BMT Commercial Australia Pty Ltd
Level 4, 4-14 Foster Street, Surry Hills, NSW 2010
Australia

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11 December 2023

Hunter Development Brokerage Pty Ltd
44 Church Street (PO Box 40)
Maitland, NSW 2320

Attention: Aprajita Gupta

Dear Aprajita

RE: FLOOD RISK ASSESSMENT FOR PROPOSED DEVELOPMENT AT 105 MERRIWA ROAD, DENMAN, 2328

BMT Commercial Pty Ltd ("BMT") has been commissioned by Hunter Development Brokerage Pty Ltd to undertake a flood risk assessment (FRA) for the proposed development of the BESS facility at 105 Merriwa Road, Denman.

The assessment focuses on flood hazards within the site and blocked access due to flooding of local roads. This letter documents a summary of the analysis and outcomes of the FRA undertaken by BMT.

We trust that the assessment is adequate for your purposes. If you require further information or clarification regarding any aspect of this assessment, please do not hesitate to contact the undersigned.

Yours Sincerely,

BMT

Lorena Woortmann

Graduate Scientist

1 Introduction

HDB Town Planning & Design on behalf of Clean Energy Transfer Fund Battery Developments Pty Ltd engaged BMT to complete a flood risk assessment for submission as part of a development application (DA) for a proposed fill pad and associated driveway at 105 Merriwa Road, Denman ('the Site').

The flood certificate for the Site, which is based on results from Muswellbrook Shire Council ('Council')'s 2018 Flood Risk Management Study and Plan prepared by Royal Haskoning DHV, indicates that the Site is subject to inundation at the 1% AEP event. As such, this flood risk assessment includes:

- Identification of risks to Site access in the 5% AEP, 1% AEP, and PMF events;
- A summary of consequences of cancelled maintenance to the battery facility due to blocked access into the Site during flooding;
- Evaluation of risks and treatment options.

1.1 Study Area and Proposed Development

Figure 1.1 shows the locality map and existing topography. The Site (Lot 23 DP 1731407) is located within the Muswelbrook Local Government Area (LGA) on the Hunter River floodplain at Denman, between Dalswinton and Mangoola. The Site is bounded by the Merriwa Road to the east, Muswellbrook Merriwa Railway to the west, rural properties to the north and south, and an Infrastructure Substation to its south-east corner.

Site topography, as defined by the available LiDAR and survey data, ranges from 110m AHD along the eastern boundary, sloping up to 117m AHD at the south-west corner.

The proposed development at the Site includes construction of a fill pad to house a battery compound and associated infrastructure. It is noted that the development is a non-habitable structure with no permanent staff located at the Site. BMT understands that fortnightly to monthly general maintenance visits are proposed.

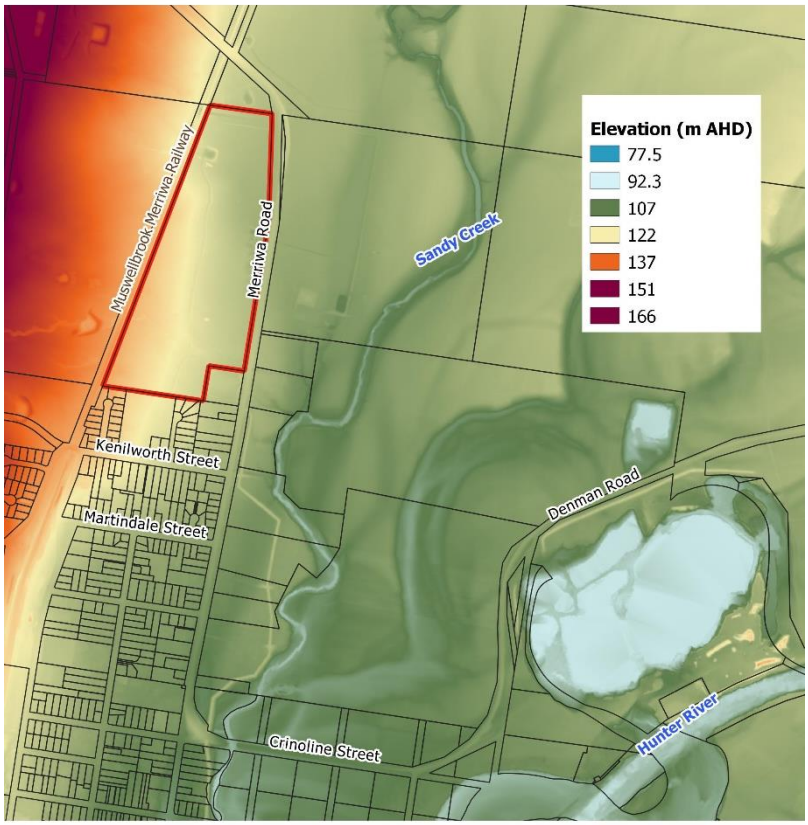

Figure 1.1 Site Locality and Topography

1.2 Flood Hazard Classification

The Hazard Vulnerability Classification applied to Council's maps included in the Site's Flood Certificate, which are used for analysis in this study, refers to Guideline 7-3 in the Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia (AIDR 2017), presented in Tables 1.1 and 1.2.

Table 1.1 Combined Hazard Curves - Vulnerability Thresholds

Hazard Vulnerability Classification	Description
H1	Generally safe for vehicles, people and buildings.
H2	Unsafe for small vehicles.
H3	Unsafe for vehicles. children and the elderly.
H4	Unsafe for vehicles and people.
H5	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.

Table 1.2 Combined Hazard Curves - Vulnerability Thresholds Classification Limits

Hazard Vulnerability Classification	Classification Limit (D and V in combination)	Limiting Still Water Depth (D in m)	Limiting Velocity (V in m/s)
H1	D*V ≤ 0.3	0.3	2.0
H2	D*V ≤ 0.6	0.5	2.0
H3	D*V ≤ 0.6	1.2	2.0
H4	D*V ≤ 1.0	2.0	2.0
H5	D*V ≤ 4.0	4.0	4.0
H6	D*V > 4.0	-	-

1.3 Existing Flood Conditions

Flood data through the Site for the 1% and 5% AEP events have been provided by Council in the Site's Flood Certificate and are shown in Table 1.3 and Table 1.4. PMF levels analysed in this assessment were provided by HDB in the Site's Plan (Figure 1.2).

Table 1.3 Maximum and Minimum data

Flood Information	5% AEP Flood Data	1% AEP Flood Data
Max. Water Level (m AHD)	116.88	116.85
Min. Water Level (m AHD)	110.45	110.75
Max. Velocity (m/s)	1.28	1.36
Min. Velocity (m/s)	0.05	0.12
Max. Depth (m)	0.78	1.05
Min. Depth (m)	0.04	0.08

Table 1.4 Key Point location flood data. Location points are shown in Annex Figures A-1 to A-3.

Location	5% AEP Level	5% AEP Velocity	5% AEP Hazard	1% AEP Level	1% AEP Velocity	1% AEP Depth	1% AEP Hazard
1	111.90	0.55	N/A	111.98	0.48	0.14	H1
2	112.05	0.63	H1	112.13	0.71	0.16	H1
3	112.71	0.82	H1	112.74	0.93	0.12	H1
4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	113.10	0.10	H1	N/A	N/A	N/A	N/A
6	N/A	N/A	H1	111.14	0.47	0.10	H1
7	112.00	0.25	H1	112.06	0.36	0.23	H1

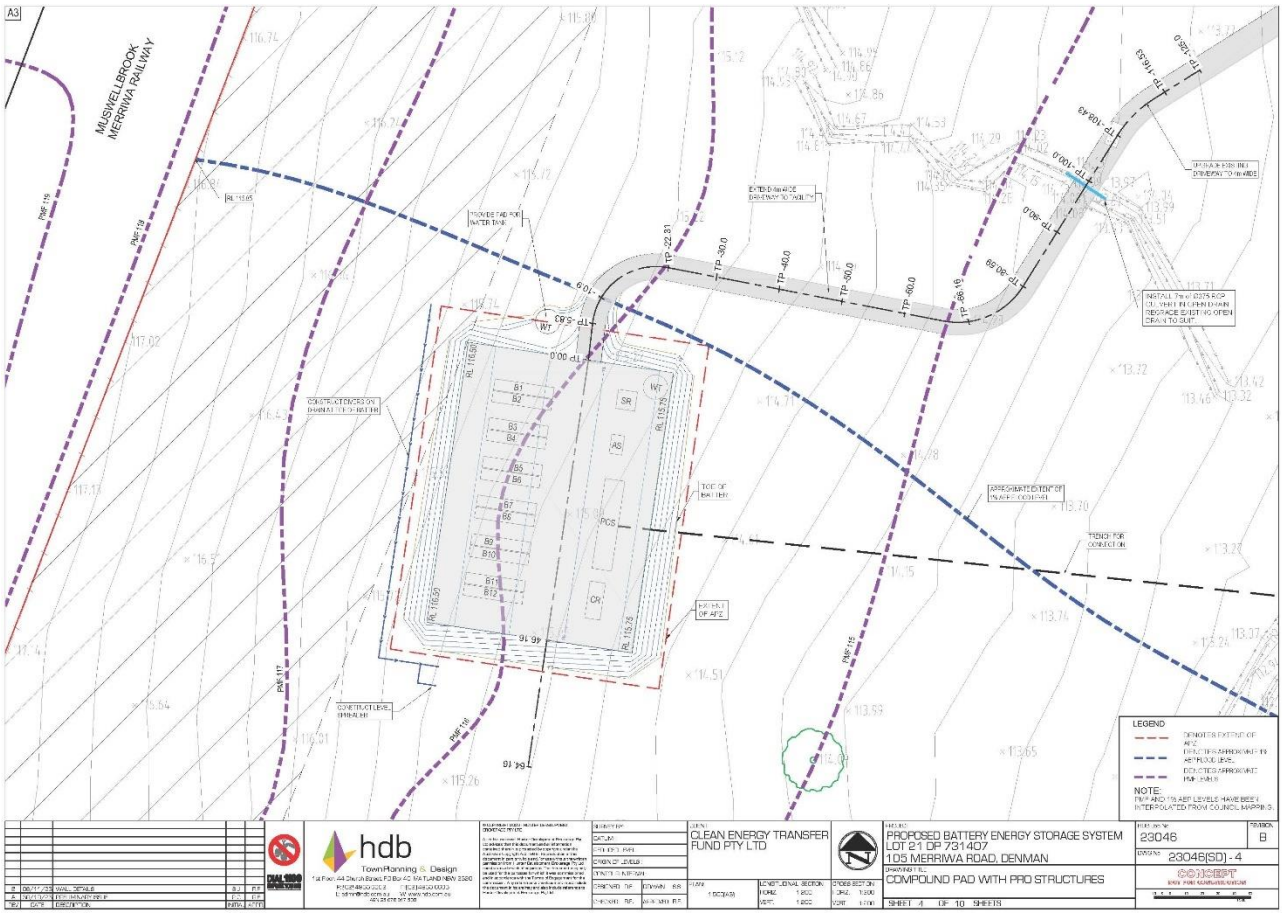

Figure 1.2 Proposed Site Plan and PMF Flood Levels (HDB, 2023).

2 Risk Assessment

The below section analyses the risk of blocked access impacting maintenance and evacuation, as well as the risks to structures or people due to floodwaters in the 5% AEP, 1% AEP and PMF events.

2.1 Blocked Access

In the 1% AEP, the peak flood hazard along the majority of the proposed driveway extent is H1, indicating conditions that are generally safe for people and vehicles. However, H3 hazards are present at the access point where the driveway meeting Merriwa Road indicating flood conditions that are unsafe for vehicles, children, and the elderly (Figure A-3).

Flood hazard results for the 5% AEP event are not available, however the 5% peak flood depths and velocities (Table 1.4) are lower than the 1% AEP. Hence, it is assumed resulting Hazard Classifications within the Site are also lower.

It is possible to reduce the potential risk to vehicles in the 1% AEP at the entrance of the site by moving the driveway 50m southwards, so that the property's gate falls within hazard classification H1. This would reduce risks to access and maintenance in the 1% AEP within the Site. Conversely, while hazards can be reduced within the Site, access may still be cut-off in the 1% AEP due to the flood immunity of local roads. Hazard mapping provided by Council indicates that regions to the East of the site may be subjected to higher hazards (Figure A-1). As such, further investigation into the route through public roads is needed to determine if shifting the driveway is a relevant treatment measure.

During rare and extreme flood events access to the Site will be inundated by hazardous floodwaters presenting potentially dangerous conditions to vehicles and peoples attempting to enter the Site. To mitigate this potential flood risk, it is recommended that maintenance is not undertaken following the issue of a major flood warning for the Hunter River until such time that the warning is rescinded.

2.2 Capability of Development to withstand the effects of flood waters up to the 1% AEP

The proposed battery storage area, located on the highest portion of the site, is flood-free in the 1% AEP. Therefore, there is no risk for all events up to and including the 1% AEP.

The minimum floor height requirement included in the Muswellbrook Shire Development Control Plan (DCP) for Industrial greenfield sites is the 1% AEP flood level, which is up to 112.74 m AHD within the Site. Hence, the proposed finished floor level of 115.75 m AHD is compliant with Council's flood controls.

2.3 PMF Conditions

PMF flood levels at the Site are presented in Figure 2.1. During the PMF, flood depth at the access point at Merriwa Road is up to 3.2 m, which could result in hazard classification from H4 to H5, both unsafe for vehicles and people. It is noted that this flood hazard classification is based on flood depths only and does not consider depth in combination with velocities as per the AIDR (2017).

The BESS pad design level ranges from 115.75 m AHD along the eastern boundary to 116.50 m AHD along the western boundary. Based on interpolating the PMF flood levels shown in Figure 1.2, the BESS pad is expected to be flood-free during the PMF event.

2.4 Risk Assessment Tables

Evaluation of risks as per the risk assessment framework is presented in table 2.1.

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Table 2.1 Risk Assessment

Hazard	Vulnerable Element	Risk	Likelihood Rating	Consequence Rating	Risk Rating	Treatment Options
Flooding	Maintenance / Access	Delay in maintenance due to cut-off access to and from site.	Rare – the site's entrance crosses a section of hazard classification H3 in the 1% AEP, however maintenance only occurs once to twice a month.	Minor – maintenance delays due to rescheduling.	Very Low	Acceptable risk.
	People	Staff trapped inside facility or forced to cross floodwaters when trying to access of escape facility.	Extremely Rare – facility is flood free up to the 1% and it is not expected that staff would be present at the site during an extreme event.	Major – injuries and drowning.	Medium	Administration controls to ensure maintenance is cancelled in the case of major flood warnings for the Hunter River.

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3 Conclusion

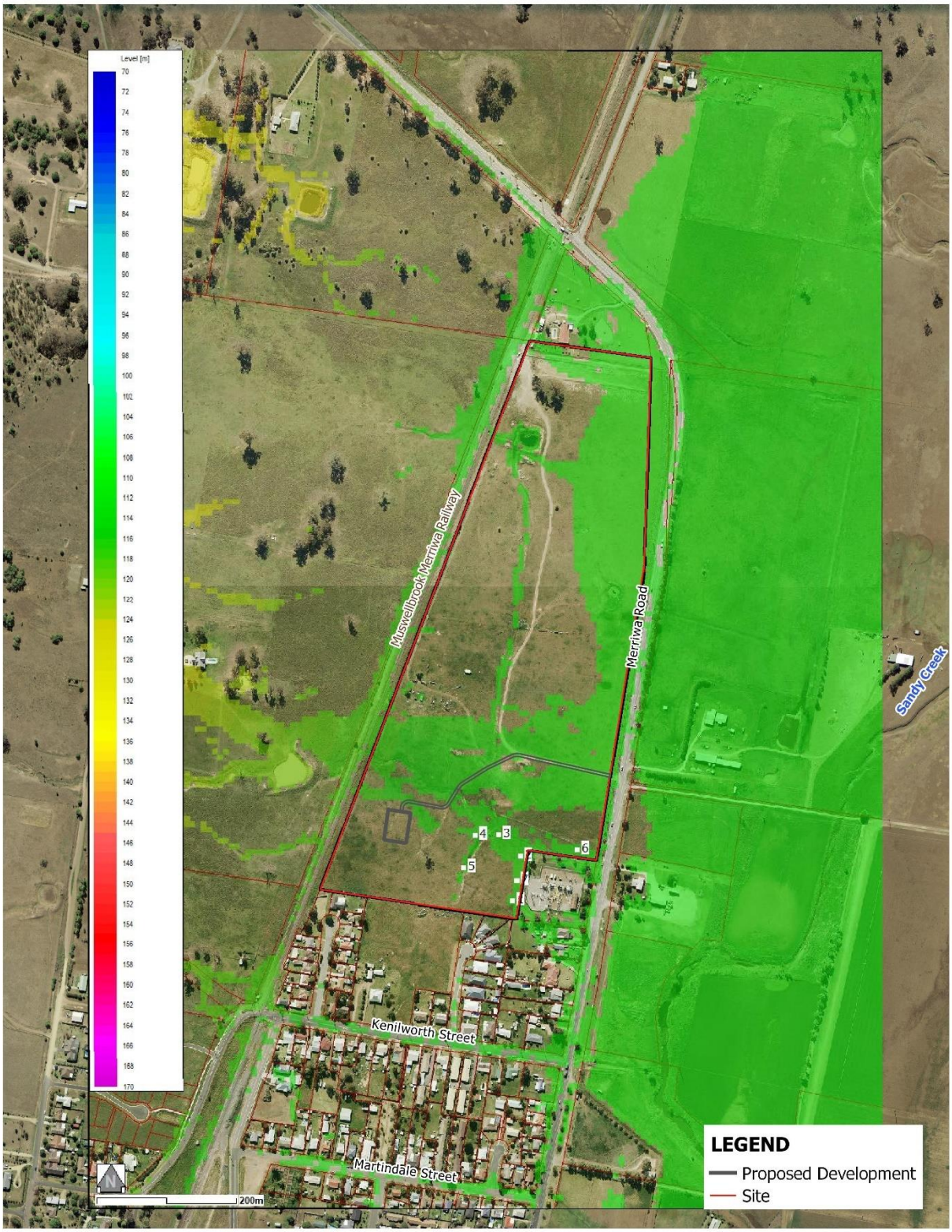
BMT has undertaken a site-specific FRA for the proposed development at 105 Merriwa Road, Denman. The risk assessment involved analysing available flood depth and hazard mapping provided by Council to determine existing flood risks to access, people, and structures. The key outcomes of the FRA include:

- Risk of maintenance delays due to loss of Site access: H3 hazards are present along the driveway access from the 1% AEP event, presenting conditions that are unsafe for vehicles. Such risk can be reduced by shifting the proposed driveway southwards into H1 classification. However, such measure would require further investigation into the flood immunity of local roads to confirm the Site can still be accessed from other regions. Additionally, it is recommended that during a 1% AEP event, monthly routine maintenance is rescheduled once flood waters have receded. It is assumed that such delays would cause minor impacts in operations.

- Risk to structures and equipment: based on interpolating the PMF levels supplied by HDB, the BESS pad is expected to be flood-free during the PMF event, and hence the proposed structures exceed the minimum flood height requirements included in Council's DCP. Therefore, no treatment controls are required to ensure construction methods and materials are capable of withstanding the force of floodwaters.

- Access during PMF event: access into the site is not viable during the PMF, with hazard classifications up to H6 along the access point and driveway, unsafe for people and vehicles.

Annex A



Title:
Peak Flood Level - 1% AEP

Figure: **A-1**

Rev: **-**

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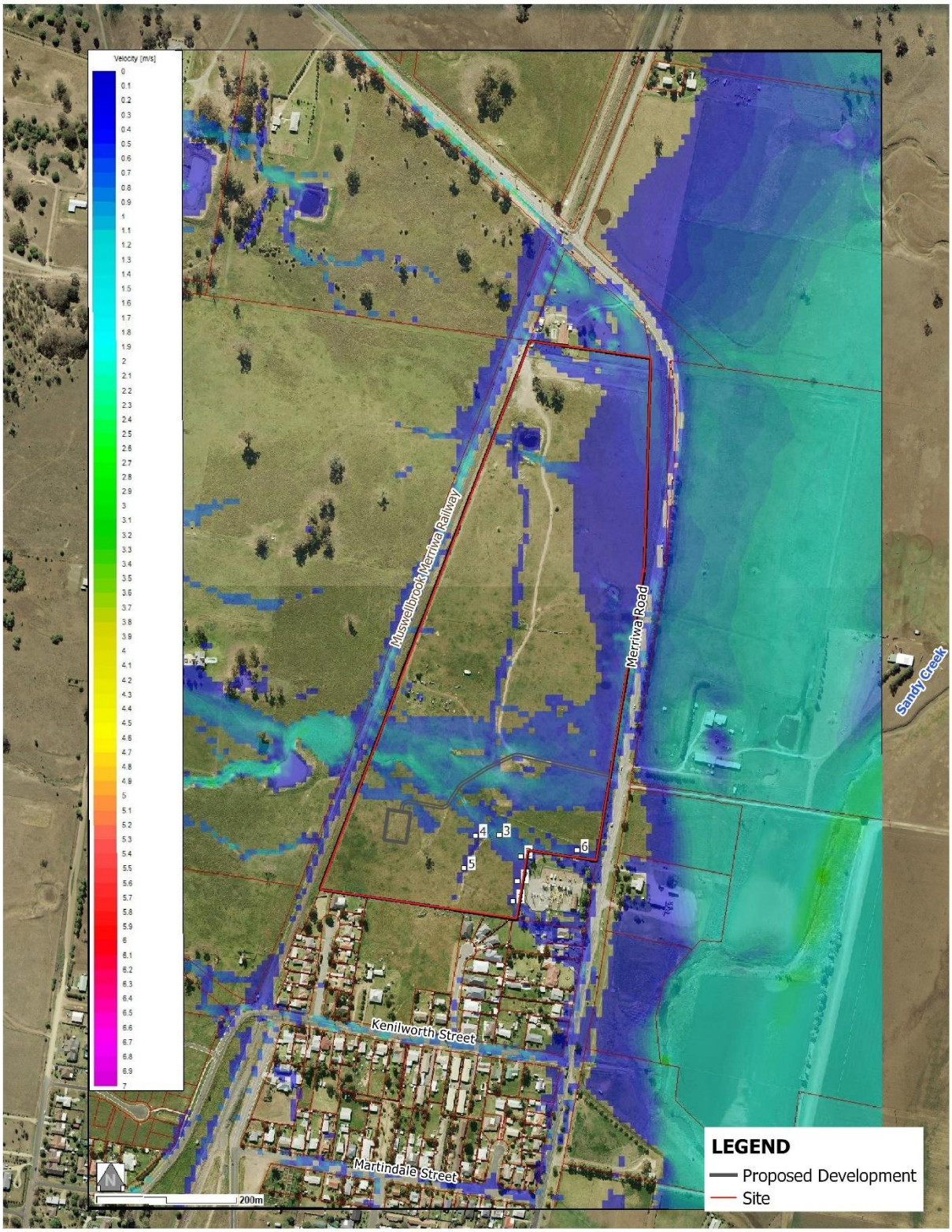

Title:
Peak Flood Velocity - 1% AEP

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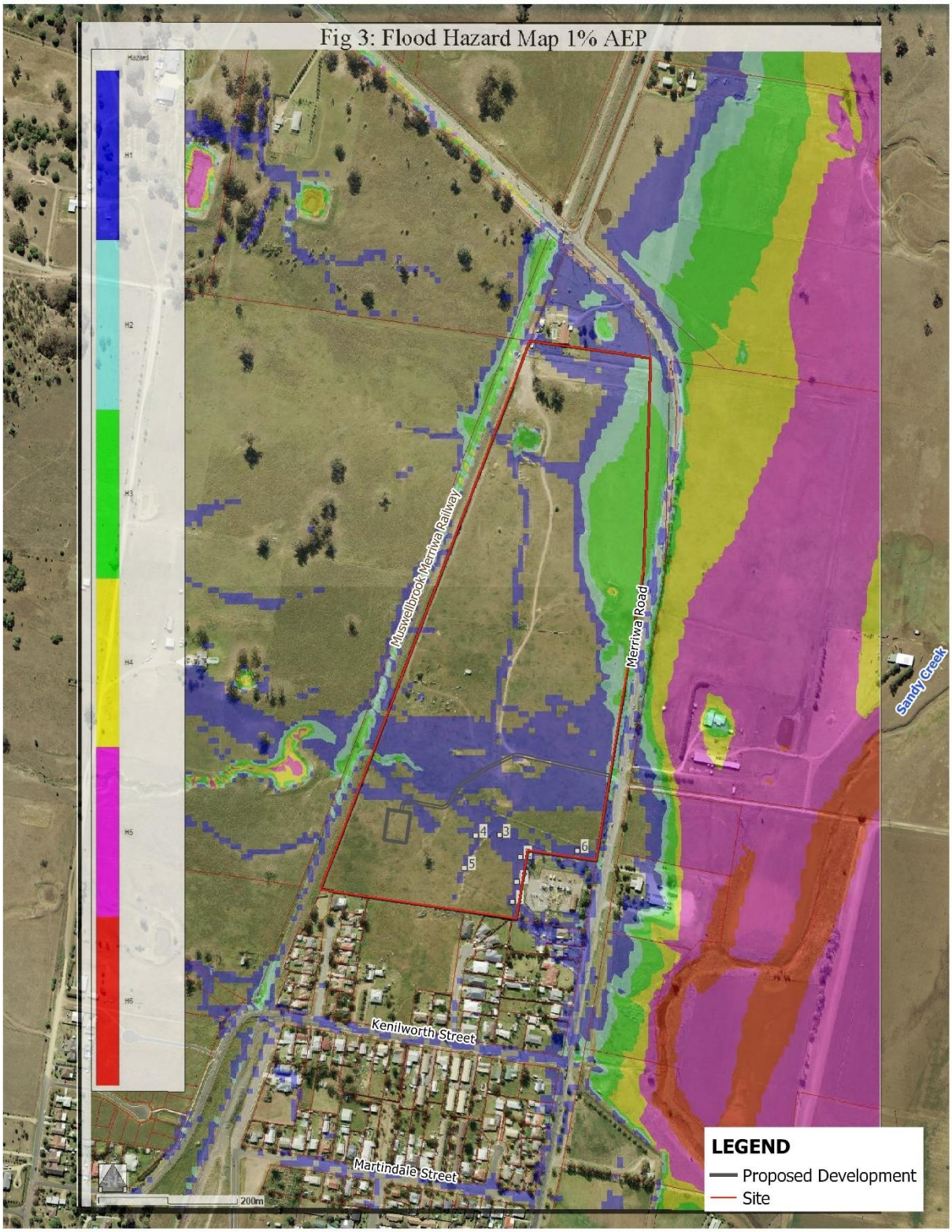
Fig 3: Flood Hazard Map 1% AEP



Title:
Peak Flood Hazard - 1% AEP

Figure: **A-3**

Rev: **-**

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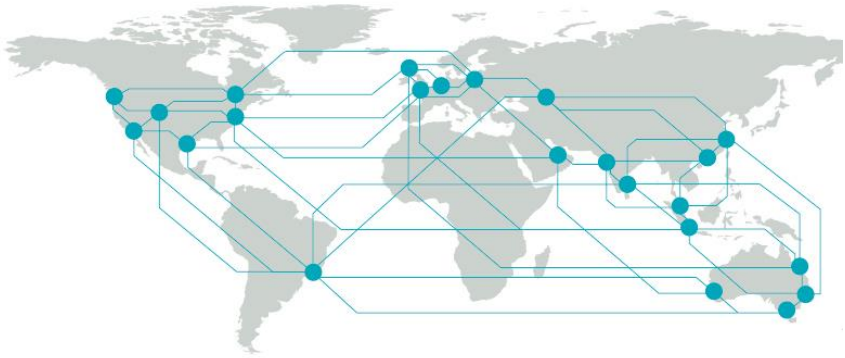

BMT is a leading design, engineering, science and management consultancy with a reputation for engineering excellence. We are driven by a belief that things can always be better, safer, faster and more efficient. BMT is an independent organisation held in trust for its employees.

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