Summary Report

Gillenbah Solar Farm Flood, Drainage and Groundwater Assessment

ACEnergy

03 May 2021

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03 May 2021

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Via email jane.bai@acleservices.com.au

Dear Jane

Gillenbah Solar Farm Flood, Drainage and Groundwater Assessment

This report documents a flood risk assessment of the proposed Gillenbah Solar Farm site at 1083 Buckingbong Road, Gillenbah NSW 2700 (Lot 22, DP 754540). The report identifies the level of flood risk for the site and provides recommendations to aid the approval process.

If you have any queries regarding this report, please do not hesitate to contact me directly.

Yours sincerely

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WATER TECHNOLOGY PTY LTD

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1 INTRODUCTION

1.1 Overview

The proposed Gillenbah Solar Farm requires the following assessments to satisfy Council requirements as part of its Development Application (DA):

- Flood assessment – identifying flood risk for the development
- Hydraulic assessment – advising on surface water / stormwater management
- Groundwater assessment – noting any potential impact of the development to groundwater

Water Technology was commissioned by ACEnergy to undertake these assessments and provide advice on potential impacts.

This report discusses the assessment completed by Water Technology, including both the hydrological and hydraulic modelling used to assess the level of flood risk for the development under existing and estimated climate change conditions. The existing scenario was assessed for the 0.5%, 1% and 10% Annual Exceedance Probability (AEP) flood events.

1.2 Background

The subject site is located at 1083 Buckingbong Road, Gillenbah, approximately 12 km southeast from Narrandera, NSW.

The location of the site is shown in Figure 1-1. The site is bounded by Buckingbong Road to the west, Dellapool Road to the north, and an irrigation drain to the east. The Murrumbidgee River is located approximately 1200 metres north of the site. The site is presently used as agricultural land (pasture).

Lyall & Associates has prepared detailed flood mapping for the Murrumbidgee River as part of the Narrandera Flood Study Review undertaken in 2015 for the Narrandera Shire Council. This study demonstrated that the site location is not impacted by the Murrumbidgee River or Sandy Creek, even in major storm events. As a check, a version of the final model was run at a larger scale, including these watercourses with flows and boundaries adopted from the 2015 study. This confirmed that riverine flows do not reach the site area, with the modelled flood extent shown in Appendix A.

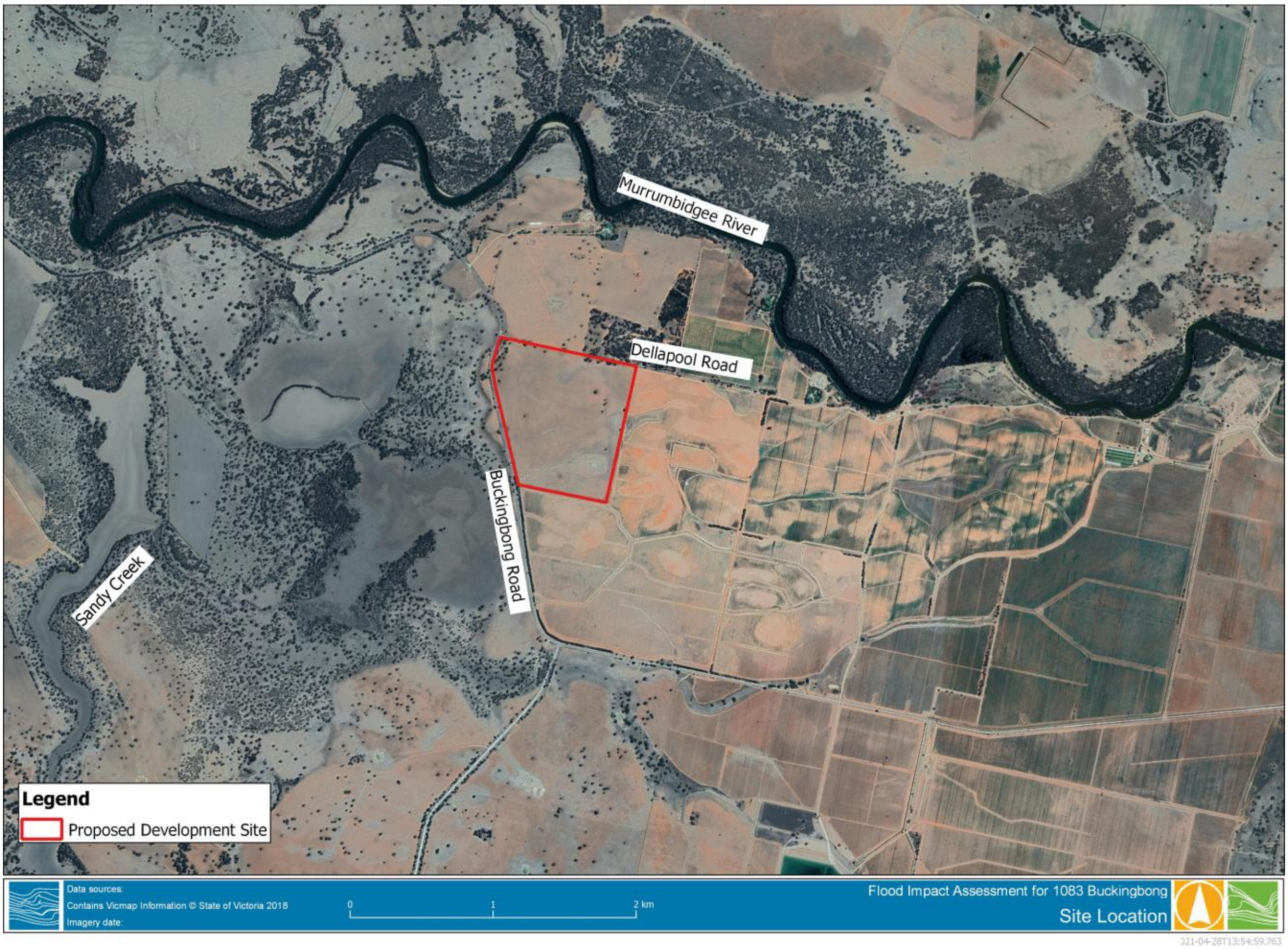

FIGURE 1-1 LOCATION OF THE SUBJECT SITE

1.3 Data

This study has been prepared using the following previous studies and data sets:

- 1 metre resolution Digital Elevation Model (DEM) for Narrandera (2020)
- Design rainfall for the proposed site from ARR2019 Data Hub
- Narrandera Flood Risk Management Study and Plan (SKM 2009)
- Narrandera Flood Study Review (Lyall & Associates 2015)

2 FLOODING ASSESSMENT

The following assessment provides flood extent, depth and velocity outputs for the 10%, 1% and 0.5% AEP flood events in line with Australian Rainfall and Runoff 2019 (ARR2019) guidelines, at the property and within the immediate catchment to the north and east.

2.1 Model Overview

For the purpose of the flood impact assessment, a TUFLOW Rain-on-Grid hydraulic model was used to demonstrate the existing inundation conditions for the 10%, 1% and 0.5% AEP flood events at the site.

TUFLOW is one of the most widely used hydraulic modelling software packages in Australia and an appropriate choice of modelling tool for flood mapping of the site. Rain-on-Grid allows the simulation of runoff generated from local rainfall on a two-dimensional (2D) grid that is representative of the site topography. Runoff moves across the grid based on the topography of the site and runoff characteristics, as it would in a real storm event.

The main component of the 2D hydraulic model is the Digital Elevation Model (DEM), which is a representative of the natural and built topography. The 1 metre grid resolution LiDAR was resampled to a 2 metre grid resolution covering the entire local catchment. A 2 metre grid resolution is suitable to represent the floodplain in a 2D modelling environment. An initial review of the site topography suggested there is only a very small catchment draining to the site, as it is 'perched' above the surrounding floodplains. The model extent is shown in Figure 2-1, with the site topography shown in Figure 2-2.

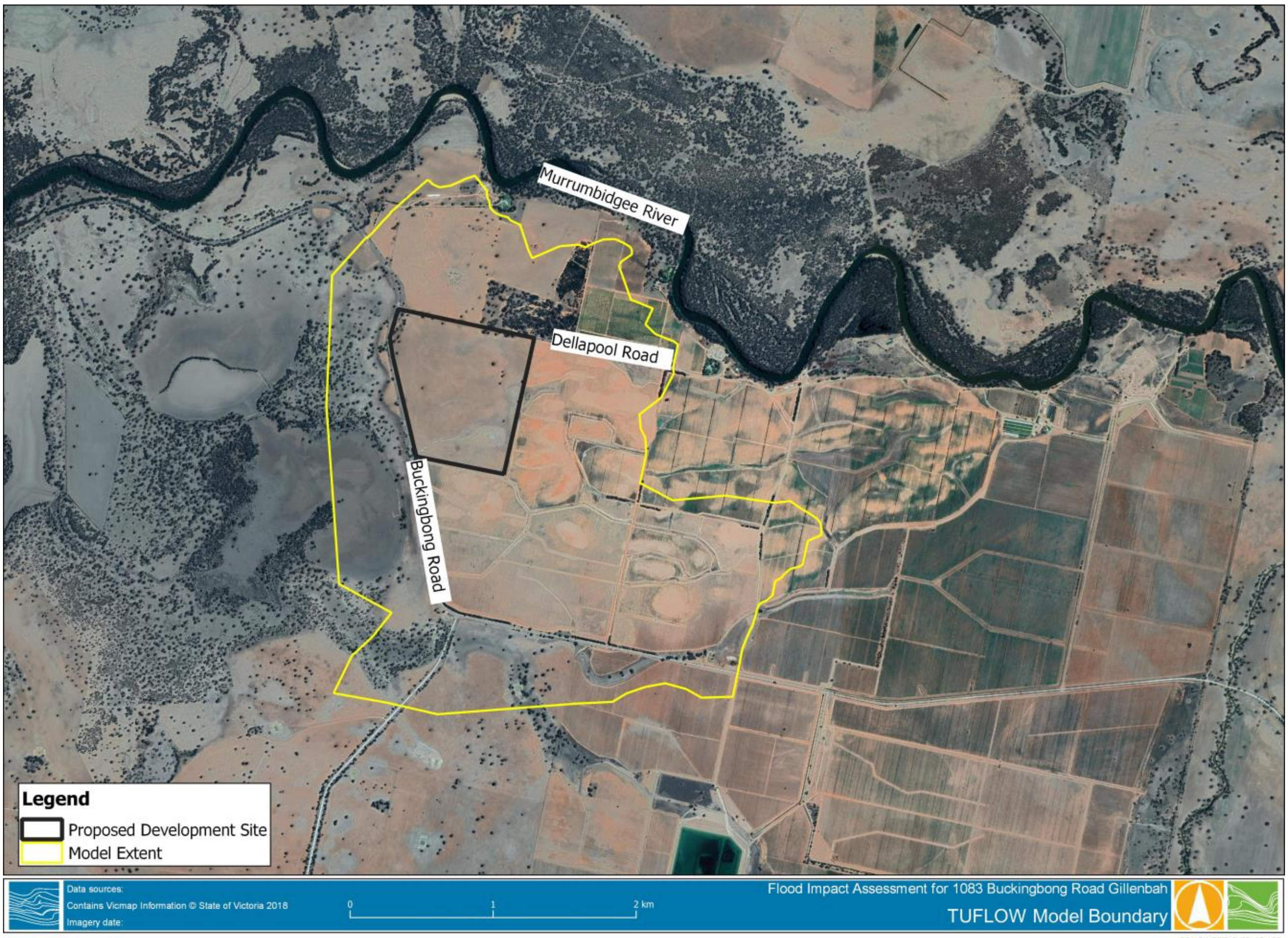

FIGURE 2-1 MODEL BOUNDARY

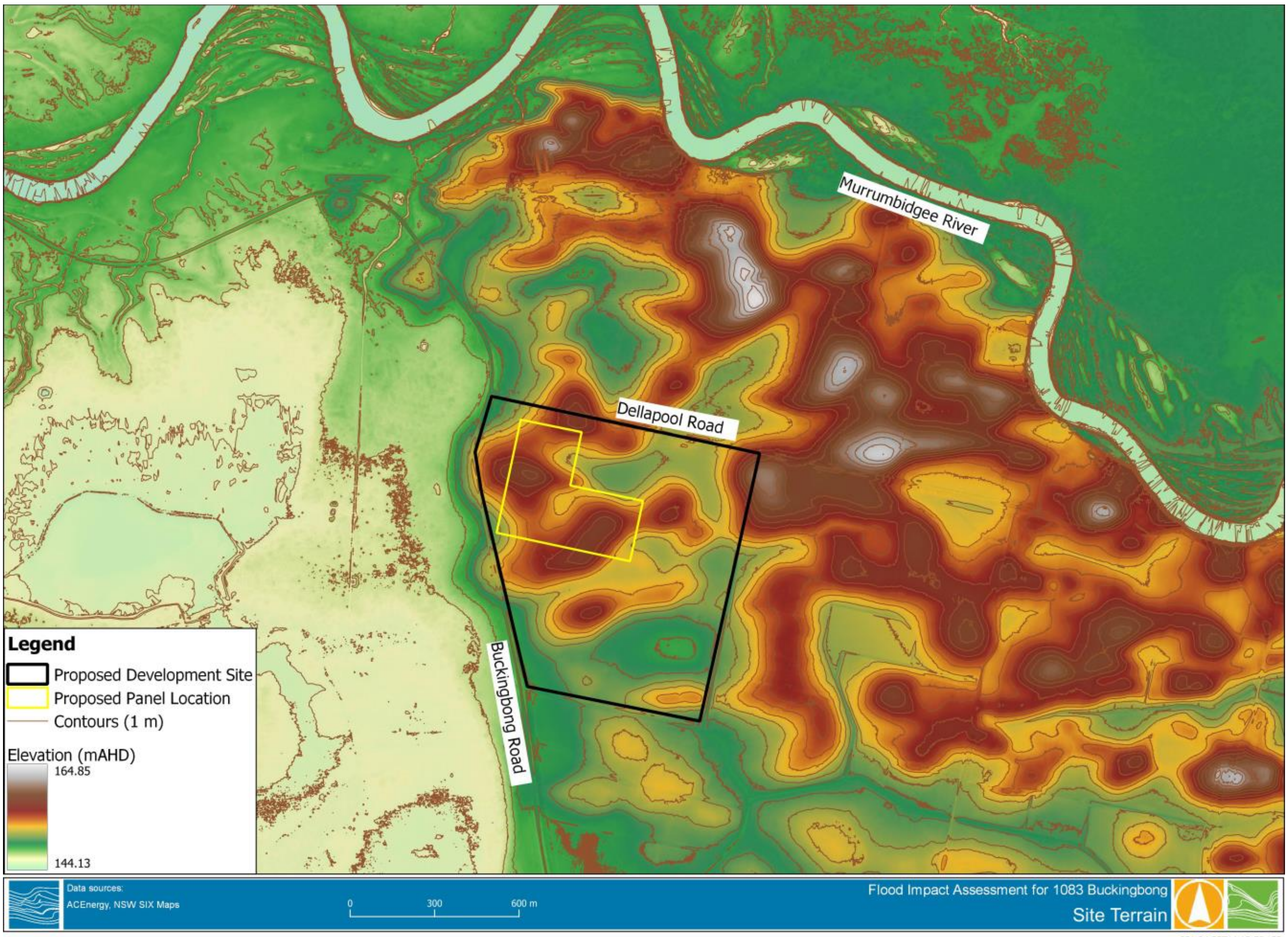

FIGURE 2-2 SITE TOPOGRAPHY

Three temporal patterns for the 1% AEP event were modelled for each of the four modelled storm durations including the 30-min, 1-hour, 2-hour and 6-hour storms. The modelled temporal patterns were selected from the available 10 temporal patterns based on adoption of a sample of representative rainfall patterns including a front loaded, uniform and back loaded storm event.

The selected temporal patterns for the 1% AEP are shown in Table 2-1. The modelled flood results were then compared to select the most critical temporal pattern at the site location for each of the four modelled storm durations. The equivalent temporal patterns were then adopted for the 10% and 0.5% AEP for each of the four durations. The results from each duration were processed to produce the combined maximum flood depth, level and velocity outputs for the 10%, 1% and 0.5% AEP flood events.

TABLE 2-1 SELECTED TEMPORAL PATTERNS FOR 1% AEP

Duration (min)	Front Loaded	Back Loaded	Uniform
30	TP01	**TP10**	TP08
60	TP04	**TP10**	TP03
120	TP01	**TP10**	TP07

Duration (min)	Front Loaded	Back Loaded	Uniform
360	TP05	**TP10**	TP08

An initial loss of 23 millimetres and a continuing loss of 0.5 millimetres, as recommended by ARR2019, were adopted for the purposes of this assessment to represent a conservative stormwater analysis based on the rain on grid modelling.

Given the unclear existing local drainage infrastructures information around the site (i.e. the culverts), this modelling excluded any impacts of the existing infrastructure. Instead it was assumed these culverts were blocked, and not conveying flow away from the site. No culverts upstream of the site were identified.

The adopted model roughness for different land use types is provided in Table 2-2. These are based on previous modelling experience in similar catchments.

TABLE 2-2 MANNING'S N ROUGHNESS COEFFICIENTS

Land Use	Manning's n Roughness Coefficient
Open Pervious Area - Moderate Vegetation	0.05
Residential – Rural (Lower Density)	0.05
Open Space of Waterway (Minimal Vegetation)	0.04
Open Space of Waterway (Moderate Vegetation)	0.06
Open Space of Waterway (Heavy Vegetation)	0.09
Roads	0.02

2.2 Model Results

The 1% AEP 30-min, 1-hour, 2-hour and 6-hour durations were modelled with the selected temporal patterns listed in Table 2-1. Temporal pattern 10 (back loaded storm) provided the highest peak flowrate across all four durations. Therefore, temporal pattern 10 was determined as the most critical temporal pattern for the 1% AEP event and equivalent back-loaded temporal patterns were used to produce the peak model results for the 10% and 0.5% AEP storm events.

The existing conditions flood depth results for the 10%, 1% and 0.5% AEP events are shown in Appendix A. Depths of less than 20 millimetres were filtered for mapping purposes.

Floods can be hazardous, producing harm to people, damage to infrastructure and potentially loss of life. In examining the potential hazard of flooding at the site, there are several factors to be considered, as outlined in ARR 2019 (Book 6 Chapter 7)[1]. An assessment of flood hazard should consider:

- velocity of floodwaters;
- depth of floodwaters;
- combination of velocity and depth of floodwaters;
- isolation during a flood;
- effective warning time; and
- rate of rise of floodwater.

The flood hazard of the site was assessed in accordance with ARR2019, which defines six hazard categories. The combined flood hazard curves are presented in Figure 2-3 and vulnerability thresholds classifications are tabulated in Table 2-3.

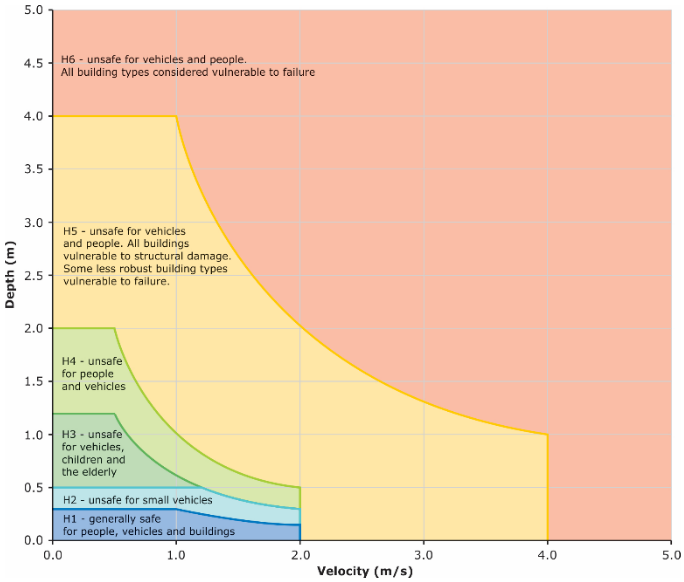

FIGURE 2-3 COMBINED FLOOD HAZARD CURVES

TABLE 2-3 HAZARD CLASSIFICATION (ARR, 2016)

Hazard Vulnerability Classification	Classification Limit (D and V in combination)	Limiting Still Water Depth (D)	Limiting Velocity (V)	Description
H1	D*V ≤ 0.3	0.3	2.0	Generally safe for vehicles, people and buildings.
H2	D*V ≤ 0.6	0.5	2.0	Unsafe for small vehicles.
H3	D*V ≤ 0.6	1.2	2.0	Unsafe for vehicles. children and the elderly.
H4	D*V ≤ 1.0	2.0	2.0	Unsafe for vehicles and people.
H5	D*V ≤ 4.0	4.0	4.0	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6	D*V > 4.0	-	-	Unsafe for vehicles and people. All building types considered vulnerable to failure.

The flood depth results indicated there is water pooling at several locations within the proposed site, and the deepest pooling occurred at the northern area of the site.

The maximum flood depth within the site (at this northern location) was 0.65 metre for 10% AEP, 0.96 metre for 1% AEP to 1.06 metre for 0.5% AEP event. Most of the flooding shown in this area was the result of overland flow from the higher parts of the site draining to this area. Within the proposed development site footprint, most of the solar panels have been proposed in areas where either no flow is estimated, or where flood depth are shown to be less than 0.1 metre. At the southern section of the proposed solar panel location,

[1] http://book.arr.org.au.s3-website-ap-southeast-2.amazonaws.com/

depths reach 0.37 m, 0.41 m and 0.44 m, for 10% AEP, 1% AEP and 0.5% AEP event, respectively. At the northernmost battery container, the estimated peak 1% AEP flood depth is 0.08 m.

Velocities within the proposed site are very low and generally below 0.5 m/s for all three AEPs, also shown in Appendix A. The higher peaks mainly occurred along the overland flow path drainage to the pooling area at the northern side of the site.

Flood hazard maps were created from the model results and are shown in Appendix A. These maps are a product of both flood depth and velocity, as described above. For the 1% AEP event, the sites and surrounds are typically classed as H1: 'Generally safe for vehicles, people and buildings'. In three locations where runoff is expected to pond within the site boundary, exceeding depths of 0.5 m, the hazard classification is H3: 'Unsafe for vehicles, children and the elderly'. Based on the hazard levels identified for the site, the site is considered a low food risk.

Peak flood levels for the three AEPs are also shown in Appendix A. Across the proposed site, these levels vary from 150 mAHD to 156 mAHD across the three AEP events. Within the 1% AEP flood event, flood levels onsite typically range between 152-154 mAHD.

Figure 2-4 to Figure 2-11 show the 1% AEP results at the site, including a set of maps zoomed to the proposed location.

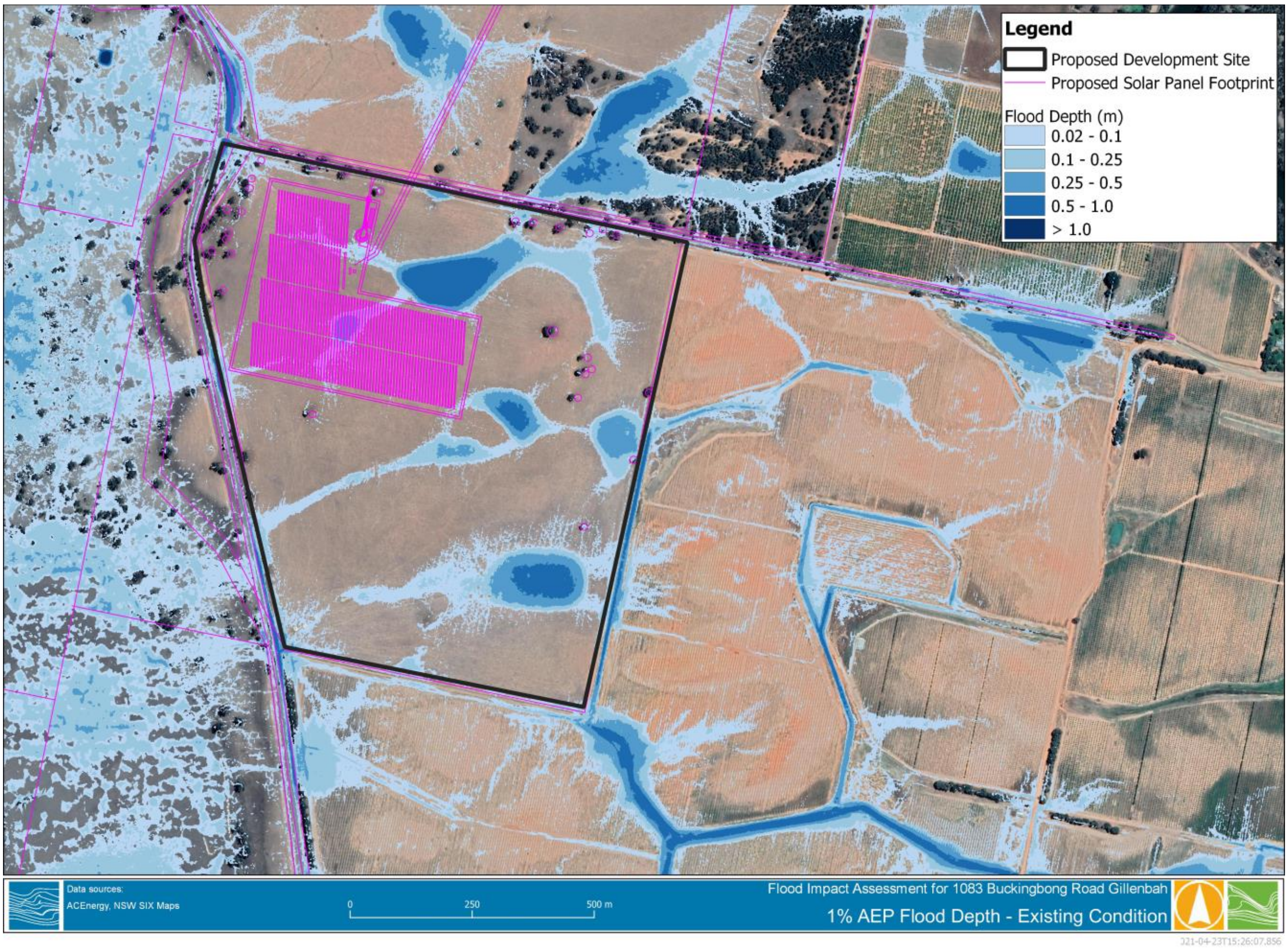

FIGURE 2-4 1% AEP FLOOD DEPTH

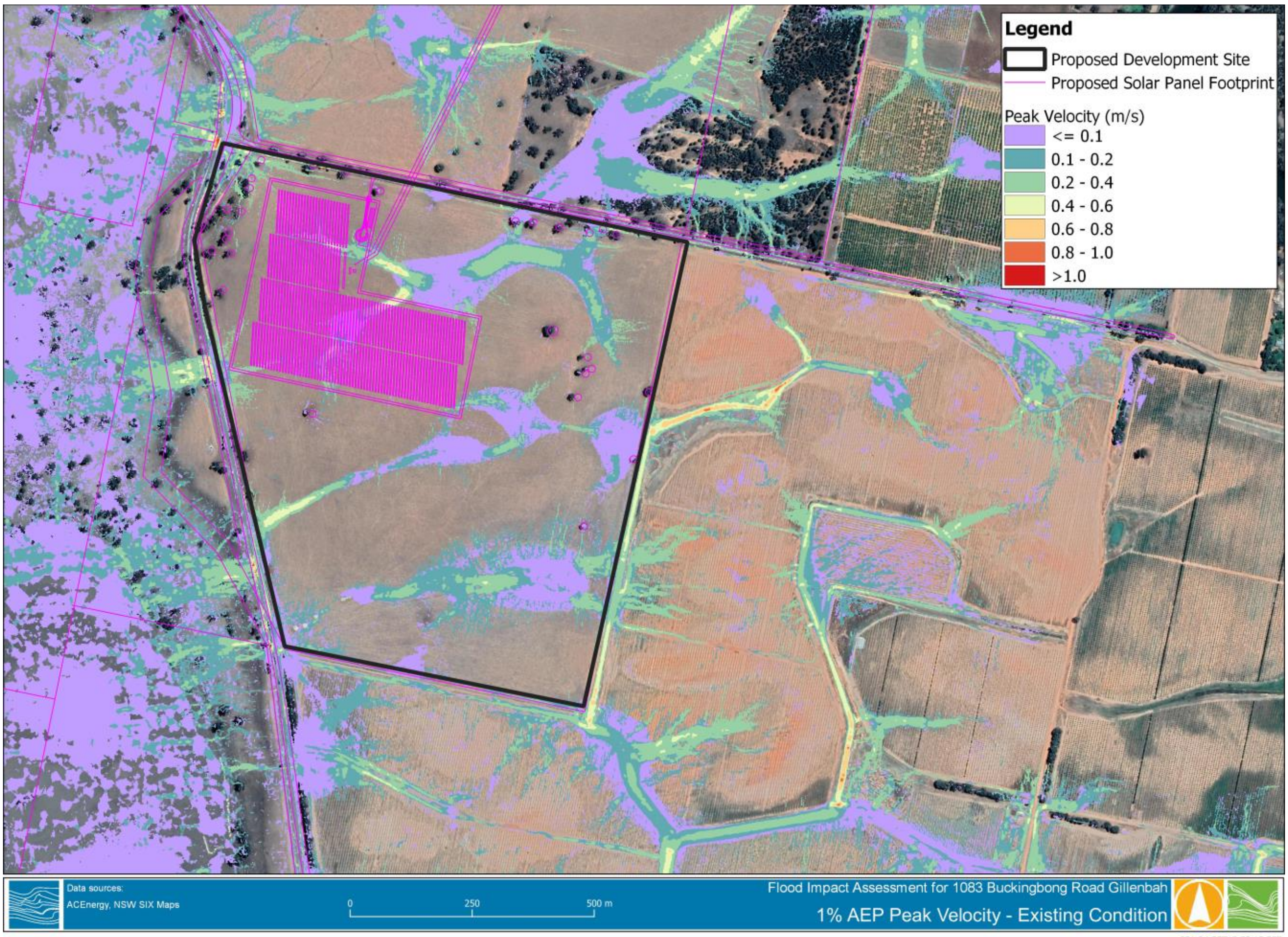

FIGURE 2-5 1% AEP PEAK VELOCITY

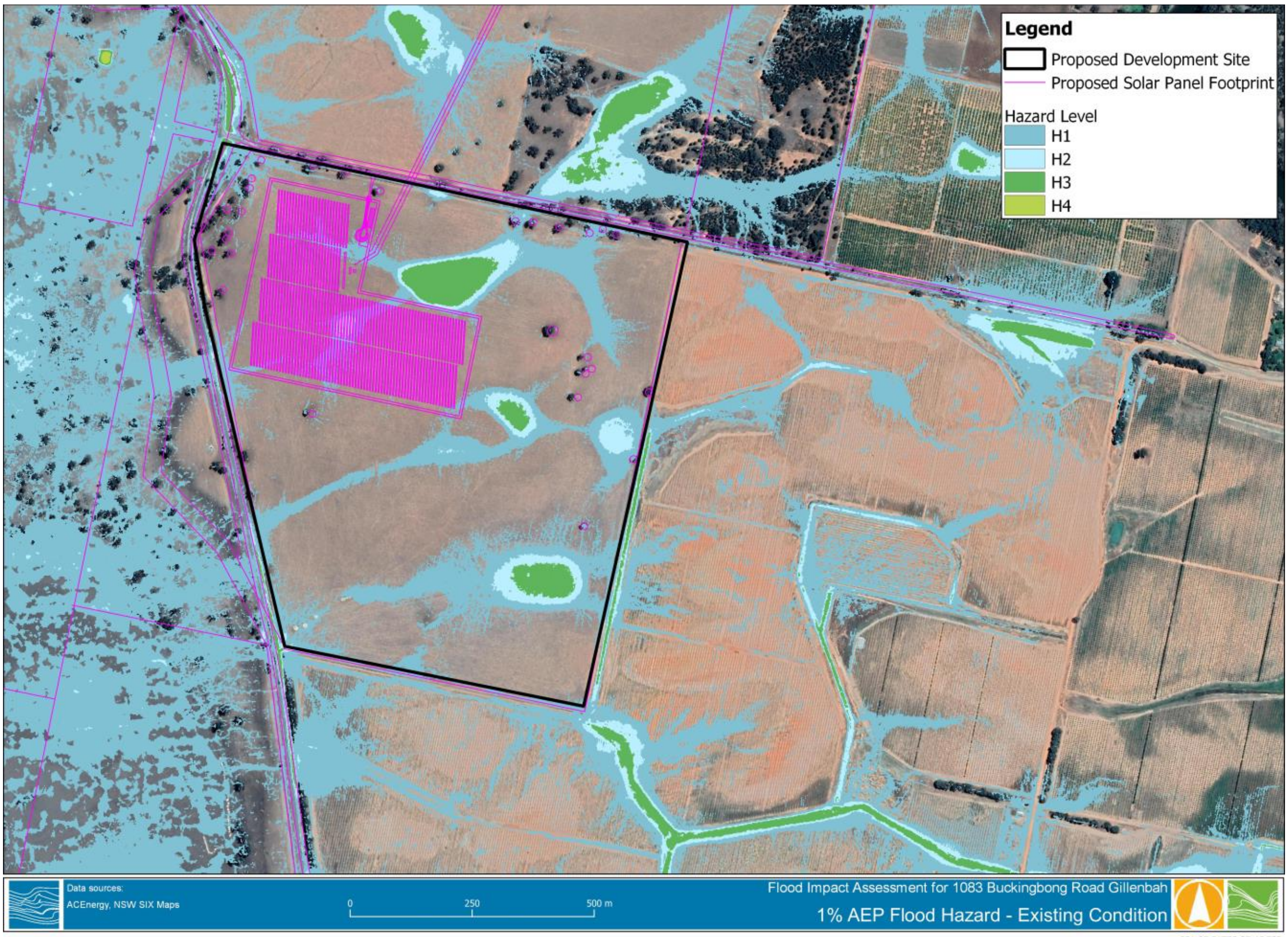

FIGURE 2-6 1% AEP FLOOD HAZARD

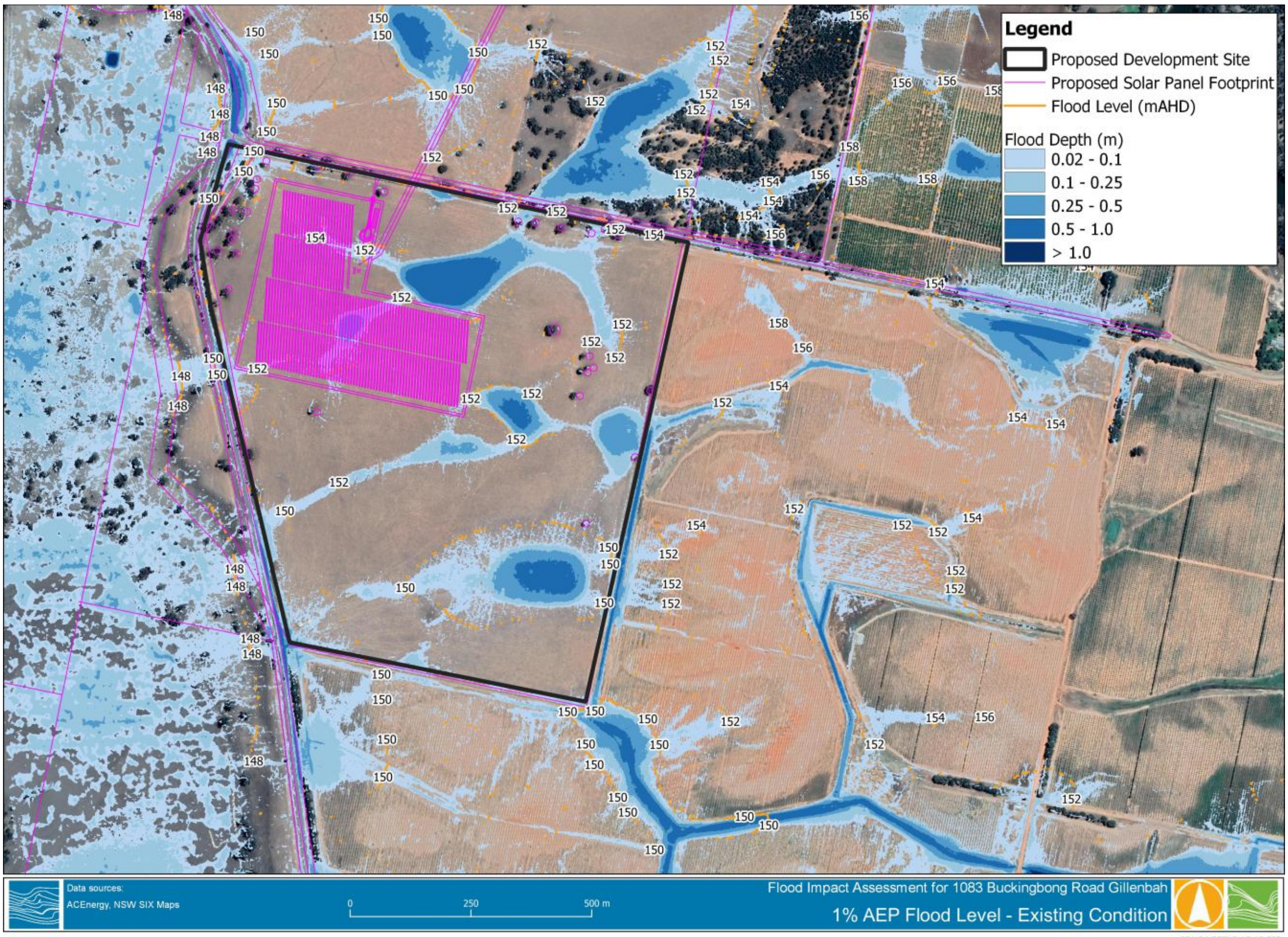

FIGURE 2-7 1% AEP FLOOD LEVEL

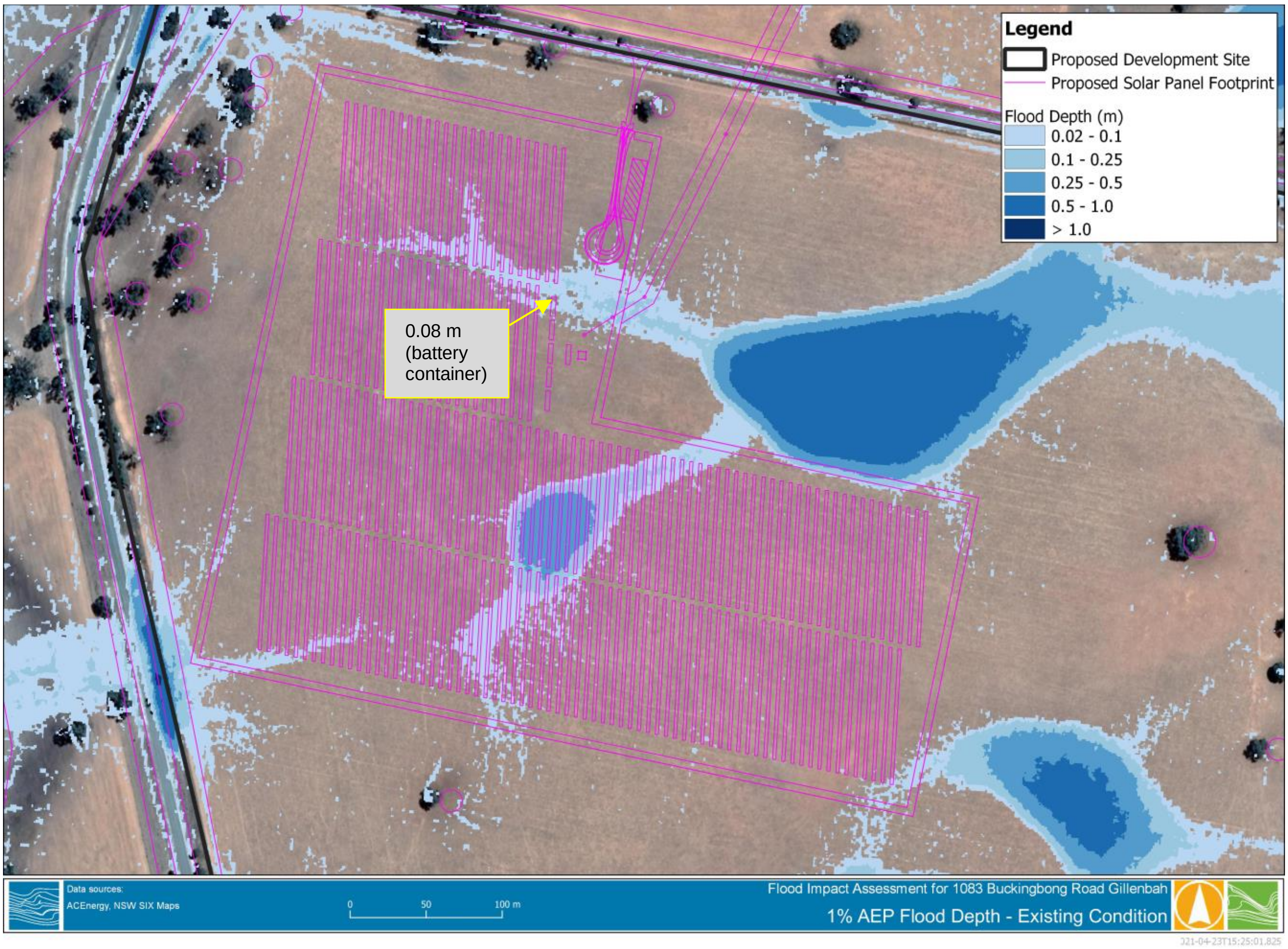

FIGURE 2-8 1% AEP FLOOD DEPTH - AT SITE LOCATION

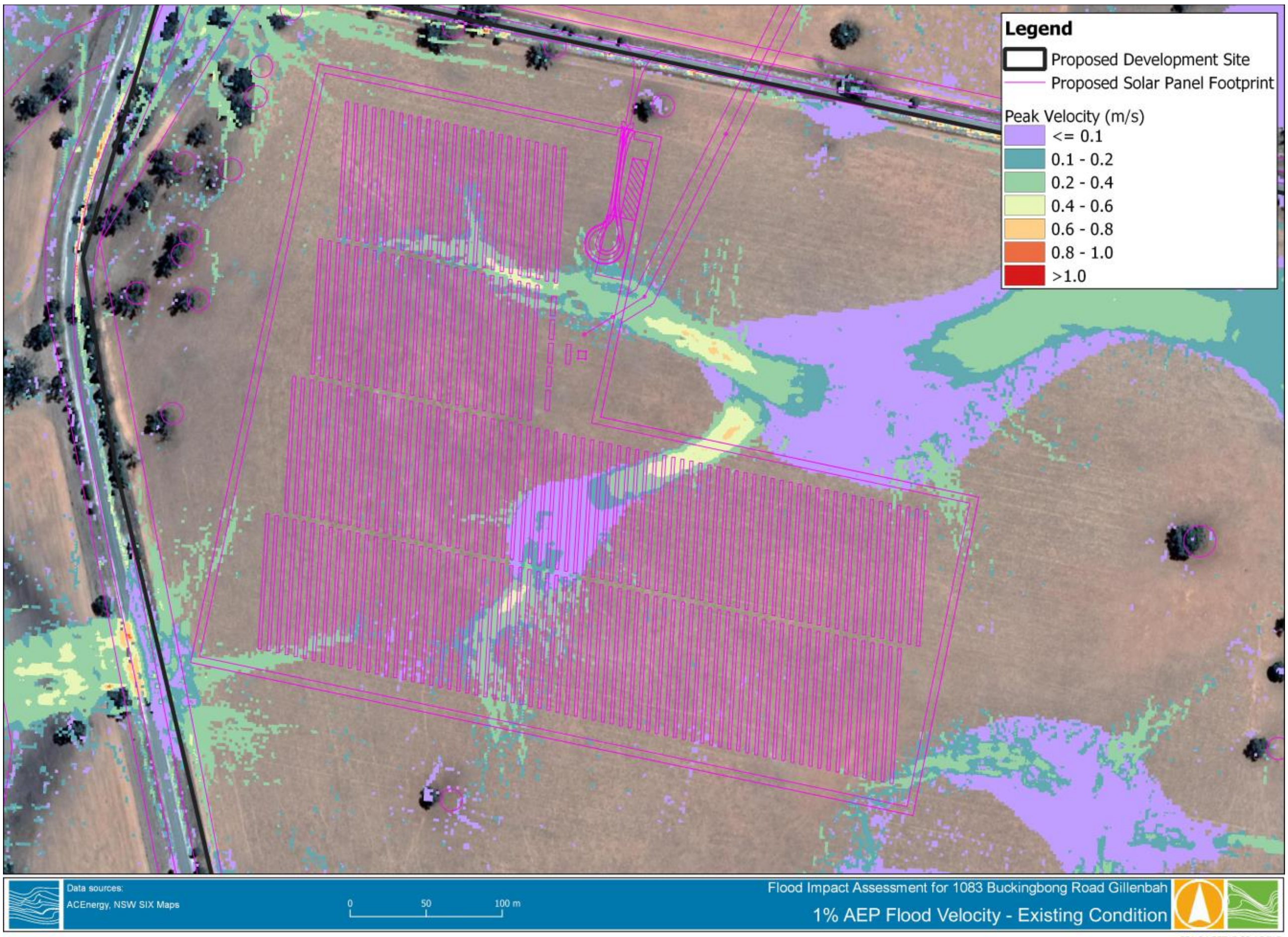

FIGURE 2-9 1% AEP PEAK VELOCITY - AT SITE LOCATION

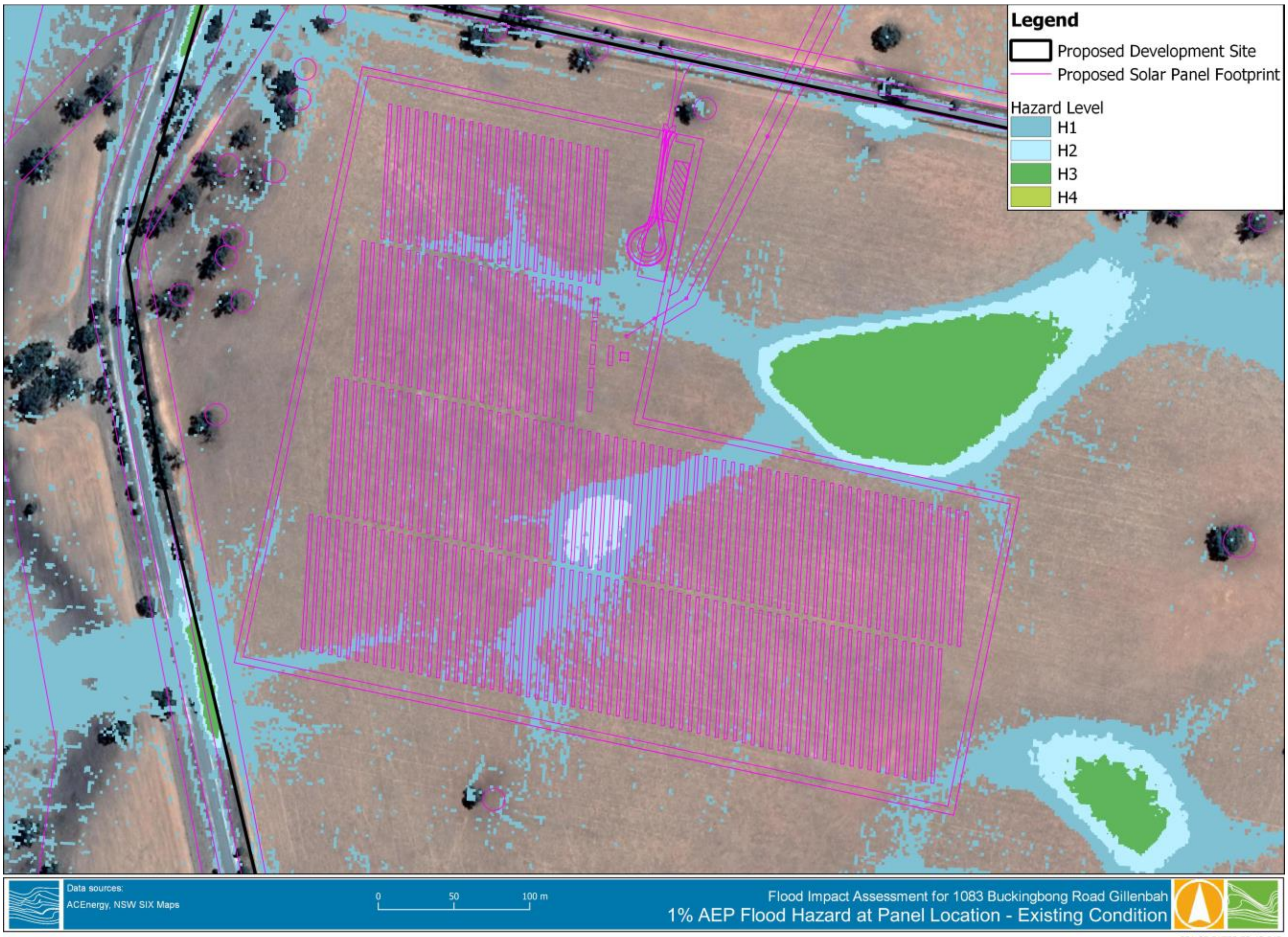

FIGURE 2-10 1% AEP PEAK HAZARD – AT SITE LOCATION

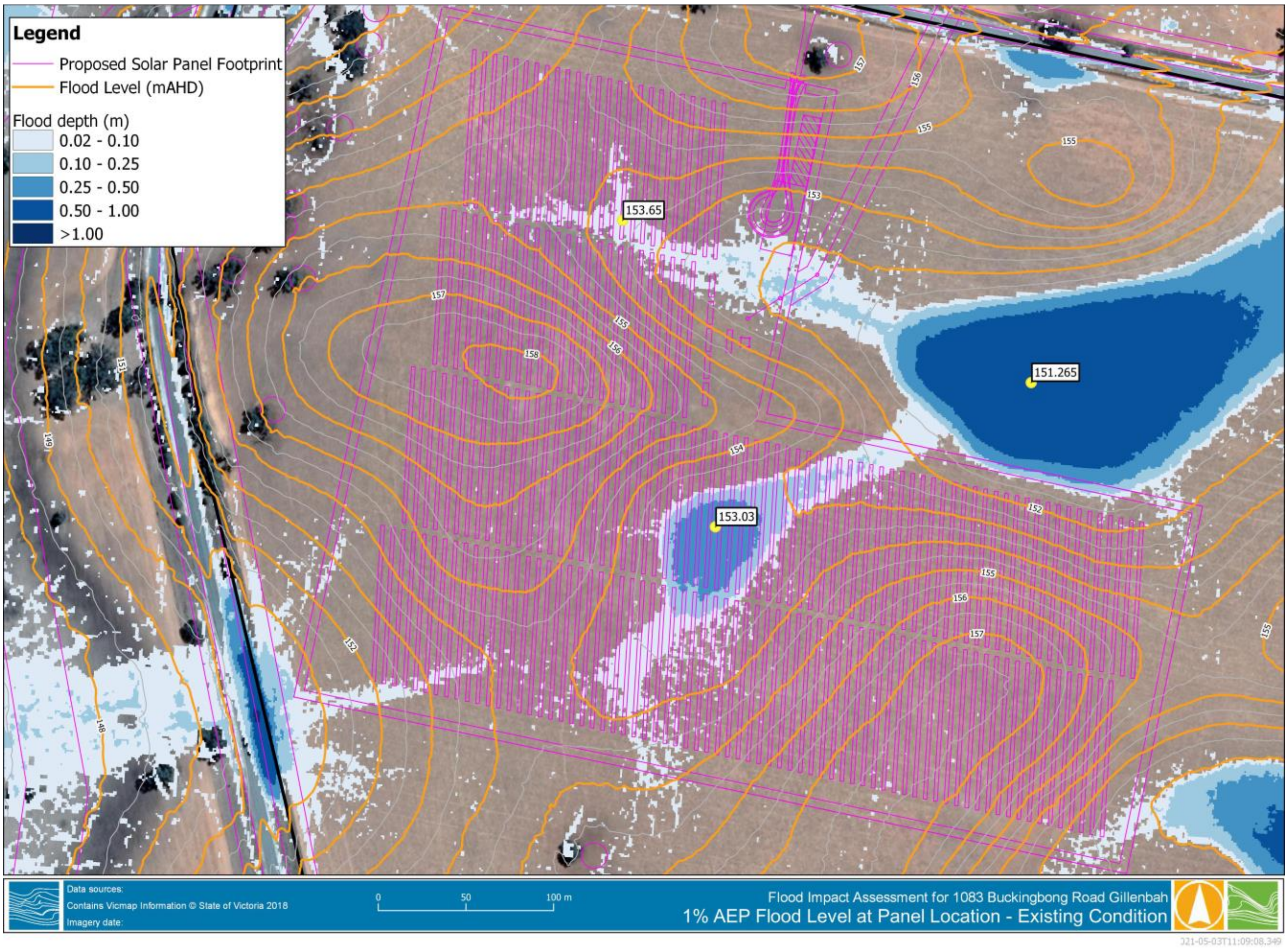

FIGURE 2-11 1% AEP FLOOD LEVEL - AT SITE LOCATION

3 SITE STORMWATER MANAGEMENT

3.1 Stormwater Volumes

The site is currently used for pasture cropping/grazing. Agricultural landuse including cropping is considered to have a low fraction imperviousness with minimal hard surfaces which generate runoff quickly. The site is relatively hilly, with a number of local depressions where water may pond.

When assessing the impact of stormwater runoff as a result of the development, consideration of the design layout and plans has been undertaken. Due to the nature of the solar panels design, which are raised well above the natural surface, placed on a stand, there will be a rain shadow under each of the panels. The shadow is where rainfall will not fall directly on the ground, runoff from the uphill panel will be able to flow across the ground and under the downhill panel, as such solar panels do not effectively increase the fraction impervious in the same way road pavement or the roof of a building do. The location of the solar panel area has been located away from the deepest ponding identified on the site (located in the north-east).

The site is to be accessed via a track from the north (Dellapool Road). It is assumed the track will be an unsealed gravel road with a hardstand area at the north of the site. The overall impact of the gravel road will be negligible in regards to runoff volumes and peak flow rates generated on the site.

The roadway is expected to account for around 1% of the site area and is likely to sit slightly higher than the surrounding levels to maintain access to the site in wet conditions. The carpark/turning area of this track is just north of a shallow overland flow path which drains to the east of the site. The access path design should take into account typical drainage requirements.

The site occupies the majority of the localised catchment with minimal upstream catchment located to the east of the site. As a result, it is not expected that any stormwater enters the site. A low-lying area to the north-east of the site along Dellapool Road may provide additional catchment to the site in large events. It is assumed (based on site feature survey) that there is no drainage infrastructure located along Dellapool Road in this area.

The site drains in several directions once the low spots (local storages) are filled. Velocities through the site are generally quite low. Flood modelling completed for the site shows some ponding of water sitting against Buckingbong Road as no culverts or drainage infrastructure has been included in the hydraulic model. This is a conservative assumption and shows that even if all culverts where stormwater leaves the site were blocked, flooding conditions on site show a relatively low risk. Directions of flow paths are marked on Figure 3-1.

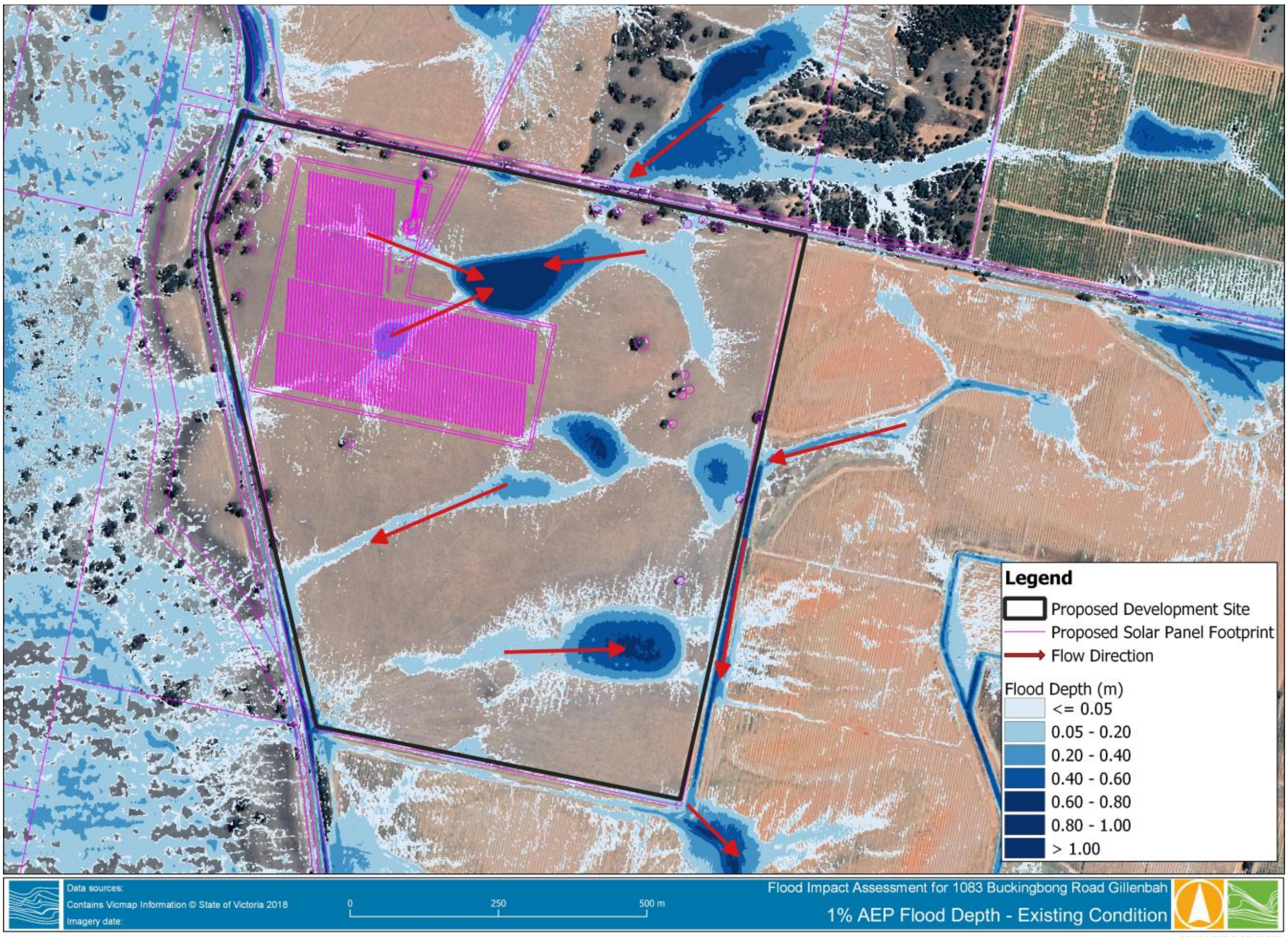

FIGURE 3-1 1% AEP FLOOD DEPTH SHOWING PRIMARY FLOW DIRECTION

3.2 Water Quality Measures

Stormwater management is an important consideration on solar farm sites as the addition of panels across large areas has the potential to increase erosion and runoff if not treated properly. If solar panels are not fixed and change direction to track the sun, the drip line of runoff from the panels will vary depending on the time of the day. It is understood, the panels proposed in this site will utilise a sun tracking device, therefore the risk of a drip line within this development is reduced (due to the drip line not being fixed).

There has been a lot of discussion and some research into the impact of solar farms on stormwater runoff in the USA and the UK. Some of the research has included theoretical modelling, and some research has been focused on applied field-based work. The general consensus with this research is that solar panels will not have a significant impact on the hydrology of the site under the following conditions:

- Ensure that the soil profile has not been overly compacted due to heavy machinery during construction, if it has, mitigate the soil to increase infiltration rates.
- Typical stormwater and environmental management practices should be undertaken during construction to minimise the likelihood of sediment leaving the site.
- Encourage vegetation cover to establish and be maintained. Native grasses would be the preference, but when dealing with cleared farmland, improved pasture is likely to exist in the soils seed bank already.

- Concentrated flows along narrow flow paths should be avoided to minimise erosion potential. There are no major flow paths within the site, therefore there is considered to be a low risk of erosion as a result of concentrated flow paths.
- The gap between each row of solar panels is greater than or equal to the width of the solar panel rows to allow the runoff from the upslope panel a buffer strip to spread across the surface and allow vegetation growth.
- Existing vegetation, for example grasses and grass cover, provide a filter for sediment control. These should be maintained where possible.

If the site layout can meet the general stormwater management principles proposed above, then there should be no adverse impacts of the solar farm on the hydrology of the catchment or the sediment loading of the runoff from the catchment.

4 PRELIMINARY GROUNDWATER ASSESSMENT

4.1 Introduction

4.1.1 Objectives and scope

Water Technology was requested to conduct a preliminary desktop groundwater assessment of the proposed solar farm from publicly available information. Although specific requirements were not provided, this assessment considers the Water Management Act 2000 and the Environmental Planning and Assessment Act 1979. The proposed solar farm would not be classified as a State Significant Development due to the capital investment value of approximately $6.4 million. It is of regional significance.

The scope of this preliminary groundwater assessment excludes the following:

- Modification of any groundwater recharge or discharge structures e.g. dams or salinised land.
- Any groundwater extraction.
- Any intersection of groundwater with excavations.
- Consideration of direct removal of groundwater dependent ecosystems (GDEs)
- Consideration of hazardous materials (e.g. sewage or chemicals from battery storage).
- Any cumulative impacts.

The scope and objective of this preliminary assessment is to consider the proximity of nearby receptors (bore users and ecosystems) to provide a high level assessment of the impacts of the planned actions considering the property has a moderately high and high groundwater vulnerability. Vulnerability ratings are mapped by the depth to watertable, net recharge, aquifer and soil media, topography and impact of the vadose zone media (NSW DLWC, 2001).

4.1.2 Legislative framework

The NSW Murray-Darling Basin Fractured Rock Groundwater: Lachlan Fold Belt MDB groundwater management area (GMA) are the aquifers of interest in the Water Sharing Plan (2020) governed by the Department of Primary Industries Water (DPI Water) under the Water Management Act 2000 for the proposed site. The Water Sharing Plan (2020) has economic, Aboriginal cultural and Social and cultural objectives. The relevant objectives of this plan include:

- Provide access to groundwater for Aboriginal cultural objectives (groundwater-dependent culturally significant area means a groundwater-dependent culturally significant area, as determined by the Minister)
  - Water Technology is not aware of any such area near the site
- High priority groundwater dependent ecosystems (GDEs)
- Provide access to water for groundwater-dependent businesses

4.1.3 Actions and impacts

Considering the solar panels and footings proposed as part of this development, altered recharge is the focus of this assessment. This may impact the beneficial uses/receptors accessing the shallow aquifer.

4.2 Local hydrogeology

The local hydrogeology comprises intermediate and local flow systems in Palaeozoic rocks or Mesozoic intrusives (GDE Atlas, 2016). Information on geology and bores within 5 km of the site are shown in Figure 4-1. Table 4-1 provides the drillers log representative for the site.

TABLE 4-1 SITE GEOLOGY – BORELOG FROM GW403567.1.1

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material
0.00	1.00	1.00	Sand Brown	Sand
1.00	3.00	2.00	Clay Brown	Clay
3.00	5.00	2.00	Clay Grey	Clay
5.00	10.00	5.00	Clay Grey and Grown	Clay
10.00	15.00	5.00	Clay Grey	Clay
15.00	18.00	3.00	Sand Brown	Sand
18.00	19.00	1.00	Clay and Sand Brown	Clay
19.00	25.00	6.00	Sand Brown GML	Sand
25.00	28.00	3.00	Clay Brown	Clay
28.00	42.00	14.00	Sand and Clay Brown Very Hard	Sand
42.00	45.00	3.00	Sand and Weathered Granite Brown	Sand
45.00	55.00	10.00	Clay and Weathered Granite Grey and White	Clay

This bore was completed from 21-24 m. Ground elevation was 153.64 mAHD and salinity was 500 mg/L total dissolved solids (TDS) which is suitable for drinking water.

With reference to Table 4-1, the clay layers below 1 m depth is likely to provide a *barrier zone* to vertical recharge (and any *threat* from contamination) where present. More detail on the distribution of the clay layer is important, as it will influence any altered to natural rainfall recharge by impermeable infrastructure.

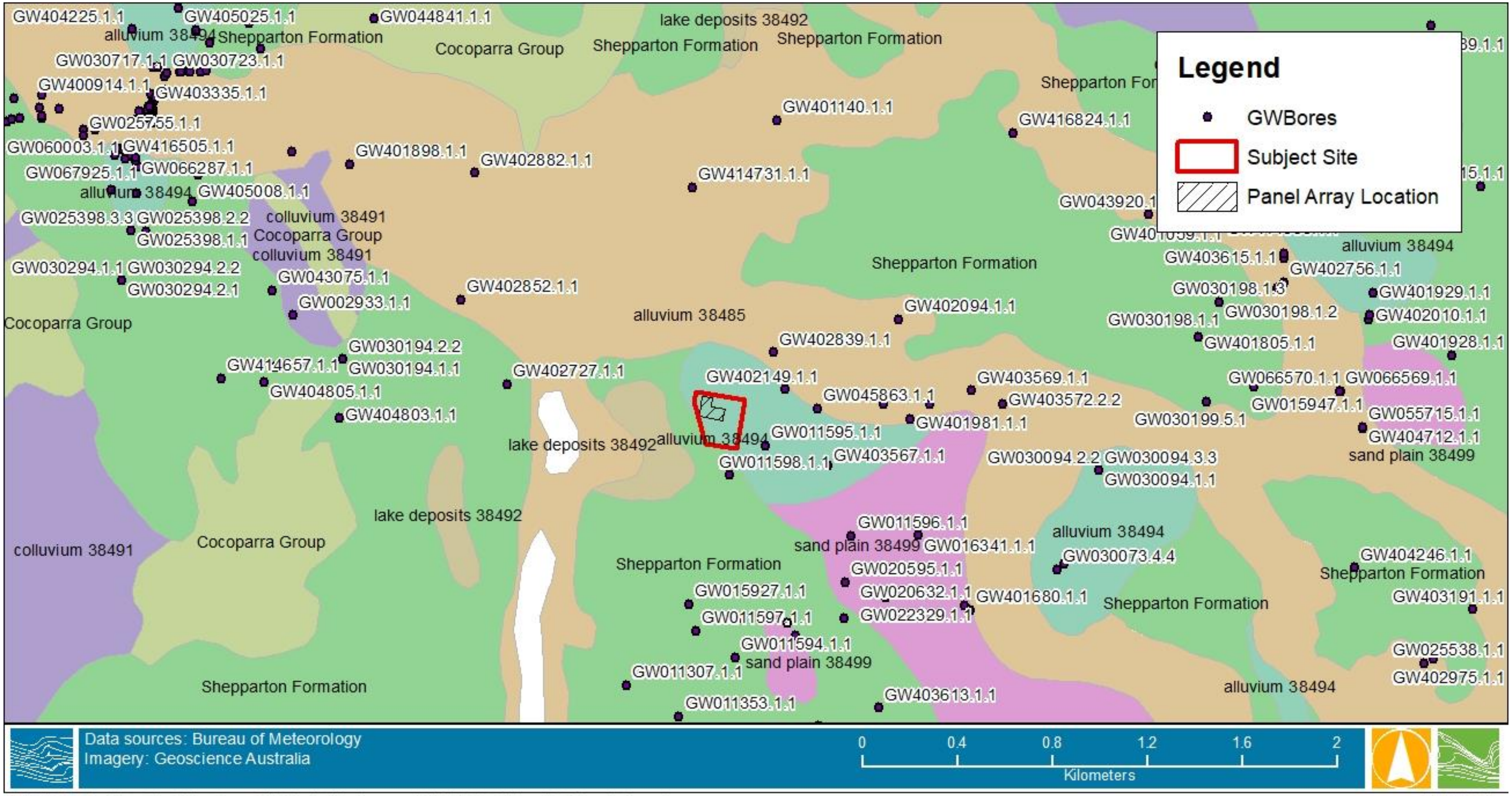

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FIGURE 4-1 SURFACE GEOLOGY (GEOSCIENCE AUSTRALIA) AND REGISTERED BORE MAP

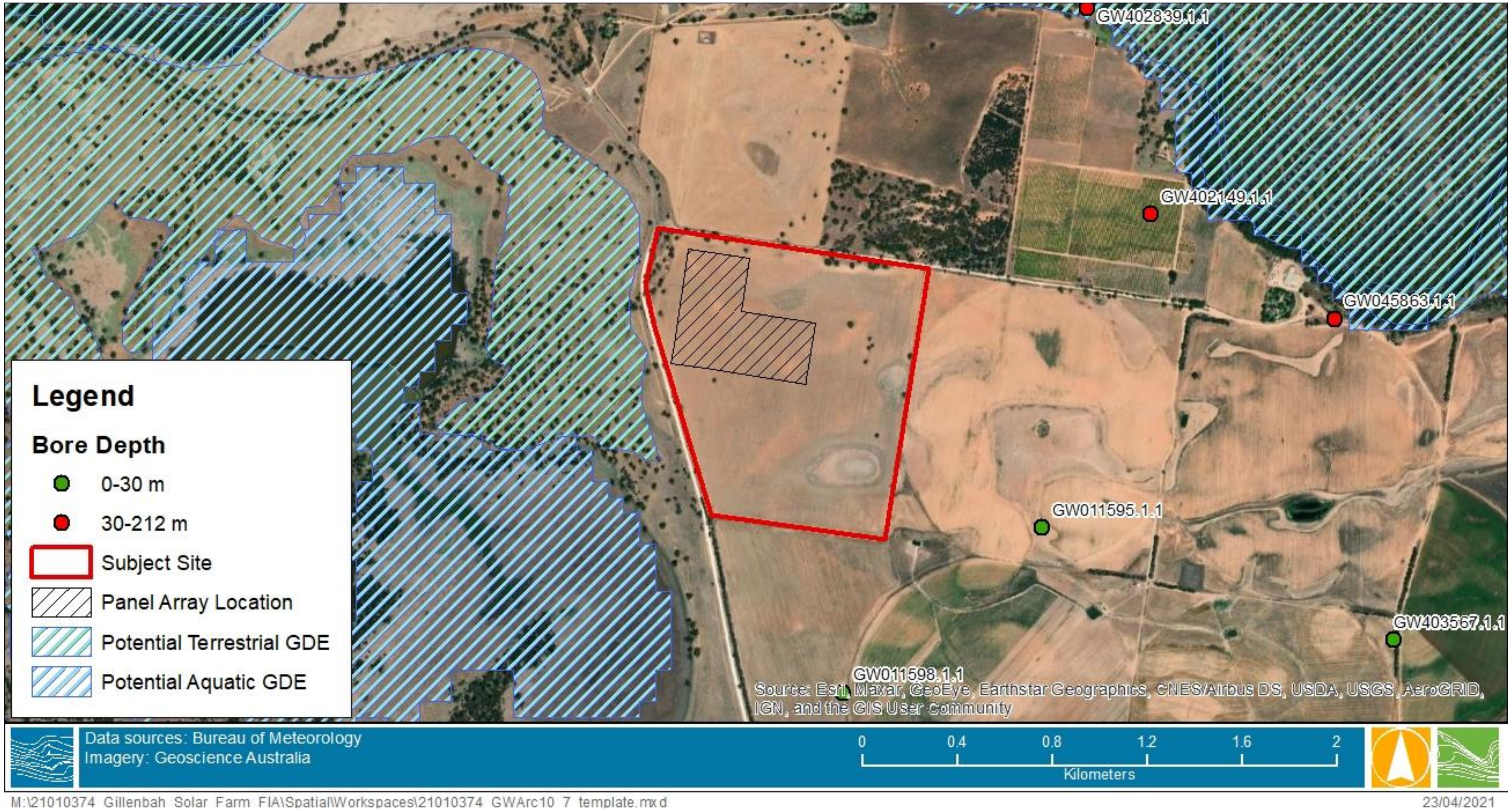

FIGURE 4-2 BORES AND LOCATIONS WITH POTENTIAL FOR GDE HABITAT (GDE ATLAS, 2016)

4.2.1 Groundwater Level

Static/standing water level (SWL) data is sparse in the area, with the majority of data from the 1970s, a SWL of 9 m was identified when drilled in 2006. Figure 4-3 shows SWL is becoming shallower, however, by 09 October 2019 WaterNSW measured SWL at 11.11 m (141.13 mAHD). This is lower than the root systems of most terrestrial GDEs.

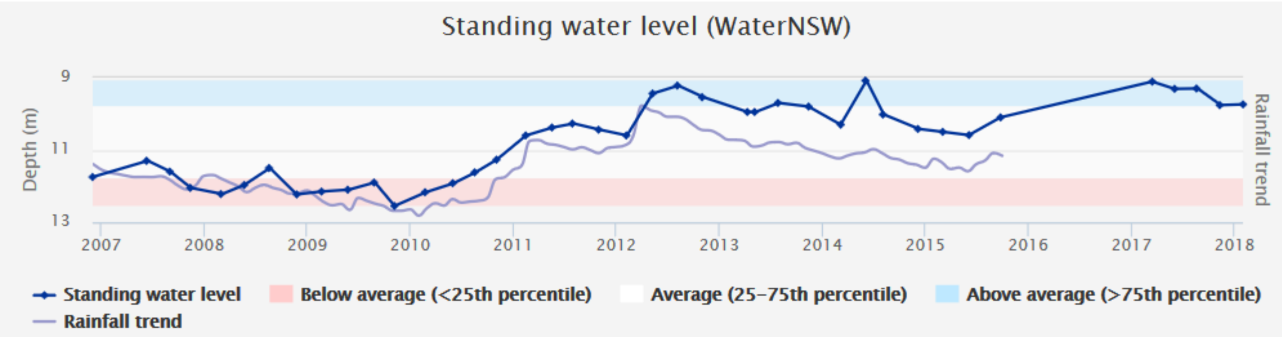

FIGURE 4-3 GROUNDWATER HYDROGRAPH FOR WATER NSW MONITORING WELL GW403567.1.1

4.3 Assessment of adverse effects to vulnerable groundwater resources

4.3.1 GDEs

High priority GDEs are protected under the Water Sharing Plan. Potential Terrestrial GDEs (*Eucalyptus* camaldulensis) are within 200 m which may cause issues under the Plan if a bore was to be drilled for the solar farm (not in scope). No potential GDEs are mapped onsite as shown in Figure 4-2 (GDE Atlas, 2016).

4.3.2 Bore users

There are no bores within one kilometre of the solar panels. There are two bores within two kilometres. Although the shallow groundwater is likely potable quality available at reasonable yield, the altered recharge from impermeable foundations is likely to have a negligible impact to receptors. As such, if detailed designs do not change the existing groundwater recharge or discharge these works are compliant with the Water Management Act 2000 and the Environmental Planning and Assessment Act (1979).

5 RECOMMENDATIONS

The following recommendations have been proposed to be adopted at the site:

- Any sensitive infrastructure such as inverters and battery storage etc, is recommended to be located above the maximum of the 1% AEP flood level with 300 mm freeboard. It is common for this type of infrastructure to be housed within shipping containers or small sheds with relatively small footprints. Given the shallow depths across the site, raising this infrastructure, either through increased footings or raised fill pads is unlikely to result in any adverse flooding impacts offsite.
- Solar panel arrays should be designed so that they can be positioned to have the lowest edge of the solar panel above the 1% AEP flood level. This need not be a permanent setting, but it is suggested that the panels could be operated to tilt so the lowest edge can lift in times of flood.
- The panel post and footings should be designed to withstand the flood velocities described in this report, which are mostly low in the areas proposed for solar panels.
- It is recommended that the best practice principles to stormwater and sediment control be incorporated into the design, construction and operation phases of the solar farm site. Sediment control is important at all stages of design, construction, and operation.
- The site can be safely accessed from Buckingbong or Dellapool Roads in a 1% AEP flood event. Design considerations should be made for the access track to ensure that overland flow paths identified in this report are catered for.
- From a groundwater perspective, considering the scope of work provided, there is no need for further action beyond preparation of an appropriate environmental management plan during detailed design.

6 SUMMARY

A flood impact assessment has been completed for the proposed development site at 1083 Buckingbong Road, Gillenbah, NSW. The assessment was based on 2D TUFLOW rain-on-grid modelling of surface flows to the site, without considerations of the existing surrounding drainage infrastructures, i.e. culverts.

Flood modelling of the proposed development site under existing condition has estimated water pooling at several lower areas located at north and east of the development site. There is some ponding within the proposed solar panel footprint, with the maximum flood depth varying from 0.37 metre during the 10% AEP event to 0.44 metre for 0.5% AEP event.

Flood levels onsite during the 1% AEP are shown to range from 152 mAHD to 154 mAHD.

For solar panels proposed in the inundated areas, it is recommended that these are located above the 1% AEP flood level. For any critical infrastructure, it is recommended that it be sited 300 mm above the 1% AEP flood level and where possible outside of the 1% AEP extent.

Stormwater impacts were considered by assessing the design layout and plans provided to identify potential increases in ‘hard’ or impervious surfaces. The most notable stormwater risk on-site is erosion, this can be managed by maintaining good vegetation cover and avoiding concentrated flow-paths.

A high-level assessment of the impacts of the planned actions to groundwater users has been conducted. The conceptual design includes solar panels and no groundwater bores. As bores are two kilometres away and no sensitive groundwater dependent ecosystems have been identified, impacts from this development can be appropriately managed.

The site is found to be a low risk of flooding for both the existing and proposed conditions. The site is not subject to inundation from the waterway to the south, with the current layout having infrastructure set back significantly from the flood extent. Minimum changes to the land topography are anticipated due to the nature of solar farm project. This results in low likelihood of changes to the hydraulic flood behaviour of a local catchment or intense storm event. Minimal changes to fraction imperviousness of the site are also expected and it is not anticipated that a storage basin or water quality treatment is expected beyond maintaining good vegetation onsite which will act as a natural filter buffer.

The proposed infrastructure design is not likely to result in changes or impacts to the groundwater environment with construction methods not likely to interact with the groundwater.

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APPENDIX A RESULT MAPS

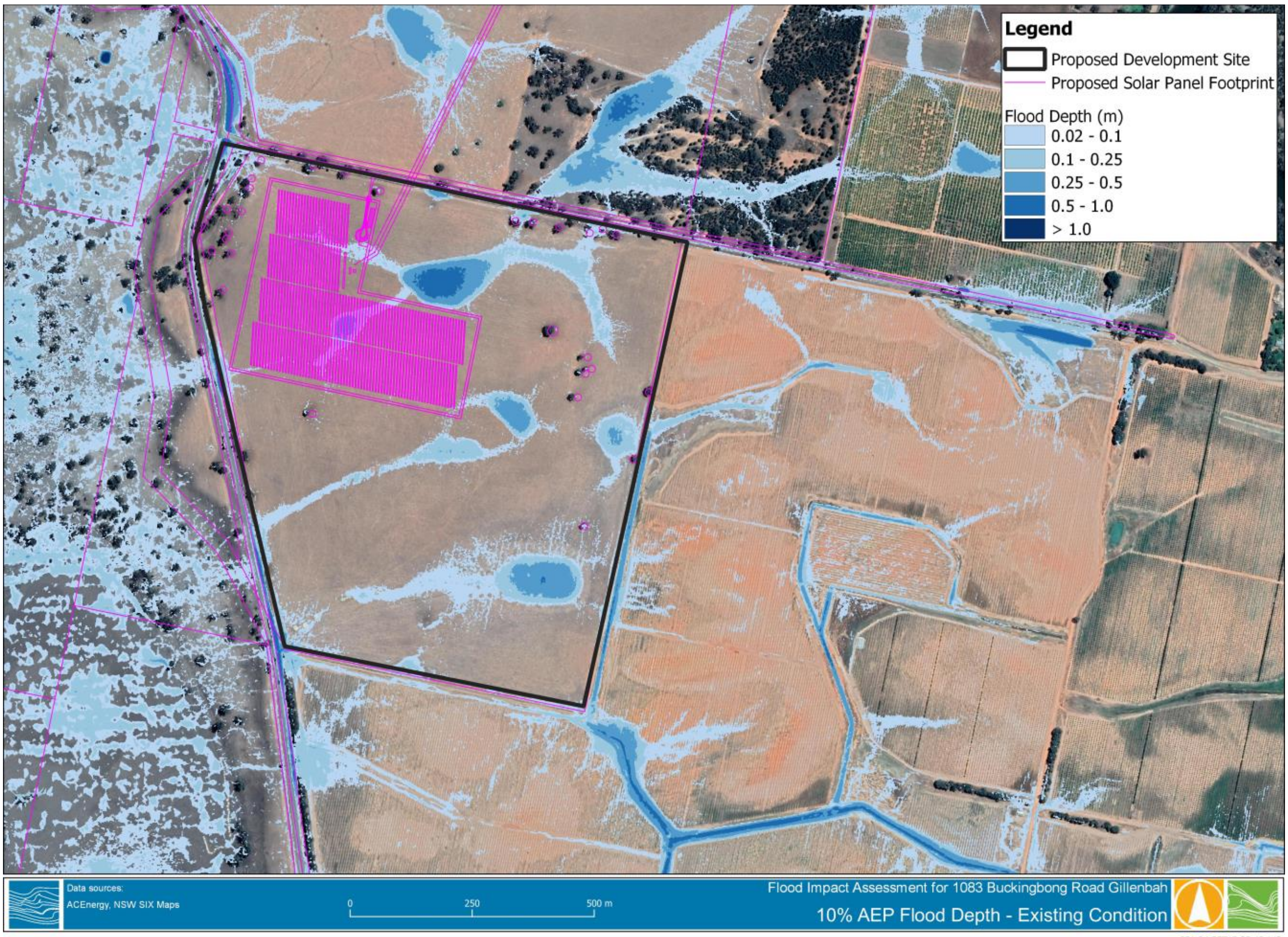

FIGURE 7-1 10% AEP FLOOD DEPTH – EXISTING CONDITION

21010374_R01V03_Gillenbah_SolarFarm.docx

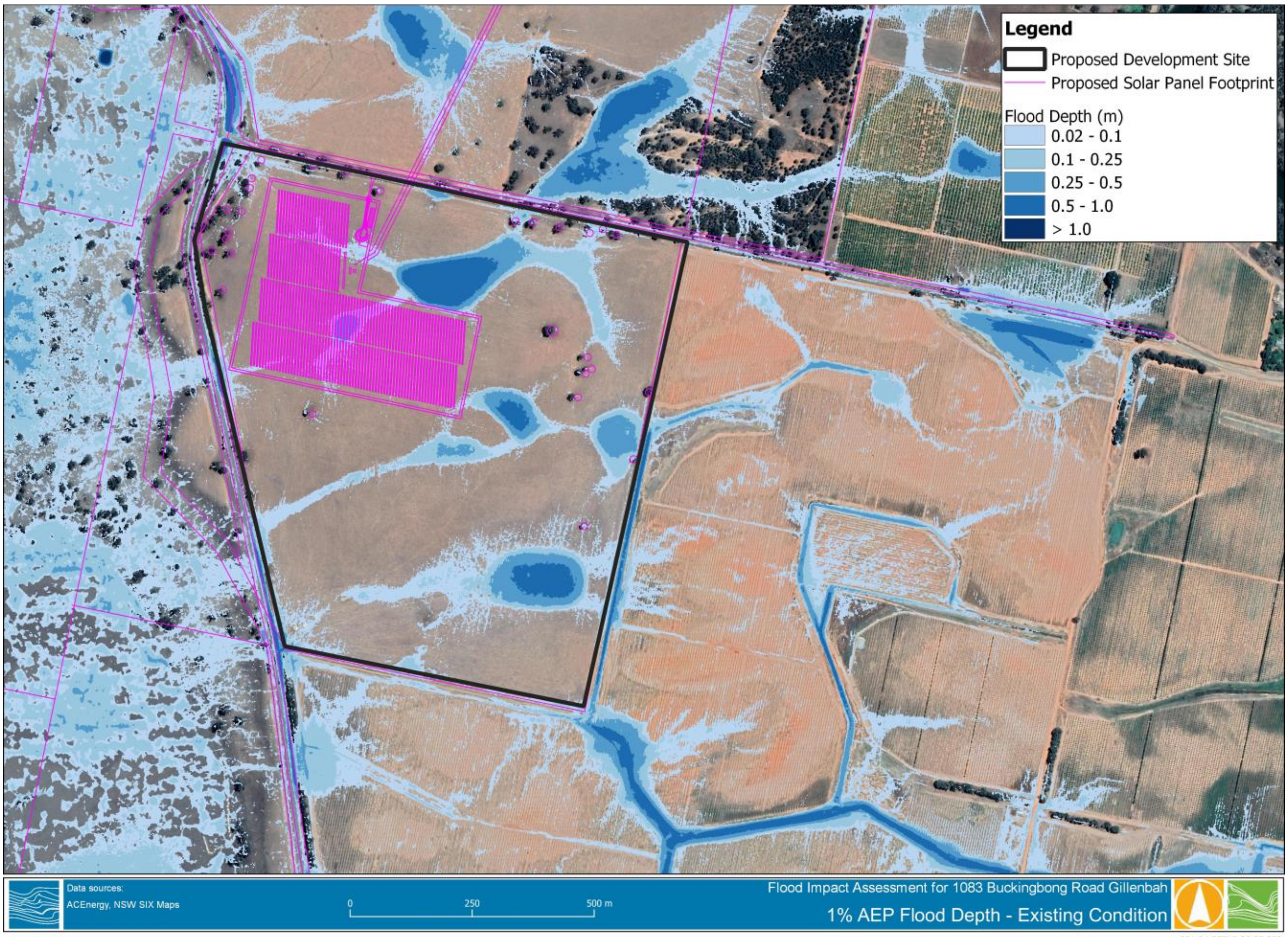

FIGURE 7-2 1% AEP FLOOD DEPTH – EXISTING CONDITION

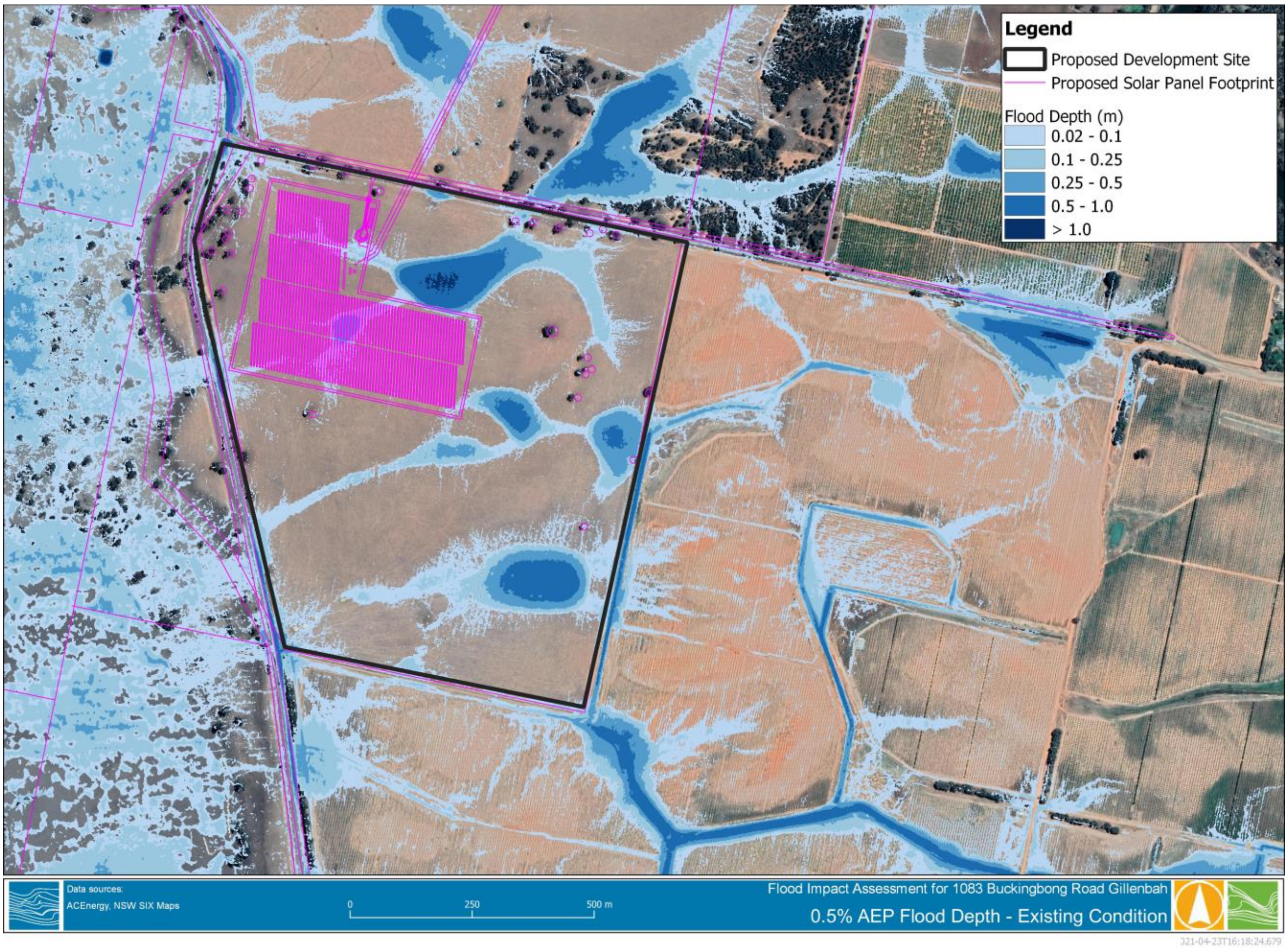

FIGURE 7-3 0.5% AEP FLOOD DEPTH – EXISTING CONDITION

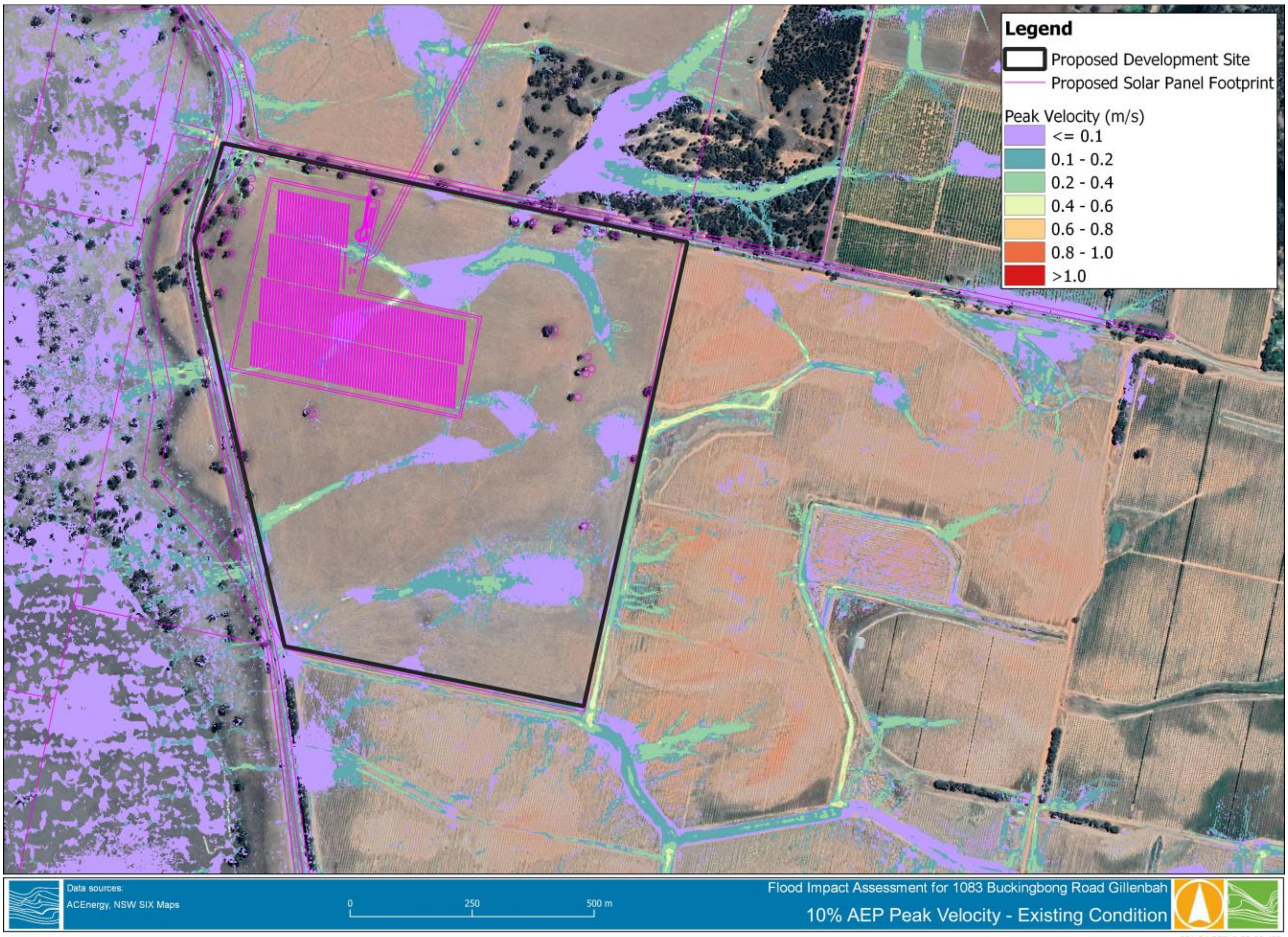

FIGURE 7-4 10% AEP PEAK VELOCITY – EXISTING CONDITION

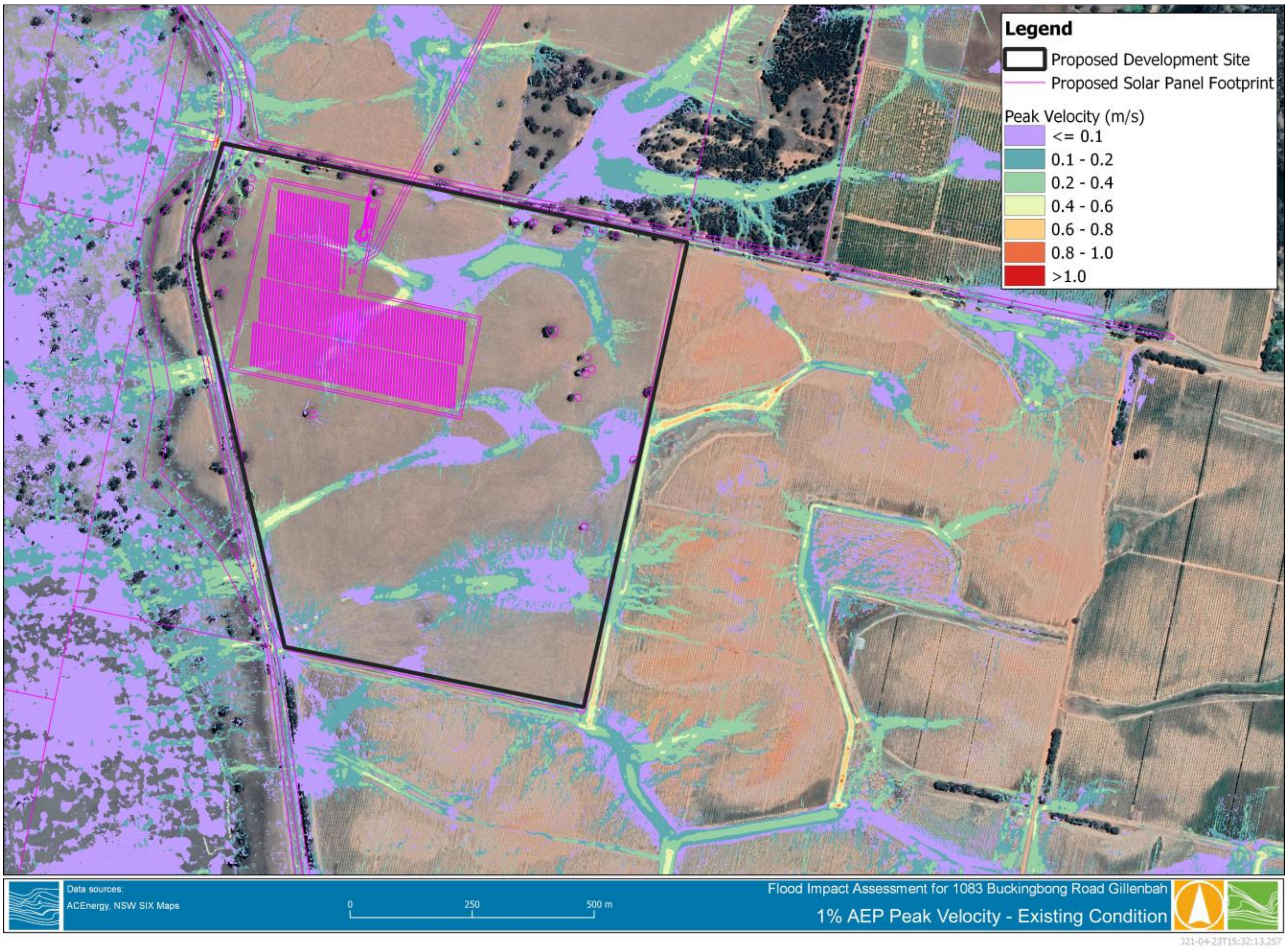

FIGURE 7-5 1% AEP PEAK VELOCITY – EXISTING CONDITION

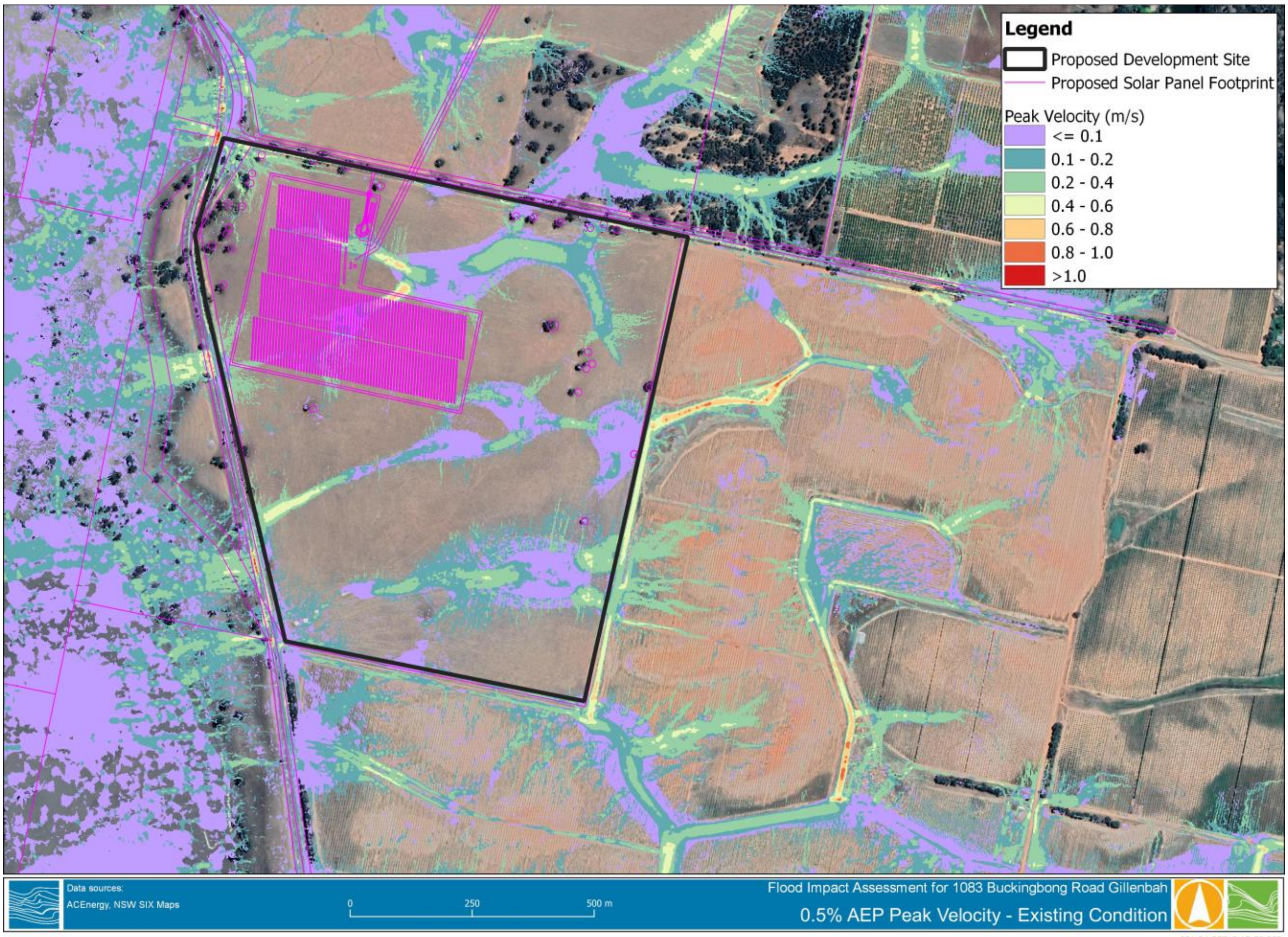

FIGURE 7-6 0.5% AEP PEAK VELOCITY – EXISTING CONDITION

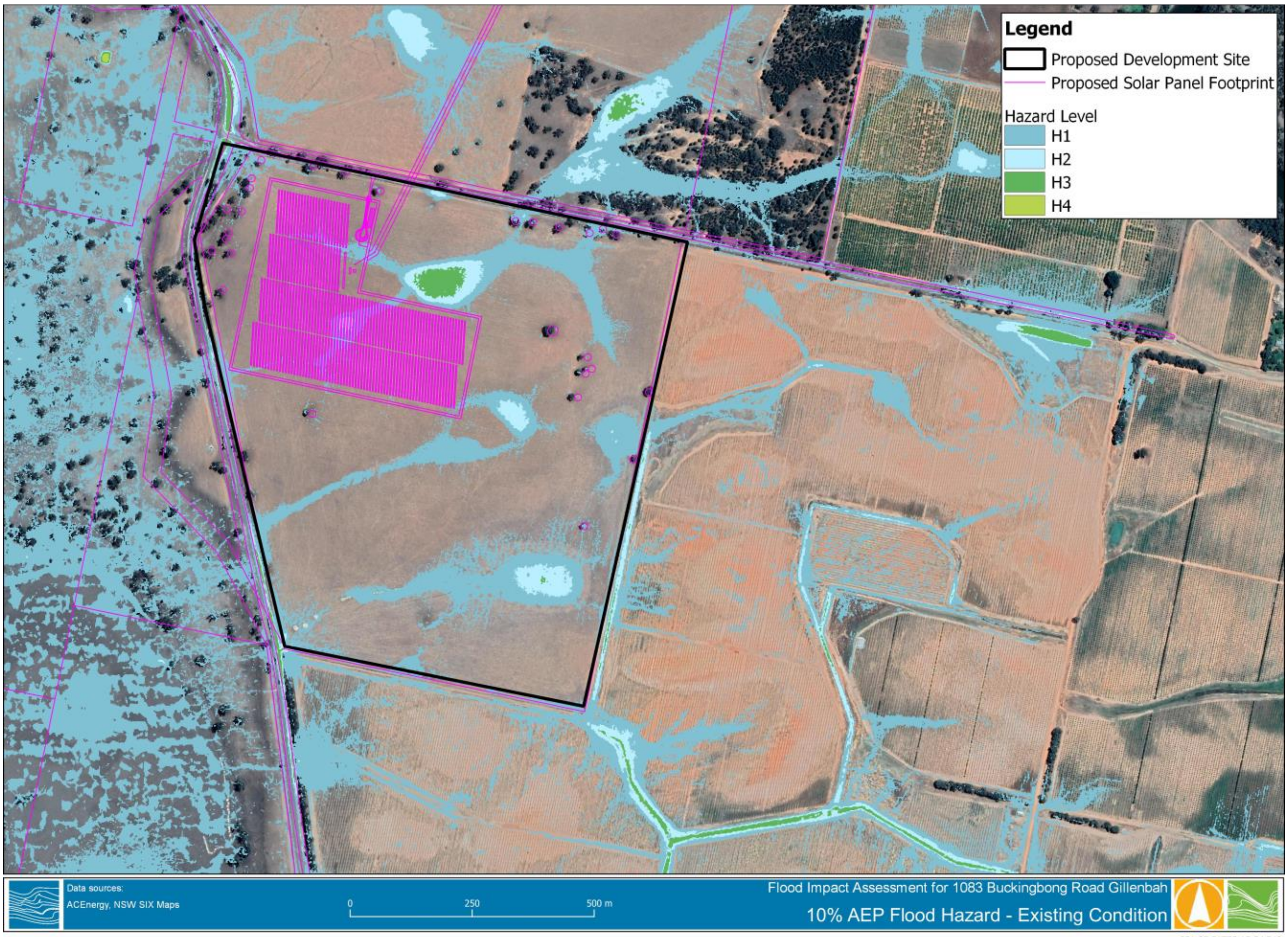

FIGURE 7-7 10% AEP PEAK FLOOD HAZARD – EXISTING CONDITION

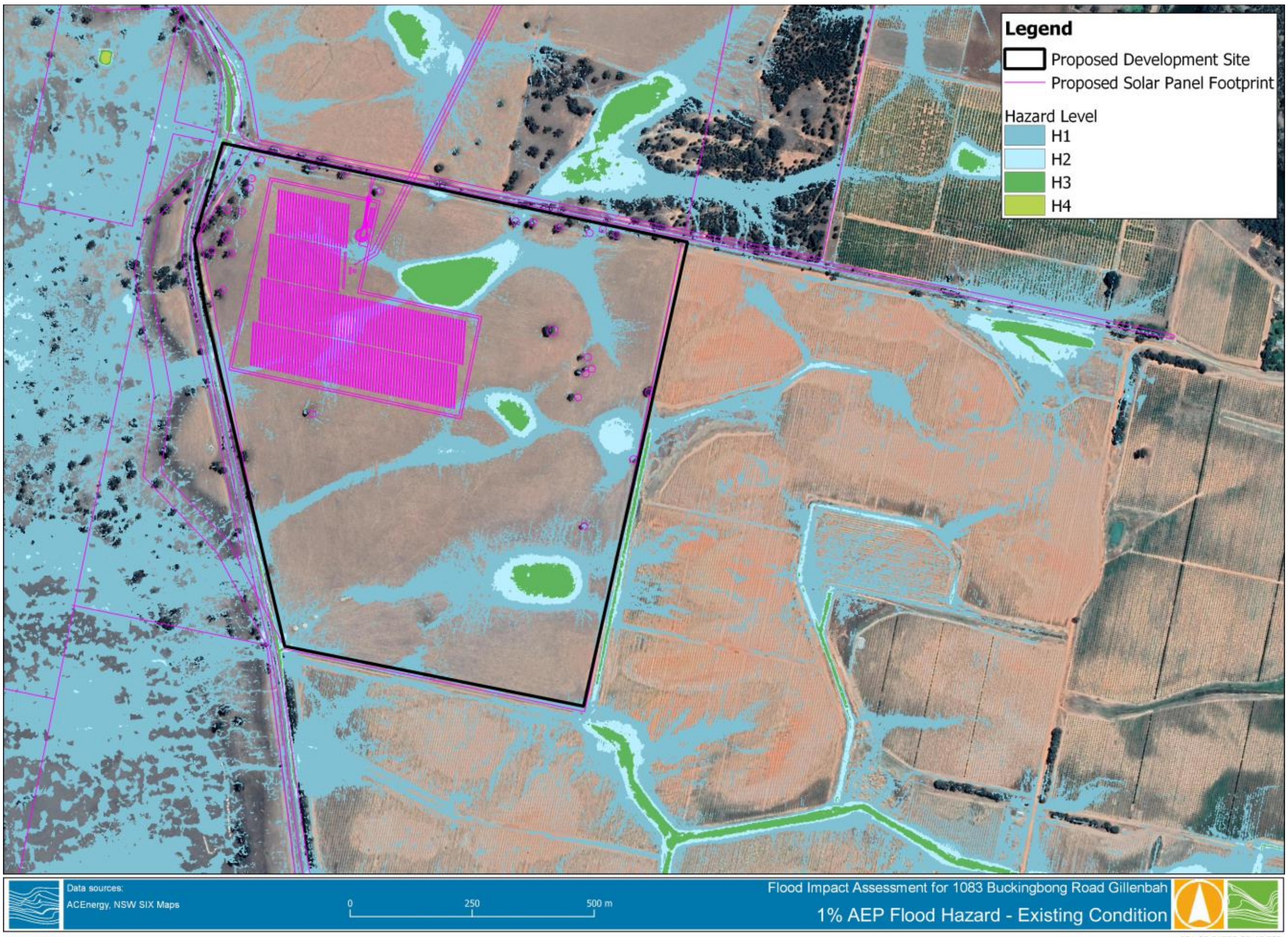

FIGURE 7-8 1% AEP PEAK FLOOD HAZARD – EXISTING CONDITION

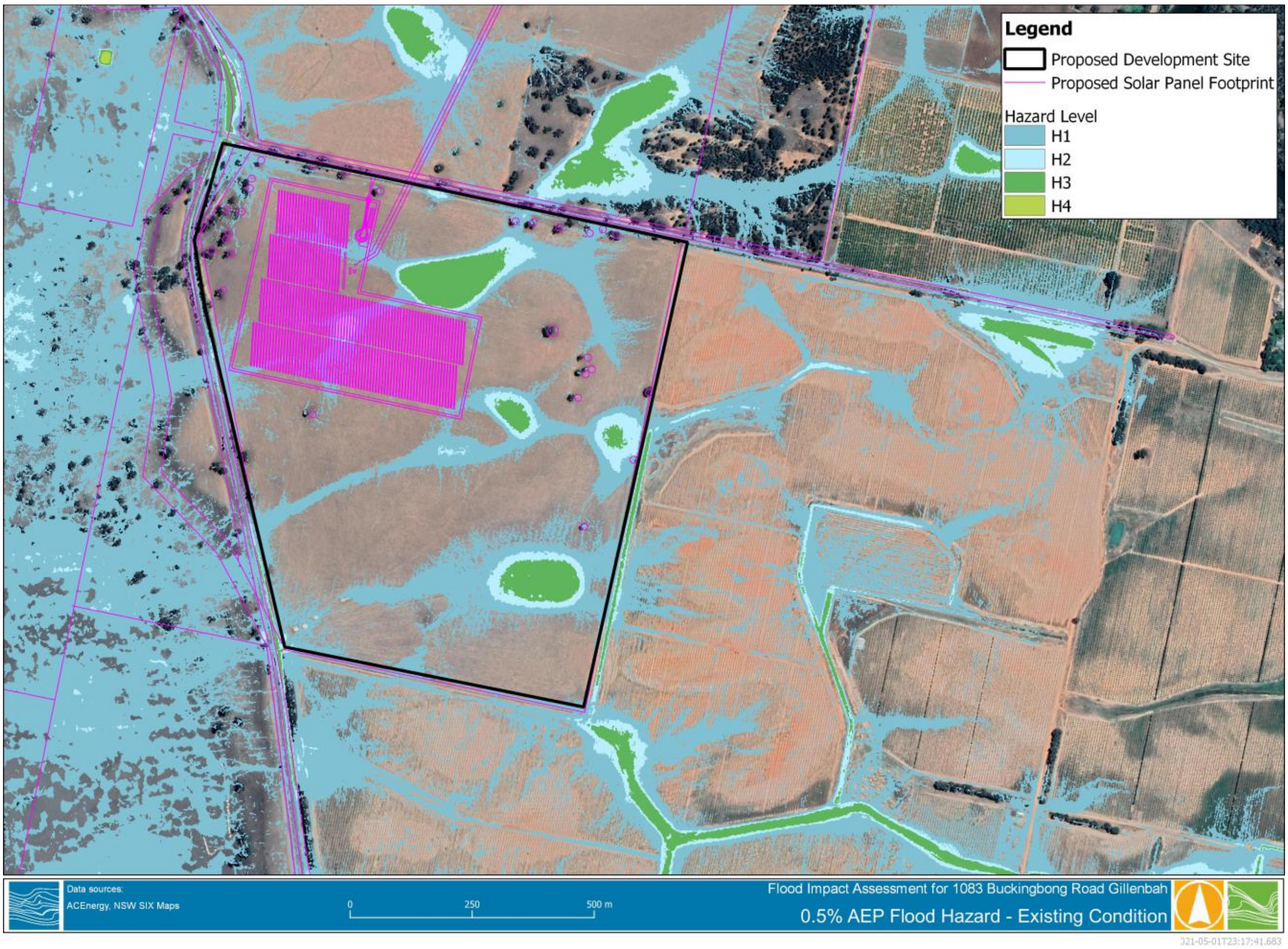

FIGURE 7-9 0.5% AEP PEAK FLOOD HAZARD – EXISTING CONDITION

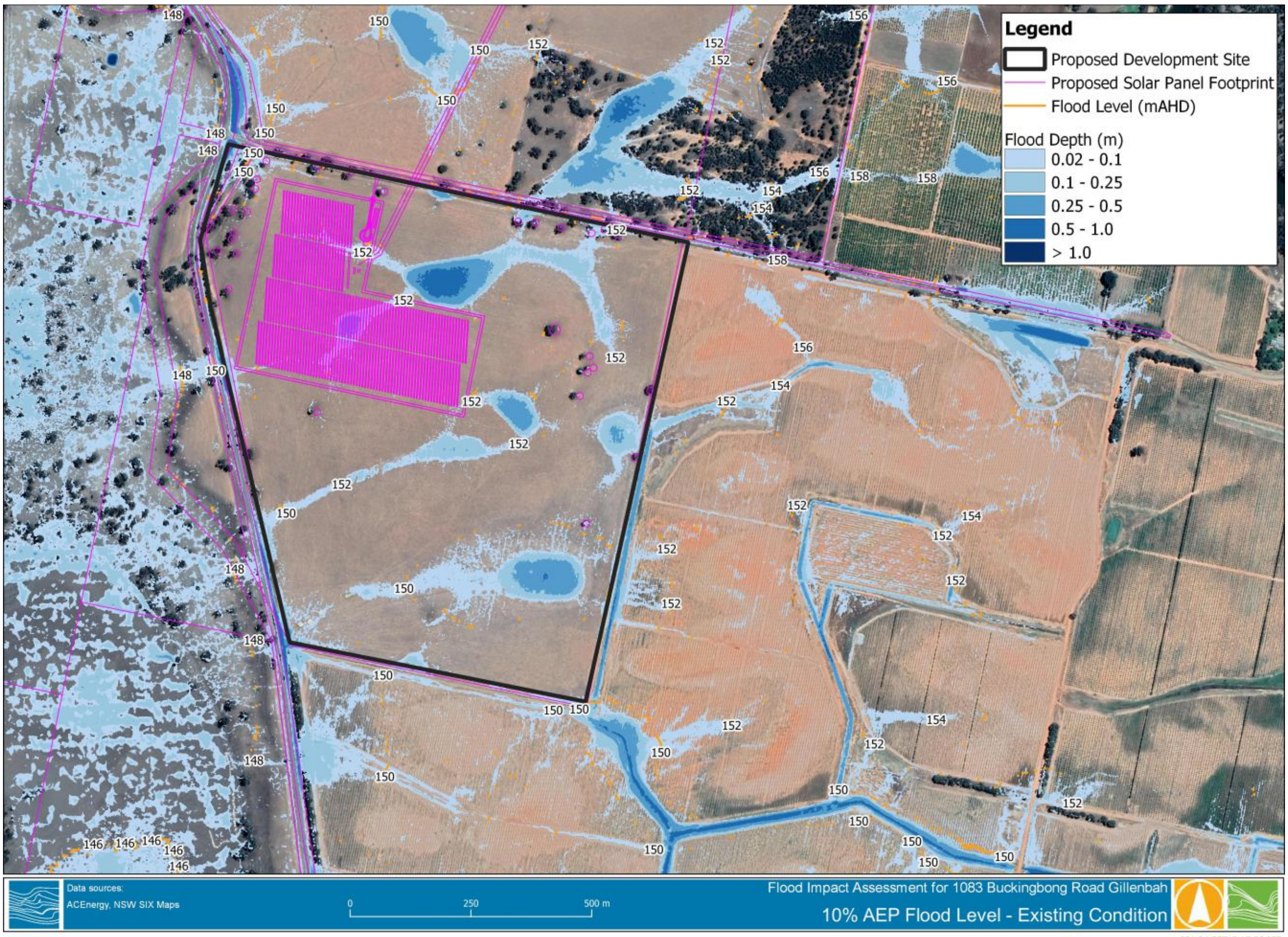

FIGURE 7-10 10% AEP FLOOD LEVEL – EXISTING CONDITION

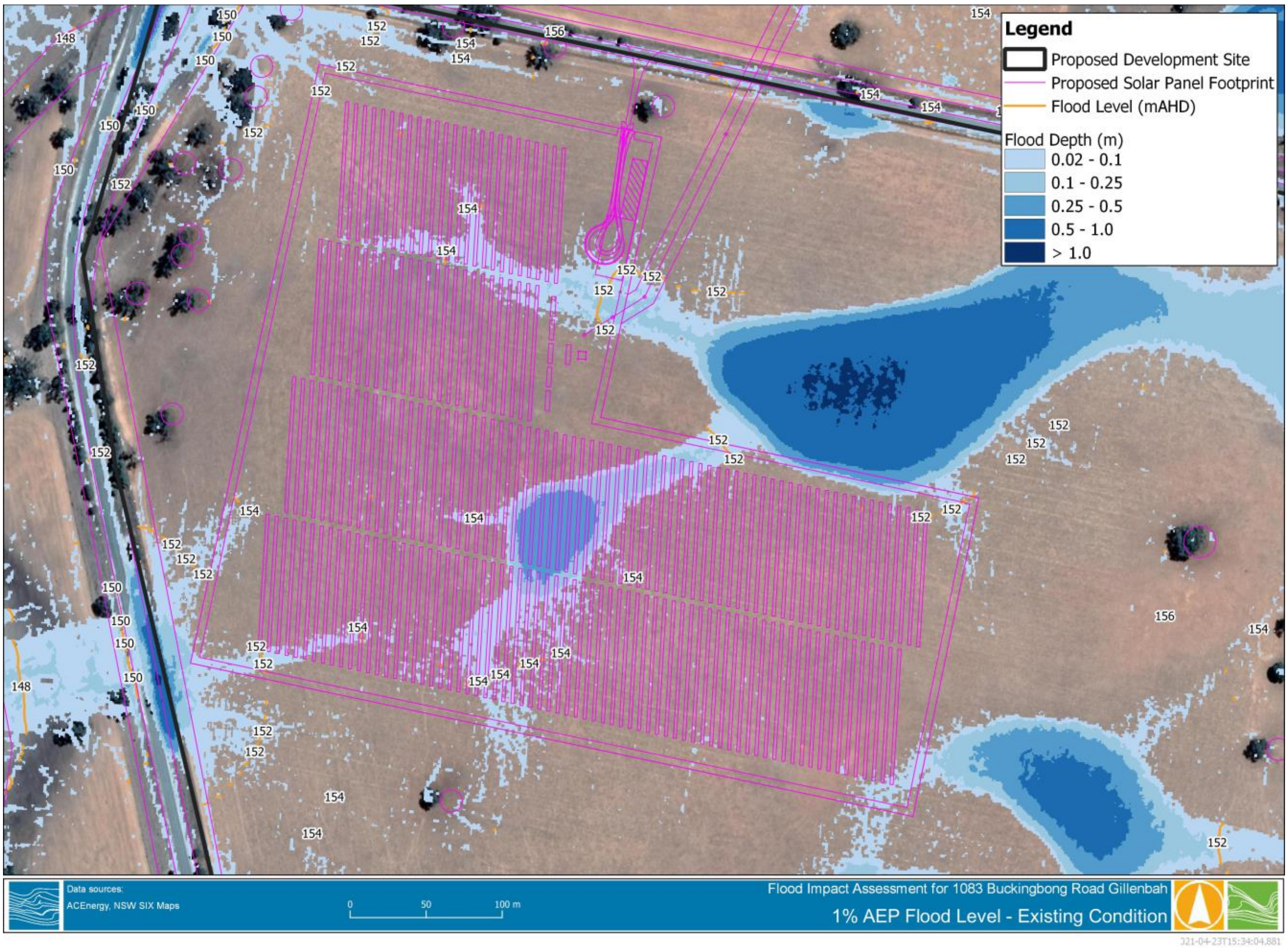

FIGURE 7-11 1% AEP FLOOD LEVEL – EXISTING CONDITION

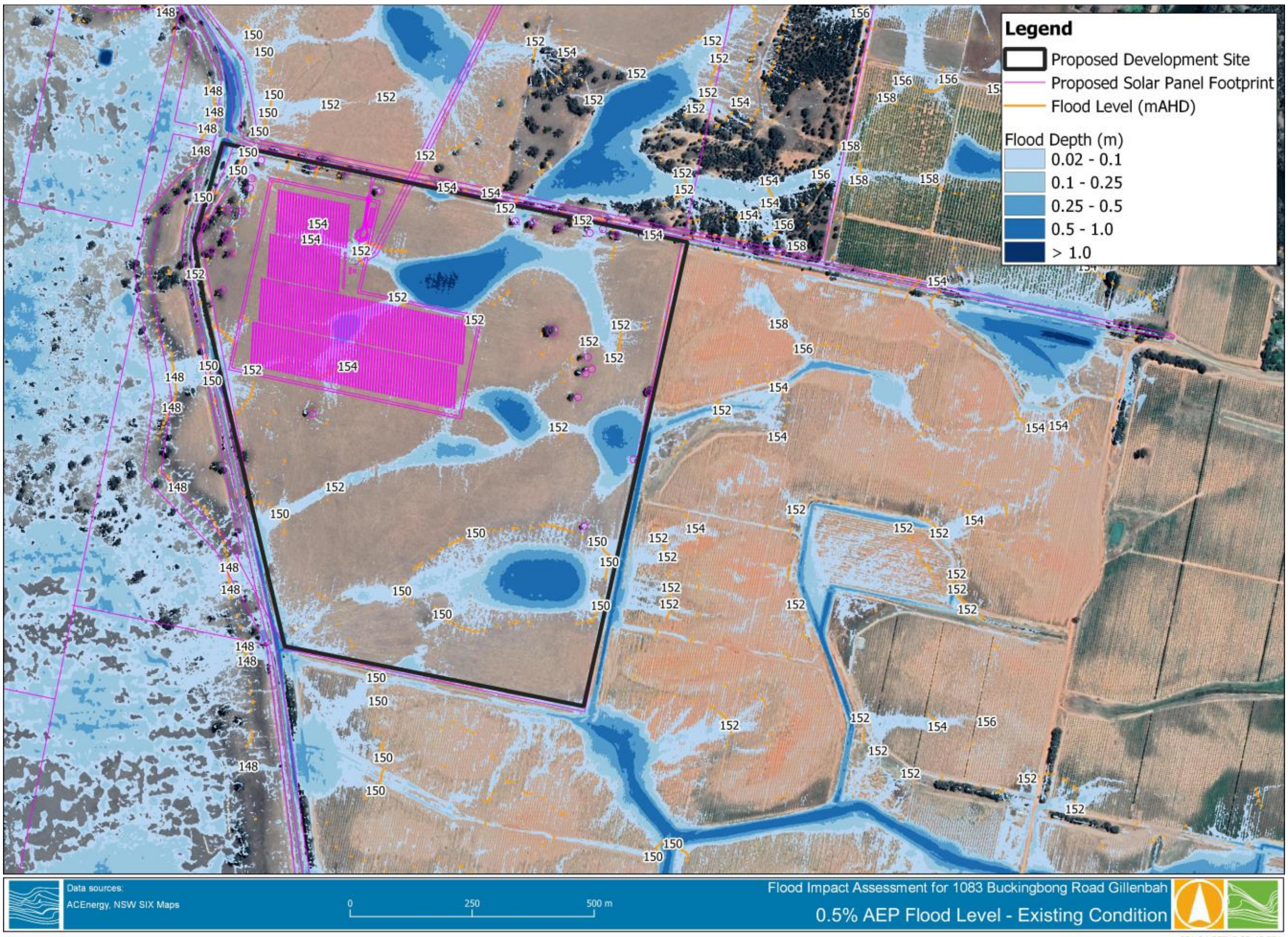

FIGURE 7-12 0.5% AEP FLOOD LEVEL – EXISTING CONDITION

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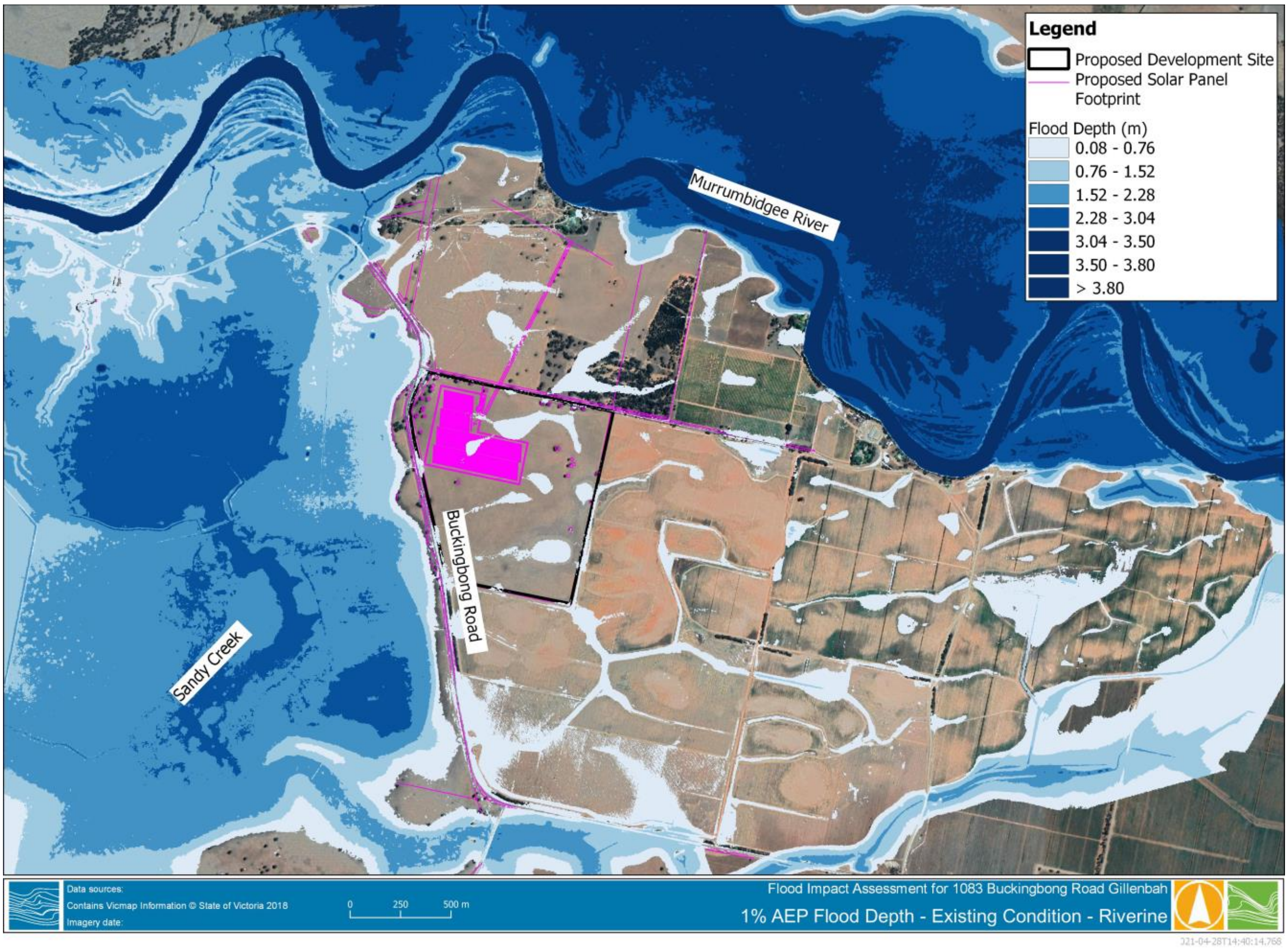

FIGURE 7-13 1% AEP FLOOD DEPTH – SHOWING RIVERINE FLOOD EXTENT

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