Sections 95 and 95A-E

Resource Management Act 1991

Decision/Report

Report pursuant to section 42A of the Resource Management Act 1991 recommending whether or not an application for resource consent should be:

- Publicly notified, limited notified or non-notified

Decision pursuant to section 95 of the Resource Management Act 1991

APPLICATION NUMBER:	**RC235464**
APPLICANT:	KeaX Limited
BRIEF DESCRIPTION OF APPLICATION:	Land use consent RC235464 is sought to construct and operate a new solar array on approximately 111ha.
SITE DESCRIPTION:	Address: 115, 150 & 187 Buckleys Road, Brookside Legal Description: Lot 1 DP 7545 Title Reference: CB751/93 Area: 20.7857ha Legal Description: Lot 2 DP 54392 Title Reference: CB32F/403 Area: 11.4121ha Legal Description: Lot 2 DP 387576 Title Reference: 352257 Area: 58.5830ha Legal Description: RS 8955 Title Reference: CB512/201 Area: 20.2343ha
ZONING / OVERLAYS	**Operative Selwyn District Plan (2016), Rural Volume** Outer Plains Zone C59 – Wahi Taonga Site **Partially Operative Selwyn District Plan (decisions notified 19 August 2023)** General Rural Zone Plains Flood Management Overlay, Liquefaction Damage Unlikely Overlay, East Plains/Te Waihora ki Waimakariri Rural Density Overlay (SCA-RD2).
OVERALL ACTIVITY STATUS:	**Discretionary**

The Application

1. The application was formally received by the Selwyn District Council on 10th of August 2023. Further information was received on the 5th, 20th & 24th of October 2023, and this information now forms part of the application.

2. The application proposes to construct and operate a new solar array covering approximately 104ha, 6km north of the Leeston Township. The applicant expects an operational generating capacity of 100 Gigawatt hours (GWh) (50MW AC / 75MW DC), that will feed into the network grid via Orion's existing Brookside Substation and will be able to power approximately 11,200 houses.

3. The total solar array will be comprised of approximately 140,000 solar panels, set within single axis tracking (SAT) tables. Each table comprises 26 pairs of solar modules (52 individual solar panels total). There will be thirteen inverters to convert the direct current into the network grid, as shown below in **Figure 1**.

4. Resource consent is required for the establishment of a renewable electricity generation activity, and to undertake earthworks exceeding the maximum permitted volume. The applicant has clarified that the resource consent is sought for an unlimited duration.

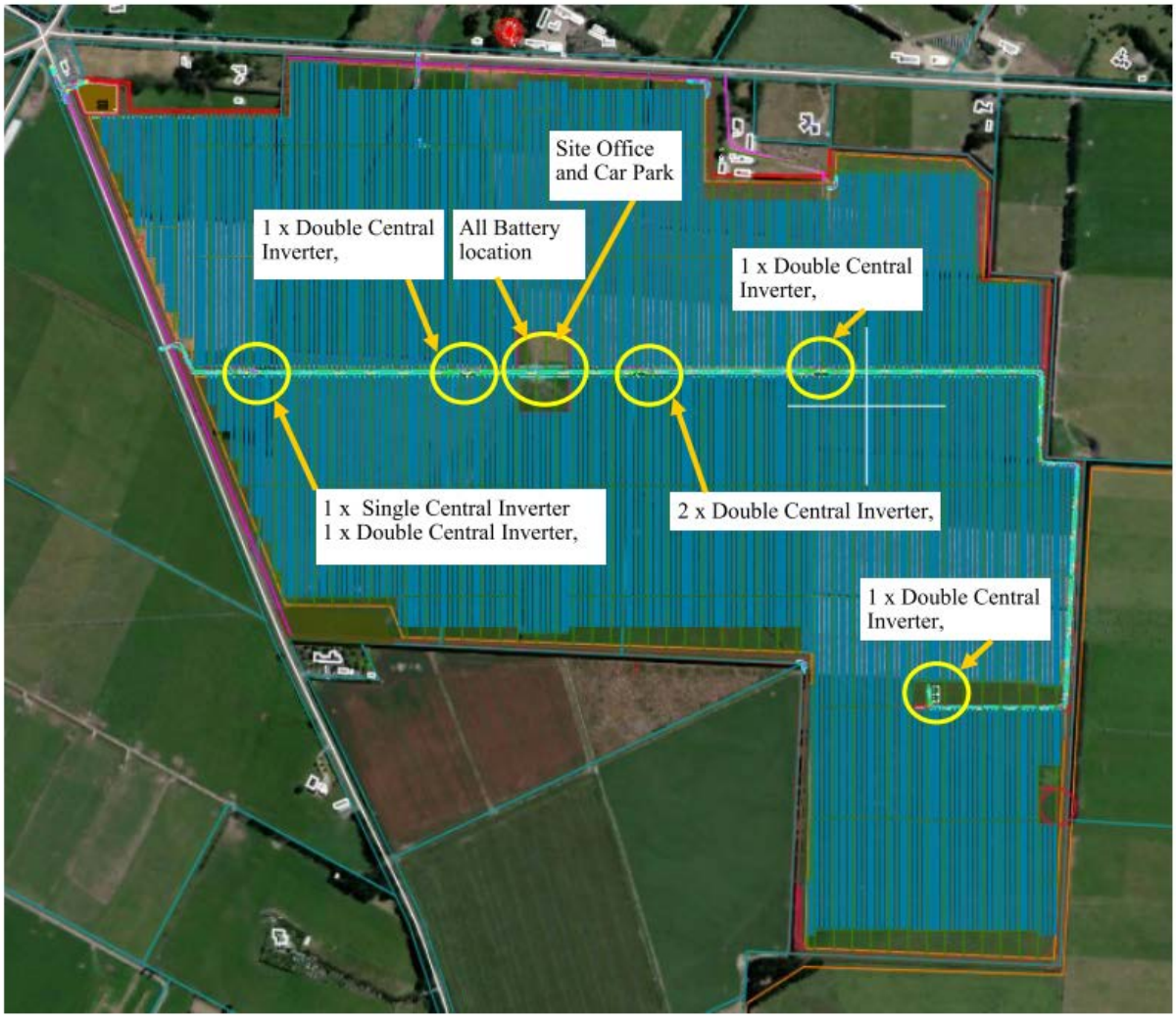


Figure 1: Proposed Site Layout and Battery Plan (Source: Applicant's s92 response)

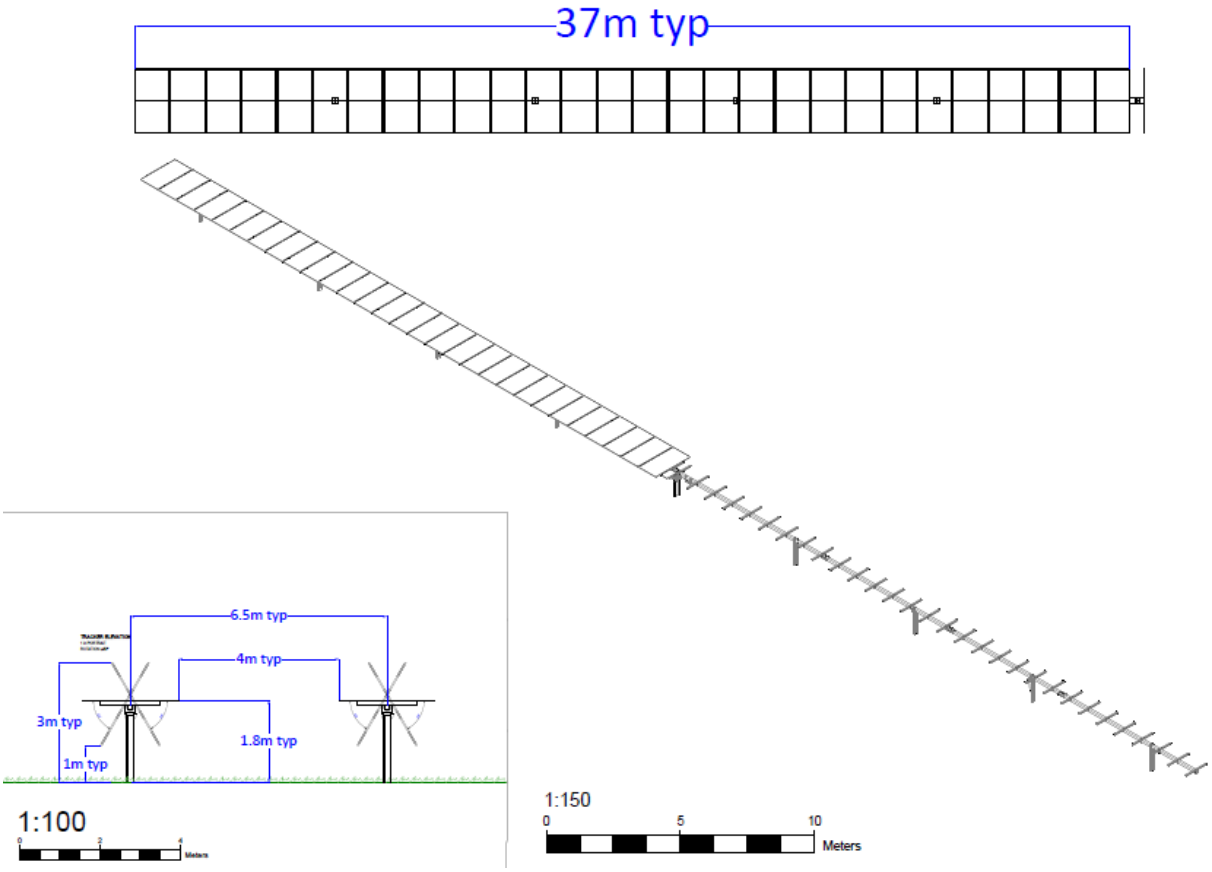


Figure 2: Indicative Tracker System Details (Source: Appendix 5 of Application)

5. A comprehensive description of the proposal is set out in the application document. The main aspects of the application are as follows:

a) The solar panels will be approximately 1.30m wide and 2.38m long, tilting on a single axis. When horizontal (stowed) they will be approximately 1.6m-1.8m above the existing ground levels. The panels will move between 500mm and 3m above existing ground level depending on the tracking, with a maximum angle of 60% when fully tilted. The reflectivity value of the panels will not exceed 4%.

b) The tables will be fixed to piles that are driven (percussive) into the ground approximately 1.8m deep and the piles will be spaced approximately 6.5m apart. The rows of panels will provide approximately 4.0m separation (between the panel edges) when the panels are horizontal/stowed for construction and maintenance access, as shown in **Figure 2** above.

c) It is proposed to construct the solar array in its entirety and in accordance with the following:

i. No staging of the development or construction is proposed. Up to 100 staff may be on-site during the peak of construction works.

ii. It is anticipated that the construction will likely take a period of 12 months to complete.

iii. Construction will be limited to weekdays only (Mon-Fri), and between the hours of 7.30am to 6.00pm.

iv. Piling equipment will only be used for approximately 6 months. Several piling rigs will be utilised to reduce the total required piling duration.

v. No stockpiling of soils or material is proposed.

d) Other buildings, infrastructure and equipment will include:

i. A single storey relocatable site office of approximately 12m length and 4.2m width, covering approximately 50.4m^2. The site office will temporarily support construction and will be removed from the site when construction works are completed.

ii. A total of thirteen inverters. A sole single skid inverter measuring 10.2m long, 2.1m wide, and 2.25m high, covering an area of approximately 21.42m^2. Twelve twin skid inverters measuring 9.2m long, 5.4m wide, and 2.35m high, covering an area of approximately 25m^2.

iii. Storage buildings for equipment and materials on-site, comprised of four shipping containers measuring 12.19m long, 2.44m wide, and 2.59m tall, covering an area of approximately 59.4m^2. They will be retained once the array is operational to accommodate storage of materials for essential maintenance and repairs. They will be positioned adjacent to the temporary site office, which is central to the site.

iv. A potential/future battery site, located in the centre of the site comprised of 14 x 40ft batteries (within containers). Batteries would manage drops in power and fluctuations, which can be caused by cloud cover. In the longer term, batteries may store and sell excess energy back to the grid during periods of high demand.

e) All internal fencing, structures, and planting internal to the site will be removed to prepare the site for the installation of the solar array structures. Unless otherwise stated, all existing perimeter boundary planting (road and internal site boundaries) will be retained.

f) Sheep grazing and other primary production is proposed to occur underneath the panels. It is also proposed to retain some of the water infrastructure, including existing water tanks, to provide water for the livestock on the site, and some irrigation. New post and wire fencing may be established in association with primary production underneath the panels.

g) It is proposed to undertake mitigation shelterbelt planting of fast growing, evergreen species to fill in gaps and to plant areas where there is no existing planting in accordance with a Landscaping Mitigation Plan (LMP). The applicant's assessment clarifies that this planting will be exotic.

i. The planting will be located between the site boundary and the security fencing to screen the site and to protect the planting from the livestock grazing the site.

ii. The planting will be implemented prior to construction on the site, and plants will be a minimum of 2m tall at establishment. Where existing vegetation needs replacing, a smaller grade of planting may be used. Planting would be maintained at a minimum height of 3.5m at 'maturity'. Any existing vegetation will be replaced if it becomes diseased or dies.

iii. New planting along Branch Drain Road will be set back 10m from the site boundary and maintained at 3.5m height to control shading effects. Where planting is directly behind vegetation that is already at, or exceeds, 2m in height, new planting will range from 0.5m-1.5m at establishment. The existing planting along Branch Drain Road (outside of the boundary fence) will be removed once the new plantings reach 3.5m height.

iv. Where planting faces the roadside, the applicant will maintain vegetation with mechanical trimmers from the 10m setback area proposed. On the inside of internal fences, a 3m wide maintenance strip is proposed between the planting and the security fencing to enable mechanical trimming.

v. Irrigation and associated infrastructure for the landscaping planting will be installed prior to commencing planting.

vi. An additional shelterbelt hedge will be planted approximately 20m from the boundary with 324 Branch Drain Road (and 33m from the existing residential unit on this site).

h) Security fencing will be established along all road boundaries. The fencing will be chain-link, with barbed wire on top. This fencing will have a maximum height of 2.6m and the posts will not exceed 3.0m. Security gates will be the same height as the proposed fencing. The fencing will be positioned behind the existing and proposed planting.

i) The proposal has the following servicing features:

i. No external lighting is proposed on the site.

ii. The relocatable temporary site office will utilise a small solar panel and battery system.

iii. Potable water will be transported onto the site (filled off-site) during construction for workers and staff. An above ground tank of up to 5,000L will be positioned adjacent to the site office for drinking water and ablutions.

iv. The site office and staff facilities will be self-contained having a surface wastewater tank (2,700L). The tank will be monitored and emptied as required at a facility that is authorised to receive the wastewater.

v. Stormwater from buildings and structures will be discharged to ground.

j) The proposal includes an approximate earthworks volume of 7,020.5m^3, in relation to the below activities. An Erosion and Sediment Control Plan (ESCP) will be implemented and will incorporate a Dust Management Plan (DMP).

   i. Driving piles to approximately 1.8m below ground level to support the solar tables/frames.

   ii. Trenching of up to 1.0m below existing ground level to lay cables, which connect the frames of the solar panels together and to the inverters, in addition to connecting the array to the adjacent substation.

   iii. Topsoil scraping & disturbance to prepare surfaces for the relocatable buildings, inverters, and the future battery site.

   iv. Spreading of material to form internal tracks where required.

k) The site will be accessed from an existing farm gate located on Branch Drain Road, approximately halfway along the Branch Drain Road frontage of the site. This vehicle crossing will be formed and sealed prior to construction in accordance with Diagram E10.D (Operative District Plan – Rural Volume), which I note exceeds TRAN-Diagram 6 in the PODP. The existing culvert within the drain will be upgraded with pre-cast concrete headwalls with RCRRJ piping and will be constructed in accordance with the Council's Engineering Code of Practice (ECOP).

l) Construction phase total equivalent car movements per day (ecm/d) will not exceed 60 (averaged over the week). This will be split between staff movements and deliveries to the site. The delivery of materials will use heavy vehicles.

   i. Up to 6 trucks will enter and exit the site per day (1 truck to and from the property = 6 equivalent car movements) at times during the construction period, resulting in 36 ecm/d.

   ii. Up to 12 staff vehicles will enter and exit the site per day (1 car to and from the property = 2 equivalent car movements), resulting in 24 ecm/d.

   iii. Car parking and manoeuvring will be accommodated within the site and no vehicle will be required to reverse onto Branch Drain Road.

m) Staff will not be required on-site on a permanent basis and will infrequently visit the site to check operations and to undertake maintenance. This is anticipated to be only 1-2 staff visits per month, resulting in up to 4 ecm per month.

n) There will be no activity on-site at night-time and the batteries and inverter will be switched off by their Programmable Logic Controller (PLC)[1].

o) As part of the initial site preparation works, the Wahi Taonga Management Site (C59) that is located on the site will be fenced off, with a 50m buffer maintained around the feature. No earthworks are proposed within this area, or within 10m of the drains along Branch Drain Road and Buckleys Road

p) The following consents have been obtained by the applicant from Environment Canterbury Regional Council (ECan) in relation to the proposal:

   i. CRC223908, issued 15th November 2022 – To undertake earthworks over aquifers.

   ii. CRC223909, issued 15th November 2022 – To discharge operational phase stormwater to land.

Background

6. The application site is subject to two relevant prior resource consent applications.

7. Resource consents 065188 and 065189 were formally received on the 31st May 2006, with RC065188 seeking to create a 1ha allotment and a balance Lot 2 of approximately 57.5ha, and RC065189 seeking to retain an existing dwelling on an undersized allotment (now described as 105 Buckleys Road). The application was approved on the 25th September 2006, and established a 19ha (Area A) 'no dwelling' area on Lot 2 via a consent notice to preserve the existing residential density. These consents have been given effect to and the subdivision was completed.

8. Resource consent 225180 was formally received on the 17th March 2022, to construct a new 258ha solar array, to retain relocated buildings on site permanently, and to undertake earthworks. This application was limited notified on the 2nd November 2022, and a hearing was held on the 23rd February 2023, with the hearing closed

[1] Confirmed by Acoustic Engineering Services Ltd in email correspondence dated 4th September 2023.

on the 6th March 2023. A Commissioner decision to decline the application was issued on the 27th March 2023 in accordance with section 104(3)(d), as it was determined that the application should have been subject to public notification and was not. A copy of that decision is available from the Council on request.

The Existing Environment

9. The application site has an approximate area of 111ha, and is comprised of the following properties:

    - 115 & 150 Buckleys Road – Lot 1 DP 7545, RS 8955 & Lot 2 DP 387576 – owned by Pitcairn Farm Limited
    - 187 Buckleys Road – Lot 2 DP 54392 – owned by Angela Ward & Pitcairn Trustees Limited

10. The site is located approximately 6km to the north of the Leeston Township. The site contains existing residential units at 115 & 187 Buckleys Road, farm buildings, shelterbelt planting and irrigation infrastructure (including 2 centre pivots). The site is currently used for dairy farming in conjunction with the property at 150 Buckleys Road and has relatively flat topography. The dairy farm at 150 Buckleys includes a small existing fixed panel solar array that supplies the on-site activities.

11. There are multiple farm accesses and vehicle crossings to Buckleys Road and an existing farm access from Branch Drain Road. In addition, there are overhead powerlines located along Buckleys Road and Branch Drain Road within the road reserve. Branch Drain Road and Buckleys Road contain classified drains[2] adjoining the boundary of the site. The Buckleys Road drain has consistent water flow and is identified in the Partially Operative District Plan as potential habitat for the threatened (nationally critical) Kowaro/Canterbury Mudfish.

12. The shelterbelt planting is well established in some parts of the site, with mature planting along the boundaries. In other areas, there are gaps in the planting where there are either small plantings or no planting at all. Existing vegetation is comprised of pasture grasses, in addition to shelterbelt and road boundary plantings. The south-eastern portion of the site contains Wahi Taonga Management Area - C59, which is identified in the Operative District Plan (Rural Volume).

13. The surrounding area is comprised of predominantly rural land uses, including dairy farming, cropping, and the rearing of livestock, while also including residential activities. There is an existing Orion New Zealand Limited (Orion) substation located in the north-western corner of the site, at the intersection of Buckleys Road and Branch Drain Road. Orion are a requiring authority and the substation is designated “ORION-5” in the Partially Operative District Plan.

[2] Within the Leeston Land Drainage Scheme - https://www.selwyn.govt.nz/__data/assets/pdf_file/0005/827141/LD-Proposed-Boundaries-2022.pdf

Figure 3: Application Site and Immediate Surrounds (Source: Canterbury maps)

Figure 4: Existing fixed solar array located at the dairy farm at 150 Buckleys Road (Source: Site visit)

Figure 5: View from Branch Drain Road towards established shelterbelt planting along southern site boundary (adjoining 324 Branch Drain Road) (Source: Site visit)

Figure 6: Additional image from Branch Drain Road along established shelterbelt adjacent to 324 Branch Drain Road (Source: Site visit)

Figure 7: View north-west along Branch Drain Road towards the sub-station (Source: Site visit)

Figure 8: View of existing vehicle access to Branch Drain Road, looking north across site towards 187 Buckleys Road (Source: Site visit)

Figure 9: View west across the property at 821 Hanmer Road towards the application site (Source: Site visit)

14. I undertook a site visit on Thursday, 21st September 2023. My site visit included travelling across the property using the existing farm track that bisects the property. I also travelled around the perimeter of the site on the adjoining road network.

Activity Status

Operative Selwyn District Plan (2016), Rural Volume

15. This application was lodged on 10th August 2023, i.e. prior to the Proposed Selwyn District Plan decisions being notified on 19th August 2023. Appeals closed on 6th October 2023; however, the Council is still currently working through the appeals, and the consequential implications of those, in order to identify which rules of the Partially Operative District Plan can be treated as operative and which rules of the Operative Plan can be treated as inoperative. Therefore, a conservative approach has been adopted and the rules of both Plans are assessed.

16. The application site is zoned Outer Plains. The site is also subject to C59 – Wahi Taonga Site.

Land Use

17. The proposed land use activity does not meet the following rules:

RULE	TOPIC	COMPLIANCE	STATUS
1.7.1.1	Earthworks and Setbacks, Volume and Site Rehabilitation	An approximate earthworks volume of 7,020.5m^3 earthworks is proposed, and a maximum volume of 5,000m^3 per project is permitted.	Discretionary (no rule reference stated)
5.1.2	Utilities - activities	The proposed solar array will generate energy to be used off-site.	Discretionary (Rule 5.1.3)

18. Notably, the undergrounding or ducting of any utility is permitted subject to compliance with Rule 1- Earthworks, except where the provisions of Rule 1.6 (Earthworks and Protected Trees) apply. However, in this case, the maximum permitted earthworks volume will be exceeded.

19. The Rules in the Rural Volume of the Operative District Plan are applicable to activities generally, including utilities. However, the rules under Rule 3 Buildings, Rule 4 Roading and Rule 9.4 Scale of Non-Residential and Non-Rural Activities do not apply to utilities, except the following;

Buildings

- Rule 3.15.1 Relocated Buildings
- Rule 3.9.1.1 Access and Parking
- Rule 3.13.1.2 Line of sight – railway crossings

Roading

- Rules 4.5.1.2 – 4.5.1.5 Roads, Accessways and Vehicular Crossings.
- Rules 4.6 Parking
- Rule 4.1.1 Outstanding Landscapes

20. Under Rule 5.1.2.4, a utility is a permitted activity, provided that the utility is not used for the generation of energy, apart from the generation of energy for use on the same site, or to enable continued supply during emergencies, maintenance or repairs. (This rule does not apply to solar, wind or petroleum based powered generators used to generate energy for use only on the site on which they are located).

21. Therefore, the land use proposal is a Discretionary activity under the Operative Selwyn District Plan.

Partially Operative Selwyn District Plan (Decisions Version – notified 19 August 2023)

22. The application site is zoned General Rural (GRUZ). The site is also subject to the following overlays:

23. Plains Flood Management Overlay, Liquefaction Damage Unlikely Overlay, East Plains/Te Waihora ki Waimakariri Rural Density Overlay (SCA-RD2).

24. As above, the Council notified its decisions on the Proposed Selwyn District Plan, Variation 1 and Notices of Requirement on 19th August 2023, with all provisions having legal effect or being treated as operative from that date. Appeals then closed on 6th October 2023. As discussed above, the Council is still currently working through the appeals, and the consequential implications of those, in order to identify which rules of the Partially Operative District Plan can be treated as operative and which rules of the Operative Plan can be treated as inoperative. Therefore, a conservative approach has been adopted and the rules of both Plans are assessed.

Land Use

25. The proposed land use activity does not meet the following rule:

RULE	TOPIC	COMPLIANCE	STATUS
EI-R31	Other Renewable Electricity Generation and Renewable Electricity Generation Activities	The establishment of a new renewable electricity generation activity requires consent.	Discretionary

26. The rule framework relevant to this proposal is located within the Energy & Infrastructure Chapter.

27. The Kea Group, including KeaX and Kea Energy, are a “participant” (i.e. a generator) with regard to the Electricity Industry Act (2010), but not an “operator”. Consequently, the activity does not meet the definition of “important infrastructure” under the PODP.

28. As required by the National Planning Standards, unless relating specifically to a Special Purpose Zone, the ‘Energy, Infrastructure and Transport’ heading has been created to be self-contained for all energy, transport and infrastructure works and activities. In this Plan, energy and infrastructure matters are contained in a separate chapter to transport matters.

29. Regarding energy or important infrastructure activities, while most of the relevant provisions are contained within this chapter, all activities must be assessed against the Transport chapter. Additionally, the objectives, policies, and methods for managing reverse sensitivity effects relating to noise sensitive activities establishing in proximity to important infrastructure are managed under the Noise Chapter of this Plan. Except where there are direct cross-

references, in all other circumstances this chapter sets out all other provisions for energy or infrastructure activities.

30. Where a rule or rule requirement from another chapter has been cross-referenced within this chapter, the relevant associated objectives and policies also apply when assessing an application for resource consent. Where an activity is within an Overlay, the associated objectives and policies from the relevant chapter for that overlay also apply when assessing an application for resource consent.

31. Therefore, the land use proposal is a Discretionary activity under the Partially Operative Selwyn District Plan.

National Environmental Standards

National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES-CS)

32. The NES-CS manages activities which involve the disturbance of land which may be contaminated. This is determined by whether activities listed in the Hazardous Activities and Industries List (HAIL) have or are likely to have occurred on the site.

33. The applicant has provided an assessment which I accept, concluding that a HAIL activity (A1, Agrichemicals including commercial premises used by spray contractors for filling, storing or washing out tanks for agrichemical application) has and will continue to occur on the site. Clause 5 (8) of the NES-CS sets out the activities that trigger if the NES-CS regulations apply. I agree with the applicant that none of the activities described in Clause 5 (8) are included in the proposal.

34. On that basis, the proposal is not a change of use of the land, as the land will not stop being used as production land. Therefore, the NES-CS does not apply.

Overall Activity Status

35. This application was lodged on 10 August 2023, i.e. prior to the decisions being notified on 19 August 2023. As such, pursuant to s 88A, the application continues to be processed, considered and decided as an application for the type of activity that it was for, or was treated as being for, at the time the application was lodged.

36. In this case, the activity status under the Partially Operative District Plan is the same as the status under the Operative District Plan at time of lodgement. Therefore, this proposal will continue being considered as a Discretionary activity.

Written Approvals (Sections 95D(e) and 95E(3)(a))

37. The provision of written approvals is relevant to the notification assessment of the effects of a proposal under sections 95D and 95E(3)(a). Where written approval has been provided, the consent authority must not have regard to any effect on that person. In addition, that person is not to be considered an affected person for the purposes of limited notification.

38. Written approval has been provided from the following owners/occupiers:

Paul Ward, Jennifer Ward	105 Buckleys Road
Matthew Ward, Priscilla Ward	150 Buckleys Road
Pitcairn Farm Limited (including all directors)	115 & 150 Buckleys Road, 10 Stewart Road
Angela Ward	187 Buckleys Road
Pitcairn Trustees Ltd (Michael Lay)	187 Buckleys Road
Darren Osbourne, Danica Williams	115 Buckleys Road
Paisley Price Farm Limited (including all directors)	821 & 883 Hanmer Road
Shane Price, Kimberley Price	821 Hanmer Road
Keith Price, Marilyn Price	821 Hanmer Road

David Duncan, Raye Packer	883 Hanmer Road

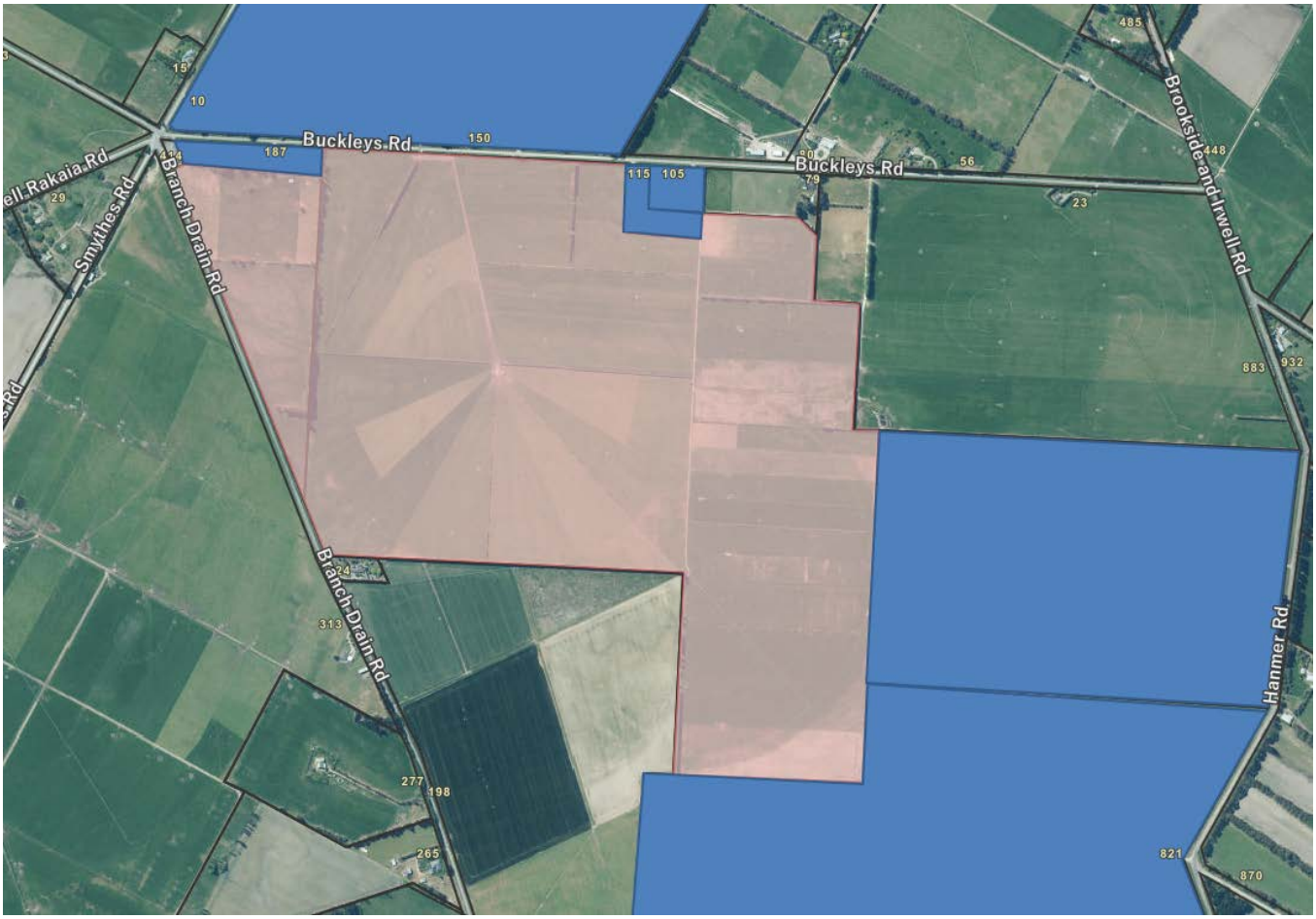


Figure 10: Aerial photo illustrating the location of properties that provided their written approval (blue) relative to the application site (red) (Source: Canterbury Maps)

Notification Assessment

Assessment of Adverse Environmental Effects (Sections 95A, 95B, 95D and 95E)

Permitted Baseline

39. Sections 95D(b) and 95E(2)(a) allow that a consent authority "may disregard an adverse effect" if a rule or a national environmental standard permits an activity with that effect, a concept known as 'the permitted baseline'. The application of the permitted baseline is discretionary, as denoted by the use of the word "may". It is understood that its intention is to identify and exclude those adverse effects that would be permitted by the Plan from consideration.

40. Case law has established that the permitted baseline test relates to the effects of non-fanciful or credible hypothetical activities which could be carried out as of right under the District Plan, as well as any existing lawfully established activity on the site or any activity for which resource consent has been granted.

41. In this case, I consider that the following would be permitted by both District Plans:

- Utility structures and buildings under both District Plans, provided they do not exceed 12m in height and meet all relevant rule requirements. Notably, under the PODP the definition of a structure includes ancillary structures and buildings.
- Construction noise provided the applicable noise limits are adhered to.
- Earthworks not exceeding 250m^3 per hectare of site area (GRUZ).
- Vehicle movements of 60 ecm/d per site (averaged over any one-week period)

42. The PODP permits plantation forestry (GRUZ-R24) and the establishment of structures (GRUZ-R2), including tunnel houses, shadehouses and greenhouses with no limitation on building coverage and with a maximum height of 12m. Both of these activities are referred to in the applicant's Landscape Effects Assessment (LEA), within the permitted baseline discussion.

43. In regard to structures, such as permitted utility structures, tunnel houses, shadehouses and greenhouses, I consider this is a fanciful activity at the scale of the solar array proposed. In my view, it would be fanciful for a rural property to have structures fully covering 104ha. Therefore, I do not agree that the landscape and visual effects of structures across the entirety of the site may be disregarded.

Rules

Operative Selwyn District Plan

44. To summarise, resource consent is required under the ODP (Rural Volume) in regard to exceeding the maximum permitted volume of earthworks, and the generation of electricity for use on a different site.

Partially Operative Selwyn District Plan

45. To summarise, resource consent is required under the PODP in respect of the establishment of a renewable electricity generating activity.

Comparison

46. The permitted volume of earthworks is proportional to the site area in the PODP, instead of a fixed threshold that exists in the ODP. Consequently, the earthworks activity does not trigger the need for resource consent under the PODP. This is the key difference between the provisions in each respective plan that are relevant to this assessment.

Assessment

47. The status of the activity is Discretionary. As such, the Council's discretion is unrestricted, and all adverse effects must be considered. The objectives, policies, reasons for rules and assessment matters in the Plans provide useful guidance when considering the adverse effects of the proposal.

48. The receiving environment for this proposal includes the existing environment and the future environment as it could be, i.e. as modified by non-fanciful permitted activities and unimplemented resource consents. As previously stated, the receiving environment is characterised by predominantly rural land uses, including dairy farming, cropping, and the rearing of livestock, while also including residential activities (on rural and rural-residential properties). Notably, the receiving environment is considered to include a potential future residential unit at 198 Branch Drain Road (Lot 2 DP 78273), at 23 Buckleys Road (RS 5723), and Stewarts Road (Lot 2 DP 78863 & Lot 3 DP 300831), on individual titles of sufficient land area to establish a residential unit.

49. I consider that 'adjacent' in s95D(a) generally refers to properties that are near to an activity, in addition to those that are directly adjoining. The wider environment is the remainder, including adjacent roads/public realm. The terms 'adjacent' or adjoining and 'non-adjacent' or wider environment are used in the following assessment.

50. The applicant has included an assessment of effects in Section 6.0 of the application. The assessment covers ecological effects, effects on visual amenity and landscape, cultural effects, construction effects, operational effects, battery storage and other environmental risks, and positive effects. I agree that these are relevant effects to the proposal. The applicant's assessment is supported by a range of technical assessments that were peer reviewed and are discussed in turn below.

51. I consider that the effects relevant to the proposal may be considered under the following headings:

- Rural character and amenity
- Glare and reflectivity
- Transportation
- Noise
- Highly productive land
- Reverse sensitivity
- Earthworks
- Cultural effects

- Ecological effects
- Hazard effects
- Servicing

Rural character and amenity effects

52. As set out in the application, the proposal will establish a solar array on a collective site of 111ha[3], although it is understood that the actual extent of the solar array will be limited to approximately 104ha. The applicant has provided an assessment of landscape effects from Boffa Miskell Ltd. This assessment has been peer reviewed on behalf of the Council by Ms. Bron Faulkner (NZILA Registered Landscape Architect), and this is appended as **Appendix 1**.

53. The application assessment of landscape effects is divided into two headings, being landscape effects and visual effects. Landscape effects are further divided by the applicant into what is described as physical landscape effects and rural character effects.

54. The assessment of landscape effects describes that the site is located within a highly modified rural landscape and is characterised by several forms of linearity including shelterbelts and paddocks. This assessment also recognises that the site possesses a distinctive rural character and states that the following amenity values are associated with the site:

    i. *Areas of open, green pasture which are separated into paddocks by linear shelterbelts and mature trees that criss-cross the landscape.*

    ii. *There is a general lack of structures and buildings, aside from the pivot irrigators and power lines.*

55. The assessment notes that the majority of the land south of the Selwyn River has been converted into irrigated dairy farming and has a 'spacious' appearance by views gained across the flat plains.

56. Consideration of the permitted baseline is included in Section 6.3 of the applicant's landscape assessment, where it is stated that land uses such as plantation forestry and greenhouses are permitted activities in the rural zone. The application assessment concludes that the removal of trees and shrubs will have a low (adverse) effect on the physical nature of the site, which would be mitigated by the growth of the mitigation planting proposed along the site boundaries.

57. In respect of rural character, the open pasture landscape will change from a dairy farm to a landscape containing energy infrastructure with open space reduced to areas between and around the rows of solar panels. The applicant notes that the ability for sheep to graze under panels would retain some sense of rural character. The applicant's assessment concludes that the 'on-site' effects on rural character would be low-moderate, while 'beyond the site' and with mitigation planting the rural character effects are expected to reduce over time to low.

58. The applicant's assessment of visual effects considers the effects prior to growth of the mitigation planting (at planting establishment – plants are 2m height) and with the landscaping mitigation established. The assessment included a range of static viewpoints from public and private locations, and transient views from nearby roads. Glint and glare were also assessed, although I will discuss those effects further below under a separate heading.

59. The application's visual effects assessment concludes that *the visual effects will range from low to low-moderate from public viewing locations, and neutral to low for private viewing locations following the construction of the solar farm. As the mitigation planting establishes within the 'gap' areas and grows to form a dense impermeable screen, the visual effects will reduce to very low from all public viewing locations and very low to neutral from all private viewing locations.*

60. To summarise Ms. Faulkner's views:

    - Ms. Faulkner agrees that the applicant's description of the existing landscape is complete and accurate.
    - In regard to a permitted baseline, Ms. Faulkner only considered the presence of structures in so far as their potential visibility from public areas, and not in relation to a scenario where they would cover the entire site.
    - Ms. Faulkner questioned why the physical changes to the site were restricted to earthworks and vegetation, excluding the solar array structures, which she also considers is a physical change.
    - Ms. Faulkner agrees that this assessment is a very thorough analysis for potential effects, which she verified on her site visit. She stated that "*The existing and proposed vegetation on the boundaries,*

[3] Being the sum area of the collective titles of the site.

combined with the distance of views (in some cases), and relatively low stature of the solar structures contribute to the low magnitude of visual effects beyond the site."

- Ms. Faulkner agrees with the analysis and conclusions of the visual effects assessment and in her summary, she concludes that the overall effects on the landscape character and rural amenity of the locality and rural zone would be low. It is her view that this would translate within RMA terminology as an effect of less than minor.

Rural Character and Amenity

61. In regard to rural character, Ms. Faulkner concluded that the magnitude of effects within the site have been somewhat understated by the landscape assessment. In her view, *the solar structures would dominate the site and bring a predominantly built character to it with consequent effects of at least moderate (adverse).* I agree with Ms. Faulkner that the changes to the landscape will be substantial and that the solar structures would be a dominating feature on the site. Ms. Faulkner agrees with the applicant's findings *that the effects on the rural character of the wider landscape beyond the site would be low.* I do not entirely agree with Ms Faulkner's conclusion, as follows.

62. The Resource Management Act 1991 (RMA) defines 'amenity values' as being *'those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes'.* The District Plan is the 'medium' or 'vehicle' that expresses the qualities and characteristics envisaged or anticipated for an area.

63. Section B3.4 of the ODP (Rural Volume) states that *the rural area has a character which is distinct from townships. There are common perceptions which many people share about the character of the rural area. These include:*

- *Predominance of vegetation cover.*
- *Dominant land uses (but not all land uses) are associated with primary production: agriculture, horticulture, forestry, pastoralism.*
- *Views of mountains, basins and river valleys which are not modified by structures.*
- *Being able to see, hear and smell animals and birds.*

Rural character can also mean different things to different people.

- *People who live in the rural area as an alternative to living in a town may value a sense of open space, panoramic views and their perception of a rural outlook.*
- *People carrying out farming and other business activities may share some of these values. They also perceive the rural area as a business area and expect to be able to carry out existing activities; adopt new technology and practices; and to diversify activities as markets change.*
- *Some people value the rural area as a place to locate activities that need lots of space. These people may value large areas of land and distance from neighbours.*

64. The General Rural Zone overview in the PODP describes *the primary purpose being to provide for primary production activities and other compatible activities. Generally, character and amenity within the General Rural Zone is characterised by a landscape dominated by openness and vegetation, and with significant visual separation between neighbouring residential buildings.*

Rural landscapes include rural production activities, including plantation forestry, mineral extraction, farming (including research farming and associated facilities) and associated structures and buildings as well as rural support services and rural industry. These activities may have associated levels of noise, dust and odour.

65. In this rural context, both District Plans describe the rural area as being characterised by a landscape dominated by openness and vegetation.

66. The application includes an LMP that is expected to eventually provide visual screening of the site and activities. It is my view that further consideration is required in relation to the expected qualities and characteristics of the rural landscape that people value. The site will change to a landscape with a predominantly built character due to the solar array, which was described by Ms. Faulkner as dominating the site.

67. I consider it is inappropriate to conclude that if the site will eventually be screened by landscaping in the long term and that construction activities are limited in duration, that the proposal will not affect the qualities and characteristics of an area that contribute to people's appreciation of the pleasantness and aesthetic coherence of that area (in alignment with the amenity values definition in the Act).

68. In consideration of the adjacent or adjoining environment, it is my view, that the moderate (more than minor) on-site rural character effect described by Ms. Faulkner will not be entirely confined to the subject site with the addition

of the landscaping, which will primarily mitigate a visual effect. Adjoining landowners/occupiers will perceive and be aware of the predominantly built character of the adjacent solar array, resulting from the temporary construction effects (noise & vehicle movements), and through views of the array structures and security fencing from their properties or as users of the local road network. Related adverse character effects on non-adjacent road users are considered to be no more than minor.

69. The perceivable change in land use does not align with the characterisation of a rural landscape dominated by openness and vegetation. I accept that the land beneath the solar panels can be occupied by vegetation of some form, although the solar activity use would dominate the site. The change in the qualities and characteristics of the site will, in my view, likely affect people's appreciation of the pleasantness and aesthetic coherence of that area and may change how they associate themselves with the locality. An effect of less than minor would be very low or insignificant, and some may also describe this effect as indiscernible.

70. Whilst the on-site character effect is described by Ms. Faulkner as moderate, I consider that a change in the physical characteristics and qualities of the scale proposed will have a discernible effect on rural character. It is my view that the effect on those properties adjoining the site would be at least low and aligned with an at least minor effect. I conclude that the adverse effects on adjoining properties will be at least minor.

71. In regard to the non-adjacent or wider environment, I recognise that there will be a significant change in character that might be considered adverse. On balance, I conclude that the adverse effects on character in the wider environment will be minor. This is primarily as the site will continue to be used for some form of land-based primary production, the non-adjacent environment is separated from the application site by intervening properties that will assist in maintaining a landscape that is dominated by openness and vegetation, while also providing separation from the substantial construction activities that would discern a change in land use, and the occasional or transitory non-adjacent persons in the road environment will be less sensitive to a perceptible change in character.

Visual Effects

72. In regard to visual effects, Ms Faulkner concluded that the range of visual effects would not exceed low-moderate. I accept the applicant and Ms. Faulkner's position that the visual effects would be no more than minor, for the mitigating reasons discussed and considered.

73. I recognise section 3 of the RMA, and the meaning of effect. In particular, the term 'effect' includes both any temporary and permanent effect. The applicant proposes extensive planting of evergreen exotic species around the gaps or vacant sections of the perimeter of the site that would occur prior to construction. The visual simulations in the assessment indicate the appearance of the site at construction, and at approximately 5 years growth. Ms. Faulkner confirms that the future tree growth scenarios depicted in the simulations appear accurate. Mitigation planting would be approximately 2.0m height at establishment.

74. Despite the LMP proposed, it will be evident from the public environment and adjoining properties that the rural qualities and characteristics of the site will change due to the visibility of security fencing and the partial views available to the solar array before the planting reaches maturity. Although the visual effects would be temporary, there is still a notable effect.

75. On balance, I conclude that the adverse visual effects on the adjoining environment and wider environment would be no more than minor. This is primarily as the site would have planting established prior to the construction and commencement of the activity, which would eventually from a visually impermeable barrier to screen the structures from both the public environment and adjacent properties.

Affected parties

76. As discussed, I recognise the written approvals from all owners/occupants of 105, 115, 150 and 187 Buckleys Road, and 821 and 883 Hanmer Road have been obtained and therefore, any adverse effects on these persons must be disregarded.

77. In regard to other properties, I consider that the owners/occupiers of the following properties would experience at least a minor rural character effect, and minor visual effects until the landscape planting reaches maturity:

i. Stewarts Road (Lot 2 DP 78863 & Lot 3 DP 300831)
ii. 23 Buckleys Road
iii. 79 Buckleys Road
iv. 56 & 80 Buckleys Road
v. 15 Stewarts Road
vi. 29 Irwell Rakaia Road
vii. 313 Branch Drain Road

viii. 324 Branch Drain Road

ix. 198 Branch Drain Road

78. A map of illustrating the location of each of these properties is included in **Figure 12** below.

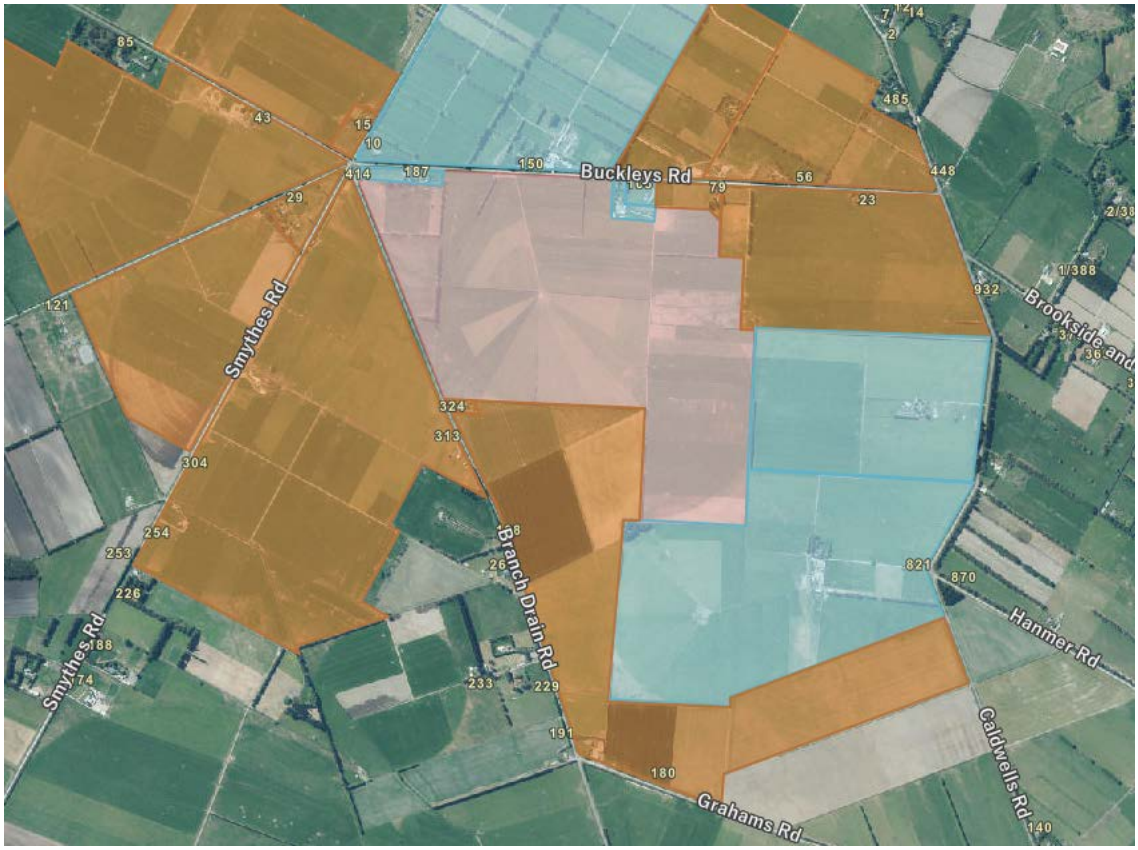


Figure 11: Aerial photo illustrating the location of adjacent properties considered to be affected (orange) relative to the application site (red) (Source: Canterbury Maps)

Glare and reflectivity effects

79. The applicant has provided an assessment of glare and reflectivity effects for the solar array. The analysis was undertaken using Forge Solar software and has analysed the potential glare for point locations at each individual residential unit in the surrounding area and for points along every 100m of nearby roads, as depicted in Figure 18 of Appendix 13 of the application. This glare and reflectivity assessment has been peer reviewed on behalf of the Council by Mr. Rudi Van der Velden (of Velden Aviation Consulting Ltd), and this is appended as **Appendix 2**.

80. Mr. Van der Velden describes that solar glare hazard is based on the potential to cause damage to any observer's eyes. Glare is split into the following categories that correspond to hazard potential:

- *"Green zone" glare is considered to have low potential to cause after-image (flash blindness) when observed prior to a typical blink response.*
- *"Yellow zone" glare is considered to have potential to cause after-image (flash blindness) when observed prior to a typical blink response time.*
- *"Red Zone" glare is considered to have high potential to cause permanent eye damage.*

81. Mr Van der Velden notes that it is normally unlikely that red zone glare is created from a solar array reflection, but that green and yellow zone glare can be potentially reflected. The applicant's assessment is based on green and yellow levels of potential glare. Whilst solar arrays can create green zone effects with low potential for after-image and have less chance of ocular damage over time, Mr Van der Velden views this as less of a concern for dynamic or moving receptors (including vehicles, aircraft, trains, etc.).

82. Mr. Van der Velden's review compares results against those obtained by the applicant for road users and dwellings as an initial reference. The review then also considers the mitigation planting proposed by the applicant.

83. In regard to the effects on dwellings, where the modelled glare is less than 10 hours per year and less than 10 minutes per day (per the applicant's criteria), Mr Van der Velden agrees with the applicant that no mitigation would be necessary. This position is based on the Australian New South Wales Government guidelines on Large Scale

Solar Energy Development. Only a single dwelling at 115 Buckleys Road would appear to exceed the threshold above (without considering existing vegetation), however the effects on these owners/occupiers must be disregarded as they have provided written approval. Mr Van der Velden concludes that the assessment of glare effects for dwellings is covered comprehensively and there is agreement with the applicant's assessment.

84. In regard to glare effects on road users, Mr. Van der Velden recognises in his review that the initial analysis did not consider eye level heights for operators of larger vehicles (including trucks, tractors and school buses) that are common users of rural roads such as those surrounding the subject site. He states that a 'typical' eye level height for a vehicle operator would be 2.5m, and that including this height for assessment would then cover the majority of road users and assumes a 'worst-case' scenario.

85. For road users, Mr. Van der Velden considered that yellow zone glare was required to be eliminated or reduced as far as practicable. Notably, the applicant has identified that glare was present in only one location aligned with a road, being the junction of Caldwells Road and Hanmer Road. This location also aligns with a gap in the proposed mitigation planting to accommodate a Wāhi Taonga management site. Consequently, the applicant has proposed that the panels in this section of the solar array do not include any back tracking to avoid the potential glare for this location.

86. Of the road routes around the subject site, the solar glare was predicted to affect a number of roads. Mr. Van der Velden recognises that when the vegetation and planned landscape planting reaches at least 3.5m height as an obstruction to potential glare, the potential yellow zone glare is essentially eliminated. However, there is a risk of potential flash blindness without vegetation reaching 3.5m height. Only two roads, Irwell Rakaia Road and Buckleys Road, are expected to have yellow zone glare lasting an hour or more per annum.

87. Further assessment was undertaken by the applicant for a larger vehicle with an operator eye level at 2.5m height and four roads in the vicinity of the site had potential for glare. Potential glare from Buckleys Road is not oriented in the direction of travel for road users and no mitigation was considered necessary. Potential glare from Brookside and Irwell Road will be screened by an intervening shelterbelt hedge that the applicant will maintain. Potential glare at Hanmer and Caldwells Roads will be mitigated by an area of extended backtracking to the south-eastern portion of the site until the planting establishes to a suitable height to prevent glare for a 2.5m eye level. Mr. Van der Velden agrees in his addendum this is acceptable.

88. In summary, Mr Van de Velden considers that the predicted yellow zone glare is minimal due to the proposed extended backtracking and presence of existing vegetation and will have a less than minor impact.

89. Therefore, I consider that glint and glare adverse effects on the adjoining and wider environment will be less than minor.

Transportation effects

90. Vehicles will access the site during construction and the on-going operation of the solar array using an existing access from Branch Drain Road. This is the only proposed point of access to the site. Branch Drain Road is a formed and sealed local classification road under the PODP with a posted speed limit of 100km/hr[4]. The applicant confirmed that the existing access will be upgraded prior to the commencement of construction on the site in accordance with Diagram E10.D (Operative District Plan – Rural Volume). This crossing standard exceeds the formation requirement (TRAN-DIAGRAM6) contained in the PODP and includes localised seal widening on the opposite side of the road, which will support efficient traffic flow.

91. As discussed, it is proposed to construct the array in its entirety and works will not be staged or deferred in any manner. Up to 100 staff will be on site during the peak of construction works, and the total duration of construction is expected to be 12 months. Construction phase total equivalent car movements per day (ecm/d) will not exceed 60 (averaged over the week). This is split between staff movements and deliveries to the site. Car parking and manoeuvring for all light and heavy vehicles will be accommodated within the site, and therefore no vehicles will be required to reverse onto Branch Drain Road. I recognise that this would also reduce potential amenity that could arise from vehicles parking within the road reserve during the construction phase.

92. Once the solar array is completed, the activity will likely generate approximately 4ecm per month when staff visit the site to inspect the array and undertake maintenance. The PODP permits up to 60 ecm/d per site (averaged over any one-week period) for any activity accessing a local classification road that is formed, sealed, and maintained by the Council. The PODP also permits a crossing to be used for an activity generating up to 40 vehicle movements per day, and the applicant's assessment indicates that they will not exceed 36 vehicle movements per day.

[4] Per National Speed Limit Register.

93. The surrounding road environment has relatively low volumes of traffic and road users have clear sightlines to the proposed vehicle crossing. Having considered the above matters, it is my view that the transportation safety related effects of the proposal on the adjoining or adjacent environment will be less than minor. I also conclude that the transportation safety adverse effects on the wider environment will be no more than minor.

94. In regard to transportation related amenity effects, an increase in vehicle movements has the potential to impact on surrounding rural amenity values, through increased noise and traffic concentration. I recognise that the PODP permits traffic noise generated within a land transport corridor, and that the scale of vehicle movements generated by the activity are permitted. Therefore, I consider that the transportation related amenity adverse effects on the adjacent environment and the wider environment will be less than minor.

Noise effects

95. The application includes an acoustic assessment of effects from Acoustic Engineering Services Limited (AES) that assesses both construction phase effects, and the on-going operational phase effects. The applicant has proposed to limit construction hours of operation to weekdays only (Monday – Friday), and between the hours of 7.30am to 6.00pm. The AES assessment concludes that noise and vibration from construction activities can comply with the PODP noise limits and guidelines, noting that the panels will be located so that there is a 50m setback between the piling rig and any dwellings.

96. The applicant's assessment was peer reviewed on behalf of the Council by Mr. Jon Farren, Marshall Day Acoustics Limited, and this is appended as **Appendix 3**. The review references the noise provisions of the PODP as appropriate. Mr. Farren considers that the applicant's daytime noise limit of 50dB L_{Aeq} at the notional boundary of the nearest residential unit is appropriate and is more stringent that the PODP permitted activity standards. The applicant has confirmed that there will be no activity on the site at night and the inverters and batteries (if established) will be switched off by their controller. Notwithstanding, Mr. Farren recommends that a night-time noise limit of 40 dB L_{Aeq} is adopted.

97. The applicant's assessment considered potential construction noise effects with reference to New Zealand Standard NZS 6803: 1999 Acoustics - Construction Noise (NZS 6803) and Mr. Farren considers this is appropriate. Notably, the NZS 6803 noise limits align with those construction noise limits contained in the PODP. The construction noise limits have been modelled using data supplied by the applicant and are agreed as appropriately conservative.

98. Mr. Farren identifies that piling and vegetation clearance will produce the greatest noise emissions. The piling would generate the highest level of 69dB L_{Aeq} at 324 Branch Drain Road, which is compliant with the construction noise limit of 70dB L_{Aeq}. Despite compliance with noise levels, the review states that it is appropriate to consider the potential adverse noise effects of the activity. Mr. Farren considers that piling noise has the largest potential to result in adverse effects at the nearest residential units. Driven (percussive) piles are proposed and several rigs would operate simultaneously across the site. The application states that piling will occur for approximately 6 months.

99. From the information supplied by the applicant, piling noise would be clearly audible for most of the piling period at dwellings adjacent to the site. In Mr. Farren's experience from other construction activities, he considers that the scale, duration, and noise emissions from the percussive piling proposed would potentially result in an adverse community reaction, warranting further consideration of mitigation. To address this, Mr. Farren recommends that construction noise should be managed in accordance with NZS 6803, which requires that the best practicable option is adopted to ensure noise from the site is minimised.

100. This would need to be demonstrated through the provision of a Construction Noise and Vibration Management Plan (CNVMP), which would include measures such as discussing and agreeing the scheduling of piling works with the adjoining owners/occupiers. At this stage, the application does not include a CNVMP, and there will be affected persons with respect to noise.

101. Potential vibration effects were discussed but are not evaluated in detail in the application. Mr. Farren agrees that the vibration effects during the operational phase are likely to comfortably comply with the PODP and considers that vibration effects can be effectively managed by the CNVMP and would largely be determined by the piling methodology.

102. In respect of operational noise (resulting from inverters & batteries), the highest predicted noise levels are 47 and 45dB L_{Aeq} at 324 and 313 Branch Drain Road, respectively. Although it is noted that the proposed activity may be clearly audible at times, the noise will comply with the PODP standards, and the review agrees with the application's assessment that the operational noise effects will be acceptable in the context of the receiving environment.

103. I accept Mr Farren's view and conclude that the noise related amenity effects on the properties at 313 and 324 Branch Drain Road would be minor.

104. I consider that noise and vibration related adverse effects on the wider or non-adjacent environment will be less than minor.

Highly productive land effects

105. The applicant has provided an assessment of effects on Highly Productive Land (HPL) based on a solar array of 104ha. The subject site is located on Land Use Capability (LUC) class 2 & 3 soils, with approximately 92% LUC 2 and 8% LUC 3. All land is defined as HPL if it is located on class 1, 2 or 3 soils. The assessment addresses solar arrays using either fixed/stationary panels and single axis tracker panels. Notably, this application proposes to use a system comprised of only single axis tracker (SAT) panels.

106. The assessment considers two forms of primary production, with the first being the grazing of small animals (e.g. sheep), and the second use being horticulture. In regard to pastoral grazing, the assessment references studies that investigated pasture growth under solar structures. Overall, the combined factors of reduced extreme temperatures (high & low), improved average temperatures and reduced evapotranspiration all contribute towards enhanced plant growth (in the studies referenced).

107. In regard to horticulture, the assessment refers to examples of vegetable crops that have been successfully grown in conjunction with solar overseas, with the panels attributed to creating a favourable environment for plants to grow under or around the panels. Overall, the applicant's assessment concludes that *the proposal allows for the land to support land based primary production in the long term both as enhanced pastoral production and in the potential for horticultural production.* It also concludes that the 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.

108. The applicant's assessment was peer reviewed on behalf of the Council by Mr. Jamie Gordon, MacFarlane Rural Business Limited (MRB), and this is appended as **Appendix 4**. Mr. Gordon considers that, with the proposed solar array configuration, sheep breeding or finishing is the most likely land-based primary production. The removal of silage/baleage during peak pasture growth may also be necessary and the applicant would need to accommodate this in their operations. In respect of pastoral grazing, Mr. Gordon summarises that *the data available is variable but it is possible that the pasture production on the proposed solar site will not be negatively impacted by the panels, based on the use of the SAT array system.* It is also agreed that some horticulture could also take place.

109. Productive capacity is defined in the NPS-HPL as:

…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

(c) the size and shape of existing and proposed land parcels

110. The NPS-HPL implementation guide states that the key measure of productive capacity depends on the 'potential' capacity of the land to support land-based primary production activities. In this context, there are no relevant legal constraints, and the proposal will not alter the size and shape of any existing parcels. In regard to physical characteristics, the proposal will require earthworks for trenching and piling, although I agree that these are minimal in the context of the site and scale proposed.

111. Based on the assessment supplied by the applicant and the Council's peer review, I accept that land-based primary production (i.e. grazing) can continue in the long-term, and that the potential loss of productive capacity is 'minimised'.

112. For the reasons discussed above, I consider that the adverse effect on highly productive land will be less than minor.

Reverse sensitivity effects

113. The potential for reverse sensitivity effects can exist when a new and sensitive activity establishes, and then complains about or objects to the effects generated by a lawfully established existing activity or a permitted activity. The PODP defines reverse sensitivity as:

"The potential for an approved (whether by consent or designation), lawfully established existing or permitted activity to be compromised, constrained, or curtailed by the more recent establishment, intensification, or alteration of another activity that may be sensitive to the actual, potential or perceived adverse environmental effects generated by the approved, lawfully established existing or permitted activity".

114. The General Rural Zone is described by the PODP as "areas predominantly used for primary production activities, including intensive indoor primary production". The zone may also be used for a range of activities that support primary production activities, including associated rural industry, and other activities that require a rural location".

115. Land-based primary production activities can produce effects such as noise, dust, traffic and odour effects, which may be perceived by a sensitive activity as potential nuisance effects, particularly where that new activity does not generate those same effects and may be more sensitive to those 'typical' primary production effects. In the context of this proposal, the proposed future use of the site will include land-based primary production (i.e. grazing or horticulture), which may decrease the potential risk of reverse sensitivity effects. In addition, the relocatable site office will not be permanently retained on the site for use as an office by staff, as visitors to the General Rural Zone.

116. The applicant's assessment states that the proposal will not generate reverse sensitivity effects on adjoining primary production activities, as the solar array will not be sensitive to noise or general farming activities, such as ploughing, harvesting and fertilising. In regard to dust from adjoining primary production, the applicant's assessment states that rain is sufficient to keep the panels clean and that the proposed planting would also provide some mitigation from dust generated on adjoining properties.

117. I have considered the potential for reverse sensitivity effects, and I conclude that the proposal will not generate reverse sensitivity effects on adjoining primary production activities. It is my view that reverse sensitivity adverse effects on both the adjoining and the wider environment will be less than minor.

Earthworks

118. The application proposes an approximate earthworks volume of 7,020.5m^3 (63.2m^3/ha) for trenching (up to 1.0m below existing ground level) to lay cables, which will be backfilled once the cables are in place. Notably, this volume is compliant with the PODP. The cables are required to connect the frames of the solar panels together and to the inverters, in addition to connecting the array to the adjacent substation. Piles will also be driven (percussive) up to 1.8m depth below existing ground level to support the frames/tables of the solar panels.

119. Earthworks will also include topsoil scraping & disturbance to prepare surfaces for the relocatable office, storage buildings, inverters, and the future battery site, in addition to spreading of material to form internal tracks where required. No stockpiling of material is proposed. I agree with the applicant that only a small area of earth (relative to the total site area) will be exposed during the required earthworks. Fencing will be installed around the Wāhi Taonga Management Site – C59 prior to construction. No earthworks are proposed within this area or within 10m of the drains that run adjacent to the site boundaries.

120. The applicant has volunteered that an Erosion and Sediment Control Plan (ESCP) will be implemented and will incorporate a Dust Management Plan (DMP). They state that this is a precautionary measure to ensure that dust and sediment effects are mitigated and to protect the drains adjoining the site. The general principles that will be adopted during earthworks and incorporated in the ESCP are:

- *Minimise the disturbance area due to earthwork activities as far as practicable, while satisfying all requirements for construction of the site.*
- *Progressively stabilise exposed areas following completion.*
- *Divert all clean water runoff away from exposed earthworks areas, thus reducing the contribution of the site to the catchment.*
- *Intercept sediment-laden runoff from exposed areas with sediment retention ponds to provide filtration and retention of sediment prior to discharging to the downstream environment.*
- *Implement measures to prevent construction traffic exiting the construction area onto public roads with sediment and other materials attached to the undercarriage and tyres.*
- *Ensure the exposed earthwork areas remain in a damp condition, utilising water trucks as necessary, until surfaces have been stabilised.*
- *Regularly inspect the erosion and sediment control measures and undertake any maintenance necessary to maximise the potential retention of sediment on the site.*
- *In the event of a heavy rain forecast, stabilise the site as far as practicable and cease works until weather becomes suitable to recommence works.*
- *If necessary, earthwork activities may be limited in specific areas during periods of high wind.*
- *Ongoing assessment of the erosion and sediment control measures and, if required, adjustments as the work progresses.*

- *Ensure site staff are aware of the requirements of the E&SCP and the relevant resource consent conditions prior to the works commencing.*
- *Ensure that after hours contact details are available.*

121. Based on the above matters, I conclude that potential adverse effects relating to earthworks will be managed through the proposed ESCP and DMP. I consider that the earthworks related adverse effects on both the adjoining and wider environment will be less than minor.

Cultural effects

122. The applicant states that they engaged Boffa Miskell Ltd.'s Cultural Advisor to assist with engaging with Te Taumutu Rūnanga and determine effects that the proposal may have on cultural values. The applicant states that they have also engaged with the Rūnanga directly and via Mahaanui Kurataio Ltd. As discussed, the Operative District Plan (Rural Volume) identified a Wāhi Taonga Management Site – C59 within the south-eastern portion of the site.

123. In regard to potential cultural effects, the applicant proposes to establish a 50m fenced buffer around the identified Wāhi Taonga Management Site, for the purposes of excluding both earthworks and the solar array. The applicant considers that this will ensure that the risks of adverse effects on the cultural site are minimised. The application also volunteered to adhere to an Accidental Discovery Protocol (ADP) across the entirety of the site, should any unexpected artefacts be encountered during the earthworks.

124. Mahaanui Kurataiao Ltd have reviewed this application and undertook an assessment of the proposal against the Mahaanui Iwi Management Plan (IMP). They then met with the Kaitiaki representatives who have been appointed by the Papatipu Rūnanga to assess the application and provide feedback based on Mātauranga Māori. A cultural advice report –appended as Appendix 5 - has been supplied to incorporate the views of the Rūnanga and guidance to avoid, remedy or mitigate any effects on cultural values. The Rūnanga state that if their recommended conditions of consent are provided for, they will not consider themselves to be an adversely affected party.

125. With regard to the cultural effects raised in the cultural advice report, and conditions recommended, I note that a range of these matters are addressed or addressed in part by the applicant. In regard to earthworks, the Rūnanga support the implementation of an ESCP, in particular to avoid effects on water within the drains along Branch Drain Road and Buckleys Road. I note that an ESCP is volunteered by the applicant, and that no earthworks are proposed within 10m of the drains along each respective road. The minimum panel setback from Buckleys Road will be 25m, and approximately 21m from Branch Drain Road.

126. In addition, the applicant has agreed to an ADP, and an exclusion area of agreed dimensions around the identified Wāhi Taonga Management Site. CRC223908 was obtained by the applicant from ECan for earthworks over an aquifer and includes a consent condition requiring an ESCP. The cultural advice report identified the need to avoid oil spills or other hazardous substances, which I consider will be addressed by condition 18 (spills) of CRC223908.

127. The advice report has identified a need to plant and maintain a riparian buffer of indigenous vegetation on-site to mitigate the impacts of earthworks and the on-going operations for the protection of the drains. The report indicates that the riparian strip would function as an erosion and sediment control for both construction and operational phases.

128. The advice report has requested that the proposed landscape mitigation planting comprised of fast-growing exotic species be replaced with indigenous eco-sourced plants overtime. The applicant has indicated that this would be a costly process and not very sustainable. As the Rūnanga have identified an adverse cultural effect in relation to the planting proposed and the recommended mitigation will not be adopted by the applicant, I consider that there may be at least a minor adverse effect.

129. The potential for the solar panels to cause contamination was identified in the report as a concern. CRC223909 was obtained by the applicant from ECan for discharge of operational phase stormwater to land within the boundary of the site. I consider that the potential effects of contamination and stormwater management are adequately addressed by this consent and the relevant conditions, which includes regular inspections and maintenance.

130. Overall, I consider Te Taumutu Rūnanga to be affected by the proposal in a way that is at least minor.

Ecological effects

131. The applicant has provided a desktop-based assessment of terrestrial ecological effects resulting from the proposed solar array. The assessment memorandum identifies that the site is located in the Low Plains Ecological District and that the original vegetation in this area is substantially depleted by fire and land clearance for agriculture and settlement. The assessment states that the solar array is located within an acutely threatened land environment, where only 10% or less of indigenous vegetation remains.

132. The assessment concludes that the site is not significant in terms of the CRPS, although the drains that surround the site that support Canterbury mudfish are significant in terms of the CRPS. The assessment considers there is no ecological effect from the proposal on indigenous vegetation on the site. In regard to the value of vegetation present and similar habitat types in the surrounding area, any change resulting from the panels is considered to have a very low level of ecological effect. In addition, the magnitude of ecological effect in regard to bird disturbance during the construction of the solar array is also expected to have a very low level of effect.

133. The assessment acknowledges the possibility of injury or death to birds from collision with solar panels and considers it would be likely that it would affect a small number of indigenous birds, if any. The ecological effect is assessed to be in the range of very low to low. Potential effects on freshwater invertebrates were also considered, and assessed as unlikely that any important populations of indigenous vertebrates are present on the site.

134. In regard to potential effects on the Canterbury Mudfish, which is identified to be potentially present in the existing drain adjoining the site along Buckleys Road, the assessment notes that the works will be within an existing farmed area and set back at least 10m from the site boundaries. On that basis, it was concluded that the proposal will not have any effects on the drains that support Canterbury Mudfish.

135. Ms. Denise Ford, Council's Senior Biodiversity Specialist, has reviewed the applicant's assessment on the behalf of the Council. Ms. Ford agrees with the recommendations for impact management from the applicant's assessment, in particular the setbacks from drains and the removal of shelterbelts and establishment of panels to be outside of breeding seasons for birds/or a pre-construction survey be undertaken. Ms. Ford considers that some form of monitoring of bird strike should be undertaken, as was suggested by the applicant's assessment, and is in agreement that locally sourced indigenous species may provide an improved habitat.

136. Based on the above assessment, I consider that the ecological related effects on both the adjoining and wider environment will be less than minor.

Hazard related effects

137. The subject site is located within the Plains Flood Management Overlay (PFMO), which identifies areas where flooding from a 200-year Average Recurrence Interval (ARI) flood event needs to be managed. Some discrete plots on the site are also identified by the flood model to be located within what is a defined 'high hazard' area, where in a 500-year average recurrence interval (ARI) flood event, either the water depth is greater than 1 m, or the water depth (in metres) x the water velocity (in metres per second) is equal to or greater than 1. The modelled 'high hazard' areas within the application site are shown in orange and red in **Figure 13** below.

138. The applicant's assessment has considered flood risks in relation to this overlay. I agree with the applicant that the proposed earthworks are not of a scale or manner that will exacerbate flooding effects on any adjoining properties, nor will the works affect existing overland flow paths, as no filling is proposed. In regard to potential effects on the solar array, the panels would range from 0.5m to 3.0m above existing ground levels, which will generally exceed common surface flooding depths. However, during the modelled flood events the panels can be stowed at 1.8m horizontally above the existing ground levels, which will provide suitable protection. The applicant also notes that the panels will be sealed to avoid damage from water.

Figure 12: 500-year ARI rainfall and river high hazard map (Source: Selwyn's flooding and coastal hazard Maps)

139. The inverters and batteries will be positioned on steel skids that are mounted on either piles or a concrete slab. The applicant states that this will achieve at least 1m above the existing ground level, providing suitable mitigation for the 200-year and 500-year rainfall ARI and the 500-year ARI Selwyn River flood depth. Therefore, I consider that the potential flood hazard effects will be acceptable.

140. In regard to geotechnical hazards, the applicant has supplied a geotechnical assessment from Tonkin & Taylor Ltd. The assessment concludes that the development of a solar array is feasible from a geotechnical perspective. Liquefaction related ground damage is not expected on the site. Subsidence is not expected to occur due to ground conditions, and hazards related due to slope instability are not present due to the flat topography of the site. Overall, the assessment considers that the development is unlikely to accelerate, worsen or result in geotechnical hazards. The geotechnical assessment was peer reviewed on the behalf of Council by Mr. Ian McCahon of Geotech Consulting Ltd. Mr. McCahon considers that the report is representative of the site conditions and agrees with the conclusions provided.

141. The applicant has considered fire risk and states that they have an active role in reducing fire risk, in particular for long grass that could interfere with the effectiveness of the panels. Under the Health and Safety at Work Act and Fire and Emergency Act, the applicant will need to provide a Health and Safety Management Plan and a Fire Emergency Plan. The applicant notes that the Fire Emergency Plan will need to be approved by the local fire service in accordance with the relevant legislation.

142. In respect of land contamination, I recognise that managing discharges, including contaminants, is the responsibility of ECan. As discussed, CRC223909 was obtained by the applicant from ECan for discharge of operational phase stormwater to land within the boundary of the site. Therefore, I have not considered this matter further.

143. Based on the above assessment, I consider that the hazard related effects on both the adjoining and wider environment will be less than minor.

Servicing effects

144. The application proposes to have independent services for construction phase activities. Potable water will be transported to the site as required, and stored within a 5,000L above ground tank positioned adjacent to the temporary relocatable site office. The site office and staff facilities will have an above ground wastewater storage

tank with a capacity of 2,700L that will be emptied as required. Stormwater runoff from buildings and structures will be discharged to ground, and as discussed, the applicant has obtained the necessary consent from ECan.

145. Based on the above assessment, I consider that the servicing related effects on both the adjoining and wider environment will be less than minor.

Positive Effects

146. Positive effects are not relevant to the consideration of notification.

Conclusion

147. The planning frameworks are similar in the context of this application, and I consider that the conclusions using each Plan as a guide are the same. Therefore, only one set of conclusions is considered necessary.

148. Whilst some affected persons have provided written approval, I consider that the adverse effects of the proposal will be at least minor on some persons that have not provided their written approval.

149. I consider that the effects on the wider environment would be no more than minor.

Public Notification (Section 95A)

150. Section 95A states that a consent authority must follow the steps in the order given to determine whether to publicly notify an application for resource consent.

Step 1: mandatory public notification in certain circumstances (sections 95A(2) and 95A(3))	Y	N
Has the applicant requested that the application be publicly notified?	☐	✓
Is public notification required under section 95C (no response or refusal to provide information or agree to the commissioning of a report under section 92)?	☐	✓
Has the application has been made jointly with an application to exchange recreation reserve land under section 15AA of the Reserves Act 1977?	☐	✓

*If the answer to any of the above criteria is yes, the application must be **publicly notified**, and no further Steps are necessary.*

*If the answer is no, continue to **Step 2**.*

Step 2: public notification precluded in certain circumstances (sections 95A(4) and 95A(5))	Y	N
Are all activities in the application subject to one or more rules or national environmental standards that preclude public notification?	☐	✓
Is the application for one or more of the following, but no other types of activities: • A controlled activity?	☐	✓
• A boundary activity only (as per the definition of "boundary activity" in s 87AAB of the Act)?	☐	✓

*If the answer to any of the above criteria is yes, continue to **Step 4**.*

*If the answer is no, continue to **Step 3**.*

Step 3: public notification required in certain circumstances (sections 95A(7) and 95A(8))	Y	N
Is the activity subject to a rule or national environmental standard that requires public notification?	☐	✓
Will the activity have, or is it likely to have, adverse effects on the environment that are more than minor?	☐	✓

*If the answer to any of the above criteria is yes, the application must be **publicly notified**, and no further Steps are necessary.*

*If the answer is no, continue to **Step 4**.*

Step 4: public notification in special circumstances (section 95A(9))	Y	N
Do special circumstances exist in relation to the application that warrant public notification?	☐	✓

*If the answer is yes, the application must be **publicly notified**.*

If the answer is no, do not publicly notify the application, but determine whether to give limited notification of the application.

151. I have specifically considered the existence of any special circumstances and I conclude that there is nothing extraordinary or unique about this application, and that the proposal has nothing out of the ordinary run of things

to suggest that public notification should occur due to special circumstances (despite the general notification provisions that apply).

152. In conclusion, in accordance with the provisions of section 95A, the application must not be publicly notified and a determination on limited notification must be made, as follows.

Limited Notification (Section 95B)

153. Section 95B states that a consent authority must follow the steps in the order given to determine whether to give limited notification of an application for resource consent, if it is not publicly notified under section 95A.

Step 1: certain affected groups and affected persons must be notified (sections 95B(1)-(4))	Y	N
Are there any affected protected customary rights groups, as defined in s 95F?	☐	✓
Are there any affected customary marine title groups, as defined in s 95G (in the case of an application for a resource consent for an accommodated activity (as defined in the Act))?	☐	✓
Is the proposed activity on or adjacent to, or may it affect, land that is the subject of a statutory acknowledgement made in accordance with an Act specified in Schedule 11; and is the person to whom that statutory acknowledgement is made an affected person under s 95E?	☐	✓

*If the answer is yes, **notify the application to each affected group/person** and continue to Step 2.*

*If the answer is no, continue to **Step 2**.*

Step 2: limited notification precluded in certain circumstances (sections 95B(5) and 95B(6))	Y	N
Are all activities in the application subject to one or more rules or national environmental standards that preclude public notification?	☐	✓
Is the application for a controlled activity only and not a subdivision of land?	☐	✓

*If the answer is yes, continue to **Step 4**.*

*If the answer is no, continue to **Step 3**.*

Step 3: certain other affected persons must be notified (sections 95B(7)-(9))	Y	N
In the case of a "boundary activity", is an owner of an allotment with an infringed boundary an affected person?	☐	✓
For any other activity, are there any affected persons in accordance with section 95E of the Act (as assessed in the Assessment of Adverse Environmental Effects above)?	✓	☐

*If the answer is yes, **notify the application to each affected person** and continue to **Step 4**.*

*If the answer is no, continue to **Step 4**.*

Step 4 – Limited notification in special circumstances	Y	N
Do any special circumstances exist in relation to the application that warrant notification to any other persons not already determined to be eligible for limited notification (excludes persons assessed under section 95E as not being affected)?	☐	✓

*If the answer is yes, **notify the application to those persons**.*

If the answer is no, do not notify anyone else.

154. As above, I have specifically considered the existence of any special circumstances and I conclude that there is nothing extraordinary or unique about this application, and that the proposal has nothing out of the ordinary run of things to suggest that limited notification should occur due to special circumstances (despite the general notification provisions that apply).

155. In conclusion, in accordance with the provisions of section 95B, the application must be limited notified.

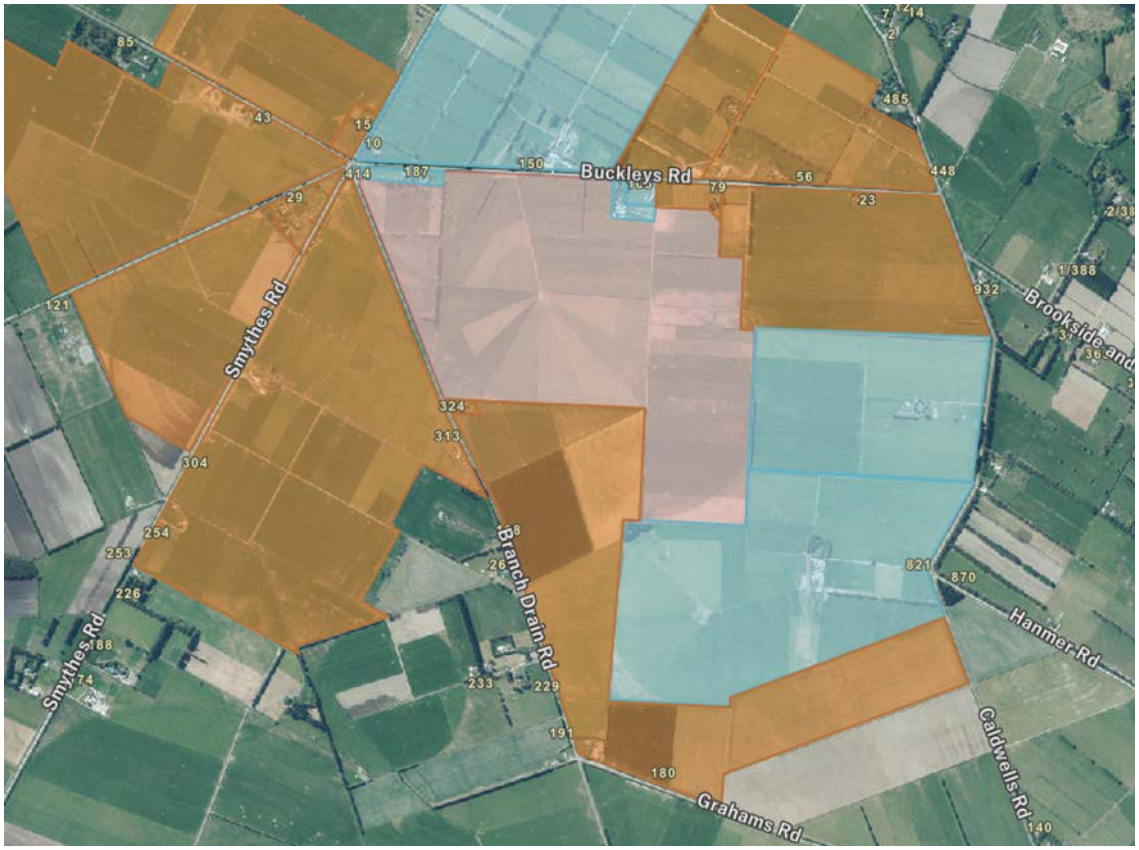
Notification Recommendation

156. I recommend that the application (RC235464) is processed on a **limited notified** basis in accordance with sections 95A-E of the Resource Management Act 1991, with the following being affected persons for the purposes of notification:

Te Taumutu Rūnanga; and

The owners and occupiers of:

- 23 Buckleys Road
- 79 Buckleys Road
- 80 Buckleys Road
- 15 Stewarts Road
- 29 Irwell Rakaia Road
- 313 Branch Drain Road
- 324 Branch Drain Road
- 198 Branch Drain Road



Reported and recommended by:	**Date: 31 October 2023**
Richard Bigsby, Senior Resource Management Planner	

Notification Decision

157. For the reasons set out in the report above, the Notification Recommendation is adopted under delegated authority.

158. I have read through the application documentation and associated correspondence. I have then reviewed the assessment in the above report prepared pursuant to s95 (A-E) of the Resource Management Act. I concur with the conclusions reached in the above s95 assessment by Mr Bigsby. Therefore, acting under delegated authority from the Selwyn District Council I have decided that the application be processed on a limited-notified basis to the parties identified above at [156].

159. I am acutely aware that the site is the subject of a previous application for a solar array, albeit materially different in terms of scale. That application was the subject of considerable scrutiny and a decision to decline the application predicated on a consideration relating to wider public notification.

160. There are two matters arising. Firstly, that this application is to be considered on its own merits and within the context of the consideration of effects undertaken by both the applicant and the Council Team. As above I concur with the conclusions reached and the recommendation from Mr Bigsby as to limited notification and the parties therein.

161. Secondly in terms of whether special circumstances apply which warrant the application being publicly notified. I reiterate the conclusion reached by Mr Bigsby above, that they do not. For the avoidance of doubt, I understand special circumstances are those that are circumstances outside the common run of things, which are exceptional, abnormal or unusual but less than extraordinary or unique. Solar farms of the scale proposed are relatively new to New Zealand but are becoming more widespread. Lastly, it is neither considered that the relative novelty of an activity or previous public scrutiny is sufficient reason, in and of itself, to justify public notification.

Commissioner Name	**Date: 7 November, 2023**
 Matt Bonis Commissioner	

Appendix 1 – Landscape Effects Assessment Peer Review

KeaX Limited

Solar Array Application

RC235464

PEER REVIEW – LANDSCAPE ASSESSMENT

Prepared for

Selwyn District Council

by

Bron Faulkner

31 August 2023

1.0 Introduction and Scope

KeaX Limited is seeking a resource consent to construct a solar array on a 111ha site at 150 Buckleys Road, Brookside. The Site lies within the Selwyn District Outer Plains Rural Zone where the proposal is a Discretionary activity.

I have been engaged by the Selwyn District Council (SDC) to undertake a Peer Review of the landscape assessment prepared for this proposal. I am familiar with the Leeston/Southbrook area and I visited the Application Site (the Site) on 23 August 2023.

In preparing this report I have reviewed the following:

- *Assessment of Landscape Effects* and *Graphic Supplement,* August 2023 (**Assessment**) prepared by Boffa Miskell Ltd. (Appendix 13 of the Application)
- *Assessment of Environmental Effects* (**AEE**) 9 August 2023 Prepared by Boffa Miskell.

2.0 Purpose of the Peer Review

The purpose of this review is to appraise both the method and findings of the Landscape Assessment prepared for the application by Boffa Miskell. This review follows the principles set out in NZILA Landscape Assessment Guidelines[1]. The matters for review are addressed under the following headings;

	Review Considerations - Does the landscape assessment;
Appropriate methodology & method	- contain a method statement and is the methodology consistent with the concepts and principles of the NZILA Assessment Guidelines[2]? -present plans, photographs, visual simulations etc in an accurate and fair way?
Existing landscape	-identify and describe the site and its landscape context including landscape attributes, character and values and any relevant consents or permitted baselines, if pertinent to the Application?
Proposal Description	- describe the proposal clearly enough to understand the potential landscape effects?
Statutory planning provisions	-identify and respond to the relevant provisions?
Landscape effects	- identify the potential effects on landscape values in the context of relevant statutory provisions? -explain (with reasons) both the nature and magnitude of assessed effects including both adverse and positive landscape effects?
Design response / Mitigation measures	-include design measures that would be effective to avoid potential adverse effects, or to remedy or mitigate such

[1] *Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines*, Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022.
[2] *Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines*, Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022

effects?

3.0 Appropriate Methodology and Methods

The assessment method statement is provided in Appendix 1 of the Assessment, where it is stated to be, *consistent with the methodology (high-level system of concepts, principles, and approaches) of 'Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines', Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022.* I confirm that the Assessment is consistent with these Guidelines and that the assessment method is appropriate to the nature and scale of this proposal.

The Graphic supplement contains plans, photographs of the site, and two visual simulations showing the proposed tree planting at two locations. I confirm that the graphics accurately represent the Site, in particular the details related to the existing vegetation on external boundaries, which are fundamental to the proposed mitigation measures. The future tree growth scenarios depicted in the simulations appear accurate to me.

4.0 Existing Landscape

Section 4 of the Assessment describes the Site, its broader landscape context and landscape values. I concur with the Assessment's descriptions of the working rural landscape and related rural amenity values being characterised by a patchwork of paddocks enclosed by shelterbelts with few structures excepting irrigators and fences. The description of the existing landscape is complete and accurate.

The visual catchment of the Site is also identified in Section 4, and gives consideration of both public and private locations from where the Site could be seen. 28 nearby dwellings and 15 viewpoints on public roads are identified and the potential visibility of the proposal on each of these is analysed in Appendix 2 of the Assessment.

Consideration of the permitted baseline is included in Section 6.3 of the Assessment where it is noted that land uses such as plantation forestry and horticultural hot houses are anticipated activities in the Rural Zone. I agree that consideration of these activities as a permitted baseline is relevant to this application.

5.0 Proposal Detail

Section 3 of the Assessment, through graphics and descriptions, clearly describes the construction and operation activities of the proposed solar array enabling any potential effects of the proposal to be easily understood.

6.0 Statutory Planning Provisions

The Assessment considers the suite of statutory documents identifying amenity values and quality of the environment as being most relevant to this Application, including the Operative District Plan, (ODP) Proposed District Plan (PDP). The General Rural Zone provisions in the Partially Operative District Plan (PODP) which are also relevant encompass the same pertinent matters as identified in

the higher order documents, the ODP and PDP; namely the maintenance and enhancement of rural character and rural amenity. Relevant PODP provisions below:

GRUZ-O1 Subdivision, use, and development in rural areas that:

1. supports, maintains, or enhances the function and form, character, and amenity value of rural areas;
2. prioritises primary production, over other activities to recognise its importance to the economy and wellbeing of the district;
3. allows primary production ~~to operate without being compromised by reverse sensitivity;~~ and those activities that directly support primary production and have a functional or operational need to locate with the General Rural Zone and important infrastructure, to operate without being compromised by incompatible sensitive activities and reverse sensitivity effects;
4. retains a contrast in character to urban areas.

GRUZ-P1 Maintain or enhance rural character and amenity values of rural areas by:

1. retaining a low overall building density, ~~and predominance of vegetation cover~~;
2. enabling primary production while managing adverse effects of intensive primary production, and mineral extractive industries;
3. managing the density and location of residential development; and
4. retaining a clear delineation and contrast between the district's rural areas and urban areas; and ~~including Christchurch City~~.
5. recognising that primary production activities can produce noise, dust, odour and traffic that may be noticeable to residents and visitors to the General Rural Zone

The Selwyn District Planning Maps identify a Wāhi Taonga Management Site – C59 located partly within the Site.

7.0 Landscape and Visual Effects Assessment

The Assessment of effects have been considered under two headings being; landscape effects and visual effects. The landscape effects assessment is discussed in terms of the physical effects on the Site and Rural Character effects on the Site and wider landscape.

7.1 Physical Landscape Effects

The assessment of the physical effects considers modifications to the landform and existing vegetation on the Site. I am not sure why the physical changes to Site are restricted to just earthworks and vegetation, excluding the addition of the solar panels, which I consider is also a physical change. However, the effects of the addition of the solar structures to the Site have been included when it comes to landscape character in the following section.

7.2 Rural Character Effects

The Assessment describes the changes to character of the Site as an infilling of the open pasture with the solar structures and a transition from a dairy farm to a landscape containing energy infrastructure with open space being reduced to the spaces between the rows of solar panels. It notes that the ability for sheep to graze under the panels retains some sense of rural character.

The Assessment concludes that *the effects on the rural character values and amenity of the Site would be Low Moderate(adverse).* But beyond the Site, and with the proposed mitigation in place *the adverse effects on the landscape are expected to reduce over time to Low (adverse).*

I consider that the magnitude of the effects on the rural character within the Site have been somewhat understated. In my view the solar structures will dominate the site and bring a predominantly built character to it with consequent effects of at least Moderate (adverse). Notwithstanding this I do concur with the Assessment's finding that the effects on the rural character of the wider landscape beyond the Site would be Low (adverse).

7.3 Visual effects

The assessment of visual effects considers the effects prior to mitigation and with mitigation in place. It includes static viewpoints from both public and private locations and transient views from nearby roads.

The visual effects assessment is supported by photographs from 15 public locations (Graphic Attachment Figures 8-15) including two simulations showing the proposed mitigation at years 0 and 5. A detailed commentary of the visibility and visual effects that could be experience from travelling along surrounding public roads the Site was also provided.

A glint and glare analysis was undertaken for roads in the vicinity of the Site. It found that potential glare will be screened by the proposed shelterbelt planting around the Site with the exception of the junction of Caldwells and Hanmer Roads where glare may occur. Mitigation measures to avoid this effect are proposed (a section of the solar farm panels will not backtrack).

Appendix 2 of the Assessment provides a comprehensive analysis of the visual effects and glare effects for 29 nearby dwellings and properties which potentially have views to the Site (noting that these private properties were not visited, rather desktop review of aerial photography and field work was used).

The Assessment concludes that, *the visual effects will range from **low to low-moderate (adverse**) from public viewing locations and **neutral to low (adverse)** for private viewing locations following construction of the solar farm. As the mitigation planting establishes within the 'gap' areas and grows to form a dense impermeable screen, the visual effects will reduce to **very low (adverse)** from all public viewing locations and **very low (adverse)** to **neutral** from all private viewing locations.*

Altogether this constitutes a very thorough analysis of the potential visual effects which I was able to verify on my site visit. The existing and proposed vegetation on the boundaries, combined with the distance of views (in some cases), and relatively low stature of the solar structures contribute to the low magnitude of visual effects beyond the Site. I concur with the analysis and findings of the Assessment.

7.4 Response to statutory provisions

The statutory provisions seek to maintain and enhance the rural character and rural amenity of the Rural Zone. GRUZ-P1 (1) seeks to retain the overall low overall building density that characterises the rural environment.

The proposal will reduce the rural character of the Site through the removal of internal shelterbelts and the addition of built structures on most of the Site. While sheep will continue to graze under the solar structures the character of the Site, in my opinion will change to a predominantly built character. The Assessment compares the effects of the solar array to permitted rural activity such as horticultural green houses which can introduce bulky and relatively tall structures (up to 12m). I agree that the low profile of the solar structures have less visual bulk than a large greenhouse and are therefore more easily able to be screened from view by vegetation.

As discussed above I consider that the existing and proposed vegetation can effectively contain the adverse effects of the landuse change within the Site. So, while the Site itself will be transformed from open paddocks to a predominantly built character this change and consequent effects on the rural character and amenity of the surrounding area will be retained.

7.5 Summary of Effects

The table below collates the findings of the Assessment.

	Post construction	Following mitigation
Physical landscape effects (Site)	Low (adverse)	n/a
Landscape Character & Amenity –(Site)	Low-Moderate (adverse)	n/a
Landscape Character & Amenity (Beyond Site)	-	Low (adverse)
Visual Effects- Public	Low to Low-Moderate (adverse)	Very Low (adverse)
Visual Effects- Private	Low (neutral- adverse)	Very Low (adverse to neutral)

Based on my review of the Assessment and own analysis I consider that overall the effects of the proposal on the landscape character and rural amenity of the local area and Rural Zone would be Low. If this magnitude of effects needs to be referenced in the RMA terminology of 'minor' [3] the effects would be less than minor.

8.0 Design Response / Mitigation Measures

The establishment of dense vegetation buffers capable of screening views into the Site is the fundamental objective of the proposed mitigation, which aims to effectively contain the visual and landscape effects within the Site. A 3.0m wide, 3.5m high, dense tree buffer is proposed for all of the Site's external boundaries with the exception of the entrance and the Wāhi Taonga Management Site (C59). The proposal clearly details the type and location of planting that would be used to fill

[3] Required for RMA s95A as one of the tests for deciding if an application is to be publicly notified and based on guidance in *Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines*, Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022.

existing gaps in the boundary vegetation as well as futureproofing existing boundary vegetation with a second row of new planting.

Development of a Landscape Management Plan (LMP) is proposed to ensure the successful establishment and ongoing maintenance of the tree buffers. I strongly support the proposal to implement planting prior to construction of the solar farm. I support the draft content of the LMP provided in Section 7 of the Assessment and recommend that additional detail needs to be included in relation to; the logistics and space for mechanical tree trimmers in proximity to the security and boundary fences and the existing vegetation; how the existing vegetation will be managed in the long term; How the 10m setback along Branch Drain Road (section A, Figure 6) will be maintained.

I agree with the approach to mitigation as proposed and consider the suggested tree species and proposed planting as detailed in Figures 3,4,5,19 and 20 of the Assessment are appropriate to the Site and its rural setting. I also confirm that if implemented as proposed the boundary tree planting would achieve sufficient visual screening to largely isolate adverse landscape effects within the Site.

The applicant, in consultation with Te Taumutu Rūnanga, has agreed to place a 50m exclusion buffer around the Wāhi Taonga Management Site (C59) on its eastern boundary. There will therefore not be any planting along this section of the boundary.

9.0 Summary and Conclusions

I confirm that the Assessment methodology, findings and overall conclusions are credible and are supported by appropriate level of detail and analysis. I concur with all of the findings of the Assessment with the exception of the effects on the rural character within the Site that I consider would be greater than the Assessment does. However, due to the effectiveness of the proposed boundary vegetation I agree that overall the effects of the proposal on the rural character and rural amenity of area and wider Rural Zone would be Low.

10.0 Recommendations

I have three minor recommendations in relation to the LMP as detailed in 8.0 above.

In addition to the LMP detail proposed in the Assessment the following should be added;

1. How access will be provided for maintenance of the boundary vegetation in proximity to the security and boundary fences and the existing vegetation including for mechanical tree trimmers;
2. How the existing vegetation will be managed in the long term;
3. How the 10m setback along Branch Drain Road (as shown in section A, Figure 6) will be maintained.

Bron Faulkner
NZILA Registered Landscape Architect
31 August 2023

Appendix 2 – Glint & Glare Peer Review

SELWYN DISTRICT COUNCIL

Review of Boffa Miskell Assessment of Glint and Glare at Buckleys Road Solar Farm

Prepared by: Rudi Van der Velden
Date: 21 September 2023
Velden Aviation Consulting Ltd

CONTENTS

1 INTRODUCTION

1.1 Overview

At request of Selwyn District Council, the following report is based on a review of a Glare and Glint Study carried out by Boffa Miskell on a revised proposal for implementation of a Solar Farm located at Brookside in the Selwyn District.

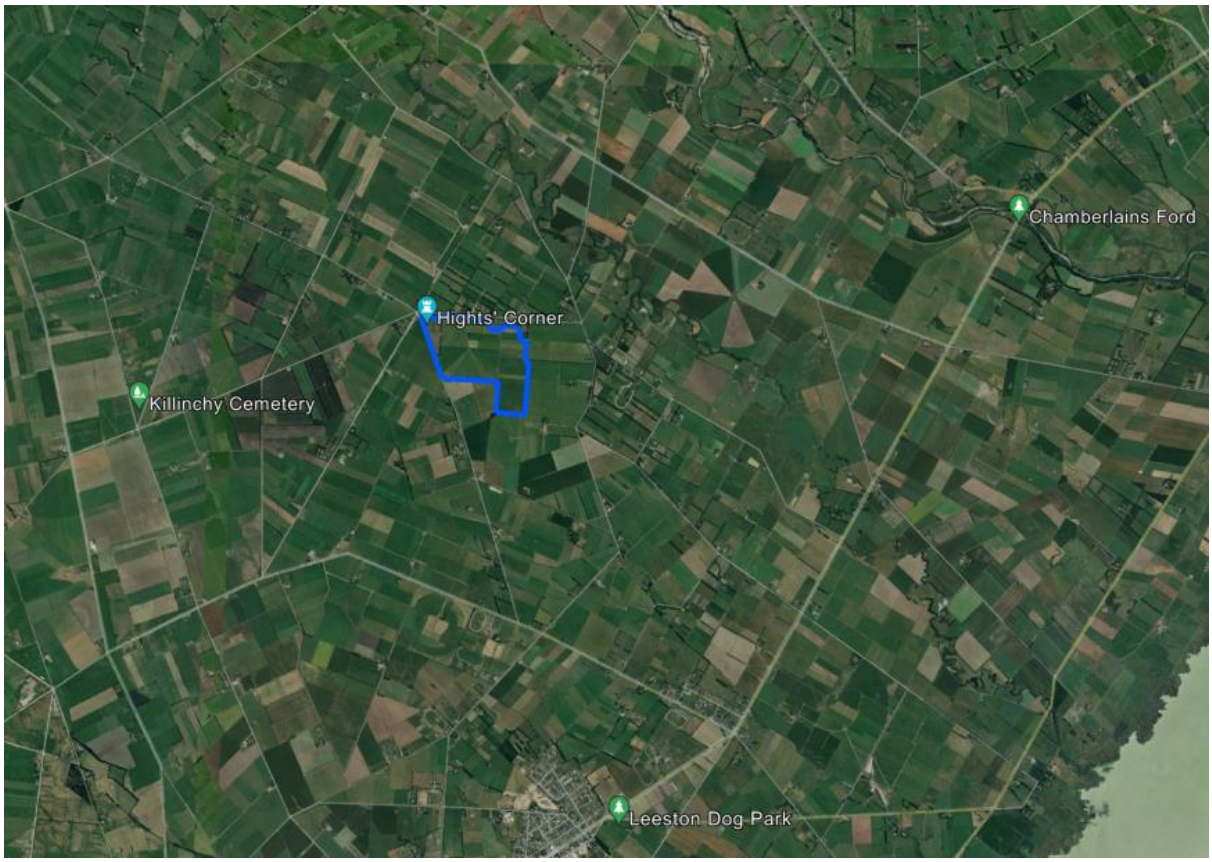


Figure 1. Brookside Solar Farm outlined in blue

1.2 Scope/Brief

Brief: To review report provided by Boffa Miskell on the Solar Farm at Brookside and assess the accuracy of findings in terms of impact of the potential glare and glint on surrounding dwellings as well as road users.

Scope :
i. To determine whether further information is required to complete the peer review
ii. Whether any additional mitigation measures should be used.
iii. Recommendations as to which parties are affected by the proposal.
iv. Recommended conditions of consent.

v. A written review of the proposal and the glare assessment, with specific comment on the suitability of the methodology used and the assumptions made and the reliability of the conclusion.

Figure 1.2 Site Boundary (Ref: Boffa Miskell Report Image 1)

1.3 Solar Panel Photovoltaic (PV) Array Information Considered

Technical Information on Solar Farm PV Array system

1. Single Axis Tracking System
2. PV panels 1.30m wide x 2.38m long
3. Rotation Axis Height 1.8m above ground level
4. Max height of panel 3m above ground level at max tilt angle of 60 degrees.
5. Reflectivity value < 4%.

System description below

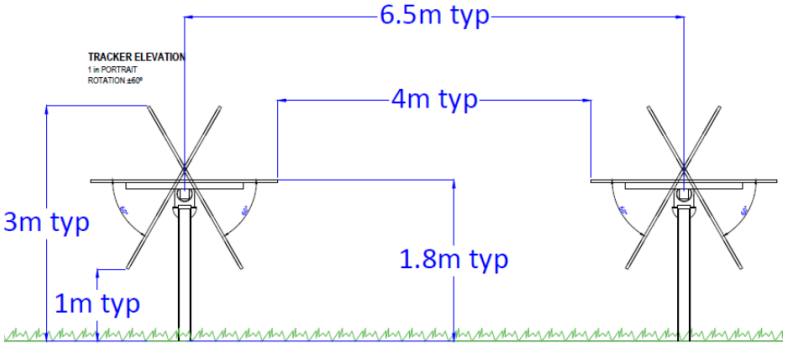


Figure 1.3 Keax Development PV Array set up (Ref. Boffa Miskell Report Image 3)

1.4 Methodology

This review considers the results of the Boffa Miskell Limited (BML) glint and glare analysis carried out on the proposed Solar Farm PV array considered for Brookside.

The review looks to verify the results obtained by BML based on the parameters of the Solar PV array being considered by Keax for the Brookside solar farm development.

It compares results based on use of the ForgeSolar, Solar Glare Hazard Analysis Tool and evaluation of potential glare on road users and dwellings.

For road users the BML assessment evaluation was based on 1.5m eye height for driver's receptors.

For residential dwellings, the BML assessment based on 1.8m receptor height for dwellings with single storey and 3.6m receptor eye height for dwellings with two storeys.

This review compares results against those obtained by BML for road users and dwellings as an initial reference.

It then considers any measures proposed by BML planned landscape plantings to mitigate any potential impact of glare from the solar farm on road users and dwellings in the immediate area of Brookside solar farm development.

Methodology around Mitigation Modelling

For Road Users

It is noted that the BML report does not include driver eye level hights for larger vehicles such as haulage vehicles and tractors etc which are a predominant feature of rural roads such as those surrounding the Solar Farm.

A typical driver eye level height for such vehicles is normally taken as 2.5m. The assessment should ideally have taken this height as the eye receptor level and based considerations on the results or simulation outcomes for this driver eye level.

This also provides a greater level of certainty that mitigation will cover all affected parties with regard to road users as it provides outcomes based on worst case scenarios.

For Residents of Dwellings

The Boffa Miskell Report considers 28 dwellings. (See below diagram).

The raw data provided by BML indicated that only the receptor eye level height of 1.8m above ground level was considered for the simulations carried out. A number of the

dwellings however are two storey for which the receptor eye level height is considered to be 3.6m as noted by Boffa Miskell.

This would represent a worst case value to be considered for dwellings.

Figure 1.4. Dwelling locations 1-28. (Ref BM report Viewpoint location Map Fig 2)

<u>Simulations carried out for this Report</u>

The simulations carried out for this report are based on the worst case eye level heights of 2.5m for driver eye levels and 3.6m for the 2 storey dwelling eye levels.

Simulations are based on a SAT with back tracking PV array system. Where 2m high mitigation shelterbelt plant species are considered, these will provide visual obstruction to the driver eye levels heights of 1.5m and dwelling levels of 1.8m that have been considered.

However, they will not provide visual obstruction of the PV arrays for the 2.5m receptor eye level for drivers of larger vehicles and 3.6m receptor eye level heights for residents of 2 storey dwellings.

Any landscape mitigation being planned therefore may also need to address these eye level heights where necessary as determined from the results for potential predicted glare for these eye receptor levels .

2. Executive Summary

This review evaluates the Boffa Miskell Glare Assessment Report in terms of conclusions reached with regard to potential glare impacts on neighbouring dwellings and roads in the vicinity of the proposed Buckleys Road Solar Farm development.

This independent review of the Boffa Miskell report is based on utilisation of the same software utility developed by ForgeSolar that is used to assess solar glare hazards.

KeaX Energy use of a Tracking Solar Array system has significantly reduced glare impacts compared to a Fixed Tilt Solar Array system and much larger area proposed for the Brookside Solar Farm development that had been submitted for consent previously.

The review agrees with the Boffa Miskell assessment for the predicted solar glare impact and that existing vegetation as well as proposed landscape should sufficiently mitigate any hazardous glare impacts to the neighbouring residents occupying single as well as two storey dwellings.

The Boffa Miskell assessment however, appeared to only address drivers of small vehicles where the assessed driver eye level height is taken to be 1.5m.
Given rural roads are likely to include large vehicles such as tractors, trucks, school buses and other large haulage vehicles, the reviewer considered it necessary to address these also as it presented worst case scenario in terms of driver eye level height and associated potential impact to road traffic safety.

For road users it was considered that 'yellow level' glare (or glare that had potential to cause flash-blindness) was required to be eliminated or reduced as far as practicable.

Although the review of the Boffa Miskell assessment determined that the duration of yellow glare for larger vehicle road traffic was in general greater than that for smaller vehicles, the difference was significant for only a couple of the roads and is detailed further in the results covered in this report.

As a result, it has been recommended that Boffa Miskell may wish to re-consider planned mitigation landscape planting heights to be increased from planned 3.5m to higher levels for some locations.

Overall, the reviewer believes that the Boffa Miskell solar glare assessment is comprehensive and well considered to enable solid justification on which to progress consent regarding potential solar glare from the proposed KeaX solar farm development and how it can be mitigated to largely eliminate impacts to less than minor levels.

3 BACKGROUND DATA

3.1 Array Proposed

The Buckleys Road Solar Farm PV array system being utilised is known as a Single Axis Tracking system. The data used by BML during their analysis was based on the following Tracking System parameters.

1. *Backtracking System*

Backtracking is used to provide various strategies that rotate the modules away from the sun to reduce shading. These strategies typically take effect when the sun's position lies outside the range of rotation defined by the **maximum tracking angle** of the PV panels, or when substantial shading occurs, depending on the strategy selected.

2. *Shade Backtracking*. Used when the PV panels are on flat ground
3. *Resting Angle*. The angle of rotation when the sun is outside of the tracking range. In the PV system considered this is 0 degrees.
4. *PV panel material.* Smooth glass without anti-reflective coating.

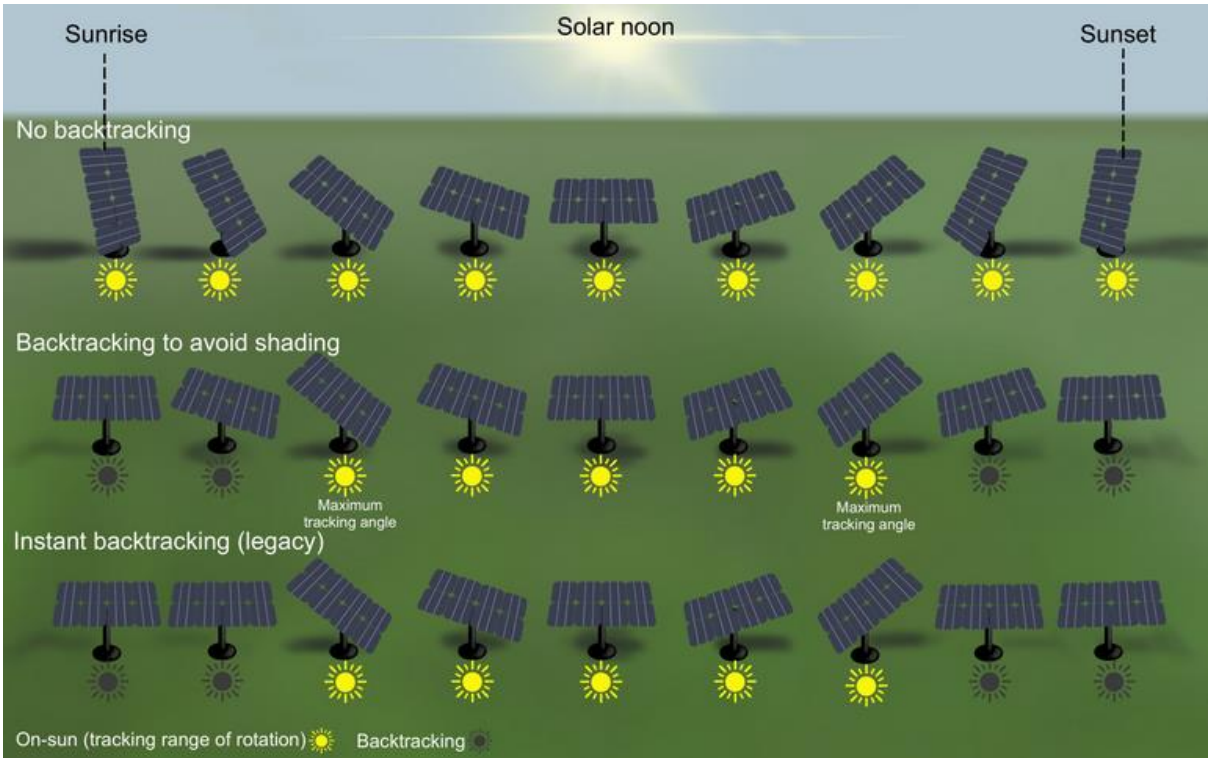


Figure 3.1 Backtracking strategies. (Reference ForgeSolar)

3.2 Solar Glare Impact Analysis

Solar Glare Impact

Although most PV solar panels have anti-glare coatings to minimise glare as much as possible there is always some residual glare present that has potential to create a hazard.

The Boffa Miskell Glare Assessment is based on analysis using the ForgeSolar solar glare hazard analysis software utility. This provides glare assessment associated with impact to the human eye in terms of levels of glare and its hazard potential.

General Consideration

Solar glare hazard analysis (SGHA) is based on potential to cause damage to any observer's eyes.

The chart in the figure below applies a colour code of green, yellow or red depending on the hazard potential and any PV arrays causing issues to designated observation points.

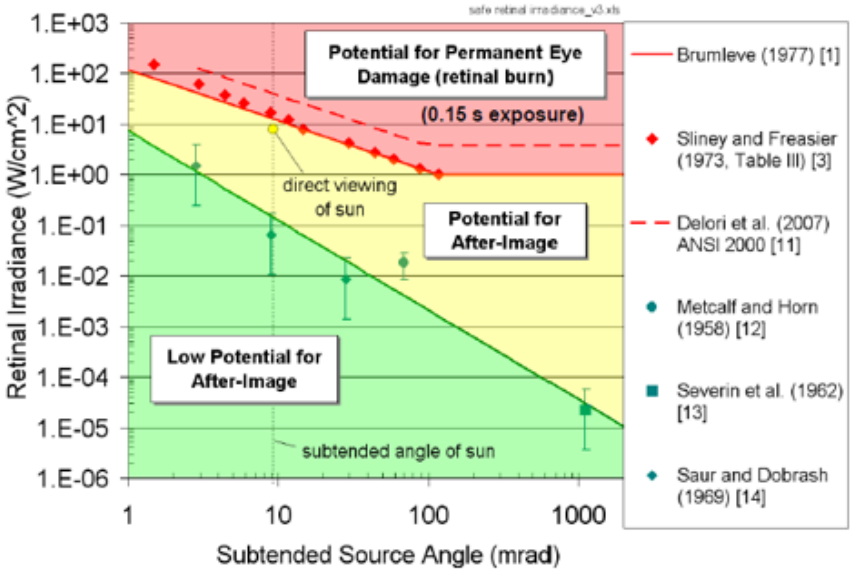


Figure 5.1: Potential ocular impact

"**Green zone**" glare is considered to have low potential to cause after –image (flash blindness) when observed prior to a typical blink response.

"**Yellow zone**" glare is considered to have potential to cause after image (flash blindness) when observed prior to a typical blink response time.

"**Red Zone**" glare is considered to have high potential to cause permanent eye damage.

It is normally unlikely that red glare is created from any PV reflection but green and yellow level solar glare can be potentially be reflected.

The Boffa Miskell report assessment is based on tghese two levels of ptential glare.

Although any PV arrays that create issues that fall in the green zone have low potential for after-image, and less chance of ocular damage over time, this is seen as less of a problem for dynamic or moving receptors such as vechicles, trains or aircraft.

Use of SGHA comes with the following assumptions applied;

1 Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.

2 Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints.

3 The subtended source angle (glare spot size) is constrained by the PV array footprint size.

4 Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.

5 Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.

6 The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.

7 Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

It should be added that solar glare is experienced every day, however static occupational observation points such as dwellings does not necessarily mean that solar glare impacts the predominant direction the observer is looking.

Most dwellings have blinds as well as tinted windows that limit glare. This should not be seen as a precursor for mitigating glare however.

These are considerations that can be taken into account when deciding overall impact of solar glare from proposed PV arrays.

4 SOLAR GLARE ANALYSIS RESULTS

4.1 Impact on Dwellings

The following table summarises results from the BML report with an added column summarising and comparing results obtained from this independent review.

Where the results are similar this is addressed as concurrence with the BML assessment. Where no dwelling level is provided this is assumed to be two storey which provides a worst case scenario. Where this has less than 10 hours per year and less than 10 minutes per day as per BML applied criteria then there is also agreement with the BML recommendation with regard to mitigation not being required.

Appendix C provides a summary of amount of glare that can be expected for each dwelling based both on BML assessment for single storey and reviewer (Velden Aviation Consulting Ltd -VACL) assessment for two storey dwellings. Overall, there is still very good agreement on glare impact between both sets of results as summarised in the table below. **Note:** For the results below no mitigation modelling has been applied. This is however considered in Section 5.

ID/ OP	Address/Viewing Audience	Description of potential glare effects (BML, 1.8m Receptor heights.) Based on 1.8m receptor level for single storey Dwelling only	VACL Review potential glare (Based on 1.8m and 3.6m Receptor heights for 1 or 2 storey dwellings.)
1	187 Buckleys Road	Modelling identifies no glare geometrically possible	Google Map image indicates single storey. No glare predicted.
2	150 Buckleys Road	Modelling identifies low potential for glare of a low duration (less than 10 min per day, totalling 1.6 hours per year). Effects are therefore considered to be low, no further mitigation is required.	Google Map indicates single Storey. Modelling concurs with BML. Duration less than 5 mins per day. Effect considered minimum so no further mitigation required.
3	115 Buckleys Road	Modelling identifies potential for glare of a low duration (less than 10 minutes per day, 3.3 hours per year). Effects are therefore considered to be low, no further mitigation is required.	Google Map indicates single storey. Total predicted Green and yellow glare 14.1 hours per annum. Duration less than 10 minutes per annum so unlikely to require mitigation.
4	105 Buckleys Road. Single Storey	The dwelling is surrounded by shelterbelts which screen the property from view. Modelling identifies potential for glare but of a low duration (less than 10 minutes per day, 0.4 hours per year), with low potential for glare also identified beneath this threshold. Effects are therefore considered to be low, no further mitigation is required.	Concur with BML
5	79 Buckleys Road Single Storey	The dwelling is surrounded by shelterbelts which screen the property from view. Modelling identifies potential for glare but of a low duration (less than 5 minutes per day, 0.4 hours per year), with low potential for glare also identified beneath this threshold. Effects are therefore considered to be low, no further mitigation is required.	Concur with BML

ID/ OP	Address/Viewing Audience	Description of potential glare effects (BML, 1.8m Receptor heights.) Based on 1.8m receptor level for single storey Dwelling only	VACL Review potential glare (Based on 1.8m and 3.6m Receptor heights for 1 or 2 storey dwellings.)
6	80 / 56 Buckleys Road Single Storey	The dwelling is surrounded by established planting which screens the property from view. Modelling identifies low potential for glare that is also short in duration (1.7hr per year). Effects are therefore considered to be low, no further mitigation is required.	Concur with BML
7	23 Buckleys Road Single Storey	Modelling identifies no glare geometrically possible	Concur with BML
7a	883 Caldwells Road	No dwelling on this property	N/A
8	932 Hanmer Road Single Storey	Modelling identifies no glare geometrically possible.	Concur with BML
9	381 Brookside and Irwell Road Single Storey	Modelling identifies no glare geometrically possible.	Concur with BML
10	375 Brookside and Irwell Road	Modelling identifies no glare geometrically possible.	Concur with BML
11	365 Brookside and Irwell Road	There is established vegetation between the dwelling and the site which screens the property from view. Modelling identifies low potential for glare that is also short in duration (0.6hr per year). Effects are therefore considered to be low, no further mitigation is required.	Concur with BML
12	870 Hanmer Road	This dwelling has no view of the proposed development. Modelling identifies potential for glare that is also of a low duration (less than 10 minutes per day, 2.5 hrs per year). Effects are therefore considered to be low, no further mitigation is required	Modelling dwelling as 2 storey given level not provided. Glare up to 7.5 hours per year. Duration slightly less than 10 mins per day. Effects considered still to be low so no mitigation required. Concur with BML.
13	851 Caldwells Road	No view is identified from the dwelling, with partial views from the wider property. Modelling identifies potential for glare that is also of a low duration (less than 10 minutes per day, 3.1 hrs per year). Effects are therefore considered to be low, no further mitigation is required	Dwelling level not provided so 2 storey assumed. Glare up to 7.5 hours per year. Duration slightly less than 10 mins per day. Effects considered low so no mitigation required. Concur with BML
14	821 Caldwells Road (2 land parcels)	Written approval provided	N/A
15	180 Grahams Road	Modelling identifies no glare geometrically possible.	Concur with BML
15a	198 Branch Drain Road	No dwelling on this property	N/A
16	191 Branch Drain Road	Modelling identifies no glare geometrically possible	Concur with BML
17	229 Branch Drain Road Single storey	No view is identified from the dwelling, due to surrounding screening. Modelling identifies only low potential for glare, of a short duration (0.9 hours per year). No further mitigation is required	Concur with BML

ID/ OP	Address/Viewing Audience	Description of potential glare effects (BML, 1.8m Receptor heights.) Based on 1.8m receptor level for single storey Dwelling only	VACL Review potential glare (Based on 1.8m and 3.6m Receptor heights for 1 or 2 storey dwellings.)
18	233 Branch Drain Road (Lot 1 DP 446980) Single Storey	Modelling identifies no glare geometrically possible.	Concur with BML
19	265 Branch Drain Road Single storey	Modelling identifies no glare geometrically possible.	Concur with BML
20	277 Branch Drain Road Two storeys	Modelling identifies no glare geometrically possible	Modelling identifies glare is geometrically possible for 2 storeys dwelling with eye level at 3.6m but is less than 10 hours per year (up to 6.9 hours per year glare). Duration less than 10 mins per day. Low impact therefore and no mitigation necessary.
21	313 Branch Drain Road Single storey	This dwelling obtains only a glimpsed view of the proposed development during the winter months. Mitigation proposed will screen views form this dwelling. Modelling identifies only low potential for glare, of a short duration (less than 5 minutes per day, 1.5 hours per year). No further mitigation is required.	Concur with BML for single storey at this site. Total hours per year >10 and max duration per day >10 mins if a 2 storey residence is considered at this dwelling in future.
22	324 Branch Drain Road Single Storey	Modelling identifies no glare geometrically possible	Concur with BML for single storey at this site. Total hours per year >10 and max duration per day >10 mins if a 2 storey residence is considered at this dwelling in future.
23	121 Irwell Rakaia Road	Modelling identifies no glare geometrically possible	2 Storey dwelling assumed. Results concur with BML
24	29 Irwell Rakaia Road	Modelling identifies no glare geometrically possible	At most 0.4 hours per year predicted for 2 storeys dwelling and less than 3mins per day. No further mitigation required. Concur with BML
25	43 Dunsandal and Brookside Road	Modelling identifies no glare geometrically possible	2 Storey dwelling assumed. Results concur with BML
26	15 Stewarts Road	Modelling identifies no glare geometrically possible	2 storey dwelling assumed. Results concur with BML
27	10 Stewarts Road	Modelling identifies no glare geometrically possible	1.3 hours total per year based on 2 storeys assumed. Duration Less than 5 mins per day. No further mitigation required. Concur with BML
28	414 Branch Drain Road	Modelling identifies no glare geometrically possible.	Two storey dwelling assumed. Results concur with BML
29	Lot 1 DP 77659 & Lot 2 DP 77659	No dwelling on this property	N/A

Dwelling Review General Comments

Apart from 115 Buckleys Road which appears to have a predicted annual glare of slightly more than 10 hours per annum, the review of BML glare assessments for dwellings largely agrees with the results where in most cases the glare is expected to be less than 10 hours per year and with any daily maximum duration to be less than 10 minutes.

As such given the overall glare based on the Australian New South Wales Government solar farm guidelines, which are the more conservative of the international standards referenced by BML, mitigation against predicted potential solar glare is essentially not required for dwellings. In nearly all cases the predicted solar glare from the proposed solar farm PV array system is mostly less than 10 hours per year and less than 10 mins duration in any day.

The assessment does not consider any existing vegetation or planned landscaping to provide some screening and as such this should further reduce an already low impact of solar glare.

4.2 Impact on Road Traffic

The following table provides predicted glare hours based on BML assessment for 1.5m driver eye level. (Ref Road Route Locations in **Appendix D**)

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
BrooksideandIrwellRoad	410	6.8	290	4.8
BuckleysRoad	161	2.7	252	4.2
CaldwellsRoad	146	2.4	807	13.4
HanmerRoad	383	6.4	664	11.1
SmythesRoad	23	0.4	0	0.0
BranchDrainRoad	0	0.0	0	0.0
DunsandelandBrooksideRoad	0	0.0	0	0.0
GrahamsRoad	0	0.0	0	0.0
IrwellRakaiaRoad	0	0.0	0	0.0
StewartsRoad	0	0.0	0	0.0

Table 4.2.1 Predicted glare levels based on 1.5m Driver eye level.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
BranchDrainRoad	80	1.3	269	4.5
BrooksideandIrwellRoad	438	7.3	277	4.6
BuckleysRoad	352	5.9	925	15.4
CaldwellsRoad	128	2.1	850	14.2
HanmerRoad	372	6.2	721	12.0
IrwellRakaiaRoad	35	0.6	107	1.8
SmythesRoad	10	0.2	8	0.1
DunsandelandBrooksideRoad	0	0.0	0	0.0
GrahamsRoad	0	0.0	0	0.0
StewartsRoad	0	0.0	0	0.0

Table 4.2.2 Predicted glare levels based on large vehicle driver eye level heights of 2.5m

Table 4.2.2 above indicates that some increase in duration of glare can be expected for the drivers of larger vehicles for which driver eye level is taken as 2.5m.

Direct comparison from the above tables total hours for yellow glare between small vehicle driver eye level at 1.5m and large vehicle driver eye level at 2.5m are provided below in Table 4.2.3 .

Road ID	BML Total hours p.a. yellow glare per year based on 1.5m driver eye level	VACL total hours p.a. yellow glare based on 2.5m driver eye level	Remarks
Branch Drain Road	0	4.8	Mitigation recommended
Brookside and Irwell Road	4.8	4.6	Mitigation recommended
Buckleys Road	4.2	15.4	Mitigation recommended
Caldwells Road	13.4	14.2	Mitigation recommended
Dunsandel and Brookside Rd	0	0	Mitigation not Required
Grahams Rd	0	0	Mitigation not Required
Hanmer Rd	11.1	12	Mitigation recommended
Irwell Rakaia Rd	0	2.4	Mitigation recommended
Smythes Rd	0	0.1	Mitigation not Required
Stewart Rd	0	0	Mitigation not Required

Table 4.2.3 Comparison of yellow glare hours per year for 1.5m and 2.5m driver eye levels

From Table 4.2.3 the assessment based on predicted glare for yellow levels are not expected to require any mitigation given the low or that there is no glare expected for the following roads: Dunsandel and Brookside Road, Grahams Road, Smythes Road and Stewart Road.

Branch Drain Road, Buckleys Road and Irwell Rakaia Road are highlighted in yellow however as they indicate significant difference between the BML assessed level and that obtained in this review.

The following table further considers the above results from the BML analysis for the 1.5m driver eye level and is compared against results obtained from this review with regard to a 2.5m driver eye level. The comparison takes into account the worst case scenario for larger vehicles such as tractors, haulage trucks, school buses etc. that also share the roads in question.

Assessment for the larger vehicles and hence higher driver eye level are addressed given the safety implications associated with potential glare for road traffic.

Figure 18 that is referred to in the BML analysis column is provided in **Appendix F**.

Road Name	BML Analysis Results based on 1.5m Driver Eye level.	BML Recommendations	VACL Analysis Results based on 2.5m Driver Eye level.	VACL Recommendations
Branch Drain Road	Modelling identifies no glare geometrically possible	No further mitigation required	Modelling predicts potential glare is along Branch Drain road for a total of 5.8 hours per year although for duration of less than 5 minutes per day between 5 and 6 am from mid-October to most of March.	Consider mitigation at points along road where glare is predicted. (See Section 5 on Mitigation)
Brookside and Irwell Road	Modelling identifies a small stretch of the road has the potential for glare approaching the bend in the road, as illustrated on **Figure 18**. Glare has the potential to occur between the months of Feb-May and August to November, between the hours of 5-8pm. Duration of the glare period during these times is predicted at less than 10 minutes per day	Potential glare available in the direction of travel towards the site would be screened by proposed planting along eastern site boundary.	A similar level of glare is predicted for driver eye level at 2.5m as for the smaller vehicle with driver eye level at 1.5m for approximately 12 hours per year.	Concur with BML
Buckleys Road	Modelling identifies a small stretch of the road potential for glare as illustrated on **Figure 18**. Glare has the potential to occur between the months of October to April between the hours of 5-6am in the morning	Potential Glare in the location of VPs 1 & 2 would be oblique to the direction of travel along the road corridor. Mitigation is not required, however,	A significant amount of glare would be experienced by drivers of larger vehicles at 15.4 hours per year compared to standard car at 4.2 hours per year . with durations of up to 10 mins	Consider mitigation at points along road where glare is predicted. (See Section 5 on Mitigation)

	and 5-8pm in the evening. Duration of the glare period during these times is predicted at less than 5 minutes per day. **Note :** Reference to **Figure 18** is provided in **Appendix F**	proposed planting along the site boundary would screen any potential glare from view.	per day for large vehicles and under 5 minutes per day for smaller vehicles. Mitigation is recommended contrary to BML conclusion.	
Caldwells Road	Modelling identifies a small stretch of the road has the potential for glare approaching the bend in the road, as illustrated on Figure 18. Glare has the potential to occur between the months of Potential glare identified at the junction of Caldwells and Hanmer Road in the location of VP6 would be mostly screened by proposed Boffa Miskell Ltd | Buckleys Road Solar Farm | Landscape Effects Assessment | 9 August 2023 21 April to September, between the hours of 4-6pm. Duration of the glare period during these times is predicted at 10 minutes per day or less	Potential glare identified at the junction of Caldwells and Hanmer Road in the location of VP6 would be mostly screened by proposed planting along eastern site boundary For the area where a gap in planting is proposed around the Wahi Taonga site, it is proposed to have no panel backtracking in this location, to avoid the effects of glare in alignment with the road corridor	Concur with BML in terms of type of PV system without backtracking or otherwise provide mitigation screening.	Concur with BML
Dunsandel and Brookside Road	Modelling identifies no glare geometrically possible	No further mitigation required.	Concur with BML	Concur with BML
Grahams Road	Modelling identifies no glare geometrically possible.	No further mitigation required.	Concur with BML	Concur with BML
Hanmer Road	Modelling identifies that a small stretch of the road has the potential for glare as illustrated on Figure 18. Glare has the potential to occur between the months of April to October between the hours of 4- 6pm. Duration of the glare period during these times is predicted at 10 minutes per day or less.	Potential glare identified at the junction of Caldwells and Hanmer Road in the location of VP6 would be mostly screened by proposed planting along eastern site boundary. For the area where a gap in planting is proposed around the Wahi Taonga site, it is proposed to have no panel backtracking in this location, to avoid the effects of glare in alignment with the road corridor.	The amount of predicted glare per year as well as durations are essentially the same for small as well as large vehicles for this road.	Concur with the approach taken by BML to mitigate impacts of this glare.
Irwell Rakaia Road	Modelling identifies no glare geometrically possible	No further mitigation required.	Modelling predicts some glare of up to 2.4 hours is possible, so mitigation is recommended particularly as it is prevalent near the main intersection.	Recommend some mitigation to remove glare at points along Solar farm boundary adjacent to road where glare is prevalent.

Smythes Road	Modelling identifies low potential for glare from a limited location only.	No further mitigation required.	Minimal amount of glare predicted at up to 0.4 hours per year for both small and large vehicles. Duration less than 2-3 mins per day between 8am and 9 am from mid -Maty to mid-July.	Although minimal glare, review of existing vegetation or other screening to reduce this further may need to be considered.
Stewarts Road	Modelling identifies no glare geometrically possible	No further mitigation required.	Modelling indicates no glare predicted. Concur with BML.	Concur with BML.

Table 4.2.4 Glare Impact on Road Users BML and VACL Comparison

Based on the results associated with predicted solar glare for road users, mitigation will need to be considered as per the recommendations in Table 4.2.4 above.

Mitigation modelling based on landscape planting as proposed by BML is considered in Sections 5 and 5.3 more specifically.

5. MITIGATION CONSIDERATIONS

5.1 Glare Mitigation Requirements for Dwellings

The Australian New South Wales Government Guidelines on Large Scale Solar Energy Development as referenced by the BML report has the following for dwellings in relation to glare impacts. (Section 5.6 Glint and Glare, Page 32).

As indicated any glare of over 10 hours ideally per year and more than 10 minutes per day should have mitigation measures to reduce impacts.

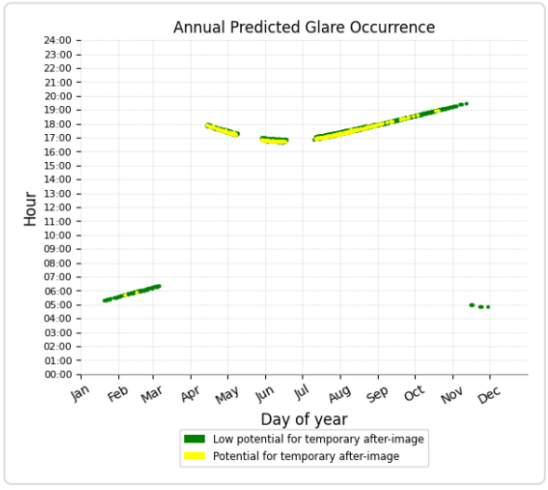
The results from the BML report indicate that for the single storey dwellings where receptor eye heights of 1.8m is considered, there are no significant impacts predicted due to solar glare reflected from the prosed solar farm development.

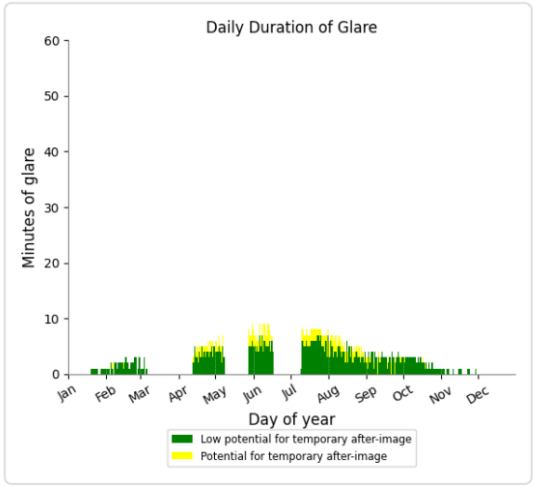
Table 2: Impact rating and performance objectives for glare impacts to residential dwellings

High glare impact	Moderate glare impact	Low glare impact
> 30 minutes per day > 30 hours per year	< 30 minutes & > 10 minutes per day < 30 hours & > 10 hours per year	< 10 minutes per day < 10 hours per year
Significant amount of glare that should be avoided.	Implement mitigation measures to reduce impacts as far as practicable.	No mitigation required.

Table 5.1 Australia NSW Government Guidelines for glare impacts on Dwellings

For dwellings, only 115 Buckleys Road appears to indicate total glare per annum greater than 10 hours. This is with no mitigation such as existing vegetation or planned landscape planting considered. This is illustrated in the plots below showing annual predicted glare occurrence and daily duration of glare.





Once existing vegetation surrounding 115 Buckleys Road is taken into account as well as any planned landscaping, further assessment shows that this essentially mitigates any glare predicted for the dwelling at 115 Buckleys road.

As per results outcome in section 4.1 predicted glare impacts to both single and two storey dwellings are predominantly within the more conservative guidelines of Table 5.1 where this is considered to have low glare impact. As such this review agrees with the BML assessment that no mitigation requirements are really needed for the dwellings considered based on the solar farm PV array system proposed.

Existing vegetation around dwellings and also planned landscaping for visual screening (as per Landscape Plan in **Appendix E**) should reduce any low level glare impacts to the dwellings even further.

5.2 Glare Mitigation Requirements for Road Users

Due to greater safety concerns associated with road users, ideally glare should be minimised as far as practicable. This should especially be the case at or near intersections where glare may create a greater potential hazard.

It should be noted that the more conservative Australian Guidelines referenced by BML as shown in Table 5.2 below on solar glare for road users, does not provide any duration or time limits on glare apart from that it should be addressed as far as practicable.

This allows for a wide degree of subjectivity in terms of what amount of glare and duration is considered to impact on road safety. This may range from being impacted by glare during critical moments on the road such as being struck by glare when overtaking or encountering it while approaching, crossing, or turning at an intersection when there is oncoming traffic. The difficulty is in weighing up risks associated with each scenario and the likelihood of each in terms of major incident occurrence.

Table 7: Glint and glare requirements

	Scope	Methodology	Performance objective
Road and rail	All roads and rail lines within 1km of the proposed solar array.	Solar glare analysis to identify whether glint and glare are geometrically possible within the forward looking eyeline of motorists and rail operators.	If glare is geometrically possible then measures should be taken to eliminate the occurrence of glare. Alternatively, the applicant must demonstrate that glare would not significantly impede the safe operation of vehicles or the interpretation of signals and signage.

Table 5.2 Australian Solar Farm Guidelines on Glint and Glare Assessment Approach for Road Users.

As noted by BML report, the Forge Solar utility that was used identifies two levels of glare. This has been covered in section 3.2 in relation to green and yellow glare.
Green glare is less of an issue for dynamic situations such as for moving traffic as this level of glare is low level and the duration is expected to be very small due to traffic moving quickly past areas of potential reflection.
Yellow level glare would have greater impact due to causing short duration flash blindness and hence is more important to address and mitigate as far as practicable.

5.3 Mitigation of Glare to Road Users

Of the road routes considered around the Brookside solar farm site, and based on table 4.2.3, solar glare impacts were predicted for the following roads.

1. Branch Drain Road
2. Brookside and Irwell Road.
3. Buckleys Road
4. Caldwell Road
5. Hanmer Road
6. Irwell Rakaia Road

Figure 5.3.1 provides an example of footprint and associated road route for Branch Drain road. The ForgeSolar Solar Glare hazard analysis software does not initially take into account any existing or planned vegetation that provide screening unless it is specifically modelled.

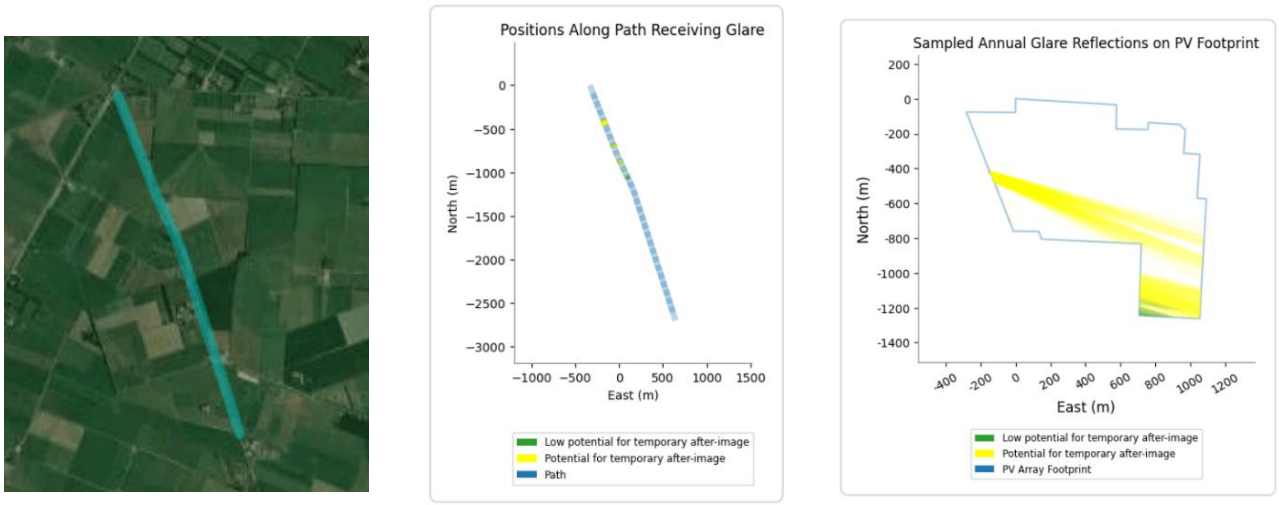


Figure 5.3.1 *Branch Drain Road Solar Glare Plots*

Figure 5.3.2 Existing Vegetation along Branch Drain Road as per view point 1 in Figure 5.3.3

Figure 3: Landscape Plan

Figure 5.3.3 Boffa Miskall Landscape Plan around Buckleys Road Solar Farm

The landscape plan as proposed by Boffa Miskell in Figure 5.3.3 indicate existing vegetation as well as plans for additional planting. (**Appendix D** provides this in more detail along with the Legend)

Table 5.3 shows the results of predicted glare when the above vegetation and planned landscape plantings, upon reaching at least 3.5m in height, are taken into account and modelled on the solar glare software utility as obstruction to any potential glare. The glare is reduced to less than minor levels with potential yellow glare essentially eliminated.

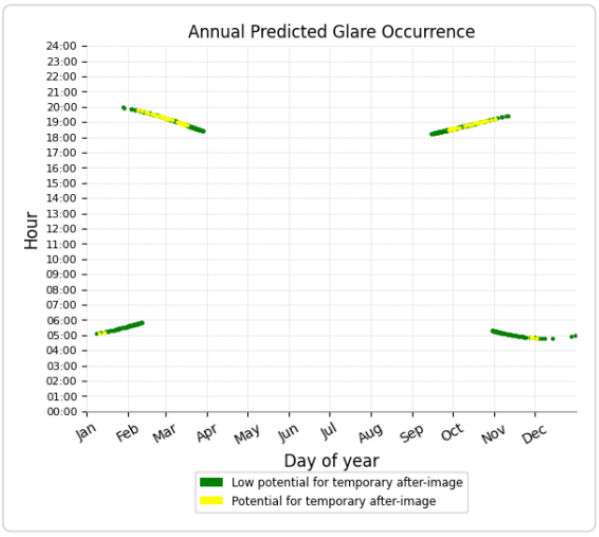
Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

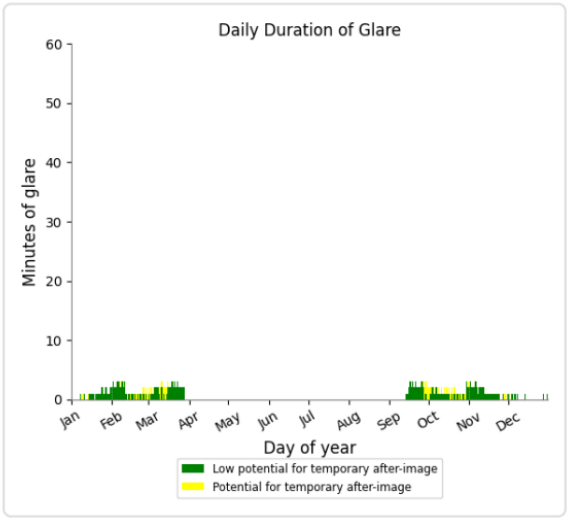
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
BranchDrainRoad	35	0.6	34	0.6
BrooksideandIrwellRoad	464	7.7	6	0.1
BuckleysRoad	208	3.5	58	1.0
CaldwellsRoad	774	12.9	36	0.6
DunsandelandBrooksideRoad	0	0.0	0	0.0
GrahamsRoad	0	0.0	0	0.0
HanmerRoad	174	2.9	0	0.0
IrwellRakaiaRoad	19	0.3	84	1.4
SmythesRoad	0	0.0	0	0.0
StewartsRoad	0	0.0	0	0.0

Table 5.3 Predicted glare with existing and planned vegetation screening taken into account

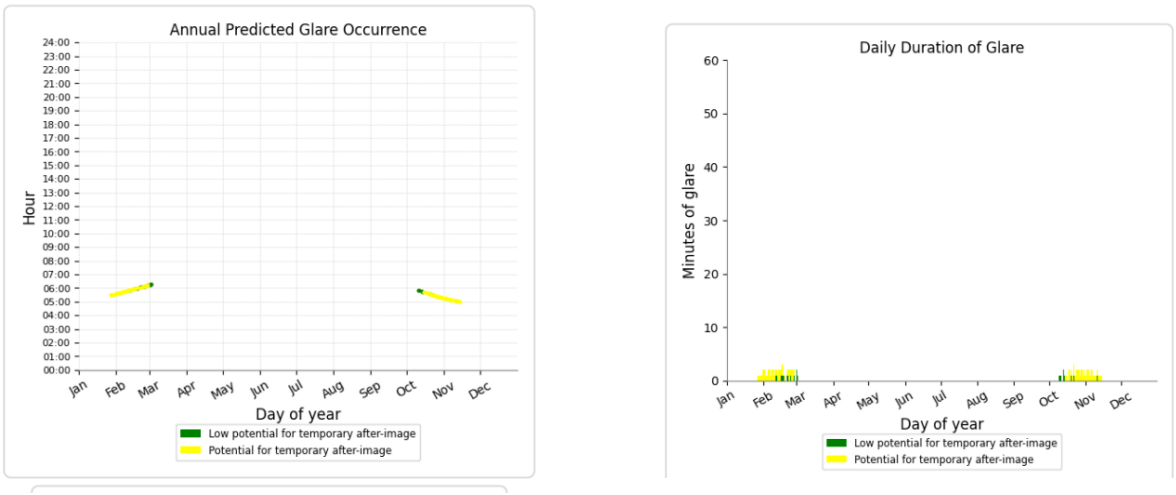
From Table 5.3 only two of the road routes, Irwell Rakai and Buckleys Roads, considered are expected to have yellow glare lasting an hour or more per annum.

Plots for the annual predicted glare occurrence and daily duration of glare are provided below.





Buckleys Road Annual Predicted Occurrence and Daily Duration of Glare.



Irwell Rakaia Annual Predicted Occurrence and Daily Duration of Glare

Although the predicted yellow glare is minimal and likely to have less than minor impact , any further mitigation required to eliminate it completely should be easily addressed by considering plantings with growth to heights of more than 3.5m. These may only be required at very localised areas if needed at all.

6. SUMMARY AND CONCLUSION OF RESULTS FOR BROOKSIDE SOLAR FARM

Brookside Solar Farm impacts on nearby Dwellings

The analysis provided by BML was for a Single Axis Tracking PV system based on the parameters as described in Sections 1.3 and 3.1.

Overall, the independent assessment results of this report correspond well with the BML assessment for road user driver eye level heights of 1.5m and dwelling based on 1.8m for eye level heights for residents. This is shown in the comparison of results from BML and this review check in **Appendix A**.

The BML assessment did not appear to base their review on the 3.6m dwelling heights based on the data input for the dwelling receptor eye levels which appeared to be set for 1.8m. for all the dwellings (See **Appendix B**).

The results however indicate that there is little difference to predicted glare impacts for assessment for both single and two storey levels for the dwellings considered.

Boffa Miskell assessment of the impacts and mitigations proposed for the dwellings is covered comprehensively and very well and there is good agreement with the results they have obtained.

Brookside Solar Farm impact on adjacent Road Traffic

It was surprising that BML did not base analysis on the worst case eye height associated with larger vehicles such as tractors and other large vehicles such as trucks, buses and haulage vehicles etc, that would frequently use these roads given the greater safety impact associated with glare impacts on road traffic. The eye heights for these are considered around 2.5m.

The ForgeSolar utility also considers drivers field of view to be ±50 degrees based on research. As such results are for road traffic are largely based on this rather than a focussed direct ahead viewpoint.

Boffa Miskells proposal around landscaping as well as consideration of existing vegetation should largely mitigate the majority of predicted yellow glare to road traffic.

As noted in some areas, additional mitigation measures that consider having plantings to at least 3.5m would be essential to minimise glare to acceptable levels to ensure less than minor impact.

Conclusion

Parties most likely to be affected are drivers of large vehicles such as tractors who are not likely to be travelling as fast as other large haulage vehicle drivers. A number of the dwelling owners are likely to be farmers who own tractors.

Glare should be minimised if not eliminated at intersections where such traffic is likely to slow down and possibly even stop before crossing or turning into another road and suddenly be faced with glare when doing so.

Safety impacts are therefore more significant for road traffic whether it is for less than 10 minutes a day or less than a minute.

As per the Australian NSW Government guidelines applying to Aviation or Road and Rail users , ***" measures should be taken to eliminate the occurrence of glare. Alternatively, the applicant must demonstrate that glare would not significantly impede the safe operation of vehicles or the interpretation of signals and signage***."

Where predicted glare impact to road traffic would be substantially reduced with the proposed landscape plantings and as well as existing vegetation, consideration may need to be given to establishing plant heights greater than 3.5m to reduce this glare as far as practicable.

7. RECOMMENDATIONS

The analysis and simulations performed are based on information and data received from Selwyn District Council and based on the Boffa Miskell Limited glint and glare Reports provided, and in particular the Glint and Glare study based of their report. The following are offered as recommendations for consent.

1. Given the BML report and glare analysis is based on the PV parameters provided, it is recommended that should any of these differ then the new glint and glare study be carried out to verify that the results have not changed significantly with regard potential glare to either the Dwellings or road users.

2. That any mitigation landscape planting being considered by BML be based on road user driver height of 2.5m to take into account drivers of larger vehicles which are just as likely to be using the roads as standard cars.

3. With regard to road routes where there is predicted glare, that consideration be given to interim mitigation measures before proposed plantings reach full maturity heights of 3.5m after 5 years. This could be to include planting of more established trees at 3m or higher or appropriate vegetation in the small local areas where predicted glare levels for road traffic may have greater impact.

8. IMPORTANT NOTES

While care is taken on the input data accuracy it is based on what information has been provided by the client and any noted assumptions.

While the overall results from the ForgeSolar glare analysis simulation generally provide an accurate analysis of potential glare based on comparison of simulation against actual installations, these are based on implementation of PV array systems as per tilts and orientations provided.

The algorithm does not rigorously represent the detailed geometry of a system. Detailed features such as gaps between modules, variable height of the PV array, and support structures may impact on glare results.

The algorithm does not consider obstacles, either man made or natural, between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills buildings, etc.

Reference Documents

[1]: Boffa Miskell Report : Buckleys Road Solar Farm, Landscape Effects Assessment Prepared for KeaX Energy, 9 August 2023
[2]: Boffa Miskell, Buckleys Solar Farm, Application for Resource Consent and Assessment of Environment Effects, Prepared for KeaX Limited, 9 August 2023
[3]: Brookside Solar Farm, Location Plan, Site Overview, Date 13 July, Rev 0
[4]: Appendix 4, Site Layout and Battery Plan
[5]: ForgeSolar analysis report brooks-230730-2241-399_b2055mm_V2
[6]: Email Correspondence

APPENDIX A: Comparison Boffa Miskell and Review Check Yellow Glare

Receptor	BML Result		VACL Review Check	
	min	hr	min	hr
BranchDrainRoad	0	0.0	0	0.0
BrooksideandIrwellRoad	290	4.8	289	4.8
BuckleysRoad	252	4.2	248	4.1
CaldwellsRoad	807	13.4	807	13.4
DunsandelandBrooksideRoad	0	0.0	0	0.0
GrahamsRoad	0	0.0	0	0.0
HanmerRoad	664	11.1	664	11.1
IrwellRakaiaRoad	0	0.0	0	0.0
SmythesRoad	0	0.0	0	0.0
StewartsRoad	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	196	3.3	190	3.2
OP 4	22	0.4	19	0.3
OP 5	24	0.4	23	0.4
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	148	2.5	148	2.5
OP 13	184	3.1	184	3.1
OP 14	154	2.6	154	2.6
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0

APPENDIX B:BML Assessment Data for Dwellings with 1.8m eye level height.

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-43.701199	172.280025	37.00	1.80
OP 2	2	-43.700745	172.284686	36.00	1.80
OP 3	3	-43.701957	172.288641	34.00	1.80
OP 4	4	-43.701927	172.289858	34.00	1.80
OP 5	5	-43.701743	172.292807	34.00	1.80
OP 6	6	-43.701175	172.295232	33.00	1.80
OP 7	7	-43.702019	172.299039	33.00	1.80
OP 8	8	-43.704427	172.304607	31.48	1.80
OP 9	9	-43.706263	172.307928	31.00	1.80
OP 10	10	-43.706442	172.308488	31.00	1.80
OP 11	11	-43.707253	172.309372	31.00	1.80
OP 12	12	-43.710731	172.305301	30.00	1.80
OP 13	13	-43.708835	172.301892	31.00	1.80
OP 14	14	-43.713405	172.297355	31.00	1.80
OP 15	15	-43.719466	172.287119	32.00	1.80
OP 16	16	-43.719891	172.286002	32.00	1.80
OP 17	17	-43.717450	172.283961	33.00	1.80
OP 18	18	-43.716398	172.283152	33.00	1.80
OP 19	19	-43.713937	172.283424	33.00	1.80
OP 20	20	-43.712090	172.280581	34.18	1.80
OP 21	21	-43.710159	172.281167	35.00	1.80
OP 22	22	-43.708609	172.281496	35.00	1.80
OP 23	23	-43.706051	172.263789	41.00	1.80
OP 24	24	-43.702129	172.273681	39.00	1.80
OP 25	25	-43.699187	172.272123	40.00	1.80
OP 26	26	-43.699269	172.277433	38.00	1.80
OP 27	27	-43.700411	172.277929	38.00	1.80
OP 28	28	-43.701144	172.277003	38.00	1.80

APPENDIX C -Comparison Single and Two Storey Dwelling Levels

i. *Ref BML ForgeSolar Report- ForgeSolar-analysis-report-brooks-230730-2241-399_B_2055mm_V2 based on single storey)* ***No mitigation is assumed***.

Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	94	1.6	0	0.0
OP 3	653	10.9	196	3.3
OP 4	280	4.7	22	0.4
OP 5	192	3.2	24	0.4
OP 6	102	1.7	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	38	0.6	0	0.0
OP 12	303	5.0	148	2.5
OP 13	256	4.3	184	3.1
OP 14	280	4.7	154	2.6
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	53	0.9	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	88	1.5	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0

ii. *Ref VACL ForgeSolar Analysis with Dwelling levels set according to number of storeys 1.8m and 3.6m). No mitigation assumed.*

Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	94	1.6	0	0.0
OP 3	653	10.9	190	3.2
OP 4	269	4.5	19	0.3
OP 5	188	3.1	23	0.4
OP 6	103	1.7	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	37	0.6	0	0.0
OP 12	277	4.6	171	2.9
OP 13	233	3.9	210	3.5
OP 14	246	4.1	183	3.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	55	0.9	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	377	6.3	38	0.6
OP 21	82	1.4	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	19	0.3	3	0.1
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	67	1.1	12	0.2
OP 28	0	0.0	0	0.0

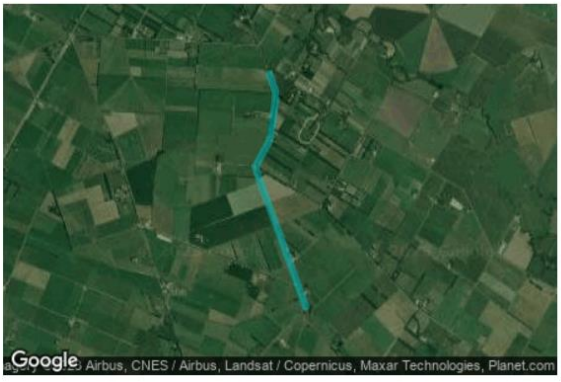
APPENDIX D:Route Receptors

Name: BranchDrainRoad
Path type: Two-way
Observer view angle: 50.0°

Name: BrooksideandIrwellRoad
Path type: Two-way
Observer view angle: 50.0°

Name: BuckleysRoad
Path type: Two-way
Observer view angle: 50.0°

Name: CaldwellsRoad
Path type: Two-way
Observer view angle: 50.0°



Name: DunsandelandBrooksideRoad
Path type: Two-way
Observer view angle: 50.0°

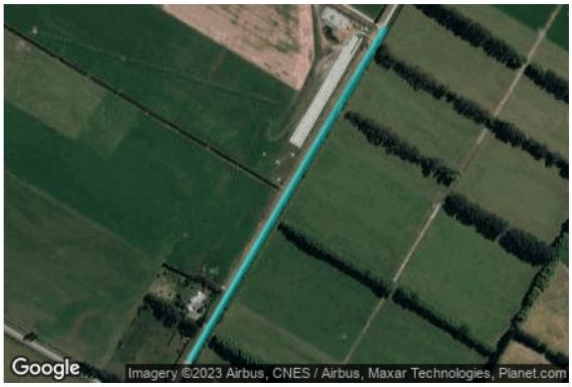
Name: GrahamsRoad
Path type: Two-way
Observer view angle: 50.0°

Name: HanmerRoad
Path type: Two-way
Observer view angle: 50.0°

Name: IrwellRakaiaRoad
Path type: Two-way
Observer view angle: 50.0°

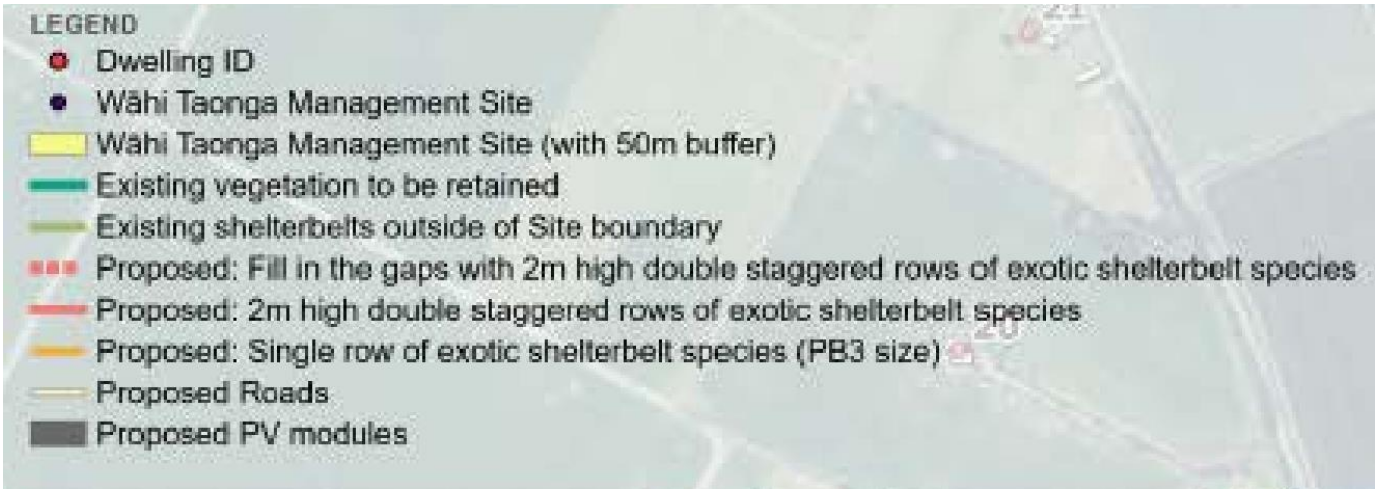
Name: SmythesRoad
Path type: Two-way
Observer view angle: 50.0°

Name: StewartsRoad
Path type: Two-way
Observer view angle: 50.0°

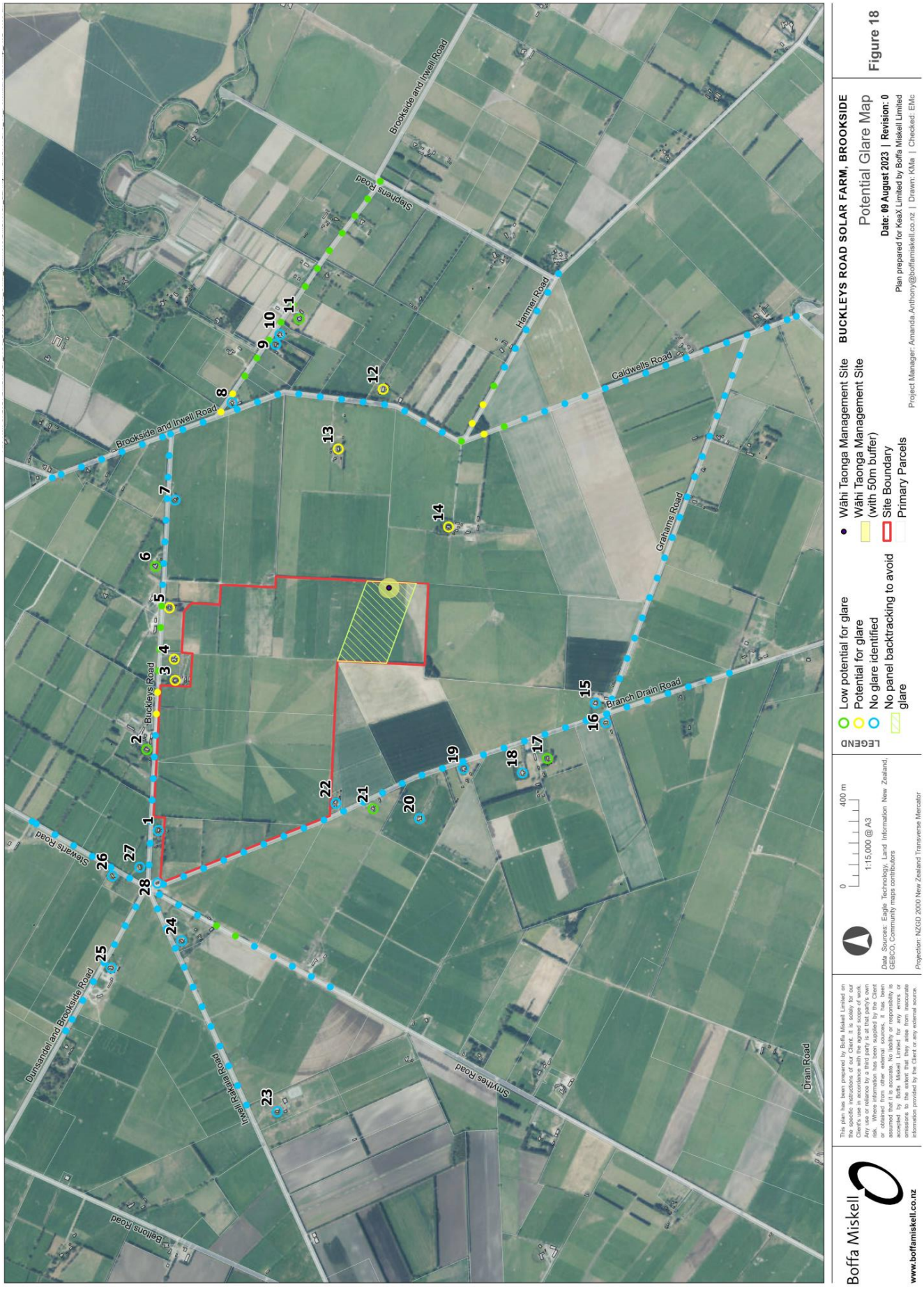


APPENDIX E:Landscape Plan

Figure 3: Landscape Plan



APPENDIX F: Potential Glare Map Road Routes (Figure 18)



Velden Aviation Consulting Ltd

To: Richard Bigsby , Selwyn District Council

From: Rudi Van der Velden, Consultant Velden Aviation Consulting Ltd

Date: 25 October 2023

Addendum to Velden Aviation Consulting Report : *Selwyn District Council - Review of Boffa Miskell Assessment of Glint and Glare at Buckleys Roads Solar Farm, Dated 21 September 2023.*

Reference: Boffa Miskell Memorandum 24 October 2023 as attached. (Attachment A)

Addendum Note:

With reference to BM memorandum and notification that further assessment has been carried out for a larger vehicle 2.5m driver eyesight height.

Velden Aviation Consulting Ltd is satisfied with the Boffa Miskell further assessment and mitigation considerations based on their resultant amendment to eliminate backtracking for roads deemed to be susceptible to glare, for the period until road corridor plantings are established at a height of at least 3m.

On this basis it can be expected that recommendations 2 and 3 proposed in the Velden Aviation report dated 21 September 2023 are satisfied with the further assessment and mitigation proposed by Boffa Miskell and conclusions they have reached.

Attachment A : Boffa Miskell Memorandum 24 October to Selwyn District Council

Boffa Miskell

Memorandum

☐ **Whangarei** 35 Walton Street Whangarei 0110 +649 358 2526

☐ **Auckland** PO Box 91250 Auckland 1142 +649 358 2526

☐ **Hamilton** PO Box 1094 Hamilton 3240 +647 960 0006

☐ **Tauranga** PO Box 13373 Tauranga 3141 +647 571 5511

☒ **Wellington** Level 4 1 Post Office Square Wellington 6011 PO Box 11340 Wellington 6142 +644 385 9315

☐ **Nelson** 51 Halifax Street Nelson 7010 +643 548 8551

☐ **Christchurch** PO Box 110 Christchurch 8140 +643 366 8891

☐ **Queenstown** PO Box 1028 Queenstown 9348 +643 441 1670

☐ **Dunedin** 49 Water Street Dunedin 9016 +643 470 0460

Attention:	Richard Bigsby at SDC
Company:	Boffa Miskell Ltd
Date:	24 October 2023
From:	Emma McRae, Principal Landscape Architect
Message Ref:	Buckleys Road Solar Farm: Further Information request - Glint and Glare
Project No:	BM210727

Introduction

The following memo provides further information as requested by Selwyn District Council in their s92 request of 29th September 2023. The letter states:

The applicant's Glint & Glare analysis in Appendix 13 was reviewed and assessed on behalf of the Council. The review identified that the applicant's assessment did not consider worst case eye height associated with larger vehicles such as tractors and other large vehicles such as trucks, buses and haulage vehicles, etc, that would frequently use these roads. There would be a greater safety impact associated with glare impacts on larger vehicles. The eye heights for these vehicles are considered around 2.5m.

With regard to road routes where there is predicted glare at an eye height of 2.5m, please advise what interim mitigation measures will be used before the proposed plantings reach the minimum height that they will be maintained at. This could include the planting of more established trees at 3m or greater, or appropriate vegetation in the small local areas where predicted glare levels for road traffic may have greater impact.

Additional analysis

In response to this, further analysis has been carried out on the roads surrounding the site. A bare earth analysis with an eye height of 2.5m was analysed to determine the incidence of glare at this eye height. The findings are outlined in Table 1 below:

Table 1: Glint and Glare Analysis of nearby Roads at 2.5m eye height
*Refer to **Figure 18** in the Landscape Assessment Graphic Supplement*

Road Name	Analysis results	Recommendations
Branch Drain Road	Modelling identifies that a small stretch at the northern end of the road has the potential for glare. This coincides with existing vegetation of approximately 3m height on the boundary of Branch Drain Road (see VP14).	No further mitigation required.
Brookside and Irwell Road	Modelling identifies a small stretch of the road has the potential for glare approaching the bend in the road, as illustrated on **Figure 18**. Glare has the potential to occur between the months of February to May and August to November, between the hours of 5-8pm.	Potential glare available in the direction of travel towards the site would be screened by existing vegetation as illustrated on Figure 19 along eastern site boundary. This vegetation is

	Duration of the glare period during these times is predicted at less than 10 minutes per day.	between 3 and 10m in height and is visible in the right-hand side of VP3 on Figure 10.
Buckleys Road	Modelling identifies a small stretch of the road potential for glare as illustrated on **Figure 18**. Glare has the potential to occur between the months of October to April between the hours of 5-6am in the morning and 5-8pm in the evening. Duration of the glare period during these times is predicted at less than 10 minutes per day.	Potential Glare in the location of VPs 1 & 2 would be oblique to the direction of travel along the road corridor. Mitigation is not required, however, proposed planting along the site boundary would screen any potential glare from view.
Caldwells Road	Modelling identifies a small stretch of the road has the potential for glare approaching the bend in the road, as illustrated on **Figure 18**. Glare has the potential to occur between the months of April to September, between the hours of 4-6pm. Duration of the glare period during these times is predicted at 10 minutes per day or less.	For potential glare identified at the junction of Caldwells and Hanmer Road in the location of VP6, it is proposed to have no panel backtracking in this location, to avoid the effects of glare in alignment with the road corridor until planting achieves a height of 3m where it would screen views from higher vehicles. For the area of the Wahi Taonga site where there is no planting, no backtracking is proposed to eliminate glare.
Dunsandel and BrooksideRoad	Modelling identifies no glare geometrically possible.	No further mitigation required.
Grahams Road	Modelling identifies no glare geometrically possible.	No further mitigation required.
Hanmer Road	Modelling identifies that a small stretch of the road has the potential for glare as illustrated on **Figure 18**. Glare has the potential to occur between the months of April to October between the hours of 4-6pm. Duration of the glare period during these times is predicted at 10 minutes per day or less.	For potential glare identified at the junction of Caldwells and Hanmer Road in the location of VP6, it is proposed to have no panel backtracking in this location, to avoid the effects of glare in alignment with the road corridor until planting achieves a height of 3m where it would screen views from higher vehicles. For the area of the Wahi Taonga site where there is no planting, no backtracking is proposed to eliminate glare.
Irwell Rakaia Road	Modelling identifies potential glare of less than 5 minutes per day between 5 and 7am in February/March and September/October at northern end of the road. Existing vegetation at the corner of Irwell Rakaia Rd and along Branch Drain Road (see VP14) would screen this glare from view.	No further mitigation required.
Smythes Road	Modelling identifies potential for glare from a limited location and duration (less than 2 mins per day) only.	No further mitigation required.
Stewarts Road	Modelling identifies no glare geometrically possible	No further mitigation required.

Conclusion

Further analysis at 2.5m high on a bare earth scenario has identified that four roads (Brookside and Irwell, Buckleys Road, Caldwells Road and Hanmer Road) in the vicinity of the site have the potential for glare visible to road travellers in higher vehicles. Potential glare from Buckleys Road is not orientated in the direction of travel for road users, therefore no further mitigation is required. Potential glare from Brookside and Irwell Road will be screened by existing tall shelterbelt vegetation. For potential glare from Hanmer and Caldwells Roads, the area of no backtracking will be extended to the southeastern quadrant of the site to avoid the potential for glare while proposed planting establishes to a height where it would screen viewers in higher vehicles.

Appendix 3 – Noise & Vibration Peer Review

MARSHALL DAY Acoustics

292 Montreal Street
PO Box 4071
Christchurch 8140 New Zealand
T: +64 3 365 8455
www.marshallday.com

21 September 2023

Selwyn District Council
2 Norman Kirk Drive
Rolleston 7643

Attention: Richard Bigsby

Dear Richard

RC235464: BUCKLEYS SOLAR ARRAY– NOISE PEER REVIEW

Selwyn District Council has requested that Marshall Day Acoustics carry out a peer review of the noise assessment provided in support of the Solar Array Project at 115 and 150 Buckleys Road, Leeston (the site). Our review is based on the following documents:

1. *Application for Resource Consent and Assessment of Environmental Effects (AEE)* – Boffa Miskell – 9 August 2023
2. *Assessment of Environmental Noise Effects* – Acoustic Engineering Services (AES) – 19 July 2023

Rather than provide a line-by-line assessment of the AES report, we have focussed on those aspects that have a bearing on our review. Should consent be granted, we have provided outline conditions of consent for consideration.

We note that after the preparation of the AES noise assessment and receipt of the application, decisions were made on the Proposed District Plan (PDP) on 19 August 2023 and these provisions have legal effect. Our review references the noise provisions of the Partially Operative District Plan (PODP) as appropriate.

We have sought further clarification from AES on some aspects of their assessment and these are discussed below.

The proposed noise limits are appropriate

1. Overall the proposal is considered a Discretionary activity under the ODP and, as such, it is appropriate to consider the potential adverse noise effects of the activity.
2. For their report, AES has reviewed both the operative and proposed (now partially operative) District Plans and have proposed a daytime noise limit of 50 dB L_{Aeq} at the notional boundary of the nearest dwelling. We agree this is an appropriate limit. The proposed limit is more stringent than both District Plans' permitted activity standards.
3. AES has confirmed[1] there will be no activity on site at night and the batteries and inverter will be switched off by their PLC (controller). However, for completeness, we recommend a night-time noise limit of 40 dB L_{Aeq} should also be adopted.
4. AES has considered potential construction noise effects with reference to New Zealand Standard *NZS 6803: 1999 Acoustics - Construction Noise* and we consider this to be appropriate. NZS 6803 construction noise limits align with those set out in Rule NOISE-R2.1 and NOISE-REQ2 of the PODP.

[1] William Reeve AES email correspondence dated 4 September 2023

Construction noise predictions are conservative

5. Construction noise levels have been modelled based on sound data supplied by the applicant or BS 5228 and are appropriately conservative.

6. Piling and tree clearance are the construction activities that generate the highest activity noise levels, with piling generating the highest level of 69 dB L_{Aeq} at 324 Branch Drain Road which just complies with the applicable construction noise limit of 70 dB L_{Aeq}.

7. We consider AES' assumption that piling will occur 30% of the time to be optimistic noting that, if longer duration were to occur, construction noise could feasibly be higher than 70 dB L_{Aeq} and exceed the daytime construction noise limit. However, we note that the highest noise levels will only occur when piling is carried out close to the dwelling and will be lower than this value for most of the time.

Piling methodology must demonstrate the best practicable option

8. We consider piling noise has the potential to result in notable adverse effects at the nearest dwellings. Driven (percussive) piles are proposed and several piling rigs will operate at the same time across the site. Based on the information provided with the application, we estimate that more than 15,000 piles will be required to support the solar array. The AEE states that piling will occur for approximately six months.

9. Based on the current information, piling noise will range from approximately low 50s to 70 dB L_{Aeq} at the nearest dwellings which, based on existing ambient noise levels, means that piling will be clearly audible for most of the piling period at dwellings adjacent the site. Based on our experience of other construction sites, we consider the quantity, noise level and duration of percussive piling that is proposed, will potentially result in adverse community reaction and requires further justification.

10. Should consent be granted, we consider that construction noise should be managed and assessed in accordance with NZS 6803: 1999 "*Acoustics – Construction Noise*". Inherent in this Standard, is the requirement to adopt the best practicable option to ensure noise from the site is minimised. We consider this is best demonstrated through the preparation of a Construction Noise and Vibration Management Plan (CNVMP) that is prepared in accordance with Annex E3 of NZS 6803, and submitted to Council for approval before construction commences. We have attached Annex E to this report for reference. We note the Applicant has stated a willingness to adopt a CNVMP.

11. With reference to NZS 6803, we would expect the CNVMP to include a discussion of piling methodologies (driven, screw etc) with respect to factors such as source noise level, efficiency (exposure duration) and practicality. If driven piles are the BPO, mitigation options should be evaluated such as screening around the hammer and pile head and/or a pile dolly. For example, a shroud around the piling head can result in notable noise level reduction (e.g. https://duraflex.co.nz/hushtec/pile-rig-attachments/). The CNVMP will also provide a method for liaison with the community.

12. If this CNVMP process is followed, we consider that construction noise effects will be reasonable.

Construction vibration will be minimal

13. Vibration effects are briefly discussed by AES but not evaluated in detail. We agree that vibration effects during the operational phase are likely to comfortably comply with the guideline values from DIN 4150 and therefore comply with PODP Rule NOISE-R14. We consider that any construction vibration effects can be effectively managed with a CNVMP and will largely be determined by the piling methodology used.

Operational noise

14. During the operational phase, we understand the dominant noise sources will be the inverters, batteries and transformers which are distributed across the site. AES has predicted noise levels based on source data provided by the manufacturer and the resulting noise levels are plausible.

15. AES consider that a 5 dB penalty for special audible characteristics is not appropriate for some of the noise sources (inverters and batteries). We consider that, if consent is granted, this should be verified through compliance monitoring.
16. The highest predicted noise levels during the operational phase are 47 and 45 dB L_{Aeq} at 324 and 313 Branch Drain Road respectively. AES notes the proposed activity may be clearly audible at times.
17. The predicted noise levels can comply with the proposed daytime noise limit of 50 dB L_{Aeq} and are notably lower than the permitted activity standards in the Operative and Partially Operative District Plans.
18. On that basis, we agree with AES that operational noise effects will be acceptable in the context of the receiving environment.

We recommend additional noise conditions

19. Should Council decide to grant consent, we recommend that conditions of consent be developed based on the following suggested text

    1. The consent holder shall ensure that all activities on the site measured in accordance with *NZS6801:2008 Acoustics - Measurement of environmental sound*, and assessed in accordance with the provisions of *NZS6802:2008 Acoustics - Environmental noise*, shall not exceed the following noise limits at any point within the notional boundary of any residential site, during the following timeframes:

        (a) 0730 to 2000 hrs 50 dB L_{Aeq}

        (b) 2000 to 0730 hrs 40 dB L_{Aeq} and 75 dB L_{Amax}

    2. Within 6 weeks of the solar array becoming operational, a suitably qualified and experienced acoustic consultant shall perform measurements to confirm compliance with both the daytime and night-time noise limits in Condition 1. The assessment shall include an objective analysis of any special audible characteristics during the day and at night in accordance with Appendix B4 of NZS 6802:2008 *Acoustics - Environmental Noise.*
    3. Construction activities must be conducted in accordance with NZS 6803: 1999 "Acoustics – Construction Noise" and must comply with the "typical duration" noise limits contained within Table 2 of that Standard.
    4. At least 20 working days prior to any construction occurring on site, a Construction Noise and Vibration Management Plan (CNVMP) shall be prepared and submitted to Council for certification. The CNVMP shall address, as a minimum, the measures identified in Annex E3 of NZS 6803: 1999 "Acoustics – Construction Noise".
    5. For the avoidance of doubt, within the CNVMP required by Condition 4, the Applicant shall demonstrate the proposed piling methodology has been selected with respect to the best practicable option.

Please contact us with any queries.

Yours faithfully

MARSHALL DAY ACOUSTICS LIMITED

Jon Farren
Principal

APPENDIX A ANNEX E FROM NZS6803:1999

ANNEX E
PROJECT MANAGEMENT
(Normative)

E1 General

The intention at each stage of the project should be to reduce construction noise by the best practicable option. This should include giving consideration to:

(a) Applicable noise limits or restrictions on working hours;

(b) Site layout, for example the location of static noise sources, and the use of site buildings, material dumps etc. as ad hoc noise barriers;

(c) The construction methods and machinery likely to be used, and whether alternatives would achieve less noisy operations;

(d) Specific measures such as the use of silencers, mufflers, shielding, enclosures and barriers;

(e) Planning the hours of working to be considerate of the people in the neighbourhood.

E2 Noise management plans

Noise management requirements for a project should be identified at an early stage and integrated into all phases of the project planning and development, and incorporated into tender documents and contracts. Measures include:

(a) Process of community liaison;

(b) Need for educating management and workers in maintaining community goodwill;

(c) Likely affected persons and special needs of those people or the public in general;

(d) Designating responsible public relations persons;

(e) The role of the local/regional authority;

(f) Complaints procedures;

(g) Establish likely noise emissions;

(h) Establish likely durations of exposure on a specific neighbourhood basis;

(j) Determine the need for any special construction activities, e.g. activities that must take place outside normal working hours;

(k) Consultation procedures for special works;

(m) The practicable noise control measures available;

(n) The applicable noise performance standards;

(o) Any resulting limits on hours of operation;

(p) Site screening and landscaping;

(q) Noise monitoring procedures;

(r) Education and training of workers in noise management.

E3 Planning stage

E3.1
It is essential that planners, developers, architects and engineers all play their part in ensuring the lowest practicable noise levels. Acoustical advice should be sought at the outset and integrated into stages of the project.

E3.2
Each project should be considered to ensure that its design keeps to a minimum the number of operations which are likely to be noisy.

E3.3
It will be necessary to determine the expected sound level of construction noise received off-site in the neighbourhood. The developer, architect and engineer will need to know whether the processes they intend to use are likely to be permitted. An early consultation should be made with the responsible authorities in order to ascertain the noise limits which apply, and a survey of the immediate surroundings should be conducted to determine the location of noise-sensitive areas.

E3.4
Account should be taken of other remedial measures and their effects. For example, where permanent barriers are a feature of the final design, consideration should be given to their early construction so as to provide protection during construction operations.

E4 Design stage

E4.1
All available information should be assessed in order to consider the implications of construction noise.

E4.2
The design of the project will have considerable influence on the contractor's use of the site. It will partially determine where such items as haulage roads, batching plants, generators, and pumps will be sited.

E4.3
Preferred off-site vehicle routes should be established to keep access traffic away from noise sensitive areas, such as dwellings, hospitals and schools.

E4.4
Site sub-soil conditions should be thoroughly investigated in order to consider methods of working that minimize site noise.

E5 Tender and contract stage
Both the tender and contract documents should take into account, where appropriate:

(a) The noise limits for the construction site;

(b) The proximity of neighbouring noise-sensitive areas;

(c) The obligation of the contractor to use the best practicable options to minimize noise;

(d) The obligation of the contractor to predict noise levels;

(e) Noise monitoring methods to be used.

E6 Training of personnel

Personnel should be informed about the need to reduce noise and about the hazards of excessive noise. As part of their training, special attention should be given to the following:

(a) Proper selection, use and maintenance of tools, machinery, and related noise control devices;

(b) Positioning of machinery on site;

(c) Avoidance of unnecessary noise;

(d) Operation of sound measuring equipment by selected personnel;

(e) Procedures for receiving, referral and investigation of complaints.

Appendix 4 – Highly Productive Land Peer Review

REVIEW OF HIGHLY PRODUCTIVE LAND (HPL) ASSESSMENT

Prepared for: **Selwyn District Council (SDC)**

Date: **25 September 2023**

Consultant: **Jamie Gordon**

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1. Introduction

1.1. Report Requested

Richard Bigsby (Resource Management Planner SDC) has requested a review the HPL assessment provided as part of the resource application RC235464 to construct a new solar array (solar farm) on approximately 111 hectares. This review has been undertaken based on information provided by the SDC, with particular reference to the AEE and the associated appendix 16 "Effects on HPL". Other New Zealand and international information has been researched and used alongside internal knowledge and information.

The review considers any impacts in relation to the National Policy Statement for Highly Productive Land (NPS-HPL) 2022.

1.2. Disclaimer

Neither the author or Macfarlane Rural Business (MRB) are formally trained in policy and planning or experts in solar electricity generation. MRB consultants are land-based agriculturalists focused on optimising physical production and financial viability of primary production systems.

The information in this document is based on information researched from publicly available sources and supplied by external parties as well as internal information held by MRB Ltd. The conclusions expressed in the report are the views of the author based on the available information and previous experience and training of the author. The author and MRB Ltd have endeavoured to obtain the best available and accurate information at the time of publication. However, users of this publication are advised that:

- It does not constitute farm system, legal or accounting advice, and users should take specific advice from qualified professionals before taking any action based on information in this publication.
- Where information has been obtained from other external sources, it has been assumed that it is accurate, without independent verification, unless otherwise indicated. No liability or responsibility is accepted by MRB Ltd for any errors or omissions to the extent that they arise from inaccurate information provided by any external source.
- Neither the author or MRB Ltd accept any responsibility or liability whatsoever whether in contract, tort, equity, or otherwise for any action taken as a result of reading, or reliance placed on this discussion document because of having read any part, or all, of the information in this discussion paper or for any error, or inadequacy, deficiency, flaw in, or omission from the information in this discussion paper.

2. NPS-HPL

Policies 1, 4, 7, and 8 of the NPS-HPL describe LUC 1,2 and 3 land as a valuable resource which should be preserved for land-based primary production (agricultural, pastoral, horticultural, or forestry activities, that are reliant on the soil).

Clause 3.9 "Protecting highly productive land from inappropriate use and development" is of particular importance to this consent application and is referred to in appendix 16.

MRB have been requested to review the application in regards to Clause 3.9.

Figure 1 shows the HPL areas on the site as mapped by OURENVIRONMENT, with the dark green being LUC 2 (103Ha) and lighter green LUC 3 (10Ha)

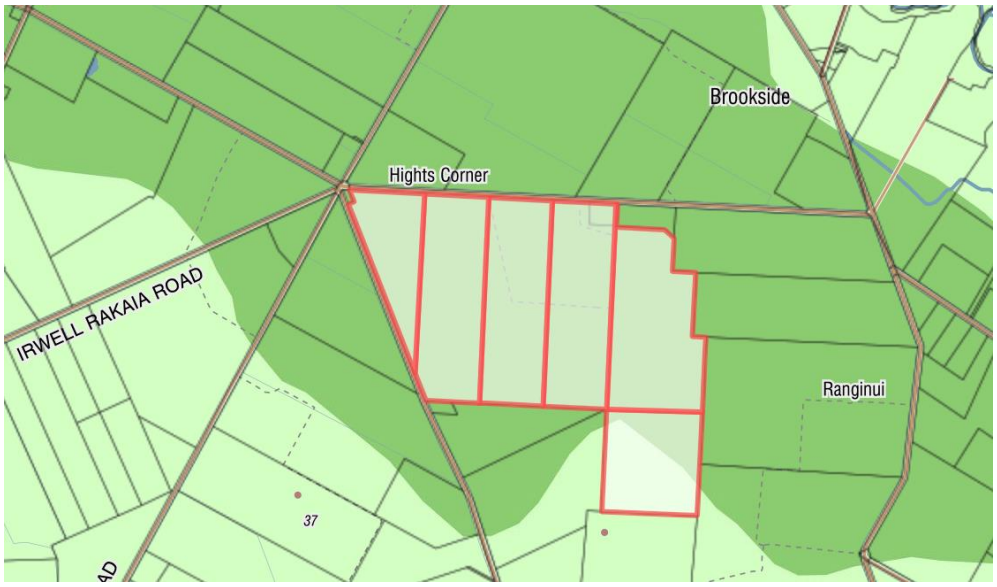

Figure 1: HPL Land
Source: https://ourenvironment.scinfo.org.nz/

3. Solar Array Configuration

Section 4 of the AEE states that the solar array will comprise a total of 140,000 tracking panels. However, appendix 16, section 2.1, provisions for the installation of two types of solar arrays, being fixed/stationary panels (2.1.1) and single axis tracker panels (2.12). It has been confirmed by Richard Bigsby that only Single Axis Tracker (SAT) Panels will be installed.

The dimensions of the SAT panels are documented in the AEE as follows:

- 6.5m between rows of panels
- 1.6-1.8m to top of pile (panel pivot point)
- 500mm above ground when the panel is vertical.
- 4m between panels when they are horizontal.

The dimensions documented in appendix 5 are shown in figure 2 and displays a 1m height above ground when the panels are vertical. This is twice the height documented in the AEE and appendix 16. This height is important for the following reasons:

- A height of 500mm could impede sheep movement and there is also a risk the sheep will chew electric cables etc.
- The height needs to be considered in regard to agricultural activities such as mowing, spraying, fertilising and drilling.

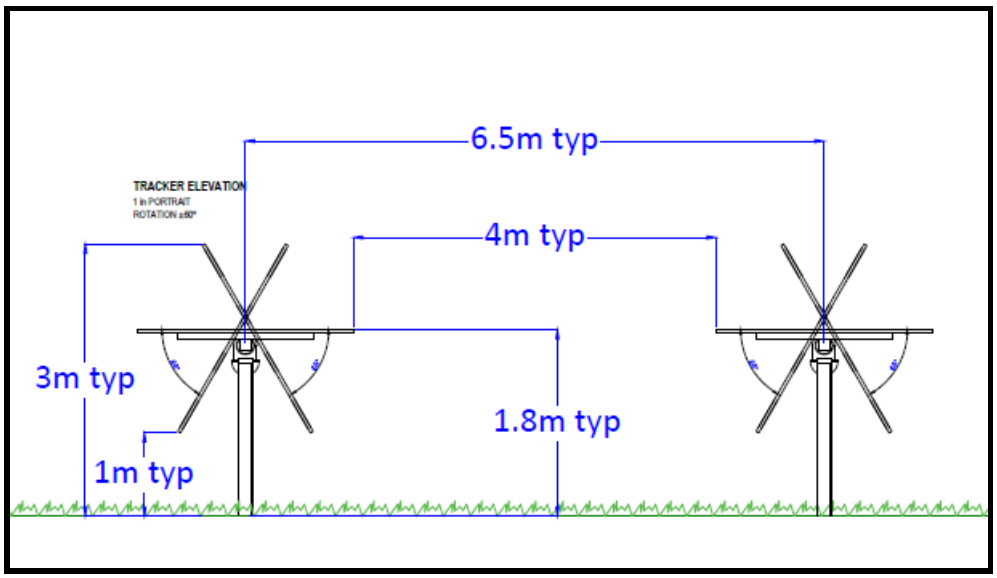

Figure 2: SAT Panel Design taken from Appendix 5

Appendix 16 (appendix B) provided a diagrammatic example of the SAT solar arrays as shown in figure 3. The array has a metal shaft going between rows of panels, possibly to drive the rotation of the panels. This shaft will make any agricultural activity such as cropping, re-grassing, mowing etc. difficult and could impact productivity. The shafts could also impede livestock movements.

Buckleys Road, Brookside tracking system after 9 years

Figure 3: Fixed and Tracking Solar Arrays from Appendix 16

Figure 4 is taken from the Landscapes Affects Assessment (appendix 13) and shows a plan of the solar arrays. The size of the gaps at the ends of rows is difficult to ascertain but appear to be approximately 5m. If these are required for the turning of vehicles between rows it is likely they will not be wide enough for an agricultural tractor with implements such as mowers, balers, drills, sprayers etc.

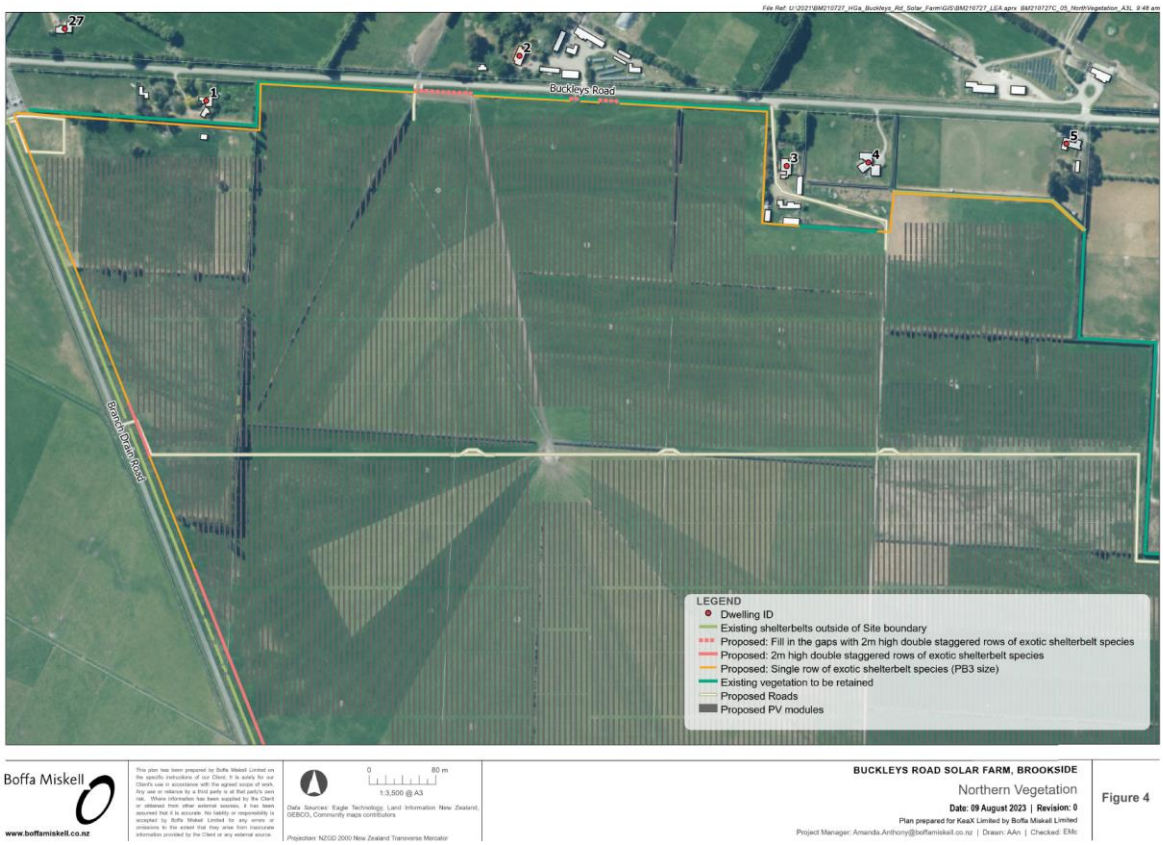

Figure 4: Solar Array Plan – taken from appendix 13.

4. Farm Production

4.1. Current Farm System

The farm is currently farmed as a dairy farm with the majority of the property irrigated with centre pivot irrigators. It is assumed that there is sufficient water availability to undertake other farm activities such as cropping or lamb finishing.

4.2. Pastoral Grazing

With the proposed solar array configuration, sheep breeding or finishing is the most likely pastoral option. The removal of silage/baleage during peak pasture growth may also be required. The ability to harvest silage/baleage under the SAT arrays will depend on the drive system for the panels and the method shown in figure 2 will not practicably allow harvesting. Sufficient area at the end of the rows is also required to enable vehicle turning.

A review of published literature documented a variation in the impact of solar panels on pasture production. The following is a list of some of the literature reviewed:

- An Oregon State University study (Andrew, Higgins, Smallman, Graham, & Ates, 2021) showed similar annual growth in unshaded and partially shaded areas, but lower growth in fully shaded areas. However, feed quality was better in shaded areas.
- A Cornell University Study (Kochendoerfer, C. E. McMillan, M. A. Zaman, S. H. Morris, A. DiTommaso) showed a decline in annual herbage production by 2.5 times in shaded areas and concluded that this was not surprising taking into consideration the vast literature available investigating forage yield in shaded conditions.
- The "Australian Guide To Agrisolar for Large-Scale Solar" report produced by the Clean Energy Council (CEC) did not report any trial work but farmers in Parkes and Dubbo showed improved pasture production during dry periods due to condensation from the panels running off.
- Whilst the Fraunhofer Institute for Solar Energy Systems (ISE) 2020 report focused predominantly on cropping and horticulture, the development of microclimates under Agrivoltaic systems could also enhance pasture production. Grazing under solar panels has been occurring in Europe for a number of years.
- Preliminary results from the first seven months of a study being undertaken at Massey University showed that "*pasture growth was reduced by 84 per cent directly under the panels, but increased by 38 per cent in the larger areas between panels. Pasture growth in both cases was compared to pasture growth in areas away from the panels. Professor Danny Donaghy, who co-led the study, says that direct shading under the panels likely has a negative influence on pasture growth, unlike some previous international research in generally hotter and drier climates. In contrast, in the area between the solar panels, the panels might offer some 'protective' effects, possibly by keeping soil temperatures cooler and also slowing down loss of soil moisture due to wind, compared to an open paddock".* This study is being undertaken under fixed solar panels so there is a large difference in shading under the panels compared to between the panels. The SAT panels being proposed for this site rotate so will not have the same shading impact as fixed panels. The preliminary Massey results demonstrate that there could be a micro-climate impact that would maintain or improve pasture production.

Differences in climate, pasture types and grazing management need to be considered when comparing grazing systems globally. For example, in Australia some agrisolar systems are in arid climates with no irrigation, have low producing pasture types and low intensity grazing systems with limited

subdivision. Similarly, the studies at Oregon and Cornell were undertaken on dryland unimproved pastures. Solar impacts of pasture and animal production in these environments cannot necessarily be transferred to an intensive New Zealand pastoral system.

Anecdotal photo evidence in Appendix 16 (appendix B) shows that pasture growth is maintained or improved both under and between the panels although there is no analytical data to support this.

In summary, the literature available is variable, but based on the use of the SAT array system, it is probable that the pasture production on the proposed solar site will not be negatively impacted by the panels.

Despite the potential for no direct impact of the solar panels on pastoral and animal production, more significant will be the adaption of good pastoral management practices to operate under the solar arrays. Consideration and planning needs to be given to:

- Pasture renewal, including spaying, drilling and cultivation if required.
- Feed Conservation.
- Fertilising.
- Subdivision.
- Irrigation systems.
- Livestock water.

Failure to implement these key programmes and infrastructure could reduce the productive potential of the land. Specialist equipment maybe required to fit along the rows and under the bottom edge of the panel. For the efficient use of machinery, consideration needs to be given to the drive mechanism of the solar panels and the turning room for tractors and implements at the end of rows as discussed in section 3.

4.3. Cropping/Horticulture

International literature documents the growing of a number of crop types under solar panels, although much of this has been recently developed and is on smaller solar farms or research facilities. It appears that crop yields are more sensitive to solar radiation reduction and typically the solar panels are higher off the ground and often have gaps between the panels.

The "Australian Guide To Agrisolar for Large-Scale Solar" report produced by the Clean Energy Council (CEC) stated that "*Although long-term data on crop growth below solar panels is not yet available, early studies, mainly from arid or rangeland climates, suggest that the efficacy and extent of the positive impacts caused by solar panels is dependent on the plant species, the agrisolar system and the climate. In more humid climates, the compatibility of crops and solar PV is largely unknown at this time".* This demonstrates the infancy of cropping under solar panels and the difficulty in transferring this information technology to New Zealand. The CEC also reported that *"Plants with less root density and a high net photosynthetic rate are ideal for agrisolar systems. Studies undertaken in the USA have found that the following crops could be successfully grown under and around ground-mounted solar panels"* and listed tomatoes, jalapenos, kale and chard, and broccoli as crops suitable to be grown between ground-mounted panels. However, these crops were grown in California and Arizona in more arid environments.

With the exception of the crops listed above it appears to date that most crops are grown under more elevated solar panels with the photo's in appendix I showing some examples from the literature reviewed.

The National Renewable Energy Laboratory (NREL) report "*The 5 Cs of Agrivoltaic Success Factors in the United States: Lessons From the InSPIRE Research Study"* summarised that *"most crop types have shown variations in performance depending on location and configuration"* and this is shown in Figure 5.

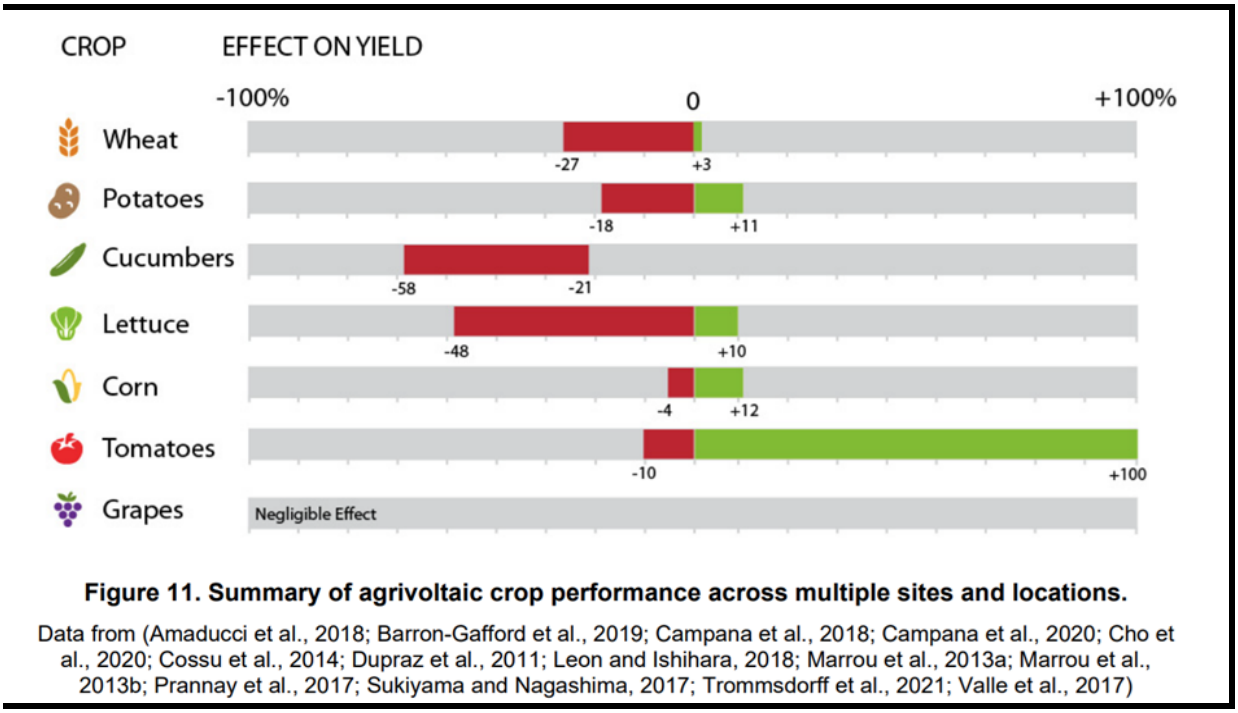

Figure 11. Summary of agrivoltaic crop performance across multiple sites and locations.

Data from (Amaducci et al., 2018; Barron-Gafford et al., 2019; Campana et al., 2018; Campana et al., 2020; Cho et al., 2020; Cossu et al., 2014; Dupraz et al., 2011; Leon and Ishihara, 2018; Marrou et al., 2013a; Marrou et al., 2013b; Prannay et al., 2017; Sukiyama and Nagashima, 2017; Trommsdorff et al., 2021; Valle et al., 2017)

Figure 5: Crop Yield Variations
Source: NREL

4.4. Summary

Based on the type of solar panels being installed on the site, the grazing of sheep or lambs is the most probable farm system. Some cropping could also take place in conjunction with this, although investment into specialised tailor-made machinery may be required.

Regardless of the farm system, it is important that productivity is maintained on as much of the land as possible, with the greatest risk of lost productivity being close to the piles. Minimising the loss of productivity will require appropriate infrastructure and management practises to farm under the solar panels.

Assuming that potential pasture production is not negatively impacted by the solar arrays and that the land could continue to support primary production, the potential productive capacity (as per the definition) would be maintained.

Appendix I: Photo's of Elevated Solar Panels with Cropping/Horticulture.

Sources: *Fraunhofer ISE*
National Renewable Energy Laboratory (NREL)
Climate Energy Council (CEC)
Solar Power Europe
University of Sheffield, UK








Appendix II: Literature Review Sources

American Solar Grazing Association
National Renewable Energy Laboratory (NREL)
Climate Energy Council (CEC) - Australian Guide to Agrisolar for Large-Scale Solar
Solar Power Europe
University of Sheffield, UK
Oregon State University study (Andrew, Higgins, Smallman, Graham, & Ates, 2021)
Cornell University Study (Kochendoerfer, C. E. McMillan, M. A. Zaman, S. H. Morris, A. DiTommaso)
Fraunhofer Institute for Solar Energy Systems (ISE) 2020 - Agrivoltaics: Opportunities for agriculture and the energy transition - A guideline for Germany
Massey University,NZ

Appendix 5 – Cultural Advice Report

226 Antigua Street, Central Christchurch, Telephone: +64 3 377 4374
Website:www.mahaanuikurataiao.co.nz

CULTURAL ADVICE REPORT

J5835 – 150 Buckleys Road (RC235464)

To: Selwyn District Council

Contact: Richard Bigsby

1.0 Mana Whenua Statement

Ngāi Tahu are tangata whenua of the Canterbury region and hold ancestral and contemporary relationships with Canterbury. The contemporary structure of Ngāi Tahu is set down through the Te Rūnanga o Ngāi Tahu Act 1996 (TRoNT Act). The TRoNT Act and Ngāi Tahu Claims Settlement Act (NTCSA) 1998 sets the requirements for recognition of tangata whenua in Canterbury.

The Te Rūnanga o Ngāi Tahu Act 1996 and the NTCSA 1998 gives recognition to the status of Papatipu Rūnanga as kaitiaki and mana whenua of the natural resources within their takiwā boundaries. Each Papatipu Rūnanga has their own respective takiwā, and each is responsible for protecting the tribal interests in their respective takiwā, not only on their own behalf of their own hapū, but again on behalf of the entire tribe.

The following Rūnanga hold mana whenua over the project's location, as it is within their takiwā:

- Te Taumutu Rūnanga

2.0 Summary of Proposal

KeaX Limited has applied for resource consent from Selwyn District Council (RC235464) to construct a new solar array (solar farm) on approx. 111 ha.

The activity status is considered discretionary under the Operative Selwyn District Plan, relating to rules 1.7.1.2, 3.15.4, and 5.1.3.

3.0 Consultation Methodology

Mahaanui Kurataiao Limited review the application documents and undertake an assessment of the application against the Mahaanui Iwi Management Plan.

A briefing report is prepared for Kaitiaki representatives who have been mandated by the Papatipu Rūnanga they represent to speak on behalf of hapū on environmental issues.

A Mahaanui Kurataiao Limited staff member meets with Kaitiaki representatives to discuss the application and Kaitiaki provide feedback based on Mātauranga Māori.

The Cultural Advice Report is provided to outline the relevant policies in the Mahaanui Iwi Management Plan and the feedback provided by Kaitiaki representatives.

The relevant policies and Kaitiaki feedback for this application are provided in the following sections of this report.

4.0 Mahaanui Iwi Management Plan 2013

The Mahaanui Iwi Management Plan (IMP) is a written expression of kaitiakitanga, setting out how to achieve the protection of natural and physical resources according to Ngāi Tahu values, knowledge, and practices. The plan has the mandate of the six Papatipu Rūnanga, and is endorsed by Te Rūnanga o Ngāi Tahu, as the iwi authority.

Natural resources – water (waterways, waipuna (springs), groundwater, wetlands); mahinga kai; indigenous flora and fauna; cultural landscapes and land - are taonga to mana whenua and they have concerns for activities potentially adversely affecting these taonga. These taonga are integral to the cultural identity of ngā rūnanga mana whenua and they have a kaitiaki responsibility to protect them. The policies for protection of taonga that are of high cultural significance to ngā rūnanga mana whenua are articulated in the IMP.

The policies in this plan reflect what Papatipu Rūnanga support, require, encourage, or actions to be taken with regard to resolving issues of significance in a manner consistent with the protection and enhancement of Ngāi Tahu values, and achieving the objectives set out in the plan.

The relevant Policies of the IMP to this proposal have been identified as:

5.1 KAITIAKITANGA

TE TIRITI O WAITANGI

K2.3 In giving effect to Te Tiriti, government agencies and local authorities must recognise and provide for kaitiakitanga and rangatiratanga. As the tāngata whenua who hold manawhenua, Ngāi Tahu interests in resource management extend beyond stakeholder or community interests.

Comment: *Kaitiakitanga is fundamental to the relationship between Ngāi Tahu and the environment. It is the intergenerational responsibility and right of tāngata whenua to take care of the environment and resources upon which we depend. The responsibility of kaitiakitanga is twofold: first, there is the ultimate aim of protecting mauri; and second, there is the duty to pass the environment to future generations in a state that is as good as, or better than, the current state.*

5.3 WAI MĀORI

CHANGING THE WAY WATER IS VALUED

WM2.2 To require that water is recognised as essential to all life and is respected for its taonga value ahead of all other values.

WATER QUALITY

WM6.2 To require that water quality in the takiwā is of a standard that protects and provides for the relationship of Ngāi Tahu to freshwater. This means that:

(a) The protection of the eco-cultural system (see Box - Eco-cultural systems) is the priority, and land or resource use, or land use change, cannot impact on that system; and

(c) Ngāi Tahu and the wider community can engage with waterways for cultural and social well-being; and

(d) Ngāi Tahu and the wider community can participate in mahinga kai/food gathering activities without risks to human health.

Discharges

WM6.8 To continue to oppose the discharge of contaminants to water, and to land where contaminants may enter water.

WM6.11 Consented discharge to land activities must be subject to appropriate consent conditions to protect ground and surface water, including but not limited to:

(a) Application rates that avoid over saturation and nutrient loading;

(b) Set backs or buffers from waterways, wetlands and springs;

(c) Use of native plant species to absorb and filter contaminants; including riparian and wetland establishment and the use of planted swales; and

(d) Monitoring requirements to enable assessment of the effects of the activity.

ACTIVITIES IN THE BEDS AND MARGINS OF RIVERS AND LAKES

Riparian areas

WM12.2 To require the protection and restoration of native riparian vegetation along waterways and lakes in the takiwā as a matter of priority, and to ensure that this can occur as a permitted activity.

Rural activities along and in the beds and margins of rivers

WM12.14 To protect the beds and margins of foothill, lowland, and coastal waterways from effects associated with rural land use by requiring a 20 metre buffer or set back area from the waterway, or whatever distance is appropriate to ensure:

(a) Capture of run-off and protection of water quality;

(b) Protection of eco-cultural attributes such as mahinga kai; and

(c) Prevention of stock access to waterways.

WM12.15 Recognising that a 5 metre well-planted buffer along a healthy stream may be as effective as a 20 metre buffer along a degraded waterway, the appropriate size of buffers or set back areas along waterways as per Policy WM12.14 should be based on an assessment of:

(a) The nature of the adjacent land use and therefore risk to waterway health;

(b) The existing state of cultural health of the waterway; and

(c) The existing pressures on the waterway.

DRAIN MANAGEMENT

WM14.1 To require that drains are managed as natural waterways and are subject to the same policies, objectives, rules and methods that protect Ngāi Tahu values associated with freshwater, including:

(a) Inclusion of drains within catchment management plans and farm management plans;

(b) Riparian margins are protected and planted;

(c) Stock access is prohibited;

(d) Maintenance methods are appropriate to maintaining riparian edges and fish passage; and

(e) Drain cleaning requires a resource consent.

Comment: *Wai is a significant cultural resource, connecting Ngāi Tahu to the landscape and culture and traditions of the tūpuna. Wai is a taonga, and a life giver of all things. The protection and enhancement of wai is, therefore, of utmost importance to tāngata whenua. The health and mauri of the wai must be prioritised, giving effect to Te Mana o Te Wai – the fundamental concept in the National Policy Statement for Freshwater Management 2020.*

5.4 PAPATŪĀNUKU

STORMWATER

P6.1 To require on-site solutions to stormwater management in all new urban, commercial, industrial and rural developments (zero stormwater discharge off site) based on a multi tiered approach to stormwater management:

(a) Education - engaging greater general public awareness of stormwater and its interaction with the natural environment, encouraging them to take steps to protect their local environment and perhaps re-use stormwater where appropriate;

(b) Reducing volume entering system - implementing measures that reduce the volume of stormwater requiring treatment (e.g. rainwater collection tanks);

(c) Reduce contaminants and sediments entering system - maximising opportunities to reduce contaminants entering stormwater e.g. oil collection pits in carparks, education of residents, treat the water, methods to improve quality; and

(d) Discharge to land based methods, including swales, stormwater basins, retention basins, and constructed wetponds and wetlands (environmental infrastructure), using appropriate native plant species, recognising the ability of particular species to absorb water and filter waste.

P6.2 To oppose the use of existing natural waterways and wetlands, and drains, for the treatment and discharge of stormwater in both urban and rural environments.

DISCHARGE TO LAND

P8.1 To require that discharge to land activities in the takiwā:

(a) Are appropriate to the soil type and slope, and the assimilative capacity of the land on which the discharge activity occurs;

(b) Avoid over-saturation and therefore the contamination of soil, and/or run off and leaching; and

(c) Are accompanied by regular testing and monitoring of one or all of the following: soil, foliage, groundwater and surface water in the area.

SOIL CONSERVATION

P9.3 To protect the land from induced soil erosion as a result of unsustainable land use and development.

EARTHWORKS

Indigenous vegetation

P11.8 To require the planting of indigenous vegetation as an appropriate mitigation measure for adverse impacts that may be associated earthworks activity.

Erosion and sediment control

P11.9 To require stringent and enforceable controls on land use and earthworks activities as part of the resource consent process, to protect waterways and waterbodies from sedimentation, including but not limited to:

(a) The use of buffer zones;

(b) Minimising the extent of land cleared and left bare at any given time; and

(c) Capture of run-off, and sediment control.

VEGETATION BURNING AND CLEARANCE

P12.5 To require the use of appropriately sized and generous buffers to protect waterways from the vegetation clearance activities.

ENERGY

P17.5 To support in principle the use of wind and solar energy generation in the region (see Section 5.7, Issue TAW1).

Comment: *Papatūānuku is the birthplace of all things of the world and the place to which they return. The protection of the mauri of Papatūānuku, and the enhancement of mauri where it has been degraded, is therefore of upmost importance to Ngāi Tahu. Development activities can compromise the mauri of the land and the life it supports if not managed appropriately. Development activities must adhere to waterway setback rules, implement low impact, innovative, and sustainable solutions to water issues including stormwater management.*

5.5 TĀNE MAHUTA

INDIGENOUS BIODIVERSITY

Integrating indigenous biodiversity into the landscape

TM2.8 To require the integration of robust biodiversity objectives in urban, rural land use and planning, including but not limited to:

(a) Indigenous species in shelter belts on farms;

(b) Use of indigenous plantings as buffers around activities such as silage pits, effluent ponds, oxidation ponds, and industrial sites; and

(d) Establishment of planted indigenous riparian margins along waterways.

Comment: *Ngāi Tahu has a particular interest in indigenous biodiversity, both for its inherent value on the landscape and the ecosystem services it provides, and with regard to mahinga kai. Indigenous flora and fauna have sustained tāngata whenua for hundreds of years, providing food, fibre, building materials, fuel, medicine and other necessities. The relationship between tāngata whenua and indigenous biodiversity has evolved over centuries of close interaction and is an important part of Ngāi Tahu culture and identity.*

5.8 NGĀ TŪTOHU WHENUA

WĀHI TAPU ME WĀHI TAONGA

CL3.1 All taonga within the takiwā of Ngāi Tahu, accidental discovery or otherwise, belong to the Papatipu Rūnanga/ Te Rūnanga o Ngāi Tahu.

Protecting wāhi tapu and wāhi taonga

CL3.8 To require, where a proposal is assessed by tāngata whenua as having the potential to affect wāhi tapu or wāhi taonga, one or more of the following:

(a) Low risk to sites:

(i) Accidental discovery protocol (ADP) - See Appendix 1.

(b) High risk to sites:

(i) Cultural Impact Assessment (CIA);

(ii) Site visit;

(iii) Archaeological assessment, by a person nominated by the Papatipu Rūnanga;

(iv) Cultural monitoring to oversee excavation activity, record sites or information that may be revealed, and direct tikanga for handling cultural materials;

(v) Inductions for contractors undertaking earthworks;

(vi) Accidental discovery protocol agreements (ADP); and/or

(vii) Archaeological Authority from the New Zealand Historic Places Trust.

CL3.9 To support a range of methods to protect sites identified as wāhi tapu and wāhi taonga, including but not limited to:

(a) Registration with Historic Places Trust as wāhi tapu or wāhi tapu area;

(b) Covenants (e.g. heritage, open space);

(c) Heritage orders;

(d) Designation as Historic Reserve or local purpose reserve, under the Reserves Act 1977;

(e) Tribally developed ‘hot zones’, Heritage Risk Models or Heritage Alert Layers to protect wāhi tapu, wāhi taonga and archaeological sites; and

(f) Methods to protect and restore cultural landscapes, as per Policy CL1.7.

Comment: *Wāhi tapu and wāhi taonga are sites and places that are culturally and spiritually significant to tāngata whenua history and identity. These include sites such as urupā, pā, midden, umu, urupā, tauranga waka, and places where taonga have been found.*

6.11 TE WAIHORA

CULTURAL HEALTH OF TE WAIHORA

TW4.1 To require that the management of land and water in the Te Waihora catchment recognises and provides for the relationship between catchment land use, tributary flow, drain management, water quality, the coastal environment and the cultural health of Te Waihora.

CULTURAL HEALTH OF LOWLAND WATERWAYS AND GROUNDWATER

TW7.1 To require that the restoration of water quality in lowland streams is addressed as a matter of priority in the takiwā, to enable Ngāi Tahu and the wider community to fish, swim and engage with our waterways as we once did.

Comments: *Te Waihora is a tribal taonga representing a major mahinga kai and an important source of mana. For the last 160 years, management of the lake and its catchment has reflected farming and settlement values, at the expense of Ngāi Tahu values. The effect of intensive land use on the lake, waterways and groundwater in the catchment is a key concern for tāngata whenua. A focus on Te Waihora is the means to 'drive change from the bottom up'. Resolving the issues required to restore the cultural health of Te Waihora will ultimately restore the cultural health of the wider catchment.*

4.1 Guidance to Avoid, Remedy, or Mitigate any Effects on Cultural Values

The above policies from the Mahaanui IMP provide a framework for assessing the potential adverse effects of the proposed activity on cultural values and provide guidance on how these effects can best be avoided, mitigated, and/or remedied.

As per Section 5.4 in the Mahaanui IMP, earthwork is a significant issue as they can have adverse impacts on the environment through erosion and sedimentation and can damage or destroy Māori artefacts or wāhi taonga. Policy P11.9 states that stringent and enforceable controls must be in place for land use and earthwork activities to protect waterways and waterbodies from sedimentation. All erosion and sediment controls installed must be constructed, inspected, and maintained in accordance with Environment Canterbury's *Erosion and Sediment Control Toolbox*. These measures must ensure the protection of nearby water bodies such as the water races along the property boundary on Branch Drain Road and Buckleys Road. Where measures prove to be inadequate, works must cease until appropriate and effective measures are in place.

Any activity that involves land disturbance has the potential to uncover or damage previously unrecorded Māori artefacts or taonga. To ensure the protection of taonga and Māori archaeological sites, an Accidental Discovery Protocol (Appendix 1) must be in place during all earthwork activities. This protocol outlines the procedures to be followed if culturally sensitive material is uncovered.

Wāhi tapu and wāhi taonga are sites and places that are culturally and spiritually significant to tāngata whenua history and identity, and include sites such as urupā, pā, midden, umu, urupā, tauranga waka, and places where taonga have been found. Mana whenua have the right to identify any site as a wāhi tapu or wāhi taonga, and have the discretion as to how these sites are protected, including the right to identify sites that must be protected from development. Therefore, the proposed fencing of the 50 m buffer zone surrounding the protected wāhi taonga site must be established and maintained. Any form of ground disturbance must not take place within this buffer zone for the protection of wāhi taonga values.

The decline in water quality in the takiwā because of the continuing practice of using water as a receiving environment for the discharge of contaminants and waste, and unsustainable rural and urban land use is one of the most significant natural resource issues for tāngata whenua. To protect water quality, measures must be in place to ensure oil spills, or any other hazardous substances are avoided. This includes avoiding refuelling machineries in areas where spills may enter surface water.

Drains are a common feature across Ngā Pākihi Whakatekateka o Waitaha, given that much of the land in lower catchment areas was originally swamp. An extensive network of drains provides flood protection for settlement and land use. Some of these drains are modified natural waterways, and many connect or empty into existing waterways and waterbodies. For this reason drain management is an important kaupapa for tāngata whenua. While drains may not be highly valued in the wider community, drains that function as mahinga kai habitat and where mahinga kai resources are gathered may be identified as wāhi taonga by Ngāi Tahu. The Applicant is therefore required to plant and maintain a riparian buffer of indigenous vegetation on-site to mitigate the impacts of earthworks and on-going operations for the protection of the water races. The riparian buffer must be densely planted as an erosion and sediment control measure for both construction and operational phases. Additionally, earthworks must not occur within 10 m of the water races (at a minimum) that runs adjacent to the Branch Drain Road and Buckleys Road boundaries. Further, overland flow must be directed away from water races.

Indigenous biodiversity, and landscapes and ecosystems that support it, is a fundamental part of the culture, identity and heritage of Ngāi Tahu. Planting of indigenous species provides a range of benefits such as the sequestation of carbon and the binding of soil – all of which support a healthy environment. The Applicant must therefore replace fast-growing exotic plantings with indigenous eco-sourced plants over time. Existing indigenous vegetation onsite must also not be cleared to the greatest practical extent. If indigenous plant(s) must be cleared, the Applicant must replace one with two indigenous plants via transplantation (or other methods) at or around the site as an environmental offset measure. Kaitiaki also support the recommendations made in the Ecological Impact Assessment for the protection of indigenous species.

To avoid the loss of chemicals from the solar panels over time, the Applicant must undertake 6 monthly checks (at a minimum) on the panels for any signs of damage that could allow leakage of internal chemicals. Contaminated material can have adverse effects on the environment through leaching of contaminants into groundwater and surrounding surface waters and can have impacts on Ngāi Tahu cultural associations (especially as this site contains wāhi taonga).

Land use and development activities in the takiwā must be managed in way that works with the land and not against it. Papatūānuku sustains the people, and the people must in turn ensure their actions

do not compromise the life supporting capacity of the environment. The cultural, social and economic wellbeing of people and communities is dependent on a healthy and resilient environment. Soil is a fundamental resource, and together with air and water, is the basis on which life depends. Land use, subdivision and development activities must have appropriate controls to avoid over-saturation, contamination, and erosion of soils. Therefore, Consent Conditions 10, 12, and 14 to 16 have been provided.

The practice of discharging sewage into waterways and the marine environment is highly offensive for tāngata whenua, as these areas are, or are connected to, mahinga kai or food gathering areas. Therefore, the effluent tank proposed onsite must be located away from permanent or temporary surface water flow paths and must be located where they will not be inundated by stormwater.

Stormwater runoff from urban, industrial and rural environments can have significant effects on water quality and waterway health. Improving stormwater management requires on site, land-based solutions to stormwater disposal, alongside initiatives to reduce the presence of sediments and contaminants in stormwater, and reducing the volume of stormwater requiring treatment. Low impact development and low impact urban design are fundamental features of sustainable stormwater management. Aligning stormwater treatment and disposal with best practice methods will have an overall benefit to water quality. Just because a waterway is degraded does not mean it is acceptable to use it for the disposal and treatment of stormwater. Therefore, all hard areas must have an appropriate mechanism in place to capture heavy metals.

5.0 Rūnanga – Affected Party or Not

The Kaitiaki representatives of Te Taumutu Rūnanga have reviewed this application and provided the consent conditions and advice notes outlined in Section 6.0 to align this proposal more closely with the provisions in the Mahaanui IMP. If the consent conditions are provided for, the Rūnanga will not consider themselves to be an adversely affected party.

6.0 Consent Conditions

If a resource consent is granted, the following conditions are recommended to mitigate the effects of this proposed activity on mana whenua values:

1. All erosion and sediment control measures installed must be constructed, inspected, and maintained in accordance with Environment Canterbury's *Erosion and Sediment Control Toolbox* for Canterbury.
    a. If the erosion and sediment controls prove to be inadequate, works must cease until appropriate and effective measures are in place.
2. An Accidental Discovery Protocol must be in place for the entirety of works and all contractors made familiar with this protocol as per policy CL3.8 in the MIMP.
3. All practicable measures must be taken to avoid spills of fuel or any other hazardous substances within the site. These measures shall include:

a. Refuelling of machinery and vehicles must not occur within 20 metres of:
    i. Open excavations; or
    ii. Surface water bodies.
b. Storing fuel securely or removing fuel from site overnight.
c. A spill kit must be kept on site that is capable of absorbing the quantity of oil and petroleum products that may be spilt on site at any one time, remains on site at all times.
d. In the event of a spill of fuel or any other hazardous substance, the spill must be cleaned up as soon as practicable, the area must be inspected and cleaned, and measures taken to prevent a recurrence.

4. The Applicant is required to plant and maintain a riparian buffer of indigenous vegetation on-site to mitigate the impacts of earthworks and on-going operations.
5. The Applicant must replace fast-growing exotic plantings with indigenous eco-sourced plants over time.
6. The riparian buffer must be densely planted as an erosion and sediment control measure for both construction and operational phases.
    a. The Applicant must use indigenous eco-sourced plants to the greatest practical extent.
7. The proposed fencing of the 50 m buffer zone surrounding the protected Wāhi Taonga site must be established and maintained. Any form of ground disturbance must not take place within this buffer zone for the protection of Wāhi Taonga values.
8. Earthworks must not occur within 10 m of the water races (at a minimum) that runs adjacent to the Branch Drain Road and Buckleys Road boundaries.
9. Existing indigenous vegetation onsite must not be cleared to the greatest practical extent. If indigenous plant(s) must be cleared, the Applicant must replace one with two indigenous plants via transplantation (or other methods) at or around the site as an environmental offset measure.
10. During works, the consent holder must adopt the best practicable options to:
    a. Minimise soil disturbance and prevent soil erosion.
    b. Avoiding placing cut or cleared vegetation, debris, or excavated material in a position such that it may enter surface water.
11. To avoid the loss of chemicals from the solar panels over time, the Applicant must undertake 6 monthly checks (at a minimum) on the panels for any signs of damage that could allow leakage of internal chemicals.
12. Regular inspection and maintenance of land for erosion must be undertaken. Where land appears to be eroding, repair must be undertaken.
    a. This must include regular monitoring and maintaining healthy groundcover.
13. Overland flow must be directed away from water races.
14. The area of land left bare at any time during construction and operational phases must be kept to a minimum to reduce erosion, minimise stormwater run-off and protect waterways from sedimentation.

a. The sowing of shade-tolerant grass variants can be considered if shading from solar panels is a concern.

15. Periodic inspection of the drip line of solar panels (particularly after a period of wet weather or in the event of a significant snow melt), must be undertaken to check for signs of soil erosion, and where necessary repair or install a protection layer.
16. The bottom edge of the solar panels must be kept to less than 3m above the ground surface to avoid erosion of soil under the drip line of the panel, or alternatively reinforcing the ground to protect soil beneath the drip line from erosion.
17. The effluent tank proposed onsite must be located away from permanent or temporary surface water flow paths and must be located where they will not be inundated by stormwater.
18. All hard areas must have an appropriate mechanism in place to capture heavy metals.

The following advice notes must be included in final decision:

19. Kaitiaki support the recommendations made in the Ecological Impact Assessment for the protection of indigenous species, including:
    a. Where internal shelterbelts are to be cleared, this should occur outside of the main bird breeding season (September – January) to avoid any risk of impacts to nesting protected indigenous birds.

    b. Construction of solar panel arrays should occur outside of the main bird breeding season (September – January), to avoid adverse effects to breeding indigenous birds in general, but particularly because there is some chance that an At Risk species (e.g., South Island pied oystercatcher, SIPO) may breed in pasture areas of the site.

On behalf of Mahaanui Kurataiao Ltd, this report has been prepared by Irene Setiawan | Mahaanui Kurataiao Ltd Environmental Advisor, and peer reviewed by Megan Hickey | Mahaanui Kurataiao Ltd Senior Environmental Advisor.

Date: 14th September 2023

Appendix 1: Accidental Discover Protocol (ADP)

PRIOR TO COMMENCEMENT OF ANY WORKS, A COPY OF THIS ADP SHOULD BE MADE AVAILABLE TO ALL CONTRACTORS WORKING ON SITE.

Purpose

This Accidental Discovery Protocol (ADP) sets out the procedures that must be followed in the event that taonga (Māori artefacts), burial sites/kōiwi (human remains), or Māori archaeological sites are accidentally discovered. The Protocol is provided by Te Taumutu Rūnanga. Te Taumutu Rūnanga are the representative body of the tangata whenua who hold mana whenua in the proposed area.

Background

Land use activities involving earthworks have the potential to disturb material of cultural significance to tangata whenua. In all cases such material will be a taonga, and in some cases such material will also be tapu. Accidental discoveries may be indicators of additional sites in the area. They require appropriate care and protection, including being retrieved and handled with the correct Māori tikanga (protocol).

Under the *Heritage New Zealand Pouhere Taonga Act 2014*, an archaeological site is defined as any place associated with pre-1900 human activity, where there is material evidence relating to the history of New Zealand. It is unlawful for any person to destroy, damage or modify the whole or any part of an archaeological site (known or unknown) without the prior authority of the Heritage New Zealand Pouhere Taonga (HNZPT). This is the case regardless of the legal status of the land on which the site is located, whether the activity is permitted under the District or Regional Plan or whether a resource or building consent has been granted. The HNZPT is the statutory authority for archaeology in New Zealand.

Note that this ADP does not fulfil legal obligations under the Heritage New Zealand Pouhere Taonga Act 2014 regarding non-Māori archaeology. Please contact the HNZPT for further advice.

Immediately following the discovery of material suspected to be a taonga, kōiwi or Māori archaeological site, the following steps shall be taken:

1. All work on the site will cease immediately.
2. Immediate steps will be taken to secure the site to ensure the archaeological material is not further disturbed.
3. The contractor/works supervisor/owner will notify the Kaitiaki Rūnanga and the Area Archaeologist of the HNZPT. In the case of kōiwi (human remains), the New Zealand Police must be notified.
4. The Kaitiaki Rūnanga and HNZPT will jointly appoint/advise a qualified archaeologist who will confirm the nature of the accidentally discovered material.

5. If the material is confirmed as being archaeological, the contractor/works supervisor/owner will ensure that an archaeological assessment is carried out by a qualified archaeologist, and if appropriate, an archaeological authority is obtained from HNZPT before work resumes (as per the *Heritage New Zealand Pouhere Taonga Act 2014*).

6. The contractor/works supervisor/owner will also consult the Kaitiaki Rūnanga on any matters of tikanga (protocol) that are required in relation to the discovery and prior to the commencement of any investigation.

7. If kōiwi (human remains) are uncovered, in addition to the steps above, the area must be treated with utmost discretion and respect, and the kōiwi dealt with according to both law and tikanga, as guided by the Kaitiaki Rūnanga.

8. Works in the site area shall not recommence until authorised by the Kaitiaki Rūnanga, the HNZPT (and the NZ Police in the case of kōiwi) and any other authority with statutory responsibility, to ensure that all statutory and cultural requirements have been met.

9. All parties will work towards work recommencing in the shortest possible time frame while ensuring that any archaeological sites discovered are protected until as much information as practicable is gained and a decision regarding their appropriate management is made, including obtaining an archaeological authority under the *Heritage New Zealand Pouhere Taonga Act 2014* if necessary. Appropriate management may include recording or removal of archaeological material.

10. Although bound to uphold the requirements of the Protected Objects Act 1975, the contractor/works supervisor/owner recognises the relationship between Ngāi Tahu whānui, including its Kaitiaki Rūnanga, and any taonga (Māori artefacts) that may be discovered.

IN DOUBT, STOP AND ASK; TAKE A PHOTO AND SEND IT TO THE HNZPT ARCHAEOLOGIST

Contact Details

HNZPT Archaeologist: (03) 357 9615 archaeologistcw@historic.org.nz

HNZPT Southern Regional Office (03) 357 9629 infosouthern@historic.org.nz

HNZPT Māori Heritage Advisor (03) 357 9620 mhadvisorcw@historic.org.nz

Kaitiaki Rūnanga:

Te Taumutu Rūnanga: 03 371 2660, taumutu@ngaitahu.iwi.nz