AGRICULTURAL ASSESSMENT

CONSTRUCTION AND OPERATION

of the proposed

BARWON SOLAR FARM

Prepared by

A.J. Pitt
B.Ag Sci(hons), M. Ag. Sci

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1. Introduction

1.1 Project Brief

Ag-Challenge Consulting has been instructed by URBIS planning and design consultants to investigate the agricultural impacts of a proposed solar farm on approximately 735 hectares of farming land near Little River, west of Melbourne and north of Geelong. Elgin Energy proposes to develop a solar farm at this site on the Little River-Ripley Road. The site is approximately 735 hectares in total and is comprised of multiple properties which are predominantly used for agricultural activities.

The site has existing 500 kV and 220 kV transmission lines and is therefore well placed for the export of renewable energy. Site investigations are ongoing and detailed plans are being developed with respect to all physical and cultural considerations and following engagement with communities and authorities.

This investigation describes the existing agricultural use in both a local and regional context. The investigation is to consider the impact of the solar development on the existing uses of the land, identify any potential impacts on adjacent properties and determine whether the proposal is likely to have any adverse impacts on surrounding land uses.

The combined area of land is hereinafter referred to as the Project Site and the separate parcels that comprise the Project Site are listed in Table 1. The Project Site comprises a series of separate titles and separate individual holdings most of which have in the past been operated as separate entities. The separate parcels lie along both sides of the Little River – Ripley Road and form one contiguous area separated only by the road and road reserve that runs through the middle of the contiguous area. The proposed solar farm would potentially operate across part or possibly all of each of the holdings. The collective land area is identified by the addresses and registered titles listed in Table 1.

Table 1. Title specifications of subject area.

Property Ownership	Address of the subject land	Parcel	Total Approx. Parcel Area (ha)
Galea	1000 Little River – Ripley Road, Little River	24\PP3910	106.6
Galea	1050 Little River – Ripley Road, Little River	2\TP15944	82.4
Griffiths	1240 Little River – Ripley Road, Balliang	17\PP3910	109.5
Galea	1150-1190 Little River – Ripley Road, Little River	1\PS434520 & 1\TP15944	123.1
Spalding	1085-1135 Little River – Ripley Road, Little River	23\993910	126.3
Sarain	1145-1215 Little River – Ripley Road, Little River	22\PP3910	128.0
Covelli	1320 Little River – Ripley Road, Balliang	2\LP140470	78.6

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Figure 1. The Project Site.

1.2 Experience and Capability of Ag-Challenge Consulting

Ag-Challenge Consulting is an agricultural consultancy company servicing the dairy, beef, and potato industries as well as other high rainfall and irrigated agriculture industries of Southern and Northern Victoria. The company is based at Warragul and the principals of the company have been providing independent farm consultancy advice since 1988 from this location. There are five active consultants within the company that service approximately 200 individual farmer clients with consultancy services from Ag-Challenge Consulting, as well as industry associations, financial institutions, and government. The company is active in vocational training, running focus farms and discussion groups and undertaking farm design work. The recycled water industry is a significant user of Ag-Challenge Consulting for the design and monitoring of recycled water projects. The renewable energy industry has collectively been a significant client of Ag-Challenge Consulting, using the company services for site selection and design, liaison with adjacent farm businesses and assistance in satisfying the provisions of planning schemes.

2. Regional Context

2.1 Planning Provisions

The Project Site is all within the Farming Zone of the City of Greater Geelong Planning Scheme and is subject to the provisions of that zone. The Farming Zone is denoted by the acronym FZ on the Planning Scheme Map. The purpose of the Farming Zone[1] is:

- *To implement the Municipal Planning Strategy and the Planning Policy Framework.*
- *To provide for the use of land for agriculture.*
- *To encourage the retention of productive agricultural land.*
- *To ensure that non-agricultural uses, including dwellings, do not adversely affect the use of land for agriculture.*
- *To encourage the retention of employment and population to support rural communities.*
- *To encourage use and development of land based on comprehensive and sustainable land management practices and infrastructure provision.*
- *To provide for the use and development of land for the specific purposes identified in a schedule to this zone.*

A planning permit is required for the development and use of a Renewable Energy Facility within the Farming Zone, and the Planning Scheme states that a condition of approval is that the facility must meet the provisions of Clause 53.13 of the Planning Scheme. Among other provisions, Clause 53.13 states that the applicant must undertake a site and context analysis including a description of the site and surrounding area. This agricultural assessment forms part of the response to the provisions of Clause 53.13.

An Environmental Significance Overlay (ESO) applies to the Project Site and all the properties are subject to Schedule 4 of this overlay (ESO4) which seeks to protect remnant native grasslands of the Werribee plains. Two of the properties on the north side of the Little River – Ripley road (17\PP3910 and the combined parcel of 1\PS434520 & 1\TP15944) are also subject to Schedule 1 of this overlay (ESO1) which seeks to protect areas of flora and fauna habitat and areas of geological and natural interest.

A Significant Landscape Overlay applies to two of the properties on the south side of the little River – Ripley road, and they are subject to the provisions of Schedule 1 (SLO1). This overlay seeks to protect the numerous views of the You Yangs as seen from the surrounding basalt plains.

The Solar Energy Facilities Design and Development Guideline (August 2019) specifies a number of factors that need to be considered during the site selection and decision making process in order that agricultural production is not unduly detrimentally affected. These factors include:

- Protecting strategically important agricultural and primary production land from incompatible land use.
- Protecting productive agricultural land that is of strategic significance to a local area or in a regional context.
- Avoiding the loss of productive agricultural land without considering the impact of the loss on the agricultural sector and its consequential effect on other sectors.

[1] Victorian Planning Provisions – DELWP - http://planning-schemes.delwp.vic.gov.au/schemes/vpps/35_07.pdf.

The agricultural values of the land will be assessed in accordance with these guidelines, including an assessment of the agricultural significance of the land and the location of agriculturally significant land within the shire and the region.

2.2 Climate

Climate records from the Bureau of Meteorology weather station at Avalon Airport (Site number 087113) are presented in Table 2 below. This climate station is some 15 km to the south of the Project Site and is moderately representative of the prevailing climate. Average annual rainfall from these records is a very modest 455 mm per annum and the rainfall is fairly evenly distributed throughout the year. Winter temperatures are comparatively mild, but frost occurs regularly each year during the months of May to September and occasionally outside these months in both April and October. Summer temperatures are variable with some summers having no days above 38^{0}C, but other summers having one or more clusters of extreme temperatures with several days above 40^{0}C. The hottest day on record was 48^{0}C on 7th February 2009.

Table 2 Climatic Averages from Bureau of Meteorology at Avalon Airport

Avalon Airport	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (°C)	26.5	26.2	24.3	20.5	17.3	14.7	14.2	15.4	17.8	20.3	22.6	24.5	20.4
Mean minimum temperature (°C)	14.2	14.4	12.6	9.7	7.6	5.7	5.2	5.5	6.7	8.1	10.6	11.9	9.4
Mean rainfall (mm)	33.9	32.4	27.1	38.0	37.8	38.4	36.7	42.2	44.8	47.1	49.0	29.4	454.8
Decile 5 (median) rainfall (mm)	25.2	22.0	24.2	30.0	31.0	35.6	30.4	39.4	43.2	41.7	42.4	26.8	441.0
Mean number of days of rain ≥ 1 mm	3.0	2.5	3.1	4.5	5.8	6.2	6.6	6.9	6.7	6.2	5.2	3.5	60.2
Mean 9am temperature (°C)	18.9	18.5	16.3	14.4	11.6	9.1	8.3	9.8	12.4	14.4	15.9	17.4	13.9
Mean 9am relative humidity (%)	68	71	74	76	84	86	85	80	72	66	69	66	75
Mean 3pm temperature (°C)	24.0	24.2	22.4	18.8	15.8	13.6	12.9	14.1	15.9	17.9	20.3	21.8	18.5
Mean 3pm relative humidity (%)	50	49	49	56	64	68	66	62	58	53	54	53	57

A rainfall only weather station is located at Mount Rothwell (Met Bureau Site No 87048) which is just to the east and immediately adjacent to the Project Site. This meteorological station is one of the oldest in Victoria with rainfall records from as far back as 1882. The mean rainfall data available for this station are presented in Table 3 and the data are very similar to the data for Avalon Airport. Included in Table 3 are the highest individual daily totals for each month through the year at the Mt Rothwell recording station. These data show occasional very heavy falls of up to 100 mm or more in a 24 hour period during the summer and autumn months, with more benign extreme rainfall events during winter and spring. This may have design implications for the management of storm runoff.

Table 3 Rainfall Records from Meteorological Station 87048 (Mt Rothwell).

Little River	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean monthly rainfall	30.8	37.4	33.3	40.1	38.4	35.8	34.4	38.7	43.8	48.6	45.9	41.0	468.2
Highest daily rainfall	56.4	118.6	89.4	76.7	38.9	29.0	56.6	53.3	56.9	56.0	58.2	121.9	

The climatic data can be used to assess the growing season for dryland pasture. Winter and early spring rainfall for the Project Site would normally be adequate to support evapotranspiration losses from pasture and annual crops, but the average October rainfall and all the months from November till April are all below estimated pasture requirements for evapotranspiration. The normal growing season would thus extend for about 5 months from mid May to mid October, assuming some carry forward of soil moisture into October each year from the previous month. This is a comparatively short growing season for southern Victoria and the pasture plants that are able to grow and persist with this short growing season have to be well adapted to prolonged dry periods.

2.3 Regional Land Form

The Project Site is located within the Werribee Plains on the west side of Melbourne. These plains are roughly bounded by the Brisbane Ranges to the west, the Central Highland uplands to the north and north west and Port Phillip to the south. The plains have been formed from a mixture of basalt flows and riverine deposits across an old highly weathered landscape. Highly weathered sedimentary sandstones and mudstones outcrop intermittently across the plains. There are also some extensive alluvial deposits, particularly along the margins of the main drainage lines and towards Port Phillip. Stony rise outcrops of vesicular basalt occur irregularly across the plain, but mostly the surface landscape is moderately rock free. There are prominent remnants of old volcanic vents and granite monoliths within the plains which form dominant geological features such as the You Yangs. The dominant land feature are the basalt flows and with the exception of the prominent geological features, the landscape is gently undulating to almost flat.

2.4 Regional Land Use

The traditional land use in this area has been dryland cropping of cereals, pulse crops and oilseeds together with sheep grazing for wool and/or fat lambs. The area has a low to moderate and unreliable rainfall such that more intensive agriculture has not been a feature of the area.

In more recent years, the expansion of the metropolitan area of Melbourne to the hinterland north of Werribee, and the improved rail link from Geelong to Melbourne has generated more interest in the Little River and Bacchus Marsh areas for rural living and lifestyle properties. There has been some limited subdivision and closer development to small rural properties around Balliang and Anakie to the west of the Project Site and around Little River to the east of the Project Site. The pressure for this sort of closer development of rural holdings is likely to continue.

3 Site Characteristics

3.1 Description of the Land

The eastern side of the Project Site is part of a gently undulating and extensive basalt flow which extends from Bacchus Marsh in the north, along the east side of the You Yangs, and terminates near Lara and Avalon Airport in the south. Slopes along this basalt plain are very gentle at just 1 or 2 degrees. The drainage is irregular and indeterminate and locally the plain falls towards the north.

The western side of the Project Site is underlain by highly weathered sandstones and siltstones which are part of the old landscape that predates the basaltic extrusions. This area is also characterized by gentle slopes of just 1 or 2 degrees, but with a more regular drainage pattern.

There are extensive granitic outcrops to the south of the Project Site and this has influenced the southern landforms of the Project Site with colluvial wash material from the foothills of these granite monoliths. At the southern end the land starts to rise and the slopes approach 5 degrees, but all slopes are quite modest. A small granite outcrop (Mt Rothwell) along the eastern perimeter of the Project Site has created some more elevated areas with slopes of around 5 degrees and well defined drainage.

3.2 Soils

The soils of the basalt plains and hinterland were examined, described and mapped by at a reconnaissance level by Maher and Martin (1987)[2]. They ascribed mapping unit number 231 to the area that includes all the basalt outcrop within the Project Site. Mapping unit 231 is described as consisting of undulating rises with the dominant soils being alkaline red duplex soils and many surface stones. They specify that the mapping unit has minor occurrences of mottled yellow and black duplex soils, and also grey cracking clays in low lying areas.

The dominant soil across this landscape is described by Maher and Martin as having apedal dark reddish brown shallow loam or clay loam surface soils, typically 10 cm deep, underlain by well structured reddish brown medium or heavy clay. The soils are alkaline throughout and the surface soil is hard setting when dry. There is no A2 horizon present. Soft and hard calcium carbonate concretions occur at depth. The soils are usually about 100 cm deep before weathered basaltic rock is encountered, but in places the parent material of the soil may be encountered at just 60 cm depth, and rock floaters may occur at any depth in the profile.

The soils of the old weathered sedimentary surface in the western part of the Project Site are also duplex profiles but deeper and with deeper surface horizons. A typical description of these soils is given by Maher and Martin. The A1 horizon is an apedal dark greyish brown fine sandy loam or fine sandy clay loam typically 20cm deep. They also have a tendency to set hard when dry. An apedal bleached fine sandy loam or sandy loam A2 horizon is naturally present but regular cropping and mixing with the A1 may mask its presence. The A2 horizon is typically 20 cm thick and is underlain by yellowish brown medium to heavy clay B horizon with red and bright yellow mottles at about 40 cm below the soil surface. With depth the B horizon

[2] JM Maher and J Martin, 1987, *Soil and Landforms of South-Western Victoria, Part 1 Inventory of Soils and their Associated Landscapes.* Research Report Series No 40, Department of Agriculture and Rural affairs

becomes lighter and may merge to a sandy clay. Total soil depth is normally in excess of 100 cm. Soils may be acid at the surface but become more neutral or slightly alkaline with depth.

More restricted within the Project Site are the alkaline mottled yellow duplex soils which occur on the colluvial slopes associated with outcrops of the You Yangs and Mt Rothwell. The soil profile is similar to those of the weathered sedimentary surface except that textures may be lighter (coarse sandy loam or loamy sand surface soils) with a sandy fabric and the B horizon may be weak structured or even massive. These soils are particularly prone to sheet and gully erosion.

3.3 Native Vegetation and Riparian Zone

There are scattered remnants of a former open woodland vegetation that would have once occurred across part of this landscape. Red Gum (*Eucalyptus camaldulensis*) occurs as remnant trees along the margins of a small tributary to Little River as it traverses 1150-1190 Little River-Ripley Road. There are a significant number of specimens of Red Gum along the margins of Little River, particularly to the west of where this small tributary joins Little River. Remnant vegetation of possibly a former open forest occurs along the south margins of the Project Site where the land starts to rise towards the foothills of the You Yangs.

While these pockets of remnant vegetation indicate that an established woodland and possibly an open forest once covered part of the Project Site, it is likely that much of the Project Site was originally a treeless plain or a grassland with only occasional scattered trees.

3.4 Water Supply

Most farm water supply is from small farm dams that are at least partially ephemeral. The only property within the Project site that has a secure water supply is 1085-1135 Little River-Ripley Road. This property has a large centrally located dam. Farm water supply is also seasonally available from the Little River for those properties with river frontage, but this watercourse is liable to stop flowing in dry periods. Without a reliable water supply, destocking of the properties during drier periods will be required.

3.5 Current Land Use

The predominant land use across the Project Site is dryland cropping. At the time of the site inspection, crops of barley, canola and wheat were all observed. One of the landowners has advised that satisfactory crops of vetch, and dun peas have also been grown on this property in the past.

At the time of the site inspection, grazing with sheep was currently being undertaken on two of the properties. No shearing facilities are present on any of the farms and one of the current farm tenants has advised that he trucks sheep away to another property for the purpose of shearing. Loading and unloading facilities together with serviceable yards that could be suitable for either sheep or cattle were present on two of the properties. However neither set of yards would be considered to be in good condition and both lacked many of the basic facilities required for good stock husbandry.

4 Land Capability and Agricultural Production Potential Assessment

4.1 Agricultural Land Capability Classification

Land Capability Rating systems for a series of land uses, including agricultural land uses were developed by Rowe, Howe and Alley[3]. This Land Capability Rating system adopts the highest assessed value across a range of relevant risk factors to determine the overall land capability rating for a particular site and land use. The Project Site is moderately extensive and includes a number of different but broadly similar land types. For the purpose of the land capability assessment the land types have been bundled together. The limiting rating may thus apply to a particular part of the Project Site rather than the whole of the Project Site. An alternative approach would be to develop land capability ratings for each land type and for each existing and potential land use. The approach adopted is instructive in identifying whether there are severe constraints and serious risk factors impacting on a particular land use.

The land capability rating for low rainfall grazing use is provided in Table 4 below. For each land feature to be assessed, the appropriate attribute is highlighted in the table. The overall land capability is determined by the highest assessed numerical value, which gives an overall rating of 3. A rating of 3 means that the land is suitable but significant risk factors do exist. In this case the limiting risk is determined by weak soil structure leading to localised erosion and scalding.

Table 4. Land Capability for Grazing in low rainfall areas (500 mm to 625 mm per annum)[6].

	Land Capability Class[6]				
Land Feature	**1**	**2**	**3**	**4**	**5**
Slope	Less than 10%	10% to 20%	20% to 30%	30% to 45%	More than 45%
Aspect	E. SE	S, SW, NE	N, NW, W		
Soil Group (northcote)	Gradational soils, Um soils	Duplex soils with A horizon of 25 to 40 cm thickness	Other duplex soils; Ur & Ug soils	Uc soils	
Average soil depth	More than 1.0 m	0.6 m to 1.0 m	0.3 m to 0.6 m	0.15m to 0.3 m	Less than 0.15 m
Surface rock	Less than 2%	2% to 15%	15% to 25%	25% to 40%	More than 40%
Nominal DSE/ha rating	More than 5	3.5 to 5	2 to 3.5	0.5 to 2	Less than 0.5

A Land Capability rating of 1 or 2 means that the land is suitable for these uses and the hazards associated with such use are low to very low. It means that this is a sustainable form of land for grazing from an environmental risk perspective. A Land Capability rating of 3 indicates that there is a minor hazard and risk of land degradation hazard associated with this use, which can usually be corrected with appropriate prudent management. A Land Capability Rating of 4 indicates that significant land degradation risks are associated with the particular land use, while a rating of 5 indicates that risks are severe and that the land may not be suitable for such use without very significant and potentially expensive intervention.

The Land Capability rating for cropping is presented in Table 5. The rating criteria for this use was based on the production of annual

[3] Rowe, Howe and Alley, 1981, *Guidelines for Land Capability Assessment in Victoria*, Soil Conservation Authority.

horticultural crops rather than grain and oilseed crops, but it is nevertheless considered to be a relevant assessment tool for this site. The combined land parcel is determined to have a Land Capability rating of 3 with the limiting attributes being the imperfect drainage, shallow rooting depth, poor aggregate stability, and presence of surface rock.

Table 5. Land Capability Rating for Intensive Cropping[6].

LAND FEATURES AFFECTING USE	CAPABIITY CLASS[6]				
	1	2	3	4	5
SOIL STRUCTURE Gradient: Apedal – weak	0 - 4%	4% to 8%	8% to 15%	15% to 20%	More than 20%
Moderate, S.G.	0 - 8%	8% to 15%	15% to 20%	20% to 35%	More than 25%
Strong	0-15%	15% to 20%	20% to 35%	35% to 50%	More than 50%
FLOODING RETURN PERIOD	More than 20 years	20 years to 10 years	10 years to 5 years	5 years to 1 year	Several times per year
SOIL DRAINAGE CLASS	Well drained, Moderately well drained	Excessively well drained	Imperfectly drained	Poorly drained	Very poorly drained
ROOTING DEPTH	More than 50 cm	50 cm to 30 cm	30 cm to 20 cm	20 cm to 15 cm	Less than 15 cm
TEXTURE OF A HORIZON	L, SL, CL	SCL, LS, S	C	-	-
AGGREGATE STABILITY OF A HORIZON	1 (stable)	2	3	4.5 (dispersing)	
GRAVELS & STONES	Less than 4%	4% to 10%	10% to 20%	20% to 30%	More than 30%
BOULDERS AND ROCK OUTCROP	Less than 0.01%	0.01% to 0.05%	0.05% to 1%	1% to 10%	More than 10%

4.2 Land Quality & Strategically Important Agricultural Land

Agricultural land may be considered to be high value and strategically important due to a combination of features such as high quality or niche soils, good rainfall, access to irrigation, resilience to climate change, existing infrastructure investment and/or its special role within a specific industry. None of this land fits within these criteria. In particular, the soils are not high quality or niche soils, the rainfall is only low to moderate and quite variable from year to year, and there is no specific farm or public infrastructure which makes the land inherently productive or special from an agricultural perspective.

The agricultural attributes of land that identify whether a particular parcel may be strategically important land or strategically significant are presented in Table 6, together with an assessment of how the subject land performs with respect to these attributes. The combined parcel of land can be described as fair quality land for grazing and for broad acre cropping, but it has no special values. The combined parcel of land is not significant agricultural land, in that it is not unique, not highly productive, not highly versatile for a multiple range of uses, and not located within an irrigation district. It is currently part of the expansive land resource that supports the grazing and broad acre cropping districts of the Werribee Plains west of Melbourne.

Table 6. Assessment of the agricultural values of the Combined parcel land.
Attribute groups adapted from Solar Energy Facilities – Design and Development Guideline (2019).

Attribute Group	Assessment Criteria	Assessment	Comments
Soils and Landscape	Inherent Soil Quality Niche Soil Inherent Soil Versatility	Fair quality soils No Moderate versatility	These soils are moderately well drained, have low natural fertility and have fair water holding capacity. They are not highly productive and have some management constraints with apedal surface horizons and a tendency for hard setting.
Water and Climate	Access to modern irrigation infrastructure	No access	Subject land is entirely dependent on natural rainfall. Annual rainfall of the area is 470 mm which is low and constricts the length of the growing season to around 5 months.
Impact of fragmentation	Impact on local and regional productivity	Low	The impact on local and regional productivity is estimated to be a loss of a little less than 1% of the dryland cropping land within the Geelong statistical area as defined by the Australian Bureau of Statistics.
Impact of change of land use	Recent reform to update and modernize production or create industry clusters	No	No recent changes to these properties or within the general area.
Specific planning protection for agricultural values	Land set aside or defined for agricultural use and development in a planning scheme or other strategic document	No	The land has no special protection for agricultural values outside of the schedule to the farming zone (FZ).
Government Investment	Government investment to support productivity from the site or the area	No	There is no specific government investment relevant to the agricultural use of this property or this area.
Co-location of solar energy facility with agriculture	Opportunity to co-locate the solar energy facility with agricultural production to diversify farm income without reducing productivity	Yes	The solar farm design will enable the grazing of sheep under the panels, thus mitigating some of the potential loss of agricultural production.

The combined parcel of land is productive farmland. The proposed change of primary land use to solar energy production will mean that the current agricultural versatility (cropping or grazing) will be lost in favour of the alternative primary use for energy production. The design of the solar farm will however enable sheep to be grazed underneath the solar panels, thus retaining some of the current level of agricultural productivity. Agricultural productivity will be reduced, rather than lost.

4.3 The Agriculture of the Project Site in a Regional Context

The Project Site comprises a combined farm area of 735 hectares of which around 90% is potentially suitable for cropping, and an estimated 500 hectares or 70% is cropped at any particular time. Canola yields for the cropping activities at the Project Site are likely to average around 1.0 t/ha but with some considerable flexibility depending on seasonal conditions. Wheat yields will similarly be variable but will generally be much higher at around 3.0 tonnes per hectare average. Cropping gross margins from dryland cropping are highly dependent on seasonal conditions, and also vary significantly depending on current prices. At the time of writing, farm gate Canola prices were at very high levels of $800 per tonnes but this is expected to ease as harvest gets fully underway. Wheat prices were quoted at $320/tonne. Indicative gross margins on both a per hectare and total enterprise basis for 500 hectares of either wheat and/or canola at a range of prices are provided in Table 7.

Table 7 Indicative Gross Margins for Canola and Wheat crops.

	Range of yields and prices	Gross margin $/ha	Enterprise gross margin from 500 hectares
Canola	At $500/tonne, 0.9 tonne/ha	Loss ($92/ha)	-$46,000
	At $650/tonne, 1.4 tonnes/ha	$251/ha	$125,500
	At $800/tonne, 1.7 tonnes/ha	$682/ha	$341,000
Wheat	At $240/tonne, 2.2 tonnes per ha	$197/ha	$98,500
	At $300/tonne, 3.0 tonnes/ha	$472/ha	$236,000
	At $380/tonne, 3.5 tonnes/ha	$541/ha	$270,500

5. Environmental Risks

5.1 Fuel Load and Fire Risk

Rainfall rather than sunlight is probably the main limitation to plant growth at the Project Site. Much of the incident rainfall at the Project Site will be directed by the panels to the soil surface directly below the panel rim. The soil surface beneath the panels will need to be protected from this concentrated rainfall impact (see discussion below), and the growth of the protective ground cover will potentially become long and rank without planned management. If unplanned, the growth could become a fire hazard.

The growth will need to be controlled to prevent an excessive accumulation of fuel and the development of a fire risk. Growth can be controlled by grazing but this can be an imperfect solution as the decisions on grazing management for optimum liveweight gain in ewes and lambs can be quite different from the decisions for fire risk mitigation. One option would be to incorporate a provision into the design of the solar arrays such that the ground beneath the panels can be mown efficiently and effectively.

5.2 Weeds

Serrated tussock (*Nassella trichotoma*) is a significant problem within the Project Site. Classified as a regionally controlled weed and regarded as an environmental weed of concern, the management of serrated tussock across the Project Site will require some forward planning.

In cropping use, serrated tussock is usually well suppressed by the combination of cultivation and selective use of herbicides which, when strategically used, will remove unwanted species. In pastures, serrated tussock control is often more difficult, as the most effective herbicides also suppress desirable pasture species. Most landholders resort to regular spot spraying to remove serrated tussock. Left unchecked, serrated tussock will seed prolifically and form dense swards of unpalatable herbage which are difficult to walk or drive a vehicle through. The eradication of this weed is extremely difficult, and it is likely to remain as a long term target weed species within the Project Site. Suppression will be the management objective.

Other regionally controlled weeds recorded during the site inspection include artichoke thistle (*Cyanara cardunculus*), African boxthorn (*Lycium ferrocissimum*), and scotch thistle (*Onopordium acanthium*). Strategic use of herbicides will be necessary to ensure that these weeds are also kept under control, although unlike serrated tussock, they are more confined to specific areas within the Project Site.

A weed management plan will be prepared as part of the project design. The weed management plan will aim to minimise the growth of weeds and ensure that the regionally controlled weeds of concern such as serrated tussock are suppressed as far as practical.

5.3 Soil Erosion

The design and management of surface runoff for the Project Site requires special consideration. There is only minor evidence of degradation currently across the various properties, but these soils are potentially susceptible to erosion. Once an erosion head is established on these soils, it can be difficult to contain. The development of the Project Site for solar energy facility will involve substantial changes to the local hydrology, and special consideration of the risks of soil erosion is required.

In the first instance, water runoff from the panels may result in impact damage and dispersion of the soil below the panels where the water falls. The panel will tend to concentrate runoff as both an impact and an increased flow into a relatively small area. The degree of concentration will depend on the size of the panels, with smaller panels providing a lower level of risk than larger panels. The lack of soil structure in the surface soil (surface soil is apedal) and the tendency to be hard setting means that these soils are prone to impact damage and surface erosion. It will be necessary to either maintain good permanent pasture cover or consider placing crushed rock below each panel where water falls to absorb the impact energy of the rain splash.

With impact damage minimized, it will also be prudent to introduce measures that will retard surface runoff and increase infiltration. The total area of panels is substantial and the runoff from storm events will be concentrated by hard surfaces. The surface runoff within and across the Project Site needs to be dispersed and retarded as far as is practically possible around the property, so that no higher storm runoff occurs within any natural or manmade waterway. These soils would be prone to rilling and gullying along drainage lines where concentrated flows occur during storm events. The retardation of the surface runoff and stable, slow moving drainage channels will be a key requirement of project design.

While the design needs to consider soil erosion risks and mitigate against this appropriately, it would also be prudent to incorporate a soil loss and land degradation review into the monitoring program. Other measures to prevent soil loss can be introduced if the design needs modification. An annual review for the first five years of operation would be appropriate.

6. Agricultural Impacts of the Proposal

6.1 Impact of Solar Farm on Neighbouring Farms.

To the south and west of the Project Site is a large property owned by Ford Motor company and used for the testing and commissioning of vehicles. There is no agricultural use of this property. To the south and east of the Project Site are the northern extremities of the You Yangs National Park and the Mount Rothwell Wildlife Sanctuary. There is no agricultural use of these tracts of land.

East of the Project Site and north of the Mt Rothwell Wildlife Sanctuary, along the entire northern extremity and part of the western perimeter of the Project Site, the neighbouring properties are in various forms of agricultural use. The use includes sheep grazing, broadacre cropping for cereals and oilseeds, an Olive Grove, some beef cattle grazing and equine grazing. No interdependence between the farms of the Project Site and these adjoining properties has been identified. They operate as separate stand-alone enterprises. There is no clearly identifiable impact from the installation of solar panels on any of these surrounding farming businesses.

Overall the removal of up to 735 hectares from grazing and cropping use should not result in any discernible negative impacts on the agricultural use of the adjacent properties.

6.2 The Agricultural Amenity of the Region.

The Australian Bureau of Statistics (ABS) collects, collates and publishes agricultural statistics. An appropriate level of detail for review and analysis of statistical data on agricultural production is the Statistical area level 4 (SA4), which in Victoria are combinations of several municipalities. The relevant statistical area SA4 for the Project Site is the Geelong region, region code 203, which is a combination of the Golden Plains Shire, the City of Greater Geelong, and the Surf Coast Shire. Statistical data for 2015/2016 shows that the Geelong statistical area has some 200,000 hectares of agricultural land, of which 52,000 hectares were cropped during 2015/2016 with a total farm gate value of $98m. More recent data for 2019/20 indicates a farm gate value of $34m for wheat crops, $26m for barley crops, and $24m for canola crops within the Geelong statistical area. A further $40m farm gate income is derived from wool production for the Geelong statistical area for 2019/20.

The Project Site comprises a combined farm area of 735 hectares of which around 90% is potentially suitable for cropping, and an estimated 70% is being cropped at any particular time. That is, the Project Site potentially comprises around 1% of the cropping area of the Geelong statistical area. The Project site also supports a small livestock population, of less than 2000 sheep and the wool production would be less than 0.1% of the wool income for the Geelong statistical area.

7. Conclusions and Summary

- The Project Site comprises approximately 735 hectares of agricultural land at Little River in seven separate parcels. The land is currently utilised for grazing and cropping.
- There are no inherently unique features about the Project Site that distinguish it from neighbouring farms in the area.
- The climate of the area is notable for dry and hot summers, low to moderate annual rainfall, and a significant frost incidence from May to September.
- Much of the original indigenous vegetation has been removed over the years. Some mature Eucalypts remain sporadically scattered through some the land parcels, along watercourses and along the southern extremity of the Project Site.
- The landform is a flat to gently undulating plain and is part of the extensive landscape of the Werribee Plains.
- The soil types present are noted for their duplex profiles (contrasting texture between surface soils and subsoils), absent soil structure at the soil surface and medium to heavy clay subsoils. The soils are all prone to hard setting when dry.
- The dominant agricultural use of the land is broadacre cropping for wheat, barley and oilseeds (canola). There is a considerable area dedicated to grazing of sheep.
- The land is neither highly productive nor highly versatile. It is not considered to be significant land or strategically important land from an agricultural perspective.
- The development of a solar energy facility on the combined property will alter the nature of the farms. Cropping will no longer be practical. With appropriate design of the panels and improvement of stock water availability, sheep may be able to graze the land. The carrying capacity of the farm will be reduced.
- If grazing is not to be part of the on-going management, consideration needs to be given as to how to control the vegetive growth beneath the panels, particularly in the areas below the panels where rainfall is concentrated and growth will be comparatively lush.
- Consideration is also required as to how the grass Serrated Tussock will be controlled. This *regionally controlled* weed is already well established across the Project Site and efficient and effective herbicide use will need to be part of maintenance. A weed management plan which includes periodic assessment and review is required.
- Heightened wildfire risk will occur if attention is not given to how fuel loads are managed. Flexible fuel load management needs to be considered as part of the project design.
- There are no perceived detrimental impacts of the development of the solar energy facility to the surrounding farm businesses. The impacts to the agricultural amenity of the Region are not significant.
- The concentration of runoff from the panels onto the soil surface may initiate soil erosion. Consideration needs to be given to minimizing this risk in the design stage. A soil and land degradation plan which includes a periodic review process risks is required as part of the project design.