GLINT AND GLARE ASSESSMENT
MILFORD ROAD, PENNINGTON
WATER TREATMENT WORKS

VERSION 1.0

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1 INTRODUCTION

Metrica Environmental Consulting Ltd ('Metrica') has been commissioned to undertake a glint and glare assessment in relation to the proposed solar installation at Milford Road Water Treatment Works ('the Development'), located southwest of Pennington, Hampshire ('the Site'), on behalf of Downing Renewable Developments LLP.

2 GLINT AND GLARE DEFINITION

'Glint' and 'Glare' are the effects caused by the reflection of sunlight from reflective surfaces such as glazing or solar photovoltaic (PV) panels. The United States' Federal Aviation Administration's (FAA) glint and glare guidance[1] defines these terms as follows:

- Glint: *"A momentary flash of bright light";* and
- Glare: *"A continuous source of bright light".*

It goes on to say that... *"solar PV employs glass panels that are designed to maximize absorption and minimize reflection to increase electricity production efficiency. To limit reflection, solar PV panels are constructed of dark, light-absorbing materials and covered with an anti-reflective coating. Today's panels reflect as little as 2% of the incoming sunlight."* The guidance states this level of reflection is slightly more than black asphalt, and similar to bodies of water.

Further details on FAA guidance are provided in Section 4.2.4 of this report.

3 DEVELOPMENT OVERVIEW

The Development consists of a Solar PV array and associated infrastructure, situated in a semi-rural and industrial environment in Hampshire, adjacent to the existing Pennington Water Treatment Works (WTW).

The Development's proposed solar array consists of fixed-tilt PV panels, with a tilt angle of 25 degrees and both east and west facing panels (azimuth of 90 degrees for east-facing and 270 degrees for west-facing). A layout drawing showing the Development boundary is provided in Appendix 1 for reference).

4 GUIDANCE

4.1 PLANNING GUIDANCE

The following guidance and standards are pertinent to this assessment:

- The National Planning Policy Framework (NPPF)[2]; and
- National Policy Statement for Renewable Energy Infrastructure (EN-3)[3]

4.1.1 The National Planning Policy Framework

The NPPF sets out the Government's planning policies for England, providing a framework within which local policies can be developed. The key principle of the NPPF is a presumption

[1] Federal Aviation Administration (2021) Review of Solar Energy System Projects on Federally-Obligated Airports.

[2] UK Government (2012). National Planning Policy Framework (last updated 5th September 2023).

[3] UK Government (2023). National Policy Statement for Renewable Energy Infrastructure.

in favour of sustainable development, although no specific references to solar PV development or glint and glare effects are made.

4.1.2 National Policy Statement for Renewable Energy Infrastructure

EN-3 notes that solar PV panels are specifically designed to absorb, rather than reflect light, however, they may nevertheless reflect the sun's rays at certain times / angles, potentially causing glint and glare effects.

EN-3 recommends a two-stage approach to determining the potential for glint and glare impacts. As a first stage, receptors should be mapped qualitatively to identify any potential glint and glare issues and determine whether a detailed glint and glare assessment is necessary as part of the application.

When a quantitative glint and glare assessment is found to be necessary, the geometric possibility of glint and glare affecting nearby receptors should be investigated through modelling, and an assessment of potential impact provided, based on the angle and duration of incidence and the intensity of the reflection.

4.2 TECHNICAL GUIDANCE

UK planning guidance does not provide a specific methodology for assessing the impact of glint and glare. However, the following guidance is regularly applied to assessments in the UK and together is considered to provide a reasonable and robust approach:

- Measurement and Assessment of Light Immissions[4];
- Rail Industry Standard (RIS) RIS-0737-CCS[5];
- Renewable Energy Developments: Solar Photovoltaic Developments[6]; and
- Review of Solar Energy System Projects on Federally-Obligated Airports[7].

4.2.1 Measurement and Assessment of Light Immissions

The German Ministry for Environment, Health and Consumer Protection published the *Measurement and Assessment of Light Immissions* in 1993, which was most recently updated in 2014. Paragraph 8 of the most recent version of the guidelines is dedicated to the assessment of reflections from solar PV panels.

The guidelines state that… [translated from German] *"experience has shown that immission locations that are more than approximately 100 m away from a photovoltaic system only experience short-term glare effects. Only in the case of extensive photovoltaic parks could more distant emission locations still be relevant."*

For those receptors within the study area described above, the guidelines state that effects are acceptable providing that glare is experienced for no more than 30 minutes on any given day, or more than 30 hours per year.

[4] Ministry for the Environment, Health and Consumer Protection (2014). Light Guidelines (Leitlinie des Ministeriums für Umwelt, Gesundheit und Verbraucherschutz zur Messung und Beurteilung vonm Lichtimmissionen,

[5] Rail Industry Standard (RIS) RIS-0737-CCS 'Signal Sighting Assessment Requirements'

[6] CAA (2023). Solar photovoltaic Developments CAST Aerodrome Safeguarding Guidance Note

[7] Federal Aviation Administration (2021) Review of Solar Energy System Projects on Federally-Obligated Airports.

4.2.2 RIS-0737-CCS

Network Rail guidance does not provide a specific methodology for the assessment of glint and glare effects on rail infrastructure. However, Rail Industry Standard (RIS) RIS-0737-CCS states that…*"a planned change external to the railway could affect signal sighting, for example changes that affect the built environment (for example, a new structure causing obscuration, a solar farm causing reflection)."*

4.2.3 Renewable Energy Developments: Solar Photovoltaic Developments

The UK Civil Aviation Authority (CAA) issued a guidance note in July 2023. This guidance note was prepared by the Combined Aerodrome Safeguarding Team (CAST), supported by the CAA, and aims to provide safeguarding advice in relation to solar photovoltaic developments on a range of matters, including glint and glare.

With specific reference to glint and glare effects, the guidance note states that:

"In most cases, an assessment should be undertaken for a solar PV development which is being proposed within a specific distance (indicated by the aerodrome authority) from an aerodrome. For many aerodromes, 5km is the distance of choice but it could be considered out to 10km. In exceptional circumstances, assessments may be required beyond 10km."

No specific methodology or assessment criteria are defined for assessing the impact of glint and glare on aviation infrastructure.

4.2.4 Review of Solar Energy System Projects on Federally-Obligated Airports

The United States' Federal Aviation Administration (FAA) guidance states that for a solar PV development to obtain FAA approval or to receive no objection, there should be no more than a "*low potential for after-image"* along the final approach path for any existing or proposed runway. This criterion was originally defined to relate to Sandia Laboratories' Solar Glare Hazard Analysis Tool (SGHAT). However, the FAA has since withdrawn this requirement as the SGHAT software is no longer available. Metrica therefore uses modelling software developed by Forge Solar, which applies the same methodology as SGHAT.

SGHAT, categorises glint / glare into three tiers of severity (ocular hazards) that are shown by different colours in the model output. It should be noted that these categories are a function of the intensity of the reflection and the viewing angle, rather than being duration-dependant:

- Red glare: Glare predicted with a potential for permanent eye damage (retinal burn);
- Yellow glare: Glare predicted with a potential for temporary after-image; and
- Green glare: Glare predicted with a low potential for temporary after-image.

It also notes that no significant impacts are possible for reflections located more than 50 degrees either side of the direction of travel.

In the absence of specific guidance on the assessment of glint and glare impacts on road and rail infrastructure, it is generally accepted in the UK and elsewhere that in addition to aircraft, the FAA assessment criteria are also appropriate for drivers of other vehicles (i.e., road and rail traffic).

5 STUDY AREAS

5.1 RESIDENTIAL RECEPTORS

As stated in Section 4.2.1, glint and glare effects are unlikely to be an issue for receptors more than approximately 100 m from PV panels, due to the reduced intensity and short duration of effects beyond this distance. However, as this distance is approximate and dependent upon the extent of the Development, the residential receptor study area for this assessment has been based upon a 200 m buffer distance in order to ensure a robust approach.

5.2 ROAD AND RAIL INFRASTRUCTURE

As the assessment criteria for road and rail infrastructure relates purely to glare intensity, rather than duration of effects, it is considered that the 200 m study area applied to residential receptors is not appropriate.

A study area of 500 m has therefore been applied for the identification of road and national rail infrastructure as a conservative approach. It should be noted that in line with generally accepted best practice, local roads within the 500 m study area are not typically assessed; this is due to local roads having the lowest traffic densities and speeds, meaning the potential impact due to a temporary reflection is low.

5.3 AERODROMES AND AVIATION INFRASTRUCTURE

The study area for aerodromes recommended in CAA guidance (See section 4.2.3), is as follows:

- 10 km for safeguarded civil or military aerodromes[8]; and
- 5 km for other / non-safeguarded aerodromes.

Notwithstanding the above, the UK Government requires Local Planning Authorities to consult with aerodromes for any relevant development within 13 km of a safeguarded aerodrome[9]. In line with this, and as a conservative approach, an initial search area of 13 km has been applied in this assessment.

5.4 EXCLUSION AREAS

No visible reflections can occur at receptors located 'behind' the proposed PV panels. For east-facing panels, this covers a sector between 180 and 360 degrees, from the westernmost panel. For west-facing panels, this covers a sector between 0 and 180 degrees, from the easternmost panel. As this Development is to utilise both east and west facing panels, the above exclusion sectors have been applied to each respective orientation.

[8] CAA (2023). Solar photovoltaic Developments CAST Aerodrome Safeguarding Guidance Note

[9] UK Government (2002). The town and country (safeguarded aerodromes, technical sites and military explosives storage areas) direction 2002 (last updated 22nd December 2016).

6 ASSESSMENT CRITERIA

6.1 RESIDENTIAL RECEPTORS

The assessment criteria for residential receptors are those described in Section 4.2.1, i.e., that the glint and glare effects are acceptable providing such effects occur for no more than 30 minutes per day, or 30 hours (equivalent to 1,800 minutes) per year.

6.2 ROAD, RAIL AND AVIATION RECEPTORS

The assessment criteria for road, rail and aviation receptors are those described in Section 4.2.4, i.e. that the glint and glare effects are acceptable providing there is found to be no more than a low potential for after-image (i.e., 'green glare') when assessing in accordance with the SGHAT methodology. As previously stated, the SGHAT methodology is based purely upon the intensity of the reflection and the viewing angle and is not duration-dependant.

7 METHODOLOGY

As discussed in Section 4.2.4, modelling and assessment of glint and glare effects has been conducted using software implementing the SGHAT methodology, which accounts for the following site-specific parameters:

- Reflection Source:
  - Latitude, longitude and elevation of the Development;
  - Panel tilt, height and azimuth (orientation relative to north); and
  - Panel technology (fixed / tracking, and presence of anti-reflective coatings);
- Propagation path:
  - Local terrain; and
  - Existing or proposed obstructions (e.g., forestry, non-sensitive buildings, etc.)
- Receptor:
  - Receptor type e.g. (dwelling, road, rail, flight path, ground-based aviation assets);
  - Receptor location;
  - Height above ground level (typically taken as 1.5 m for terrestrial receptors, except for rail where a height of 2.75 m is applied, or high-rise structures which are modelled on a case-by case basis); and
  - Viewing angle and direction of travel (mobile receptors only).

7.1 IDENTIFICATION OF RECEPTORS

Figure 1 presents the Development boundary with the study areas applicable to this assessment. As shown in Figure 1 no residential receptors, rail lines, nor national / regional roads lie within their respective study areas.

In order to present a figure of a readable scale, the aviation study area boundaries are not shown in Figure 1, however it is confirmed that no active aviation assets have been identified within 13 km of the Development.

As such, assessment of glint and glare effects from the Development is not required.

8 ASSESSMENT OF IMPACT

As can be seen in Figure 1, no glint and glare receptors have been identified within their respective study areas. In line with the Government guidance described in EN-3 (See section 4.2.1) detailed modelling of the Development has been scoped out, as there is no reasonable prospect of adverse glint and glare impacts.

9 CONCLUSION

Metrica was commissioned to undertake a Glint and Glare impact assessment in relation to the proposed Solar PV Development at Milford Road.

No glint and glare receptors have been identified within the respective study areas described in this report. As such, it can be concluded that is no reasonable prospect of adverse glint and glare impacts, and the Development is therefore considered to be acceptable.

10 GLOSSARY OF TERMS

After-Image: An image that continues to appear in the eyes after exposure to the original image has ceased.

Axis Tracking: Motorised PV array modules which are able change their tilt and / or azimuth angle in order to face the sun as it tracks across the sky.

Azimuth: A direction or bearing defined a horizontal angle between 0° and 359° measured clockwise from North.

Elevation: height above mean sea level.

Elevation Angle: An angle that is formed between the horizontal line (0°) and the line of interest.

Glare: A continuous source of bright light typically received by static receptors or from large reflective surfaces.

Glint: A momentary flash of bright light typically received by moving receptors or from moving reflectors.

Green Glare: glare predicted with a low potential for temporary after-image.

Receptor: In this context, a receptor is a potential viewer of glint and glare effects.

Red Glare: glare predicted with a potential for permanent eye damage (retinal burn),

Tile Angle: See Elevation Angle

Yellow Glare: glare predicted with a potential for temporary after-image.

Metrica
ENVIRONMENTAL CONSULTING

Milford Road Site boundary

Residential buffer (200m)

Road / Rail buffer (500m)

N

0 200 400 m

1:8,000

Date: 10/11/2023

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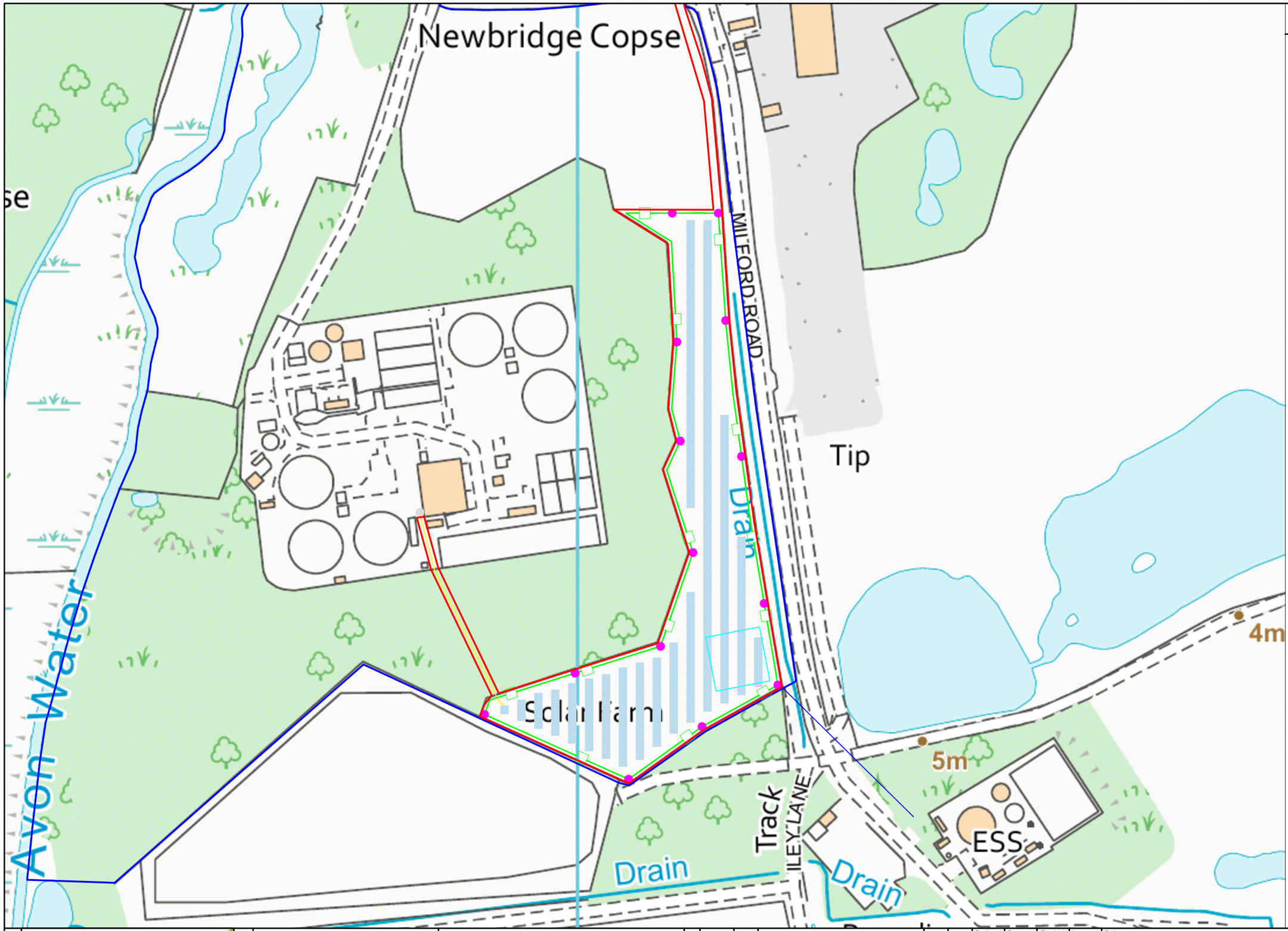
Figure 1
Study Areas

Milford Road
Milford Road Glint and Glare Assessment

APPENDIX 1: DEVELOPMENT LAYOUT



NOTES

Inverter Location is situated on back of Solar PV Modules

KEY:

- SOLAR PV MODULE
- DEER FENCE
- CABLE ROUTE
- SITE BOUNDARY
- LANDOWNERSHIP BOUNDARY
- CCTV
- TEMPORARY CONSTRUCTION COMPOUND
- GATE
- GRID CONNECTION

DECLARED NET CAPACITY = 650kW AC

TOTAL INSTALLED CAPACITY = 850kW DC

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NOTES

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Date: 07/08/23

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Project No: -

Project: SOUTHERN WATER PPA

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