

Resonate

Whittingham Solar Farm

Preliminary Noise and Vibration Assessment

S190463RP1 Revision A

Wednesday, 15 April 2020



Document Information

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|-----------------------|--|
| Project | Whittingham Solar Farm |
| Client | i ³ consulting Pty Ltd |
| Report title | Preliminary Noise and Vibration Assessment |
| Project Number | S190463 |

Revision Table

| Report revision | Date | Description | Author | Reviewer |
|------------------------|-----------------|--------------------|---------------|-----------------|
| 0 | 30 January 2020 | For Issue | Tom Evans | Lucy Bowden |
| A | 15 April 2020 | Updated Layout | Tom Evans | Lucy Bowden |
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Glossary

| | |
|-------------------------------|---|
| A-weighting | A spectrum adaption that is applied to measured noise levels to represent human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies. |
| Daytime | Between 7 am and 6 pm as defined in the NPI. |
| dB | Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. We typically perceive a 10 dB increase in sound as a doubling of that sound level. |
| dB(A) | 'A' Weighted sound level in dB. |
| Evening | Between 6 pm and 10 pm as defined in the NPI. |
| Frequency (Hz) | The number of times a vibrating object oscillates (moves back and forth) in one second. Fast movements produce high frequency sound (high pitch/tone), but slow movements mean the frequency (pitch/tone) is low. 1 Hz is equal to 1 cycle per second. The human ear responds to sound in the frequency range of 20 to 20,000 Hz. |
| NPI | New South Wales <i>Noise Policy for Industry</i> , 2017. |
| Intrusive Noise | Noise emission that when assessed at a noise-sensitive receiver (principally a residential premises boundary) is greater than 5 dB(A) above the background noise level. |
| L ₁₀ | Noise level exceeded for 10% of the measurement time. The L ₁₀ level is commonly referred to as the average maximum noise level. |
| L ₉₀ | Noise level exceeded for 90% of the measurement time. The L ₉₀ level is commonly referred to as the background noise level. |
| L _{eq} | Equivalent Noise Level—Energy averaged noise level over the measurement time. |
| L _{max} | Maximum measured sound pressure level in the time period. |
| Night-time | Between 10 pm on one day and 7 am on the following day as defined in the NPI. |
| Rating Background Level (RBL) | Overall single-figure A-weighted background level representing an assessment period (Day/Evening/Night). For the short-term method, the RBL is simply the measured L _{90,15min} noise level. For the long-term method, it is the median value of all measured background levels during the relevant assessment period. |

Table of Contents

| | |
|---|----|
| Executive summary..... | 2 |
| 1 Introduction | 3 |
| 1.1 Overview | 3 |
| 1.2 Proposal..... | 3 |
| 2 Assessment criteria..... | 5 |
| 2.1 Operational noise..... | 5 |
| 2.2 Construction noise and vibration | 6 |
| 2.2.1 Construction noise | 6 |
| 2.2.2 Construction road traffic..... | 7 |
| 2.2.3 Construction vibration | 7 |
| 3 Preliminary assessment..... | 8 |
| 3.1 Operational noise..... | 8 |
| 3.1.1 Key residences | 8 |
| 3.1.2 Typical source sound power levels | 8 |
| 3.1.3 Prediction methodology | 9 |
| 3.1.4 Preliminary prediction results..... | 9 |
| 3.2 Construction noise and vibration | 10 |
| 4 Conclusion | 11 |
| Appendix A—Site layout | 12 |
| Appendix B—Preliminary noise contour map..... | 13 |

Executive summary

RES Australia proposes to develop the Whittingham Solar Farm, approximately 14 km southeast of the township of Singleton and 12 km west of the township of Braxton in New South Wales. The solar farm will connect into the National Electricity Market (NEM) via two existing transmission lines within proximity to the subject site.

Resonate has been engaged by i³ consulting, on behalf of RES Australia, to undertake a Preliminary Noise and Vibration Assessment for the proposed solar farm to inform an application to the Department of Planning, Industry and Environment (DPIE) requesting Secretary's Environmental Assessment Requirements (SEARs).

Operational noise

Operational noise from the site has been assessed based on the preliminary layout and assumed sound power levels based on our previous experience, against the minimum applicable noise trigger level from the NSW *Noise Policy for Industry* (NSW NPI) of 35 dB(A).

The highest predicted noise level at any residence is 34 dB(A). Therefore, it is predicted that operational noise from the site will be able to comply with the NPI noise trigger levels with appropriate design of the site during further planning stages.

Construction noise and vibration

Noise and vibration from construction works, including decommissioning, would need to be managed for the project in accordance with relevant guidance for NSW as provided in:

- Department of Environment & Climate Change (now Environment Protection Authority) *Interim Construction Noise Guideline* (ICNG) for noise from construction works.
- Department of Environment, Climate Change & Water (now Environment Protection Authority) *Road Noise Policy* (RNP) for noise from construction-related traffic.
- Department of Environment & Conservation *Assessing Vibration – A Technical Guideline* (the Vibration Guideline) for vibration from construction works.

It is envisaged that noise and vibration from construction and decommissioning activities will be able to be managed appropriately, with the application of effective management measures and community consultation.

Summary

On the basis of this preliminary assessment, it is expected that the Whittingham Solar Farm will be able to operate in compliance with the minimum applicable NPI trigger levels with appropriate design of the site. Additionally, it is expected that noise and vibration associated with construction and decommissioning works will be able to be managed to acceptable levels.

It is considered that appropriate SEARs for the proposal would require:

- operational noise from ancillary facilities to be assessed in accordance with the NSW NPI
- construction noise to be assessed in accordance with the NSW ICNG
- noise from construction-related traffic to be assessed in accordance with the NSW RNP
- construction vibration to be assessed in accordance with the NSW Vibration Guideline.

1 Introduction

1.1 Overview

RES Australia proposes to develop the Whittingham Solar Farm, approximately 14 km southeast of the township of Singleton and 12 km west of the township of Braxton in New South Wales. The solar farm will connect into the National Electricity Market (NEM) via two existing transmission lines within proximity to the subject site.

Resonate has been engaged by i³ consulting, on behalf of RES Australia, to undertake a Preliminary Noise and Vibration Assessment for the proposed solar farm to inform an application to the Department of Planning, Industry and Environment (DPIE) requesting Secretary's Environmental Assessment Requirements (SEARs).

The objectives of this assessment are to:

- identify noise and vibration sources associated with the proposed solar farm
- identify relevant noise and vibration criteria that will apply to the development
- undertake a preliminary assessment of noise from the solar farm operation to inform future planning stage assessments.

1.2 Proposal

The Whittingham Solar Farm will be constructed across a site covering approximately 339 hectares across the lot parcels of:

- Lot 1 DP1248572
- Lot 1 DP33992
- Lot 2 DP1248572
- Lot 11 DP825903

The site will consist of photovoltaic (PV) panels installed on single axis trackers, supported by inverters, a substation and a potential Battery Energy Storage System (BESS). A number of residential receptors have been identified around the site by i³ consulting.

Potential noise and vibration sources associated with the development will include:

- noise associated with the operation of the solar farm, substation, BESS and, potentially transmission line corona and aeolian noise
- noise and vibration associated with construction of the solar farm and decommissioning at the end of its life.

A preliminary detailed site layout is included in Appendix A but will be subject to change as the design of the site develops. Figure 1 shows the project boundary, key features and surrounding receptor locations.



Figure 1 Site layout

2 Assessment criteria

2.1 Operational noise

Operational noise from the site will need to comply with the relevant requirements of the NSW *Noise Policy for Industry* (NPI).

The NPI sets out the procedure to determine project noise trigger levels relevant to a particular industrial development, with the trigger levels applicable at existing noise-sensitive receivers around the site. If it is predicted that a development is likely to result in an exceedance of the project noise trigger levels, then management measures need to be considered to seek to reduce the predicted noise levels.

The project noise trigger levels set forth in the NPI vary for different times of day, namely:

- Day: 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays
- Evening: 6 pm to 10 pm
- Night: the remaining periods.

Consistent with community expectations, more stringent noise trigger levels apply at Night in comparison to Day and Evening.

Components of the solar farm will operate continuously, although the PV panels and supporting components would be limited to daylight hours. Given the potential for daylight to begin prior to 7 am, dependent on time of year, compliance with the more stringent Night trigger levels would be required. Achieving compliance with the Night trigger levels would ensure compliance during the less sensitive Day and Evening periods.

The NPI establishes project noise trigger levels as the lower of the following:

- Intrusiveness level: 5 dB(A) above the Rating Background Level (RBL) for each time of day. The NPI sets forth minimum intrusiveness noise levels that can apply as detailed in Table 1. While background monitoring would be used to determine the existing noise environment and intrusiveness noise levels, the intrusiveness noise level for Night would not be lower than 35 dB(A) in accordance with the NPI.

Table 1 NPI minimum assumed RBLs and project intrusiveness noise levels

| Time of day | Minimum assumed RBL, dB(A) | Minimum intrusiveness noise levels, dB(A) L_{eq} |
|-------------|----------------------------|--|
| Day | 35 | 40 |
| Evening | 30 | 35 |
| Night | 30 | 35 |

- Amenity level: a criterion established with reference to the land zoning of an area and with the aim of not increasing industrial noise levels in an area. Amenity levels for residential land uses in rural areas are presented in Table 2. Note the project amenity level is set 5 dB below the recommended amenity level.

Based on the NPI, the minimum applicable project noise trigger level for Night would be 35 dB(A) L_{eq} and this preliminary assessment has been based on this minimum trigger level. Background noise level monitoring should be undertaken during later planning stages to more clearly establish the intrusiveness level and establish the NPI trigger levels for the solar farm.

Table 2 NPI amenity levels for residences in rural areas

| Time of day | Recommended amenity level, dB(A) L_{eq} | Project amenity level, dB(A) L_{eq} |
|-------------|---|---------------------------------------|
| Day | 50 | 45 |
| Evening | 45 | 40 |
| Night | 40 | 35 |

2.2 Construction noise and vibration

2.2.1 Construction noise

Construction noise in New South Wales is assessed using the Department of Environment & Climate Change (now Environment Protection Authority (EPA)) *Interim Construction Noise Guideline (ICNG)*.

The ICNG aims to manage noise from construction works regulated by the EPA. It is also intended to provide guidance to other interested parties in the management of construction noise. The ICNG prescribes $L_{eq,15min}$ Noise Management Levels (NML) for sensitive receivers as part of a quantitative construction noise assessment. Where the predicted or measured construction noise level exceeds these management levels, then all feasible and reasonable work practices should be implemented to reduce construction noise, and community consultation regarding construction noise is required to be undertaken.

The NMLs prescribed for residential land uses by the ICNG are presented in Table 3.

Table 3 Noise management levels for residential land uses

| Time of day | NML, $L_{eq,15min}$ | Application notes |
|---|---------------------------------|---|
| Recommended Standard Working Hours of: <ul style="list-style-type: none"> 7 am to 6 pm Mon – Fri 8 am to 1 pm Sat | Noise affected: RBL + 10 dB(A) | May be some community reaction to noise. <ul style="list-style-type: none"> Where the predicted or measured construction noise level exceeds the noise affected level, all feasible and reasonable work practices should be applied to meet the noise affected level. All residents potentially impacted by the works should be informed of the nature of the works, the expected noise levels and duration, and provided with site contact details. |
| | Highly noise affected: 75 dB(A) | May be strong community reaction to noise. <ul style="list-style-type: none"> Where construction noise is predicted or measured to be above this level, the relevant authority may require respite periods that restrict the hours that the very noisy activities can occur. Respite activities would be determined taking into account times identified by the community when they are less sensitive to noise, and if the community is prepared to accept a longer period of construction to accommodate respite periods. |
| Outside recommended Standard Working Hours | Noise affected: RBL + 5 dB(A) | <ul style="list-style-type: none"> A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the affected noise level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the affected noise level, the proponent should negotiate with the affected community. |

The ICNG also prescribes NMLs for other sensitive land uses, including educational buildings and hospitals, however these are not considered relevant to the immediate areas around the Whittingham Solar Farm site.

2.2.2 Construction road traffic

Noise associated with construction traffic using local roads is assessed in NSW using the Department of Environment, Climate Change & Water (now EPA) *Road Noise Policy* (RNP).

The RNP recommends that land use developments that generate additional traffic on existing freeways/arterial/sub-arterial roads should limit road traffic noise levels at sensitive receptors to:

- 60 dB(A) $L_{eq,15h}$ during the daytime (7 am to 10 pm)
- 55 dB(A) $L_{eq,9h}$ during the night time (10 pm to 7 am).

Where the above criteria are already exceeded, the RNP recommends limiting the increase in road traffic noise levels to no more than 2 dB.

It is noted that any increase in noise from construction road traffic would only be temporary during the construction phase. Where the increase in traffic resulting from construction works exceeds the above criteria, then additional noise management measures should be investigated.

2.2.3 Construction vibration

Ground vibration generated by construction can have a range of effects on buildings and building occupants. The main effects are generally classified as:

- human disturbance – disturbance to building occupants: vibration which inconveniences or interferes with the activities of the occupants or users of the building
- effects on building structures – vibration which may compromise the condition of the building structure itself.

In general, vibration criteria for human disturbance are more stringent than vibration criteria for effects on buildings. Building occupants will normally feel vibration readily at levels well below those which may cause a risk of cosmetic or structural damage to a structure. However, it may not always be practical to achieve the human comfort criteria. Furthermore, unnecessary restriction of construction activities can prolong construction works longer than necessary, potentially resulting in other undesirable effects for the local community.

During future planning stages, construction vibration criteria would be adopted from the following sources to assess the potential vibration generated from construction works associated with the project:

- Cosmetic and structural damage to buildings: German Standard DIN 4150-3¹
- Human comfort: NSW Department of Environment & Conservation *Assessing Vibration – A Technical Guideline* (the Vibration Guideline).

¹ German Standard DIN 4150-3, 1999, *Structural Vibration – Part 3: Effects of vibration on structures*.

3 Preliminary assessment

3.1 Operational noise

3.1.1 Key residences

The nearest residences in different orientations around the site boundary have been identified as summarised below in Table 4. The locations of these key residences are shown on Figure 1.

Table 4 Key residences identified around project boundary, coordinates in UTM WGS84 Zone 56S

| Residence ID | Easting | Northing | Approximate distance to site boundary, m |
|--------------|---------|----------|--|
| R1 | 333184 | 6389088 | 390 |
| R2 | 334058 | 6389546 | 405 |
| R3 | 334688 | 6389490 | 430 |
| R4 | 335601 | 6388784 | 610 |
| R5 | 336535 | 6385584 | 870 |
| R6 | 334444 | 6386115 | 880 |
| R7 | 333619 | 6387166 | 530 |
| R8 | 333244 | 6387703 | 690 |

3.1.2 Typical source sound power levels

The primary operational noise sources associated with the site will include:

- solar panel array motor (assumed one per single axis tracker)
- inverters housed at the PCU sites shown in Appendix A
- transformer housed at the substation
- BESS.

Typical source sound power levels, based on our previous experience, are summarised in Table 5. These will require confirmation during later planning and design stages once further information is available on equipment types, quantities and locations.

Table 5 Assumed source sound power levels

| Source | Sound power level in dB(A) at octave band frequency in Hz | | | | | | | Overall dB(A) |
|--------------------------------|---|-----|-----|-----|------|------|------|------------------|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | |
| Motor (per unit) ¹ | 47 | 50 | 52 | 55 | 55 | 54 | 49 | 61 |
| Inverter stations (per unit) | 75 | 80 | 86 | 90 | 90 | 85 | 80 | 95 |
| Transformer | 92 | 93 | 93 | 93 | 91 | 89 | 86 | 100 |
| BESS including cooling systems | 82 | 84 | 88 | 90 | 92 | 93 | 88 | 98 |

(1) Includes a correction based on an assumption that a tracking motor will not be used for more than 30 seconds out of any typical 15-minute period.

3.1.3 Prediction methodology

To predict wind farm noise levels from Whittingham Solar Farm, an environmental noise model has been developed in SoundPlan version 8.1 environmental noise prediction software. The noise model implements the CONCAWE algorithm, based on Category 6 meteorological conditions, which represents conditions conducive for the propagation of noise from source to receiver.

Predictions have been undertaken on the basis of the following parameters:

- Source locations as per the preliminary design shown in Appendix A. A source height of 4 m above ground has been assumed.
- All sources operating simultaneously at sound power levels listed in Table 5.
- Receiver locations as per Section 3.1.1.
- Topographical contours provided by i³ consulting.
- Ground absorption factor of 75% typical for rural areas.
- Receiver height of 1.5 m above ground.

3.1.4 Preliminary prediction results

Table 6 presents the predicted operational noise levels for the key receivers. A preliminary noise contour map showing the predicted 35 dB(A) noise level contour for the preliminary layout is included as Appendix B.

Table 6 Preliminary operational noise predictions in dB(A)

| Residence ID | Minimum criterion, dB(A) | Preliminary predicted noise level, dB(A) | Complies? |
|--------------|--------------------------|--|-----------|
| 1 | 35 | 34 | ✓ |
| 2 | 35 | 34 | ✓ |
| 3 | 35 | 34 | ✓ |
| 4 | 35 | 30 | ✓ |
| 5 | 35 | 18 | ✓ |
| 6 | 35 | 29 | ✓ |
| 7 | 35 | 32 | ✓ |
| 8 | 35 | 31 | ✓ |

The predicted noise levels indicate that compliance is expected to be achieved with the minimum applicable noise trigger levels at the nearest identified sensitive receivers. It should be noted that this is considered to be a conservative assessment as it is based on typical worst case propagation from source to receiver, under downwind conditions, with each receiver assumed to be downwind of all sources simultaneously. Due to the layout of the site, this is unlikely to occur for a number of receivers.

On the basis of this preliminary assessment, it is expected that the Whittingham Solar Farm will be able to operate in compliance with the minimum applicable NPI trigger levels. As the project design progresses and further planning stage assessments are carried out, the following should be considered:

- updated operational noise predictions to reflect the finalised layout and equipment selections,
- background noise monitoring at the nearest receivers to establish project intrusiveness noise levels and determine noise trigger levels in accordance with the NPI,
- selection of lower noise site equipment where possible,
- if necessary, consideration of on-site control measures, such as localised barriers, to address noise levels from key sources.

3.2 Construction noise and vibration

Construction noise and vibration would be assessed as the project progresses through later planning stages.

Given the considerable distance between the site and the nearest sensitive receptors, it is expected that construction noise and vibration from the site, including noise and vibration during decommissioning works, will be able to be appropriately controlled to minimise any impacts to an acceptable level.

The nearest sensitive receptor is located approximately 400 m from the site boundary and, at this distance:

- While noisier works may be audible at times, construction noise during standard working hours would be expected to be able to be managed through the application of standard construction noise management and mitigation measures.
- Construction vibration levels are not expected to be perceptible.

Given the site's proximity to the New England Highway, it is anticipated that noise associated with construction traffic would be able to be appropriately managed through planning site access routes along existing major roads.

Measures to manage construction noise and vibration would be expected to include:

- Development of a Construction Noise and Vibration Management Plan for implementation by the appointed construction contractor(s). The Construction Noise and Vibration Management Plan would identify activities with the potential to impact on sensitive receptors and detail measures to be implemented to manage these impacts.
- Limiting works to standard daytime working hours wherever feasible.
- Restricting deliveries to site to daytime hours where possible.
- Notifying the community of the times of work, particularly noise- or vibration-intensive activities proposed outside of standard hours.
- Maintaining an effective complaint management and response system during construction.
- Planning site access routes to minimise the impact on sensitive land uses as much as is feasible.
- Planning site compounds such that they are sufficiently removed from sensitive land uses.
- Maximising the offset distance between construction works and sensitive land uses.
- Selecting quieter equipment and work practices.

4 Conclusion

A preliminary noise and vibration assessment has been carried out for the Whittingham Solar Farm, a proposed solar farm to be located approximately 14 km southeast of the township of Singleton and 12 km west of the township of Braxton in New South Wales. The assessment has been carried out to inform an application to DPIE requesting SEARs for further planning investigations.

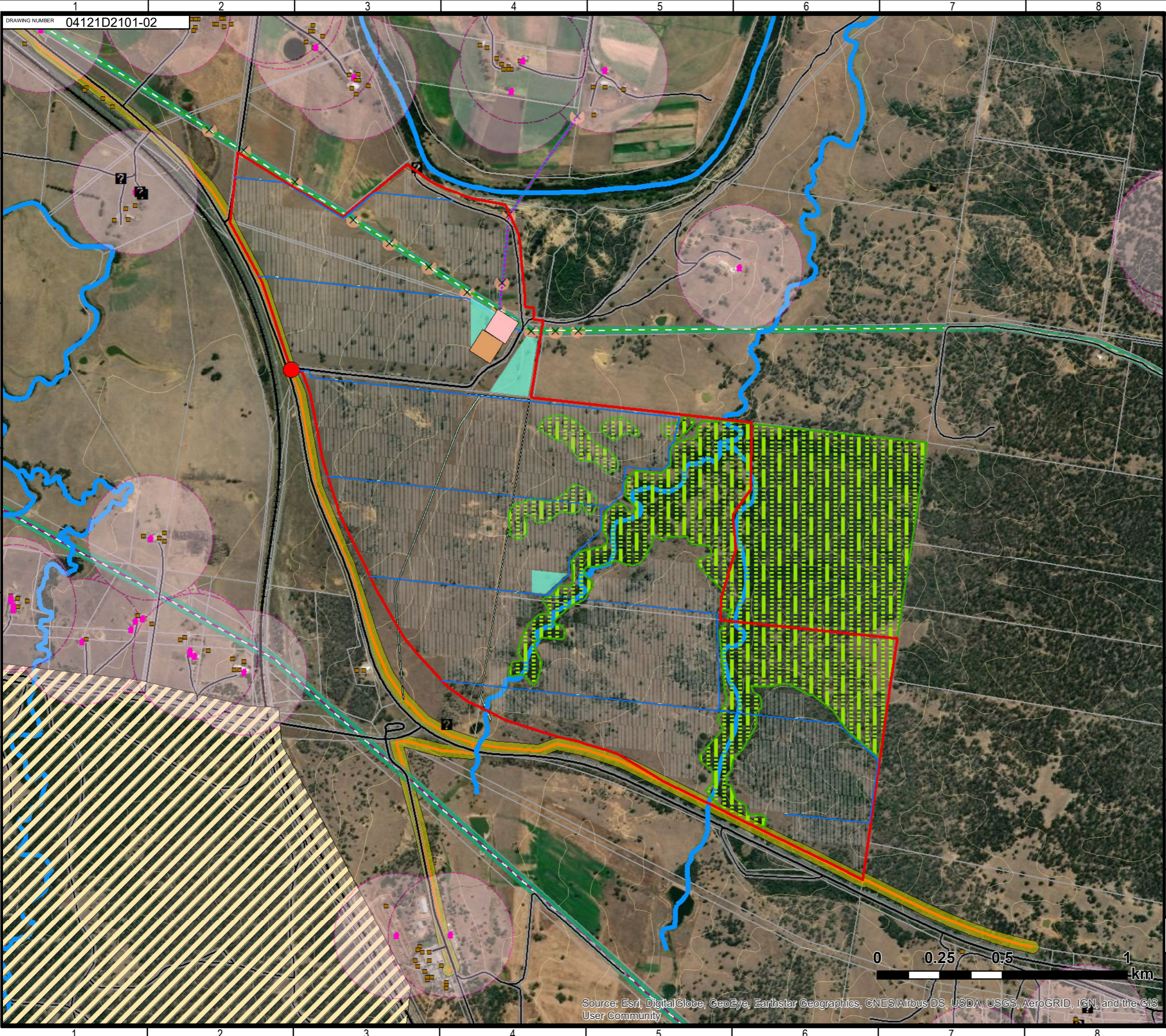
On the basis of this preliminary assessment, it is expected that the Whittingham Solar Farm will be able to operate in compliance with the minimum applicable NPI trigger levels with appropriate design of the site. Additionally, it is expected that noise and vibration associated with construction and decommissioning works will be able to be managed to acceptable levels.

It is considered that appropriate SEARs for the proposal would require:

- operational noise from ancillary facilities to be assessed in accordance with the NSW NPI
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- noise from construction-related traffic to be assessed in accordance with the NSW RNP
- construction vibration to be assessed in accordance with the NSW Vibration Guideline.



Appendix A—Site layout



SOURCE DATA © NEW SOUTH WALES CROWN
(SPATIAL SERVICES)

N

LEGEND

- SITE ENTRANCE
- SINGLE AXIS TRACKERS
- PROPOSED ACCESS ROAD
- PCU WITH HARDSTANDING
- PROPOSED SUBSTATION LOCATION AND UTILITY AREA
- PROPOSED BATTERY STORAGE AREA
- PROPOSED TEMPORARY CONSTRUCTION COMPOUND AND LAYDOWN
- BUILDING OCCUPANCY UNKNOWN
- HOUSE
- UNOCCUPIED BUILDING
- HOUSE BUFFER, 250m
- VEGETATION (DIGITISED FROM FIREBIRD MAP)
- WATERCOURSE (NSW SS)
- DUAL CARRIAGEWAY
- STANDARD ROAD
- VEHICULAR TRACK
- ROAD BUFFER, 10m
- OVERHEAD LINE (VOLTAGE UNKNOWN)
- 66 kV OVERHEAD LINE
- 132 kV OVERHEAD LINE
- TRANSMISSION LINE EASEMENT
- SHADING BUFFER
- WATER PIPELINE EASEMENT (DIGITISED)
- GASLINE (DIGITISED FROM JEMIMA MAP)
- GASLINE BUFFER, 25m
- PROHIBITED AREA (GA 2006)
- CONTOUR LINE
- SITE BOUNDARY

NOTES:
1. CONSTRAINTS HAVE BEEN DIGITISED FROM BACKGROUND MAPS. EXACT AREAS TO BE CONFIRMED.

| | | | | | |
|------------|-------|--------|------|--------|---------------------------------------|
| 2 | SM | 020420 | APPD | 030420 | NEW SITE BOUNDARY |
| 1 | SM | 191219 | AD | 231219 | FIRST ISSUE |
| ISSUE | DRAWN | DATE | APPD | DATE | REVISION NOTES |
| LAYOUT DWG | N/A | | | | LAYOUT NO. INFRASTRUCTURE 05 20200327 |

DRAWING NUMBER **04121D2101-02**

COORDS GDA 1994 MGA Zone 56

PURPOSE PRELIMINARY

SCALE 1:15,000 ORIGINAL PLOT SIZE A3

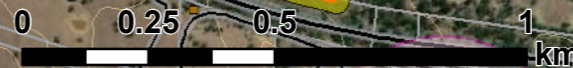
PROJECT TITLE **WHITTINGHAM SOLAR FARM**

DRAWING TITLE **SITE LAYOUT AND CONSTRAINTS**

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community





Appendix B—Preliminary noise contour map

