposed to identify and avoid impact to high-risk ecological receptors during the construction phase, as detailed in Appendix G of Volume 3 Appendix P Ecological Assessment and Table 7-17 of this chapter. Key measures include:

- Targeted surveys for conservation significant plants in accordance with Flora Survey Guidelines (DES 2014)
- Targeted surveys for breeding places of conservation significant species listed under the NC Act and preparation of High Risk SMPs. This would be proposed to minimise impact on



breeding places for the ornamental snake, squatter pigeon (southern) and the black-throated finch (southern)..

- Utilise micro-siting options to avoid or minimise direct impact on areas of high ecological value including populations of conservation significant flora, breeding places for conservation significant fauna and aquatic habitats
- Use of specialist fauna spotter-catchers for clearance of high-risk habitats including areas of Mitchell grass plains providing habitat for the Julia Creek dunnart and plains death adder and areas of potential habitat for the night parrot.
- Use of koala clearing protocols to minimise impact on koalas including the use of koala-specialist spotter-catchers, sequential clearing of koala habitat and allowing koalas to move out of clearing zones of their own accord.
- Ongoing consultation with members of the Night Parrot Recovery Team to identify optimal ways to assess and minimise impact of clearing activities in areas of suitable habitat.

The measures proposed are consistent with the principles of harm avoidance and minimisation recommended by the Commonwealth government.

Key impacts on ecological values are restricted to the construction phase. Areas of high ecological sensitivity will require targeted management measures to mitigate construction impact. Local ecological management plans will be developed as part of the field development plan during detailed design following the EIS process, to manage construction risks to the following key areas:

- Ballara Nature Refuge and other areas of potential habitat value for the night parrot
- Areas of potential breeding habitat for the ornamental snake
- Areas of potential nesting habitat for the black-throated finch (southern)
- Areas of koala habitat particularly koala movement corridors
- Known populations of conservation significant plants.

