

APPENDIX O SHEEP GRAZING VEGETATION MANAGEMENT TRIAL REPORT



SHEEP GRAZING VEGETATION MANAGEMENT TRIAL REPORT – NUMURKAH SOLAR FARM

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1 EXECUTIVE SUMMARY

A long term sustainable and cost-effective method to control vegetation (grasses & weeds) within the Numurkah solar farm boundary was proposed in April 2019 as an alternative to slashing and mowing for managing the vegetation of the solar farm. Mowing is highly time consuming and can take up to 3 weeks to mow the entire solar farm. The solar farm also has a regulatory requirement included in the development application from the CFA (Country Fire Authority Victoria) to maintain grass fuel loads during the fire danger period at less than 100mm in height. Given the seasonal growth in this region of Victoria it could take several mows to effectively manage the on-site vegetation to these requirements. As a result, Downer and the client agreed to conduct a sheep grazing trial as an alternative vegetation management option.

The practice of managing vegetation through grazing is a relatively new concept for Australian solar generators with little publicly available information on the risks involved. A cautious two stage trial was agreed to with Neoen to measure the benefits of grazing while carefully managing the risks. In addition to examining the efficacy of managing the on-site vegetation the trial also allowed for the demonstration of “dual use solar farming” to show that grazing could still occur on land developed for solar projects.

The primary advantages of utilising a grazing strategy over a mechanical means were identified as being;

- Reduced machine operation and purchase costs,
- Slashing leaves residual cuttings to blow across site which does not alleviate our fire risks and may impug on panel efficiencies.
- Demonstrates commitment to sustainable partnerships with local community members.
- Zero cost establishment for O&M; as graziers are responsible under agreement for purchase of livestock, installation of all fencing and any ancillary equipment and animal husbandry costs.
- Zero fee agistment of solar farm lands for farmers in return for mutually beneficial grass management.
- Sustainable and long-term evidence of partnerships between Numurkah Solar Farm and primary producers.

For the purposes of the trial a local grazier was approached by Downer to assist with conducting the trial in line with community engagement protocols.

Stage 1 of the trial began in April 2019 following a comprehensive risk assessment. The first stage trial included 300 sheep in an adjacent paddock to the solar farm (Fig 7, Sheep 1 area) and involved measuring the time it took for the sheep to graze a 120 acre parcel of land. The area also included a number of “dummy panels” in the area to ascertain if the sheep would eat the cables. This first stage of the trial was concluded after 3 weeks with vegetation eaten to just above ground level and with no impacts to the equipment.

Following the successful first stage, the second stage of the trial was authorised in July 2019 and focused on having the flock within the solar farm in a contained area of approximately 80 acres (Fig 7 Sheep 2 area) the focus of the second trial was to assess the impact of the sheep to the installed infrastructure on a larger scale (as grazing times had already been established in trial 1). For this trial a 148 sheep were introduced and later increased to 376 a week later. Grazing in this area from initial introduction of the first 148 sheep took 2.5 weeks. During the trial daily inspections for both the welfare of the sheep and infrastructure were performed.

Throughout both the trial stages the amount of feed was assessed and monitored continuously to ensure the animals would not be left without feed and contingency plans were in place to relocate all of the sheep on short notice in the event of low feed levels or cancellation of the trial being due to equipment damage.

2 STAGE-1 INITIAL TRIAL

A comprehensive risk assessment (RA) was conducted and approved by both Downer and Neoen to proceed in utilising sheep for vegetation management within the fenced boundaries of the solar farm. This RA covered all foreseen aspects of the trial including:

- Weed and parasite introduction
- Damage to vegetation
- Animal losses & animal husbandry
- Breed of sheep

- Impacts on equipment

A 3 week limited trial was conducted outside the solar farm with 300 Merino sheep to ascertain the level of reduction in fuel, with limited “Dummy arrays” placed in situ also to ascertain if the sheep would cause damage to panels, trackers or wiring.

Medium frame Merino sheep were chosen for the trial since they do not tend to raise their heads above their backline (impacts on PV modules), and do not jump unlike other breeds of sheep such as Dorper’s, Goats etc.

In accordance with Downer weed and seed control requirements contained within the environmental management plans to prevent the introduction of foreign weeds and also parasites; The sheep were drenched prior to being brought to the district and were grazed on another local farm during the drench withholding period to ensure they had cleared their bowels of any introduced non local seeds, grasses and parasites.

Daily checks of the grazing area were conducted with a focus on animal welfare and vegetation height. Following the trial secondary checks examined the trial area for the introduction of any weeds or non-native grasses.

The trial concluded with positive vegetation management results with no discernible impact to the generation “infrastructure” and no evidence of introduction of any non-local vegetation (weeds & grasses).

3 STAGE-2 TRIAL

A second trial within the solar farm was given client approval in July 2019. The area around PCU09 (Fig 1) was temporarily fenced off for the trial. PCU09 was chosen for the Stage 2 trial because the area was easy to fence and would be easier assess pre and post-trial impacts on vegetation.

The Stage 2 trial involved using sheep to manage the vegetation around actual operating equipment rather than “dummy arrays” for a period of 3 weeks. The Stage 1 RA was amended to account for the operating equipment and the trial began with 148 Merino sheep which was increased to 376 sheep 7 days later.

Sheep welfare Inspections were conducted twice each day during the trial along with daily walkdowns of the equipment within the trial area looking for any damage or other issues caused by the sheep.

During the trial periodic status reports were supplied to both Downer and Client management for review; No damage or impacts were noted during the 3 week trial period.

The height of the vegetation within PCU 09 at the beginning of the trial varied from ground level to 1.2m tall dependent upon the species of grass/weed. An average of 600mm height was established as the baseline prior to the introduction of the sheep. A noticeable reduction in foliage throughout the PCU area was observed following the 3 week trial period with an average post trial height of 100mm to 200mm (70-80% in vegetation height).

The following observations and opportunities for improvement were observed.

- Sheep can pass under panels easily without posing risk of contact even when the arrays are fully tilted at 52° (Fig 2 & 4).
- Exposed DC bus cables & IPC wiring was untouched by sheep despite evidence of grazing immediately below the modules and around the area (Fig 3).
- The sheep quickly adjusted to sudden starts of drivelines and are not startled.
- No damage was noted on any of the equipment including drivelines.
- No evidence of wool transfer or residue on any equipment/ infrastructure from rubbing or contact from by the sheep was observed.
- A reduction in vegetation of approximately 70-80% within the trial area (approximately 50 acres) during the 3 week trial.
- Sheep may reduce their calorific requirements as they approach full term and begin lambing; which could impact the amount of vegetation consumed (Slashing may have to make up these areas that are not controlled by the time the ewes begin lambing)
- No impacts to installed infrastructure have been noted.

4 FUTURE CONSIDERATIONS

- The Stinging nettle has not grazed during the trial and is now the main vegetation left in the Stage 2 trial area. The sheep will only eat it after it has died, which will require the use of a broadleaf herbicide, and a subsequent grazing withholding period of 10 days before resuming grazing. The use of a broadleaf herbicide is permitted under our vegetation management plan. A herbicide weed control program should be performed prior to the agistment of livestock (including allowance for any grazing withholding periods) to manage the Stinging nettle.
- Engagement with local graziers prior to construction to establish responsibilities and requirements (who is purchasing animals, purchase and erection of fences, provision of animal husbandry, vegetation improvement/seeding) prior to construction.
- Due to construction activity there were some sparse areas of grass coverage both within the rows and other areas of the farm which have proved difficult to sow and establish a seed bank due to access requirements for agricultural machinery. To mitigate this issue for future projects it would be highly beneficial to have agistment agreements in place prior to construction activities (above point) with scope for the engagement of the graziers prior to early works commencing. This would allow for a more thorough stepped approach to projects utilising grazing. The steps being;
 - Weed control spray prior to construction,
 - Sow appropriate seed throughout areas prior to infrastructure placement to ensure seed bank is in place,
 - Construct project,
 - Pastures will start to develop from the seeded areas as construction activity reduces
 - O&M/Grazing

The above stepped approach would enable immediate grazing once construction has completed and reduce potential for grasses to have become out of control requiring mowing and grazing to initially manage the fuel loads.

- In areas that need re-vegetation following construction sowing a clover species of grass should be considered. Not only does clover have a lower overall height (150mm max) than other grasses such as Wimmera rye grass which can grow to 1,200 mm tall and is prevalent onsite. The lower overall height will reduce the fire risk during summer but will also choke out invasive species such as nettles and marshmallow weed.
- If grazing is contemplated for future solar projects the livestock fencing should be incorporated into the overall design to ensure livestock fencing does not impede array access. We were fortunate to be able to use existing channel banks that set back from the array edges to align our fences to avoid array access issues.

5 CONCLUSION

The results of the sheep grazing trial show that it was successful in managing the vegetation without causing damage or otherwise impacting operations of the solar farm. The success of the trial is largely due to the high level of planning and thorough Risk assessment (RA) that was undertaken prior to the trial. This ensured a well-considered implementation and stringent monitoring practices to ensure the welfare of the sheep and the integrity of the equipment during the trials.

The success of this trial could be replicated amongst other solar farms that are either already operating or under development.

APPENDIX A – IMAGES OF RESULTS OF TRIAL



Figure 1 Sheep grazing



Figure 2 Sheep grazing while underneath panels



Figure 3 Ground disturbance and evidence of proximity without damage to infrastructure.



Figure 4 Sheep under tilted panels

Fig 5a Before and after comparison (at 1.5 weeks post introduction)



Figure 5 Height difference of rye grass height before and after sheep grazing. 400mm of left, 150mm on right



Figure 6a (left) & 6b (right) Vegetation height comparison at 3 weeks with pen for scale.

Non-Grazed side 500mm Avg. Height. Grazed side 35-50mm Avg. Height



Figure 7 Proposed fence/gate areas