SOUTH COREE BESS

FLOOD IMPACT ASSESSMENT

Prepared For NGH Consulting

February 2026

Cumulus Engineering
FLOOD RISK SPECIALISTS

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Cover Image: South Coree Road Finley, NSW, retrieved from Commercial Real Estate Website.

In the spirit of reconciliation, Cumulus Engineering acknowledges the Traditional Custodians of country throughout Australia and their connections to land, sea, and community. We pay our respect to their Elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples today.

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1 Introduction

Cumulus Engineering has undertaken a Flood Assessment for the proposed South Coree Battery Energy Storage System (BESS) development (hereafter referred to as the 'project site') to understand the existing overland flow regime and assess potential impacts associated with the development.

As a State Significant Development (SSD), the project is subject to the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning, Housing and Infrastructure (DPHI). This report addresses the flood-related assessment criteria outlined by the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW), noting that while the site is not affected by riverine flooding, it may be impacted by overland flows due to the flat topography and the surrounding network of raised open irrigation channels (see Figure 1-1), which may contribute to ponding and the trapping of overland flows.

1.1 Background

The project site is located approximately 4.5 kilometres west of the central township of Finley, NSW and is located adjacent to the existing Finley Solar Farm on Broockmanns Road. The proposed development consists of the construction of a BESS at the site, with an associated internal road network and noise walls along the northern and eastern boundaries, as illustrated in Figure 1-2.

As per SEARs outlined by the DPHI, the following requirements are to be addressed for the proposed development in relation to flooding:

- Assessment of the likely impacts of the development (including flooding and flood modelling) on surrounding watercourses (including their Strahler Stream Order)
- Assessing the impacts of the development, including any changes to flood risk and overland flows on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required.
- Flood Risk: identification of any flood risk on site having regard to adopted flood studies, the potential effects of climate change and any relevant provision of the NSW Flood Risk Management Manual:
    - Where the development could alter flood behaviour, affect flood risk to the existing community or expose its users to flood risk, provide a flood impact and risk assessment (FIRA) prepared in accordance with the Flood Impact and Risk Assessment – Flood Risk Management Guide LU01;
    - Detailed design solutions and operational procedures to mitigate flood risk where required.

Advice provided by the BCS of the DCCEEW outlined the following items in relation to flooding to be addressed within the EIS for the development:

Requirement 6: Map the following features relevant to flooding including:

a) Flood prone land.
b) Flood planning area, the area below the flood planning level.
c) Hydraulic categorisation (floodway and flood storage areas).
d) Flood hazard.

Requirement 7: Conduct and describe flood assessment and modelling undertaken in determining the project's design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP, flood levels and the Probable Maximum Flood (PMF), or an equivalent extreme event.

Requirement 8: Model the effect of the project (including fill) on the current flood behaviour under the following scenarios:

a) Current flood behaviour for a range of design events as identified in Requirement 7 above. This includes the 0.5% and 0.2% AEP year flood event as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.

Requirement 9: Modelling must consider and document:

a) Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies.
b) The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood.
c) Impacts of the project on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazard categories and hydraulic categories.
d) Relevant provisions of the Flood Risk Management Manual: the policy manual for flood liable land (2023).

Requirement 10: Assess the impacts of the project on flood behaviour, including:

a) Whether there will be detrimental increases in the potential flood affectation of other properties, assets, and infrastructure.
b) Consistency with Council floodplain risk management plans
c) Consistency with any Rural Floodplain Management Plans.
d) Compatibility with the flood hazard of the land.
e) Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.
f) Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.
g) Any impacts the project may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the NSW SES and Council.
h) Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the NSW SES and Council.
i) Emergency management, evacuation and access, and contingency measures for the project considering the full range of flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the NSW SES.
j) Any impacts the project may have on the social and economic costs to the community.

Table 1-1 outlines sections within the report that relate to each of the requirements outlined above.

TABLE 1-1 SEARS REQUIREMENTS REFERENCE

Sears Requirement	Report Location
Requirement 6	4.1.1Flood Planning Area 4.1.2Flood Function
Requirement 7	2 Hydrology 3 Hydraulics
Requirement 8	4.2 Design Conditions
Requirement 9a	1.2 Review of Existing Report Review of Existing Report
Requirement 9b-d	4.2 Design Conditions

Sears Requirement	Report Location
Requirement 10	4.4 Impacts on Flood BehaviourFlood Evacuation and Planning

1.2 Review of Existing Report

No existing flood reports or models have been identified that cover the project site. Berrigan Shire Council were contacted directly to request existing flood data and confirmed that no data was available at the location of the site. While one flood study is available on the Council's website – the Berrigan Tocumwal Flood Study Final (2025) – it does not extend to Finley and only includes the towns of Barooga and Tocumwal.

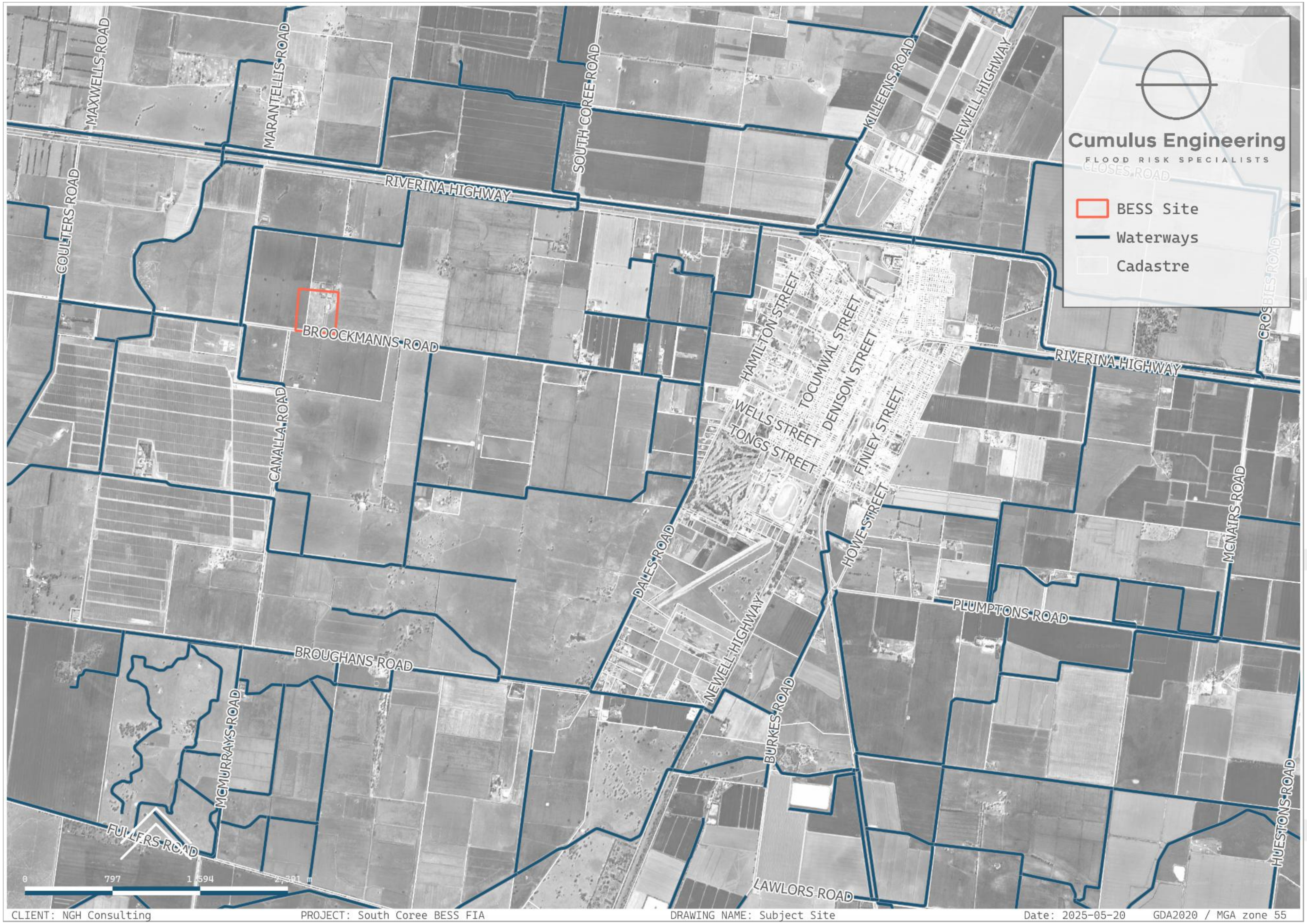
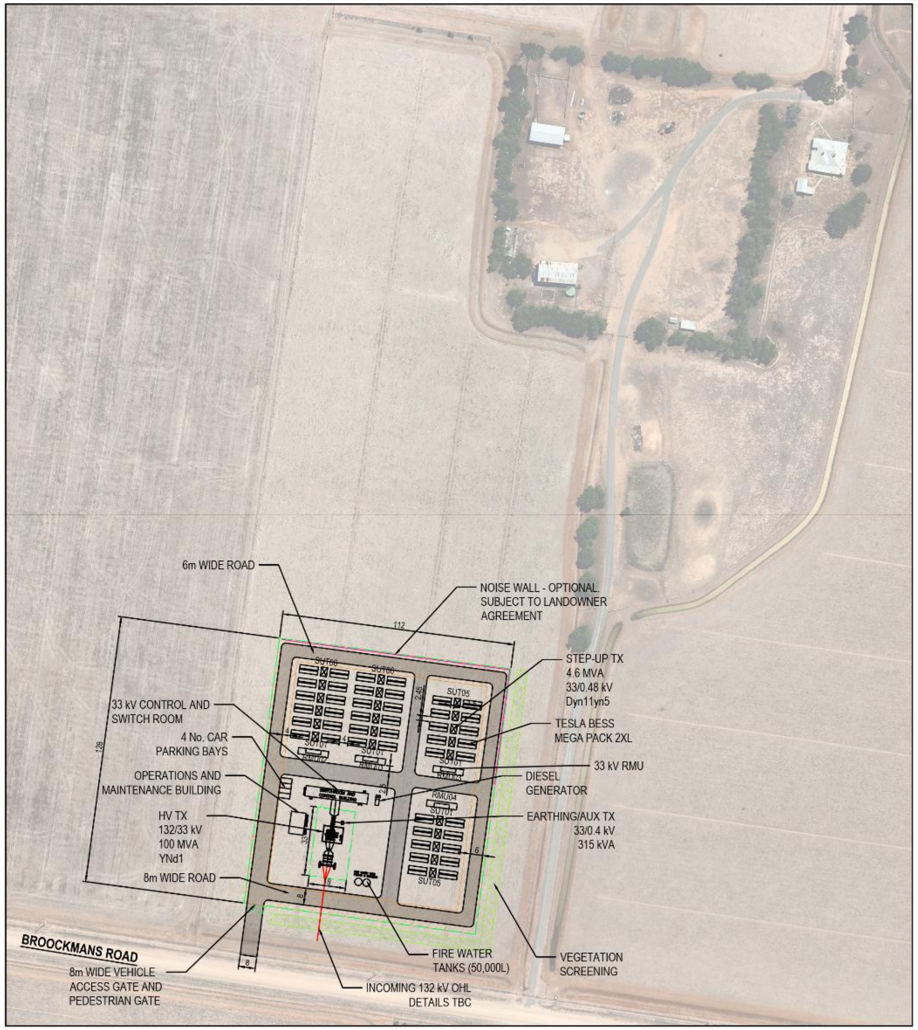


FIGURE 1-1 SUBJECT SITE



PLAN
SCALE 1:1000

PROJECT INFORMATION

1. CLIENT: SAMSUNG C&T
2. LOCATION: SOUTH COREE, NSW
3. STORAGE CAPACITY: 80 MW / 320 MWh
4. BESS: 88 x 979 kW TESLA MEGAPACK 2XL

LEGEND:

- 132 kV AC LINE
- ASSET PROTECTION ZONE
- BESS YARD FENCE
- NOISE WALL
- VEGETATION SCREENING

NOTES:

1. THIS LAYOUT IS A PRELIMINARY CONCEPT LAYOUT TO DETERMINE FOOTPRINT. THE LAYOUT SHALL BE DEVELOPED FURTHER IN DETAILED DESIGN.
2. ACCESS INTO THE STATION AND ACCESS ROADS TO BE CONFIRMED.
3. ALL DIMENSIONS IN METERS UNLESS SPECIFIED
4. AMENITIES ROOM TO BE INCLUDED INSIDE SWITCHROOMS.
5. BESS DIMENSIONS TO BE CONFIRMED BY TESLA.

1:1000 0 20 40 60 80 100m AT A1

CONCEPT DESIGN

REV	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED	DATE
F	CONCEPT DESIGN - VEGETATION SCREENING, NOISE WALL, PARKING BAYS UPDATES	RB	JR	RM	DB	23/06/25
E	CONCEPT DESIGN - SHIFT LAYOUT NORTH 5m	RB	JR	RM	DB	06/05/25
D	CONCEPT DESIGN - LAYOUT MODIFICATIONS - SHIFTING AWAY FROM EE EASEMENT	RB	JR	RM	DB	24/04/25
C	CONCEPT DESIGN - LAYOUT MODIFICATION	RB	RB	RM	DB	01/04/25
B	CONCEPT DESIGN - MOVED PROJECT SOUTH	RB	JR	RM	DB	07/02/25

middleton Group
SAMSUNG
SAMSUNG C&T

CLIENT
SAMSUNG
SOUTH COREE BESS, NSW

DRAFTER	DESIGNER	REVIEWER	APPROVER
J.ROBERTS	R.BARAKAT	R.MEYER	D.BURN

TITLE
SOUTH COREE 80 MW BESS
SITE LAYOUT
CONCEPT DESIGN

PROJECT DATUM	Original Size	CODE	MIDDLETON GROUP DRAWING NUMBER	REV
-	A1	E	24211-E-DRG-001	F

SCALE 1:1000

FIGURE 1-2 DESIGN LAYOUT

2 Hydrology

The RORB hydrological model Version 6.51 (Laurenson, Mein and Nathan, 2010) was used for the analysis of local catchment runoff. RORB is a rainfall-runoff model which calculates flood hydrographs from storm rainfall hyetographs and can be used for modelling natural, part urban and fully urban catchments. RORB is an industry standard modelling package that is used widely in hydrological studies in Australia.

2.1 Local Catchment Delineation

An analysis of the upstream catchment topography indicates that the area is extremely flat, and the presence of a network of raised irrigation channels further complicates the delineation of the catchment based on topography alone.

A preliminary catchment delineation was undertaken using automated tools in QGIS, based on a 5-metre Digital Elevation Model (DEM) (NSW Government - Spatial Service, 2015). While 5-metre DEMs are not highly accurate in terms of absolute elevation, they provide a useful indication of surface gradients and flow direction, making them suitable for an initial delineation of the catchment.

The initial catchment delineation was incorporated into a simple hydraulic model where rain was applied to model domain to confirm accuracy of the preliminary catchment delineation. Flood depths from the hydraulic modelling were used to verify the preliminary catchment extents as illustrated in Figure 2-1. Model outputs clearly show that subareas located east of the township of Finley (subareas labelled A, B, C, and D, in Figure 2-1) do not contribute to flows conveyed toward the project site.

Based on outputs of the hydraulic model, the catchment boundaries were adjusted to reflect the hydraulic behaviour observed within the modelling. The final delineation of the local upstream catchment is presented in Figure 2-2.

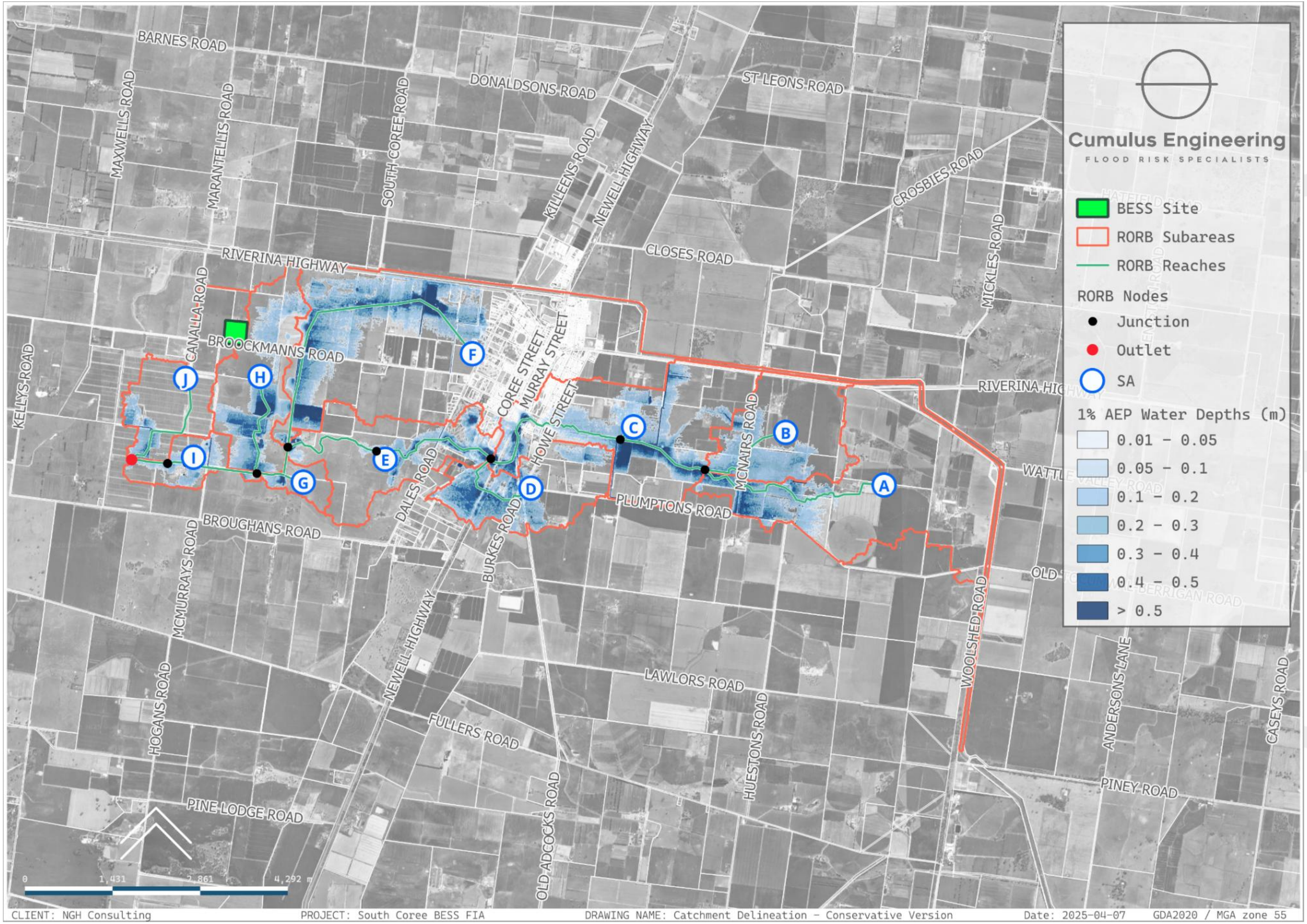


FIGURE 2-1 SUPERSED CATCHMENT DELINEATION - CONSERVATIVE METHOD

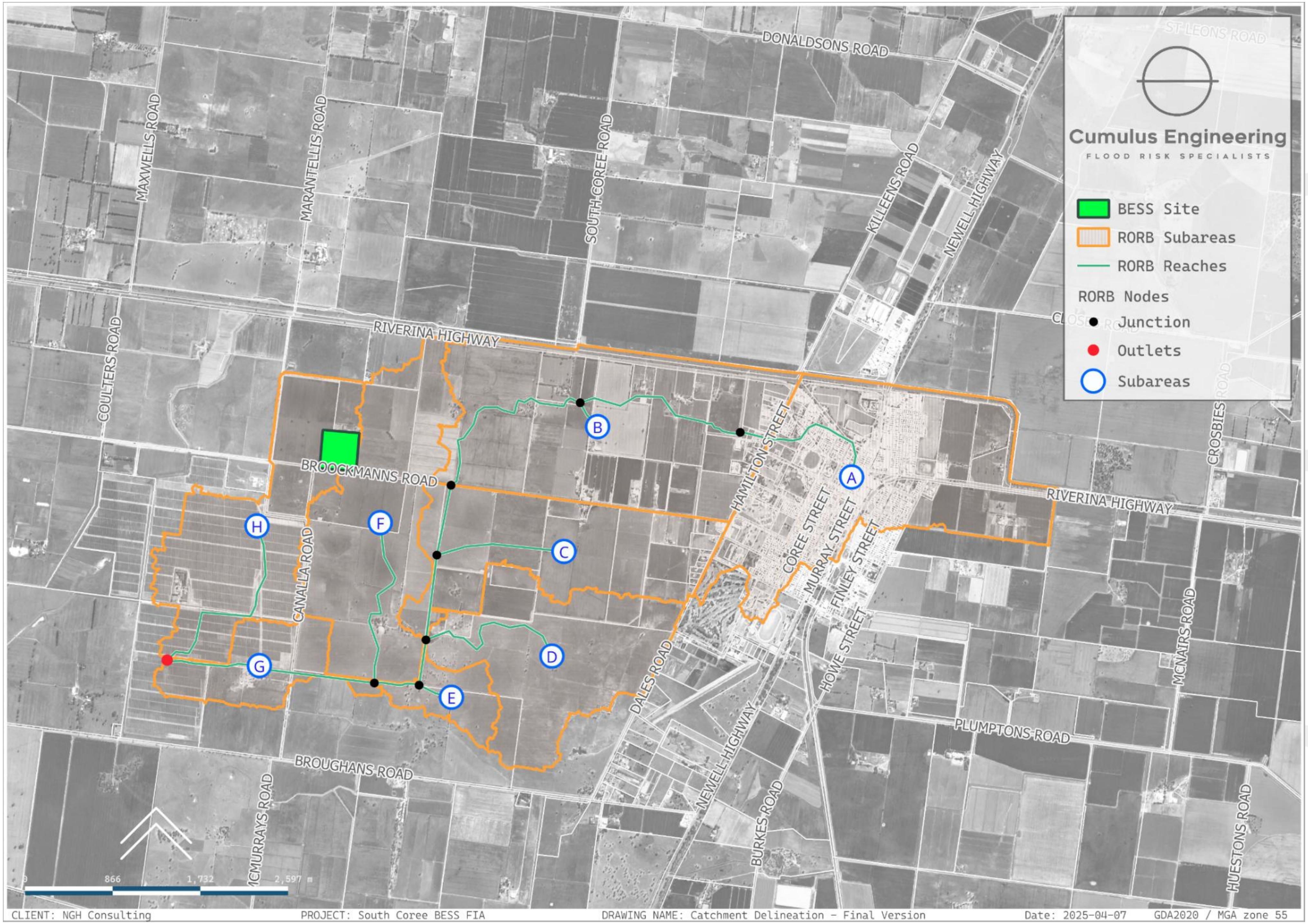


FIGURE 2-2 CATCHMENT DELINEATION - ADOPTED VERSION

2.2 RORB Modelling Parameters

2.2.1 Values of Fraction Imperviousness

Values of fraction imperviousness (FI) were determined through aerial imagery and planning zone codes using standard values obtained from ARR2019. Weighted values of FI are outlined in Table 2-1.

TABLE 2-1 FRACTION IMPERVIOUSNESS: WEIGHTED AVERAGE VALUES

Subarea	Area (km^2)	Weighted FI
A	4.43	0.35
B	4.81	0.14
C	2.71	0.11
D	2.73	0.10
E	0.54	0.10
F	3.15	0.10
G	1.03	0.11
H	2.84	0.12

2.2.2 Loss and Routing Parameters

Currently in NSW, rainfall losses are derived utilising a hierarchy of approaches depending on the available loss information for a particular catchment. The hierarchy for selecting losses is as follows:

- Use the average of calibration losses from the actual study on the catchment if available.
- Use the average calibration losses from other studies in the catchment, if available and appropriate for the study.
- Use the average calibration losses from other studies in the similar adjacent catchments, if available and appropriate for the study.
- Use the NSW FFA-reconciled losses available through the ARR Data Hub. These losses may be used within the catchment in which they were derived or similar adjacent catchments with appropriate scrutiny.
- Use default ARR data hub continuing losses with a multiplication factor of 0.4.

Losses were initially taken from the ARR datahub, with the suggested 24mm for initial loss and 0.0 mm/hr for continuing loss. As the study area is not surrounded by any closer catchments and is sited in NSW, the continuing loss is then multiplied by the factor of 0.4.

As there are no streamflow gauges nor existing study within the study area catchment to directly calibrate RORB model to. Prediction equations for ungauged catchments were used to inform the selection of a 'reasonable 'routing parameter, K_{c}.

The RORB routing parament K_c was estimated using the eastern NSW (Kleemola) equation ($1.18A^{0.46}$) which is for catchments east and west if the Great Dividing Range for New South Wales. The typical value for the m value of 0.8 was adopted across the catchment. Loss and routing parameters adopted for the model are outlined in Table 2-2.

TABLE 2-2 ADOPTED LOSS AND ROUTING PARAMETERS

Input Parameter	Adopted Value
m	0.80
K_c	4.91
Initial Loss (IL)	24.00
Continuing Loss (CL)	0.00

2.2.3 Preburst Rainfall

As the site is located in NSW, Probability Neutral Burst was adopted for this project.

2.2.4 Probable Maximum Flood (PMF)

The PMF hydrology was undertaken utilising both the Generalised Short Duration Method (GSDM) and the Generalised Southeast Australia Method (GSAM) as per ARR2019 Guidelines. The GSDM is applicable for durations of up to six hours and areas of up to 1,000 km^2 (Bureau of Meteorology, 2003) whereas the GSAM is generally adopted for durations greater than 6 hours. Both methods were considered appropriate given the short durations anticipated for the local catchment as well as potential for flooding during longer events due to the low-grade terrain in the area for the catchments upstream. Zones of application for longer duration methods are outlined in Figure 2-3.

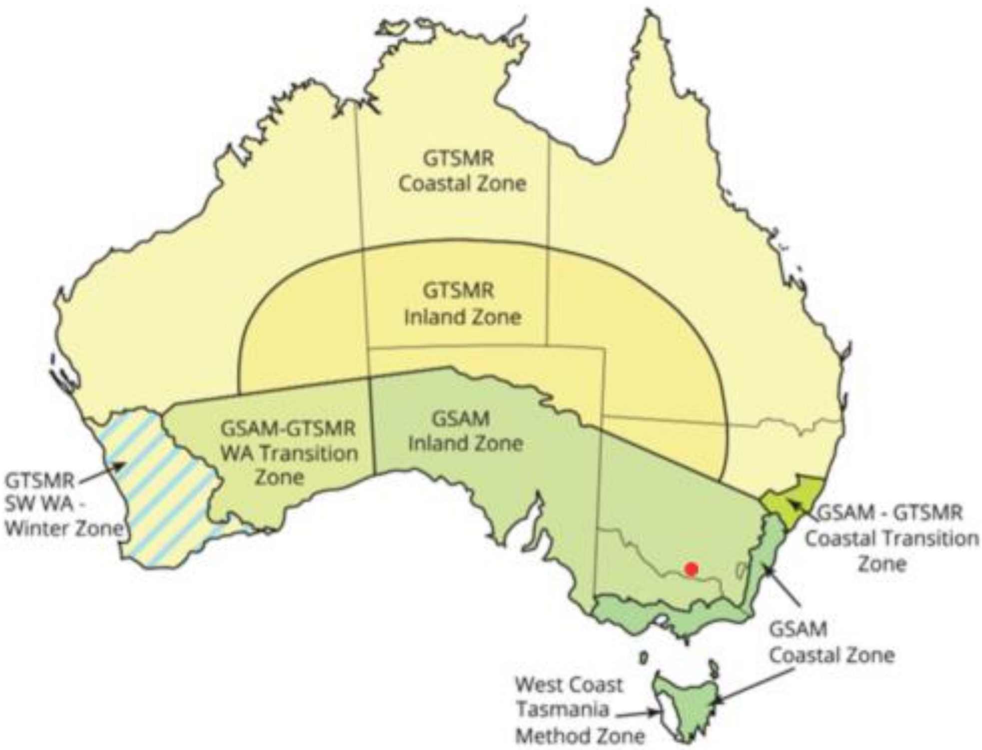


FIGURE 2-3 GENERALISED LONG-DURATION PROBABLE MAXIMUM PRECIPITATION METHOD ZONES (NATHAN, WEINMANN, 2019).

GSDM and GSAM temporal and spatial patterns were used in line with the ARR2019 recommendations for each of the respective events. The durations adopted for PMF calculations were generally the same as those adopted throughout all design events including the 0.5 hours, 2 hours, 4.5 hours and 6 hours durations as well as the 12 hour and 24 hours for the longer durations. The same loss model that was adopted for all previous design events was adopted for PMF and the median pre-burst temporal pattern was adopted, as per all previous design events.

2.2.5 Event Durations and Temporal Patterns

A range of design storms have been evaluated for durations ranging from 10 minutes to 72 hours for the 5%, 1%, 0.5% and 0.2% AEP event as well as the PMF event downstream of the site. In line with the procedure outlined in ARR2019, the full range of temporal patterns (TPs) for the region were adopted for the ensemble analysis.

Following the ensemble analysis, post processing of results was completed to determine which temporal pattern provided a peak flow closest to the ensemble peak. The temporal pattern which provided the closest value was then adopted.

Based on the delineation and given topography of the Finley area, longer-duration storm events were also considered in the analysis as flat terrain tends to result in slower runoff and extended flood durations. With the inclusion of longer-duration events, the analysis provides a more comprehensive understanding of potential flood risks under various conditions.

To expedite modelling and reduce model run times, a sensitivity analysis was conducted to determine whether a single representative temporal pattern for each duration could be adopted instead of multiple temporal patterns for each duration. The model was run for a range of durations adopting the front-loaded, middle-loaded, and rear-loaded temporal pattern as outlined in Table 2-3. Results from the broad range of temporal patterns were compared to results from the median temporal pattern only with flood depth differences illustrated in Figure 2-4.

The results show that the middle-loaded scenario results in slightly higher water depths (with a difference up to 19 mm), but generally minimal variation, with no difference in water depths observed at the subject site.

TABLE 2-3 INITIALLY SELECTED TEMPORAL PARTTERNS FOR CRTITCIAL DURATIONS

Critical Duration (Minutes)	Adopted Temporal Patterns	
180	Front	1
	Middle	2
	Rear	6
270	Front	4
	Middle	6
	Rear	10
360	Rear	1
	Front	4
	Middle	8
720	Front	4
	Rear	5
	Middle	8
1440	Front	6
	Middle	7
	Rear	10

Based on outputs of the sensitivity analysis, the middle-loaded temporal pattern is considered the more conservative approach and was therefore adopted for the assessment with adopted durations and temporal patterns for each of the flood event outlined in Table 2-4.

TABLE 2-4 ADOPTED CRITICAL DURATIONS AND TEMPORAL PATTERNS

Event	Critical Duration (Minutes)	Adopted Temporal Patterns
5% AEP	180	6
	270	6
	360	8
	720	8
	1440	7
1% AEP	180	6
	270	6
	360	8
	720	8
	1440	7
0.5% AEP	180	6
	270	6
	360	8
	720	8
	1440	7
0.2% AEP	180	6
	270	6
	360	8
	720	8
	1440	7

2.3 RORB Model Validation

The flow estimates were compared against the ARR Regional Flood Frequency Estimation Tool (RFFE). This method, commonly used in hydrological analysis, estimates peak discharge based on factors such as catchment area, rainfall intensity, and runoff coefficients, providing an indicative approximation for design flows in the absence of more detailed regional data. Additionally, the Rational Method was also adopted to validate peak flows obtained from the RORB modelling.

Table 2-5 outlines a comparison of the Rational Method and RFFE and the outputs from the RORB model, with the flows obtained from the modelled data higher than the ARR 2016 Rational Method results but sit within the Lower and Upper Confidence Limit of RFFE.

TABLE 2-5 PEAK FLOW VALIDATION

Event	Rational Method Flow Estimate (m^3/s)	RFFE Flow Estimate (m^3/s)	RFFE Lower Confidence Limit (5%) (m^3/s)	RFFE Upper Confidence Limit (95%) (m^3/s)	RORB Peak Flow (m^3/s)
1% AEP	50.9	34.8	10.9	117	99.6
5% AEP	30.4	20.	6.71	68.1	63.8

The results show that most RORB generated flows are in between the upper and lower confidence limit of the RFFE estimates under 1% AEP. These differences are expected due to the RORB model's incorporation of detailed catchment characteristics, including spatial rainfall distribution and runoff routing, which are not considered in the RFFE method. Additionally, RORB simulates varying storm durations and intensities, providing a more dynamic representation of peak flows compared to the Rational Method's uniform assumptions. It is important to note that rainfall for this assessment is applied directly in the TUFLOW model domain, with all routing occurring within TUFLOW.

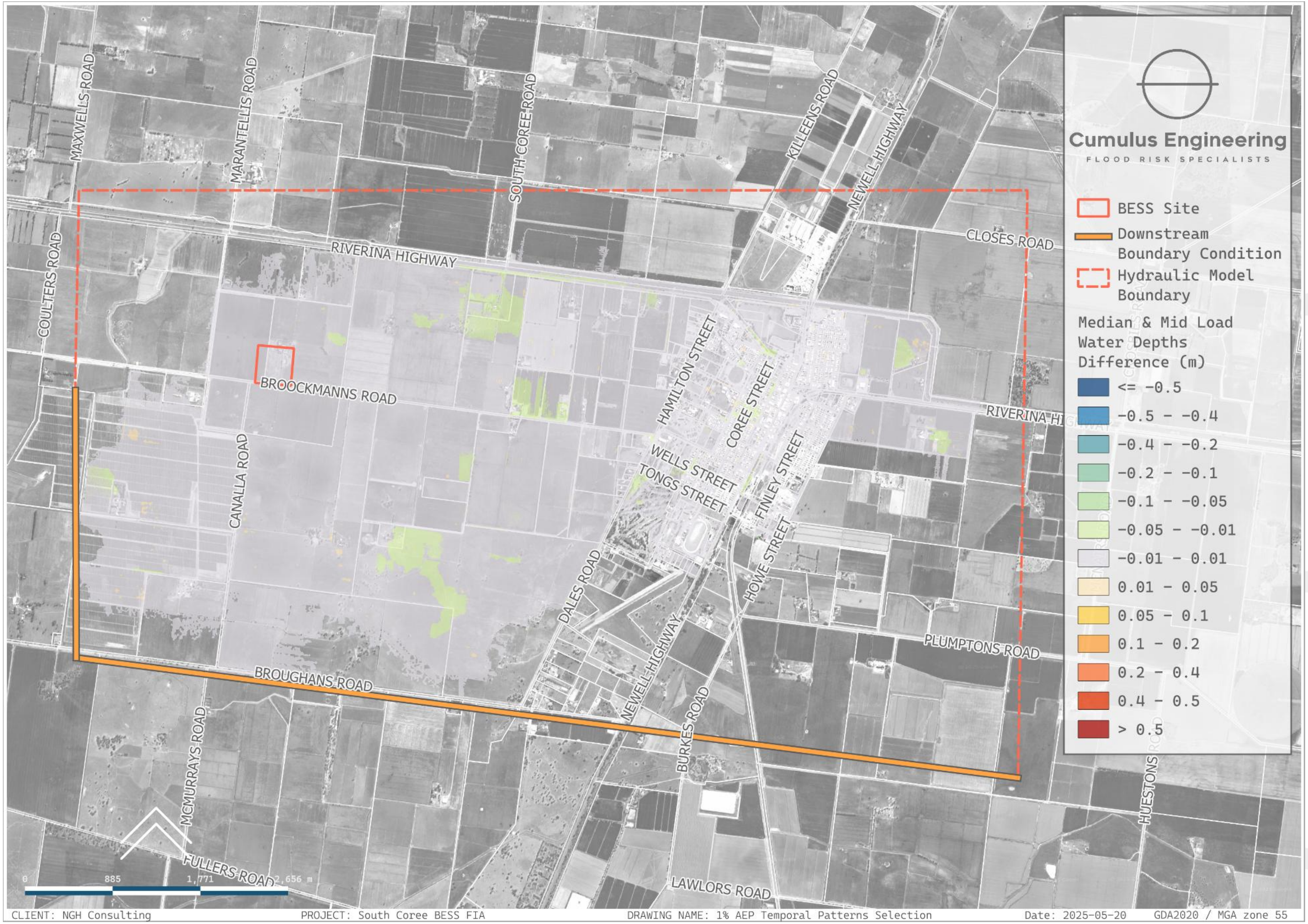


FIGURE 2-4 SENSITIVITY ANALYSIS - TEMPORAL PATTERNS SELECTION

3 Hydraulics

Hydraulic modelling of the existing and design scenarios was undertaken by developing a combined 1-dimensional and 2-dimensional model in the industry standard software TUFLOW. TUFLOW is a numerical model widely used to simulate the hydrodynamic behaviour of rivers, floodplains, and urban drainage environments and is considered the industry standard in Australia.

3.1 Modelling Methodology

Hyetographs for the design events (5%, 1%, 0.5%, 0.2% AEP, and Probable Maximum Flood (PMF)) with varying storm durations and temporal patterns (as outlined in Table 3-1) generated using RORB and applied to the TUFLOW model as excess rainfall hyetographs. These were assigned to subareas delineated within the hydrological model, within the hydraulic model extent.

A range of storm durations were adopted, which capture localised rainfall intensities as well as the potential for ponding due to the low-lying terrain. These events, along with their associated middle loaded temporal patterns (see Table 2-4) were analysed for the 5%, 1%, 0.5% and 0.2% AEP and PMF (in accordance with ARR2019) were adopted for the study.

3.2 Model Setup – Existing Conditions

The hydraulic model covers the project site and surrounding areas to ensure any potential impacts due to the development are identified. The model parameters representing existing conditions are outlined in Table 3-1 and illustrated in Figure 3-1. The model parameters adopted for the hydraulic model are outlined in detail in Appendix A.

It should be noted that the existing conditions is inclusive of the Finley Solar Farm (currently in operation) and the Finley BESS (proposed) located south to south west of the site in order to capture cumulative effects of surrounding development.

TABLE 3-1 HYDRUALIC MODEL - EXISTING SCENARIO

Model Parameter	Description
Model Extent	Determined by catchment delineation inclusive of all local catchments
Topography	5-metre LiDAR captured in 2015 owned by the NSW Government; modified by adding a terrain modifier layer to improve terrain accuracy 2-meter LiDAR captured in 2017 owned by the NSW Government – Spatial Services 1-meter LiDAR captured in 2021 owned by the NSW Government – Spatial Services
Initial Water Level	Initial water levels (2d_iwl) were set along the irrigation channels using LiDAR-derived elevations, representing the approximate channel bed levels to ensure a wet start to the simulation
Mannings Roughness	Residential: Urban - Higher Density (Remainder of parcel) Residential: Rural – Lower Density (Remainder of parcel) Industrial/Commercial Open Pervious Areas: Minimal Vegetation Open Pervious Areas: Moderate Vegetation Open Pervious Areas: Heavy Vegetation Waterway/Channel: Minimal Vegetation Waterbodies/Lakes

Model Parameter	Description
	Car Park/Pavement/Driveway/Road
Inflow Boundary Condition	2D Inflow – Local Catchment Applied rainfall excess hyetographs extracted from each of the RORB Subareas to all cells equally (2d_sa_all)
Downstream Boundary Condition	HQ (water level–discharge) boundaries were applied using the respective slope upstream of each boundary location, including one along the southern model extent to prevent 'glass wall' effects at the edge of the domain.
Building & Infrastructure Blockage	Buildings were blocked out for both existing and design conditions. The infrastructure pads in the BESS design layout plan were blocked for design conditions.
2D Outputs	Water levels, Depths, Velocity, Hazard (ZAEM1)

3.3 Model Setup – Design Conditions

To determine potential impacts due to the proposed development, the existing scenario was modified to include the following:

- Manning's roughness value remained as 0.04 (Minimal vegetation) for the peripheral greening vegetation areas within the BESS site.
- The entire BESS infrastructure (four pads) as well as internal roads and noise walls at northern and eastern boundaries were removed from the model domain.

Preliminary modelling indicated that the site is inundated therefore, adopts a more conservative approach, the entire BESS site was 'blocked' from the model and represents a worst-case scenario. It is anticipated that once the site layout has been finalised during the detailed design phase of the project, the model will be updated to represent the finished levels and locations of infrastructure.

The model schematics for the design scenario are illustrated in Figure 3-2.

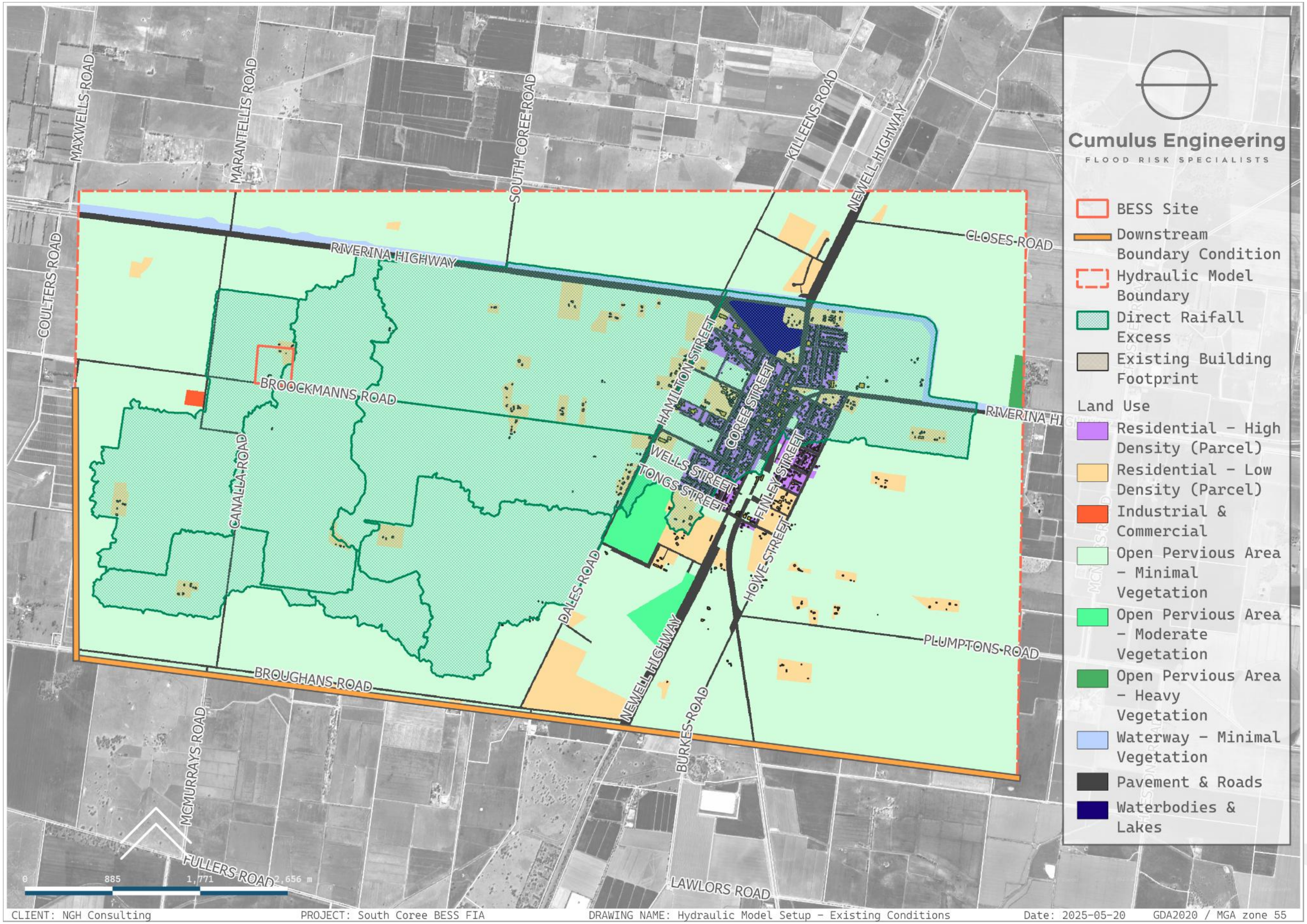


FIGURE 3-1 HYDRAULIC MODEL SETUP - EXISTING CONDITIONS

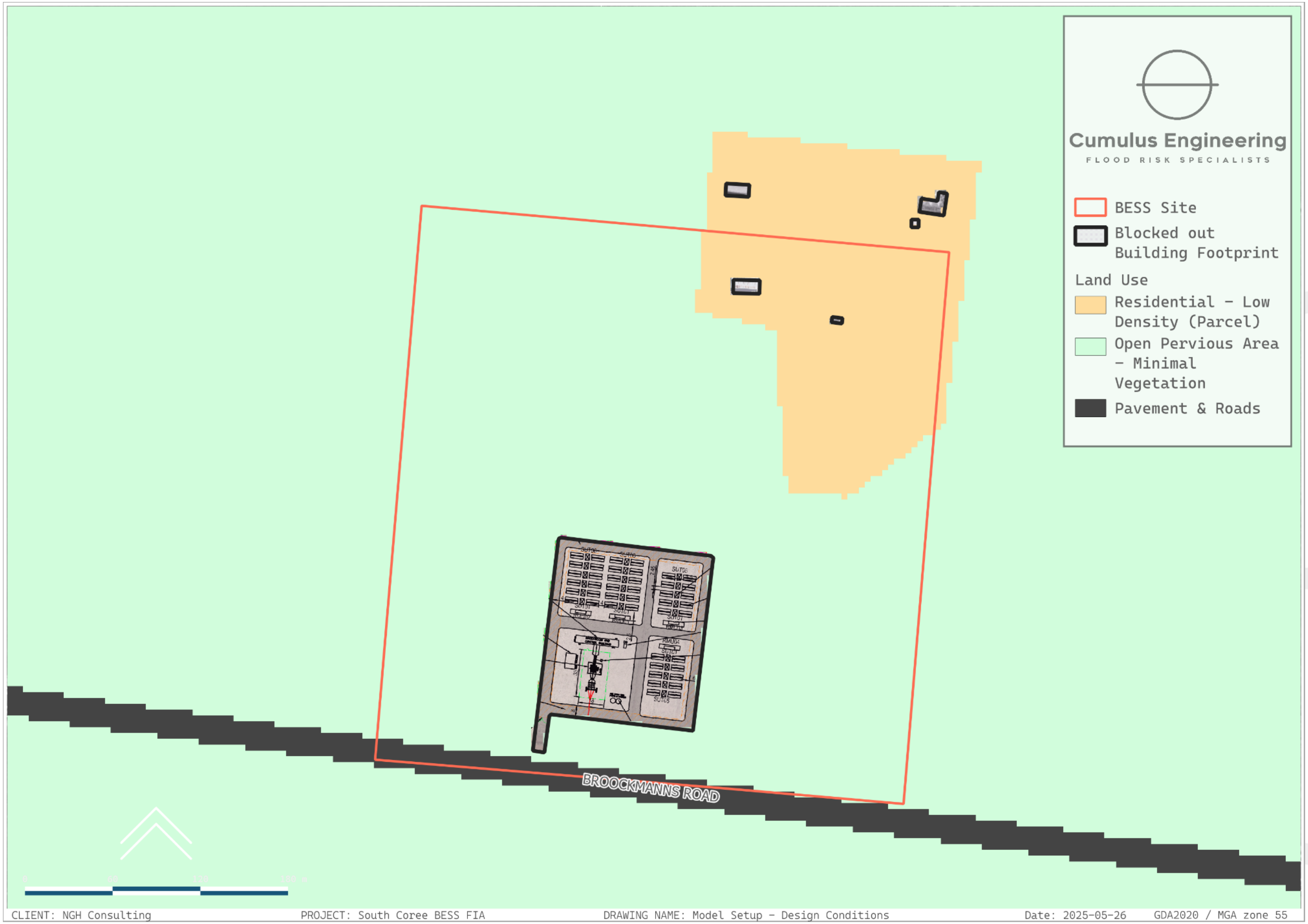


FIGURE 3-2 MODEL SETUP - DESIGN SCENARIO

4 Results

The model was run for a range of flood events, including 5%, 1%, 0.5%, 0.2% AEP flood event and Probable Maximum Flood (PMF) events for both existing and design conditions. Gridded results of flood depths and water levels were post-processed and mapped from the TUFLOW raw outputs for all modelled scenarios. The full suite of maps for existing and design scenarios can be found in Appendix B. Flood Maps.

4.1 1% AEP Results - Existing Conditions

The subject site is bisected by a slightly elevated access track running south to north, connecting the household at northeast to Broockmanns Road. Under the 1% AEP design conditions, the majority of the site is inundated, with flood depths ranging from approximately 30 mm to 335 mm, as shown in Figure 4-1 with the highest depths located at the south-west corner of the site. The area is inundated due to overland flows from the north of the site with little movement throughout the area due to the low-lying flat terrain causing a 'bathtub' effect.

Due to the site's flat terrain, water surface elevations (WSE) vary minimally, ranging from 107.69 mAHD to a peak of 107.76 mAHD at the southern boundary of the site. Flow velocities across the site are generally low, with the highest velocity recorded at the north-western corner of the site at 0.13 m/s, decreasing to around 0.01 m/s at the northern boundary.

Flood hazard classifications across the site are predominantly H1, indicating conditions are generally safe for pedestrian and vehicle movement during a 1% AEP event (refer to Figure 4-2). This increases in the PMF event where most of the site is under H2 (unsafe for small vehicles) hazard level with the area around the proposed infrastructure under hazard classification H3 (unsafe for vehicles and the elderly).

4.1.1 Flood Planning Area

Typically, the Flood Planning Area (FPA) is developed based on the Flood Planning Level (FPL) which for most locations is based on the 1% AEP flood extent plus a freeboard of 0.5 metres.

From previous studies completed in Deniliquin (which has similar topography), adoption of the typical FPA criteria is not considered appropriate for shallow overland flows in low gradient catchments as adoption of the criteria under those circumstances results in a significant area which can include areas outside of even the PMF extent which represents land not subject to flood risk in even the most extreme event modelled.

To account for the low gradient and shallow overland flow within the study area the following criteria has been considered as appropriate for determination of the FPA which is consistent with the approach adopted within similar catchments in riverain region:

- 1% AEP flood extent excluding areas with depths of less than 150 mm
- 1% AEP Floodway (including areas with depth less than 150 mm)
- 1% AEP H5 and H6 Hazard Classification (including areas with depths less than 150 mm).

The resulting FPA is illustrated in Figure 4-3. It should be noted that the suggested FPA presented as part of this assessment is considered high level and indicative only. Development of FPA's particularly those that include widespread low flows should be considered as part of a wider flood study.

4.1.2 Flood Function

Given the rural nature of the catchment, and based on previous criteria applied to similar catchments in NSW the flood function for all events were determined using the following criteria for the 1% AEP event:

- **Floodway:** Hazard (VxD) greater than 0.25 m2/s and velocity > 0.25 m/s OR Velocity >1m/s
- **Flood storage:** Area outside of the floodway which exceed 0.5 metres in depth.
- **Flood Fringe:** Remainder of the flood extent for depths exceeding 10mm and less than 0.5 metres. Removal of islands and some manual smoothing adopted.

Results of the flood function analysis for the 1% AEP event (as shown in Figure 4-4) indicate that the majority of the site is situated within the flood fringe. No part of the site falls within the flood storage area, and no floodway zones have been identified throughout the flood extent.

4.2 Design Conditions

4.2.1 1% AEP Results

The entire BESS site, including the internal access roads and noise walls shown in the design layout plan, has been modelled as fully blocked out in the design scenario. The water depths surrounding the site remain largely unchanged, with minor increases observed at a local topographic low point to the west of the proposed infrastructure. Across the BESS site, design scenario water depths range from 0.03 m to 0.336 m. Flood levels within the site vary between 107.69 mAHD and 107.77 mAHD, indicating no significant changes between the existing and design scenarios.

Velocities under design conditions show a similar distribution to the existing scenario. Localised differences are noted across the site, with the maximum velocity difference being 0.02 m/s, occurring west of the site. The flood hazard classification remains at H1 (no restrictions) for nearly the entire BESS site under the 1% AEP design event. Results for flood depths and hazard under the design condition are presented in Figure 4-5 and Figure 4-6.

Figure 4-7 illustrates the change in flood levels between the design and existing conditions. Positive values indicate increases in flood level (afflux), while negative values indicate reductions. Areas that no longer flood or now experience inundation under design conditions are also shown.

A small area of up to 69 mm afflux is observed south of the internal road connecting to Broockmanns Road. This is the only location where any noticeable afflux has occurred.

The afflux can be attributed to the bathtub-like topography of the BESS site, which limits overland flow across the area. The site behaves as a shallow depression, where rainfall tends to pond rather than flow in or out, resulting in negligible overland flow paths.

Overall, the design scenario inclusive of BESS infrastructure and the noise walls located on the northern and eastern boundaries does not cause increased flood levels on neighbouring or downstream properties, except for the minor localised increase adjacent to the Broockmanns Road access. This conclusion is consistent across all modelled events, including the 5%, 1%, 0.5%, 0.2% AEP and PMF events (refer to Appendix B. Flood Maps for full results).

4.2.2 PMF Results

To consider the flood resilience of infrastructure up to and including the PMF, modelling has been undertaken to assess flood behaviour under extreme conditions for both existing and design scenarios.

Results from the PMF design scenario (see Appendix B. Flood Maps) indicates a peak flood level of 108.04 m AHD across the site (Figure 4-8). The flood hazard classification remains at H2 (Unsafe for small vehicles) and H3 (Unsafe for small vehicles and elderly) for nearly the entire BESS site under the PMF design event (Figure 4-9).

As stated in section 4.2, the design scenario inclusive of BESS infrastructure and the noise walls located on the northern and eastern boundaries does not cause increased flood levels on neighbouring or downstream properties, except for the minor localised increase adjacent to the Broockmanns Road access.

4.2.3 Design Considerations and Recommendations

The NSW Flood Risk Management Manual (NSW Government, 2023) provides guidance on establishing Flood Planning Levels (FPL) for development, which combine the Design Flood Event (DFE) level with an appropriate freeboard allowance. The Manual recommends that for typical development, the FPL should generally be determined using the 1% AEP flood level plus a freeboard of typically 500mm.

The adopted finished floor level (FFL) for critical infrastructure is therefore 108.24 m AHD (107.74 m AHD + 500mm freeboard). Importantly, this design approach not only provides substantial freeboard above the 1% AEP event but also results in critical infrastructure being elevated approximately 200 mm above the modelled PMF level (108.04 m AHD). This outcome satisfies the NSW SES recommendation to place sensitive infrastructure above the PMF level where feasible, thereby minimising risk to property and potential financial losses from extreme flooding events.

It is recommended during the detailed design phase of this project, due to relatively high flood levels observed in and around the infrastructure, including internal roads:

- Flood modelling completed as part of the detailed design will verify that flood impacts off-site are minimised and will confirm flood levels within the subject site to inform the Finished Floor Levels for the design.
- The project site, specifically the batteries and electrical equipment will be elevated above the 1% AEP flood level with a 500mm freeboard requirement.

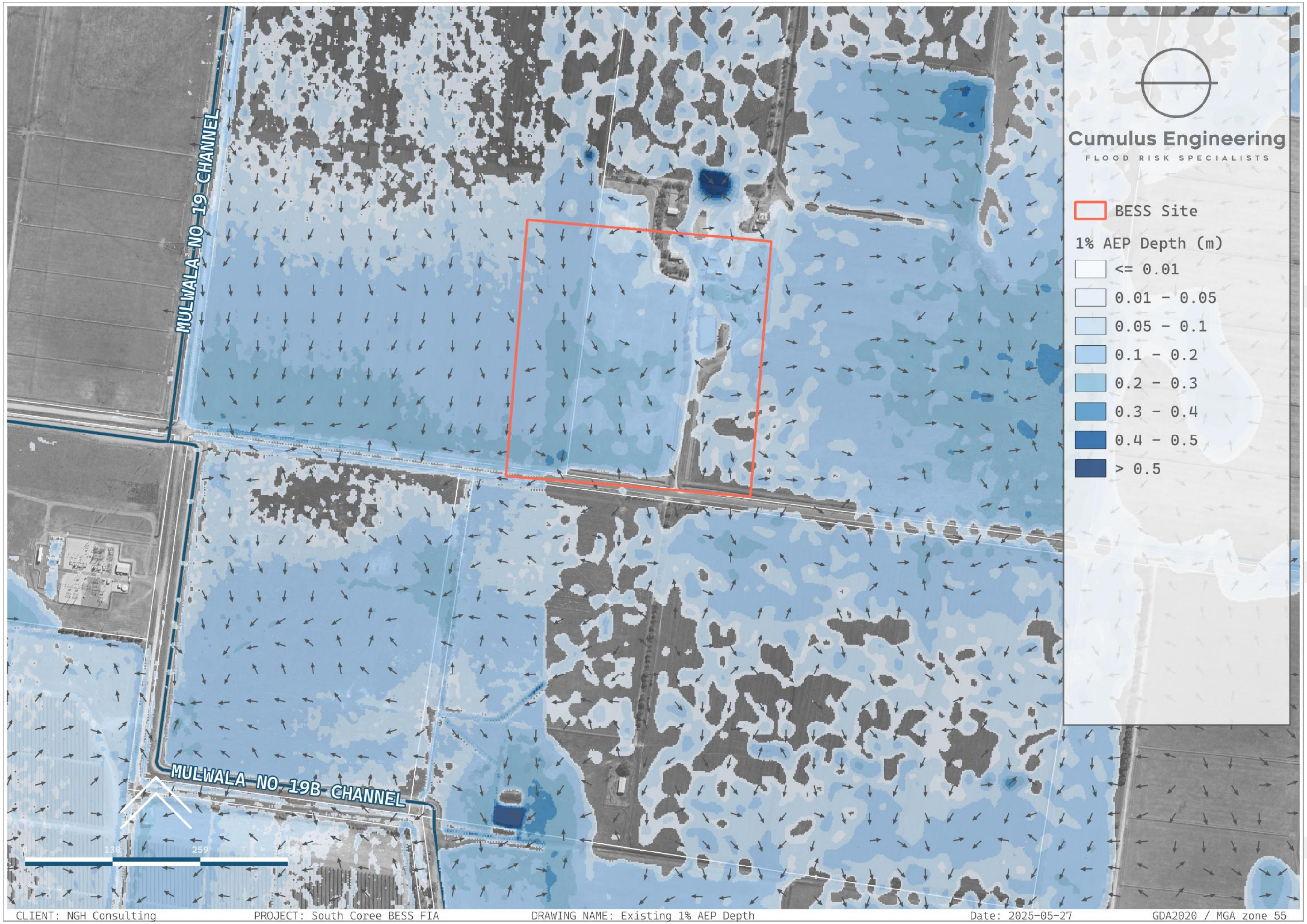


FIGURE 4-1 EXISTING CONDITIONS - 1% AEP DEPTH

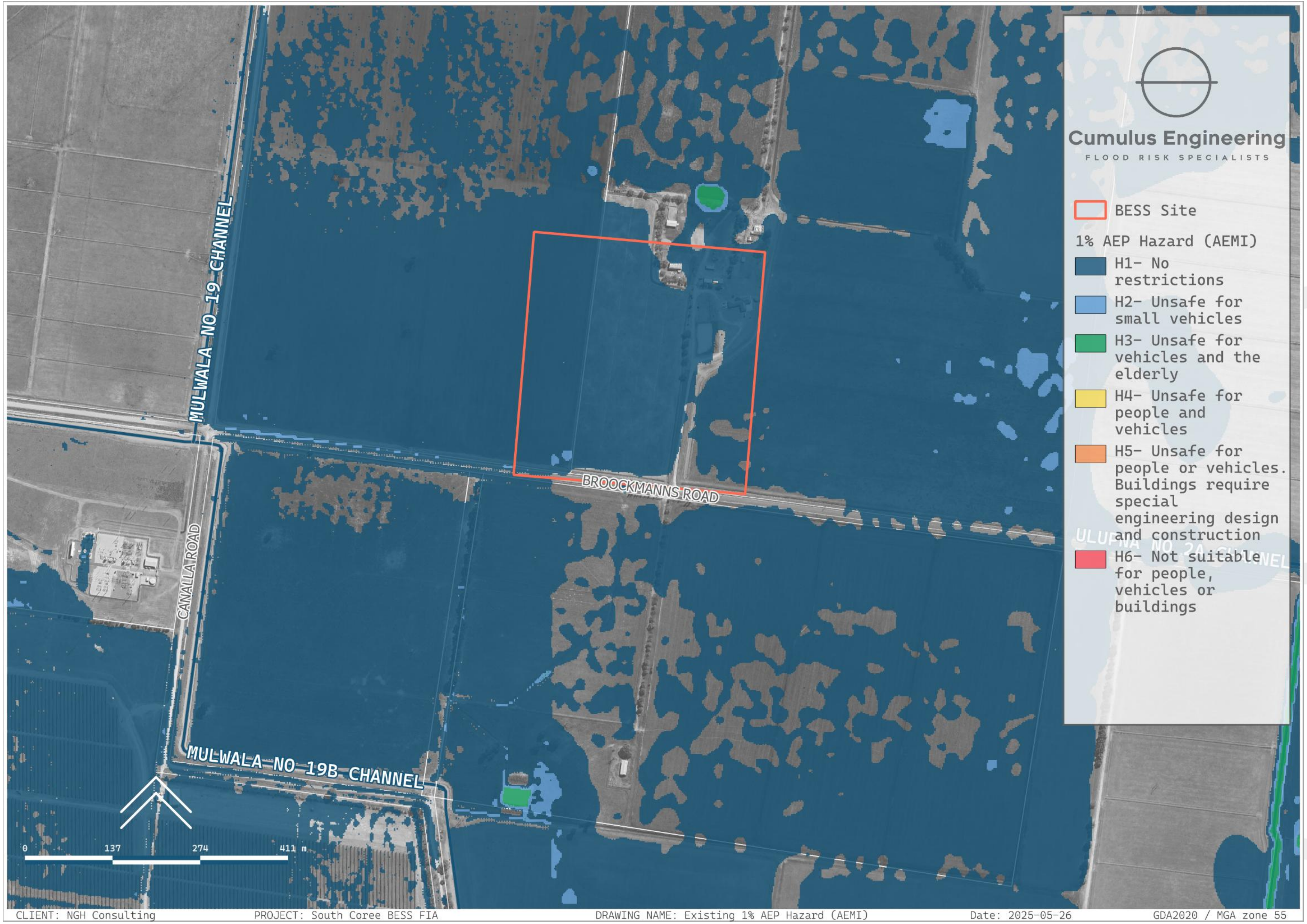


FIGURE 4-2 EXISTING CONDITIONS - 1% AEP HAZARD (AEMI)

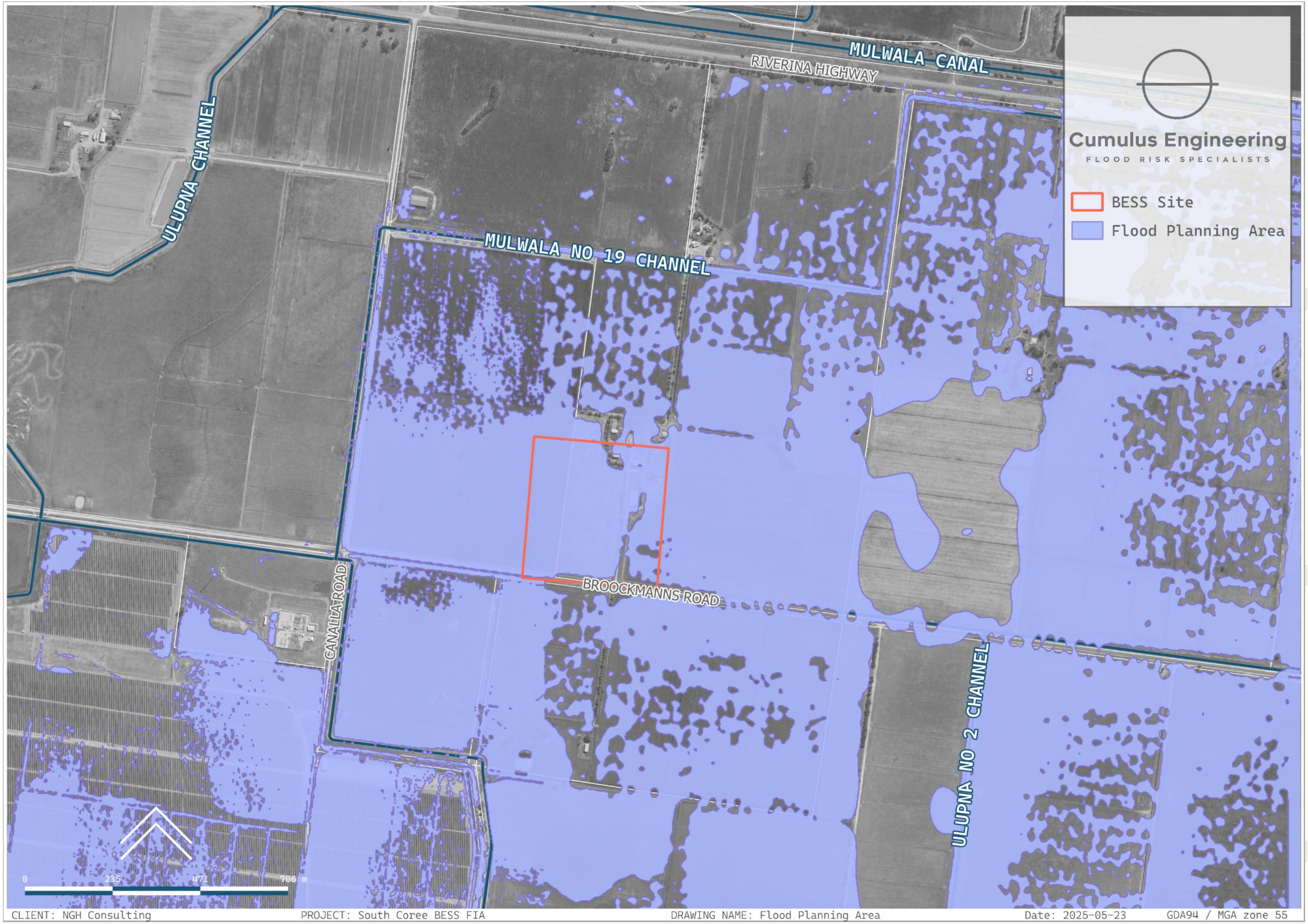


FIGURE 4-3 FLOOD PLANNING AREA

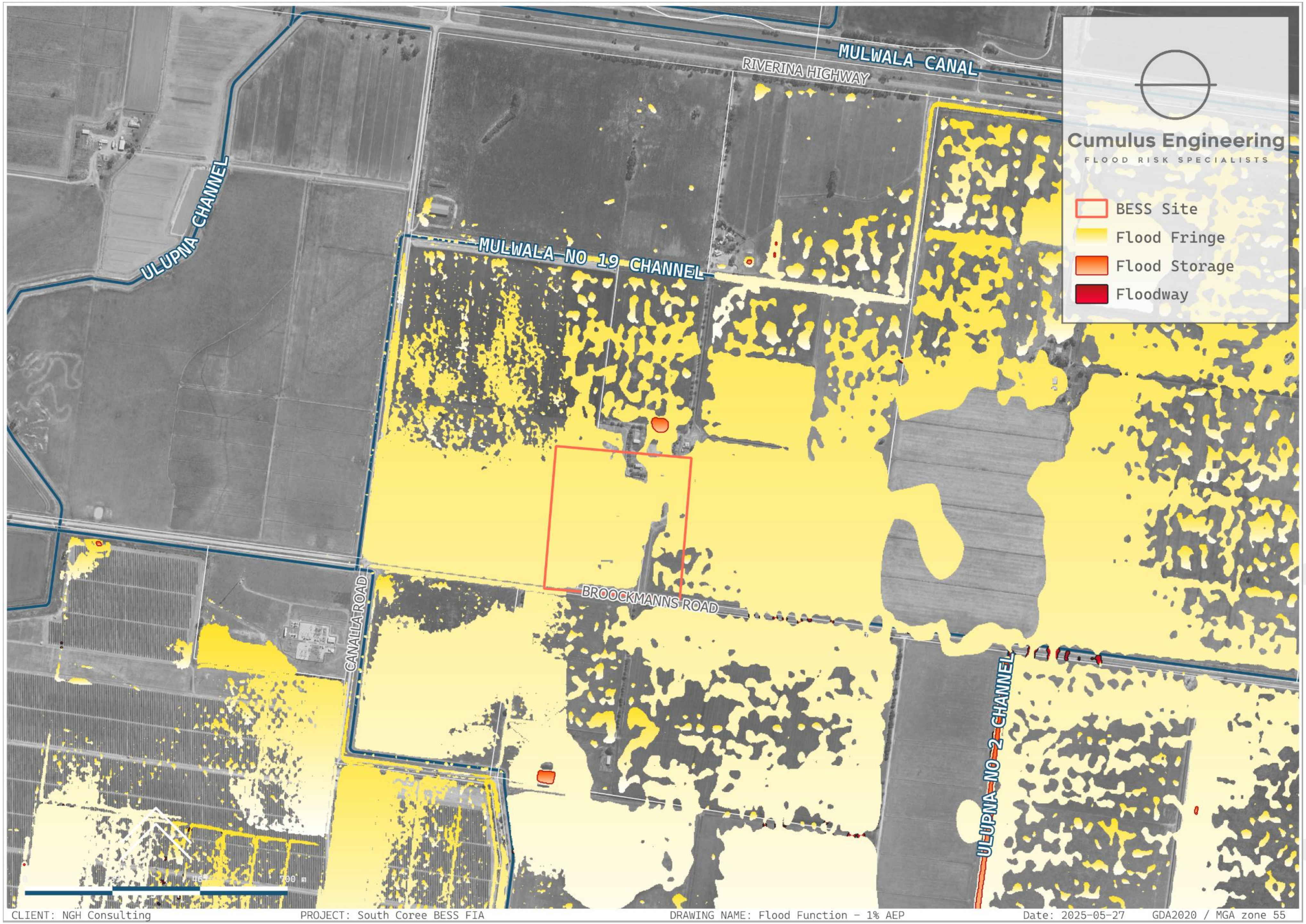


FIGURE 4-4 FLOOD FUNCTION

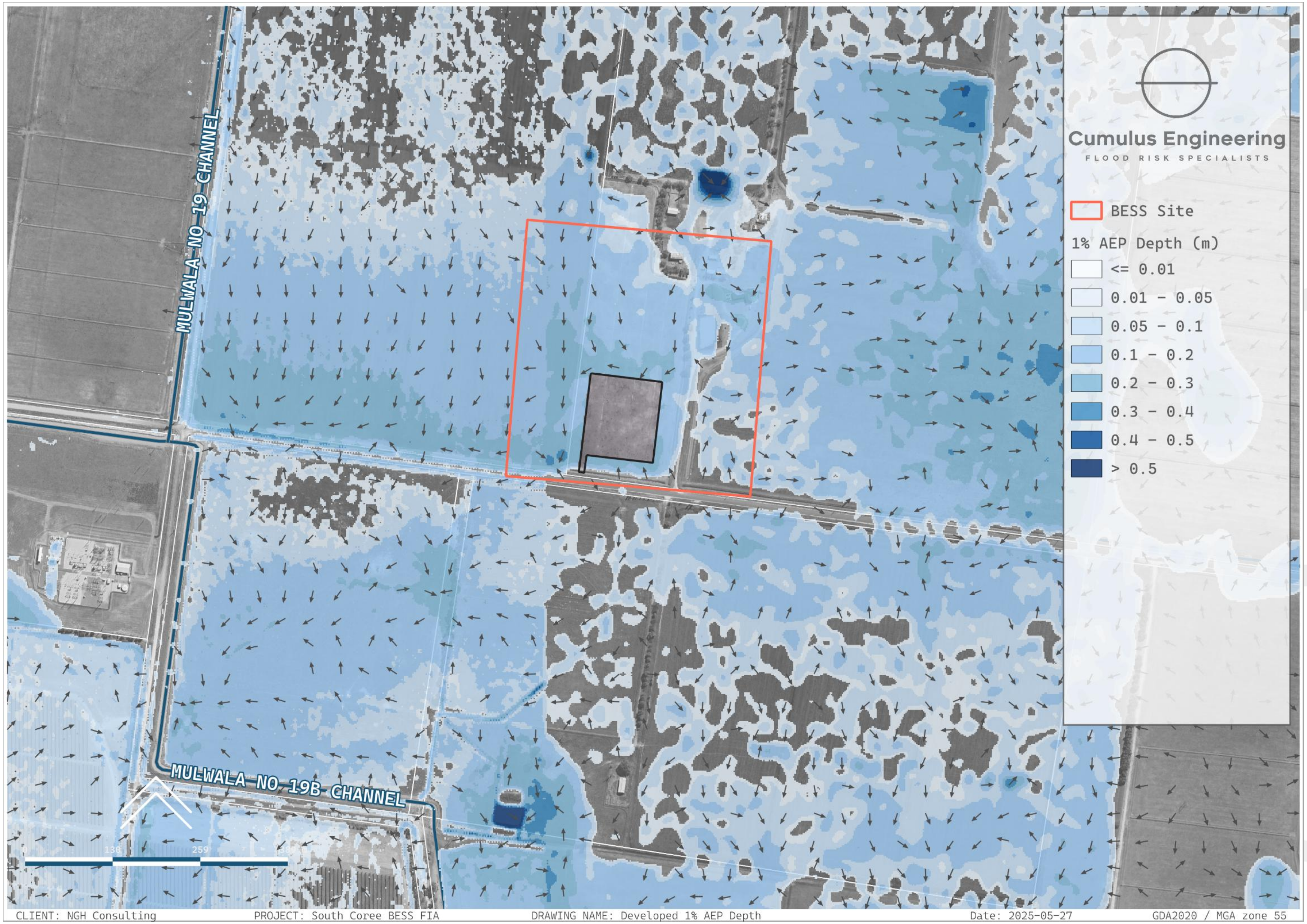


FIGURE 4-5 DESIGN CONDITIONS - 1% AEP DEPTH

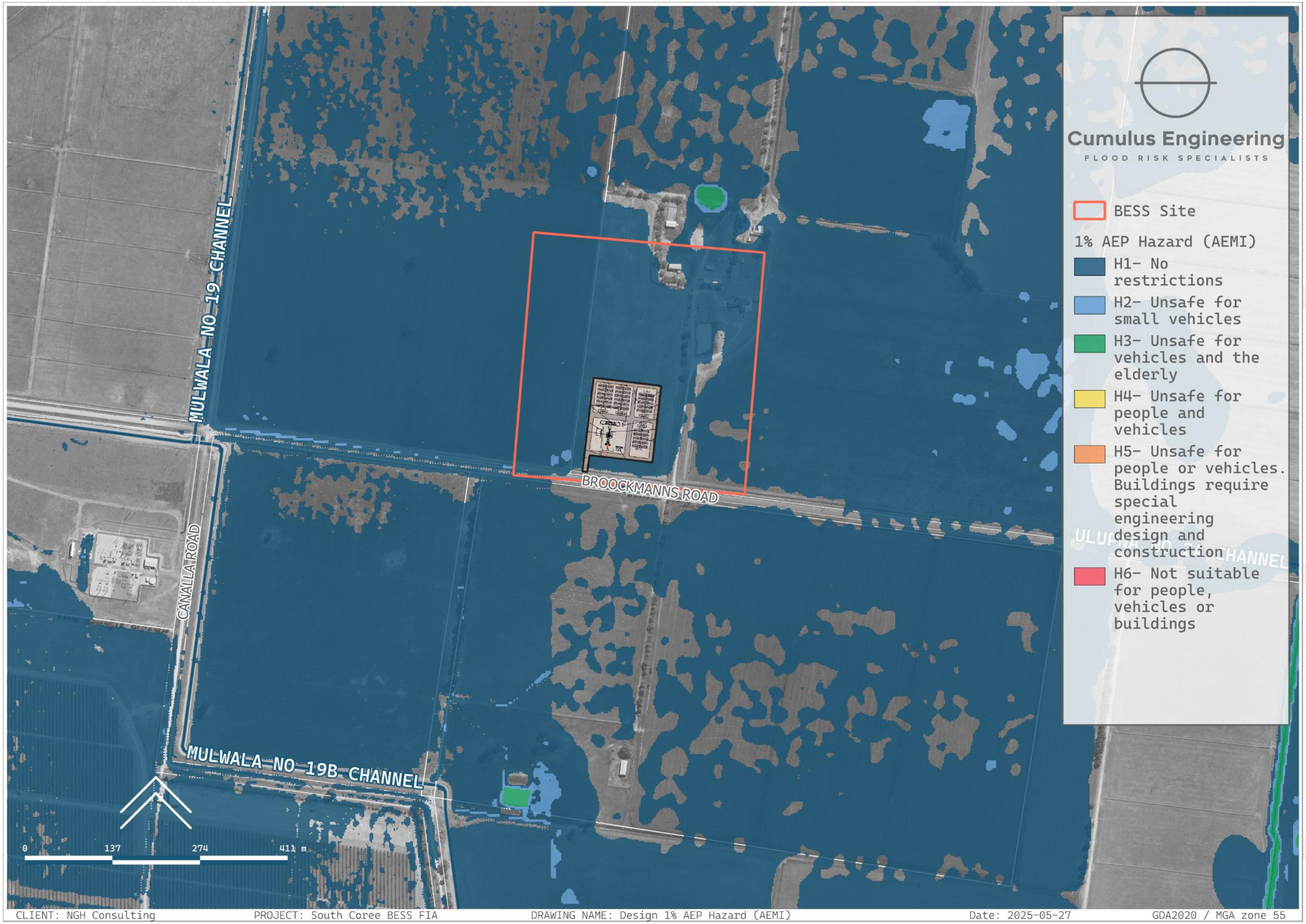


FIGURE 4-6 DESIGN CONDITIONS - 1% AEP HAZARD (AEMI)

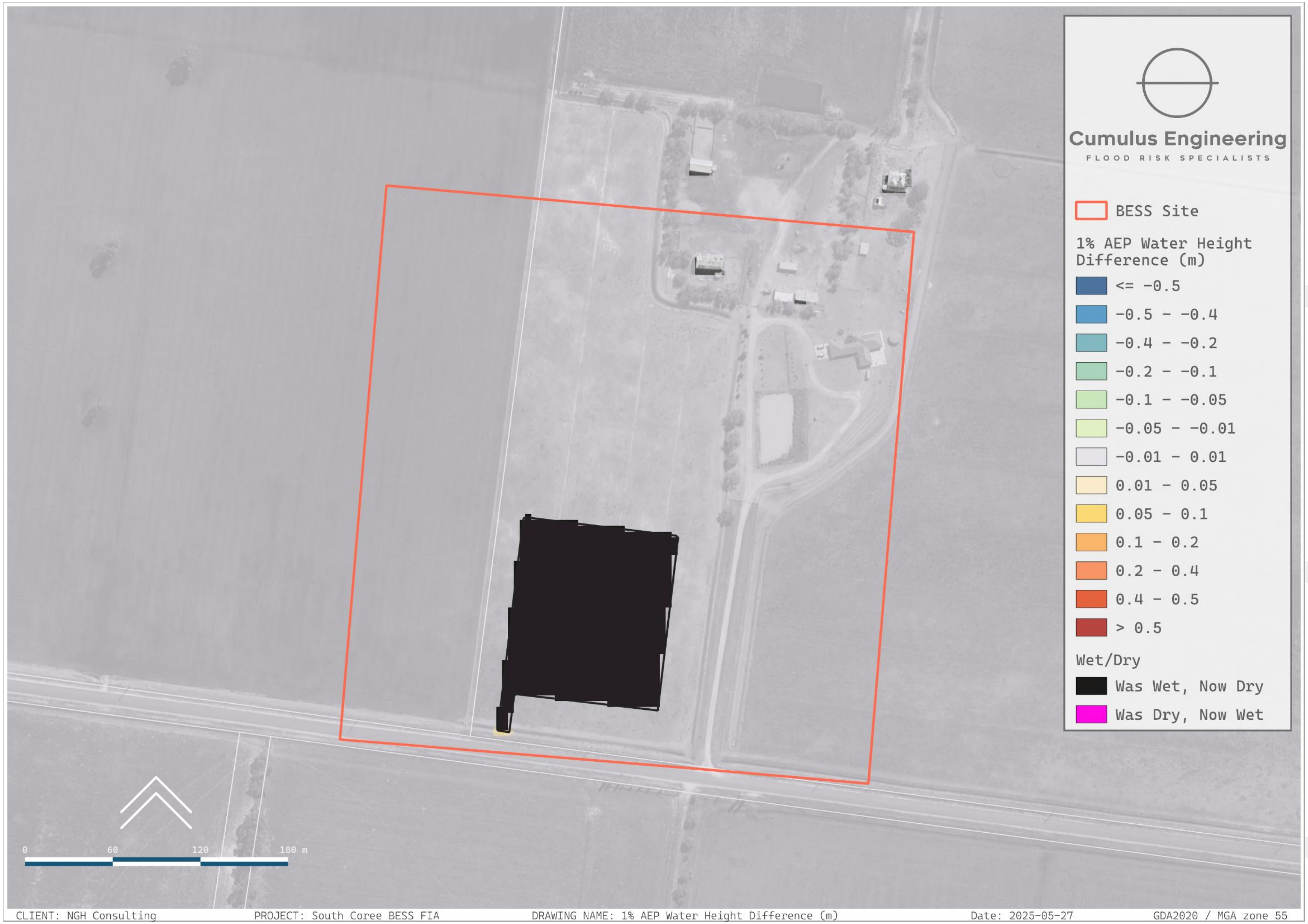


FIGURE 4-7 1% AEP AFFLUX HEIGHT (DESIGN VS. EXISTING)

FIGURE 4-8 DESIGN CONDITIONS - PMF WATER LEVEL

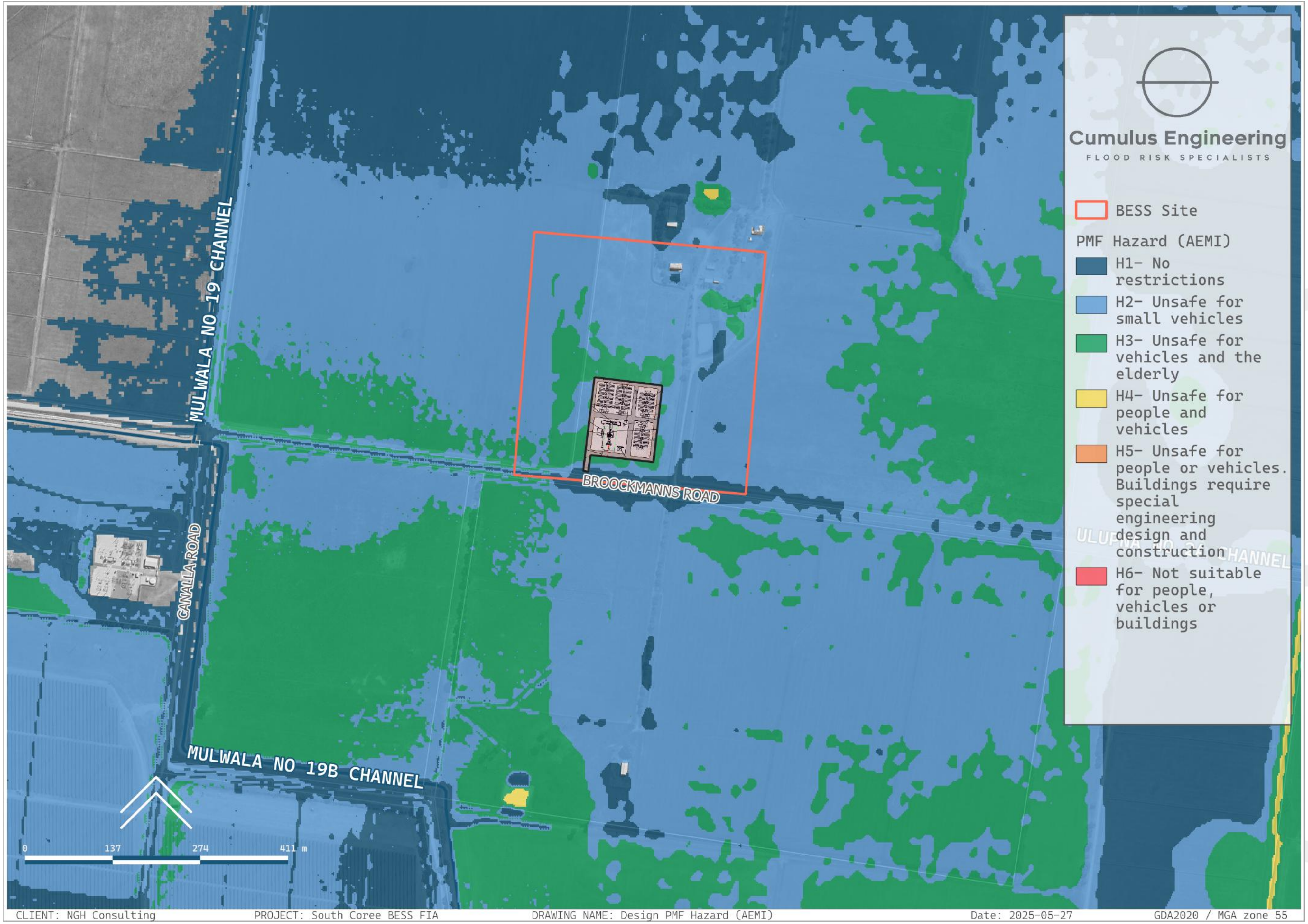


FIGURE 4-9 DESIGN CONDITIONS - PMF HAZARD (AEMI)

4.3 Flood Evacuation and Planning

Flood modelling indicates that the subject site is located in a low-lying, flat catchment which is prone to shallow inundation during a 1% AEP event. The maximum flood depth around the internal access routes is approximately 335 mm. Despite these depths, modelling shows that flood velocities remain low, resulting in a H1 hazard classification (no restriction) across the majority of the site and along the internal access roads. This indicates a very low flood hazard and suggests that access remains safe for both pedestrians and vehicles during the design flood event.

The BESS infrastructure – including buildings and key access roads – has been blocked out in the model to reflect the final design. This approach ensures that flood impacts are accurately represented and conservative and confirms that the development will not obstruct floodwaters. The inundation around the buildings is characterised by high depth but low velocity, reinforcing the low hazard classification.

All access and egress considerations, including potential delays or temporary isolation during extreme events, can be appropriately managed through the implementation of a site-specific Flood Emergency Response Plan (FERP) which it is proposed to be developed during the detailed design phase of the project when the layout and design of the development is finalised. Modelling indicates that peak inundation typically occurs 7.5 to 10 hours after rainfall commencement, providing adequate lead time for activation of emergency procedures, including evacuation if required, before the site becomes isolated.

Broockmanns Road, the key access route connecting the site to Finley and the Riverina Highway via Coulters Road, shows very low hazard (H1 classification) and remains trafficable during the 1% AEP event. This safe evacuation route, combined with the available warning period, enables occupants to relocate or prepare for extended isolation in a planned and controlled manner for more extreme events up to and including PMF.

4.3.1 NSW SES Recommendations and Response

As outlined within the **Requirement 10**, Emergency management, evacuation and access, and contingency measures for the project are to be discussed with and have the support of Council and the NSW SES.

A meeting was coordinated with both Berrigan Shire Council and NSW SES on 24th June 2025 to discuss flood risk management considerations for the project and any concerns SES and Council may have in relation to flood risk for the project. Both NSW SES and Council were provided with the draft version of this report and was reviewed prior to the meeting. Minutes from this meeting can be found in Appendix C. Consultation with NSW SES & Berrigan Shire Council.

NSW SES provided detailed recommendations in their correspondence dated 17th July 2025 (Ref: ID 3156) regarding flood impact assessment, emergency management planning, and infrastructure resilience considerations for the project. The recommendations emphasised the importance of considering flood risks up to and including the PMF event, infrastructure flood resilience, access and egress constraints, cumulative impacts from multiple BESS developments in the area, and the development of a comprehensive FERP aligned with existing emergency management strategies.

Table 4-1 below provides a systematic response to each of the NSW SES recommendations, demonstrating how the project design, flood assessment, and proposed management measures address the identified flood emergency planning considerations. This response demonstrates that all SES recommendations have been comprehensively addressed through a combination of conservative infrastructure design (elevation above PMF), detailed flood modelling (including PMF assessment), robust emergency management planning and coordination with relevant agencies.

TABLE 4-1 RESPONSE TO NSW SES RECOMMENDATIONS

NSW SES Recommendations	Response
Duration of inundation and isolation: Clearly outline the duration to inundation and of isolation in the FIRA, noting that the flat terrain tends to result in slower runoff and extended flood durations, to inform appropriate emergency management measures.	The flat topography results in ponding and slow drainage, with the site potentially isolated for up to 13 hours during a 360-minute 1% AEP storm event and up to 22 hours during a 1440-minute 1% AEP storm event, while during a PMF event, the site would potentially be isolated up to 33 hours (1.4 days). Notably, peak inundation typically occurs 7.5 to 10 hours after rainfall commencement, providing sufficient lead time for implementation of flood emergency procedures including evacuation and pre-positioning of emergency supplies. This warning period allows occupants to safely relocate before access routes become impassable. According to Berrigan Shire Local Flood Emergency Sub Plan (2023), no flood information is available for Finley, noting occasional issue with local drainage that results in inconvenience but no property damage.
PMF consideration: Emphasise that flood emergency response planning should consider events up to and including the PMF event. Impact of flooding on roadways should go beyond immediately adjacent to the site to fully understand evacuation constraints and ensure people can evacuate to an area above PMF before access routes are cut. Evacuation must not require people to drive or walk-through floodwater.	PMF modelling has been undertaken and demonstrates that critical infrastructure will be elevated to 108.24 m AHD, which is 200 mm above the modelled PMF level (108.04 m AHD). The FERP (to be developed as part of the detailed design stage of the project once the site layout has been finalised) will be triggered in advance of access road inundation, enabling evacuation before Broockmanns Road becomes impassable. During PMF events, the site will be evacuated prior to access being cut, with personnel evacuating to Finley (above PMF) via Broockmanns Road before H2-H3 hazard conditions develop. No evacuation will require driving or walking through floodwater. The hydraulic model extent will be extended further during the detailed design phase to inform the FERP on roads impacted outside of the catchment which the site is located within.
Access/egress road resilience: Recommend considering flood resilience of proposed access/egress roads; ideally, access/egress routes should provide rising road access and/or be passable up to at least a 1 in 500-year (0.2% AEP) local flooding event.	The main access via Broockmanns Road remains trafficable and maintains H1 hazard classification during the 1% AEP event. However, during extreme events (0.2% AEP and PMF), extensive inundation occurs across the broader Finley area due to the flat topography and network of raised irrigation channels. Upgrading Broockmanns Road to provide rising road access to the 0.2% AEP standard would require raising substantial sections of the road corridor beyond the immediate site frontage, which is beyond the scope of this project. The FERP will address this constraint through early warning triggers and pre-emptive evacuation procedures, ensuring site personnel evacuate via Broockmanns Road before it becomes impassable in extreme events. Site access upgrades will incorporate localised drainage improvements to maintain safe vehicle access during frequent flood events.
Cumulative impacts: Recommend considering cumulative impacts of multiple proposed and existing developments (Berrigan BESS, Finley BESS, Finley Solar Farm) on flood behaviour, particularly the increase in impervious surfaces (hardstand areas, paved roads, noise walls, etc.).	The existing Finley Solar Farm and the Finley BESS are located within the flood model extent and have been accounted for in the baseline terrain used for flood modelling. Design modelling demonstrates negligible afflux at neighbouring property boundaries, with the conservative block-fill approach representing worst-case scenario conditions. Further cumulative assessment incorporating the proposed Berrigan BESS is not currently practicable due to the absence of detailed design information (finished levels, site layout, infrastructure footprints) for that development. Should detailed design information for other proposed developments become available, cumulative flood impact assessment will be considered as part of the post approval detailed design flood modelling.
DCCEEW consultation: Recommend seeking advice from the Department of Climate Change, Energy, the Environment and Water	DCCEEW has been engaged as part of the project consultation process. The flood impact assessment demonstrates that the development design results in no adverse impacts to flood behaviour at the site or downstream areas, with minimal afflux at property boundaries and appropriate stormwater management measures incorporated.

NSW SES Recommendations	Response
(DCCEEW) regarding the impact of the proposed development on flood behaviour at the site and downstream areas.	Ongoing consultation with DCCEEW will continue as the project progresses to detailed design and prior to construction commencement, ensuring any further flood-related matters are appropriately addressed.
Infrastructure flood resilience (PMF): Recommend considering flood resilience of infrastructure likely to be damaged or contaminated by floodwater, to events up to and including the PMF. This could include placing sensitive infrastructure such as battery storage, inverters, etc., above the PMF level, if feasible, to minimise risk to property and financial losses.	All critical infrastructure (battery storage, inverters, transformers, switchgear, and control systems) will be elevated to a finished floor level of 108.24 m AHD. This design provides 500 mm freeboard above the 1% AEP level (107.74 m AHD) and approximately 200 mm clearance above the modelled PMF level (108.04 m AHD), thereby exceeding the NSW SES recommendation to place sensitive infrastructure above PMF where feasible. This approach minimises risk to property and financial losses from extreme flooding events.

4.4 Impacts on Flood Behaviour

As per Requirement 14 of advice received from BCD regarding the Environmental impacts Statement, the impacts of the proposed development on flood behaviour are outlined in Table 4-2.

TABLE 4-2 IMPACTS OF THE DESIGN ON FLOOD BEHAVIOUR

Requirement	Response	Requirement Met?
Are there detrimental increases in the potential flood affectation of other properties, assets, and infrastructure?	Afflux mapping between the existing conditions and design conditions water heights show negligible increase in flood levels limited to within the site for all modelled events. Increases in flood levels are observed south of the designed internal road to Broockmanns Rd. No off-site impacts are observed because of development	✓
Is the development consistent with Council floodplain risk management plans	There are currently no existing Council floodplain risk management plans available for review for the subject site. However, based on the flood modelling outcomes—which show flood depths exceeding 1% AEP thresholds—it is recommended that the development be designed to align with best-practice floodplain management principles. A Flood Risk Management Plan (FRMP) will need to be prepared, to address access and egress, emergency management, and site-specific mitigation measures during flood events.	✓
Is the development consistent with Rural Floodplain Management Plans?	No local floodplain management plan was found as the subject site is not located within an active floodplain adjacent or adjacent to major waterways or tributaries.	✓
Is the development compatible with flood hazard of the land?	Flood Hazard over the site is AEMI hazard category of H1 (no restrictions) with surrounding areas generally of the same category, showing that the site is compatible with flood hazard under all events except PMF event with most of the site under H2 (unsafe for small vehicles) hazard level, and the area around the proposed infrastructure under hazard classification H3 (unsafe for vehicles and the elderly).	✓
Is the development compatible with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.	The proposed project site is located outside the floodway, with no areas situated within the flood storage zones. The site is primarily impacted by local rainfall and runoff and will therefore have no effect on the function of the broader floodplain.	✓
Will there be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site	An analysis of the results shows that the development has negligible impact on both the frequency, depth and time of inundation for the catchment, Impacts are minor and concentrated to within the site.	✓
Will there be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses	Negligible risk. The site is not close to any significant river. The development will have little to no impact on these processes.	✓
Will the development have any impacts on existing community emergency management arrangements for flooding. These matters are to be discussed with the NSW SES and Council	Consultation with NSW SES has been undertaken to determine if any additional flood management measures are required. The NSW SES has stated that the development of the floodplain does not impact on the ability of the existing community to respond to a flood safely and effectively.	✓
Does the project incorporate specific measures to manage risk to life from flood?	The development is situated outside the floodway. The fill pad and internal access track will be raised sufficiently with adequate freeboard to ensure no local ponding or inundation of infrastructure.	✓
Does the project have any impacts on the social and economic costs to the community as a consequence of flooding	Flood risk for the development is low with no impacts observed in any modelled event for surrounding properties or infrastructure therefore it is not anticipated that the development will have impacts on social to economic costs in the event of a flood.	✓

5 Conclusion and Recommendations

Cumulus Engineering have undertaken a Flood Assessment for the South Coree Battery Energy Storage System (BESS) to determine the existing overland flow regime at the site and to identify any potential impacts due to the development.

The assessment has demonstrated that:

- The project site experiences inundation from local runoff during the 5%, 1%, 0.5%, 0.2% AEP events and the PMF event. The modelling indicates that the site remains within an area of low overall flood risk under all events except PMF event, which shows higher flood risk across the site and surrounding area.
- Based on results of the design flood modelling, it is recommended that 500mm freeboard above the 1% AEP flood level be adopted for BESS infrastructure to ensure that the site remains flood free up to and including the PMF event. The FFL is suggested to be elevated to 108.24 m AHD, which is 200 mm above the modelled PMF level (108.04 m AHD).
- The results show that the proposed BESS development does not adversely impact the flood behaviour on neighbouring properties and/or infrastructure with negligible increase in water depths and flood levels under all design events.
- Access to the site is impacted in all modelled flood events exceeding the 5% AEP event, restricting access and egress to the subject site. It is recommended that a Flood Emergency Response Plan (FERP) be implemented as part of this development in order to facilitate safe evacuation prior to inundation of the site.
- It is recommended that during the Detailed Design phase of this project the following is included:
    - Modify design conditions within the hydraulic model to represent the final design including finished floor levels, elevations throughout the site, infrastructure layout and roughness type.
    - Extension of the hydraulic model domain to better inform the FERP on roads impacted outside of the catchment which the site is located within.
    - Consider cumulative impacts of multiple proposed and existing developments where additional information is available

6 References

Australian Government & Engineering Australia. (2019). Australian Rainfall & Runoff. https://www.arr-software.org/pdfs/ARR_190514.pdf

Department of Planning and Environment. (2023). Flood Risk Management Manual. NSW Environment and Heritage. https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-risk-management-manual

Department of Environment, Land, Water and Planning. (2019). Guidelines for development in flood affected areas. In Department of Environment, Land, Water and Planning [Report]. https://www.water.vic.gov.au/__data/assets/pdf_file/0024/662325/guidelines-for-development-in-flood-affected-areas.pdf

Appendix A. Hydraulic Model Setup

A1. Model Summary

A summary of the TUFLOW Model is presented in Table A 1.

TABLE A 1 HYDRAULIC MODEL PARAMETERS

Model Parameter	Description
Model Engine	TUFLOW HPC GPU
Model Build	2025.0.2-iSP-w64
1D/2D time steps	Adaptive time step
Model Extent	Determined by catchment delineation inclusive of all local catchments.
Topography	5 metre LiDAR captured in 2015 owned by NSW Government – Spatial Services 2 metre LiDAR captured in 2017 owned by NSW Government – Spatial Services 1 meter LiDAR captured in 2021 owned by NSW Government - Spatial Services *Note that the 5-metre LiDAR dataset was adjusted by applying a 400 mm terrain modifier to lower its elevation, addressing discrepancies identified when compared with finer-resolution LiDAR datasets as discussed in A3. Topography
Initial Water Level	Initial water levels (2d_iwl) were set along the irrigation channels using LiDAR-derived elevations, representing the approximate channel bed levels to ensure a wet start to the simulation
Terrain Modifiers	Two sets of terrain modifiers were applied in this model including: - Terrain modifier to lower the 5-metre LiDAR by 400mm - Terrain modifiers to represent the raised BESS platform in design scenario (100m Fill)
2d Grid Size	4 metres
Mannings Roughness	Standard ARR2019 values applied, detailed in Table A 2.
Inflow Boundary Condition	2D Inflow – Local Catchment • Applied rainfall excess hyetographs extracted from each of the RORB Subareas to all cells equally (2d_sa_all) for subareas located wholly within the model extent (see 2d Direct Rainfall Inflow illustrated in Figure 3-1).
Downstream Boundary Condition	HQ (stage-discharge) boundaries were applied using local channel slope data upstream of each boundary location. One boundary was set at the downstream end, aligned with the outlet channel, while another was positioned along the southern edge of the hydraulic model extent to minimise glass wall effects and allow flow conveyance out of the domain.
2d Outputs	Depths, water levels, velocity, and hazard (AEMI)

A2. Model Extent & Boundary Conditions

The model extent was determined by the catchment delineation completed as part of the hydrologic analysis (as illustrated in Figure 2-2).

Inflows were applied to the model as rainfall excess hyetographs for the respective event extracted from each of the RORB subareas completed as part of the hydrologic analysis. Rainfall was applied to the model domain with a Source-Area boundary which evenly distributes the rainfall hyetograph to all cells equally (2d_sa_all).

Two HQ type boundary condition lines were implemented at the downstream boundary of the model with slopes of 0.0001 and 0.0004, derived from the elevation data and distances between points along the downstream boundary with elevation data obtained from LiDAR.

A3. Topography

The Digital Elevation Model (DEM) has been constructed using 5 metre LiDAR which was captured in 2015 by NSW Government represented by Geoscience Australia. To address discrepancies in elevation, the 5-metre LiDAR dataset was adjusted by reducing elevations by 400 mm using a terrain modifier.

Although multiple LiDAR resolutions are publicly available, only the 5-metre (NSW Government, 2015) dataset provides full coverage of both the site and its upstream catchment. To validate the accuracy of using the 5-metre LiDAR, a comparison was conducted with the available 1-metre (NSW Government, 2021) and 2-metre (NSW Government, 2017) LiDAR datasets. The results indicated that the 5-metre LiDAR consistently overestimated ground elevations by approximately 400 mm when compared to the finer-resolution datasets. As such, the 5-metre dataset was corrected by applying a uniform reduction of 400 mm before being incorporated into the TUFLOW model. To ensure localised accuracy, the 1-metre and 2-metre LiDAR datasets were also integrated into the model where available.

Terrain modifiers were used to represent areas of BESS infrastructure within the subject site, as illustrated in Figure A 2.

A4. Mannings Roughness Values

The local catchment area is a mix of large open pervious areas (grasslands and paddocks) and lined channels and watercourses. Values of Manning’s roughness were adopted as per ARR2019 guideline recommendations, and adjusted as necessary, with reference to aerial imagery.

The Manning’s n roughness values for various land use types are presented in Table A 2.

TABLE A 2 ADOPTED MANNING'S N ROUGHNESS

Land Use	Adopted Manning’s n
Residential: Urban - Higher Density (When building footprints and remainder of parcel are modelled together (with one roughness value)	0.04
Residential: Rural – Lower Density (When building footprints and remainder of parcel are modelled together (with one roughness value)	0.06
Industrial/Commercial (Or large/significant buildings on site)	0.05
Open Pervious Area – Minimal Vegetation (Golf Course)	0.04
Open Pervious Area – Moderate Vegetation (Pasture & Grassland)	0.06
Open Pervious Area – Heavy Vegetation (Trees)	0.08
Waterway/Channel – Minimal Vegetation	0.03
Waterbodies/Lakes	0.03
Driveway / Car Park / Roadway	0.03

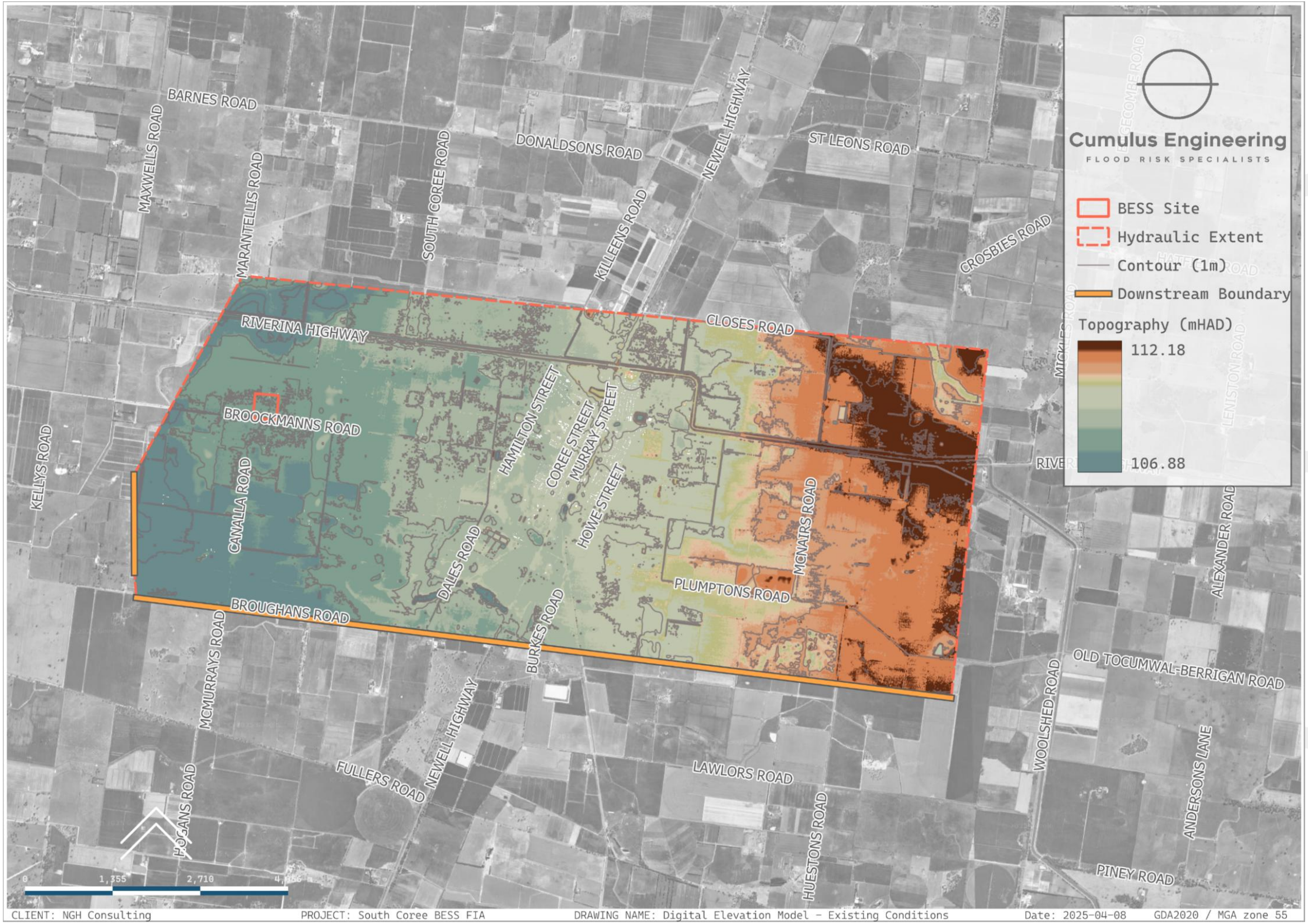


FIGURE A1 DIGITAL ELEVATION MODEL – EXISTING CONDITION

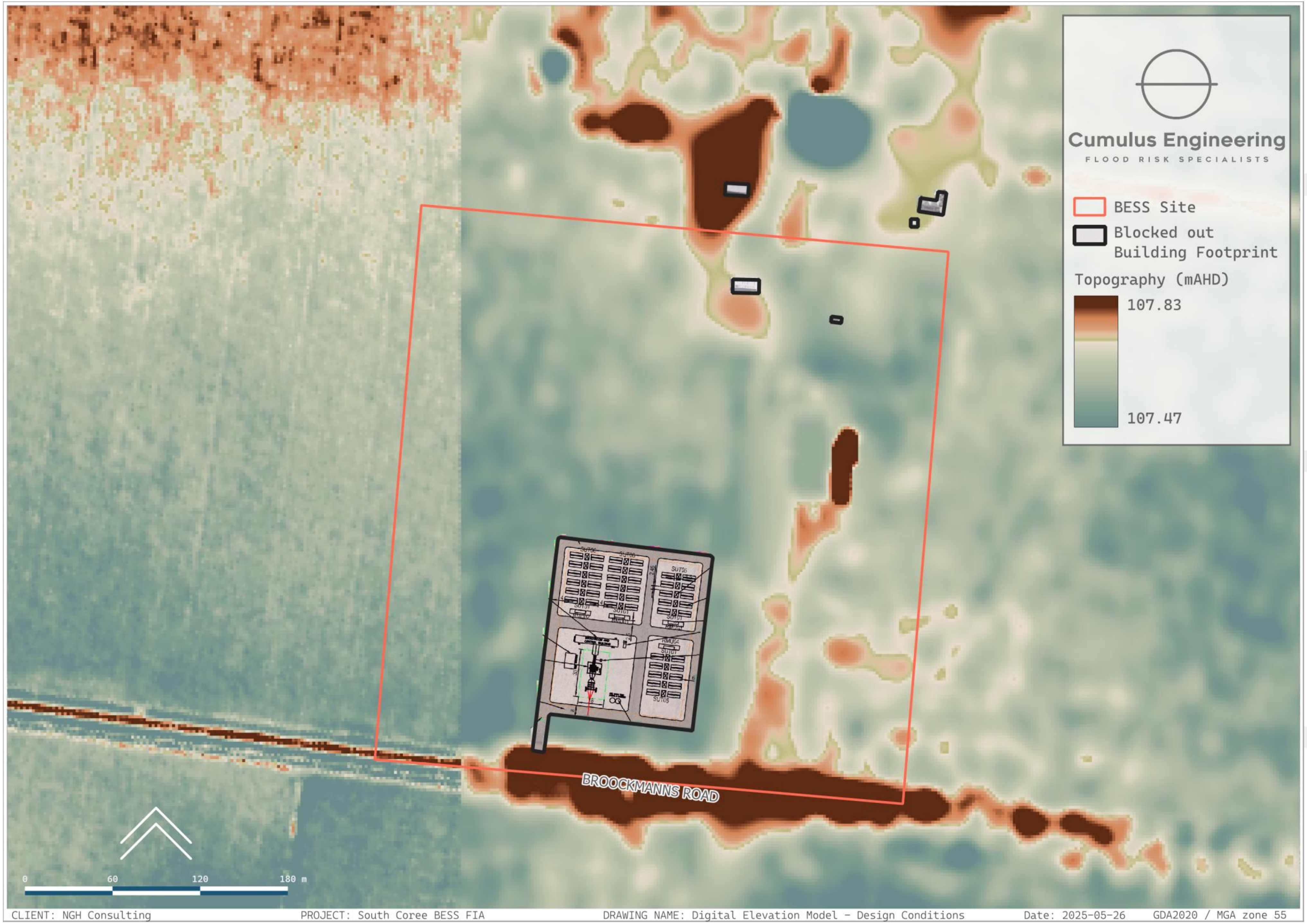
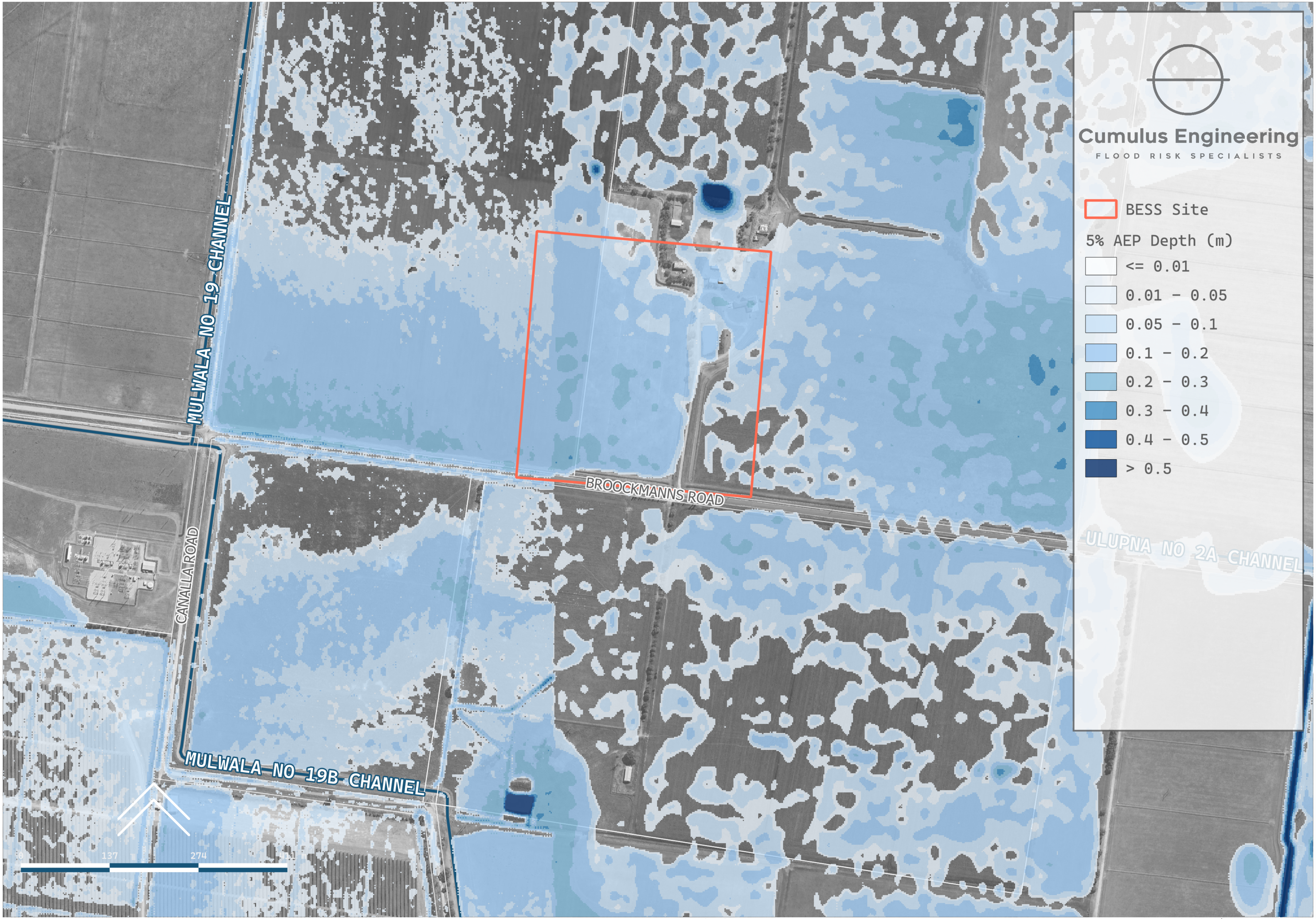
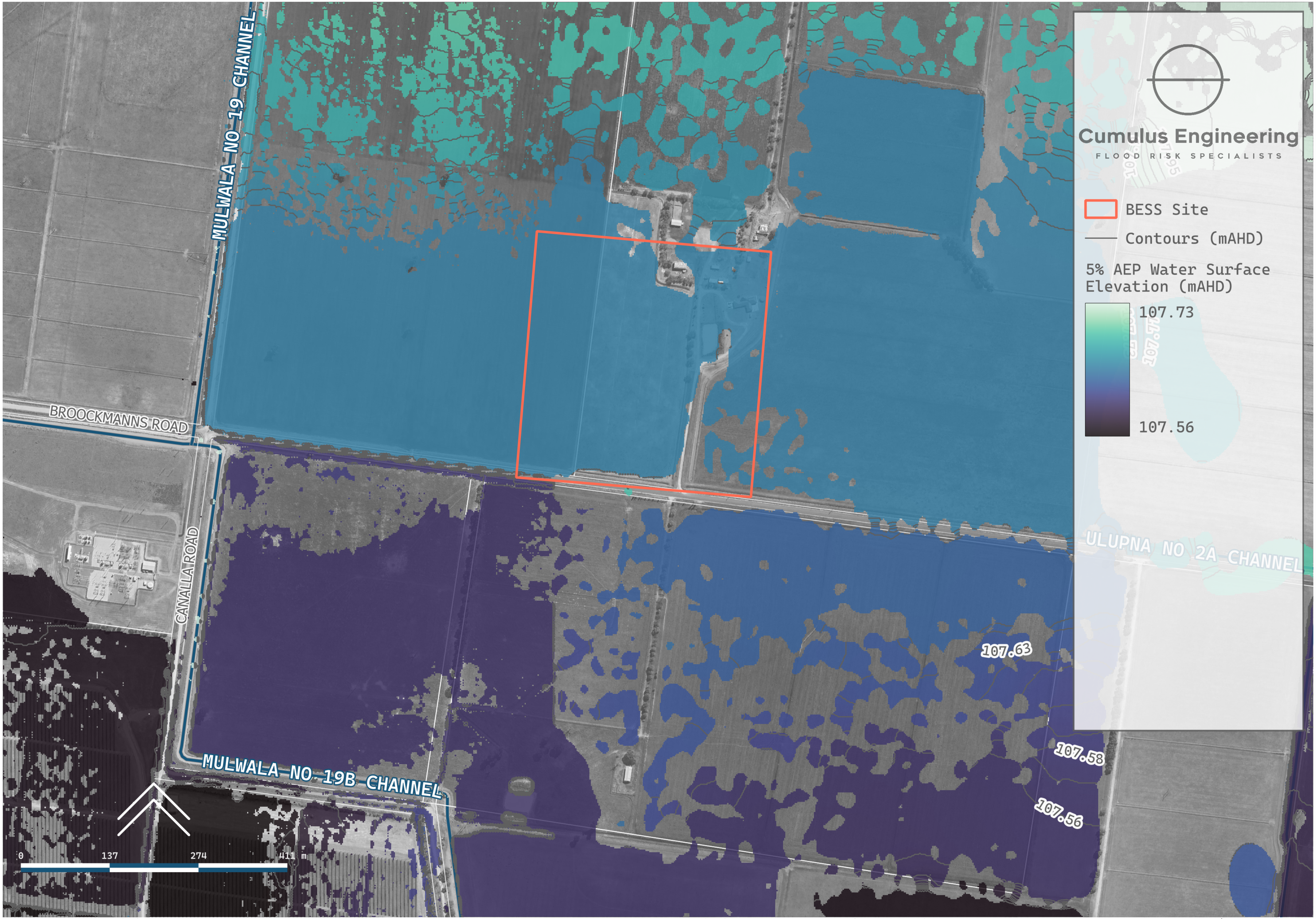


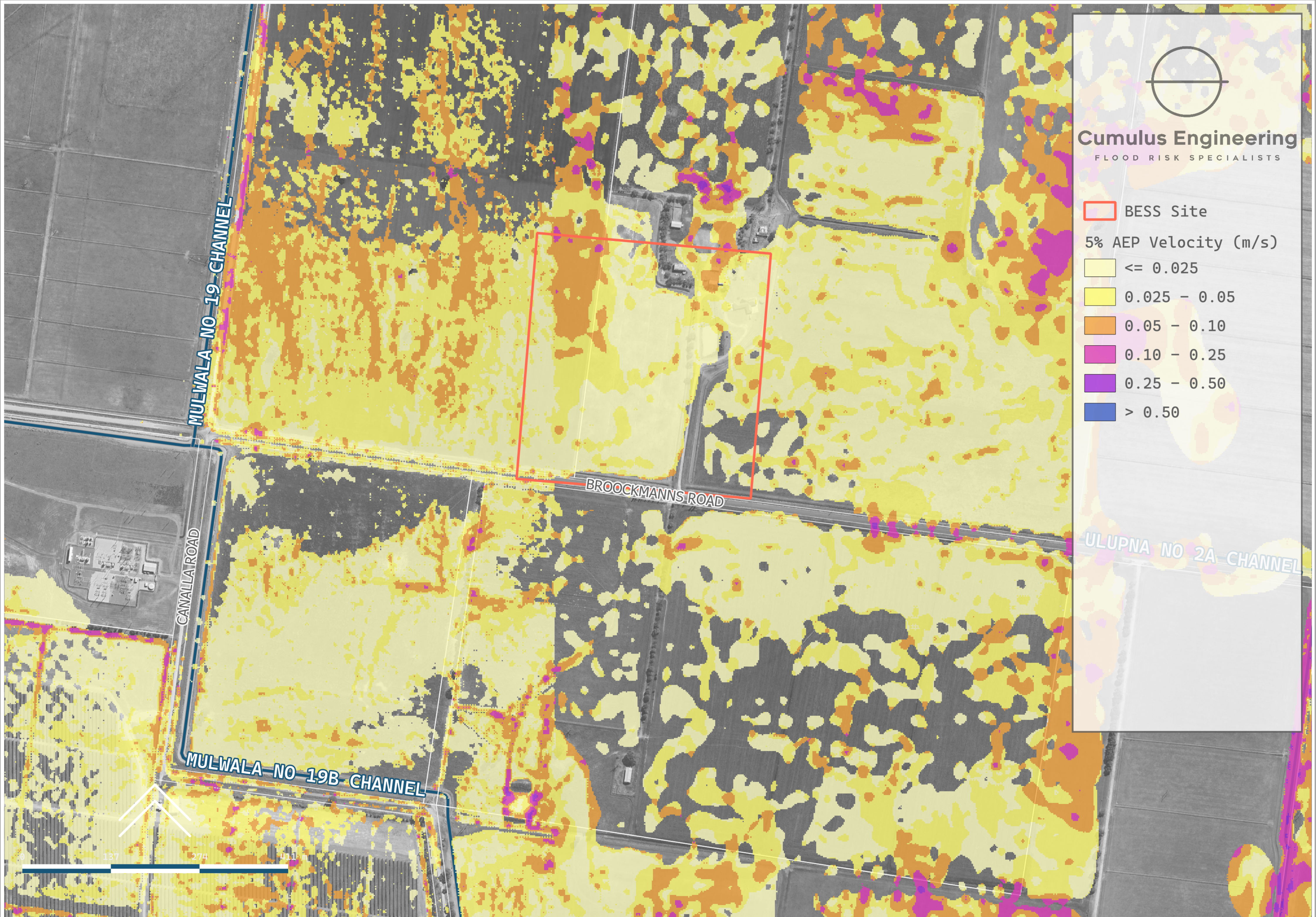
FIGURE A 2 DIGITAL ELEVATION MODEL – BESS DESIGN CONDITIONS

Appendix B. Flood Maps

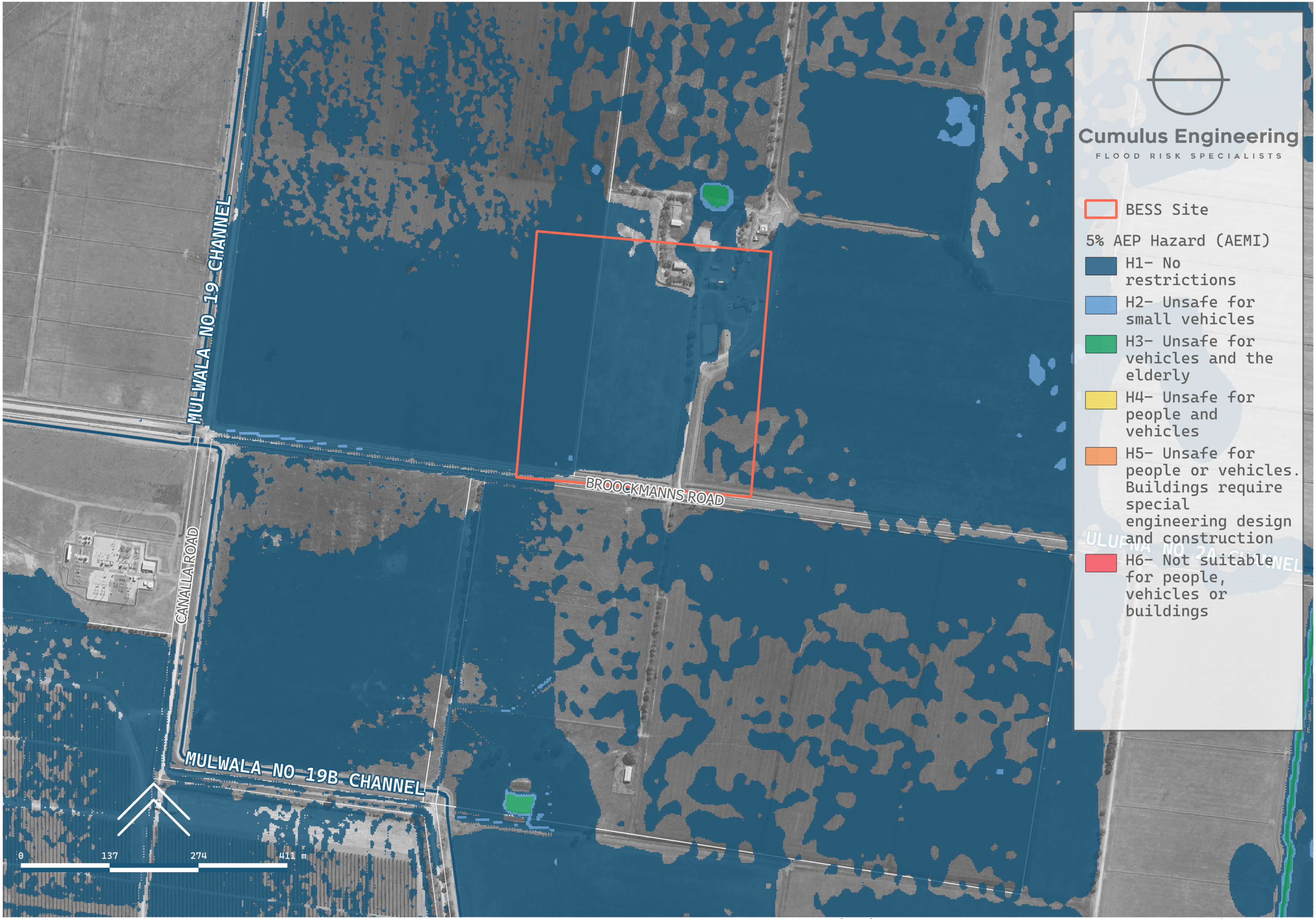


CLIENT: NGH Consulting | PROJECT: South Coree BESS FIA | DRAWING NAME: Existing 5% AEP Depth | Date: 2025-05-26 | GDA2020 / MGA zone 55

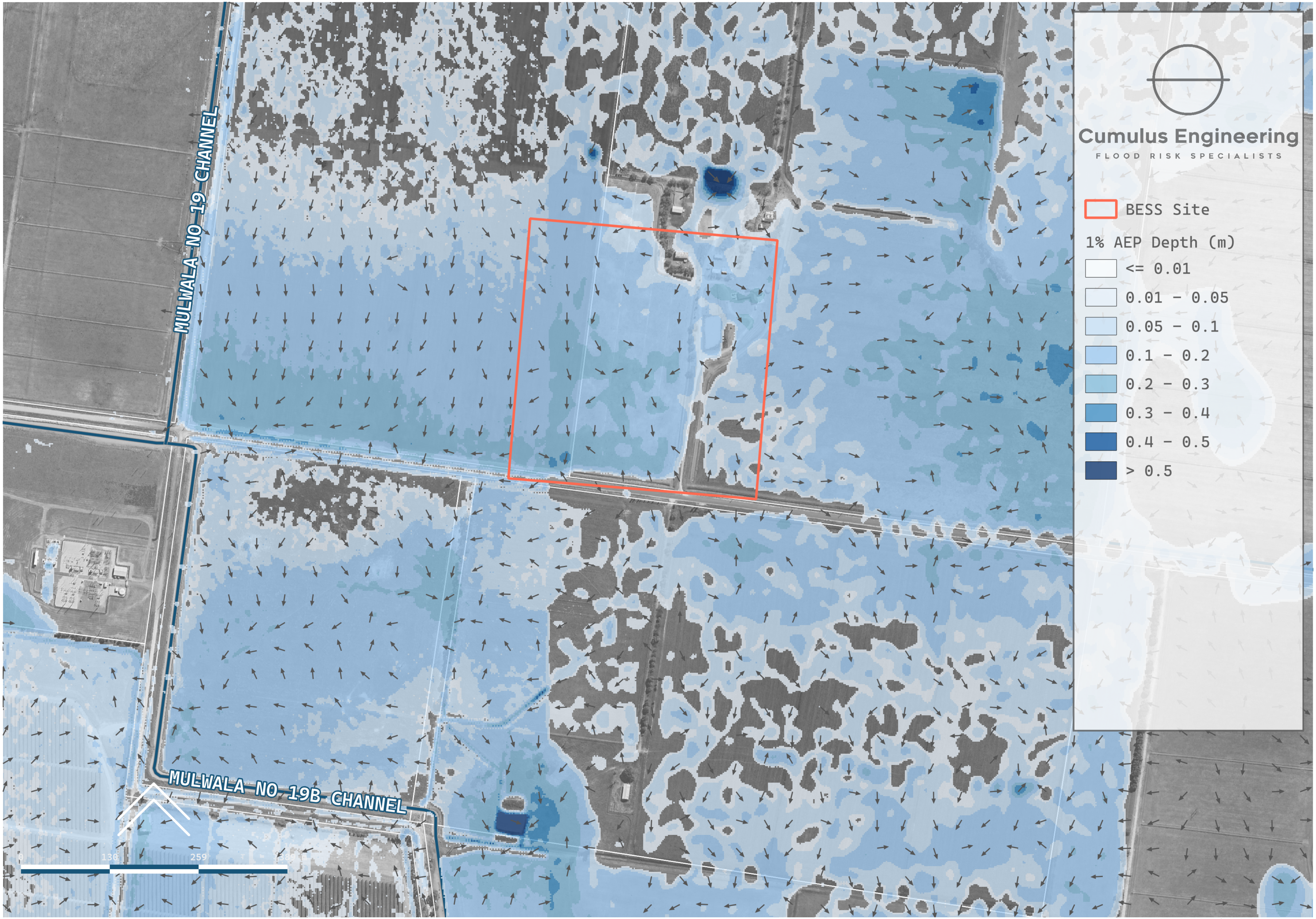

MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
ULUPNA NO 2A CHANNEL
MULWALA NO 19B CHANNEL
107.63
107.58
107.56
Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
Contours (mAHD)
5% AEP Water Surface Elevation (mAHD)
107.73
107.56
0
137
274
411 m



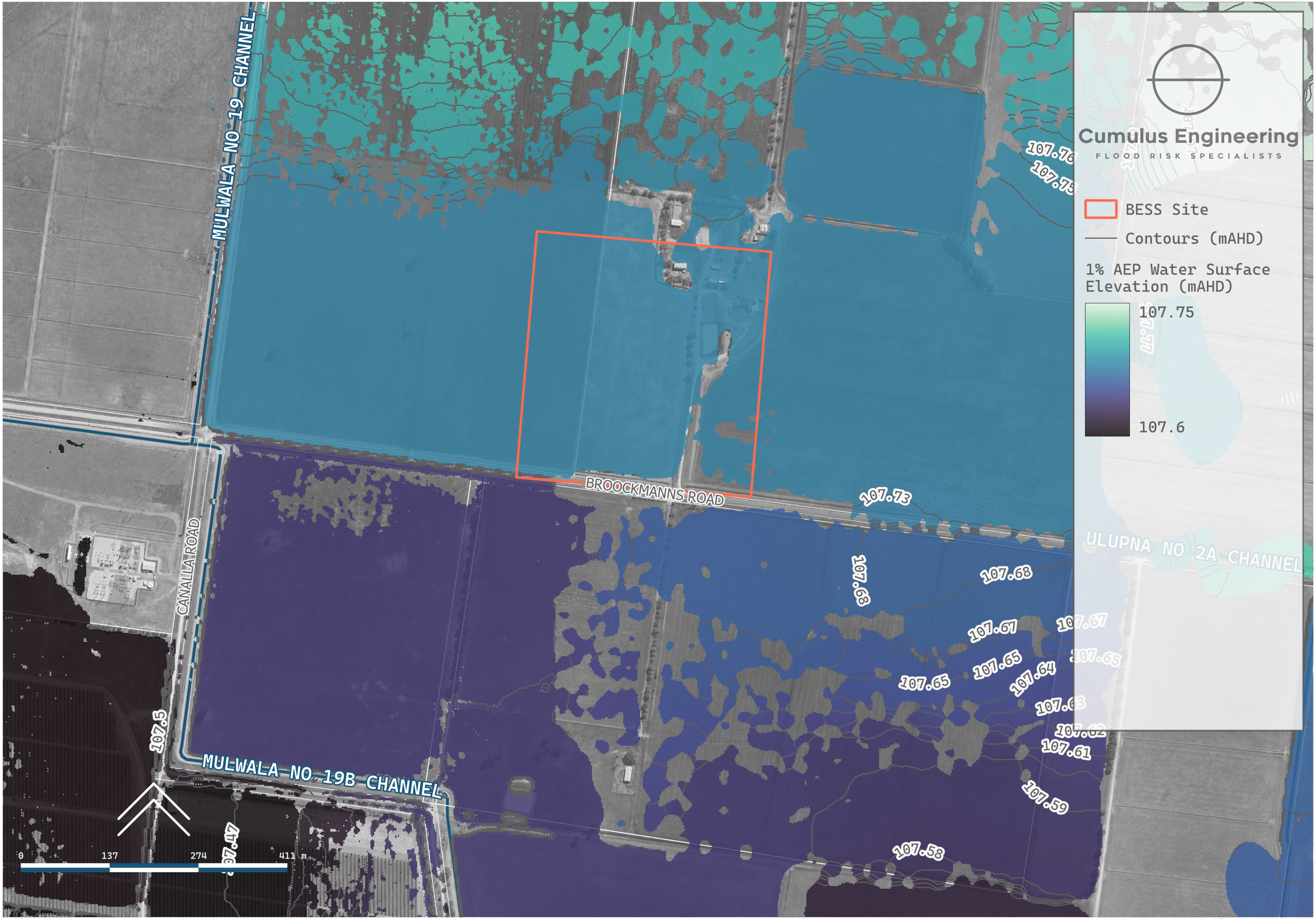
CLIENT: NGH Consulting PROJECT: South Coree BESS FIA DRAWING NAME: Existing 5% AEP Velocity Date: 2025-05-26 GDA2020 / MGA zone 55



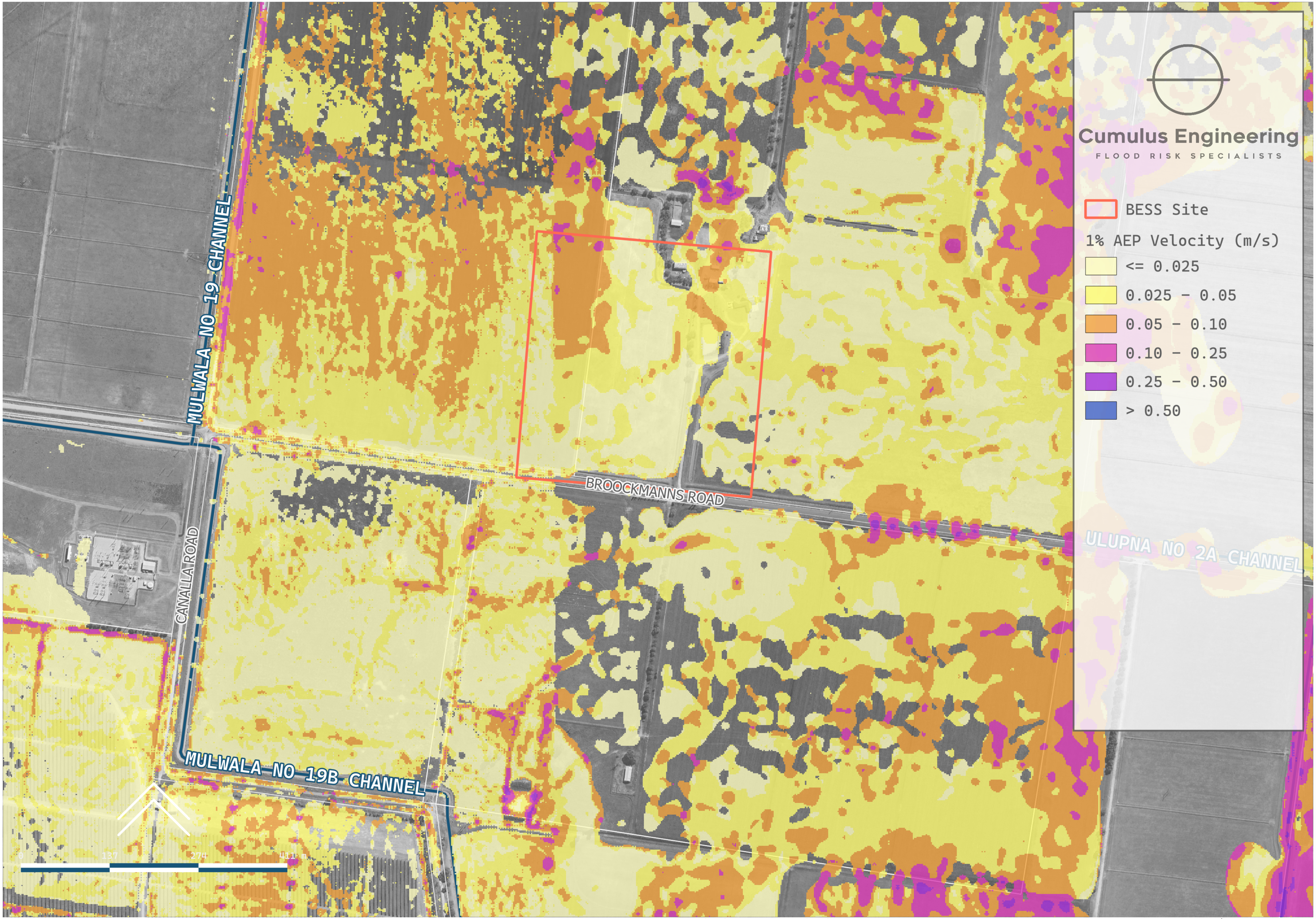
Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
5% AEP Hazard (AEMI)
H1- No restrictions
H2- Unsafe for small vehicles
H3- Unsafe for vehicles and the elderly
H4- Unsafe for people and vehicles
H5- Unsafe for people or vehicles. Buildings require special engineering design and construction
H6- Not suitable for people, vehicles or buildings
MULWALA NO 19 CHANNEL
MULWALA NO 19B CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
ULUPNA NO 2A CHANNEL
0
137
274
411 m

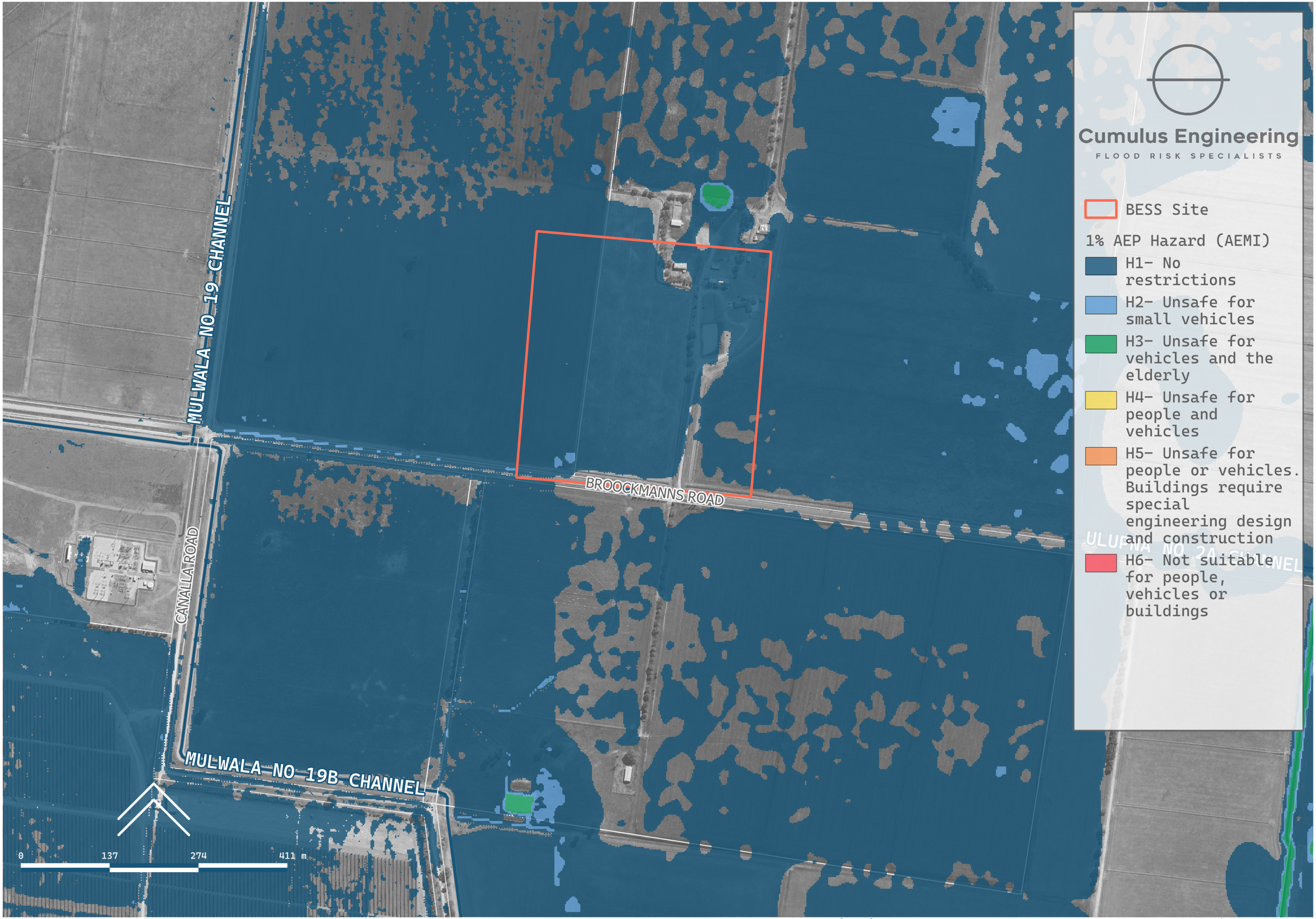


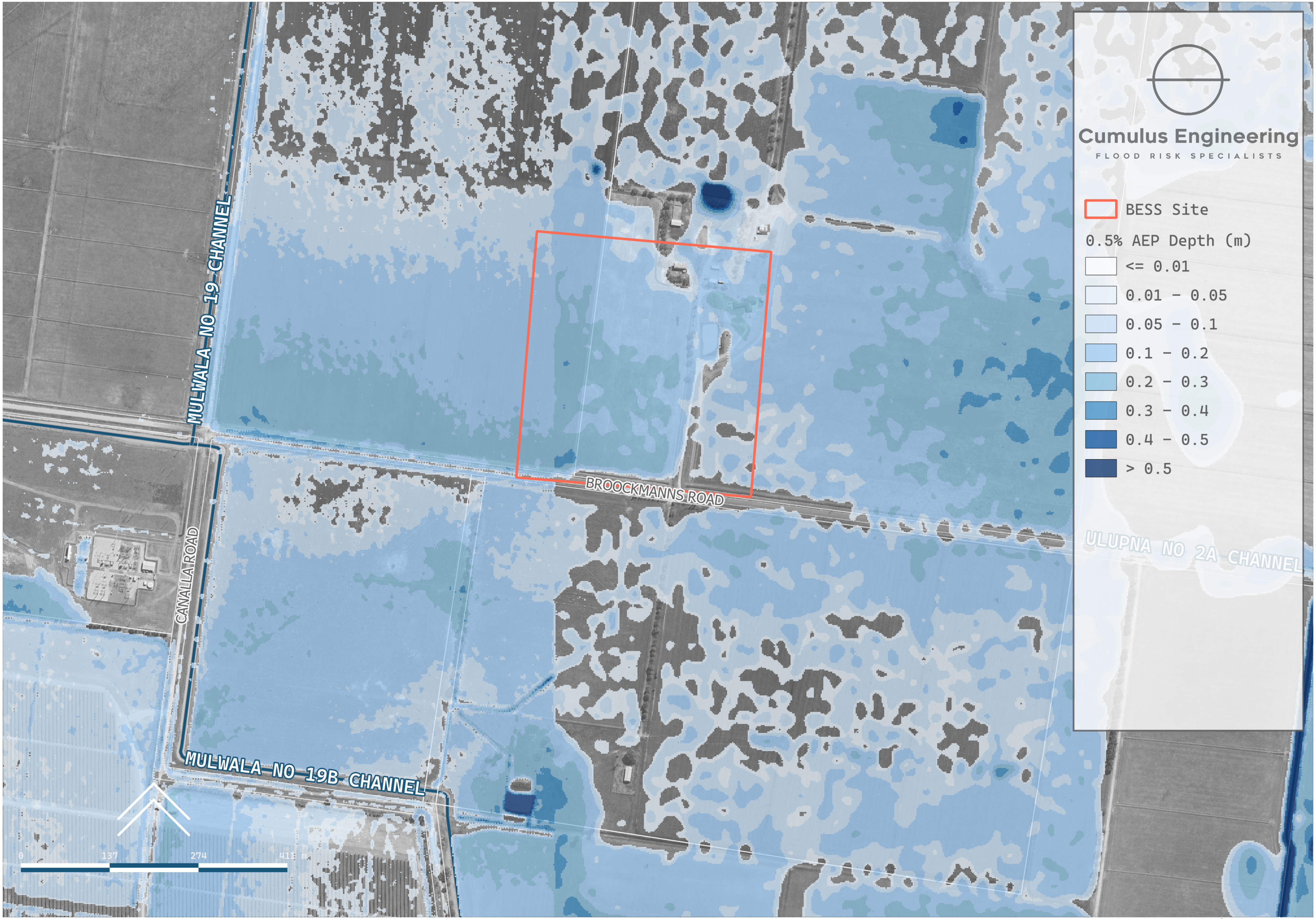
CLIENT: NGH Consulting | PROJECT: South Coree BESS FIA | DRAWING NAME: Existing 1% AEP Depth | Date: 2025-05-27 | GDA2020 / MGA zone 55

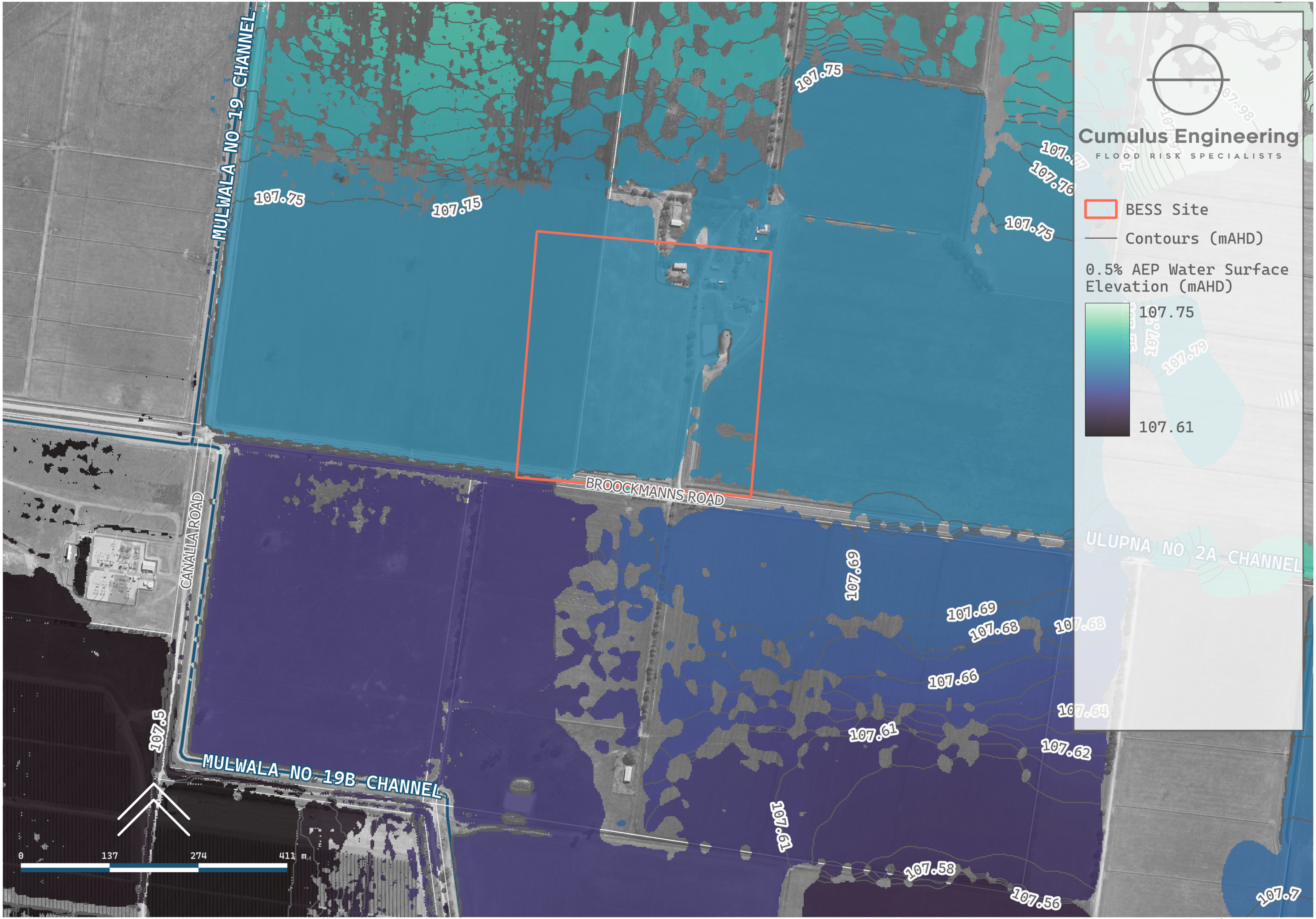


CLIENT: NGH Consulting PROJECT: South Coree BESS FIA DRAWING NAME: Existing 1% AEP Water Surface Elevation Date: 2025-05-26 GDA2020 / MGA zone 55

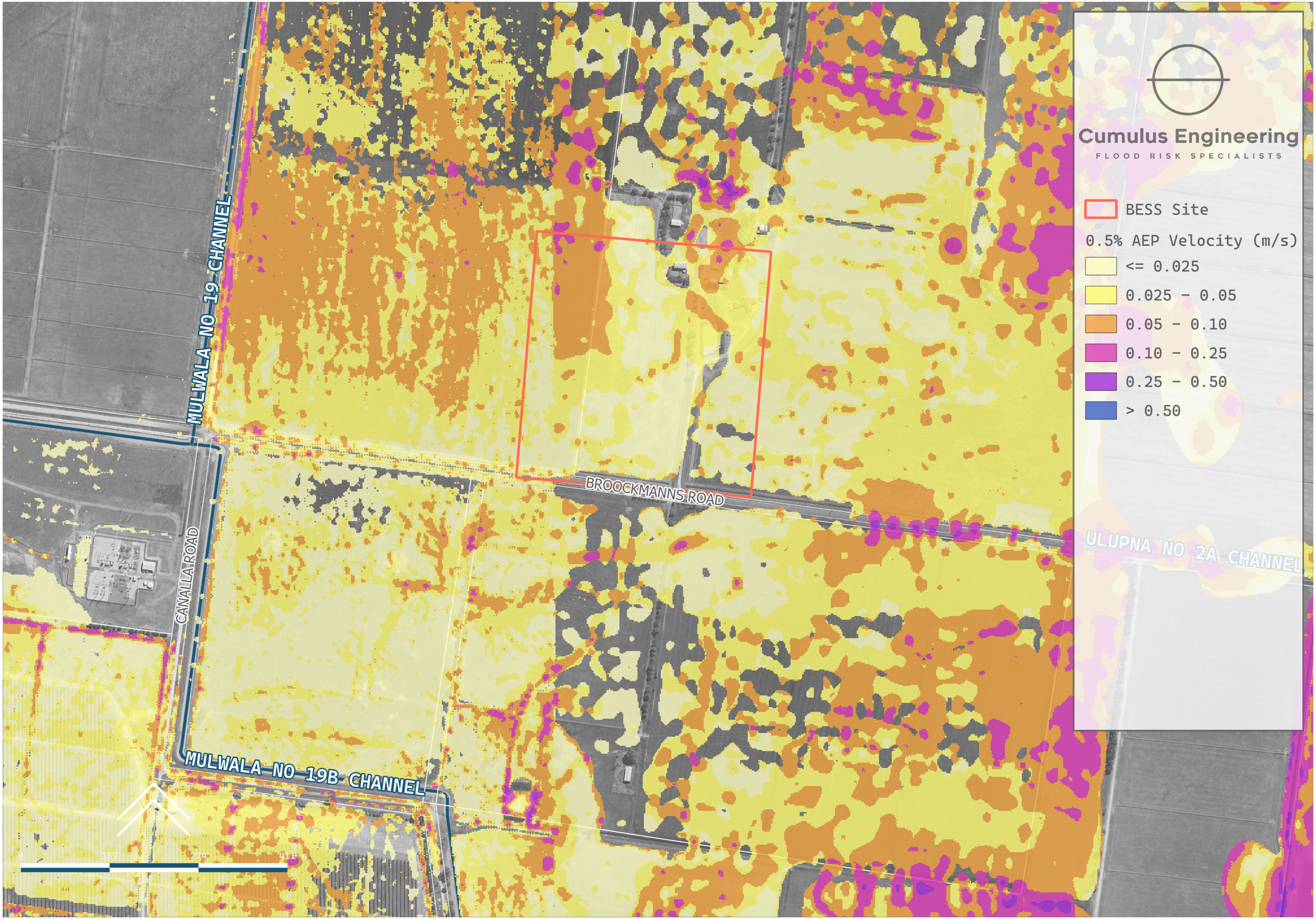

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
1% AEP Velocity (m/s)
<= 0.025
0.025 - 0.05
0.05 - 0.10
0.10 - 0.25
0.25 - 0.50
> 0.50
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
CANALLA ROAD
MULWALA NO 19B CHANNEL

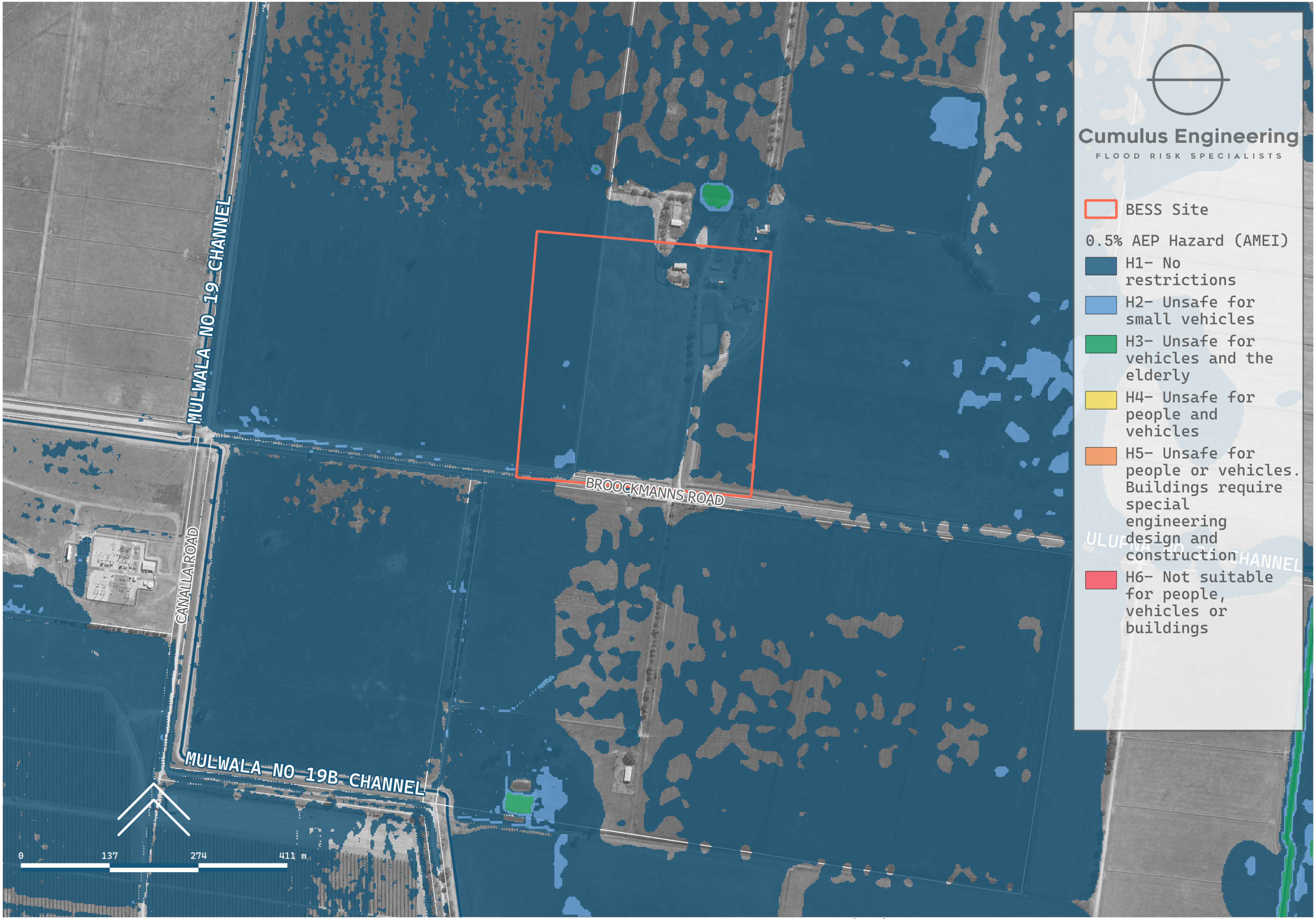

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
1% AEP Hazard (AEMI)
H1- No restrictions
H2- Unsafe for small vehicles
H3- Unsafe for vehicles and the elderly
H4- Unsafe for people and vehicles
H5- Unsafe for people or vehicles. Buildings require special engineering design and construction
H6- Not suitable for people, vehicles or buildings
MULWALA NO 19 CHANNEL
MULWALA NO 19B CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
0
137
274
411 m

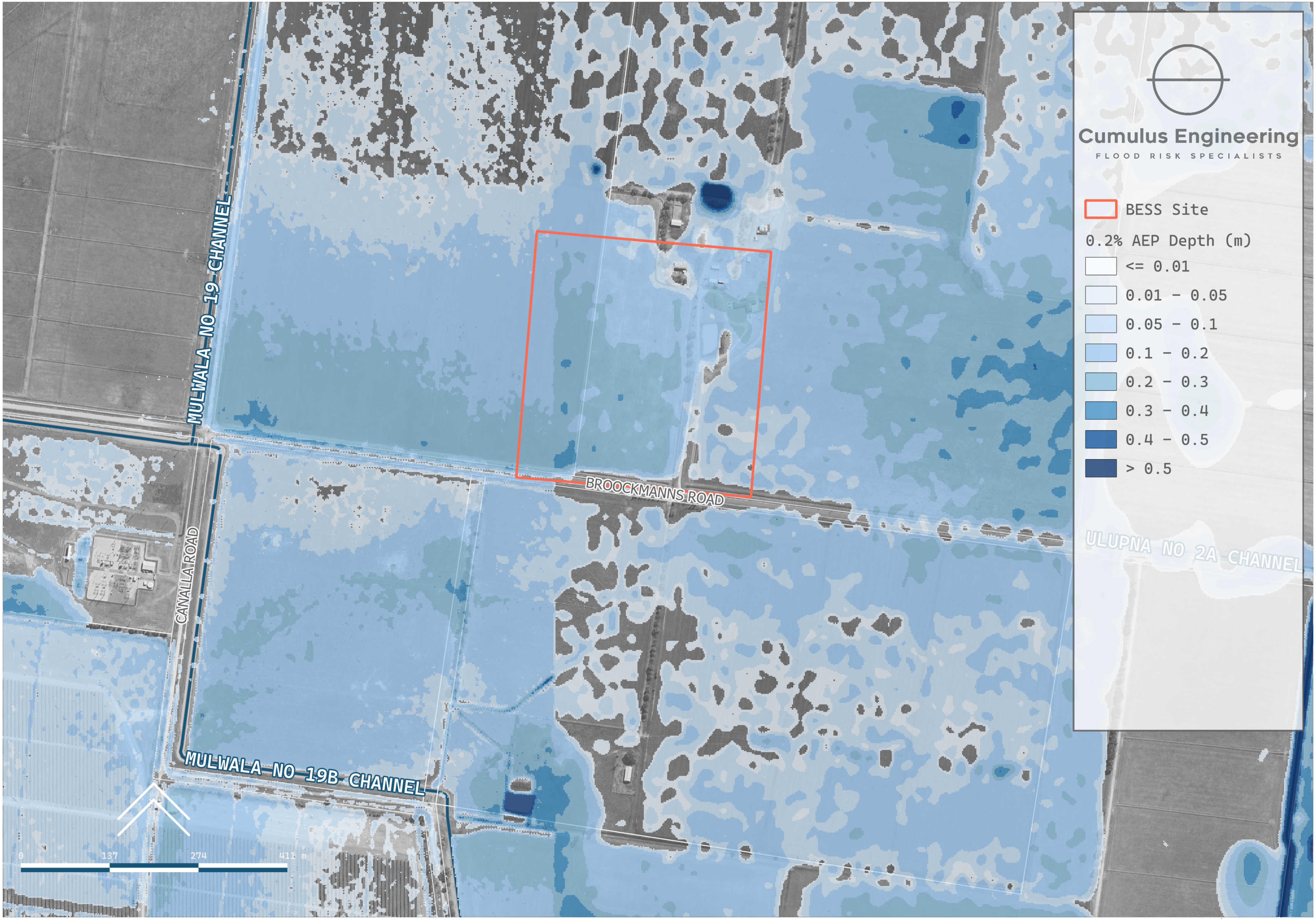

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
0.5% AEP Depth (m)
<= 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
> 0.5
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
CANALLA ROAD
MULWALA NO 19B CHANNEL
0
137
274
411 m

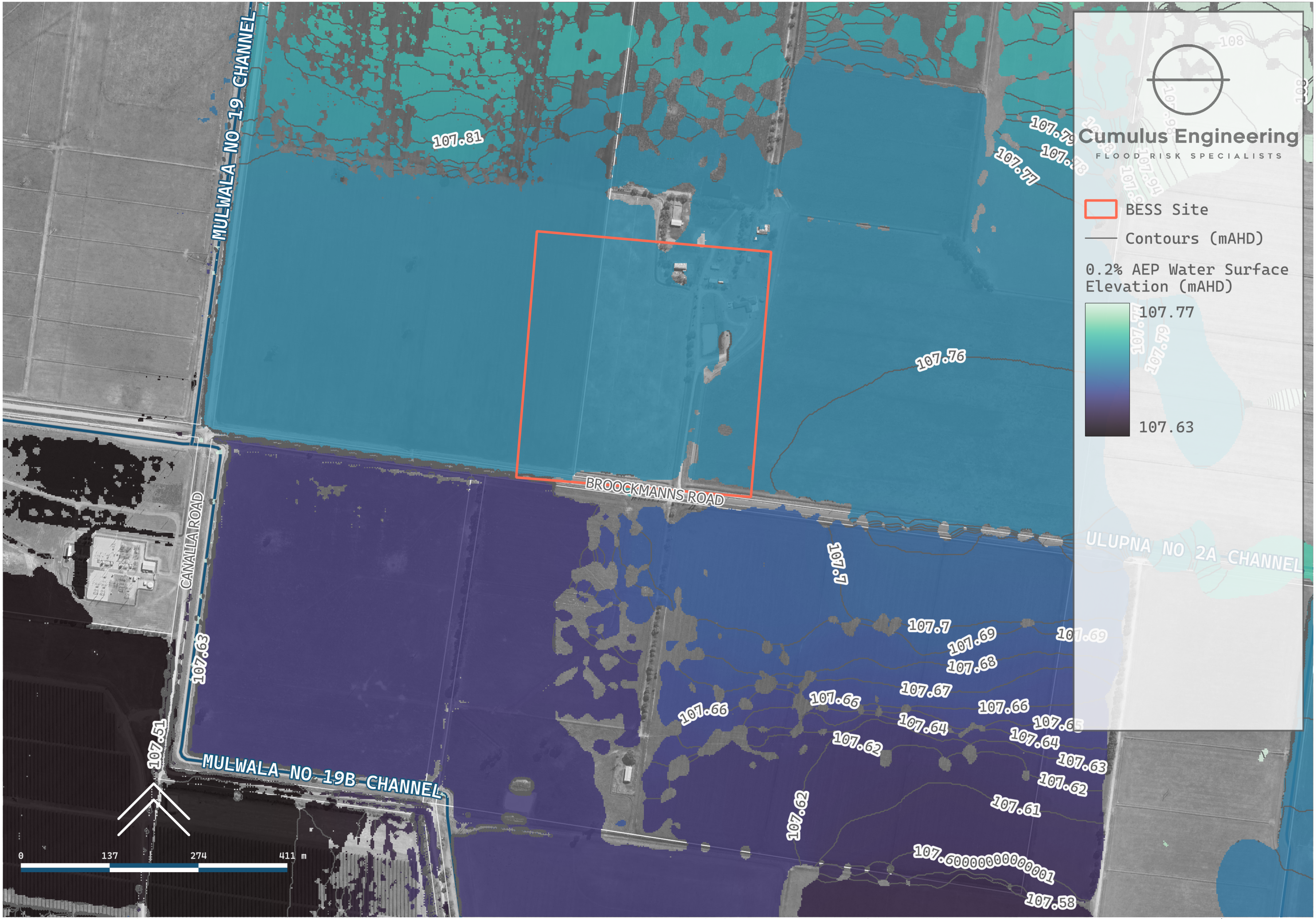


Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
Contours (mAHD)
0.5% AEP Water Surface Elevation (mAHD)
107.75
107.61
MULWALA NO 19 CHANNEL
MULWALA NO 19B CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
ULUPNA NO 2A CHANNEL
107.75
107.76
107.69
107.68
107.66
107.64
107.62
107.61
107.58
107.56
107.5
107.7
0
137
274
411 m

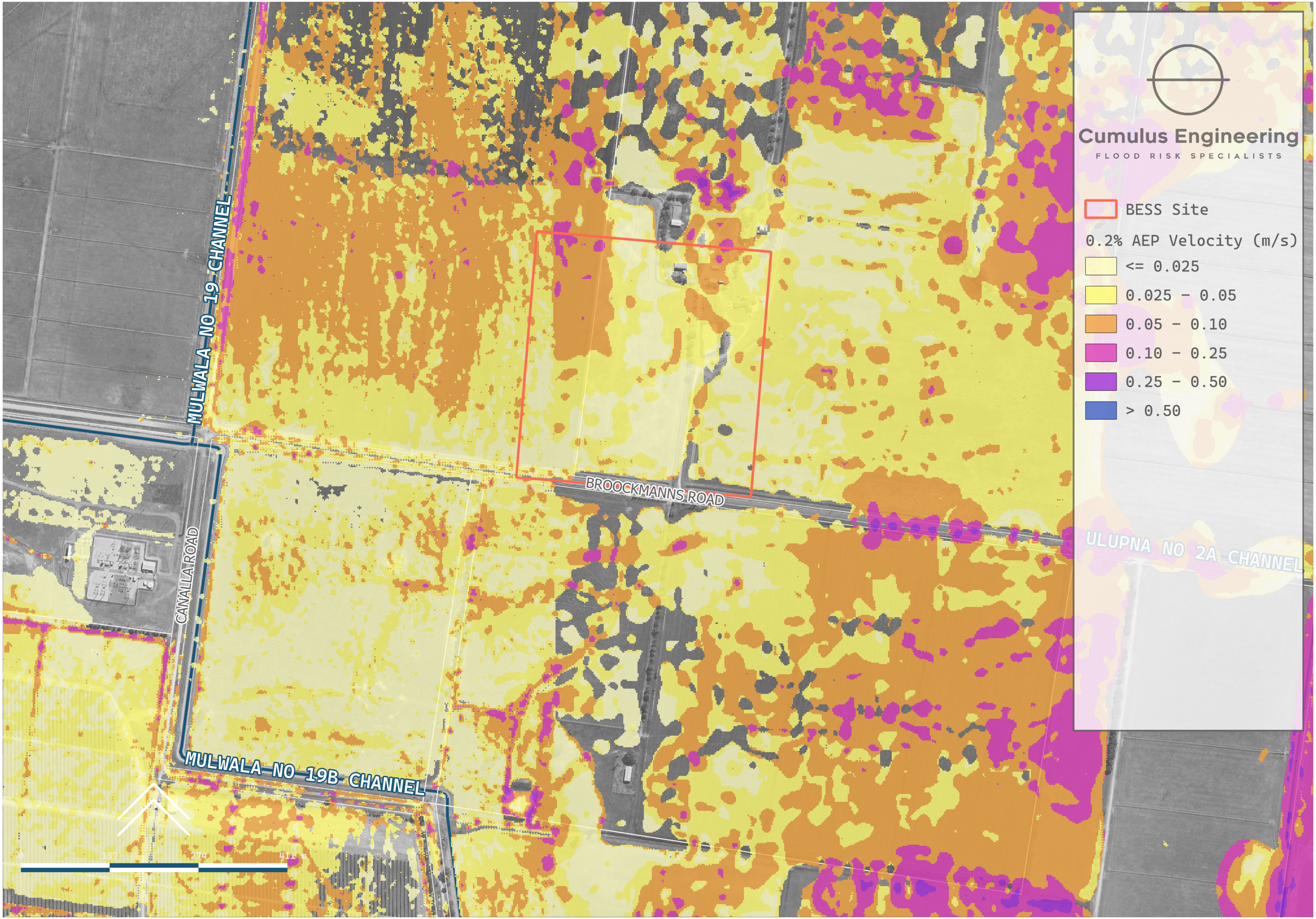

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
0.5% AEP Velocity (m/s)
<= 0.025
0.025 - 0.05
0.05 - 0.10
0.10 - 0.25
0.25 - 0.50
> 0.50
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
CANALLA ROAD
MULWALA NO 19B CHANNEL
0
137
274
411 m


Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
0.5% AEP Hazard (AMEI)
H1- No restrictions
H2- Unsafe for small vehicles
H3- Unsafe for vehicles and the elderly
H4- Unsafe for people and vehicles
H5- Unsafe for people or vehicles. Buildings require special engineering design and construction
H6- Not suitable for people, vehicles or buildings
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
MULWALA NO 19B CHANNEL
0
137
274
411 m

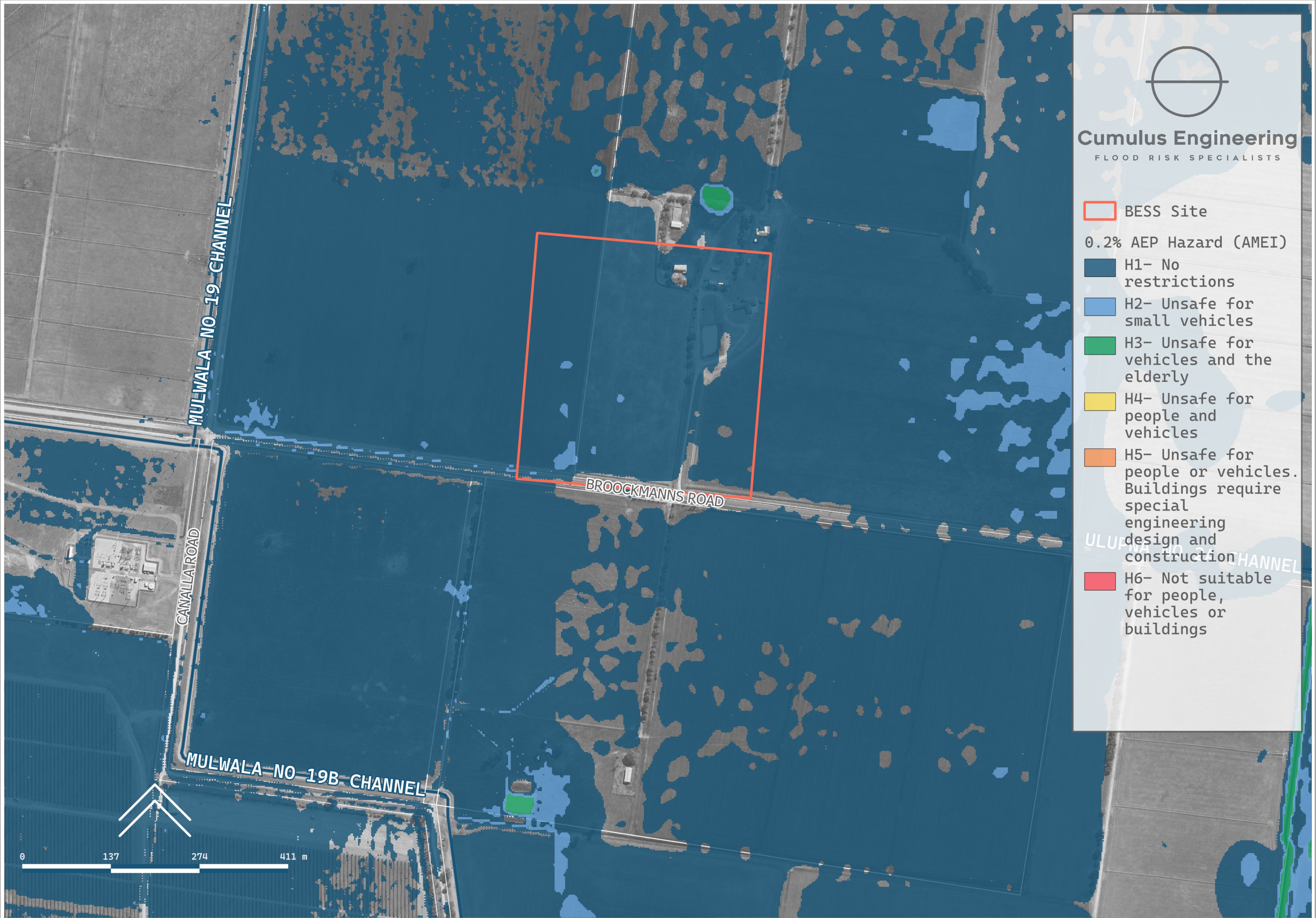

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
0.2% AEP Depth (m)
<= 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
> 0.5
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
CANALLA ROAD
MULWALA NO 19B CHANNEL
0
137
274
411 m

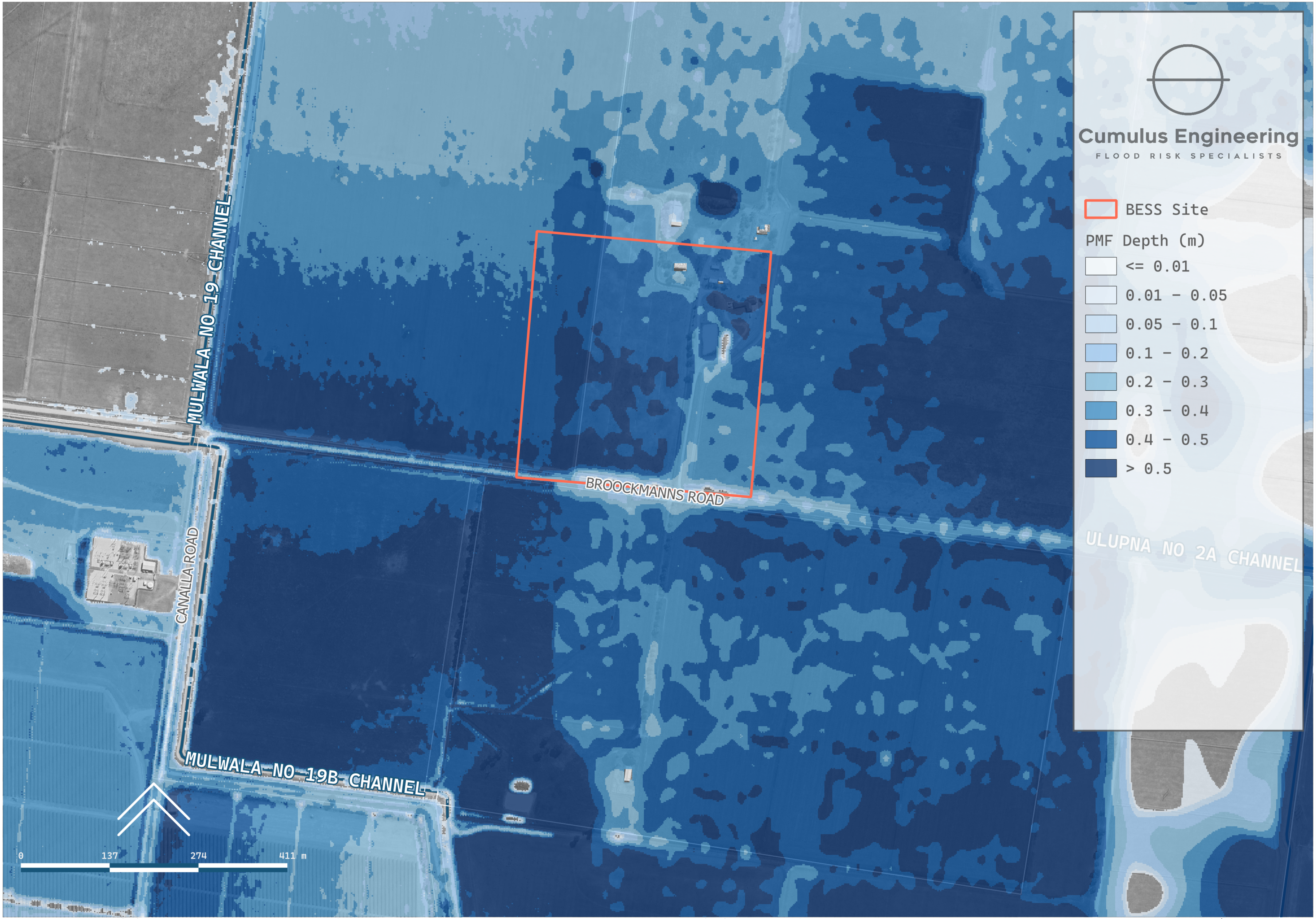


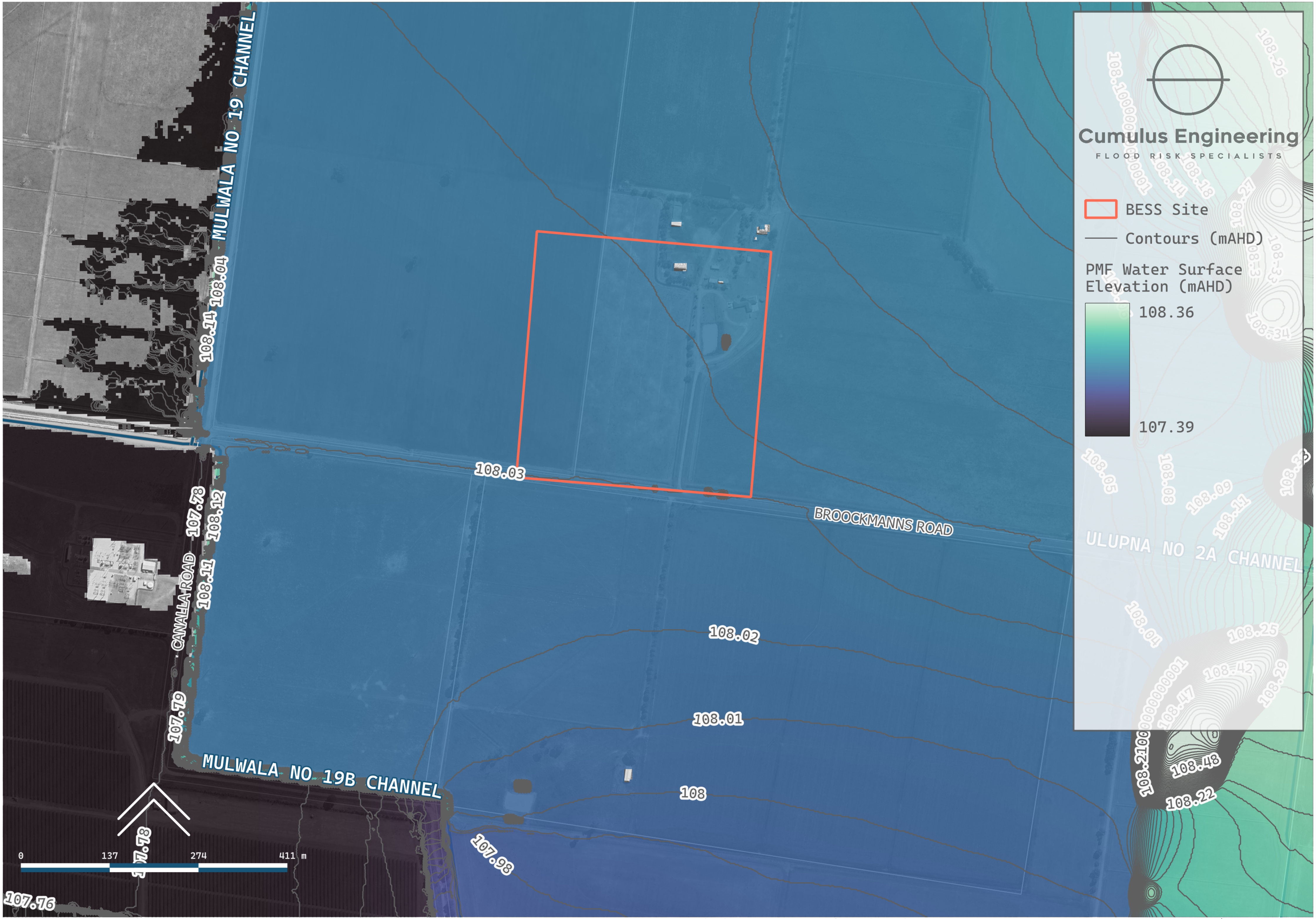
CLIENT: NGH Consulting PROJECT: South Coree BESS FIA DRAWING NAME: Existing 0.2% AEP Water Surface Elevation Date: 2025-05-26 GDA2020 / MGA zone 55

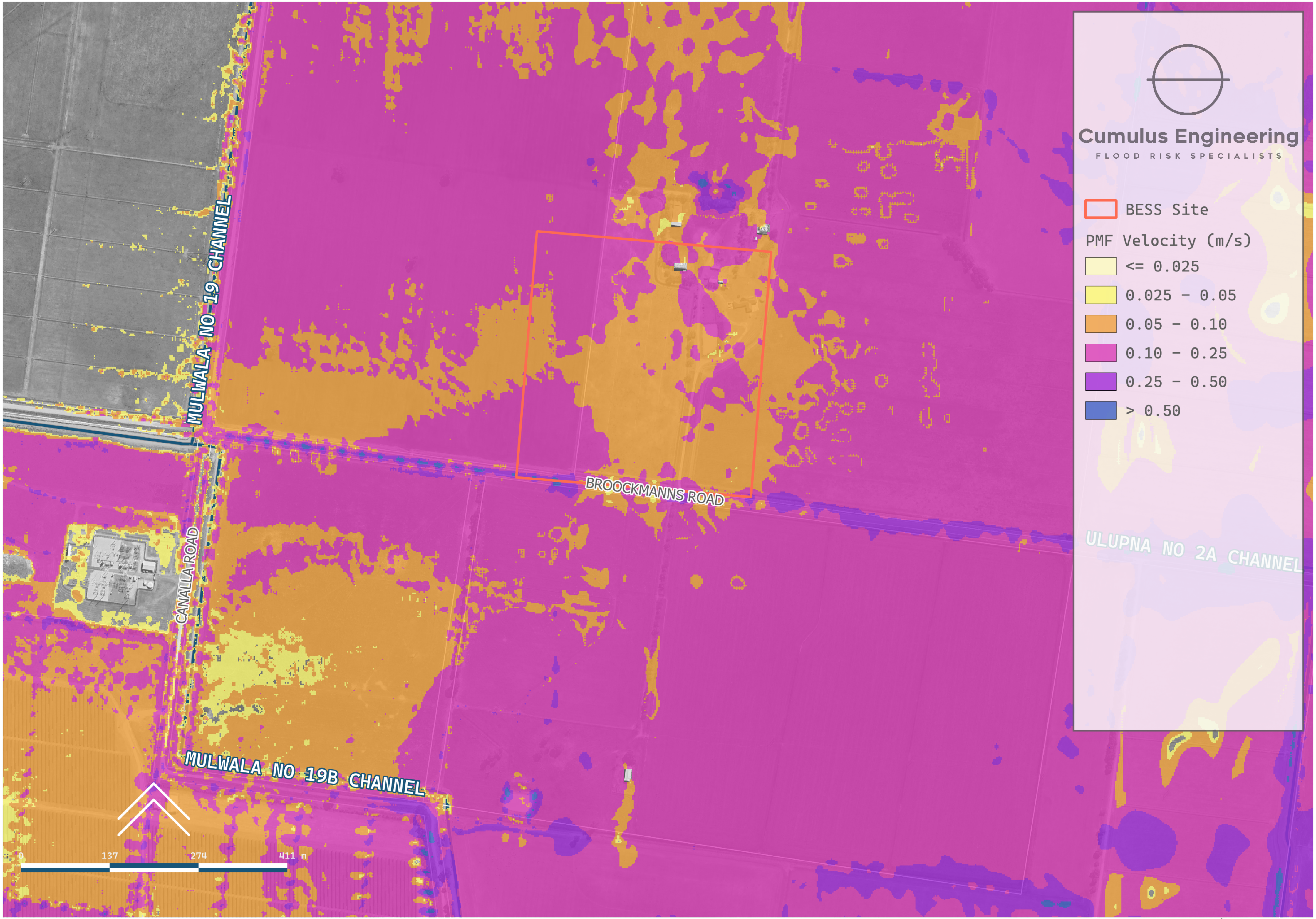


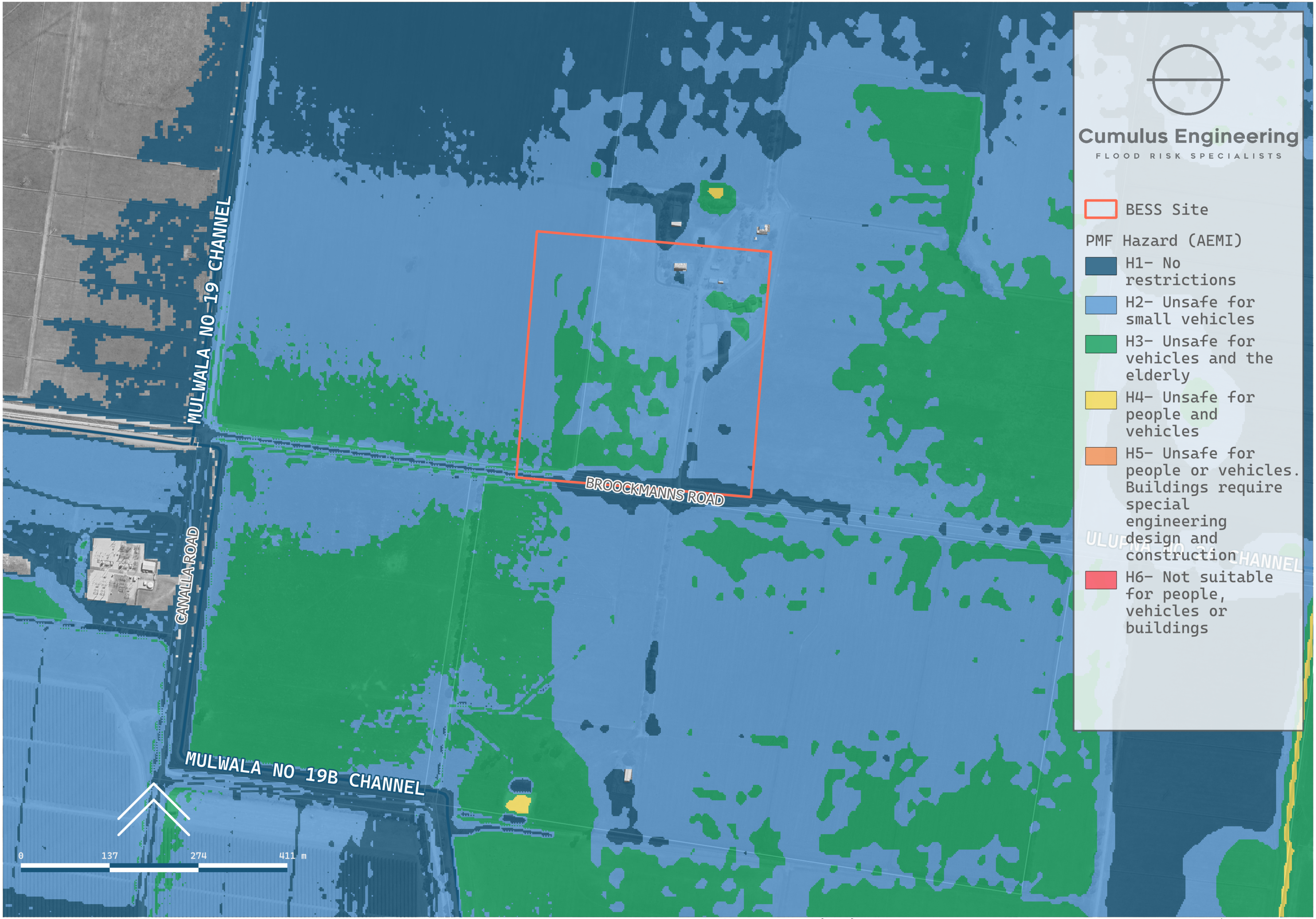
Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
0.2% AEP Velocity (m/s)
<= 0.025
0.025 - 0.05
0.05 - 0.10
0.10 - 0.25
0.25 - 0.50
> 0.50
MULWALA NO 19 CHANNEL
BROCKMANNS ROAD
ULUPNA NO 2A CHANNEL
CANALLA ROAD
MULWALA NO 19B CHANNEL
0
137
274
411 m


Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
0.2% AEP Hazard (AMEI)
H1- No restrictions
H2- Unsafe for small vehicles
H3- Unsafe for vehicles and the elderly
H4- Unsafe for people and vehicles
H5- Unsafe for people or vehicles. Buildings require special engineering design and construction
H6- Not suitable for people, vehicles or buildings
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
MULWALA NO 19B CHANNEL
0
137
274
411 m

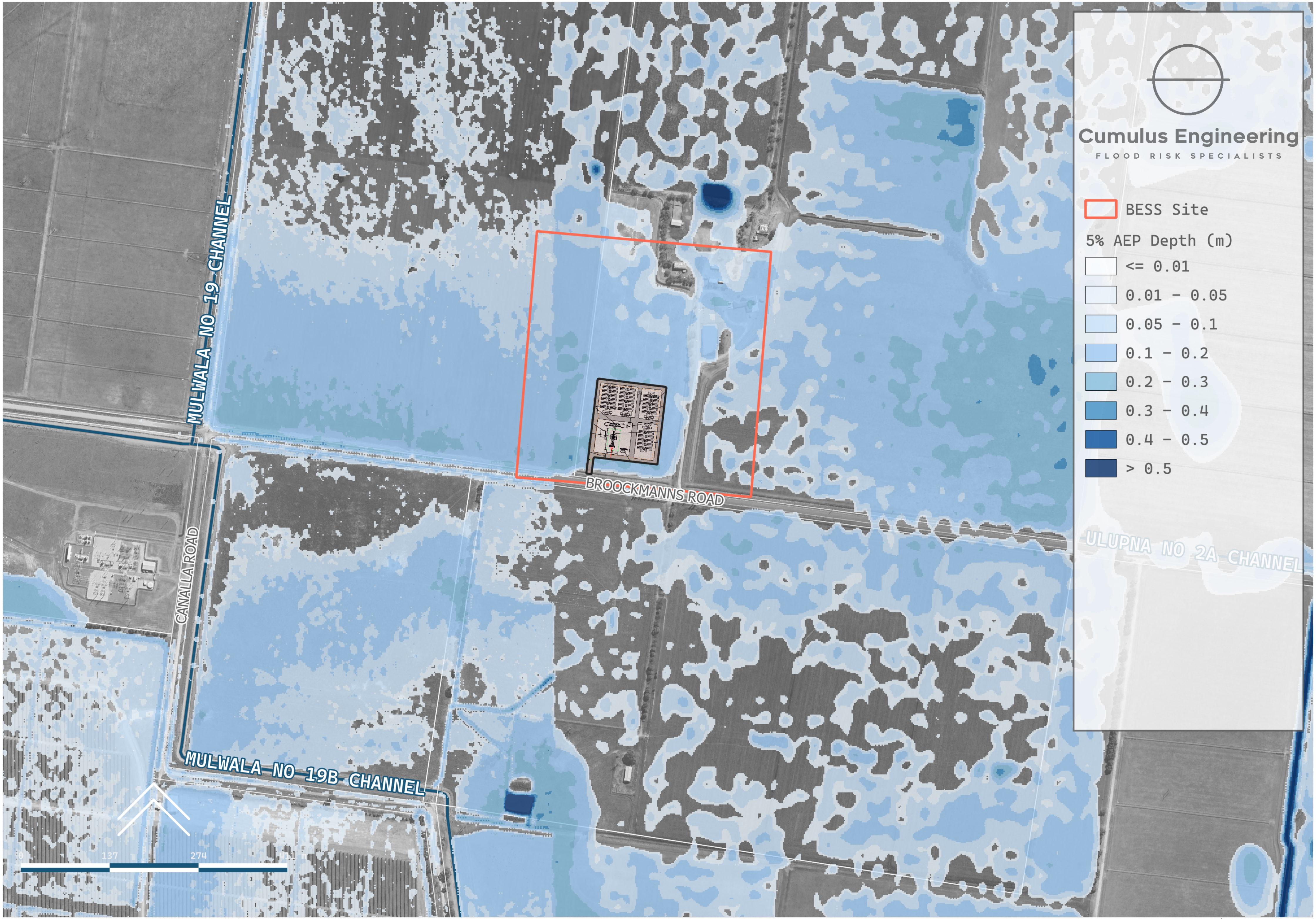

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
PMF Depth (m)
<= 0.01
0.01 – 0.05
0.05 – 0.1
0.1 – 0.2
0.2 – 0.3
0.3 – 0.4
0.4 – 0.5
> 0.5
MULWALA NO 19 CHANNEL
BROCKMANNS ROAD
CANALLA ROAD
ULUPNA NO 2A CHANNEL
MULWALA NO 19B CHANNEL
0
137
274
411 m

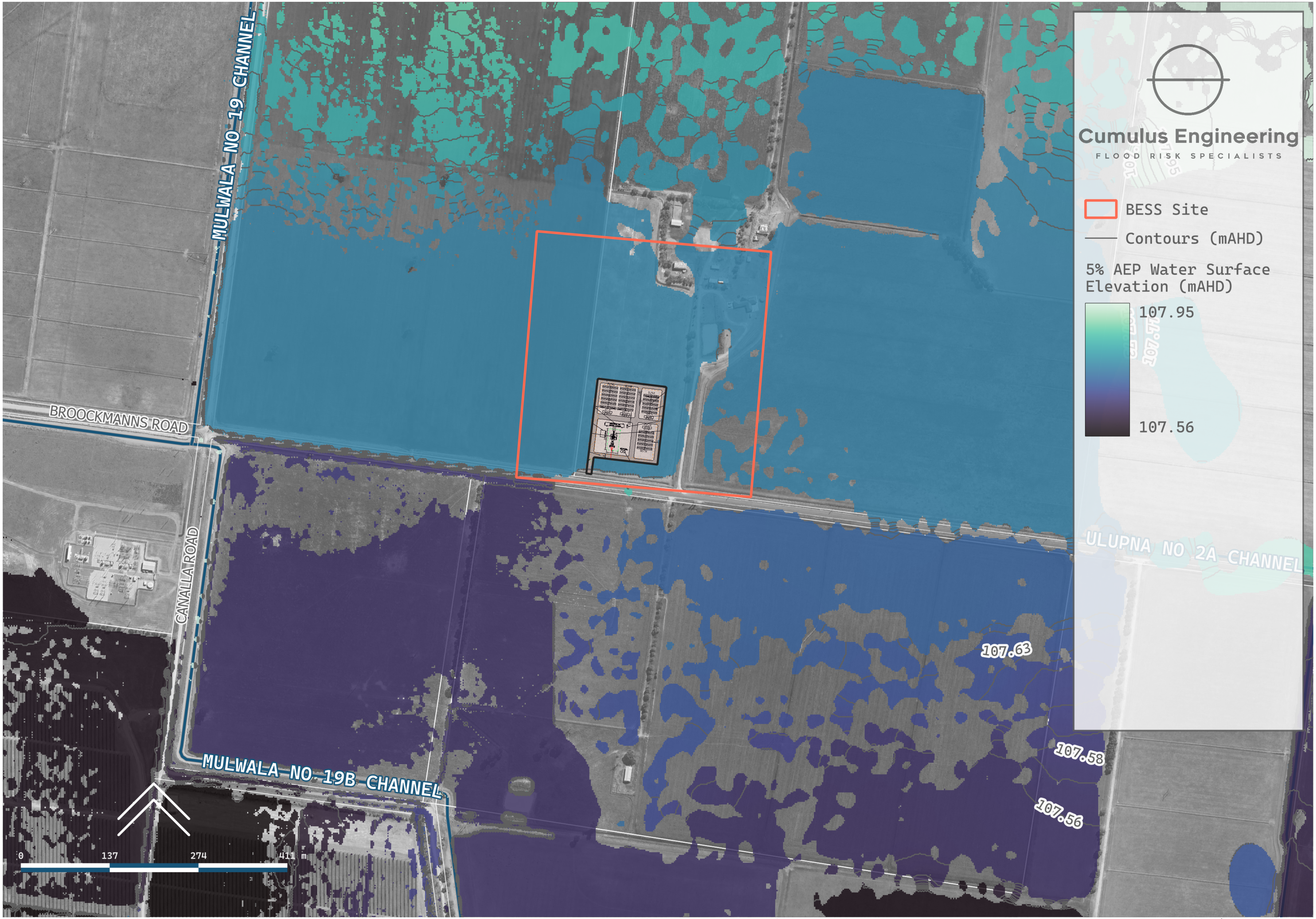

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
Contours (mAHD)
PMF Water Surface
Elevation (mAHD)
108.36
107.39
MULWALA NO 19 CHANNEL
108.04
108.14
108.03
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
107.78
108.12
CANALLA ROAD
108.11
107.79
MULWALA NO 19B CHANNEL
108.02
108.01
108
107.98
107.76
108.48
108.22
0
137
274
411 m

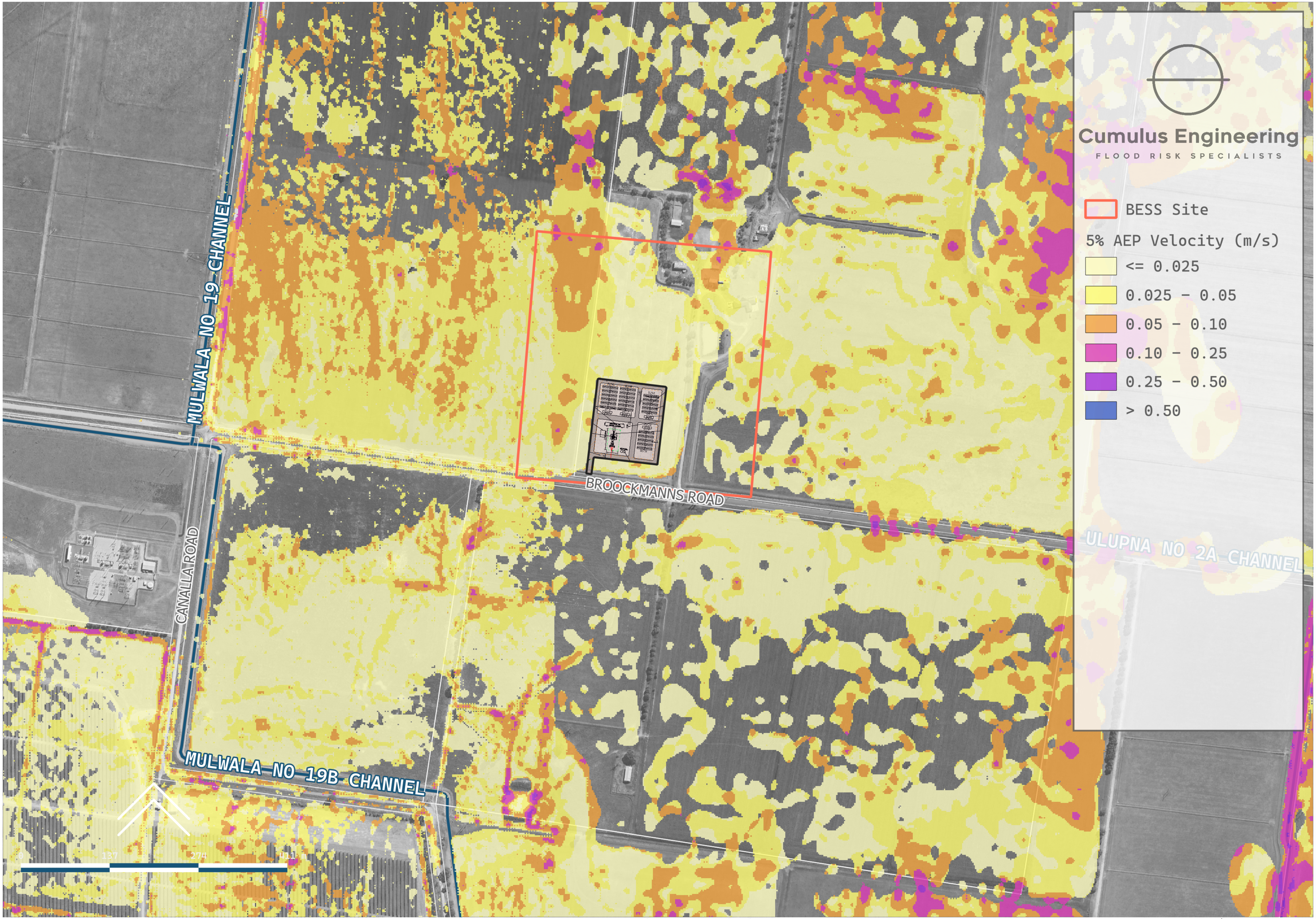

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
PMF Velocity (m/s)
<= 0.025
0.025 - 0.05
0.05 - 0.10
0.10 - 0.25
0.25 - 0.50
> 0.50
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
CANALLA ROAD
MULWALA NO 19B CHANNEL
0
137
274
411 m

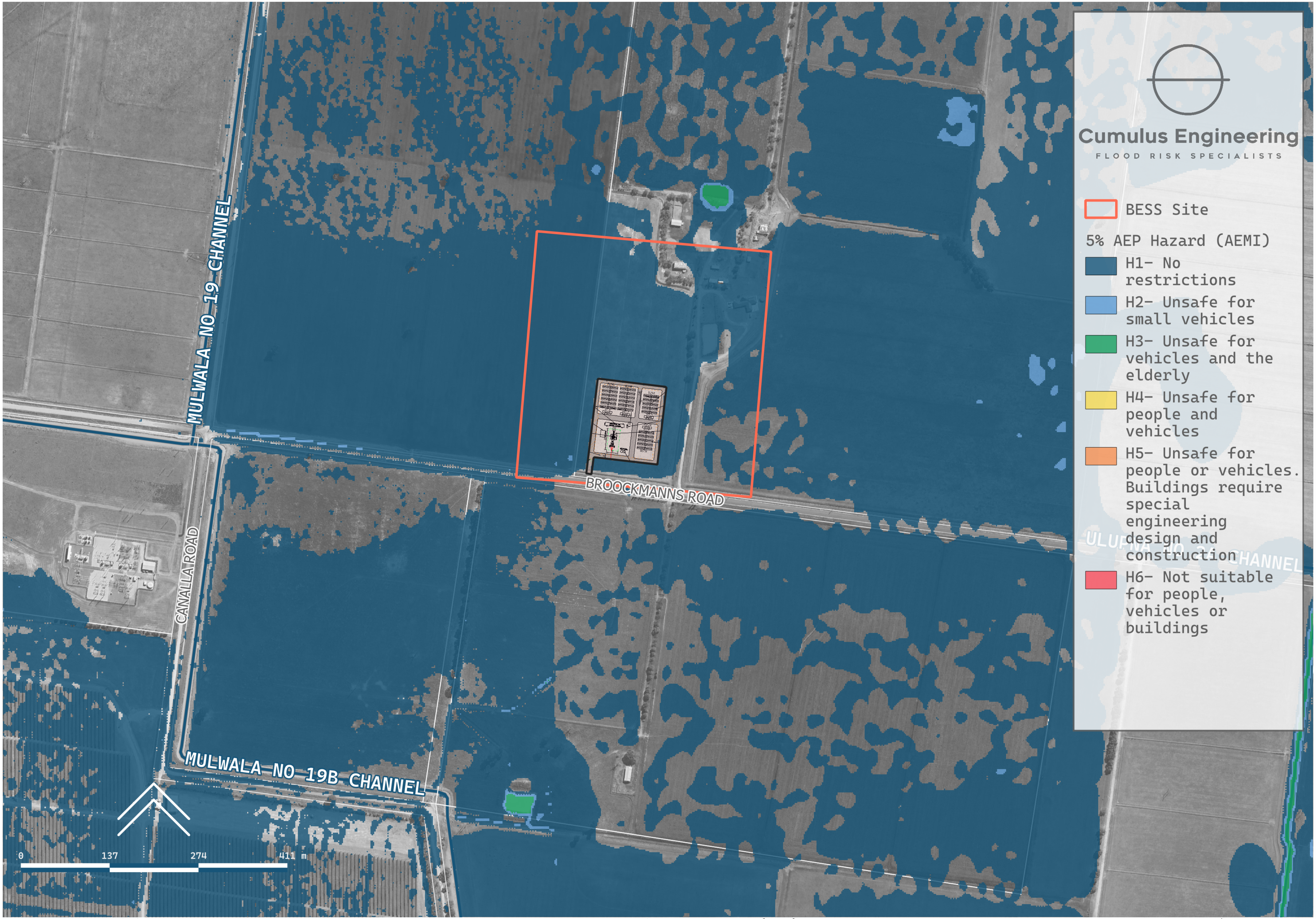


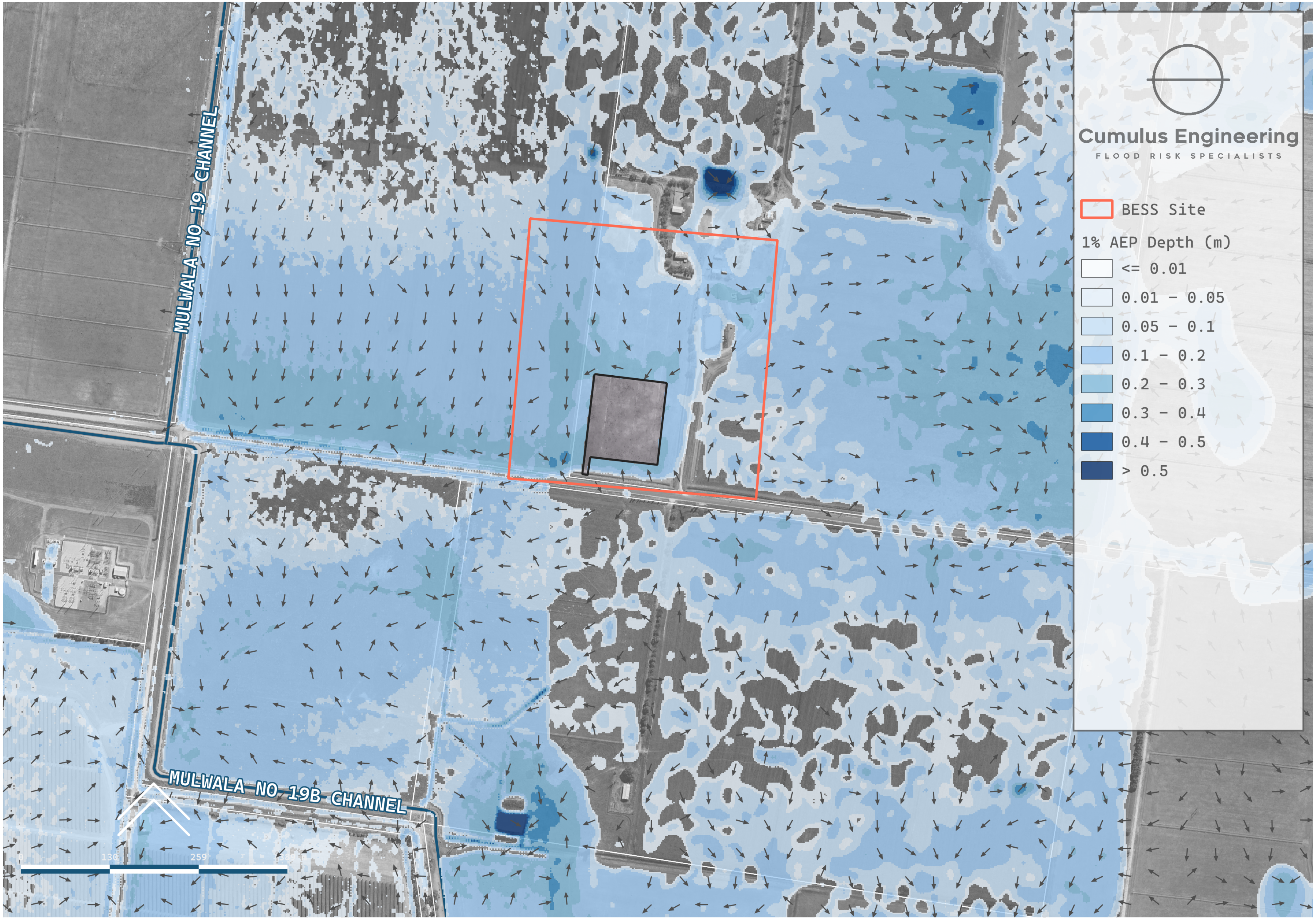
CLIENT: NGH Consulting PROJECT: South Coree BESS FIA DRAWING NAME: Existing PMF Hazard (AEMI) Date: 2025-05-26 GDA2020 / MGA zone 55


Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
5% AEP Depth (m)
<= 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
> 0.5
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
CANALLA ROAD
MULWALA NO 19B CHANNEL
137
274

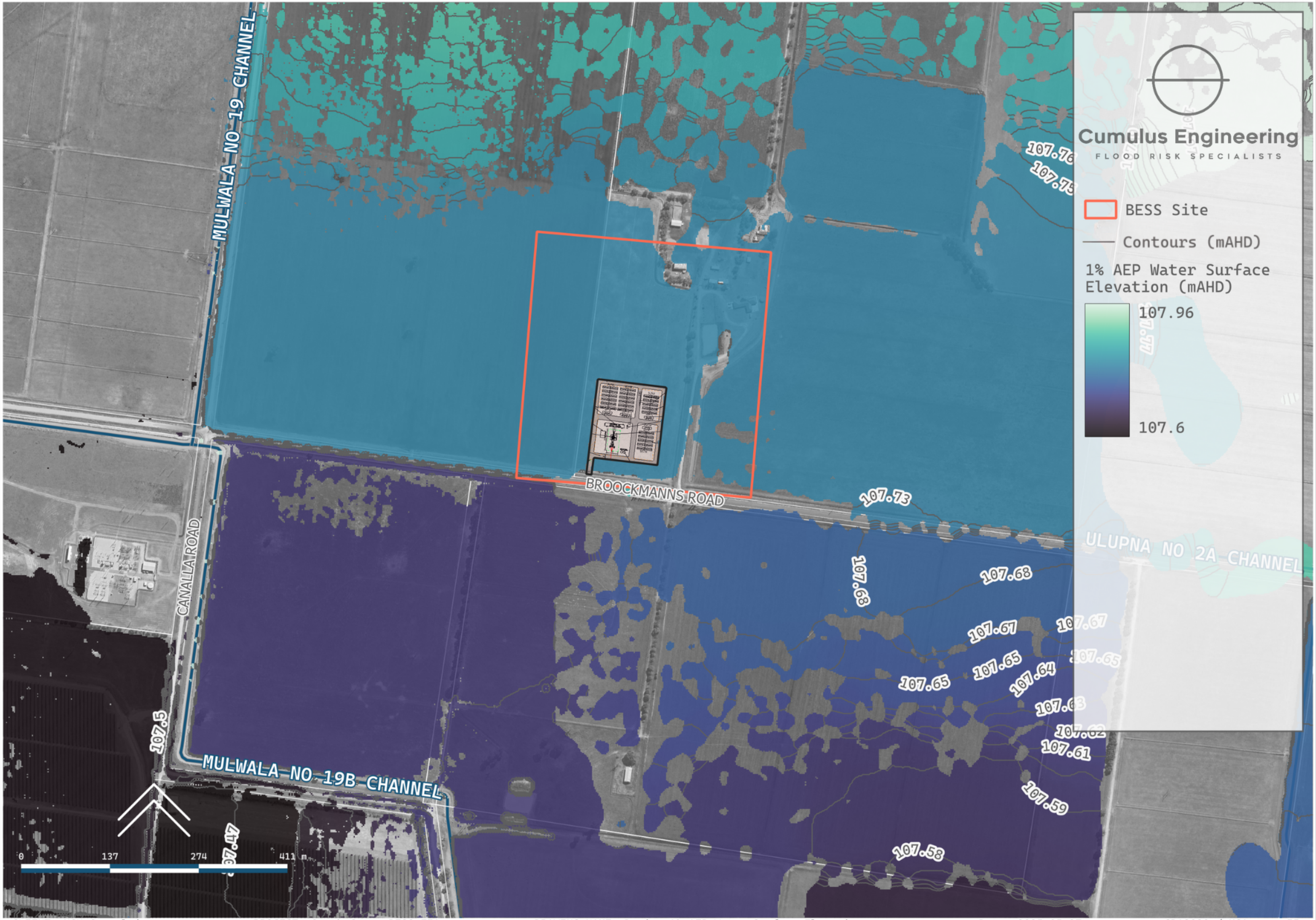

MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
ULUPNA NO 2A CHANNEL
MULWALA NO 19B CHANNEL
107.63
107.58
107.56
Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
Contours (mAHD)
5% AEP Water Surface Elevation (mAHD)
107.95
107.56
0
137
274
411 m

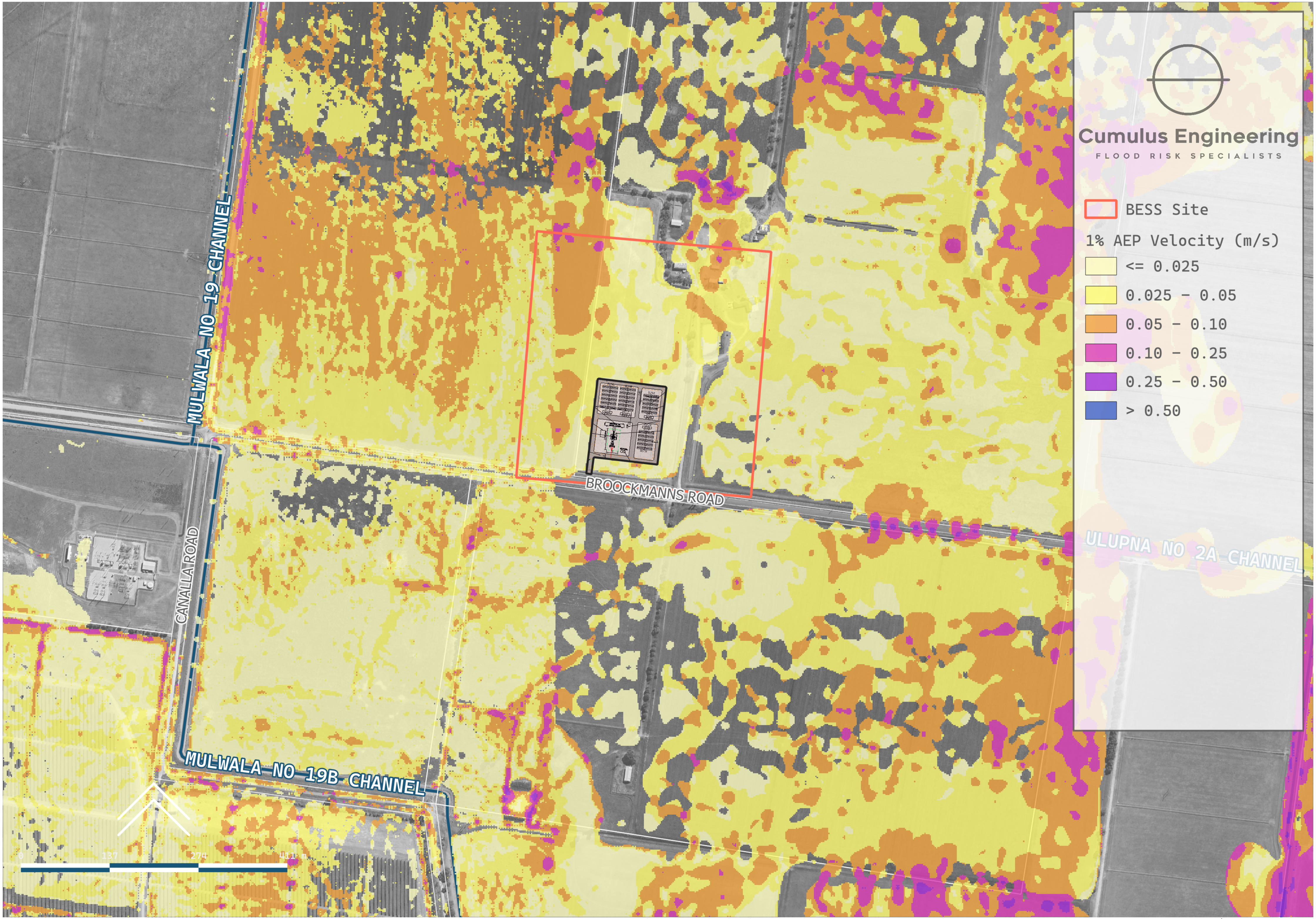

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
5% AEP Velocity (m/s)
<= 0.025
0.025 - 0.05
0.05 - 0.10
0.10 - 0.25
0.25 - 0.50
> 0.50
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
CANALLA ROAD
MULWALA NO 19B CHANNEL

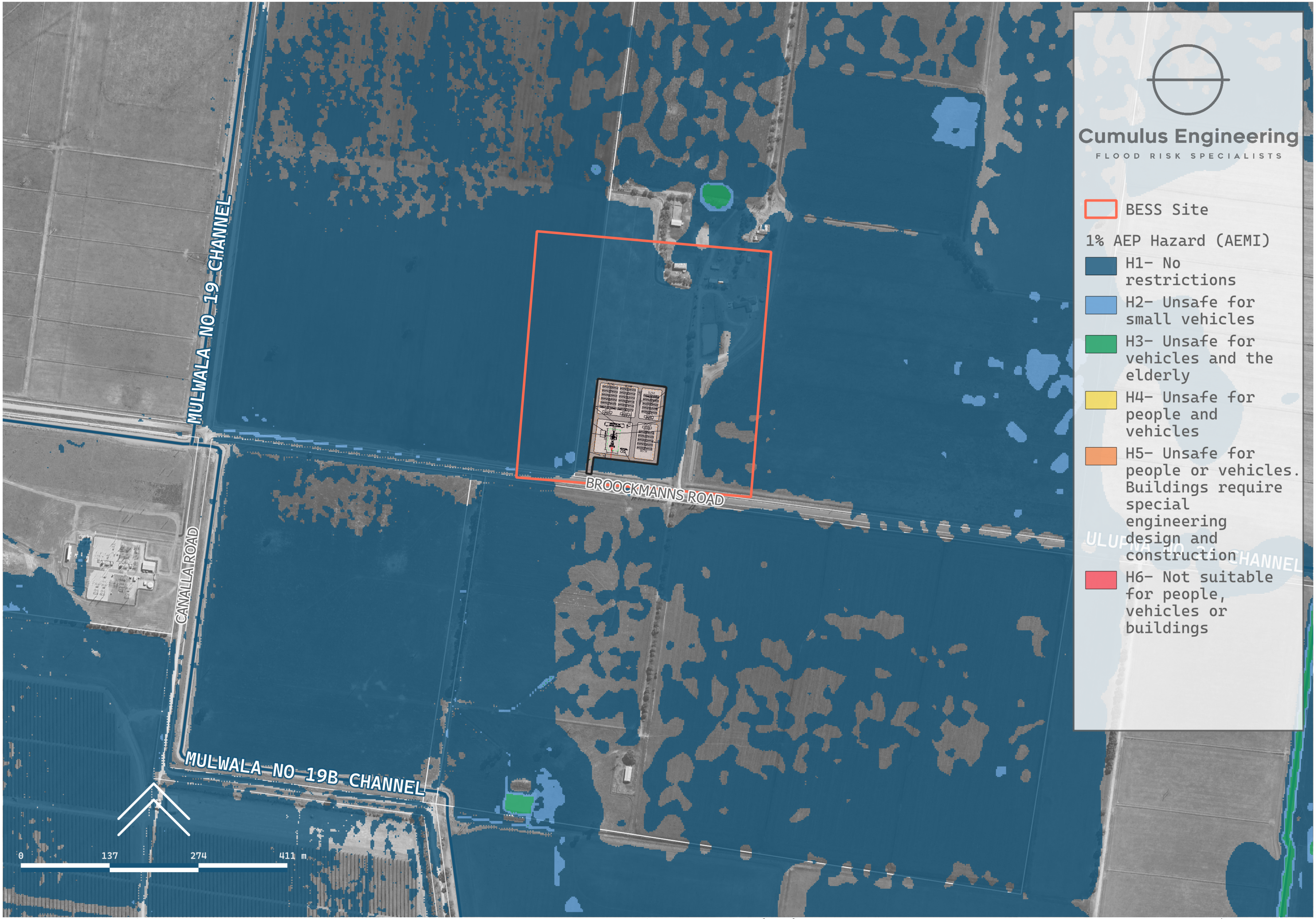

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
5% AEP Hazard (AEMI)
H1- No restrictions
H2- Unsafe for small vehicles
H3- Unsafe for vehicles and the elderly
H4- Unsafe for people and vehicles
H5- Unsafe for people or vehicles. Buildings require special engineering design and construction
H6- Not suitable for people, vehicles or buildings
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
MULWALA NO 19B CHANNEL
ULUPNA NO 24 CHANNEL
0
137
274
411 m

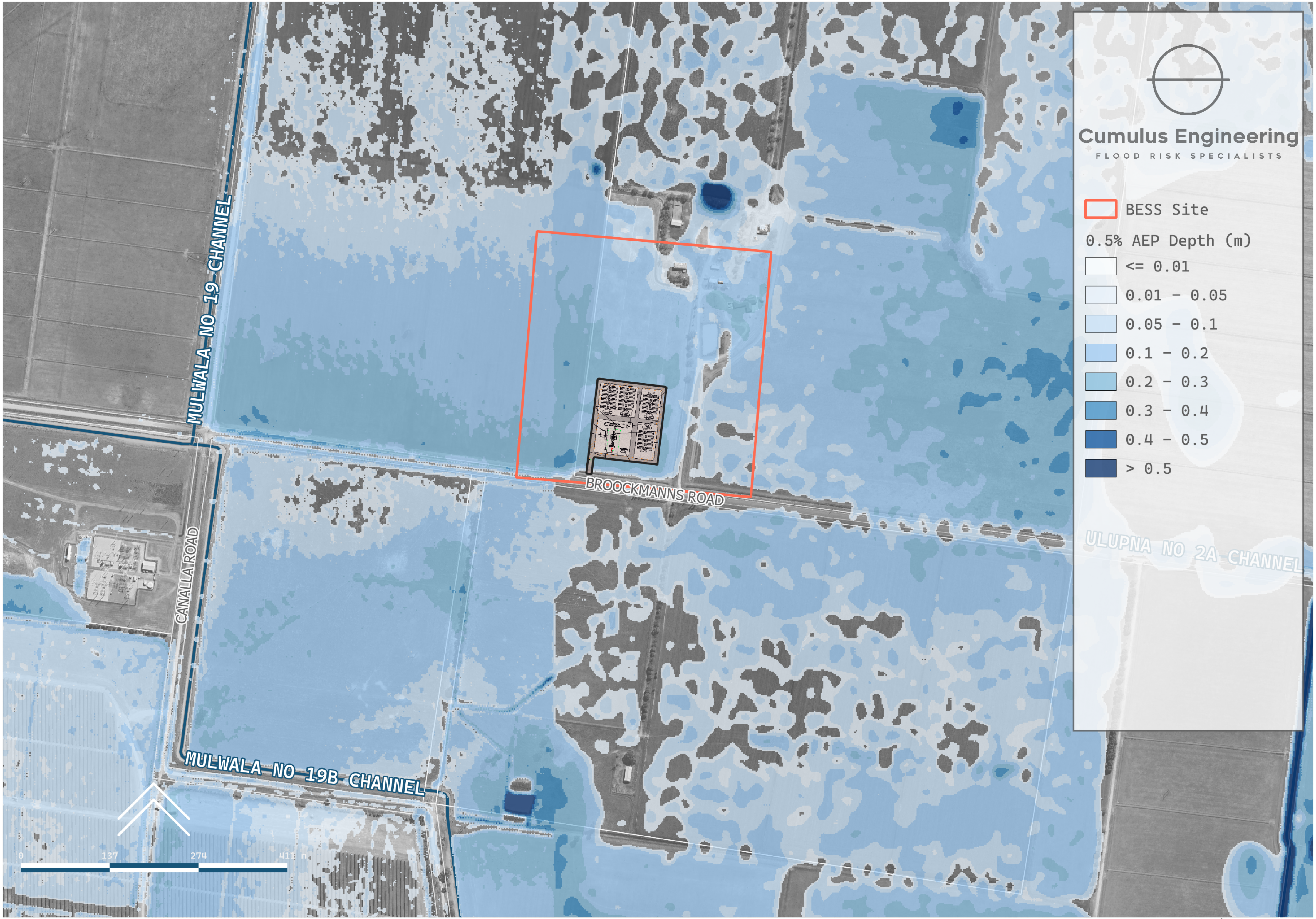


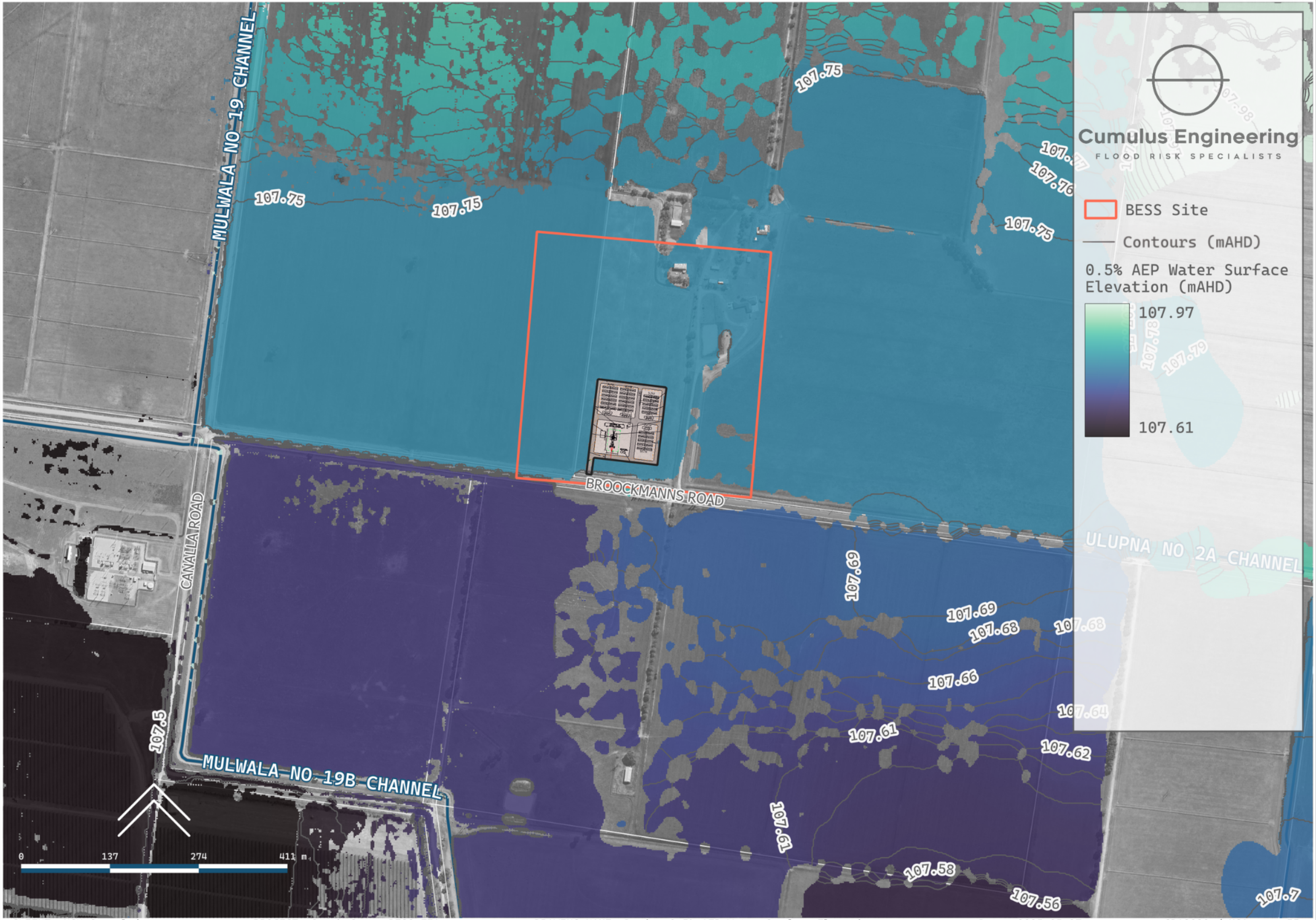
CLIENT: NGH Consulting PROJECT: South Coree BESS FIA DRAWING NAME: Developed 1% AEP Depth Date: 2025-05-27 GDA2020 / MGA zone 55

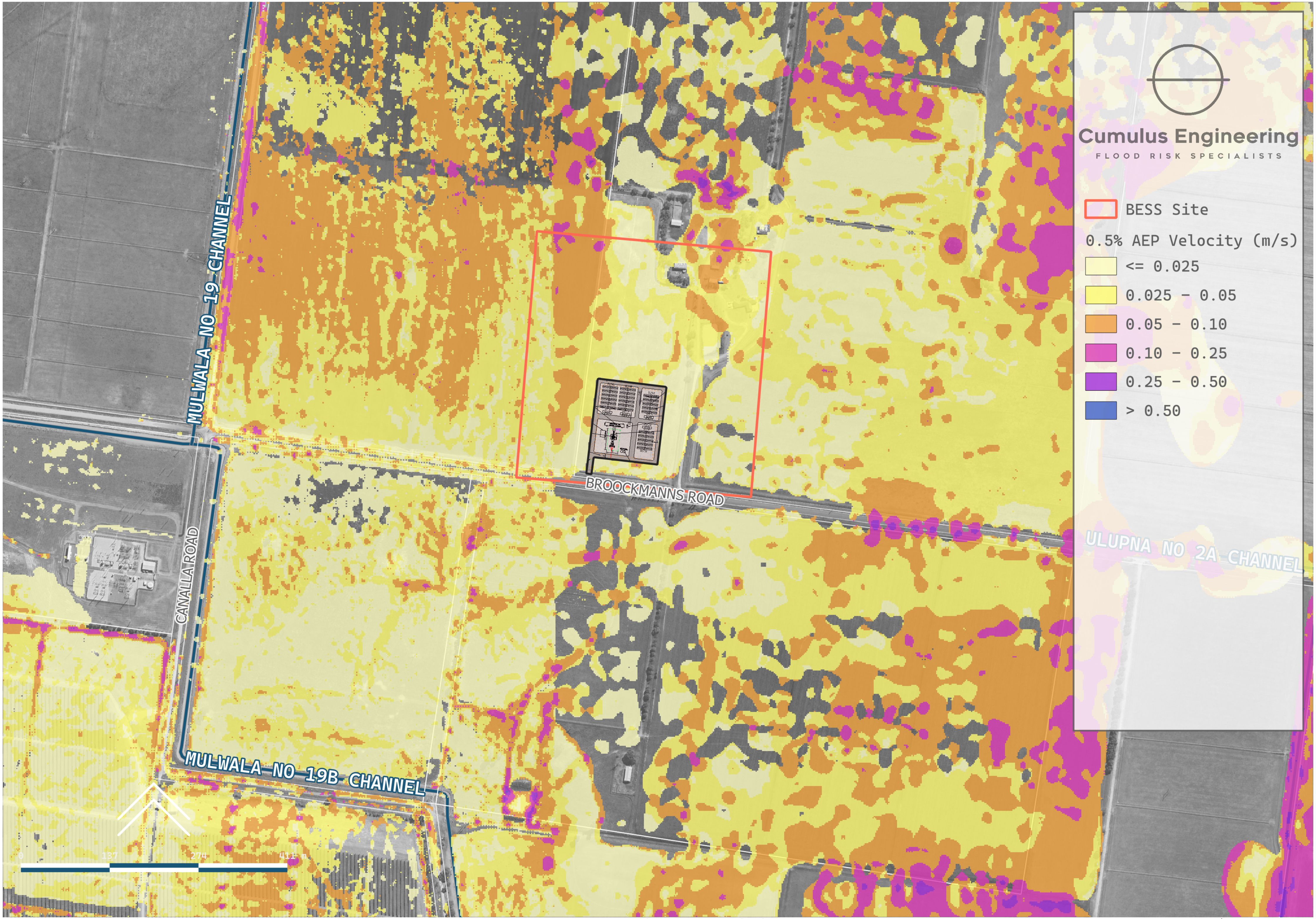

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
Contours (mAHD)
1% AEP Water Surface Elevation (mAHD)
107.96
107.6
MULWALA NO 19 CHANNEL
MULWALA NO 19B CHANNEL
ULUPNA NO 2A CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
107.76
107.75
107.73
107.68
107.68
107.67
107.67
107.65
107.65
107.65
107.64
107.61
107.59
107.58
107.5
0
137
274
411 m


Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
1% AEP Velocity (m/s)
<= 0.025
0.025 - 0.05
0.05 - 0.10
0.10 - 0.25
0.25 - 0.50
> 0.50
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
CANALLA ROAD
MULWALA NO 19B CHANNEL
0
137
274
411 m

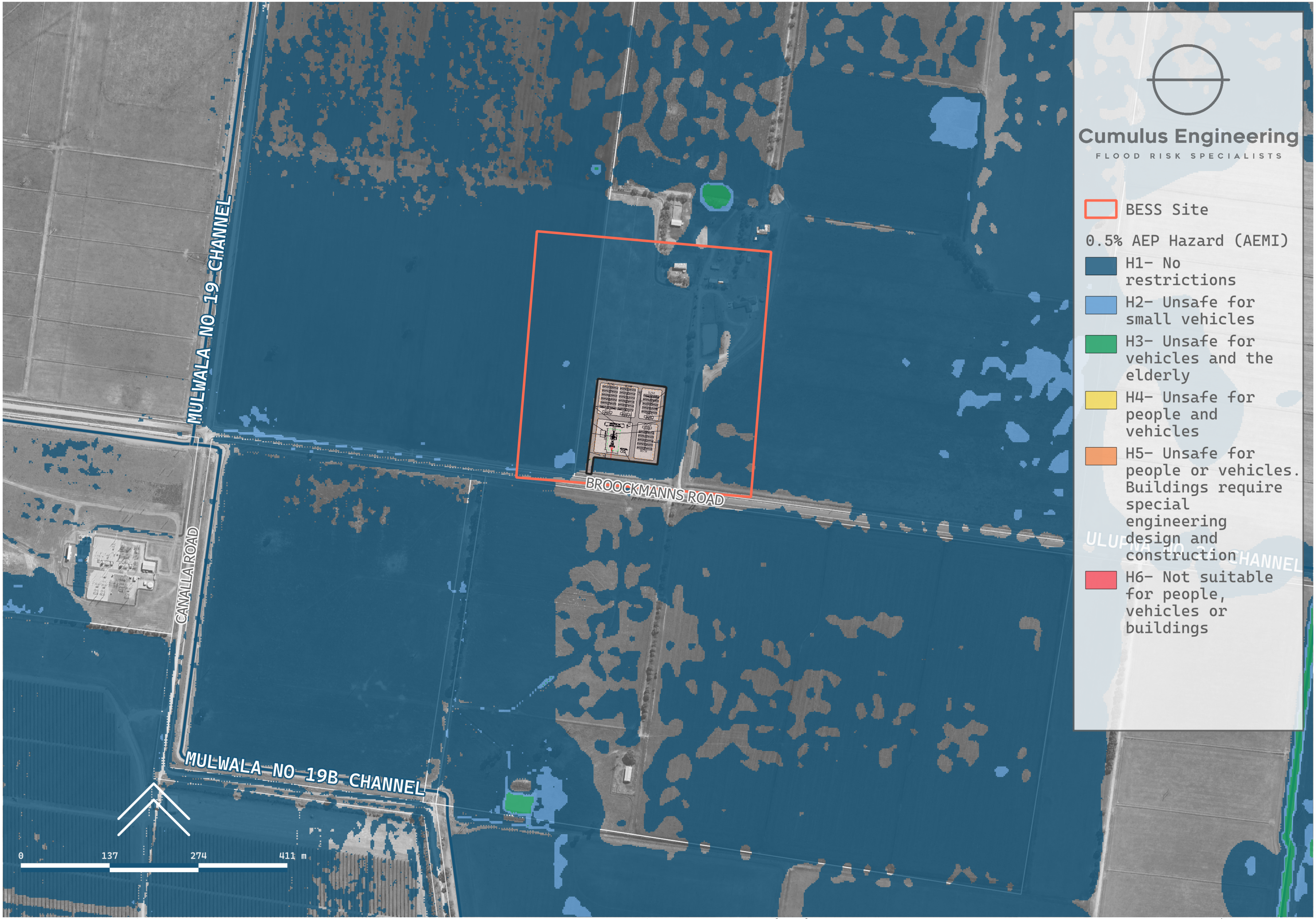

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
1% AEP Hazard (AEMI)
H1- No restrictions
H2- Unsafe for small vehicles
H3- Unsafe for vehicles and the elderly
H4- Unsafe for people and vehicles
H5- Unsafe for people or vehicles. Buildings require special engineering design and construction
H6- Not suitable for people, vehicles or buildings
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
MULWALA NO 19B CHANNEL
0
137
274
411 m


Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
0.5% AEP Depth (m)
<= 0.01
0.01 – 0.05
0.05 – 0.1
0.1 – 0.2
0.2 – 0.3
0.3 – 0.4
0.4 – 0.5
> 0.5
MULWALA NO 19 CHANNEL
MULWALA NO 19B CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
ULUPNA NO 2A CHANNEL
0
137
274
411 m

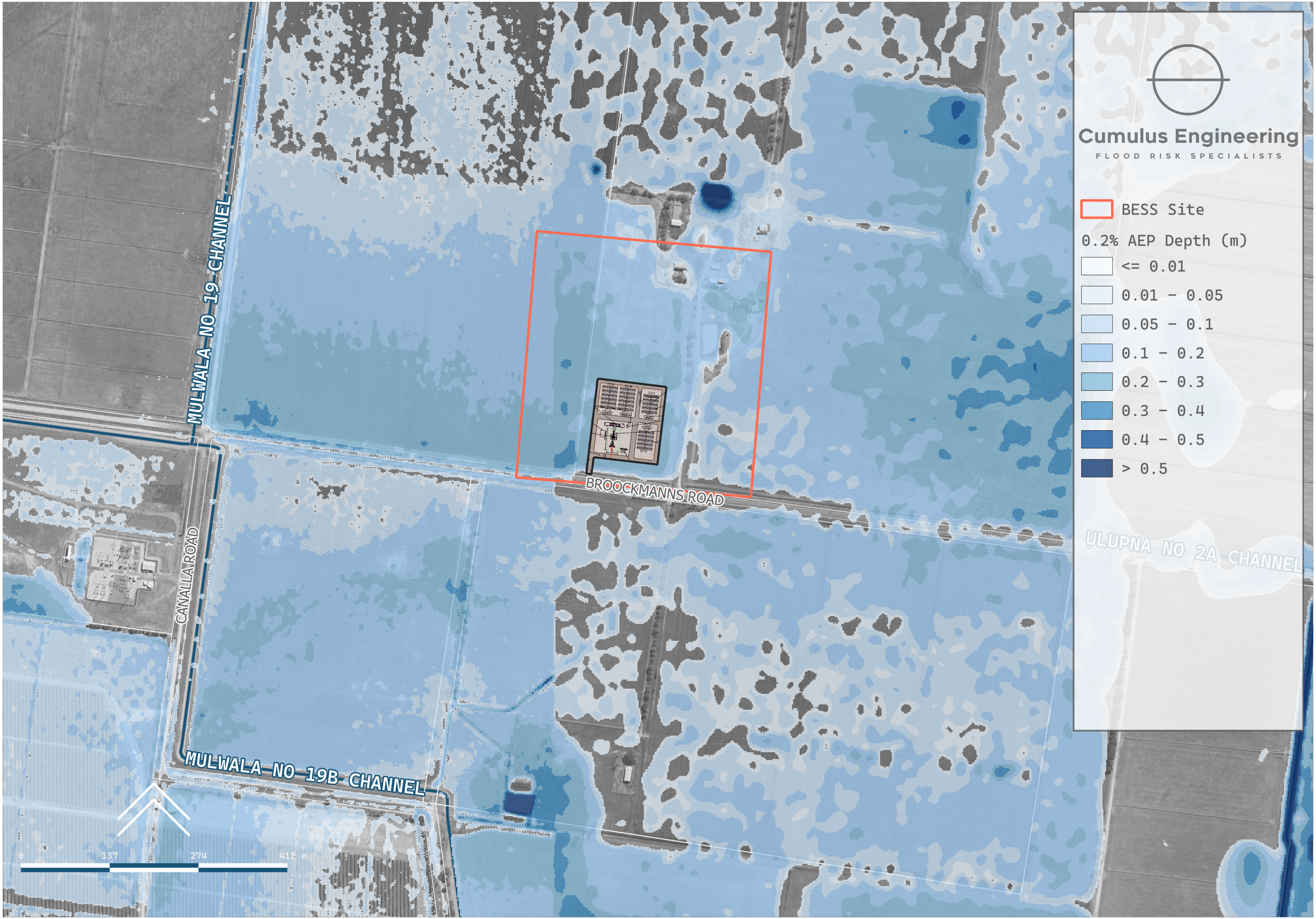

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
Contours (mAHD)
0.5% AEP Water Surface Elevation (mAHD)
107.97
107.61
MULWALA NO 19 CHANNEL
MULWALA NO 19B CHANNEL
ULUPNA NO 2A CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
107.75
107.69
107.68
107.66
107.62
107.61
107.58
107.56
107.5
107.7
107.76
107.79
107.78
0
137
274
411 m



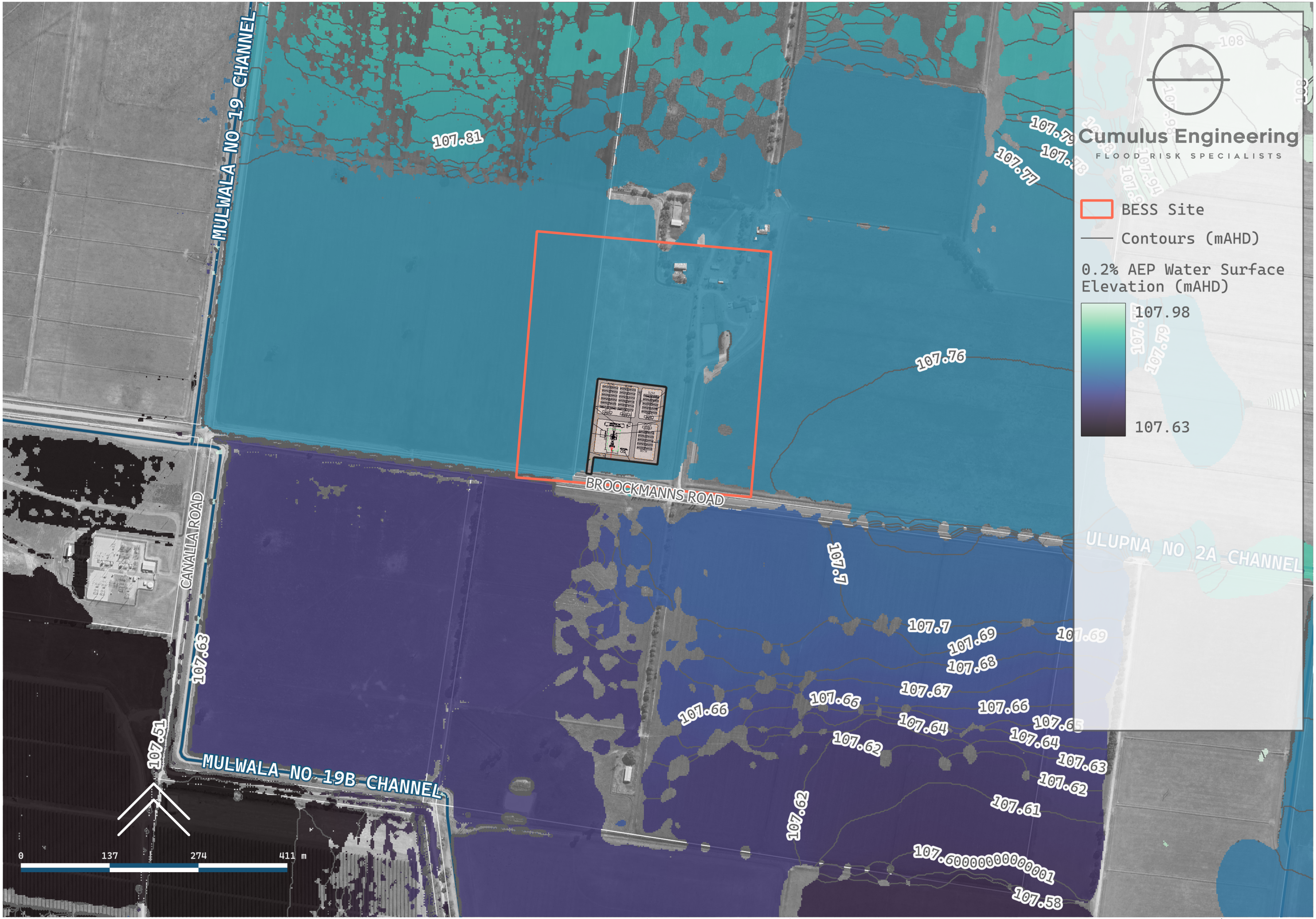
CLIENT: NGH Consulting PROJECT: South Coree BESS FIA DRAWING NAME: Design 0.5% AEP Velocity Date: 2025-05-27 GDA2020 / MGA zone 55

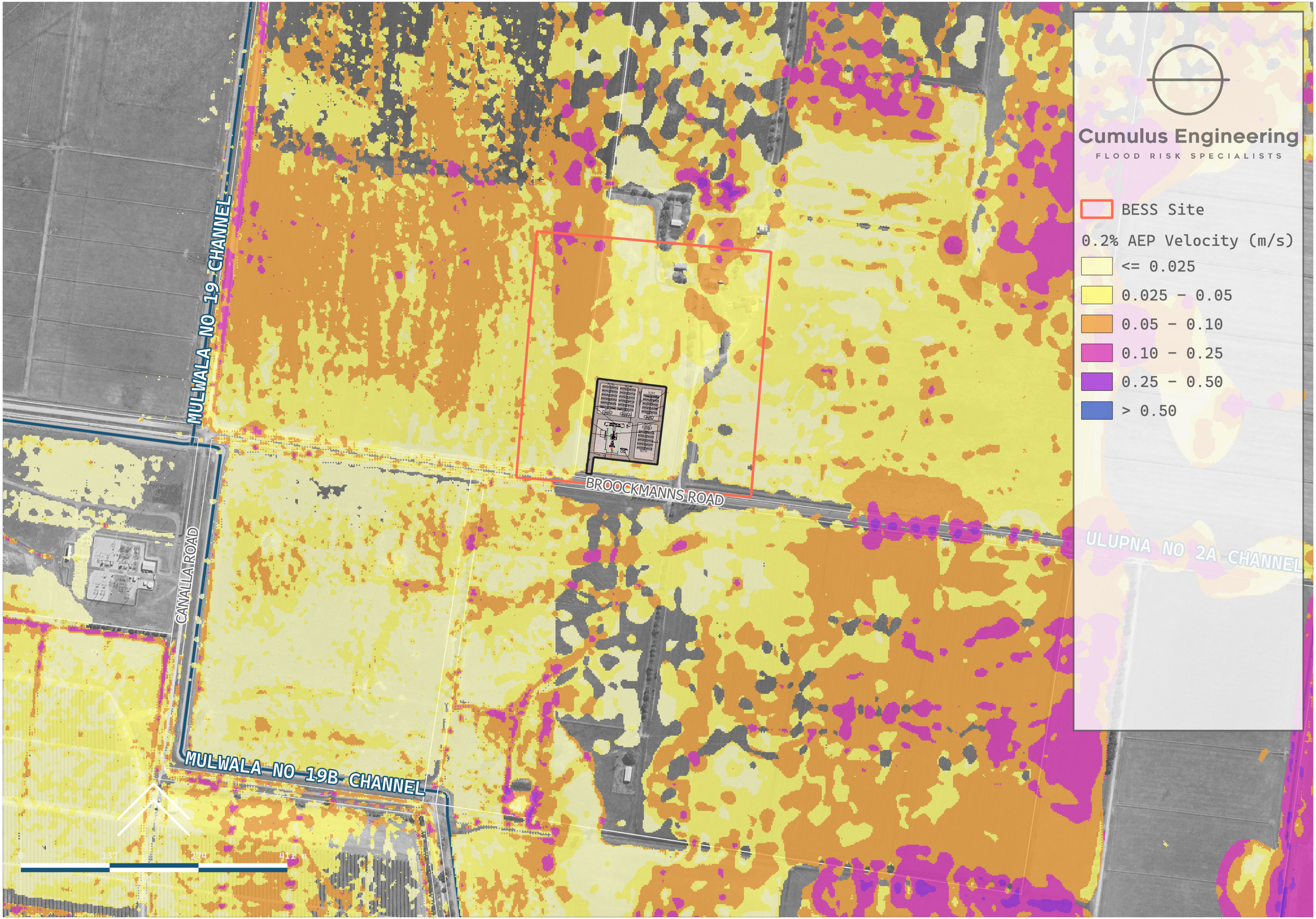


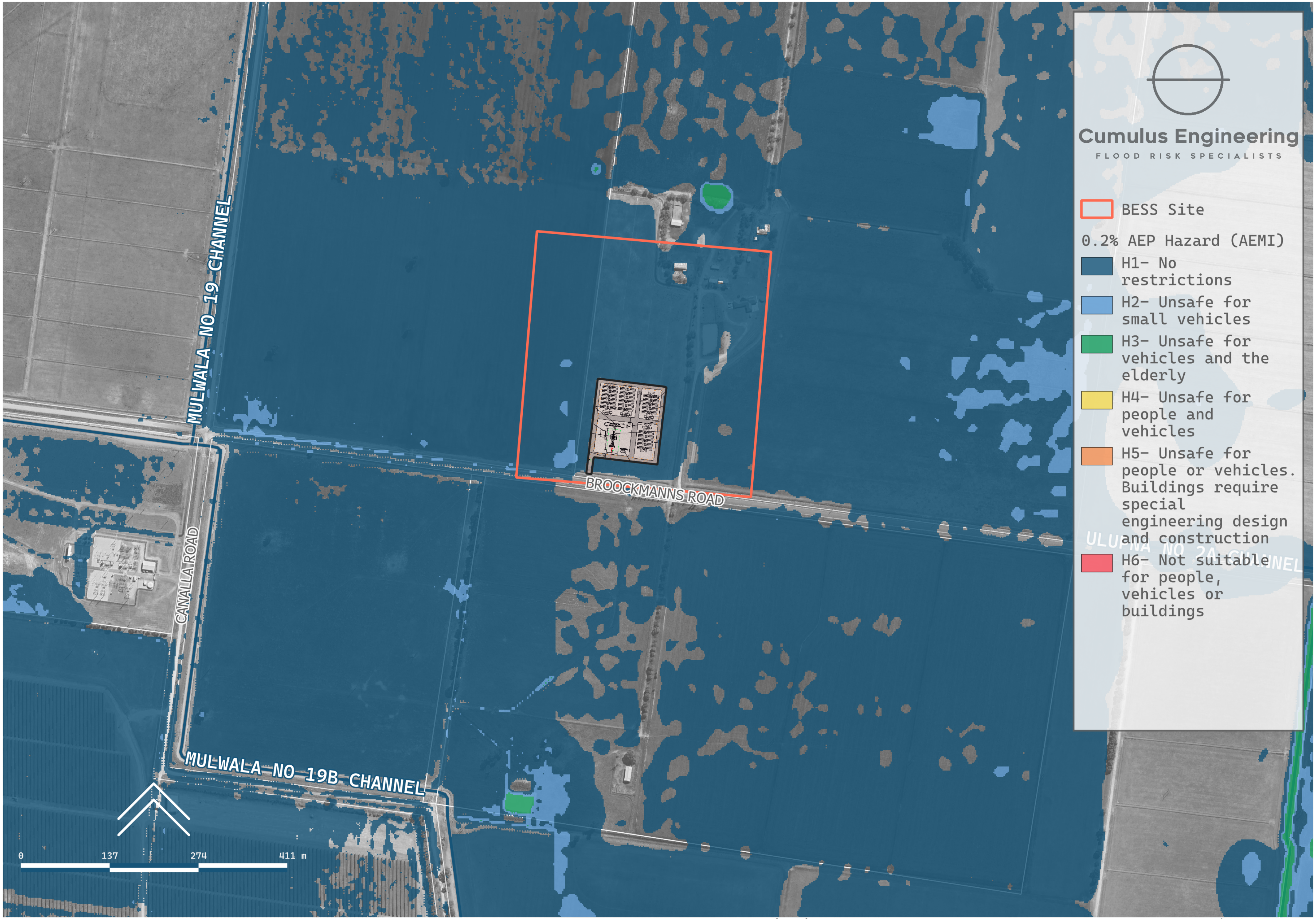
CLIENT: NGH Consulting PROJECT: South Coree BESS FIA DRAWING NAME: Design 0.5% AEP Hazard (AEMI) Date: 2025-05-27 GDA2020 / MGA zone 55

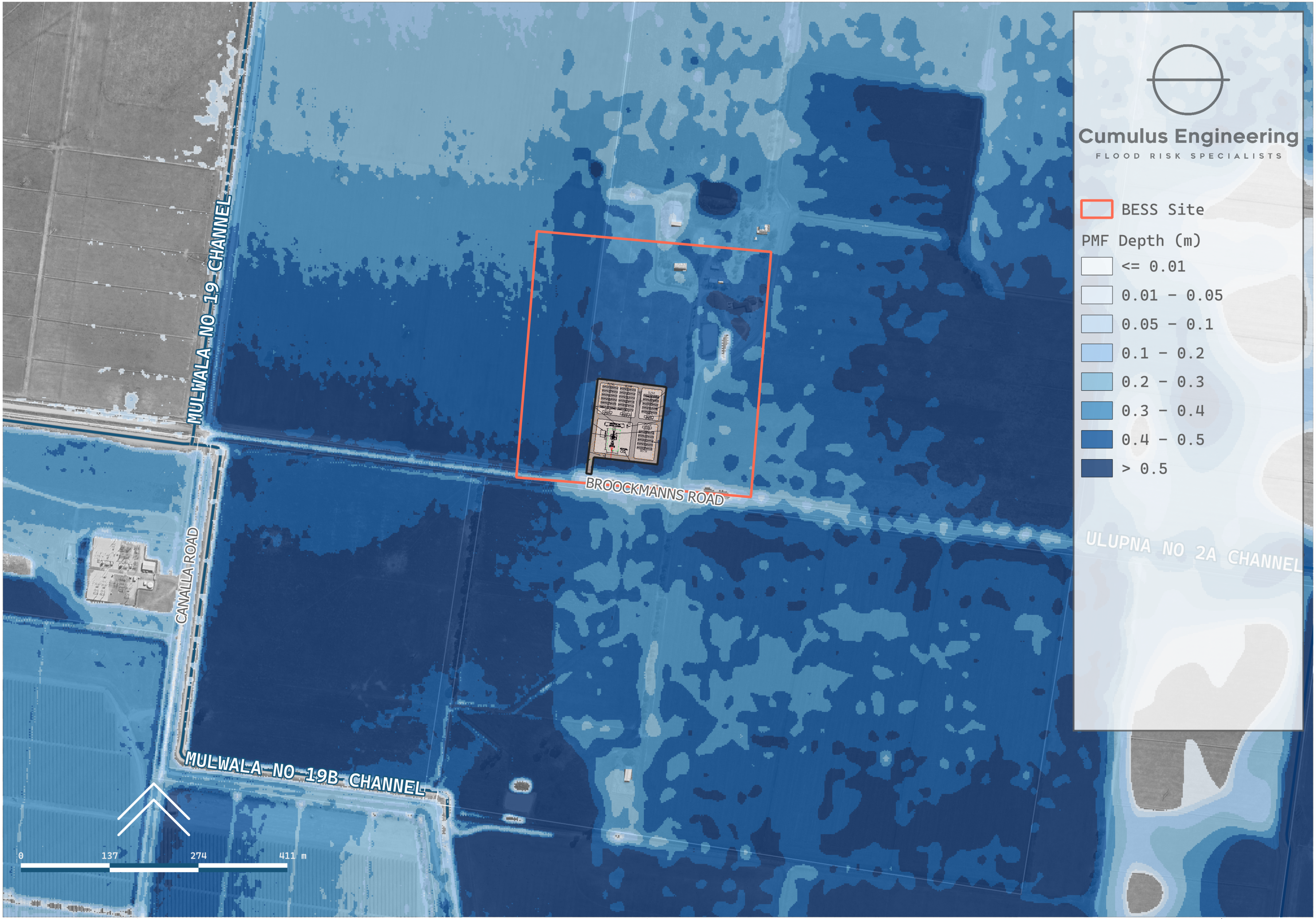


Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
0.2% AEP Depth (m)
<= 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
> 0.5
MULWALA NO 19 CHANNEL
MULWALA NO 19B CHANNEL
CANALLA ROAD
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
0
137
274
411 m

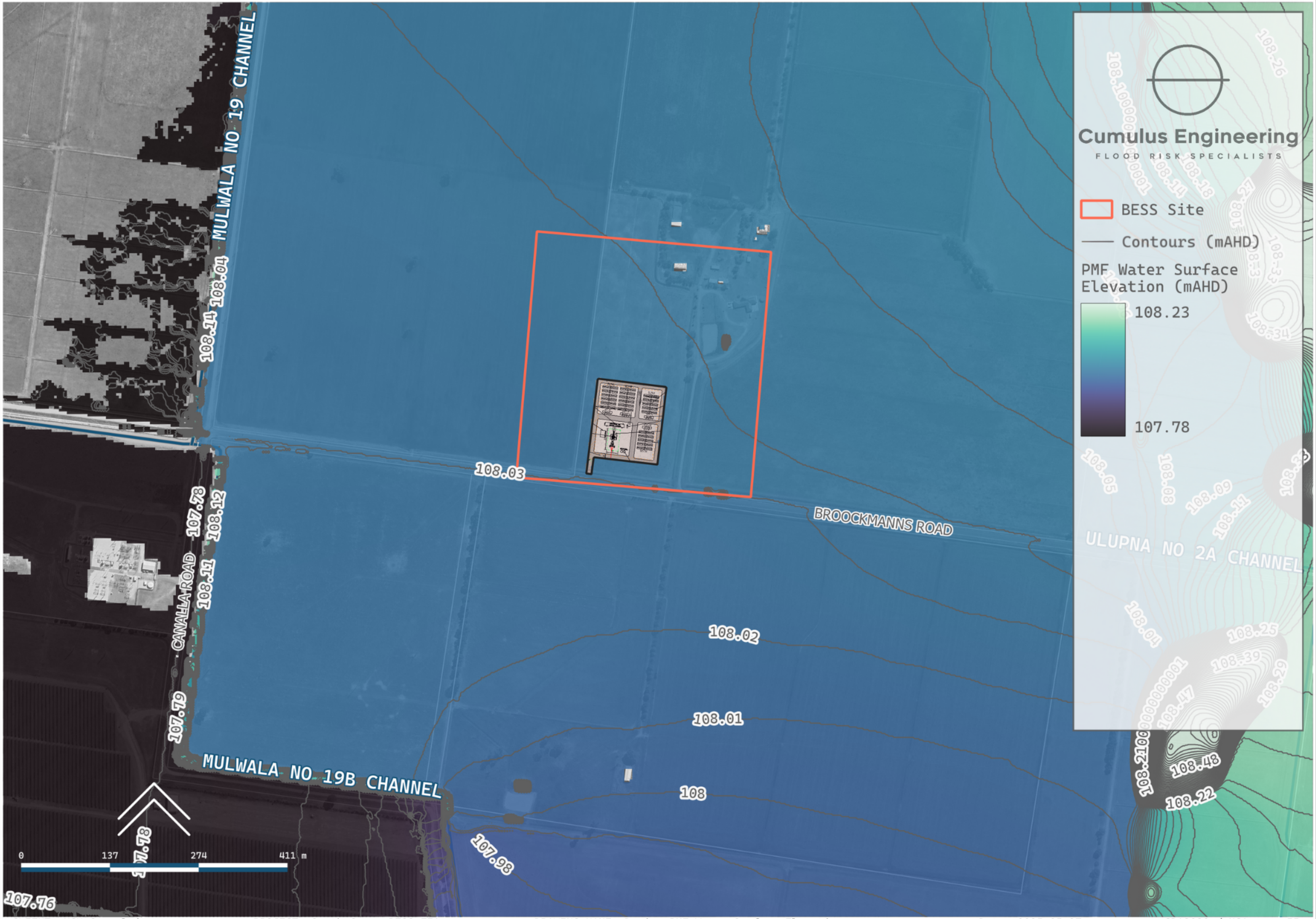

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
Contours (mAHD)
0.2% AEP Water Surface Elevation (mAHD)
107.98
107.63
MULWALA NO 19 CHANNEL
MULWALA NO 19B CHANNEL
CANALLA ROAD
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
107.81
107.79
107.78
107.77
107.76
107.7
107.69
107.68
107.67
107.66
107.65
107.64
107.63
107.62
107.61
107.600000000001
107.58
107.51
0
137
274
411 m

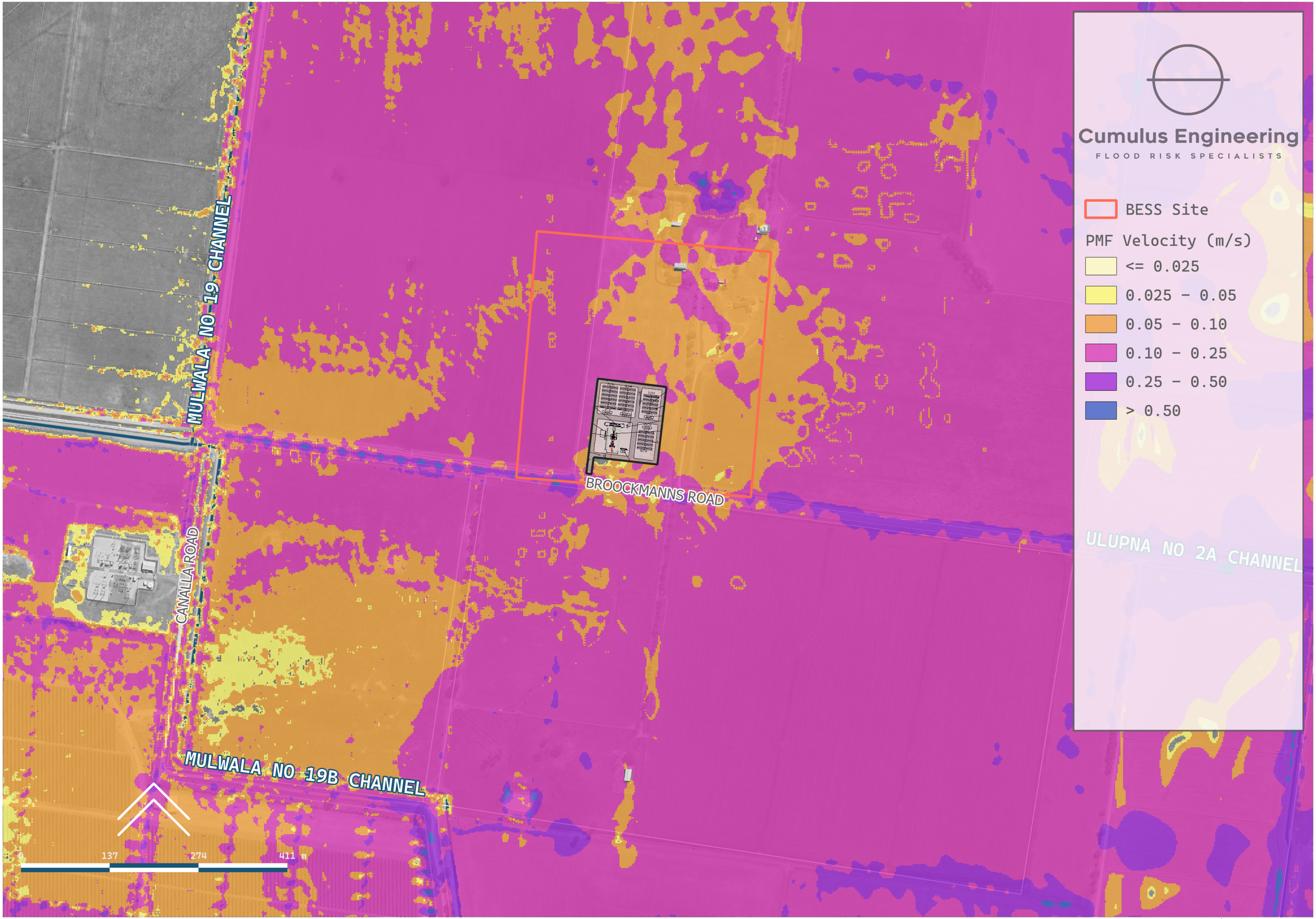

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
0.2% AEP Velocity (m/s)
<= 0.025
0.025 - 0.05
0.05 - 0.10
0.10 - 0.25
0.25 - 0.50
> 0.50
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
ULUPNA NO 2A CHANNEL
CANALLA ROAD
MULWALA NO 19B CHANNEL
0
137
274
411 m

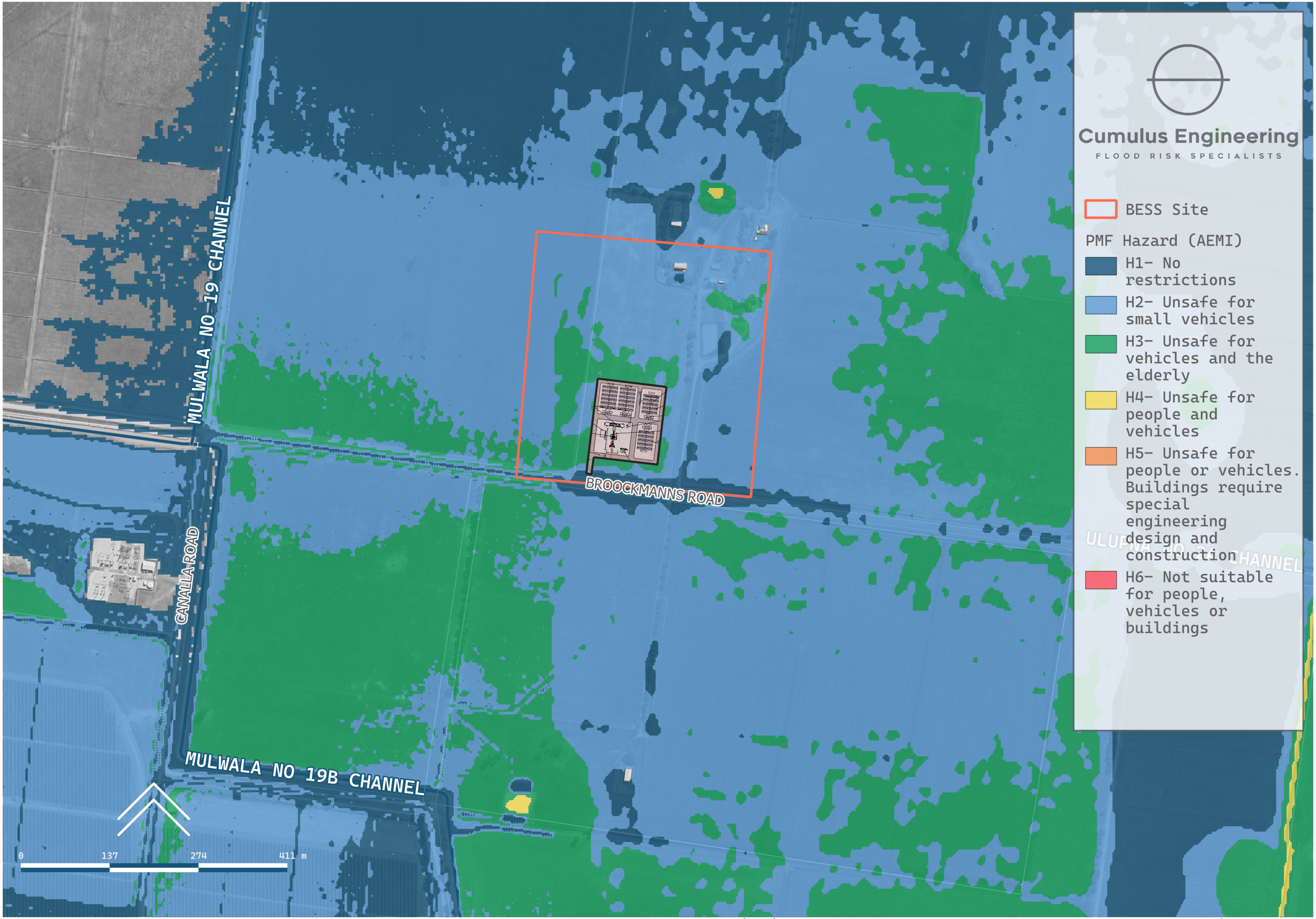

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
0.2% AEP Hazard (AEMI)
H1- No restrictions
H2- Unsafe for small vehicles
H3- Unsafe for vehicles and the elderly
H4- Unsafe for people and vehicles
H5- Unsafe for people or vehicles. Buildings require special engineering design and construction
H6- Not suitable for people, vehicles or buildings
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
MULWALA NO 19B CHANNEL
0
137
274
411 m



CLIENT: NGH Consulting PROJECT: South Coree BESS FIA DRAWING NAME: Design PMF Depth Date: 2025-05-27 GDA2020 / MGA zone 55


Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
Contours (mAHD)
PMF Water Surface Elevation (mAHD)
108.23
107.78
MULWALA NO 19 CHANNEL
MULWALA NO 19B CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
ULUPNA NO 2A CHANNEL
108.14
108.04
108.03
108.02
108.01
108
107.98
107.78
108.12
108.11
107.79
107.76
108.26
108.14
108.18
108.27
108.34
108.05
108.08
108.09
108.11
108.04
108.25
108.39
108.29
108.47
108.48
108.22
0
137
274
411 m


Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
PMF Velocity (m/s)
<= 0.025
0.025 – 0.05
0.05 – 0.10
0.10 – 0.25
0.25 – 0.50
> 0.50
MULWALA NO 19 CHANNEL
BROOCKMANNS ROAD
CANALLA ROAD
ULUPNA NO 2A CHANNEL
MULWALA NO 19B CHANNEL
0
137
274
411 m



CLIENT: NGH Consulting | PROJECT: South Coree BESS FIA | DRAWING NAME: Design PMF Hazard (AEMI) | Date: 2025-05-27 | GDA2020 / MGA zone 55


Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
5% AEP Water Height Difference (m)
<= -0.5
-0.5 – -0.4
-0.4 – -0.2
-0.2 – -0.1
-0.1 – -0.05
-0.05 – -0.01
-0.01 – 0.01
0.01 – 0.05
0.05 – 0.1
0.1 – 0.2
0.2 – 0.4
0.4 – 0.5
> 0.5
Wet/Dry
Was Wet, Now Dry
Was Dry, Now Wet
0
60
120
180 m

CLIENT: NGH Consulting PROJECT: South Coree BESS FIA DRAWING NAME: 1% AEP Water Height Difference (m) Date: 2025-05-27 GDA2020 / MGA zone 55


Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
0.5% AEP Water Height Difference (m)
<= -0.5
-0.5 – -0.4
-0.4 – -0.2
-0.2 – -0.1
-0.1 – -0.05
-0.05 – -0.01
-0.01 – 0.01
0.01 – 0.05
0.05 – 0.1
0.1 – 0.2
0.2 – 0.4
0.4 – 0.5
> 0.5
Wet/Dry
Was Wet, Now Dry
Was Dry, Now Wet
0
60
120
180 m

CLIENT: NGH Consulting | PROJECT: South Coree BESS FIA | DRAWING NAME: 0.2% AEP Water Height Difference (m) | Date: 2025-05-27 | GDA2020 / MGA zone 55

Cumulus Engineering
FLOOD RISK SPECIALISTS
BESS Site
PMF Water Height Difference (m)
<= -0.5
-0.5 – -0.4
-0.4 – -0.2
-0.2 – -0.1
-0.1 – -0.05
-0.05 – -0.01
-0.01 – 0.01
0.01 – 0.05
0.05 – 0.1
0.1 – 0.2
0.2 – 0.4
0.4 – 0.5
> 0.5
Wet/Dry
Was Wet, Now Dry
Was Dry, Now Wet
0
60
120
180 m

Appendix C. Consultation with NSW SES & Berrigan Shire Council

Cumulus Engineering Pty. Ltd.
www.cumuluseng.com.au
ABN 63 661 813 869

South Coree BESS – Flood Assessment & Evacuation Discussion

Meeting Minutes

Meeting Details:	***24/06/2025, 1pm, Teams Meeting***
Attendees:	*Ana-Maria-Bianca Chitu (AMB – NSW SES)* *Brendon Johnson (BJ – NSW SES)* *Gillian Webber (GW – NSW SES)* *Vageesh Nonavinakere (VN – Berrigan Shire Council)* *Ramesh Shrestha (RS – Berrigan Shire Council)* *Darron Fruend (DF – Berrigan Shire Council)* *Gary George (GG – Berrigan Shire Council)* *Sarah Hillis (SHi – NGH Consulting)* *Sarah Hollis (SHo – Cumulus Engineering)* *Yi Wei (YW – Cumulus Engineering)*
Absences (Optional Attendees):	*Joshua Stanbury (JS – NSW SES)* *Sarah Griffiths (SG – Berrigan Shire Council)* *Stephan Mitchell (SM – Samsung)*

Project Overview:

Cumulus Engineering have been engaged by NGH Consulting and the client Samsung C&T Renewable Energy Australia (SREA) to conduct a flood impact and evacuation assessment for the proposed South Coree Battery Energy Storage System (BESS) facility.

The project is in the concept phase with preliminary design only. Final levels, emergency plans, and construction staging to follow development approval.

Topic 1 – Presentation of current finding, including the emergency management arrangements and access

The presentation is to give an overall summary of the flood impact assessment for a proposed development in South Coree.

SHo presented the findings from the assessment which included hydrological and hydraulic modelling, simulating flood behaviour under different flood design events (1% AEP, 5% AEP, 0.2% AEP, 0.5% AEP, as well as PMP event). The main event that was addressed regarding the flood evacuation arrangements was the 1% AEP event.

Flood Modelling Approach:

- Hydraulic modelling completed from the 5% AEP to PMF.
- Focus of evacuation considerations is on the 1% AEP event.
- Site is naturally in a flat terrain, surrounded by irrigation channels.
- The site infrastructure was blocked out in the model to represent a conservative scenario assuming the development will be raised above flood levels.
- Key outcomes:
    - Maximum flood depth (developed conditions): 336mm.
    - Average flood depth: 200mm
    - Average hazard classification: H1 (no restriction), indicating floodwaters is mostly stationary due to flat topography – bathtub-like effect.
    - Small areas of H2 hazard exist in localised low points.

Flood Impact Observations:

- Flood hazard and depth mapping show that most of the BESS site is subject to low hazard (H1) or no inundation at all, especially along key access roads.
- Afflux map (change in water level pre- and post- development) shows minimal to no offsite flood impacts, even under worst-case assumptions (fully blocked site)
- Localised impacts observed only at the southern access road, likely tied to a small existing drainage channel-expected to be addressed in future design.
- The site is not impacted by riverine flooding and is mostly affected by local overland flow.

Emergency Management Notes:

- Broockmanns Road remains accessible in the 1% AEP event and maintains low hazard (H1) conditions, ensuring a safe evacuation route.
- The site is in an ungauged catchment and not near a waterway, meaning warning times can vary significantly.
- A site-specific Flood Response Management Plan (FRMP) is recommended to handle evacuation procedures and address flood awareness gaps, as there are currently no existing flood studies or flood intelligence cards available for the site.
- Day-to-day site operations, with personnel only visiting for routine maintenance (every 2 weeks to a month), reducing emergency exposure.
- No significant issues identified with community or emergency services coordination due to the site's isolated nature.

Topic 2 - Q&A Session

Flood Modelling Technical Questions

Q1:

VN inquired whether the development area is fully impervious.

SHo clarified that while the entire site was blocked out in the model for a conservative assessment, the actual infrastructure footprint is not 100% impervious.

Q2:

VN asked whether the reported 336 mm flood level corresponds to the 1% AEP event.

SHo confirmed this and noted a conceptual flood planning level had also been developed, comprising the 1% AEP level plus 500 mm freeboard (discussed internally with Samsung).

Q3:

VN asked whether the development will affect existing overland flow paths to local channels.

SHo confirmed no impacts, with channels modelled as full (i.e., no additional storage available), ensuring a worst-case scenario was assessed.

Q4:

VN queried the rainfall data and whether calibration was undertaken.

SHo explained that due to the ungauged nature of the catchment, calibration was not possible. Model validation was based on RFFE and internal QA via the rational method, but verification options were limited.

SES Evacuation Related Concerns & Questions

GW raised concerns about potential road closures on Broockmanns Road, referencing SES guidance against driving through floodwaters exceeding 150 mm. Requested further detail on depths at road low points, especially for up to the PMF event.

SHo responded that hazard mapping indicates the road is classified as H1 or not impacted. Asked whether there's local history of road closure.

DF confirmed that Broockmanns Road has never been closed due to flooding.

BJ advised that if access remains open and planning is done in advance, SES is satisfied. Suggested shapefile sharing to assist broader emergency planning.

SHo agreed to share data but advised it is from a non-calibrated, conceptual model, and should be used indicatively.

BJ asked about lead time for floodwaters, particularly if influenced by riverine sources such as the Murray or Edward Rivers.

SHo confirmed the site is not affected by riverine flooding, as it is too far removed from major waterways. Flooding at the site is driven by local overland flow, with warning times dependent on event scale. An indicative estimate of warning times can be provided if required.

Action Items:

- Provide the shapefiles of the flood mapping to the SES and Council for records.
- Circulate the meeting minutes to all attendees.
- Follow up on any further questions or concerns from SES and Council regarding the flood assessment.

NSW STATE EMERGENCY SERVICE

Our Ref: ID 3156
Your Ref: SSD-77238990

17 July 2025

Wennie Wei
Cumulus Engineering
Via email

email: yi.wei@cumuluseng.com.au
CC: joshua.stanbury@ses.nsw.gov.au

Dear Wennie,

State Significant Development (SSD) South Coree Battery Energy Storage System

Thank you for the opportunity to provide comment on the Flood Impact Assessment (FIA) for the proposed development at South Coree Battery Energy Storage System (BESS) at 384 Broockmanns Road, Finley. It is understood that the Project would involve the development, construction, operation, and decommissioning of a BESS with a capacity of up to 100MW / 400MWh and is expected to create up to 60 Project related jobs during construction and employ 2 operational staff.[1] The Project would include:

- BESS including battery enclosures, inverters, transformers, switchgear and control room.
- Onsite substation including transformer switch bays and switchgear housed in portable substation containers.
- Underground or overhead 132 kV transmission lines to connect the BESS to the Finley substation.
- Finley substation upgrade works to facilitate connection with the BESS.
- Permanent office, operation and maintenance (O&M) buildings, hardstands and Project signage.
- Site access to the BESS from Broockmanns Road, internal site access tracks and parking.
- Stormwater management infrastructure, lighting, fencing and security.

The NSW State Emergency Service (NSW SES) is the agency responsible for dealing with floods, storms and tsunami in NSW. This role includes, planning for, responding to and coordinating the initial recovery from floods. As such, the NSW SES has an interest in the public safety aspects of the development of flood prone land, particularly the potential for changes to land use to either exacerbate existing flood risk or create new flood risk for communities in NSW.

[1] NGH. 2024. Scoping Report – South Coree BESS, page 20 & 22

The NSW SES recommends that consideration of flooding issues is undertaken in accordance with the requirements of NSW Government's Flood Prone Land Policy as set out in the Flood Risk Management Manual 2023 (the Manual) and supporting guidelines, including the Support for Emergency Management Planning and relevant planning directions under the *Environmental Planning and Assessment Act, 1979*. Some of the key considerations relating to emergency management are further detailed in **Appendix A**.

We note that the subject site is not affected by riverine flooding, but a significant part of the site and its access/egress become impacted by overland flooding (up to 0.3 metres and H1 - H2 hydraulic hazard category) as frequently as 5% Annual Exceedance Probability (AEP) events.[2] In a Probable Maximum Flood (PMF) event, the entire site as well as access on Broockmanns road become inundated with flood depths that can exceed 0.5 metres and H2 – H3 flood hazard level.[3] **In summary**, we:

- **Recommend** the duration to inundation and of isolation are clearly outlined in the FIRA, noting that the *"flat terrain tends to result in slower runoff and extended flood durations",[4]* to inform the appropriate emergency management measures for the site.
- **Emphasise** that flood emergency response planning should consider events up to and including the PMF event. Also, the impact of flooding on the roadways should go beyond immediately adjacent to the site to fully understand any evacuation constraints and ensure that any people that may be at the site during a flood event are able to evacuate to an area above the PMF before access routes getting cut. **Evacuation must not require people to drive or walk through flood water.**
- **Recommend** considering flood resilience of the proposed access/egress roads, noting that access off Broockmanns Road *"would require upgrading to enable safe entry and exit from the Project Site for all vehicles;"*[5] ideally, access/egress routes should provide rising road access and/or be passable up to at least a 1 in 500-year local flooding.
- **Note** there are several other proposed BESS projects in Finley, with two proposed sites (Berrigan and Finley BESS) and the Finley Solar Farm - currently operational, located adjacent/in proximity to the proposed Subject site [6] We **recommend** considering cumulative impacts of the multiple proposed and existing developments on the flood behaviour in this area, particularly considering the increase in impervious surfaces (proposed hardstand areas, paved roads,[7] noise wall,[8] etc., that could impact on flood behaviour.

[2] Cumulus Engineering. 2025. Flood Impact Assessment – South Coree BESS, Appendix B, Existing 5% AEP Depth map
[3] Ibid., Design PMF Depth map
[4] Ibid., page 7
[5] NGH. 2024. Scoping Report – South Coree BESS, page 11
[6] Urbis. 2025. Engagement Outcomes Report – Finley Battery Energy Storage System SSDA, page 9
[7] NGH. 2024. Scoping Report – South Coree BESS, page 59
[8] Cumulus Engineering. 2025. Flood Impact Assessment – South Coree BESS, Figure 1-2 Design Layout

- **Recommend** seeking advice from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) in relation to the impact of the proposed development on flood behaviour at the site and downstream areas.
- **Recommend** considering flood resilience of the infrastructure, which is likely to be damaged or contaminated by flood water, to events up to and including the PMF. This could include placing any sensitive infrastructure such as battery storage, inverters, etc., above the PMF level, if feasible, to minimise risk to property and financial losses.

Further useful information can be found here:

- NSW SES website
- Emergency Business Continuity Plan
- The Department of Climate Change, Energy, the Environment and Water website

Please feel free to contact Ana Chitu via email at rra@ses.nsw.gov.au should you wish to discuss any of the matters raised in this correspondence. The NSW SES would also be interested in receiving future correspondence regarding the outcome of this referral via this email address.

Yours sincerely,

Elspeth O'Shannessy

Elspeth O'Shannessy
Manager Emergency Risk Assessment
NSW State Emergency Service

ATTACHMENT A: Principles Outlined in the Support for Emergency Management Planning Guideline[9]

Principle 1 Any proposed Emergency Management strategy should be compatible with any existing community Emergency Management strategy.

Any proposed Emergency Management strategy for an area should be compatible with the evacuation strategies identified in the NSW State Flood Plan[10] and the Berrigan Shire Flood Emergency Sub Plan,[11] where evacuation is the preferred emergency management strategy for people impacted by flooding.

Principle 2 Decisions should be informed by understanding the full range of risks to the community.

Decisions relating to future development should be risk-based and ensure Emergency Management risks to the community for the full range of floods, are effectively understood and managed.

We note that once operational, the site would be largely operated remotely,[12] however, some operational staff and maintenance crews are expected onsite during operations.[13] To ensure risk to life and property from flooding is appropriately identified and managed, risk assessment should consider the full range of flooding, including events up to the Probable Maximum Flood (PMF) and not only limited to the 1% Annual Exceedance Probability (AEP) events, along with climate change impacts considerations in line with NSW Government Guidelines.

While the site is not affected by riverine flooding, it is impacted by overland flows due to the flat topography and the surrounding network of raised open irrigation channels, contributing to ponding and trapping of overland flows.[14]

A significant part of the site as well as the site's access on Broockmanns Road (both east and west of the site) become inundated by fairly shallow flooding (up to 0.3 metres depth) as frequently as 5% AEP events.[15] The modelling suggests the hydraulic hazard category remains generally H1 across the site up to and including 0.2% AEP events, with the exception of some areas of H2 hazard level in the western part of the site and the western part of Broockmanns Road.[16] In a PMF event the entire site becomes inundated with flood depths in excess of 0.5

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9 NSW Government. 2023. Principles Outlined in the Support for Emergency Management Planning Guideline
10 NSW Government. 2024. NSW State Flood Plan. Section 5.1.7, page 34
11 NSW SES. 2023. Berrigan Shire Flood Emergency Sub Plan. Section 1.6.2, page 7
12 NGH. 2024. Scoping Report – South Coree BESS, Appendix A - Introductory letter to residents within 2 km
13 NGH. 2024. Scoping Report – South Coree BESS, page 59
14 Cumulus Engineering. 2025. Flood Impact Assessment – South Coree BESS, Section 1 - Introduction
15 Ibid., Appendix B, Existing 5% AEP Depth map
16 Ibid., Appendix B, Existing 0.2% AEP Hazard & Design 0.2% AEP Hazard maps

metres in some areas of the site, as well as parts of Broockmanns Road,[17] H2 – H3 flood hazard level.[18]

"Access to the site is impacted in all modelled flood events exceeding the 5% AEP event, restricting access and egress to the subject site."[19] The FIA notes there are "*potential delays or temporary isolation during extreme events*".[20] We **recommend** the duration to inundation and of isolation are clearly outlined in the FIRA, noting that the *"flat terrain tends to result in slower runoff and extended flood durations",*[21] to inform the appropriate emergency management measures for the site.

While we **note** that Broockmanns Road, which is the key access route to Finley and the Riverina Highway, remains trafficable in 1% AEP events,[22] the site becomes completely inundated in a PMF event and Broockmanns road gets overtopped by flooding of H2 – H3 hazard level, isolating the site. We would like to **emphasise** that flood emergency response planning should consider events up to and including the PMF event. Also, the impact of flooding on the roadways should go beyond immediately adjacent to the site to fully understand any evacuation constraints and ensure that any people that may be at the site during a flood event are able to evacuate to an area above the PMF before access routes getting cut. **Evacuation must not require people to drive or walk through flood water.**

Understanding that main access to the site is provided via the existing entry off Broockmanns Road, "*which would require upgrading to enable safe entry and exit from the Project Site for all vehicles,"*[23] we **recommend** considering flood resilience of the proposed access/egress roads; ideally, access/egress routes should provide rising road access and/or be passable up to at least a 1 in 500-year local flooding.

It is understood that there are several other proposed BESS projects in Finley - the proposed Berrigan BESS and the proposed Finley BESS located adjacent to the proposed Subject site, all north of Broockmanns Road; the Finley Solar Farm, which is currently operational, is also located in proximity to the project site, just south of Broockmanns Road.[24] Noting that flooding was not considered as part of the cumulative impacts assessment,[25] we **recommend** considering cumulative impacts of the multiple proposed and existing developments on the flood behaviour in this area, particularly considering the increase in impervious surfaces (e.g.

[17] Cumulus Engineering. 2025. Flood Impact Assessment – South Coree BESS, Appendix B, Design PMF Depth map
[18] Ibid., Appendix B, Design PMF Hazard map
[19] Ibid., page 26
[20] Ibid., page 24
[21] Ibid., page 7
[22] Ibid., page 24
[23] NGH. 2024. Scoping Report – South Coree BESS, page 11
[24] Urbis. 2025. Engagement Outcomes Report – Finley Battery Energy Storage System SSDA, page 9
[25] NGH. 2024. Scoping Report – South Coree BESS, page 63

proposed hardstand areas, paved roads,[26] the proposed noise wall,[27] etc., that could impact flood behaviour.

We also **recommend** seeking advice from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) in relation to the impact of the proposed development on flood behaviour at the site and for adjacent and downstream areas.

In addition, we **recommend** considering flood resilience of the infrastructure, which is likely to be damaged or contaminated by flood water, to events up to and including the PMF. This could include placing any sensitive infrastructure such as battery storage, inverters, etc., above the PMF level, if feasible, to minimise risk to property and financial losses.

Principle 3 Development of the floodplain does not impact on the ability of the existing community to safely and effectively respond to a flood.

The ability of the existing community to effectively respond (including self-evacuating) within the available timeframe on available infrastructure is to be maintained. It is not to be impacted on by the cumulative impact of new development.

Risk assessment should have regard to flood warning and evacuation demand on existing and future access/egress routes. Consideration should also be given to the impacts of localised flooding on evacuation routes. Evacuation must not require people to drive or walk through flood water.

Principle 4 Decisions on development within the floodplain does not increase risk to life from flooding.

Managing flood risks requires careful consideration of development type, likely users, and their ability respond to minimise their risks. This includes consideration of:

- **Isolation** – There is no known safe period of isolation in a flood, the longer the period of isolation the greater the risk to occupants who are isolated.
- **Secondary risks** – This includes fire and medical emergencies that can impact on the safety of people isolated by floodwater. The potential risk to occupants needs to be considered and managed in decision-making.
- **Consideration of human behaviour** – The behaviour of individuals such as choosing not to remain isolated from their family or social network in a building on a floor above the PMF for an extended flood duration or attempting to return to a building during a flood, needs to be considered.

Principle 5 Risks faced by the itinerant population need to be managed.

[26] NGH. 2024. Scoping Report – South Coree BESS, page 59
[27] Cumulus Engineering. 2025. Flood Impact Assessment – South Coree BESS, Figure 1-2 Design Layout

Any Emergency Management strategy needs to consider people visiting the area or using a development.

Principle 6 Recognise the need for effective flood warning and associated limitations.

An effective flood warning strategy with clear and concise messaging understood by the community is key to providing the community an opportunity to respond to a flood threat in an appropriate and timely manner.

We note that the Finely BESS Water Impact Assessment[28] identified the critical storm duration for the local catchment to be 1.5 hours, and for the broader catchment area identified the 9-hour storm duration.[29] This suggests the local catchment is subject to flash flooding, giving people little to no warning time to appropriately respond in a flooding event. As there are no formal flash flood warning available for this area, Severe Weather Warnings and Thunderstorm Warnings will be the most likely form of advice about the potential for flood producing storms and rainfall.

Principle 7 Ongoing community awareness of flooding is critical to assist effective emergency response.

The flood risk at the site and actions taken to reduce risk to life should be communicated to any site users (includes increasing risk awareness, preparedness actions, appropriate signage and emergency drills), during and after the construction phase, for the life-span of the development. However, it is important to note that the NSW SES is opposed to the imposition of development consent conditions requiring private flood evacuation plans rather than the application of sound land use planning and flood risk management.

[28] Premise. 2025. Water Impact Assessment – Finley Battery Energy Storage System

[29] Premise. 2025. Water Impact Assessment – Finley Battery Energy Storage System, page 49