BEFORE THE	**Selwyn District Council Hearing Commissioner**
IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of Resource Consent Application by **KeaX Limited** in relation to RC235464 – Solar array at 115 and 187 Buckleys Road, Leeston.

STATEMENT OF EVIDENCE BY ISOBEL STOUT

1.0 Qualifications and Experience

1.1 My full name is Isobel Louise Stout. I am Service Leader - Environmental Science at Pattle Delamore Partners Limited (PDP) which I joined in April 2023.

1.2 I hold a Bachelor of Science degree and Post Graduate qualifications in both Public Health and Environmental Health. I am a past President of the New Zealand Institute of Environmental Health and am now a Life Member and Fellow of that organisation. I am a Certified Environmental Practitioner (Reg no.1732).

1.3 I was employed at Christchurch City Council in the roles of Environmental Health Officer (6 years) and then Senior Environmental Health Officer for a total of 33 years. I have reported on numerous resource consent applications during my time at Council including giving evidence to both the District Court and the Environment Court on the potential adverse effects of noise and contaminated land as well as electromagnetic radiation, light spill and hazardous substances as appropriate.

1.4 Whilst this is not an Environment Court hearing, I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. I have complied with it in preparing this evidence and I agree to comply with it in presenting evidence at this hearing. The evidence I give is within my area of expertise except where I state that my evidence is given in reliance on another person's evidence. I have considered all material facts that are known to me that might alter or detract from the opinions that I express in this evidence.

2.0 Scope of Evidence

2.1 This evidence covers my expert assessment for the Selwyn District Council's section 42A report on the limited notified land use consent referenced RC235464, and in particular addresses the potential adverse effect of electromagnetic fields, and contaminants that may be released to air, soil or water.

2.2 I have read and used the following documents in preparing this evidence:

- The application document "Buckleys Solar Array" dated 9 August 2023
- Appendices 2, 4, 5, 6, 7, 12, 13, 14, 15 and 17 to the application.
- The eight submissions received by Selwyn District Council after limited notification of the application.

3.0 Evaluation of The Proposal

3.1 KeaX Ltd seeks land use consent for a solar array of approximately 111 ha on farmland currently used for dairying. The installation includes accessory equipment such as inverters, transformers and batteries (possibly) as well as the arrays of photovoltaic (PV) panels.

3.2 To aid Selwyn District Council in understanding how concerns raised by submitters are linked to the proposal it is helpful to describe how a solar array generates electricity and what is involved in sending that electricity into an existing network.

3.3 Most of the array is made up of the flat panels, mounted on supports so they can tilt to follow the sun across the sky from east to west. Each panel is made up of rows of individual cells. Each cell is a photovoltaic (PV) 'sandwich' made up most commonly of crystalline silica and sealed into an encapsulated module. The cells are linked with metal strips to conduct the electricity that is generated when the photons from sunlight hit the semiconducting silicon. Each set of cells is further sealed into a flat panel frame to protect them from the weather, typically the panel is made of an aluminium frame with a specialty glass surface.

3.4 The panels need to be mounted securely; the application shows galvanised steel piles.

3.5 The electricity then needs to be converted from 'direct current' DC to 'alternating current' AC, and the voltage adjusted to meet the needs of the network it connects to. This is the role of the inverters and transformers.

3.6 There is an existing substation at the intersection of Buckleys and Branch Drain Roads. This will be the network input point for the electricity generated by the solar array.

3.7 The surrounding land is flat plain, predominantly pasture farmed and currently used for dairying. Residential houses, farm buildings and pivot irrigators are widely spaced in conjunction with each farm unit. Local roads, often with hedgerows connect the farms.

4.0 Issues arising in submissions.

4.1 Eight submissions were received by Selwyn District Council, seven opposed to the proposal and one in support.

4.2 The seven submissions in opposition all raised similar concerns about adverse effects from;

- leaching or release of contaminants, principally metals, into the ground, stormwater and air, and
- the electromagnetic fields that will be generated

5.0 Leaching of contaminants

There are three potential sources of contaminants, the PV panels, the support frames they are mounted on and the inverter/transformer modules.

PV Panels

5.1 Submitters are concerned there are toxic compounds used in the manufacture of the PV cells in this proposal and that these may escape into the environment. There are three main types of PV cells on the current market and one type known as 'thin film' do contain particularly toxic metals such as cadmium. The type of PV cell to be used in this proposal is not stated but it is mostly likely to be a crystalline silicon type that dominates current global sales.[1]

5.2 There is evidence that metals used in the production of the proposed cells may be released when broken up for recycling or broken up in landfills but with proper maintenance as described in the application the sealed units are not a risk to the environment. The potential for panels to break/break up when installed is more so a natural hazard risk assessment, but it is valuable to note the site is not within a High Wind Zone, tornados are not common, yet the structural integrity of the panels needs to withstand hailstorms and snow loadings to avoiding any breakage.

5.3 The possible release of the PFAS family of compounds (most commonly found in firefighting foam) is raised. It is possible related compounds were used to repel water and dirt from panels, but they were not PFAS itself which has now been banned. The panels will be readily accessible from the ground should they need cleaning as part of the regular maintenance schedule.

Support Frame

5.4 The example photograph in the application shows support frames of galvanised steel. The galvanising process is essentially a zinc coating on the steel to prevent the steel rusting. Zinc may leach into the soil, mostly where in direct contact with it, and where the soils are particularly acidic.

[1] https://www.iea.org/energy-system/renewables/solar-pv

5.5 Zinc is an essential trace element and not a priority contaminant in soils in New Zealand.[2] There is no maximum acceptable value for zinc in drinking water.[3] Metals such as zinc bind well to soil particles and are not especially soluble in this form and therefore not dissolved readily into storm or ground water. Zinc directly discharged to water however is harmful to aquatic ecology but that is not occurring in this situation.

5.6 The zinc metal itself will not be worn off on to animals that may rub against the support frame nor be absorbed in feed in any concentrations of concern. Zinc sources will already be present on most farms in corrugated iron, yards, gates, and water pipes for example and arguably offers a more environmentally sustainable option for support structures compared with copper, chrome, arsenic (CCA) treated timber or concrete.

Inverters, transformers and batteries

5.7 The equipment described in the application as a 'single skid' and a 'double skid' inverter is a set of connected components all mounted on the same base for ease of transport and installation.

5.8 The set is likely to comprise the inverter to take electric power from DC to AC and a transformer to take the power to the desired voltage. A double skid being two singles 'bolted' together. Transformers contain oil and are typically built with alarmed safety systems to prevent leakage and fire.

5.9 A battery energy storage system (BESS) is a possible addition to this proposal. The batteries are likely to be lithium and will be housed in a separate container that most likely will contain fire detection and suppression systems as standard equipment.

5.10 Lithium fires are a known hazard, and so for a BESS, the risk of fire can be readily avoided or contained.

6.0 Release of contaminants into the air

6.1 Contaminants from PV cells are only likely to be released to the air in a fire. There are numerous codes of practice and standards that must be followed in the installation of any electrical equipment not just solar arrays, as detailed in the application.

6.2 Solar panels have been involved in fires, incorrect installation and poor maintenance being the most common causes and most often in domestic rooftop situations.

[2] www.mfe.govt.nz
[3] www.taumataarowai.govt.nz

7.0 Electromagnetic fields

7.1 An electric field exists around an electric charge whether that charge is positive or negative, at rest or moving. When electric charges move, along a wire for example, a magnetic field is produced. These fields are not carrying energy away from the wire in the way energy is carried away from the sun or a light bulb or a radio transmitter, so it is not 'radiation' as such.

7.2 The field strengths drop away very quickly with distance from the moving charges. Field strengths can readily be measured, and this has been done for similar solar arrays in New Zealand to this one. The strongest fields will be around the parts of the system where the electric charges converge at the inverters and transformers. The field strengths will also be larger around higher voltage lines than lower voltage ones.

7.3 The potential for adverse health effects from exposure to electromagnetic fields has been studied for many years. The key question remaining seems to be whether long term average exposure to relatively high electromagnetic fields increases the risk of leukaemia in children. The World Health Organisation and other reviewers have concluded that the evidence is too weak to suggest a causal relationship.

7.4 The proposed solar array would make no appreciable difference to the environment beyond the site and may be too weak to effectively measure at the boundary of the site. The same reduction in field strength exists above the array and so no adverse effect would be expected for birds or bees as is the same for existing electrical infrastructure such as the substation.

7.5 One submission mentioned solar waves and another the potential for localised heating effects. Whilst not the same as electromagnetic fields this is likely a reference to effects of reflected sunlight.

7.6 There is some literature on air temperatures being raised for some meters above solar arrays. The same effect occurs over sealed carparks. In a flat surrounding environment like Brookside (Leeston) any temperature change that may be created very locally would not have an effect on the open space beyond the site.

7.7 Sunlight is a waveform, the panels are described as having a reflectivity of 4% so some of that sunlight will be reflected. Light reflected from a flat surface is likely to be polarised and the concern seems to be about how this may affect flying insects. There would be many sources of reflected light in the environment already with no particular effects noted.

8.0 Conclusion

8.1 The concerns raised by submitters are valid, but it is important to assess the actual effects known, and the degree of those actual effects, as well as the potential effects, including the likelihood of those potential effects occurring. If the risks were significant enough, this application could benefit from a risk-based assessment.

8.2 With the regulated controls in place regarding electrical installations the level of adverse effect from the solar array from contaminants and electromagnetic fields is less than minor.

Isobel Stout
1 February 2024