Premise

Scoping Report

GLANMIRE SOLAR FARM

June 2021

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4 June 2021

CONTENTS

FIGURES

TABLES

APPENDICES

GLOSSARY

AIS	Agricultural Impact Statement
BAM	Biodiversity Assessment Method
BDAR	Biodiversity Development Assessment Report
BESS	Battery Energy Storage System
BRC	Bathurst Regional Council
BSAL	Biophysical Strategic Agricultural Land
BVMP	Bathurst Vegetation Management Plan
CASA	Civil Aviation Safety Authority
CER	Clean Energy Regulator
CIV	Capital Investment Value
DA	Development Application
DAWE	Department of Agriculture, Water and Environment
DCP	Development Control Plan
DECCW	Department of Environment, Climate Change and Water
DP&E	NSW Department of Planning and Environment
EIS	Environmental Impact Statement
FAA	Federal Aviation Authority
GAG	Glanmire Action Group
GSF	Glanmire Solar Farm
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ISEPP	Infrastructure State Environmental Planning Policy
LEP	Local Environmental Plan
NEM	National Energy Market
NES	National Environmental Significance
OEH	Office Environment & Heritage
OLS	Obstacle Limitation Surfaces
PHA	Preliminary Hazard Analysis
REAP	Renewable Energy Action Plan
RET	Renewable Energy Target
RFS	Rural Fire Service
SAT	Spot Assessment Technique
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policies
SSD	State Significant Development
TfNSW	Transport for NSW

1. INTRODUCTION

1.1 Applicant

Elgin Energy is an international solar developer with established operations in the United Kingdom and Ireland. To date the company has delivered 21 projects (230 MW) in the UK and is currently developing a pipeline of projects across New South Wales and Vitoria.

Elgin Energy established an Australian office in 2018.

1.2 Project Description

The proposed Glanmire Solar Farm (GSF) would have a capacity of approximately 60 MW_{AC}, comprising ground mounted solar photovoltaic (PV) modules and a centralised battery energy storage system (BESS) with a power rating up to approximately 60 MW AC/DC coupled (approximately 60 MW hours). Connection to the grid is proposed at Essential Energy's Raglan Zone substation.

The development site is located at 4823 Great Western Highway Glanmire, approximately 11 km east of the city of Bathurst and approximately 4.5 km east of the suburb of Raglan.

The regional and local setting of the development site are shown on **Figure 1** and **Figure 2** respectively.

1.3 Development Objective

The development objective is to generate renewable energy in a manner that:

- minimises impacts on neighbours;
- provides for community benefit sharing;
- maximises utilization of existing grid infrastructure and capacity;
- helps reduce greenhouse gas emissions,
- contributes to Australia's Paris Agreement commitments;
- contributes to New South Wales's objective of achieving net-zero emissions by 2050; and
- contributes to the Central West and Orana region's vision for increased renewable energy generation.

1.4 Site Selection

The proposed development site has been selected through a screening process based initially on land owner interest in hosting a solar farm, desk top environmental due diligence studies and select site investigations for ground truthing.

The process commenced in 2019 with Elgin Energy validating the quality of the solar resource and initiating consultations with Essential Energy to check available network capacity and the proximity of transmission lines to facilitate a practicable connection to a network substation.

In July 2019 Elgin Energy wrote to landowners in the locality enquiring as to their potential interest in hosting a solar farm. Elgin Energy subsequently entered into an agreement with the owner of Lot 141 DP 1144786, a 186 hectare holding.

Figure 1 – Regional Setting

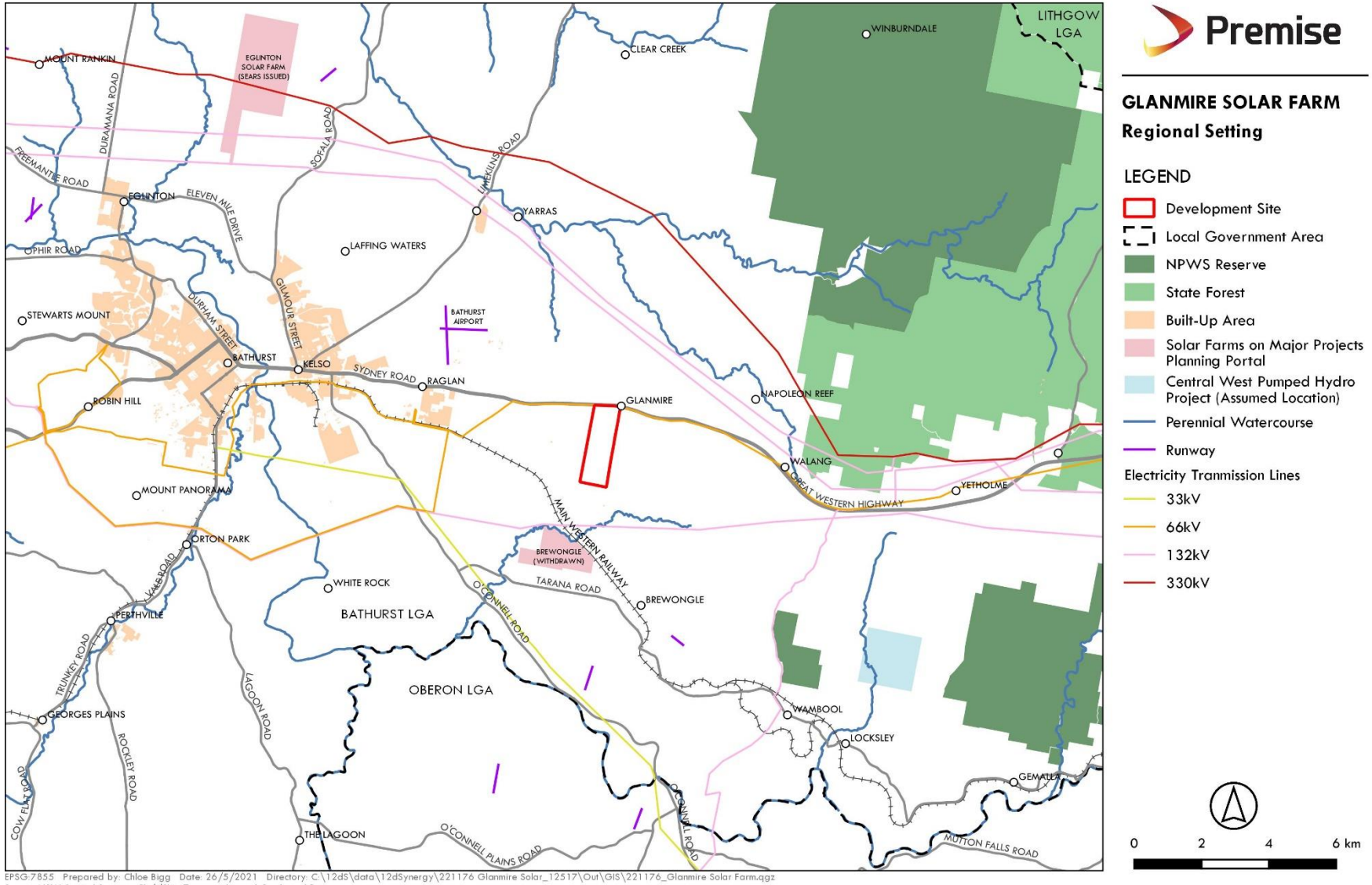
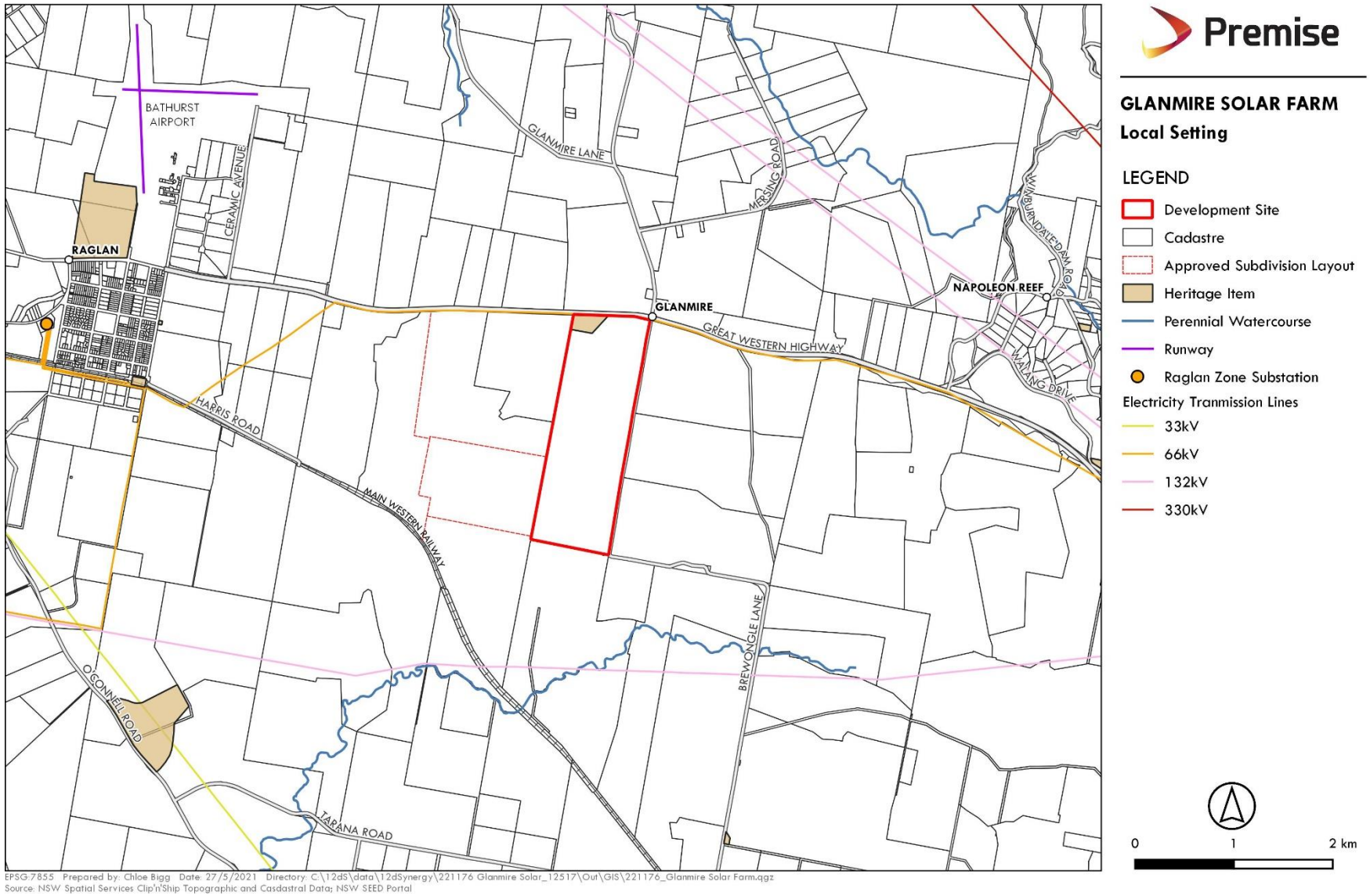


Figure 2 – Local Setting



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Source: NSW Spatial Services Clip'n'Ship Topographic and Casdastral Data; NSW SEED Portal

Elgin Energy has since instigated desktop and field surveys to screen the suitability of the site based on consideration of key site constraints identified in the NSW Government's (2018) *Large-Scale Solar Energy Guideline for State Significant Development*.

The extent and outcomes of these investigations are addressed in **Section 2.2** of this Scoping Report and include, but are not limited to:

- establishing land use permissibility;
- determination of the Land and Soil Capability class of the land;
- checking the Biophysical Strategic Agricultural Land (BSAL) status of the site;
- identification of landscape sensitivity and visual amenity values;
- consideration of potential risks to Aboriginal heritage; and
- identifying biodiversity values.

The results of these investigations indicate the site has suitable attributes and features that justify further assessment of development of a solar farm.

1.5 Network Connection

Planning approval will be required for the infrastructure works needed to connect the GSF to the electricity network. To this end, Elgin Energy has been in consultation with Essential Energy since 2019 and feasibility studies on network capacity and grid connection options to the Raglan Zone Substation are continuing.

The capacity for the grid to accommodate the electricity generated has been confirmed. Similarly, Essential Energy has also confirmed that options exist for the refurbishment/augmentation of existing transmission lines built for 66 kV capacity within existing easements, with the possibility of relocation of a short section of 11 kV line. Studies are continuing to confirm the optimal configuration for connection works to and within the Raglan Zone Substation within existing easements.

Development for the purpose of these electricity transmission and network distribution works will be subject to assessment under Part 5 of the *Environmental Planning and Assessment Act 1979* and Essential Energy will be the determining authority.

Consent is not being sought for these network connection works as part of the proposed development.

Notwithstanding, consistent with the *Large-Scale Solar Energy Guideline for State Significant Development* the Environmental Impact Statement (EIS) will provide details of these works to assist in the consideration of all aspects of the proposed GSF development.

2. STRATEGIC CONTEXT

2.1 Justification of the Project

Commonwealth, state and local government policies and plans provide strategic support for the development.

2.1.1 NATIONAL

The Clean Energy Regulator (CER) introduced the Renewable Energy Target (RET) in 2001, which is a Commonwealth Government scheme designed to reduce emissions of greenhouse gases in the electricity sector and encourage the additional generation of electricity from sustainable and renewable sources. The national target is to achieve 33,000 gigawatt hours of renewable electricity generation by 2030

Australia has also committed to the Paris Agreement, a global agreement to tackle climate change with the aim of keeping global warming below two degrees Celsius (COP21 Paris, 2015). The commitment is to achieve an emissions target of a 26-28% reduction by 2030 compared to 2005 levels. The proposed GSF would contribute to the Australian effort to help meet this binding international target.

2.1.2 STATE

The NSW Government's *Net Zero Plan Stage 1: 2020– 2030* is a commitment to taking action on climate change. The Plan has the goal of reducing the State's emissions by 35% by 2030, compared to 2005 levels.

The NSW Government has committed to an aspirational objective of achieving net-zero emissions by 2050. This objective is intended to provide a statement of the government's intent, commitment, and level of ambition and to set expectations about future emissions pathways.

The *NSW Climate Change Policy Framework* (OEH, 2016) supports Australia's COP21 commitments and outlines the State's long-term objectives to achieve net-zero emissions by 2050. The Framework highlights the opportunities in advanced energy sectors and confirms the NSW Government's commitment to support opportunities to grow these emerging industries in NSW.

Electricity generation is a significant contributor of greenhouse gas emissions. The GSF would contribute to the decarbonisation of this emissions intensive sector and assist prepare for the transition from traditional, thermal electricity generators that are fast approaching the end of their intended design-life.

2.1.3 REGIONAL

The *Central West and Orana Regional Plan 2036* (June 2017) identifies four key goals with 29 supporting directions to realize the vision for this region. Direction 9 in the first goal, which is to become the most diverse regional economy in NSW, is to increase renewable energy generation.

2.1.4 LOCAL

Bathurst Regional Council's *Renewable Energy Action Plan 2020* (Bathurst REAP) sets out Council's strategy to minimise its dependence on fossil fuel energy sources and has targets for 25% of Council's electricity consumption to be from renewable sources by 2023, and 50% by 2025. The GSF would create a new local renewable energy source with the potential opportunity to assist Council meet these targets.

Protecting the productive capacity of rural land while increasing the availability and use of renewable energy sources, is also identified as potential pathway to a sustainable Bathurst region in Council's (draft) *Vision Bathurst 2040 Local Strategic Planning Statement*

2.2 Key Features of the Site

2.2.1 LOCAL COMMUNITY

The population of Glanmire was recorded as 156 in the 2016 census. This comprised 53 families, with an average of 1.8 children per family (for families with children). Children aged 0- 14 made up 13.4% of the population and adults over 65 made up 19.7% pf the population. 7.8 per cent of the population identified as Aboriginal and/or Torres Strait Islander. Median weekly household income in Glanmire was $1421 and the most common industries of employment were agriculture (23.7% beef, 9.5% sheep, 7.1% beef and sheep), 9.5% site preparation services and 9.5% electrical services (ABS, 2016a).

There are 62 landowners with property located within 3 km of the development site lot boundary. The location of these is shown on **Figure 3**.

2.2.2 NEIGHBOURS

South of the Great Western Highway the development site has five neighbours (inclusive of two on the eastern side of Brewongle Lane). The location and size of these properties, inclusive of dwellings (both existing and proposed) is shown on **Figure 3**.

Land adjoining the proposed development site to the west has been subject to relatively recent acquisition and approved sub-division. Specifically, Bathurst Regional Council in March 2021 approved the subdivision of this 406.7 ha property into four lots ranging from 96 ha to 110 ha in size (DA2020/299). Two of these lots have existing dwellings (3 in total) and the Development Application (DA) identified the two vacant lots are intended to each have future dwellings, subject to separate DAs. No DAs have as yet been lodged for these additional dwellings although the landowner has indicated the proposed dwelling sites. It is noted that the *Bathurst Regional Development Control Plan 2014* requires a boundary setback of 50 m for lots greater than 20 ha in size.

Similarly, two lots recently purchased on the eastern side of Brewongle Lane (Lot 11 DP 1130775 and Lot 12 DP 1265711) are 119 ha and 123 ha in size respectively. Under the provisions of Bathurst LEP both these lots could secure dwelling entitlements, subject to DAs and securing development consent. The landholder has stated this is the intent. Indicative locations of these two potential dwellings are shown on **Figure 3**, although at this time these have not yet been confirmed by the landowner.

In addition to the above, the two lots in the same ownership immediately to the south of the development site provide a combined holding of 205.9 ha. There is an existing dwelling within this holding and a capacity, subject to a DA, to secure consent for a sub-division and a second dwelling entitlement. The intentions of the landowner to pursue this option is not known.

2.2.3 LAND USE

Surrounding land uses are mixed, although predominantly agriculture. On the northern side of the Highway there is a transport business and animal boarding kennels, with smaller land parcels dominating. On the southern side of the Highway land use is agriculture, including grazing, improved pasture and farming (fodder, cereals and oilseed).

Figure 3 – Land Ownership and Receptors

2.2.4 BIO-PHYSICAL QUALITIES

2.2.4.1 Soil Resource

The 186 ha development site is 92% (172 ha) of Class 4 and 8% (14 ha) of Class 5 land assessed, conservatively, in accordance with *The Land and Soil Capability Assessment Scheme* (OEH,2012). The soil type is a Sodosol with a moderate (Class 4) and moderately low (Class 5) agricultural capability rating. The dominant limitations relate to water logging and water erosion. **Figure 4** identifies the mapping of land and soil capability class across the site. **Appendix A** provides the detailed analysis of the field assessment undertaken. Class 4 lands have moderate capability with moderate to high limitations for high-impact land uses that restrict land management options for regular high-impact land uses such as cropping, high intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology. Class 5 lands have a moderate-low capability and high limitations for high impact land uses that restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long term degradation. Field investigations, inclusive of soil sampling in accordance with the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH, 2013) has verified that the site is not Biophysical Strategic Agricultural Land (BSAL). **Appendix B** provides the BSAL verification assessment.

A Review of the NSW EPA Contaminated Land Record and List of NSW Contaminated Sites Notified to the EPA confirms the is not listed for known contamination.

2.2.4.2 Water Resources

Several Strahler Class One and two Class 2 watercourses are mapped over the site. The Class 2 watercourses are also mapped as Key Fish Habitat. The site supports six farm dams, is located within a Drinking Water Catchment and mapped as moderate and moderately high groundwater vulnerable land in the *Bathurst Regional Local Environmental Plan 2014*. The site has no registered groundwater bores, with the closest registered bore approximately 400 m to the north, on the northern side of the Great Western Highway. Hydrological features of the site are shown on **Figure 5**.

2.2.4.3 Biodiversity

Vegetation within the development site consists of Category 1 Land (Cropped) and 18 paddock trees. The paddock trees are derived from plant community type 1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion.

All trees are old growth Blakey's Red Gums or Yellow Box. A preliminary survey of the site has been undertaken to identify biodiversity values and is provided in **Appendix C**.

This preliminary assessment included the Spot Assessment Technique (SAT) to physically assess all paddock trees for Koala evidence and all trees were assessed for hollows and for hollow dependant species activity

Database searches (NSW and Commonwealth) were also completed to provide regional environmental context, a list of threatened species which may use the development area and consider potential constraints under relevant statutory documents.

The development site is in a highly disturbed and cleared landscape. **Figure 6** shows mapped native vegetation, areas of high environmental value and the closest recordings of threatened species.

Figure 4 – Hazards and Land Capability

Figure 5 – Hydrology

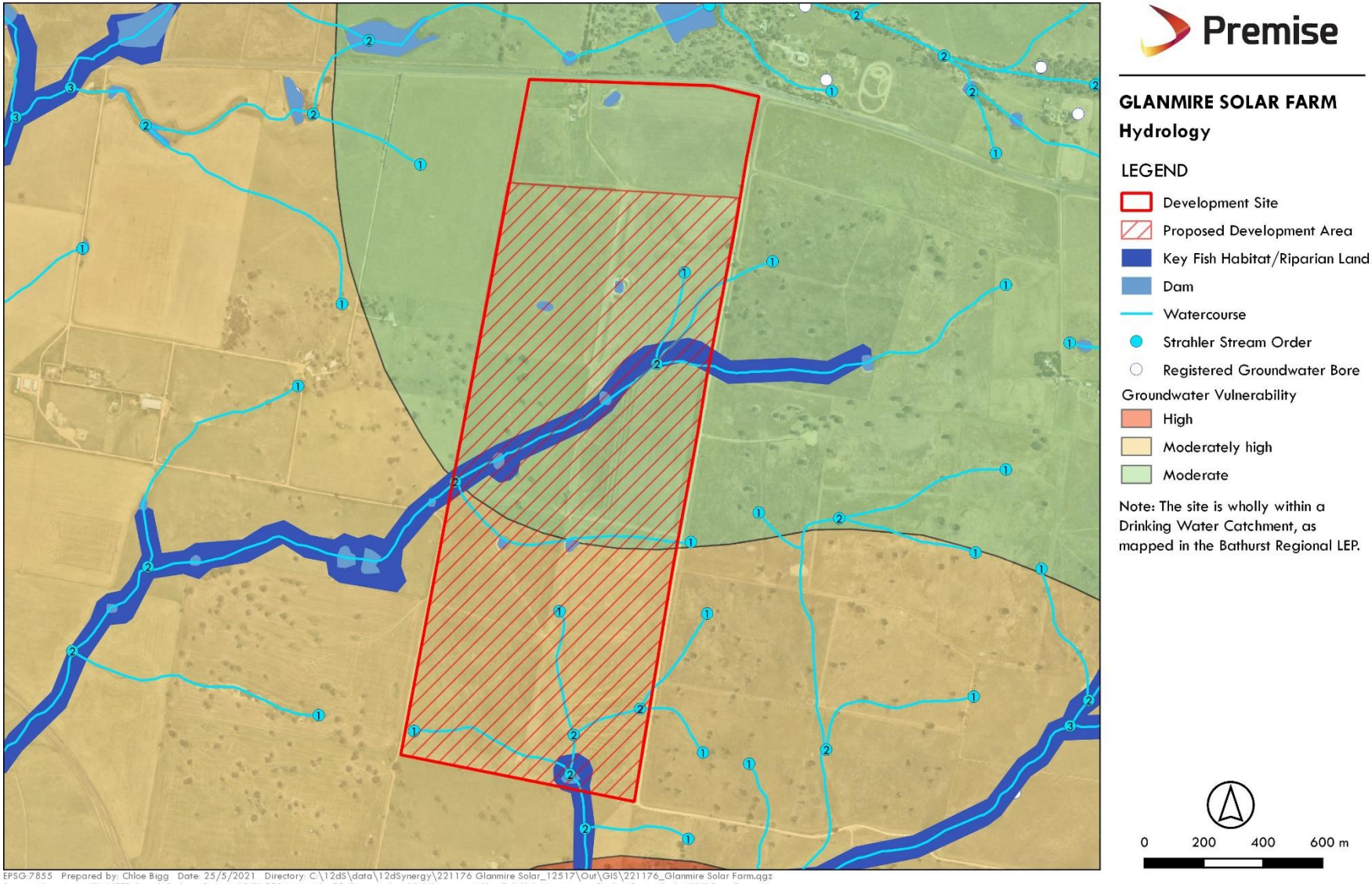
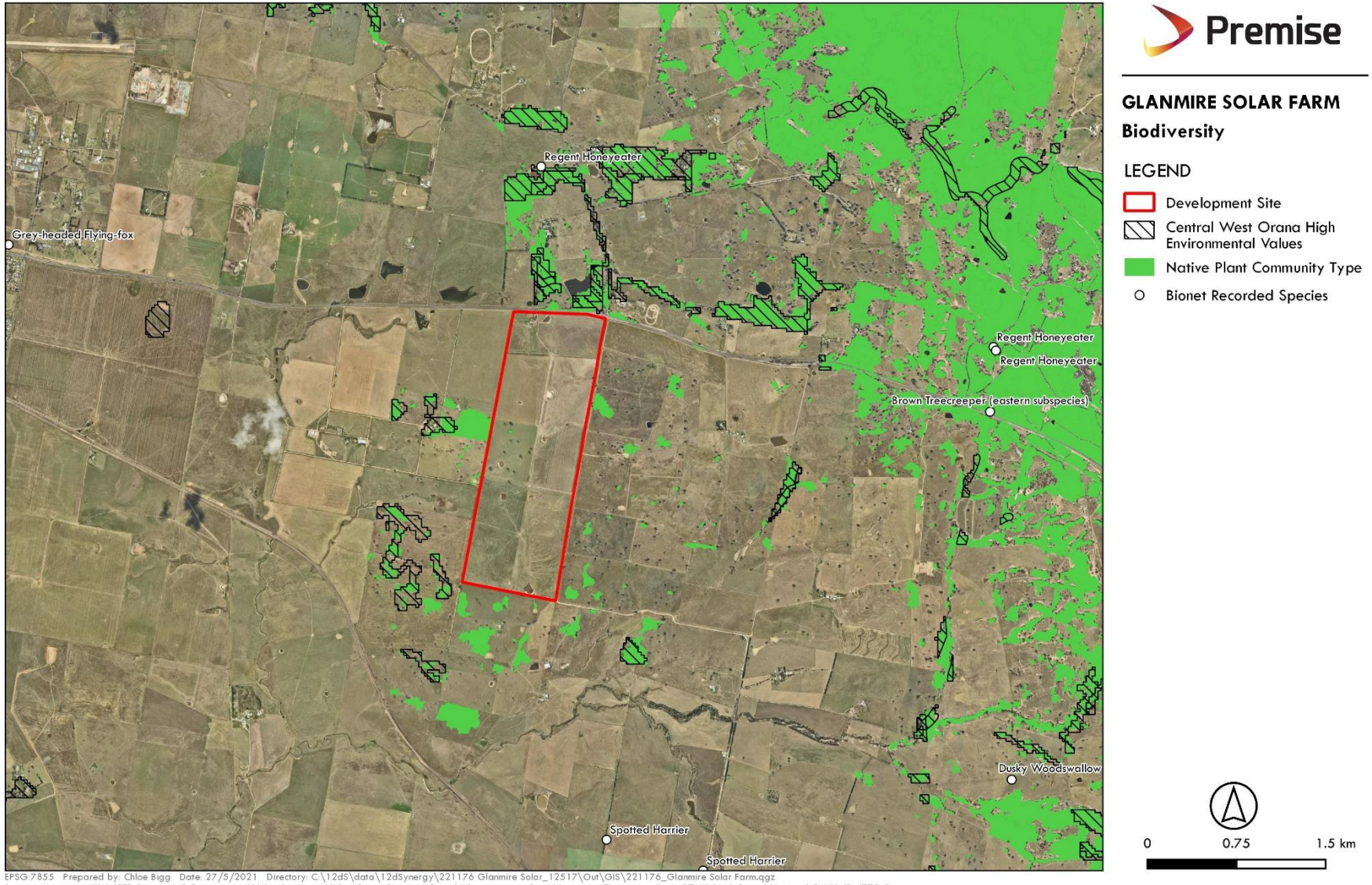


Figure 6 – Biodiversity



2.2.4.4 Hazards

The development site is not mapped as either flood or bushfire prone land and is not covered by any prospective resource development (including areas covered by exploration leases).

2.2.5 LANDSCAPE SENSITIVITY

Preliminary mapping and field inspections have been undertaken to gain an appreciation of the landscape and visual characteristics of the site, and identify planning considerations relevant to the protection of scenic amenity values. A copy of this initial assessment is provided in **Appendix D**.

2.2.5.1 Landscape and visual characteristics of the site

The locality of Glanmire is on the western edge of the Great Dividing Range in the Macquarie River plain, also known as the Bathurst Plains. The Bathurst Plains are described in the *Bathurst Vegetation Management Plan* as being '*typified by a treeless landscape'* which '*provides a contrast to the builtup area of the urban environment'* of Bathurst (Bathurst Regional Council, 2019).

The site itself has a gently undulating terrain, forming a series of small valleys and dams. The site is currently occupied by open grazing pastures and sown paddocks with some scattered trees in central parts of the site, and a dense corridor of trees to the north east of the site, adjacent to an existing dwelling, '*Woodside'* (formerly Woodside Inn). The landscape surrounding the site is characterised by largely open paddocks, with corridors of vegetation located along boundaries and roads, ornamental gardens surrounding scattered rural dwellings, vegetated creeks, cleared drainage lines and ridgelines.

The hills of the Great Dividing Range to the east, form a scenic backdrop to the valley, and Mt Panorama can be seen amongst the hills beyond Raglan and Bathurst to the west. This includes a clear view of the iconic Mt Panorama sign. Within the local visual setting, there are attractive views south east across the Salt Water Creek valley towards the more elevated areas of Brewongle.

There is an existing rail corridor and transmission lines in the vicinity of the site. This includes a 66 kV line which runs past the site adjacent to the Highway and towards Raglan, and a 132 kV line about one kilometre to the south of the site.

2.2.5.2 Planning considerations

The *Bathurst Vegetation Management Plan 2019* (BVMP, Bathurst Regional Council 2019) identifies that the landscapes surrounding the city give it a sense of containment and provide a backdrop to the views from within and into the city. In particular, the Bathurst Plains are '*particularly significant as a natural gateway feature*' which are '*viewed from the eastern approach to Bathurst City'* from the Great Western Highway (p.36). While the Region's '*agricultural land'* is generally considered to comprise '*significant landscapes for visual amenity and valued vistas into and out of the Region*', the site is not identified as part of the '*visually significant portion'* of the Bathurst Plains landscape. The '*floodplain'* and '*prominent ridges and hillsides'* surrounding Bathurst are described as contributing to the unique '*rural identity'* of the city (p.35).

Section 11 provides guiding principles to enhance the 'gateways' or main entrances to Bathurst and surrounding villages. The land between Glanmire and Raglan, along the Great Western Highway (Eastern Approach to Bathurst) is described as a '*predominately a rural setting situated on the generally treeless Bathurst Plains*', with existing roadside vegetation consisting of '*exotic grasses, widely dispersed small isolated clumps of immature Silver Wattle and Hawthorn'* (s. 11.3.3). Objective 4 aims to '*create a significant eastern gateway (Great Western Highway) into Bathurst that enhances the rural vistas, provides unity amongst many discordant visual effects and reflects the heritage values of the City'.*

Section 6.2 of the *Bathurst Region Rural Strategy* identifies the need for the protection and enhancement of the Region's '*Rural Landscapes and Features*', which contribute to the '*identity and character'*, including '*hilltops and ridges, natural landscapes and rural views and vistas*' (s.6.2).

This includes the protection and enhancement of the Region's '*Areas of High Scenic Quality and Important Landscape Features'* (Section 6.2.1). Scenic locations for the region are identified in this plan, however, there are none near the project site. The strategy suggests, however, that *'all roadways throughout the rural areas have a high scenic value',* including *'all drives from Bathurst to all village and settlement locations and drives between villages and settlement locations'.* (s.6.2.1) Section 6.2.2, '*Protection of Rural Landscapes and Features',* identifies the key *'threats to scenic quality'* to include *'inappropriately sited development located adjacent to roadways'.* This plan includes several actions recommended to ensure that the *'general scenic quality of the region is protected'.* This includes setbacks to *'reduce the visibility of new development and to enable opportunities to revegetate and therefore screen new development',* and also to *'avoid locating new development on ridges and hilltops where it is highly visible'.* (s.6.2.2)

The site is in RU1 Primary Production zoned land and the *Bathurst Regional Local Environmental Plan 2014* identifies one zone objective is to '*maintain the rural and scenic character of the land'*.

Similarly, the *Bathurst Regional Development Control Plan 2014* (DCP) recognises the visual quality of the rural landscape, stating that development should include 'consideration be given to the location, design and materials of fences, driveways and property access roads, particularly near main roads and *'gateway approaches to the City'*, to minimise 'visual impact' and ensure they are '*compatible with the rural landscape'*.

The DCP recognizes the importance of the region's 'rural vistas', and does not identify any specific views, lookouts or areas of valued landscape character within the vicinity of the site. In relation to landscaping, the DCP states it should aim to improve '*visual amenity and to ensure that developments do not dominate their surroundings*'.

2.2.5.3 Site visibility

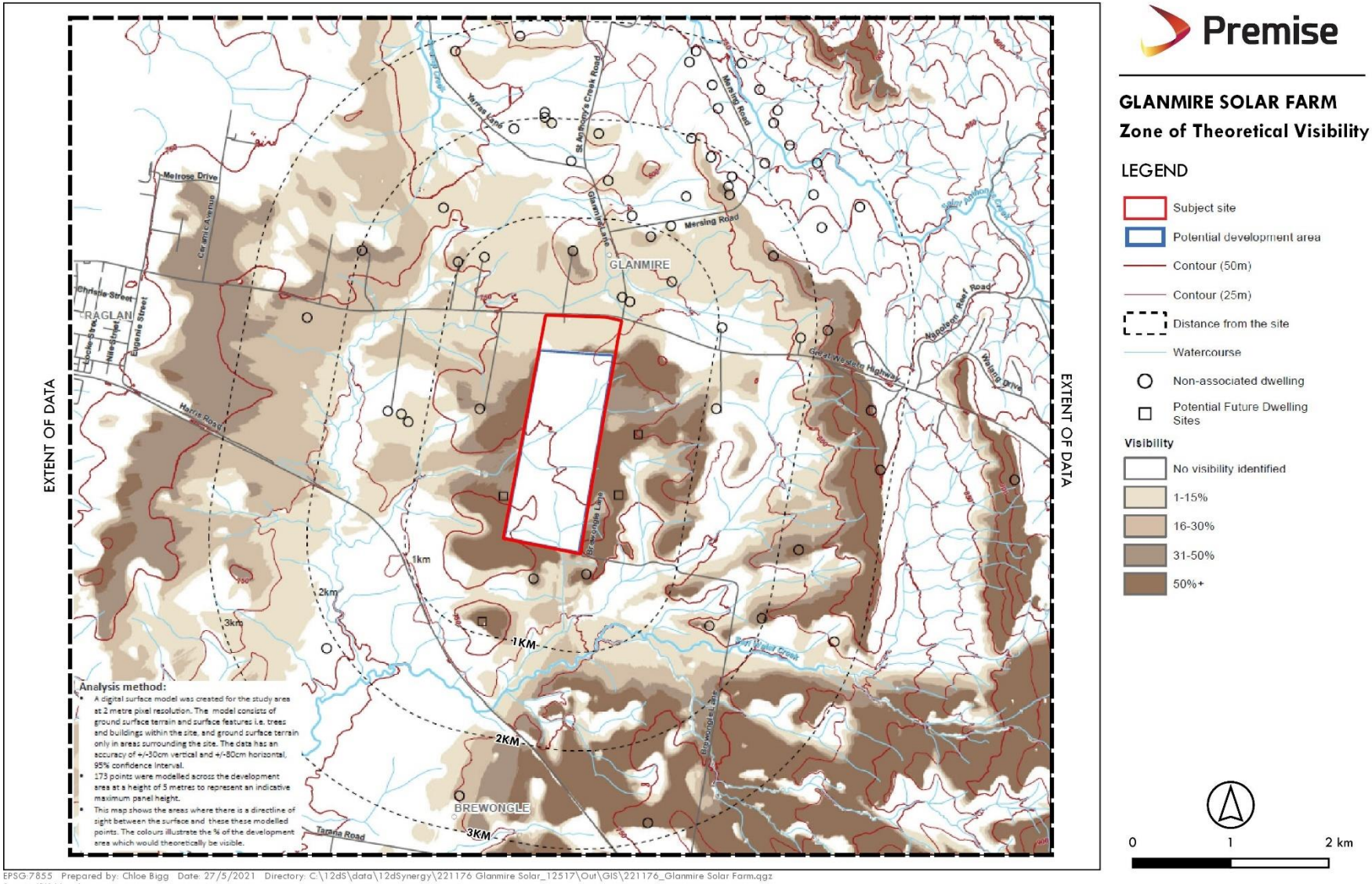
The potential visibility of the project is largely determined by landform and vegetation. The site and surrounding Bathurst plain is undulating, with several north to south aligned gentle ridges, which contain local views into smaller visual catchments. The landform rises to more elevated areas in the east, forming part of the Great Dividing Range.

The potential visibility of the development has been identified through an analysis based on the topography of the site. This analysis shows a worst-case scenario for visibility as it does not include off-site vegetation and built form which would provide some screening and filtering of views. This analysis shows the pattern of potential visibility and is a starting point for detailed analysis. This zone of theoretical visibility is shown on **Figure 7**.

Generally, this preliminary analysis shows:

- There would be close and mid-range views from the rural properties to the west of the site on the slopes facing the site and elevated areas within 500 metres of the site;
- Views to the site are contained to the west by elevated land about 3.5 kilometres west of the site, and to the east of Raglan, this landform obstructs view to the site from the dwellings within Raglan;
- To the north of the highway there is the potential for views of the site within the elevated areas to the west of Swamp Creek north west of the site, in the vicinity of Glanmire House, and from elevated areas south of Mersling Road about 1-2 kilometres north east of the site;

Figure 7 – Zone of Theoretical Visibility



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Source: IRIS Visual

- There would be close and mid-range views from the rural areas to the east of the site within one kilometre, on the elevated areas at about 2-3km from the site; and also from elevated areas further east at about four kilometres from the site;
- To the south of Salt Water Creek, and south east of the site, there is the potential for views from elevated areas at between one kilometre and over four kilometres from the site extending to the south east and directly south;
- There would be close and mid-range views to the project from the rural areas to the south of the site, directed mainly up the valleys created by the undulations on the site.

Overall, based on this preliminary analysis the site is expected to have a relatively small visual catchment with views being most likely from areas in close proximity to the site or from parallel ridges, south of the highway. Areas where a greater percentage of the site may be seen are the slopes facing the site and elevated areas within one kilometre, as well as the more elevated areas to the east of the site which are at two to four kilometres from the site and aligned parallel to the rectangular shaped project site.

The existing stand of pines running east-west and approximately 350 m set back from the Highway have been retained in this preliminary analysis and would reduce the visual prominence of the development from the north. There is also existing vegetation within the surrounding rural landscape, that has not been included in this preliminary analysis, which would further reduce the potential visual catchment of the site as some views would be screened by or filtered through trees. The vegetation on the surrounding hills and ridgelines would also provide a vegetated backdrop to views of the project. Overall, the vegetation and undulating local landform would increase the visual absorption of the proposed development into the surrounding landscape.

2.2.5.3.1 Views from the Great Western Highway

When travelling west along the Great Western Highway, approaching Kelso and Bathurst, the northern most areas of the site would be visible, where not obstructed by roadside trees and landform. This area has been removed from the proposed development footprint to minimise the potential visibility of the site from the Highway and respond to the intention in the planning scheme to protect and create a gateway experience on the approach to Bathurst. Eastbound views along the Highway include attractive long views across the valley to the hills of the Great Dividing Range. Due to the landform of the site, which generally slopes away from the highway, this journey would include a glimpse to the north western corner of the potential development area of the site. This glimpsed view would be seen within the broader views across the valley.

2.2.5.3.2 Views from residential properties

The project would be visible from some of the rural areas surrounding the site which contain scattered residences and has the potential for future development of dwellings.

North of the highway, there would be six dwellings within one kilometre, and a further nine dwellings within two kilometres of the site that would have partial views to the project. These views would be mostly to the northern end of the site.

South of the Highway, and with the potential for greater visibility of the site, there are three existing dwellings and four potential future dwelling sites which have been identified by the adjoining landholders within one kilometres of the site. A further five dwellings are located up to two kilometres from the site and there is one dwelling between two and three kilometres of the site, to the west and near the Highway, that also has the potential for views due to the rising landform towards Kelso. As the distance increases the landform reduces the potential visibility of the site and there is a greater potential for screening by intervening vegetation.

There are also dwellings located on the elevated land to the east of the site, at a distance of between two and three kilometres, and one dwelling at about four kilometres from the site. While the elevation and locations would allow an increased visibility into the site, the panoramic nature of views from the more elevated locations and increasing distance are expected to provide some mitigation of the project from these locations. Many of these dwellings include existing views to the Highway, rail line and transmission line infrastructure crossing the valley. There are also large sheds and other structures associated with these dwellings which support the rural activities within the area.

2.2.6 HERITAGE VALUES

2.2.6.1 Aboriginal heritage

Until consultation with the Aboriginal community is undertaken and a site survey completed in accordance with The Aboriginal Cultural Heritage Consultation Requirements for Proponents (ACHCRs) an understanding of Aboriginal heritage constraints is unknown. Initiating this consultation is a priority action to identify Aboriginal parties who may provide cultural heritage information relevant to the locality.

Preliminary survey and research has been completed as part of the environmental due diligence of the site. A copy of this assessment is provided **in Appendix E**.

An extensive search of the AHIMS database for an area within 10 km of the development site was conducted and revealed 41 recorded Aboriginal sites within this search area. Most are recorded as 'Artefact' with the second highest site type being 'Modified Tree'. None of these sites are located within 2 km of the development site.

No items relative to Aboriginal heritage within the development footprint are listed on the *Bathurst Regional Local Environmental Plan 2014*. There are no Native Title claims within the proposed development footprint and no sites of Aboriginal heritage are on the State Heritage Register database nearby to the development footprint.

Areas of archaeological potential are regarded as any sensitive landform with a reasonable level of intactness (i.e. little to no disturbance or minor ground surface disturbance only and in areas not on self-mulching soils). Sensitive landforms follow the definitions supplied in the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (Due Diligence code of practice) (DECCW 2010) and include:

- within 200m of waters located within a sand dune system;
- located on a ridge top, ridge line or headland;
- located within 200m below or above a cliff face
- within 20m of or in a cave, rock shelter, or a cave mouth.

The development site contains mapped watercourses and trees of an age to be culturally modified. The development site also has potential to contain stone artefacts, scatters and culturally modified trees.

The preliminary survey of the site included inspection of all trees for cultural modification. No modification was evident and no Aboriginal objects were recorded, however ground surface visibility was limited as the paddocks were under fodder crop at the time. Further, Aboriginal Parties did not participate in the preliminary assessment and therefore there is no cultural knowledge informing this initial assessment.

2.2.6.2 Historic Heritage

The development site contains the 'Woodside' residence. Woodside is a built heritage relic of local heritage significance as listed on the *Bathurst Regional Local Environmental Plan 2014* (tem I142). Archaeological reports and heritage inventory lists identify that the Woodside Inn was built on a portion of Thomas Aspinall's 1823 land grant of Blarnie.

The Inn was constructed during the early 1850s, with a verandah added c. 1930, and was associated with the gold mining boom of the period, catering for miners and travellers. The Inn also operated as part of the Glanmire Post office service. Records show the Woodside Inn was also a popular meeting place for riding groups in the region and hosted lunches after riding events such as hurdle races. In January of 1856 the Governor General arrived at the Woodside Inn on horseback, escorted by mountain troopers on his way to Bathurst. Bushranger activity has been reported at the Inn between 1862 and 1866.

The proposed development footprint for the GSF would avoid any impact to this heritage item.

2.2.7 ACCESS

Access to the development site is now provided directly off the Great Western Highway. Subject to consultations with both Transport for NSW (TfNSW) and Bathurst Regional Council, it is proposed to access the solar farm off Brewongle Lane. To this end, it is noted that the NSW Government is currently undertaking road improvement works on the Great Western Highway at Glanmire. These works include a range of safety upgrades on the Highway, including widening of the road shoulder, installing safety barriers, relocating road signs and renewing road markings to provide a safer road for motorists

Specifically, the key features of these works include:

- Installation of a wide centreline treatment, tying into painted median east of the Brewongle Lane intersection
- Installation of profile audio tactile line marking on the edge and centre lines.
- Installation of roadside wire rope barrier.
- Construction of a westbound Auxiliary Left-turn Lane Treatment (AUL) into Brewongle Lane.

2.2.8 PRELIMINARY CONSTRAINTS ANALYSIS

The proposed development site is not free of constraints.

Known and potential constraints within and adjacent to the development site include:

- the proximity to existing (and proposed) dwellings,
- mapped Class 1 and Class 2 watercourses;
- mapped Key Fish Habitat;
- 18 paddock trees; and
- the heritage value of the Woodside cottage.

A preliminary constraints map is provided in **Figure 8** and Table 1 provides an assessment against key site constraint considerations identified in the NSW Government's (2018) *Large-Scale Solar Energy Guideline*.

Table 1 – Key Site Constraints

Consideration	Preliminary Screening
Visibility and topography	The site does not have high visibility for significant numbers of viewers. It is not on prominent or high ground, and provision of a buffer at the northern end of the development site will help protect the Bathurst gateway.
Biodiversity	The site does not contain areas of high biodiversity value or significant habitat for threatened species or ecological communities.
Residences	The development site is not located near a residential zone or urbanised area. It does, however, have three existing and four potential future dwellings located within 1 km of the site from which visual impacts will occur.
Agriculture	The land is not Biophysical Strategic Agricultural Land and the Land and Soil Capability class is predominantly Class 4 with some Class 5.
Natural hazards	The development site is not flood or bushfire prone, but does have inherent limitations for high impact land uses that can result in gully erosion.
Resources	The development site is not subject to resource development or exploration licence.
Crown lands	The development site is privately owned land and no Crown Lands would be impacted.

2.3 Likelihood of Cumulative Impacts

The development site is located sufficiently distant from other potential significant development to avoid cumulative impacts.

Neoen Australia's proposed 200-250 $MW_{(AC)}$ Eglinton Solar Farm is located approximately 12.5 km to the north west. The Secretary's Environmental Assessment Requirements (SEARs) for this State Significant Development (SSD 8994273) were issued in September 2020.

SEARs for the 131 MW Brewongle Solar Farm (SSD 8722) that was proposed by Photon Energy lapsed in September 2019 and development status on the Department of Planning Industry and Environment's major

Figure 8 – Preliminary Site Constraints

projects planning portal is listed as withdrawn. The location of the Brewongle Solar Farm was approximately 1.6 km to the south of the GSF site.

While nothing is yet registered on the major projects planning portal, information is in the public domain regarding the proposed 325 MW Central West Pumped Hydro project. The development site appears to be located approximately 10 km to the south east of the proposed GSF in the Mount Tennyson locality.

The indicative locations of these developments in relation to the GSF are shown on **Figure 1**.

2.4 Agreements with Other Parties

At this stage Elgin Energy has not entered into any agreements with other parties to mitigate or offset impacts of the development. The need and or opportunity to enter such agreements will be determined through the impact assessment process and further consultation with the community.

For example, outcomes of investigations relating to Aboriginal heritage and biodiversity assessment may identify areas requiring either avoidance and/or the need for offsetting impacts under the *Biodiversity Conservation Act 2016*.

Notwithstanding the above, Elgin Energy is committed to delivering community benefit sharing opportunities in consultation with the community. Community benefit sharing is a feature of all Elgin Energy developments and in projects completed in the UK to date the company has provided community contributions. Benefit sharing initiatives have taken the form of supporting upgrades to local infrastructure, restoration of historic monuments and participation on education initiativer.

How, where and in what form a community benefit sharing initiative can be best realized for the proposed GSF will remain a key objective of community engagement during the preparation of the Environmental Impact Statement.

3. PROJECT

3.1 Solar Farm Infrastructure

The GSF is proposed to have a capacity of approximately 60 $MW_{(AC)}$ and infrastructure would comprise:

- ground mounted solar photovoltaic (PV) panels either on a fixed-tilt or single-axis tracking system;
- inverters and voltage step-up transformers positioned throughout the solar arrays;
- underground and aboveground cabling to connect the arrays to the inverters/transformers;
- a battery energy storage system with a power rating up to approximately 60 MW AC/DC coupled (approximately 60 MW hours);
- a switchyard and on-site substation;
- National Energy Market (NEM) compliant metering;
- internal access tracks to enable site maintenance;
- security fencing around the perimeter with CCTV;
- an operations and maintenance building; and
- site access off Brewongle Lane.

3.2 Concept Refinement

Investigations to be undertaken as part of the Environmental Impact Statement and outcomes of further engagement with the community will assist in informing a proposed solar farm layout and identifying mitigation measures to be incorporated into the final design.

This would include, but not necessarily be limited to:

- infrastructure interface with mapped drainage lines;
- boundary offsets to provide appropriate buffers;
- screen plantings to mitigate visual impacts;
- internal stock fencing, gates and provision of watering troughs/dams to facilitate efficient sheep grazing once the solar farm is operational; and
- secondary access/egress to provide for emergency access.

3.3 Construction

Construction is anticipated to be completed over a 12 month period and will require establishment of temporary construction offices, material laydown areas and construction vehicle parking.

4. STATUTORY CONTEXT

4.1 Approvals Pathway

Pursuant to Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011* the proposed GSF is a State Significant Development (SSD) because it is a development for the purpose of an electricity generating works, using solar as the energy source, and will have a Capital Investment Value (CIV) of more than $30 million.

Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* establishes the approval pathway for development that is SSD.

The consent authority is the Minister for Planning (or delegate).

4.2 Permissibility

Pursuant to Clause 34 of Division 4 of Part 3 of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) the development of electricity generating works are permitted on prescribed rural, industrial or special use zones. An electricity generating works is defined by the standard instrument as a building or place used for the purpose of making or generating electricity, or electricity storage.

The proposed development site is located on land zoned RU1- Primary Production in the *Bathurst Regional Local Environmental Plan 2014* (LEP) and entails the carrying out of electricity generating works.

The development is therefore permissible through clause 34 of the ISEPP

4.3 Other Approvals

4.3.1 CONSISTENT APPROVALS

Pursuant to Section 4.42 of the *Environmental Planning and Assessment Act 1979* the following relevant authorisations cannot be refused if they are necessary for carrying out a SSD that is authorised by a development consent and are substantially consistent with the consent:

- an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997*; or
- consent under Section 138 of the *Roads Act 1993*.

4.3.2 EPBC APPROVAL

A search of the online Protected Matters Search Tool (PMST) for an area incorporating a 10 km buffer to the development site confirms no World Heritage Properties, National Heritage Places or Wetlands of International Importance. Habitat availability in and around the development site restricts the likelihood of impact on any listed threatened and migratory species or ecological communities. The development would not have an impact on any Commonwealth owned land.

It is considered unlikely that the development will have or is likely to have a significant impact on a matter of National Environmental Significance (NES) and referral to the Commonwealth Department of Agriculture, Water and Environment (DAWE) is not likely. The biodiversity assessment and findings relating to ecological impacts to be undertaken as part of the Environmental Impact Statement will confirm the need or not for referral to the Commonwealth.

4.3.3 OTHER APPROVALS

Section 4.41 of the *Environmental Planning and Assessment Act 1979* specifies that the following authorisations are not required for a SSD that is authorised by a development consent:

- a permit under section 201, 205 or 219 of the *Fisheries Management Act 1994*;,
- an approval under Part 4 or an excavation permit under section 139 of the *Heritage Act 1977*,
- an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974*;
- a bush fire safety authority under section 100B of the *Rural Fires Act 1997*, or
- a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000*.

5. ENGAGEMENT

5.1 Engagement carried out

Engagement activities and consultation undertaken to date is summarised below.

5.1.1 BATHURST REGIONAL COUNCIL

An initial meeting was held with Bathurst Regional Council's (BRC) Manager Development Assessment in April 2020 where the planning requirements for the development were discussed. During this initial consultation BRC flagged:

- the requirement for effective community engagement; and
- the heritage listing of the former Woodside Inn on the property.

A video conference meeting with BRC's Manager Development Assessment and Manager Technical Services in August 2020 to discus the Obstacle Limitation Surface Map and implications of the GSF development for the airport's operations. Council noted:

- circuits and approach paths may pass directly over the development site, including flight training circuits;
- four times a year (every school holidays) the RAAF holds glider flying camps that do have aircraft flying over the development site;
- all infrastructure associated with the development, including equipment used during construction, will need to be cognizant of obstacle height penetration considerations; and
- early CASA consultation recommended.

Elgin Energy was also advised to provide a briefing to Bathurst Councillors before commencing community engagement. A presentation to BRC Councillors was provided in October 2020.

5.1.2 CIVIL AVIATION SAFETY AUTHORITY

In September 2020 Elgin initiated consultation with CASA. The preliminary advice received was that, with respect to glare impacts, there is currently no CASA regulation or standards associated with the installation of solar panels in the vicinity of an aerodrome. CASA apply the United States Federal Aviation Authority (FAA) guidance material that states a glare analysis should be conducted on any solar installation.

In relation to the proposed development, CASA noted:

- There is no air traffic control tower at Bathurst.
- The development site is not located under the approach or take off surfaces for any of the runways.
- As the aerodrome operator, Council must report all Obstacle Limitation Surfaces (OLS) penetrations (permanent and temporary) to CASA for a hazard assessment.
- While it is unlikely that the GSF would cause an unacceptable risk to aviation due to glare, a glare analysis should still be conducted.

5.1.3 STATE MEMBER

Elgin Energy requested a briefing and met with the State Member for Bathurst in October 2020.

5.1.4 DEPARTMENT OF PLANNING, INDUSTRY AND ENVIRONMENT

5.1.4.1 Planning and Assessment Group

In August 2020 Elgin Energy had the initial Scoping Meeting with DPIE. The project (scale and location) and preliminary understanding of site constraints were discussed. DPIE confirmed the project be assessed as State Significant Development (SSD). A follow up meeting was held in April 2021 to discuss progress on the development and Elgin Energy's expected project schedule.

5.1.4.2 Energy Infrastructure and Zones

In April 2021 Elgin Energy, on request, provided a briefing on the development to the Director Energy Infrastructure and Zones.

5.1.5 LOCAL COMMUNITY

Community consultation to date has been targeted to engaging with the local community (neighbours) and the 62 landowners with property within 3 km of the development site lot boundary.

Two project information flyers were distributed in October and November 2020. Information included key project details, a project overview, a description of the physical elements of a solar farm and information about Elgin Energy. Contact details (1800 number and email) were provided and an invitation extended to arrange a time to discuss the project in person.

Elgin was contacted by and met with seven landowners. Issues raised included:

- a buffer to the Great Western Highway and vegetative screening;

- retention of the on-site residence (old Woodside Inn); and

- questions relating to the capacity to graze within a solar farm.

Concerns included the impact on land values, the protection of the gateway entrance into Bathurst, loss of visual amenity and loss of prime agricultural land. At a subsequent meeting convened by seven landowners and attended by Elgin Energy issues relating to traffic, community benefit and economic loss were also discussed.

In November 2020 Elgin Energy was contacted by the Glanmire Action Group (GAG) requesting further engagement. With the lead in to the Christmas period Elgin Energy advised engagement would recommence in 2021.

In April 2021 Elgin Energy invited the 62 landowners to attend an on-site community drop-in session held on a Friday afternoon/Saturday morning (14/15th May). A separate invitation was sent to the Glanmire Action Group with the offer to meet as a stakeholder group.

Invitations were also extended to Bathurst Regional Council staff and Councillors, as well as the State Member for Bathurst.

5.2 Community views

Over the two drop-in sessions 22 landowners attended, including

- 5 of the 9 landowners located within 1 km of the site;
- 7 of the 24 landowners located between 1-2 km of the site; and
- 3 of the 27 landowners located between 2-3 km of the site.

In addition to the above, 6 residents located > 3km from the site also attended. Only one attendee's landownership was not established.

The sessions were designed to provide the opportunity to meet locals, listen to their views and for both Elgin Energy and the Premise project team to answer questions.

Matters raised in one-on-one discussions with individual attendees covered a range of issues, including:

- loss of visual amenity;
- lighting at night;
- site access and road safety given narrow road formation and two blind crests on Brewongle Lane;
- fuel load management, access and the need for consultation with the local Glanmire-Walang Rural Fire Service (RFS) brigade;
- leasing opportunities for grazing;
- Elgin Energy's business model and intentions once the farm is built;
- the quality of solar irradiance in Bathurst;
- microclimate effects of solar farms;
- impact on helicopter and fixed wing RAAF flight training from Richmond;
- glare impacts for motorists on the Great Western Highway;
- why solar farms can't be on more remote, poorer quality country;
- community benefit sharing with equestrian focus; and
- decommissioning surety.

The Glanmire Action Group stated its strong opposition to the development, noting that the development:

- would have an adverse impact on land values;
- would result in a financial loss to the Bathurst community;
- would provide no benefit to the Bathurst community in terms of cheaper electricity;
- should be located in the Central West Orana Renewable Energy Zone (REZ);
- would be an inappropriate use of high-quality agricultural land; and
- would impact adversely on neighbours with respect to insurance (both increased costs and/or an inability to insure).

The capacity for Elgin Energy to financially guarantee their debts was also questioned.

5.3 Engagement to be carried out

To date community consultation has focussed on Elgin Energy's neighbours – those within 3 km of the development site and part of the local Glanmire (and Walang and Napolean Reef) community.

During the preparation of the Environmental Impact Statement (EIS) additional and broader consultation will be undertaken with this local community, the Glanmire Action Group, as well as other stakeholders groups and the wider Bathurst community.

The community engagement plan will evolve to accommodate the interests of all stakeholders and incorporate appropriate engagement tools.

Commitments include:

- Face to face meetings with neighbours and stakeholder groups as required.
- Maintenance of the project website (http://www.glanmiresolarfarm.com.au/) to provide updates on progress and enable stakeholders to contact the project team.
- Notification and provision of project information to stakeholders as the outcomes of investigations become available and concept design parameters are formulated.
- Actively pursuing opportunities for developing a local community benefit sharing scheme in partnership with the community.
- Maintaining a communication's register to accurately record all contact with stakeholders whilst respecting people's privacy.
- Hosting further drop-in sessions prior to lodgement of the Development Application, with access to specialists from within the project team as required.

6. PROPOSED ASSESSMENT OF IMPACTS

6.1 Key Issues

As a result of the preliminary investigations and community engagement undertaken to date there are key matters requiring further assessment in the Environmental Impact Statement. These are addressed below.

6.1.1 VISUAL IMPACT

During the preparing of an EIS a visual impact assessment would be prepared that would further analyse the potential visual impact of the development and options for mitigation. This would include a more detailed consideration of views from the Highway to ensure the Bathurst gateway is not adversely impacted, and determination of impacts in particular for those receptors (both existing and proposed) located within 1 km of the site, as well as more distant receptors at elevation. The potential amenity impacts of glare would also need to be modelled for private residential dwellings, roads and the operations associated with the Bathurst Airport.

Further analysis of the visibility of the site, and site investigations would be undertaken to refine the development footprint, determine the location of any larger scale infrastructure, and provision of screening vegetation to respond to the views from residential dwellings with views to the site.

A landscape strategy would also be prepared to identify the proposed location of screen planting to mitigate any potential visual impacts of the project. This strategy would be determined in consultation with the community and specifically address the potential for views from the Highway to ensure the project does not adversely affect the gateway experience intended for this route.

6.1.2 ECONOMIC IMPACT

Community consultation to date has identified a key issue being the economic cost to the Bathurst community resulting from a change in land use on the 186 ha site from agriculture to electricity generation. The EIS will need to provide an Agricultural Impact Statement (AIS) that quantifies post-development impacts to gross annual farm gate value of production and gross related economic activity.

Similarly, the economic contribution to the Bathurst and broader community resulting from the construction and operation of the proposed GSF will also need to be quantified through the conduct of a socio-economic impact assessment. This assessment would identify direct and secondary effects of the economic activity generated, including considerations such as the production of goods and services, accommodation, engineering, freight services, construction materials and equipment, local labour and technical contractors.

6.1.3 HYDROLOGY

The soil resource within the development site has poor drainage, acidic topsoil and strongly sodic subsoils. The granite based parent material is susceptible to erosion and the impacts of this limitation are evident across the broader landscape where extensive creek rehabilitation works undertaken by landowners continue to be implemented to restore gully erosion. It is also noted that the development site contains several ephemeral, Strahler Class 1 and Class 2 mapped watercourses.

The design of the solar farm layout will need to ensure off-site hydraulic impacts do not occur over time. The quantity and velocity of surface water run-off onto neighbouring lands from storm events should not exceed pre-development flows. The EIS will need to demonstrate how solar farm infrastructure interfaces with drainage features over the development site. This will require both hydrologic and hydraulic modelling to quantify predicted impacts.

6.2 Matters requiring assessment

6.2.1 COMMUNITY ENGAGEMENT

The EIS will need to demonstrate consultation during the preparation of the EIS with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups and affected landowners. The EIS will need to describe the consultation process and the issues raised and identify where and how the concept design of the solar farm has been responsive to these issues.

6.2.2 HERITAGE

6.2.2.1 Aboriginal heritage

The EIS will need to include an assessment of the likely Aboriginal heritage (cultural and archaeological) impacts of the development and consultation with the local Aboriginal community in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents*.

6.2.2.2 Historic heritage

Whilst the proposed development would not impact on the "Woodside' cottage, this is a local heritage listing for which a Heritage Impact Statement would be prepared in consultation with the local branch of the National Trust and Bathurst Regional Council's heritage advisor.

It is noted that potential restoration of the old Woodside Inn, complimented with an equestrian theme, was raised as a possibility for community benefit sharing during the community drop-in sessions.

6.2.3 BIODIVERSITY

The EIS will need to include an assessment of the biodiversity values and the likely biodiversity impacts of the development in accordance with the *Biodiversity Conservation Act 2016* (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless the Biodiversity Conservation Directorate DPIE determine the development is not likely to have any significant impacts on biodiversity values.

The assessment will need to:

- demonstrate the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM;
- provide an assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the *Fisheries Management Act 1994*, and a description of the measures to minimise and rehabilitate impacts; and
- if an offset is required, detail the measures proposed to address the offset obligation.

6.2.4 LAND USE

The EIS will need to include an assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including

- consideration of impacts on neighbouring agricultural lands,
- any cumulative impact of nearby developments;
- an assessment of the compatibility of the development with existing land uses,
- consideration of the zoning provisions applying to the land, and
- a Land Use Conflict Risk Assessment in accordance with the Department of Industry's *Land Use Conflict Risk Assessment Guide*.

6.2.5 NOISE

The EIS will need to include an assessment of:

- the construction noise impacts of the development in accordance with the *Interim Construction Noise Guideline* (ICNG),
- operational noise impacts in accordance with the *NSW Noise Policy for Industry* (2017),
- cumulative noise impacts (considering other developments in the area), and
- a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.

6.2.6 TRANSPORT

The EIS will need to include a traffic impact assessment that identifies:

- the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation; -
- an assessment of the likely transport impacts to the site access route (including the Great Western Highway and Brewongle Lane),
- site access point(s),
- the capacity and condition of Brewongle Lane, road safety and intersection performance of the Great Western Highway/Brewongle Lane intersection;
- any cumulative impact assessment of traffic from nearby developments; and
- details of measures to mitigate and/or manage potential impacts developed in consultation with Transport for NSW and Bathurst Regional Council as the relevant road authorities.

6.2.7 HAZARDS

The EIS will need to include an assessment of:

- potential hazards and risks associated with the development in accordance with *SEPP No. 33 - Hazardous and Offensive Development* (SEPP33), including the completion of a Preliminary Hazard Analysis (PHA) if required;
- bushfire risks against the RFS *Planning for Bushfire Protection 2019*; and
- compliance with the International Commission on Non-Ionizing Radiation Protection (ICNIRP) *Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields*;.

6.2.8 WASTE MANAGEMENT

The EIS will need to identify, quantify and classify the likely waste stream to be generated during construction and operation of the proposed GSF, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.

6.3 General matters

The EIS for the development will need to comply with the requirements in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* and must include:

- a stand-alone executive summary;
- a full description of the development, including: - details of construction, operation and decommissioning;
- a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process);
- a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development; ·
- a strategic justification of the development focusing on site selection and the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential);
- a description of the existing environment likely to be affected by the development
- an assessment of the likely impacts of all stages of the development, including any cumulative impacts,
- a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development; and
- reasons why the development should be approved having regard to relevant matters for consideration under the *Environmental Planning and Assessment Act 1979*, including:
    - the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development;
    - the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and
    - feasible alternatives to the development (and its key components), including the consequences of not carrying out the development. ·

- consideration of the capability of the project to contribute to the security and reliability of the electricity system in the National Electricity Market, having regard to local system conditions and;
- a detailed evaluation of the merits of the project as a whole.

6.4 Matters requiring no assessment in the EIS

As detailed in **Section 1.5** development consent is not being sought for the network connection works as part of the proposed Development Application.

Development for the purpose of these electricity transmission and network distribution works will be subject to assessment under Part 5 of the *Environmental Planning and Assessment Act 1979* and Essential Energy will be the determining authority.

Notwithstanding, consistent with the *Large-Scale Solar Energy Guideline for State Significant Development* the EIS will provide details of these works to assist in the consideration of all aspects of the proposed GSF development.

7. REFERENCES

Bathurst Regional Council (2014) Bathurst Regional Development Control Plan 2014

Bathurst Regional Council (2020) *Renewable Energy Action Plan*

Bathurst Regional Council (Draft) *Vision Bathurst 2040 – Bathurst Region Local Strategic Planning Statement*

Bathurst Regional Council (2010) *Bathurst Region Rural Strategy*

NSW Department of Planning and Environment (DP&E). (2017). Central West and Oran Regional Plan 2036

NSW Department of Planning and Environment (DP&E). (2018). *Large-Scale Solar Energy Guideline for State Significant Development*.

NSW Department of Planning and Environment (DP&E). (2017). *Guideline for Engaging Stakeholders*.

NSW Office of Environment and Heritage (2012) *The land and soil capability assessment scheme (second approximation) : A general rural land evaluation system for New South Wales*

Roads and Maritime Service (May 2019) *HW5 Glanmire Wide Centreline P.0033816 Review of Environmental Factors*

APPENDIX A

LAND AND SOIL CAPABILITY ASSESSMENT

GLANMIRE SOLAR FARM

Land & Soil Capability Assessment

Prepared for:

Elgin Energy

SLR Ref: 630.30108
Version No: v1.0
May 2021

PREPARED BY

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Elgin Energy (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.30108 LSC	May 2021	Murray Fraser	Rod Masters	Rod Masters

CONTENTS

CONTENTS

DOCUMENT REFERENCES

TABLES

FIGURES

APPENDICES

1 Introduction

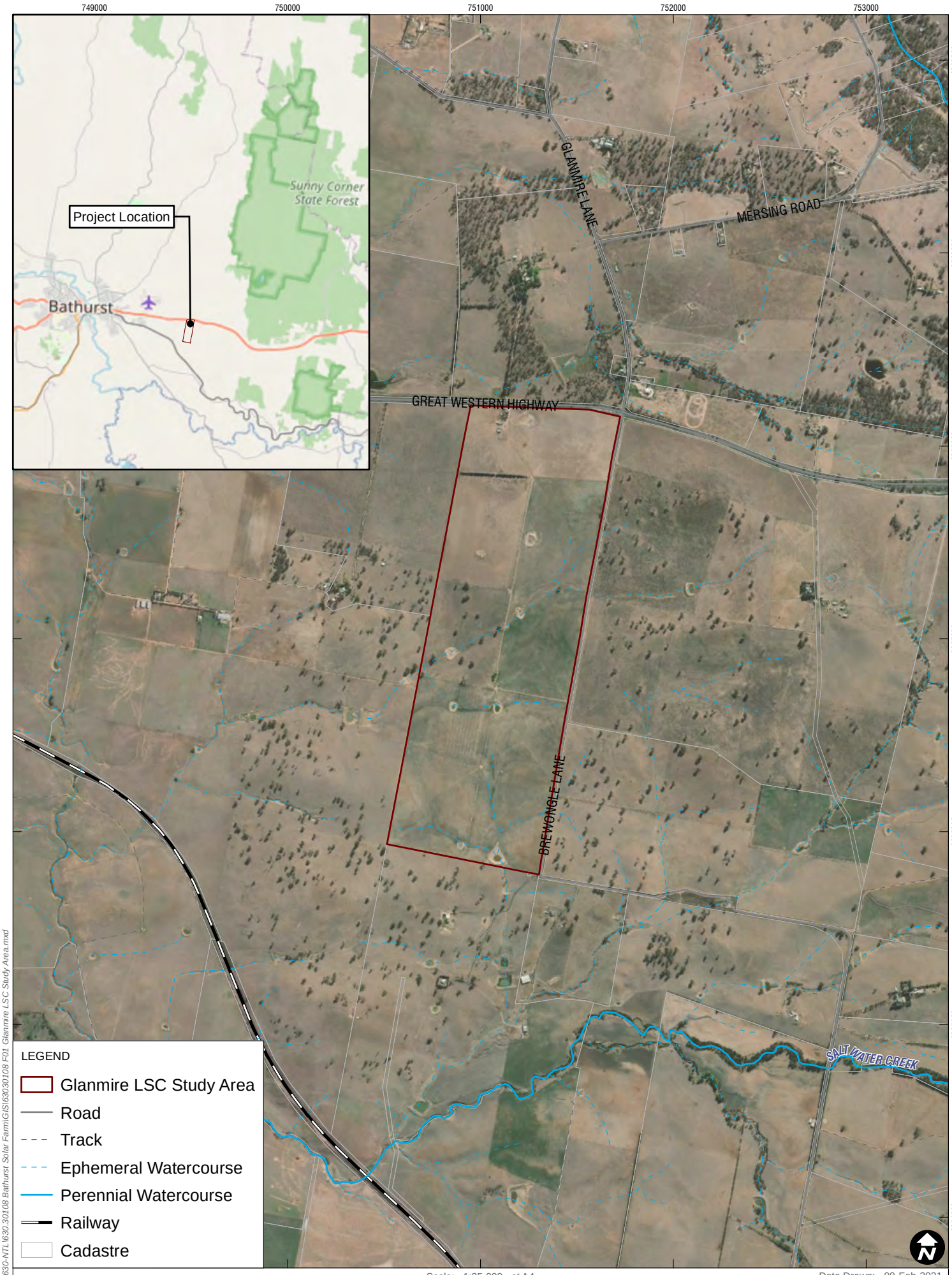
SLR has been commissioned by Elgin Energy to complete a Land & Soil Capability (LSC) Assessment for the Glanmire Solar Farm Project (the Project). The purpose of this LSC Assessment is to form part of the site due diligence and ultimately inform any Environmental Impact Statement (EIS) for the Project in support of a development application, to be submitted under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (NSW Department of Planning and Environment (DP&E), 1979).

1.1 Background

Elgin Energy is a leading international solar developer with operations in Australia, UK, and Ireland. To date, Elgin have delivered 21 projects including the largest operational solar farms in Scotland (13MW) and Northern Ireland (46MW)

Elgin Energy are proposing to develop the Glanmire Solar Farm at 4823 Great Western Highway, Glanmire, NSW 2795. This site is located approximately 11 kilometres east of the township of Bathurst and approximately 4.5 kilometres east of Raglan. A Region Locality and Study Area Plan is provided at **Figure 1** for reference. The site has a total area of approximately 186 hectares and is currently used for grazing and for intermittent cropping. The general area comprises a range of farming properties and rural living properties.

The LSC Study Area comprises the entirely of Lot 141 DP1144786 (186 hectares), whilst the project will cover a development footprint of approximately 140 hectares and comprise single axis tracking solar photovoltaic technology laid out in north south rows and will also include ancillary infrastructure such as inverters, connection equipment and energy storage equipment.



Scale: 1:25,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 09-Feb-2021
Project Number: 630.30108

Data Source: © OpenStreetMap contributors

Study Area

FIGURE 1

H:\Projects-SLR\610-SnySYD\630-NTL\630.30108 Bathurst Solar Farm\GIS\630.30108 F01 Glanmire LSC Study Area.mxd

1.2 Objective

The objective was to conduct an LSC Assessment for an area of land proposed for the Project to support any EIS/Development Application for the project.

1.3 Scope of Work

The LSC Assessment includes:

- Detailed assessment of the site and soil characteristics as per the requirements of *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012).
- Completion of field work to obtain required level of field samples in accordance with any relevant guidelines.
- Documentation of the results of the detailed assessment comprising of a written report and associated mapping to address specific items in *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012).

1.4 Study Area

Elgin Energy requires a LSC Assessment for the Area of Interest (the Study Area) as shown in **Figure 1**, to support the Project. **Table 1** shows the areas requiring soil survey for the LSC Study Area.

Table 1 Study Area

Assessment Component	Hectares
Development Footprint	140
Remaining Area Lot 141 DP1144786	46
Total LSC Study Area	**186**

1.5 Legislation and Standards

The Large-Scale Solar Energy Guideline (LSSEG) for State Significant Development was issued in December 2018 by the NSW Government (NSW Government, 2018). The guideline provides the community, industry, applicants and regulators with general guidance on the planning framework for the assessment and determination of State Significant large-scale energy projects under the Environmental Planning and Assessment Act 1979. Under Section 4 of the LSSEG one of the key site constraints identified for site selection is agriculture including Land and Soil Capability and BSAL.

The appropriate guideline for assessment of Land and Soil Capability is *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012)

A BSAL Verification Assessment has been previously undertaken by SLR (2021).

2 LSC Assessment Methodology

The LSC classification applied to the Study Area was in accordance with the OEH guideline *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012). This scheme uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes, which classify the land based on the severity of long-term limitations. The LSC Classes are described in **Table 2** and their definition has been based on two considerations:

- The biophysical features of the land to derive the LSC classes associated with various hazards.
- The management of the hazards including the level of inputs, expertise and investment required to manage the land sustainably.

Table 2 Land & Soil Capability Assessment Classification

Class	Land and Soil Capability
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, conservation)	
1	**Extremely high capability land**: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	**Very high capability land**: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	**High capability land**: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	**Moderate capability land**: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land**: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)	
6	**Low capability land**: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.
Land generally incapable of agricultural land use (selective forestry and nature conservation)	
7	**Very low capability land**: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	**Extremely low capability land**: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

2.1.1 Calculating LSC Classes

The biophysical features of the land that are associated with various hazards are broadly soil, climate and landform and more specifically: slope, landform position, acidity, salinity, drainage, rockiness; and climate.

The eight hazards associated with these biophysical features that are assessed by the scheme are:

1. Water erosion
2. Wind erosion
3. Soil structure decline
4. Soil acidification
5. Salinity
6. Water logging
7. Shallow soils and rockiness
8. Mass movement

Each hazard is assessed against set criteria tables, as described in the LSC Guideline; each hazard for the land is ranked from 1 through to 8 with the overall ranking of the land determined by its most significant limitation.

Hazard 1: Water Erosion

The Study Area lies within the Easter NSW Division, and the appropriate criteria for this division were used in the assessment. Assessment of water erosion hazard is almost solely dependent on the slope percentage of the land, based on each Soil Landscape Unit. The only exception is land which falls within the slope range of 10 to 20%, which may be designated LSC Class 4 or LSC Class 5 depending on the presence of gully erosion and/or sodic/dispersible soils. A slope analysis for the Study Area is shown on **Figure 2** while the slope analysis methodology is shown in **Appendix A**.

Hazard 2: Wind Erosion

There are four factors used to assess wind erosion hazard for each soil type. Three criteria were assessed to be consistent for each soil type:

- Average rainfall determines the capacity of the land to maintain vegetative cover and keep soil wet. The average rainfall for the region is 635 millimetres (BOM, 2021), and therefore the Study Area lies within the “greater than 500 millimetres rainfall” category for the purpose of assessing wind erosion hazard.

- Wind erosive power for the Study Area has been mapped as “Moderate” (NSW Department of Trade and Investment); and

- Exposure of the land to wind was also determined to be “Moderate” throughout the Study Area.

The determining factor with regard to wind erosion hazard was therefore the erodibility of each soil type as determined by soil texture according the LSC Guideline.

Hazard 3: Soil Structure Decline

Soil structure decline is assessed on soil characteristics, including surface soil texture, sodicity (laboratory tested) and degree of self-mulching (field tested). These parameters assess the soil structure, stability and resilience of the soil.

Hazard 4: Soil Acidification

The soil acidification hazard is assessed using three criteria, being soil buffering capacity, pH and mean annual rainfall. In this assessment, soil buffering capacity was based on soil Great Soil Group; surface soil pH and a regional mean annual rainfall range of 550 to 700 millimetres.

Hazard 5: Salinity

The salinity hazard is determined through a range of data and criteria. The recharge potential for the site was determined based on an average annual rainfall of 635 millimetres, with annual evaporation of 1,400 to 1,600 millimetres (BOM, 2021). This would suggest a low recharge potential.

Based on the annual rainfall data (635 millimetres) and an average annual evapotranspiration of 600 to 700 millimetres, a low discharge potential exists for the site due to a likely balanced rate of water flow. The Study Area according to the Salt Store Map of NSW, is located in an area of low salt store. However, due to the current available scale of this mapping, laboratory tested EC values were used to determine salt store, all of which were non-saline.

Hazard 6: Water Logging

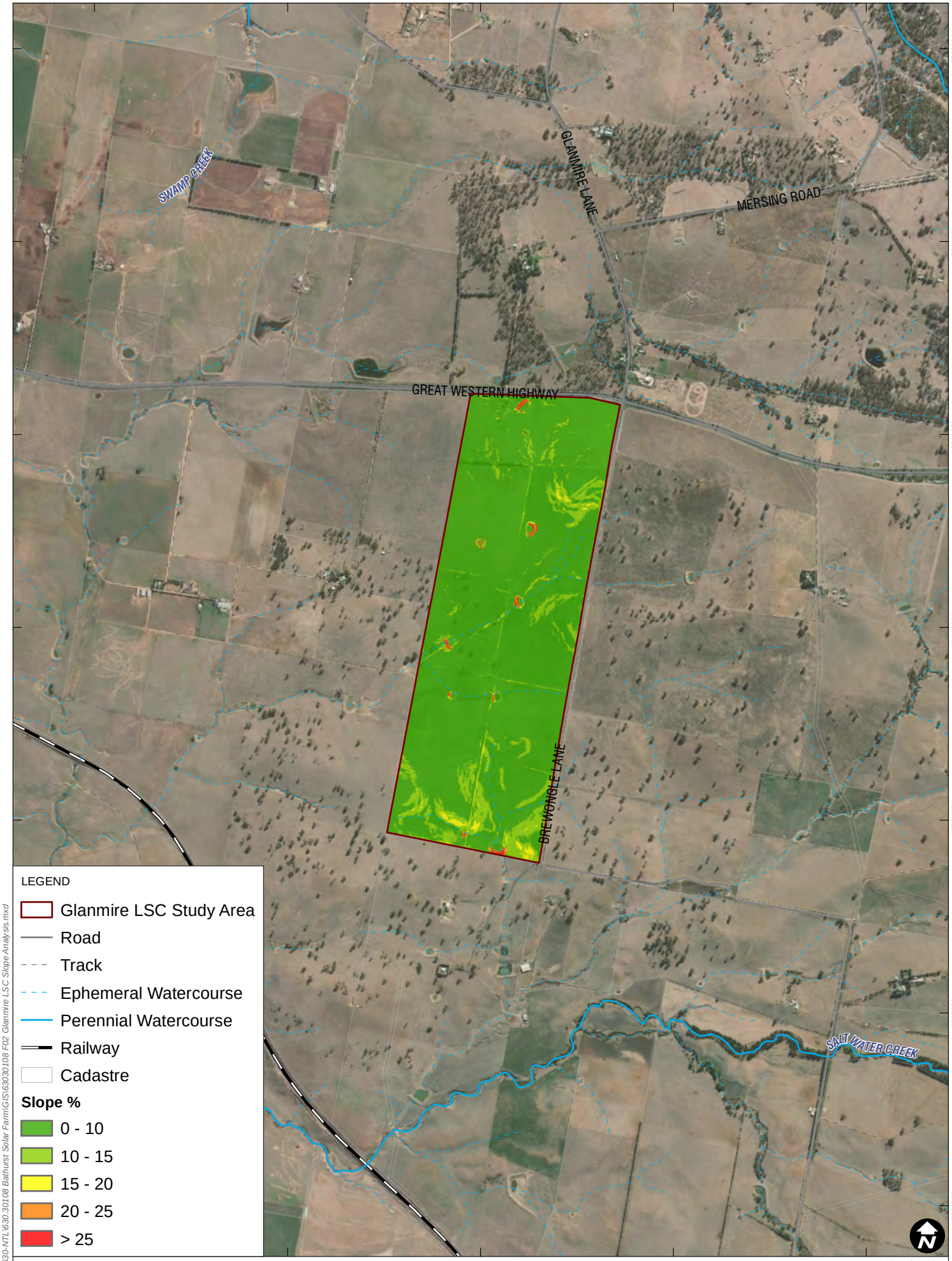
Water logging was determined by the soils drainage characteristics, specifically field sample evidence of mottling, soil texture attributes as well as slope and climate. Seasonal water logging, as indicated by strong mottling, was one of the major limitations for the Subnatric Grey-Brown Sodosol.

Hazard 7: Shallow Soils and Rockiness

The shallow soils and rockiness hazard is determined by an estimated exposure of rocky outcrops and average soil depth.

Hazard 8: Mass Movement

The mass movement hazard is assessed through a combination of three criteria; mean annual rainfall, presence of mass movement and slope class.



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Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 09-Feb-2021
Project Number: 630.30108

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SLR

Slope Analysis

FIGURE 2

2.1.2 Risk Assessment

The soil survey was originally designed to meet the requirements for BSAL Verification and the *Interim Protocol*, a risk assessment was undertaken to determine the required survey density. The *Interim Protocol* states *"the proponent should undertake a risk assessment as this will influence the density of soil sampling required as explained in Section 9.6.1. The proposed activity on parts or all of the project area may be of low risk to agriculture and so may only require a sampling density of 1:100,000. Alternatively other areas may be at higher risk of impact and so should have a sampling density of 1:25,000."*

To identify the potential for a project to impact on agricultural resources and the appropriate level of soil survey required, an evaluation of risk to agricultural resources and enterprises has been undertaken. The risk assessment is based on the probability of occurrence and the consequence of the impact as described in the *Interim Protocol*. The potential impacts were assessed as:

- Level 5 – Very minor damage and minor impact to agricultural resources or industries. Probability: B – Likely, known to occur or it has happened. The risk matrix result was B5 which is considered a low risk. The Study Area requires an inspection density of 1:100,000.

Based on the Project only being temporary and having no permanent impact on the intrinsic properties of the soil, an inspection density of 1:100,000 was adopted across the Study Area.

2.1.3 Field Soil Survey

The field survey for the LSC Assessment was undertaken during November 2020 by SLR's Principal Agronomist Murray Fraser and overseen by SLR's Regional Rector Leader Rod Masters (CPSS-3).

To satisfy soil mapping requirements, although only a minimum of 3 sites were required, the field soil survey program comprised 14 described sites in total, as shown on **Figure 3**. A breakdown of the required soil survey density, as per *Interim Protocol* requirements, is provided in **Table 3**, which exceeds the requirements for an LSC Assessment.

Table 3 Assessment of Soil Survey Density

Category	LSC Study Area
Total Study Area Hectares	186
1:100,000 Survey Density Target	Minimum 3 Required Sites
Detailed Sites	8
Check Sites	6
Total Number Sites	**14**
Laboratory Analysed Sites	**4**

2.1.4 Soil Survey Observation Types

Soil profiles were assessed at 6 sites in accordance with the *Australian Soil and Land Survey Field Handbook* (NCST, 2009). Each soil-profile exposure was sampled with a hydraulic soil corer, either a depth of 1.2 metres, to equipment refusal, or to bedrock. Detailed soil profile morphological descriptions were prepared at all sites to record the information specified in *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012) Information was recorded for the major parameters specified in **Table 4**.

Global Positioning System (GPS) readings was taken for all sites where soil descriptions are recorded. Vegetation type, landform and aspect were also noted. Soil exposures from pits were photographed during field operations.

Table 4 Field Assessment Parameters

Descriptor	Application
Horizon depth	Weathering characteristics, soil development
Field colour	Permeability, susceptibility to dispersion/erosion
Field texture grade	Erodibility, hydraulic conductivity, moisture retention, root penetration
Boundary distinctness and shape	Erosional/dispositional status, textural grade
Consistence force	Structural stability, dispersion, ped formation
Structure pedality grade	Soil structure, root penetration, permeability, aeration
Structure ped and size	Soil structure, root penetration, permeability, aeration
Stones – amount and size	Water holding capacity, weathering status, erosional/depositional character
Roots – amount and size	Effective rooting depth, vegetative sustainability
Ants, termites, worms etc.	Biological mixing depth

A total of 14 sites were evaluated. Of the 14 sites, 6 sites were detailed sites and 8 sites were check sites. Check sites are mapping observations examined in sufficient detail to allocate the site to a specific soil type and map unit. For detailed sites, soil was collected from each major soil horizon (soil layer).

Soil samples from 4 detailed sites were utilised in the LSC Assessment laboratory testing program. Samples were analysed in order to classify Australian Soil Classification (ASC) (Isbell, 2002) soil taxonomic class and enable LSC classification.

Soil collected from each major soil horizon (soil layer) was sent to a National Association of Testing Authorities Australia (NATA) accredited laboratory (EAL Laboratories) for analysis. The selected physical and chemical laboratory analysis properties and their relevant application are listed in **Table 5**.

Table 5 Laboratory Analysis Parameters

Property	Application
Coarse Fragments (>2mm)	Soil workability; root development
Particle-Size Distribution (<2mm)	Determine fraction of clay, silt, fine sand and coarse sand; nutrient retention; exchange properties; erodibility; workability; permeability; sealing; drainage; interpretation of most other physical and chemical properties and soil qualities
Soil Reaction (pH)	Nutrient availability; nutrient fixation; toxicities (especially aluminium and manganese); liming; Sodicity; correlation with other soil properties
Electrical Conductivity (EC)	Appraisal of salinity hazard in soil substrates or groundwater; total soluble salts
Cation Exchange Capacity (CEC) & Exchangeable Cations	Nutrient status; calculation of exchangeable cations including sodium, calcium, magnesium, potassium and exchangeable sodium percentage (ESP); assessment of other physical and chemical properties, especially dispersivity, shrink – swell, water movement, aeration
Munsell Colour Chart (Munsell)	Drainage, oxidation, fertility, correlation with other physical, chemical and biological properties

Soil salinity in the samples from the detailed sites was determined through measurement of the electrical conductivity (EC) of soil:water (1:5) suspensions. These values were converted to the EC of a saturated extract (EC_e) based on soil texture in accordance with the *Interim Protocol*.

3 Soil Assessment

One soil map unit was identified within the Study Area, a Subnatric Grey-Brown Sodosol, and was mapped according to the dominant ASC soil type (**Figure 3**) using a combination of the soil survey and laboratory analysis results. This soil unit and the observation sites associated with each are shown below in **Table 6**.

A description of one detailed representative site from the mapped soil unit follows **Table 6**, with the remaining detailed soil profile descriptions shown in **Appendix B** and check site descriptions in **Appendix C**. Laboratory certificates of analysis are shown in **Appendix D**.

Table 6 Soil Units within Study Area

SMU	ASC Soil Type	Soil Type Group	Detailed Site	Check Site	Hectares
1	Subnatric Grey-Brown Sodosol	Dominant	BS1, BS2, BS3, BS4, BS6	C1 – C8	186
	Eutrophic Grey Chromosol	Sub-Dominant	BS5	Nil	
				Total	**186**

3.1 Soil Unit 1: Subnatric Grey-Brown Sodosol

Subnatric Grey Sodosol

Table 7 Summary Subnatric Grey Sodosol (Site BS2)

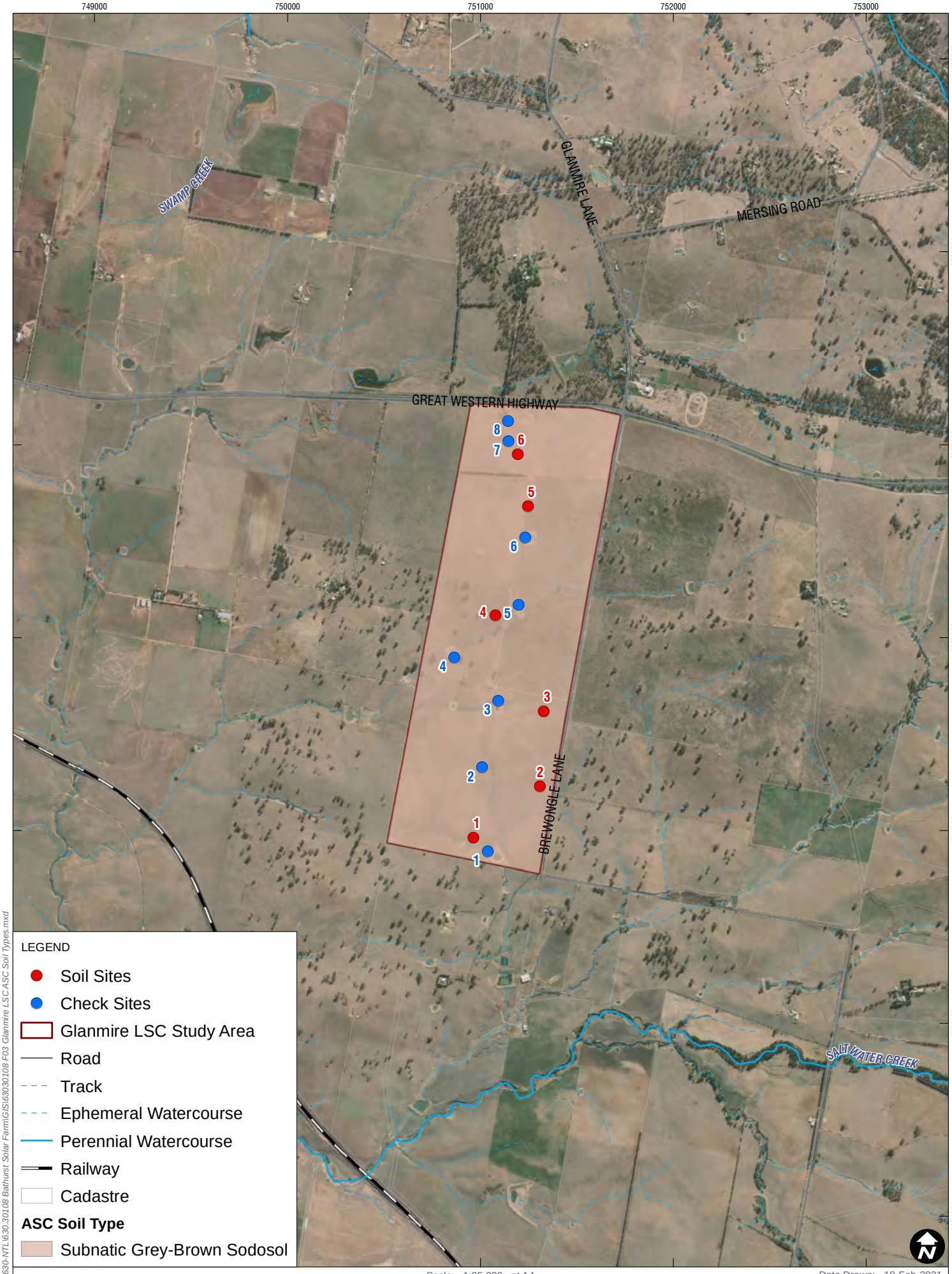
Overview	
Landscape Site BS2	
	
ASC Name	Subnatric Grey Sodosol
Representative Site	BS2
Other Mapped Sites	BS1, BS3, BS4, BS6
Survey Type	Detailed Lab
Dominant Topography	Lower Slope
Dominant Land Use	Fodder Cropping
Vegetation	Wheat Stubble
Inherent Soil Fertility	Moderately Low
Slope (%)	1
Surrounding Slope (%)	1-2
Aspect	South
LSC Class	4
Verified	Non-BSAL – Inherent Fertility, Poor Drainage & Sodicity

Table 8 Profile: Subnatric Grey Sodosol (Site BS2)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (10YR 3/3) loam, weak structure of 5-10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; 50% gravel content <5 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.15 – 0.30	Brown (10YR 5/3) bleached loam, weak structure of 5-10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; 40% gravel content <5 mm; nil segregations; well drained with a clear and even boundary. Sampled 0.20 – 0.30.
	B21 0.30 – 0.60	Grey (10YR 6/1) light clay, strong structure of 20-40 mm blocky peds with a rough fabric and moderate consistence. 30% distinct yellow mottling; 30% gravel content 5-10 mm; nil segregations; poorly drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B22 +0.60	Grey (5Y 6/1) medium clay, strong structure of >40 mm blocky peds with a rough fabric and moderate consistence. 30% distinct yellow mottling; 25% gravel content 5-10 mm; 10% hard manganese nodules <10 mm; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sample depth.

Table 9 Chemical Parameters: Subnatric Grey Sodosol (Site BS2)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.3	Strongly Acidic	4.7	Non-Sodic	0.6	Non-Saline	3.4	Ca Low
A2	5.9	Moderately Acidic	8.1	Marginally Sodic	0.2	Non-Saline	3.3	Ca Low
B21	7.2	Neutral	8.8	Marginally Sodic	0.4	Non-Saline	1.3	Ca Low
B22	7.7	Mildly Alkaline	17.2	Strongly Sodic	0.7	Non-Saline	0.7	Ca Deficient



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Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 10-Feb-2021
Project Number: 630.30108

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SLR

ASC Soil Types

FIGURE 3

4 Land & Soil Capability Assessment

All sites within the Study Area were classified as LSC Class 4, as listed in **Table 10**.The exception to these are all areas of greater than or equal to 10% slope which are classified as LSC Class 5, due to the presence of sodic subsoils (Hazard 1: Water Erosion).

Table 10 Land & Soil Capability Assessment

Site	Soil Type	Hazard Criteria								LSC
	ASC Great Group	1	2	3	4	5	6	7	8	
1	Brown Sodosol	3	4	3	4	2	4	1	1	**4**
2	Subnatric Grey Sodosol	3	4	3	4	2	4	1	1	**4**
3	Subnatric Grey Sodosol	3	4	3	3	2	4	1	1	**4**
4	Grey Sodosol	3	4	3	4	2	4	1	1	**4**
5	Eutrophic Grey Chromosol	3	4	3	4	2	4	1	1	**4**
6	Subnatric Brown Sodosol	3	4	3	4	2	4	1	1	**4**

Two LSC Classes were identified, dominated by 172 hectares of LSC Class 4 with the remaining 14 hectares LSC Class 5 (areas greater than or equal to 10% slope), and are summarised in **Table 11** and shown on **Figure 4**. The major assessment points are listed below.

LSC Class 4 is considered to have moderate agricultural capability with moderate to high limitations for high-impact land uses which restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. LSC Class 4 is associated with the Sodosol on areas of less than 10% slope and comprises 92% of the Study Area.

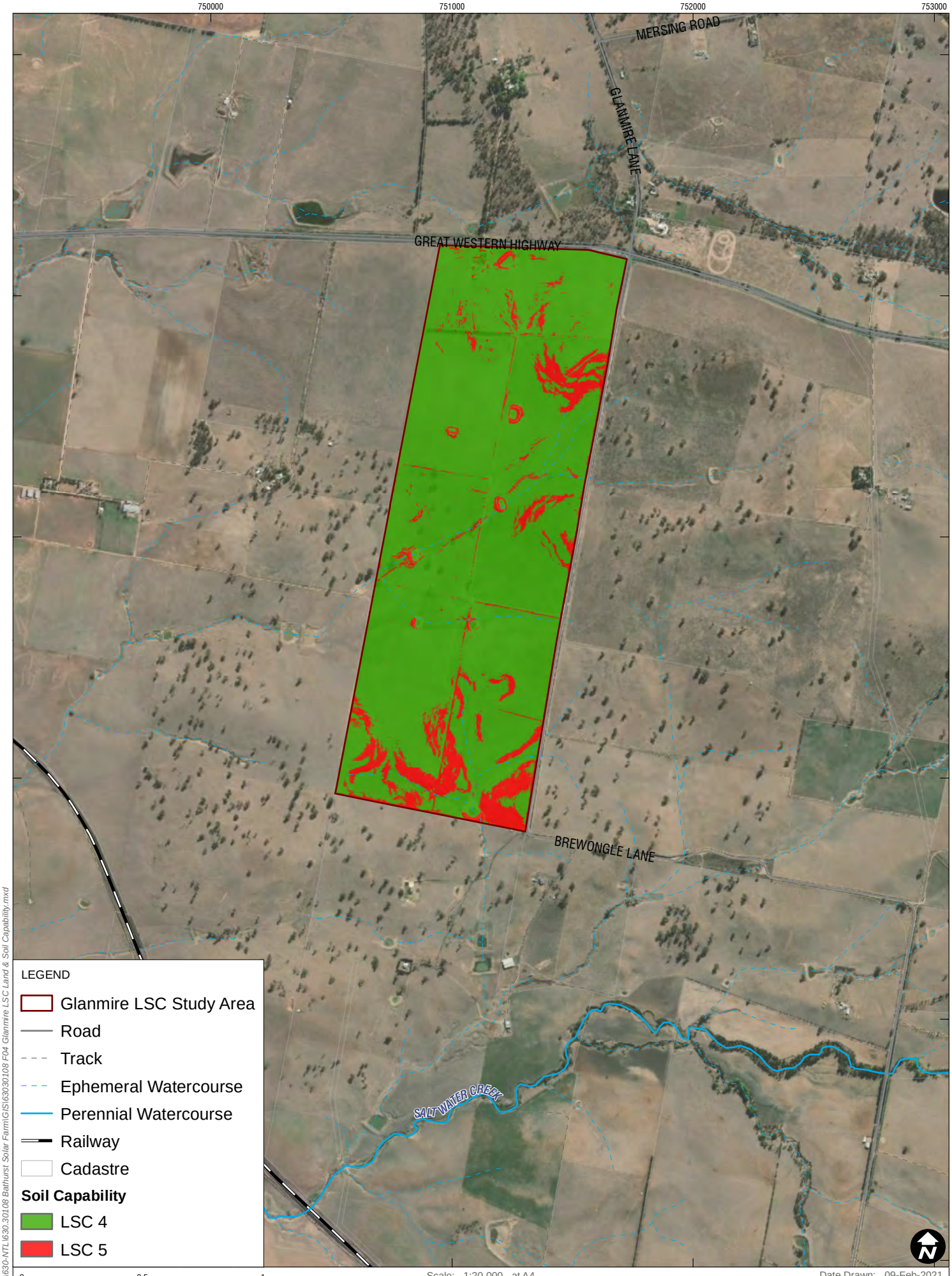
LSC Class 5 is considered to have moderate-low agricultural capability and has severe limitations for high impact land management uses such as cropping. This land is generally more suitable for grazing with some limitations or very occasional cultivation for pasture establishment. LSC Class 5 is associated with the Sodosols found on areas of greater than or equal to 10% slope and comprises 8% of the Study Area.

It should be noted that during the LSC Assessment the entire Study Area could have been classified as LSC Class 5 due to *Hazard 6: Water Logging*, however a conservative estimate was taken that the return period for waterlogging was “every 2 to 3 years” (LSC Class 4) rather than “every year” (LSC Class 5).

The entire Study Area is considered to have moderate to moderately low agricultural capability according to definitions given in *The Land and Soil Capability Assessment Scheme: Second Approximation* (OEH, 2012).

Table 11 Land and Soil Capability

LSC	Site	Soil Type	Limitation	Agricultural Capability Rating	Hectares
4	1, 2, 3, 4, 5, 6	Sodosol	Water Logging	Moderate	172
5	Slope >10%	Sodosol	Water Logging & Water Erosion	Moderately Low	14
				Total	**186**



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SLR

Land & Soil Capability

FIGURE 4

5 Conclusion

SLR Consulting has completed an LSC Assessment according to *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012) encompassing the proposed Glanmire Solar Farm, totalling 186 hectares.

The LSC Assessment found 172 hectares of LSC Class 4 (moderate capability land) and 14 hectares of LSC Class 5 (moderately low capability land) within the Study Area.

A previous BSAL assessment (SLR, 2021) found the entire Study Area (including a 100 metre buffer) is non-BSAL, comprising 24 hectares of BSAL exclusion area and one Soil Map Unit (a Subnatric Grey-Brown Sodosol), comprising the remaining 227 hectares. The Subnatric Grey-Brown Sodosol was verified as non-BSAL due to poor drainage and moderately low inherent fertility.

The Study Area is suited to grazing with occasional cultivation for the production of fodder crops and improved pastures. It is not considered highly productive agricultural land as defined in *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH 2012).

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SLR (2021) *Elgin Energy Glanmire Solar Farm Biophysical Strategic Agricultural Land Verification*

APPENDIX A

Slope Analysis Methodology

11th May 2021

Elgin Energy
Glanmire Solar Farm
LSC Assessment
SLR Slope Analysis Methodology

1. Acquire appropriate elevation information.

2. Load Contours into ArcMap 10.3

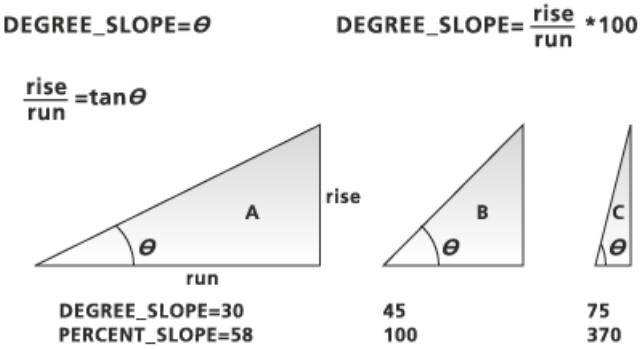
3. Using 3D Analyst Extension - Create a TIN Surface based on the contours (http://resources.arcgis.com/en/help/main/10.1/index.html#/Create_TIN/00q90000001v000000/)

4. Using 3D Analyst Extension – Run the Surface Slope Tool (http://resources.arcgis.com/en/help/main/10.1/index.html#//00q900000076000000) using a custom Break File (attached).

5. Using a Spatial Join, correlate the Surface Slope at the Soil Survey coordinates.

The Surface Slope Tool

Surface Slope creates an output polygon feature class containing polygons that classify an input TIN or terrain dataset by slope. The slope is the angle of inclination between the surface and a horizontal plane, which may be analysed in degrees or percent. Slope in degrees is given by calculating the arctangent of the ratio of the change in height (dZ) to the change in horizontal distance (dS), or slope = Arctan (dZ/dS). Percent slope is equal to the change in height divided by the change in horizontal distance multiplied by 100, or (dZ/dX) * 100.



The {**slope_field**} is the name of attribute field used to record the polygon aspect codes. Its default value is SlopeCode.

Each triangle is classified into a slope class. Contiguous triangles belonging to the same class are merged during the formation of output polygons. The {units} parameter can be set to use PERCENT or DEGREES. The default is PERCENT. The default percent slope class breaks are 1.00, 2.15, 4.64, 10.00, 21.50, 46.40, 100.00, 1000.00. Optionally, DEGREES may be used to classify slope. The default degree slope class breaks are 0.57, 1.43, 2.66, 5.71, 12.13, 24.89, 45.0, 90.0.

The {**class_breaks_table**} is used to define custom slope classes. The table can be either a TXT or DBF file for a Windows environment, and a DBF file in a UNIX environment. Each record in the table needs to contain two values that are used to represent the slope range of the class and its corresponding class code.

Table example:

break, code

10.0, 11

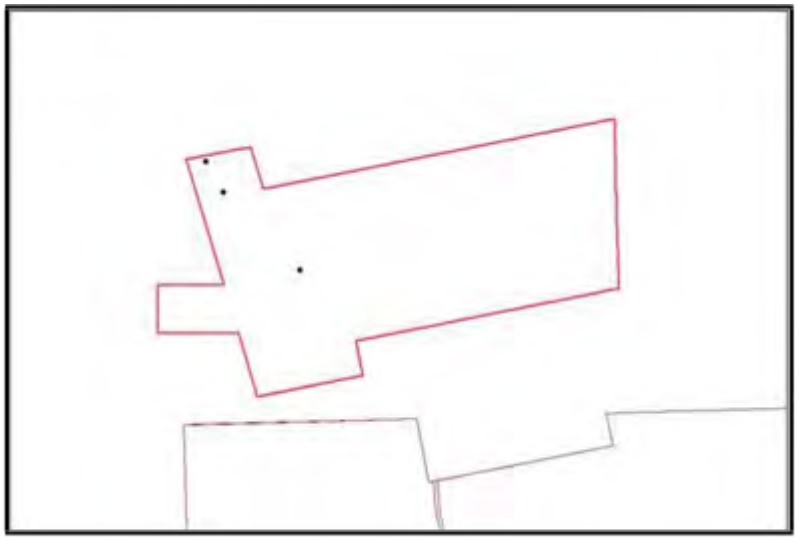
25.0, 22

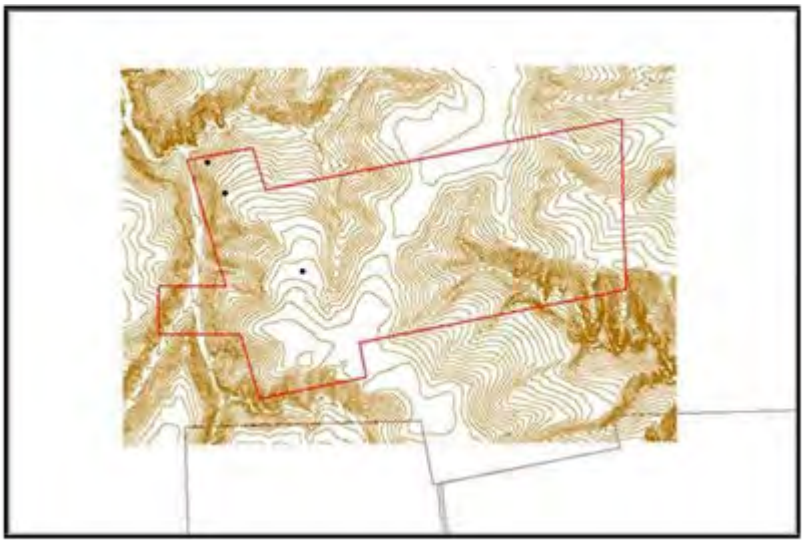
40.0, 33

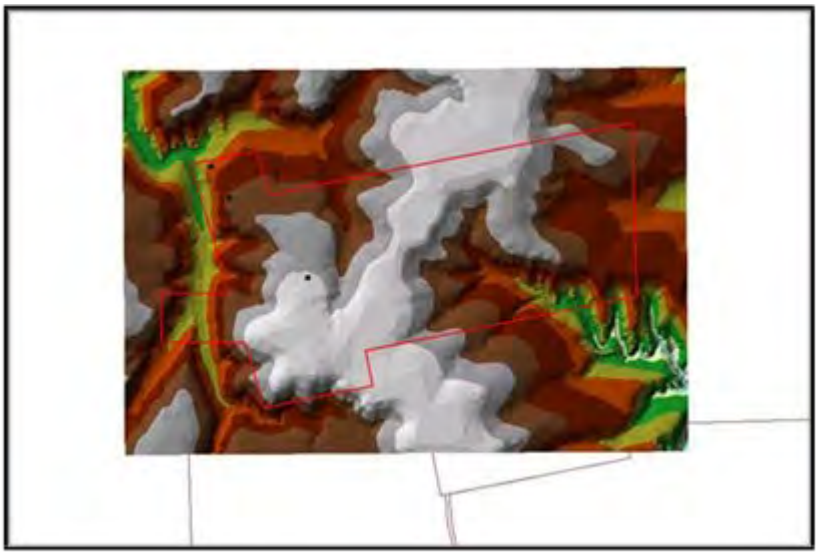
70.0, 44

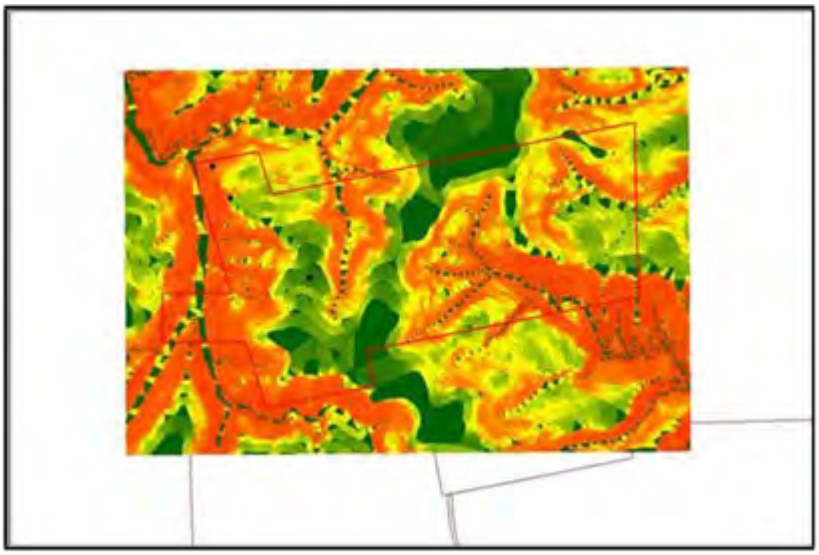
Note the comma delineation and use of decimals in the first field. Field names are needed but are ignored. The first field represents the breaks and values need to be decimal, the second field represents codes and values need to be integer. The units of the slope range are defined by the {units}. When this argument is not specified, the default classification is used.

And here is how we do it pictographically (example study shown):









APPENDIX B

Detailed Soil Profile Descriptions

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 1 Summary: Brown Sodosol (Site BS1)

Overview	
Landscape Site BS1	
	
ASC Name	Brown Sodosol
Representative Site	BS1
Other Mapped Sites	BS2, BS3, BS4, BS6
Survey Type	Detailed
Dominant Topography	Lower Slope
Dominant Land Use	Fodder Cropping
Vegetation	Wheat Stubble
Inherent Soil Fertility	Moderately Low
Slope (%)	19
Surrounding Slope (%)	<10
Aspect	South
LSC Class	4
Verified	Non-BSAL – Slope, Inherent Fertility & Poor Drainage

Table 2 Profile: Brown Sodosol (Site BS1)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (7.5YR 3/4) loam, weak structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 20% gravel content 5-10 mm; nil segregations; well drained with a clear and wavy boundary. Sampled 0.0 – 0.10.
	B21 0.15 – 0.50	Dark yellowish-brown (10YR 4/6) medium clay, strong structure of 20-40 mm blocky peds with a rough fabric and strong consistence. 30% distinct yellow mottling; <10% gravel content 5-10 mm; nil segregations; poorly drained with a gradual and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50.
	B22 +0.50	Greyish brown (2.5Y 5/2) heavy clay, strong structure of >40 mm blocky peds with a rough fabric and strong consistence. 30% distinct yellow mottling; 10% gravel content 5-10 mm; nil segregations; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 3 Field Parameters: Brown Sodosol (Site BS1)

Layer	Field pH		Field Dispersion	Field Effervescence
	Unit	Rating	Rating	Rating
A1	5.5	Strongly Acidic	Nil	Nil
B21	6.5	Slightly Acidic	High	Nil
B22	7.0	Neutral	High	Nil

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 4 Summary: Subnatric Grey Sodosol (Site BS3)

Overview	
Landscape Site BS3 	
ASC Name	Subnatric Grey Sodosol
Representative Site	BS3
Other Mapped Sites	BS1, BS2, BS4, BS6
Survey Type	Detailed Lab
Dominant Topography	Lower Slope
Dominant Land Use	Fodder Cropping
Vegetation	Wheat Stubble
Inherent Soil Fertility	Moderately Low
Slope (%)	1
Surrounding Slope (%)	1-2
Aspect	West
LSC Class	4
Verified	Non-BSAL – Inherent Fertility & Poor Drainage

Table 5 Profile: Subnatric Grey Sodosol (Site BS3)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark brown (7.5YR 3/2) loam, weak structure of 5-15 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 50% gravel content <10 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.20 – 0.40	Light brownish-grey (10YR 6/2) bleached loamy sand, weak structure of <10 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 50% gravel content <10 mm; nil segregations; well drained with a clear and even boundary. Sampled 0.20 – 0.30.
	B21 0.40 – 0.60	Light brownish-grey (2.5Y 6/2) clay loam, strong structure of 20-40 mm blocky peds with a rough fabric and moderate consistence. 20% distinct red mottling; 40% gravel content 5-10 mm; nil segregations; poorly drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B22 +0.60	Gray (2.5Y 6/1) heavy clay, strong structure of >40 mm blocky peds with a rough fabric and strong consistence. 30% distinct red mottling; 25% gravel content 5-10 mm; nil segregations; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 6 Chemical Parameters: Subnatric Grey Sodosol (Site BS3)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.6	Moderately Acidic	2.5	Non-Sodic	0.6	Non-Saline	3.7	Ca Low
A2	5.9	Moderately Acidic	5.4	Non-Sodic	0.5	Non-Saline	4.1	Balanced
B21	7.0	Neutral	8.4	Marginally Sodic	0.3	Non-Saline	1.6	Ca Low
B22	7.3	Neutral	12.3	Sodic	0.4	Non-Saline	0.9	Ca Deficient

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 7 Summary: Grey Sodosol (Site BS4)

Overview	
Landscape Site BS4 	
ASC Name	Grey Sodosol
Representative Site	BS4
Other Mapped Sites	BS1, BS2, BS3, BS6
Survey Type	Detailed
Dominant Topography	Lower Slope
Dominant Land Use	Fodder Cropping
Vegetation	Wheat Stubble
Inherent Soil Fertility	Moderately Low
Slope (%)	1
Surrounding Slope (%)	1-2
Aspect	South
LSC Class	4
Verified	Non-BSAL – Inherent Fertility & Poor Drainage

Table 8 Profile: Grey Sodosol (Site BS4)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.30	Very dark brown (7.5YR 2.5/2) loam, weak structure of 5-10 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 25% gravel content <10 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.30 – 0.50	Greyish brown (10YR 5/2) bleached loamy sand, weak structure of <10 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 40% gravel content <10 mm; nil segregations; well drained with a clear and even boundary. Sampled 0.30 – 0.40.
	B2 +0.50	Light brownish-grey (2.5Y 6/2) heavy clay, strong structure of >40 mm blocky peds with a rough fabric and strong consistence. 40% distinct yellow mottling; 10% gravel content 5-10 mm; nil segregations; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 9 Field Parameters: Grey Sodosol (Site BS4)

Layer	Field pH		Field Dispersion	Field Effervescence
	Unit	Rating	Rating	Rating
A1	6.0	Moderately Acidic	Nil	Nil
A2	6.0	Moderately Acidic	Nil	Nil
B2	7.0	Neutral	High	Nil

Soil Unit 1: Subnatric Grey-Brown Sodosol

Sub-Dominant Soil Type: Eutrophic Grey Chromosol

Table 10 Summary: Eutrophic Grey Chromosol (Site BS5)

Overview	
Landscape Site BS5	
	
ASC Name	Eutrophic Grey Chromosol
Representative Site	BS5
Other Mapped Sites	Nil
Survey Type	Detailed Lab
Dominant Topography	Midslope
Dominant Land Use	Fodder Cropping
Vegetation	Grazing Canola
Inherent Soil Fertility	Moderately High
Slope (%)	1
Surrounding Slope (%)	1-2
Aspect	South-East
LSC Class	4
Verified	Non-BSAL –Poor Drainage

Table 11 Profile: Eutrophic Grey Chromosol (Site BS5)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark brown (7.5YR 3/2) loamy sand, weak structure of 5-15 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 50% gravel content 5-10 mm; nil segregations; well drained with a clear and even boundary. Sampled 0.0- 0.10.
	A2 0.20 – 0.50	Light brownish-grey (10YR 6/2) bleached loamy sand, apedal structure with a sandy fabric and weak consistence. Nil mottling; 50% gravel content 5-10 mm; nil segregations; well drained with an abrupt and even boundary. Sampled 0.30 – 0.40.
	B21 +0.50	Light brownish-grey (2.5Y 6/2) clay loam, moderate structure of 10-30 mm blocky peds with a rough fabric and weak consistence. 20% distinct brown mottling; 60% gravel content 5-10 mm; nil segregations; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 12 Chemical Parameters: Eutrophic Grey Chromosol (Site BS5)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.1	Strongly Acidic	1.1	Non-Sodic	1.3	Non-Saline	6.0	Mg Low
A2	6.6	Neutral	3.7	Non-Sodic	0.4	Non-Saline	5.6	Balanced
B21	6.2	Slightly Acidic	2.9	Non-Sodic	0.2	Non-Saline	3.9	Ca Low

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 13 Summary: Subnatric Brown Sodosol (Site BS6)

Overview	
Landscape Site BS6 	
ASC Name	Subnatric Brown Sodosol
Representative Site	BS6
Other Mapped Sites	BS1, BS2, BS3, BS4
Survey Type	Detailed Lab
Dominant Topography	Upper Slope
Dominant Land Use	Grazing
Vegetation	Saffron Thistle, Paterson's Curse
Inherent Soil Fertility	Moderately Low
Slope (%)	1
Surrounding Slope (%)	1-2
Aspect	North-East
LSC Class	4
Verified	Non-BSAL – Inherent Fertility & Poor Drainage

Table 14 Profile: Subnatric Brown Sodosol (Site BS6)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Very dark brown (7.5YR 2.5/3) loam, weak structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 50% gravel content <5 mm; nil segregations; well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10.
	A2 0.10 – 0.20	Dark yellowish-brown (10YR 4/4) bleached loam, weak structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 40% gravel content <5 mm; nil segregations; well drained with a clear and wavy boundary. Sampled 0.10 – 0.20.
	B21 0.20 – 0.50	Dark yellowish-brown (10YR 4/4) heavy clay, strong structure of 20-40 mm blocky peds with a rough fabric and strong consistence. 30% distinct yellow mottling; 10% gravel content 5-10 mm; nil segregations; poorly drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B22 +0.50	Dark grey (2.5Y 4/1) heavy clay, strong structure of >40 mm blocky peds with a rough fabric and strong consistence. 40% distinct yellow mottling; 20% gravel content 5-10 mm; nil segregations; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 15 Chemical Parameters: Subnatric Brown Sodosol (Site BS6)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.4	Strongly Acidic	1.9	Non-Sodic	0.7	Non-Saline	3.0	Ca Low
A2	6.2	Slightly Acidic	2.4	Non-Sodic	0.3	Non-Saline	1.8	Ca Low
B21	6.1	Slightly Acidic	7.1	Marginally Sodic	0.5	Non-Saline	0.7	Ca Deficient
B22	8.2	Moderately Alkaline	10.0	Sodic	0.8	Non-Saline	0.7	Ca Deficient

APPENDIX C

Check Site Descriptions

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 1 Site C1 Grey Sodosol

Profile	Horizon	Description
	B2	Pale brown (10YR 6/3) heavy clay, strong structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C1
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Lower Slope
Dominant Land Use	Dam Bank
Vegetation	Nil
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Neutral

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 2 Site C2 Brown Sodosol

Profile	Horizon	Description
	B2	Yellowish brown (10YR 5/4) medium clay, strong structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C2
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Mid Slope
Dominant Land Use	Stock Laneway
Vegetation	Nil
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Mildly Alkaline

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 3 Site C3 Brown Sodosol

Profile	Horizon	Description
	B2	Yellowish brown (10YR 5/6) light-medium clay, strong structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C3
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Midslope
Dominant Land Use	Dam Inflow
Vegetation	Nil
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Slightly Acidic

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 4 Site C4 Brown Sodosol

Profile	Horizon	Description
	B2	Brown (7.5YR 5/4) light-medium clay, strong structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C4
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Midslope
Dominant Land Use	Dam Inflow
Vegetation	Nil
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Neutral

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 5 Site C5 Grey Sodosol

Profile	Horizon	Description
	B2	Light brown (10YR 6/3) light-medium clay, moderate structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C5
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Lower Slope
Dominant Land Use	Dam Inflow
Vegetation	Grazing Canola
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Neutral

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 6 Site C6 Brown Sodosol

Profile	Horizon	Description
	B2	Brown (10YR 5/6) light-medium clay, moderate structure. Moderate field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C6
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Midslope
Dominant Land Use	Dam Inflow
Vegetation	Nil
Inherent Soil Fertility	Moderately Low
Field Dispersion	Moderate
Field pH	Neutral

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 7 Site C7 Brown Sodosol

Profile	Horizon	Description
	B2	Strong brown (7.5YR 5/8) light-medium clay, moderate structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C7
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Upper Slope
Dominant Land Use	Stock Laneway
Vegetation	Grass Pasture
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Mildly Alkaline

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 8 Site C8 Brown Sodosol

Profile	Horizon	Description
	B2	Brown (10YR 4/4) light clay, moderate structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C8
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Upper Slope
Dominant Land Use	Stock Laneway
Vegetation	Grass Pasture
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Neutral

APPENDIX D

Laboratory Certificate of Analysis

Environmental Analysis Laboratory

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AGRICULTURAL SOIL ANALYSIS REPORT

15 samples supplied by SLR Consulting Australia Pty Ltd on 30/11/2020. Lab Job No.K1174
Analysis requested by Murray Fraser. Your Job: PO: SLR 630 30108; Bathurst Solar
10 Kings Road NEW LAMBTON NSW 2305

			Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
		Sample ID:	BS 2 0-10	BS 2 20-30	BS 2 40-50	BS 2 65-75	BS 3 0-10	BS 3 20-30
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Elgin	Elgin	Elgin	Elgin	Elgin	Elgin
	Parameter	Method reference	K1174/1	K1174/2	K1174/3	K1174/4	K1174/5	K1174/6
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.30	5.90	7.21	7.69	5.59	5.86
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.068	0.018	0.043	0.091	0.067	0.021
		(cmol$_+$/kg)	1.7	0.85	3.4	4.3	2.5	1.1
	Exchangeable Calcium	(kg/ha)	751	383	1,545	1,937	1,132	502
		(mg/kg)	335	171	690	865	505	224
		(cmol$_+$/kg)	0.49	0.26	2.6	5.9	0.69	0.27
	Exchangeable Magnesium	(kg/ha)	132	71	719	1,611	187	74
		(mg/kg)	59	32	321	719	83	33
		(cmol$_+$/kg)	0.36	<0.12	0.25	0.23	0.28	<0.12
	Exchangeable Potassium	(kg/ha)	312	<112	221	199	247	<112
		(mg/kg)	139	<50	99	89	110	<50
		(cmol$_+$/kg)	0.15	0.12	0.61	2.2	0.10	0.09
	Exchangeable Sodium	(kg/ha)	75	61	315	1,119	50	47
		(mg/kg)	33	27	141	500	22	21
		(cmol$_+$/kg)	0.19	0.06	0.01	0.01	0.04	0.05
	Exchangeable Aluminium	(kg/ha)	37	12	2.5	2.6	8.5	11
		(mg/kg)	17	5.2	1.1	1.2	3.8	4.8
		(cmol$_+$/kg)	0.23	0.09	<0.01	<0.01	0.17	0.05
	Exchangeable Hydrogen	(kg/ha)	5.1	2.1	<1	<1	3.8	1.2
		(mg/kg)	2.3	<1	<1	<1	1.7	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	3.1	1.5	7.0	13	3.8	1.7
	Calcium (%)		54	59	49	34	66	66
	Magnesium (%)		16	18	38	47	18	16
	Potassium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	12	5.1	3.6	1.8	7.4	6.2
	Sodium - ESP (%)		4.7	8.1	8.8	17	2.5	5.4
	Aluminium (%)		6.0	4.0	0.18	0.10	1.1	3.2
	Hydrogen (%)		7.4	6.3	0.00	0.00	4.5	3.1
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.4	3.3	1.3	0.73	3.7	4.1
	pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	4.64	5.04	6.06	6.42	4.95	4.97
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10 YR 3/3 Dark Brown	10 YR 5/3 Brown	10 YR 6/1 Gray	5 Y 6/1 Gray	7.5 YR 3/2 Dark Brown	10 YR 6/2 Light Brownish Gray
	Mottles Munsell Colour		..	..	7.5 YR 5/8 Strong Brown	7.5 YR 6/8 Reddish Yellow	..	..
	Degree of Mottling (%)		..	..	30	80	..	..

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Analysis requested by Murray Fraser. Your Job: PO: SLR 630 30108; Bathurst Solar
10 Kings Road NEW LAMBTON NSW 2305

			Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12
		Sample ID:	BS 3 40-50	BS 3 65-75	BS 5 0-10	BS 5 30-40	BS 5 65-75	BS 6 0-10
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Elgin	Elgin	Elgin	Elgin	Elgin	Elgin
	Parameter	Method reference	K1174/7	K1174/8	K1174/9	K1174/10	K1174/11	K1174/12
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.98	7.25	5.09	6.61	6.22	5.40
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.030	0.076	0.057	0.016	0.020	0.072
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.9	5.1	2.0	0.55	2.4	2.6
	Exchangeable Calcium (kg/ha)		1,308	2,307	881	247	1,099	1,170
	Exchangeable Calcium (mg/kg)		584	1,030	393	110	491	522
	Exchangeable Magnesium (cmol$_+$/kg)		1.8	5.5	0.33	0.10	0.63	0.87
	Exchangeable Magnesium (kg/ha)		486	1,500	89	27	172	238
	Exchangeable Magnesium (mg/kg)		217	670	40	12	77	106
	Exchangeable Potassium (cmol$_+$/kg)		0.12	0.20	0.25	<0.12	0.17	0.58
	Exchangeable Potassium (kg/ha)		<112	178	219	<112	146	511
	Exchangeable Potassium (mg/kg)		<50	79	98	<50	65	228
	Exchangeable Sodium (cmol$_+$/kg)		0.44	1.5	<0.065	<0.065	0.10	0.09
	Exchangeable Sodium (kg/ha)		228	785	<33	<33	51	44
	Exchangeable Sodium (mg/kg)		102	350	<15	<15	23	20
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.01	0.08	<0.01	0.03	0.15
	Exchangeable Aluminium (kg/ha)		3.3	2.5	16	1.7	6.3	29
	Exchangeable Aluminium (mg/kg)		1.5	1.1	7.2	<1	2.8	13
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.16	<0.01	0.08	0.20
	Exchangeable Hydrogen (kg/ha)		<1	<1	3.6	<1	1.9	4.4
	Exchangeable Hydrogen (mg/kg)		<1	<1	1.6	<1	<1	2.0
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	5.3	12	2.8	0.82	3.5	4.5
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	55	41	69	67	71	58
	Magnesium (%)		34	44	12	12	18	19
	Potassium (%)		2.3	1.6	8.8	13	4.8	13
	Sodium - ESP (%)		8.4	12	1.8	6.2	2.9	1.9
	Aluminium (%)		0.31	0.10	2.8	1.0	0.90	3.2
	Hydrogen (%)		0.00	0.00	5.7	0.00	2.4	4.4
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.6	0.93	6.0	5.6	3.9	3.0
	pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.68	6.00	4.50	5.90	5.26	4.58
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	2.5 Y 6/2 Light Brownish Gray	2.5 Y 6/1 Gray	7.5 YR 3/2 Dark Brown	10 YR 6/2 Light Brownish Gray	2.5 Y 6/2 Light Brownish Gray	7.5 YR 2.5/3 Very Dark Brown
	Mottles Munsell Colour		10 YR 5/6 Yellowish Brown	2.5 YR 4/8 Red	..	..	..	..
	Degree of Mottling (%)		10	60	..	..	..	..

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10 Kings Road NEW LAMBTON NSW 2305

	Parameter		Method reference	Sample 13	Sample 14	Sample 15	*Heavy Soil*	*Medium Soil*	*Light Soil*	*Sandy Soil*
	Sample ID:			BS 6 20-30	BS 6 40-50	BS 6 65-75				
	Crop:			Soil	Soil	Soil				
	Client:			Elgin	Elgin	Elgin	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
				K1174/13	K1174/14	K1174/15	Indicative guidelines - refer to Notes 6 and 8			
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.19	6.07	8.23	*6.5*	*6.5*	*6.3*	*6.3*
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.032	0.084	0.134	*0.200*	*0.150*	*0.120*	*0.100*
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.1	6.5	8.4	*15.6*	*10.8*	*5.0*	*1.9*
		(kg/ha)		959	2,900	3,774	*7000*	*4816*	*2240*	*840*
		(mg/kg)		428	1,295	1,685	*3125*	*2150*	*1000*	*375*
	Exchangeable Magnesium	(cmol$_+$/kg)		1.2	9.0	12	*2.4*	*1.7*	*1.2*	*0.60*
		(kg/ha)		317	2,451	3,235	*650*	*448*	*325*	*168*
		(mg/kg)		142	1,094	1,444	*290*	*200*	*145*	*75*
	Exchangeable Potassium	(cmol$_+$/kg)		0.40	0.60	0.42	*0.60*	*0.50*	*0.40*	*0.30*
		(kg/ha)		351	530	369	*526*	*426*	*336*	*224*
		(mg/kg)		157	236	165	*235*	*190*	*150*	*100*
	Exchangeable Sodium	(cmol$_+$/kg)		0.09	1.3	2.3	*0.3*	*0.26*	*0.22*	*0.11*
		(kg/ha)		48	655	1,192	*155*	*134*	*113*	*57*
		(mg/kg)		21	292	532	*69*	*60*	*51*	*25*
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.03	0.27	0.01	*0.6*	*0.5*	*0.4*	*0.2*
		(kg/ha)		5.6	54	2.5	*121*	*101*	*73*	*30*
		(mg/kg)		2.5	24	1.1	*54*	*45*	*32*	*14*
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.03	0.25	<0.01	*0.6*	*0.5*	*0.4*	*0.2*
		(kg/ha)		<1	5.5	<1	*13*	*11*	*8*	*3*
		(mg/kg)		<1	2.5	<1	*6*	*5*	*4*	*2*
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	3.9	18	23	*20.1*	*14.3*	*7.8*	*3.3*
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	55	36	36	*77.6*	*75.7*	*65.6*	*57.4*
	Magnesium (%)			30	50	52	*11.9*	*11.9*	*15.7*	*18.1*
	Potassium (%)			10	3.4	1.8	*3.0*	*3.5*	*5.2*	*9.1*
	Sodium - ESP (%)			2.4	7.1	10	*1.5*	*1.8*	*2.9*	*3.3*
	Aluminium (%)			0.72	1.5	0.05	*6.0*	*7.1*	*10.5*	*12.1*
	Hydrogen (%)			0.75	1.4	0.00				
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.8	0.72	0.71	*6.5*	*6.4*	*4.2*	*3.2*
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.27	4.98	7.09	..			
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	10 YR 4/4	10 YR 4/4	2.5 Y 4/1	..			
				Dark Yellowish Brown	Dark Yellowish Brown	Dark Gray	..			
	Mottles Munsell Colour			..	2.5 YR 3/6	7.5 YR 5/8	..			
				..	Dark Red	Strong Brown	..			
	Degree of Mottling (%)			..	50	5	..			

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

15 soil samples supplied by SLR Consulting Pty Ltd on 30 November, 2020 - Lab Job No. K1174.
Analysis requested by Murray Fraser. Your Project: PO SLR 630 30108 Bathurst Solar
10 Kings Road NEW LAMBTON NSW 2305

SAMPLE ID	Lab Code	MOISTURE CONTENT (% of water in air-dry sample)	TOTAL GRAVEL > 2 mm (% of total oven-dry equivalent)	COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent)	FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent)	SILT 2-20 µm ISSS (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)	Total soil fractions (incl. Gravel)
BS 2 0-10	K1174/1	15.0%	51.1%	2.5%	30.5%	9.3%	6.6%	100.0%
BS 2 20-30	K1174/2	8.0%	46.8%	2.0%	34.7%	9.5%	6.9%	100.0%
BS 2 40-50	K1174/3	8.4%	31.4%	5.6%	29.7%	7.1%	26.3%	100.0%
BS 2 65-75	K1174/4	13.7%	24.9%	15.0%	16.2%	9.6%	34.3%	100.0%
BS 3 0-10	K1174/5	14.1%	46.7%	2.5%	34.9%	9.3%	6.5%	100.0%
BS 3 20-30	K1174/6	7.5%	50.1%	2.4%	33.2%	9.9%	4.4%	100.0%
BS 3 40-50	K1174/7	8.3%	42.3%	1.8%	24.6%	10.3%	20.9%	100.0%
BS 3 65-75	K1174/8	17.0%	23.9%	1.0%	21.5%	11.1%	42.4%	100.0%
BS 5 0-10	K1174/9	10.9%	50.5%	1.4%	35.1%	9.0%	4.0%	100.0%
BS 5 30-40	K1174/10	4.3%	54.4%	1.1%	32.5%	11.2%	0.8%	100.0%
BS 5 65-75	K1174/11	6.5%	56.9%	1.7%	23.1%	7.7%	10.5%	100.0%
BS 6 0-10	K1174/12	17.9%	47.7%	3.5%	32.3%	8.5%	8.1%	100.0%
BS 6 20-30	K1174/13	5.0%	40.1%	5.8%	31.4%	11.1%	11.7%	100.0%
BS 6 40-50	K1174/14	20.9%	13.1%	0.7%	15.2%	8.5%	62.5%	100.0%
BS 6 65-75	K1174/15	16.5%	17.1%	0.6%	25.1%	8.4%	48.9%	100.0%

Note:

1: The Hydrometer Analysis method was used to determine the percentage sand, silt and clay,
modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986),
in *Methods of Soil Analysis. Part 1* Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.

2: Australian Standard 1289.3.8.1-1997 (see attached)

3. Analysis conducted between sample arrival date and reporting date.

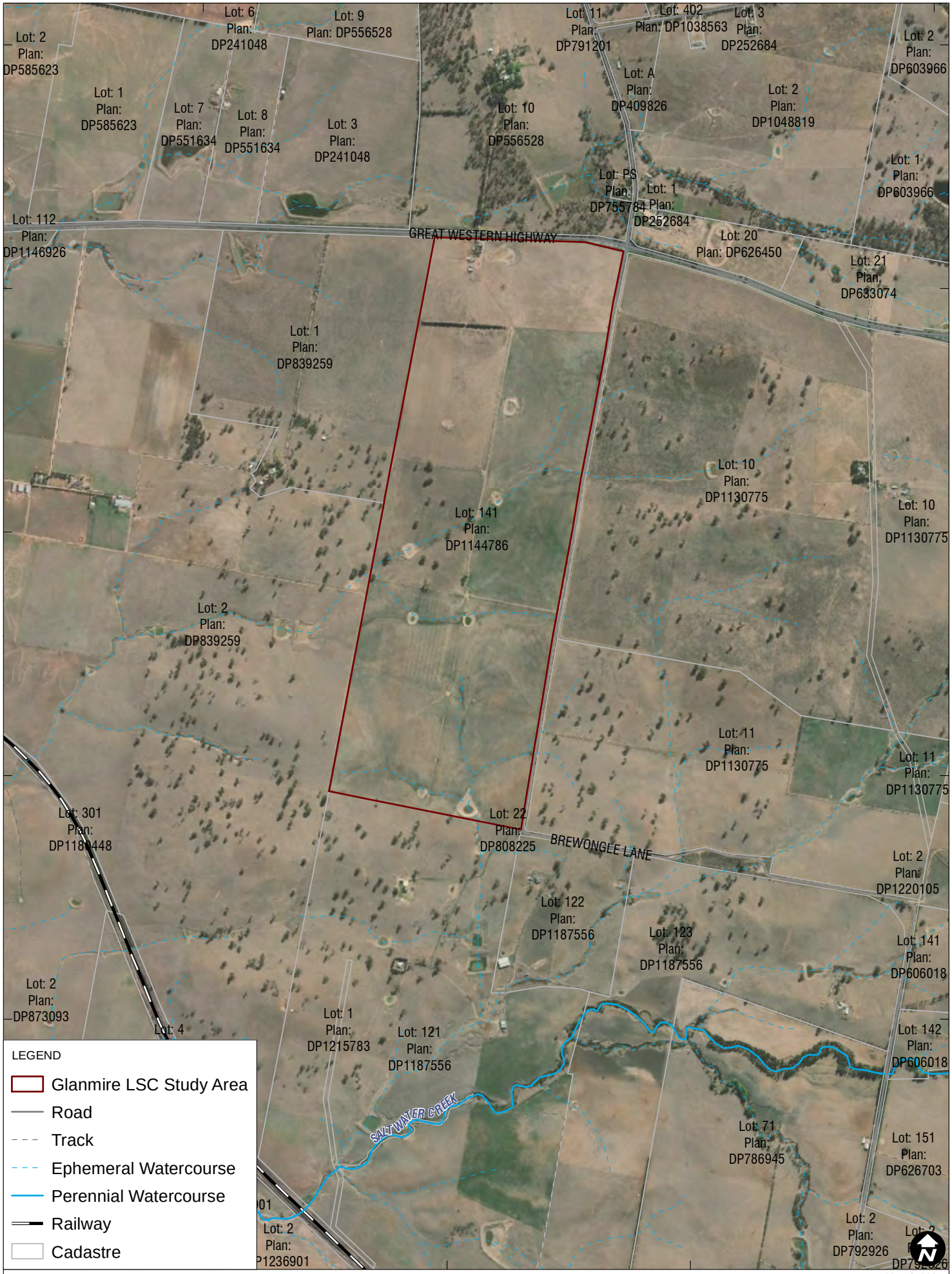
4. This report is not to be reproduced except in full.

5. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions.
These Terms and Conditions are available on the EAL website: scu.edu.au/eal, or on request.

6. This report was issued on 09/12/2020.

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager



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Project Number: 630.30108

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SLR

Lot and Plan Number

FIGURE A

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Appendix B

BIOPHYSICAL STRATEGIC AGRICULTURAL LAND

GLANMIRE SOLAR FARM

Biophysical Strategic Agricultural Land Verification

Prepared for:

Elgin Energy

SLR Ref: 630.30108
Version No: v1.0 Final
May 2021

PREPARED BY

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Elgin Energy (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.30108 BSAL	May 2021	Murray Fraser	Rod Masters	Rod Masters

CONTENTS

CONTENTS

DOCUMENT REFERENCES

TABLES

FIGURES

APPENDICES

1 Introduction

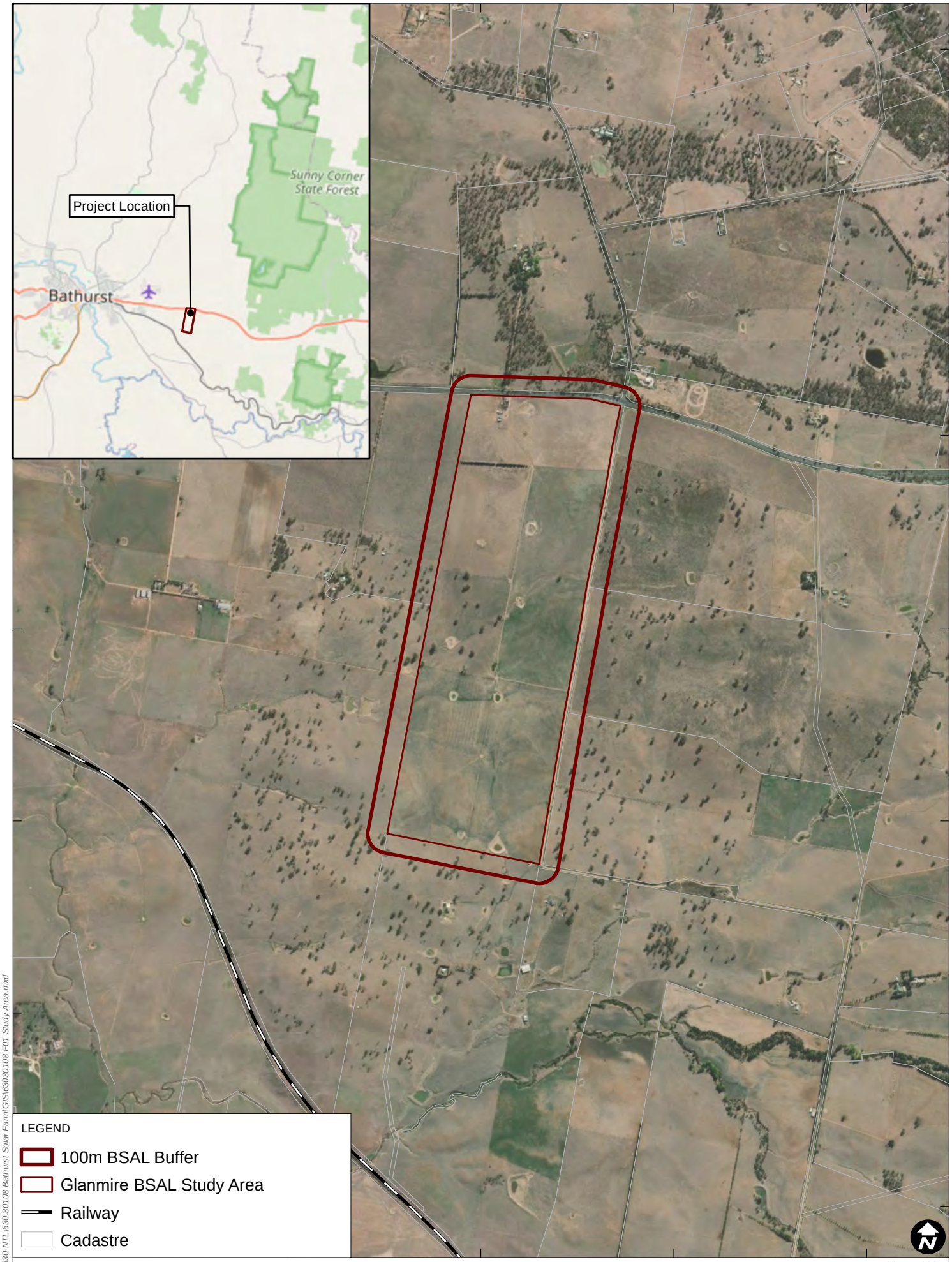
SLR has been commissioned by Elgin Energy to complete a Biophysical Strategic Agricultural Land (BSAL) Assessment for the Glanmire Solar Farm Project (the Project). The purpose of this BSAL assessment is to form part of the site due diligence and ultimately inform any Environmental Impact Statement (EIS) for the Project in support of a development application, to be submitted under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (NSW Department of Planning and Environment (DP&E), 1979).

1.1 Background

Elgin Energy is a leading international solar developer with operations in Australia, UK, and Ireland. To date, Elgin have delivered 21 projects including the largest operational solar farms in Scotland (13MW) and Northern Ireland (46MW)

Elgin Energy are proposing to develop the Glanmire Solar Farm at 4823 Great Western Highway, Glanmire, NSW 2795. This site is located approximately 11 kilometres east of the township of Bathurst and approximately 4.5 kilometres east of Raglan. A Region Locality and Study Area Plan is provided at **Figure 1** for reference. The site has a total area of approximately 186 hectares and is currently used for grazing and for intermittent cropping. The general area comprises a range of farming properties and rural living properties.

The project will cover a development footprint of approximately 140 hectares and comprise single axis tracking solar photovoltaic technology laid out in north south rows and will also include ancillary infrastructure such as inverters, connection equipment and energy storage equipment.



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Date Drawn: 22-Jan-2021
Project Number: 630.30108

Data Source: © OpenStreetMap contributors

SLR

Study Area

FIGURE 1

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1.2 Objective

The objective was to conduct a BSAL assessment for an area of land proposed for the Project, to support a Site Verification Certificate application if no BSAL is identified and support any EIS/Development Application for the project.

1.3 Scope of Work

The BSAL Verification Assessment includes:

- Detailed assessment of the site and soil characteristics as per the requirements of the *Interim Protocol*;
- Completion of field work to obtain required level of field samples in accordance with any relevant guidelines (*Interim Protocol* and Land & Soil Capability);
- The assessment should identify areas of the Project Area that may be considered BSAL or otherwise including mapping at the appropriate scale;
- Documentation of the results of the detailed assessment comprising of a written report and associated mapping to address specific items in the *Interim Protocol*; and
- Submission of on-line soil profile data to eDIRT and GIS data package in accordance with the *Interim Protocol*.

1.4 Study Area

Elgin Energy requires a BSAL Assessment for the Area of Interest (the Study Area) as shown in **Figure 1**, to support the Project. **Table 1** shows the area requiring additional soil survey for BSAL Study Area.

Table 1 Study Area

Assessment Component	Hectares
BSAL Verification Area	186
100 Metre Buffer	65
Total BSAL Investigation Area	**251**

1.5 Legislation and Standards

The Large-Scale Solar Energy Guideline (LSSEG) for State Significant Development was issued in December 2018 by the NSW Government (NSW Government, 2018). The guideline provides the community, industry, applicants and regulators with general guidance on the planning framework for the assessment and determination of State Significant large-scale energy projects under the Environmental Planning and Assessment Act 1979. Under Section 4 of the LSSEG one of the key site constraints identified for site selection is agriculture including BSAL and land and soil capability.

The *State Environment Planning Policy (Mining, Petroleum Production and Extractive Industries) Amendment 2013* (the 2013 Mining SEPP amendment) requires certain types of developments to verify whether the proposed site is on BSAL. In April 2013, the *Interim Protocol* (NSW Office of Environment and Heritage, 2013) was released by the NSW Government. The *Interim Protocol* outlines the process for seeking verification of whether or not land mapped as BSAL meets the established BSAL criteria. The purpose of the Interim Protocol is to assist proponents and landholders to understand what is required to identify the existence of BSAL. It outlines the technical requirements for the on-site identification and mapping of BSAL.

BSAL is land with a rare combination of natural resources highly suitable for agriculture. These lands intrinsically have the best quality landforms, soil and water resources which are naturally capable of sustaining high levels of productivity and require minimal management practices to maintain this high quality.

The criteria used to measure BSAL under the original SRLUP were based on three parameters:

1. Soil Fertility – based on the Draft Inherent General Fertility of NSW;
2. Land and Soil Capability – based on Land and Soil Capability Mapping of NSW; and
3. Access to reliable water supply.

The Strategic Regional Land Use Plans (SRLUP) for the Upper Hunter and New England North West was released by the NSW Government in September 2012. The BSAL mapping for the remainder of the State was released in January 2014. The SRLUPs represent the Government's proposed framework to support growth, protect the environment and respond to competing land uses, whilst preserving key regional values over the next 20 years.

2 Methodology

The site verification methodology for the Study Area has been undertaken consistent with the process described within the *Interim Protocol*; including the following steps:

1. Identify the project area (termed Study Area in this report) which will be assessed for BSAL;
2. Confirm access to a reliable water supply;
3. Choose the appropriate approach to map the soils information;
4. Undertake a risk assessment; and
5. Undertake field Soil Surveys and BSAL Assessment.

Each of these steps is described in further detail in the following subsections.

2.1.1 Step 1: Identify the Project Area which will be Assessed for BSAL

The *Interim Protocol* requires that *"the assessment area should include the entire project area and include at least a 100 metre buffer to take into account minor changes in design, surrounding disturbance and minor expansion. If BSAL is part of a larger contiguous mass of BSAL then the boundary of this area must also be identified."*

The Study Area for the BSAL Verification Assessment is shown in **Figure 1**. The Study Area includes a 100 metre buffer surrounding the Study Area.

2.1.2 Step 2: Confirm Access to a Reliable Water Supply

The *Interim Protocol* requires that *"BSAL lands must have access to a 'reliable water supply'",* which includes rainfall of 350 millimetres (mm) or more per annum in 9 out of 10 years.

The Project is located near Bathurst in the Central West, with an annual average rainfall of 635 millimetres (BOM, 2021), therefore the Study Area has access to a "reliable water supply".

2.1.3 Step 3: Choose the Appropriate Approach to Map the Soils Information

The *Interim Protocol* states *"access to the project area will define the level of investigation that the proponent can undertake. If the proponent has access to the land then the BSAL verification requirements for on-site soils assessment as described in sections 6 and 9 of the Interim Protocol should be met. If the proponent does not have access then the proponent should develop a model of soils distribution guided by sections 6 and 9 based on landscape characteristics using the information listed in Section 5 of the Interim Protocol."*

Some assessment sites were relocated away from drainage lines with the revised locations selected to be still representative of the surrounding soil unit for mapping and assessment purposes.

2.1.4 Step 4: Risk Assessment

The *Interim Protocol* states *"the proponent should undertake a risk assessment as this will influence the density of soil sampling required as explained in Section 9.6.1. The proposed activity on parts or all of the project area may be of low risk to agriculture and so may only require a sampling density of 1:100,000. Alternatively other areas may be at higher risk of impact and so should have a sampling density of 1:25,000."*

To identify the potential for a project to impact on agricultural resources and the appropriate level of soil survey required, an evaluation of risk to agricultural resources and enterprises has been undertaken. The risk assessment is based on the probability of occurrence and the consequence of the impact as described in the *Interim Protocol*. The potential impacts were assessed as:

- Level 5 – Very minor damage and minor impact to agricultural resources or industries. Probability: B – Likely, known to occur or it has happened. The risk matrix result was B5 which is considered a low risk. The Study Area requires an inspection density of 1:100,000.

Based on the Project only being temporary and having no permanent impact on the intrinsic properties of the soil and that grazing can still be undertaken during the life of the Project, an inspection density of 1:100,000 has been adopted across the Study Area.

2.1.5 Step 5: Field Soil Survey and BSAL Assessment

The field survey for the BSAL Verification Assessment was undertaken during November 2020 by SLR's Principal Agronomist Murray Fraser and overseen by SLR's Regional Rector Leader Rod Masters (CPSS-3).

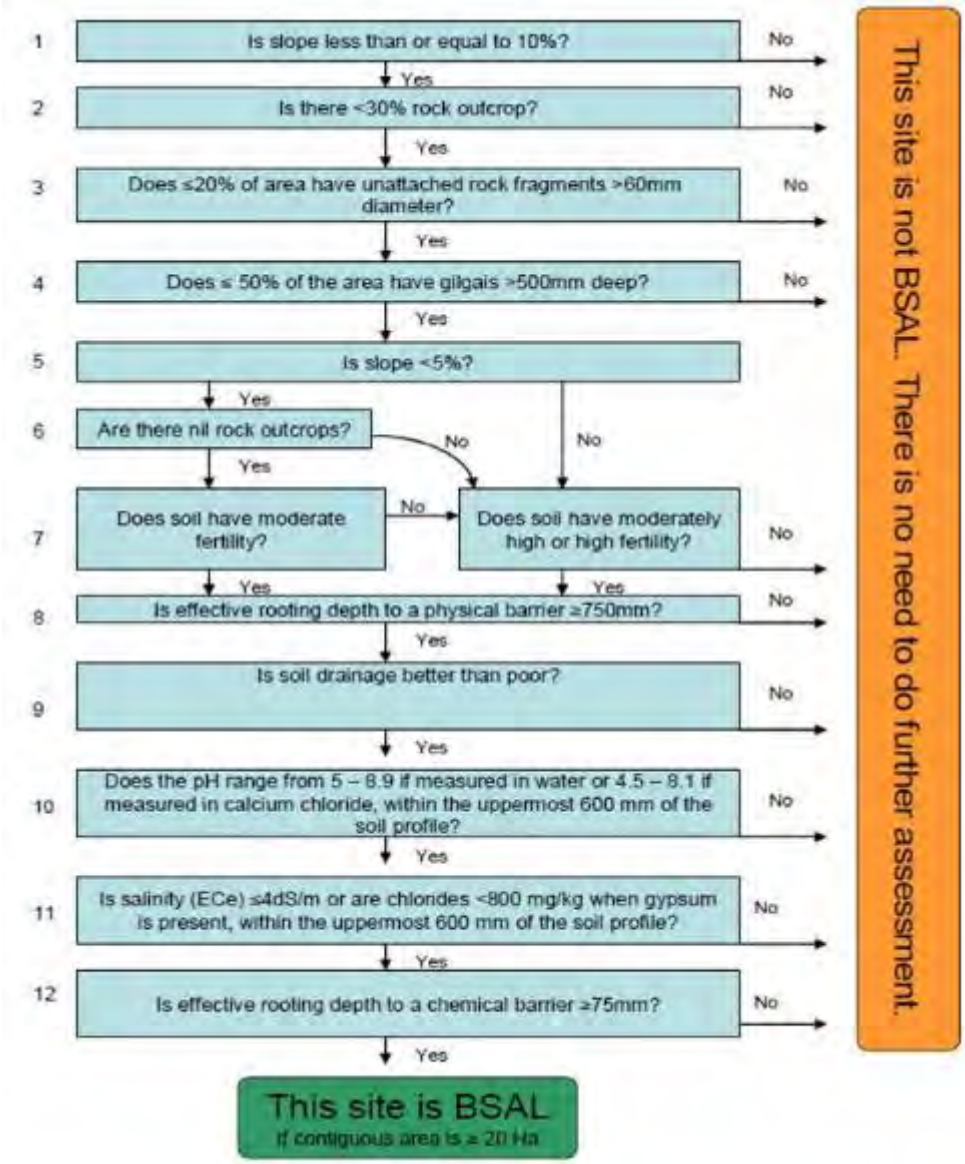
2.1.6 Field Soil Survey Methodology

For soil to be classified as BSAL it must meet the criteria outlined in the flow chart shown in **Diagram 1**. If any criterion is not met (except for those outlined in step 5 or step 6), the site is not BSAL and there is no need to continue the assessment.

Section 6 of the *Interim Protocol* states *"slope is the upward or downward incline of the land surface, measured in per cent. BSAL soils must have a slope of less than or equal to 10 per cent. If any criteria are not met, the site is not BSAL and there is no need to continue the assessment"*.

The design of the soil survey program was developed by following a process of applying the BSAL methodology as a desktop exercise in the first instance to identify any areas that could not meet the criteria (termed exclusion zones). The field survey program was then developed to target the areas that could potentially meet BSAL criteria.

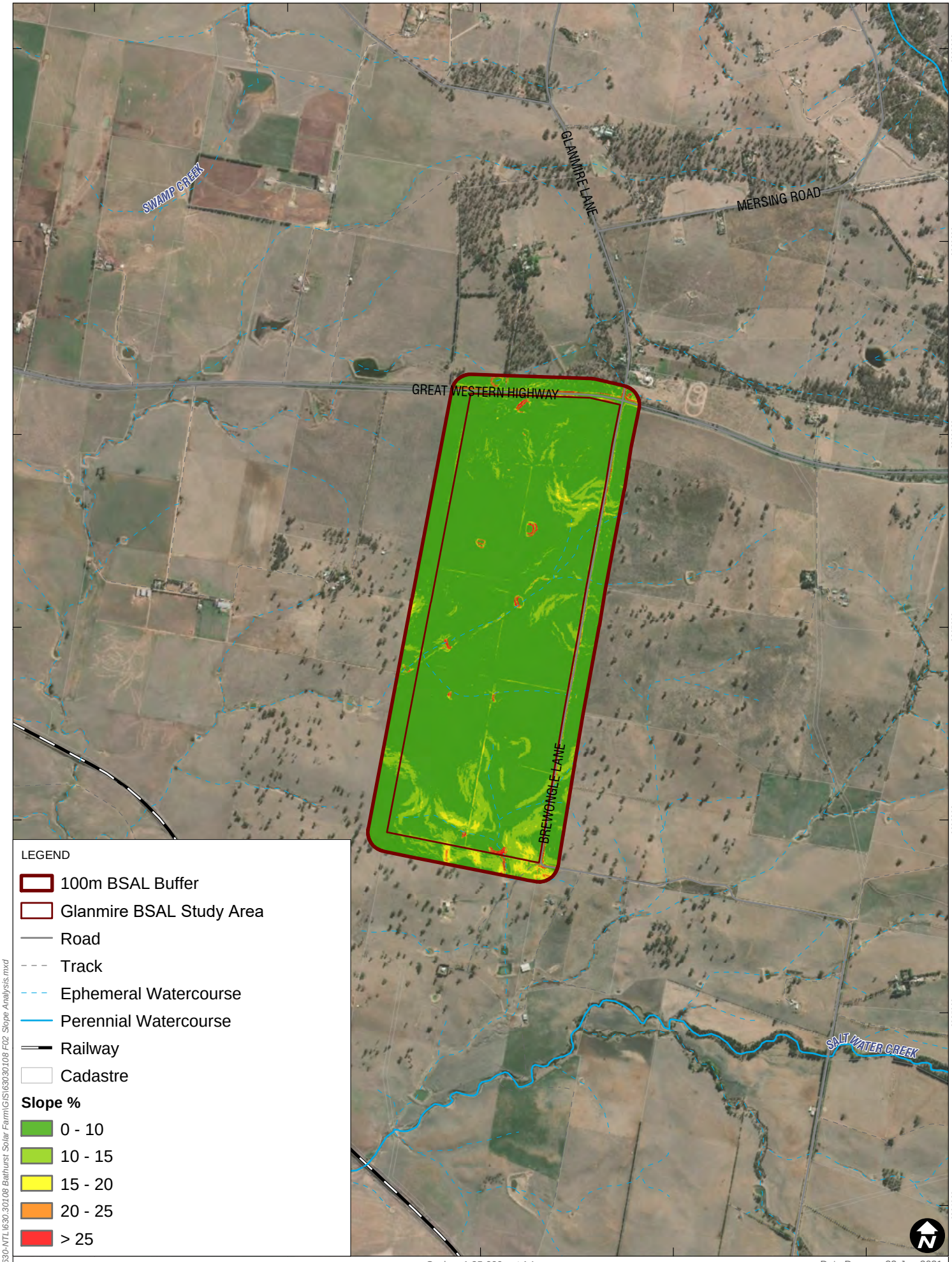
Diagram 1 BSAL Criteria Flow Diagram



Note: In applying step 12 it was assumed that the effective rooting depth to a chemical barrier of ≥75 mm was incorrect as stated in Diagram 1, and instead a value of ≥750 mm was adopted as stated in Section 6.10 of the Interim Protocol.

2.1.6.1 Exclusion Zones

Land greater than 10% slope (**Figure 2**) within the Study Area was identified, and excluded from the soil survey program, along with any areas which were less than or equal to 10% slope and also less than 20 hectares in contiguous area. In total, 24 hectares of the Study Area was determined not to meet the BSAL methodology Criteria 1, as shown in **Diagram 1** and on **Figure 3**. The Slope Analysis methodology is provided in **Appendix A**.



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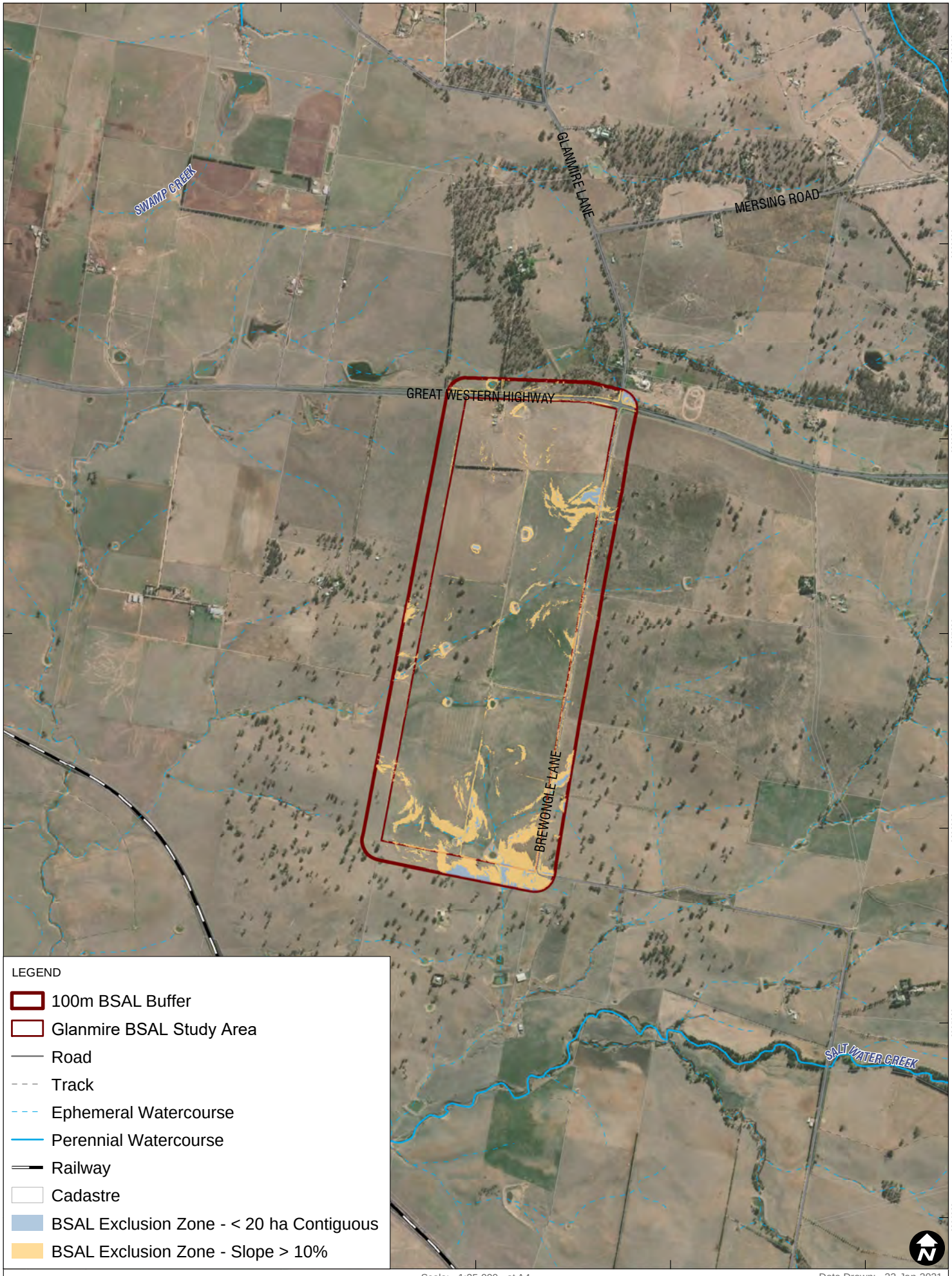
Slope Analysis

FIGURE 2



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Coordinate System: GDA 1994 MGA Zone 55

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Project Number: 630.30108

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BSAL Exclusion Areas

FIGURE 3

2.1.6.2 Soil Survey Density

To satisfy soil mapping requirements, although only a minimum of 3 sites were required, the field soil survey program comprised 14 described sites in total, as shown on **Figure 4**. A breakdown of the required soil survey density, as per *Interim Protocol* requirements, is provided in **Table 1**.

Table 2 Assessment of Soil Survey Density

Category	BSAL Study Area
Total Study Area Hectares	251
BSAL Exclusion Area (Greater Than 10% Slope) Hectares	22
BSAL Exclusion Area (Less Than 20 Hectares Contiguous)	2
BSAL Survey Area Hectares	**227**
Survey Density	**BSAL Survey Area**
1:100,000 Survey Area Hectares	227
1:100,000 Survey Density Target	Minimum 3 Required Sites
Total Number Sites	**6 Detailed and 8 Check Sites**
Laboratory Analysed Sites	**4**

2.1.6.3 Soil Survey Observation Types

Soil profiles were assessed at 6 sites in accordance with the *Australian Soil and Land Survey Field Handbook* (NCST, 2009). Each soil-profile exposure was sampled with a hydraulic soil corer, either a depth of 1.2 metres, to equipment refusal, or to bedrock. Detailed soil profile morphological descriptions were prepared at all sites to record the information specified in the *Interim Protocol*. Information was recorded for the major parameters specified in **Table 3**.

Global Positioning System (GPS) readings was taken for all sites where soil descriptions are recorded. Vegetation type, landform and aspect were also noted. Soil exposures from pits were photographed during field operations.

Table 3 Field Assessment Parameters

Descriptor	Application
Horizon depth	Weathering characteristics, soil development
Field colour	Permeability, susceptibility to dispersion/erosion
Field texture grade	Erodibility, hydraulic conductivity, moisture retention, root penetration
Boundary distinctness and shape	Erosional/dispositional status, textural grade
Consistence force	Structural stability, dispersion, ped formation
Structure pedality grade	Soil structure, root penetration, permeability, aeration
Structure ped and size	Soil structure, root penetration, permeability, aeration
Stones – amount and size	Water holding capacity, weathering status, erosional/depositional character

Descriptor	Application
Roots – amount and size	Effective rooting depth, vegetative sustainability
Ants, termites, worms etc.	Biological mixing depth

A total of 14 sites were evaluated. Of the 14 sites, 6 sites were detailed sites and 8 sites were check sites. Check sites are mapping observations examined in sufficient detail to allocate the site to a specific soil type and map unit. For detailed sites, soil was collected from each major soil horizon (soil layer).

Soil samples from 4 detailed sites were utilised in the BSAL verification laboratory testing program. Samples were analysed in order to classify Australian Soil Classification (ASC) (Isbell, 2002) soil taxonomic class and enable BSAL verification.

Soil collected from each major soil horizon (soil layer) was sent to a National Association of Testing Authorities Australia (NATA) accredited laboratory (EAL Laboratories) for analysis. The selected physical and chemical laboratory analysis properties and their relevant application are listed in **Table 4**.

Table 4 Laboratory Analysis Parameters

Property	Application
Coarse Fragments (>2mm)	Soil workability; root development
Particle-Size Distribution (<2mm)	Determine fraction of clay, silt, fine sand and coarse sand; nutrient retention; exchange properties; erodibility; workability; permeability; sealing; drainage; interpretation of most other physical and chemical properties and soil qualities
Soil Reaction (pH)	Nutrient availability; nutrient fixation; toxicities (especially aluminium and manganese); liming; Sodicity; correlation with other soil properties
Electrical Conductivity (EC)	Appraisal of salinity hazard in soil substrates or groundwater; total soluble salts
Cation Exchange Capacity (CEC) & Exchangeable Cations	Nutrient status; calculation of exchangeable cations including sodium, calcium, magnesium, potassium and exchangeable sodium percentage (ESP); assessment of other physical and chemical properties, especially dispersivity, shrink – swell, water movement, aeration
Munsell Colour Chart (Munsell)	Drainage, oxidation, fertility, correlation with other physical, chemical and biological properties

Soil salinity in the samples from the detailed sites was determined through measurement of the electrical conductivity (EC) of soil:water (1:5) suspensions. These values were converted to the EC of a saturated extract (EC_e) based on soil texture in accordance with the *Interim Protocol*.

3 Soil Assessment

One soil unit was identified within the Study Area, a Subnatric Grey-Brown Sodosol, and was mapped according to the dominant ASC soil type (**Figure 4**) using a combination of the soil survey and laboratory analysis results. This soil unit and the observation sites associated with each are shown below in **Table 5**.

Section 9.6.2 of the *Interim Protocol* states "*All soil map units will have some soil variation. The dominant soil type upon which BSAL status is determined should comprise great [sic] than 70 per cent of a soil map unit*." Section 9.6.3 of the *Interim Protocol* further confirms "*BSAL status is determined on the dominant soil type within a soil map unit*."

A description of one detailed representative site from the mapped soil unit follows **Table 5**, with the remaining detailed soil profile descriptions shown in **Appendix B** and check site descriptions in **Appendix C**. Red font is used within these tables to indicate the BSAL criteria which are not met for each site. Laboratory certificates of analysis are shown in **Appendix D**.

Table 5 Soil Units within Study Area

SMU	ASC Soil Type	Soil Type Group	Detailed Site	Check Site	Hectares
1	Subnatric Grey-Brown Sodosol	Dominant	BS1, BS2, BS3, BS4, BS6	C1 – C8	251
	Eutrophic Grey Chromosol	Sub-Dominant	BS5	Nil	
				Total	**251**

3.1 Soil Unit 1: Subnatric Grey-Brown Sodosol

Subnatric Grey Sodosol

Table 6 Summary Subnatric Grey Sodosol (Site BS2)

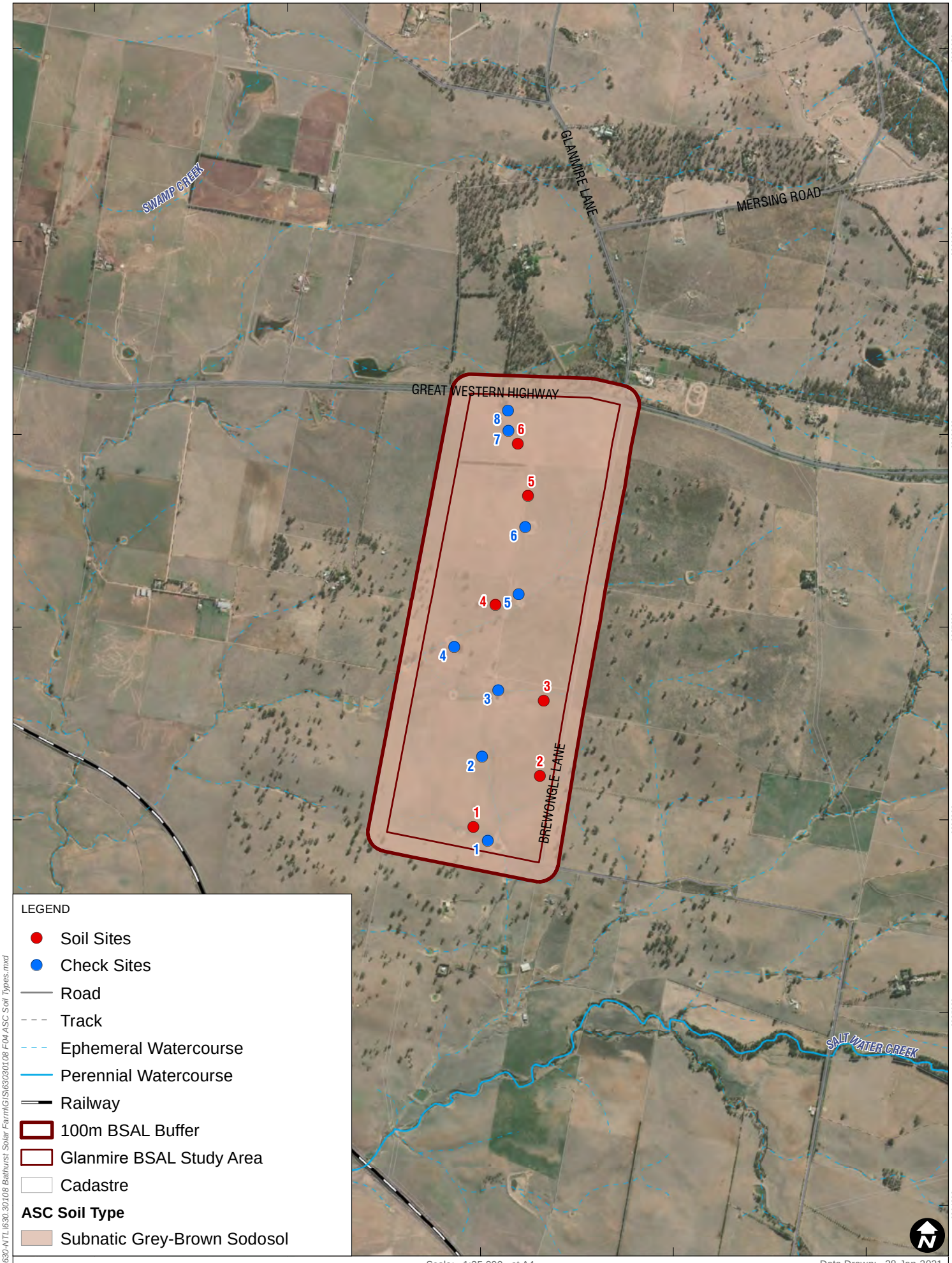
Overview	
Landscape Site BS2	
	
ASC Name	Subnatric Grey Sodosol
Representative Site	BS2
Other Mapped Sites	BS1, BS3, BS4, BS6
Survey Type	Detailed Lab
Dominant Topography	Lower Slope
Dominant Land Use	Fodder Cropping
Vegetation	Wheat Stubble
Inherent Soil Fertility	Moderately Low
Slope (%)	1
Surrounding Slope (%)	1-2
Aspect	South
Verified	Non-BSAL – Inherent Fertility, Poor Drainage & Sodicity

Table 7 Profile: Subnatric Grey Sodosol (Site BS2)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (10YR 3/3) loam, weak structure of 5-10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; 50% gravel content <5 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.15 – 0.30	Brown (10YR 5/3) bleached loam, weak structure of 5-10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; 40% gravel content <5 mm; nil segregations; well drained with a clear and even boundary. Sampled 0.20 – 0.30.
	B21 0.30 – 0.60	Grey (10YR 6/1) light clay, strong structure of 20-40 mm blocky peds with a rough fabric and moderate consistence. 30% distinct yellow mottling; 30% gravel content 5-10 mm; nil segregations; poorly drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B22 +0.60	Grey (5Y 6/1) medium clay, strong structure of >40 mm blocky peds with a rough fabric and moderate consistence. 30% distinct yellow mottling; 25% gravel content 5-10 mm; 10% hard manganese nodules <10 mm; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sample depth.

Table 8 Chemical Parameters: Subnatric Grey Sodosol (Site BS2)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.3	Strongly Acidic	4.7	Non-Sodic	0.6	Non-Saline	3.4	Ca Low
A2	5.9	Moderately Acidic	8.1	Marginally Sodic	0.2	Non-Saline	3.3	Ca Low
B21	7.2	Neutral	8.8	Marginally Sodic	0.4	Non-Saline	1.3	Ca Low
B22	7.7	Mildly Alkaline	17.2	Strongly Sodic	0.7	Non-Saline	0.7	Ca Deficient



SLR

ASC Soil Types

FIGURE 4

3.2 Biophysical Strategic Agricultural Land

This BSAL Verification Assessment has been conducted in accordance with the *Interim Protocol*. The BSAL status was determined on the dominant soil type within each soil unit. According to the *Interim Protocol*, the findings of this BSAL Verification Assessment are shown in **Table 9** and **Figure 5**.

- Exclusion areas of 22 hectares for land greater than 10% slope were identified and excluded as potential BSAL in the Study Area for this assessment.
- Exclusion areas of 2 hectares for land of slope less than 10%, but with less than 20 hectares contiguous area were identified and excluded as potential BSAL in the Study Area for this assessment.
- There were 227 hectares, comprising one Soil Map Unit, which was verified as non-BSAL due to poor drainage and moderately low inherent fertility, within the Study Area for this assessment.

The BSAL assessment and limitations of the soil unit and sample sites is shown in **Table 10**.

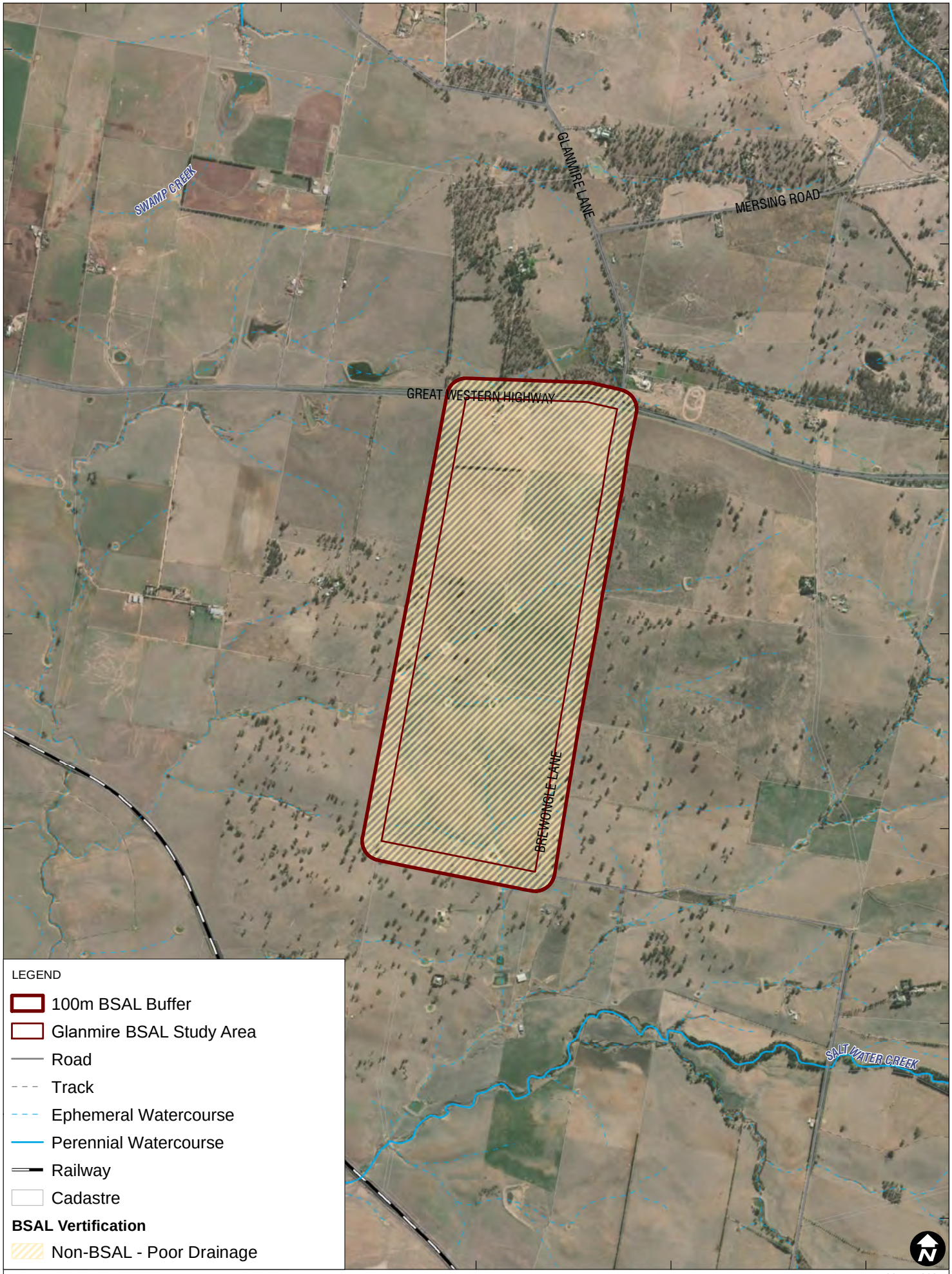
Table 9 BSAL Assessment Summary

Soil Survey BSAL Assessment	Hectares
Verified BSAL	Nil
Verified Non-BSAL	227
Exclusion Area	24
BSAL Assessment Total	**251**
Verified Non-BSAL	**Hectares**
Soil Type Verified Non-BSAL	227
Exclusion Greater Than 10% Slope	22
Exclusion Less Than 20 Hectares Contiguous Area	2
Verified Non-BSAL Total	**251**

Table 10 BSAL Assessment

Soil Map Unit	Site Number	Inspection Type	ASC Soil Type (to ASC Great Group for detailed sites)	1. Is slope < 10%?	2. Is there < 30% Rock Outcrop?	3. < 20% unattached Rock Fragments > 60mm?	4. Does < 50% have Gilgai >500mm deep?	5. Is Slope <5%?	6. Are there nil rock outcrops?	7a. Does soil have moderate fertility?	7b. Does soil have moderately high or high fertility?	8. Is ERD to a physical barrier >750mm?	9. Is drainage better than poor?	10. Is pH between 5.0 and 8.9 (water) and 4.5 and 8.1 (CaCl2)?	11. Is salinity (ECe) < 4 dS/m	12. Is ERD to a chemical barrier >750mm?	Is the Site BSAL?	Is the Soil Unit BSAL?
1	BS1	Detailed	Brown Sodosol	✓	✓	✓	✓		✓	✘	✘	✓	✘	N/A	N/A	N/A	Non-BSAL	No
	BS2	Detailed Lab	Subnatric Grey Sodosol	✓	✓	✓	✓		✓	✘	✘	✓	✘	✓	✓	✘	Non-BSAL	
	BS3	Detailed Lab	Subnatric Grey Sodosol	✓	✓	✓	✓		✓	✘	✘	✓	✘	✓	✓	✓	Non-BSAL	
	BS4	Detailed	Grey Sodosol	✓	✓	✓	✓		✓	✘	✘	✓	✘	N/A	N/A	N/A	Non-BSAL	
	BS5	Detailed Lab	Eutrophic Grey Chromosol	✓	✓	✓	✓		✓	✓	✓	✓	✘	✓	✓	✓	Non-BSAL	
	BS6	Detailed Lab	Subnatric Brown Sodosol	✓	✓	✓	✓		✓	✘	✘	✓	✘	✓	✓	✓	Non-BSAL	

✓ = passes the BSAL criteria ✘ = fails the criteria but not excluded as BSAL ✘ = fails the BSAL criteria



LEGEND

- 100m BSAL Buffer
- Glanmire BSAL Study Area
- Road
- Track
- Ephemeral Watercourse
- Perennial Watercourse
- Railway
- Cadastre

BSAL Vertification

- Non-BSAL - Poor Drainage

0 0.5 1 km

Scale: 1:25,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 22-Jan-2021
Project Number: 630.30108

H:\Projects-SLR\610-SnySYD\630-NTL\630.30108 Bathurst Solar Farm\GIS\630308 F05 BSAL Vertification.mxd

SLR

BSAL Vertification

FIGURE 5

4 Conclusion

SLR Consulting has completed a BSAL assessment according to the *Interim Protocol*, encompassing the proposed Glanmire Solar Farm, including a 100 metre buffer, totalling 251 hectares.

The assessment found no areas of verified BSAL within the Study Area. The entire Study Area is non-BSAL, comprising 24 hectares of BSAL exclusion area and one Soil Map Unit (a Subnatric Grey-Brown Sodosol), comprising the remaining 227 hectares, which was verified as non-BSAL due to poor drainage and moderately low inherent fertility.

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APPENDIX A

Slope Analysis Methodology

10th May 2021

Elgin Energy
Glanmire Solar Farm
BSAL Verification
SLR Slope Analysis Methodology

1. Acquire appropriate elevation information.

2. Load Contours into ArcMap 10.3

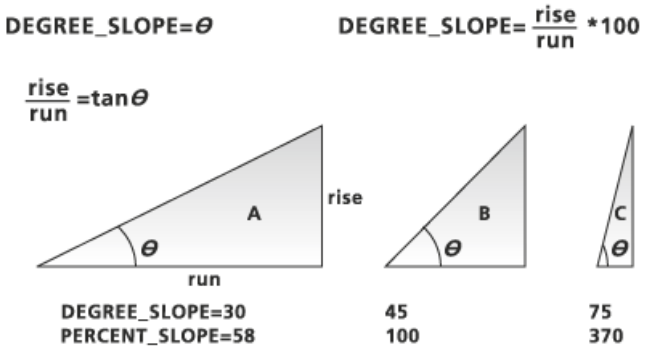
3. Using 3D Analyst Extension - Create a TIN Surface based on the contours (http://resources.arcgis.com/en/help/main/10.1/index.html#/Create_TIN/00q90000001v000000/)

4. Using 3D Analyst Extension – Run the Surface Slope Tool (http://resources.arcgis.com/en/help/main/10.1/index.html#//00q900000076000000) using a custom Break File (attached).

5. Using a Spatial Join, correlate the Surface Slope at the Soil Survey coordinates.

The Surface Slope Tool

Surface Slope creates an output polygon feature class containing polygons that classify an input TIN or terrain dataset by slope. The slope is the angle of inclination between the surface and a horizontal plane, which may be analysed in degrees or percent. Slope in degrees is given by calculating the arctangent of the ratio of the change in height (dZ) to the change in horizontal distance (dS), or slope = Arctan (dZ/dS). Percent slope is equal to the change in height divided by the change in horizontal distance multiplied by 100, or (dZ/dX) * 100.



The {**slope_field**} is the name of attribute field used to record the polygon aspect codes. Its default value is SlopeCode.

Each triangle is classified into a slope class. Contiguous triangles belonging to the same class are merged during the formation of output polygons. The {units} parameter can be set to use PERCENT or DEGREES. The default is PERCENT. The default percent slope class breaks are 1.00, 2.15, 4.64, 10.00, 21.50, 46.40, 100.00, 1000.00. Optionally, DEGREES may be used to classify slope. The default degree slope class breaks are 0.57, 1.43, 2.66, 5.71, 12.13, 24.89, 45.0, 90.0.

The {**class_breaks_table**} is used to define custom slope classes. The table can be either a TXT or DBF file for a Windows environment, and a DBF file in a UNIX environment. Each record in the table needs to contain two values that are used to represent the slope range of the class and its corresponding class code.

Table example:

break, code

10.0, 11

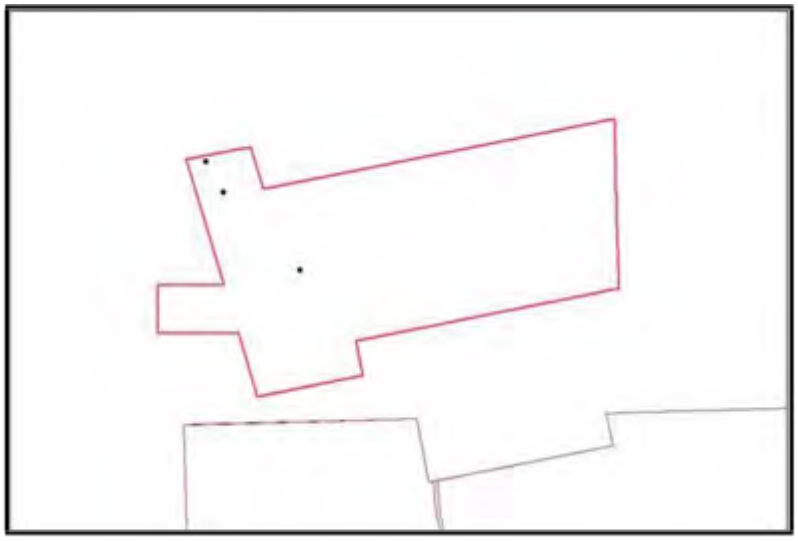
25.0, 22

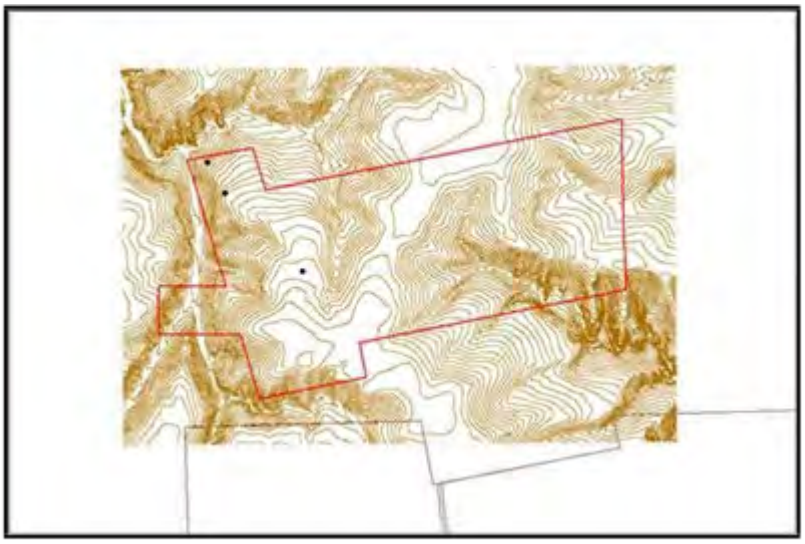
40.0, 33

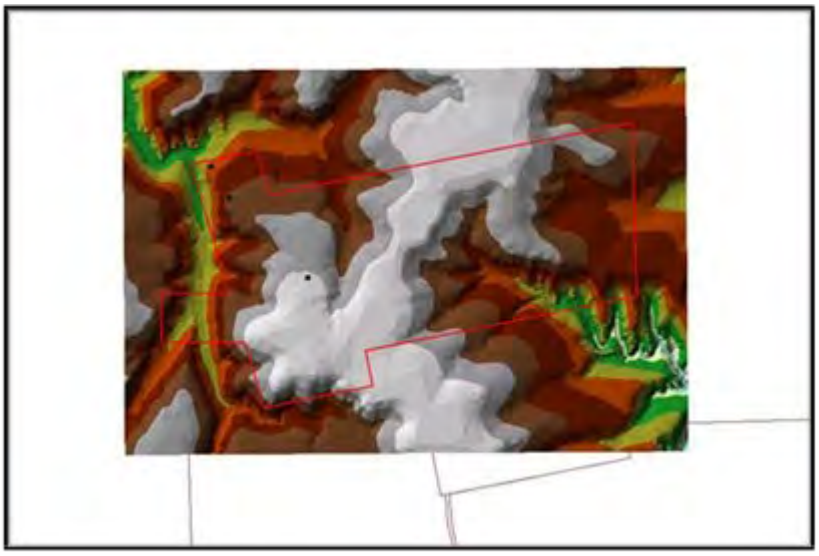
70.0, 44

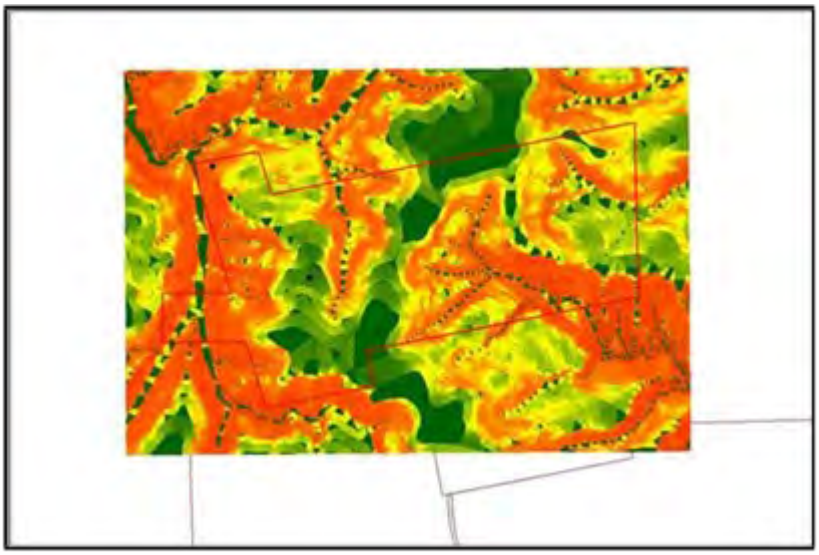
Note the comma delineation and use of decimals in the first field. Field names are needed but are ignored. The first field represents the breaks and values need to be decimal, the second field represents codes and values need to be integer. The units of the slope range are defined by the {units}. When this argument is not specified, the default classification is used.

And here is how we do it pictographically (example study shown):









APPENDIX B

Detailed Soil Profile Descriptions

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 1 Summary: Brown Sodosol (Site BS1)

Overview	
Landscape Site BS1	
	
ASC Name	Brown Sodosol
Representative Site	BS1
Other Mapped Sites	BS2, BS3, BS4, BS6
Survey Type	Detailed
Dominant Topography	Lower Slope
Dominant Land Use	Fodder Cropping
Vegetation	Wheat Stubble
Inherent Soil Fertility	Moderately Low
Slope (%)	19
Surrounding Slope (%)	<10
Aspect	South
Verified	Non-BSAL – Slope, Inherent Fertility & Poor Drainage

Table 2 Profile: Brown Sodosol (Site BS1)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (7.5YR 3/4) loam, weak structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 20% gravel content 5-10 mm; nil segregations; well drained with a clear and wavy boundary. Sampled 0.0 – 0.10.
	B21 0.15 – 0.50	Dark yellowish-brown (10YR 4/6) medium clay, strong structure of 20-40 mm blocky peds with a rough fabric and strong consistence. 30% distinct yellow mottling; <10% gravel content 5-10 mm; nil segregations; poorly drained with a gradual and even boundary. Sampled 0.20 – 0.30 and 0.40 – 0.50.
	B22 +0.50	Greyish brown (2.5Y 5/2) heavy clay, strong structure of >40 mm blocky peds with a rough fabric and strong consistence. 30% distinct yellow mottling; 10% gravel content 5-10 mm; nil segregations; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 3 Field Parameters: Brown Sodosol (Site BS1)

Layer	Field pH		Field Dispersion	Field Effervescence
	Unit	Rating	Rating	Rating
A1	5.5	Strongly Acidic	Nil	Nil
B21	6.5	Slightly Acidic	High	Nil
B22	7.0	Neutral	High	Nil

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 4 Summary: Subnatric Grey Sodosol (Site BS3)

Overview	
Landscape Site BS3 	
ASC Name	Subnatric Grey Sodosol
Representative Site	BS3
Other Mapped Sites	BS1, BS2, BS4, BS6
Survey Type	Detailed Lab
Dominant Topography	Lower Slope
Dominant Land Use	Fodder Cropping
Vegetation	Wheat Stubble
Inherent Soil Fertility	Moderately Low
Slope (%)	1
Surrounding Slope (%)	1-2
Aspect	West
Verified	Non-BSAL – Inherent Fertility & Poor Drainage

Table 5 Profile: Subnatric Grey Sodosol (Site BS3)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark brown (7.5YR 3/2) loam, weak structure of 5-15 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 50% gravel content <10 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.20 – 0.40	Light brownish-grey (10YR 6/2) bleached loamy sand, weak structure of <10 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 50% gravel content <10 mm; nil segregations; well drained with a clear and even boundary. Sampled 0.20 – 0.30.
	B21 0.40 – 0.60	Light brownish-grey (2.5Y 6/2) clay loam, strong structure of 20-40 mm blocky peds with a rough fabric and moderate consistence. 20% distinct red mottling; 40% gravel content 5-10 mm; nil segregations; poorly drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B22 +0.60	Gray (2.5Y 6/1) heavy clay, strong structure of >40 mm blocky peds with a rough fabric and strong consistence. 30% distinct red mottling; 25% gravel content 5-10 mm; nil segregations; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 6 Chemical Parameters: Subnatric Grey Sodosol (Site BS3)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.6	Moderately Acidic	2.5	Non-Sodic	0.6	Non-Saline	3.7	Ca Low
A2	5.9	Moderately Acidic	5.4	Non-Sodic	0.5	Non-Saline	4.1	Balanced
B21	7.0	Neutral	8.4	Marginally Sodic	0.3	Non-Saline	1.6	Ca Low
B22	7.3	Neutral	12.3	Sodic	0.4	Non-Saline	0.9	Ca Deficient

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 7 Summary: Grey Sodosol (Site BS4)

Overview	
Landscape Site BS4 	
ASC Name	Grey Sodosol
Representative Site	BS4
Other Mapped Sites	BS1, BS2, BS3, BS6
Survey Type	Detailed
Dominant Topography	Lower Slope
Dominant Land Use	Fodder Cropping
Vegetation	Wheat Stubble
Inherent Soil Fertility	Moderately Low
Slope (%)	1
Surrounding Slope (%)	1-2
Aspect	South
Verified	Non-BSAL – Inherent Fertility & Poor Drainage

Table 8 Profile: Grey Sodosol (Site BS4)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.30	Very dark brown (7.5YR 2.5/2) loam, weak structure of 5-10 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 25% gravel content <10 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.30 – 0.50	Greyish brown (10YR 5/2) bleached loamy sand, weak structure of <10 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 40% gravel content <10 mm; nil segregations; well drained with a clear and even boundary. Sampled 0.30 – 0.40.
	B2 +0.50	Light brownish-grey (2.5Y 6/2) heavy clay, strong structure of >40 mm blocky peds with a rough fabric and strong consistence. 40% distinct yellow mottling; 10% gravel content 5-10 mm; nil segregations; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 9 Field Parameters: Grey Sodosol (Site BS4)

Layer	Field pH		Field Dispersion	Field Effervescence
	Unit	Rating	Rating	Rating
A1	6.0	Moderately Acidic	Nil	Nil
A2	6.0	Moderately Acidic	Nil	Nil
B2	7.0	Neutral	High	Nil

Soil Unit 1: Subnatric Grey-Brown Sodosol

Sub-Dominant Soil Type: Eutrophic Grey Chromosol

Table 10 Summary: Eutrophic Grey Chromosol (Site BS5)

Overview	
Landscape Site BS5 	
ASC Name	Eutrophic Grey Chromosol
Representative Site	BS5
Other Mapped Sites	Nil
Survey Type	Detailed Lab
Dominant Topography	Midslope
Dominant Land Use	Fodder Cropping
Vegetation	Grazing Canola
Inherent Soil Fertility	Moderately High
Slope (%)	1
Surrounding Slope (%)	1-2
Aspect	South-East
Verified	Non-BSAL –Poor Drainage

Table 11 Profile: Eutrophic Grey Chromosol (Site BS5)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark brown (7.5YR 3/2) loamy sand, weak structure of 5-15 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 50% gravel content 5-10 mm; nil segregations; well drained with a clear and even boundary. Sampled 0.0- 0.10.
	A2 0.20 – 0.50	Light brownish-grey (10YR 6/2) bleached loamy sand, apedal structure with a sandy fabric and weak consistence. Nil mottling; 50% gravel content 5-10 mm; nil segregations; well drained with an abrupt and even boundary. Sampled 0.30 – 0.40.
	B21 +0.50	Light brownish-grey (2.5Y 6/2) clay loam, moderate structure of 10-30 mm blocky peds with a rough fabric and weak consistence. 20% distinct brown mottling; 60% gravel content 5-10 mm; nil segregations; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 12 Chemical Parameters: Eutrophic Grey Chromosol (Site BS5)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.1	Strongly Acidic	1.1	Non-Sodic	1.3	Non-Saline	6.0	Mg Low
A2	6.6	Neutral	3.7	Non-Sodic	0.4	Non-Saline	5.6	Balanced
B21	6.2	Slightly Acidic	2.9	Non-Sodic	0.2	Non-Saline	3.9	Ca Low

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 13 Summary: Subnatric Brown Sodosol (Site BS6)

Overview	
Landscape Site BS6 	
ASC Name	Subnatric Brown Sodosol
Representative Site	BS6
Other Mapped Sites	BS1, BS2, BS3, BS4
Survey Type	Detailed Lab
Dominant Topography	Upper Slope
Dominant Land Use	Grazing
Vegetation	Saffron Thistle, Paterson's Curse
Inherent Soil Fertility	Moderately Low
Slope (%)	1
Surrounding Slope (%)	1-2
Aspect	North-East
Verified	Non-BSAL – Inherent Fertility & Poor Drainage

Table 14 Profile: Subnatric Brown Sodosol (Site BS6)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Very dark brown (7.5YR 2.5/3) loam, weak structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 50% gravel content <5 mm; nil segregations; well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10.
	A2 0.10 – 0.20	Dark yellowish-brown (10YR 4/4) bleached loam, weak structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 40% gravel content <5 mm; nil segregations; well drained with a clear and wavy boundary. Sampled 0.10 – 0.20.
	B21 0.20 – 0.50	Dark yellowish-brown (10YR 4/4) heavy clay, strong structure of 20-40 mm blocky peds with a rough fabric and strong consistence. 30% distinct yellow mottling; 10% gravel content 5-10 mm; nil segregations; poorly drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B22 +0.50	Dark grey (2.5Y 4/1) heavy clay, strong structure of >40 mm blocky peds with a rough fabric and strong consistence. 40% distinct yellow mottling; 20% gravel content 5-10 mm; nil segregations; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 15 Chemical Parameters: Subnatric Brown Sodosol (Site BS6)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.4	Strongly Acidic	1.9	Non-Sodic	0.7	Non-Saline	3.0	Ca Low
A2	6.2	Slightly Acidic	2.4	Non-Sodic	0.3	Non-Saline	1.8	Ca Low
B21	6.1	Slightly Acidic	7.1	Marginally Sodic	0.5	Non-Saline	0.7	Ca Deficient
B22	8.2	Moderately Alkaline	10.0	Sodic	0.8	Non-Saline	0.7	Ca Deficient

APPENDIX C

Check Site Descriptions

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 1 Site C1 Grey Sodosol

Profile	Horizon	Description
	B2	Pale brown (10YR 6/3) heavy clay, strong structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C1
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Lower Slope
Dominant Land Use	Dam Bank
Vegetation	Nil
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Neutral

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 2 Site C2 Brown Sodosol

Profile	Horizon	Description
	B2	Yellowish brown (10YR 5/4) medium clay, strong structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C2
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Mid Slope
Dominant Land Use	Stock Laneway
Vegetation	Nil
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Mildly Alkaline

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 3 Site C3 Brown Sodosol

Profile	Horizon	Description
	B2	Yellowish brown (10YR 5/6) light-medium clay, strong structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C3
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Midslope
Dominant Land Use	Dam Inflow
Vegetation	Nil
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Slightly Acidic

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 4 Site C4 Brown Sodosol

Profile	Horizon	Description
	B2	Brown (7.5YR 5/4) light-medium clay, strong structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C4
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Midslope
Dominant Land Use	Dam Inflow
Vegetation	Nil
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Neutral

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 5 Site C5 Grey Sodosol

Profile	Horizon	Description
	B2	Light brown (10YR 6/3) light-medium clay, moderate structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C5
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Lower Slope
Dominant Land Use	Dam Inflow
Vegetation	Grazing Canola
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Neutral

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 6 Site C6 Brown Sodosol

Profile	Horizon	Description
	B2	Brown (10YR 5/6) light-medium clay, moderate structure. Moderate field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C6
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Midslope
Dominant Land Use	Dam Inflow
Vegetation	Nil
Inherent Soil Fertility	Moderately Low
Field Dispersion	Moderate
Field pH	Neutral

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 7 Site C7 Brown Sodosol

Profile	Horizon	Description
	B2	Strong brown (7.5YR 5/8) light-medium clay, moderate structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C7
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Upper Slope
Dominant Land Use	Stock Laneway
Vegetation	Grass Pasture
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Mildly Alkaline

Soil Unit 1: Subnatric Grey-Brown Sodosol

Table 8 Site C8 Brown Sodosol

Profile	Horizon	Description
	B2	Brown (10YR 4/4) light clay, moderate structure. High field dispersion.

ASC Name	Grey-Brown Sodosol
Representative Site	C8
Other Mapped Detailed Sites	BS1, BS2, BS3, BS4, BS6
Survey Type	Check Site
Dominant Topography	Upper Slope
Dominant Land Use	Stock Laneway
Vegetation	Grass Pasture
Inherent Soil Fertility	Moderately Low
Field Dispersion	High
Field pH	Neutral

APPENDIX D

Laboratory Certificate of Analysis

Environmental Analysis Laboratory

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AGRICULTURAL SOIL ANALYSIS REPORT

15 samples supplied by SLR Consulting Australia Pty Ltd on 30/11/2020. Lab Job No.K1174
Analysis requested by Murray Fraser. Your Job: PO: SLR 630 30108; Bathurst Solar
10 Kings Road NEW LAMBTON NSW 2305

			Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
		Sample ID:	BS 2 0-10	BS 2 20-30	BS 2 40-50	BS 2 65-75	BS 3 0-10	BS 3 20-30
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Elgin	Elgin	Elgin	Elgin	Elgin	Elgin
	Parameter	Method reference	K1174/1	K1174/2	K1174/3	K1174/4	K1174/5	K1174/6
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.30	5.90	7.21	7.69	5.59	5.86
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.068	0.018	0.043	0.091	0.067	0.021
		(cmol$_+$/kg)	1.7	0.85	3.4	4.3	2.5	1.1
	Exchangeable Calcium	(kg/ha)	751	383	1,545	1,937	1,132	502
		(mg/kg)	335	171	690	865	505	224
		(cmol$_+$/kg)	0.49	0.26	2.6	5.9	0.69	0.27
	Exchangeable Magnesium	(kg/ha)	132	71	719	1,611	187	74
		(mg/kg)	59	32	321	719	83	33
		(cmol$_+$/kg)	0.36	<0.12	0.25	0.23	0.28	<0.12
	Exchangeable Potassium	(kg/ha)	312	<112	221	199	247	<112
		(mg/kg)	139	<50	99	89	110	<50
		(cmol$_+$/kg)	0.15	0.12	0.61	2.2	0.10	0.09
	Exchangeable Sodium	(kg/ha)	75	61	315	1,119	50	47
		(mg/kg)	33	27	141	500	22	21
		(cmol$_+$/kg)	0.19	0.06	0.01	0.01	0.04	0.05
	Exchangeable Aluminium	(kg/ha)	37	12	2.5	2.6	8.5	11
		(mg/kg)	17	5.2	1.1	1.2	3.8	4.8
		(cmol$_+$/kg)	0.23	0.09	<0.01	<0.01	0.17	0.05
	Exchangeable Hydrogen	(kg/ha)	5.1	2.1	<1	<1	3.8	1.2
		(mg/kg)	2.3	<1	<1	<1	1.7	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	3.1	1.5	7.0	13	3.8	1.7
	Calcium (%)		54	59	49	34	66	66
	Magnesium (%)		16	18	38	47	18	16
	Potassium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	12	5.1	3.6	1.8	7.4	6.2
	Sodium - ESP (%)		4.7	8.1	8.8	17	2.5	5.4
	Aluminium (%)		6.0	4.0	0.18	0.10	1.1	3.2
	Hydrogen (%)		7.4	6.3	0.00	0.00	4.5	3.1
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.4	3.3	1.3	0.73	3.7	4.1
	pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	4.64	5.04	6.06	6.42	4.95	4.97
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10 YR 3/3 Dark Brown	10 YR 5/3 Brown	10 YR 6/1 Gray	5 Y 6/1 Gray	7.5 YR 3/2 Dark Brown	10 YR 6/2 Light Brownish Gray
	Mottles Munsell Colour		..	..	7.5 YR 5/8 Strong Brown	7.5 YR 6/8 Reddish Yellow	..	..
	Degree of Mottling (%)		..	..	30	80	..	..

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Analysis requested by Murray Fraser. Your Job: PO: SLR 630 30108; Bathurst Solar
10 Kings Road NEW LAMBTON NSW 2305

			Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12
		Sample ID:	BS 3 40-50	BS 3 65-75	BS 5 0-10	BS 5 30-40	BS 5 65-75	BS 6 0-10
		Crop:	Soil	Soil	Soil	Soil	Soil	Soil
		Client:	Elgin	Elgin	Elgin	Elgin	Elgin	Elgin
	Parameter	Method reference	K1174/7	K1174/8	K1174/9	K1174/10	K1174/11	K1174/12
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.98	7.25	5.09	6.61	6.22	5.40
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.030	0.076	0.057	0.016	0.020	0.072
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.9	5.1	2.0	0.55	2.4	2.6
	Exchangeable Calcium (kg/ha)		1,308	2,307	881	247	1,099	1,170
	Exchangeable Calcium (mg/kg)		584	1,030	393	110	491	522
	Exchangeable Magnesium (cmol$_+$/kg)		1.8	5.5	0.33	0.10	0.63	0.87
	Exchangeable Magnesium (kg/ha)		486	1,500	89	27	172	238
	Exchangeable Magnesium (mg/kg)		217	670	40	12	77	106
	Exchangeable Potassium (cmol$_+$/kg)		0.12	0.20	0.25	<0.12	0.17	0.58
	Exchangeable Potassium (kg/ha)		<112	178	219	<112	146	511
	Exchangeable Potassium (mg/kg)		<50	79	98	<50	65	228
	Exchangeable Sodium (cmol$_+$/kg)		0.44	1.5	<0.065	<0.065	0.10	0.09
	Exchangeable Sodium (kg/ha)		228	785	<33	<33	51	44
	Exchangeable Sodium (mg/kg)		102	350	<15	<15	23	20
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.01	0.08	<0.01	0.03	0.15
	Exchangeable Aluminium (kg/ha)		3.3	2.5	16	1.7	6.3	29
	Exchangeable Aluminium (mg/kg)		1.5	1.1	7.2	<1	2.8	13
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.16	<0.01	0.08	0.20
	Exchangeable Hydrogen (kg/ha)		<1	<1	3.6	<1	1.9	4.4
	Exchangeable Hydrogen (mg/kg)		<1	<1	1.6	<1	<1	2.0
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	5.3	12	2.8	0.82	3.5	4.5
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	55	41	69	67	71	58
	Magnesium (%)		34	44	12	12	18	19
	Potassium (%)		2.3	1.6	8.8	13	4.8	13
	Sodium - ESP (%)		8.4	12	1.8	6.2	2.9	1.9
	Aluminium (%)		0.31	0.10	2.8	1.0	0.90	3.2
	Hydrogen (%)		0.00	0.00	5.7	0.00	2.4	4.4
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.6	0.93	6.0	5.6	3.9	3.0
	pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.68	6.00	4.50	5.90	5.26	4.58
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	2.5 Y 6/2 Light Brownish Gray	2.5 Y 6/1 Gray	7.5 YR 3/2 Dark Brown	10 YR 6/2 Light Brownish Gray	2.5 Y 6/2 Light Brownish Gray	7.5 YR 2.5/3 Very Dark Brown
	Mottles Munsell Colour		10 YR 5/6 Yellowish Brown	2.5 YR 4/8 Red	..	..	..	..
	Degree of Mottling (%)		10	60	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: PO: SLR 630 30108; Bathurst Solar
10 Kings Road NEW LAMBTON NSW 2305

	Parameter		Method reference	Sample 13	Sample 14	Sample 15	*Heavy Soil*	*Medium Soil*	*Light Soil*	*Sandy Soil*
	Sample ID:			BS 6 20-30	BS 6 40-50	BS 6 65-75				
	Crop:			Soil	Soil	Soil				
	Client:			Elgin	Elgin	Elgin	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
				K1174/13	K1174/14	K1174/15	Indicative guidelines - refer to Notes 6 and 8			
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.19	6.07	8.23	*6.5*	*6.5*	*6.3*	*6.3*
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.032	0.084	0.134	*0.200*	*0.150*	*0.120*	*0.100*
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.1	6.5	8.4	*15.6*	*10.8*	*5.0*	*1.9*
		(kg/ha)		959	2,900	3,774	*7000*	*4816*	*2240*	*840*
		(mg/kg)		428	1,295	1,685	*3125*	*2150*	*1000*	*375*
	Exchangeable Magnesium	(cmol$_+$/kg)		1.2	9.0	12	*2.4*	*1.7*	*1.2*	*0.60*
		(kg/ha)		317	2,451	3,235	*650*	*448*	*325*	*168*
		(mg/kg)		142	1,094	1,444	*290*	*200*	*145*	*75*
	Exchangeable Potassium	(cmol$_+$/kg)		0.40	0.60	0.42	*0.60*	*0.50*	*0.40*	*0.30*
		(kg/ha)		351	530	369	*526*	*426*	*336*	*224*
		(mg/kg)		157	236	165	*235*	*190*	*150*	*100*
	Exchangeable Sodium	(cmol$_+$/kg)		0.09	1.3	2.3	*0.3*	*0.26*	*0.22*	*0.11*
		(kg/ha)		48	655	1,192	*155*	*134*	*113*	*57*
		(mg/kg)		21	292	532	*69*	*60*	*51*	*25*
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.03	0.27	0.01	*0.6*	*0.5*	*0.4*	*0.2*
		(kg/ha)		5.6	54	2.5	*121*	*101*	*73*	*30*
		(mg/kg)		2.5	24	1.1	*54*	*45*	*32*	*14*
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.03	0.25	<0.01	*0.6*	*0.5*	*0.4*	*0.2*
		(kg/ha)		<1	5.5	<1	*13*	*11*	*8*	*3*
		(mg/kg)		<1	2.5	<1	*6*	*5*	*4*	*2*
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	3.9	18	23	*20.1*	*14.3*	*7.8*	*3.3*
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	55	36	36	*77.6*	*75.7*	*65.6*	*57.4*
	Magnesium (%)			30	50	52	*11.9*	*11.9*	*15.7*	*18.1*
	Potassium (%)			10	3.4	1.8	*3.0*	*3.5*	*5.2*	*9.1*
	Sodium - ESP (%)			2.4	7.1	10	*1.5*	*1.8*	*2.9*	*3.3*
	Aluminium (%)			0.72	1.5	0.05	*6.0*	*7.1*	*10.5*	*12.1*
	Hydrogen (%)			0.75	1.4	0.00				
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.8	0.72	0.71	*6.5*	*6.4*	*4.2*	*3.2*
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.27	4.98	7.09	..			
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	10 YR 4/4	10 YR 4/4	2.5 Y 4/1	..			
				Dark Yellowish Brown	Dark Yellowish Brown	Dark Gray	..			
	Mottles Munsell Colour			..	2.5 YR 3/6	7.5 YR 5/8	..			
				..	Dark Red	Strong Brown	..			
	Degree of Mottling (%)			..	50	5	..			

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

15 soil samples supplied by SLR Consulting Pty Ltd on 30 November, 2020 - Lab Job No. K1174.
Analysis requested by Murray Fraser. Your Project: PO SLR 630 30108 Bathurst Solar
10 Kings Road NEW LAMBTON NSW 2305

SAMPLE ID	Lab Code	MOISTURE CONTENT (% of water in air-dry sample)	TOTAL GRAVEL > 2 mm (% of total oven-dry equivalent)	COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent)	FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent)	SILT 2-20 µm ISSS (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)	Total soil fractions (incl. Gravel)
BS 2 0-10	K1174/1	15.0%	51.1%	2.5%	30.5%	9.3%	6.6%	100.0%
BS 2 20-30	K1174/2	8.0%	46.8%	2.0%	34.7%	9.5%	6.9%	100.0%
BS 2 40-50	K1174/3	8.4%	31.4%	5.6%	29.7%	7.1%	26.3%	100.0%
BS 2 65-75	K1174/4	13.7%	24.9%	15.0%	16.2%	9.6%	34.3%	100.0%
BS 3 0-10	K1174/5	14.1%	46.7%	2.5%	34.9%	9.3%	6.5%	100.0%
BS 3 20-30	K1174/6	7.5%	50.1%	2.4%	33.2%	9.9%	4.4%	100.0%
BS 3 40-50	K1174/7	8.3%	42.3%	1.8%	24.6%	10.3%	20.9%	100.0%
BS 3 65-75	K1174/8	17.0%	23.9%	1.0%	21.5%	11.1%	42.4%	100.0%
BS 5 0-10	K1174/9	10.9%	50.5%	1.4%	35.1%	9.0%	4.0%	100.0%
BS 5 30-40	K1174/10	4.3%	54.4%	1.1%	32.5%	11.2%	0.8%	100.0%
BS 5 65-75	K1174/11	6.5%	56.9%	1.7%	23.1%	7.7%	10.5%	100.0%
BS 6 0-10	K1174/12	17.9%	47.7%	3.5%	32.3%	8.5%	8.1%	100.0%
BS 6 20-30	K1174/13	5.0%	40.1%	5.8%	31.4%	11.1%	11.7%	100.0%
BS 6 40-50	K1174/14	20.9%	13.1%	0.7%	15.2%	8.5%	62.5%	100.0%
BS 6 65-75	K1174/15	16.5%	17.1%	0.6%	25.1%	8.4%	48.9%	100.0%

Note:

1: The Hydrometer Analysis method was used to determine the percentage sand, silt and clay,
modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986),
in *Methods of Soil Analysis. Part 1* Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.

2: Australian Standard 1289.3.8.1-1997 (see attached)

3. Analysis conducted between sample arrival date and reporting date.

4. This report is not to be reproduced except in full.

5. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions.
These Terms and Conditions are available on the EAL website: scu.edu.au/eal, or on request.

6. This report was issued on 09/12/2020.

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checked: .....
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APPENDIX C

BIODIVERSITY SCOPING ASSESSMENT

Scoping Assessment: Proposed Glanmire Solar Farm

Biodiversity

Bathurst Regional LGA NSW
Report to Elgin Energy Pty Ltd
May 2021

AREA
ENVIRONMENTAL & HERITAGE CONSULTANTS

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AREA Environmental Consultants & Communication acknowledge Traditional Owners of the country on which we work

Document controls

Proponent	Elgin Energy Pty Ltd		
Client	Elgin Energy Pty Ltd		
Quote number	QU-0574		
Project No / Purchase Order No	**N/A**		
Document Description	Biodiversity Scoping Assessment: Proposed Glanmire Solar Farm		
Clients Representative Managing this Document	**AREA Person(s) Managing this Document**		
Erika Dawson	Phil Cameron (PJC)		
Location; Lithgow, NSW	AREA Job No.		
Document Status:	Version	Date	Action
Series V1.X = internal edits (Draft)	V1.0 V1.1	29.5.2021	PJC to
Series V2.X = Client internal edits (Draft)	V2.0 V2.1		
FINAL (Draft approved by client)	V3.0		Final submitted
	V3.1		
	V3.2		
Prepared For	**Prepared By**		
Elgin Energy Pty Ltd	Phillip Cameron Managing Director AREA Environmental & Heritage Consultants Pty Ltd "Old Macquarie Brewery' c.1876, 72 Brisbane St Dubbo NSW 2830 E phil@areaenv.com.au ABN:29 616 529 867		

Executive summary

Elgin Energy are proposing to construct a solar farm on Lot 141 DP1144786 in Glanmire NSW in the Bathurst Regional Local Government Area of NSW.

Lot 141 DP1144786 is 186 hectares, and the proposed development area is approximately 140 hectares. The northern most two paddocks fronting the Bathurst bound lane of the Mitchell Highway area excluded from the proposal. The proposed development area consisting of the rest of the Lot and DP is likely to be accessed via Brewongle Lane along its eastern boundary (Figures 1-1 and 1-2).

This scoping assessment has been informed by a physical preliminary inspection and a desk top assessment of Lot 141 DP1144786. This deliverable is deliberately succinct, it focuses on identifying actual risks to biodiversity requiring assessment under standard assessment frameworks for a state significant development.

A preliminary survey of the development area was conducted on 9 June 2020 by Phillip Cameron of AREA Environmental & Heritage Consultants.

Vegetation within the development area consists of:

- Category 1 Land (cropped); and
- 18 paddock trees within cropped areas.

The paddock trees are derived from plant community type 1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion. All trees are old growth Blakey’s Red Gums or Yellow Box.

The Spot Assessment Technique (SAT) was used to physically assess all paddock trees on the Lot and DP for Koala evidence and all trees were assessed for hollows and for hollow dependant species activity.

Database searches (NSW and Commonwealth) were completed to provide regional environmental context, a list of threatened species which may use the development area and consider potential constraints under relevant statutory documents.

In my opinion, the development area meets the criteria to be assessed as a scattered tree (formerly paddock tree) or small area streamlined development assessment.

Contents

1 Introduction

1.1 The proposal

Elgin Energy are proposing to construct a solar farm on Lot 141 DP1144786 in Glanmire NSW in the Bathurst Regional Local Government Area of NSW.

Lot 141 DP1144786 is 186 hectares, and the proposed development area is approximately 140 hectares. The northern most two paddocks fronting the Bathurst bound lane of the Mitchell Highway area excluded from the proposal. The proposed development area consisting of the rest of the Lot and DP is likely to be accessed via Brewongle Lane along its eastern boundary (Figures 1-1 and 1-2).

Figure 1-1: Location of the development area

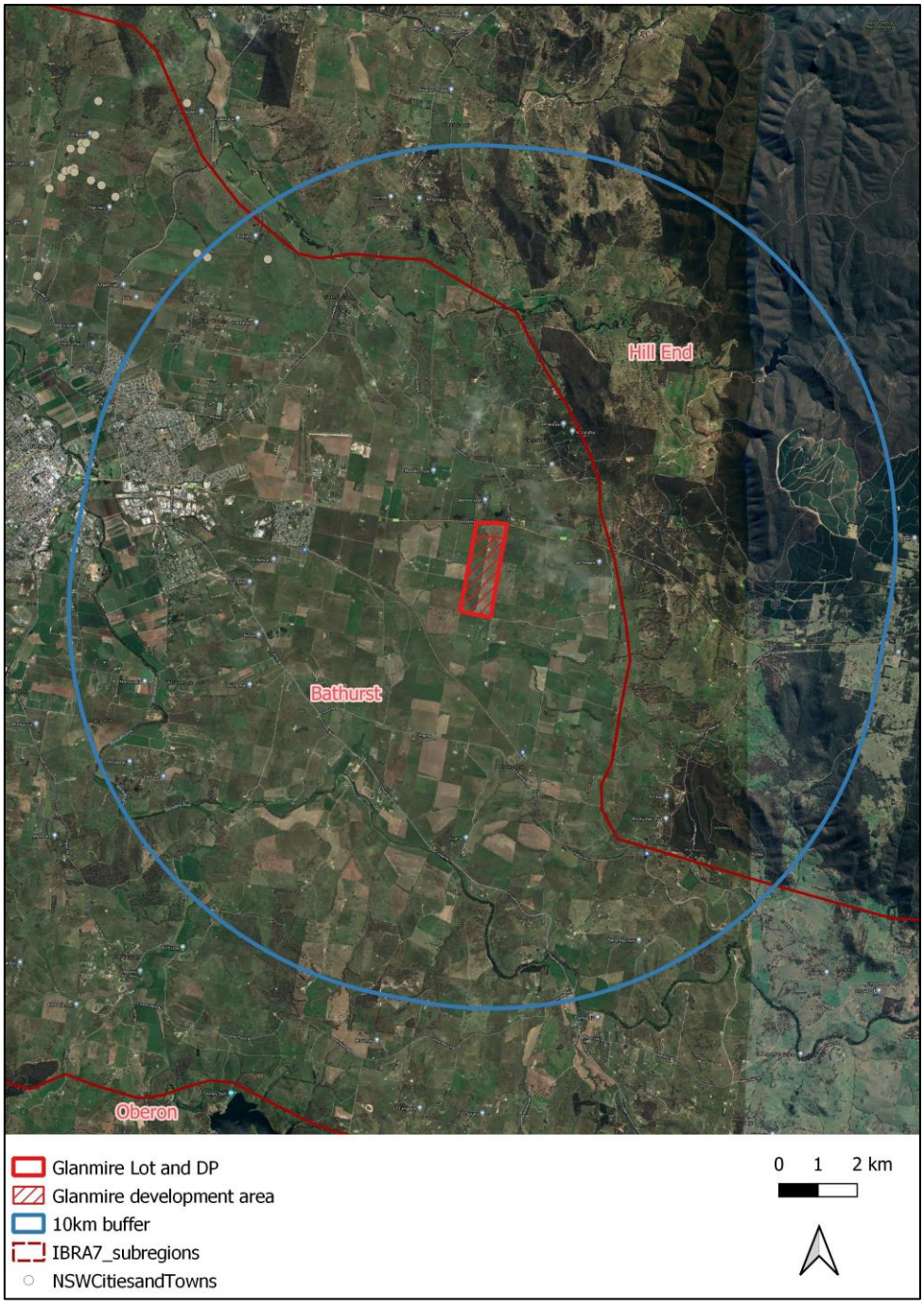
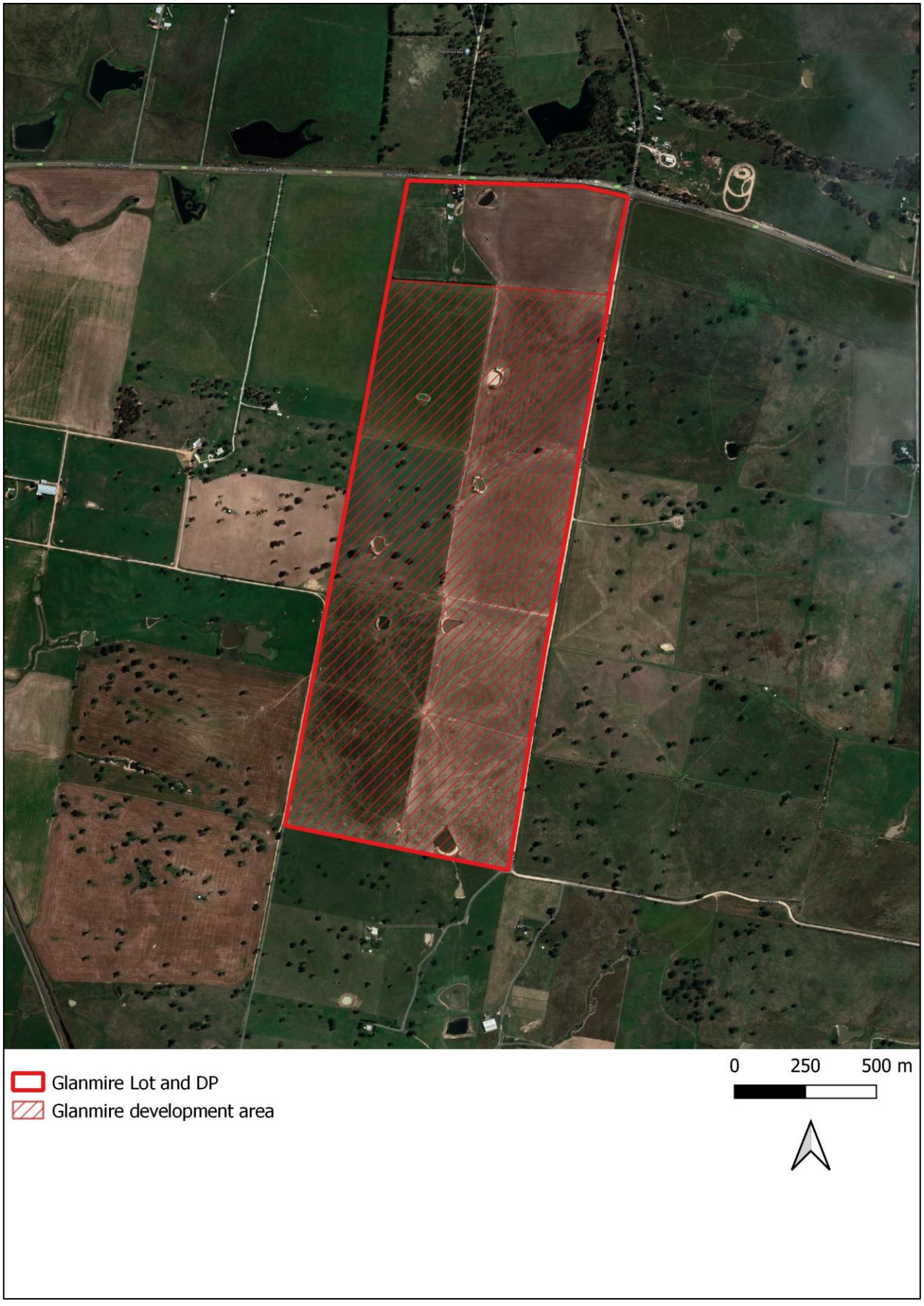


Figure 1-2: The development area



2 Methods

2.1 Personnel

This Biodiversity Scoping Assessment and associated field inspection was completed by appropriately qualified and experienced ecologists (Table 2-1).

Table 2-1: Summary of AREA project teams' qualifications

Name	Position	CV Details	Role in this ecology report and experience
Addy Watson	Manager of Biodiversity	• Grad. Dip. Captive Vertebrate Management, Charles Sturt University • Grad. Cert. Social Impact, University of NSW • B. Env. Sc. University of New England. • Diploma Project Management • NSW Biodiversity Assessment Method Accredited Assessor (BAAS19066) • Lean Six Sigma Certificate (Sydney Uni) • WHS White Card • Apply First Aid. Certificate number: 07328 • AHCPCM201- Recognising grasses	**Role** Editing QMS
Phillip Cameron	Managing Director	• BSc. Macquarie University • Ass Dip App Sci. University of Queensland. • Certified Environmental Practitioner (EIANZ) and practicing member. • NSW DPIE BioBanking and Bio-certification Assessor: accreditation number 0117. • NSW Biodiversity Assessment Method Assessor: accreditation number BAAS17082). • AHCPCM201- Recognising grasses • NSW DPIE Scientific License: 101087. • NSW DPI Ethics Approval 17/459 (3). • Practicing member of the NSW Ecological Consulting Association. • WHS White Card and Blue Card. • Apply First Aid (Parasol) ID: 6007221.	**Role** Field assessment Report writing Project management

Desktop assessment

Desktop assessment included a review of threatened species databases and considered state and Commonwealth environmental classifications. The following sources of information were used:

- BioNet- the website for the Atlas of NSW Wildlife Database: http://www.bionet.nsw.gov.au
- DPIE Threatened biodiversity database: https://www.environment.nsw.gov.au/threatenedspeciesapp/
- NSW Department of Primary Industries (DPI) Council and Developer Toolkit https://www.dpi.nsw.gov.au/fishing/habitat/protecting-habitats/toolkit
- The federal Department of Environment's Protected Matters Search Tool: http://environment.gov.au/erin/ert/epbc/index.html
- Critical habitat registers available on the:
  - OEH website at http://www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtectionByDoctype.htm

    - DPI NSW (Fisheries) website at http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what/register
    - Federal Department of the Environment website at http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl
- DPIE vegetation information system (VIS) database: http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx
- The federal Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE): http://www.bom.gov.au/water/groundwater/gde/map.shtml
- Department of Environment's directory of important wetlands: http://www.environment.gov.au/cgi-bin/wetlands/search.pl?smode=DOIW
- DPI's database for aquatic TECs: http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what-current
- Native Vegetation Regulatory Map: https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=NVRMap
- Biodiversity values map: https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap
- Koala habitat assessment: https://www.lmbc.nsw.gov.au/arcgis/rest/services/KoalaHabitat

2.2 Preliminary field survey

The preliminary field assessment occurred on 9 June 2020 and was conducted by Phillip Cameron of AREA. Due to the land use of the property (intensive ploughing agriculture), the development area was assessed using a combination of driving to confirm areas of Category 1 Land and walking to inspect each paddock tree, drainage line or other areas of interest without driving on crops.

Weather on the day of the assessment was fine, reaching a maximum of approximately 19 degrees Celsius.

2.2.1 Vegetation surveys

The preliminary assessment was design to align remnant paddock trees to a described Plant Community Type on the BioNet database collection and confirm the presence / absence of any Threatened Ecological Communities. No Biodiversity Assessment Method 2017 / 2020 (BAM) vegetation plots were completed as no vegetation zones were present, just isolated paddock trees.

All trees were observed for size group, species, and potential habitat (hollows).

The DPIE threatened species search by IBRA subregion was generated prior to the field assessment and was used during the field assessment as an indication of threatened flora / fauna and ecological communities which may occur in the development area. Threatened flora search transects were completed if habitat for threatened flora was observed.

2.2.2 Targeted fauna surveys

Searches for threatened species were conducted as far as possible during one day of assessment. These searches included:

- opportunistic observation of fauna including using the Spot Assessment Technique (SAT) for Koala
- walked search transects in areas of interest
- identification of species previously recorded in the development area (BioNet records).

Search for threatened fauna was limited to opportunistic sightings, however, will contribute to evidence towards describing the extent to which fauna may use the habitat in the development area.

2.3 Limitations

There were no limitations associated with the weather or season of the assessment within a cropped agricultural paddock with 18 remnant paddock trees.

Not all animals and plants can be fully accounted for within any given development area. The presence of threatened species is not static, and it changes over time, often in response to longer term natural forces which can at any time be dramatically influenced by man-made disturbance or weather.

The following assessment methods were not employed for this scoping assessment:

- Trapping (physical or indirect)
- Microbat ultrasonic call capture
- Nocturnal assessments.

3 Constraints Assessment

3.1 Desktop searches and results

3.1.1 Regional context

Regional, national and international environmental matters are considered in Table 3-1.

Table 3-1: Proximity of environmentally sensitive areas to the development footprint

Environmental Considerations	In the development footprint?
Commonwealth land?	No
An area reserved or a dedicated National Park?	No
Is the proposal located within land reserved or dedicated for preservation of other environmental protection purposes?	No
A World Heritage Area?	No
National Heritage Place?	No
Environmental Protection Zones in environmental planning instruments?	No
Land identified in an Act as wilderness?	No
Wetland areas dedicated under the Ramsar Wetlands Convention?	No
Great Barrier Reef or Marine Park?	No
Commonwealth Marine Area?	No
Critical habitat state or nationally?	No
An area mapped as Key Fish Habitat?	Yes – 2nd Order drainage lines, See Figure 3-4
An area mapped on the Biodiversity Values map?	No
An area mapped on the Native Vegetation Regulation map?	No

3.1.2 Threatened species database searches

Sightings of threatened species recorded on the BioNet Atlas between within 1500 metres and 10-kilometres of the development area is summarised in Table 3-2 and Figure 3-1. The BioNet results showed none of the 134 individual records of the 36 species known to occur in the 10 kilometre search area are in the development area or within 1500 metres.

Table 3-4 shows threatened species predicted in the EPBC Act Predicted Matters Report.

Table 3-2: BioNet records within 10km of the development area

Scientific	Common Name	NSW Status	Comm Status	No of records
Litoria booroolongensis	Booroolong Frog	Endangered (E) Protected (P)	E	23
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable (V) P	V	16
Paralucia spinifera	Purple Copper Butterfly Bathurst Copper Butterfly	E1	V	11
Callocephalon fimbriatum	Gang-gang Cockatoo	VP		10
Phascolarctos cinereus	Koala	VP	V	9
Miniopterus orianae oceanensis	Large Bent-winged Bat	VP		7
Litoria aurea	Green and Golden Bell Frog	EP	V	5
Circus assimilis	Spotted Harrier	VP		4

Scientific	Common Name	NSW Status	Comm Status	No of records
Hieraaetus morphnoides	Little Eagle	VP		4
Ninox strenua	Powerful Owl	VP		4
Petroica boodang	Scarlet Robin	VP		4
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	VP		3
Anthochaera phrygia	Regent Honeyeater	Critically E (CE)	CE	3
Petroica phoenicea	Flame Robin	VP		3
Stagonopleura guttata	Diamond Firetail	VP		3
Hirundapus caudacutus	White-throated Needletail	P	VCJK	2
Falco subniger	Black Falcon	VP		2
Gallinago hardwickii	Latham's Snipe	P	JK	2
Artamus cyanopterus cyanopterus	Dusky Woodswallow	VP		2
Anseranas semipalmata	Magpie Goose	VP		1
Apus pacificus	Fork-tailed Swift	P	CJK	1
Botaurus poiciloptilus	Australasian Bittern	EP	E	1
Haliaeetus leucogaster	White-bellied Sea-Eagle	VP		1
Lophoictinia isura	Square-tailed Kite	VP		1
Rostratula australis	Australian Painted Snipe	EP	E	1
Calidris acuminata	Sharp-tailed Sandpiper	P	CJK	1
Calyptorhynchus lathami	Glossy Black-Cockatoo	VP		1
Epthianura albifrons	White-fronted Chat	VP		1
Daphoenositta chrysoptera	Varied Sittella	VP		1
Dasyurus maculatus	Spotted-tailed Quoll	VP	E	1
Cercartetus nanus	Eastern Pygmy-possum	VP		1
Petaurus australis	Yellow-bellied Glider	VP		1
Petauroides volans	Greater Glider	P	V	1
Chalinolobus dwyeri	Large-eared Pied Bat	VP	V	1
Eucalyptus aggregata	Black Gum	V	V	1
Eucalyptus cannonii	Capertee Stringybark	V		1
36				134

Figure 3-1: BioNet records with 1500m of the development area

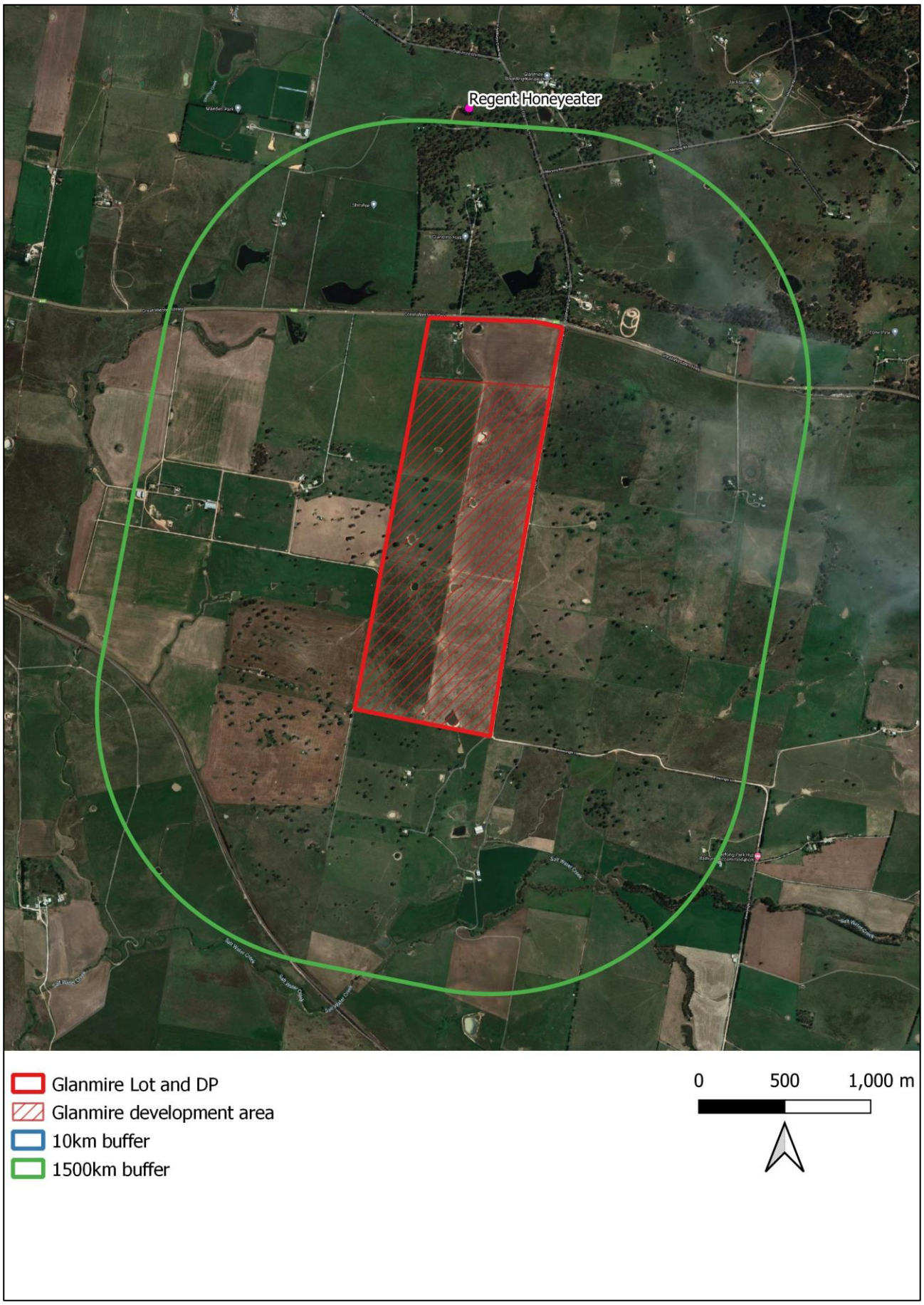


Table 3-3: Predicted listed species for South Eastern Highlands Bioregion, Bathurst subregion

Scientific name	Common name	NSW status	Commonwealth status	Occurrence
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Critically Endangered	Known
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable		Known
Burhinus grallarius	Bush Stone-curlew	Endangered		Predicted
Callocephalon fimbriatum	Gang-gang Cockatoo	Vulnerable		Known
Calyptorhynchus lathami	Glossy Black-Cockatoo	Vulnerable		Known
Chthonicola sagittata	Speckled Warbler	Vulnerable		Known
Circus assimilis	Spotted Harrier	Vulnerable		Known
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Vulnerable		Known
Daphoenositta chrysoptera	Varied Sittella	Vulnerable		Known
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable		Known
Glossopsitta pusilla	Little Lorikeet	Vulnerable		Known
Grantiella picta	Painted Honeyeater	Vulnerable	Vulnerable	Known
Hieraaetus morphnoides	Little Eagle	Vulnerable		Known
Lathamus discolor	Swift Parrot	Endangered	Critically Endangered	Known
Lophoictinia isura	Square-tailed Kite	Vulnerable		Predicted
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Vulnerable		Predicted
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Vulnerable		Known
Ninox connivens	Barking Owl	Vulnerable		Known
Ninox strenua	Powerful Owl	Vulnerable		Known
Petroica boodang	Scarlet Robin	Vulnerable		Known
Petroica phoenicea	Flame Robin	Vulnerable		Known
Polytelis swainsonii	Superb Parrot	Vulnerable	Vulnerable	Known
Stagonopleura guttata	Diamond Firetail	Vulnerable		Known
Tyto novaehollandiae	Masked Owl	Vulnerable		Known
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Vulnerable	Known
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Vulnerable		Known
Myotis macropus	Southern Myotis	Vulnerable		Known
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Vulnerable		Known
Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable		Known
Acacia flocktoniae	Flockton Wattle	Vulnerable	Vulnerable	Known
Asterolasia buxifolia	Asterolasia buxifolia	Endangered		Known
Eucalyptus aggregata	Black Gum	Vulnerable	Vulnerable	Known
Eucalyptus pulverulenta	Silver-leafed Gum	Vulnerable	Vulnerable	Known
Goodenia macbarronii	Narrow Goodenia	Not listed		Known
Lepidium hyssopifolium	Aromatic Peppercress	Endangered	Endangered	Known
Leucochrysum albicans var. tricolor	Hoary Sunray	Not listed	Endangered	Predicted
Swainsona sericea	Silky Swainson-pea	Vulnerable		Predicted
Thesium australe	Austral Toadflax	Vulnerable	Vulnerable	Predicted
Veronica blakelyi	Veronica blakelyi	Vulnerable		Predicted
Zieria obcordata	Granite Zieria	Endangered	Endangered	Known
Litoria aurea	Green and Golden Bell Frog	Endangered	Vulnerable	Known
Litoria booroolongensis	Booroolong Frog	Endangered	Endangered	Known
Litoria raniformis	Southern Bell Frog	Endangered	Vulnerable	Predicted
Mixophyes balbus	Stuttering Frog	Endangered	Vulnerable	Predicted
Paralucia spinifera	Purple Copper Butterfly, Bathurst Copper Butterfly	Endangered	Vulnerable	Known
Cercartetus nanus	Eastern Pygmy-possum	Vulnerable		Known
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Endangered	Known
Petaurus australis	Yellow-bellied Glider	Vulnerable		Known
Petaurus norfolcensis	Squirrel Glider	Vulnerable		Known
Petrogale penicillata	Brush-tailed Rock-wallaby	Endangered	Vulnerable	Known
Phascogale tapoatafa	Brush-tailed Phascogale	Vulnerable		Predicted

Scientific name	Common name	NSW status	Commonwealth status	Occurrence
Phascolarctos cinereus	Koala	Vulnerable	Vulnerable	Known
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Vulnerable	Known
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	Endangered Ecological Community		Known
White Box Yellow Box Blakely's Red Gum Woodland	White Box Yellow Box Blakely's Red Gum Woodland	Endangered Ecological Community	Critically Endangered	Known
Aprasia parapulchella	Pink-tailed Legless Lizard	Vulnerable	Vulnerable	Predicted
Delma impar	Striped Legless Lizard	Vulnerable	Vulnerable	Predicted
Hoplocephalus bungaroides	Broad-headed Snake	Endangered	Vulnerable	Predicted
Varanus rosenbergi	Rosenberg's Goanna	Vulnerable		Known

Table 3-4: Listed species predicted in the EPBC Act Protected Matters Report

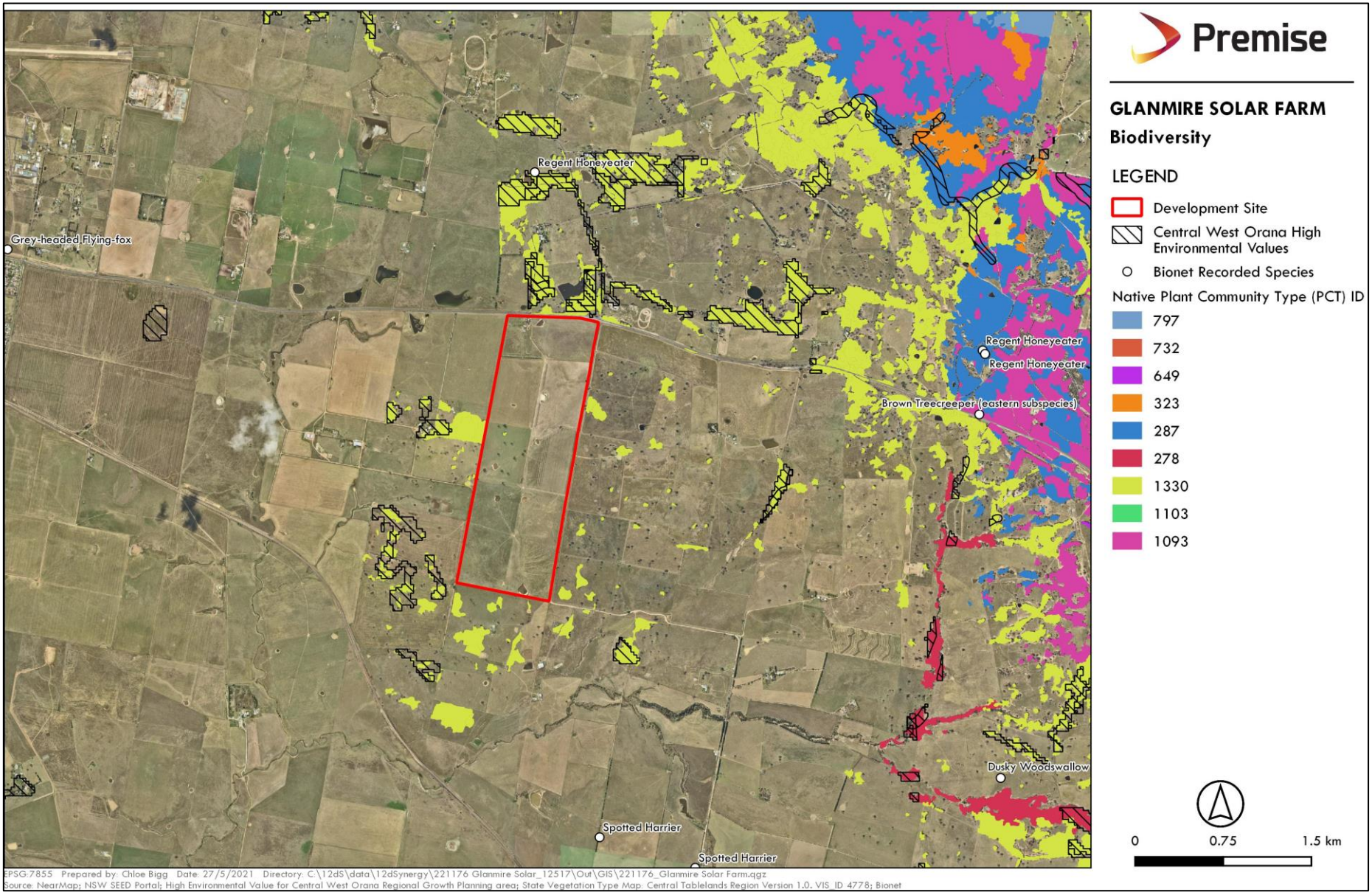
Scientific name	Common name	NSW status	Commonwealth Status
Natural temperate Grassland of the South Eastern Highlands			Critically Endangered
White Box-Yellow Box_Blakely's Red Gum Grassy Woodland and Derived Native Grassland		Endangered	Critically Endangered
Anthochaera phrygia	Regent Honeyeater		Critically Endangered
Calidris feruginea	Curlew Sandpiper		Critically Endangered
Grantiella picta	Painted Honeyeater		Vulnerable
Lathamus discolor	Swift Parrot	Endangered	Critically Endangered
Leipoa ocellata	Malleefowl	Endangered	Vulnerable
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew		Critically Endangered
Macquaria australasica	Macquarie Perch		
Litoria aurea	Green and Golden Bell Frog	Endangered	Vulnerable
Litoria booroolongensis	Booroolong Frog	Endangered	Endangered
Litoria raniformis	Southern Bell Frog	Endangered	Vulnerable
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Vulnerable
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Endangered
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Vulnerable
Phascolarctos cinereus	Koala	Vulnerable	Vulnerable
Dicanthium setosum	Bluegrass	Vulnerable	Vulnerable
Eucalyptus pulverulenta	Silver-leaved Mountain Gum	Vulnerable	Vulnerable
Euphrasia arguta		Critically Endangered	Critically Endangered
Lepidium hyssopifolium	Aromatic Peppercress	Endangered	Endangered
Leucochrysum albicans var. tricolor	Hoary Sunray	Not listed	Endangered
Aprasia parapulchella	Pink-tailed Legless Lizard	Vulnerable	Vulnerable
Delma impar	Striped Legless Lizard	Vulnerable	Vulnerable

3.1.3 Plant community mapping

The NSW Department of Planning, Infrastructure and Environment (DPIE) State Vegetation Type Map: Central Tablelands Version 0.1p0 4778 was accessed via the NSW Government SEED website (https://datasets.seed.nsw.gov.au/). This database mapped the entire development area, except for one paddock tree, as not native vegetation (Figure 3-2). The paddock tree is mapped as plant community type 1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion.

Field assessment confirmed the rest of the paddock trees on the property are remnants of plant community type 1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion.

Figure 3-2: Plant Community Types mapped on the SVM within 1500m of the development area (Source: Premise)



3.1.4 Koala habitat assessment

Koala (*Phascolarctos cinereus)* under a SSD framework, is a dual credit species, being a candidate species credit species where there is important habitat present in the development area. Koala presence and use of the area will be covered in ecosystem credits as addressed in an assessment for the proposal (i.e., removal of the paddock trees will trigger an offsetting requirement).

Species specific 'General Notes' as recorded on the TBDC (survey requirements) for koala discusses 'Important' habitat (however Glanmire is not a mapped important habitat area) which is defined by the density of koalas and quality of habitat determined by on-site survey.

Determination of a development area as important Koala habitat for this report includes review of:

- BioNet records for Koala – considering proximity to the development area and recency / consistency of records
- abundance of Koala food trees
- application of the Koala Habitat Protection SEPP 2021
- suitability of the habitat for Koala
- abundance of Koala.

Outcome:

Koala (important habitat) excluded.

Justification for exclusion:

No koala or signs of koala (tree scratches, scat etc) were detected during field assessment. No spotlighting and camera traps were used however the burden of proof was accepted by undertaking the Spot Assessment Technique for Koala at each tree in the development area.

No koala have been previously recorded in the development area nor within 1500 metres.

There is suitable food trees in the development area, however there are multiple disturbances surrounding it and impediments to safe movement. The vegetation in and around the development area is cropped paddocks which is not connected to another potential habitat. The northern boundary of the development area is a dual carriage highway.

Discussion:

See following sections for further discussion which also concludes the development area does contain suitable habitat for koala, it cannot be defined as 'important' or 'çore' koala habitat, demonstrated by the absence of a local koala population.

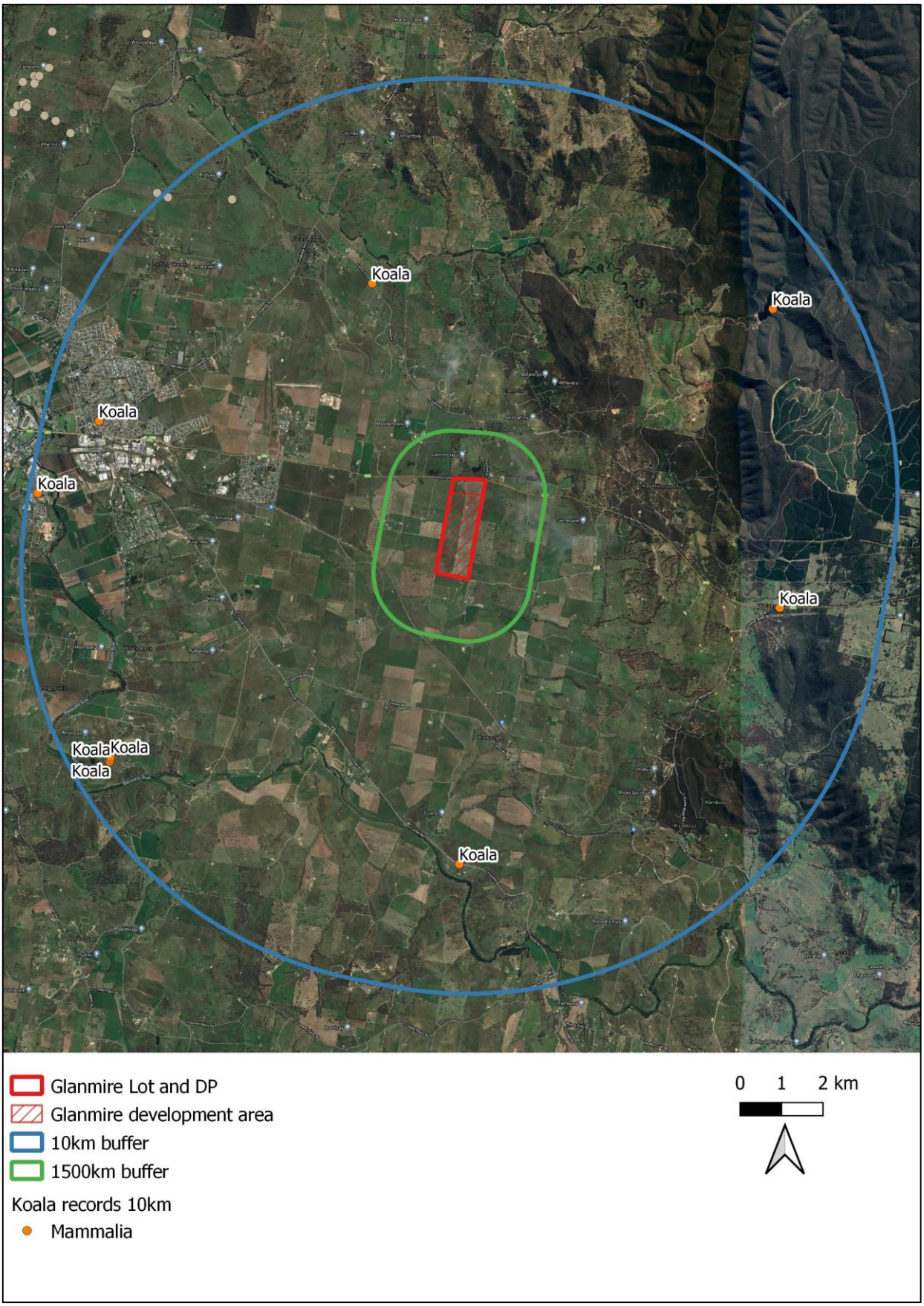
BioNet Records

Nine Koala records exist within 10 kilometres of the development area (Figure 2-8), these are mostly associated with a larger waterway or within proximity to an area with a large patch size of native vegetation. No records are within 1500 metres.

A close up of the development area illustrates connectivity to other areas (Figures 1-2 and 2-8). The development area does not provide a critical vegetation link between areas of high-quality habitat. Extensive areas of ploughed agricultural land, roads and a railway corridor runs between

the development area and other Koala Bionet records within 10 kilometres. Cleared agricultural land dominates the landscape around the development area.

Figure 3-3: BioNet Koala *Phascolarctos cinereus* records within 10km



EPBC Koala Habitat Assessment Tool

The Koala habitat assessment tool provided in EPBC Act Referral Guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DoE 2014) has been used to determine the sensitivity, value and quality of habitat within the development area, and, therefore, whether it contains habitat critical to the survival of the Koala. Areas scoring five or more using the habitat assessment tool (Table 3-5), contain habitat critical to the survival of the Koala (DoE 2014).

It was determined habitat of the development area scores **+4**. The development area does not connect habitat critical to the survival of the koala. Loss of habitat that is not habitat critical to the survival of the species is highly unlikely to have a significant impact on the koala for the purposes of the EPBC Act.

Table 3-5: Koala habitat assessment tool

Attribute	Score	Inland Criteria	Result (score for project site)
Koala occurrence	+2 (high)	Evidence of one or more Koalas within the last 5 years.	**0** No records of a Koalas exists within 2km.
	+1 (medium)	Evidence of one or more Koalas in 2km of the edge of the impact area within the last 10 years.	
	0 (low)	None of the above	
Vegetation composition	+2 (high)	Has forest or woodland or shrubland with emerging trees with 2 or more known Koala food tree species OR 1 food tree species that alone accounts for > 50% of the vegetation in the relevant strata.	**+2** Yellow Box (infrequent use) and Blakely's Red Gum (low use) are present in the development area.
	+1 (medium)	Has forest or woodland or shrubland with emerging trees with only 1 species of known Koala food tree present	
	0 (low)	None of the above.	
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥1000ha.	**0** The development area is in a rural landscape which is separated from contiguous landscapes by artificial barriers of roads, a railway line and cleared agricultural land which have no effective koala passage measures.
	+1 (medium)	Area is part of a contiguous landscape <1000ha, but ≥500ha.	
	0 (low)	None of the above.	
Key existing threats	+2 (high)	Little or no evidence of Koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for Koala occurrence and have no dog or vehicle threat present	**+1** The development area scores 0 for Koala occurrence and is likely to have some degree dog or vehicle threat present. The development area is adjacent to road with moderate levels of used. Urban development at which dogs are housed occurs within 1500m.
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for Koala occurrence, OR Areas which score 0 for Koala occurrence and are likely to have some degree dog or vehicle threat present.	
	0 (low)	Evidence of frequent or regular Koala mortality from vehicle strike or dog attack in the proposal site at present, OR Areas which score 0 for Koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 (of the DoE guidelines).	**+1** The development area is adjacent to rural development at which dogs are housed and a well-used road. It is unclear if the development area is likely to contribute to achieving interim recovery objectives.
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 (of the DoE guidelines).	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1(of the DoE guidelines).	
Total score:			**+4**

Justification that this proposal will not have an adverse impact on habitat critical to the survival of the koala lies in the following points:

- A score of 4 is low score
- Koala are not present, nor have they historically been present in the development area
- Koala are unlikely to be present, as the vegetation in and around the development area does not connect to other potential habitat due to being surrounded by major road and railway corridors and cleared agricultural land.
- Koala are unlikely to use suitable habitat in the development area as it is very isolated from other potential habitat.
- Koala are unlikely to be impacted by the proposal.

The proposal will not adversely affect habitat critical to the survival of the koala. Referral to the Commonwealth is not recommended.

3.1.5 Plant communities

Confirmation of the Plant Community Types in a highly cleared landscape can be challenging as diagnostic species assemblages are not present or are significantly limited.

To assist in the PCT selection the BioNet VIS Classification database was used to review the profile for PCT1330. The review was limited to PCT1330 as other candidates shown in Figure 3-2 are associated with different landforms. In doing this the PCT profile was used to review the tree species observed in the development area and was found to be consistent. Other attributes such as landscape position etc were checked and were also found to be consistent with the description.

For the purposes of the scoping assessment, the 18 paddock trees in the development area is Category 2 Land comprising of plant community type 1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion.

3.1.6 Threatened Ecological Communities

Plant Community Type 1330 is associated with one Threatened Ecological Community (TEC) – White Box, Yellow Box Blakely’s Red Gum Woodland which is listed as Critically Endangered under the BC Act.

The 18 paddock trees forming part of PCT1330 are not part of the Commonwealth listing because it is not consistent with the criteria.

3.1.7 Terrestrial habitat

The development area is in a highly disturbed and cleared landscape.

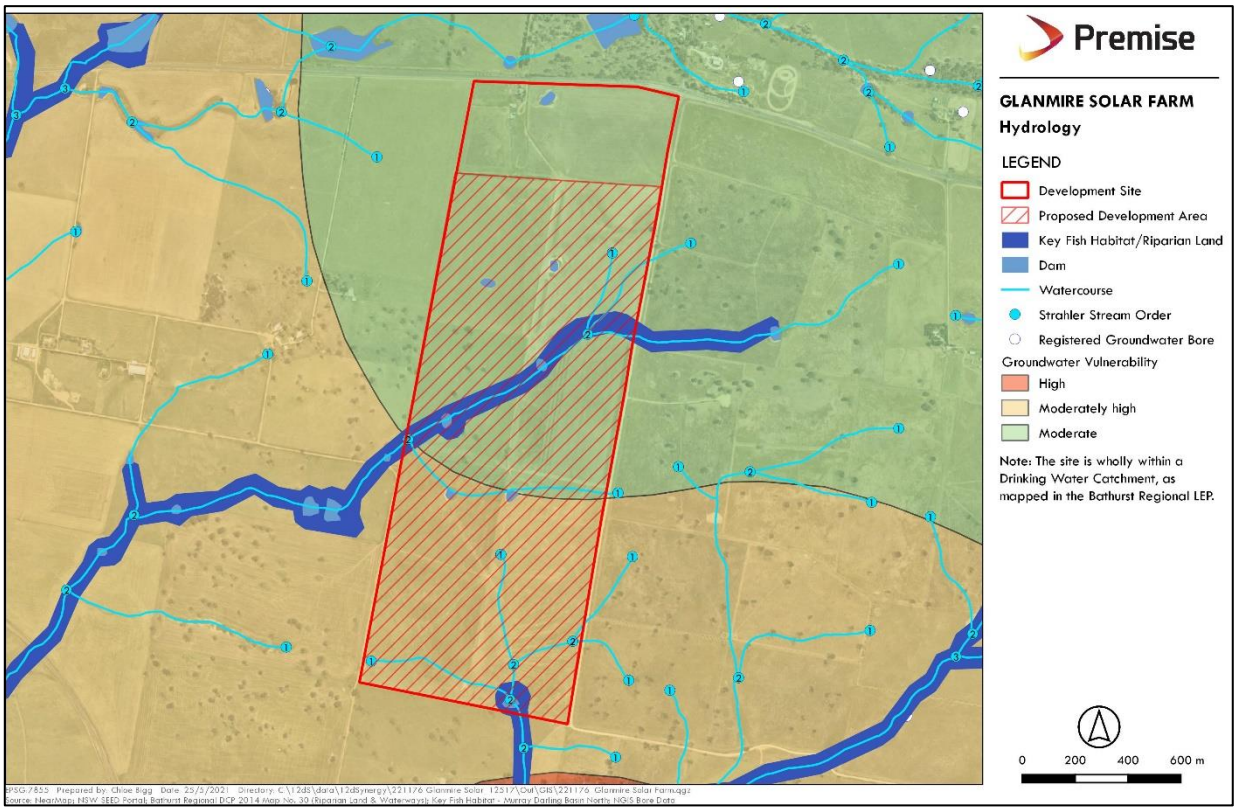
There are no to very few fallen logs, branches or potential artificial habitat (debris) in the development area, except occasionally beneath large trees.

All trees within the development area were identified and checked for hollows. Nearly all trees possess hollows and / or stags and none had a tree hollow over 20 centimetres in diameter.

3.1.8 Aquatic habitat

Two unnamed 2nd Order streams and six 1st Order drainage lines are within the development area (Figure 3-4). Key Fish Habitat is mapped in the development area. The closest third Order stream (semi-permanent water) is Saltwater Creek 2.5km south of the development area.

Figure 3-4: Topography of the development area (source: Premise)



A field assessment confirmed no aquatic habitat occurs in the development area as all has been converted into cropping (Figures 3-5 to 3-7).

Figure 3-5: First Order stream aquatic habitat in the development area

Figure 3-6: First Order stream and dam aquatic habitat in the development area

Figure 3-7: Second Order stream and dam aquatic habitat in the development area

3.1.9 Ground water dependant ecosystems (GDE)

A search of the Bureau of Meteorology Groundwater Dependent Ecosystems Atlas showed the development area:

- Does not possess an aquatic GDE
- Has small areas mapped as possessing a terrestrial GDE
- Is entirely mapped as possessing a subterranean GDE.

As the development is for a proposed solar farm, a GDE will not be affected by the proposal. Ground water mapped by Premise (See Figure 3-4) shows the lower half of the development area has moderate ground water vulnerability and the upper half had moderately high ground water vulnerability.

3.1.10 Weeds and pests

No High Threat Weeds were recorded in the development area.

Other exotic species recorded include:

- Pine – Pinus sp.
- Flatweed - Hypochaeris radicata
- Phalaris sp.
- Hedge Mustard – Sisymbrium officinale
- Sweet Vernal Grass – Anthoxanthum odoratum
- Sweet Briar – Rosa rubiginosa

4 Requirement for assessment as a State Significant Development

In my opinion, the development area meets the criteria to be assessed as a scattered tree (formerly paddock tree) or small area streamlined development assessment.

The BAM Calculator was updated on 22 October 2020 to align with BAM 2020. BAM Support will need to be contacted for guidance on how to use the BAM Calculator to apply the transitional arrangements.

5 Proposal offsetting

The removal of the 18 paddock trees will require an offset obligation. This can be met by:

- Paying required amount direct to the Biodiversity Conservation Trust
- Purchase credits from the open market (dependent on availability of required credits)
- Establishing a Biodiversity Stewardship Site to generate the credits required.

For this proposal, purchasing credits on the open market or from the Biodiversity Conservation Trust may be the most logical approach given the low numbers of credits required.

Establishing a Biodiversity Stewardship Site may be a long and challenging process, the value of which is not commensurate with the size and nature of the proposal.

6 References

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DPIE Biodiversity Values Map https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap

DPIE Koala Habitat Protection SEPP https://webmap.environment.nsw.gov.au/Html5Viewer291/index.html?viewer=KoalaSEPP.htm5

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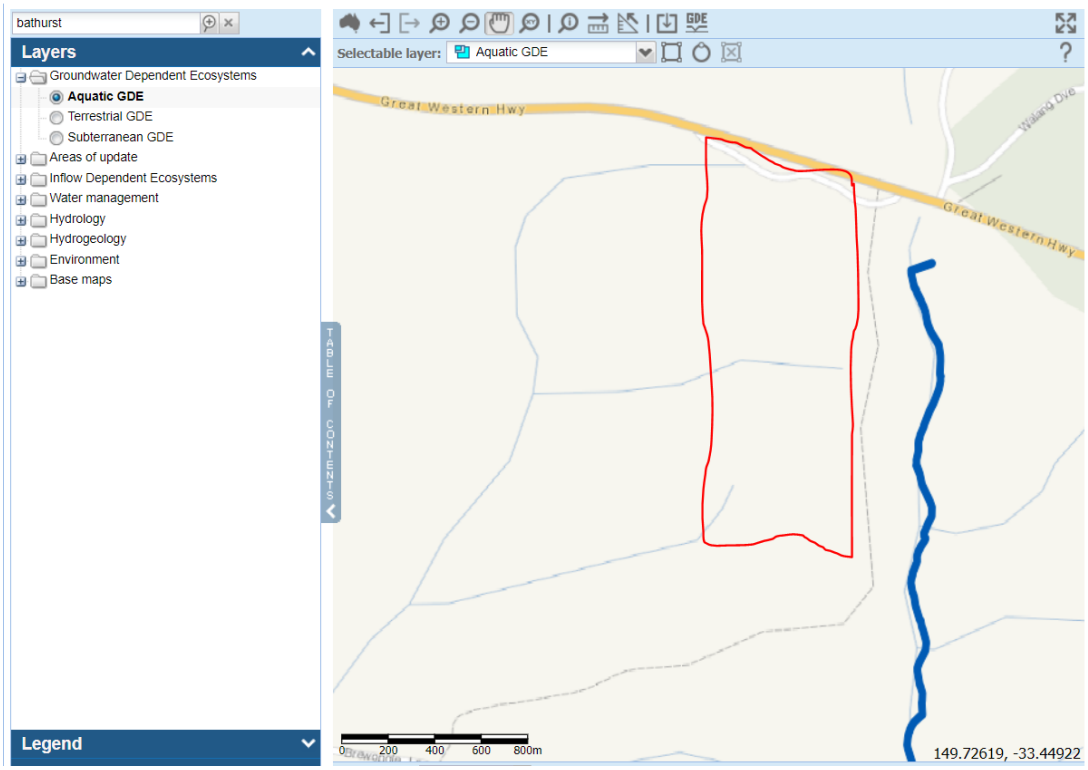
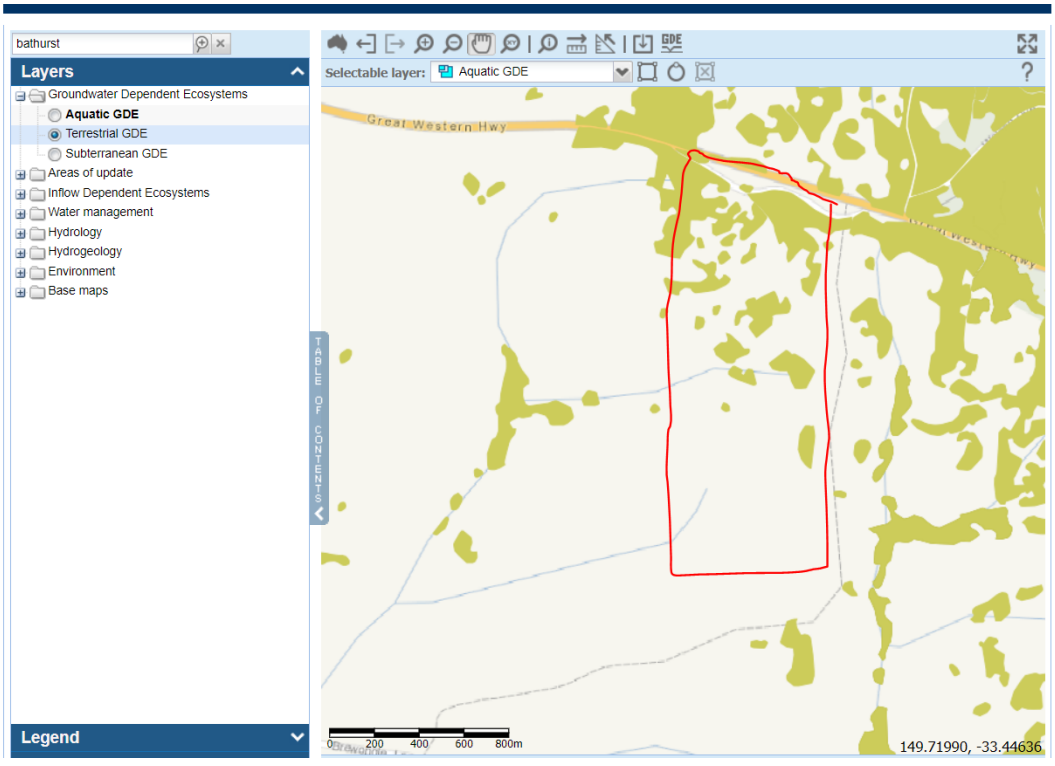
Appendix A – Database search

Groundwater Dependent Ecosystems

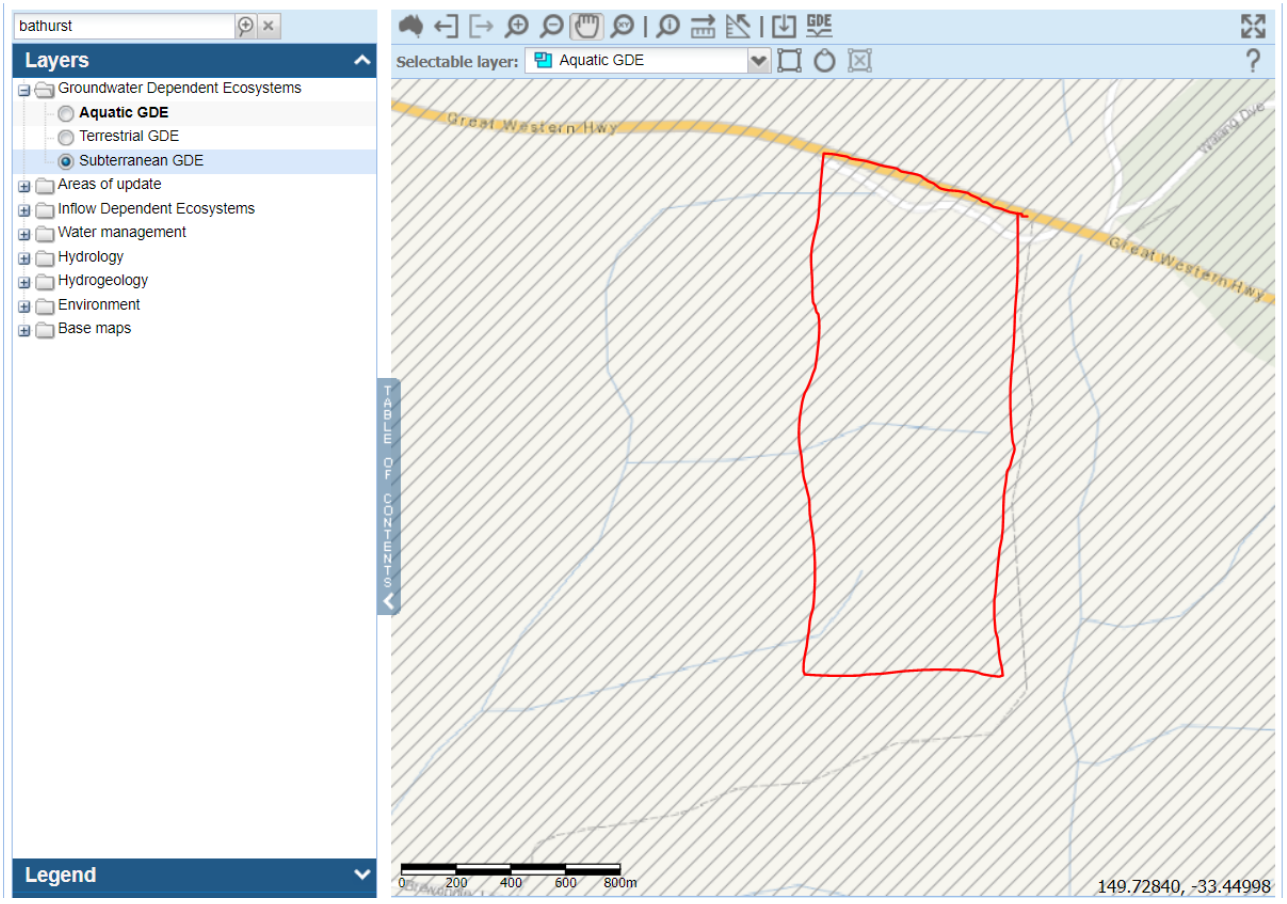
Aquatic GDE (Red polygon represents approximate location of the development area) (Source: http://www.bom.gov.au/water/groundwater/gde/)



Terrestrial GDE (Red polygon represents approximate location of the development area) (Source: http://www.bom.gov.au/water/groundwater/gde/)



Subterranean GDE (Red polygon represents approximate location of the development area)
(Source: http://www.bom.gov.au/water/groundwater/gde)



EPBC Act Protected Matters Report
See next page

APPENDIX D

LANDSCAPE VISUAL AMENITY SCOPING ASSESSMENT

78 Macgregor Terrace, Bardon 4064
PO Box 189 Red Hill 4059
ABN 72166862157

iris

MEMO

To: Tim Averill, General Manager – Australia, Elgin Energy

From: Suzie Rawlinson, Director

Date: 28th May, 2021

Re: **Glanmire Solar Farm Project**

Landscape and visual amenity preliminary advice

Introduction

The Glanmire solar farm project is in the Central West and Orana region of NSW, approximately 11 kilometres east of Bathurst. The Glanmire solar farm project site ('the site') is located to the south of the Great Western Highway. The locality of Glanmire is on the western edge of the Great Dividing Range in the Macquarie River plain, also known as the Bathurst Plains.

Landscape and visual characteristics of the site

The Bathurst Plains are described in the *Bathurst Vegetation Management Plan* as being '*typified by a treeless landscape'* which '*provides a contrast to the builtup area of the urban environment'* of Bathurst (Bathurst Regional Council, 2019).

The site itself has a gently undulating terrain, forming a series of small valleys and dams. The site is currently occupied by open grazing pastures and sown paddocks with some scattered trees in central parts of the site, and a dense corridor of trees to the north east of the site, adjacent to an existing dwelling, '*Woodside'* (formerly Woodside Inn). The landscape surrounding the site is characterised by largely open fields, with corridors of vegetation located along field boundaries and roads, ornamental gardens surrounding scattered rural dwellings, vegetated creeks and ridgelines.

The attractive hills of the Great Dividing Range to the east, form a dramatic and scenic backdrop to the valley, and Mt Panorama can be seen amongst the hills beyond Raglan and Bathurst to the west. This includes a clear view of the iconic Mt Panorama sign. Within the local visual setting, there are attractive views south east across the Salt Water Creek valley towards the more elevated areas of Brewongle.

There is an existing rail corridor and transmission lines in the vicinity of the site. This includes a 66Kv line which runs past the site adjacent to the Highway and towards Raglan, and a 132Kv line about one kilometre to the south of the site.

Planning considerations

The site is within the Central West and Orana Region and Bathurst Regional Council area. The Local Environmental Plan (LEP) and Development Control Plan (DCP) are supported by the *Central West and Orana Regional Plan 2036* and *Bathurst Regional Local Strategic Planning Statement* (LSPS) which set the future direction for the region.

Central West and Orana Regional Plan 2036

This Plan is intended to guide the land use planning priorities for the region over the next 20 years. It says that the … '*rich soils, mountains and vast plains form a mosaic of beautiful landscapes*' (p.8). Among the directions set out in the plan, those relating to the landscape are Direction 1, which aims to '*protect the region's diverse and productive agricultural land*' (p.19) and Direction 12, which aims to '*Plan for greater land use compatibility'* and to limit impact on '*areas with rural landscape value*' (p.35).

The renewable energy industry is recognised as providing growing job opportunities, with '*Landmark solar'* projects distinguishing the region as a '*leader in renewable energy development'* (p.8). In particular, Direction 9 aims to '*Increase renewable energy generation'* and recognises the region's '*vast open spaces'* and associated potential for '*large-scale solar energy'* (p.31).

Vision Bathurst 2040 Bathurst Local Strategic Planning Statement, 2020

The site is located in the rural area east of Bathurst and Raglan and is not identified within or near any areas identified for '*residential expansion*' in the LSPS. A '*Future Employment*' area (for industrial purposes) is identified in the structure plan to the east of the airport, about 2.5 kilometres west of the project site. To the west of the airport, a '*Gateway Investigation Area'* is identified in the structure plan, along Sydney Road and about four kilometres west of the project site. The LSPS states that '*detailed investigations as to their suitability for urban purposes*' is required, to determine '*whether infrastructure is available to service the lands and how the scenic quality of the gateway to the city can be preserved and enhanced'* (p.28).

The LSPS intends for the management of the growth of the City of Bathurst and to '*minimise the encroachment of incompatible land uses in the vicinity of the Bathurst Regional Airport and the Main Western Railway Line'* (Action 7.8). The Main Western Railway Line is located about 1.5km to the south of the project site, between Raglan and Brewongle Stations.

Planning Priority 12: Enhance environmentally sensitive land and biodiversity says in relation the landscape and views … '*The Bathurst Region enjoys a range of important landscapes and vistas. The gateways into the urban areas of the city, particularly along the Great Western Highway and Mitchell Highway, have undergone new plantings under Council's Vegetation Management Plan to achieve a strong unified landscaped environment that recognises the transition between the rural and urban landscapes with natives merging to exotics.'* (p.81)

It describes the views of the Macquarie River floodplain … *'with its patchwork of market gardens and remnant wetlands, further enhances the City's unique identity, especially on the eastern approach from Kelso and Raglan. The floodplain also allows for an unobstructed line of sight to Mount Panorama from the Great Western Highway.'* (p.81)

Relevant actions to meet Planning Priority 12 include:

- To review Council's land use planning instruments and guidelines including '*Identification and protection of scenic and cultural landscapes'* (Action 12.4)
- *'Improve the scenic quality of the Region by limiting urban and rural lifestyle development in areas of high biodiversity, on hilltops and ridges and provide a green edge between the urban and rural environment'* (Action 12.10)
- '*Improve and enhance the city's gateways by controlling built form, providing screening between fences and arterial roads, and providing appropriate buffers to screen urban growth'* (Action 12.11)
- '*Ensure the protection of the Sydney Road gateway is a key priority'* in planning for the '*gateway investigation area*', City of Bathurst Structure Plan (Action 12.12)
- '*To protect rural lands at the City's edges from inappropriate development and urban landuse encroachment'* (Action 12.19).

Bathurst Vegetation Management Plan 2019

The *Bathurst Vegetation Management Plan 2019* (BVMP, Bathurst Regional Council 2019) identifies that the landscapes surrounding the city give it a sense of containment and provide a backdrop to the views from within and into the city. In particular, the Bathurst Plains are '*particularly significant as a natural gateway feature*' which are '*viewed from the eastern approach to Bathurst City'* from the Great Western Highway (p.36). While the Region's '*agricultural land'* is generally considered to comprise '*significant landscapes for visual amenity and valued vistas into and out of the Region*', the site is not identified as part of the '*visually significant portion'* of the Bathurst Plains landscape. The '*floodplain'* and '*prominent ridges and hillsides'* surrounding Bathurst are described as contributing to the unique '*rural identity'* of the city (p.35).

Section 6 provides guiding principles to protect and manage the Region's '*Significant Natural Landscapes'*, and includes:

- Maintain *'vistas of the slopes and hilltops'* from urban areas
- Contain the '*urban edge of urban development'* and preserve the *'ridges and hills running generally north-south to the west of Bathurst*'
- Protect the '*gentler slopes to the north, east and southwest'* as a '*contribution to the unique rural identity of the City'*
- Protect the '*scenic value of the wooded slopes and ridges'* to '*ensure the Region's rural landscapes, views and vistas are preserved and enhanced'* (s.6.3).

Section 11 provides guiding principles to enhance the 'gateways' or main entrances to Bathurst and surrounding villages. The land between Glanmire and Raglan, along the Great Western Highway (Eastern Approach to Bathurst) is described as a '*predominately a rural setting situated on the generally treeless Bathurst Plains*', with existing roadside vegetation consisting of '*exotic grasses, widely dispersed small isolated clumps of immature Silver Wattle and Hawthorn'* (s. 11.3.3).

Objective 4 aims to '*create a significant eastern gateway (Great Western Highway) into Bathurst that enhances the rural vistas, provides unity amongst many discordant visual effects and reflects the*

heritage values of the City'. This plan includes specific management strategies and recommendations to achieve this goal.

Bathurst Region Rural Strategy 2010

Section 6.2 of the Bathurst Region Rural Strategy identifies the need for the protection and enhancement of the Region's '*Rural Landscapes and Features*', which contribute to the '*identity and character'*, including '*hilltops and ridges, natural landscapes and rural views and vistas*' (s.6.2).

This includes the protection and enhancement of the Region's *'Areas of High Scenic Quality and Important Landscape Features'* (Section 6.2.1). Scenic locations for the region are identified in this plan, however, there are none near the project site. The strategy suggests, however, that *'all roadways throughout the rural areas have a high scenic value',* including *'all drives from Bathurst to all village and settlement locations and drives between villages and settlement locations'.* (s.6.2.1)

Section 6.2.2*,* '*Protection of Rural Landscapes and Features',* identifies the key *'threats to scenic quality'* to include *'inappropriately sited development located adjacent to roadways'.* This plan includes several actions recommended to ensure that the *'general scenic quality of the region is protected'.* This includes setbacks to *'reduce the visibility of new development and to enable opportunities to revegetate and therefore screen new development',* and also to *'avoid locating new development on ridges and hilltops where it is highly visible'.* (s.6.2.2)

Bathurst Regional Local Environmental Plan 2014

The purpose of the Bathurst Regional Local Environmental Plan 2014 (LEP) is to '*promote development that is consistent with the principles of ecologically sustainable development and the management of climate change*' (Bathurst Regional Council, 2014b, cl.1.2.2b). This includes the aim to '*protect and enhance the region's landscapes, views, vistas and open spaces*' (cl.1.2.2l).

The project site is in the RU1 Primary Production zone, which aims to '*maintain the rural and scenic character of the land'* (cl.RU1 zone). The LEP also aims to '*provide for a range of compatible land uses that are in keeping with the rural character of the locality, do not unnecessarily convert rural land resources to non-agricultural land uses, minimise impacts on the environmental qualities of the land and avoid land use conflicts'* in this zone (Land Use Table, zone RU1 objectives).

The project site includes '*Woodside'* (formerly Woodside Inn), a heritage listed (local) single storey dwelling located at 4823 Great Western Highway. The historic '*Glanmire Hall'* is located to the north of the highway, about 600 metres north of the project site, however the building or gardens are not listed as a local or State heritage item. An objective of the heritage conservation clause in the LEP is to conserve the heritage significance of heritage items and heritage conservation areas, including '*settings and views*' (cl.5.10).

Bathurst Regional Development Control Plan 2014

The DCP recognises the visual quality of the rural landscape, stating that development in rural areas (including RU1) should '*protect highly valued agricultural lands'* and '*minimise the alienation of rural lands from competing and conflicting land uses*' (Chapter 6, s. 6.1.2). It also states that adequate buffer areas and setbacks should be used to minimise negative impacts on rural dwellings from adjoining land uses, including 50 metres for 'Rural Industry' and 150 metres for more intense land uses such as Extractive Industries, Sawmills and Road Transport Facilities (Chapter 6, s. 6.1.3). It suggests that consideration be given to the location, design and materials of fences, driveways and

property access roads, particularly near main roads and '*gateway approaches to the City'*, to minimise '*visual impact'* and ensure they are '*compatible with the rural landscape'* (Chapter 6, s.6.3).

The DCP recognizes the importance of the region's 'rural vistas' in Chapter 7 (s.7.10.1), generally, and does not identify any specific views, lookouts or areas of valued landscape character within the vicinity of the site. In relation to the preparation of a landscape plan, Chapter 13 of the DCP says landscaping should aim to improve '*visual amenity and to ensure that developments do not dominate their surroundings'* as well as '*provide landscaped buffers to reduce the potential for conflict between land uses*' (Chapter 13, s.13.3.1).

Potential visibility of the project

The potential visibility of the project is largely determined by landform and vegetation. The site and surrounding Bathurst plain is undulating, with several north to south aligned gentle ridges, which contain local views into smaller visual catchments. The landform rises to more elevated areas in the east, forming part of the Great Dividing Range. (Refer Figure A)

The potential visibility of the project (Refer to Figure B Zone of theoretical visibility) has been identified through an analysis based on the topography of the site. This analysis shows a worst-case scenario for visibility as it does not include vegetation and built form which would provide some screening and filtering of views. This analysis shows the pattern of potential visibility and is a starting point for detailed analysis.

Generally, it shows:

- There would be close and mid-range views from the rural properties to the west of the site on the slopes facing the site and elevated areas within 500 metres of the site;
- Views to the site are contained to the west by elevated land about 3.5 kilometres west of the site, and to the east of Raglan, this landform obstructs view to the site from the dwellings on Eugenie Street and within Raglan;
- To the north of the highway there is the potential for views of the site within the elevated areas to the west of Swamp Creek north west of the site, in the vicinity of Glanmire House, and from elevated areas south of Mersling Road about 1-2 kilometres north east of the site;
- There would be close and mid-range views from the rural areas to the east of the site within one kilometre, on the elevated areas at about 2-3km from the site; and also from elevated areas further east at about four kilometres from the site;
- To the south of Salt Water Creek, and south east of the site, there is the potential for views from elevated areas at between one kilometre and over four kilometres from the site extending to the south east and directly south;
- There would be close and mid-range views to the project from the rural areas to the south of the site, directed mainly up the valleys created by the undulations on the site.

Overall, based on this preliminary analysis the site is expected to have a relatively small visual catchment with views being most likely from areas in close proximity to the site or from parallel ridges, south of the highway. Areas where a greater percentage of the site may be seen are the slopes facing the site and elevated areas within one kilometre, as well as the more elevated areas to the east of the site which are at two to four kilometres from the site and aligned parallel to the rectangular shaped project site.

The existing mature vegetation located along the north western boundary of the proposed development area of the site has been included in this preliminary analysis (Refer figure B) and would reduce the visual prominence of the project from the north. There is also existing vegetation within the surrounding rural landscape, that has not been included in this preliminary analysis, which would further reduce the potential visual catchment of the site as some views would be screened by or filtered through trees. The vegetation on the surrounding hills and ridgelines would also provide a vegetated backdrop to views of the project. Overall, the vegetation and undulating local landform would increase the visual absorption of the proposed development into the surrounding landscape.

Views from the Great Western Highway

When travelling west along the Great Western Highway, approaching Kelso and Bathurst, the northern most areas of the site would be visible, where not obstructed by roadside trees and landform. This area has been removed from the proposed development footprint to minimise the potential visibility of the site from the Highway and respond to the intention in the planning scheme to protect and create a gateway experience on the approach to Bathurst.

Eastbound views along the Highway include attractive long views across the valley to the hills of the Great Dividing Range. Due to the landform of the site, which generally slopes away from the highway, this journey would include a glimpse to the north western corner of the potential development area of the site. This glimpsed view would be seen within the broader views across the valley.

Views from residential properties

The project would be visible from the rural areas surrounding the site which contain scattered residences and has the potential for future development of dwellings.

North of the highway, there would be six dwellings within one kilometre, and a further nine dwellings within two kilometres of the site that would have partial views to the project. These views would be mostly to the northern end of the site and are likely to also include the recently widened highway in the view.

South of the Highway, and with the potential for greater visibility of the site, there are three existing dwellings and four potential future dwelling sites which have been identified by the adjoining landholders within one kilometres of the site. A further five dwellings are located in the fields up to two kilometres from the site and there is one dwelling between two and three kilometres of the site, to the west and near the Highway, that also has the potential for views due to the rising landform towards Kelso. As the distance increases the landform reduces the potential visibility of the site and there is a greater potential for screening by intervening vegetation.

There are also dwellings located on the elevated land to the east of the site, at a distance of between two and three kilometres, and one dwelling at about four kilometres from the site. While the elevation and locations would allow an increased visibility into the site, the panoramic nature of views from the more elevated locations and increasing distance are expected to provide some mitigation of the project from these locations.

Many of these dwellings include existing views to the Highway, rail line and transmission line infrastructure crossing the valley. There are also large sheds and other structures associated with these dwellings which support the rural activities within the area.

Potential visual mitigation measures

During the preparing of an EIS a visual assessment would be prepared that would further analyse the potential visual impact of the site. This would include a more detailed consideration of views from the Highway and surrounding private residential dwellings. The potential amenity impacts of glare would also be considered from private residential dwellings, roads and the airport as required.

Further analysis of the visibility of the site, and site investigations would be undertaken to refine the development footprint, determine the location of any larger scale infrastructure, and provision of screening vegetation, to respond to the views from residential dwellings with views to the site.

A landscape strategy would also be prepared to identify the proposed location of screen planting to mitigate any potential visual impacts of the project. This strategy would be determined in consultation with the community and specifically address the potential for views from the highway to ensure the project does not adversely affect the gateway experience intended for this route.

References

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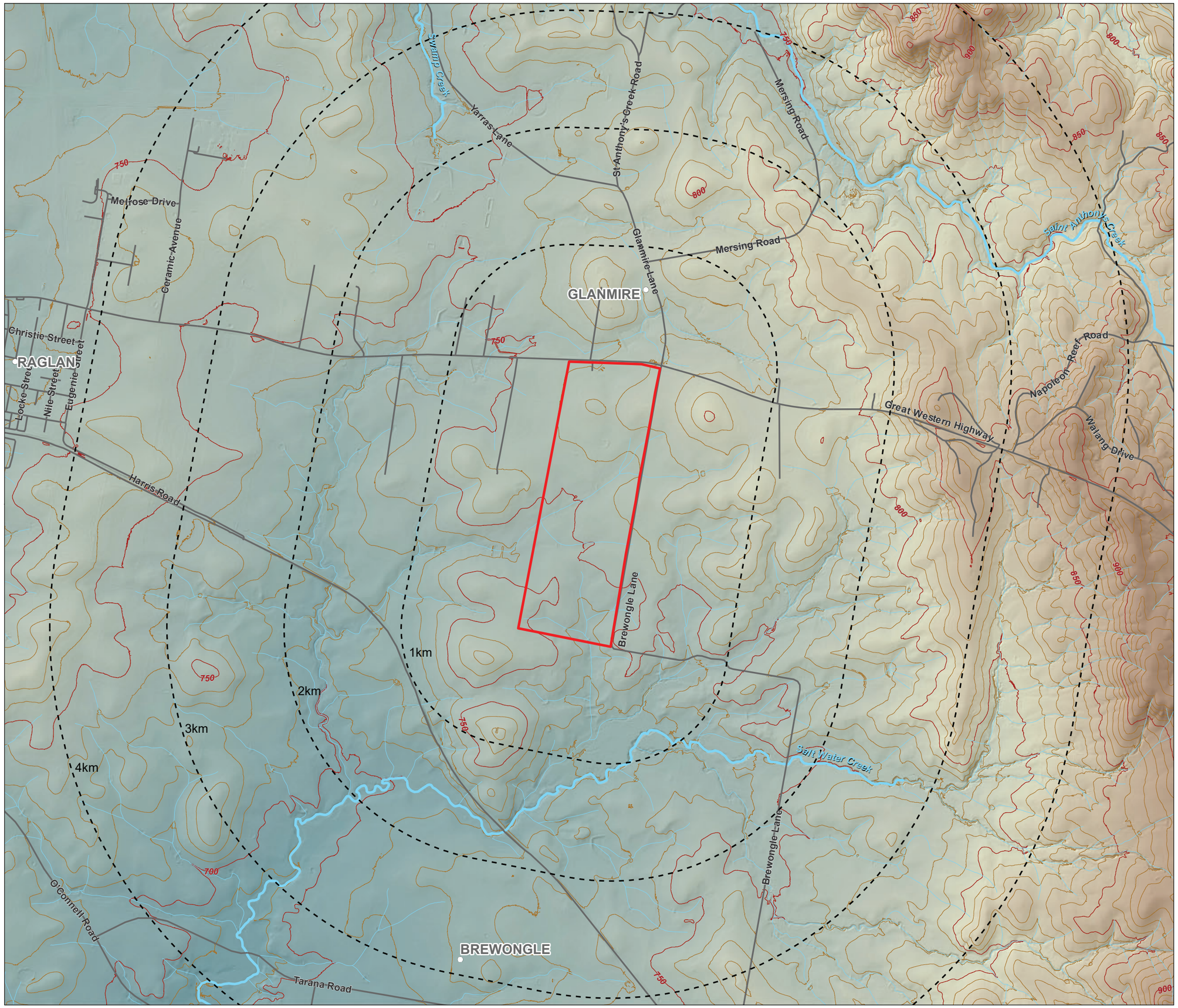

Glanmire Solar Farm |
Visual impact analysis

Figure A:
Topography

- Subject Site
- Contour (50m)
- Contour (10m)
- Distance from the site
- Watercourse

SOURCE:
Surface analysys: Derived from 2m LiDAR, Bathurst201510-LID2-AHD_7446292_55_0002_0002_2m © Department Finance, Services and Innovation 2015
Watercourse: GeoScience Australia 2015

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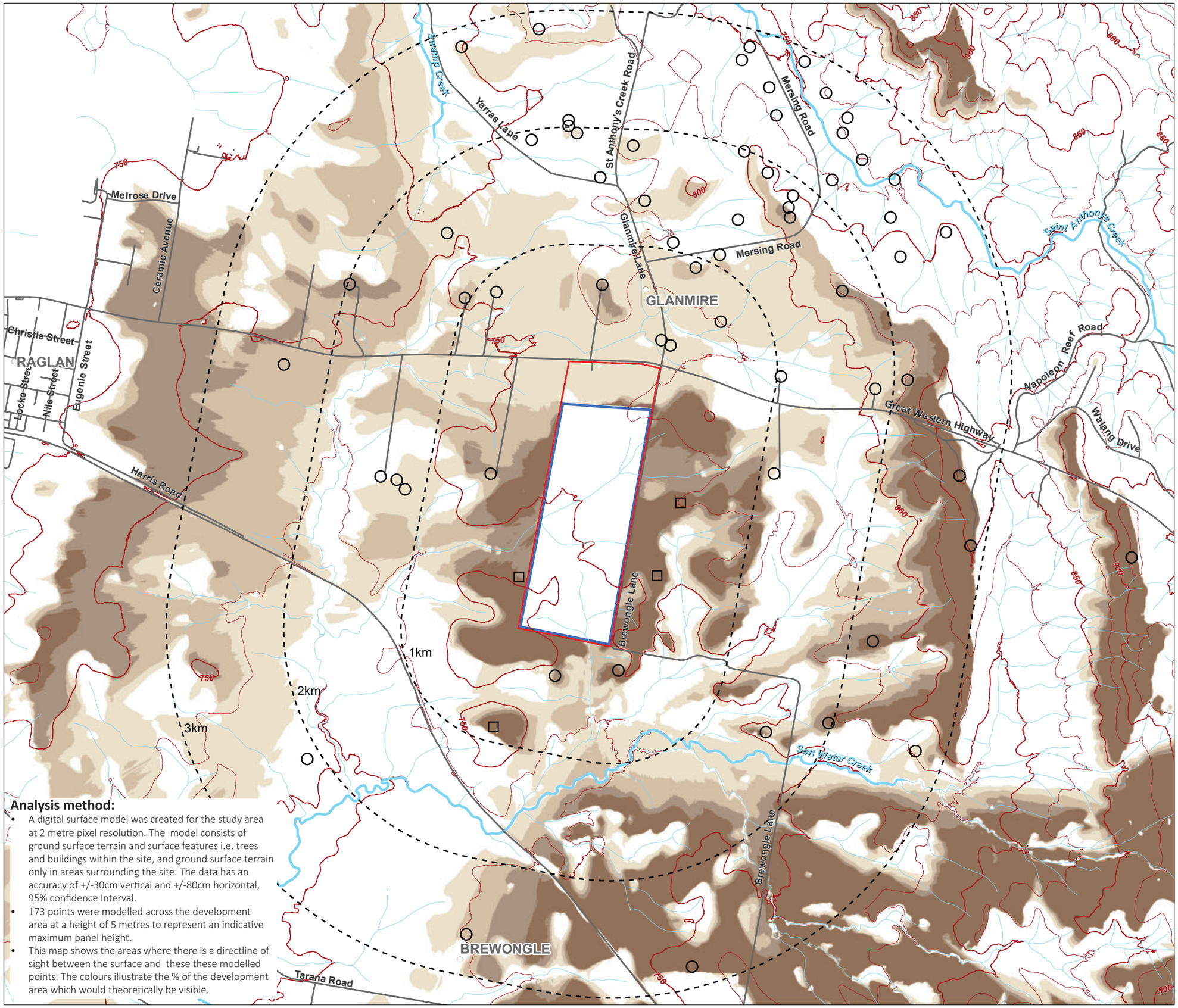
Kilometres

A3 Scale: 1:30,000

File:Glanmire Solar-Fig1-TopoMap-210330 Date: 30/03/2021



Analysis method:

- A digital surface model was created for the study area at 2 metre pixel resolution. The model consists of ground surface terrain and surface features i.e. trees and buildings within the site, and ground surface terrain only in areas surrounding the site. The data has an accuracy of +/-30cm vertical and +/-80cm horizontal, 95% confidence Interval.
- 173 points were modelled across the development area at a height of 5 metres to represent an indicative maximum panel height.
- This map shows the areas where there is a directline of sight between the surface and these these modelled points. The colours illustrate the % of the development area which would theoretically be visible.

iris

Glanmire Solar Farm | Visual impact analysis

Figure B: Zone of theoretical visibility (ZTV)

- Subject site
- Potential development area
- Contour (50m)
- Contour (25m)
- Distance from the site
- Watercourse
- Non-associated dwelling
- Potential Future Dwelling Sites

Visibility

- No visibility identified
- 1-15%
- 16-30%
- 31-50%
- 50%+

SOURCE:
Surface analysys: Derived from 2m LiDAR, Bathurst201510-LID2-AHD_7446292_55_0002_0002_2m © Department Finance, Services and Innovation 2015
Watercourse: GeoScience Australia 2015

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0 0.5 1 1.5
Kilometres

A3 Scale: 1:30,000

File:Glanmire Solar-Fig3-VisualCatchment-210527 Date: 27/05/2021

GEOVIEW

APPENDIX E

ABORIGINAL HERITAGE SCOPING ASSESSMENT

Scoping Assessment: Proposed Glanmire Solar Farm

Aboriginal Heritage

Bathurst Regional LGA NSW

Report to Elgin Energy Pty Ltd

May 2021

AREA Environmental Consultants & Communication

(1) 6 Belmore Street Dubbo NSW 2830

(2) "The Old Macquarie Brewery" c1876, 72 Brisbane Street Dubbo NSW 2830

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AREA Environmental & Heritage Consultants

- ✓ Environmental impact assessment, auditing, and approvals
- ✓ High level preliminary environmental assessment (PEA)
- ✓ Review of environmental factors (REF)
- ✓ Peer review
- ✓ Community engagement
- ✓ Biobanking and biodiversity offsetting assessments
- ✓ Aboriginal heritage assessments and community walkovers
- ✓ Landscape architecture and design

AREA Environmental Consultants & Communication acknowledge Traditional Owners of the country on which we work.

Document Controls

Proponent	Elgin Energy Pty Ltd		
Client	Elgin Energy Pty Ltd		
AREA Job No.			
Document Description	Scoping Assessment: Aboriginal Heritage		
Clients Representative Managing this Document	Andrew Brownlow		
AREA Person(s) Managing this Document	Philip Cameron		
Cover image	Typical view of the study area		
Document Status	**Version**	**Date**	**Action**
DRAFT (Internal document)	V1.0 V1.1	28.5.2021	PJC to AD
DRAFT (AREA / Client)	V2.0	28.5.2021	AREA to Client
FINAL	V3.0 V3.1	29.5.2021	AREA to Client
Prepared For	Elgin Energy Pty Ltd		
Prepared By	Phillip Cameron | Managing Director AREA Environmental & Heritage Consultants a: "The Old Macquarie Brewery" c1876, 72 Brisbane Street, Dubbo, NSW, 2830 e: phil@areaenv.com.au w: www.areaenvironmental.com.au Instagram: areaenvironmental m:0409 852 098		

Executive Summary

Elgin Energy are proposing to construct a solar farm on Lot 141 DP1144786 in Glanmire NSW in the Bathurst Regional Local Government Area of NSW.

Lot 141 DP1144786 is 186 hectares, and the proposed development area is approximately 140 hectares. The northern most two paddocks fronting the Bathurst bound lane of the Mitchell Highway area excluded from the proposal. The proposed development area consisting of the rest of the Lot and DP is likely to be accessed via Brewongle Lane along its eastern boundary (Figures 1-1 and 1-2).

This scoping assessment has been informed by a physical preliminary inspection and a desk top assessment of Lot 141 DP1144786. This deliverable is deliberately succinct, it focuses on identifying actual risks to cultural heritage requiring assessment under standard assessment frameworks for a state significant development.

A preliminary survey of the development site was conducted on 9 June 2020 by Phillip Cameron of AREA Environmental & Heritage Consultants.

The development area meets the Local Land Services definition of Category 1 Land - ploughing agriculture, except for 18 remnant paddock trees. All paddock trees on the Lot and DP are old enough to possess Aboriginal cultural modification (scarring). Exposures along tracks were assessed, paddocks were not as they were under crop (see front cover of this report) and all paddock trees were assessed for cultural modification.

No Aboriginal objects or areas of potential archaeological deposits were identified during the preliminary assessment and an AHIMS database search (updated 27 May 2021) did not plot any data within the proposed development area.

Based on the assessment, the following recommendations are made:

- The Aboriginal Cultural Heritage Consultation Requirements for Proponents (ACHCRs) can be used to identify Aboriginal parties who may provide cultural heritage information relevant to the proposal.
- An unexpected Aboriginal archaeological finds protocols should be developed for the proposal.
- If changes are made to the proposal which could impact locations outside of the current development area, further archaeological investigation may be required.

Table of Contents

Figures

Tables

Terms and acronyms used in this document

Acronym	Definition
BOM	Bureau of Meteorology
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
GPS	Global positioning system
GSV	Ground Surface Visibility
Development area	Cumulatively all components disturbance areas affected by the proposal

1 Introduction

1.1 Background

Elgin Energy are proposing to construct a solar farm on Lot 141 DP1144786 in Glanmire NSW in the Bathurst Regional Local Government Area of NSW.

Lot 141 DP1144786 is 186 hectares, and the proposed development area is approximately 140 hectares. The northern most two paddocks fronting the Bathurst bound lane of the Mitchell Highway area excluded from the proposal. The proposed development area consisting of the rest of the Lot and DP is likely to be accessed via Brewongle Lane along its eastern boundary (Figures 1-1 and 1-2).

This scoping assessment has been informed by a physical preliminary inspection and a desk top assessment of Lot 141 DP1144786.

A preliminary survey of the development site was conducted on 9 June 2020 by Phillip Cameron of AREA Environmental & Heritage Consultants.

1.2 Locality

The development footprint is located within the Bathurst LGA. The regional geographical context of the development footprint is provided in Table 1-1.

Table 1-1: Regional geographical context of the development area

Criteria	Development footprint
Central coordinates (GDA94 z55 E/N)	751127/6297031
Interim Biogeographic Regionalisation for Australia (IBRA Region)	NSW South-eastern Highlands (Bathurst)
State	NSW
Topographical map sheet	Bathurst 250 000
Local Government Area (LGA)	Bathurst Regional
Local Aboriginal Land Council area (LALC)	Bathurst LALC
Schedule of Native Title Determination Applications (Claims, ILUA Future Acts etc.)	NA
Nearest town / locality	Bathurst
Accessed from nearest town by	Mitchell Highway
Land use / disturbance	Intensive agriculture (ploughing)
Nearest waterway (Name, Strahler Order)	Two unnamed 2nd Order streams and six 1st Order drainage lines are within the development area (Figure 2-1).
Spot point Australian Height Datum (AHD)	750 m
Surrounding land use	Road corridor, agriculture

Figure 1-1: Location of the development area(10 km buffer shown in blue)

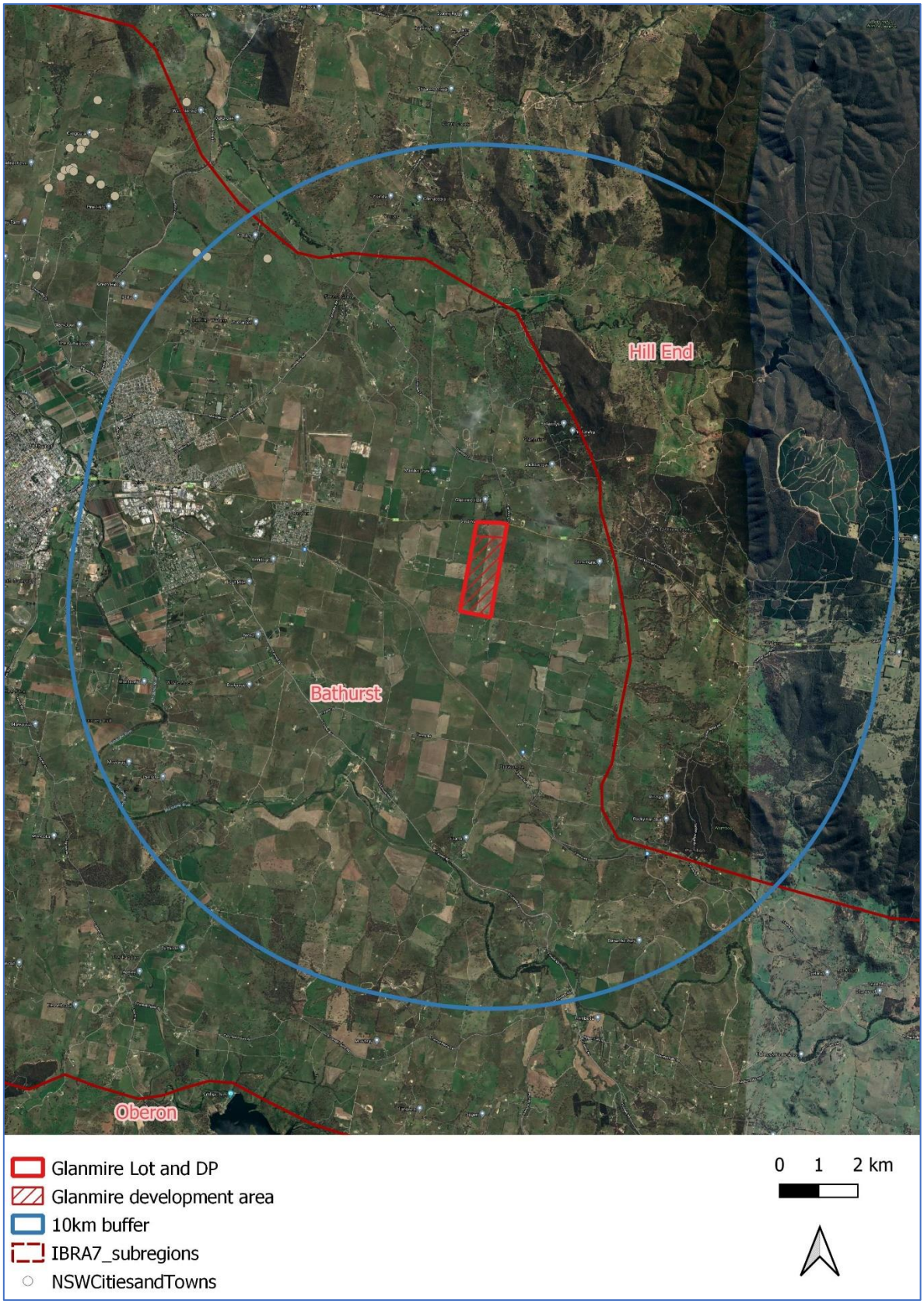
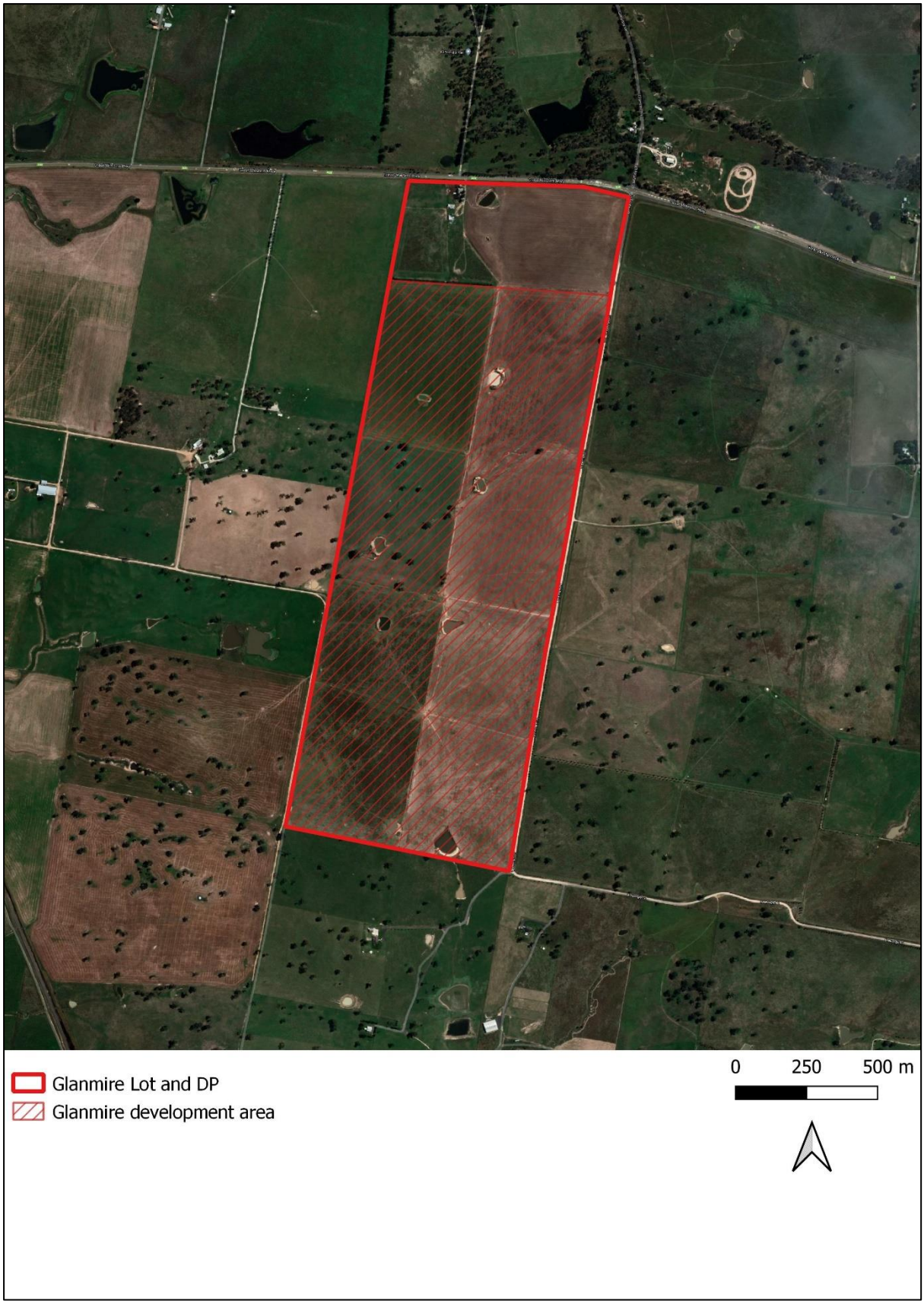


Figure 1-2: The development area



1.3 Project description

A proposed solar farm will be constructed potentially affecting all land within the development area (Figure 1-2).

1.4 Project personnel

This assessment was carried out by appropriately experienced and qualified staff (Table 1-2). The field survey and scoping was conducted by Phil Cameron of AREA.

Table 1-2: Summary the project team's qualifications

Name	Position	CV Details	Suitability for the task
Phillip Cameron	Managing Director	• BSc. Macquarie University • Ass Dip App Sci. University of Queensland • Certified Environmental Practitioner (EIANZ) • Practicing member of the Environment Institute of Australia and New Zealand (EIANZ)	• Phillip Cameron is an appropriately skilled and experienced person (degree or relevant experience) in the field of Aboriginal cultural heritage management. He has the equivalent of two years full-time experience in Aboriginal archaeological investigation, including involvement in a project of similar scope, a demonstrated ability to conduct a project of the scope required through inclusion as an attributed author on a report of similar scope under the NSW OEH Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW. • Phillip has been undertaking heritage assessments as an environmental consultant since 2004.

2 Landscape features

2.1 Overview

A review of the landscape of the development footprint and surrounds allows for comparison with other areas archaeologically investigated. It also assists in assessing existing and previous disturbances which may have affected the integrity of archaeological remains. Environmental features such as landforms, topography, water sources, geology, soils, and vegetation are also relevant for an archaeological assessment.

The proposal is within the NSW South-eastern highlands Bathurst Subregion and Bathurst Granites NSW Landscape (Mitchel 2002). These landscapes are characterised by undulating to steep hills on Carboniferous granites and granodiorite. It has tors and rock outcrops on the margins of the pluton surrounded by a distinctive contact ridge with steep slopes and a general elevation 650 to 1000m, local relief 250m. The landscape has shallow red earths or siliceous sands on ridges, gritty texture-contrast soils with yellow clay subsoils on the slopes with deep coarse sands along streamlines and dense black clays in small swamps. Woodlands occur to open forest of yellow box (Eucalyptus melliodora), broad-leaved peppermint (Eucalyptus dives), red stringybark (Eucalyptus macrorhyncha) and white box

(Eucalyptus albens) on ridges and slopes, manna gum (Eucalyptus viminalis) and river oak (Casuarina cunninghamiana) in valleys. Patches of black cypress pine (Callitris endlicheri) occur in rocky outcrops, grasslands with patchy snow gum (Eucalyptus pauciflora) woodlands in cold air drainage hollows.

2.2 Landforms and vegetation

Landforms within the development area are undulating hills with a general elevation of 750m with local relief of 30m.

Vegetation within the development consists of:

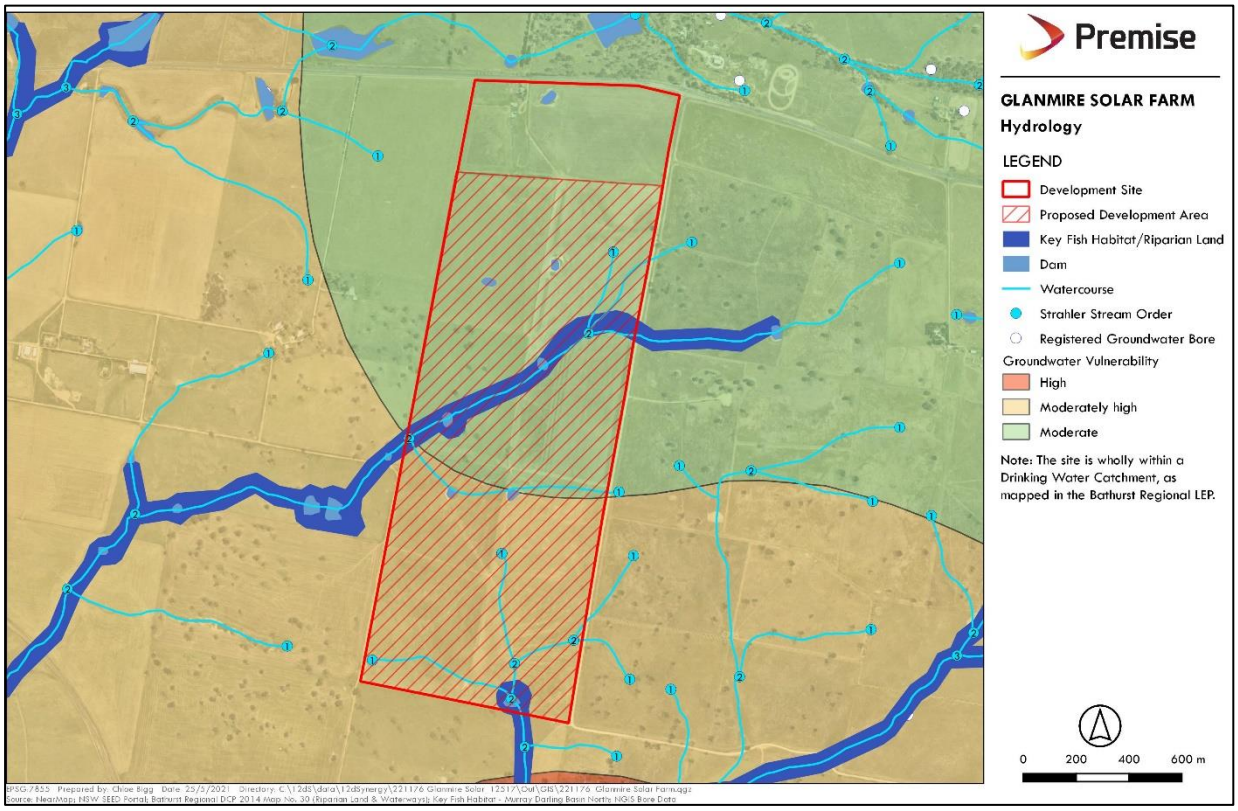
- Category 1 Land (cropped); and
- 18 paddock trees within cropped areas.

The paddock trees are derived form plant community type 1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion. All trees are old growth Blakey's Red Gums or Yellow Box and are old enough to possess cultural modification.

2.3 Waterways

Two unnamed 2nd Order streams and six 1st Order drainage lines are within the development area (Figure 2-1). The closest third Order stream (semi-permanent water) is Saltwater Creek 2.5km south of the development area.

Figure 2-1: Topography of the development area



2.4 Soils

SLR (2021) undertook soil mapping in the development area for a Land Capability Assessment. This report identifies one soil map unit within the Study Area, a Subnatric Grey-Brown Sodosol. These soil map unit is described as bon-BSAL – Inherent Fertility, Poor Drainage & Sodicity. For further information refer to the source document.

In general terms sodosols have an abrupt clay increase down the profile and high sodium content, which may lead to clay dispersion and instability. Seasonally perched watertables are common because of the structure of the subsoil. These soils are usually associated with a dry climate and they are widely distributed in the eastern half of Australia and the western portion of WA, where they are used extensively for grain crops. These soils are usually very hard when dry, are prone to crust formation and have subsoil constraints to root growth. The dispersivc subsoil makes them prone to tunnel and gully erosion.

2.5 Climate

The nearest long-term climate statistics are available from Bathurst (BoM 2021). Average climate data from the weather station is provided in (Table 2-1). This region has a suitable climate for all year Aboriginal occupation.

Table 2-1: Climate statistics for Bathurst (max red, min blue)

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature													
Mean maximum temperature (°C)	29	27.5	24.7	20.9	16.3	12.7	12.1	13.8	17.2	20.6	23.9	26.8	20.5
Mean minimum temperature (°C)	14	13.6	10.8	6.4	3.1	1.8	0.8	1.1	3.6	6.3	9.4	11.8	6.9
Rainfall													
Mean rainfall (mm)	62.2	57.5	61.4	33.1	32.9	38.5	42.1	39.8	47.6	51.7	63.4	72	605.5
Mean number of days of rain ≥ 1 mm	6.1	5.6	5.4	3.7	4.7	6.2	6.3	6	5.3	6.4	7.1	6.8	69.6

3 Archaeological Context

3.1 Database search results

The results of cultural heritage database searches are presented in this section. The objective of these searches is to identify any recorded Aboriginal objects, sites or places within the development area and to provide archaeological context for the proposal. The results of the database searches are summarised in Table 3-1.

Table 3-1: Summary of database searches for Aboriginal cultural heritage

Database	Date of Search	Parameters	Results
Aboriginal Heritage Information Management System (AHIMS) Client ID: 587314	27/05/2021	GDA94 Zone 55 741407 - 760710 mE 6286262 - 6307552 mN	41 Aboriginal sites are recorded with 10km of the development area. One sites is restricted[1] but is not within the development footprint.
Bathurst LEP 2014	27/05/2021	Schedule 5: Environmental Heritage	No items relative to aboriginal heritage within the development footprint are listed on the LEP
Native Title Vision https://nntt.maps.arcgis.com/	3/05/2021	NSW	There are no native title claims within the development footprint
State Heritage Register http://www.environment.nsw.gov.au/heritageapp/heritagesearch.aspx	3/05/2021	Bathurst LGA	No sites of Aboriginal heritage are on the database nearby to the development footprint.

The location of Aboriginal sites is considered culturally sensitive information. For this reason, AHIMS data is mapped at a large scale and site type or identification information in not shown on Figure 3-1.

An extensive search of the AHIMS database was conducted on 27/05/2021 (Client ID: 587314) revealed 41 Aboriginal sites within the search area. Most of the Aboriginal sites were recorded as 'Artefact' (n=20), with the second highest site type being 'Modified Tree (n=6). One sites is restricted, from previous work in the region AREA can confirm the proposal would not affect this restricted site.

The frequency of the site types is listed in

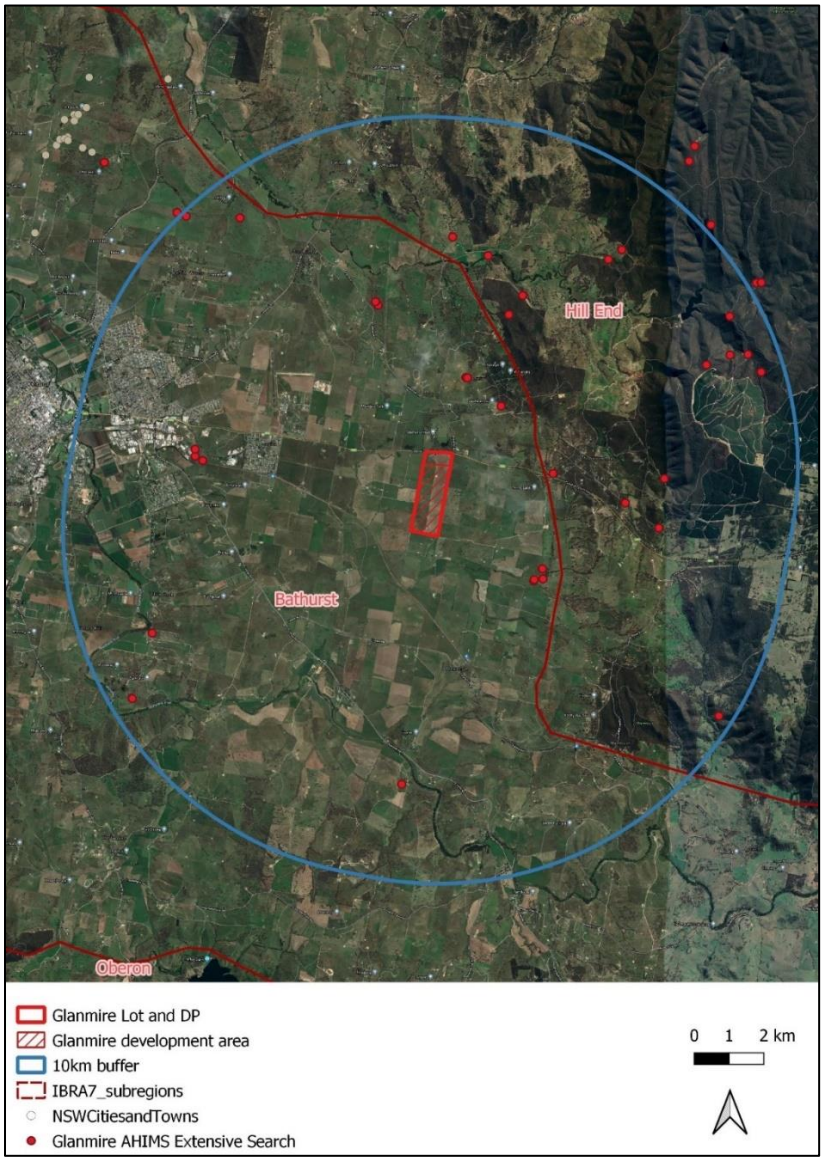
Table 3-2 and the distribution of recorded Aboriginal sites is shown in 3-1. The full list of results is provided in Appendix A.

[1] An Aboriginal site can be categorised as 'restricted' on the AHIMS database for a variety of reasons but most often due to significance of the place or object recorded to the Aboriginal stakeholders or less commonly by an archaeologist and details of the site or object are not for public knowledge. In general terms an Aboriginal Party by requesting a 'restricted category' ensures access or knowledge of the site through a nominated individual.

Table 3-2: Frequency of recorded site types

Site features	n	%
Aboriginal Ceremony and Dreaming : - Grinding Groove : -	1	2.44
Artefact : -	20	48.78
Artefact : - Aboriginal Ceremony and Dreaming : -	3	7.32
Artefact : 1 Potential Archaeological Deposit (PAD) : 1	3	7.32
Burial : - Modified Tree (Carved or Scarred) : -	1	2.44
Grinding Groove : -	1	2.44
Modified Tree (Carved or Scarred) : -	6	14.63
Potential Archaeological Deposit (PAD) : 1	1	2.44
Restricted	1	2.44
Stone Arrangement : -	4	9.76
	41	100.00

Figure 3-1: AHIMS data plotting within 10km of the development area



3.2 Predictive Model

Areas of archaeological potential are regarded as any sensitive landform with a reasonable level of intactness (i.e. little to no disturbance or minor ground surface disturbance only and in areas not on self-mulching soils). The definition of disturbance used here follows that of the NPW Regulation 2009 (Clause 80B, Subclause 4). Sensitive landforms follow the definitions supplied in the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (Due Diligence code of practice) (DECCW 2010):

- within 200m of waters
- located within a sand dune system
- located on a ridge top, ridge line or headland
- located within 200m below or above a cliff face
- within 20m of or in a cave, rock shelter, or a cave mouth.

The development footprint is located within 200m of waters, two unnamed 2nd Order streams and six 1st Order drainage lines and possesses trees of an age to be culturally modified. The development site has potential to contain stone artefacts, scatters and culturally modified trees.

4 Fieldwork Preliminary Results

4.1 Overview

A preliminary survey of the development footprint was conducted on 9 June 2020 by Phil Cameron of AREA.

4.2 Methodology

The preliminary survey was conducted by vehicle (in areas with no ground surface visibility) and on foot (where exposures occurred), see Figures 4-1 to 4-6. All mature trees were inspected for cultural modification. The purpose of the preliminary survey was to identify any previously-undetected Aboriginal sites and evaluate the possible need for further investigation.

4.3 Constraints

Most of the development area at the time of the assessment was under crop. Ground surface visibility was generally high along farm tracks.

Aboriginal Parties did not participate in the preliminary assessment therefore there is no cultural knowledge informing this deliverable.

4.4 Results

No Aboriginal objects were recorded within the development area.

Figure 4-1: Photo of land use mapping in the development area showing Cat 1 Land

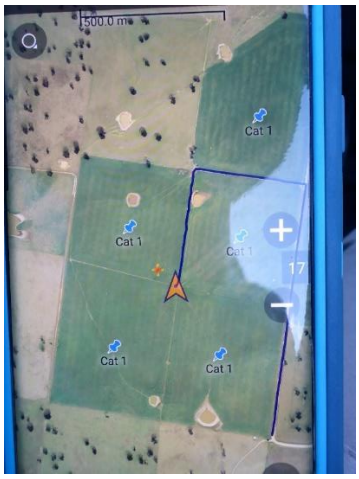


Figure 4-2: Example of low GSV in cropped areas but high GSV along tracks

Figure 4-3: Example of remnant Blakey's Red Gum trees assessed in the development area

Figure 4-4: Existing land use within the development area

Figure 4-5: Existing land use within the development area

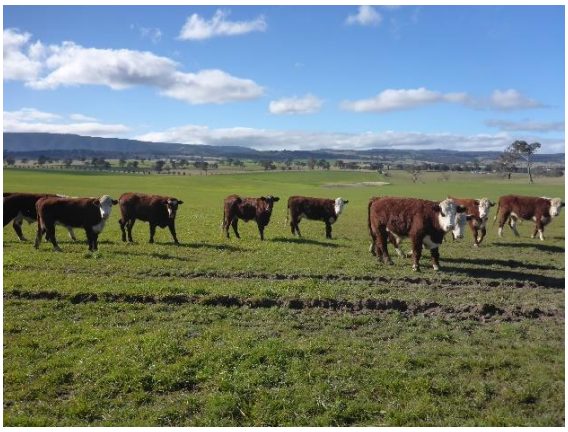


Figure 4-6: Example of off track GSV in the development area

4.5 Discussion

The predictive model set out in Section 3.2 indicated a potential of artefact and culturally modified site types to be within the development area. While the assessment was limited to areas of exposure it seems unlikely undetected Aboriginal artefacts would be recorded in the development area. As all trees were assessed, it is known no culturally modified trees occur in the development area.

As the preliminary assessment was not informed with Aboriginal Party cultural knowledge it is possible that non-physical site types could occur in the development area.

4.6 Management

No impact to Aboriginal objects is apparent in the development area.

As the proposal is a state significant development formal consultation should be conducted according to the *Aboriginal Cultural Heritage Consultation Requirements for Proponents*.

5 References

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SLR (2021) GLANMIRE SOLAR FARM Land & Soil Capability Assessment Prepared for: Elgin Energy

Appendix A: Database Search Results

Office of Environment & Heritage NSW

AHIMS Web Services (AWS)

Your Ref/PO Number : Glanmire 2

Client Service ID : 594399

Note: This Excel report shows the sites found in AHIMS on the 28/05/2021. If this date is not the same as the original date of the Search Results letter obtained during the Basic Search then the search results might be different. The PDF version of this report will always coincide with the Basic Search Results letter.

Site ID	Site name	Datum	Zone	Easting	Northing	GDAz55E	GDAz55N	Context	Site status	Primary contact	Site features	Site types	Recorders	Reports	Permits	Longitude GDA94	Latitude GDA94
44-3-0108	BH-OS-1Browns Hill	AGD	55	754500	6297400	754614	6297584	Open sit	Valid		Artefact : -	Open Camp Site	Central West Archaeological and Heritage Services Pty Ltd			149.74	-33.43
44-3-0117	Restriction applied. F							Open sit	Valid	Bill Allen			Bill Allen				
44-3-0134	Big Flat Stone Arrang	AGD	55	759044	6304562	759158	6304746	Open sit	Valid		Stone Arrangement : 9		Mr.Gavin Newton			149.79	-33.37
44-3-0132	Winburndale Fire Tra	AGD	55	759580	6301925	759694	6302109	Open sit	Valid		Modified Tree (Carved or Scarred) : 1		Mr.Gavin Newton			149.79	-33.39
44-3-0133	Gulf Boundary Road I	AGD	55	758915	6300525	759029	6300709	Open sit	Valid		Artefact : 1		Mr.Gavin Newton			149.79	-33.40
44-6-0012	Fish River - Carved T	AGD	55	750144	6288455	750258	6288639	Open sit	Valid		Burial : - Modified Tre	Burial/sCarved Tree	David BellNPWS - Bla	651298		149.69	-33.51
44-3-0245	HP-IF-01	GDA	55	744536	6297956	744536	6297956	Open sit	Valid		Artefact : -		Apex ArchaeologyMs.Jenni Bate			149.63	-33.43
44-3-0042	Gulf Stream Stone Ar	AGD	55	759590	6300813	759704	6300997	Open sit	Valid		Stone Arrangement : - Stone Arrangement		ASRSYS	1298		149.79	-33.40
44-3-0045	Fontana Reef Modifie	AGD	55	753228	6301974	753342	6302158	Open sit	Valid		Modified Tree (Carvec Carved Tree		ASRSYS	653531298		149.72	-33.39
44-3-0079	Cave Creek 1	AGD	55	757703	6297253	757817	6297437	Open sit	Valid		Artefact : - Aboriginal Ceremony and Dreami		ASRSYS	2321298		149.77	-33.43
44-3-0080	Winburndale 2	AGD	55	752630	6303670	752744	6303854	Open sit	Valid		Artefact : - Aboriginal Ceremony and Dreami		L Cubis	2321298		149.72	-33.37
44-3-0063	RaglanBathurst	AGD	55	744200	6297900	744314	6298084	Open sit	Valid		Artefact : -	Open Camp Site	ASRSYS	606		149.63	-33.43
44-3-0064	RaglanBathurst	AGD	55	744200	6298100	744314	6298284	Open sit	Valid		Artefact : -	Open Camp Site	ASRSYS	606		149.63	-33.43
44-3-0066	Little Wonder Gully IF	AGD	55	753629	6302528	753743	6302712	Open sit	Valid		Artefact : -	Open Camp Site	ASRSYS	832321298		149.73	-33.38
44-3-0138	Eskdale Gulf Trail OS	AGD	55	760106	6300830	760220	6301014	Open sit	Valid		Artefact : 3		Mr.Gavin Newton			149.80	-33.40
44-3-0081	Winburndale 1	AGD	55	751610	6304210	751724	6304394	Open sit	Valid		Artefact : - Aboriginal Ceremony and Dreami		ASRSYS	2321298		149.71	-33.37
44-3-0170	W20 A7	GDA	55	756692	6296736	756692	6296736	Open sit	Valid		Artefact : 1 Potential Archaeological Deposit		Navin Officer Heritage	104298	3764	149.76	-33.44
44-3-0171	W20 A8	GDA	55	757657	6296015	757657	6296015	Open sit	Valid		Artefact : 1 Potential Archaeological Deposit		Navin Officer Heritage Consultants Pty Ltd	3764		149.77	-33.44
44-3-0172	W20 A13	GDA	55	745603	6304942	745603	6304942	Open sit	Destroyed		Artefact : 1		Navin Officer Heritage	104298		149.64	-33.37
44-3-0175	Dry Arm Creek Stone	GDA	55	758691	6307007	758691	6307007	Open sit	Valid		Stone Arrangement : 3		Mr.Gavin Newton			149.78	-33.35
44-3-0174	Dry Arm Creek Modifi	GDA	55	758528	6306577	758528	6306577	Open sit	Valid		Modified Tree (Carved or Scarred) : 1		Mr.Gavin Newton			149.78	-33.35
44-3-0158	W20 PAD 4	GDA	55	749582	6302429	749582	6302429	Open sit	Valid		Potential Archaeological Deposit (PAD) : 1		Navin Officer Heritage Consultants Pty Ltd			149.68	-33.39
44-3-0164	W20 A11	GDA	55	743794	6305097	743794	6305097	Open sit	Valid		Artefact : 1		Navin Officer Heritage Consultants Pty Ltd			149.62	-33.37
44-3-0165	W20 A12	GDA	55	744055	6304992	744055	6304992	Open sit	Valid		Artefact : 1 Potential Archaeological Deposit		Navin Officer Heritage Consultants Pty Ltd			149.62	-33.37
44-3-0166	W20 A25	GDA	55	749504	6302531	749504	6302531	Open sit	Valid		Modified Tree (Carved or Scarred) : 1		Navin Officer Heritage Consultants Pty Ltd			149.68	-33.39
44-3-0167	W20 A9	GDA	55	752101	6300348	752101	6300348	Open sit	Destroyed		Artefact : 1		Navin Officer Heritage	104298	3764	149.71	-33.41
44-3-0168	W20 A10	GDA	55	753118	6299525	753118	6299525	Open sit	Valid		Artefact : 1		Navin Officer Heritage Consultants Pty Ltd		3764	149.72	-33.41
44-3-0231	Salt Water Creek IF-2	GDA	55	754321	6294548	754321	6294548	Open sit	Valid		Artefact : -		OzArk Environmental	104280		149.74	-33.46
44-3-0232	Salt Water Creek IF-1	GDA	55	754055	6294493	754055	6294493	Open sit	Valid		Artefact : -		OzArk Environmental	104280		149.73	-33.46
44-3-0233	Salt Water Creek OS-	GDA	55	754073	6294530	754073	6294530	Open sit	Valid		Artefact : -		OzArk Environmental	104280		149.73	-33.46
44-3-0220	W20 A9 & W20 A13 -	GDA	55	752151	6300337	752151	6300337	Open sit	Valid		Artefact : -		OzArk Environmental and Heritage Management		Miss.Philippa Sok	149.71	-33.41
44-3-0215	Scar tree women's ar	GDA	55	742507	6291104	742507	6291104	Closed s	Valid		Modified Tree (Carved or Scarred) : -		Mr.Jade FlynnWiradyuri Traditional Owners Central West (WTOCW			149.61	-33.49
44-3-0216	Stone fire pit Penrise	GDA	55	754307	6294842	754307	6294842	Closed s	Valid		Aboriginal Ceremony and Dreaming : - Grin		Mr.Jade FlynnWiradyuri Traditional Owners Central West (WTOCW			149.74	-33.46
44-3-0217	Grinding grooves per	GDA	55	743079	6292992	743079	6292992	Closed s	Valid		Grinding Groove : -		Mr.Jade FlynnWiradyuri Traditional Owners Central West (WTOCW			149.62	-33.47
44-3-0276	CWPSH-IA-001	GDA	55	759385	6290603	759385	6290603	Open sit	Valid		Artefact : -		Niche Environment and HeritageNiche Environment and Heritage			149.79	-33.49
44-3-0112	Winburndale Fire Tra	AGD	55	760350	6302890	760464	6303074	Open sit	Valid		Artefact : -	Open Camp Site	Bill(snr) Allen			149.80	-33.38
44-3-0111	Winburndale Fire Tra	AGD	55	760490	6302900	760604	6303084	Open sit	Valid		Artefact : -	Open Camp Site	Bill Allen			149.80	-33.38
44-3-0018	Saltram Creek	AGD	55	741590	6306356	741704	6306540	Open sit	Valid		Artefact : -	Open Camp Site	ASRSYS	3531298		149.60	-33.35
44-3-0026	Gulf Stream Stone Ar	AGD	55	760486	6300321	760600	6300505	Open sit	Valid		Stone Arrangement : - Stone Arrangement		ASRSYS	3531298		149.80	-33.40
44-3-0177	Goulds Creek Artefac	GDA	55	756204	6303746	756204	6303746	Open sit	Valid		Artefact : 5		Mr.Gavin Newton			149.75	-33.38
44-3-0187	Goulds Creek Trail M	GDA	55	756592	6304027	756592	6304027	Open sit	Valid		Modified Tree (Carved or Scarred) : 1		Mr.Gavin Newton			149.76	-33.37

Premise