Banana Range Wind Farm Connection Project

Final Corridor Selection Report

For Powerlink Queensland

30 March 2023
62094-150,140

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Executive Summary

EDF Renewables (EDF) is the proponent of the proposed Banana Range Wind Farm (BRWF) project located approximately 20km west of Biloela in Central Queensland. Stage one of the BRWF project comprises around 50 wind turbines and a battery energy storage system with an initial output of approximately 230 megawatts (MW) of renewable energy.

Powerlink Queensland (Powerlink) is the owner, developer and operator of Queensland's electricity transmission network and has been engaged by EDF to connect their project to the network. Powerlink has examined a range of options, including connecting the Banana Range Wind Farm to the existing 132kV transmission line between Calvale, Biloela and Moura and replacing the existing 132kV transmission line with a new 275kV transmission line. It was determined the most feasible solution is to construct a new 275kV double circuit transmission line from Powerlink's existing Calvale Substation (near Callide Power Station) to the proposed BRWF Substation.

The purpose of this Final Corridor Selection Report (FCSR) is to outline the public consultation process recently undertaken regarding the Draft Corridor Selection Report (DCSR), how submissions have been considered and any amendments to Powerlink's Northern Corridor 1 as the Study Corridor within which to locate the proposed transmission line.

Early engagement for the project commenced in June 2022 with phone calls and letters to landholders in the Study Area. Meetings were also undertaken from this time and are ongoing. In mid-June 2022, letters were sent inviting all landholders in the Study Area to attend the first community information drop-in sessions at the Biloela Civic Centre in mid-July 2022 to find out more about the project.

The key matters raised by landholders include:

- Impacts to farming operations including biosecurity, loss of productivity, irrigation systems such as centre pivots and travelling irrigators;
- Proximity to homes;
- Visual impacts of the transmission line;
- Loss of property value; and
- Perceived health effects from Electric and Magnetic Fields (EMFs).

Feedback from the Study Area engagement process provided valuable information for the initial identification of potential corridors for the proposed transmission line. Three potential corridors generally 1km wide were identified for detailed analysis and in late August 2022, landholders within each corridor were contacted together with a range of other stakeholders to provide initial comments on the suitability of the corridors. Landholders, the wider community and other stakeholders were also invited to attend the second community information drop-in sessions in mid-September 2022 where more than 25 members of the community participated.

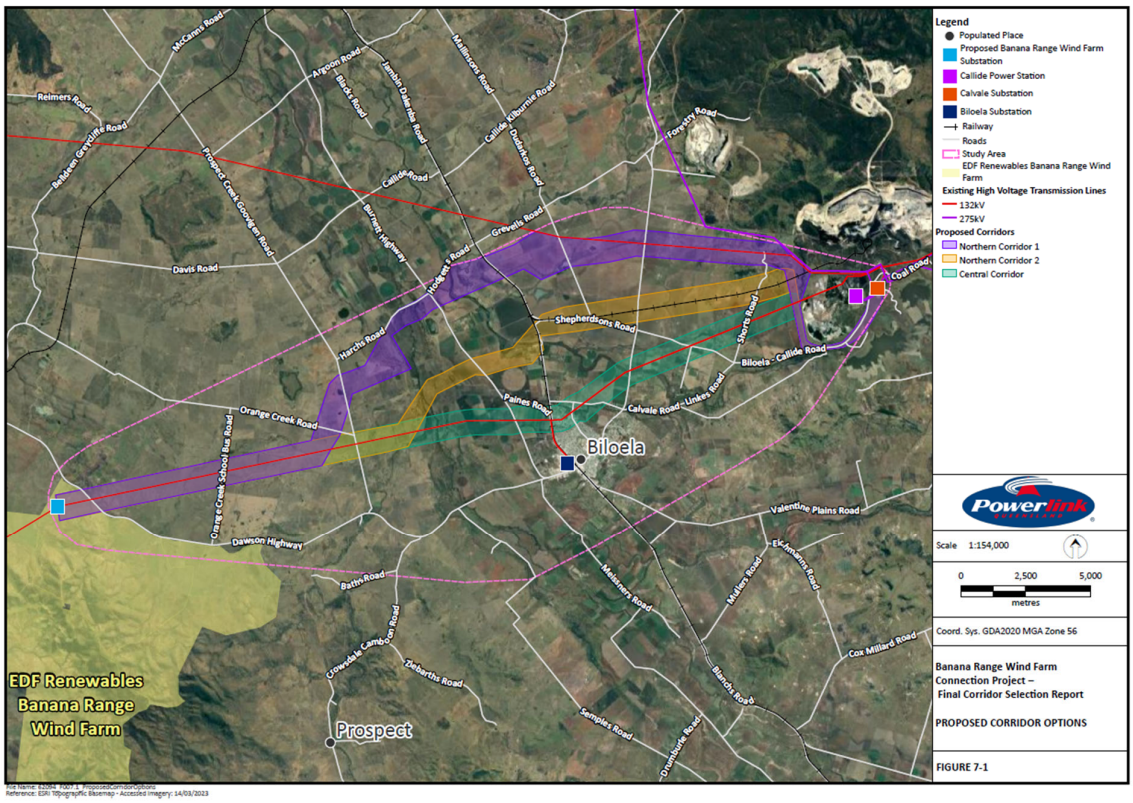
Initial feedback received from landholders within the potential corridors and the broader community was consistent with the earlier engagement undertaken in July 2022 with some new matters raised, including:

- Impacts to transport routes and airstrip and aviation facilities within or nearby the potential corridors; and
- Impacts to major development plans on some properties, including other renewable generation projects.

The key matter raised by landholders across the early engagement phase was for the location of the transmission line corridor to minimise impacts on high value cultivated land due to concerns regarding farm productivity and personal safety. More specifically, these concerns related to:

- Permanent removal of areas from production and associated loss of revenue;
- Electrical safety concerns for farm infrastructure operating in proximity of the transmission line; and
- Impact of EMF on farm personnel and Radio Frequency Interference on GPS guided farm machinery.

Based on analysis of the Study Area, community and landholder feedback from the initial early engagement process and Powerlink's own experience developing electricity transmission infrastructure, three proposed corridor options were identified for comparative assessment. The corridors are generally 1km wide, with a small number of locations where proposed corridors have been slightly expanded and these are shown as Northern Corridor 1, Northern Corridor 2, and Central Corridor below.



Northern Corridor 1 is found in the northern most section of the Study Area and seeks to reduce the level of interaction with high value cultivation land. It provides significant opportunities to align the transmission line to property boundaries and also co-locate the proposed 275kV transmission line with a section of the existing Calvale to Baralaba 132kV line. Finally, the corridor contains less than 10 houses and other places of assembly.

Northern Corridor 2 is similar to Northern Corridor 1 but is located further south and centred on co-location opportunities with the Moura rail line servicing the Callide Power Station and Mine. This corridor also contains a comparatively low number of houses or places of assembly (10 in total); however, it traverses significant areas of high value cultivation land, based on Strategic Cropping Land and Agricultural Land Class definitions and mapping, significant impacts an airfield on Shepherdson's Road and includes the Teys Abattoir site.

The Central Corridor is co-located with Powerlink's existing Calvale to Biloela to Moura 132kV transmission line and like Northern Corridor 2, traverses directly across extensive areas of cultivation between the power station west to Kroombit Creek. The 132kV line was built in the 1960s and since that time, many houses have been built in close proximity to the transmission line. This has resulted in more than 240 houses now being located within the 1km wide Central Corridor. All proposed corridor options are common around the southern half of the Callide Power Station area and also from west of Prospect Creek Goovigen Road to the BRWF Substation. This commonality is due to significant restrictions posed by existing transmission lines around the northern side of the power station and strong co-location opportunities with the existing Calvale-Biloela-Moura 132kV line in grazing country west of Kroombit Creek.

Environmental values within all corridors are limited due to historical and current land use with higher value areas generally confined to existing creek lines and an area south-west of Calvale Substation along Biloela-Callide Road.

The comparative assessment of proposed corridor options, informed by feedback from the early engagement process, identified Northern Corridor 1 as the recommended corridor for the proposed 275kV transmission line connecting the BRWF to the electricity transmission network at Calvale Substation. While slightly longer than the other corridors, Northern Corridor 1 has the lowest social impacts given it affects the least number of land parcels and houses and has the smallest area of Strategic Cropping Land and Class A and B land. Northern Corridor 1 also avoids direct impacts on an airfield and Teys Abattoir which occurs along Northern Corridor 2. While the shortest in length, the Central Corridor traverses extensive areas of cultivation and has the highest number of houses due to the urban growth of Biloela since the 1960s. The proposed 275kV transmission line structures will be significantly larger (approximately 20m taller, wider, with larger steel members and bigger footprint) than the existing 132kV structures due to the difference in voltage and modern design standards. Powerlink considers an additional line in this corridor will have a compounding impact on visual amenity for directly affected and nearby houses even after discounting for the existing visual impact from the smaller 132kV line. Potential environmental impacts to protected flora and fauna are low across all proposed corridor options and mainly limited to watercourses which can be easily spanned by the project.

In early November 2022, Powerlink briefed local, state and federal elected representatives and community leaders ahead of the release of the Draft Corridor Selection Report (DCSR) later that month. Landholders within the three corridors, wider Study Area, elected representatives and industry representative bodies were notified by phone, email or letter. The DCSR was also placed on Powerlink's website and a print version held by Banana Shire Council.

Powerlink held community information drop-in sessions on 29 and 30 November 2022 to support the release of the DCSR and provide landholders and the community with opportunities to discuss the assessment directly with project staff. Based on stakeholder feedback that end of year harvest would limit availability to make a submission before Christmas, the consultation period was then extended to Friday 20 January 2023 (originally closing 16 December 2022).

A total of nine submissions were received, mainly from landholders within Northern Corridor 1, together with CS Energy and the Federal Member for Flynn.

Key themes expressed by the submitters are summarised below:

- The proposed transmission line's interaction with CS Energy's existing and future infrastructure at Callide Power Station needs to be carefully designed and managed;
- Concerns regarding impacts of the proposed transmission line on high quality agricultural land (especially cultivation);

- Concerns regarding the lack of engagement between the renewable energy sector and agricultural sector;
- Locating the proposed line adjacent the existing 132kV line traversing Biloela or replacing the existing line within the Central Corridor is the lowest impact option;
- The recommended Northern Corridor 1 unduly affects food and fodder producers with calls for the line to be located within the Central Corridor;
- Use of the Ministerial Infrastructure Designation process and compulsory easement acquisition process under the *Acquisition of Land Act 1967* is inappropriate for a private sector development;
- Some landholders nominated areas within their properties most suitable for the proposed line;
- Land use, house and land parcel data has been manipulated as it does not take account of properties already affected by the existing 132kV line between Calvale-Biloela-Banana Range;
- Consultation and communication has been poor;
- Endangered vegetation will be removed and should be protected; and
- The project is a private nuisance and constitutes Assault by Force under the Queensland Criminal Code.

Powerlink has carefully reviewed each submission to identify matters which materially impact the recommendation and has determined that only minor changes are required to Northern Corridor 1 namely:

- Small reduction in corridor width west of Kroombit Creek to focus corridor on alignment with property boundaries in this location; and
- Small increase in corridor width in the area near Dudarkos Road to provide additional flexibility to determine an alignment with landholders that considers the impact on housing and planned future land use for cultivation activities.

All mapping and assessment tables in this FCSR have been amended to reflect these changes which do not affect the comparative assessment of corridor options. Powerlink has responded to each submitter detailing how the matters raised in their submissions have been addressed. A table summarising all matters raised and Powerlink's response can be found in Appendix A of this report. For privacy reasons, private landholder details and property names have been removed from the table.

Powerlink will now adopt Northern Corridor 1 shown in this report as the Study Corridor within which detailed landholder engagement will shortly commence to determine a suitable alignment for the proposed transmission line. Development approval and land acquisition for the proposed transmission line will commence later in 2023 with construction expected to occur from 2024.

1. Introduction

1.1 Project Need

EDF Renewables (EDF) is the proponent of the proposed Banana Range Wind Farm (BRWF) project located approximately 20km west of Biloela in Central Queensland. Stage one of the BRWF project comprises around 50 wind turbines and a battery energy storage system with an initial output of approximately 230 megawatts (MW) of renewable energy. Powerlink Queensland (Powerlink) owns and operates Queensland's electricity transmission network and has been engaged by EDF to connect their project to the network.

1.2 Transmission Connection Options Considered

Powerlink has examined a range of options to connect the proposed wind farm to the electricity transmission network and determined the most feasible solution is to construct a new 275kV double circuit transmission line from Powerlink's existing Calvale Substation (near Callide Power Station) to the proposed BRWF Substation.

Figure 1-1 shows the existing Powerlink 132kV and 275kV network in the region and the proposed BRWF Project Area.

Other potential connection options considered by Powerlink include: –

- Utilising the existing Calvale to Biloela to Moura 132kV transmission line which traverses the wind farm site; and
- Replacing the existing 132kV line with a new 275kV line from Calvale Substation to the proposed BRWF Substation.

A brief overview of these options is provided below.

1.2.1 Connecting the Banana Range Wind Farm to the existing 132kV transmission line between Calvale, Biloela and Moura

A section of Powerlink's existing 132kV transmission line between Calvale, Biloela and Moura traverses the BRWF Project Area as shown in **Figure 1-1** below. This line supplies electricity to Biloela and Moura and cannot be removed from service as there is no alternative supply that can meet the electricity demand requirements. As part of the early engagement process discussed in Section 4, several landholders asked whether the proposed wind farm could connect to the existing 132kV transmission line. This line was built in the early 1960s and has a capacity of approximately 100MW. With existing loads on this line, available spare capacity for new generation is limited to approximately 50MW. The proposed capacity of the wind farm is currently 230MW and therefore exceeds the capacity of this line. Landholders have also queried whether the existing line could be rebuilt to a higher capacity. Installation of modern conductor would increase the capacity of the line; however, the additional weight of the larger conductor exceeds the loading limits of the existing transmission towers. A new line would need to be built on a separate alignment.

In summary, Powerlink's existing 132kV transmission line traversing the BRWF Project Area does not have sufficient spare capacity to connect the proposed wind farm and cannot be upgraded to provide the capacity required.

1.2.2 Replacing the existing 132kV transmission line with a new 275kV transmission line

Some landholders have asked whether the proposed 275kV transmission line could be built adjacent to the existing 132kV line which would then be removed. This supply option would require building a new 275/132kV substation at Biloela and the BRWF project site. The cost for these additional works makes this supply option uneconomic compared to other supply options considered.

Legend

- Populated Place
- Proposed Banana Range Wind Farm Substation
- Callide Power Station
- Calvale Substation
- Biloela Substation
- Railway
- Roads
- EDF Renewables Banana Range Wind Farm

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Powerlink Queensland

Scale 1:154,000

0 2,500 5,000

metres

Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

LOCALITY MAP

FIGURE 1-1

File Name: 62094_F001.1_LocalityMap
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

2. Transmission Line Project Description

The proposed 275kV transmission line will comprise steel lattice towers in a double circuit arrangement. A representative photo is shown in Photo 1.

Photo 1 Self-supporting steel lattice tower in double circuit configuration

Tower heights vary depending on topographical and land use features and typically range between 40-60m in height. Span lengths between towers also vary depending on the same features with a typical length on flat ground being around 450m.

275kV transmission lines are generally located within a 60m wide easement registered on each property title. The easement provides Powerlink with a legal right to access land and build, operate and maintain transmission infrastructure Ownership of the land remains with the landholder and farming activities can continue within the easement and under the transmission line conductors subject to safety and operational restrictions as specified in the easement terms. A key focus of the engagement process is for Powerlink to work with each directly affected landholder to understand their property operations and where possible, place transmission structures and provide sufficient conductor height above ground to minimise impacts to farming operations.

Construction of a transmission line is undertaken in five stages:

- Vegetation clearing and access tracks;
- Transmission tower benching and foundations;
- Tower assembly and erection;
- Installation of conductor (powerline wires) onto the transmission tower; and
- Site rehabilitation and demobilisation.

These are discussed in greater detail in Sections 2.1 to 2.4.

2.1 Vegetation clearing and access tracks

Sufficient vegetation is cleared from the easement to enable the transmission line to be safely operated. A range of clearing methods may be used depending on land use, environmental constraints, maintenance requirements and landholder preferences. Existing tracks are used where possible and new tracks installed to provide access to each tower site. Tracks are typically left in place following the completion of construction to facilitate ongoing access requirements for operation and maintenance activities.

2.2 Transmission tower benching and foundations

Geotechnical assessments undertaken prior to construction determine the type of foundation to be installed in a particular location. Bored foundations are most common and typically excavated down 8-12m depending on the underlying geology. Reinforcing steel is placed in the excavation and a jig set-up to ensure the tower leg stub is held in the correct orientation. Concrete is placed into the excavation with the foundation column finished slightly above ground level.

2.3 Tower assembly and erection

Steel for lattice towers is fabricated, galvanised, sorted and bundled ready for delivery to each tower site typically by a semi-trailer. Assembly of the tower is usually carried out adjacent to its final site and involves tower sections being lifted by crane into position and bolted together (Photo 2).

Photo 2 Tower assembly

2.4 Installation of conductor onto the transmission tower

This stage involves installing the conductors (or wires) onto the tower in a process known as 'stringing'. Conductor is installed in sections along the line. A powerful winch is set up at one end of the section and a brake at the other. Pulleys are attached to the insulators on each tower cross arm and a small draw wire/rope is drawn through the pulleys, in some instances by a helicopter. The conductor is connected to the draw wire which is drawn through the winch. The winch pulls out the conductor under tension through each pulley on the tower. The conductor is then clamped in final position at the end of each insulator and equipment is repositioned to the next stringing section to repeat the process. Photo 3 shows a helicopter running out the draw wire through the pulleys on the tower crossarms.

Photo 3 Helicopter stringing

2.5 Site rehabilitation and demobilisation

Once construction activities are completed, each tower site is rehabilitated to ensure the soil is stable and provides a matrix for vegetation establishment to prevent erosion. Rehabilitation also includes the replacement or reinstallation of farm infrastructure that may have been removed and remediation of paddocks affected by construction activities to allow farming activities to continue. Powerlink works with each landholder to agree on the rehabilitation requirements on each property.

3. Purpose of this report

The purpose of this Final Corridor Selection Report (FCSR) is to outline the public consultation process recently undertaken regarding the Draft Corridor Selection Report (DCSR), how submissions have been considered and any amendments to Powerlink's recommendation to adopt Northern Corridor 1 as the Study Corridor within which to locate the proposed transmission line. The assessment of proposed corridor options in the DCSR considered a range of social, environmental and physical factors identified via desktop and limited field-based analysis as detailed in Section 5. This analysis has been complemented by broad, early engagement with landholders, the wider community and other stakeholders (refer Section 4 of this report).

3.1 Assessment Methodology

The methodology adopted for this FCSR comprises the following steps:

- Define a broad Study Area for the transmission line project incorporating the two substation locations and of sufficient width to enable flexibility in the identification and assessment of viable corridor options;
- Build a project-specific geographical information system database which includes data that is publicly available or supplied by Powerlink;
- Undertake initial engagement with landholders, the local community and other stakeholders within the Study Area to understand matters of importance to them and obtain detailed local knowledge to help inform the identification and assessment of potential corridors;
- Undertake a desktop and limited field-based assessment of environmental, land use and social characteristics and features using the geographical information system database, topographic maps, satellite imagery, local government planning schemes, government mapping, database searches and inspections from roads and other public areas;
- Use the information from the engagement and assessment processes to evaluate the Study Area and identify potential transmission line corridors generally 1km wide;
- Undertake initial engagement with landholders, the local community and other stakeholders regarding the potential corridors and seek feedback on their suitability and opportunities for refinement;
- Comparatively assess the potential corridors and identify the recommended corridor within which to locate the transmission line.
- Publicly release the DCSR to provide landholders, the local community and other stakeholders with an opportunity to review the assessment and make a formal submission on the suitability of the findings.
- Review all submissions received, provide a detailed written response to submitters and undertake further engagement and technical assessments as necessary before finalising the CSR; and
- Publicly release this FCSR to notify stakeholders of the outcome of the public consultation and determination of the corridor within which the transmission line will be located. This corridor is known as the Study Corridor and is then subject to detailed technical assessment and engagement with directly impacted landholders, the local community and other stakeholders.

4. Early engagement with landholders and the community

Electricity transmission infrastructure requires the construction of large steel structures along a linear alignment which may impact on the existing social and environmental characteristics of the receiving community. Powerlink recognises its proposed infrastructure may cause uncertainty for members of the community and is committed to engaging early and transparently with landholders, the broader community and other stakeholders in its development process to ensure they are aware of the project (a 'no surprises' approach), have multiple opportunities to provide valuable local knowledge and insights, and can comment on the suitability of Powerlink's project moving forward.

4.1 Consultation regarding the Study Area

Early engagement for the project commenced in June 2022 with phone calls and letters to landholders in the Study Area. Meetings were also undertaken from this time and are ongoing. In mid-June 2022, letters were sent to all landholders in the Study Area inviting them to attend the first community information drop-in sessions at the Biloela Civic Centre in mid-July 2022 to find out more about the project.

Data from engagement regarding the Study Area is provided below:

- Number of phone calls made/received – 157;
- Number of letters (June 2022) sent – 227;
- Number of individual meetings – 3;
- Number of feedback forms received – 7;
- Number of emails received – 4;
- Number of entries on interactive mapping site (Social Pinpoint) – 6;
- Number of feedback forms submitted at community information drop-in sessions – 27; and
- Number of people attending community information drop-in sessions – 35.

The key matters raised by landholders during the early engagement phase for the Study Area are summarised in Plate 1.

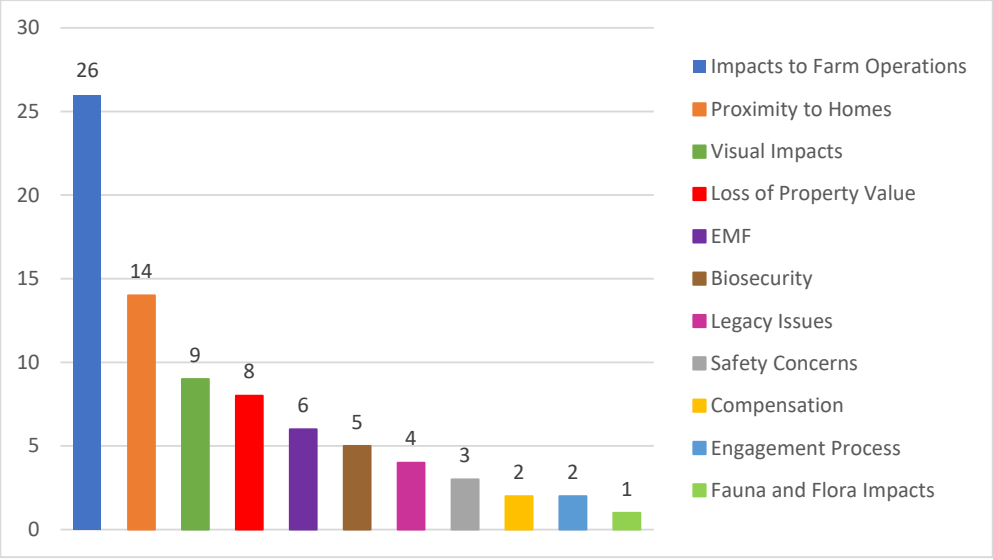


Plate 1 Matters raised by landholders during early engagement for the Study Area

The top 5 matters raised by landholders included:

- Impacts to farming operations including biosecurity, loss of productivity, impact on machinery movement and access, compaction of soils, irrigation systems such as centre pivots and travelling irrigators;
- Proximity to homes;
- Visual impacts of the transmission line;
- Loss of property value; and
- Perceived health effects from Electric and Magnetic Fields (EMFs).

4.2 Initial consultation regarding the potential transmission line corridors

Feedback from the Study Area engagement provided valuable information for the assessment of potential corridors for the proposed transmission line. Three potential corridors generally 1km wide were identified for detailed analysis and in late August 2022, landholders within each corridor were contacted together with a range of other stakeholders and invited to provide initial comments on the suitability of the corridors. They were also invited to attend the second round of community information drop-in sessions in mid-September 2022 where over 25 members of the community participated. These sessions enabled the project team to meet face-to-face with landholders within the potential corridors and other stakeholders in the project area to discuss any issues or concerns and provide valuable feedback on the proposed corridor options. All interactions with landholders were captured with feedback options remaining open for comment until 30 September 2022.

Data from initial engagement regarding the potential transmission line corridors is provided below:

- Number of phone calls made/received – 60;
- Number of Corridor Option letters and supporting information (via email or post) sent – 56;
- Number of attendees at community information drop-in sessions – 28;
- Number of meetings – 21;
- Number of email submissions received – 11;
- Number of feedback forms received – 1; and
- Number of entries on interactive mapping site (Social Pinpoint) – 6 (from 28 August 2022)

The feedback received from landholders within the potential corridors and the broader community was consistent with the earlier engagement undertaken in July 2022 with some new matters identified including:

- Impacts to transport routes and airstrip and aviation facilities within or nearby the potential corridors.
- Impacts to major development plans on some properties, including other renewable generation projects.

Plate 2 graphs the key matters raised by landholders and other stakeholders across the corridor option phase engagement.

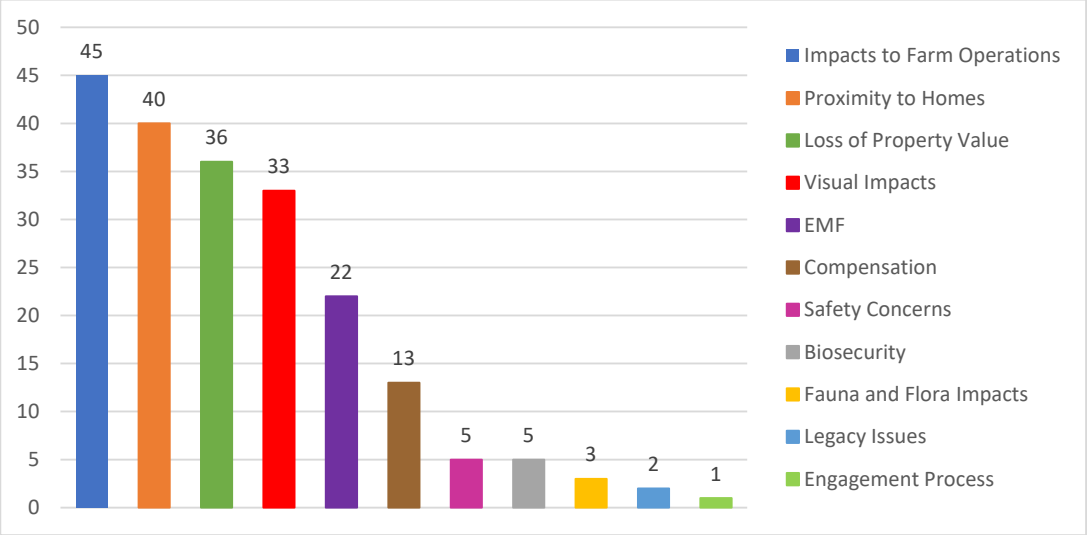


Plate 2 Matters raised by landholders during early engagement on the proposed corridor options

There was a wide range of feedback received on the proposed corridor options, particularly in relation to transport routes, airstrip and aviation facility operations and the potential for proposed corridors to impact upon planned development or investment in infrastructure on properties. Small amendments were made to the boundaries of some of the corridors as part of updating the DCSR.

4.2.1 Farming Near Transmission Lines

The key matter raised by landholders across the early engagement phase was for the transmission line to minimise impacts on high value cultivated land due to concern for farm productivity and personnel safety. More specifically these concerns have related to:

- Permanent removal of areas from production and associated loss of revenue;
- Electrical safety concerns for farm infrastructure operating in proximity of the transmission line; and
- Impact of EMF on farm personnel and Radio Frequency Interference on GPS guided farm machinery.

This section provides an initial overview of these matters with more detailed information to be provided by Powerlink as engagement progresses.

4.2.2 Removal of areas from production

The base of transmission towers varies in size depending on the height of the structure and whether it is on a bend point or part of a straight run. Generally, tower bases range in size from 8m x 8m up to 20m x 20m. A clearance area of 20 metres around towers needs to be maintained for all planting type activities. The permanent loss of the tower base, clearance area and access tracks to agricultural production is assessed as part of the compensation process. Agricultural activities, such as grazing or production of low growing crops (less than 3.5m high) are permitted within the remainder of the easement, although approval may be necessary for tall operating equipment.

Powerlink will work with each directly affected landholders to locate towers, so far as practicable, in locations which minimise impacts to farming operations. There are design and cost limitations to what can be achieved which may restrict tower locations to the specific location requested by a landholder, however, Powerlink will work closely with landholders to examine and consider their particular property requirements to minimise impacts as much as possible. It is Powerlink's preference to, where possible, position towers close to boundaries or other existing infrastructure to

minimise impacts on cropping activities. Co-location advantages include minimising impacts on cropping land by limiting the impacts to one area, and ability to utilise existing access tracks and points for maintenance.

4.2.3 Electrical safety

Powerlink will also work with each landholder to understand the operating height of farm machinery that may work safely under the transmission line conductors and may consider increasing the height of the towers so farming activities can be undertaken safely.

4.2.4 Electric and Magnetic Fields, including Radio Frequency Interference

EMF are found everywhere electricity or electrical equipment is used, including in the home, office, work sites and around transmission lines.

Electric fields are present in any appliance plugged into a power point which is switched on or on stand-by. They are proportional to the voltage of the appliance and the distance the user is from it. They are strongest close to their source and their strength diminishes rapidly as you move away in much the same way as noise decreases as you move away from the source. Electric fields are also shielded by most objects including trees, buildings and even human skin.

Magnetic fields are present in any appliance plugged into a power point, switched on and operating. They are proportional to the amount of electrical current flowing in the device. When an appliance is completely turned off, there is no magnetic field. Again, these are strongest close to their source, and their strength diminishes rapidly as you move away.

The power industry in Australia has a proactive management program specific to EMF at power frequencies (50 Hz). In conjunction with this, the Federal Government's Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) also maintains continual oversight of emerging research into the potential health effects of EMF exposure from powerlines and other electrical sources in order to provide accurate and up-to-date advice. The scientific evidence from independent bodies does not establish that exposure to EMF found around the home, the office or near powerlines and other electrical sources is a hazard to human health.

ARPANSA publishes guidelines for EMF exposure relating to all relevant situations to ensure community safety and the safety of electricity industry staff who work at much closer distances.

For magnetic fields, Powerlink's transmission network is designed and operated well below the general public exposure guideline limits of 200 micro-Tesla (μT). Similarly for electric fields, the network is designed and operated to observe the recommended general public guideline limit of 5 kilovolts per metre (kV/m).

Powerlink recognises community interest in EMF and is committed to working closely with landholders, the local community and other stakeholders by:

- Taking a prudent avoidance approach. Where possible, locating proposed transmission infrastructure away from houses and habitable buildings so they do not materially add to EMF levels that already exist in a typical household environment;
- Providing information to the public regarding the latest findings from independent and credible scientific research into potential health impacts;
- Designing transmission lines to reduce EMFs in accordance with best practice guidelines; and
- Providing the maximum EMF generated by proposed transmission lines as part of public consultation for planned projects.

Some landholders have raised concerns with Powerlink regarding the impact of EMF (more specifically Radio Frequency Interference) on GPS guided precision agricultural equipment.

An independent study commissioned by Transgrid in 2022 for Project EnergyConnect (proposed 330kV and 500kV lines) in southern NSW stated that modern transmission lines must comply with radio frequency limits set out in Australian Standard 2344. These lines are not expected to cause interference to GPS signals due to corona or gap discharges, however, there may be instances where signals are temporarily blocked in very close proximity to a transmission structure, similar to passing a tree or other physical impediment.

A report was commissioned by Powerlink in 2011 to understand the impacts of high voltage transmission lines on Precision Agriculture technology, mainly high accuracy RTK (Real-time Kinematic) GNSS (Global Navigational Satellite Systems). This report was conducted by Tim Neale and Kevin McDougall from USQ (University of Southern Queensland). Due to the significant time that has since passed from the original report, Powerlink initiated a review process.

Powerlink engaged Tim Neale from Data Farming in 2022 to undertake a contemporary assessment of the potential impacts of transmission lines on precision agriculture in line with the previously prepared 2011 report. The review of the 2011 report, recent literature and current RTK GNSS technologies used on farm showed that the impacts of high voltage transmission lines should be less today than 10 years ago (Data Farming 2022). Hardware, software, and firmware technology has improved, and the integration of RTK GNSS in all new machines has occurred. Robot technology has entered the market and will increasingly be adopted for a range of activities on farm and in agricultural production. Whilst agricultural producers would preference transmission lines to not be located on their property, the potential impacts are predicted to be minimal and most typically include:

- Potential collision impact of agricultural equipment with transmission towers,
- Aerial spraying challenges,
- Double ups and overlaps of chemicals and fertilisers by driving around towers, and
- Aesthetic impacts.

This report has been included in Appendix B.

Powerlink will work with directly affected landholders to understand the type and layout of precision agricultural equipment being used and, if necessary, conduct in-field testing before and after construction to determine if there are any impacts on GPS systems from the transmission line. Remedial actions will be undertaken by Powerlink should impacts be identified such as the installation of booster equipment.

4.3 Consultation on the Draft Corridor Selection Report (DCSR)

In early November 2022, Powerlink briefed local, state and federal elected representatives and community leaders ahead of the release of the DCSR which occurred later that month. Landholders within the three corridors and wider Study Area and elected representatives and industry representative bodies were notified by phone, email or letter. The report was also placed on Powerlink's website.

Powerlink held community information drop-in sessions on 29 and 30 November 2022 to support the release of the DCSR and provide landholders and the community with opportunities to discuss the assessment directly with project staff.

Based on stakeholder feedback that end of year harvest would limit availability to make a submission before Christmas, the consultation period was then extended to Friday 20 January 2023 (originally closing 16 December 2022).

4.3.1 Submissions Received

Powerlink acknowledges the time and effort undertaken by stakeholders who made a submission to the DCSR. Nine submissions were received from:

- CS Energy;
- Mr Colin Boyce, Federal Member for Flynn; and
- Seven (7) submissions from landholders within Northern Corridor 1.

Key themes from the submissions

Key themes expressed by the submitters are summarised below:

- The proposed transmission line's interaction with CS Energy's existing and future infrastructure at Callide Power Station needs to be carefully designed and managed;
- Concerns regarding impacts of the proposed transmission line on high quality agricultural land (especially cultivation);
- Concerns regarding the lack of engagement between the renewable energy sector and agricultural sector;
- Locating the proposed line adjacent the existing 132kV line traversing Biloela or replacing the existing line within the Central Corridor is the lowest impact option;
- The recommended Northern Corridor 1 unduly affects food and fodder producers with calls for the line to be located within the Central Corridor;
- Use of the Ministerial Infrastructure Designation process and compulsory easement acquisition process under the *Acquisition of Land Act 1967* is inappropriate for a private sector development;
- Some landholders nominated areas within their properties most suitable for the proposed line;
- Land use, house and land parcel data has been manipulated as it does not take account of properties already affected by the existing 132kV line between Calvale-Biloela-Banana Range;
- Consultation and communication has been poor;
- Endangered vegetation will be removed and should be protected; and
- The project is a private nuisance and constitutes Assault by Force under the Queensland Criminal Code.

A table summarising all submissions and Powerlink's response to each matter raised can be found in Appendix A. For privacy reasons, private landholder details and property names have been removed from the table. Powerlink has provided a full written response to all submitters.

4.4 Amendments to the Corridor Selection Report and Determination of the Study Corridor

As outlined in Powerlink's response to submitters, Northern Corridor 1 has been identified as having:

- The lowest impact on Strategic Cropping Land and Class A and B Agricultural Land,
- The lowest number of houses; and
- Strong opportunities for the alignment to follow property boundaries or co-locate with existing transmission lines.

Of the three corridors assessed, this corridor most closely aligns with feedback provided by landholders and the community as part of the early engagement process. The top five (5) matters raised were:

- Impacts to farming operations including biosecurity, loss of productivity, irrigation systems;
- Proximity to houses;
- Visual impacts of the transmission line;
- Loss of property value; and
- Perceived health effects from Electric and Magnetic Fields.

In recommending Northern Corridor 1, Powerlink is very mindful that cultivation land still needs to be crossed and landholders remain concerned about the impact of the proposed line on farming operations, property values, perceived health effects and other matters.

Powerlink will work with landholders to apply a number of impact mitigation measures in circumstances where cultivation land needs to be crossed including;

- Working with each landholder to provide location flexibility to integrate with their existing operations such as placing the alignment near property / paddock boundaries, adjacent existing transmission lines or following the shortest distance across a particular property;
- Within design limits, maximising span lengths to minimise the number of towers in cultivation and placing towers in locations requested by landholders;
- Ensuring sufficient separation to nearby houses where possible;
- Assisting landholders to ensure metallic farming equipment, such as centre pivots, used in very close proximity to the transmission line is adequately earthed for electrical safety. Powerlink will undertake remedial actions such as installation of dragging chains and earthing of the pivot point. Powerlink also recommends no part of a centre pivot be 'parked' under a transmission line for extended periods; and
- Designing the transmission line to comply with radio frequency interference limits in Australian Standard 2344 to minimise any interference with modern GPS guided farming equipment. Powerlink will also work with directly affected landholders to understand the type and layout of precision agricultural equipment being used and if necessary, conduct infield testing before and after construction to determine if there are any impacts on GPS systems from the transmission line. Remedial actions will be undertaken should impacts be identified.

Powerlink has carefully reviewed each submission to identify matters which materially impact its recommendation and has determined that only minor changes are required to Northern Corridor 1 namely:

- Small reduction in corridor width west of Kroombit Creek to focus corridor on alignment with property boundaries in this location; and
- Small increase in corridor width in the area near Dudarkos Road to provide additional flexibility to determine an alignment with landholders that considers the impact on housing and planned future land use for cultivation activities.

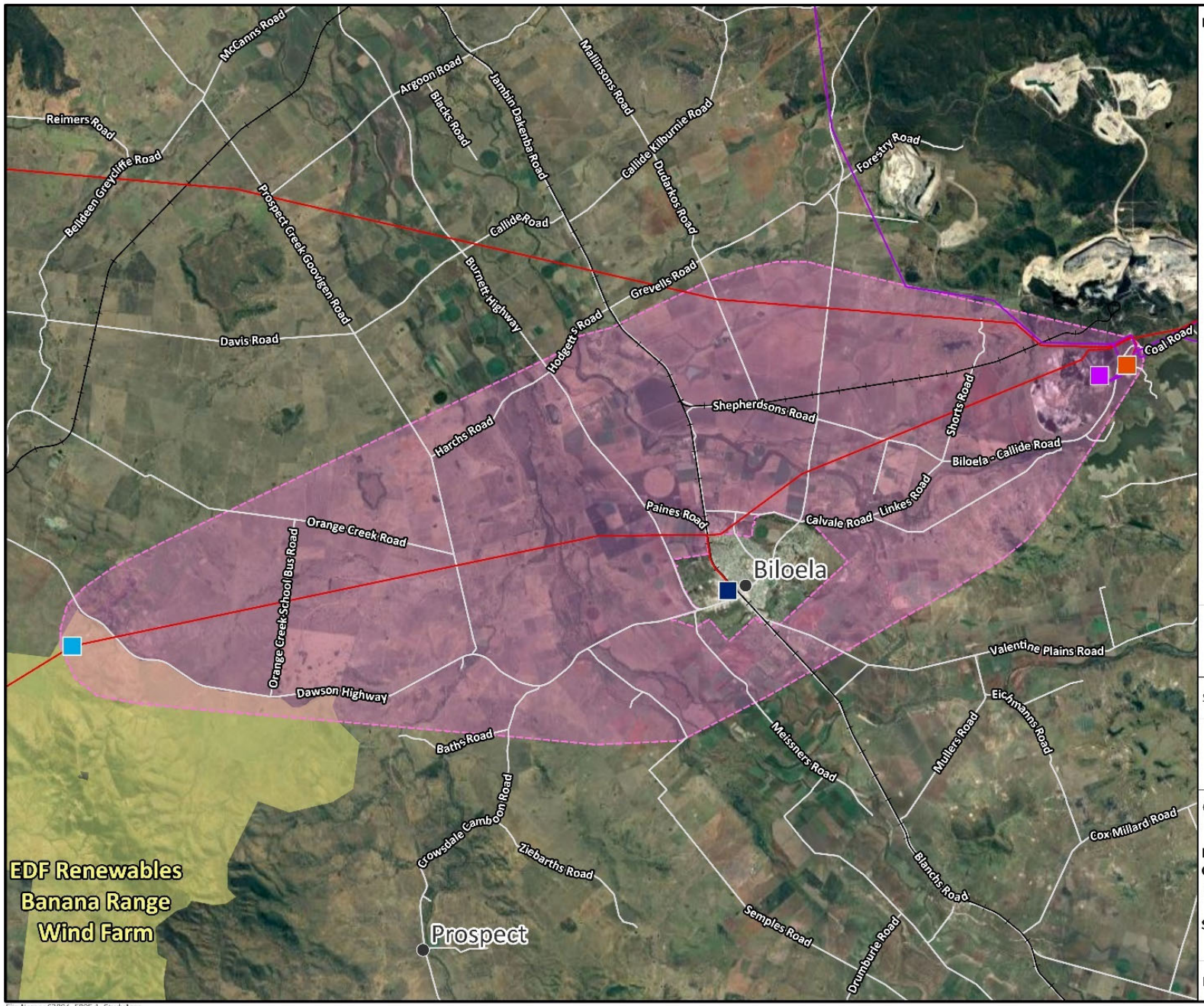
All mapping and assessment tables in this FCSR (Sections 5 – 7) have been amended to reflect these changes. The changes made to Northern Corridor 1 do not affect the comparative assessment of corridor options. Accordingly, Powerlink will now adopt Northern Corridor 1 as the Study Corridor within which detailed landholder engagement will shortly commence to determine a suitable alignment for the proposed transmission line.

5. Description of the Study Area

The Study Area for the transmission line project wraps around the town of Biloela within the Banana Shire Council Local Government Area. It encompasses an area of around 28,000 hectares between the proposed BRWF Substation location and Powerlink's existing Calvale Substation as shown in **Figure 5-1** below. The northern boundary of the Study Area generally extends to near Grevells and Hodgetts Road at Dakenba and in the south to the hill section south-west of Callide Dam and through to Valentine Plains. West of Biloela, the Study Area converges to the BRWF Substation site at the base of the Banana Range. The residential area within Biloela has been excluded from the Study Area as this type of land use is not compatible with transmission line development.

Key features of the Study Area include:

- The Burnett and Dawson Highways;
- The Callide Power Station and Calvale Substation;
- Moura Railway line;
- Several high voltage transmission lines from the power station including the:
    - Calvale to Stanwell 275kV transmission lines;
    - Calvale to Biloela to Moura 132kV transmission line; and
    - Calvale to Baralaba 132kV transmission line.
- Wallumbilla to Gladstone to Rockhampton Branch Pipeline – Jemena QLD Gas Pipeline Pty Ltd;
- Residential and rural residential dwellings within and nearby Biloela;
- Significant cultivation land from Kroombit and Grevillea Creeks extending east to the Callide Power Station;
- Significant grazing land generally west of Kroombit and Grevillea Creeks with further areas toward the top of the Study Area and south-west of Callide Dam; and
- Extensive Strategic Cropping Land (SCL) areas covering the majority of the Study Area from near Callide Power Station west to Prospect.



Legend

- Populated Place
- Proposed Banana Range Wind Farm Substation
- Callide Power Station
- Calvale Substation
- Biloela Substation
- Railway
- Roads
- Study Area
- EDF Renewables Banana Range Wind Farm

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Powerlink QUEENSLAND

Scale 1:154,000

0 2,500 5,000

metres

Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

STUDY AREA

FIGURE 5-1

File Name: 62094_F005.1_StudyArea
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

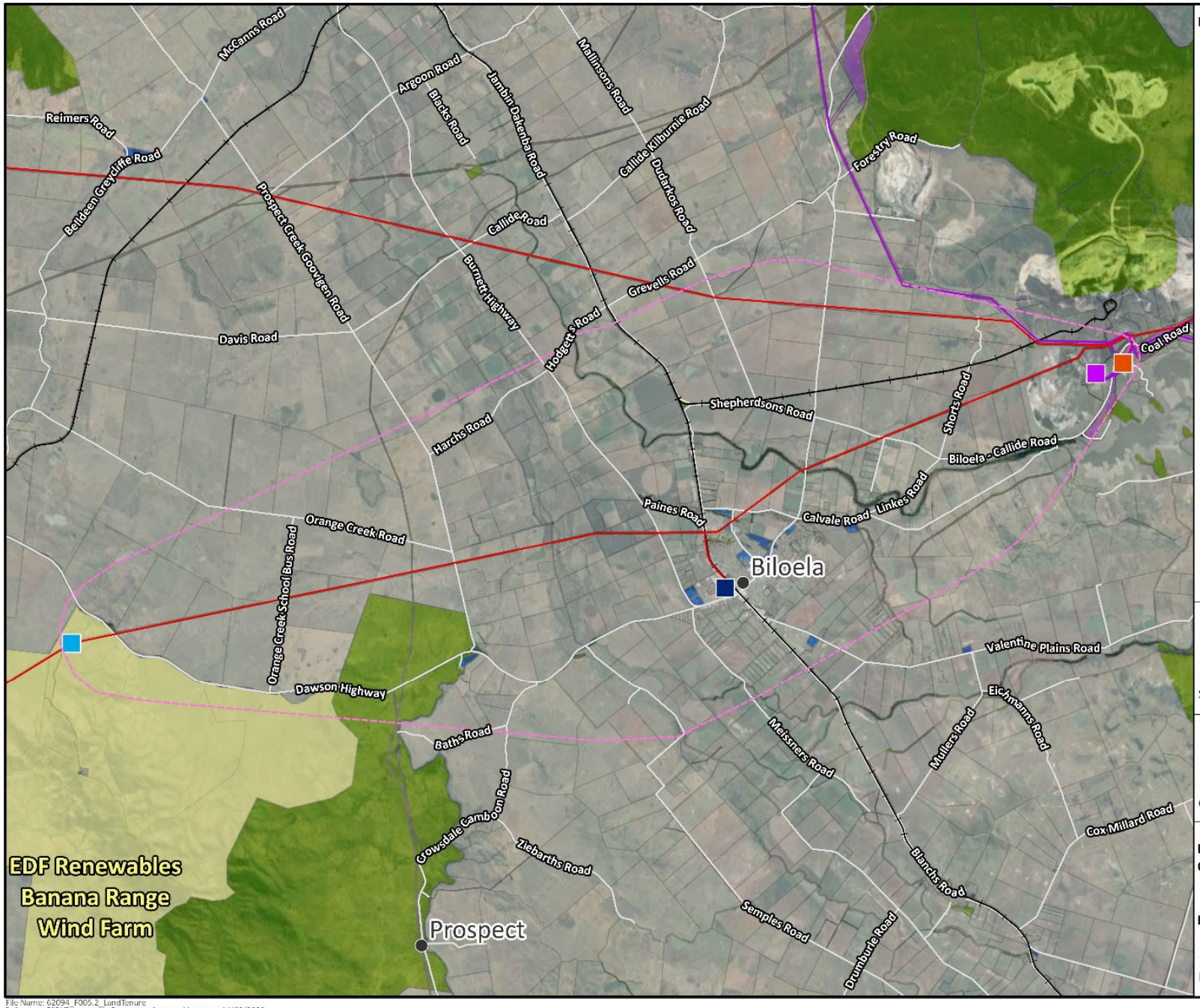
5.1 Social Environment

5.1.1 Tenure

Land tenure within the Study Area is predominantly freehold with some leased land, easements, road reserves and unallocated state land (see Figure 5-2). Land parcels vary in size from 0.06 ha (smaller lots in the town of Biloela to 9,480 ha (farm holdings).

The main existing easements and leases within the Study Area include:

- Moura Railway line;
- Calvale to Biloela to Moura 132kV transmission line;
- Calvale to Baralaba 132kV transmission line;
- Calvale to Stanwell 275kV lines; and
- Wallumbilla to Gladstone to Rockhampton Branch Pipeline – Jemena QLD Gas Pipeline Pty Ltd.



Legend

- Populated Place
- Proposed Banana Range Wind Farm Substation
- Callide Power Station
- Calvale Substation
- Biloela Substation
- Railway
- Roads
- Study Area
- EDF Renewables Banana Range Wind Farm

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Land Tenure

- Freehold
- Lands Lease
- Reserve
- State Land
- State Forest
- Covenant
- Easement

Powerlink Queensland

Scale 1:154,000

0 2,500 5,000

metres

Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

LAND TENURE

FIGURE 5-2

File Name: 62094_F005.2_LandTenure
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

5.1.2 Land use

The Study Area intersects the Banana Shire Council Local Government Area.

Under the Banana Shire Council Planning Scheme, land is mostly zoned 'rural' with the exception of areas around Biloela zoned as general residential, recreation and open space and community facilities.

The Callide Mine and Power Station and Calvale Substation are located within the eastern extent of the Study Area and provide a major source of employment for the local community of Biloela.

Rural land uses generally consists of grazing as well as intensive cropping such as lucerne and cotton. The intent of the rural zoning is to preserve land for agricultural purposes and protect the rural character and amenity of the region. It also recognises the need to provide opportunities for compatible non-rural uses and for areas to be managed for their contribution to the economy, landscape character and ecological values.

The Study Area is located within the Central Queensland Regional Plan. Key mapped regional interests within the Study Area include 'priority agricultural areas' and 'SCL' which covers most of the Study Area with the exception of some small pockets and 'priority living areas' around the township of Biloela (see Figure 5-3). A number of irrigation channels are present across the Study Area which are utilised by the agricultural properties in the area.

The Queensland Government maps agricultural land classes across Queensland, to assist with the identification of important agricultural areas in the State.

Types of agricultural land classes include:

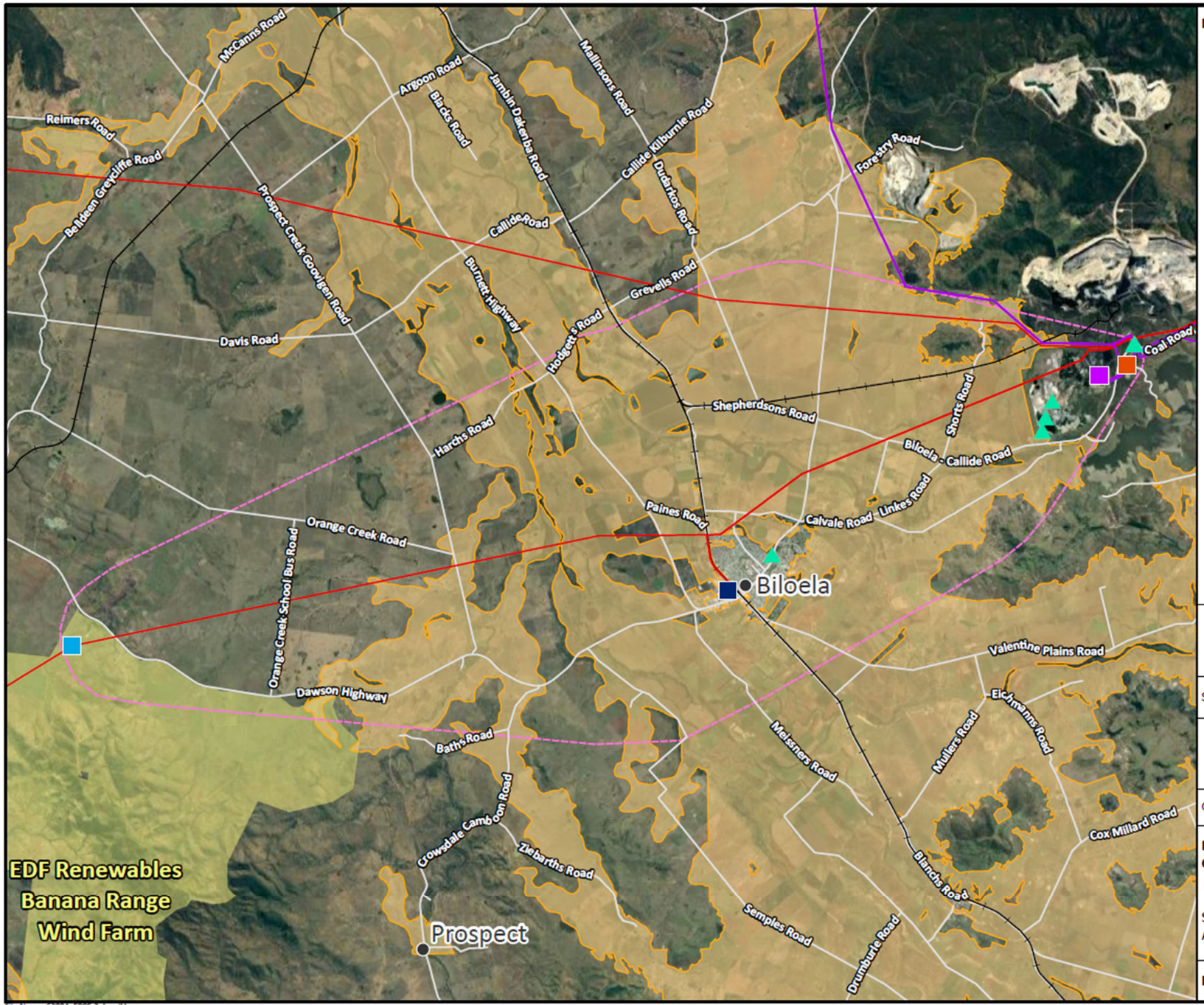
- Class A: Crop land that is suitable for a wide range of current and potential crops with nil to moderate limitations to production;
- Class B: Limited crop land that is suitable for a narrow range of current and potential crops due to severe limitations but is highly suitable for pastures. May be suitable for cropping with engineering or agronomic improvements;
- Class C: Pastureland that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production; and
- Class D: Non-agricultural land and land not suitable for agricultural uses due to extreme limitations (ie. undisturbed land with significant conservation values, steep slopes, shallow soils, poor drainage, or is an urbanised area).

The land classes inform strategic policy, planning and investment decisions, including providing protection of locally important agricultural areas and investment in infrastructure which supports agriculture. The Queensland Government State Planning Policy (Agriculture State Interest)[1] protects Agricultural Land Classification Class A and B.

Land within the Study Area contains mostly Agricultural Land Class A and Class C, with some areas of Class B as shown in Figure 5-4.

Land use has been confirmed through field inspections which identified existing house locations and current land use as consistent with what is mapped.

[1] https://dsdmipprd.blob.core.windows.net/general/spp-july-2017.pdf



Legend

- Populated Place
- Proposed Banana Range Wind Farm Substation
- Callide Power Station
- Calvale Substation
- Biloela Substation
- Cultural Heritage Site
- Railway
- Roads
- Study Area
- Strategic Cropping Land Zones
- EDF Renewables Banana Range Wind Farm
- QLD Herritage Register

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Powerlink Queensland

Scale 1:154,000

0 2,500 5,000

metres

Coord. Sys. GDA2020 MGA Zone 56

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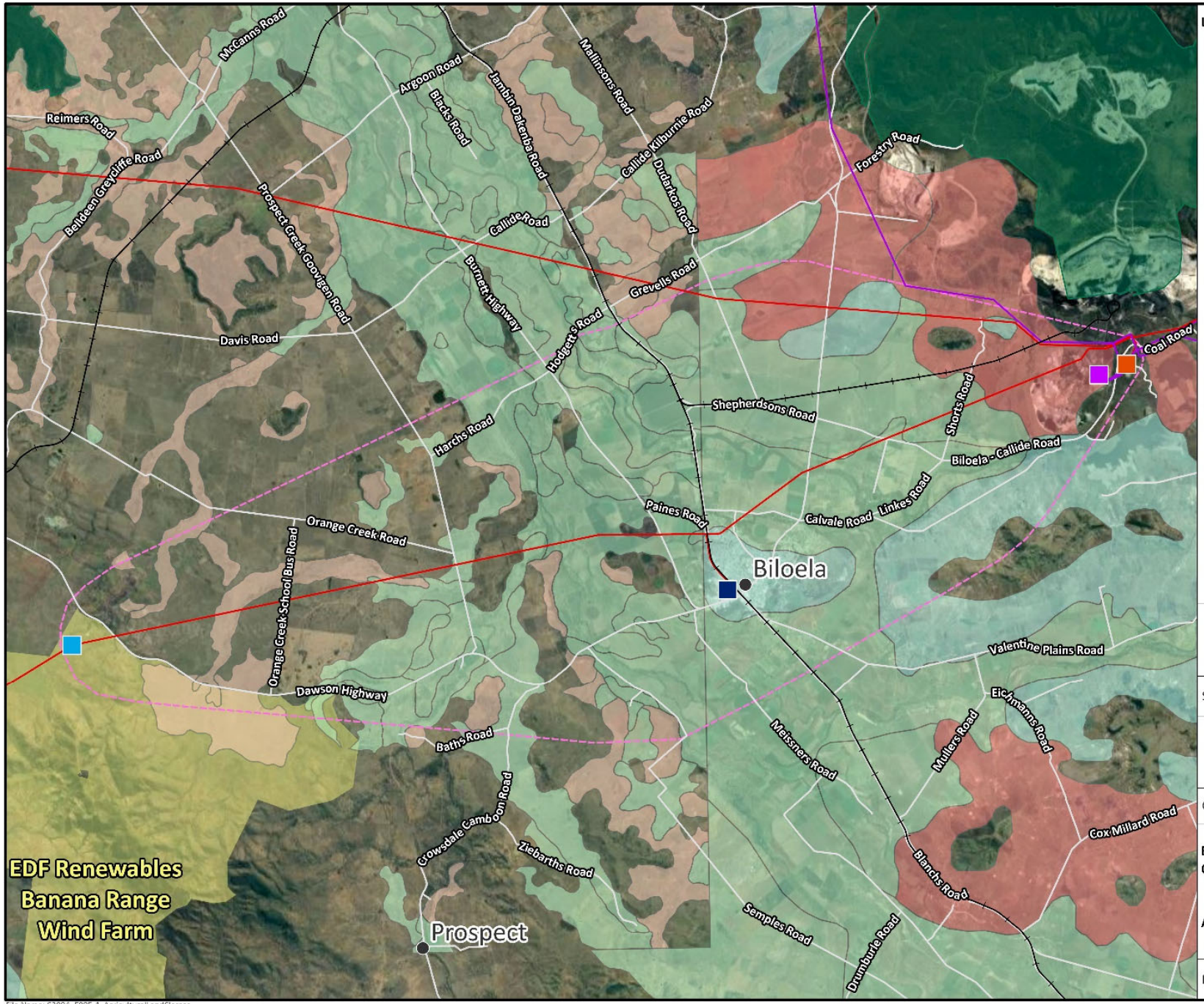
STRATEGIC CROPPING LAND AND HERITAGE SITES

FIGURE 5-3

File Name: 62094_F005.3_LandUses
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023



Legend

- Populated Place
- Proposed Banana Range Wind Farm Substation
- Callide Power Station
- Calvale Substation
- Biloela Substation
- Railway
- Roads
- Study Area
- EDF Renewables Banana Range Wind Farm
- Protected Areas

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Landclasses

- Landclass A1
- Landclass A1/C1
- Landclass B
- Landclass C1/A1

Powerlink Queensland

Scale 1:154,000

0 2,500 5,000

metres

Coord. Sys. GDA2020 MGA Zone 56

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AGRICULTURAL LAND CLASSES

FIGURE 5-4

File Name: 62094_F005.4_AgriculturalLandClasses
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

5.1.3 Heritage

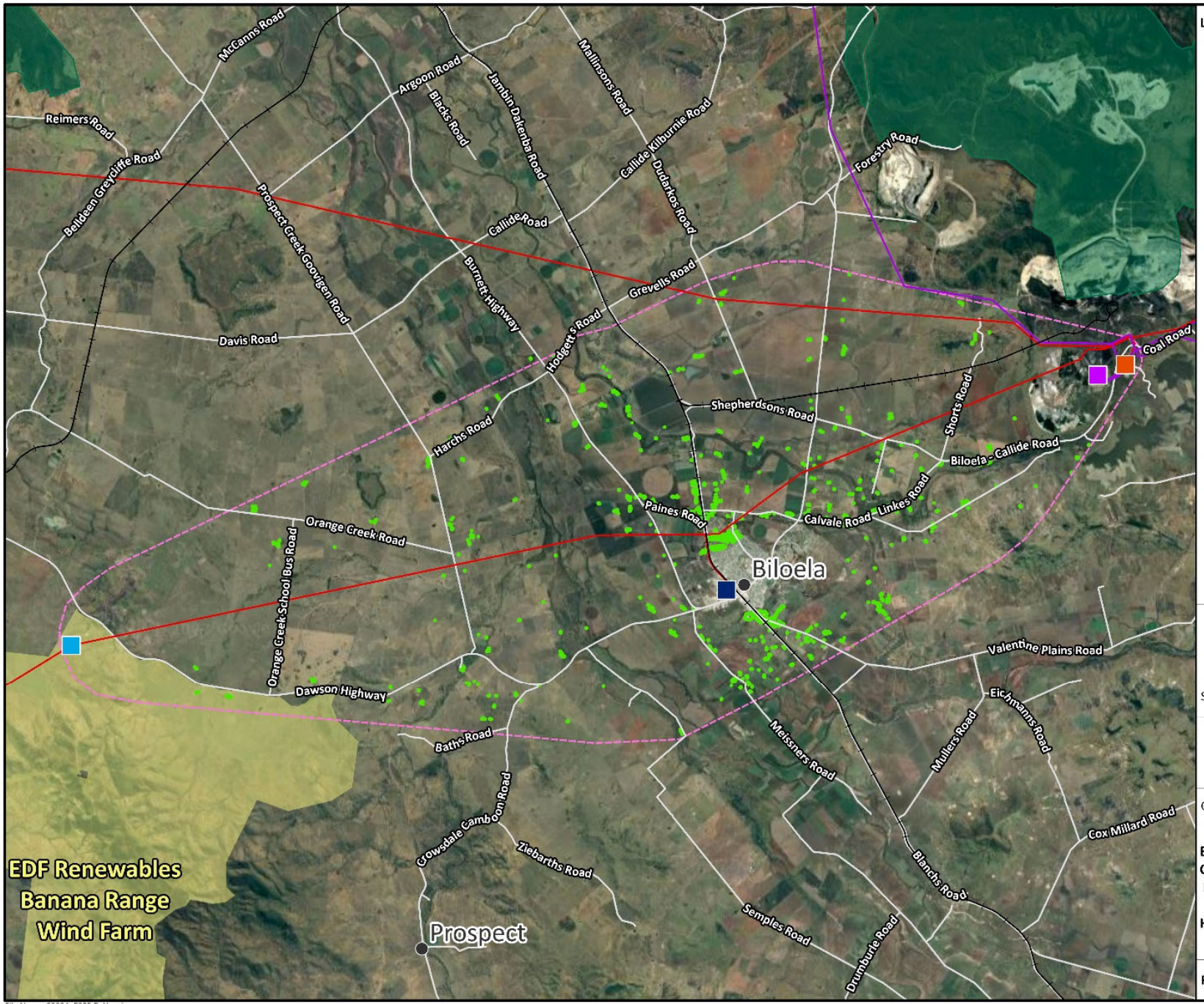
The study area is within the registered native title claim area of Gaangalu National People. A search of the Department of Aboriginal and Torres Strait Islander Partnerships' cultural heritage database shows previously recorded cultural heritage sites within 1 km of the study area (Appendix C). Powerlink has engaged the Gaangalu People and will conduct further on-site cultural heritage surveys with them to confirm the locations of Aboriginal cultural heritage in the corridor. No heritage places listed on the Australian Heritage Database are present within the study area.

One Queensland Heritage Place and local heritage place is located within the study area being the Greycliffe Homestead at 48 Gladstone Road, Biloela (see Figure 5-3). The Homestead is listed as a heritage place due to its significance in early European exploration and settlement within Queensland and is one of the early homesteads in the Leichhardt Pastoral District (Appendix C).

5.1.4 Housing

The majority of residences are concentrated around the Biloela township with rural residences spread across the remainder of the Study Area.

Dwelling locations within the Study Area are mapped in Figure 5-5. It should be noted that public data on property dwellings and structures is not completely accurate and therefore property buildings have been identified manually using aerial imagery. While care was taken to identify all possible built structures within the Study Area, a comprehensive analysis and ground-truthing of all potentially affected properties will need to be undertaken in future studies.



Legend

- Populated Place
- Proposed Banana Range Wind Farm Substation
- Callide Power Station
- Calvale Substation
- Biloela Substation
- Railway
- Roads
- Study Area
- Houses
- EDF Renewables Banana Range Wind Farm
- Protected Areas

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Powerlink Queensland

Scale 1:154,000

0 2,500 5,000

metres

Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

HOUSING

FIGURE 5-5

File Name: 62094_F005.5_Housing
Reference: ESRI Topographic Basemap Accessed Imagery: 14/03/2023

5.1.5 Resource interests

Two mineral exploration permits are present in the western section of the Study Area, however, it is noted these permits are not prohibitive to development of the proposed transmission line.

The Callide Coal Mine is located in the north-east of the Study Area adjacent to the Callide Power Station. The proposed corridor options discussed in Section 7 avoid this area.

5.1.6 Transport and traffic

Two State-controlled roads traverse the Study Area:

- Burnett Highway, which connects Monto to Mt Morgan through Biloela; and
- Dawson Highway, which connects Gladstone to Banana through Biloela.

A number of local roads are located within the Study Area and are managed by Banana Shire Council.

There are five aerodromes listed within the Banana Shire Local Government Area:

- Baralaba Aerodrome;
- Moura Aerodrome;
- Taroom Aerodrome;
- Thangool Aerodrome; and
- Theodore Aerodrome.

None of these aerodromes are located within the Study Area, however, two private airstrips have been identified:

- Fitzy's Airfield, located along Dudarkos Road; and
- Airfield located along Shepherdsons Road.

Transmission lines located in close proximity to airstrips can prevent planes from safely landing and taking off and therefore adequate distances must be maintained where possible.

The Moura Railway traverses the north-eastern portion of the Study Area and connects the Callide Mine to the wider rail network.

5.1.7 Native Title

The study area is located entirely within the registered native title claim area of the Gaangalu Nation People (QC2012/009). Detailed investigation of tenures against native title considerations will occur once the alignment is determined. Engagement with the native title party on the impact of the transmission line on native title rights and interests will need to be addressed in accordance with the Native Title Act 1993.

An Indigenous Land Use Agreement (QI2014/006) intersects the study area approximately 7km west of the Burnett Highway. The Indigenous Land Use Agreement is between the Gaangalu Nation People and Australia Pacific LNG Pty Ltd and Australia Pacific LNG Gladstone Pipeline Pty Ltd.

5.2 Natural Environment

5.2.1 Flora

The Study Area is relatively cleared and modified as a result of historical and current land practices such as grazing, cropping and other rural industry uses, however, the Protected Matters Search Tool (PMST) identified 13 *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (EPBC Act) listed threatened plant species that have the potential to occur within the Study Area, including (Appendix C):

- Hairy-joint grass (*Arthraxon hispidus*) (EPBC Act – vulnerable, NC Act – vulnerable);
- *Bertya opponens* (EPBC Act – vulnerable);
- Miniature moss-orchid (*Bulbophyllum globuliforme)* (EPBC Act – vulnerable, NC Act – vulnerable);
- Ooline (*Cadellia pentastylis)* (EPBC Act – vulnerable, NC Act – vulnerable);
- Cossinia (*Cossinia Australiana)* (EPBC Act – endangered, NC Act – endangered);
- *Cycas megacarpa* (EPBC Act – endangered, NC Act – endangered);
- King bluegrass (*Dichanthium queenslandicum)* (EPBC Act – endangered, NC Act – vulnerable);
- Blugrass (*Dichanthium setosum*) (EPBC Act – vulnerable);
- *Polianthion minutiflorum* (EPBC Act – vulnerable, NC Act – vulnerable);
- Quassia (*Samadera bidwilli*) (EPBC Act – vulnerable, NC Act – vulnerable);
- *Solanum dissectum* (EPBC Act – endangered, NC Act – endangered);
- *Solanum johnsonianum* (EPBC Act – endangered, NC Act – endangered); and
- *Xerothamnella herbacea* (EPBC Act – endangered, NC Act – endangered).

High risk areas for protected plants represent land where plants listed as endangered, vulnerable or near threatened under the *Nature Conservation Act 1992* are known or likely to occur.

Small clusters of high-risk areas are scattered across the eastern section of the Study Area around the existing Calvale Substation, with a few other scattered areas to the south of Biloela (Figure 5-8). Some of these areas coincide with areas of mapped essential habitat and therefore it is likely for the *Cycas megacarpa*.

Regulated vegetation and regional ecosystems

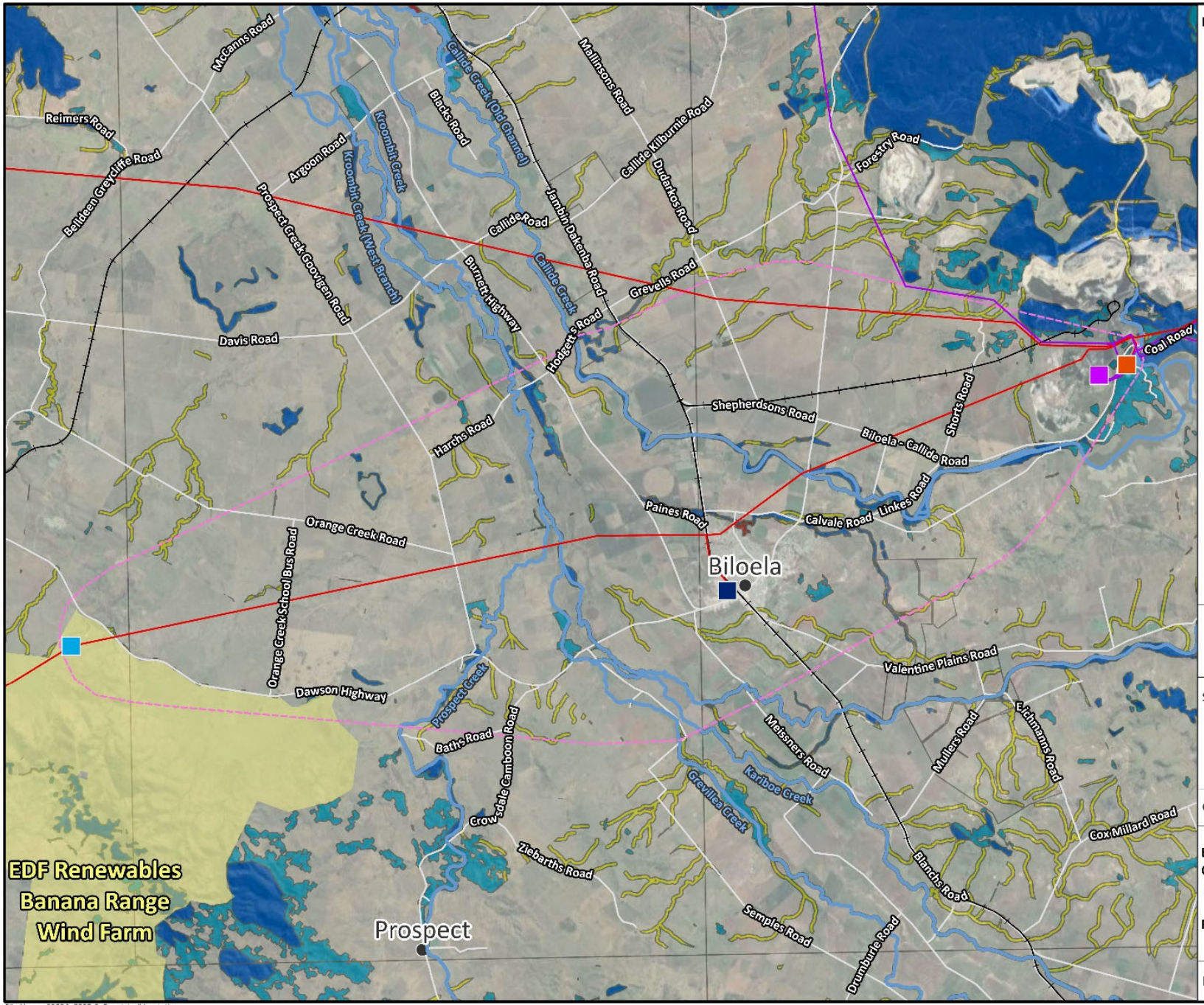
Native vegetation is regulated under the *Vegetation Management Act 1999* (Qld) and is categorised as:

- **Category A:** Compliance areas, environmental offset areas and declared areas;
- **Category B:** Remnant vegetation that is:
    - An ‘endangered’ regional ecosystem;
    - An ‘of concern’ regional ecosystem; or
    - A ‘least concern’ regional ecosystem.
- **Category C:** High-value regrowth vegetation areas that is:
    - On freehold land, indigenous land or land subject to a lease under the *Land Act 1994;* or
    - In an area that has not been cleared for at least 15 years, if the area is:

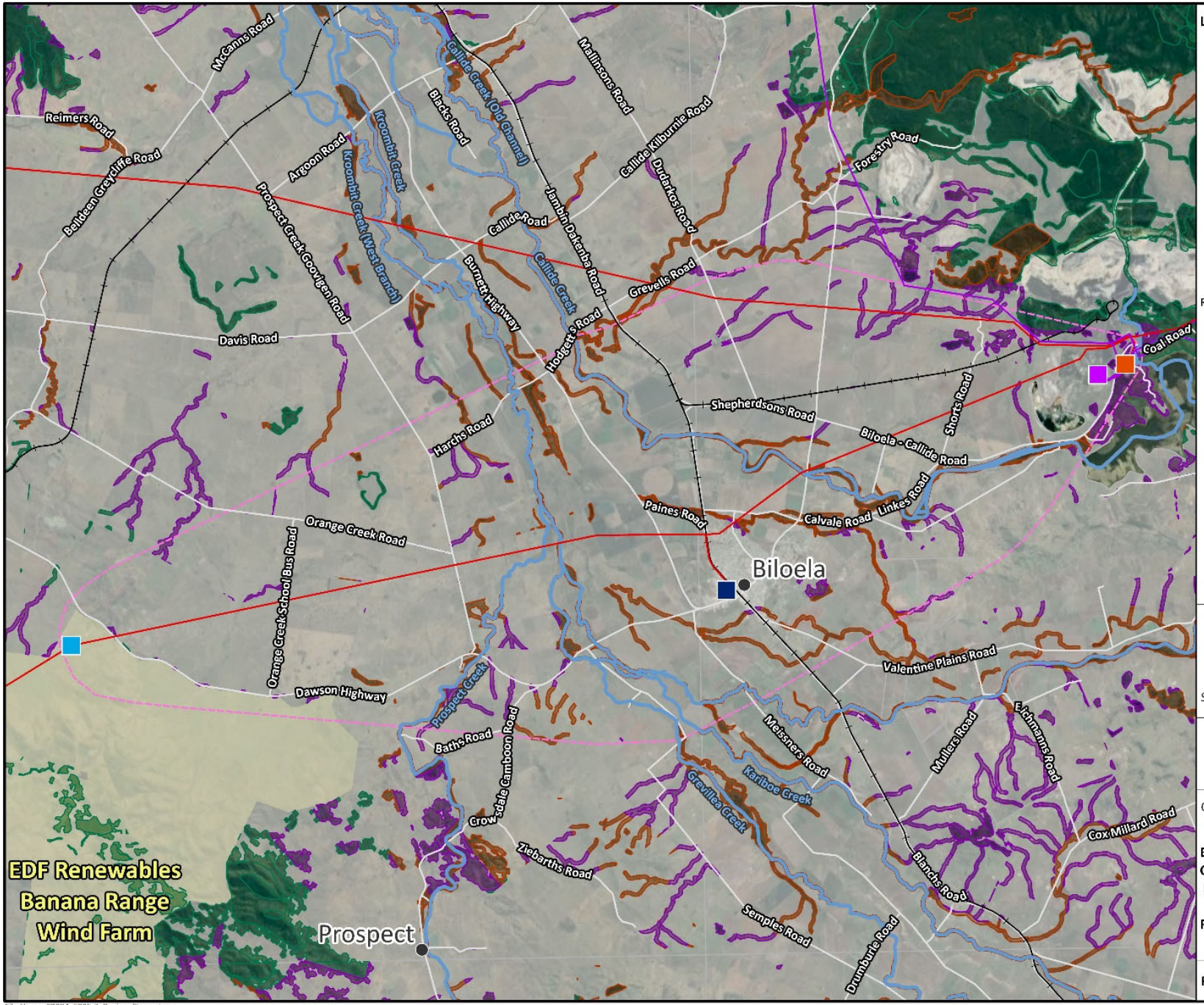
  - An ‘endangered’ regional ecosystem;
  - An ‘of concern’ regional ecosystem; or
  - A ‘least concern’ regional ecosystem.
- **Category R:** Areas within 50 m of a watercourse or drainage feature in all Great Barrier Reef Catchments; and
- **Category X:** An area that has been cleared of vegetation and does not correspond with Categories A, B, C or R.

The Study Area is generally mapped as non-remnant (Category X) vegetation, which reflects the current and historical agricultural practices of the area, however, waterways, creeks and drainage lines across the Study Area are mapped as containing Category B, C and R vegetation. An Area of Category A vegetation (offset area) is located to the east of the Biloela Showgrounds (see Figure 5-6) (Appendix C).

Regional ecosystems (RE) are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil regulated under the *Vegetation Management Act 1999*. RE within the Study Area generally include endangered and of concern communities (see Figure 5-7) and are mainly associated with waterways.



File Name: 62094_F005.6_RegulatedVegetation
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023



File Name: 62094_FD05.7_RegionalEcosystems
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

Threatened ecological communities

RE listed under the *Vegetation Management Act 1999 (Qld)*, correspond to ecological communities listed under the EPBC Act.

The Protected Matters Search Tool report identified five Threatened Ecological Communities listed as endangered under the *EPBC Act* as known, likely to or may occur within the Study Area including:

- Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions (endangered);
- Poplar Box Grassy Woodland on Alluvial Plains;
- Weeping Myall Woodlands;
- Brigalow (*Acacia harpophylla* dominant and co-dominant); and
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions.

Details around the known distribution and habitat and corresponding RE of these Threatened Ecological Communities is provided in Table 5.1.

Table 5.1 Potential Threatened Ecological Communities within the Study Area

Known distribution and habitat	Corresponding RE
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions (endangered)	
This TEC is associated floodplains and drainage areas and is likely to occur in the Banana Local Government Area. This TEC represents occurrences of one type of eucalypt woodland, where *Eucalyptus coolabah* supsp. *Coolabah (*Coolabah) and/or *Eucalyptus largiflorens* (Black Box) are the dominant canopy species (TSSC, 2011).	• Regional Ecosystem 11.3.3: *Eucalyptus coolabah* woodland on alluvial plains • Regional Ecosystem 11.3.15*: Eucalyptus coolabah*, *Acacia stenophylla, Muehlenbeckia florulenta* fringing woodland on alluvial plains • Regional Ecosystem 11.3.16: *Eucalyptus largiflorens*, ± *Acacia cambagei* ± *Acacia harpophylla* woodland to low open woodland on alluvial plains • Regional Ecosystem 11.3.28: *Eucalyptus coolabah* ± *Casuarina cristata* open woodland on alluvial plains • Regional Ecosystem 11.3.37: *Eucalyptus coolabah* fringing woodland on alluvial plains
Poplar Box Grassy Woodland on Alluvial Plains (endangered)	
This TEC mostly occurs in gently undulating to flat landscape and occasionally on gentle slopes on a wide range of soil types of alluvial and depositional origin. This TEC is typically a grassy woodland with a canopy dominated by *Eucalyptus populnea* (DoEE, 2019).	• Regional Ecosystem 11.3.2: *Eucalyptus populnea* woodland on alluvial plains • Regional Ecosystem 11.3.17: *Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains • Regional Ecosystem 11.4.7: *Eucalyptus populnea* with *Acacia harpophylla* and/or *C. cristata* open forest to woodland on Cainozoic clay plains • Regional Ecosystem 11.4.12: *Eucalyptus populnea* woodland on Cainozoic clay plains • Regional Ecosystem 12.3.10: *Eucalyptus populnea* +/- *Eucalyptus tereticornis* grassy woodland/tall woodland +/- patches of *Acacia harpophylla* and *Melaleuca bracteata*
Weeping Myall Woodlands (endangered)	
This TEC occurs on the inland alluvial plains west of the Great Dividing Range on flat areas, shallow depressions or gilgais on raised alluvial plains. This TEC occurs in open woodlands to woodlands, in which *Acacia pendula* (Weeping Myall) trees are the sole, or dominant overstory species (TSSC, 2009).	• Regional Ecosystem 11.3.2: *Eucalyptus populnea* woodland on alluvial plains • Regional Ecosystem 11.3.28: *Eucalyptus coolabah* ± *Casuarina cristata* open woodland on alluvial plains

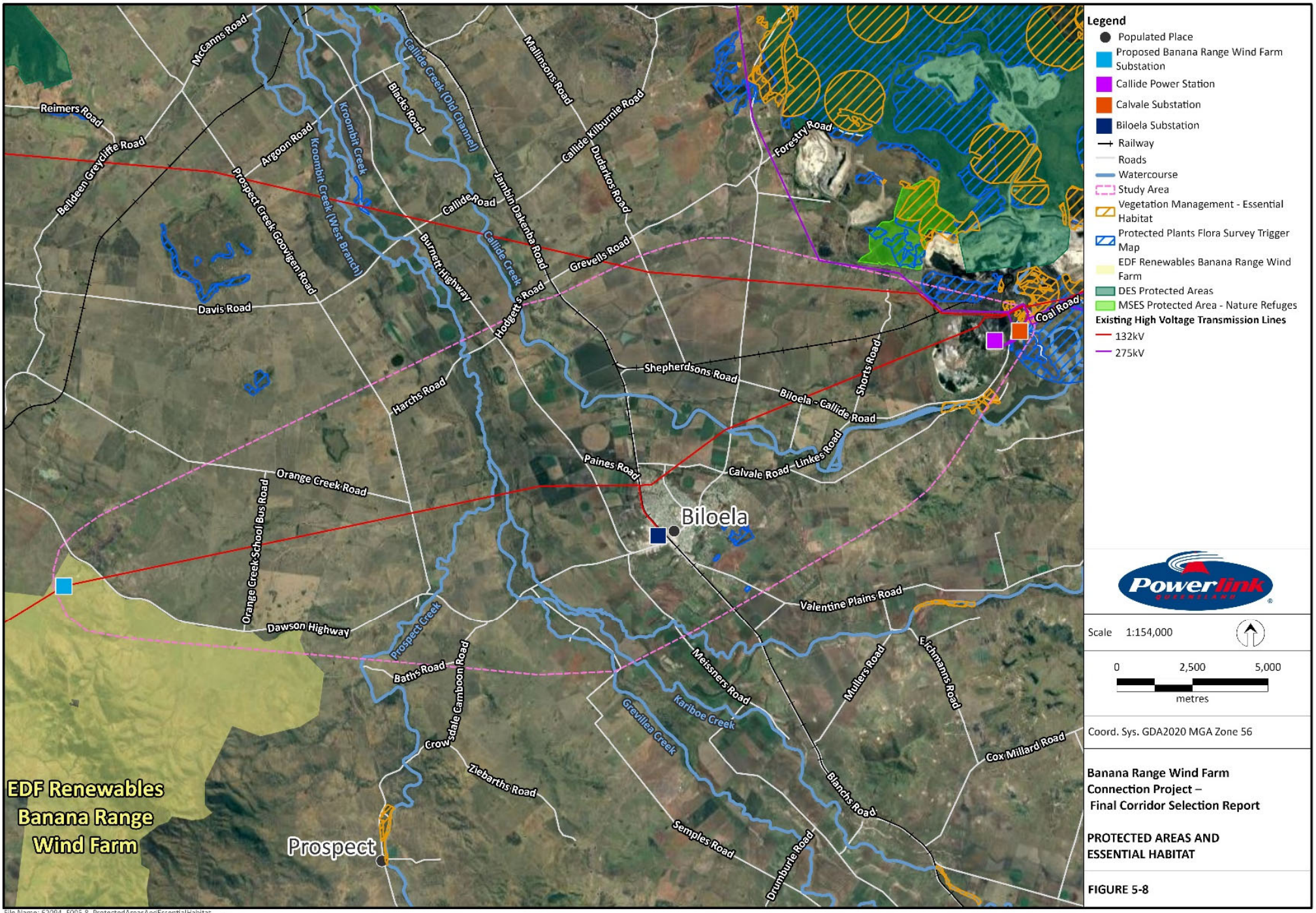
Known distribution and habitat	Corresponding RE
Brigalow (*Acacia harpophylla* dominant and co-dominant) (endangered)	
This TEC is found in the Brigalow Belt North, Brigalow Belt South IBRA Bioregions. This TEC is characterised by the present of *Acacia harpophylla* as one of the most abundant species and commonly consists of open forests and woodlands (TSSC, 2001).	• Regional Ecosystem 11.3.1: *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains. • Regional Ecosystem 11.4.3: *Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains. • Regional Ecosystem 11.4.7: Open forest to woodland of *Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* on Cainozoic clay plains. • Regional Ecosystem 11.4.8: *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *Acacia argyrodendron* on Cainozoic clay plains. • Regional Ecosystem 11.4.9: *Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains. • Regional Ecosystem 11.4.10: *Eucalyptus populnea* or *Eucalyptus pilligaensis*, *Acacia harpophylla*, *Casuarina cristata* open forest to woodland on margins of Cainozoic clay plains. • Regional Ecosystem 11.5.16*: Acacia harpophylla* and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains/remnant surfaces. • Regional Ecosystem 11.9.1: *Acacia harpophylla- Eucalyptus cambageana* open forest to woodland on fine-grained sedimentary rocks. • Regional Ecosystem 11.9.5: *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks. • Regional Ecosystem 11.9.6: *Acacia melvillei* +/- *Acacia harpophylla* open forest on fine-grained sedimentary rocks. • Regional Ecosystem 11.11.14: *Acacia harpophylla* open forest on deformed and metamorphosed sediments and interbedded volcanics. • Regional Ecosystem 11.12.21: *Acacia harpophylla* open forest on igneous rocks; colluvial lower slopes.
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (endangered)	
This TEC is considered a dry seasonal subtropical rainforest and occurs in areas with a subtropical, seasonally dry climate on soils of high to medium fertility and is generally characterised by the prominence of trees with microphyll sized leaves and the frequent presence of *B. Australis* and *B. ruperstris* (DERM, 2010).	• Regional Ecosystem 11.2.3: Microphyll vine forest on sandy beach ridges • Regional Ecosystem 11.3.11: Semi-evergreen vine thicket on alluvial plains • Regional Ecosystem 11.4.1: Semi-evergreen vine thicket ± *Casuarina cristata* on Cainozoic clay plains • Regional Ecosystem 11.5.15: Semi-evergreen vine thicket on Cainozoic sand plains/remnant surfaces • Regional Ecosystem 11.8.3: Semi-evergreen vine thicket on Cainozoic igneous rocks • Regional Ecosystem 11.8.6: *Melodrum leichhardtii* thicket on Cainozoic igneous rocks • Regional Ecosystem 11.8.13: Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks • Regional Ecosystem 11.9.4: Semi-evergreen vine thicket on Cainozoic fine-grained sedimentary rocks • Regional Ecosystem 11.9.8: *Melodrum leichhardtii* thicket on Cainozoic fine-grained sedimentary rocks • Regional Ecosystem 11.11.18: Semi-evergreen vine thicket on old sedimentary rocks with varying degrees of metamorphism and folding

Essential habitat

Essential Habitat is vegetation in which a species that is Endangered or Vulnerable under the *Nature Conservation Act 1992 (Qld)* (NC Act) has been known to occur. A patch of essential habitat for the *Cycas megacarpa* (listed as endangered under the NC Act) is located within the eastern section of the Study Area (Figure 5-8).

Protected areas

The Study Area does not intersect any protected areas under Commonwealth or State legislation, noting that the Callide Timber Reserve and Mount Murchison Natural Refuge are located directly northeast of the Study Area (Figure 5-8).



File Name: 62094_F005.8_ProtectedAreasAndEssentialHabitat
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

5.2.2 Fauna

Threatened fauna species

The PMST report identified 41 threatened and migratory species that have the potential to occur within the Study Area, as identified in Table 5.2.

Table 5.2 Threatened fauna listed as occurring within 1 km of the Study Area

Common Name	Scientific Name	EPBC Act Listing	NC Act Listing
BIRDS			
Curlew Sandpiper	*Calidris ferruginea*	Critically endangered, migratory	Critically endangered
Red goshawk	*Erythrotriorchis radiatus*	Vulnerable	Endangered
Grey falcon	*Falco hypoleucos*	Vulnerable	Vulnerable
Squatter pigeon	*Geophaps scripta scripta*	Vulnerable	Vulnerable
Painted honeyeater	Grantiella picta	Vulnerable	Vulnerable
White-throated needletail	*Hirundapus caudacutus*	Vulnerable, migratory	Vulnerable
Star finch	*Neochmia ruficauda ruficauda*	Endangered	-
Eastern curlew	*Numenius madagascariensis*	Critically endangered, migratory	Endangered
Australian painted snipe	*Rostratula australis*	Endangered	Endangered
Black-breasted button quail	*Turnix melanogaster*	Vulnerable	Vulnerable
MAMMALS			
Large-eared pied bat	*Chalinolobus dwyeri*	Vulnerable	Vulnerable
Northern quoll	*Dasyurus hallucatus*	Endangered	-
Semon's leaf-nosed bat	*Hipposideros semoni*	Vulnerable	Endangered
Ghost bat	*Macroderma gigas*	Vulnerable	Endangered
Corben's long-eared bat	*Nyctophilus corbeni*	Vulnerable	Vulnerable
Greater glider	*Petauroides Volans*	Vulnerable	Endangered
Yellow-bellied glider	*Petaurus australis australis*	Vulnerable	Endangered
Koala	*Phascolarctos cinereus*	Endangered	Endangered
Grey-headed flying fox	*Pteropus poliocephalus*	Vulnerable	-
REPTILES			
Adorned delma	*Delma torquata*	Vulnerable	Vulnerable
Ornamental snake	*Denisonia maculate*	Vulnerable	Vulnerable
Yakka skink	*Egernia rugosa*	Vulnerable	Vulnerable
Southern snapping turtle	*Elseya albagula*	Critically endangered	-
Dunmall's snake	*Furina dunmalli*	Vulnerable	-
Fitzroy River turtle	*Rheodytes leukops*	Vulnerable	Vulnerable
MIGRATORY SPECIES			
Fork-tailed swift	*Apus pacificus*	Migratory	-
Salt water crocodile	*Crocodylus porosus*	Migratory	-
Oriental cuckoo	*Cuculus optatus*	Migratory	-
Black faced monarch	*Monarcha melanopsis*	Migratory	-
Satin flycatcher	*Myiagra cyanoleuca*	Migratory	-
Rufous fantail	*Rhipidura rufifrons*	Migratory	-
Common sandpiper	*Actitis hypoleucos*	Migratory	-

Common Name	Scientific Name	EPBC Act Listing	NC Act Listing
Sharp-tailed sandpiper	*Calidris acuminata*	Migratory	-
Pectoral sandpiper	*Calidris melanotos*	Migratory	-
Latham's snipe	*Gallinago hardwickii*	Migratory	-
Osprey	*Pandion haliaetus*	Migratory	-

Essential habitat

A patch of essential habitat for the southern snapping turtle (*Elseya albagula)* (listed as critically endangered under the NC Act) is located within the eastern section of the Study Area (see Figure 5-8).

5.3 Physical Environment

5.3.1 Topography

The topography of the Study Area ranges from 175m to 269m AHD. Elevation is approximately 269m Australian Height Datum (AHD) at the BRWF substation connection, drops to 168m where the Study Area intersects the Burnett Highway, before gradually reaching 255m AHD at the existing Calvale Substation. The majority of farming properties within the Study Area are found on flat terrain below 200m AHD.

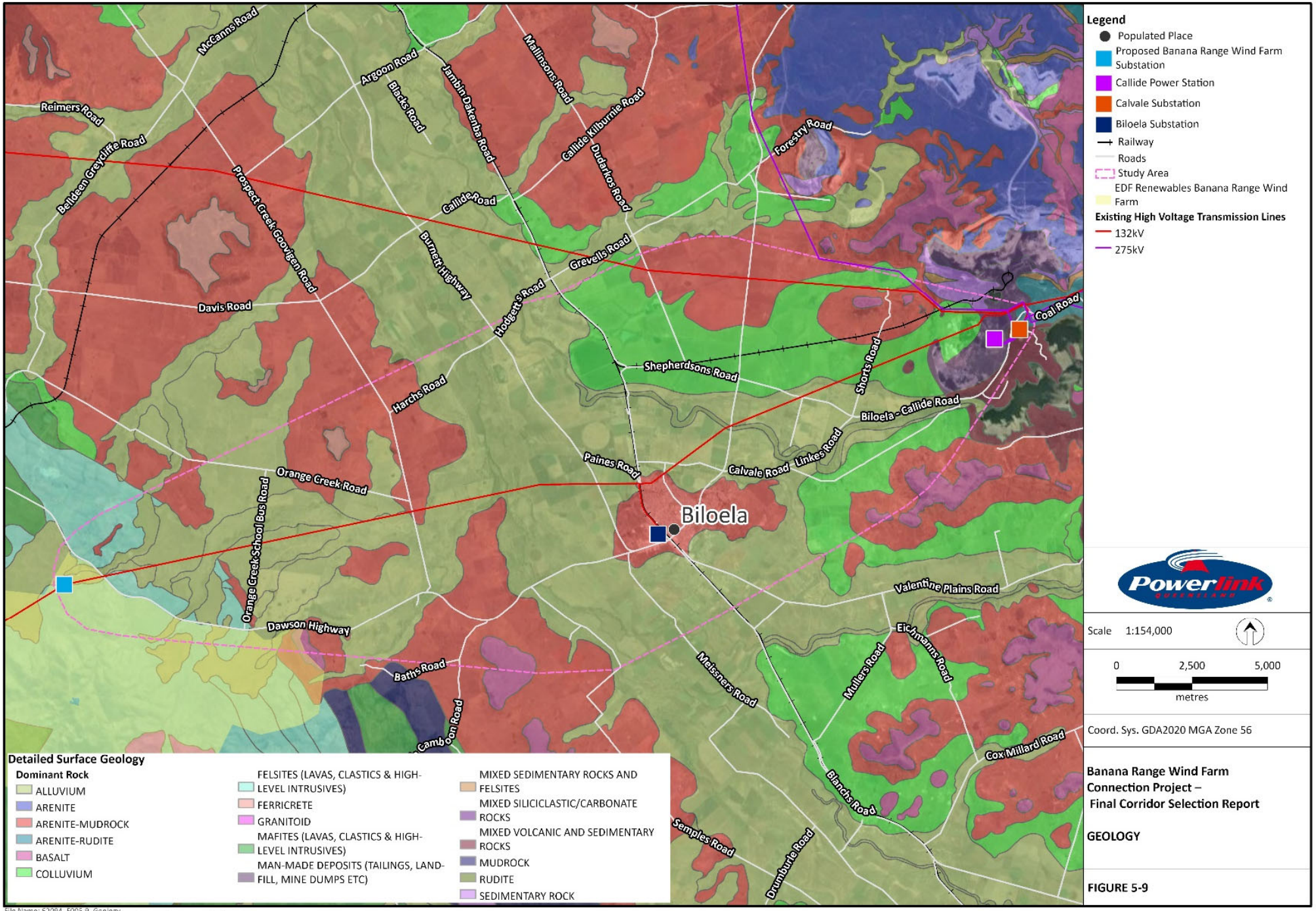
No topographical features have been identified in the Study Area which will impact constructability of the project.

5.3.2 Geology

Geology across the Study Area varies and includes a mix of alluvium, felsites, volcanic and sedimentary deposits and man-made deposits (see Table 5.3; Figure 5-9).

Table 5.3 Geological formations within the Study Area

Geological Unit Name	Age	Dominant Rock Type	Locality
Torsdale Volcanics (CPvt)	Late Carboniferous – Early Permian	Felsites (lavas, clastics and high level intrusives)	Located around the BRWF substation connection point.
Qf-QLD	Quaternary	Alluvium	Located around the BRWF substation connection point.
Qpa-QLD	Pleistocene	Alluvium	Located in the west of the Study Area.
Qa-QLD	Quaternary	Allium	Located over the majority of the Study Area.
Biloela Formation	Eocene	Arenite-mudrock	Located over the township of Biloela.
TQr-QLD>Biloela Formation	Late Tertiary - Quaternary	Colluvium	Located in the southeast of the Study Area
Qha-QLD	Holocene	Alluvium	Located along Callide Creek.
Lochenbar Formation	Late Devonian	Mixed volcanic and sedimentary rocks	Located in the east of the Study Area near the Callide Power Station.
Qhh-QLD	Anthropocene	Man-made deposits (tailings, landfill, mine dumps)	Located at the Callide Mine and Power Station.
Callide Coal Measures	Late Triassic	Sedimentary Rock	Located at the Callide Mine.



File Name: 62094_F005.9_Geology
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

5.3.3 Soils

Mapped soil units include rudosols, located in the western portion of the Study Area near the BRWF and vertosols over the remaining portion of the Study Area (see Figure 5-10).

Rudosol soil order accounts for soils that have negligible pedologic organisation and are generally young soils that have had little time to pedologically modify parent rocks or sediments and are generally sandy, loamy or clayey in texture. The soils can vary widely in terms of texture and depth, with many being stratified, whilst some are highly saline. Rudosols generally have a loose to firm surface which means they are susceptible to rapid infiltration and erosion.

Vertosol soils are the most common soil in Queensland and generally consist of cracking clay throughout with mottled subsoils and limestone sediments and generally have a well-structured surface which is self-mulching, cracking, firm and sometimes crusting. These soils often contain dispersive subsoils, which have a high erosion risk, however, soils formed on dolomite or limestone are generally non-dispersive.

Geotechnical investigations will confirm soil type and bearing capacity.

Legend

- Populated Place
- Proposed Banana Range Wind Farm Substation
- Callide Power Station
- Calvale Substation
- Biloela Substation
- Railway
- Roads
- Study Area
- EDF Renewables Banana Range Wind Farm

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Dominant Soil Type

- DERMOSOLS
- RUDOSOLS
- VERTOSOLS

Powerlink QUEENSLAND

Scale 1:154,000

0 2,500 5,000

metres

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SOILS

FIGURE 5-10

File Name: 62094_F005.10_Soils
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

5.3.4 Hydrology

The Study Area falls within the Fitzroy Basin. The major watercourses which traverse the Study Area include Callide Creek, Kroombit Creek, Prospect Creek and Grevillea Creek (see Figure 5-11).

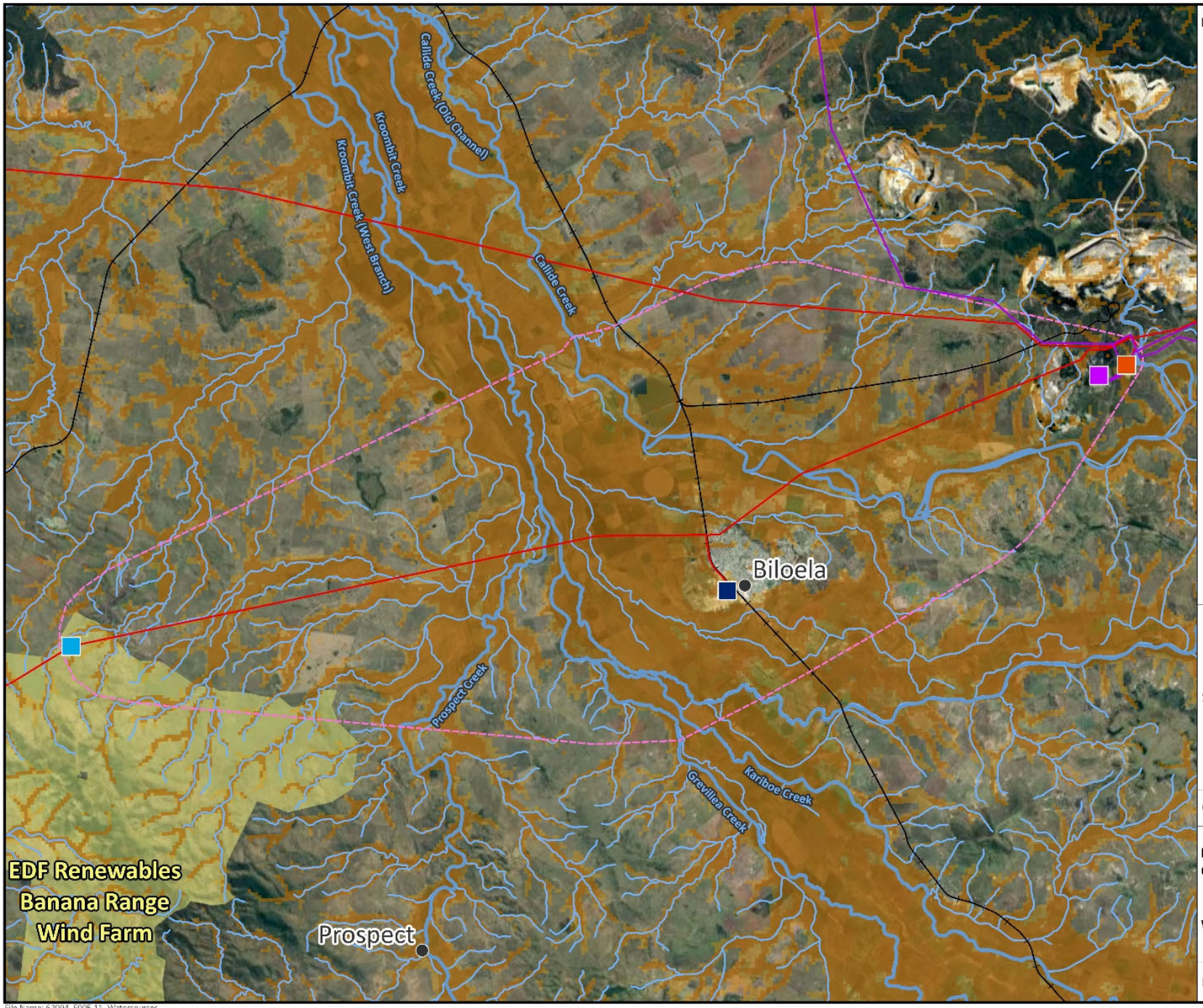
Waterway barrier works are regulated under the *Fisheries Act 1994* (Qld) and the *Planning Act 2016 (Qld)* and are barriers to fish movement, including partial barriers, that are installed across waterways. Barrier works include construction, raising, replacement and some maintenance works on structures such as culvert crossings, bed level and low-level crossings, weirs and dams (both permanent and temporary). To help define the limits of waterways for the purpose of managing impacts of waterway barriers on fish passage, waterways are broken into four categories; low, moderate, high and major risk waterways.

Callide, Kroombit, Prospect and Grevillea Creeks are all mapped as major-risk waterways for waterway barrier works. These creeks also contain a number of branching tributaries that are classed as low, moderate and major-risk waterways. Where works require the construction of a new access track across a waterway, consideration will need to be given to potential waterway barrier works approvals and the requirements for waterway barriers under the *Fisheries Act 1994.*

The *Water Act 2000* (Qld) provides a legislative framework for the sustainable use, allocation and management of water resources in Queensland and regulates activities occurring within designated watercourses under the Act. The Watercourse Identification Map categorises water features as either a designated watercourse, drainage feature, downstream limit of a watercourse or lake and is used to determine the assessment requirements for undertaking activities within a watercourse. Callide, Kroombit, Prospect and Grevillea Creeks are all mapped watercourses under the *Water Act 2000.* Consideration will need to be given to works within these watercourses and whether an approval is required to undertake activities within the watercourse.

Flood mapping of the Fitzroy basin for Peak (100m/100yr) and extreme (100m) are shown on Figure 5-11. The four creeks located within the Study Area are mapped as being within the peak and extreme flood extents, with the downstream areas (southern extent) of the Study Area being impacted the greatest by flooding.

Lake Callide is located within the eastern section of the Study Area and supports coal mining, beef production, power generation, dryland cropping and irrigation cropping such as lucerne and cotton within the region.



Legend

- Populated Place
- Proposed Banana Range Wind Farm Substation
- Callide Power Station
- Calvale Substation
- Biloela Substation
- Railway
- Waterway (Waterway Barrier Works)
- Watercourse
- Study Area
- EDF Renewables Banana Range Wind Farm

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Fitzroy Basin Flood Extent

- Peak (100m/100yr)
- Extreme Peak (100m)

Powerlink Queensland

Scale 1:154,000

0 2,500 5,000

metres

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WATERCOURSE

FIGURE 5-11

File Name: 62094_F005.11_Watercourses
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

5.3.5 Contaminated land

Contaminated land searches (including searches of the Environmental Management Register and Contaminated Sites Register) were not undertaken as part of this assessment given the size of the study area and the low likelihood for these results to affect corridor selection assessments. Further detailed studies will be undertaken in future project stages. Land generally associated with the Environmental Management Register and Contaminated Sites Register include railways, service stations, landfill sites, mine sites and manufacturing sites.

5.3.6 Unexploded ordnance

The Defence Unexploded Ordnance Mapping identifies no land subject to potential Unexploded Ordnance within the Study Area.

5.4 Key Constraints and Opportunities

The desktop analysis of the Study Area has identified the following key constraints and opportunities affecting the identification and assessment of potential transmission line corridors:

- Extensive agricultural land across the Study Area, including SCL and Agricultural Land Class A and B areas east of Kroombit and Grevillea Creeks;
- Powerlink's existing Calvale to Biloela to Moura 132kV transmission line and Calvale to Baralaba 132kV transmission line and Moura Railway line may provide potential co-location opportunities;
- The location of residential houses and other places of assembly;
- Major watercourses and flood areas. While the number of major watercourses is limited, the area of potential flooding is extensive;
- Presence of remnant vegetation, potential Threatened Ecological Communities, *Nature Conservation Act 1992* flora survey trigger areas, threatened flora and fauna and mapped essential habitat for the *Cycas megacarpa* and southern snapping turtle (*Elseya albagula)*;
- The existing road network, particularly Burnett and Dawson Highways; and
- Existing airfields within the Study Area.

These factors have been taken into consideration in the corridor assessment.

6. Transmission Line Corridor Assessment Criteria

This section identifies the criteria for the comparative assessment of potential transmission line corridor options. It has been developed from an analysis of the Study Area, feedback received from landholders, the local community and other stakeholders during the early engagement process, and Powerlink's own experience developing transmission infrastructure.

Criteria not considered to be relevant to the purpose of this Study have been excluded from the comparative assessment. This occurred in cases where there was little or no variation in the criterion across the Study Area.

Where it was determined that criteria were relevant (either due to relevance to the Study Area or variation between the proposed corridor options), performance indicators were identified.

Table 6.1 Assessment criteria

Assessment Criteria	Relevance	Performance Indicator
Social environment		
Tenure	All corridor options traverse similar tenure types (freehold, lands lease), and zoning type, including rural zoned land and therefore using tenure as a differentiating factor will not assist in corridor selection.	N/A
Land use	The Study Area comprises agricultural land use of varying intensity and productive value i.e. cropping compared to grazing. Transmission lines have potential to constrain cropping operations including the use of mobile irrigation systems, crop dusting and aerial spraying. Mapped SCL and Agricultural Land Class A and B provides a measure of the type and value of agricultural production. Corridor options with least impact to Class A and B are preferred.	Corridors that intersect SCL and Agricultural Land Class A and B.
Heritage	One place of local heritage and a number of Aboriginal cultural heritage sites are located within the Study Area. The lack of baseline data restricts the potential to differentiate between corridor options without further ground truthing occurring, and therefore, it is not a differentiating factor in corridor selection.	N/A
Housing	Numerous residential properties are dispersed throughout the Study Area. Potential impacts include a loss of visual amenity, general property amenity and perceived health concerns for local residents and other persons spending significant time in close proximity to the development. Development options with least potential impact to dwellings and other sensitive receptors are preferred.	Number of houses within a potential corridor and number of land parcels within a potential corridor.
Resource interests	Two mineral exploration permits are present in the western section of the Study Area; however, it is noted these permits do not affect land use rights and therefore are not a constraint and have not been considered	N/A
Transport and Infrastructure	Infrastructure intersecting the Study Area includes road, rail, existing transmission lines and gas pipelines. Potential impacts occur at the intersection of the proposed transmission alignment and other infrastructure, which may	Number of road, rail, transmission line and pipelines intersected by the corridor.

Assessment Criteria	Relevance	Performance Indicator
	influence corridor/alignment/site selection. Potential corridor options with the least potential impact to transport and other infrastructure are preferred. Two small airfields were identified within the Study Area. There is the potential for the project development to impact on the operations of one or more of these facilities.	Number of airfields within or adjacent to the corridor.
Native title	The Study Area is located entirely within an active native title claim and therefore the presence of native title claims do not differentiate between corridor options.	N/A
Natural environment		
Protected flora and fauna	The Study Area comprises areas of protected vegetation, mapped RE, essential habitat and threatened ecological communities. Corridor options with least potential impact to flora and fauna are preferred.	Area of remnant vegetation to be cleared (including mapped RE, essential habitat, threatened ecological communities).
Physical environment		
Topography	All corridor options traverse similar terrain. Thus, topography is not considered to be a differentiating factor for corridor/alignment selection.	N/A
Geology and soils	The corridor options traverse varied geology and soil conditions. However, soil and geology is not considered to be a differentiating factor for corridor / alignment selection.as this is mitigated through design of the transmission line.	N/A
Hydrology	Various ephemeral waterways and flood plains intersect the Study Area. Potential impacts to surface waters occur at the intersection of the development and these waterways and floodplains, which may influence corridor/alignment/site selection. Corridor options with least potential impact to surface waters are preferred.	Number of waterways intersected by the corridor.
Contaminated land	No contaminated land searches or assessments have been undertaken. The lack of baseline data restricts the potential to differentiate between corridor options without further ground truthing occurring, and therefore, it is not a differentiating factor in corridor selection.	N/A
Unexploded ordnance	No UXO have been recorded within the Study Area and therefore this is not a differentiating factor in corridor selection.	N/A
Costs		
Cost and constructability	Cost of construction (including the length and potential number of bend points) and the practicality of access to the transmission line (i.e. through built up areas or intersection with rail corridors) are relevant to the route selection process.	Length of corridor Number of bend points

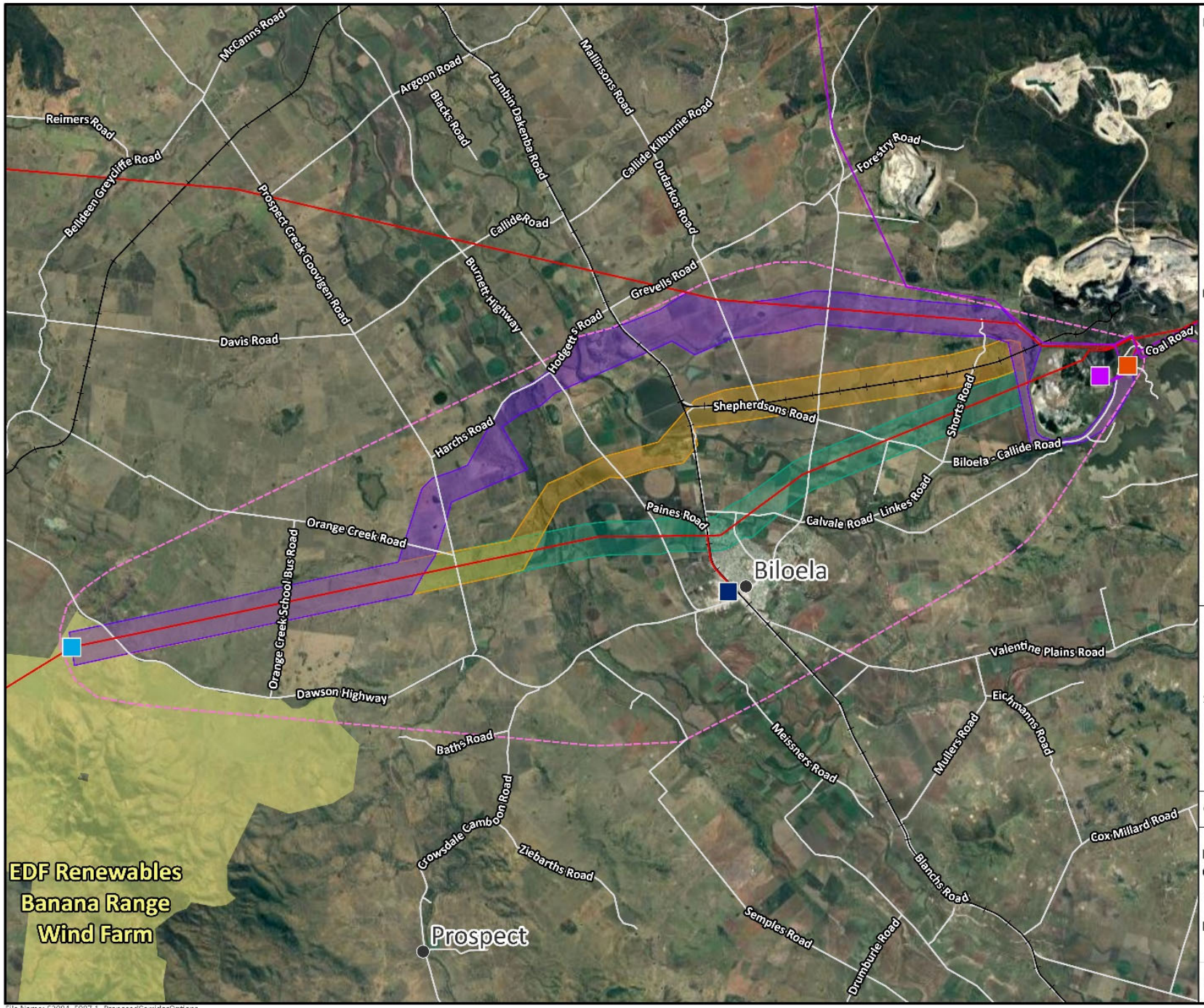
7. Transmission Line Corridors

Three corridor options have been identified following analysis of the environmental, social and physical characteristics of the Study Area and feedback from the early stakeholder engagement process.

The corridors comprise:

- Northern 1 option (partially co-located with existing Calvale to Baralaba 132kV and Calvale to Moura 132kV transmission lines);
- Northern 2 option (partially co-located with the existing Calvale to Moura 132kV transmission line); and
- Central option (predominantly co-located with the existing Calvale to Moura 132kV transmission line).

The options are shown in Figure 7-1 and described in detail in Sections 7.1, 7.2, and 7.3.



Legend

- Populated Place
- Proposed Banana Range Wind Farm Substation
- Callide Power Station
- Calvale Substation
- Biloela Substation
- Railway
- Roads
- Study Area
- EDF Renewables Banana Range Wind Farm

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Proposed Corridors

- Northern Corridor 1
- Northern Corridor 2
- Central Corridor

Powerlink Queensland

Scale 1:154,000

0 2,500 5,000

metres

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PROPOSED CORRIDOR OPTIONS

FIGURE 7-1

File Name: 62094_F007.1_ProposedCorridorOptions
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

7.1 Northern Corridor 1

Description

From Calvale Substation, the corridor moves south-west then west adjacent to Biloela-Callide Road. This area is constrained by the power station and dam immediately north and south. An alternative corridor north and then west from the substation was also considered, however, it was found to require several crossings of existing transmission lines which would have significant electricity supply reliability and cost impacts.

The corridor then turns north and stays near the western boundary of the power station property seeking to minimise impacts on the agricultural land immediately west. It crosses the east-west rail line and joins the existing Calvale to Baralaba 132kV line for around 8km to near Dudarkos Road. Where possible, the new transmission line would be located adjacent the existing 132kV line in this area.

The corridor then turns south-west to cross Jambin-Dakenba Road, Callide Creek, Burnett Highway and Kroombit Creek before joining the existing Calvale to Biloela to Moura 132kV transmission line around 1km west of the junction of Orange Creek Road and Prospect Creek Goovigen Road. It then continues west to the proposed Banana Range Wind Farm substation site. Once again, the new transmission line would be located adjacent to the existing 132kV line in this area where possible.

Key Characteristics

- Opportunity to co-locate with the existing Calvale to Baralaba and Calvale to Moura 132kV lines;
- Significant opportunities for the transmission line to follow property boundaries;
- From west of the power station to Kroombit Creek, land use comprises cultivation and grazing areas;
- Low number of houses;
- Larger land parcels;
- Longer corridor includes more grazing land which is generally compatible with a transmission line and reduced impacts on cultivation land to the south; and
- Potential impact on Remnant Vegetation.

Views from the Dawson Highway, looking west towards the location of Northern Corridor 1 and from Hodgetts Road looking southeast are provided in Photo 4, Photo 5, Photo 6 and Photo 7.

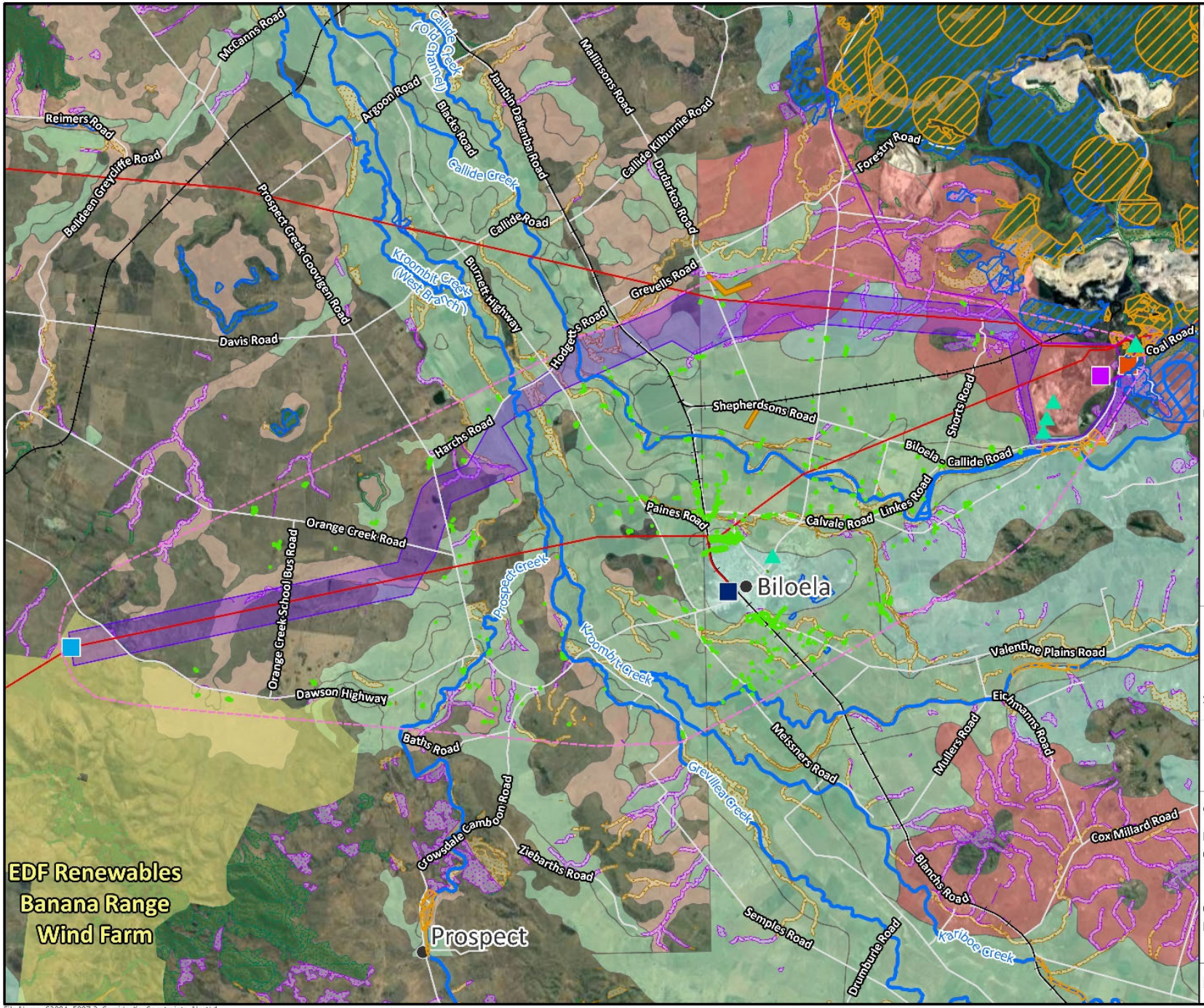
Figure 7-2 shows Northern Corridor 1 and its associated constraints.

Photo 4 Views from the Dawson Highway, looking west

Photo 5 Views from Hodgetts Road, looking southeast

Photo 6 View west from Dudarkos Road

Photo 7 View east from Shorts Road



Legend

- Populated Place
- Proposed Banana Range Wind Farm Substation
- Callide Power Station
- Calvale Substation
- Biloela Substation
- Cultural Heritage Site
- Railway
- Roads
- Watercourse (Water Act)
- Study Area
- Houses
- EDF Renewables Banana Range Wind Farm
- Proposed Northern Corridor 1
- QLD Heritage Register
- Airfields
- Protected Plants Flora Survey Trigger Map
- Vegetation Management - Essential Habitat

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Regional Ecosystem Mapping

- Endangered Vegetation (Category A,B,C or R)
- Of Concern Vegetation (Category A,B,C or R)
- Least Concern Vegetation (Category A,B,C or R)

Agricultural Land Classes

- Landclass A1
- Landclass A1/C1
- Landclass B
- Landclass C1/A1

Powerlink Queensland

Scale 1:154,000

0 2,500 5,000

metres

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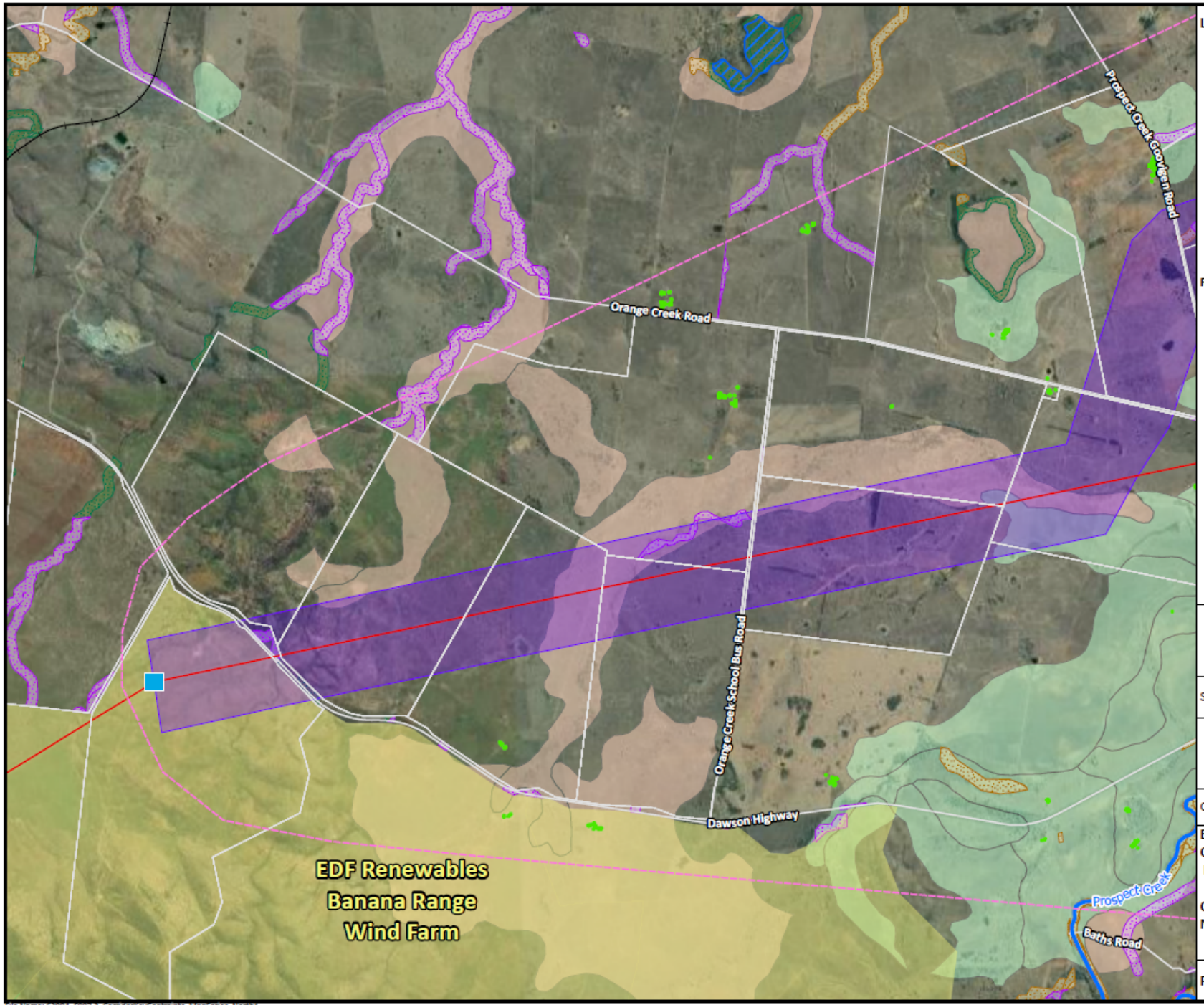
Corridor Key Constraints - Proposed Northern Corridor, Option 1

FIGURE 7-2

File Name: 62094_F007.2_CorridorKeyConstraints_North1
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023



Legend

- Proposed Banana Range Wind Farm Substation
- Railway
- Roads
- Watercourse (Water Act)
- EDF Renewables Banana Range Wind Farm
- Study Area
- Cadastre
- Houses
- Proposed Northern Corridor 1
- Protected Plants Flora Survey Trigger Map

Existing High Voltage Transmission Lines

- 132kV

Regional Ecosystem Mapping

- Endangered Vegetation (Category A,B,C or R)
- Of Concern Vegetation (Category A,B,C or R)
- Least Concern Vegetation (Category A,B,C or R)

Agricultural Land Classes

- Landclass A1
- Landclass B

Powerlink Queensland

Scale 1:55,000

0 1,000 2,000
metres

Coord. Sys. GDA2020 MGA Zone 56

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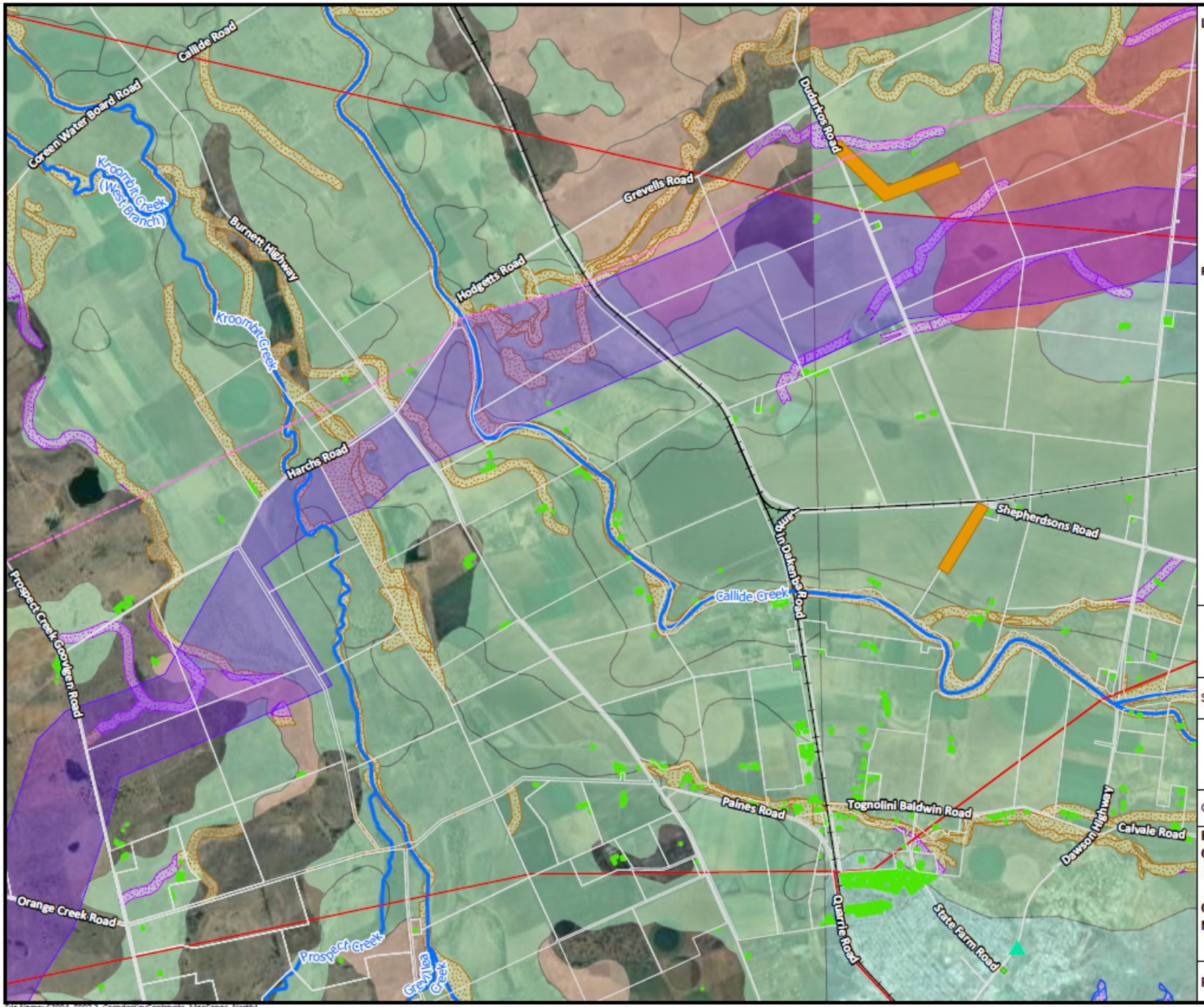
Corridor Key Constraints - Proposed Northern Corridor, Option 1

FIGURE 7-2a

File Name: 62094_F007.2_CorridorKeyConstraints_MapSeries_North1



Legend

- Cultural Heritage Site
- Railway
- Roads
- Watercourse (Water Act)
- Study Area
- Cadastre
- Houses
- Proposed Northern Corridor 1
- QLD Heritage Register
- Airfields
- Protected Plants Flora Survey Trigger Map

Existing High Voltage Transmission Lines

- 132kV

Regional Ecosystem Mapping

- Endangered Vegetation (Category A,B,C or R)
- Of Concern Vegetation (Category A,B,C or R)

Agricultural Land Classes

- Landclass A1
- Landclass A1/C1
- Landclass B
- Landclass C1/A1

Powerlink QUEENSLAND

Scale 1:55,000

0 1,000 2,000
metres

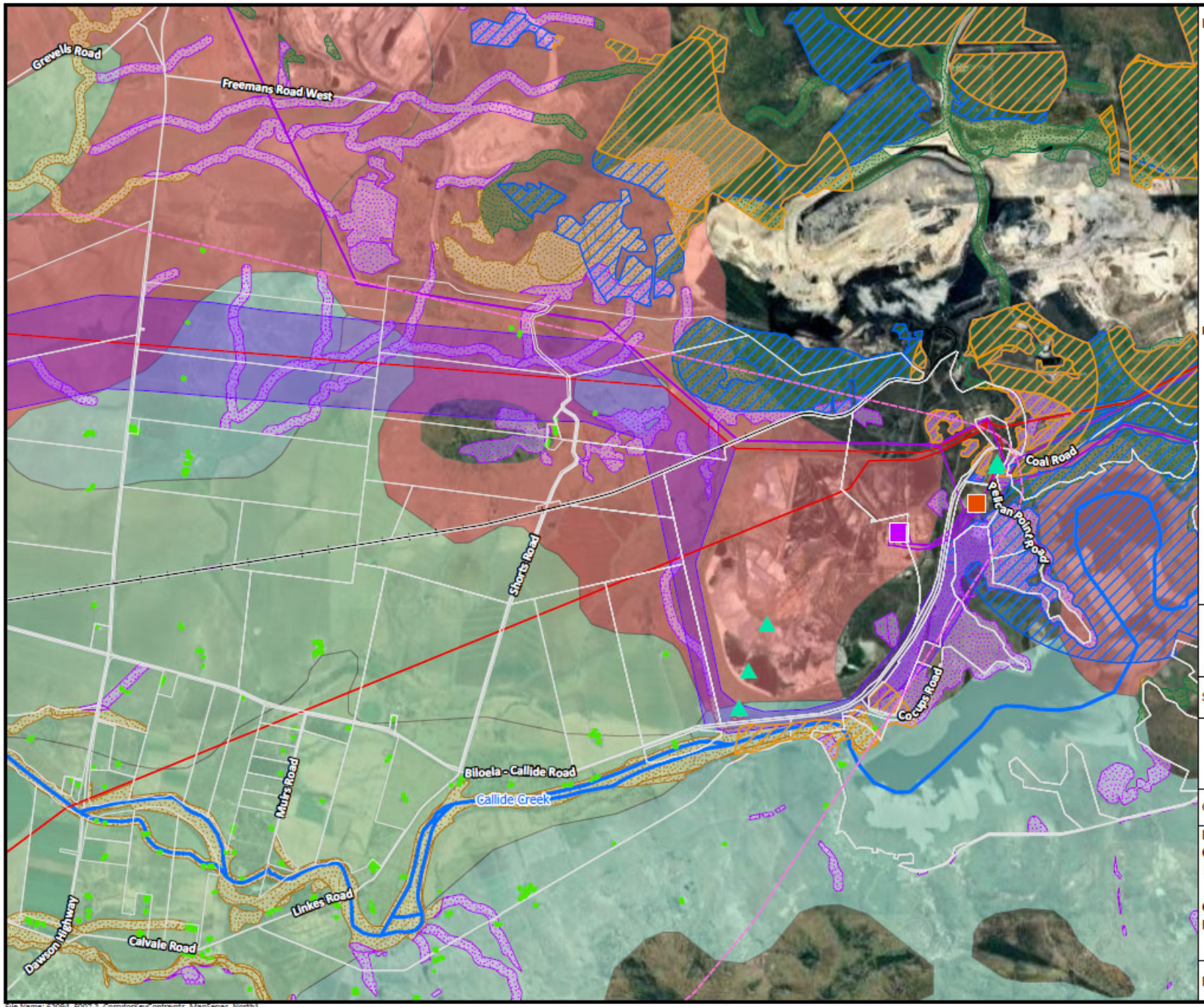
Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

Corridor Key Constraints - Proposed Northern Corridor, Option 1

FIGURE 7-2b

File Name: 62094_F007.2_CorridorKeyContraints_MapSeries_North1
Reference: ESRI Topographic Basemap - AccessedImagery: 14/03/2023



Legend

- Callide Power Station
- Calvale Substation
- Cultural Heritage Site
- Railway
- Roads
- Watercourse (Water Act)
- Study Area
- Cadastre
- Houses
- Proposed Northern Corridor 1
- Protected Plants Flora Survey Trigger Map
- Vegetation Management - Essential Habitat

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Regional Ecosystem Mapping

- Endangered Vegetation (Category A,B,C or R)
- Of Concern Vegetation (Category A,B,C or R)
- Least Concern Vegetation (Category A,B,C or R)

Agricultural Land Classes

- Landclass A1
- Landclass A1/C1
- Landclass C1/A1

Powerlink QUEENSLAND

Scale 1:55,000

0 1,000 2,000
metres

Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

Corridor Key Constraints - Proposed Northern Corridor, Option 1

FIGURE 7-2c

File Name: 62084_F007.2_CorridorKeyConstraints_MapSeries_North1
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

7.2 Northern Corridor 2

Description

From Calvale Substation, the corridor moves south-west then west adjacent to Biloela-Callide Road. This area is constrained by the power station and dam immediately north and south. An alternative corridor north and then west from the substation was also considered, however, it was found to require several crossings of existing transmission lines which would have significant supply reliability and cost impacts.

The corridor then turns north and stays near the western boundary of the power station property seeking to minimise impacts on the agricultural land immediately west. It turns west at the rail line and continues until Jambin-Dakenba Road. Where possible, the new transmission line would be located adjacent the railway in this area.

The corridor then moves south-west across Callide Creek, Burnett Highway and Kroombit Creek before joining the existing Calvale to Biloela to Moura 132kV transmission line just west of the junction of Zischkes Lane and Bowketts Lane. It then continues west to the proposed BRWF Substation. Once again, the new transmission line would be located adjacent to the existing 132kV line in this area where possible.

Key Characteristics

- Opportunity to co-locate with the existing Moura Railway and Calvale to Biloela to Moura 132kV line;
- Includes Teys Bros abattoir site;
- From west of the power station to Kroombit Creek impacts intensively cultivated land;
- Low number of houses;
- Larger land parcels;
- Opportunity to follow property boundaries where possible; and
- Potential impact on Remnant Vegetation.

Views of a number of proposed crossings of road and rail infrastructure intersected by Northern Corridor 2 are provided in Photo 8, Photo 9, Photo 10 and Photo 11.

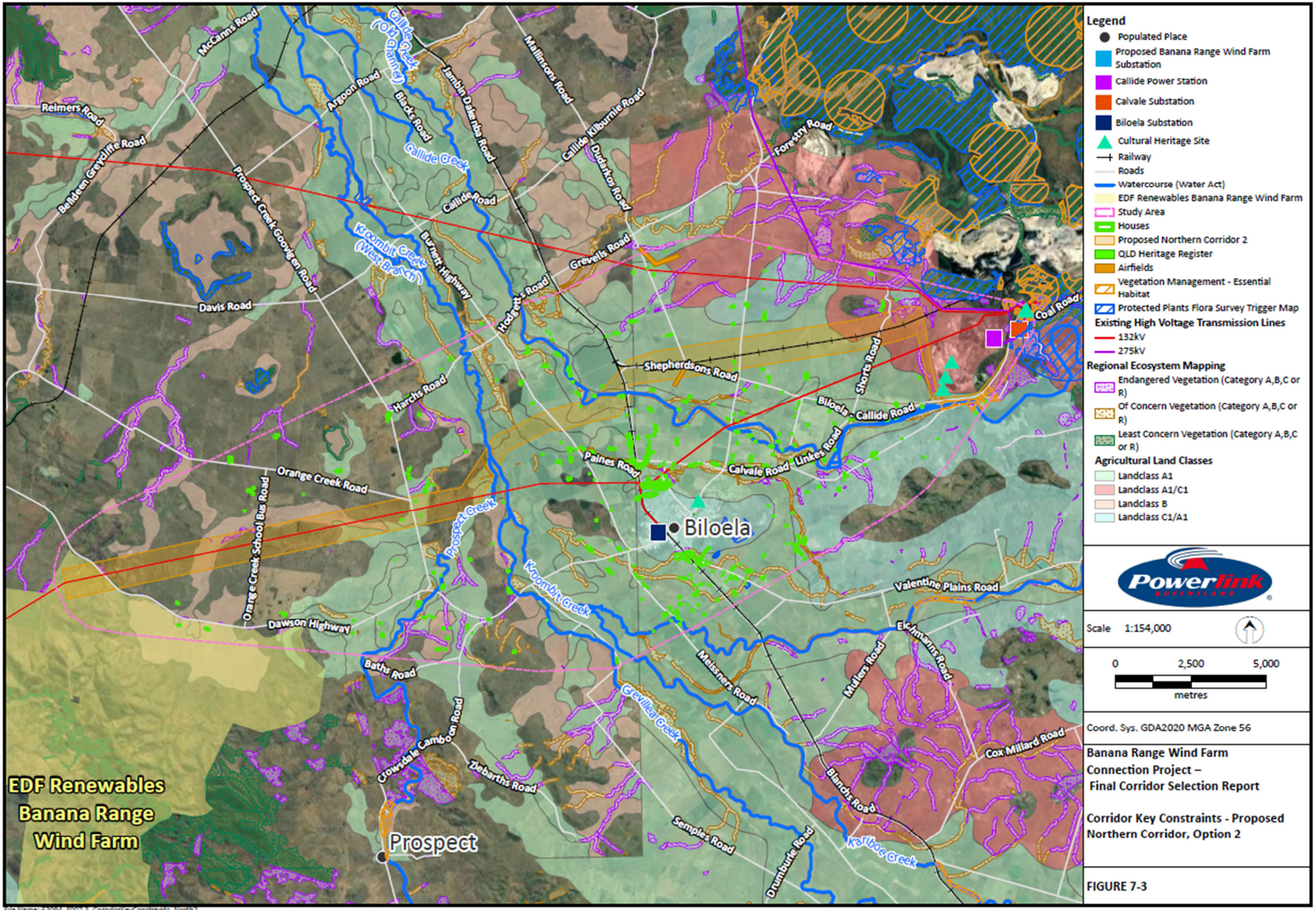
Figure 7-3 shows Northern Corridor 2 and its associated constraints associated with the corridor.

Photo 8 Views from Teys Road showing constrained road and agricultural operations

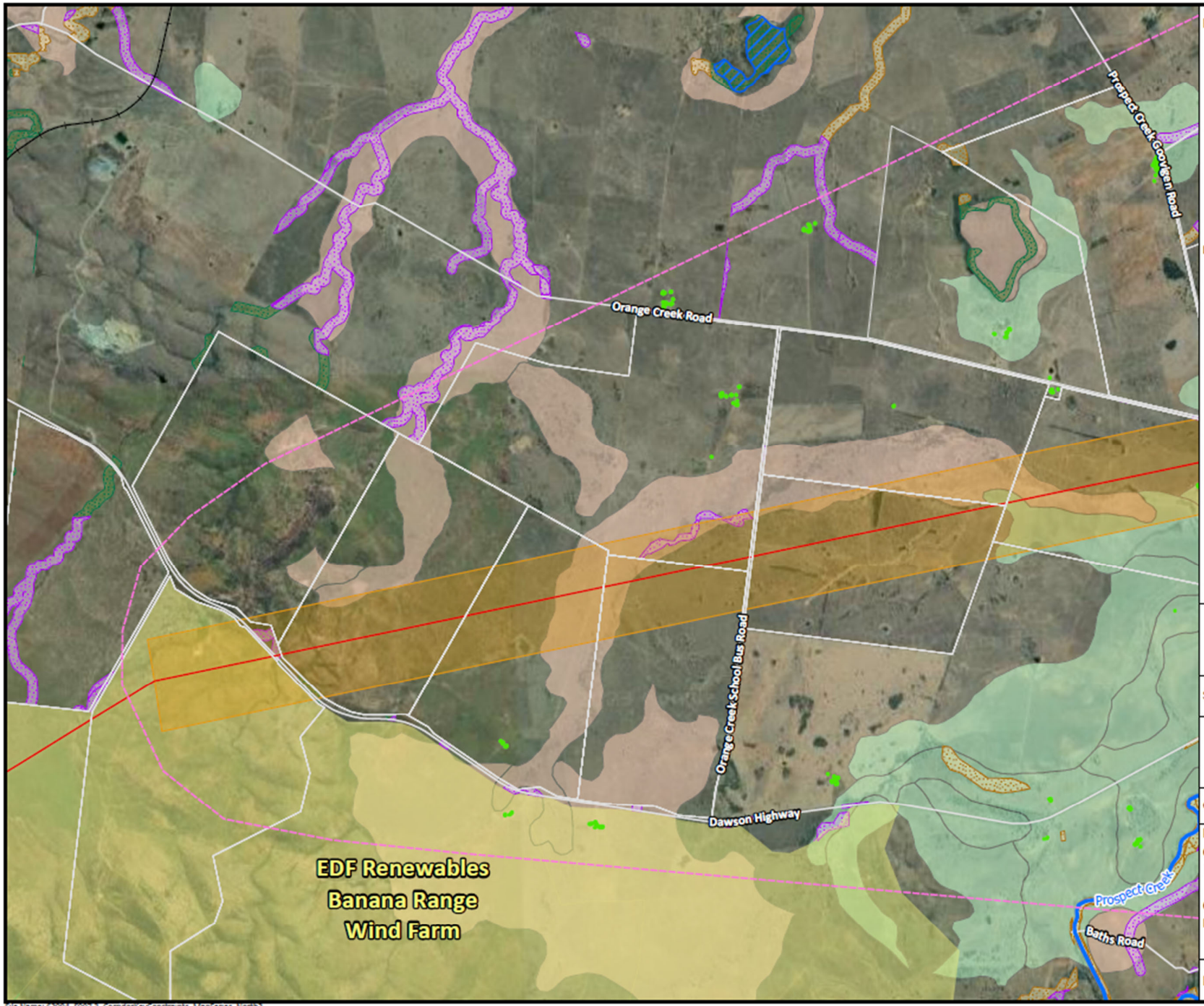
Photo 9 View from Shorts Road rail crossing

Photo 10 Views from Dudarkos Road facing southwest

Photo 11 Views from Jambin Dakenba Road



File Name: 62094_F007.3_CorridorKeyConstraints_North2
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023



Legend

- Railway
- Roads
- Watercourse (Water Act)
- Study Area
- Cadastre
- Houses
- Proposed Northern Corridor 2
- EDF Renewables Banana Range Wind Farm
- Protected Plants Flora Survey Trigger Map

Existing High Voltage Transmission Lines

- 132kV

Regional Ecosystem Mapping

- Endangered Vegetation (Category A,B,C or R)
- Of Concern Vegetation (Category A,B,C or R)
- Least Concern Vegetation (Category A,B,C or R)

Agricultural Land Classes

- Landclass A1
- Landclass B

Powerlink Queensland

Scale 1:55,000

0 1,000 2,000

metres

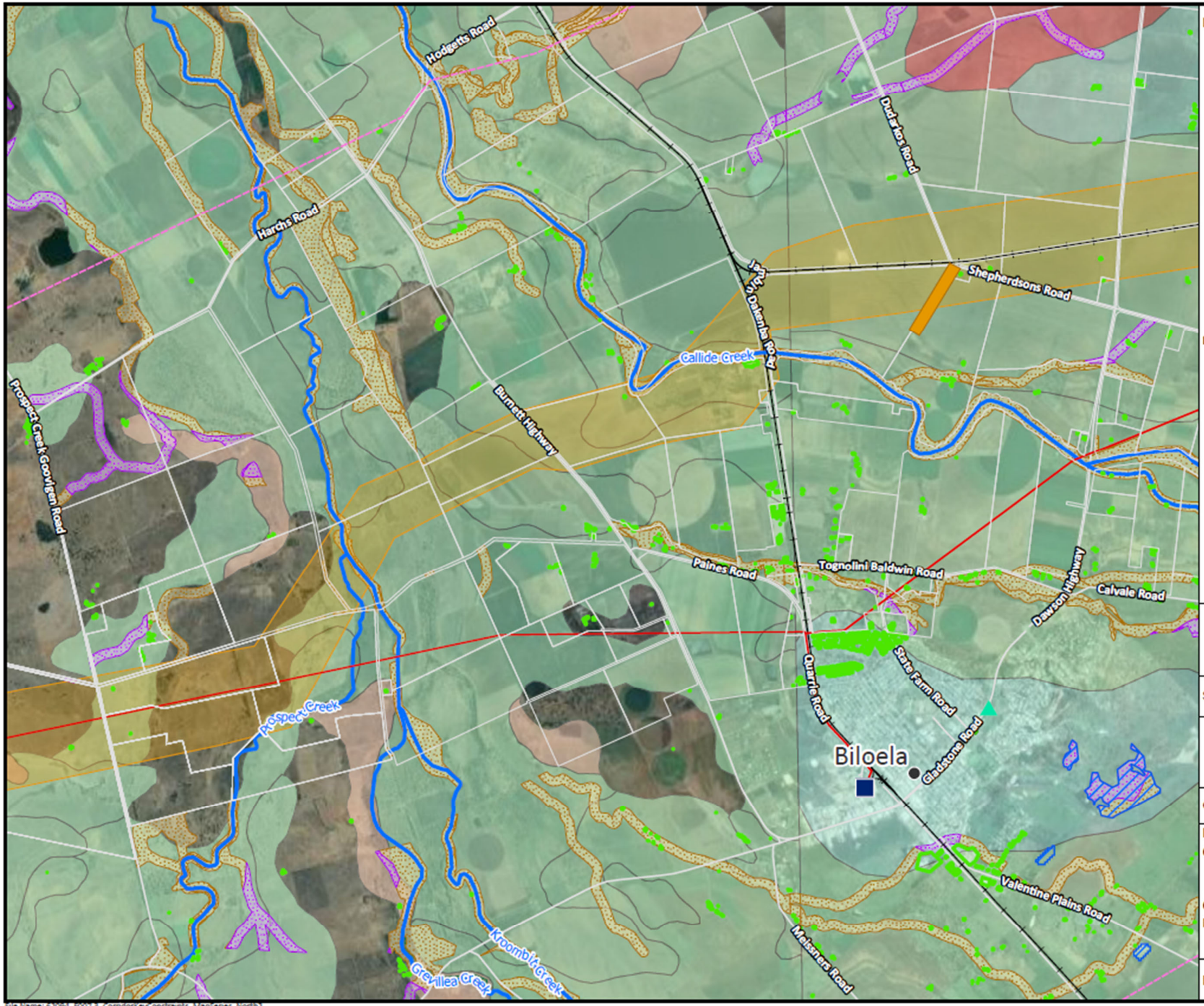
Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

Corridor Key Constraints - Proposed Northern Corridor, Option 2

FIGURE 7-3a

File Name: 62694_R007.3_CorridorKeyConstraints_MapSeries_North2
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023



Legend

- Populated Place
- Biloela Substation
- Cultural Heritage Site
- Railway
- Roads
- Watercourse (Water Act)
- Study Area
- Cadastre
- Houses
- Proposed Northern Corridor 2
- Proposed Banana Range Wind Farm Substation
- QLD Heritage Register
- Airfields
- Protected Plants Flora Survey Trigger Map

Existing High Voltage Transmission Lines

- 132kV

Regional Ecosystem Mapping

- Endangered Vegetation (Category A,B,C or R)
- Of Concern Vegetation (Category A,B,C or R)
- Least Concern Vegetation (Category A,B,C or R)

Agricultural Land Classes

- Landclass A1
- Landclass A1/C1
- Landclass B
- Landclass C1/A1

Powerlink QUEENSLAND

Scale 1:55,000

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metres

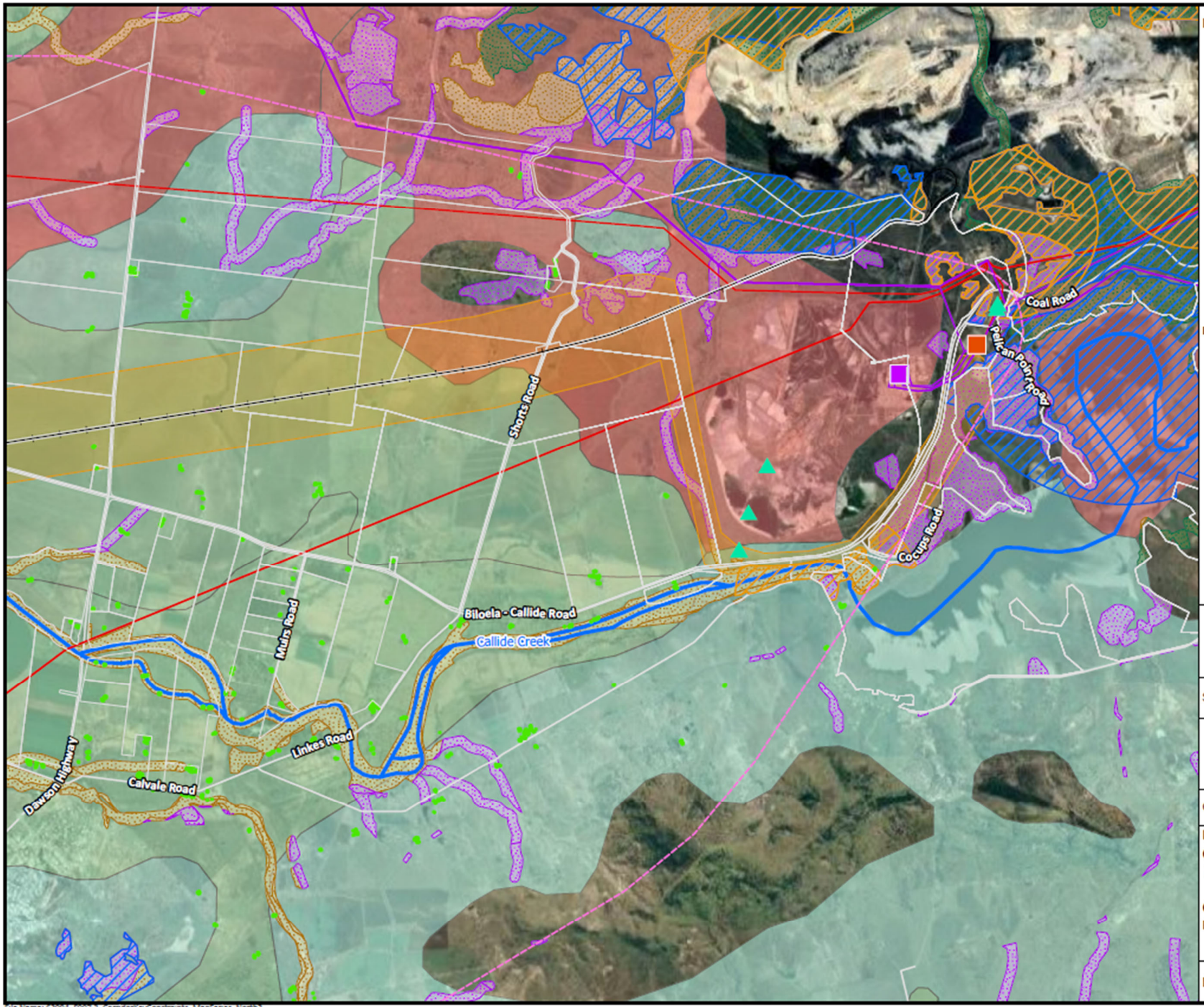
Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

Corridor Key Constraints - Proposed Northern Corridor, Option 2

FIGURE 7-3b

File Name: 620694_R007.3_CorridorKeyConstraints_MapSeries_North2
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023



Legend

- Callide Power Station
- Calvale Substation
- Cultural Heritage Site
- Railway
- Roads
- Watercourse (Water Act)
- Study Area
- Cadastre
- Houses
- Proposed Northern Corridor 2
- Vegetation Management - Essential Habitat
- Protected Plants Flora Survey Trigger Map

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Regional Ecosystem Mapping

- Endangered Vegetation (Category A,B,C or R)
- Of Concern Vegetation (Category A,B,C or R)
- Least Concern Vegetation (Category A,B,C or R)

Agricultural Land Classes

- Landclass A1
- Landclass A1/C1
- Landclass C1/A1

Powerlink Queensland

Scale 1:55,000

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metres

Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

Corridor Key Constraints - Proposed Northern Corridor, Option 2

FIGURE 7-3c

File Name: 62094_F007.3_CorridorKeyConstraints_MapSeries_North2
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

7.3 Central Corridor

Description

From Calvale Substation, the corridor moves south-west then west adjacent to Biloela-Callide Road. This area is constrained by the power station and dam immediately north and south. An alternative corridor north and then west from the substation was also considered, however, it was found to require several under crossings of existing transmission lines which would have significant supply reliability and cost impacts.

The corridor then turns north and stays near the western boundary of the power station property seeking to minimise impacts on the agricultural land immediately west. It then turns west and joins the existing Calvale to Moura 132kV line through to the proposed Banana Range Wind Farm substation site. Where possible, the new transmission line would be located adjacent to the existing 132kV line in this area.

Key Characteristics

- Very significant opportunity to co-locate with the existing Calvale-Moura 132kV line;
- From west of the power station to Kroombit Creek impacts intensively cultivated land;
- Impacts the Biloela Showgrounds and residential properties along Auburn Street;
- Very significant number of houses within the corridor;
- Significant number of land parcels;
- Most direct corridor between the two substations;
- Intersects large and small properties;
- Does not follow property boundaries; and
- Potential impact on Remnant Vegetation.

Views of a number of proposed crossings of road and rail infrastructure intersected by the Central Corridor are provided in Photo 12, Photo 13, Photo 14, Photo 15, Photo 16 and Photo 17.

Figure 7-4 shows the Central Corridor and its associated constraints.

Photo 12 Orange Creek School Bus Road facing east towards Biloela

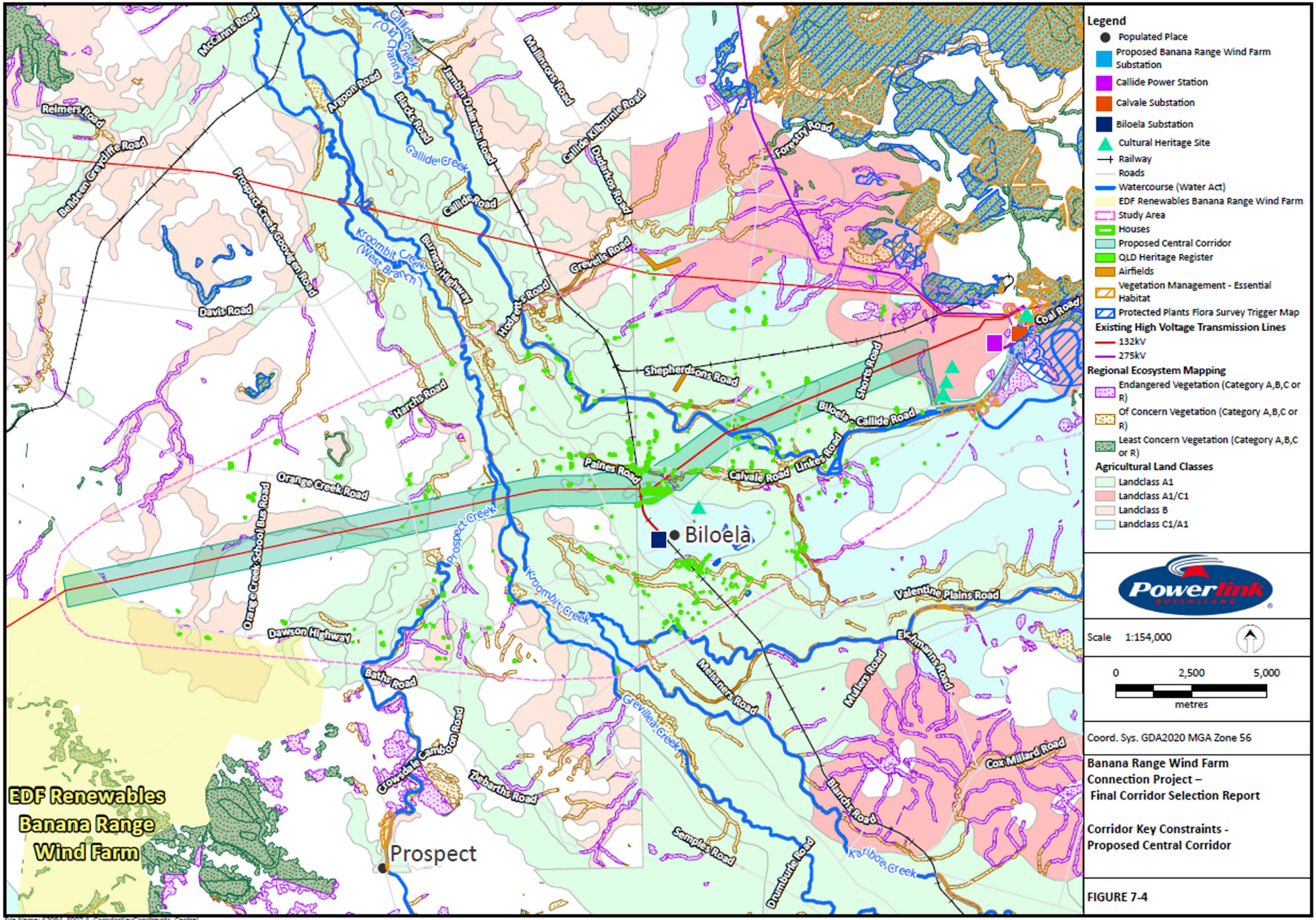
Photo 13 Prospect Creek Goovigen Road facing west towards Banana Range

Photo 14 View east along existing 132kV line along Auburn St

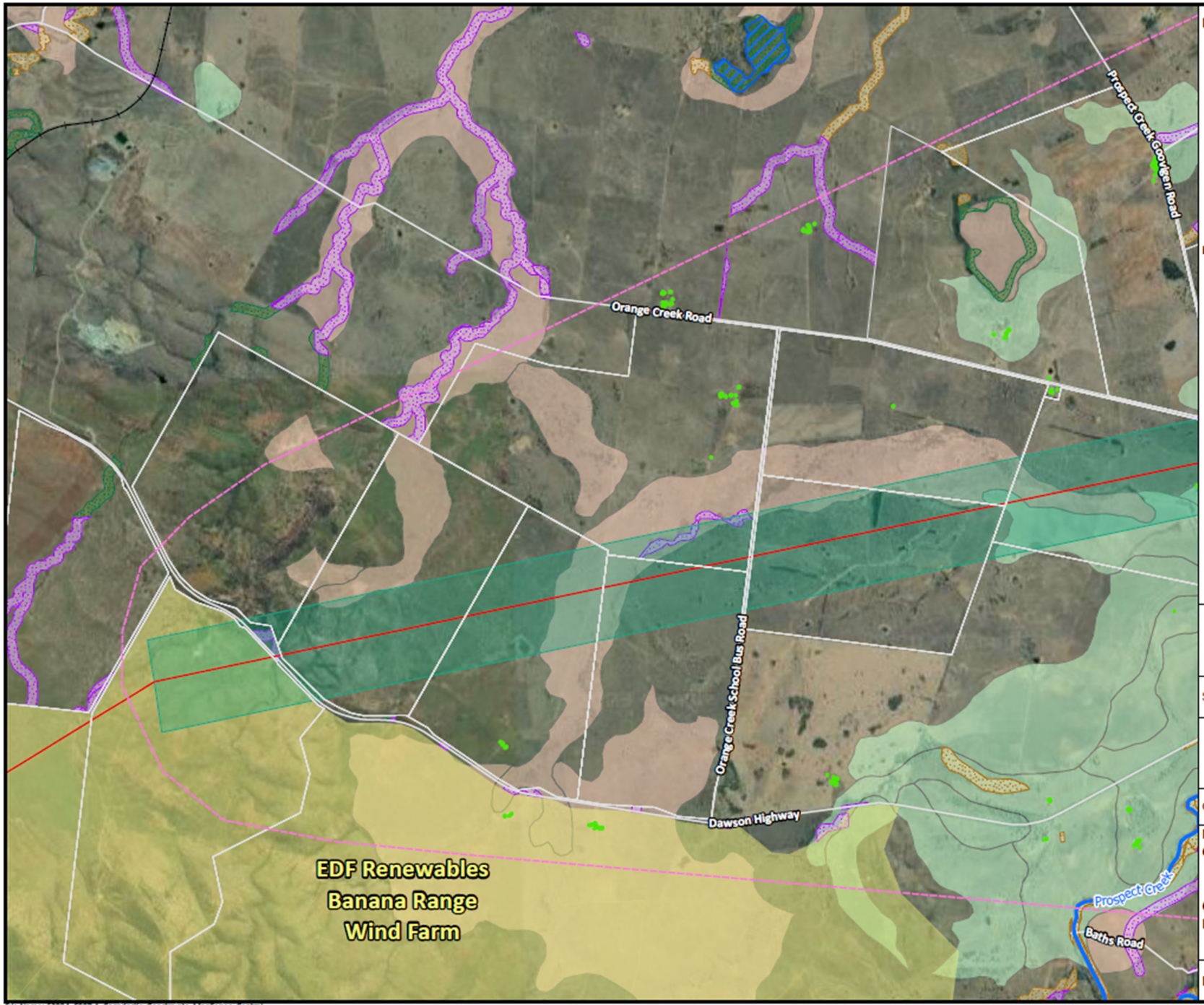
Photo 15 View northeast along State Farm Road with interface between existing 132 kV line and Ergon distribution line

Photo 16 Shorts Road facing west towards Biloela

Photo 17 Biloela Callide Road view north along vegetation at bottom of Callide Power Station ash dam



File Name: 62094_R007.4_CorridorKeyConstraints_Central
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023



Legend

- Railway
- Roads
- Watercourse (Water Act)
- EDF Renewables Banana Range Wind Farm
- Study Area
- Cadastre
- Houses
- Proposed Central Corridor
- Protected Plants Flora Survey Trigger Map

Existing High Voltage Transmission Lines

- 132kV

Regional Ecosystem Mapping

- Endangered Vegetation (Category A,B,C or R)
- Of Concern Vegetation (Category A,B,C or R)
- Least Concern Vegetation (Category A,B,C or R)

Agricultural Land Classes

- Landclass A1
- Landclass B

Powerlink Queensland

Scale 1:55,000

0 1,000 2,000

metres

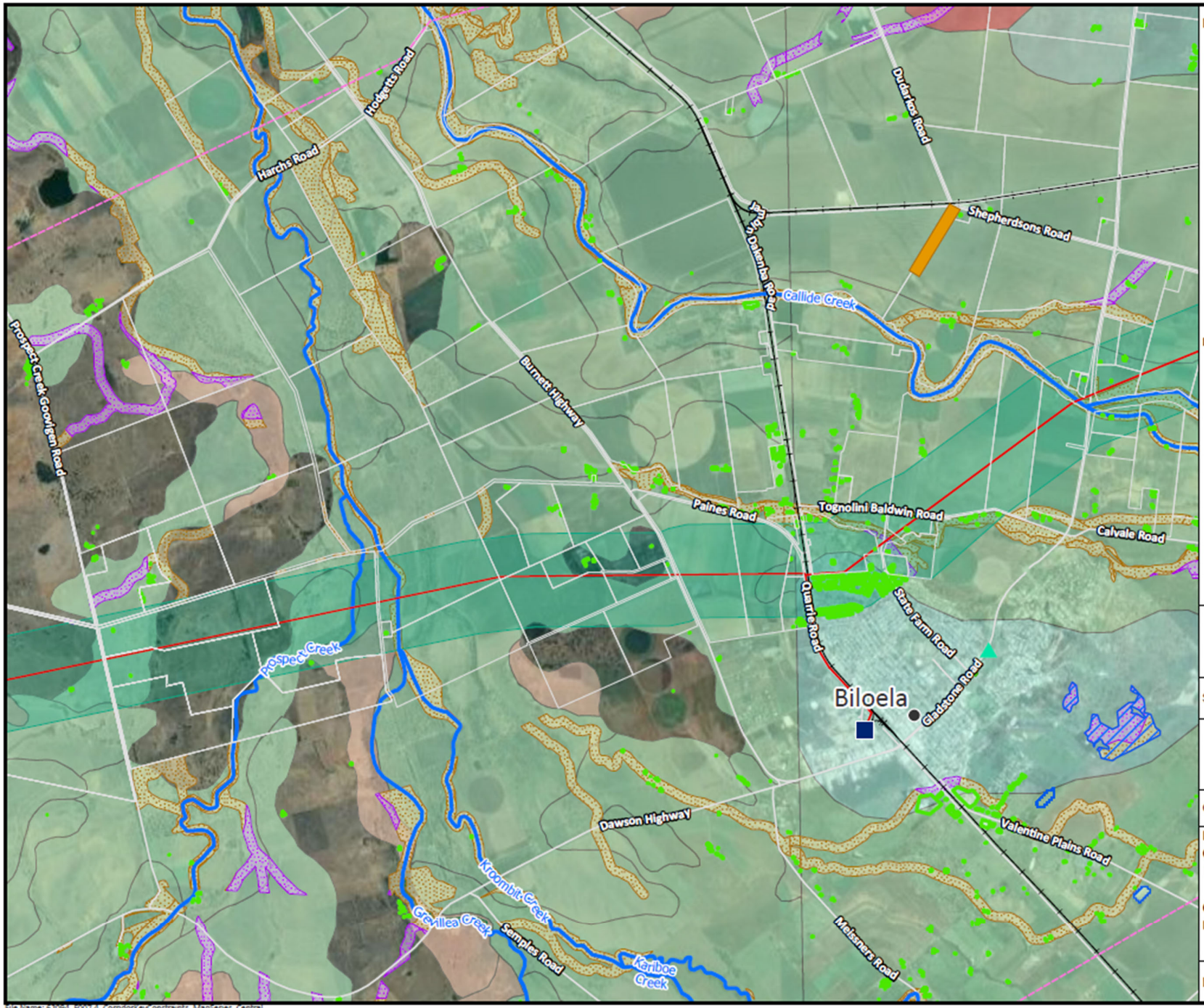
Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

Corridor Key Constraints - Proposed Central Corridor

FIGURE 7-4a

File Name: 62094_F007.4_CorridorKeyConstraints_MapSeries_Central
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023



Legend

- Populated Place
- Proposed Banana Range Wind Farm Substation
- Biloela Substation
- Cultural Heritage Site
- Railway
- Roads
- Watercourse (Water Act)
- Study Area
- Cadastre
- Houses
- Proposed Central Corridor
- QLD Heritage Register
- Airfields
- Protected Plants Flora Survey Trigger Map

Existing High Voltage Transmission Lines

- 132kV

Regional Ecosystem Mapping

- Endangered Vegetation (Category A,B,C or R)
- Of Concern Vegetation (Category A,B,C or R)
- Least Concern Vegetation (Category A,B,C or R)

Agricultural Land Classes

- Landclass A1
- Landclass A1/C1
- Landclass B
- Landclass C1/A1

Powerlink QUEENSLAND

Scale 1:55,000

0 1,000 2,000
metres

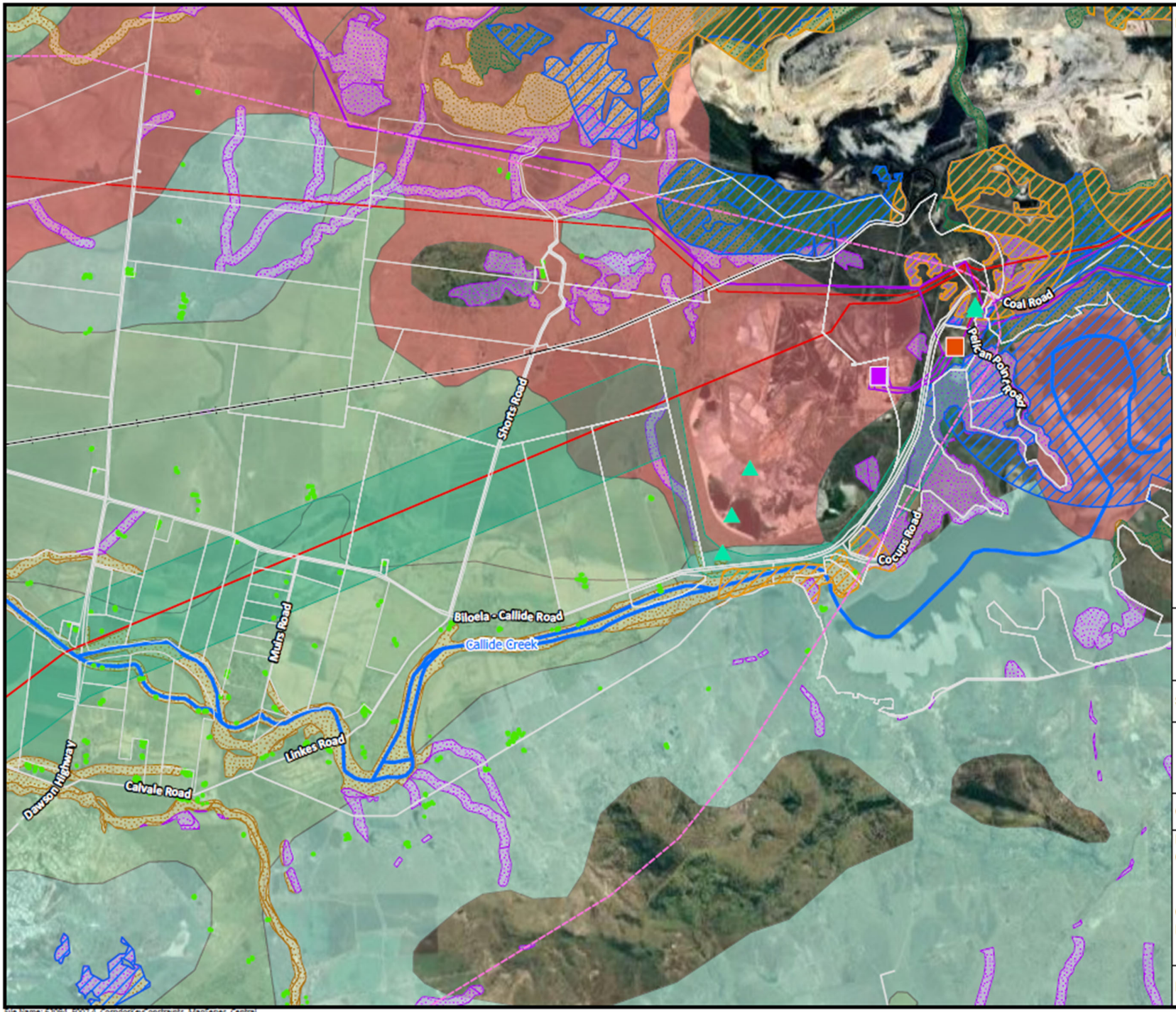
Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

Corridor Key Constraints - Proposed Central Corridor

FIGURE 7-4b

File Name: 62094_F007.4_CorridorKeyConstraints_MapSeries_Central
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023



Legend

- Callide Power Station
- Calvale Substation
- Cultural Heritage Site
- Railway
- Roads
- Watercourse (Water Act)
- Study Area
- Cadastre
- Houses
- Proposed Central Corridor
- Vegetation Management - Essential Habitat
- Protected Plants Flora Survey Trigger Map

Existing High Voltage Transmission Lines

- 132kV
- 275kV

Regional Ecosystem Mapping

- Endangered Vegetation (Category A,B,C or R)
- Of Concern Vegetation (Category A,B,C or R)
- Least Concern Vegetation (Category A,B,C or R)

Agricultural Land Classes

- Landclass A1
- Landclass A1/C1
- Landclass C1/A1

Powerlink QUEENSLAND

Scale 1:55,000

0 1,000 2,000

metres

Coord. Sys. GDA2020 MGA Zone 56

Banana Range Wind Farm Connection Project – Final Corridor Selection Report

Corridor Key Constraints - Proposed Central Corridor

FIGURE 7-4c

File Name: 62094_F007.4_CorridorKeyConstraints_MapSeries_Central
Reference: ESRI Topographic Basemap - Accessed Imagery: 14/03/2023

7.4 Consideration of a corridor option south of Biloela

A southern corridor option was initially considered, however following engagement with landholders, the wider community and other stakeholders, as well as a technical assessment, this option was not considered viable moving forward, mainly due to significant social impacts. This includes impacts on many small properties south of Biloela township in the Prospect and Valentine Plains areas and the community and sporting facilities along Valentine Plains Road.

7.5 Comparative Assessment of Proposed Corridor Options

The corridor options have been assessed using a quantitative analysis and ranking against each assessment criteria. Further analysis was then undertaken based on qualitative issues relating to the magnitude of impact and/or the potential for impacts to be mitigated. Using this approach, the benefits and disadvantages of the corridor options against each criterion were considered and discussed and from this a recommended corridor has been identified.

7.5.1 Land use

The potential impact of the transmission line on SCL and Agricultural Land Classes A and B has been the key issue raised through the early engagement process. As discussed in Section 5.1.2, SCL is defined and regulated with respect to certain developments under the *Regional Planning Interests Act 2014* and is land that is, or is likely to be, highly suitable for cropping because of a combination of the lands soil, climate and landscape features. Agricultural land classes are defined under the State Planning Policy and provide for the protection of agriculture and agricultural development opportunities. The percentage area of each corridor which overlays SCL and Agricultural Land Classes A, B and C are shown in Table 7.1.

Table 7.1 Corridor intersection with SCL and Agricultural Land Classes

Constraint (% of total corridor area)	Northern Corridor 1	Northern Corridor 2	Central Corridor
SCL	47.68%	50.9%	52.4%
Agricultural Land Class A	28.6%	44.8%	48.4%
Agricultural Land Class B	8.64%	6.6%	6.9%
Agricultural Land Class C	37.97%	37.8%	37.1%

All proposed corridor options intersect large areas of SCL from just west of Callide Power Station to Kroombit Creek. Moving further west, land use becomes grazing with limited areas of SCL.

Agricultural Land Classification mapping shows all corridors traversing mainly Class A and Class B land between the Callide Power Station to Bowketts Lane. The corridors become common west of Bowketts Lane with mostly Class C and some areas of Class A land being affected. A pocket of A1/C1 and C1/A1 is located within Northern Corridor 1 to the north of Mount Murchison State School. Small pockets of A1/C1 and C1/A1 are located along Northern Corridor 2 and Central Corridor.

Agriculture is one of the main industries within the Banana Shire with both irrigation and dryland farming being undertaken to grow a range of produce including lucerne, cotton, sorghum, wheat, legumes and herbs. One of the largest mung bean exporters is based in Biloela. As such, given the nature of the Study Area and the intensive use of the area as cropping, not all cropping land could be avoided and therefore the objective of the corridor development was to minimise and/or mitigate impact. Where corridors intersect cropping land, towers will be positioned, where possible, close to boundaries or other existing infrastructure to minimise impacts on cropping activities. Co-location advantages include minimising impacts on cropping land by limiting the impacts to one area, and ability to utilise existing access tracks and points for maintenance.

Northern Corridor 1 intersects the lowest percentage of SCL and Agricultural Land Class A and B and is the recommended option on this basis.

7.5.2 Houses / land parcels

Houses and other sensitive receptors located within the Study Area are described in Section 5.1.4. The number of houses and land parcels within each corridor is represented in Figure 7-2, Figure 7-3 and Figure 7-4.

Table 7.2 Corridor interaction with houses/land parcels

Constraint	Northern Corridor 1	Northern Corridor 2	Central Corridor
Houses within the corridor	8	10	243**
Land parcels within the corridor	63	84	334**

** For comparative assessment, these numbers also include houses and land parcels within the Biloela township that fall within 500m of the existing transmission line.

The number of houses and land parcels within a corridor provides an understanding of the intensity of development and likely visual amenity impacts from a proposed transmission line.
For the Central Corridor, significant land use changes have occurred since the 132kV line was constructed in the 1960s including expansion of Biloela township to the north, development of the showgrounds and rural small lot subdivision such that many houses are now located within 500m of the existing line. This means there are many houses, community uses and industrial sheds directly affected by or in close proximity to the existing line and this is reflected in the table above. The proposed 275kV transmission line structures will be significantly larger (approximately 20m taller with heavier steel members and bigger footprint) than the existing 132kV structures due to the difference in voltage and modern design standards. Powerlink considers that an additional line in this location will have a compounding impact on visual amenity for directly affected and nearby houses even after discounting for the existing visual impact from the smaller 132kV line.

Northern Corridor 1 intersects the fewest number of lots and has the fewest number of houses within its corridor.

Northern Corridor 1 is the recommended option on this basis.

7.5.3 Transport and other infrastructure

Transport and other infrastructure located within the Study Area are described within Section 5.1.6. The number of crossings for each corridor option is summarised in Table 7.3.

Table 7.3 Corridor intersection with transport and other infrastructure

Constraint	Northern Corridor 1	Northern Corridor 2	Central Corridor
Main roads	3	3	3
Railway	2	3	1
Transmission Line (high voltage)	2	2	3
Pipeline	1	1	1
Airstrips	0	1	0

All proposed corridor options intersect Biloela-Callide Road, Burnett Highway and Dawson Highway as well as a high-pressure gas pipeline (Wallumbilla to Gladstone to Rockhampton Branch Pipeline – Jemena QLD Gas Pipeline Pty Ltd). There is limited differentiation between interactions with roads, railways and transmission lines between the corridors..

Fitzy's Airfield, a private airstrip, is located approximately 250 m north of Northern Corridor 1. The existing Calvale to Baralaba 132kV line is located between the airstrip and Northern Corridor 1 and where possible, the transmission line will be sited to minimise impacts on this airfield.

Northern Corridor 2 has a very significant impact on a property that contains a private airstrip along Shepherdsons Road. The Civil Aviation Safety Authority has no guidelines for the development of infrastructure near private airstrips however reference is made to Part 139 (Aerodromes) Manual of Standards 2019[2]. The Standards state that on approach to a Code 1 (non-instrumental) runway, the slope requires 5%, therefore, tall infrastructure should be built around 800 – 1,200 m (depending on height of tower) from the end of the airstrip to enable its continued operation.

Opportunities to co-locate the proposed transmission line with other linear infrastructure provides the following benefits –

- Confines land use impacts to one corridor instead of multiple corridors on a property;
- Reduces biosecurity risk and impacts on farming operations; and
- Helps to maintain the landholder's privacy with third parties only accessing one area of their property.

The Central Corridor is the recommended option on the basis it has the least number of potential road and railway infrastructure interactions.

7.5.4 Protected flora and fauna

A description of the protected flora and fauna within the Study Area is provided in Section 5.2. A review of the proposed corridor options against the flora and fauna mapping was undertaking to identify the potential impacts as summarised below.

The PMST report identified five TECs listed as endangered under the EPBC Act as known, likely to, or may occur within the Study Area. It is likely that all proposed corridor options will intersect potential TEC based on the location of mapped corresponding REs. Remnant and regrowth vegetation is scattered across all three proposed corridor options, particularly near watercourses and roadsides. Vegetation near the Calvale Substation, which intersects all three corridors, is mapped as both essential habitat and a high-risk area for protected plants.

Therefore, the presence of TEC within each option does not differentiate and/or assist with identifying a preferred corridor option. The area of mapped remnant vegetation has been expressed as a percentage of the total area for each corridor option as represented in Table 7.4. The table shows that areas of remnant vegetation within each corridor is very small, with mapping showing it generally limited to the watercourses. All watercourses can be easily spanned by the proposed transmission line.

Table 7.4 Corridor intersection with vegetation and essential habitat

Constraint	Northern Corridor 1	Northern Corridor 2	Central Corridor
- **Category A vegetation**	-	-	10.3 ha (0.3%)
- **Category B vegetation**	87.2 ha (2.5%)	31.4 ha (1.0%)	46.8 ha (1.5%)
- **Category C vegetation**	92.2 ha (2.6%)	73.8 ha (2.4%)	58.9 ha (1.9%)
- **Category R vegetation**	203.1 ha (5.9%)	27.7 ha (0.9%)	43.2 ha (1.4%)
Essential habitat (ha and % of the total corridor area)	0.2%	0.2%	0.2%
High risk area for protected plants (ha and % of the total corridor area)	7.3 ha (0.2%)	7.4 ha (0.2%)	7.4 ha (0.2%)

[2] Part 139 (Aerodromes) Manual of Standards 2019 (legislation.gov.au)

For this criteria, Northern Corridor 2 is the recommended option as it has the lowest amount of vegetation coverage due to the historical use of land for cropping with limited native vegetation near the major watercourses.

7.5.5 Hydrology

A description of watercourses within the Study Area is provided in Section 5.3.4. The number of watercourse crossings for each corridor is summarised in Table 7.5.

Table 7.5 Corridor intersection with watercourses

Constraint	Northern Corridor 1	Northern Corridor 2	Central Corridor
Number of watercourse intersections (major)	2	2	3

The existing Calvale to Moura 132kV transmission line crosses the Kroombit and Callide Creeks and associated floodplains. Transmission towers are engineered and designed to be resilient to inundation by floodwaters. Each tower and its foundations are designed for local conditions and in accordance with relevant engineering guidelines and standards. The watercourses and floodplains traversed by the corridor options would not impede construction of a new transmission line and has no impact on constructability or operation of the transmission line.

Northern Corridors 1 and 2 intersect the least number of waterways and are equally the most recommended on this basis.

7.5.6 Cost

The cost to construct the transmission line and the ongoing maintenance cost is considered in the assessment of corridor options. The cost to construct and maintain a transmission line is generally proportional to the length of the route and the number of angle structures. Significant changes in the direction, different construction types and foundation types of a route will increase construction costs.

As a basis for this comparative assessment, the length of the corridor and potential bend points (or changes in direction) as presented in Table 7.6 is taken as a proxy of capital cost.

Table 7.6 Corridor length

Constraint	Northern Corridor 1	Northern Corridor 2	Central Corridor
Corridor length	40.78 km	37.57 km	35.35 km
Potential bend points	20	21	20
Potential colocation opportunities with other linear infrastructure	20 km	23 km	30 km

Northern Corridor 1 provides co-location opportunities with the Calvale to Baralaba 132kV transmission line and Calvale to Moura 132kV line.

Northern Corridor 2 provides co-location opportunities with the Moura Railway line and Calvale to Moura 132kV line. However, this corridor intersects an airstrip and would not have enough separation distance to the airstrip to allow for continued operations without also impacting on adjacent property land uses.

Central Corridor provides significant co-location opportunities with the existing Calvale to Moura 132kV line.

Central Corridor has the shortest length and comparable number of potential bend points, consistent with the number of Northern Corridor 1, and also has the greatest length of co-location opportunity. Central Corridor is the recommended option on this basis.

7.6 Assessment summary

The comparative assessment of each corridor option is shown in Table 7.7. Based on their impact, each option has been ranked 1-3, with 1 being the least impact and 3 being the highest impact.

Table 7.7 Summary of corridor assessment

	Northern Corridor 1		Northern Corridor 2		Central Corridor	
	Impact	Rank	Impact	Rank	Impact	Rank
LAND USE						
SCL	47.6%	1	50.9%	2	52.4%	3
Agricultural Land Class A & B	37.2%	1	51.2%	2	55.3%	3
Agricultural Land Class C*	37.9%	1	37.8%	2	37.1%	3
HOUSING						
Houses within the corridor	8	1	10	2	243	3
Land parcels within the corridor	63	1	84	2	334	3
INFRASTRUCTURE						
Main roads	3	1	3	1	3	1
Railway	2	2	3	3	1	1
Transmission Line (high voltage)	2	1	2	1	3	2
Airstrips	0	1	1	3	0	1
PROTECTED FLORA AND FAUNA						
Category A, B, C or R vegetation	10.9%	3	4.3%	1	5.1%	2
WATERCOURSES						
Number of watercourse intersections (major)	2	1	2	1	3	2
COST						
Corridor length	40.78 km	3	37.57 km	2	35.35 km	1
Potential bendpoints	20	1	21	2	20	1
Potential colocation with existing rail or transmission lines	20km	3	23km	2	30km	1
TOTAL SCORE	21		26		27	
TOTAL RANK	1		2		3	

***This criteria and performance indicator is ranked 1-3, with 1 being the highest impact and 3 being the least impact. This has been undertaken due to the approach taken to minimise impacts on high quality agricultural land (i.e. Class A and B agricultural land).**

Based on a comprehensive assessment of the proposed corridor options outlined in this report, Northern Corridor 1 has been identified as the recommended corridor for the proposed 275kV transmission line connecting the BRWF to the electricity transmission network at Calvale Substation.

Northern Corridor 1, while slightly longer than the other two corridors, has the lowest social impact given it contains the least number of land parcels and houses and intersects the lowest percentage of areas of SCL and Class A and B land compared to both Northern Corridor 2 and Central Corridor. This has been confirmed through field inspections which identified existing house locations and current land use. Powerlink is very mindful that cultivation will still be affected by a transmission line located in Northern Corridor 1 and will work closely with all landholders to understand their operations and where possible, locate the transmission line within their property to minimise impacts noting other environmental, social and technical factors that need to be considered.

Powerlink will work with landholders to apply a number of impact mitigation measures in circumstances where cultivation land needs to be crossed including;

- Providing a minimum of 12m clearance between the bottom conductor and the ground to enable equipment up to 6m in height to operate safety under the line. Powerlink will also work with each landholder to determine whether additional clearance is required.
- Working with each landholder to provide location flexibility to integrate with their existing operations such as placing the alignment near property / paddock boundaries, adjacent existing transmission lines or following the shortest distance across a particular property.
- Within design limits, maximising span lengths to minimise the number of towers in cultivation and placing towers in locations requested by landholders.
- Ensuring sufficient separation to nearby houses where possible.
- Assisting landholders to ensure metallic farming equipment, such as centre pivots, used in very close proximity to the transmission line is adequately earthed for electrical safety. Powerlink will undertake remedial actions such as installation of dragging chains and earthing of the pivot point. Powerlink also recommends no part of the centre pivot be 'parked' under a transmission line for extended periods.
- Designing the transmission line to comply with radio frequency interference limits in Australian Standard 2344 to minimise any interference with modern GPS guided farming equipment. Powerlink will also work with directly affected landholders to understand the type and layout of precision agricultural equipment being used and if necessary, conduct infield testing before and after construction to determine if there are any impacts on GPS systems from the transmission line. Remedial actions will be undertaken should impacts be identified.

While potential environmental impacts to protected flora and fauna are higher for Northern Corridor 1, they are mainly limited to watercourses where impacts can be avoided through appropriate siting of transmission towers and over-spanning of vegetation. Northern Corridor 1 also avoids impacts on an airfield which occurs for Northern Corridor 2.

8. Legislative and Approval Requirements

A number of Commonwealth, State and Local planning and environmental approvals may be required for the Project under the following legislation:

- *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*
- *Native Title Act 1993 (Cth)*
- *Aboriginal Cultural Heritage Act 2003 (Cth)*
- *Acquisition of Land Act 1967 (QLD)*
- *Nature Conservation Act 1992 (QLD)*
- *Fisheries Act 1994 (QLD)*
- *Planning Act 2016 (QLD)*
- *Vegetation Management Act 1999 (QLD)*
- *Water Act 2000 (QLD).*

9. Conclusion and Next Steps

Since June 2022, Powerlink has been engaging with landholders, the broader community and other stakeholders regarding a proposed 275kV transmission line connection between EDF Renewable's Banana Range Wind Farm and Powerlink's existing Calvale Substation. The engagement process has sought to raise awareness about the proposed transmission line and provide several opportunities for landholders, the community and other stakeholders to provide local knowledge and input on matters which should be considered when assessing proposed corridor options for the project.

Based on feedback from this early engagement process and technical assessment of the project Study Area, three potential corridors were identified and evaluated in this report, namely Northern Corridor 1, Northern Corridor 2 and Central Corridor.

Comparative assessment of these corridors identified Northern Corridor 1 as the overall recommended corridor for the proposed 275kV transmission line. This corridor has the lowest potential social impacts with the least number of land parcels and houses, and lowest impact on strategic cropping and class A and B land. This is offset by slightly higher construction costs due to its slightly longer length and requirement to traverse and potentially over-span a greater proportion of creek lines that support flora and fauna.

In November 2022, Powerlink released the DCSR to landholders and the broader community for review and comment. Nine (9) submissions were received mainly from landholders in Northern Corridor 1 together with CS Energy and the Federal Member for Flynn. Powerlink has carefully reviewed each submission to identify matters which materially impact the recommendation and has determined that only minor changes are required to Northern Corridor 1 namely:

- Small reduction in corridor width west of Kroombit Creek to focus corridor on alignment with property boundaries in this location; and
- Small increase in corridor width in the area near Dudarkos Road to provide additional flexibility to determine an alignment with landholders that considers planned future land use changes.

Powerlink will now adopt Northern Corridor 1 as the Study Corridor within which detailed landholder engagement will shortly commence to determine a suitable alignment for the proposed transmission line.

Development approval and land acquisition for the proposed transmission line will commence later in 2023 with construction expected to commence in 2024.

10. References

Data Farming (2022). *Review of Transmission line impacts on Precision Agriculture.* Toowoomba, Queensland.

Department of Environment and Resource Management (2010) *National Recovery Plan for the 'Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions' Ecological Community.* Australian Government. Available from: National recovery plan for the "Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions" ecological community - DCCEEW

Department of the Environment and Energy (2019). Conservation Advice (including listing advice) for the Poplar Box Grassy Woodland on Alluvial Plains. Canberra: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/141pb-conservation-advice.pdf. In effect under the EPBC Act from 04-Jul-2019.

Threatened Species Scientific Committee (2009). *Commonwealth Listing Advice on Weeping Myall Woodlands*. Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/98-listing-advice.pdf. In effect under the EPBC Act from 07-Jan-2009.

Threatened Species Scientific Committee (TSSC) (2001). *Commonwealth Listing Advice on Brigalow* (Acacia harpophylla *dominant and co-dominant)*. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/brigalow.html. In effect under the EPBC Act from 04-Apr-2001.

Threatened Species Scientific Committee (TSSC) (2011). Commonwealth Listing Advice on Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions. Department of Sustainability, Environment, Water, Population and Communities. Canberra, ACT: Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/66-listing-advice.pdf. In effect under the EPBC Act from 01-Mar-2011.

Appendix A Summary of Submissions and Powerlink Responses

Public Consultation Process

In early November 2022, Powerlink briefed local, state and federal elected representatives and community leaders ahead of the release of the Draft Corridor Selection Report (DCSR) which occurred in mid-November 2022. Landholders within the three corridors and wider Study Area and elected representatives and industry representative bodies were notified by phone, email or letter. It was also placed on Powerlink's website.

Powerlink held community information drop-in sessions on 29 and 30 November 2022 to support the release of the DCSR and provide landholders and the community with opportunities to discuss the assessment directly with project staff.

Based on stakeholder feedback that end of year harvest would limit availability to make a submission before Christmas, the consultation period was then extended to Friday 20 January 2023 (originally closing 16 December 2022).

Submissions Received

Powerlink acknowledges the time and effort undertaken by stakeholders who made a submission to the DCSR. Nine submissions were received from:

- CS Energy;
- Mr Colin Boyce, Federal Member for Flynn; and
- Seven (7) submissions from landholders within Northern Corridor 1.

Key themes from the submissions included:

- The proposed transmission line's interaction with CS Energy's existing and future infrastructure at Callide Power Station needs to be carefully designed and managed;
- Concerns regarding impacts of the proposed transmission line on high quality agricultural land (especially cultivation);
- Concerns regarding the lack of engagement between the renewable energy sector and agricultural sector;
- Locating the proposed line adjacent the existing 132kV line traversing Biloela or replacing the existing line within the Central Corridor is the lowest impact option;
- The recommended Northern Corridor 1 unduly affects food and fodder producers with calls for the line to be located within the Central Corridor;
- Use of the Ministerial Infrastructure Designation process and compulsory easement acquisition process under the *Acquisition of Land Act 1967* is inappropriate for a private sector development;
- Some landholders nominated areas within their properties most suitable for the proposed line;
- Land use, house and land parcel data has been manipulated as it does not take account of properties already affected by the existing 132kV line between Calvale-Biloela-Banana Range;
- Consultation and communication has been poor;
- Endangered vegetation will be removed and should be protected; and
- The project is a private nuisance and constitutes Assault by Force under the Queensland Criminal Code.

The following table summarises all submissions and Powerlink's response to each matter raised. For privacy reasons, private landholder details and property names have been removed from the table.

Submission from CS Energy	
Summary of Matters Raised	**Summary of Powerlink Response**
Waste Containment Facility Access and Work Requirements The Waste Containment Facility (WCF) is located on the western side of the power station site and the recommended corridor runs along its western and southern boundaries. The existing and potential new infrastructure requires maintenance which is undertaken by heavy earthmoving equipment and it is important CS Energy retain ongoing access. Other considerations in this area: • Ash Dam wall stability • Telemetry • Extensive groundwater seepage recovery program • PFAS contaminated soil • Dust monitors in place • Remnant vegetation exists in SW corner • Existing electrical installations and proposed electrical installations	Powerlink will work closely with CS Energy to minimise or avoid impacts to its waste containment facility and other infrastructure.
Raw Water Make-up Powerlines run from the raw water make-up hut up the hill toward the power station. These are lines owned by CS Energy – we need to confirm Powerlink are aware of these lines and the HV lines won't interfere with their operation. It is understood that these connect to the power station via underground lines. There is also a raw water line that runs parallel to the overhead lines from the raw water make-up hut to the top of the hill opposite the power station entrance.	Powerlink is aware of this infrastructure and will ensure the transmission line does not interfere with its operation.
Future Energy Projects CS Energy is working on concepts for future energy projects. There is potential for these projects to overlap with the proposed corridor location. For any discussions between Powerlink and CS Energy, representatives from the future energy team will be engaged.	Noted.

Submission from Mr Colin Boyce	
Summary of Matters Raised	**Powerlink Response**
Impact on prime agricultural land Object to the proposed transmission line being constructed within Northern Corridors 1 or 2 due to potential impacts on prime agricultural land. The agricultural industry is important to the Australian economy and prime land is being lost to the renewable energy industry. A recent submission to the Federal Government from the National Farmers Federation highlighted the lack of consultation between the renewable energy industry and regional and rural stakeholders. Several constituents have raised concerns regarding the impact of the proposed line on their farming operations and that transmission lines are a major issue for GPS guided precision agriculture and the structures are difficult for farm machinery to move around. Impacts on farming operations should be assessed as part of the compensation process as it may potentially determine the future of these families' livelihoods.	Section 4 of the Draft Corridor Selection Report outlines the early engagement process undertaken by Powerlink to capture feedback from landholders and the wider community regarding matters they consider are important when identifying and assessing potential corridors and ultimately the alignment for the proposed transmission line. The top 5 matters raised by the community align with Mr Boyce's comments. Minimising these social impacts of the proposed development has been a key consideration for Powerlink when identifying and assessing potential transmission line corridors and in the near future, will be a key focus when working with landholders to determine an alignment within the final corridor. Powerlink's assessment of the project Study Area has not identified any east-west corridors across the Callide Valley which totally avoid cultivation land. Within the three corridors assessed, Northern Corridor 1 has been identified as having the lowest area of Strategic Cropping Land and Class A Agricultural Land. In recommending Northern Corridor 1, Powerlink is very mindful that cultivation will still be affected by the transmission line and several of Mr Boyce's constituents have raised strong concerns regarding impacts of the proposed line on their operations. As outlined in the Draft Corridor Selection Report, Powerlink will work closely with all landholders to understand their operations and where possible, locate the transmission line within the property to minimise impacts noting other environmental, social and technical factors that need to be considered. Powerlink outlines below some of the impact mitigation measures it will be applying through cultivation land – • Providing a minimum of 12m clearance between the bottom conductor and the ground to enable equipment up to 6m in height to operate safety under the line. • Working with each landholder to provide location flexibility to integrate with their existing operations. • Within design limits, maximising span lengths and placing towers in locations requested by landholders. • Ensuring sufficient separation to nearby houses where possible. • Assisting landholders to ensure metallic farming equipment, such as centre pivots, used in very close proximity to the transmission line is adequately earthed for electrical safety. • Designing the transmission line to comply with radio frequency interference limits in Australian Standard 2344 to minimise any interference with modern GPS guided farming equipment. Remedial actions will be undertaken should impacts be identified. Recognising landholder concerns regarding this particular matter, Powerlink commissioned a technical study from precision agricultural experts Data Farming at Toowoomba. A copy of the report is attached to Powerlink's response to submitters who raised this matter and appended to the Final Corridor Selection Report. The technical study found impacts should be minimal and still largely centred around potential collision with a tower, aerial spraying challenges and double ups or overlaps of chemicals and fertilizers by driving around a tower.

Submission from Mr Colin Boyce	
Summary of Matters Raised	**Powerlink Response**
	Compensation will be paid to landholders directly affected by the transmission line and amongst other things, will include impacts to business operations. A factsheet outlining the compensation process is attached to Powerlink's response to submitters who raised this matter, will be placed on the Powerlink website and provided to all landholders as part of the detailed engagement process to determine the alignment for the transmission line.
Assessment of Central Corridor The Draft Corridor Selection Report would be more informative if it considered agricultural land and residences that were already impacted by the existing 132kV line and easement between Calvale and Banana Range with the report noting that more than 240 properties are already affected by the line. The percentage of new land affected would potentially highlight the Central Corridor as the preferred option with much of the Strategic Cropping Land and Agricultural Land Classes already affected by the existing line and easement.	The existing 132kV transmission line was built in the 1960s and since that time, significant land use changes have occurred around the line. This means there are many houses, community use areas and industrial sheds directly affected by or in close proximity to the existing line and this is reflected in the Central Corridor assessment in the Draft Corridor Selection Report. The proposed 275kV transmission line structures will be significantly larger than the existing 132kV structures (around 20m taller with heavier steel members and larger footprint) due to the difference in voltage and modern design standards. Powerlink considers the new line will have a compounding impact on visual amenity for directly affected and nearby houses even after discounting for the existing visual impact from the smaller 132kV line. Building the proposed line adjacent to the existing 132kV line will also compound impacts on significant areas of Strategic Cropping Land and Class A agricultural land under cultivation generally between Kroombit Creek east to the power station (excluding Biloela township). Impacting the smallest area of high value cultivation, having the lowest number of houses nearby, providing opportunities for boundary running and co-locating with the existing 132kV lines in the district are key reasons for Powerlink recommending Northern Corridor 1 be adopted. Of the three corridors assessed, Northern Corridor 1 aligns most strongly with the feedback from landholders and the community.
Impact of preferred option on large food and fodder producers The preferred option unduly affects larger food and fodder producers in the region and the protection of agricultural land should be the overwhelming factor when connecting renewable generation to the existing network.	Powerlink considers that, of the three corridors assessed, Northern Corridor 1 contains the lowest area of Strategic Cropping Land and Class A Agricultural Land.

Submissions from seven (7) landholders – **Please note:** • **Personal and property details have been removed for privacy reasons.** • **Matters which are common to more than one landholder have been collated together and one response provided by Powerlink.** • **A detailed written response has been provided to each submitter explaining how each of their matters has been considered.**	
Summary of Matters Raised by Landholders	**Powerlink Response**
Use of Government Powers to support Private Profit Enterprise Some landholders consider use by Powerlink of the Ministerial Infrastructure Designation (MID) process or similar government endorsement allows it to apply resumption powers under the *Acquisition of Land Act 1967*. As the wind farm will be privately owned and operated on a commercial basis, use of such processes and powers is inappropriate to advantage private business in negotiations for compensation with landholders. The MID process is for projects that benefit the community and general public, not a private company such as EDF. Compensation negotiations for the proposed transmission line should therefore be undertaken on a purely commercial basis. Landholders in the Surat Basin were unfairly disadvantaged in negotiations for powerline infrastructure on their property by the exploitation of legislative powers to support private resource projects. This is an abuse of such powers and action will be taken if needed to prevent the same occurring here.	landholder MID is a State development approval process under the *Planning Act 2016* which is available to public and private sector proponents for delivery of certain types of infrastructure including transmission lines. It includes steps for carrying out environmental assessment which, amongst other things, involves the proponent demonstrating it has undertaken extensive consultation and adequately considered the views of stakeholders affected by the project. The MID process is not directly related to land acquisition processes. With regard to compensation for land acquisition, it is Powerlink's intention to negotiate fair and reasonable compensation with each landholder directly affected by the project. Where it is not possible to reach a voluntary settlement, Powerlink may consider compulsory acquisition processes. A compensation factsheet is attached to Powerlink's response to submitters who raised this matter. Together with the wind farm, the two projects are expected to deliver significant local employment and service provision opportunities and facilitate the transition of the Queensland energy system to deliver clean, reliable and affordable energy consistent with the Queensland Government's Energy and Jobs Plan.
Impact on Farming Operations and Strategic Cropping Land This was a common theme from landholders, with some strongly opposing the proposed Northern Corridor 1 on that basis. Concern was raised regarding the potential impact of the transmission line on agricultural business and production. Sustainable farming practices may be affected by construction and maintenance activities through the introduction of contaminants and chemicals and some landholders proposed management measures such as a buffer zone between construction activities and the crop to minimise contaminants from vehicles, equipment and machinery. Soil compaction may impact growth potential of crops. Depending on the location of the transmission line, some landholders consider they may also lose use of additional cropping land outside the easement area in order to maintain the recommended safety clearance of at least 6m between their machinery and the powerline. Landholders also raised future farming operations, such as the installation of centre	Section 4 of the Draft Corridor Selection Report outlines the early engagement process undertaken by Powerlink to capture feedback from landholders and the wider community regarding matters they consider are important when identifying and assessing potential corridors and ultimately the alignment for the proposed transmission line. The top 5 matters raised by landholders and the community were – • Impacts to farming operations • Proximity to homes • Visual impact of the transmission line • Loss of property value Perceived health effects from Electric and Magnetic Fields Minimising these social impacts of the proposed development has been a key consideration for Powerlink when identifying and assessing potential transmission line corridors and in the near future, will be a key focus when working with landholders to determine an alignment within the final corridor. Powerlink's assessment of the project Study Area has not identified any east-west corridors across the Callide Valley which totally avoid cultivation land. Within the three corridors assessed, Northern Corridor 1 has been identified as having the lowest area of Strategic Cropping Land and Class A Agricultural Land. In seeking to minimise social impacts,

Submissions from seven (7) landholders –

Please note:

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- **A detailed written response has been provided to each submitter explaining how each of their matters has been considered.**

Summary of Matters Raised by Landholders	Powerlink Response
pivots, which will be affected by the transmission line. Landholder examples of potential disruption to routine preparation, planting, spraying and harvesting of crops included – • Preventing aerial spraying operations • Disruptions and forced work stoppage due to interference from powerlines on GPS guided farm machinery • Increased safety risk to machinery and operators due to the powerline • Additional administration burden to identify and address the powerline location and safety requirements for Workplace Health & Safety requirements in their business including to update safety regulations, inductions and manuals • Additional personnel may be required as a 'safety observer' while operating around the powerline • Additional time and resources needed to conduct scouting prior to every operation to check for additional safety hazards or changes (ie – Powerline sag during heat or sway during windy conditions) • Restricting / preventing the use of drone based technology for crop management as drones cannot be operated safely in the vicinity of powerlines.	the small additional length of Northern Corridor 1 is considered by Powerlink to be acceptable and the higher construction costs will be passed on to EDF. In recommending Northern Corridor 1, Powerlink is very mindful that cultivation will still be affected by the transmission line and some landholders have raised strong concerns regarding the impact of the proposed line on their operations. As outlined in the Draft Corridor Selection Report, Powerlink will work closely with all landholders to understand their operations and where possible, locate the transmission line within their property to minimise impacts noting other environmental, social and technical factors that need to be considered. The assessment of compensation under the *Acquisition of Land Act 1967* requires Powerlink's independent valuer to consider the transmission line's construction and operational impact on a landholder's business operations including reasonable and quantified impacts on input costs and loss of revenue. Powerlink will liaise with each landholder directly affected by the proposed transmission line to understand their existing sustainability measures and biosecurity management protocols and agree reasonable requirements to be applied during the construction and maintenance phases. Following the completion of construction activities, Powerlink remediates affected areas so they may return to agricultural production. Powerlink outlines below some of the impact mitigation measures it will be applying through cultivation land – Under the *Electricity Safety Regulation 2013*, equipment operating under the proposed 275kV transmission line must be a minimum of 6m away from the conductor. Through cultivation areas, Powerlink will be providing a minimum of 12m clearance between the bottom conductor and the ground and this will enable equipment up to 6m in height to operate safety under the line. Powerlink will also work with each landholder to determine whether additional clearance is required. Agricultural activities, such as grazing or production of low growing crops (less than 3.5 metres high) can continue within the easement. This practice already occurs under other Powerlink transmission lines throughout the district. Areas disrupted on a temporary or permanent basis are assessed by Powerlink's independent valuer as part of the compensation process. A copy of the 'Activities on an Easement' brochure is attached to Powerlink's response to submitters who raised this matter. • Working with each landholder to provide location flexibility to integrate best with their existing operations such as placing the alignment near property / paddock boundaries, adjacent existing transmission lines or following the shortest distance across a particular property.

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Summary of Matters Raised by Landholders	**Powerlink Response**
	• Within design limits, maximising span lengths to minimise the number of towers in cultivation and placing towers in locations requested by landholders. • Ensuring sufficient separation to nearby houses where possible. • Assisting landholders to ensure metallic farming equipment, such as centre pivots, used in very close proximity to the transmission line is adequately earthed for electrical safety. Designing the transmission line to comply with radio frequency interference limits in Australian Standard 2344 to minimise any interference with modern GPS guided farming equipment. Powerlink will also work with directly affected landholders to understand the type and layout of precision agricultural equipment being used and if necessary, conduct infield testing before and after construction to determine if there are any impacts on GPS systems from the transmission line. Remedial actions will be undertaken should impacts be identified. Recognising landholder concerns regarding this particular matter, Powerlink commissioned a technical study from precision agricultural experts Data Farming at Toowoomba. A copy of their report is attached which found impacts are minimal and still largely centred around potential collision with a tower, aerial spraying challenges and double ups or overlaps of chemicals and fertilizers by driving around a tower. With regard to drone use around transmission lines, Powerlink is aware this technology is being increasingly used by primary producers to inspect their properties and they can operate safely around transmission lines. A brochure outlining safe working habits when operating drones around Powerlink transmission lines is attached to Powerlink's response to submitters who raised this matter.
Corridor Selection, Use of Manipulated Data for Land Use, Houses and Lots within Corridor A small number of landholders raised concerns regarding these matters. More specifically, • Upgrading the existing line to 275kV operation would be the least impact overall as there is already an existing easement that can be utilised. There may be scope within the existing registered easement terms to upgrade the line rather than negotiate new easement terms as the Northern Corridors would require. The footprint of the powerline infrastructure would also remain the same as opposed to burdening other additional landholders with a new line. There is already existing visual impact to stakeholders from the current 132kV line and the additional visual	Several landholders asked Powerlink if the existing 132kV transmission line could be upgraded to enable connection of the wind farm or if the existing line could be entirely replaced by the proposed 275kV transmission line. Powerlink agrees both these options have merit and has considered them closely as discussed in Sections 1.2.1 and 1.2.2 of the Draft Corridor Selection Report – • The existing 132kV transmission line was built in the 1960s, is located within a single width easement with no additional space and has a capacity of approximately 100 megawatts (MW). Existing loads on this line are about 50MW with spare capacity of approximately 50MW being available for other uses such as the Banana Range Wind Farm. The proposed capacity of Stage 1 of the wind farm is 230MW and therefore exceeds the capacity of the existing line. Upgrading the capacity of the existing line by installing modern, heavy conductor will exceed the loading limits of the existing towers and in any event, will not increase capacity sufficiently to meet the requirements of the wind farm. Further, the 132kV line cannot be removed from service as it is the only supply to Biloela township. This

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Summary of Matters Raised by Landholders	**Powerlink Response**
impact from a line upgrade is less than the visual impact to stakeholders of an entirely new transmission line. Impacts to property values would be limited to those properties already burdened by the existing easement as opposed to property value losses to be suffered by landholders who previously had no easement. The quoted 243 houses within the 1000m Central Corridor is an inflated representation of the impact to houses in the central corridor due to the "comparative assessment approach". The corridor chosen should be the least invasive option to the community (being the 132kV upgrade) and any economic burden (new substation) that results should be the responsibility of EDF Renewables. Private projects should not be subsidised at the expense and burden of landholders. • Table 7.2 in the Draft Corridor Selection Report does not take into account all the existing properties already impacted by the 132KV line and easement. The graph should show existing house percentage and newly impacted houses. The report mentions that over 240 existing properties already have significant visual impacts from the 132kV line and this underpins the argument these property owners knowingly purchased or built properties within the corridor, so the impacts are actually negligible to those owners. Powerlink's assessment purposefully results in a perception that the Northern Corridor is the preferred route when the Central Corridor would be the preferred option as the percentage of new land affected would be minimal resulting in a rank score of 1 for SCL and 1 for Agricultural Land Classes A, B and C. This would then trigger an overall score of 20 making it the preferred route.	prevents the line being 'turned off' for extended periods and pulled down until an alternative supply is established. Another supply option involves building the new 275kV line adjacent to the existing 132kV line, connecting the new line into Biloela substation and the wind farm substation and then removing the old 132kV line. This option requires the establishment of a 275/132kV substation at Biloela and Banana Range whereas the current proposal only requires establishment of Banana Range as a switching station (ie – no transformers). The cost to build a substation at each location is significantly more than the cost to establish Banana Range as a switching station. The existing 132kV line was built in the 1960s and between Calvale, Biloela and the proposed Banana Range site directly affects 40 land parcels (many cultivated) with 14 houses. These parcels would also be directly affected by a new 275kV transmission line located adjacent the 132kV line. Significant land use changes have occurred since the 132kV line was constructed including expansion of Biloela township to the north, expansion of the showgrounds and rural small lot subdivision. This means there are many houses, community uses and industrial sheds directly affected by or in close proximity to the existing line and this is reflected in the Central Corridor assessment in the Draft Corridor Selection Report. The proposed 275kV transmission line structures will be significantly larger than the existing 132kV structures (around 20m higher with bigger crossarms, footprint and steel members) due to the difference in voltage and modern design standards. Powerlink considers an additional line in this location will have a compounding impact on visual amenity for directly affected and nearby houses even after discounting for the existing visual impact from the smaller 132kV line. Powerlink's assessment of the project Study Area has not identified any east-west corridors across the Callide Valley which totally avoid cultivation land. Within the three corridors assessed, Northern Corridor 1 has been identified as having the lowest area of Strategic Cropping Land and Class A Agricultural Land. In recommending Northern Corridor 1, Powerlink is very mindful that cultivation will still be affected by the transmission line. As outlined in the Draft Corridor Selection Report, Powerlink will work closely with landholders to understand their operations and where possible, locate the transmission line to minimise impacts from the transmission line noting there are other technical, environmental and social factors that also need to be considered.
Preferred Location for Transmission Line Some landholders advised a preference for the location of the transmission line within their properties.	Powerlink notes these requests.

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Summary of Matters Raised by Landholders	**Powerlink Response**
Consultation and communication from Powerlink and EDF One landholder considered that corridor discussions with Powerlink have been non-negotiable, alternatives have never been considered and the easement and exclusion zones will make their land useless. They believe their initial submission has been ignored and that despite Powerlink mentioning the overwhelming concern from landholders has been impacts to farming operations, it continues to proceed with a corridor that impacts the agricultural industry.	Chapter 5 of the Draft Corridor Selection Report outlines the assessment of the wide Study Area for the project. This process enabled Powerlink to identify social, environmental and technical attributes of the area and included feedback from landholders and other stakeholders in June and July 2022 (please refer Section 4.1 of the report). This information was used to guide the identification and assessment of three corridor options in the draft report and in August and September 2022 landholders and stakeholders were contacted about the potential corridors and invited to provide initial feedback. The feedback resulted in minor amendments to the boundaries of some corridors to remove areas and to also include other areas to provide more locational flexibility for a potential line to integrate with existing and future farming operations. The formal assessment of the proposed corridors was then presented in the Draft Corridor Selection Report released in November 2022. Powerlink is aware of the landholder's strong concerns regarding the impact of the proposed transmission line and in response, it recently reviewed areas to the north and south of their property seeking to identify whether Northern Corridor 1 could reasonably be amended bearing in mind the social, environmental, technical and economic factors it must consider when assessing corridor options. This includes the matters raised by the landholder as part of the early engagement process. Powerlink's review found to continue north-west following the Baralaba line will impact more areas of cultivation, additional landholders and houses and add further line length and cost to the project. Similarly, to the south of their property are extensive areas of cultivation and houses. Powerlink recognises the ongoing concern, burden and stress the project has placed on the landholder. We are very mindful of these impacts and can assure the landholder their matters have not been ignored and their property has not been targeted. The assessment of corridors has been undertaken professionally with a critical focus on matters provided by the community and landholders as part of the early engagement process. Through employing the impact mitigation measures outlined earlier and working closely with the landholder, Powerlink is confident that cultivation activities can continue successfully under the transmission line.
Prime agricultural land protections One landholder advised the agricultural industry has been working for years to be recognised and provides vital food and fodder which is projected to be worth over $100 billion to the economy. For this to occur, prime agricultural land needs to be protected and access assured. The National Farmers Federation (NFF) and AgForce are liaising with government to work towards this goal however the renewable industry and associated infrastructure are ignoring this. By choosing to go through the corridor with	Powerlink's assessment of the project Study Area has not identified any east-west corridors across the Callide Valley which totally avoid cultivation land. Northern Corridor 1 has been identified as having the lowest area of Strategic Cropping Land and Class A Agricultural Land. On this basis, Powerlink considers Northern Corridor 1 will have the lowest impact on food and fodder producers and aligns most strongly with the feedback provided by landholders and the community to minimise impacts to good quality agricultural land.

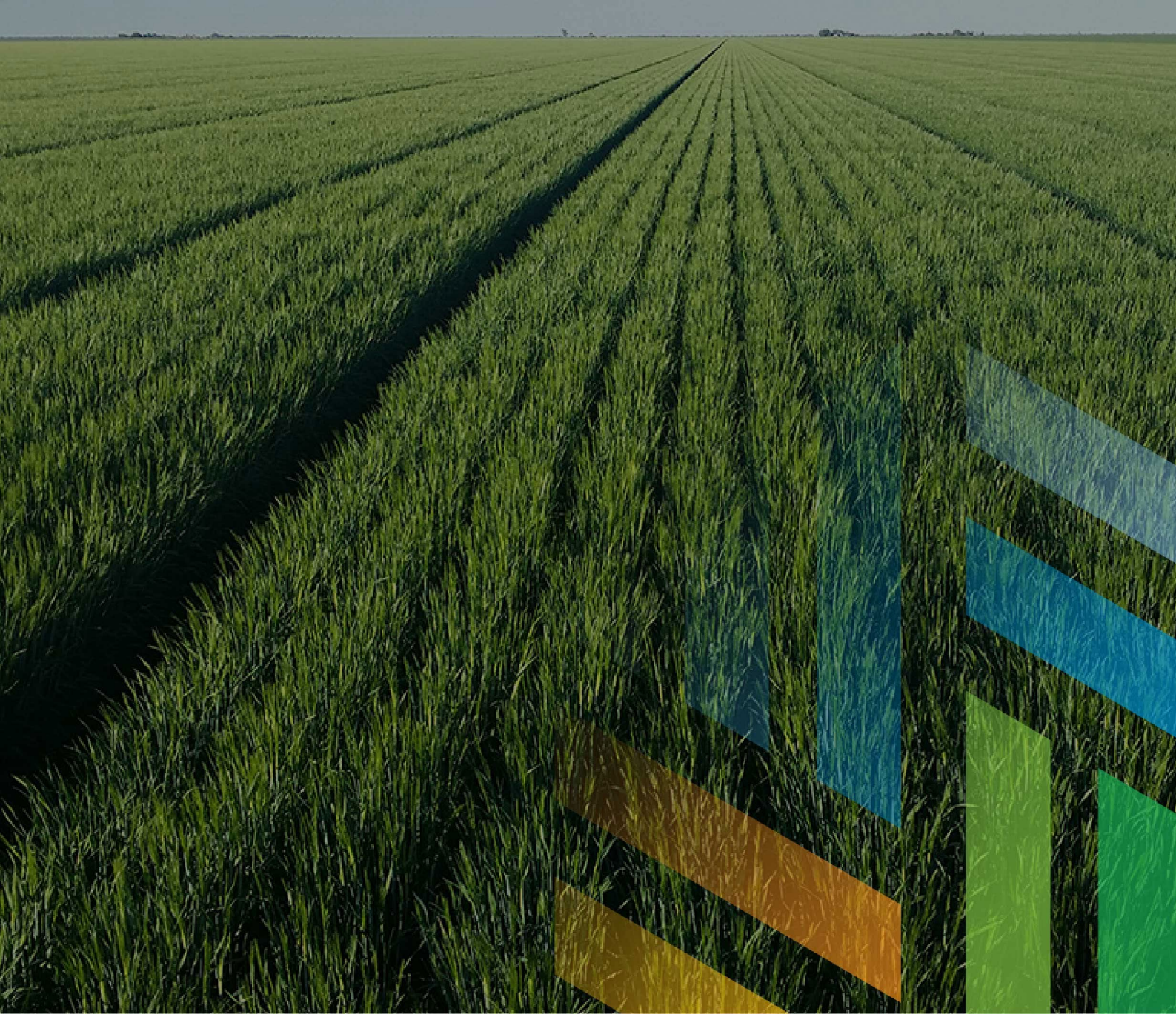
Submissions from seven (7) landholders – **Please note:** • **Personal and property details have been removed for privacy reasons.** • **Matters which are common to more than one landholder have been collated together and one response provided by Powerlink.** • **A detailed written response has been provided to each submitter explaining how each of their matters has been considered.**	
Summary of Matters Raised by Landholders	**Powerlink Response**
the lowest number of houses and larger land parcels, Powerlink is deliberately affecting larger food and fodder producers in the area. Finally, the landholder referenced a recent submission to the Federal Government where the NFF notes the renewable industry has not consulted with regional and rural stakeholders at all and farmers are left with the negative impacts of these proposals.	
Regional Ecosystem Mapping – Endangered Vegetation One landholder advised a proposed transmission line through their property will potentially impact on remnant vegetation listed as "of concern vegetation". Farmers are prohibited from clearing this vegetation and yet Powerlink has the ability to ignore these constraints in the name of advancing renewables. The property has several creeks running through it that would need to be considered when the actual easements are being designed and the landholder has difficulty seeing how the powerline infrastructure could not impact on these vegetated areas especially in the <> Road area. An offset area may appease the Queensland Government but it will still be destroying areas that should be protected.	With reference to Figure 7-2b, government mapping shows endangered and 'of concern' vegetation along the creek lines. As part of the alignment selection process, a professional ecologist will conduct field assessments to confirm the environmental values of each area and advise Powerlink on measures to minimise impacts on high value flora and fauna. Measures can include taller structures to span over lower growing mature vegetation, crossing creek lines in more degraded areas and careful tower placement. However, some vegetation will still need to be removed and as part of the design process, Powerlink will work with landholders to discuss clearing requirements and the proposed methods that will be used prior to commencement of works.
Private nuisance One landholder considers the proposed transmission line will interfere with the personal enjoyment and use of their land. They consider the noise, ozone and EMF continually emitted will be substantial.	Minimising social impacts of the proposed development has been a key consideration for Powerlink when identifying and assessing potential transmission line corridors and in the near future, will be a key focus when working with landholders to determine an alignment within the final corridor. <u>Noise</u> Corona discharges are a localised phenomenon on the surface of the conductor, or the surface/edges of metallic hardware installed to support the conductor and insulators on the structure. The electric field on the surface of these items, known as the Surface Voltage Gradient, needs to comply with guidelines to limit the occurrence of this phenomena across a range of environmental conditions (fair weather, fog and rain conditions etc) so as not to cause noise and interference issues with nearby sensitive receptors. Transmission lines are designed in accordance with guidelines outlined by AS7000 Overhead Line Design to limit the generation of corona discharges by recognising a consistent design approach and guidelines for surface voltage gradient limits. In Australia, most transmission and distribution lines are designed to have surface voltage gradients which are less than the levels where corona ions are formed (Energy Networks Association, 2009) and to primarily avoid issues with noise complaints, radio and television interference. The proposed transmission line connecting Banana Range Wind Farm will comply with the AS7000 design standard.

Submissions from seven (7) landholders – **Please note:** • **Personal and property details have been removed for privacy reasons.** • **Matters which are common to more than one landholder have been collated together and one response provided by Powerlink.** • **A detailed written response has been provided to each submitter explaining how each of their matters has been considered.**	
Summary of Matters Raised by Landholders	**Powerlink Response**
	Ozone Ozone is composed of three oxygen atoms molecularly joined together. Ground level ozone is a component of smog and is created from the interaction between sunlight and pollutant sources such as motor vehicles and combustion industries. Ozone is also generated in very minute quantities by corona discharge activity on transmission lines. The amount of ozone generated by transmission lines does not make significant contributions to atmospheric ozone levels. Since corona is only a localised surface activity on the conductor or hardware, ozone generated by corona is only measurable or detectable with a sensor placed a few centimetres from these sources. A person, or a sensor placed at ground level will not be able to detect or measure ozone at these normal distances (many metres), since it does not influence or increase the background ozone levels that exist from predominant ground based sources. The small amounts of ozone generated by a transmission line are also only created with excessive corona activity. Design guidelines for the surface voltage gradient ensure that corona generated interference and the formation of ozone are not of concern for transmission line operation designed in accordance with design standards such as AS7000. Any minute quantities of ozone generated by transmission lines also reverts back to normal molecular Oxygen (two oxygen atoms joined molecularly) typically within 30 minutes within the normal ranges of ambient temperature and humidity. For all practical purposes, it is well established from research undertaken since the 1970's that ozone has no impact on the design and operation of transmission lines. Electric and Magnetic Fields Section 4.3.3 of the Draft Corridor Selection Report provides information on electric and magnetic fields (EMF) generated by transmission lines. The impact of these fields on human health has been studied for over 40 years at a cost of more than $490 million internationally. The scientific evidence from independent bodies does not establish that exposure to EMF around the home, the office or near powerlines is a hazard to human health. However, Powerlink recognises community interest in EMF and is committed to working closely with landholders, the local community and stakeholders by – • Taking a prudent avoidance approach. Where possible, locating proposed transmission infrastructure away from houses and habitable buildings so they do not materially add to EMF levels that already exist in a typical household environment; • Providing information to the public regarding the latest findings from independent and credible scientific research into potential health impacts; • Designing transmission lines to reduce EMFs in accordance with best practice guidelines; and

Submissions from seven (7) landholders – **Please note:** • **Personal and property details have been removed for privacy reasons.** • **Matters which are common to more than one landholder have been collated together and one response provided by Powerlink.** • **A detailed written response has been provided to each submitter explaining how each of their matters has been considered.**	
Summary of Matters Raised by Landholders	**Powerlink Response**
	• Providing the maximum EMF generated by proposed transmission lines as part of public consultation for planned projects.
Assault by force One landholder noted the construction of towers and associated infrastructure on and against their property to be assault by electrical force under Section 245 of the *Criminal Code Act 1899.*	Powerlink undertakes its activities in compliance with local, state and federal legislation.
Impact on property values, lifestyle and potential for additional lines Some landholders raised concerns about the impact of the proposed transmission line on property values, lifestyle and the potential for additional transmission lines to be built within the same corridor and on this basis do not support the recommended corridor, Northern Corridor 1, as being suitable. They also consider transmission line compensation will be inadequate and inequitable compared to compensation paid to landholders directly affected by the proposed wind farm with turbines located on unproductive land while the transmission line traverses productive land. Finally, one landholder was concerned about maintenance activities and considers Powerlink should follow through with its commitments.	Section 4 of the Draft Corridor Selection Report outlines the early engagement process undertaken by Powerlink to capture feedback from landholders and the wider community regarding matters they consider are important when identifying and assessing potential corridors and ultimately the alignment for the proposed transmission line. Minimising social impacts of the proposed development has been a key consideration for Powerlink when identifying and assessing potential transmission line corridors and in the near future, will be a key focus when working with landholders to determine an alignment within the final corridor. The matters raised regarding impacts to property values from the proposed transmission line are considered as part of the compensation process. As electricity demand continues to grow and the energy system transforms to renewable generation, Powerlink cannot guarantee additional lines may be proposed in the future. Compensation paid by wind farm proponents is offered on a commercial basis. The amount of competition between proponents for the same site also influences the level of compensation paid. Compensation for electricity transmission lines is based on the impact of the proposed line on each property and is assessed in accordance with the requirements of the *Acquisition of Land Act 1967*. A factsheet outlining the matters which are considered is attached is attached to Powerlink's response to submitters who raised this matter. Powerlink recognises the proposed transmission line will impact on productive land as it traverses from east to west across the highly fertile Callide Valley. Our assessment of the project Study Area has not identified any corridors which totally avoids cultivation and other productive land. Of the three corridors assessed, Northern Corridor 1 has been identified as having the lowest area of Strategic Cropping Land and Class A Agricultural Land. Powerlink will work closely with all landholders within the Final Corridor to understand their operations and where possible, locate the transmission line within the property to minimise impacts noting other environmental, social and technical factors that need to be considered. Once constructed, Powerlink and its contractors typically inspect a transmission line based on condition and risk

Submissions from seven (7) landholders – **Please note:** • **Personal and property details have been removed for privacy reasons.** • **Matters which are common to more than one landholder have been collated together and one response provided by Powerlink.** • **A detailed written response has been provided to each submitter explaining how each of their matters has been considered.**	
Summary of Matters Raised by Landholders	**Powerlink Response**
	factors. Current practice is to inspect lines approximately every 2 or 4 years and higher risk spans on an annual basis. These personnel are expected to engage with landholders respectfully and comply with reasonable requirements. We are keen to talk further to understand any concerns regarding maintenance of the existing transmission lines.
Reduction in corridor width One landholder requested Northern Corridor 1 be reduced to only include the northern portion of some of their lots and to be totally removed off their other lots. They also referenced a discussion with Powerlink who advised it would consider an alignment utilising paddock/property boundaries to minimise impacts on irrigation land.	Northern Corridor 1 has been intentionally sited to provide boundary running opportunities for the proposed transmission line through the landholder's property. Powerlink reiterates its commitment to work with the landholder and neighbours to maximise boundary running opportunities where possible and in that regard has refined down the corridor as shown on the image below - <IMAGE NOT SHOWN TO MAINTAIN PRIVACY> Powerlink acknowledges the revision does not fully address the landholder's request, however, at this corridor selection stage it is necessary to maintain some locational flexibility for the transmission line alignment within the corridor ahead of detailed landholder engagement and environmental, heritage and design assessments which are planned to commence in the next couple of months.

Appendix B Review of transmission line impacts on Precision Agriculture, Data Farming 2022



Review of transmission line impacts on Precision Agriculture

Tim Neale November 2022

DATA FARMING

Background

A report was commissioned by Powerlink in 2011 to understand the impacts of high voltage transmission lines on Precision Agriculture technology, mainly high accuracy RTK (Real-time Kinematic) GNSS (Global Navigational Satellite Systems). This report was conducted by the author and Kevin McDougall from USQ (University of Southern Queensland). Due to the significant time that has since passed from the original report, farmers in Central Queensland have asked it to be reviewed. JBS&G tasked the original author, Tim Neale, who now works for DataFarming, to undertake the work.

The original report stated that "during the dynamic tractor testing it was found that operating under the powerlines did not appear to adversely impact on the guidance system tested with respect to the electromagnetic interference or fields caused by the high voltage powerlines."

In addition, "the results from the static testing did not identify any significant anomalies in the horizontal or vertical positional data among the three sites (4m, 25m and 50m from the tower) during the testing period." "During the UHF transmission testing, latency was almost continually at 1 epoch (~1 second) as is normally the case. On a couple of occasions during the testing period, 2 epoch delays were reached, but never more than this. This is well inside normal operating conditions, and not likely to impact on RTK performance."

Precision Agriculture is a suite of technologies that help farmers to be more efficient, sustainable, and productive. Technologies relevant to this, and the previous report, include:

- GPS/GNSS location and machine control
- Variable rate application technology for applications of inputs such as seed, fertiliser, and chemical
- Yield monitoring to assess variability of production across the field.

The main questions are (from 2011 to now):

1. Has anything changed with regards to the RTK GNSS technology?
2. How much do farmers rely on the technology?
3. Has anything with regards to what activities on farm use RTK GNSS?

Scope of works

JBS&G are seeking a review of literature to increase understanding for the potential of transmission power lines to impact precision agricultural operations and technologies. The review of literature shall include:

- Consideration and description of common precision agricultural practices in Central Queensland, particularly in the Biloela region;
- Description of current precision agricultural practices commonly used and their reliance on high accuracy technologies, including RTK GNSS and other GPS technologies;
- Consideration and description of laser and infrared technologies that may potentially be susceptible to impact from transmission power lines; and
- Trends and technological advances following publication of Assessing the impact of high voltage transmission lines on Precision Agriculture Technology (Powerlink, and FARMpos 2011).

Literature review

When reviewing the 2011 literature review in the original report, it was found that:

- **Radio Frequency Interference (RFI)** was identified as a potential issue but found that "it is unlikely that power line conductors will interfere with GPS satellite signals."
- It is unlikely that the transmission line **corona noise** could degrade operation of the GNSS receiver, and measurements in foul weather confirmed this conclusion.
- It is "highly unlikely" power line towers could physically block the **differential correction** signal reaching the receiver from UHF/VHF radios.
- A study, published in 1994, "identified an increase in initialisation times as a consequence of **multipath**" from transmission towers. It must be noted that multipath algorithms have advanced substantially since this time.
- A 2010 study found horizontal accuracy difference of around 0.022m underneath the power line and a 0.005m difference at 200m from the line suspected to be caused by **electromagnetic interference**; however, these are within tolerable limits for agriculture.

Since 2011, there has only been a small body of research conducted in powerline interference with GNSS.

Pollock and Wright[1], surveyors from Winnipeg, found in 2011 "only minor adverse effects could be measured or observed due to power lines or their respective towers. No power line effect on GNSS measurements was found to affect the quality of the navigation solutions. In addition, the test results showed normal operation of a commercially available survey grade RTK system and its radio link (450 MHz) for static and perpendicular test segments perpendicular to the power lines."

Bancroft[2], et al 2012 found that "only non-impeding effects on the receiver or incoming signals, in the form of cycle slips, were measured or detected from either overhead lines and/or their corresponding support towers. The cycle slips that did occur were so infrequent that the redundant measurements in the navigation solutions easily mitigated them. No transmission line effect on GNSS measurements was found to affect the quality of the navigation solutions. In addition, the test results showed normal operation of a commercially available survey grade RTK system and its radio link (450 MHz) for static and perpendicular test segments perpendicular to the transmission lines."

Noack et al[3] tested the impact of underground and aboveground transmission lines on three tractors with steering systems were operated over two days on two different sites. "The presence of power lines did not have a significant effect on the operability of the steering systems."

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[1] https://www.hydro.mb.ca/docs/regulatory_affairs/projects/bipole3/eis/BPIII_GPS_Reports_November_2011.pdf
[2] Bancroft, et al 2012; "Validation of GNSS under 500,000 V Direct Current (DC) transmission lines", in Computers and Electronics in Agriculture
[3] Noack, et al 2018; "Influence of electric power lines on the reception of GNSS-signals in automatic steering systems" in LandTechnik 73(3), 2018, 52–58

Common precision agriculture practice in Central Queensland

Precision agriculture practices in the study area are continually increasing in adoption. The main practices/technologies that may be influenced by high voltage transmissions lines include:

- GPS/GNSS auto-steer guidance systems on all major machines (tractors, sprayers, harvesters) generally to sub 5cm accuracy. This will include a mixture of:
    - RTK base station. This is 2cm accuracy equipment with a base station located on, or nearby, the property to provide corrections via UHF/VHF radio links.
    - RTK CORS (networked RTK), where a community network of base stations exists across CQ, and correction data is supplied via cellular modem (4G). An example is All Day RTK and Hexagon Smartnet.
    - PPP RTK type systems, such as provided by Trimble and John Deere. These are sub metre to +/-5cm accurate systems with corrections delivered via satellite.
    - SouthPAN which is a new system available deployed by the Australian government to provide higher accuracy corrections to receivers. There will be very few if any units on this system yet.
- Yield monitoring which measures the yield on the harvester as it moves through the field. This is typically using low accuracy GPS systems, however can also be connected to the GNSS/GPS systems listed above as part of the auto steering of the machine.
- Variable rate technology which varies the rates of inputs, such as fertilisers, automatically based on 'zones'. This technology typically uses low accuracy GPS systems or is connected into the tractor high accuracy GPS/GNSS system.
- Land levelling/forming techniques to improve water drainage and minimise erosion. This relies to on RTK GNSS, and laser-based systems.
- Robotic spraying has emerged from a local manufacturer in Central Queensland. More details below. Over 30 machines are being used across Queensland and NSW.

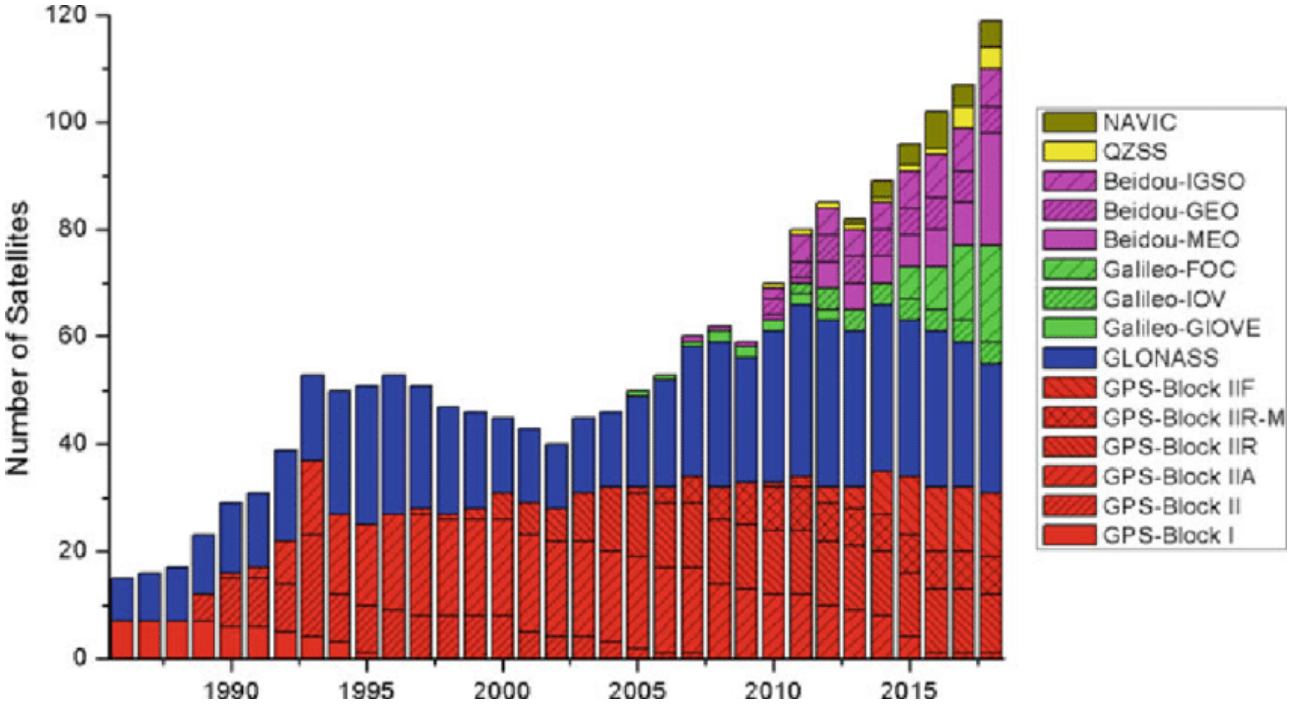
Has anything changed with RTK technology?

When we look at what might have changed in the past 10 years with regards to RTK GNSS technology, the following factors were considered. In summary, all the factors below would only reduce the potential issues of high voltage transmission lines.

FACTOR	DESCRIPTION	POTENTIAL IMPACT
QZSS	QZSS is a new satellite constellation launched by the Japanese government between 2010 and 2018.	Possible interference when directly overhead. But should only reduce the chances of errors and issues with power lines. It provides additional accuracy services over Australia.
Satellite numbers	The number of navigational satellites has increased from around 80 in 2011 to over 160 in 2021. See Figure 1 below.	This will only improve accuracy and reduce the number of dropouts from potential powerline interference.
Base station to	Technology includes UHF, VHF,	This suite of communications technology has

rover communications	satellite, and cellular modem.	essentially remained the same, with a greater number of satellite delivery options available now compared to 2011.
Accuracy levels	The accuracy levels of GNSS systems available to agriculture.	Accuracy levels have essentially remained the same at around 2cm (or marginally improved), even with the increase in satellite numbers. This level of accuracy is completely adequate for most agricultural operations.
Integration with machines	Most GNSS guidance systems are now fully integrated from the factory. In 2011, most would have been retrofitted.	This should have no detrimental impact, only improve GNSS performance, so will not be impacted by powerlines.

Figure 1 – increase in the number of GNSS satellites available over time



How much do farmers rely on RTK GNSS?

It's fair to say that the reliance on RTK GNSS has only increased over the past 10 years. All new machines used on reasonable sized farms, like that in CQ, have RTK GNSS fitted from the factory. This includes:

- Tractors – used for planting, fertilising, grain carting, land levelling, and other general activities.
- Sprayers – used for spraying weeds, pests, and diseases in crop, and weeds in fallow.
- Harvesters – used to remove and thresh grain.

All main machines now have RTK GNSS fitted, so the farms now rely heavily on this technology, especially during critical times such as planting and harvesting. Other technology like variable rate and yield monitoring do not need RTK level accuracy, however, are now often connected to the tractor GNSS system regardless.

Land levelling software and hardware has improved in the past 10 years, and almost all land levelling systems used in farming now rely on RTK GNSS with a local base station. Laser based land levelling is no longer widely used, and there are no obvious reasons that transmission towers would impact these systems as they operate using a laser light source at ground level.

Has anything with regards to what activities on farm use RTK GNSS?

Essentially there has been little or no change in the way traditional machines use high accuracy GNSS is farming, and adoption has only increased since the 2011 report (from ~70% to ~85% of farmers using GNSS technology). One area of recent change has been the advent of autonomous machines. The most popular broad acre cropping machine in Australia is that from Swarfarm robotics, based out of Gindie, South of Emerald in Central Queensland. These units are autonomously steered and operated, have two RTK GNSS receivers, and have a raft of communications technologies on board (figure 2). It is unlikely that these units will be impacted by high voltage transmission lines, except the possibility of collision with towers. However, when the fields are set up in the robot onboarding system, obstacles are mapped and avoided. Towers would be no different to other obstacles loaded into the system.

Figure 2: Swarmfarm robot weed sprayer

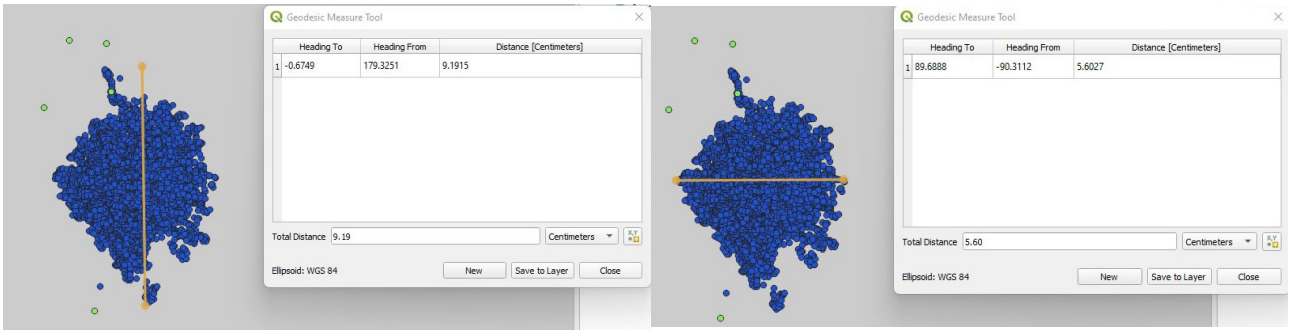
2022 Static field test using GNSS under 330KV transmission lines

Field testing was conducted on a property south of Toowoomba adjacent to the Middle Ridge to Millmerran 330KV transmission line. This was the same location as was used in the 2011 Precision Agriculture report (see Figure 3 below for map). The site was gently undulating and involved two Emlid Reach RS2 receivers, one placed under the line near a tower in rover mode, and the other placed a short distance away as the base station. The rover was statically logged at 5Hz (5 times per second) over a roughly 16-hour period, resulting in 300,000 data points.

Figure 3: map showing location of 2022 field test

The results of the comparison tests are shown below. Figures 4 and 5 show the X/Y (easting and northing) deviation from around receiver location.

Figures 4 and 5 – X/Y deviation from under the transmission line.



When analysed further, the results showed that 99.8% of the RTK (fixed) points were within +/-2cm horizontally, and 99.5% of the points were within +/-4cm vertically. This is well within normal standards for agricultural receivers and use cases.

Conclusion

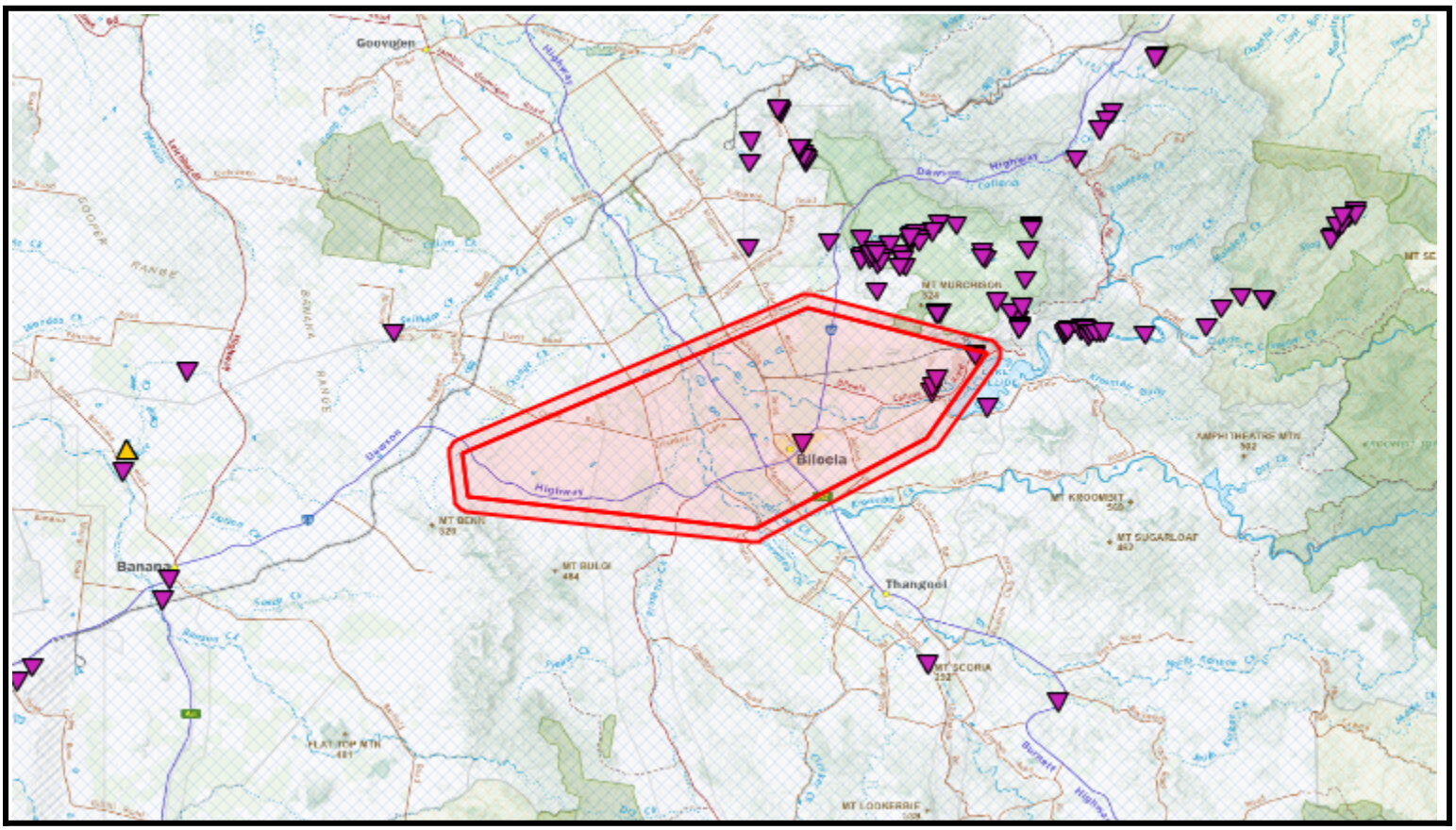
The review of the 2011 report, recent literature, and current RTK GNSS technologies used on farm, showed that the impacts of high voltage transmission lines should be less today than 10 years ago. Hardware, software, and firmware technology has improved, and the integration of RTK GNSS in all new machines has occurred. Robots have entered the market and will inevitably take over many activities on farm. Whilst farmers would not want high voltage transmission power lines on their property, the impacts should be minimal and still largely centre around:

- Potential collision impact,
- Aerial spraying challenges,
- Double ups and overlaps of chemicals and fertilisers by driving around towers, and
- Aesthetic impacts.

Appendix C Desktop searches

Digital Data Search

Reference Number:	113545
Buffer Distance:	1000 metres



Cultural heritage site points for the area are:

Site ID	Latitude	Longitude	Record Date	Attribute	Party
JE:A17	-24.362948	150.601696	Nov 1, 1981	Artefact Scatter	Gaangalu Nation People
JE:A17	-24.362948	150.601696	Nov 1, 1981	Scarred/Carved Tree	Gaangalu Nation People
JE:A18	-24.359354	150.60275	Nov 1, 1983	Artefact Scatter	Gaangalu Nation People
JE:A19	-24.354873	150.604805	Nov 1, 1981	Artefact Scatter	Gaangalu Nation People
JE:D94	-24.339605	150.629367	Dec 10, 2001	Artefact Scatter	Gaangalu Nation People
JE:D95	-24.340037	150.62928	Dec 10, 2001	Isolated Find	Gaangalu Nation People

GDA2020

Digital Data Search

Cultural heritage site points for the area are:

Site ID	Latitude	Longitude	Record Date	Attribute	Party
JE:E07	-24.395188	150.521265	Jan 1, 1997	Burial(s)	Gaangalu Nation People

There are no Aboriginal or Torres Strait Islander cultural heritage site polygons recorded in your specific search area.

Cultural heritage party for the area is:

QC Ref Number	QUD Ref Number	Name	Contact Details
QC2012/009	QUD33/2019	Gaangalu Nation People	Gaangalu Nation People Saylor Legal AMP Building PO Box 4017 VINCENT QLD 4814 Phone: (07) 4431 0074 Mobile: 0474 244 447 Email: david@saylorlegal.com.au

There is no cultural heritage body recorded in your specific search area.

Cultural Heritage Management Plans (CHMP) for the area are:

CHL Number	Sponsor	Party	Approved
CLH000456	Powerlink		Jun 9, 2009
CLH000759	Origin Energy	Gangulu People	Aug 18, 2010
CLH010008	Anglo American Metallurgical Coal	Gangulu People	Aug 2, 2011

There are no Designated Landscape Areas (DLA) recorded in your specific search area.

There are no Registered Cultural Heritage Study Areas recorded in your specific search area.

GDA2020

Digital Data Search

Regional Coordinator:

Name	Position	Phone	Mobile	Email
Cultural Heritage Unit		1300 378 401		cultural.heritage@dsdsatsip.qld.gov.

Disclaimer: The Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships is the custodian of spatial data provided by various third parties for inclusion in the Aboriginal and Torres Strait Islander cultural heritage online portal. This includes spatial data provided by the National Native Title Tribunal and Aboriginal and Torres Strait Islander parties. Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships is not responsible for the accuracy of information provided by third parties or any errors in this search report arising from such information.

Map Datum: Geographic Latitude & Longitude (GDA2020)

Digital Data Search

I refer to your submission in which you requested advice regarding Aboriginal or Torres Strait Islander cultural heritage recorded at your nominated location.

The Cultural Heritage Database and Register have been searched in accordance with the location description provided, and the results are set out in the above report.

Aboriginal or Torres Strait Islander cultural heritage which may exist within the search area is protected under the terms of the *Aboriginal Cultural Heritage Act 2003* and the *Torres Strait Islander Cultural Heritage Act 2003*, even if the Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships has no records relating to it.

Under the legislation a person carrying out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal or Torres Strait Islander cultural heritage. This applies whether or not such places are recorded in an official register and whether or not they are located on private land.

Please refer to our website https://www.dsdsatsip.qld.gov.au/people-communities/aboriginal-torres-strait-islander-cultural-heritage for a copy of the gazetted Cultural Heritage Duty of Care Guidelines, which set out reasonable and practicable measure for meeting the cultural heritage duty of care.

In order to meet your duty of care, any land-use activity within the vicinity of recorded cultural heritage should not proceed without the agreement of the Aboriginal or Torres Strait Islander Party for the area, or by developing a Cultural Heritage Management Plan under Part 7 of the legislation.

If your proposed activity is deemed a Category 5 activity pursuant to the Duty of Care Guidelines, there is generally a high risk that it may harm cultural heritage. In these circumstances, the activity should not proceed without cultural heritage assessment.

Where a Category 5 activity is proposed that may impact on features set out in Paragraph 6 of the Guidelines, it is necessary to notify the Aboriginal or Torres Strait Islander Party and seek:

a. Advice as to whether the area is culturally significant;
b. If it is, agreement on how best the activity may be managed to avoid or minimise harm to any cultural heritage values.

The features set out in Paragraph 6 include:

- Rock outcrops

Digital Data Search

- Caves
- Foreshores and coastal dunes
- Sand Hills
- Areas of biogeographical significance, such as natural wetlands
- Permanent and semi-permanent waterholes, natural springs
- Native vegetation
- Some hill and mound formations

The extent to which the person has complied with Cultural Heritage Duty of Care Guidelines and the extent the person consulted Aboriginal or Torres Strait Islander Parties about carrying out the activity – and the results of the consultation – are factors a court may consider when determining if a land user has complied with the cultural heritage duty of care.

Should you have any further queries, please do not hesitate to contact the Search Approval Officer on 1300 378 401.

Kind regards

The Director
Cultural Heritage | Community Participation | Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships

Digital Data Search

Digital Data:

POLYGON((150.30879996560208 -24.399000002316473,150.5243999549691 -24.308300000966412,150.63600004139005 -24.336800001309342,150.5983000393 -24.388999998315075,150.49080004333152 -24.44589999905618,150.31189996240448 -24.42620000281559,150.30879996560208 -24.399000002316473))

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 06-Jun-2022

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	38
Listed Migratory Species:	15

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	20
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	1
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	5
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area	In feature area
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area	In feature area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area	In feature area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area	In feature area
Weeping Myall Woodlands	Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Geophaps scripta scripta](#) Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Grantiella picta](#) Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area	In feature area
[Neochmia ruficauda ruficauda](#) Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
[Turnix melanogaster](#) Black-breasted Button-quail [923]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
[Chalinolobus dwyeri](#) Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Dasyurus hallucatus](#) Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area	In feature area
[Hipposideros semoni](#) Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat [180]	Vulnerable	Species or species habitat may occur within area	In feature area
[Macroderma gigas](#) Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Nyctophilus corbeni			
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area	In feature area
Petauroides volans			
Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Petaurus australis australis			
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat likely to occur within area	In feature area
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area	In feature area
PLANT			
Arthraxon hispidus			
Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Bertya opponens			
[13792]	Vulnerable	Species or species habitat known to occur within area	In feature area
Bulbophyllum globuliforme			
Miniature Moss-orchid, Hoop Pine Orchid [6649]	Vulnerable	Species or species habitat may occur within area	In feature area
Cadellia pentastylis			
Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Cossinia australiana			
Cossinia [3066]	Endangered	Species or species habitat likely to occur within area	In feature area
Cycas megacarpa			
[55794]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Dichanthium queenslandicum King Blue-grass [5481]	Endangered	Species or species habitat may occur within area	In feature area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Polianthion minutiflorum [82772]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Samadera bidwillii Quassia [29708]	Vulnerable	Species or species habitat known to occur within area	In feature area
Solanum dissectum [75720]	Endangered	Species or species habitat likely to occur within area	In feature area
Solanum johnsonianum [84820]	Endangered	Species or species habitat likely to occur within area	In feature area
Xerothamnella herbacea [4146]	Endangered	Species or species habitat likely to occur within area	In feature area
REPTILE			
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area	In feature area
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area	In feature area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat known to occur within area	In feature area
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area	In feature area
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat may occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Species			
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat may occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area	In feature area
Migratory Wetlands Species			

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat likely to occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Defence		
Defence - BILOELA TRAINING DEPOT [30240]	QLD	In feature area

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Reptile			
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area	In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Mount Murchison	Nature Refuge	QLD	In feature area

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Construct and operate 447km high pressure gas transmission pipeline	2009/4976	Controlled Action	Post-Approval	In feature area
ZeroGen Integrated Gasification Combined Cycle Power Plant and CO2 Capture, Transport and Storage	2009/5195	Controlled Action	Completed	In feature area
Not controlled action				
Banana Range Wind Farm, near Biloela, Qld	2019/8503	Not Controlled Action	Completed	In feature area
Expansion of the Trap Gully Open Cut Mining Area, Callide Mine	2006/2965	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Document Status

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		Name	Name	Signature	Date
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