C.3 Soil and water management plan

Soil and Water Management Plan

Oxley Solar Farm

October 2022

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W. www.nghconsulting.com.au

E. ngh@nghconsulting.com.au

BEGA - ACT & SOUTH EAST NSW
Suite 11, 89-91 Auckland Street
(PO Box 470) Bega NSW 2550
T. (02) 6492 8333

NEWCASTLE - HUNTER & NORTH COAST
Level 1, 31-33 Beaumont Street
Hamilton NSW 2303
T. (02) 4929 2301

BRISBANE
T3, Level 7, 348 Edward Street
Brisbane QLD 4000
T. (07) 3129 7633

SYDNEY REGION
Unit 17, 21 Mary Street
Surry Hills NSW 2010
T. (02) 8202 8333

CANBERRA - NSW SE & ACT
Unit 8, 27 Yallourn Street
(PO Box 62) Fyshwick ACT 2609
T. (02) 6280 5053

WAGGA WAGGA - RIVERINA & WESTERN NSW
35 Kincaid Street (PO Box 5464)
Wagga Wagga NSW 2650
T. (02) 6971 9696

GOLD COAST
19a Philippine Parade
Palm Beach QLD 4221
(PO Box 466 Tugun QLD 4224)
T. (07) 3129 7633

WODONGA
Unit 2, 83 Hume Street
(PO Box 506) Wodonga VIC 3690
T. (02) 6067 2533

NSW • ACT • QLD • VIC
W. www.nghconsulting.com.au
ABN 31 124 444 622 ACN 124 444 622

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Acronyms and abbreviations

AC	Alternate current
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AR	Amendment Report
AWS	Automatic weather station
BOM	Australian Bureau of Meteorology
CEMP	Construction environmental management plan
DC	direct current
DPIE	Department of Planning, Industry and Environment (NSW)
EIS	Environmental impact statement
EMS	Environmental Management Strategy
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPC	Engineering Procurement and Construction
ESCPS	Erosion and Sediment Control Plans
EWMS	Environmental Work Method Statements
ha	hectares
km	kilometres
kV	kilovolts
LEP	Local Environment Plan
LGA	Local Government Area
m	metres
ML	Megalitres
MW	Megawatt
MWh	Megawatt hours
NSW	New South Wales
PCU	Power Conversion Unit
SWMP	Soil and Water Management Plan

1. Introduction

1.1 Background and project description

The Oxley Solar Farm (the Proposal) is located on the southern side of Waterfall Way (Grafton Road), approximately 14 kilometres (km) south-east of Armidale, NSW. The Proposal involves the construction, operation and decommissioning of a ground-mounted PV solar array and associated infrastructure. Approximately 215 Mega Watt (MW, AC) of renewable energy would be generated and supplied directly to the national electricity grid. The Oxley Solar Farm is proposed by Oxley Solar Development (the Proponent).

Of the 1,048 hectares (ha) Proposal site, the development footprint would represent approximately 267ha which would be developed for the solar farm and associated infrastructure. Two existing TransGrid 132 kilovolts (kV) transmission lines run parallel to each other within the northern section of the Proposal site and would be used to connect the solar farm to the national electricity grid. The primary access point during the construction and operational phases for light and heavy vehicles would be off Waterfall Way (Grafton Road), north of the site.

The site layout is presented in Appendix A and includes:

- Approximately 385,280 PV solar panels mounted on either fixed structures or tracking systems, both of which are considered feasible:
    - Fixed-tilted structures in a north orientation; or
    - East-west horizontal tracking systems.
- Approximately 47 Power Conversion Units (PCU) composed of two inverters, a transformer and associated control equipment to convert DC energy generated by the solar panels to 33 kV AC energy.
- An onsite 132 kV substation containing up to two transformers and associated switchgear to facilitate connection to the national electricity grid via the existing 132 kV transmission lines onsite.
- Steel mounting frames with driven or screwed pile foundations.
- Underground power cabling to connect solar panels, combiner boxes and PCUs.
- Underground auxiliary cabling for power supplies, data services and communications.
- Buildings to accommodate a site office, indoor 33 kV switchgear, protection and control facilities, maintenance facilities and staff amenities.
- About 1 km of access track off Waterfall Way (Grafton Road) to the site which would require construction to the proposed onsite substation.
- Internal access tracks for construction and maintenance activities.
- An energy storage facility with a capacity of up to 50 MWh (i.e., 50 MW power output for one hour) and comprising of lithium-ion batteries with inverters.
- Perimeter security fencing up to 2.3 m high.
- Native vegetation planting to provide visual screening onsite and for specific receivers.

The construction phase of the Proposal would take about 12 – 18 months. The peak construction period would be a shorter period of about 6 to 9 months. Approximately 300 workers would be required during construction.

The solar farm is anticipated to be operational for about 30 years. Around five fulltime equivalent operations and maintenance staff and service contractors would operate the facility.

NGH prepared an Environmental Impact Statement (EIS) on behalf of the Proponent (NGH Pty Ltd, 2021). The EIS was prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The EIS was submitted to the Department of Planning, Industry and Environment (DPIE) in March 2021 and placed on public exhibition from 17 March 2021 until 14th April 2021.

1.2 Scope

This Soil and Water Management Sub Plan (SWMP or Plan) will form part of the Environmental Management Strategy (EMS) for the Oxley Solar Farm. This plan has been prepared to outline how mitigation measures proposed within the EIS, Amendment Report (AR) (NGH, 2022g) and Submissions Report (SR) (NGH Pty Ltd, 2022) would be implemented during construction to reduce impacts on soils and water. Additionally, it considers legislation and guidelines applicable to soil and water management during construction.

This plan will be required to be updated post approval to address any specific conditions of approval for the Proposal and after the engagement of an Engineering and Procurement Contractor (EPC) to make it specific to their company requirements and specific methodologies.

1.3 Environmental Management Strategy overview

The EMS for the Proposal provides the environmental management framework for the life of the solar farm. The EMS overarches a number of environmental management plans including this SWMP. The hierarchy of environmental management documentation will be shown in the Construction Environmental Management Plan (CEMP) for the Proposal.

Mitigation and management measures identified in this SWMP will be incorporated into site or activity specific Environmental Work Method Statements (EWMS), Safety Work Method Statements (SWMS) and progressive erosion and sediment control plans (ESCPs).

Used together, the EMS, CEMP, management measures, procedures EWMS, and SWMS form management guides that clearly identify required environmental management actions for reference by all Proposal personnel and contractors.

2. Purpose and objectives

2.1 Purpose

The purpose of this SWMP is to describe how impacts on soil and water quality will be minimised and managed during construction and operations of the Proposal.

2.2 Objectives

The key objective of the SWMP is to ensure that impacts to soil and water quality are minimised and that the commitments outlined in the EIS, AR and SR are met. To achieve this objective, the following will be undertaken:

- Ensuring appropriate environmental controls and procedures are implemented during construction activities to protect the receiving environments identified in the EIS.
- Minimising potential adverse soil and water impacts to the environment and rural community.
- Managing impacts if they occur through systematic analysis and further mitigation strategies.
- Ensure best practice controls and procedures are implemented during site establishment, construction, and road work activities to avoid, minimise, or manage potential adverse impacts to soil and water within and adjacent to the Proposal site.
- Implement appropriate measures to address the mitigation measures detailed in the EIS, AR and SR.
- Ensure measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 of this SWMP.

2.3 Targets

The following targets have been established for the management of the soil and water impacts during construction of the Proposal:

- Ensure full compliance with the relevant legislative requirements during construction.
- Ensure full compliance with relevant mitigation measures during construction.
- Implement feasible and reasonable soil and water mitigation measures to protect soils from erosion, protect streams and waterbodies from pollution and reduce accessions to and pollution of groundwater.
- Assess surface water and groundwater impacts against criteria consistent with the *Managing Urban Stormwater - Soils and Construction Vols 1 and 2, 4th Edition* (Landcom, 2004).
- Minimise the use of raw and potable water onsite during construction.
- Stage works during construction to minimise exposed soils.
- Stabilise and rehabilitate area of disturbance as soon as practicable.
- Minimising impacts from the construction work during flooding of the Gara River.
- Ensure training on best practice soil and water management is provided to all construction personnel through site inductions.

3. Environmental Requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

Legislation relevant to soil and water management includes:

- *Environmental Planning and Assessment Act 1979.*
- *Environmental Planning and Assessment Regulation 2000.*
- *Protection of the Environment Operations Act 1997.*
- *Water Management Act 2000.*
- *Contaminated Land Management Act 1997.*

3.1.2 Guidelines and standards

The main guidelines, specifications and policy documents relevant to this SWMP include:

- Landcom's Managing Urban Stormwater – Soils and Construction Vols. 1 and 2, 4th edition (Landcom 2004).
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW – March 2004.
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000)

3.2 Mitigation measures

The mitigation measures relevant to this Plan are listed in Table 3-1 below, with mitigation measures taken from the EIS, and submissions that are incorporated into the Submissions Report and Amendment Report. A cross reference is also included to indicate where the measure is addressed in this Plan or other project management documents. Once the Proposal is approved, this plan will be updated to include Proposal specific conditions of approval relating to soil and water.

Table 3-1: Mitigation measures relevant to the SWMP

ID	Mitigation measure	Addressed in this Plan
WQ1	All fuels, chemicals, and liquids would be stored at least 40m from any waterways or drainage lines, not on sloping land and would be stored in an impervious bunded area.	Table 6-1
WQ2	The refuelling of plant and maintenance would be undertaken in impervious bunded areas on hardstand areas only.	Table 6-1
WQ3	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery.	Table 6-1

ID	Mitigation measure	Addressed in this Plan
	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	
WQ4	All potential pollutants stored on-site would be stored in accordance with HAZMAT requirements and bunded.	Table 6-1
WQ5	Adequate incident management procedures would be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	Table 6-1
WQ6	Ensure appropriate drainage controls are incorporated into the design to minimise the area of disturbance, runoff and pollutant generation.	Table 6-1
WQ7	Alterations to ground water are to be avoided to prevent mobilisation of any salt stores, however low, in the soil. If groundwater is to be intercepted at any stage of the development the proponent must obtain the relevant entitlement and approval where required prior to any extraction.	Table 6-1
WQ8	Re-use of stormwater should be considered wherever possible.	Table 6-1
WQ9	Inspect stormwater control measures at least quarterly, and before (when forecasts indicate a >50% chance of rain) and after rainfall of more than 10 mm in 24 hours.	Table 6-1 Section 7.3
S1	As part of the CEMP, a Soil and Water Management Plan (SWMP) (with erosion and sediment control plans) would be prepared, implemented and monitored during the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions to: • Install, monitor and maintain erosion controls. Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads which may cause risks to	Table 6-1

ID	Mitigation measure	Addressed in this Plan
	other road users through reduced road stability. • Manage topsoil in all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. Stockpile topsoil appropriately so as to minimise weed infestation, maintain soil organic matter, maintain soil structure and microbial activity. • Handling of topsoil should be undertaken when the topsoil is moist (not wet or dry) to avoid structural decline. • Avoid stockpiles greater than 2 m in height to prevent structural decline. It should be stripped and stockpiled separately. Stockpiles should be stabilised with a groundcover (i.e., geo-textile or similar) if stockpiling is required for more than 6 weeks. • Minimise the area of disturbance from excavation and compaction; rationalise vehicle movements and restrict the location of activities that compact and erode the soils as much as practical. Any compaction caused during construction would be treated such that revegetation would not be impaired. • Manage works in consideration of heavy rainfall events; if a heavy rainfall event is predicted, the site should be stabilised, and work ceased until the wet period had passed. • Areas of soil disturbed by the proposal would be rehabilitated progressively or immediately post- construction, reducing views of bare soil.	
S2	A Groundcover Management Plan would be developed in consultation with an agronomist and to ensure final land use includes perennial ground cover establishment across the site as soon as practicable after construction and maintained throughout the operation phase. The plan would cover: • Soil handling, restoration and preparation requirements. • Plant Species election. • Soil preparation.	Groundcover Management Plan Table 6-1

ID	Mitigation measure	Addressed in this Plan
	• Establishment techniques. • Maintenance and monitoring requirements. • Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements – i.e. A target of 70% live vegetation cover would apply to protect soils, landscape function and water quality. Additional measures would be implemented where practical when live ground cover falls below 70%. Ground cover would be monitored on a monthly basis using an accepted methodology during the initial rehabilitation phase for up to 12 months, and then annually until the required groundcover is achieved. • Contingency measures to respond to declining soil or groundcover condition, i.e., any grazing stock would be removed from the site when cover falls below the target of 70% live ground cover. • Identification of baseline conditions for rehabilitation following decommissioning. • Preserve the native composition as much as possible	
S3	The array would be designed to allow sufficient space between panels to establish and promote groundcover beneath the panels and allow for implementation of weed controls.	Table 6-1
S4	A Spill and Contamination Response Plan would be developed as part of the overall Emergency Response Plan to prevent contaminants affecting adjacent surrounding environments. The plan would include measures to: • Respond to the discovery of existing contaminants at the site (e.g., pesticide containers or asbestos), including stop work protocols and remediation and disposal requirements. • Requirement to notify the EPA for incidents that cause material harm to the environment (refer s147-153 of the POEO Act). • Manage the storage of any potential contaminants onsite.	Emergency Response Plan Table 6-1

ID	Mitigation measure	Addressed in this Plan
	• Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and the EPA notification procedures and remediation. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Prevent contaminants affecting adjacent pastures, dams, water courses and native vegetation. • Monitor and maintain spill equipment • Induct and train all site staff.	
S5	The transformers will be filled with oil, and waterproof bunds built around them to manage oil spills.	Table 6-1
S6	A protocol would be developed in relation to discovering buried contaminants within the proposal site (e.g., pesticide containers). It would include stop work, remediation and disposal requirements.	Table 6-1
S7 (previously committed under B13)	A construction Erosion and Sediment Control Plan (ESCP) should be prepared for the Proposal in accordance with Landcom Soils and Construction: Managing Urban Stormwater (2004).	Table 6-1
S8	The design, construction and decommissioning of the proposal should minimise the extent and duration of ground disturbance and avoid disturbing steep slopes and waterways.	Table 6-1
S9	A revegetation plan (operation) should be prepared and include stabilisation and topsoil amelioration (e.g., incorporation of organic matter to improve soil structure or gypsum to improve structure, reduce hard-setting surfaces and reduce soil dispersion).	Table 6-1
S10	Subsoils disturbed during construction and with an exchangeable sodium percentage above 6% should be treated with gypsum to increase the levels of calcium and magnesium, and thus lowering the exchangeable sodium percentage and the dispersiveness of the soil.	Table 6-1

ID	Mitigation measure	Addressed in this Plan
S11	Reference the soil survey results (NGH , 2022f), *Australian Soil and Land Survey Handbook* (CSIRO 2009), *Guidelines for Surveying Soil and Land Resources* (CSIRO 2008) and the *Land and Soil Capability Assessment Scheme: second approximation* (OEH 2012) when remediating the soils onsite during decommissioning.	Table 6-1
LU1	Undertake a soil survey prior to construction to inform the CEMP and sub-plans, rehabilitation and operational aspects.	Section 4.2
W1	The design of buildings, equipment foundations and footings for electrical componentry and panel mounts would be designed to avoid the 1% AEP flood level to minimise impacts from potential flooding including: • The solar array mounting piers would be designed to withstand the forces of floodwater (including any potential debris loading) up to the 1% AEP flood event plus 500mm freeboard, giving regard to the depth and velocity of floodwaters. • The tracking axis for solar tracking modules would be located above 1% AEP flood event plus 500mm freeboard. • The mounting height of the solar module frames would be designed such that the lower edge of the module is clear of the predicted 1% AEP flood level. • All electrical infrastructure, including inverters, would be located above the 1% AEP flood level plus 500mm freeboard. • Where electrical cabling is required to be constructed below the 1% AEP flood level it would be capable of continuous submergence in water. • The proposed perimeter security fencing would be constructed in a manner which does not adversely affect the flow of floodwater and should be designed to withstand the forces of floodwater or collapse in a controlled manner to prevent impediment to floodwater. • Any fencing across Gara River or Commissioners Waters should be avoided in preference to creating separate fenced compounds on either side of the creeks. • The finished floor level of all buildings should be a minimum of 500mm above the 1% AEP flood level.	Section 6.1

ID	Mitigation measure	Addressed in this Plan
W2	At the substation site, slight raising of the adjacent roadway (or similar type bunding) is recommended in order to divert upslope runoff around this critical piece of infrastructure.	Section 6.2
W3	All buildings and structures (including solar arrays) associated with the proposal should be located outside high hazard areas (H5 and above) where they may be vulnerable to structural damage and have significant impact on flood behaviour.	Section 6.1
W4	If the proposed crossing structures over Gara River will be rendered impassable during significant flood events, the following would occur: • Flood warning signs and flood level indicators would be placed on each approach to the proposed crossings. • A Business Floodsafe Plan be prepared for the development to ensure the safety of employees during flood events in general accordance with the NSW SES "Business Floodsafe Toolkit and Plan".	Section 6.4
W5	Any road crossings on watercourses within the Proposal Area would be of the type defined in Table 2 of the Hydrological and Hydraulic Analysis Report was prepared by Footprint NSW Pty Ltd in Appendix F. Any proposed crossings (vehicular or service) of existing watercourses on the subject site should be designed in accordance with the following guidelines, and in the case of vehicle crossing should preferably consist of bed level crossings constructed flush with the bed of the watercourse on first and second order watercourses to minimise any hydraulic impact: • Guidelines for Watercourse Crossings on Waterfront Land (DPI, 2012) • Guidelines for Laying pipes and Cables in Watercourses on Waterfront Land (Office of Water, 2010) • *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). • Policy and Guidelines for Fish Friendly Waterway Crossings (NSW DPI, 2003).	Section 6.2

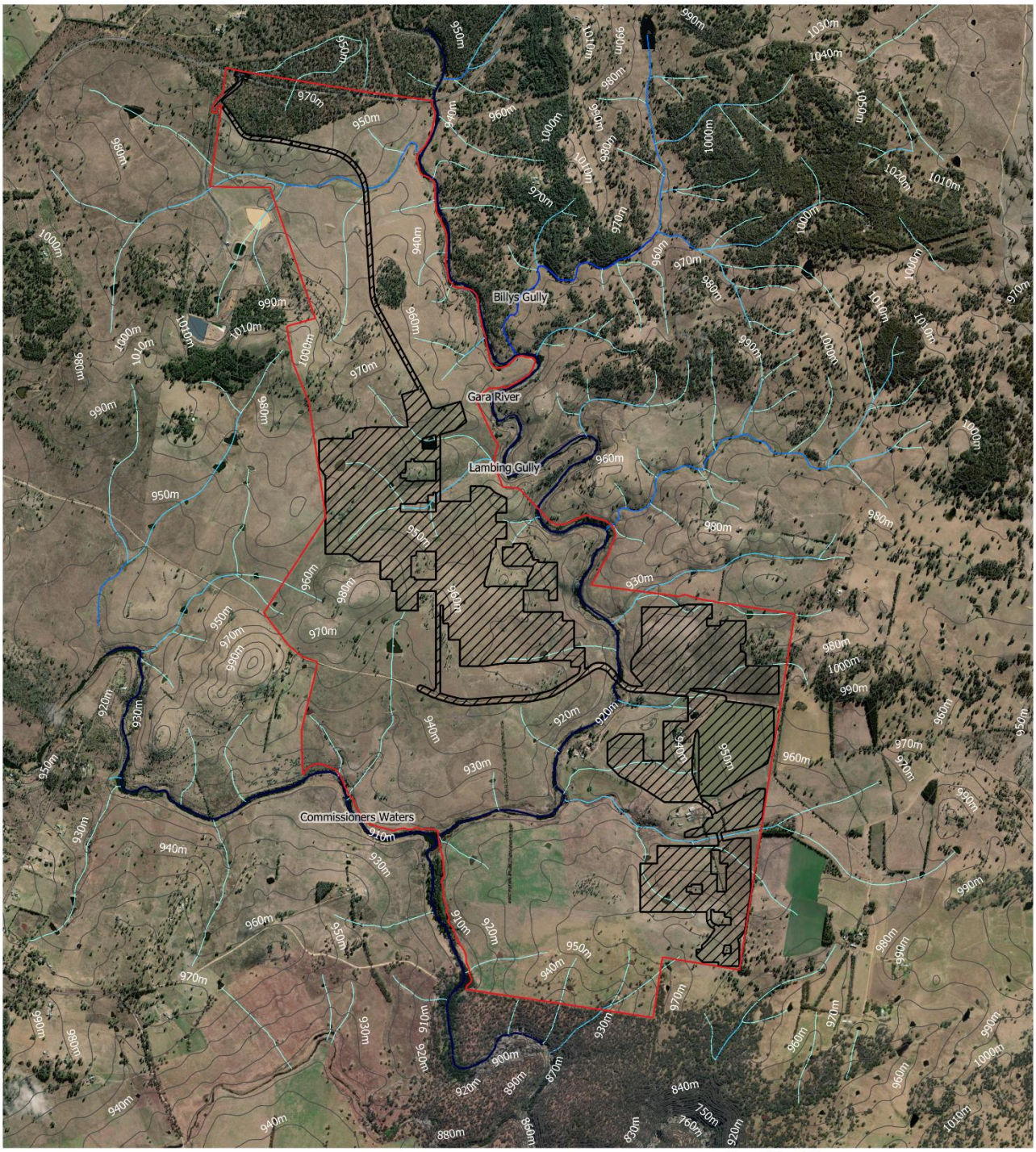
ID	Mitigation measure	Addressed in this Plan
W6	Within the floodplain access roads should be constructed as close to natural ground levels as possible so as not to form an obstruction to floodwaters. The surface treatment of roads should be designed giving regard to the velocity of floodwaters to minimise potential for scouring during flood events.	Section 6.2

4. Existing environment

4.1 Topography

The topography of the Proposal site is generally undulating. The elevation ranges from 905 - 1015 m Australian Height Datum (AHD). The Proposal site includes the following topographical features (refer to Figure 4-1):

- Undulating hills with rocky outcrops.
- Perennial waterways such as the Gara River and Commissioners Waters
- Ephemeral waterways such as Lambing Gully with several other unnamed tributaries and drainage lines.



Waterways and 10m contour lines

Legend
Proposal site
Updated Development Footprint Option 2
10m contours

Waterways
1st Order Stream
2nd Order Stream
3rd Order Stream
4th Order Stream
>5th Order Stream

0 250 500 m

Data Attribution
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Ref: 21-393 Submissions and Amendment workspace 20220523 \ Waterways and 10m contour lines
Author: kyle.m
Date created: 27.09.2022
Datum: GDA94 / MGA zone 56

NGH

Figure 4-1 Topography

4.2 Soil characteristics

The Dorrigo-Coffs Harbour 1:250,000 geological map (Minview, 2021) indicates that the geology underlying the Proposal site consists of Carboniferous sedimentary rocks for the majority of the Proposal site. Within the southernmost section of the Proposal site the geology consists of Permian S-type granites formed by the heating of sedimentary rocks.

The majority of the Proposal site is within the New England Orogen rock unit and is comprised of Permian sedimentary and volcanic rocks. More specifically, the proposal site belongs to the following:

- Coffs Harbour Association at the northern and central section of the Proposal site, which is a thick turbidite sequence dominated by siltstone that has been deformed and regionally metamorphosed to biotite grade.
- Gara Monzogranite at the southern section of the Proposal site, which is Biotite monzogranite-granodiorite, amphibole, orthopyroxene, and garnet bearing variants.

Seven soil landscapes occur across the Proposal site. The following soil landscapes and their typical erosion hazards are listed below:

- Argyle (ar) Erosional: Minor gully erosion mainly on lower slope drainage lines (gully depth <1.5m, partially stable to active). Some slopes have evidence of sheet erosion especially where overgrazing has occurred, and a protective groundcover is minimal.
- Castledoyle (cd) Erosional: Severe, active, slightly branched gully erosion exceeding 1.5 m in depth occurs along some drainage lines. Some incipient tunnel erosion is also evident at these sites. Elsewhere sheet erosion is commonplace. Tracks built on these soils are often degraded with sheet and rill/gully erosion evident.
- Commissioners Waters (cm) Alluvial: Streambank and gully erosion on streams and depressions on parts of this landscape.
- Ironstone (ir) Erosional/transferral: Sheet erosion is a problem on unprotected slopes and minor gully erosion is evident along some drainage depressions.
- Long Point (variant b) (lp) Residual: Sheet erosion (minor) is evident on exposed crests and side slopes.
- Middle Earth (me) Erosional/Transferal: Severe, often branched, gully erosion is evident on some lands. Some minor tunnel erosion is occasionally associated with the gully erosion. Sheet erosion occurs especially on disturbed areas with the removal of the A1 horizon.
- Silverton (si) Erosional: Sheet erosion occurs on most slopes. Some severe gully erosion occurs, e.g., in some of the tributaries of Herders Gully.

Refer to Appendix C for the location of the soil landscapes and Land and Soil Capability (LSC) across the Proposal site.

The Land and Soil Capability Assessment Scheme (OEH, 2012) provides LSC classes useful for broad-scale assessment of land capability. The eight classes describe land capability ranging from extremely high capability land (class 1) to extremely low capability land (class 8). The Proposal site is located on land mapped as LSC class 4 (moderate capability land) on the eastern portion of the Proposal site, LSC class 5 (moderate to low capability) across the central and western portion of the Proposal site, and LSC class 6 (low capability) within the centre of the Proposal site, west of Gara River. Class 4 is defined as moderate to severe limitations for some land uses that require conscious management to prevent soil and land degradation. Class 5 is defined as having high to

severe limitations for high impact land management uses. Class 6 is defined as having very severe limitations for a wide range of land uses and few management practices are available to overcome these limitations.

The proposal site is not mapped as Biophysical Strategic Agricultural Land (BSAL). The closest mapped BSAL is located 2km east of the proposal site. BSAL land is managed under the Strategic Regional Land Use Plan – New England Northwest (DPI, 2012). BSAL land features quality soil and water resources that can sustain high levels of agricultural productivity (NSW Government 2013).

A search of the NSW Government eSPADE database on the 23 June 2021 (eSPADE, 2021) indicated that the proposal site is mapped with a low probability of acid sulphate soils.

4.2.1 Soil Impact Assessment Results

A soil investigation was completed on 30 June 2021 and included a drilling program of 12 boreholes to a maximum depth of 1.0 metres Below Ground Level (mBGL). Refer to Appendix C for the location of the boreholes completed for the Proposal. Results of the drilling program are detailed further in the SIA.

The following site observations were recorded for each Lot:

- Lot 5 DP253346 (BH01, BH03, BH04, BH05, BH09, BH10, BH11, BH12): Bedrock was encountered at shallow depths, ranging from 0.4mBGL in BH04 and 0.5mBGL in BH01. Silty/sandy clay, loose with low plasticity was observed in both boreholes on top of bedrock. Hard clay with low plasticity and gravels were observed in BH05. BH09 observed sandy clays with high plasticity, whereas BH10 and BH11 observed loose sandy clays on top of a gravelly clay with high plasticity. BH12 observed a water layer at 0.1mBGL within a soft clayey sand layer trapped on top of a hard gravel band layer at 0.7mBGL.
- Lot 2 DP1206469 (BH02): Lower lying areas (trapping moisture and soil) were observed to have a deeper soil profile with a high moisture content. Secondary layers were observed to be predominately clay with a high plasticity. No bedrock was encountered.
- Lot 6 DP625427 (BH06, BH07, BH08): Observed sandy clays with high plasticity in all boreholes, with no topsoil encountered in BH08 which was located nearby the creek. Gravelly clay was observed at 0.9mBGL in BH07.

The results of the laboratory analysis indicate:

- The topsoil and subsoil in the north-western portion of the proposal site are consistent with the Middle Earth soil landscape. Soils include Kurosols and Sodosols. Laboratory results indicate highly sodic topsoil and subsoils in BH02 and BH03. These soils are dispersive and are highly susceptible to erosion.
- The topsoil and subsoil in the central portion of the proposal site are consistent with the Castledoyle soil landscape. Soils include Chromosols. Laboratory results indicate non sodic topsoils and subsoils. These soils non-dispersive and have a reduced likelihood of erosion.
- The topsoil and subsoil in the very central portion of the proposal site west of Gara River are consistent with the Commissioners Waters soil landscape. Soils include Kandosols and Sodosols Laboratory results indicate moderate sodic topsoils and subsoils. These soils are dispersive and are susceptible to erosion.
- The topsoil and subsoil in the eastern portion of the proposal site are consistent with the Ironstone soil landscape. Soils include brown Dermosols. Laboratory results indicate non

sodic topsoils and subsoils. These soils non-dispersive and have a reduced likelihood of erosion.

- The topsoil and subsoil in the eastern portion of the proposal site are consistent with the Long Point variant b soil landscape. Soils include brown Dermosols. Laboratory results indicate non sodic topsoils and subsoils. These soils are non-dispersive and have a reduced likelihood of erosion.

As a result of the desktop assessment and the laboratory analysis the topsoil is considered to have a low to high erosion potential and the subsoil a low to high erosion potential if not stabilised. However, with the implementation of mitigation measures recommended in Section 6 the potential risk of erosion and sedimentation would be minimised.

Erosion risk of construction activities would be considered low to moderate, dependent on their location within the landscape and the level of groundcover. Factors that indicate a low erosion risk are the predominantly low sodicity and salinity levels of the of the soil profiles. Moderate to high erosion risks would occur in areas where there are sodic subsoils.

4.3 Surface water

The existing surface water environment within the Proposal site is characterised by 34 dams, two named watercourse (Gara River and Commissioners Waters), one named tributary (Lambing Gully) and approximately 15 unnamed tributaries. The dams are located mostly along the watercourses that traverse the site.

Gara River and Commissioners Waters are perennial rivers and tributaries of Macleay River. Gara River is approximately 97km long starting within the Great Dividing Range near Llangothlin. It flows generally south and south east to join Salisbury waters within the Oxley Wild Rivers National Park. Commissioners Waters is formed by the Dumaresq Creek and Tilbuster Ponds. The river is approximately 19 km long and flows generally to the southeast by south before joining the Gara River. Gara River onsite contains aquatic habitat and vegetation and is also mapped as Key Fish Habitat.

Most of the smaller watercourses on the Proposal site are tributaries of Gara River which discharges into Salisbury Waters approximately 8.9 km south-east of the proposal site. All other watercourses are described as ephemeral and would only contain flowing water during significant rainfall events.

Water quality onsite for all the waterways would be influenced by the surrounding agriculture activities specifically stock access, informal waterway crossings and runoff of chemicals (e.g., fertilisers and herbicides) and animal waste.

4.4 Groundwater

The NSW DPI database of groundwater lists no bores located at the Proposal site or within 400m of the site. The Armidale Dumaresq Regional LEP has no mapping of areas identified as having groundwater vulnerability.

4.5 Rainfall and climate

The Proposal site is located within the New England Tableland Bioregion. The New England Tableland is dominated by temperate to climate characterised by warm summers (NSW Government , 2016). The closest climate data for the Proposal site is the Armidale Airport weather

station (site number 056238). The mean monthly rainfall Armidale Airport is outlined in Table 4-1. The region has a higher mean rainfall during the spring and summer months.

Table 4-1: Mean rainfall for Armidale Airport for years 1994 - 2021 (BOM, 2021)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean rainfall (mm)	91.8	95.2	64.7	35.2	39.1	49.5	42.6	45.1	49.5	72.6	96.5	100.8	756.8

4.6 Rainfall erosivity factor

The rainfall erosivity factor is a measure of the ability of rainfall to cause erosion (referred as “R” in the Revised Universal Soil Loss Equitation RUSLE). The rainfall erosivity factor is used to determine the soil loss in tonnes per hectare over one year and is used in calculations when sizing construction sediment basins.

The Proposal is located between two locations with existing, monthly R-factor data: Lismore and Taree. These two locations are slightly more coastal than Armidale and as such are likely to have high R values due to higher rainfall, however the detailed R-factor data for Lismore and Taree is detailed in Table 4-2 and Table 4-3, below and is considered a good nearest fit R value for Armidale.

Table 4-2: Monthly % and annual rainfall erosivity (R - factor) values for Lismore, NSW

Monthly % and annual rainfall erosivity (R – factor) values – Lismore, NSW													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
%	14.7	18.6	15.1	8.9	6.6	5.4	4.1	2.5	2.4	4.5	6.9	10.3	5119
R - Value	753	952	773	456	338	276	210	128	123	230	353	527	5119

Table 4-3: Monthly % and annual rainfall erosivity (R-factor) values for Taree, NSW

Monthly % and annual rainfall erosivity (R – factor) values – Taree, NSW													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
%	13.6	14.6	14.9	10.0	7.2	6.0	4.5	3.3	4.4	5.5	6.6	9.5	3113
R - Value	423	454	463	311	224	187	140	103	137	171	205	295	3113

4.7 Water use and supply

Water would be supplied during construction by a licenced river offtake and not by use of any onsite bore. The Engineering Procurement and Construction (EPC) contractors would apply for a Water Access Licence under Section 56 of the Water Management Act 2000 for the river offtake.

Between 2019 and 2021 the Gara River had two local utility Water access licences WAL (waterregister.waternsw.com.au/water-register-frame). These WALs had a total share component of 6902 ML at 100%. Of that allocation the use was 2077.8 ML (2021/22), 2526.8ML (2019/2020) and 3456.6ML (2018/2019). Between 2019 and 2021 the Gara River had eight unregulated River WALs. These WALs had a total share component of 1065 ML at 1ML per share. Of that allocation the use was 0.0ML. The expected 96 ML required for construction represents about 2% of water allocated but not utilised. This will have negligible impact on water levels and existing users.

Construction

Water use during the construction phase would be minimal and used predominantly for dust suppression on unsealed tracks and for the construction of new roads. The requirement for water is dependent on weather conditions, such as wind and rainfall, and is anticipated to be about 96ML in total. About 0.4 ML of potable water would be required for employees and contractors (Table 4-4).

Table 4-4 Water requirements for construction of the Proposal.

Water quality	Total construction water requirement (ML)	Sources	Availability
Potable (drinking)	0.4 ML (for about 12 – 18 months)	Bottled water	Available as required – commercial supply
Non-potable	96 ML (for about 12 – 18 months)	Truck delivery Rainwater tanks Gara River	Available as required

Operation

Run off from the Operations and Maintenance buildings would be captured in water tanks. This water would be used for firefighting needs and panel cleaning. Cleaning materials and spare parts would be made available on site for use by the maintenance staff. Panel cleaning may be required during drought conditions. As such, additional panel cleaning may also be required on occasion. As a 'maximum' upper limit, it is estimated that up to 500kL of water would be required to clean all of the panels once. Additional clean water for panel cleaning would be sourced commercially.

It is estimated that up to 1ML would be required per year under normal operating conditions. If insufficient water is collected on site from rainwater tanks and dams, water would be obtained from commercial water providers.

4.8 Flooding

The Armidale - Dumaresq Local Flood Plan covers preparation for response to and recovery from emergencies including flooding (NSW SES, 2013). According to the Plan, the area is almost entirely contained within the Macleay River Basin. The Armidale Regional Council area is located in the New England Tablelands and Gorge sections of the upper Macleay River Valley. The

primary tributaries are the Gara River, Commissioners Waters, Salisbury Waters and the Chandler River and its main tributaries.

Floods do not significantly affect the rural community of the LGA. However, flooding does cause damage to several roads, which may be cut for short periods. The areas so affected include roads in the Proposal site, which may be cut by Gara River and Commission Waters and their tributaries.

No existing flood studies of relevance to the Proposal site are available.

Hydrological and hydraulic modelling of the Proposal site shows during in a 1% Annual Exceedance Probability (AEP) event. The modelling shows that significant flood depth (>1m) is expected to occur within Gara River and Commissioners Waters with velocities of 3 m/s and up to 4m/s where flood depth is highest. Within the other smaller tributaries of the proposal site, flow depths can reach up to >1 m, however, predominately do not exceed 0.30 m in the 1% AEP event and velocity is predominately 1m/s to 1.5 m/s, except where flood depth is highest in which case velocity can exceed (refer to flood mapping in Appendix B).

5. Environmental aspects and impacts

5.1 Construction activities

Construction activities at the Proposal site, such as excavation and earthworks, have the potential to disturb soils, cause erosion and subsequent sedimentation. The Proposal does not involve any extensive earthworks or landform reshaping. The following work would impact on soils:

- Construction of internal roads.
- Construction of site compound.
- Construction of laydown and parking areas.
- Construction of footings for the onsite substation and inverters.
- Trenching for underground cabling.
- Pile driving/ screwing of module frames and fencing poles.
- Landscaping around the perimeter of the site.

5.2 Impacts and risks

The potential for impact on soil and water will depend on a number of factors. Primarily impacts will be dependent on the nature, extent and magnitude of construction activities and their interaction with the natural environment. Potential impacts attributable to construction include:

- Exposure of soils during vegetation clearing and minor earthworks, creating the potential for off-site transport of eroded sediments and pollutants through surface runoff.
- Erosion of stockpiled excavated materials.
- Alteration of surface flows through the construction of access tracks.
- Degradation of topsoil quality from excavation and handling.
- Contamination of soils, surface and groundwater from accidental spills or oil leaks. This might include grease or fuel from machinery and vehicles, construction sites or compounds, or spills of other chemicals that may be used during the course of construction.
- Disturbance of unidentified contaminated land (agricultural chemical pits). This is considered a very low risk.
- Compaction or disturbance of sodic soils during earth works.
- Slumping of trenches creating erosion hazards.
- Temporary flooding has the potential to interfere with construction or promote erosion.
- Dust generation.

6. Environmental mitigation and controls measures

6.1 Design requirements

The final design of the Oxley Solar Farm will be designed to avoid the 1% AEP flood level to minimise impacts from potential flooding including:

- The solar array mounting piers would be designed to withstand the forces of floodwater (including any potential debris loading) up to the 1% AEP flood event plus 500 mm freeboard, giving regard to the depth and velocity of floodwaters.
- The tracking axis for solar tracking modules would be located above 1% AEP flood event plus 500 mm freeboard.
- The mounting height of the solar module frames would be designed such that the lower edge of the module is clear of the predicted 1% AEP flood level.
- All electrical infrastructure, including inverters, would be located above the 1% AEP flood level plus 500 mm freeboard.
- Where electrical cabling is required to be constructed below the 1% AEP flood level it would be capable of continuous submergence in water.
- The proposed perimeter security fencing would be constructed in a manner which does not adversely affect the flow of floodwater and should be designed to withstand the forces of floodwater or collapse in a controlled manner to prevent impediment to floodwater.
- Any fencing across Gara River or Commissioners Waters should be avoided in preference to creating separate fenced compounds on either side of the creeks.
- The finished floor level of all buildings should be a minimum of 500 mm above the 1% AEP flood level.

All buildings and structures (including solar arrays) associated with the Proposal will be located outside high hazard areas (H5 and above) where they may be vulnerable to structural damage and have significant impact on flood behaviour.

6.2 Stormwater management

All road crossings of watercourses within the Proposal site will be designed in accordance with the following guidelines, and in the case of vehicle crossing should preferably consist of bed level crossings constructed flush with the bed of the watercourse on first and second order watercourses to minimise any hydraulic impact:

- Guidelines for Watercourse Crossings on Waterfront Land (DPI, 2012)
- Guidelines for Laying pipes and Cables in Watercourses on Waterfront Land (Office of Water, 2010)
- Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge, 2003).
- Policy and Guidelines for Fish Friendly Waterway Crossings (NSW DPI, 2003).

Internal road infrastructure has been typically designed at grade and aligned with the natural topography. Floodway crossings are in use where flows are more concentrated in crossing the road. Permanent site roads will be unsealed roads designed to withstand flooding in a 5-year average recurrence interval (ARI) storm event subject to wear and tear, provided the roads have been appropriately maintained. Floodway crossings are in use where flows are more concentrated

in crossing the road while a culvert is to be located at the site entrance, situated parallel to the roadside swale.

The final design of the substation site will also be slightly raised above the adjacent roadway (or similar type bunding) to divert upslope runoff around this critical piece of infrastructure.

6.3 Erosion and sediment controls

ESCPs will be prepared and progressively updated in consultation with onsite staff and industry best practice for all stages of work and are an integral component of this SWMP. The ESCPs will be prepared in accordance with *Managing Urban Stormwater - Soils and Construction Vols 1 and 2, 4th Edition (Landcom, 2004).* The ESCPs would generally contain the following, as relevant to the local conditions and workstage:

a) Drawing(s) that clearly shows the site layout and other matters listed in (b) and (c) below. A narrative should accompany the drawing that describes how erosion control and soil, and water management will be achieved onsite including ongoing maintenance of structures.
b) The drawing(s) should contain the following background information:
    - Location of site boundaries and adjoining roads.
    - Approximate grades and directions of surface water flow.
    - Approximate locations of trees and other vegetation, identifying whether or not it will be removed or retained.
    - Location of site access, proposed roads and other impervious surfaces.
    - Existing and post-construction drainage patterns with stormwater discharge points.
c) The drawing should include or be accompanied with detail on how soil conservation measures will be carried out onsite, including:
    - Timing of works.
    - Locations where groundcover will be retained.
    - Access protection measures.
    - Nature and extent of earthworks including cut and fill.
    - Diversion of runoff from sloping lands around disturbed areas.
    - Location and type of proposed erosion and sediment control measures.
    - Rehabilitation locations and activities.
    - Frequency and nature of maintenance program activities.
    - Site-specific soil or water conservation structures.

An overarching description of the fundamentals of erosion and sediment control to be implemented during construction is provided below.

6.3.1 Drainage control

Drainage control refers to the management of both ‘clean’ stormwater runoff around and through the site; and ‘dirty’ site stormwater runoff to enable treatment of sediment prior to release offsite, as defined below:

Clean water:	Water that either enters site from an external source and has not been further contaminated by sediment within site; or water that has originated from the site and is of such quality that it does not need to be treated in order to achieve the required water quality standard (IECA, 2008).

Dirty water:	Site derived water not defined as clean, thereby requiring treatment with appropriate controls prior to release from site (IECA, 2008).

Drainage control measures (temporary and permanent) will enable management of stormwater within work areas, including to:

- Enable diversion of 'clean' up-slope, run-on water either around or through the site at non-scouring velocities.
- Enable collection of 'dirty' runoff generated within construction areas and the delivery of this water to an appropriate sediment control measure.
- Minimise the risk of soil erosion caused by site-generated flows within the Proposal, through the use of 'intermediate' flow treatment and release points.
- Control of the flow velocity, volume and location of water passing through the Proposal at drainage line and waterway crossings.

6.3.2 Erosion control

Erosion control is the primary approach for the prevention of adverse impacts associated with sedimentation. Construction activities are to be undertaken to reduce the duration of soil exposure to erosive forces (wind and water), either by holding the soil in place or by shielding it.

Erosion control measures to be adopted include construction practices, structural controls and vegetative measures aimed at managing runoff at a non-erosive velocity, and the protection of disturbed soil surfaces.

The specific measures implemented will be based on seasonal erosion risk and construction activities. Measures will be documented in the ESCP.

Proposed controls include:

- Staging of the works to reduce overall exposed area as far as practical.
- Promptly stabilising exposed areas once construction stage has been completed (permanent works).
- Protection of soil surface (temporary and permanent) including placement of hardstand surfaces, use of soil binder, vegetation establishment (including landscaping), and protection with mats & blankets (e.g., jute, geotextile).
- For high-risk areas (i.e. areas noted as having sodic soils [refer to SIA (NGH , 2022f)], and/or steep slopes, areas near waterways and areas showing signs of poor stabilisation) during construction, prior to forecast rainfall of > 50% chance of 10 mm or more in 24 hours, exposed surfaces are to be temporarily ground-covered using fabric, polymer or similar.
- Dust suppression by wetting of exposed surfaces, application of soil binder, and/or application of soil cover.

6.3.3 Sediment control

Sediment control measures will be installed in combination with drainage and erosion control measures to provide effective pollution management. The Proposal will adopt a 'treatment train' approach, where various control measures are utilised in sequence.

Sediment control measures include systems, procedures and materials to filter, trap and/or settle sediment from sediment-laden waters. In addition to adopting measures as per the *Blue Book* (Landcom, 2004) and IECA (2008) standard drawings, variations to these may be implemented where it can be demonstrated that they are equally as effective and meet the intent of best practice guidelines.

6.4 Flooding

Prior to works commencing on site, a Business Floodsafe Plan will be prepared in general accordance with the NSW SES Business Floodsafe Toolkit and Plan. The plan will include contact details for Proposal and emergency staff and will be presented to all personnel. Compounds, buildings, chemical storage, stockpiles and material laydown areas will be positioned outside of flood prone land, where possible, and erosion and sediment controls will be assessed during installation for their efficacy in the event of a flood. Flood warning signs and flood level indicators would be placed on each approach to the proposed crossings of the Gara River.

A system for daily monitoring of flood alerts will be implemented by the project team so that in the event of a flood warning being issued, all unsecured material in the floodplain can be efficiently removed and other appropriate precautionary measures can be taken.

6.5 Mitigation measures

Table 6-1: Soil and Water management and mitigation measures

ID	Measure/Requirement	Resources needed	Timing	Responsibility	Reference
General					
SWMP1	Prepare an Erosion and Sediment Control Plan (ESCP) for the Work Under the Contract.		Pre-construction	Contractor	Best practice
SWMP2	All staff and subcontractors will undergo a site induction and ongoing toolbox talks that will detail best practice soil and water management measures, including erosion prevention and sediment control.	Induction package, ERSED plans	Pre-construction Construction	Contractor	Best practice
SWMP3	Undertake a soil survey prior to construction to inform the CEMP and sub-plans, rehabilitation and operational aspects.	Oxley Solar Farm Soil Impact Assessment (2021)	Pre-construction Construction	OSD	EIS
SWMP4	If groundwater is to be intercepted at any stage of the development the proponent must obtain the relevant entitlement and approval where required prior to any extraction.	*Water Management Act 2000*	Pre-construction Construction	Contractor	EIS
SWMP5	A protocol would be developed in relation to discovering buried contaminants within the proposal site (e.g., pesticide containers). It would include stop work, remediation and disposal requirements.	Unexpected finds protocol	Pre-construction Construction	Contractor	EIS
Design					

ID	Measure/Requirement	Resources needed	Timing	Responsibility	Reference
SWMP6	The array would be designed to allow sufficient space between panels to establish and promote groundcover beneath the panels and allow for implementation of weed controls.	Construction drawings	Pre-construction Construction	Contractor	EIS
SWMP7	Ensure appropriate drainage controls are incorporated into the design to minimise the area of disturbance, runoff and pollutant generation.	Construction drawings	Pre-construction Construction	Contractor	EIS
SWMP8	The design, construction and decommissioning of the Proposal should minimise the extent and duration of ground disturbance and avoid disturbing steep slopes and waterways.	Construction drawings	Pre-construction Construction	Contractor	SIA
Erosion and sediment management					
SWMP8	Prevention of erosion will be prioritised above sediment control wherever practicable, at all times during works.		Construction	Contractor	Best practice
SWMP9	There is to be no release of dirty, impacted or otherwise, water into drainage lines and/or waterways.		Construction	Contractor	Best practice
SWMP10	Install, monitor and maintain erosion controls.		Pre-construction Construction	Contractor	EIS
SWMP11	Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads which may cause risks to other road users through reduced road stability.		Construction	Contractor	EIS

ID	Measure/Requirement	Resources needed	Timing	Responsibility	Reference
SWMP12	Minimise the area of disturbance from excavation and compaction; rationalise vehicle movements and restrict the location of activities that compact and erode the soils as much as practical. Any compaction caused during construction would be treated such that revegetation would not be impaired.		Construction	Contractor	EIS
SWMP13	Manage works in consideration of heavy rainfall events; if a heavy rainfall event is predicted, the site should be stabilised, and work ceased until the wet period has passed.		Construction	Contractor	EIS
Soil and Stockpile management					
SWMP14	Where ground disturbance is required the vegetation (organic matter) should be retained and reused during rehabilitation.		Construction	Contractor	EIS
SWMP15	Subsoils disturbed during construction and with an exchangeable sodium percentage above 6% should be treated with gypsum to increase the levels of calcium and magnesium, and thus lowering the exchangeable sodium percentage and the dispersiveness of the soil.	Gypsum	Construction	Contractor	EIS
SWMP16	Avoid altering the groundwater and surface water regime to prevent mobilisation of any salt stores, however low, in the soil.		Construction	Contractor	EIS
SWMP17	Manage topsoil in all excavation activities, separate subsoils and topsoils and ensure that they are replaced				EIS

ID	Measure/Requirement	Resources needed	Timing	Responsibility	Reference
	in their natural configuration to assist revegetation.				
SWMP18	Stockpile topsoil appropriately so as to minimise weed infestation, maintain soil organic matter, maintain soil structure and microbial activity.				EIS
SWMP19	The minimisation of wind-blown dust will be prioritised during works, with water application frequency to be determined around weather forecasts and program timings.	Water cart Polymers	Construction	Contractor	Best practice
SWMP20	Stockpiles will be located outside of the tree protection zone (TPZ) of trees or native vegetation identified for retention.	Flagging	Construction	Contractor	Best practice
SWMP21	Stockpiles will be located at least 5m from likely areas of concentrated water flows and at least 40m from waterways		Construction	Contractor	Best practice
SWMP22	Stockpile heights will be no greater than 2m and slopes will be no steeper than 2:1.		Construction	Contractor	Best practice
SWMP23	Stockpiles that will be in place for more than 20 days, as well as any stockpiles that are susceptible to wind or water erosion, will be covered or otherwise protected from erosion within 10 days of forming each stockpile.		Construction	Contractor	Best practice
Work in waterways					
SWMP24	Temporary waterway crossings will be constructed and	ESCP	Construction	Contractor	Best practice

ID	Measure/Requirement	Resources needed	Timing	Responsibility	Reference
	maintained in accordance with the ESCPs and the Blue Book.	Bluebook			
SWMP25	All environmentally sensitive areas and all waterway areas in or adjacent to the site which are excluded from the work areas will be properly protected and signposted.	SAPs Flagging	Construction	Contractor	Best practice
SWMP26	Riparian vegetation removal will be minimised where practicable and access to waterways will be restricted to the minimum amount of bank length required for the activity.		Construction	Contractor	Best practice
SWMP27	Stumps in riparian zones and aquatic habitats will be retained, where practicable, to reduce the potential for bank erosion.		Construction	Contractor	Best practice
Spill and chemical management					
SWMP28	A Spill and Contamination Response Plan would be developed as part of the overall Emergency Response Plan to prevent contaminants affecting adjacent surrounding environments. The plan would include measures to: • Respond to the discovery of existing contaminants at the site (e.g., pesticide containers or asbestos), including stop work protocols and remediation and disposal requirements. • Requirement to notify the EPA for incidents that cause material harm to the environment (refer	Emergency Response Plan	Pre-construction	Contractor	EIS

ID	Measure/Requirement	Resources needed	Timing	Responsibility	Reference
	s147-153 of the POEO Act). • Manage the storage of any potential contaminants onsite. • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and the EPA notification procedures and remediation. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Prevent contaminants affecting adjacent pastures, dams, water courses and native vegetation. • Monitor and maintain spill equipment • Induct and train all site staff.				
SWMP29	All fuels, chemicals, and liquids would be stored at least 40m from any waterways or drainage lines, not on sloping land or flood prone land and would be stored in an impervious bunded area.	Bunding Spill kits	Construction	Contractor	EIS
SWMP30	The refuelling of plant and maintenance would be undertaken in impervious bunded areas on hardstand areas only.	Bunding Spill kits	Construction	Contractor	EIS
SWMP31	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery.	Inspection forms	Construction	Contractor	EIS
SWMP32	Emergency spill kits are to be kept on site at all times. All staff are to be made aware of the location of the spill	Spill kits Induction materials	Construction	Contractor	Best practice

ID	Measure/Requirement	Resources needed	Timing	Responsibility	Reference
	kit and trained in its use.				
SWMP33	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	Induction materials	Pre-construction Construction	Contractor	
SWMP34	All potential pollutants stored on-site would be stored in accordance with HAZMAT requirements and bunded.	Bunding Spill kits	Construction	Contractor	EIS
SWMP35	Adequate incident management procedures would be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	Emergency Response Plan	Pre-construction	Contractor	EIS
SWM36	The transformers will be filled with oil, and waterproof bunds built around them to manage oil spills.	Design	Pre-construction	Contractor	EIS
SWMP37	Vehicle wash down and/or cement truck washout is to occur in a designated concrete washout area as approved on a site specific ESCP.	ESCP	Construction	Contractor	Best practice
Water use					
SWMP38	Re-use of stormwater should be considered wherever possible		Construction	Contractor	EIS
Flood management					
SWMP39	A system for daily monitoring of flood alerts will be implemented so that in the event of a flood warning	BOM weather data and	Construction	Contractor	Best Practice

ID	Measure/Requirement	Resources needed	Timing	Responsibility	Reference
	being issued all unsecured material in the floodplain can be removed and other appropriate precautionary measures taken.	alerts Business Floodsafe Plan			
Inspections and maintenance					
SWMP40	Inspect stormwater control measures at least quarterly, and before and after rainfall of more than 10 mm in 24 hours.	BOM weather Inspection form	Construction	Contractor	EIS
SWMP41	All temporary erosion and sediment control measures, including drainage control measures, will be fully operational and maintained in proper working order at all times as reasonably practical.	Inspection form	Construction	Contractor	Best practice
Rehabilitation					
SWMP42	A Groundcover Management Plan would be developed in consultation with an agronomist and to ensure final land use includes perennial ground cover establishment across the site as soon as practicable after construction and maintained throughout the operation phase. The plan would cover: • Soil handling, restoration and preparation requirements. • Plant Species election. • Soil preparation. • Establishment techniques. • Maintenance and monitoring requirements.	Groundcover Management Plan Agronomist	Construction	Contractor	EIS

ID	Measure/Requirement	Resources needed	Timing	Responsibility	Reference
	• Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements – i.e. A target of 70% live ground cover would apply to protect soils, landscape function and water quality. Additional measures would be implemented where practical when live ground cover falls below 70%. Ground cover would be monitored on a monthly basis using an accepted methodology during the initial rehabilitation phase for up to 12 months, and then annually until the required groundcover is achieved. • Contingency measures to respond to declining soil or groundcover condition, i.e., any grazing stock would be removed from the site when cover falls below the target of 70% live ground cover. • Identification of baseline conditions for rehabilitation following decommissioning. • Preserve the native composition as much as possible				
SWMP43	Areas of soil disturbed by the proposal would be rehabilitated progressively or immediately post-construction, reducing views of bare soil.	Groundcover Management Plan	Construction	Contractor	EIS

7. Compliance management

7.1 Roles and responsibilities

The project teams organisational structure and overall roles and responsibilities will be outlined in the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Table 6-1 and further the EMS and CEMP.

7.2 Training

All employees, contractors and utility staff working on site will undergo site induction training relating to soil and water management issues. The induction training will address elements related to soil and water management including:

- Existence and requirements of this sub-plan, as well as associated and supporting documentation such as EWMS and ESCP.
- Relevant legislation.
- Roles and responsibilities for soil and water management.
- Water quality management and protection measures.
- Procedure to be implemented in the event of an unexpected discovery of contaminated land.
- Emergency evacuation requirements.

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in soil and water management. Examples of training topics include:

- Requirements of the environmental control measures, POEO Act and the *Water Management Act 2000.*
- ESC measure installation methodology.
- Working near or in drainage lines and creeks.
- Emergency response measures in high rainfall events.
- Preparedness for high rainfall and flood events.
- Mulch and tanning management.
- Spill response.
- Stockpile criteria.
- Identification of potentially contaminated spoil and fill material.
- Sensitive environments within and near the Proposal site.

Further details regarding staff induction and training will be outlined in the CEMP.

7.3 Monitoring and inspections

Regular monitoring and inspections will be undertaken in the lead up to, during and following construction. Monitoring and inspections will include, but not be limited to:

- Construction water quality prior to discharge.

- Inspections would occur weekly, pre/post rainfall and/or during prolonged/heavy rain to evaluate the effectiveness of erosion and sediment controls in accordance with the CEMP and this plan.
- Ensuring sediment controls are appropriately cleaned out following large rainfall events or as required, and ensuring the sediment is appropriately reused or disposed.
- Monitoring of rehabilitated areas to evaluate stability and vegetation establishment.
- Ensuring waste bins are regularly emptied to minimise potential for pollution resulting from general waste or contaminated waste.

Additional requirements and responsibilities in relation to inspections will be documented in the CEMP.

7.4 Weather monitoring

Rainfall at the Proposal site will be measured and recorded in millimetres per 24-hour period at the same time each day from the time that the site office associated with the work is established.

Rainfall will be measured either electronically (tipping bucket) or through the use of rain gauges located at the compound and at selected locations across the site.

Weekly and daily monitoring of the weather forecast will occur. Actions as required to address the impending weather forecast would be programmed in a timely manner. Rainfall will be considered when scheduling works and controlling access to and through the site.

7.5 Incident management

In the event that heavy rainfall leads to an erosion or contamination incident onsite, the contractor's incident response plan will be followed as detailed the CEMP. In the event of a spill, the spill response procedure will be followed. This spill response procedure will be developed in accordance with the EMS.

7.6 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with Proposal requirements and other relevant approvals, licenses and guidelines. Audit requirements will be detailed in the CEMP. Audits will determine the need to review and update the SMP is accordance with the EMS.

7.7 Reporting

Reporting requirements and responsibilities are documented in the CEMP and EMS.

8. Review and improvement

8.1 Continuous improvement

Continuous improvement of this Plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Document any changes in procedures resulting from process improvement
- Make comparisons with objectives and targets.

8.2 SWMP update and amendment

The processes described in the EMS may result in the need to update or revise this Plan. This will occur as needed.

Only the Environment Manager, or delegate, has the authority to change any of the environmental management documentation.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure.

9. References

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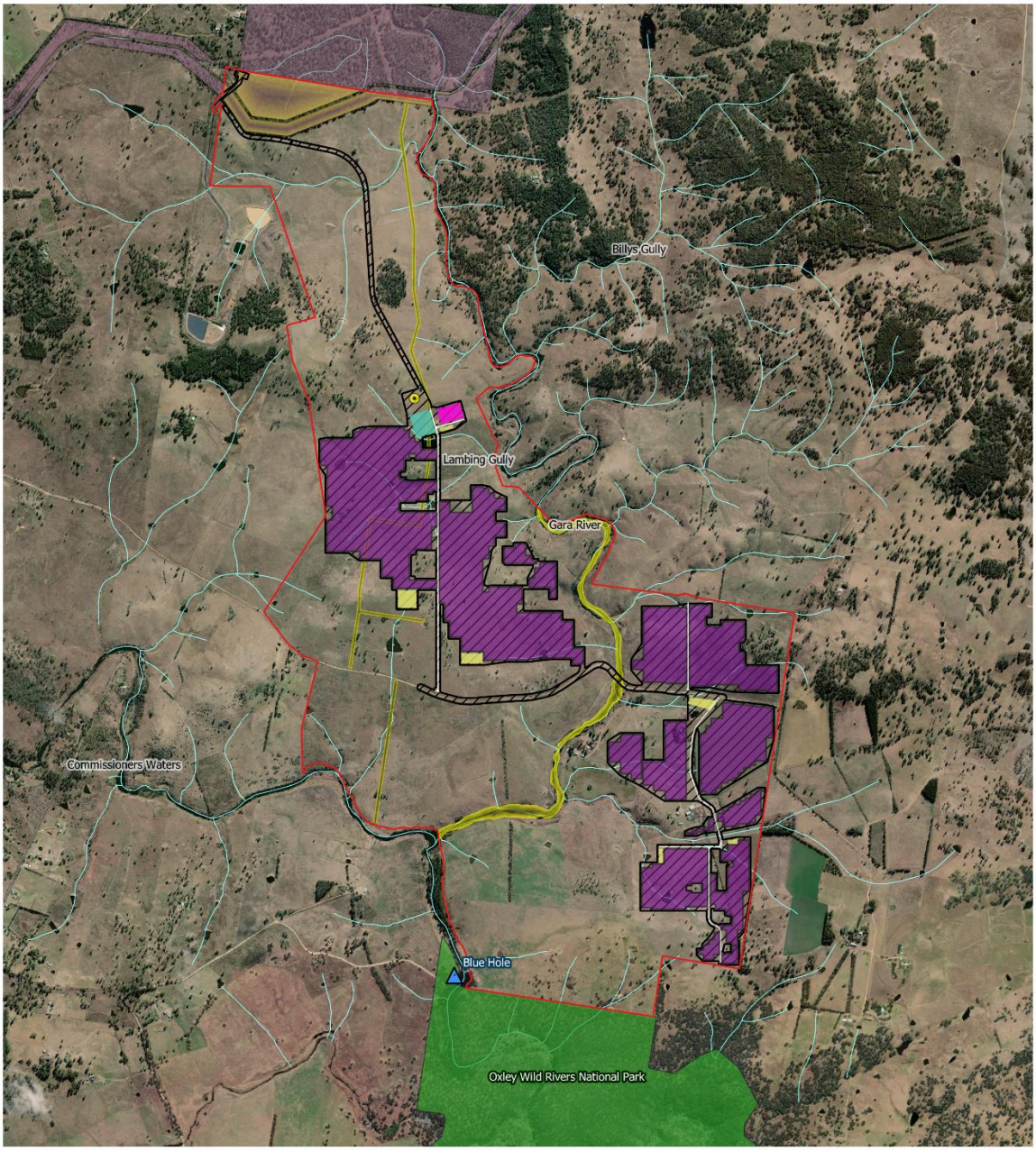
Appendix A Site layout



Development Footprint

Legend

- Proposal site
- Development Footprint
- Waterways
- National Park
- Travelling Stock Reserves
- Crown Land within Proposal site
- Blue Hole Picnic Area

Infrastructure layout

- Array area
- BATTERY STORAGE
- CONTROL ROOM
- PV-PCU
- Shed
- Site road
- Laydown areas
- Substation
- Transmission connection point

0 250 500 m

Ref: 21-393 Submissions and Amendment workspace 20220523 \ Development Footprint
Author: kyle.m
Date created: 19.09.2022
Datum: GDA94 / MGA zone 56

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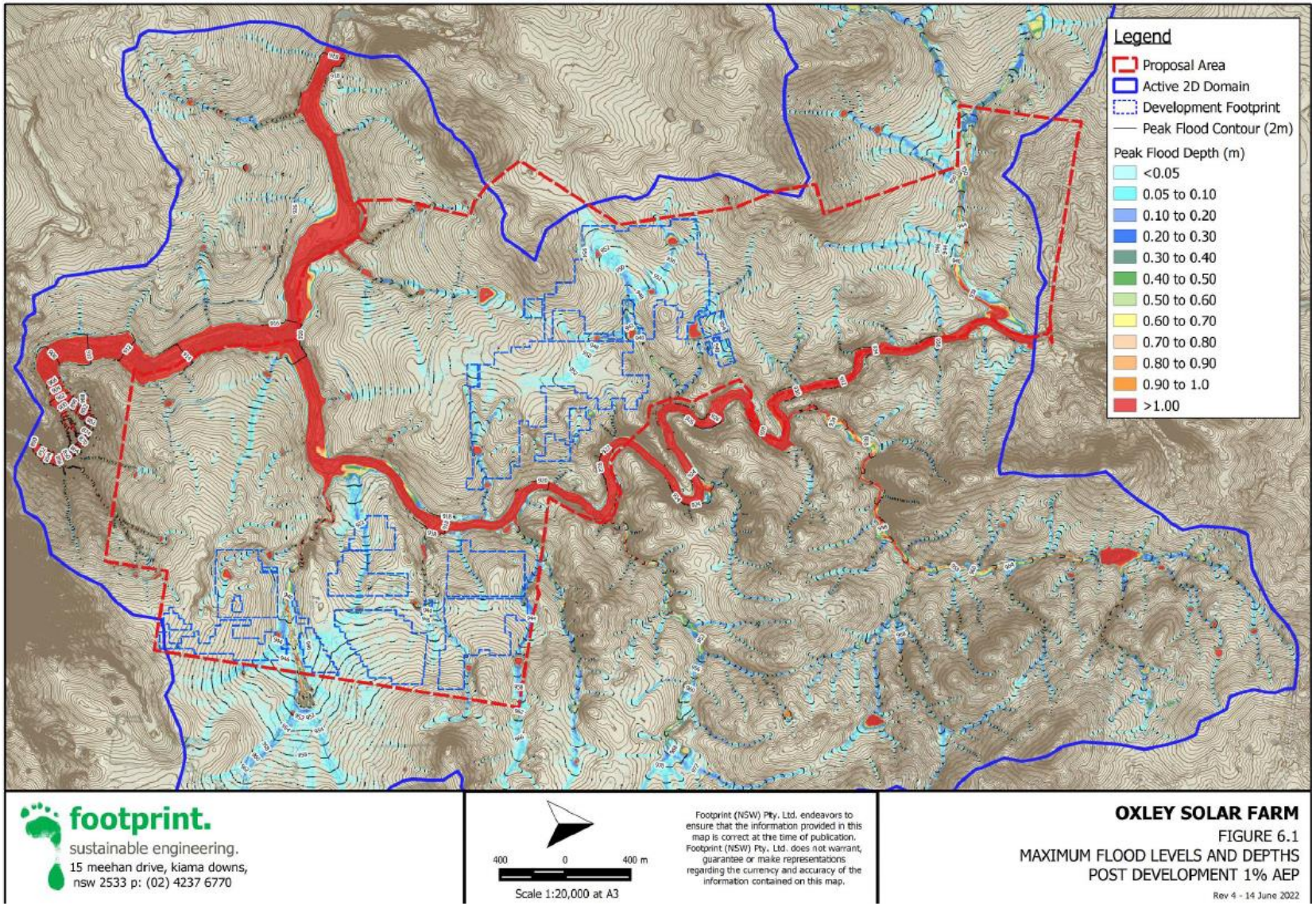
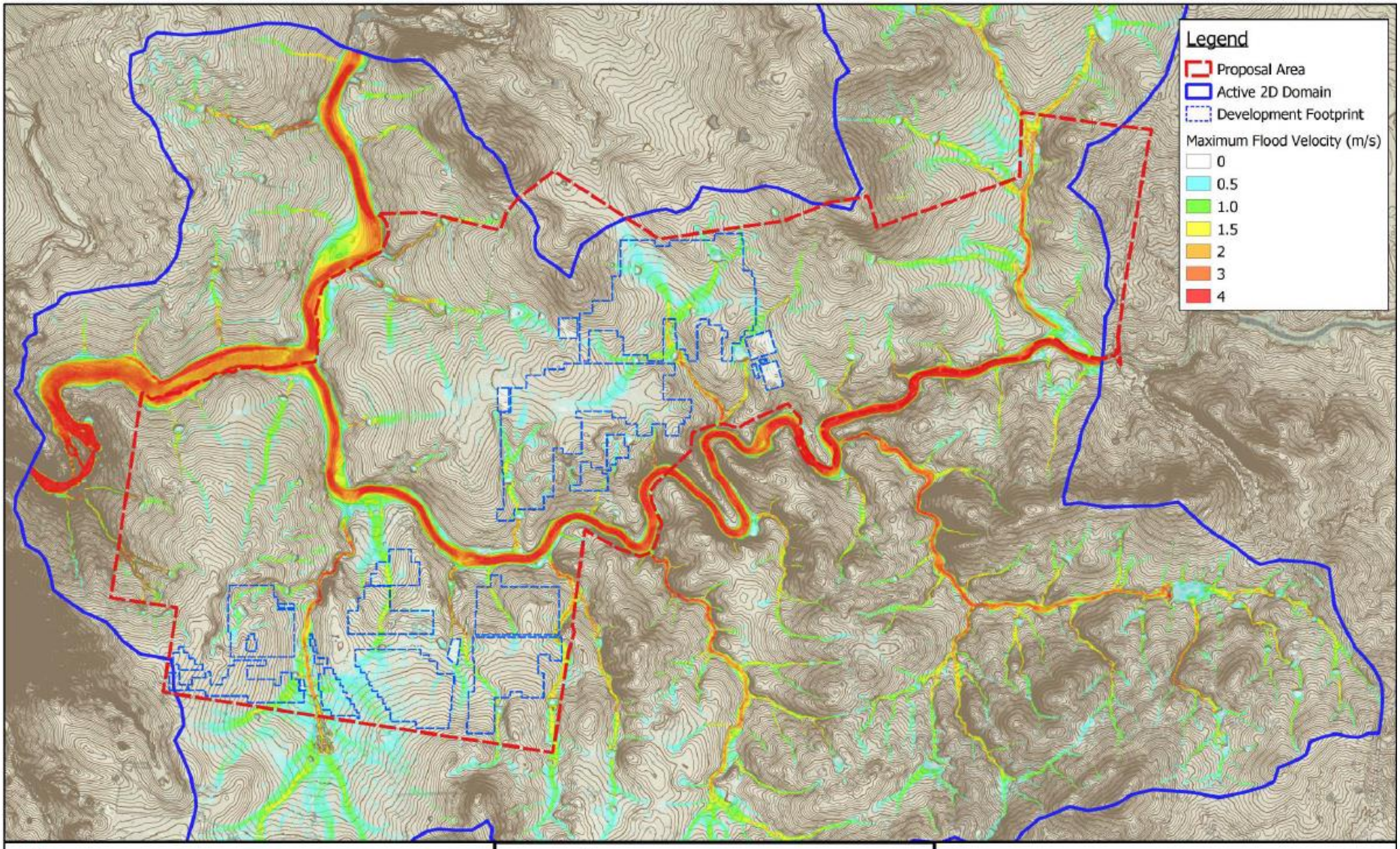
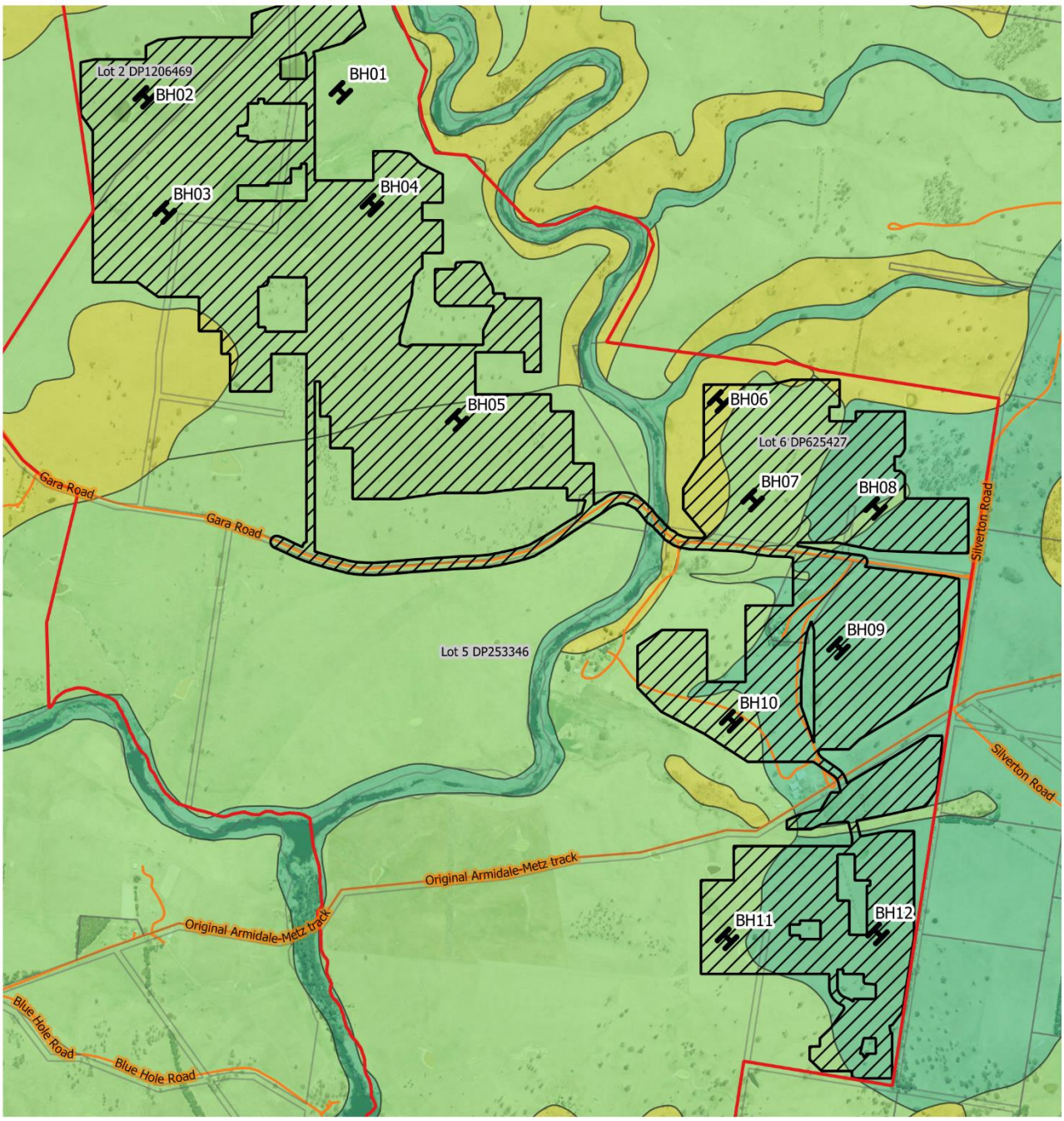
Appendix B Flood mapping




Legend
Proposal Area
Active 2D Domain
Development Footprint
Maximum Flood Velocity (m/s)
0
0.5
1.0
1.5
2
3
4
footprint.
sustainable engineering.
15 meehan drive, kiama downs,
nsw 2533 p: (02) 4237 6770
400
0
400 m
Scale 1:20,000 at A3
Footprint (NSW) Pty. Ltd. endeavors to ensure that the information provided in this map is correct at the time of publication. Footprint (NSW) Pty. Ltd. does not warrant, guarantee or make representations regarding the currency and accuracy of the information contained on this map.
OXLEY SOLAR FARM
FIGURE 6.2
MAXIMUM FLOOD VELOCITY
POST DEVELOPMENT 1% AEP
Rev 4 - 14 June 2022

Appendix C Borehole and Soil Landscape Locations



Borehole Locations

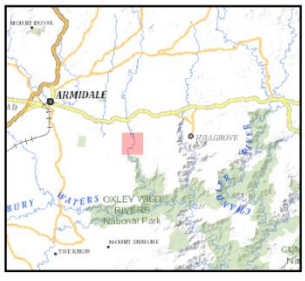
Legend

- Proposal site
- Development Footprint
- Borehole Locations
- Roads

Land and Soil Capability

- 4
- 5
- 6

0 250 500 m



Ref: 21-393 Soil Survey Workspace 20210617 \ Borehole Locations
Author: kyle.m
Date created: 31.05.2022
Datum: GDA2020 / MGA zone 56

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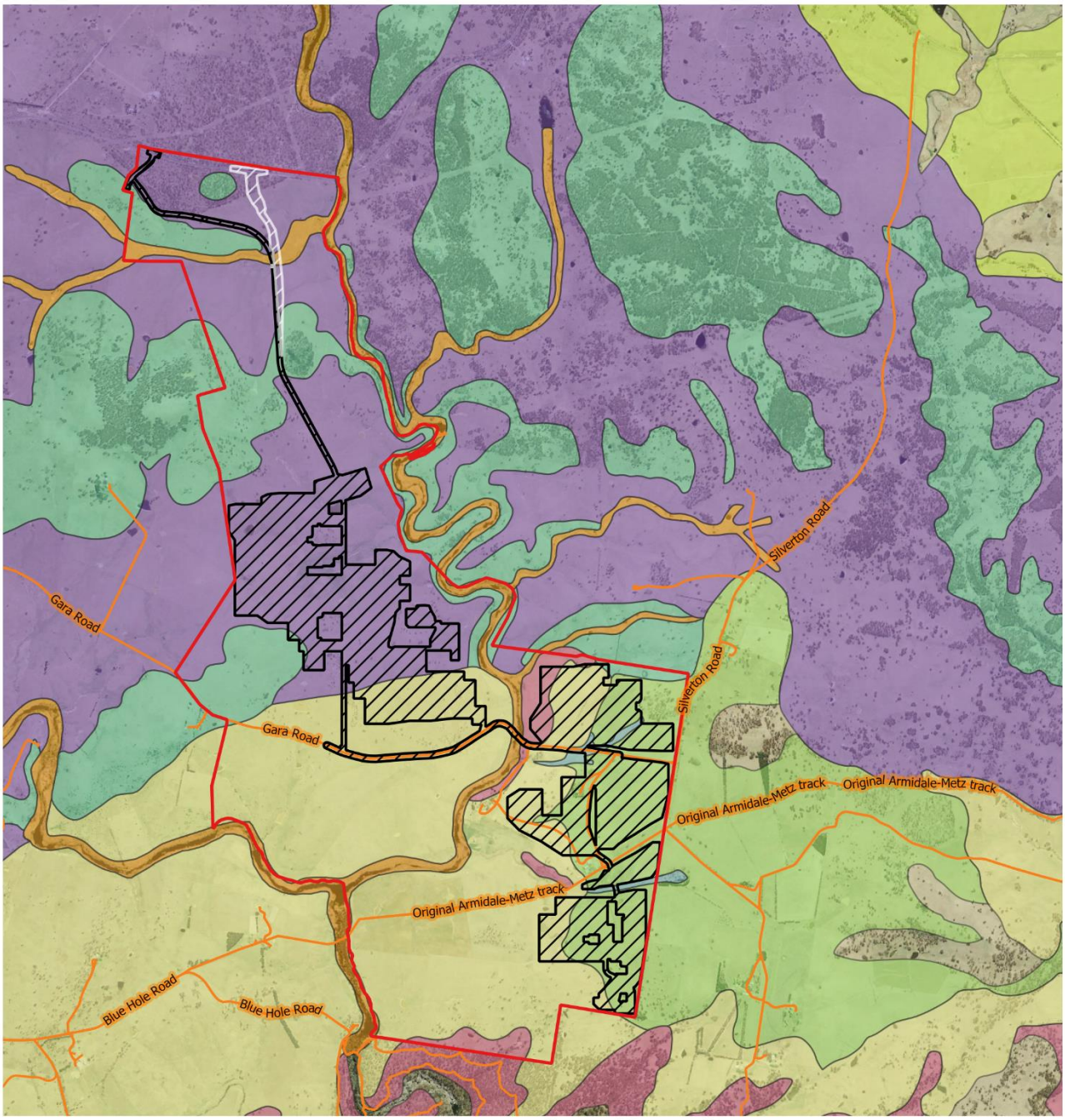

Soil Landscapes

Legend

- Proposal site
- Development Footprint Option 1
- Development Footprint Option 2
- Roads

Soil Landscapes

- Argyle
- Castledoyle
- Commissioners Waters
- Cubba Cubbah
- Ironstone
- Long Point variant b
- Middle Earth
- Silverton

0 0.5 1 km

Ref: 21-393 Soil Survey Workspace 20210617 \ Soil Landscapes
Author: kyle.m
Date created: 31.05.2022
Datum: GDA2020 / MGA zone 56

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