Assessment on the impact of Section 3.9 of the National Policy Statement on Highly Productive Land for the proposed solar farm development within the Selwyn District.

1 Background

Stuart Ford of The AgriBusiness Group (TAG) has been asked to make an assessment on the impact of Section 3.9 (3) of the National Policy Statement on Highly Productive Land (NPS-HPL) for the proposed solar farm development within the Selwyn District. Stuart Fords experience in relation to the productivity of rural land is attached in Appendix A.

The applicants propose to establish a 104 ha solar farm between Buckleys Road and Branch Drain Road at Brookside, Canterbury (the site).

1.1 Soils and Land Use Capability

The site with the approximate boundaries and Land Use Capability (LUC) classes are shown in Figure 1.

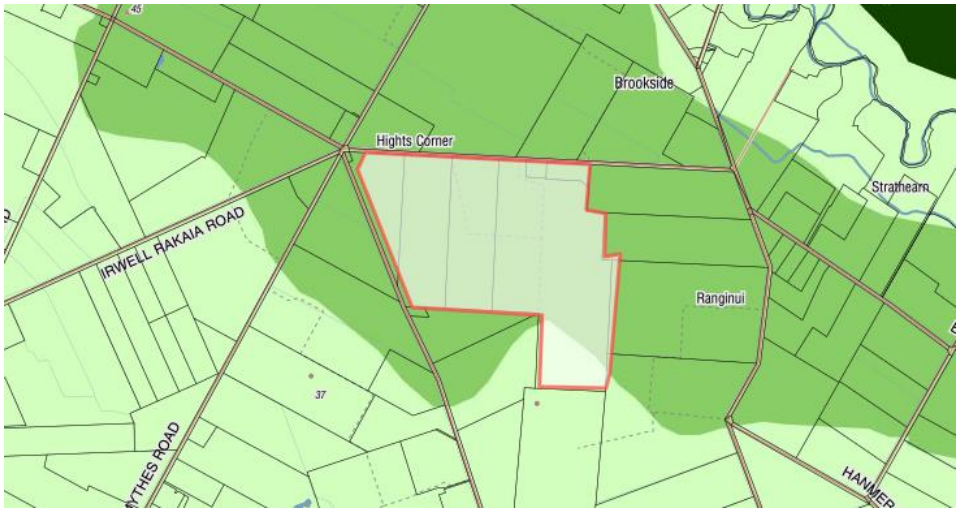


Figure 1: Location of the site and the LUC classes that it occupies. The darker green is LUC 2 and the lighter green is LUC 3. (OURENVIRONMENT website Landcare Research)

The property contains approximately 92% of LUC 2 and 8% of LUC 3.

All land is automatically defined as HPL under the NPS-HPL if it is Class 1,2 or 3.

The soil type as shown on SMap is 67% Ayreburn soil and 33% Leeston soil. The key properties of these two soils are shown in Table 1.

Table 1: Physical properties of the soil types present as listed in SMap.

Soil Name	Ayreburn	Leeston
SMap Name	Ayreburn_3a.1	Leeston_1a.1
Depth Class	Moderately Deep (45 to 90 cm)	Shallow (20 to 45 cm)
Rooting Depth	70 to 100 cm	70 to 100 cm
Depth to stony layer	Moderately Deep	Shallow
Texture profile	Clay	Clay
Topsoil stoniness	Stoneless	Slightly Stoney
Drainage class	Poorly Drained	Poorly Drained
Profile Available Water (0 to 100 cm)	122 mm	111 mm

The Ayreburn soils are moderately deep soils whilst the Leeston soils are shallow. They are both clay soils that are poorly drained and have a high level of Profile Available Water.

2 The Proposal

The proposal is to establish a 104 ha solar farm on Buckleys Road and Branch Drain Road, Brookside because it is a site which is immediately adjacent to the Orion rural zone substation. The land area will be dual purpose with providing renewable energy to the national Transpower grid and providing primary production. This dual use activity is referred to as Agrisolar.

2.1 Solar

It is proposed that the panels will either be set out as fixed/stationary or a single axis tracker system.

2.1.1 Fixed/Stationary Panels

Fixed/Stationary panels will be constructed as shown in Figure 2. The panels are approximately 4.58m wide and 15.15m long and are situated on piles which are driven into the ground approximately 1.8m and the piles are 2.65m apart. At the lowest point each panel is 700mm above the ground and at the highest point 2.88mm above the ground. It is proposed that the gaps between the rows of panels will be 8m.

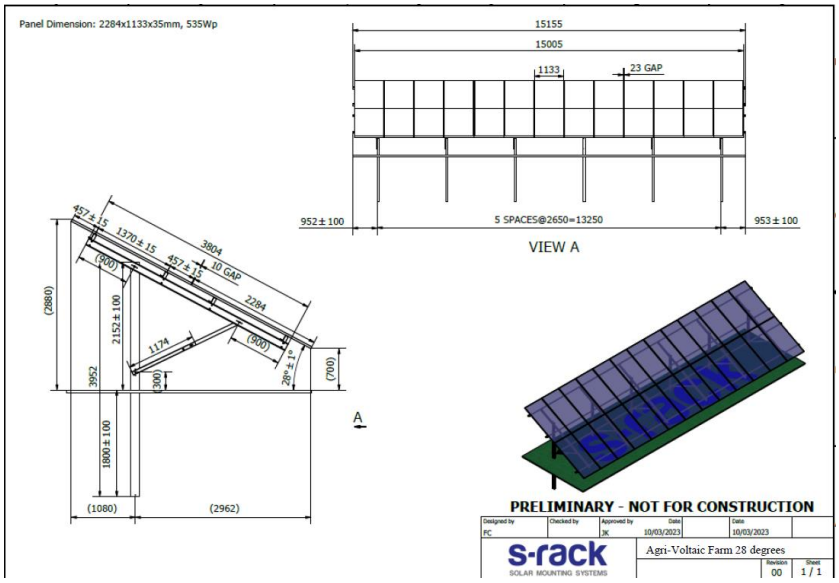


Figure 2: Panel Dimensions of the stationary panel system.

2.1.2 Single Axis Tracker Panels

The single axis tracker panels will be constructed as shown in Figure 3. The panels are approximately 1.30m wide and approximately 2.38m long. When flat/horizontal (in stow position) they are 1.60m above the ground and can be 500mm above the ground and no more than 3.0m above the ground (during maximum tilt). They are on piles that are driven into the ground approximately 1.8m and the piles are approximately 8.0m apart. It is proposed that the rows will be approximately 4.0m apart (when the panels are flat), 6.38m from pile to pile.

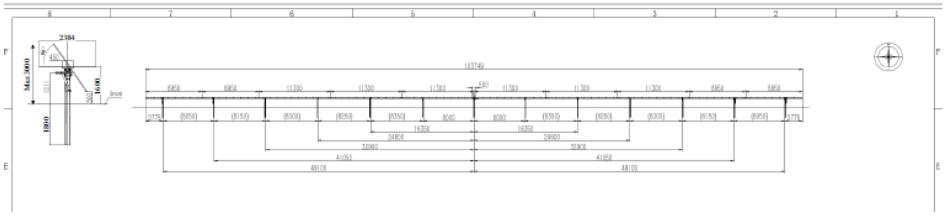


Figure 3: Panel dimensions of the single axis tracker panels.

2.2 Primary Production

Primary production is proposed to be initially in the form of lamb finishing but there is a range of potential production opportunities open to the land including intensive horticultural production.

2.2.1 Pastoral Grazing

For the fixed/stationary panels if we are to assume that the pasture that is grown within the site conforms to the study carried out by Dr D Donaghy of Massey University. This study found the grass between the panels grew at a rate 40% more than grass growth without any panels above. While the area under the panels grew at 84% less than the area without the panel above, with the net difference in grass growth in the structure area is able to grow approximately 9% more grass than the area without the structures.

Without structures: (8m between the panels x 1) + (3m under the panels x 1) = 11

With structures: (8m between the panels x 1.4) + (3m under the panels x .26) = 11.98

Difference: 11.98 / 11 = 1.09.

Dr Donaghy attributed this increase in grass growth to the fact that the panels offer a microclimate which keeps the soil temperature marginally lower during the day and marginally warmer at night and reduces the amount of moisture lost through evapotranspiration.

For the single axis tracker panels there is no reduction in pasture growth under the panels so we could expect up to a 140% of pasture grown under the structure compared to what would be grown in a straight farming situation or traditional farming methods.

This is backed up by an Australian report[1] which has been published by the Clean Energy Council (CEC) which noted that Agrisolar was first proposed in Germany in 1981. "*Since then, local and international trials and research, particularly in the past five years, have shown that solar energy and agricultural production can be highly compatible and mutually beneficial*" and it also reports that Solar Power Europe stated in 2020 that ""*Agri-PV allows for solar to be combined with specific rural and agricultural activities, providing solutions to the needs of farmers and rural communities by driving investments and creating jobs in rural areas, supporting traditional and sustainable agricultural practices, or increasing the climate resilience of agricultural activities*".

The report states"*While Australian studies are currently underway, recent international studies suggest that the growth rate of certain crops is not reduced under solar panels and indeed can even improve the performance of some crops. The key possible reasons for these improved outcomes are outlined below*.

- *Reduced exposure to sun and extreme weather events.*
- *Soil moisture is enhanced, and temperature extremes are reduced.*
- *Ambient temperatures were improved."*

The combined factors of reduction of extreme temperatures (both high and low), improved average temperatures and reduced evapotranspiration all contribute to enhanced plant growth and would support the findings of Dr Donaghy.

The experience to date in Canterbury is different to Dr Donaghy's research results with the pasture under panels being as strong in growth as the pasture not under the panels as shown in the photos in Appendix B. This may be due to both the quality of the land and the structure of the solar panels.

[1] Clean Energy Council (2021): Australian guide to Agrisolar for large-scale solar.

Agrisolar is a very advanced farming technique in the USA with the American Solar Grazing Association[2] (ASGA) which promotes the dual use of grazing and solar production across the USA and ASGA website has a vast amount of information and research papers on the grazing of sheep on solar farms and lists the following Universities who have published research papers on the activity of grazing within solar farms.

- Cornell University
- Oregon State University
- National Renewable Energy Laboratory (NREL)
- Additional Research & Private Research Institutions
- International Research
- Ohio State University
- New York State Energy Research and Development Authority (NYSERDA)

2.3 Horticulture

The CEC report quotes examples of vegetable crops that have grown successfully in conjunction with solar in the USA. These include Tomatoes, Jalapenos, Kale and Chard and Broccoli. All reports quote the yield is similar or up to double the conventional yield and that water efficiency is improved significantly.

According to the National Renewable Energy Laboratory (NREL) in the USA, agricultural crops can thrive underneath the partial shaded conditions of solar installations, with panels creating the following environment for plants grown under or around the panels:

- reducing the amount of direct sunlight reaching the crops and reducing sunburn on crops
- creating cooler conditions during the day and warmer conditions at night
- reducing heat stress as well as reducing risks of frost damage
- extending growing seasons in multiple regions
- increasing soil moisture levels, which can lead to a reduction in irrigation needs.

Berry fruit including strawberries, blackberries, blueberries, loganberries and black currents could all be grown between the rows on this site. We are aware that Lincoln University intends to grow blueberries between the rows on their AgriSolar farm which they are just setting up.

The CEC report also mention that in Australia they are researching the growing of permanent crops like pears, apples and even vineyards on Agrisolar properties.

2.4 Current land use.

The current land use is an irrigated Dairy farm. The site is within ECan's Selwyn Waihora zone which is a Red Zone this means that it is above the allowable allocation of Nitrogen leaching and irrigation water extraction. Dairy farms are required to reduce the amount of Nitrogen leaching by 30% and on renewal of a consent to extract water for irrigation it must prove that it is efficient in its water use and if the irrigation consent is transferred to another site it must surrender 50% of its current allocation.

The conversion across to the proposed Agrisolar farming operation will have positive effects for Nitrogen by reducing the amount of Nitrogen leaching significantly and use of the consented water more efficiently due to the reduced evapotranspiration. It is proposed that irrigation does continue

[2] https://solargrazing.org

on the site, some examples of use are parts of the horticulture activities partly of the pasture, and partly for the maintenance of the site.

These are both positive outcomes for the environment and for the sustainability of the land.

3 The Impact of Section 3.9 (3).

Section 3.9 (3) of the NPS-HPL states:

(3) Territorial authorities must take measures to ensure that any use or development on highly productive land:

> *(a) minimises or mitigates any actual loss or potential cumulative loss of the availability and productive capacity of highly productive land in their district; and*
>
> *(b) avoids if possible, or otherwise mitigates, any actual or potential reverse sensitivity effects on land-based primary production activities from the use or development.*

In the document *"National Policy Statement for Highly Productive Land – Guide to Implementation March 2023*" it states:

Clause 3.9(3)(a) requires territorial authorities to focus on minimising or mitigating any actual loss or potential cumulative loss of the availability and productivity capacity of HPL, when considering any proposed use and development on HPL. When considering if a use or development "minimises" or "mitigates" a loss of productive capacity, territorial authorities should consider:

• ***the location of the activity*** *– whether it can be sited somewhere on the subject site that minimises the impact on the productive capacity of HPL*

• ***the footprint of the activity*** *– whether efforts have been made to keep the footprint of the activity as small as possible to minimise the actual loss of HPL*

• ***clustering of activities*** *– whether there is an option to group a number of activities in a similar location to mitigate the cumulative loss of HPL that would occur through activities being spread out across a wider area of HPL (eg, clustering of buildings, co-location of telecommunications infrastructure or containing multiple activities in the same building, such as using an existing residential dwelling for a home business or visitor accommodation activity, rather than constructing multiple buildings)*

• ***co-existing with land-based primary production*** *– whether the activity can be designed in such a way that is does not preclude being able to carry out land-based primary production around the activity (eg, the potential for using the land around specified infrastructure to be used for vegetable production or animal grazing).*

The productive capacity of the land is defined in the NPS-HPL as:

productive capacity*, in relation to land, means the ability of the land to support land-based primary production over the long term, based on an assessment of:*

(a) physical characteristics (such as soil type, properties, and versatility); and

(b) legal constraints (such as consent notices, local authority covenants, and easements); and

3.1 *(c) the size and shape of existing and proposed land parcels.* Minimises or mitigates any actual loss or potential cumulative loss of the availability and productive capacity of highly productive land.

3.1.1 Minimises or mitigates.

It is my opinion that this proposal both minimises and mitigates any actual loss of HPL under consideration of the relevant factors of:

The location of the activity.

For the solar part of the Agrisolar enterprise to be effective it must be located close to a substation. The Brookside substation is directly adjacent to the site.

The footprint of the activity.

The Solar part of the operation covers around 30% of the land area in both configurations that have been considered as possible in this proposal. However primary production on the land will still take place under the 30% covering of the panels. Still making a large proportion of the land available.

Clustering of activities.

Not relevant to this proposal.

Co-existing with land-based primary production

It is possible to carry out land based production within the site.

3.1.2 Actual loss or potential cumulative loss of the availability and productive capacity of highly productive land.

The proposal allows for the land to support land based production in the long term both as enhanced pastoral production and in the potential for horticultural production.

When assessed against the physical characteristics criteria we find that the soil type and properties are not diminished at all under the Agrisolar proposal.

The range of primary production activities that can be undertaken on the land will be reduced as it will not be possible, for example, to graze large animals amongst the panels or grow particular crops. However, it is possible to use it for some pastoral activities and high value horticultural activities (including utilising the shade provided by the panels) which are at the upper end of land uses in terms of the potential returns, employment, wellbeing and flow on economic impacts.

The other two criteria of legal constraints and the size and shape of existing and proposed land parcels are not relevant to this site.

4 Summary

It is my opinion that the proposed land use of Agrisolar meets the requirements of the NPS-HPL in that it minimises the actual loss of any HPL and productive capacity as it allows for the land to support land-based primary production in the long term.

Appendix A: Experience of Stuart Ford in relation to the productivity of Rural Land.

The work has been carried out by Stuart Ford who is a director of TAG and an agricultural and resources economist. Stuart has given evidence to District and Regional Council hearings, Special Tribunals to consider Conservation Orders and the Environment Court in his capacity as an agricultural and resources economist.

Specific experience which relates to the capacity of soils and their value for productive uses include him working for both the applicants and Councils. Stuart has experience in relation to the productive capacity of elite / highly productive soils much of this experience has been gained from his role as a consultant resource economist for HortNZ.

His specific experience which relates to the task required in this instance includes:

- Evidence to the Auckland Council on their Proposed Auckland Unitary Plan for a number of parties.
- Evidence given on behalf of Auckland Council to the Environment Court in relation to the appeal of the Self Family Trust in regard to a land zoning decision on elite soils.
- Evidence given to an Auckland Council hearing as to the appropriate zoning of land at Clevedon.
- Initial report on the productive potential of land owned by Strategic Land Holdings at Waiau Pa.
- Support for Auckland Council in preparing a Section 42A report on a development proposal at Patumahoe South in relation to the productivity of the land.
- Support for Auckland Council in preparing a Section 42A report on a development proposal at O'Hara Waiuku in relation to the productivity of the land.
- Provision of evidence to the Environment Court on the productive potential of the land known as Sticky Forest adjacent to Wanaka.
- Provision of a report on the commercial viability of Rangitane River Park – Kerikeri to be used in a re zoning application.
- Provision of a report on the agricultural productivity and commercial viability of land at Kairua Road Tauranga.
- Provision of a report on the agricultural productivity and commercial viability of land at Maungatautari Road Cambridge for the Arvida Group.
- Reports on the agricultural productivity and commercial viability of land and their status under the NPS-HPL for five different submitters to the Selwyn District Council.
- Support for the Waimakariri District Council in preparing a Section 42A report on a development proposal at Ohoka in relation to the productivity and the commercial viability of land.
- Provision of a report on the agricultural productivity and commercial viability of land at Alfriston Road Clevedon Auckland.
- He is currently engaged in a similar capacity for proposals in Otago, Canterbury and in the Bay of Plenty.

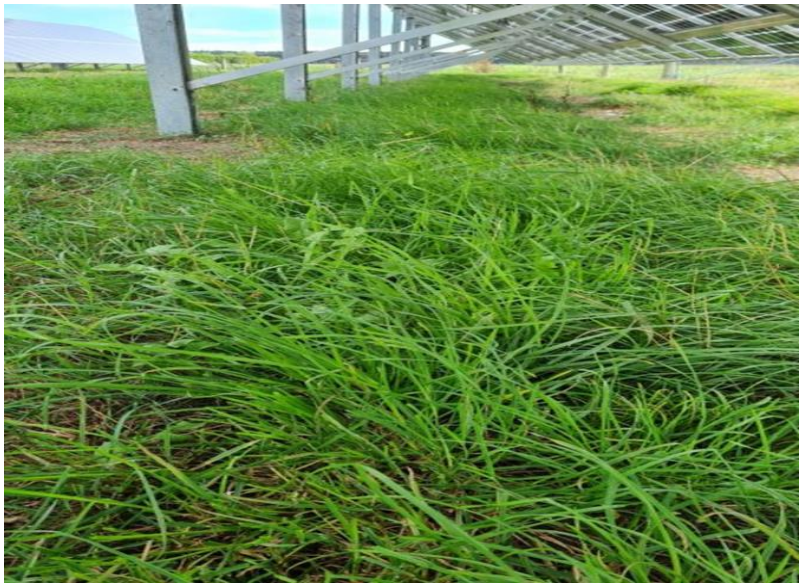
Appendix B; Photos of grass growth under existing Agrisolar properties in the Selwyn District area.

Stationary Panels.

Buckleys Road, Brookside (fixed system).

Hanmer Road, Brookside (fixed system)

North Rakaia Road, Rakaia (fixed system)



Hanmer Road, Brookside (fixed system)

Single axis tracking.

Buckleys Road, Brookside tracking system after 9 years

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Buckleys Road, Brookside tracking system after 9 years

Buckleys Road, Brookside tracking system after 9 years

Overseas example of a tracking system