

30 January 2020

Attention: Sarah Hillis
NGH Consulting
35 Kincaid Street (PO Box 5464)
Wagga Wagga NSW 2650
sarah.h@nghconsulting.com.au
BY EMAIL

Dear Sarah

Re: Land and Soil Capability (LSC) Assessment – Proposed Jindera Solar Farm

I refer to the written instructions from yourself to undertake an inspection and assessment of the area mapped as Class 3 LSC (OEH, 2012) at the proposed Jindera Solar Farm, referred to as the subject site. This assessment is for the use only of NGH Consulting for assessment purposes and is not to be relied upon for any other purpose. No responsibility is accepted to any third party who may use or rely on the whole or any part of the content of this assessment. This letter format report has been prepared to minimise the cost to the client however, comprehensive reports can be prepared at an additional cost if required. Please find as follows a summary of the inspection and assessment.

1. DM McMahon Pty Ltd (McMahon) was engaged by Sarah Hillis of NGH Consulting to undertake an inspection and assessment of the area mapped as Class 3 LSC at the subject site. David McMahon of McMahon is a certified expert in soil and geomorphological assessment with over 20 years' experience and multiple scientific qualifications and industry memberships. Based on the findings of the site inspection and assessment the following applies.

2. The context and application of the LSC mapping is largely for:

- a) Regional assessment of land capability.
- b) The assessment of land capability for broad-scale, dry-land agricultural land use.
- c) The intended usage of the LSC mapping is for strategic regional land-use plans and to provide a guide to the capability of the land and the broad identification of soil management problems.
- d) The LSC mapping is broad-scale and should only be used at the scale of the soil map datasets that underpin the maps. These maps are not suitable for site assessment at the property scale.

3. The LSC mapping is based on the best soil maps (soil landscapes, reconnaissance soils mapping, land systems) available at the time of production, plus expert local knowledge where available. The Class 3 LSC mapping at the subject site is based on Kindra SLAM Land Condition Summary for Murray (OEH, 2010) at a 1:250,000 scale. The Kindra soil landscape has been mapped with a very low confidence which is described as *"broad mapping, landscape and soil properties estimated, minimal soil profile data (less than 2 soil profiles) and no laboratory data"* (OEH, 2010).

3. When an initial LSC determination does not match known or indicative conditions of the landscape or soils, expert knowledge is used to record a modified LSC class that overrides the original assessment. The original value and reasons for the change are documented. This provides a mechanism to refine the logic/decision tables based on applied usage and

feedback in a process of continual improvement. As such a property scale assessment-based decision-based approach outlined in Section 5 of OEH (2012), has been undertaken and outlined in this letter format report.

4. McMahon conducted a detailed soil survey across the subject site in 2018 with 15 soil cores investigated to 1.5m depth. The findings of the soil survey found the following soil limitations:

- a) Silty loam topsoil with a very weak consistence with an inferred moderate to high saturated hydraulic conductivity (Ksat). Topsoil vulnerable to slaking and slightly acidic.
- b) Silty bleached A2 horizon with a very weak consistence with an inferred moderate to high Ksat.
- c) Massively structured and mottled clayey subsoil with a very low Ksat that is liable to waterlogging. Some dispersion in subsoil noted and slightly to strongly acidic.

5. Muller et al (2015) assessed the Walla Walla Hydrogeological Landscape (HGL) which the subject site lies in to be Class 4 LSC (OEH, 2012) based on the key land degradation issues. The findings by McMahon (2018) correlate with these key land degradation issues, which are as follows:

- a) sodicity in lower landscape.
- b) salinity (isolated).
- c) waterlogging (common).
- d) gully erosion (localised).
- e) poor soil structure.
- f) acidity.
- g) sheet erosion.

6. Based on the decision tables for individual hazards in Section 5 of OEH (2012) from the soil survey conducted by McMahon (2018) the following applies:

Hazard	LSC class
Water erosion	3 (based on 3-10% slope class)
Wind erosion	2 (moderate class >500mm rainfall)
Soil structural decline	4 (based on fragile silty topsoil)
Soil acidification	4 (red/yellow earth 5.5-6.7 pH water)
Salinity	3 (low recharge, low discharge, moderate salt store)
Water logging	4 (2-3-month waterlogging, every 2 to 3 years) imperfectly drained) – could be higher in wetter years
Shallow soil and rockiness	1 (nil surface outcrop >100cm soil depth)
Mass movement	1 (no mass movement present >500mm rainfall)

7. In summary, the subject site is Class 4 LSC based on the following hazards based on the decision tables in Section 5 of OEH (2012) and the findings of the McMahon soil survey (2018) which are summarised as follows:

- a) Soil structural decline with a fragile silty topsoil as found in the A and bleached A2 horizons with a weak consistence and vulnerability to slaking. It is well established that bleached A2 horizons are an indication of periodic waterlogging.
- b) Soil acidification with the red/yellow earths across the subject site with a soil pH below 6.5.
- c) Water logging with the massively structured and mottled clayey subsoil with a very low Ksat and mottling. It is well established that mottling is indication of poor profile drainage in depositional environments.

If you have any queries about the contents of the letter format report, please contact the undersigned.

Yours sincerely,

A handwritten signature in dark ink, appearing to read 'David McMahon', is written over a horizontal line.

David McMahon CEnvP
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MALGA MEIANZ MSSA

Disclaimer

The information contained in this report has been extracted from field sources believed to be reliable and accurate. DM McMahon Pty Ltd will not assume any responsibility for the misinterpretation of information supplied in this report. The accuracy and reliability of recommendations identified in this report need to be evaluated with due care according to individual circumstances. It should be noted that findings in this report are based solely upon the said site conditions at the time of inspection. The results of the said investigations undertaken are an overall representation of the conditions encountered. The properties of the substrate within the location may change due to variations in ground conditions outside the inspected area.

References

McMahon D.M., (2018), Soil Survey Report Jindera Solar Farm, DM McMahon Pty Ltd, Wagga Wagga, NSW.

Muller, R., Nicholson, A., Wooldridge, A., Jenkins, B., Winkler, M., Cook, W., Grant, S. and Moore C.L. (2015) Hydrogeological Landscapes for the Eastern Murray Catchment, Office of Environment and Heritage, Sydney, NSW.

OEH 2012, The land and soil capability assessment scheme second approximation, a general rural land evaluation system for New South Wales, Office of Environment and Heritage, Sydney.

OEH 2010, Reconnaissance Soil and Land Resources of the Murray Catchment, Office of Environment and Heritage, Sydney, NSW.