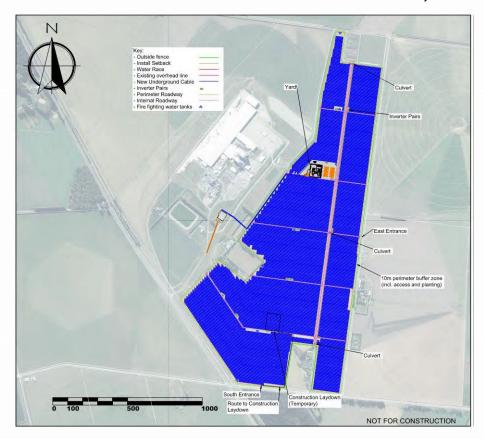


24-1239.002 Darfield Solar Farm

1352 Homebush Road, Darfield



Prepared for: Darfield Solar and Energy Storage Limited Project no: 24-1239.002

Prepared by: Matthew Sullivan-Brown | Senior Geotechnical Engineer Reviewed by: Mitch Cateley | Geotechnical Engineering Manager

Revision	Date	Status	Authorised by:
1	18/10/2024	For Information	Mitch Cateley Geotechnical Engineering Manager BE(Hons) CPEng, CMEngNZ

DISCLAIMER

This report has been prepared for our client and relates only to the proposal described therein and it is not to be used for any other project. No responsibility is accepted by BCD Group Limited or its directors, servants, agents, staff or employees for the accuracy of information provided by third parties and/or the use of any part of this report in any other context or for any other purpose.



1 INTRODUCTION

BCD Group have been engaged by Darfield Solar and Energy Storage Limited to provide a desktop geotechnical review of the proposed solar farm at 1352 Homebush Road, Darfield. BCD Group has only reviewed desktop information available to us such as existing reports, council GIS, and historic aerial imagery. A site visit and site-specific testing has not been undertaken. The recommendations outlined in this report are subject to site testing and verification. A site topographic plan has not been undertaken and site levels are referenced from LINZ data.

The site is within the jurisdictions of Environment Canterbury Regional Council (ECan) and Selwyn District Council (SDC). An agrivoltaic development is currently proposed on the site and the client would like to ascertain any geotechnical hazards or limitations to developing on this site for the proposed purpose. This letter should be utilised for guidance only, a detailed site-specific geotechnical investigation and assessment is recommended prior to design of any future development.

The site is a collection of titles with a combined area of approximately 154 ha and is currently used for farming. The site legal descriptions follow:

- Lot 2 DP 60325 (~107ha)
- Lot 1 DP 434071 (~47ha)

2 PROJECT DESCRIPTION

It is proposed to construct a new agrivoltaic development at an existing pastural farmland site. Resource consent documents are available which indicate solar panels covering the majority of the site with a substation, associated buildings, and BESS (Battery Energy Storage System) area proposed centrally toward the northern end of the site. The existing dwelling at the southern end of the property at 1352 Homebush Road will be separated from the development.

Through discussion with the client, we understand that the solar panels are proposed to be placed on driven steel piles.

3 SITE DESCRIPTION

The site is in the suburb of Darfield, Canterbury. The site location and geological Maps are in Appendix B. The site is an irregular shape which is bordered by Loes Road to the east, Homebush Road to the south, State Highway 73 to the west and Auchenflower Road to the north. The Darfield Fonterra facility shares the western boundary of the site.

The site near level with the ground surface gently sloping towards the south-southeast. Ground surface elevation grades from approximately 238 m RL at the northern end, to 221 m RL at the southern end over approximately 2.2 km distance. The is little elevation relief across the site. There appear to be some shallow swale drains running through the central paddocks.

4 DESKTOP REVIEW

4.1 Existing Documents

BCD has been provided with the following relevant documents relating to the project prepared as part of the resource consent documentation.

- Engineering & Infrastructure Report, CKL.
- Stormwater Management Plan, CKL 2024.

The engineering and infrastructure report provides preliminary information about earthworks including erosion and sediment control, roading and access, and three waters management. Earthworks are indicated as being limited to topsoil stripping and formation of erosion control measures.

The stormwater management report provides information about the overall stormwater management strategy and the district flood hazard assessment. GIS plans and photos are included which show the stormwater



channels and infostructure running through the site. The existing stormwater channel sizes and depths vary, along their length, but are typically small and shallow.

4.2 Geological Setting

The 1:250k published Geological Map for the Christchurch Area (Forsyth, et al 2008) indicates that the area is underlain by late Pleistocene River Deposits, comprising predominantly gravel. These are described as a variable mix of gravels, sand/silt/clay in low river terraces, with localised silty loess cap.

4.3 Close Proximity Active Faults

The GNS active fault database and Canterbury fault maps indicates that the nearest active fault is the Hororata Fault which is estimated to run in a north easterly direction approximately 1.5km from the site. The accuracy of the fault is noted as uncertain with little information available. The end of the fault in shown as coinciding with a localised hill to the north-west of the site.

4.4 New Zealand Geotechnical Database

The NZGD has been checked for existing geotechnical information. The following nearby investigations provide relevant geotechnical data for the site. A site plan showing the test locations is in Appendix C. The factual logs are also attached for reference in Appendix C:

- 2 No. sonic machine boreholes were drilled within the adjacent Fonterra site. Both boreholes were drilled to approximately 30 m depth supervised and logged by AECOM. The boreholes indicate the ground conditions comprise of a shallow sandy silt topsoil layer overlying a deep profile of very dense river gravels. Static groundwater measurements were not available, though fluid readings during drilling were noted at between 16m and 18m depth.
- 4 No. Test Pits were dug across a property to the east of the site. Test pits were up to 3m deep, all encountering shallow topsoil overlying dense gravels.
- 4 No. hand auger with scala tests were completed surrounding a residential dwelling to the northwest of the site. All tests again terminated shallow on dense gravels.

The cumulation of testing surrounding the site indicates consistent ground conditions comprising very dense river gravels are highly likely to be present from shallow depth.

4.5 Historic Aerial Imagery

BCD has reviewed predevelopment imagery through GRIP which indicates that the site has been used for farming from at least 1985. Though it is likely that the site has been used for farming since much earlier. Very little development has occurred at the site with only construction of the existing dwelling at the southern end of the site sometime between 1985 and 1994. No significant changes to the site have occurred since.

4.6 Environment Canterbury Map Viewer

Environment Canterbury Regional Council provides a comprehensive GIS mapping system (Canterbury Map Viewer) that provides a suite of information including information with regards to natural hazards that might affect development.

A summary of our findings with respect to the site location is provided below. Selected map exerts are provided in Appendix B for reference.

• Liquefaction hazards maps for the Canterbury Region are provided with respect to the various district studies. The Selwyn District liquefaction susceptibility map from 2006 indicates the site is within a zone of very low liquefaction potential. This earlier study does not follow the current MBIE liquefaction susceptibility framework. Though it is noted that the more recent studies from the neighbouring Canterbury districts typically indicate that majority of the surrounding plains are designated as 'liquefaction damage is unlikely'. Only areas within proximity to major rivers are designated as 'liquefaction damage is possible'. A Technical Category (TC) designation is not provided for the rural site.

The Canterbury Map viewer provides Flood Hazard mapping produced for the Selwyn District. The flood
maps covering the site provide estimated flood water depths, velocities, and hazard for both a 1 in 200year and 1 in 500-year flood event. Assessment of the flood hazard was provided within the Stormwater
Management Report completed for Resource Consent.

4.7 Buried Services

The Canterbury Map viewer indicates that the site is services by a reticulated water mains. There appear to be no public stormwater or wastewater services near the site. Private services are likely to be present near the existing dwelling.

A desktop check through beforeUdig plans indicates that services are generally limited to the road corridor. There are overhead powerlines which feed the Orion substation which is shown on the development plans.

4.8 Property File

BCD have not reviewed any specific property files as part of this desktop assessment.

Whilst there is unlikely to be much useful information within the property files for the subject site. The adjacent Fonterra site would likely have supplementary information which could be reviewed to assist with the detailed assessment and design. Additional geotechnical data, building foundation drawings and service information may be available within the property file.

5 PRELIMNARY GEOTECHNICAL HAZARD ASSESSMENT

5.1 Liquefaction

The liquefaction susceptibility maps indicate that there is a very low risk of liquefaction effects at the site. This is backed up by the surrounding geotechnical investigation data. The composition and density of the underlying gravels are such that liquefaction is not likely to pose a risk to the development.

Nevertheless, site specific testing should be undertaken at the next design stage to confirm the consistency of the underlying gravels across the site.

5.2 Slope Stability

As the site is near level, the risk of global slope instability is considered negligible. There are no known gulleys or features which might present risk of localised instability. Though this should be confirmed via a site walkover at the next stage of design.

p:\24-1239.002 solar farms - darfield\060 bcd geotechnical\064 reports\issued\24-10-18 desktop assessment - darfield 24-1239.002.docx



6 PRELIMINARY RECOMMENDATIONS

The recommendations outlined below are preliminary in nature and based solely on a desktop assessment. They are not intended to be used for a building consent application. No site visit nor site specific testing has been undertaken at this stage.

There appear to be no major geotechnical hazards that would greatly affect the development proposal. Liquefaction and slope stability risks are low risk for the site. The closest fault is not well defined but is unlikely to impact development.

Based on review of the surrounding geotechnical data, consistent geotechnical conditions are anticipated across the site comprising very dense river gravels from a shallow depth. Isolated soft spots, or areas of greater topsoil thickness may be present but are not anticipated to be widespread.

The proposed steel piled foundations are likely to be suitable to support the solar structures, subject to confirmation through site-specific investigations. Piled foundations are likely to meet effective refusal at relatively shallow depths. Test Piles should be arranged in a general grid across the site.

For the BESS and switchgear/welfare office building areas, typical shallow concrete pad and slab foundations are considered suitable. Very high bearing capacities are likely to be available due to the underlying gravels. Only topsoil stripping would be anticipated to prepare the sites for these structures.

7 SUMMARY

The preliminary recommendations are provided for the use of Darfield Solar and Energy Storage Limited and are based on our current understanding of the proposed development from a desktop perspective. If any changes are made, then BCD should be requested to comment on the on-going relevance of these recommendations.

The desktop assessment has included a detailed review of publicly available information from a range of sources including council GIS, the New Zealand Geotechnical Database, and published geological maps. A summary of geotechnical hazards is provided which highlights few risks are present based on desktop assessment which should be confirmed as part of detailed site-specific investigations at later design stages.

The desktop assessment indicates that solar panels supported by shallow piles are likely to be a viable option for the site, while the BESS and switchgear/welfare office building areas are likely to be able to be founded on typical shallow concrete foundations, subject to detailed investigation.



8 LIMITATIONS

The recommendations and opinions made in this report are based upon data from desktop assessment only. Inferences about the nature and continuity of subsoils are made but cannot be guaranteed. Actual conditions onsite may vary more gradually or abruptly than that inferred from the investigations available through desktop assessment. Steps can be taken to reduce the likelihood of unexpected conditions arising onsite. As the soil conditions are created and vary by natural processes and human activity, the report is based on desktop assessment at the time of investigation. Soil conditions onsite can change, particularly after long periods of time from the date of investigations referred to in the report via the New Zealand Geotechnical Database.

This report has been prepared for our client for information purposes only and is not intended to a consent application at this stage. It is based on our understanding of the proposed development. Should any changes to the nature of the development occur, BCD should be asked to provide comment on the ongoing applicability of recommendations made in this report. It is not to be relied upon or used out of context by any other person without reference to BCD Group Ltd. The reliance by other parties on the information or opinions contained in this report shall, without prior review and agreement in writing, be at such parties' sole risk. To avoid misinterpreting this report, we recommend that the assistance of geotechnical professionals familiar with the project and scope of this report is maintained.

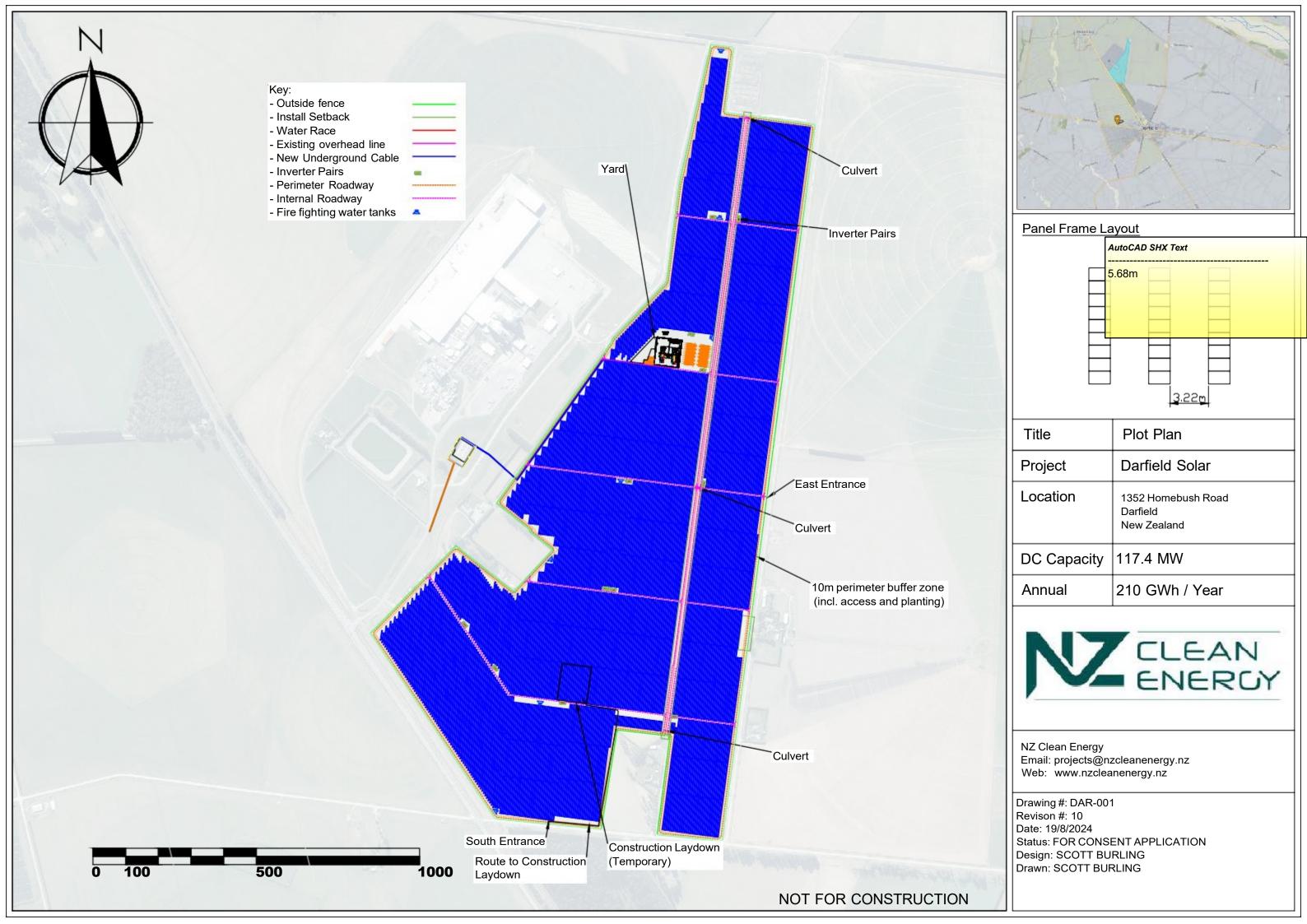
Engineering design recommendations have been made based on the information provided to BCD and available through desktop assessment. Further detailed assessment and site-specific investigation will be required prior to applying for a consent. This report covers geotechnical considerations only. We recommend the proposed works be checked against current District and Regional Council plans or checked by a registered planner.

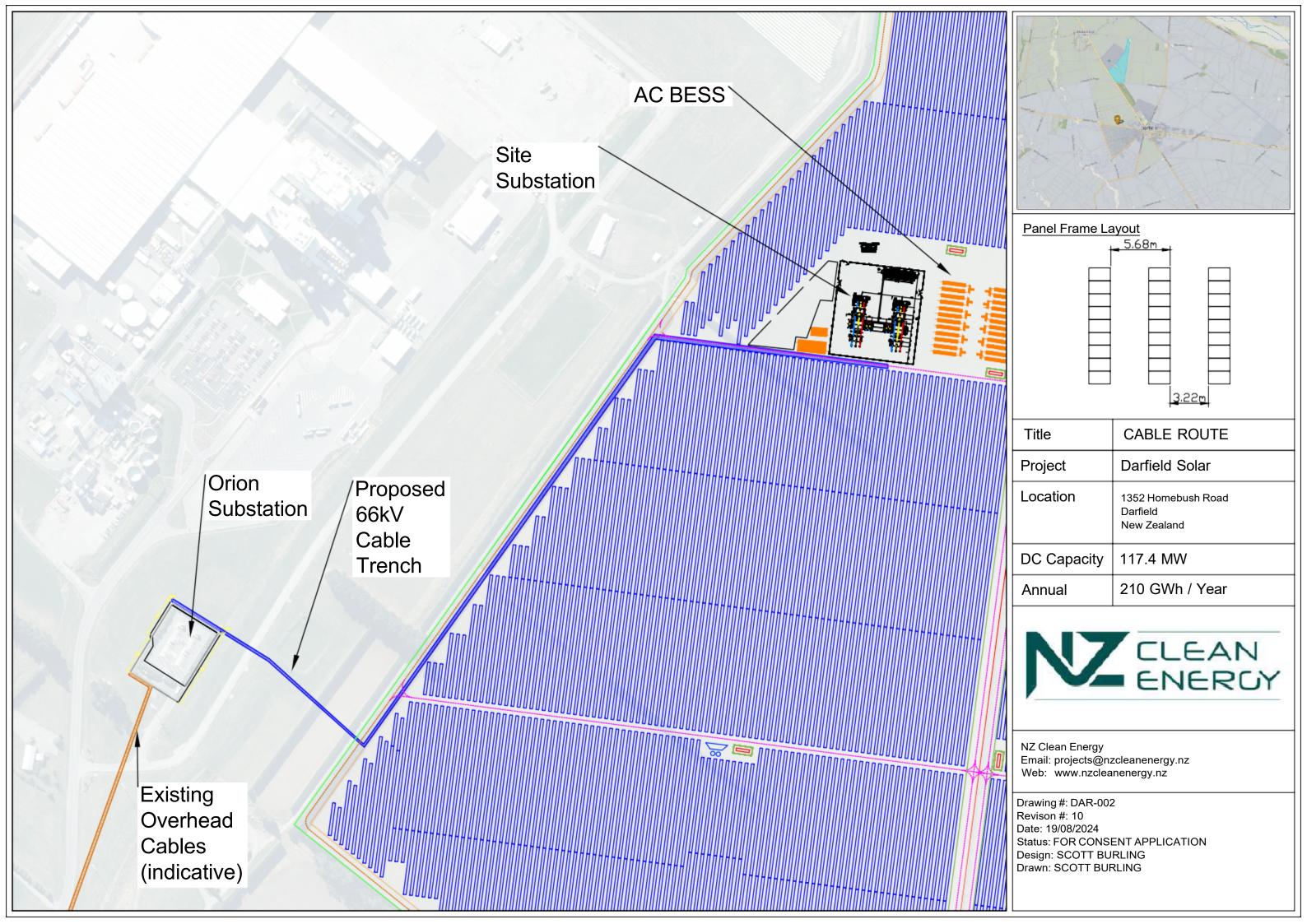
ATTACHMENTS

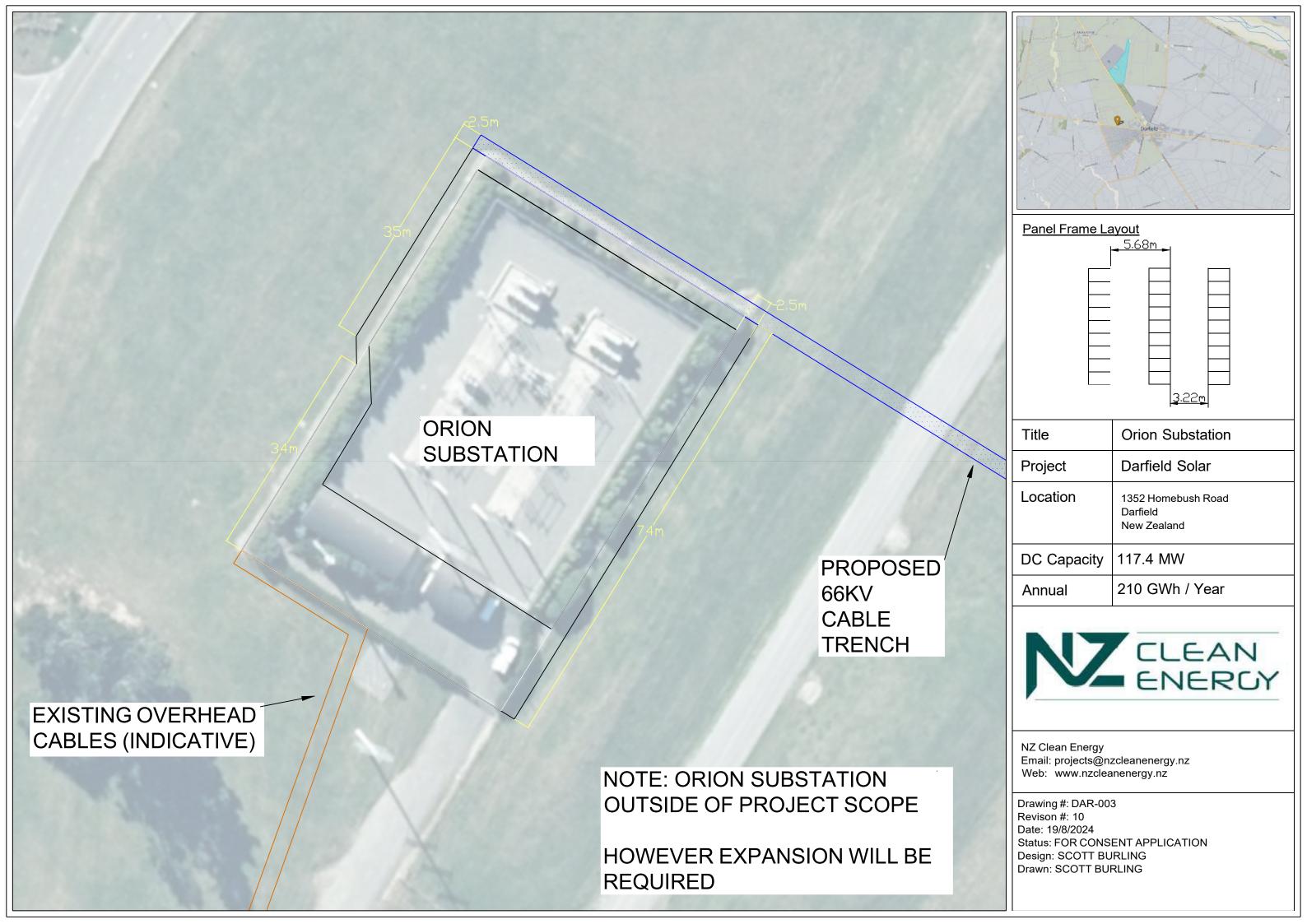
Appendix A - Selected Project Drawings

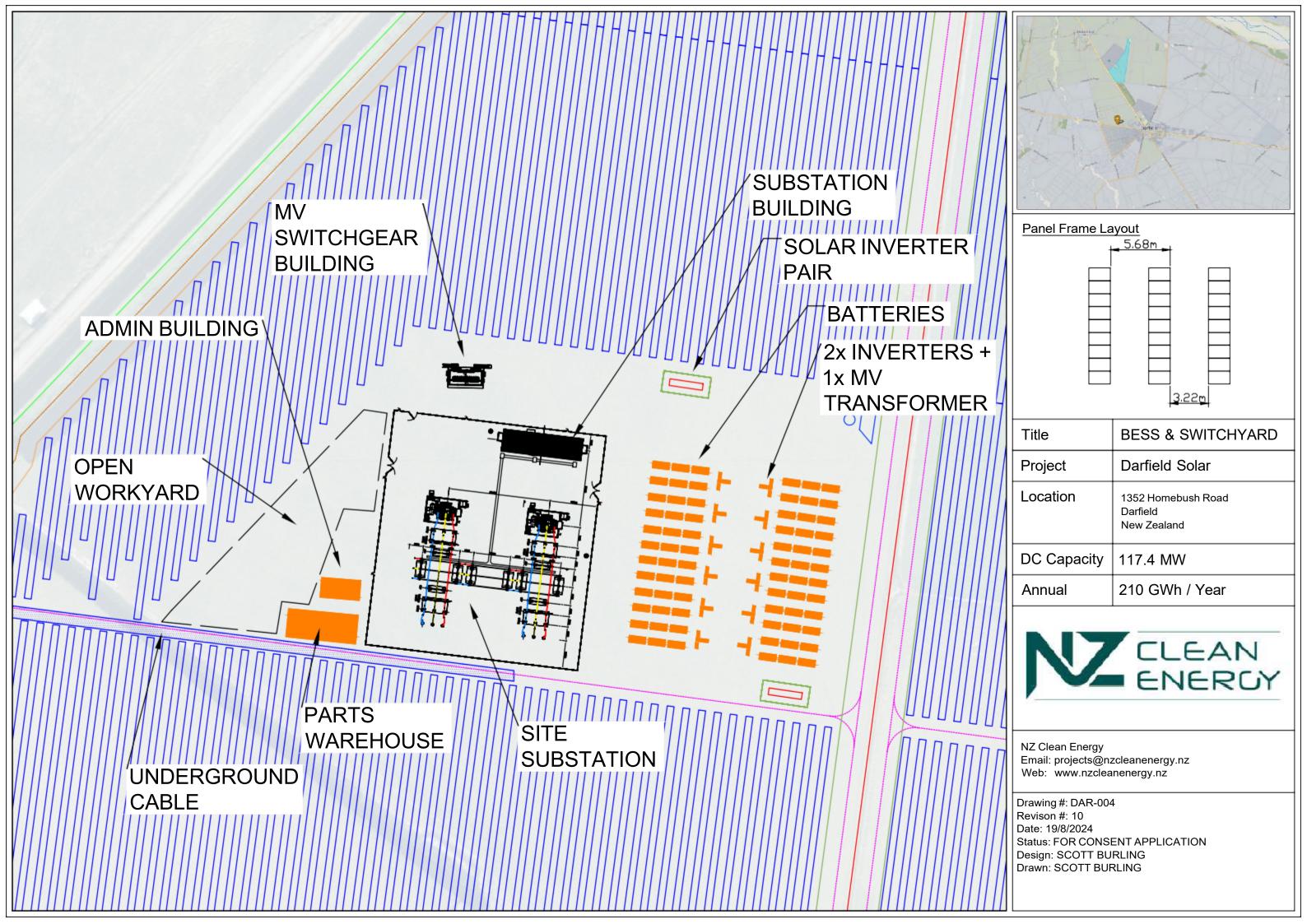
Appendix B - Desktop Information

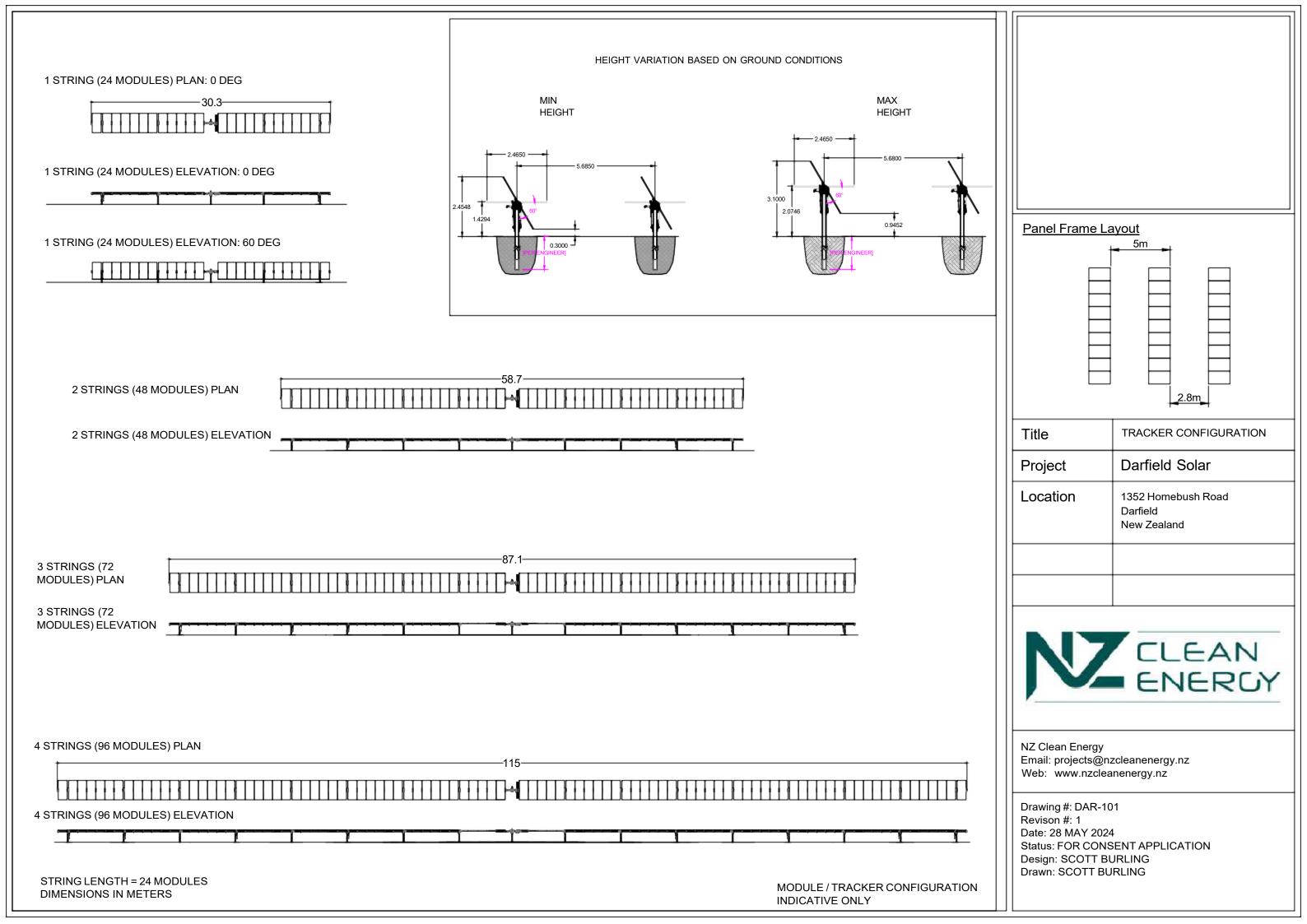
Appendix C - Site Plans

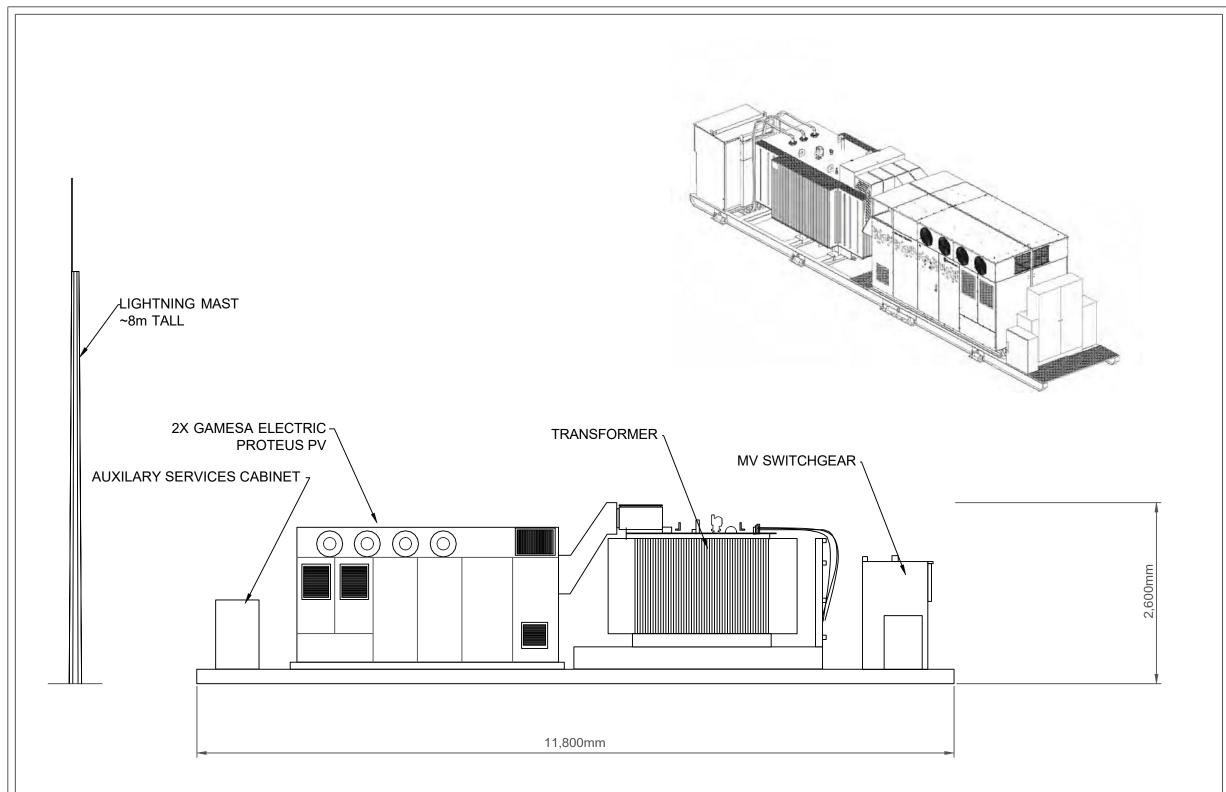












Title INVERTER + MV TRANSFORMER

Project Darfield Solar

Location 1352 Homebush Road Darfield New Zealand



NZ Clean Energy

Email: projects@nzcleanenergy.nz
Web: www.nzcleanenergy.nz

Drawing #: DAR-102 Revison #: 1

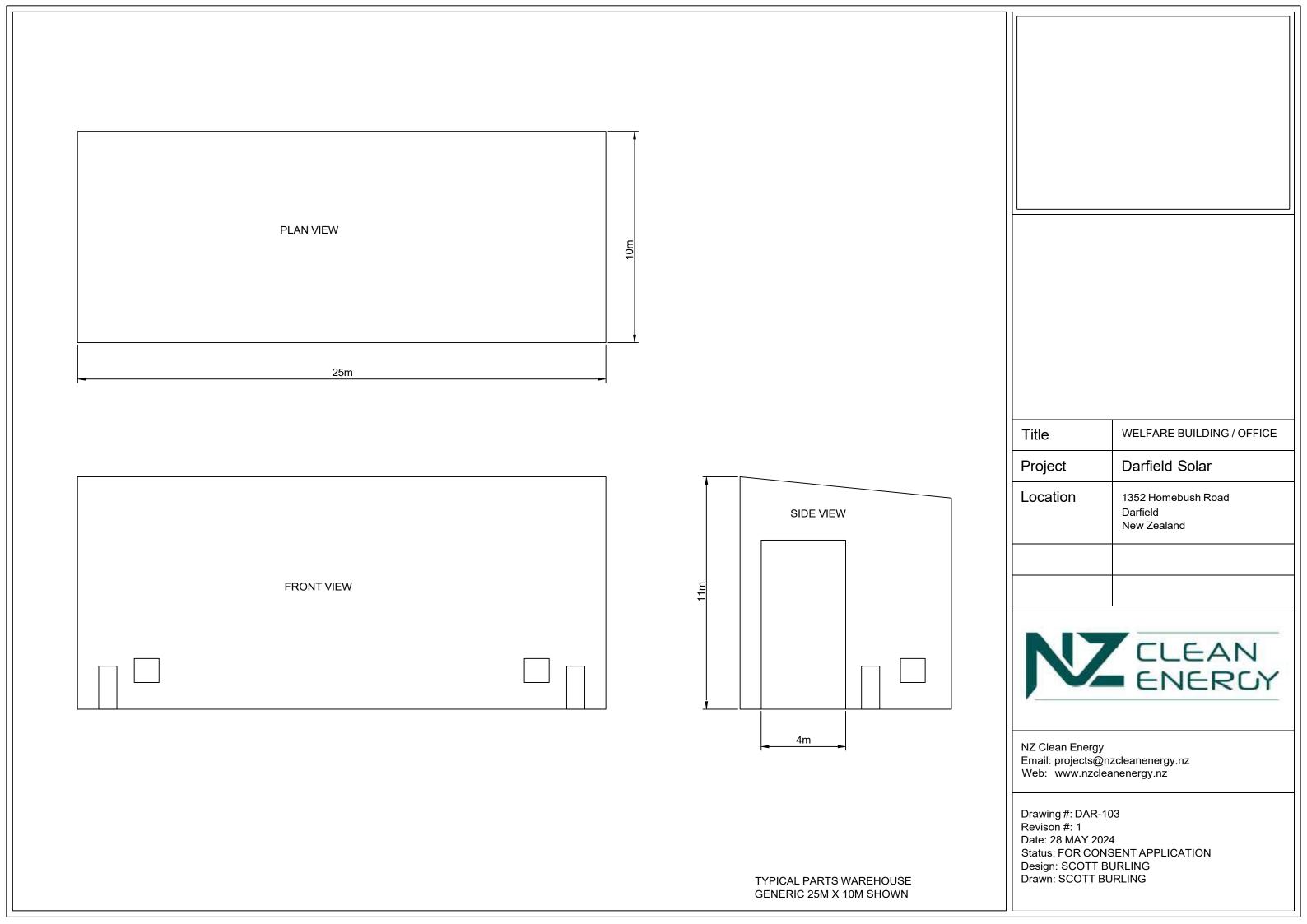
Revison #: 1 Date: 28 MAY 2024

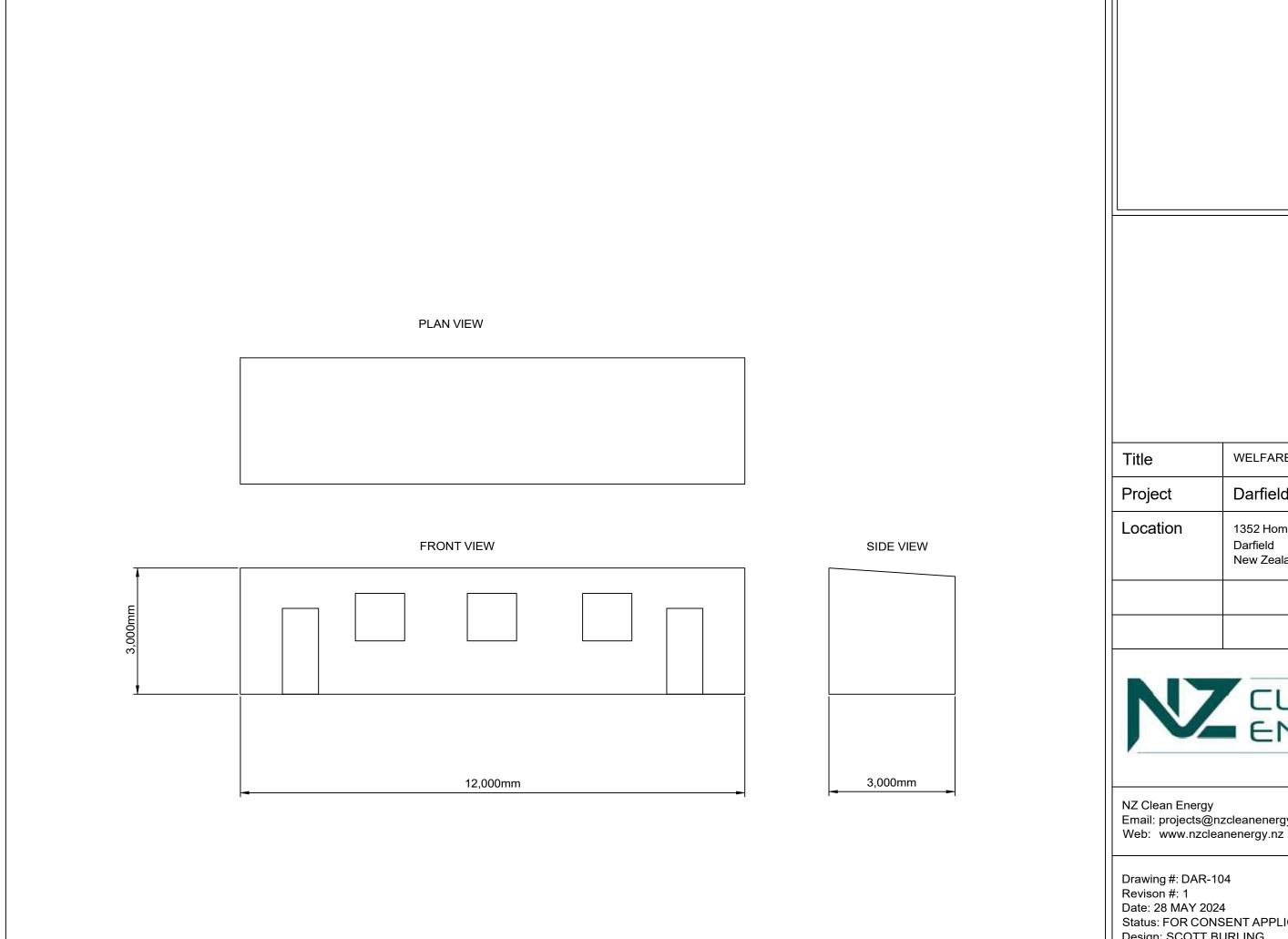
Status: FOR CONSENT APPLICATION

Design: SCOTT BURLING Drawn: SCOTT BURLING

TYPICAL INVERTER PAIR + MV TRANSFORMER GAMISA ELECTRIC PROTEUS PV SHOWN

LIGHTNING MAST ONLY REQUIRED FOR FEILD MOUNTED INVERTERS, NOT INVERTERS NEAR THE SUBSTATION





WELFARE BUILDING / OFFICE Darfield Solar 1352 Homebush Road Darfield New Zealand



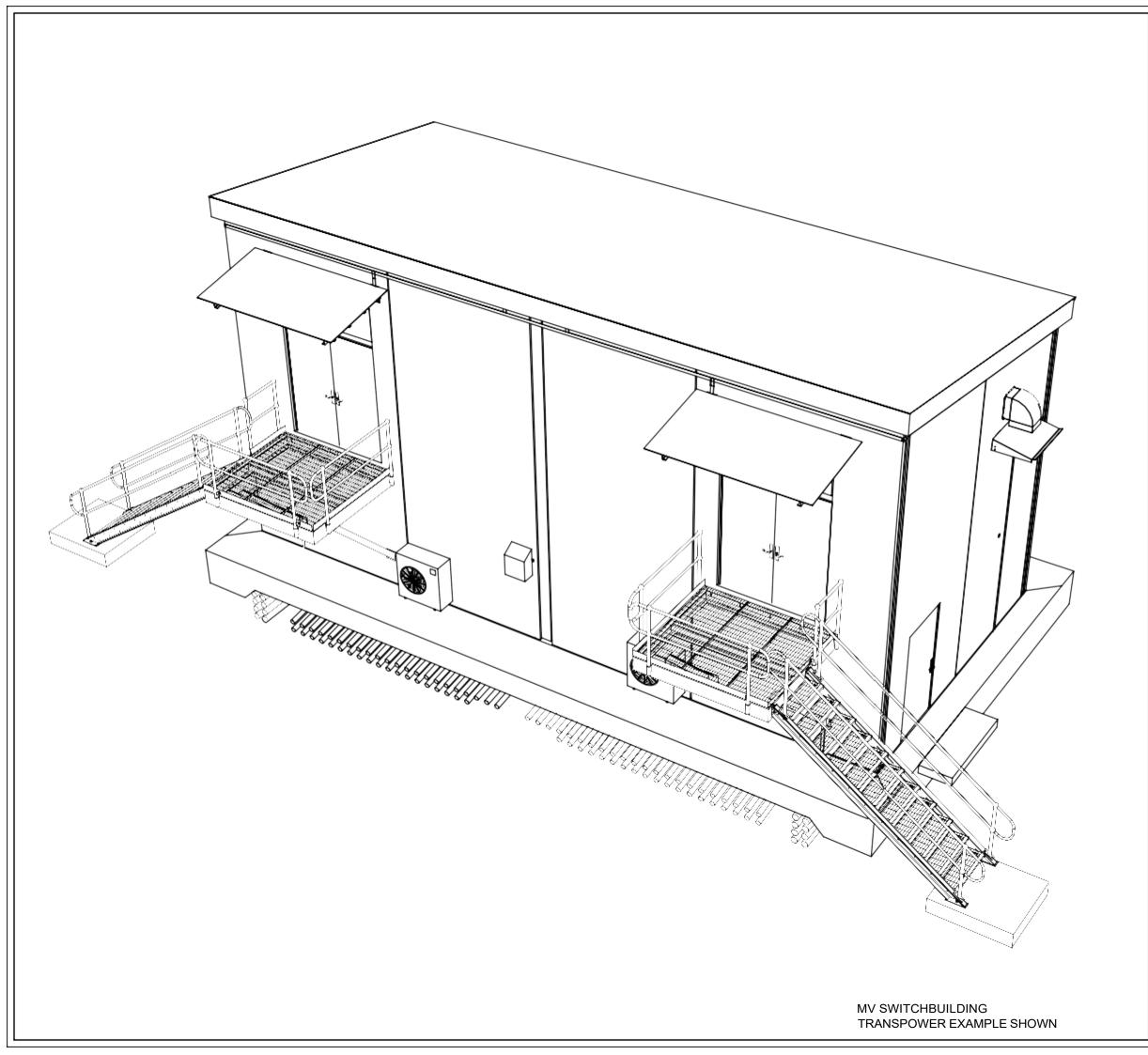
Email: projects@nzcleanenergy.nz

Status: FOR CONSENT APPLICATION

Design: SCOTT BURLING Drawn: SCOTT BURLING

TYPICAL WELFARE BUILDING / OFFICE.

GENERIC 12M X 3.0M SHOWN



Title	MV Switchgear building (1 of 2)
Project	Darfield Solar
Location	1352 Homebush Road Darfield New Zealand

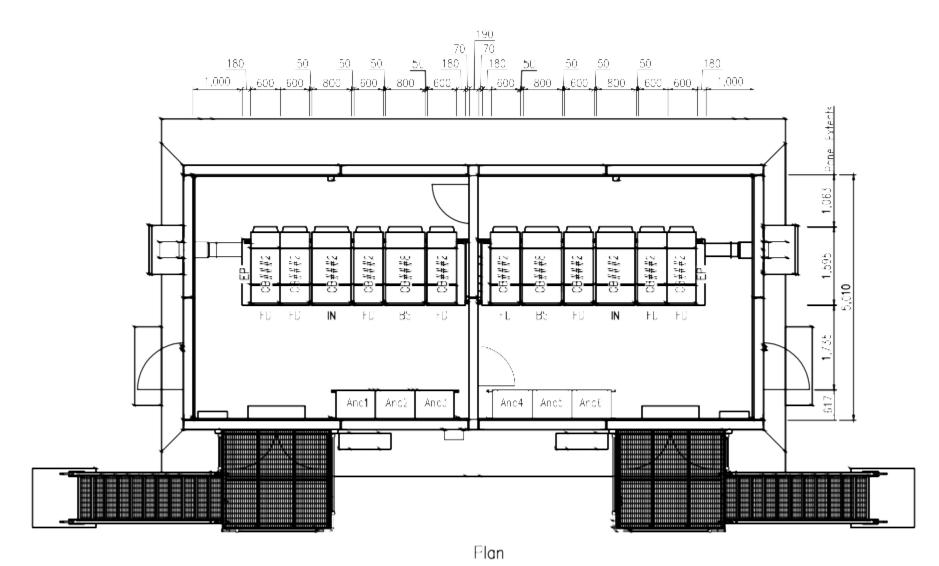


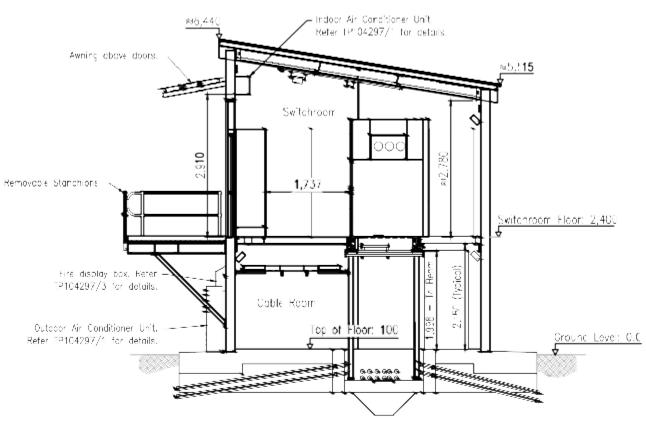
NZ Clean Energy Email: projects@nzcleanenergy.nz Web: www.nzcleanenergy.nz

Drawing #: DAR-105 Revison #: 1 Date: 28 MAY 2024

Status: FOR CONSENT APPLICATION

Design: SCOTT BURLING Drawn: SCOTT BURLING





Typical Section

NOTE: DIMENSIONS IN MM

MV SWITCHBUILDING TRANSPOWER EXAMPLE SHOWN

Title	MV Switchgear building (2 of 2)
Project	Darfield Solar
Location	1352 Homebush Road Darfield New Zealand



NZ Clean Energy

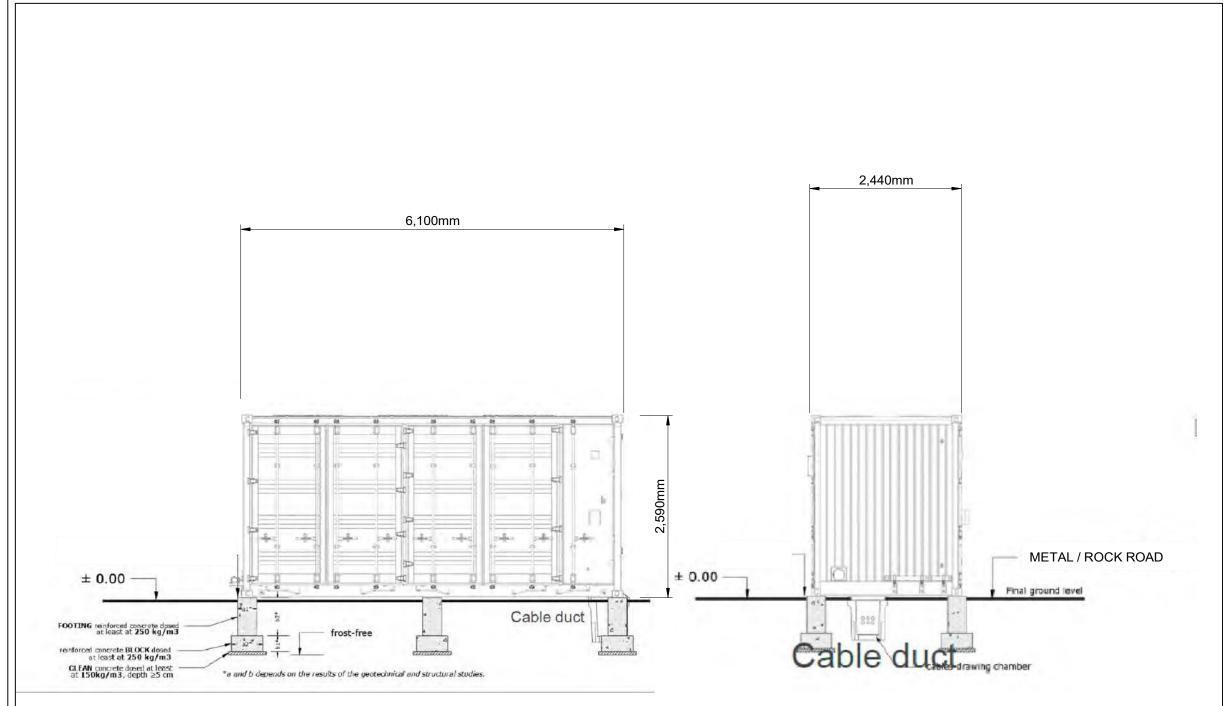
Email: projects@nzcleanenergy.nz
Web: www.nzcleanenergy.nz

Drawing #: DAR-106 Revison #: 1

Date: 28 APRIL 2024

Status: FOR CONSENT APPLICATION

Design: SCOTT BURLING Drawn: SCOTT BURLING



Title	BESS (Typical)
Project	Darfield Solar
Location	1352 Homebush Road Darfield New Zealand



NZ Clean Energy

Email: projects@nzcleanenergy.nz
Web: www.nzcleanenergy.nz

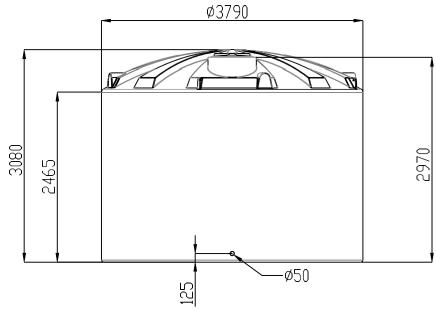
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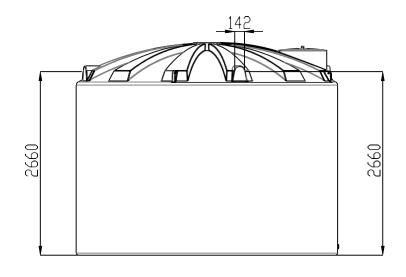
Date: 28 MAY 2024

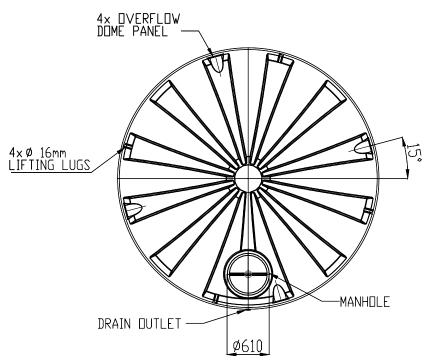
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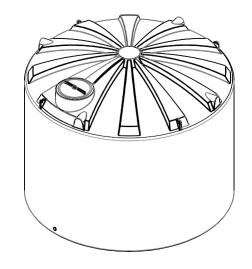
Design: SCOTT BURLING Drawn: SCOTT BURLING

TYPICAL BESS UNIT SAFT INTENSIUM SHIFT SHOWN









NDTE:

1. ALL DIMENSIONS ARE IN mm 2. TOLERANCE: 3%

Darfield New Zealand
ZELEANI

Water Tank

Darfield Solar

NZ Clean Energy

Title

Project

Location

Email: projects@nzcleanenergy.nz Web: www.nzcleanenergy.nz

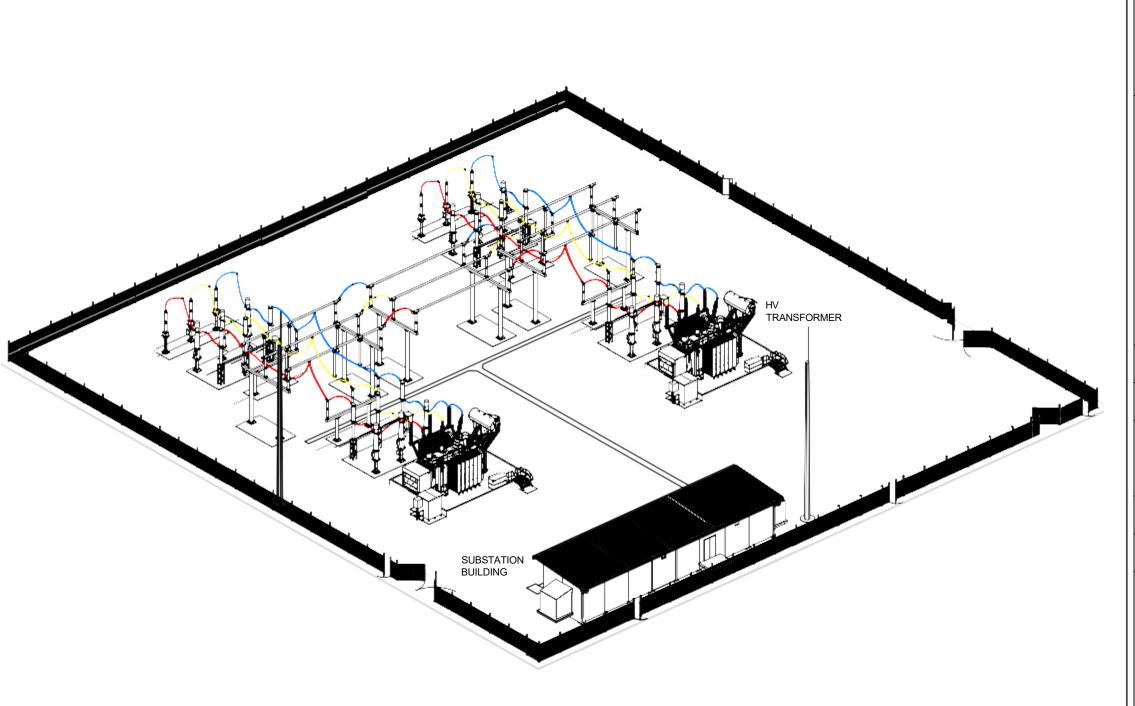
Drawing #: DAR-108 Revison #: 1

Date: 28 MAY 2024

Status: FOR CONSENT APPLICATION

Design: SCOTT BURLING Drawn: SCOTT BURLING

TYPICAL 30,000L PLASTIC WATER TANK PROMAX 30,000L SHOWN



Title	Substation
Project	Darfield Solar
Location	1352 Homebush Road Darfield New Zealand



NZ Clean Energy Email: projects@nzcleanenergy.nz Web: www.nzcleanenergy.nz

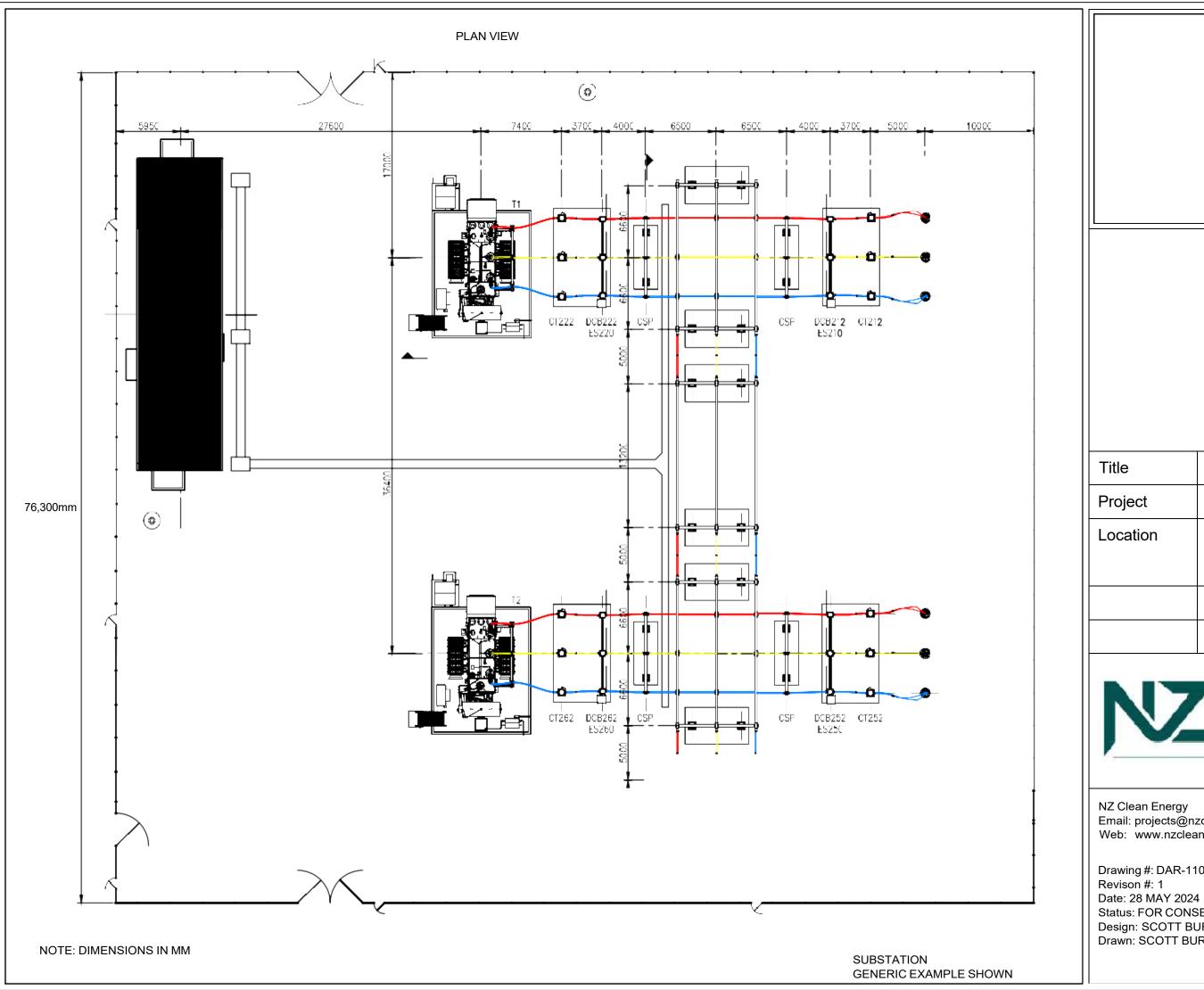
Drawing #: DAR-109 Revison #: 1

Date: 28 MAY 2024

Status: FOR CONSENT APPLICATION

Design: SCOTT BURLING Drawn: SCOTT BURLING

SUBSTATION GENERIC EXAMPLE SHOWN



Title	Substation
Project	Darfield Solar
Location	1352 Homebush Road Darfield New Zealand



NZ Clean Energy

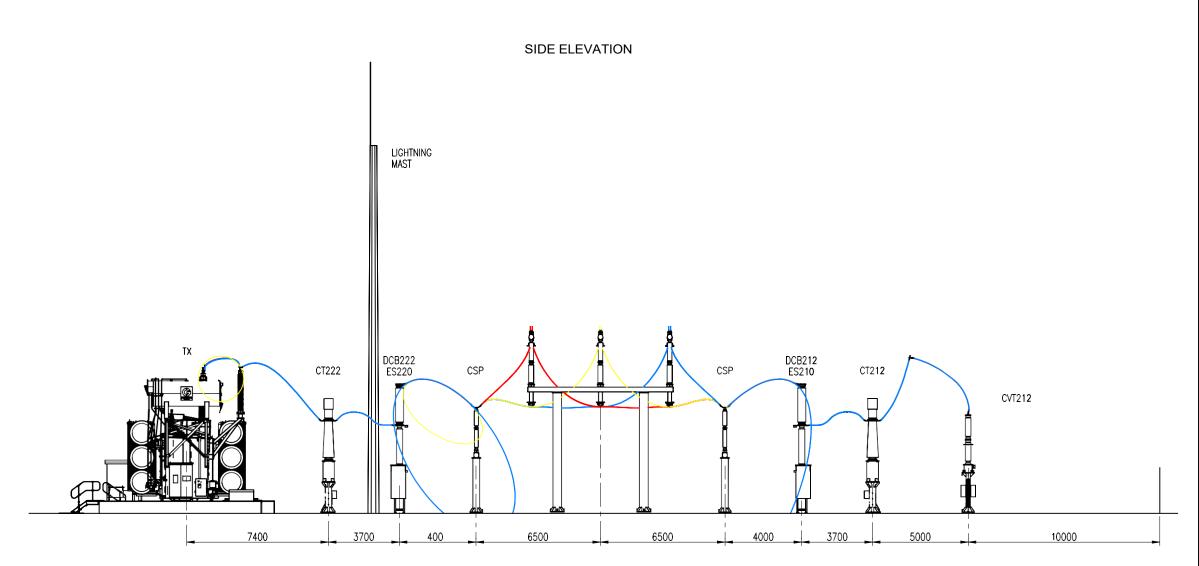
Email: projects@nzcleanenergy.nz Web: www.nzcleanenergy.nz

Drawing #: DAR-110

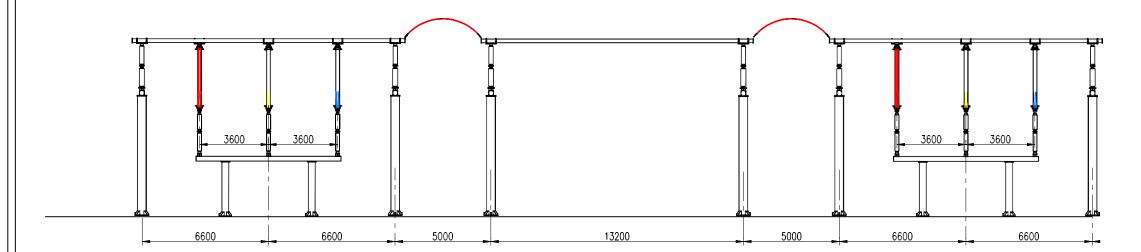
Revison #: 1

Status: FOR CONSENT APPLICATION

Design: SCOTT BURLING Drawn: SCOTT BURLING



END ELEVATION



NOTE: DIMENSIONS IN MM

SUBSTATION GENERIC EXAMPLE SHOWN

Title	Substation
Project	Darfield Solar
Location	1352 Homebush Road Darfield New Zealand



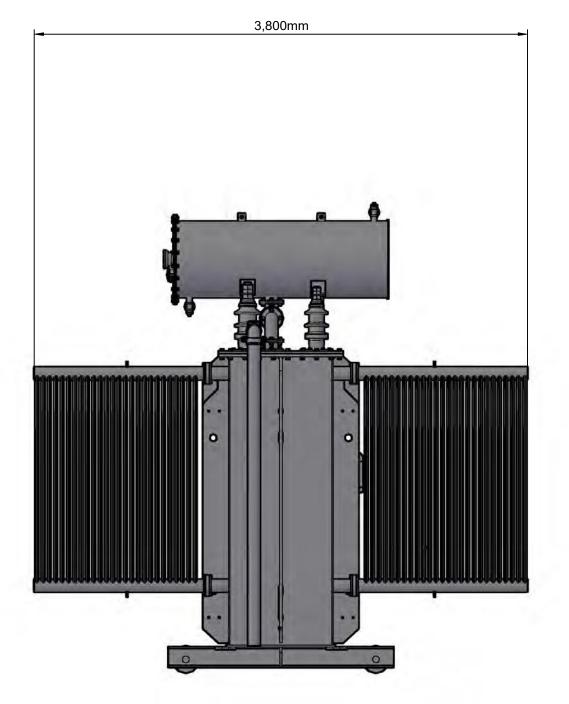
NZ Clean Energy Email: projects@nzcleanenergy.nz Web: www.nzcleanenergy.nz

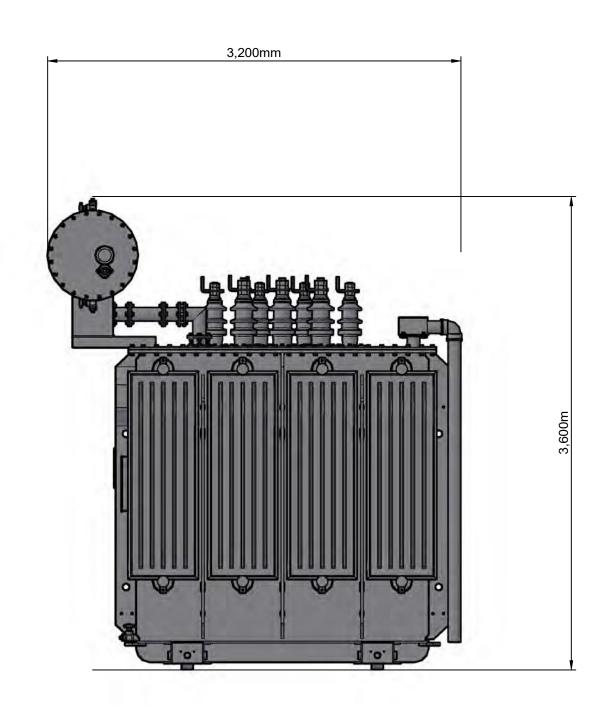
Drawing #: DAR-111 Revison #: 1

Date: 28 APRIL 2024

Status: FOR CONSENT APPLICATION

Design: SCOTT BURLING Drawn: SCOTT BURLING









NZ Clean Energy Email: projects@nzcleanenergy.nz Web: www.nzcleanenergy.nz

Drawing #: DAR-112 Revison #: 1 Date: 28 MAY 2024

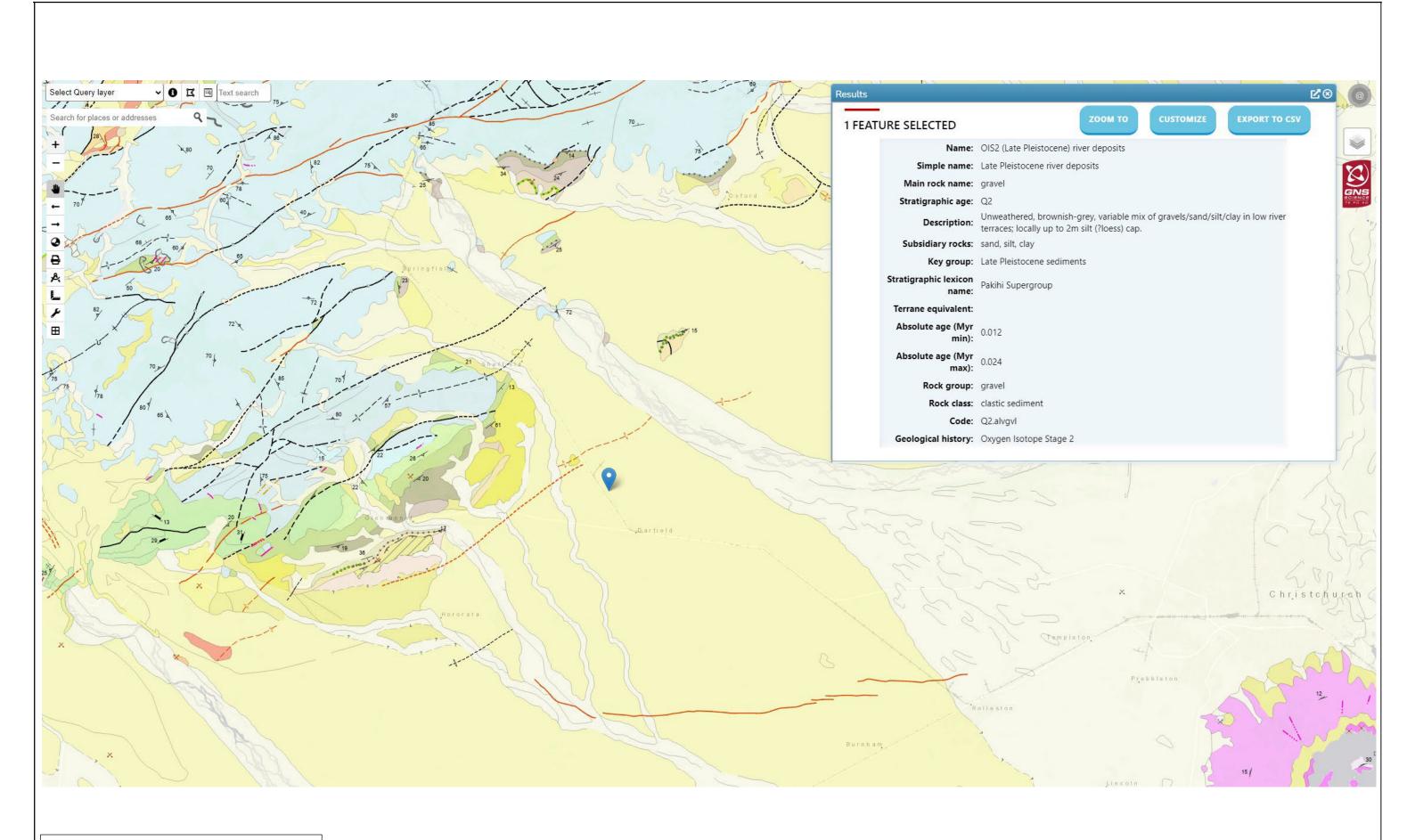
Status: FOR CONSENT APPLICATION

Design: SCOTT BURLING Drawn: SCOTT BURLING

HV TRANSFORMER GENERIC EXAMPLE SHOWN



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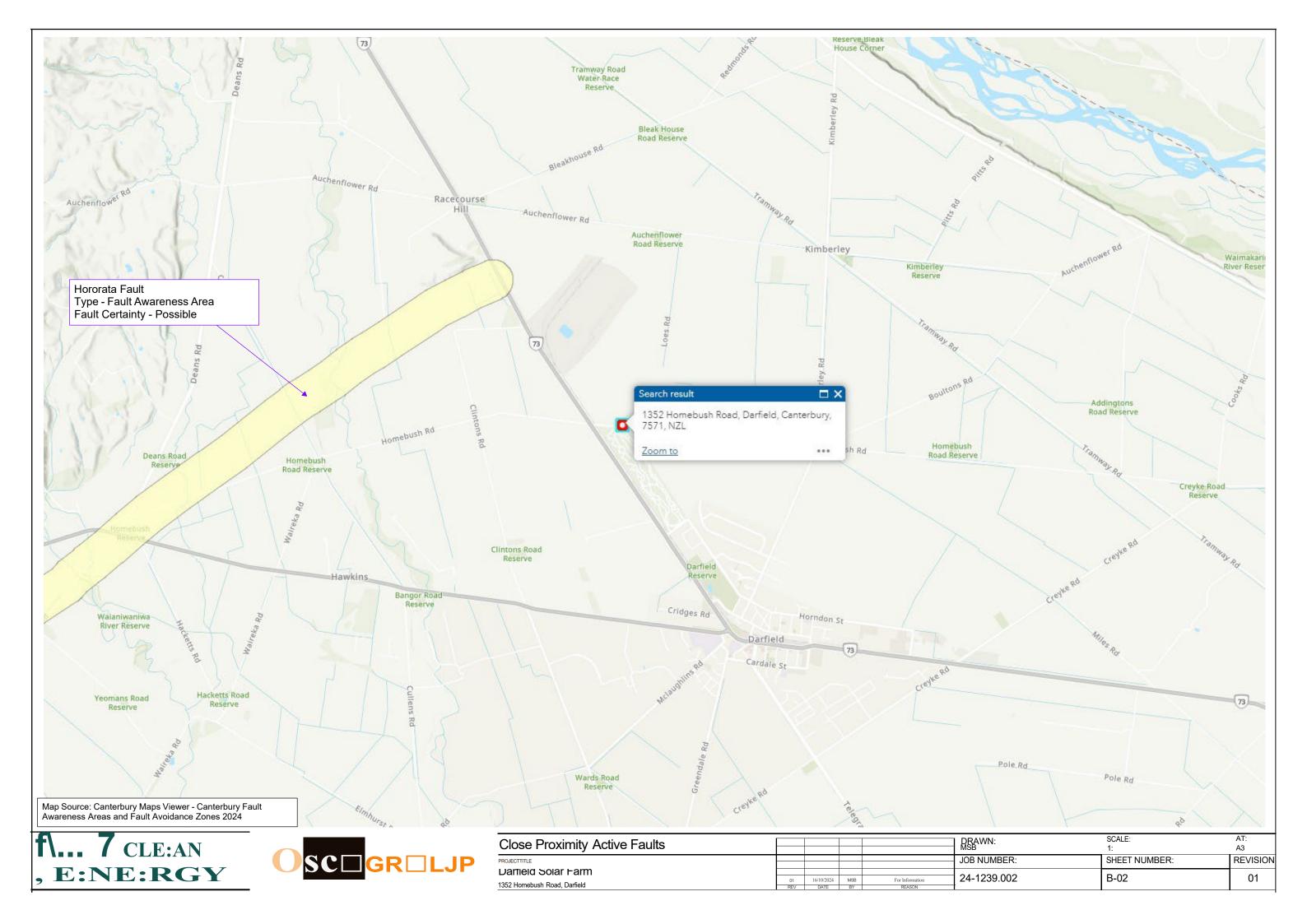


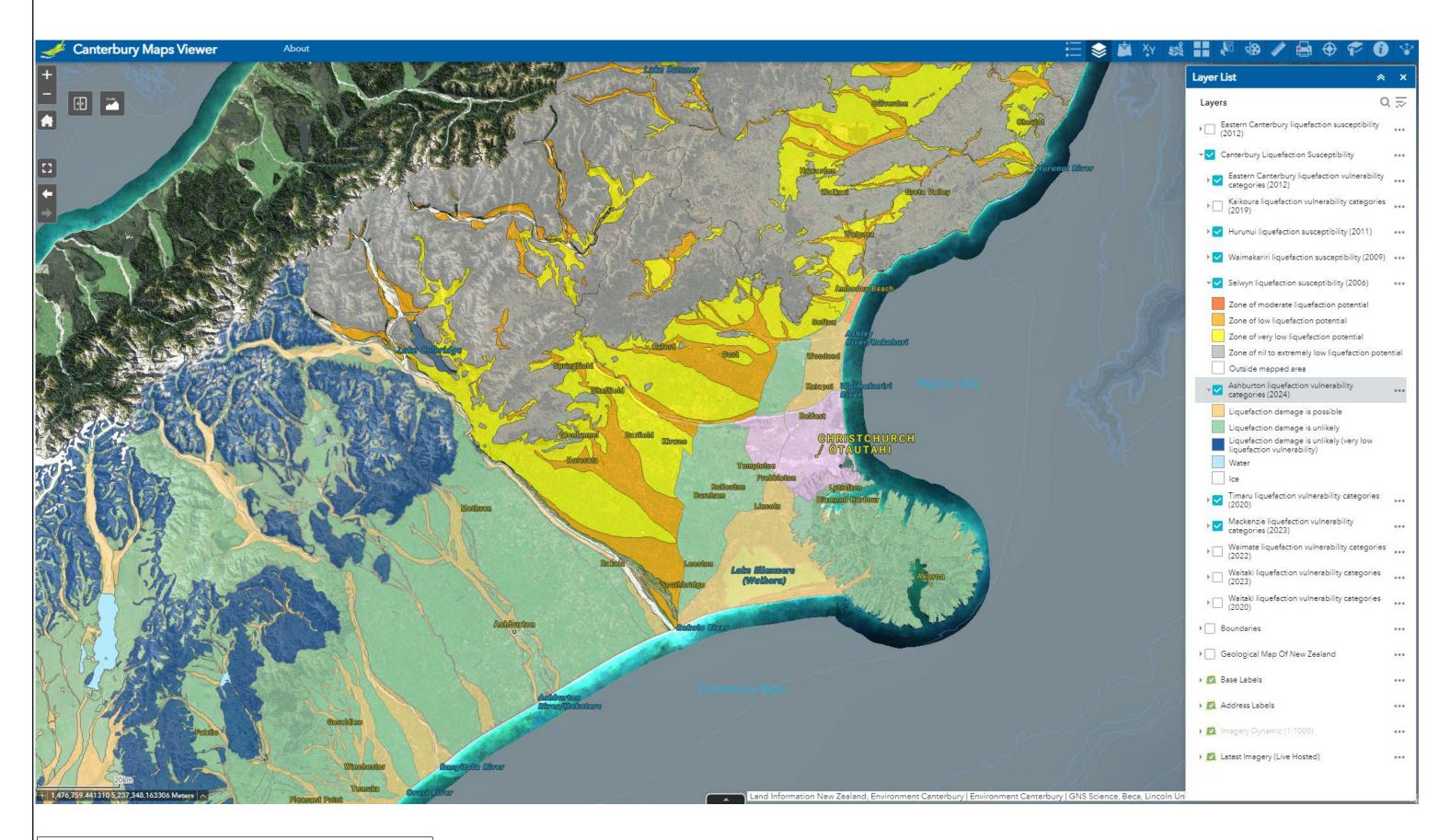
Map Source: GNS Geological Map 1:250k

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Published Geological Maps	DRAWN: MSB	SCALE: 1:	AT:				
PROJECTITLE					JOB NUMBER:	SHEET NUMBER:	REVISION
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1352 Homebush Road, Darfield	01 REV	16/10/2024 DATE	MSB BY	For Information REASON	24-1239.002	B-01	01





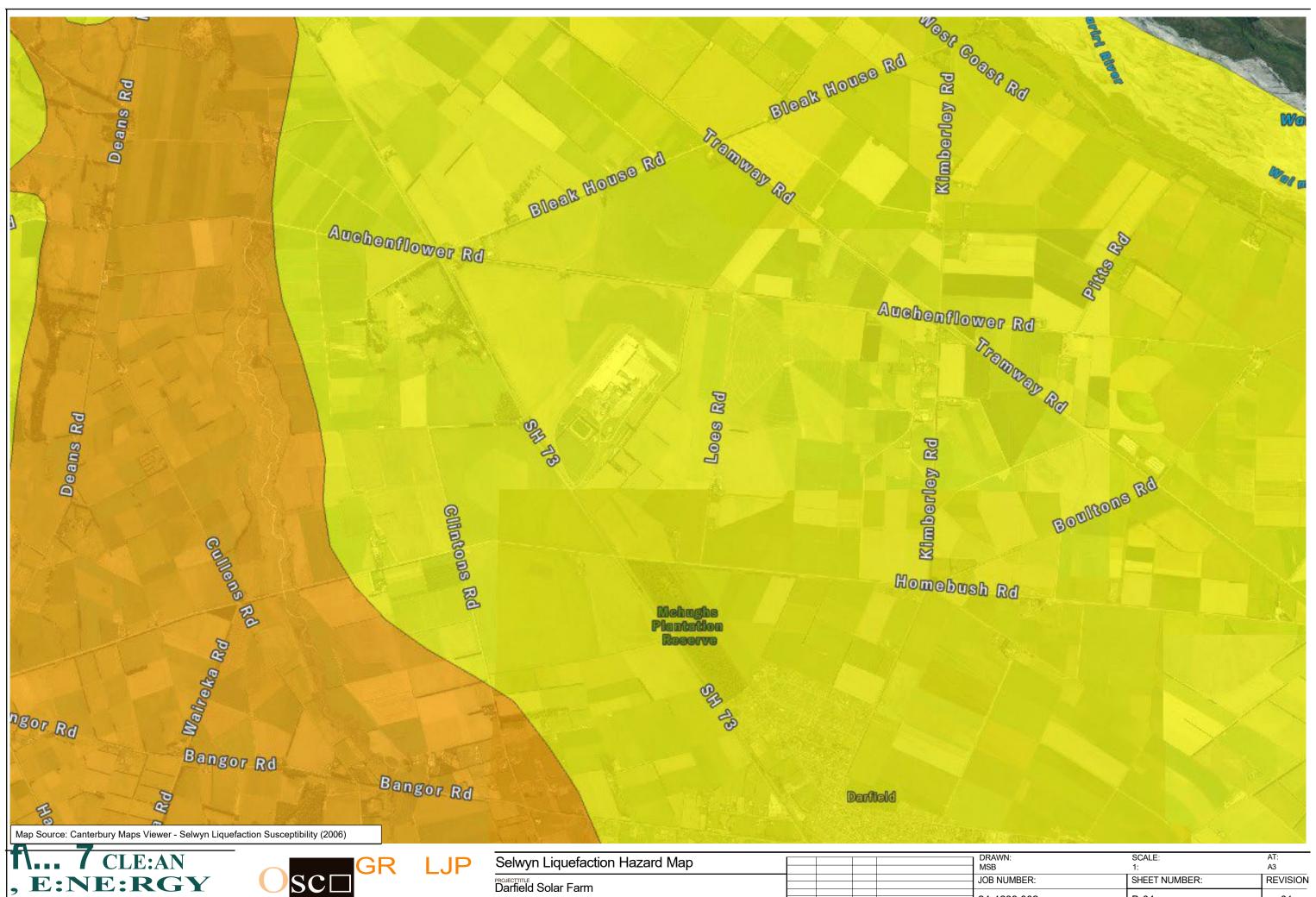
Map Source: Canterbury Maps Viewer





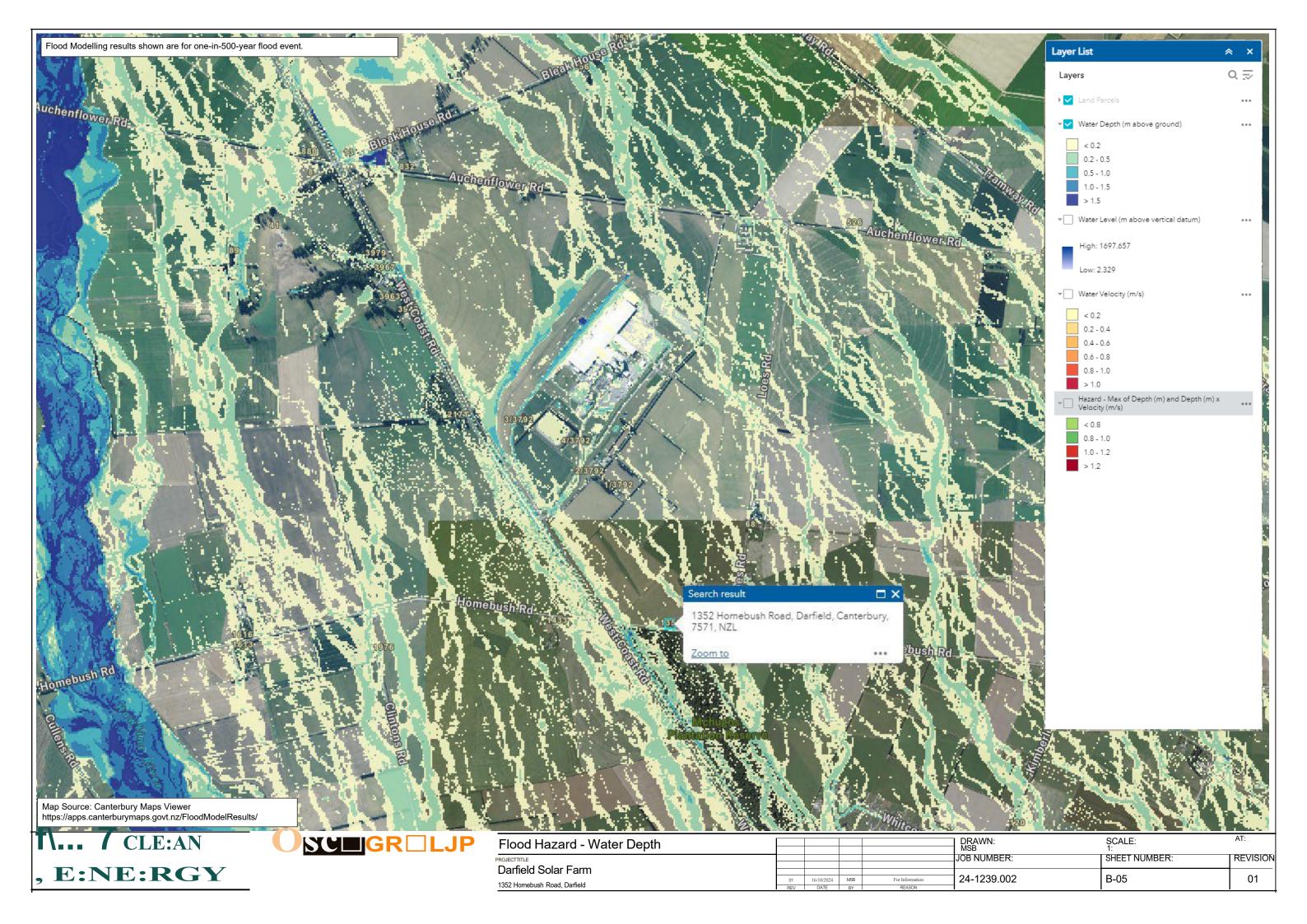


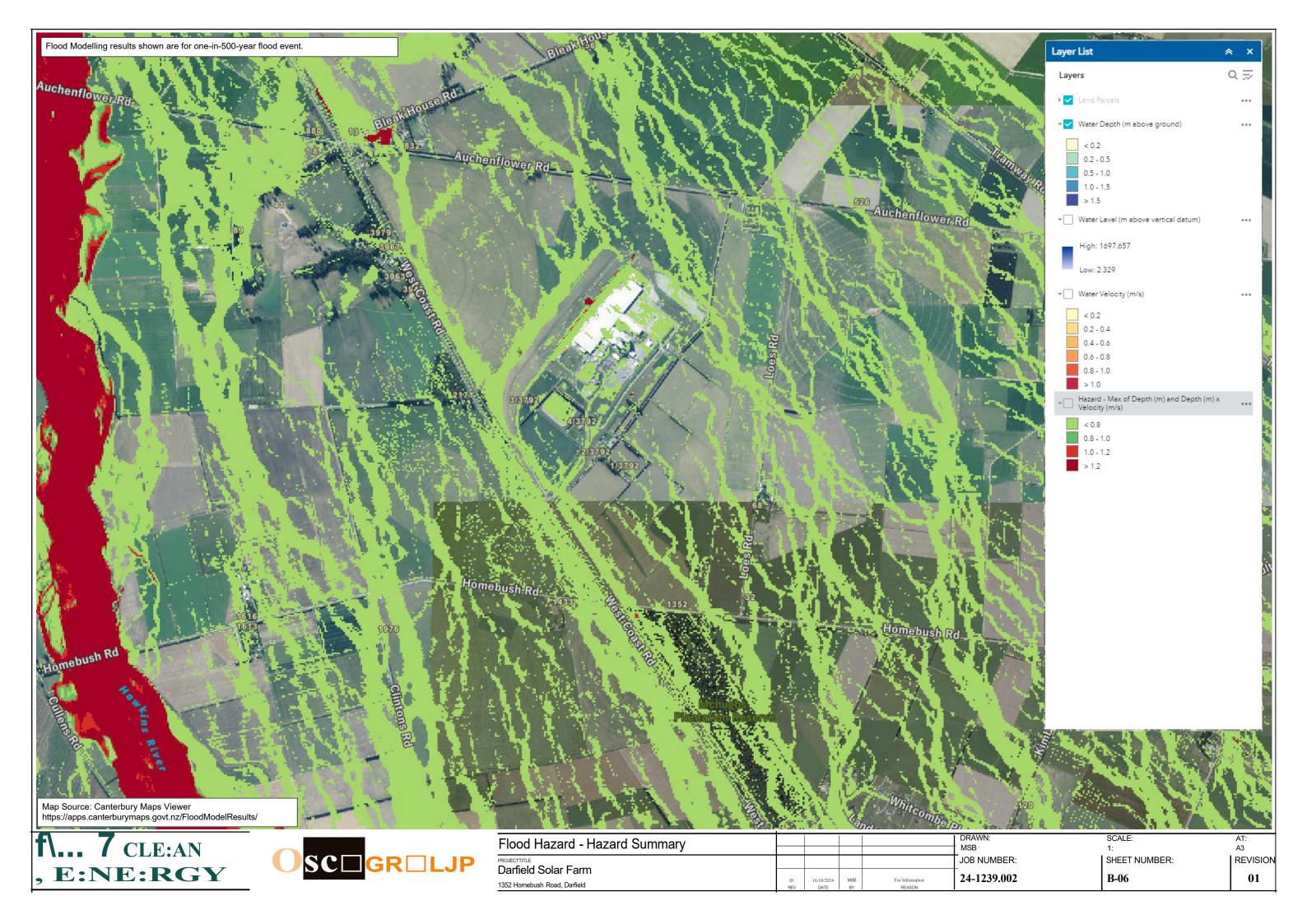
Canterbury Region Liquefaction Hazard Map					DRAWN: MSB	SCALE: 1:	AT: A3
PROJECTTITLE					JOB NUMBER:	SHEET NUMBER:	REVISION
Darfield Solar Farm					24-1239.002	B-03	01
1352 Homebush Road, Darfield	01 REV	16/10/2024 DATE	MSB BY	For Information REASON	24-1239.002	Б-03	O I

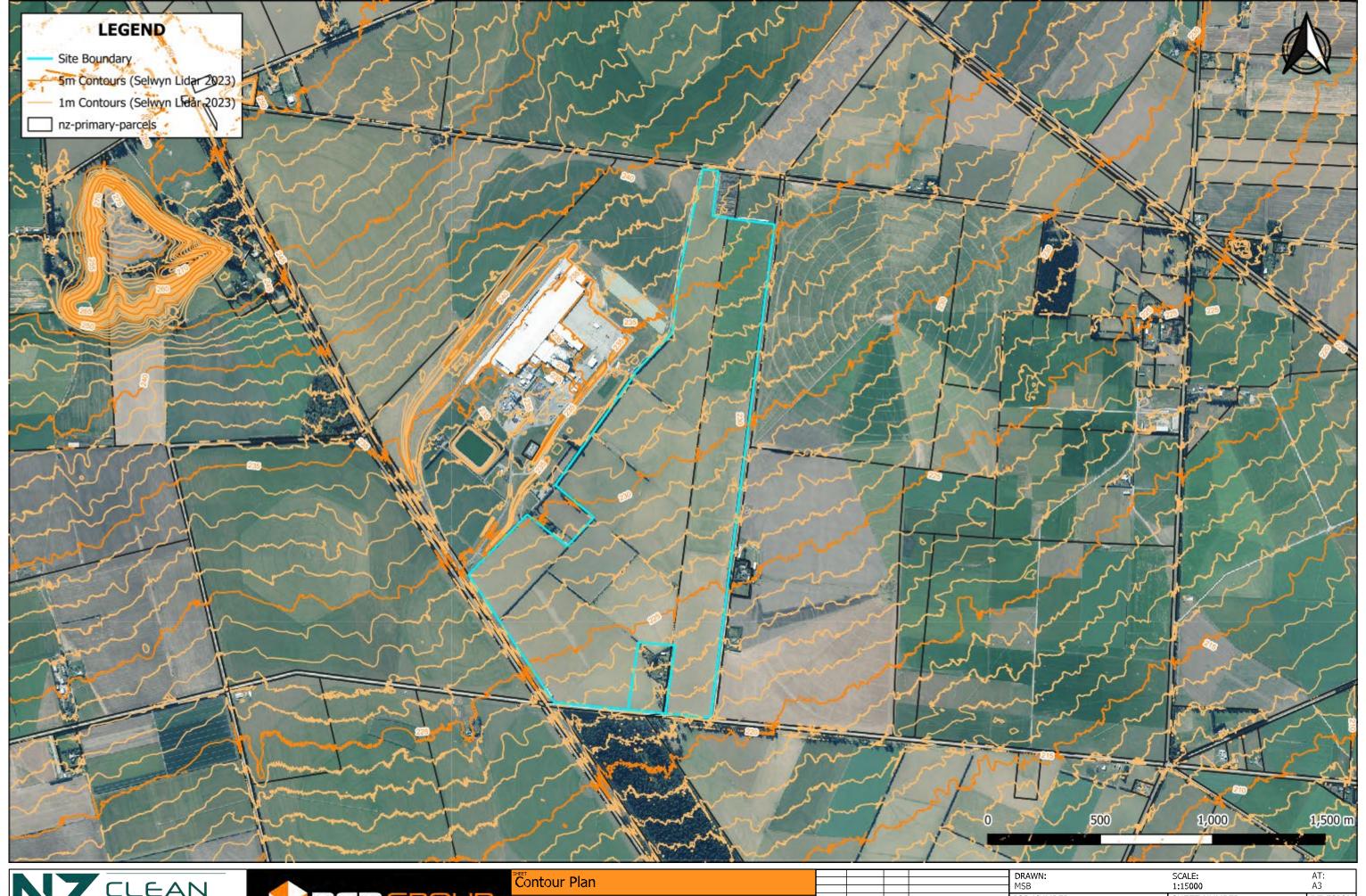




Selwyn Liquefaction Hazard Map					DRAWN: MSB	SCALE: 1:	AT: A3
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Daniela Solai i anni	01	16/10/2024	MSB	For Information	24-1239.002	B-04	01
1352 Homebush Road, Darfield	REV	DATE	BY	REASON	24-1239.002	D-07	01











Contour Plan					DRAWN: MSB	SCALE: 1:15000	AT: A3
PROJECT TITLE					JOB NUMBER:	SHEET NUMBER:	REVISION
Darfield Solar Farm					24 4220 002	C 01	0.1
1050 Hamaharib David Buffeld	01	16/10/202 4	MSB	For Information	24-1239.002	C-01	U1
1352 Homebush Road, Darfield	REV	DATE	BY	REASON			







NZGD Investigation Plan			3		DRAWN: MSB	SCALE: 1:15000	AT: A3
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Darfield Solar Farm					24 1220 002	G 02	0.1
1352 Homebush Road, Darfield	01	16/10/2024	MSB	For Information	24-1239.002	C-02	01
	REV	DATE	BY	REASON			