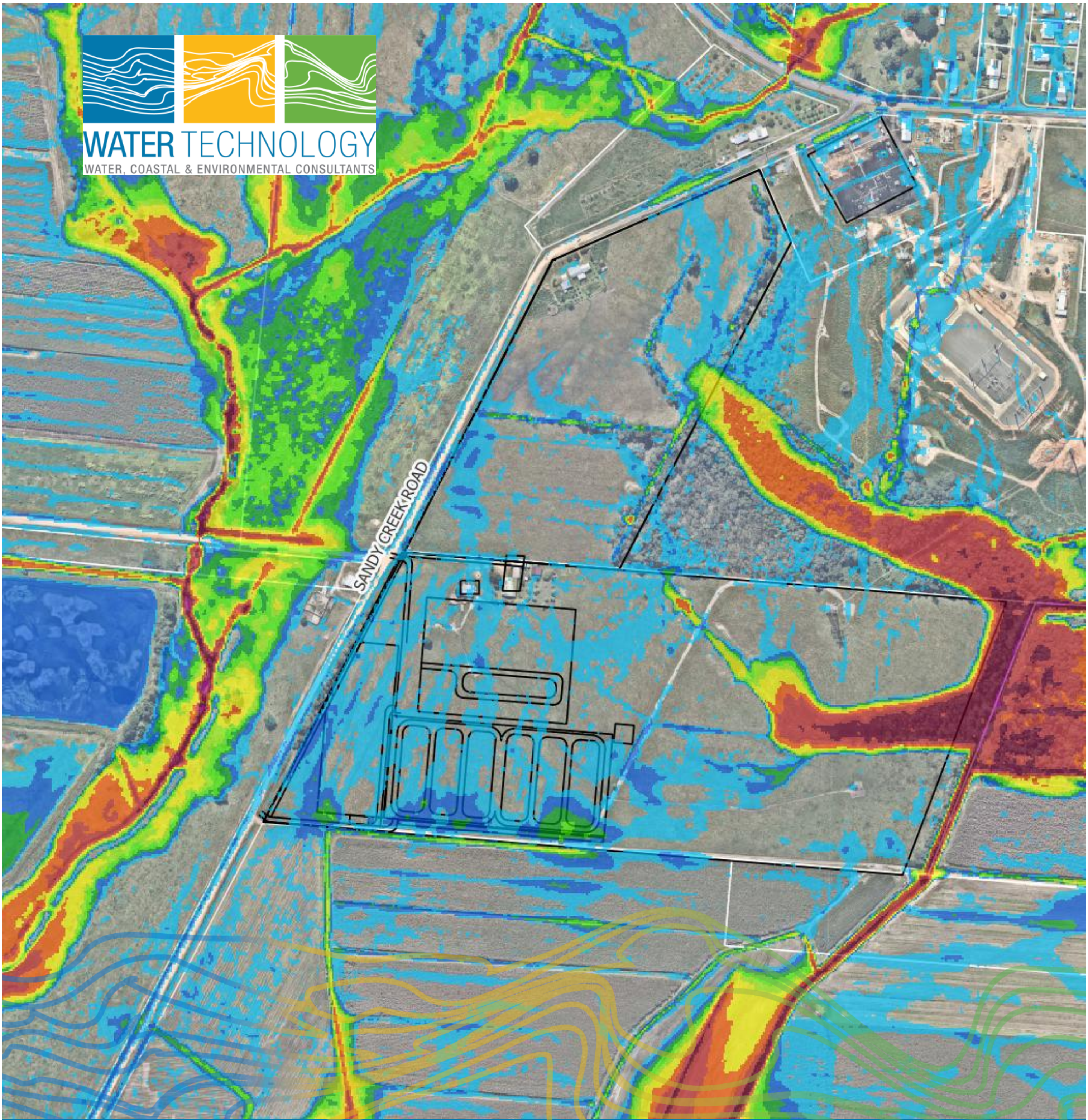
Attexó

Appendix E

Stormwater

Management Plan



WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Report

Tully BESS Stormwater Management Plan & Flood Assessment

Attexo

23 September 2025

Document Status

Version	Doc type	Reviewed by	Approved by	Date issued
V01	DRAFT	C. Wallis	A. Thompson	3 September 2025
V02	FINAL	C. Wallis	A. Thompson	23 September 2025

Project Details

Project Name	Tully BESS Stormwater Management Plan & Flood Assessment
Client	Attexo
Client Project Manager	Sue Walker
Water Technology Project Manager	Carl Wallis
Water Technology Project Director	Andrew Thompson
Authors	Mary-Anne Kossen | Danni-Elle Clowes
Document Number	25020134_TullyBESS_SMP_R01_V02

Level 5, 43 Peel Street
South Brisbane QLD 4101
Telephone (07) 3105 1460
Fax (07) 3846 5144
ACN 093 377 283
ABN 60 093 377 283

Quality ISO 9001 SAI GLOBAL
Environment ISO 14001 SAI GLOBAL
OHS ISO 45001 SAI GLOBAL

ACKNOWLEDGEMENT OF COUNTRY

The Board and employees of Water Technology acknowledge and respect the Aboriginal and Torres Strait Islander Peoples as the Traditional Custodians of Country throughout Australia. We specifically acknowledge the Traditional Custodians of the land on which our offices reside and where we undertake our work.

We respect the knowledge, skills and lived experiences of Aboriginal and Torres Strait Islander Peoples, who we continue to learn from and collaborate with. We also extend our respect to all First Nations Peoples, their cultures and to their Elders, past and present.

Artwork by Maurice Goolagong 2023. This piece was commissioned by Water Technology and visualises the important connections we have to water, and the cultural significance of journeys taken by traditional custodians of our land to meeting places, where communities connect with each other around waterways.

The symbolism in the artwork includes:

- *Seven circles representing each of the States and Territories in Australia where we do our work*
- *Blue dots between each circle representing the waterways that connect us*
- *The animals that rely on healthy waterways for their home*
- *Black and white dots representing all the different communities that we visit in our work*
- *Hands that are for the people we help on our journey*

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

Water Technology (WT) has been engaged by Attexo to prepare a Stormwater Management Plan (SMP) and Flood Assessment (FA) for the proposed Tully battery energy storage system (BESS), situated south of Tully in the Cassowary Coast Regional Council (CCRC) Local Government Area (LGA) in far north Queensland. The Location of the proposed site is presented in Figure 1-1.

1.1 Proposed Development

Attexo are assisting RWE Renewables Australia Pty Ltd (RWE) in submitting a development application for a proposed BESS, occupying an area of approximately 28.7 hectares (ha), that comprises of two freehold parcels, Lot 1 on RP735276 and Lot 1 on RP852238. The site is situated approximately 4 km south-west of Tully. The project is expected to have an approximate capacity of up to 200 MW / 800 MWh with grid connection proposed via the Powerlink owned 132 kV existing Tully Substation, located to the northeast on Lot 1 on RP716718. Figure 1-2 illustrates the BESS area with the layout of the batteries and supporting infrastructure. The proposal includes:

- BESS development area including earthworks, temporary construction ancillary facilities, foundations for installation of containerised battery system, drainage works, appropriate fencing, perimeter and site access road.
- An easement for an overhead electrical infrastructure connection running from the north of the BESS area to substation on the adjoining lot.
- Site access road off Sandy Creek Road.

1.2 Assessment Objectives and Scope

This report describes a conceptual SMP and FA to support the proposal and includes:

- A review and summary of relevant planning and legislative requirements as they relate to stormwater management and flooding.
- Identification of Environmental Values (EV's) and Water Quality Objectives (WQO's) applicable to the development.
- A SMP documenting the methodology and outcomes of the assessments undertaken to demonstrate that the proposed development achieves the stormwater quality requirements of CCRC and the Queensland State Government, including:
  - Compliance with the relevant Performance Outcomes associated with The Department of State Development, Infrastructure and Planning (DSDIP) State Code 9: Great Barrier Reef wetland protection area[1].
  - Details of construction phase erosion and sediment control measures.
  - MUSIC modelling to quantify changes to stormwater runoff quality during the operational phase.
  - Conceptual sizing of stormwater quality management measures to meet the relevant WQO's.
- A FA documenting modelling undertaken to characterise existing overland flow flood behaviour within and surrounding the site and quantify potential impacts of the proposal on overland flow flooding as well as:
  - Development of a local flood model (using TUFLOW) to characterise existing overland flow behaviour.
  - High-level recommendations to minimise impacts of flooding on the development.
  - Quantification of hydraulic impacts associated with the development and high-level recommendations to ensure the development does not cause material impacts on flooding external to the site.

[1] Queensland Department of State Development, Infrastructure, Local Government and Planning, Planning guidance – State Code 9: Great Barrier Reef wetland protection areas, 18/02/2022

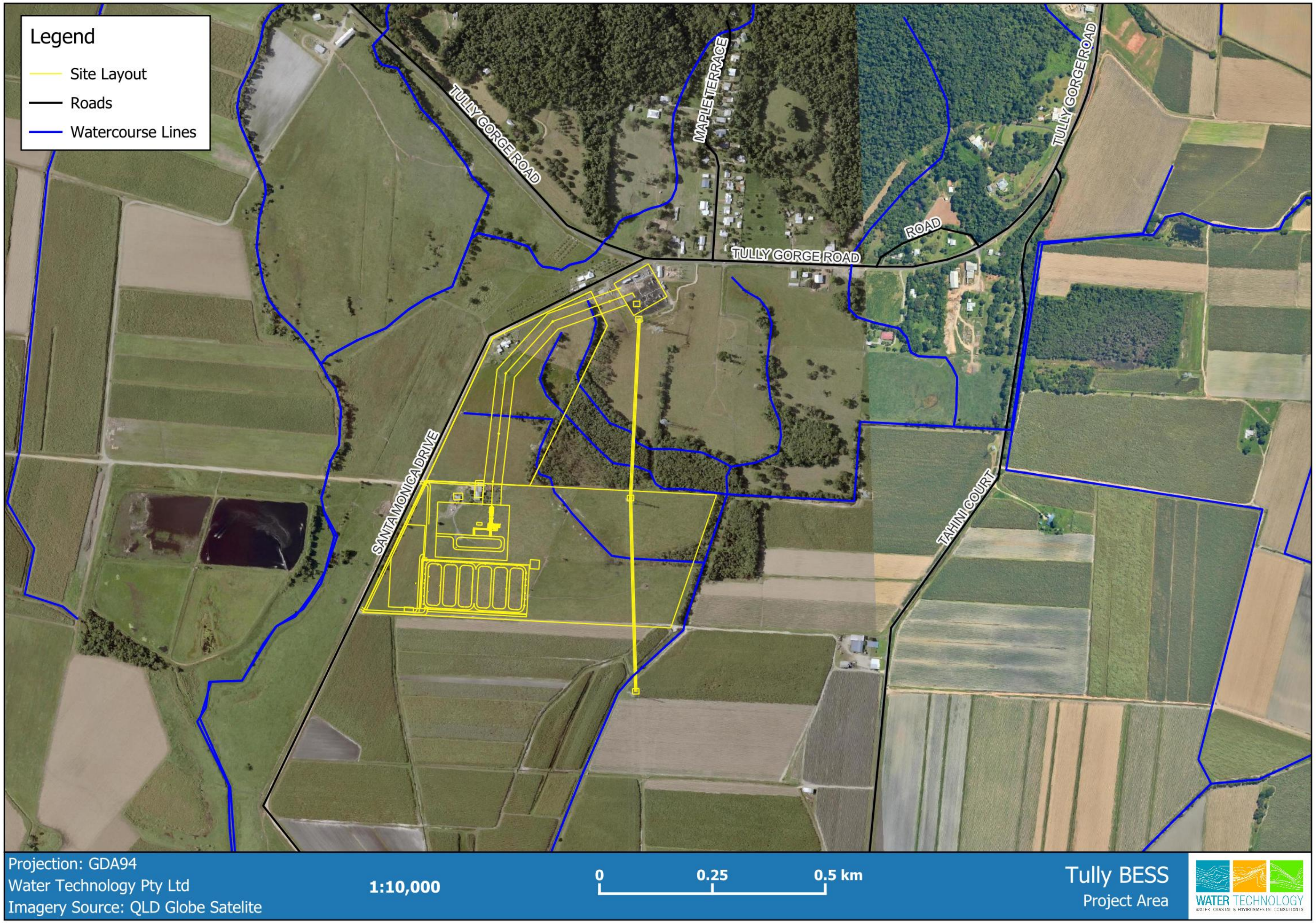


Figure 1-1 Tully BESS – Site Location

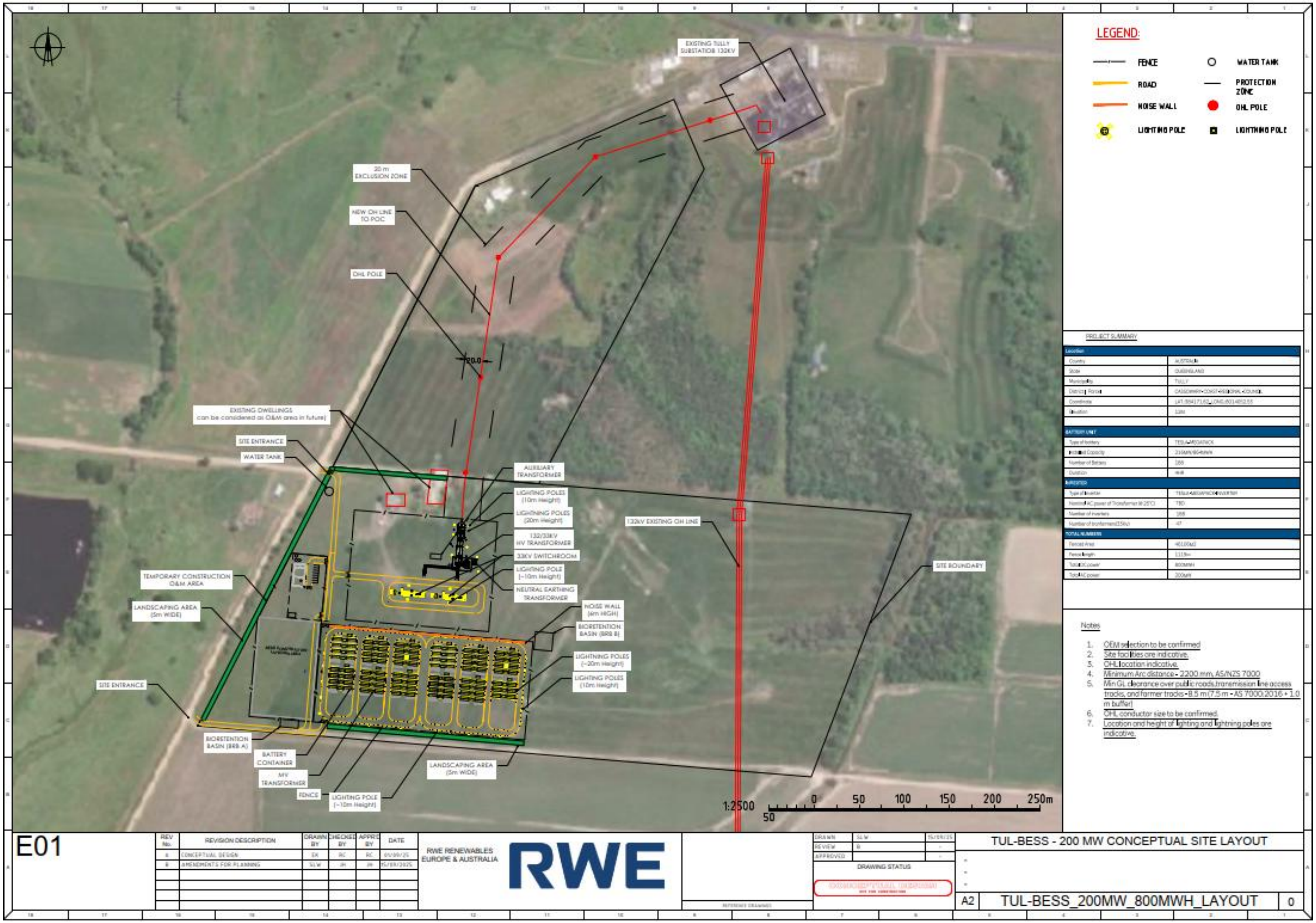


Figure 1-2 Tully BESS Site Layout

2 LEGISLATIVE CONTEXT

There are a number of legislative acts and policies in Queensland that govern development throughout the state. Those that are particularly relevant to the proposed Tully BESS in the context of the SMP are detailed in the following sections.

2.1 Environmental Protection Act 1994

The stated object of the act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development). Subordinate to this act is the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 whose purpose is to achieve the *Environmental Protection Act (1994)* objectives in relation to waters and wetlands.

2.1.1 Environmental Protection (Water and Wetland Biodiversity) Policy 2019

The Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP Water) is designed to uphold the objectives of the *Environmental Protection Act 1994* concerning the protection of Queensland's water environment while permitting ecologically sustainable development. It aims to determine Environmental Values (EV's) and Water Quality Objectives (WQO's) for Queensland waters progressively. EV's define water uses by both aquatic ecosystems and humans (such as drinking water, irrigation, aquaculture, and recreation), while WQO's set objectives for the physical, chemical, and biological characteristics of water (including nitrogen content, dissolved oxygen, turbidity, toxicants, and fish health).

The policy adopts the management framework outlined in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) to guide its implementation.

2.2 Water Act 2000

The purpose of the act, with relevance to the project, is to provide a framework for the sustainable management of Queensland's water resources. This requires:

- Incorporating the principles of ecologically sustainable development;
- Sustaining the health of ecosystems, water quality, water-dependent ecological processes and biological diversity associated with watercourses, lakes, springs, aquifers and other natural water systems, including where practicable, reversing degradation that has occurred; and
- Recognising the interests of Aboriginal people and Torres Strait Islanders and their connection with water resources.

Subordinate to this act is the Water Plan (Wet Tropics) 2013. The Water Plan provides a framework for sustainable water management balancing human development with environmental systems including the reversal of degradation in natural ecosystems.

2.3 Planning Act 2016

The *Planning Act 2016* is the primary piece of legislation that governs land use planning and development in Queensland. It establishes a framework for the preparation and implementation of planning schemes that regulate the use of land in Queensland. The development of 'battery storage facilities' advances the purpose of the Planning Act under section 5 (c) and (h):

c. promoting the sustainable use of renewable and non-renewable natural resources, including biological, energy, extractive, land and water resources that contribute to economic development through employment creation and wealth generation

h. supplying infrastructure in a coordinated, efficient, and orderly way.

2.3.1 Planning Regulation 2017

The Planning Regulation 2017 is subordinate to the *Planning Act 2016*, detailing operational elements of the Planning Act. The Planning Regulation sets out the only land use terms that may be adopted in local planning schemes in Schedule 3. These are complemented by the use terms defined in Schedule 24 of the Planning Regulation. Battery storage facilities have not yet been given a State Code with assessable benchmarks under the State Development assessment Provisions.

2.3.2 State Code 9: Great Barrier Reef Wetland Protection Areas

The project site is located within the designated Great Barrier Reef wetland protection areas, as defined by the Map of Great Barrier Reef Wetland Protection Areas under State Code 9: Great Barrier Reef Wetland Protection Areas. Table 2-1 lists the performance outcomes from State Code 9 that are applicable to this SMP.

Table 2-1 State Code 9: Great Barrier Reef wetland protection areas

Performance outcomes
Hydrology
PO3 Development maintains or improves the existing surface and groundwater hydrology in a wetland protection area.
Water Quality
PO4 Development does not unacceptably impact the water quality of the wetland in the wetland protection area and in the wetland buffer
PO5 Development does not use the wetland in the wetland protection area for stormwater treatment

2.3.3 State Planning Policy (SPP) – Water Quality

The State Planning Policy (SPP) ensures Queensland's state interests are delivered through local planning and development assessment. The SPP identifies water quality as a state interest, and local governments must reflect it in their planning schemes; where a scheme has not fully integrated a state interest, the SPP's interim development assessment requirements apply. Development must achieve post-construction stormwater design objectives, including minimum reductions in:

- Total Suspended Solids (TSS): 80%
- Total Phosphorus (TP): 60%
- Total Nitrogen (TN): 45%
- Gross Pollutants (>5 mm): 90%

These are typically achieved through water sensitive urban design (WSUD) measures such as bioretention basins, swales, and gross pollutant traps (GPT).

2.3.4 Cassowary Coast Regional Council Planning Scheme 2015 (V4)

The Cassowary Coast Regional Council Planning Scheme advances state and regional policies through detailed local provisions. While the scheme does not specifically define Battery Energy Storage Systems (BESS), development remains subject to relevant zoning provisions and infrastructure standards, including stormwater management requirements specified in the desired standards of service. These provisions align with the State Planning Policy (SPP) – Water Quality objectives discussed in Section 2.2.

2.3.4.1 Desired Standards of Service

Section 4.4 of the Planning Scheme specifies the desired standards of service for the stormwater network:

1. Collect and convey stormwater in a system of natural and engineered channels, a piped drainage network and system of overland flow paths to a lawful point of discharge in a safe manner that minimises nuisance, damage and inundation of habitable rooms and protects life;
2. Manage the water quality within urban catchments and waterways to protect and enhance environmental values and pose no health risk to the community;
3. Adopt water-sensitive urban design principles and on-site water quality management to achieve relevant water quality objectives;
4. The design of the stormwater network is in accordance with the FNQROC Regional Development Manual – Issue 7 (2017).

2.4 Fisheries Act 1994

The primary purpose of this act as stated is to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to apply and balance the principles of and promote ecologically sustainable development. Of relevance to this project, this act manages the introduction of waterway barrier works that may impact fish movement through the project area.

2.5 Vegetation Management Act 1999

The *Vegetation Management Act 1999* provides a comprehensive framework for vegetation management in Queensland, including the protection of riparian vegetation, while the specific policies and guidelines for the protection and management of riparian vegetation in Queensland aim to ensure that this unique and important type of vegetation is protected and preserved for future generations. These include the following:

- Vegetation Management Regulation 2012: Subordinate to the Vegetation Management Act 1999 and provides accepted development vegetation clearing codes.
- Queensland Government Riparian Vegetation Management Guidelines: Provides guidance on the management of riparian vegetation and aims to ensure that riparian areas are protected and managed in an ecologically sustainable manner.
- State Planning Policy: Sets out the Queensland government's position on the protection of riparian vegetation and the requirement for local governments to include provisions for the protection of riparian areas in their planning schemes.
- Regional Ecosystems: Defined areas within Queensland that have similar vegetation types and ecological characteristics and include specific provisions for the protection and management of riparian vegetation.

2.6 Soil Conservation Act 1986

This act relates to the conservation of soil resources and mitigation of soil erosion through soil conservation measures.

2.7 Non-Statutory Water Quality Guidelines

2.7.1 Reef 2050 Water Quality Improvement Plan

The Reef 2050 Water Quality Improvement Plan is a strategic framework designed to safeguard the health of the Great Barrier Reef's marine ecosystems. It focuses on reducing sediment runoff, nutrient pollution, and pesticide contamination. Key elements include targeted actions, improved land management practices, robust monitoring, community engagement, research, and adaptive management. The plan involves stakeholders from various sectors and emphasizes the use of best management practices to minimize environmental impact.

These guidelines list specific water quality objectives for relevant catchments to achieve 2025 Great Barrier Reef water quality targets. This site is situated in the in the Tully Catchment which covers 1,683 km² (8% of the Wet Tropics region).

Table 2-2 summarises the 2025 end-of catchment anthropogenic water quality targets for the Tully Catchment and associated priorities for water quality improvement.

Table 2-2 End-of-catchment anthropogenic load reductions required from 2013 baseline

Region: Wet Tropics Region, Tully catchment water quality targets		
Parameter	**Target**	**Management Priority**
Dissolved inorganic nitrogen (DIN)	190 tonnes, 50% reduction	High
Fine sediment	17 kilo-tonnes, 20% reduction	Low
Particulate phosphorus (PP)	23 tonnes, 20% reduction	Low
Particulate nitrogen (PN)	68 tonnes, 20% reduction	Low
Pesticides	n/a	Low

2.7.2 Wet Tropics Water Quality Improvement Plan

The Wet Tropics Water Quality Improvement Plan (WQIP) was developed to establish and achieve water quality targets for the region, ensure the protection of the Great Barrier Reef. The plan identifies priority areas and outlines targeted management actions that aim to reduce pollutant loads, improve land management practises and enhance ecosystem resilience.

The short-term water quality and land management targets are in accordance with the broader Reef 2050 Water Quality Improvement Plan, reinforcing efforts to protect coastal and marine environments. The Wet Tropics region is divided into distinct catchment areas to facilitate localised and strategic interventions. Key pollutants of concern include fine sediment, nutrients and pesticides, which originate mainly from agriculture activities. While some catchments have been identified as priority areas for investment, the plan promotes a proactive and preventative approach to managing water quality risks across the region, ensuring long-term sustainability.

2.7.3 Application to the Project

While the Reef 2050 WQIP and the Wet Tropics WQIP are not statutory instruments, adopting their catchment-specific targets and best-practice measures supports compliance against State Code 9 by

(a) maintaining or improving site hydrology (PO3),

(b) preventing unacceptable water quality impacts to wetlands and their buffers (PO4), and

(c) ensuring wetlands are not used as part of the stormwater treatment system (PO5).

2.8 Other Relevant Guidelines

In addition to relevant legislation, several surface water and stormwater management guidelines have been considered to ensure best practice methods and design outcomes are utilised at Tully BESS. These include:

- Australian and New Zealand Governments (ANZG) 2018, Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia.
- Australian Drinking Water Guidelines, 2011 (Updated August 2018).
- Queensland Urban Drainage Manual, 2017.
- Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia - Geoscience Australia, 2019.
- Best Practice Erosion and Sediment Control, IECA, 2008.

3 CATCHMENT HYDROLOGY AND SITE CHARACTERISTICS

3.1 Topography and Catchments

The Tully catchment is located in the south of the Wet Tropics region. The location surrounding the site is relatively flat, with lower-lying regions at approximately 4 mAHD and higher elevations at 30 mAHD, the site topography is shown in Figure 3-1. The site is situated in the lower part of the Tully River Drainage Basin, which occupies an area of approximately 1,675 km² extending south from Innisfail, as shown in Figure 3-2. The Tully River Basin drains primarily to the Pacific Ocean, with additional contributions from the Hull River and smaller tributaries. Given the region's high rainfall and complex topography, the site is subject to dynamic hydrodynamic processes, including floodplain inundation, overland flow, and potential backwater effects from downstream constraints.

3.2 Land Use

The project area is predominantly used for grazing native vegetation, as identified by the Queensland Land Use Mapping Program. The surrounding catchment features also include areas of Environmental Significance according to Cassowary Coast Regional Council online planning scheme mapping, as shown in Figure 3-3.

3.3 Great Barrier Reef Wetland Protection Areas

Figure 3-4 shows the location of the mapped Great Barrier Reef Wetland Protection Areas in the vicinity of the project. The areas of high ecological significance identified in this dataset closely correspond to the areas of Environmental Significance shown in the Cassowary Coast Regional Council online planning scheme mapping, which includes mapped wetlands near the site. The proposed infrastructure has been designed to be located wholly outside these mapped high ecological significance areas.

However, the site is within the mapped Great Barrier Reef Wetland Protection Area trigger area, which means the development must be assessed against the provisions of State Code 9: Great Barrier Reef Wetland Protection Areas under the State Development Assessment Provisions (SDAP). Compliance with State Code 9 performance outcomes is addressed in Section 5.5.3.

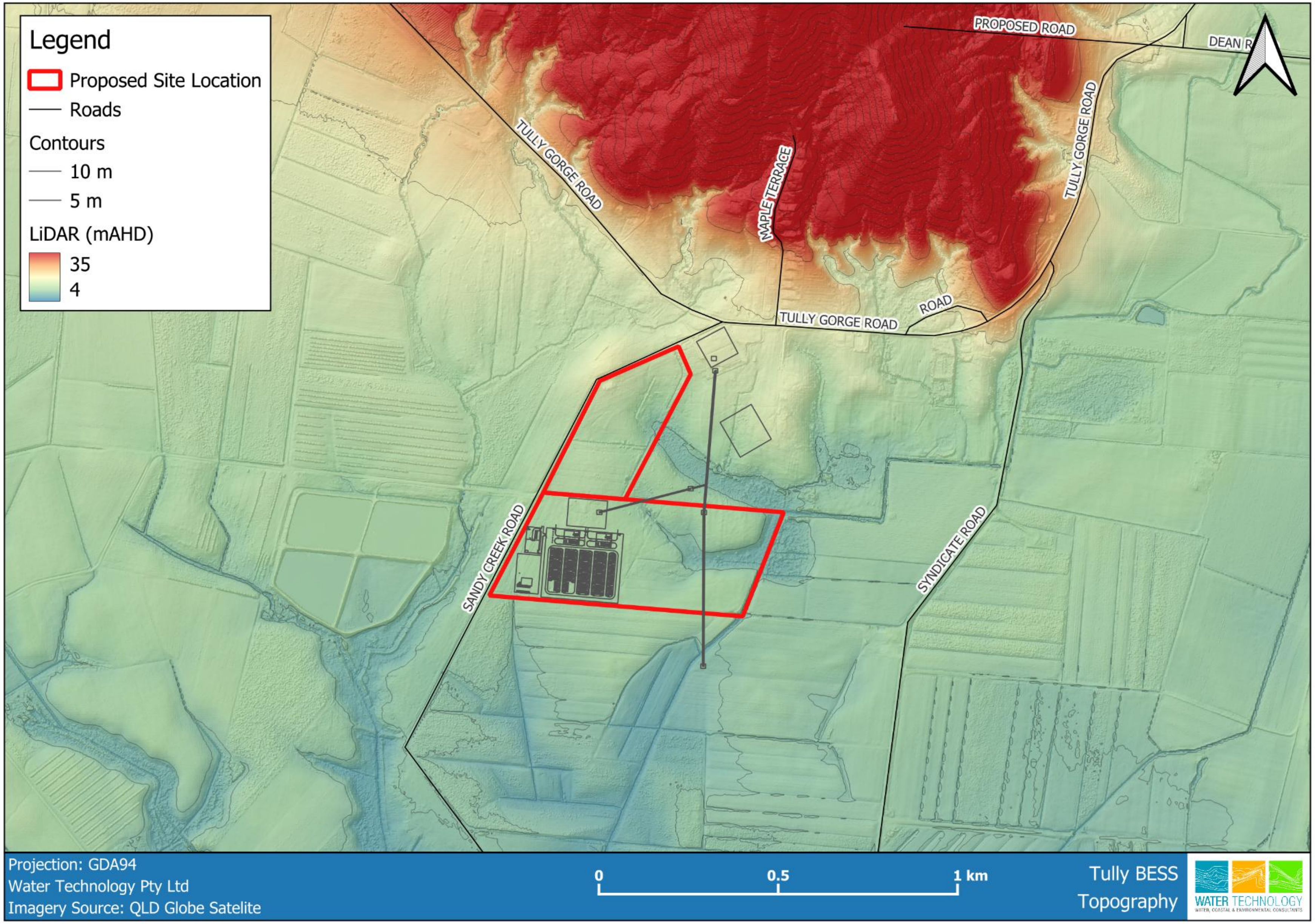


Figure 3-1 Site Topography and Local Catchment

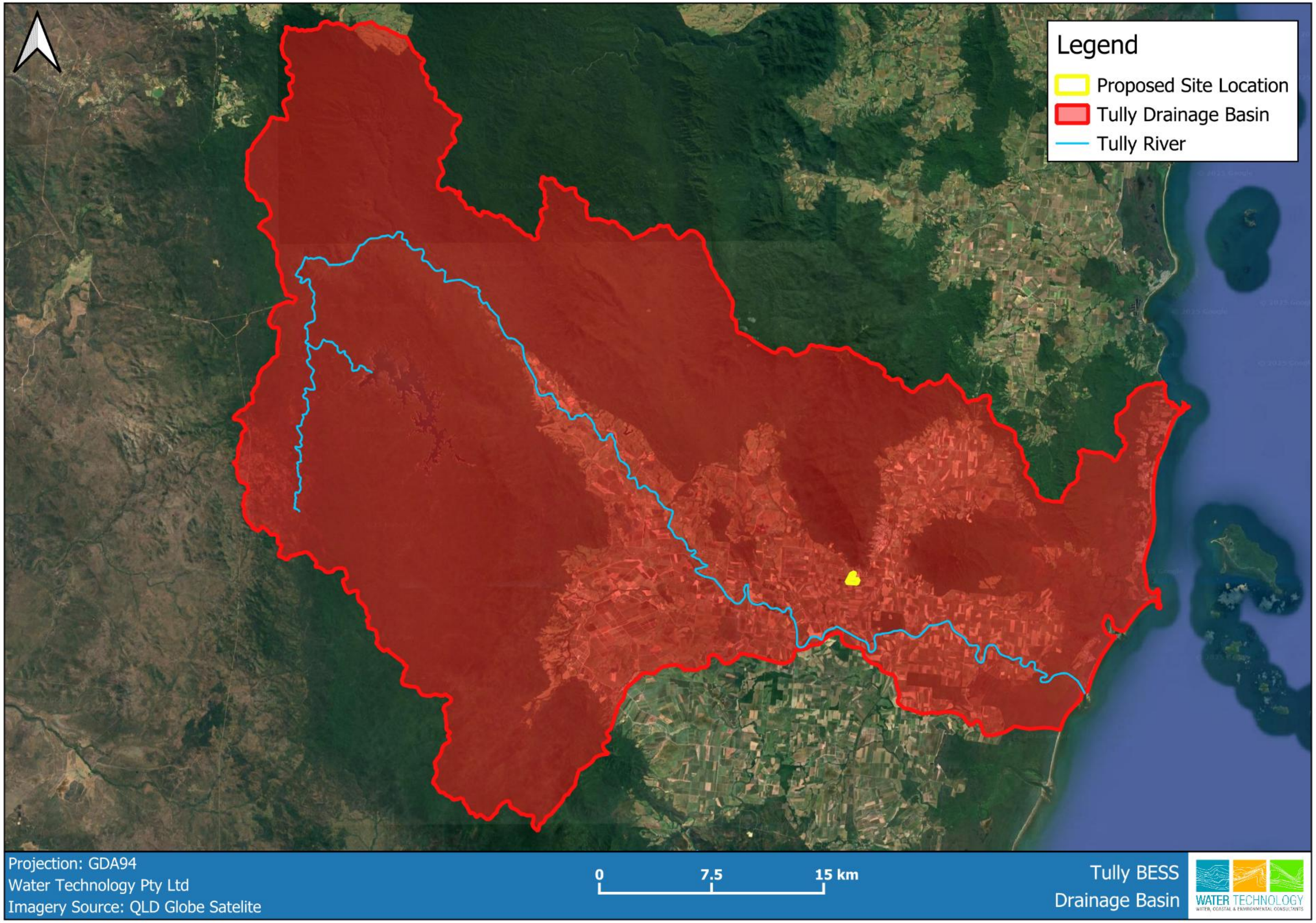


Figure 3-2 Tully Drainage Basin

Figure 3-3 Areas of Environmental Significance (Cassowary Coast Regional Council Online Planning Scheme)

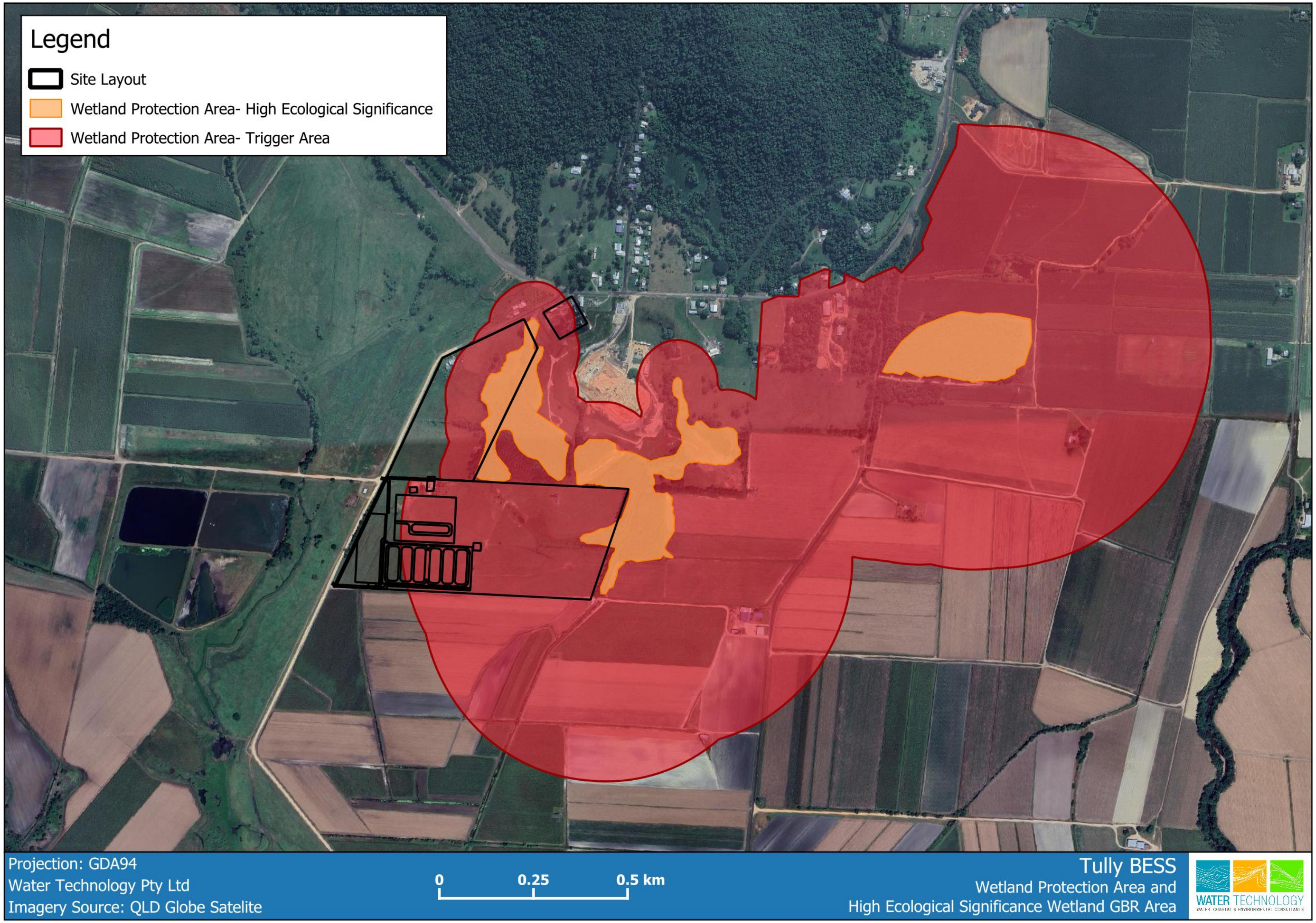


Figure 3-4 Great Barrier Reef Wetland Protection Areas

3.4 Climate

Tully Station is the nearest open station providing climate statistics and is located approximately 7.1 km northeast of the centroid of the project area. Annual rainfall statistics are provided in Table 3-1 with gauge locations presented in Figure 3-6.

Table 3-1 Annual Rainfall Statistics

Parameter	Units	Tully Sugar Mill	Bingil Bay
Station number		032042	32009
Rainfall record		1956-present	1925-present
Distance from project area centroid	km	7.1 km NE	24.5 km NE
Mean rainfall	mm/year	3,921	3,127
10th percentile rainfall	mm/year	2,881	2,339
Median rainfall	mm/year	3,825	3,002
90th percentile rainfall	mm/year	5,103	4,225
Maximum rainfall	mm/year	6,211	5,165

Figure 3-5 shows the mean monthly rainfall and pan-evaporation derived from the SILO point data for the Tully gauging station. Mean annual rainfall and evaporation at Tully are 3,921 mm and 1,833 mm, respectively. The wet season tends to occur from December - May, with lesser rainfall throughout the remainder of the year.

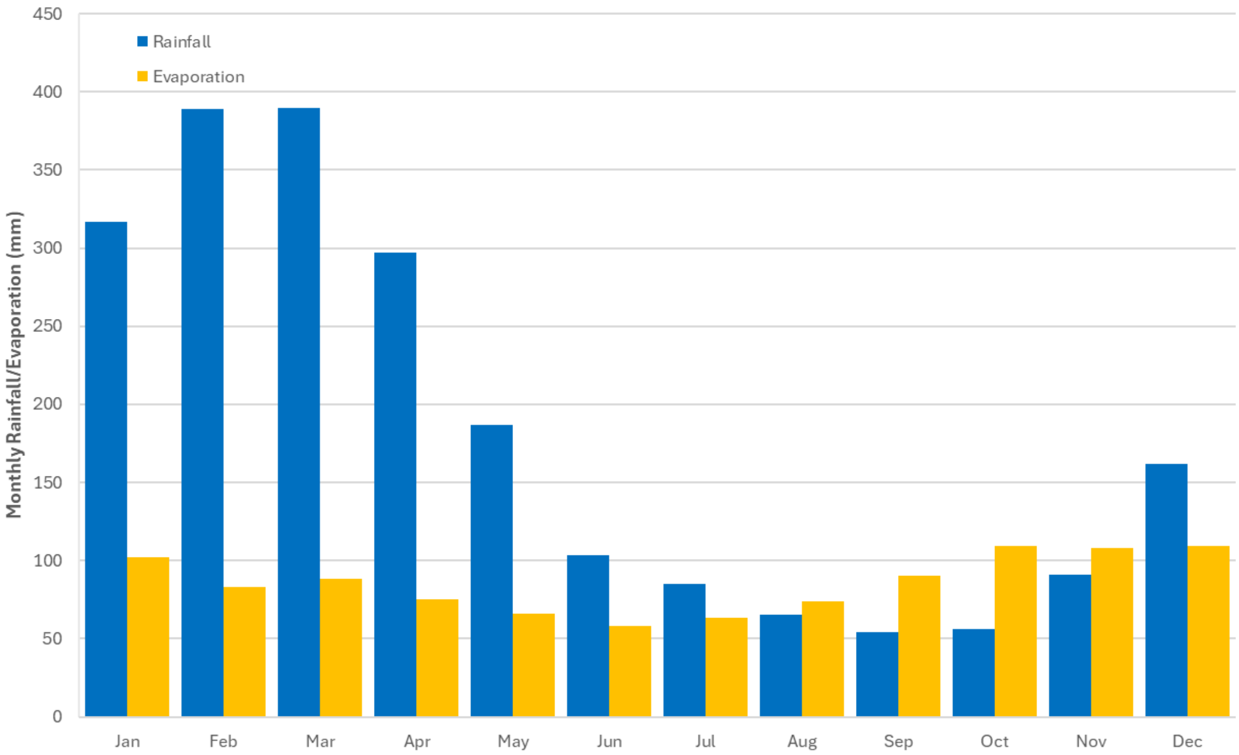


Figure 3-5 Mean Monthly Rainfall and Evaporation at Tully Sugar Mill (032042)

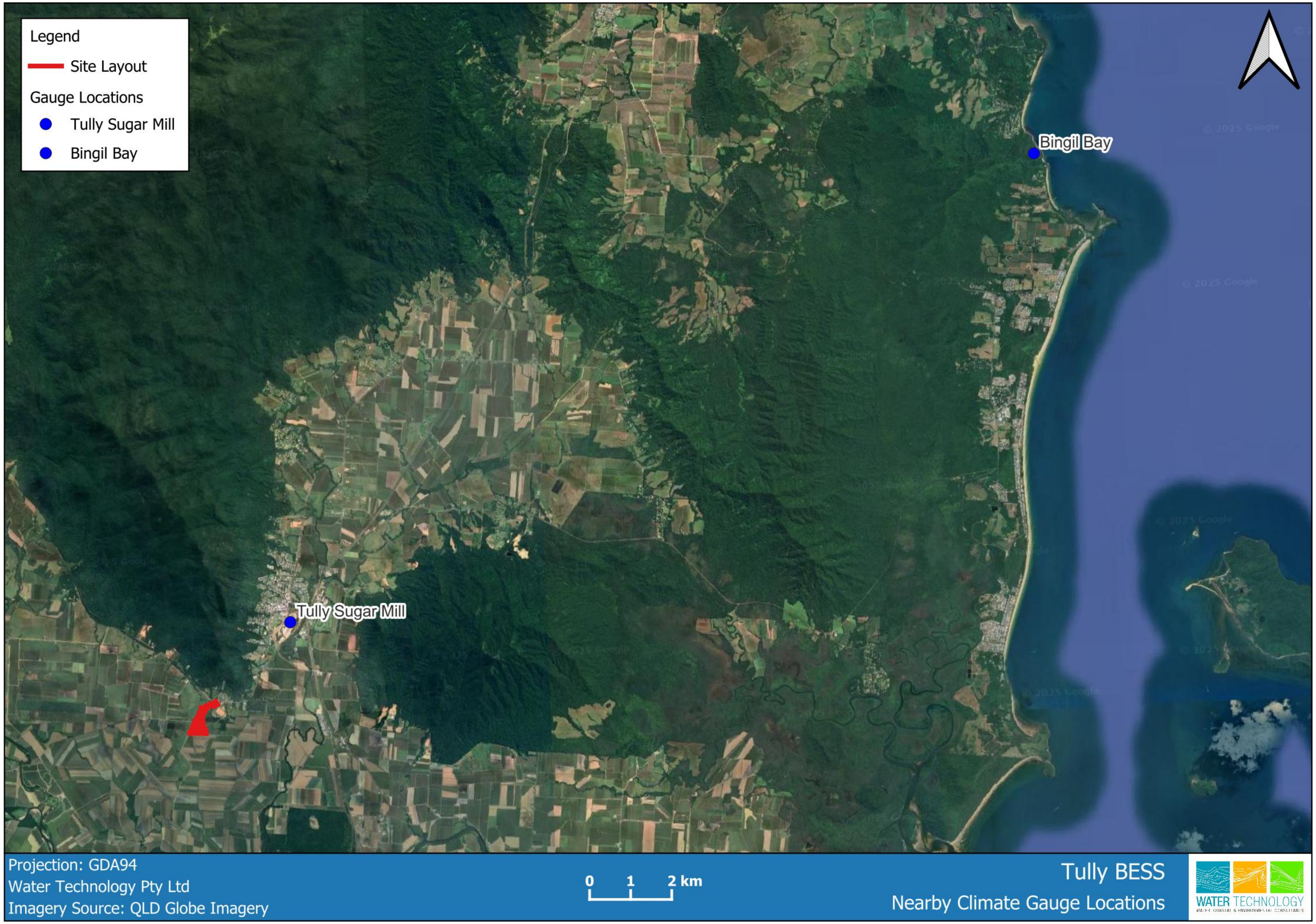


Figure 3-6 Gauge Locations

3.5 Soils

Soil data at a scale of 1:50,000 was accessed via Queensland Globe as illustrated in Figure 3-7. The Hewitt soil series dominates the site and typically comprises poorly drained soils formed on alluvial deposits, which may influence infiltration capacity and foundation design.

A portion of the site is mapped as MSC (Miscellaneous Soils Complex), a classification used for areas where detailed soil assessment is limited or where heterogeneous soil conditions occur. This designation indicates that site-specific geotechnical investigations will be important to confirm soil properties for earthworks and stormwater management design.

3.6 Geomorphology

A high-level desktop geomorphic assessment was undertaken to characterise the waterways assessed in this Study Area. The Study Area is located on the floodplain of the Tully River, at the southern foothills of Tully Gorge National Park. The geology of the area consists of alluvium materials underlain by granites. The area receives high rainfall and high intensity rainfall often leads to the River overtopping its bank and inundating the floodplains. Flat topography, regular inundation of the floodplain and poor infiltration of granitic geologies supported the development of extensive wetlands in the area historically.

To support the development of agriculture on the alluvial floodplains, many of these wetlands were drained and infilled. Channels were also constructed to divert flows. Consequently, most of the waterways in the Study Area are artificial or highly modified channels of Stream Order 1 and 2. The construction of this extensive channel network has greatly increased the drainage density of the landscape. Many of these drains have been constructed as straight channels, resulting in an increase in the efficiency of flow and sediment transfer downstream. The increase in flow rate also increases the risk of channel bank and/or bed erosion.

Extensive clearing of vegetation from the floodplain also contributed to the increased rate and volume of run-off. This further reduced the resilience of channel banks and bed. While lower order streams such as those bordering the Study Area are less likely to be affected by the cumulative effects of these erosive processes, localised disturbances may trigger changes such as channel deepening or widening.

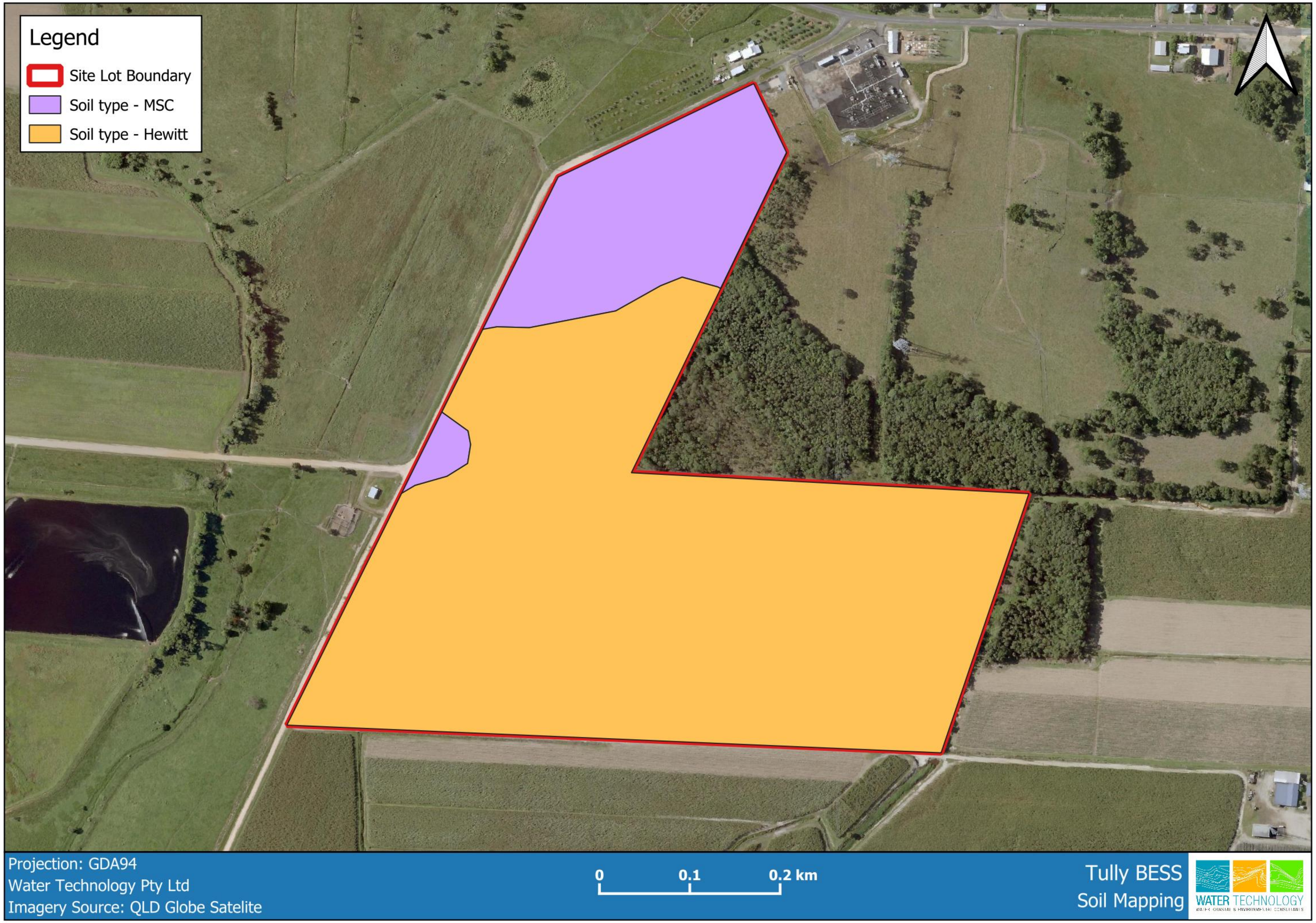


Figure 3-7 Site Soil Mapping

4 SURFACE WATER QUALITY

4.1 Environmental Values

The Environmental Protection (Water and Wetland Biodiversity) Policy 2019, which is subordinate legislation to the Environmental Protection Act 1994, provides a framework for identifying environmental values (EV) for a waterway and deciding water quality objectives (WQO) to protect or enhance those EV's. EV's for water are the qualities of water that make it suitable for supporting aquatic ecosystems and human water uses. These EVs need to be protected from the effects of habitat alteration, waste releases, contaminated runoff and changed flow to ensure healthy aquatic ecosystems and waterways that are safe for community use.

The site is located in Tully River (WQ1131 – Tully River, Murray River and Hinchinbrook Island Basins) and is mapped in the Environmental Protection (Water) Policy 2009, Wet Tropics Map Series. The site is located within the Tully River lowland fresh waters environmental value zone. The EVs specified for protection are as follows:

- Aquatic Ecosystems
- Irrigation
- Farm Supply
- Stock Water
- Human consumer
- Primary Recreation
- Secondary Recreation
- Visual Recreation
- Drinking Water
- Industrial Use
- Cultural and Spiritual Values

4.2 Water Quality Objectives

Water Quality Objectives are intended to protect the EV's of receiving waters and as such set out parameters for biological, chemical and other measures to be met in the receiving waters. The site is located in the Tully River lowland freshwaters and a management intent of 'moderately disturbed for the protection of aquatic ecosystems. Water quality should be maintained or improved in line with the WQOs. The relevant aquatic ecosystem WQOs for the Tully River catchment waters are outlined in Table 4-1 to Table 4-4.

The management of riparian vegetation related to WQOs shall be conducted with reference to regional vegetation management codes under the Vegetation Management Act 1999. This is aimed at maintaining water quality, bank stability and aquatic a terrestrial habitat. Clearing control varies according to stream order.

Table 4-1 Water quality objectives for nutrients and suspended soils to protect aquatic ecosystems EVs during high flow periods- 50th percentile

Parameter	Value*
Ammonia N	8 µg/L
Oxidised N	66 µg/L
Particulate N	153 µg/L
Dissolved organic nitrogen	106 µg/L
Total nitrogen	370 µg/L
Filterable reactive phosphorous	3 µg/L
Particulate P	10 µg/L
Dissolved organic phosphorous	5 µg/L
Total phosphorus	20 µg/L
Total suspended solids	20 mg/L

*High flow WQOs are based on measured data from high flow periods at a reference site on the Tully River in Tully Gorge National Park (gauging station 113015A).

Table 4-2 Water quality objectives for specific pesticides and biocides to protect aquatic ecosystem EVs for moderately disturbed developed fresh water

Parameter	Value
Atrazine	13 µg/l
Chlor-pyrifos	0.01 µg/l
Endo-sulfan	0.03 µg/l
Simazine	3.2 µg/l
Hexa-zinone	75 µg/l
2,4-D	280 µg/l
Tebu-thiuron	2.2 µg/l
Diazinon	0.01 µg/l

Table 4-3 Water quality objectives for ions, metals and chemical indicators in surface waters for general data across the Wet Tropics- 50th percentile

Parameter	Value
Na	7 mg/l
Ca	3 mg/l
Mg	2 mg/l
HCO3	25 mg/l
Cl	9 mg/l
SO4	1 mg/l
EC	72 mg/l
Hardness	17 mg/l
Alkalinity	20 mg/l
SAR	0.70

Table 4-4 Water quality objectives to protect human use environmental values (Source: DES 2020)

Environmental Value	Water quality objectives to protect EV
Suitability for drinking water supply	Local WQOs for drinking water supply are provided in Table 4 of DES (2020). Note: For water quality after treatment or at point of use refer to legislation and guidelines, including: ■ Public Health Act 2005 and Regulations ■ Water Supply (Safety and Reliability) Act 2008, including any approved drinking water management plan under the Act ■ Australian Drinking Water Guidelines.
Protection of the human consumer	Objectives as per AWQG and Australia New Zealand Food Standards Code, Food Standards Australia New Zealand, 2007 and updates.
Protection of cultural and spiritual values	Protect or restore indigenous and non-indigenous cultural heritage consistent with relevant policies and plans.
Suitability for industrial use	No WQOs are provided in this scheduling document for industrial uses. Water quality requirements for industry vary within and between industries. The AWQG do not provide guidelines to protect industries and indicate that industrial water quality requirements need to be considered on a case-by-case basis. This EV is usually protected by other values, such as the aquatic ecosystem EV.
Suitability for irrigation	ANZECC objectives for pathogens and metals are provided in Tables 8 and 9 of DES 2020. For other indicators, such as salinity, sodicity and herbicides, see AWQG.
Suitability for stock watering	Objectives as per AWQG, including median faecal coliforms <100 organisms per 100 mL. WQOs for total dissolved solids and metals are provided in Tables 10 and 11 of DES 2020, based on AWQG. For other objectives, such as cyanobacteria and pathogens, see AWQG.
Suitability for farm supply/use	Objectives as per AWQG.

Suitability for primary contact recreation	Objectives as per NHMRC (2008), including:
	■ water free of physical (floating and submerged) hazards
	■ temperature range: 16–34°C
	■ pH range: 6.5–8.5
	■ DO: >80%
	■ faecal contamination: designated recreational waters are protected against direct contamination with fresh faecal material, particularly of human or domesticated animal origin. Two principal components are required for assessing faecal contamination:
	    ■ assessment of evidence for the likely influence of faecal material.
	    ■ counts of suitable faecal indicator bacteria (usually enterococci).
	    ■ These two components are combined to produce an overall microbial classification of the recreational water body
	■ intestinal enterococci: 95th percentile ≤ 40 organisms per 100mL (for healthy adults) (NHMRC, 2008; Table 5.7).

Environmental Value	Water quality objectives to protect EV
Suitability for primary contact recreation	■ direct contact with venomous or dangerous aquatic organisms should be avoided. Recreational water bodies should be reasonably free of, or protected from, venomous organisms ■ waters contaminated with chemicals that are either toxic or irritating to the skin or mucous membranes are unsuitable for recreational purposes. ■ cyanobacteria/algae: Recreational water bodies should not contain: ■ Level 1: ≥ 10 µg/L total microcystins; or ≥ 50 000 cells/mL toxic Microcystis aeruginosa; or biovolume equivalent of ≥ 4 mm3 /L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume; or ■ Level 2: ≥ 10 mm3 /L for total biovolume of all cyanobacterial material where known toxins are not present; OR cyanobacterial scums consistently present. Further details are contained in NHMRC (2008) and Table 12 of DES 2020.
Suitability for secondary contact recreation	Objectives as per NHMRC (2008), including: ■ intestinal enterococci: 95th percentile ≤ 40 organisms per 100 mL (for healthy adults) (NHMRC, 2008; Table 5.7). ■ cyanobacteria/algae—refer objectives for primary recreation, NHMRC (2008) and Table 12 of DES 2020.
Suitability for visual recreation	Objectives as per NHMRC (2008), including: ■ Recreational water bodies should be aesthetically acceptable to recreational users. The water should be free from visible materials that may settle to form objectionable deposits; floating debris, oil, scum and other matter; substances producing objectionable colour, odour, taste or turbidity; and substances and conditions that produce undesirable aquatic life. ■ cyanobacteria/algae—refer objectives for primary recreation, NHMRC (2008) and Table 12 of DES 2020.

5 STORMWATER MANAGEMENT PLAN

5.1 Construction Phase

5.1.1 Overview

Management of water quality during the construction phase is necessary to minimise environmental harm to downstream receiving waters. The following section provides a brief outline of the construction phase stormwater management requirements for the proposed development. Construction phase water quality management approaches are highly-site specific. Therefore, the management approach will be refined as more details of the construction timeline are known.

5.1.2 Construction Water Quality Management

Construction phase stormwater quality management will occur in accordance with current industry standards including the requirements of the *State Planning Policy (SPP)* and *Best Practice Erosion and Sediment Control (International Erosion Control Association (IECA) 2008)*. The main tenets of construction phase water quality management are contained in Table 5-1Table 5-1. These have been adapted from the SPP and a general management approach has been nominated for each issue. Further details of the management approach will be determined in the erosion and sediment control plan (ESCP) developed for the site by a suitably qualified person.

Table 5-1 Stormwater Management Actions (Construction Phase)

Issue	Management Actions
Drainage control	▪ Design storm and design life for temporary works: – Disturbed area open for <12 months – 1 in 2-year ARI event – Disturbed area open for 12-24 months – 1 in 5-year ARI event – Disturbed area open for >24 months – 1 in 10-year ARI event ▪ Design capacity excludes minimum 150 mm freeboard. ▪ Temporary culvert crossing – minimum 1 in 1-year ARI hydraulic capacity. ▪ Manage sheet flow to minimise gully and rill erosion. ▪ Temporary drainage to provide stable concentrated flow paths, catch drains and flow diversions where necessary. ▪ The disturbed area is anticipated to be greater than 2,500 m², therefore, a sediment basin will likely be required to manage sediment run-off and regulate flows. ▪ Temporary sediment basin/s to be constructed in accordance with the *Best Practice Erosion and Sediment Control Guideline (IECA 2008)*.
Erosion control	▪ Stage clearing and construction activities to minimise exposed soil. ▪ Progressive stabilisation is to be undertaken in accordance with IECA 2008 Table 4-2 and nominated groundcover percentages achieved prior to the removal of control devices.
Sediment control	▪ Implement sediment controls such as sediment traps, silt fences, channel linings and check dams in accordance with construction ESCPs. ▪ Sediment traps are to be designed and positioned by a suitably qualified person to achieve site discharge water quality objectives.
Flow management	▪ Earthworks and the implementation of erosion and sediment controls are undertaken in ways which ensure flooding characteristics are not worsened.

5.2 Operational Phase

An assessment of stormwater quality at the site, including Water Sensitive Urban Design (WSUD) measures adopted to mitigate impacts to the quality of stormwater runoff from the developed site, has been undertaken using the Model for Urban Stormwater Conceptualisation (MUSIC).

The following section documents the conceptual sizing of a treatment train, consisting of a bioretention basin and vegetated swale, to inform site layout and civil design. These WSUD measures are proposed for the operational phase of the development and are, therefore, long-term water quality management measures following the post-construction phase of the proposed development. Potential pollutants from this development are listed in Table 5-2 below.

Table 5-2 Potential Pollutants from Site (Post-Construction Phase)

Pollutant Type	Pollutant sources
Sediment	Sediment brought in by vehicles, erosion, atmospheric deposition, organic matter, spills and accidents.
Nutrients	Fertiliser, decaying organic matter, animal faeces, detergents, atmospheric deposition.
Gross Pollutants	Litter such as food, drink and materials packaging and wrappers, leaf matter and grass clippings.
Hydrocarbons	Fuel and oil spills from cars and trucks, asphalt pavements.

5.3 MUSIC Model Schematisation

Water quality modelling of the proposed development has been undertaken using the Model for Urban Stormwater Conceptualisation (MUSIC). The MUSIC model allows the user to estimate the pollutant loads generated within and exported from the proposed BESS area within the site and quantify the relative effectiveness of the proposed stormwater quality treatment train. MUSIC provides quantitative modelling for Total Suspended Solids (TSS), Total Phosphorous (TP), Total Nitrogen (TN), and Gross Pollutants (GP).

The MUSIC model was set up in accordance with the *Water by Design MUSIC Modelling Guidelines (2018)* (WBD, 2018) which has been published under the Water by Design Program by the South-East Queensland Healthy Waterways Partnership. In addition, Healthy Waterways recommends using the latest version, MUSIC 6 to ensure compliance with stormwater pollutant load reduction objectives.

5.3.1 Catchment Areas

The proposed BESS layout was used to estimate sub-catchment areas for input to the MUSIC model, following a split catchment land use approach to modelling pollutant loads from the proposed development footprint within the site. Five land use areas were delineated for the post-development scenario, whilst a single land use was used to represent the pre-development scenario. The catchment areas adopted in the MUSIC modelling are shown on Figure 5-1. The sub catchment split is shown in Figure 5-2, and summarised in Table 5-3.

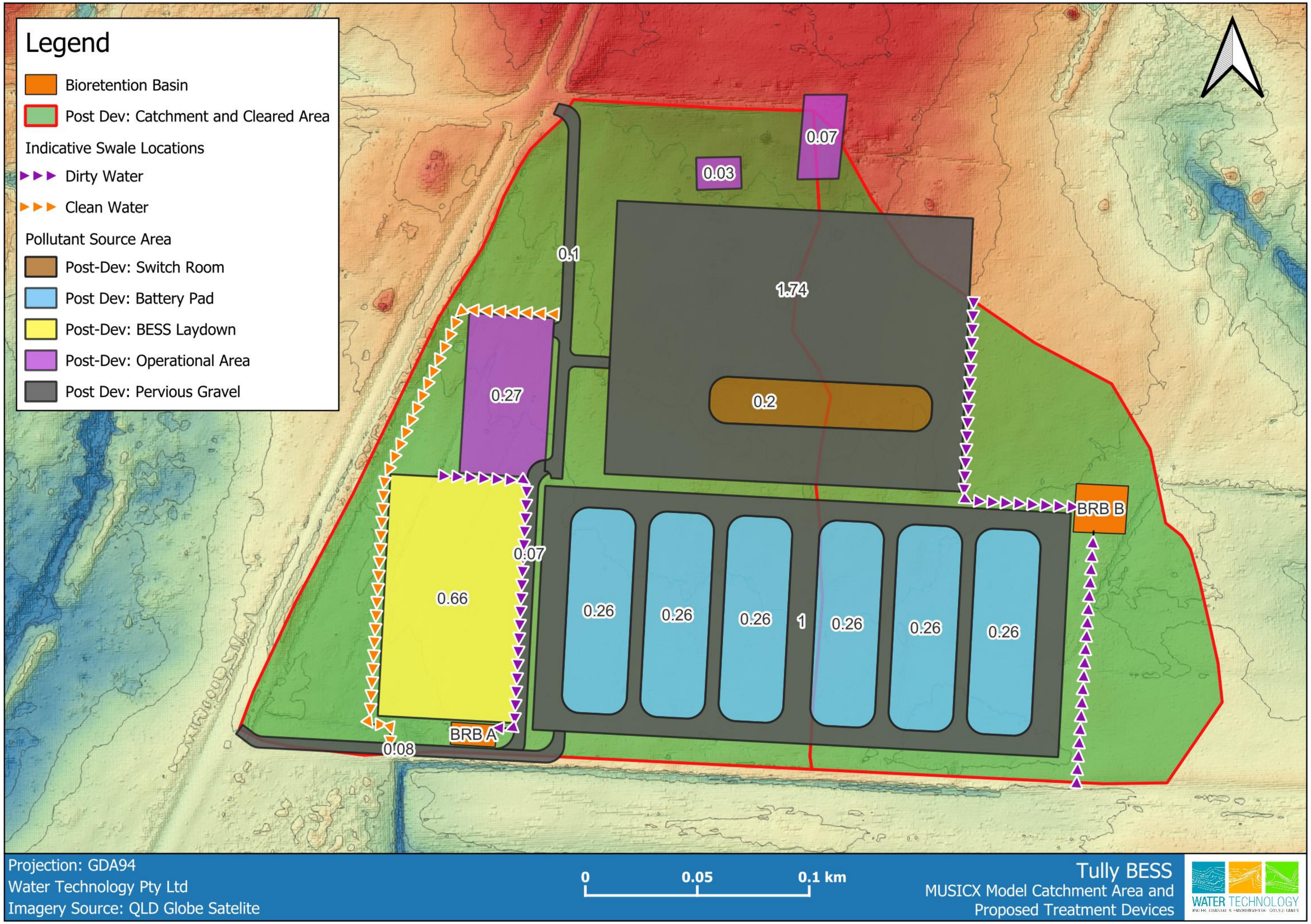


Figure 5-1 MUSICX Model Catchment Area Breakdown

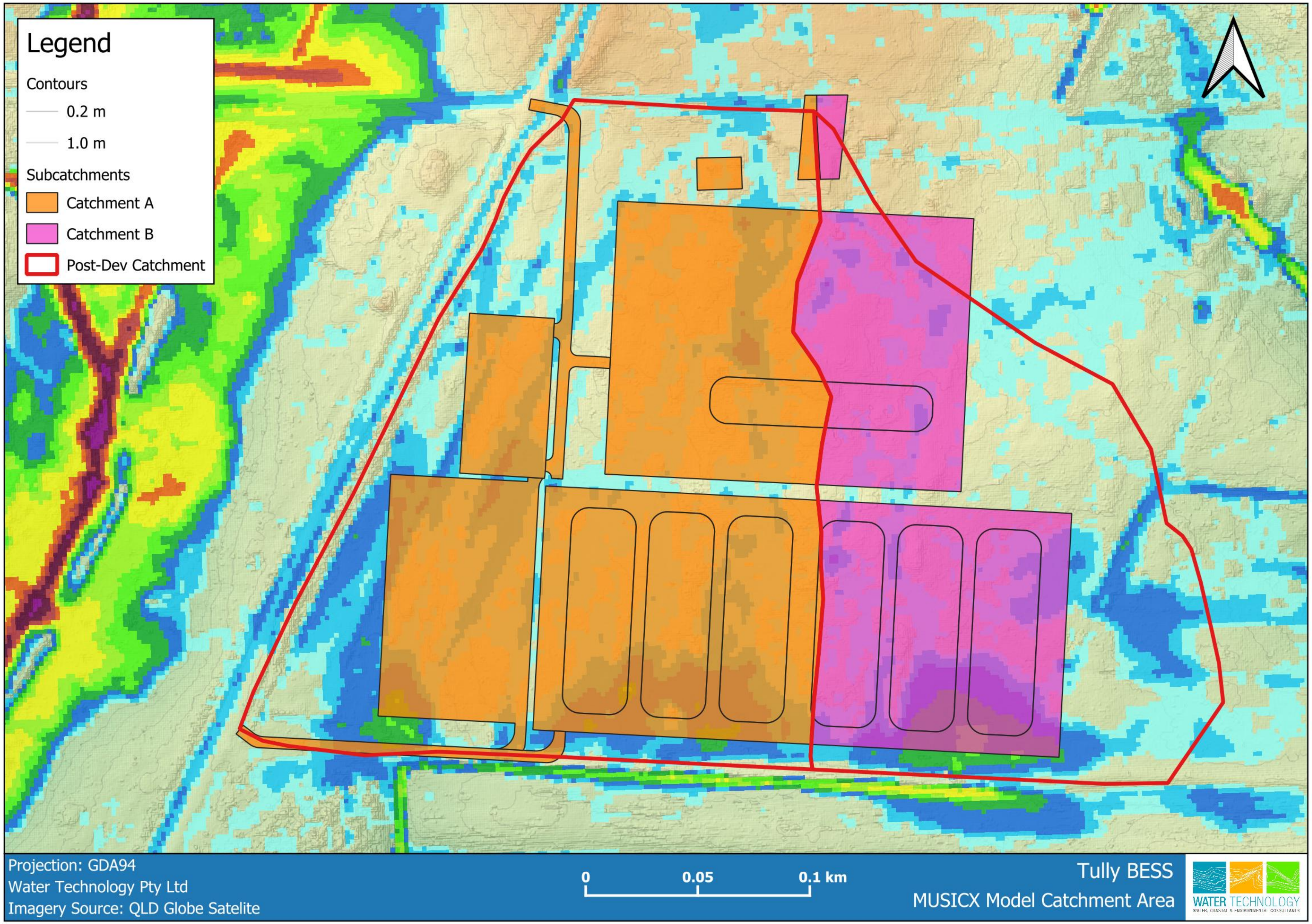


Figure 5-2 MUSICX Model Sub-catchment Areas

Table 5-3 Modelled BESS Sub-catchment Breakdown

Catchment	Total Area (ha)	Fraction Impervious (%)	MUSIC Model Landuse Type
Pre-developed Case Catchment A			
Existing	5.60	0	Rural residential
Post-Developed Catchment A			
Pervious Gravel	1.81	20%	Rural residential
Operational Area	0.33	95%	Rural residential
Battery Pad	0.79	95%	Rural residential
Switch Room	0.11	95%	Rural residential
Open Grass	1.85	0%	Rural residential
BESS Laydown	0.66	95%	Rural residential
Bioretention Basin	0.05	-	Rural residential
Total	**5.60**	**67%**	**n/a**
Pre-developed Case Catchment B			
Existing	3.50	0	Rural residential
Post-Developed Catchment AB			
Pervious Gravel	1.18	20%	Rural residential
Operational Area	0.04	95%	Rural residential
Battery Pad	0.77	95%	Rural residential
Switch Room	0.09	95%	Rural residential
Open Grass	1.40	0%	Rural residential
Bioretention Basin	0.02	-	Rural residential
Total	**3.50**	**61%**	**n/a**

5.3.2 Rainfall Runoff Parameters

WBD (2018) does not include any region-specific rainfall runoff parameters. However, the values recommended for southeast Queensland have been adopted for this study as they are the closest region with available data (see Table 5-4).

Table 5-4 Rainfall Runoff Parameters Adopted in MUSIC Modelling

Parameter	Rural Residential
Rainfall threshold (mm)	1
Soil storage capacity (mm)	98
Initial storage (% capacity)	10
Field capacity (mm)	80
Infiltration capacity coefficient a	84
Infiltration capacity coefficient b	3.3
Initial depth (mm)	50
Daily recharge rate (%)	100
Daily baseflow rate (%)	22
Daily deep seepage rate (%)	0

5.3.3 Pollutant Export Parameters

In the absence of any site-specific water quality or pollutant data, and in keeping with industry best practice the modelling adopted pollutant load export parameters from WBD (2018). The landuse types adopted in the model for the various site areas are displayed in Table 5-3 and the pollutant export parameters for each land use type are provided in Table 5-5.

Table 5-5 Pollutant export parameters

Landuse	Flow Type	TSS $\log^{10}$ values		TP $\log^{10}$ values		TN $\log^{10}$ values	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Rural Residential	Baseflow Parameters	0.53	0.24	-1.54	0.38	-0.52	0.39
	Stormflow parameters	2.26	0.51	-0.56	0.28	0.32	0.30

5.3.4 Rainfall and Evapotranspiration Data

As per the recommendations in WBD (2018), climate datasets were adopted from MUSIC's included data, with rainfall data sourced from the Tully Sugar Mill Radar 6-minute gauge, and monthly average areal potential evapotranspiration (PET) taken for the Tully Sugar Mill SILO dataset.

Rainfall, in the form of a 6-minute pluviometer data, was available from November 1972 to May 2010. From this, a ten-year period from 1 June 1999 to 31 May 2009 was selected for modelling purposes. The mean annual rainfall for the selected MUSICX dataset is 3,782 mm.

5.3.5 Treatment Nodes

The site has been split into two sub-catchments for the purposes of treating and directing clean and dirty water run-off. It is proposed to treat run off from the developed site and surrounding post-development catchment using grassed swales which channel flow into two (2) bioretention basins (BRB) located in each sub-catchment. BRB A will be located along the southern boundary of Subcatchment A and adjacent to the BESS laydown area at the down-slope end of the site. BRB B will be located to the east of Subcatchment B, adjacent to the right corner of battery pad laydown. The MUSIC model schematisation is shown below in Figure 5-3. The modelling considered a range of BRB sizes to determine the most suitable options within respect to achieving the required load reduction targets. The adopted model parameters for the proposed treatment devices is shown in Table 5-6 and Table 5-7. Indicative locations of the proposed treatment devices are shown in Figure 5-1.

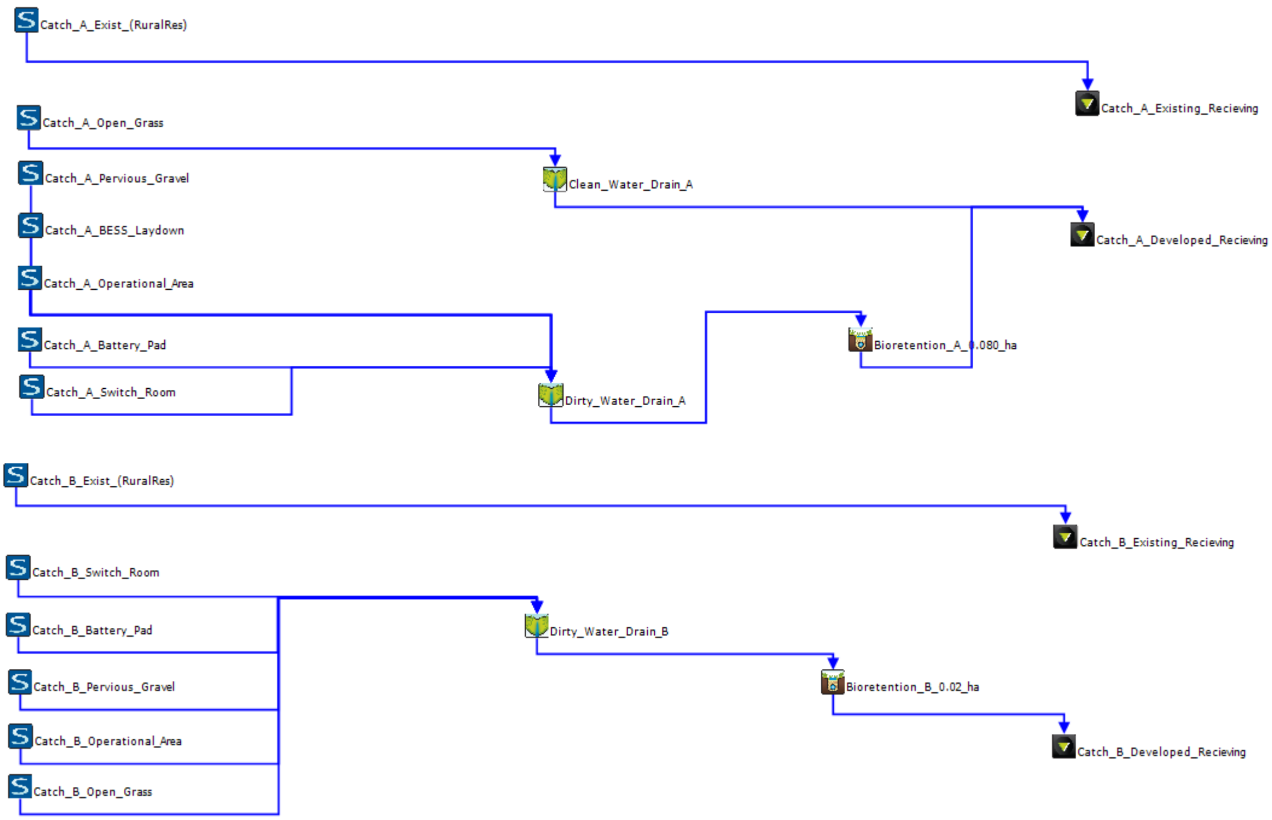


Figure 5-3 MUSIC Model Schematisation

Table 5-6 MUSIC Swale Properties

Parameter	Clean Water A	Dirt Water A	Dirty Water B
Low Flow By-pass (m^3/s)	0	0	0
Length (m)	235	150	260
Bed Slope %	1	1	1
Base Width (m)	3	3	3
Top Width (m)	4	4	4
Depth (m)	0.5	0.5	0.5
Vegetation Height (m)	0.25	0.25	0.25

Table 5-7 MUSIC Bioretention Basin Properties

Parameter	Bioretention Basin A Properties	Bioretention Basin B Properties
Low Flow By-pass (m^3/s)	0	0
High Flow By-pass (m^3/s)	1.5	1.5
Surface Area (m^2)	800	200
Extended Detention Depth (m)	0.30	0.30
Filter Area (m^2)	800	200
Unlined Filter Media Perimeter (m)	89	56
Filter Depth (m)	0.50	0.50
Saturated Hydraulic Conductivity (mm/hr)	200	200
TN Content of Filter Media (mg/kg)	400	400
Orthophosphate Content of Filter Media (mg/kg)	30	30

5.4 MUSIC Results and Discussion

Pollutant load reduction targets for the Tully Catchment have been set by the Great Barrier Reef Discharge Standards as described in the Reef 2050 Water Quality Improvement Plan (WQIP) 2017-2022 (State of Queensland, 2018). The relevant load reduction targets were described in Section 2.7. The performance of the proposed water quality treatment train must be compared to the pre-developed condition of the site, as required by the Reef WQIP's stipulation of achieving reductions compared to the 2013 baseline.

The results for BRB A, which are summarised in Table 5-8 show that the pollutant load reduction targets are met for all pollutants using a treatment train with a BRB with a filter area of 800 m² and one (1) vegetated swale of at least 150 m long. The clean water vegetated swale is 235 m long and diverts clean water along the western boundary of the development, offsite into a preexisting water way suitable for discharge.

Table 5-8 MUSIC Model Results Bioretention Basin A

Parameter	Pre-Developed Source Load (kg/yr)[1]	Developed Source Load (kg/yr)	Residual Load (kg/yr)	Required Load Reduction	Pollutant Reduction from developed source	Pollutant Reduction from pre-developed source	Target Achieved from pre-developed source
Total Suspended Solids (TSS)	46,705	60,330	993	*20%*	98%	98%	**YES**
Total Phosphorus (TP)	45	56	9	*20%*	84%	81%	**YES**
Total Nitrogen (TN)	312	428	154	*Nil*	64%	51%	*Nil*
Particulate Nitrogen (PN)[2]	94	128	46	*20%*	64%	51%	**YES**
Dissolved Inorganic Nitrogen (DIN)[3]	218	299	108	*50%*	64%	51%	**YES**
Gross Pollutants (GP)	0	1,285	0	*Nil*	100%	100%	*Nil*

[2] Particulate Nitrogen is calculated as 30% of TN
[3] Dissolved Inorganic Nitrogen (DIN) is calculated as 70% of TN

The results for BRB B, which are summarised in Table 5-9 show that the pollutant load reduction targets are met for all pollutants using a treatment train with a BRB filter area of 200 m² and two (2) vegetated swales with a combined length of at least 260 m.

Table 5-9 MUSIC Model Results Bioretention Basin B

Parameter	Pre-Developed Source Load (kg/yr)[1]	Developed Source Load (kg/yr)	Residual Load (kg/yr)	Required Load Reduction	Pollutant Reduction from developed source	Pollutant Reduction from pre-developed source	Target Achieved from pre-developed source
Total Suspended Solids (TSS)	27,614	35,005	730	*20%*	98%	97%	**YES**
Total Phosphorus (TP)	26	34	6	*20%*	84%	79%	**YES**
Total Nitrogen (TN)	212	257	106	*Nil*	59%	50%	*Nil*
Particulate Nitrogen (PN)[4]	64	77	32	*20%*	59%	50%	**YES**
Dissolved Inorganic Nitrogen (DIN)[5]	149	180	74	*50%*	59%	50%	**YES**
Gross Pollutants (GP)	0	651	0	*Nil*	100%	100%	*Nil*

5.4.1 Hazardous Materials

The introduction of contaminants to the project area for the construction, maintenance, operation and decommissioning of the project infrastructure poses a risk of these contaminants ending up in the receiving environment. Local storage of chemicals and fuels within the project area will increase this risk along with concrete batching and associated materials. Therefore, relevant guidelines and standards governing the storage and use of hazardous materials and waste removal will be followed to reduce this risk. Appropriate measures will be incorporated in the Final SMP, Construction Management Plan and Emergency Response Plan, which will be prepared in accordance with relevant conditions of the development approval.

5.4.2 Water Supply

5.4.2.1 Construction Phase

Water will be required during the construction phase for:

- Construction works
- Dust suppression
- Vegetation establishment

During the construction phase, water will be transported to the site by water tankers and stored appropriately at the site where required. Potable water will be supplied by contractors for their workforce during construction.

[4] Particulate Nitrogen is calculated as 30% of TN
[5] Dissolved Inorganic Nitrogen (DIN) is calculated as 70% of TN

5.4.2.2 Operational Phase

During the operational phase of the project there will be minimal demand for water. Potable water required by site personnel will be supplied by individuals as required. Any non-potable water requirements like short term dust suppression, cleaning or maintenance of vegetation will be transported to the site by water tankers as required. On-site water storage tanks will also be used to store water for firefighting.

5.5 Stormwater Quality Summary

An assessment of the proposed development has identified potential impacts on the environmental values of the surface waters in the receiving environment. However, these risks can be managed through proper design and the implementation of appropriate mitigation measures during the construction and operation of the BESS. The following provides details of the proposed mitigation measures.

5.5.1 Construction Phase

Any disturbance that involves the clearing of vegetation or earthworks should be carefully considered to ensure the project does not result in increased sediment loads and associated pollutants from entering the downstream receiving environment.

Construction of the proposed BESS represents the highest risk of erosion as there will be active disturbance occurring during this phase including earthworks. However, the construction period will be relatively short compared to the life of the project with construction expected to be completed within 18 months. All construction works should be completed in association with a detailed construction phase ESCP.

Once construction is complete, the risk of erosion will be greatly reduced as there will be no ongoing disturbance of soils. Further it is expected that disturbed areas not required for operations (including cut and fill batter slopes) will be revegetated.

5.5.2 Operational Phase

The surface water assessment showed that the proposed development has the potential to increase the quantity of pollutants discharging to the receiving environment. The MUSIC modelling outcomes demonstrate that the proposed BRB's and vegetated swales will benefit the receiving environment through pollutant load reduction and thus comply with the objectives of the Reef 2050 Water Quality Improvement Plan.

Appropriate measures for the safe handling and storage of chemicals and hazardous materials at the project site during the construction and operational phases should be included in the Final Stormwater Management Plan, Construction Management Plan and/or Emergency Response Plan as required.

5.5.3 Compliance note — State Code 9

The following address compliance with the requirements of PO3 to PO5 of State Code 9 Great Barrier Reef wetland protection areas:

- **PO3** (Hydrology) — Maintain or improve existing surface and groundwater hydrology in the wetland protection area.
  - The layout avoids deep cuts and does not involve significant excavation, limiting disruption to natural grades and subsoil profiles that control shallow groundwater flows and interflow. Catchment areas to each release point will also be maintained. This reduces the risk of altering the site's pre-development water balance and baseflow pathways.
  - Where practicable, external areas will use pervious finishes (e.g., gravel and grassed/vegetated surfaces) to reduce runoff volume and promote infiltration, consistent with WSUD source-control principles to maintain more natural flow pathways.

- Vegetated swales will safely convey frequent flows at shallow depth/velocity and provide pre-treatment, then discharge to bioretention basins sized and modelled as part of the stormwater treatment train in Section 5.3 and Section 5.4. Bioretention systems filter runoff through vegetated media then exfiltrate to surrounding soils and discharge via underdrainage pipes, supporting maintenance of the local water balance.
- Collectively, these measures temper frequent-flow peaks/velocities, reduce runoff volumes, and sustain shallow recharge/baseflow contributions, helping to maintain the pre-development hydrologic regime within the mapped Wetland Protection Area. This approach aligns with WSUD hydrologic intent and Queensland stormwater policy objectives for post-development management.

- **PO4** (Water quality) — No unacceptable impact on wetland/buffer water quality.
  - The stormwater strategy adopts WSUD treatment trains (including vegetated swales and bioretention) designed to achieve the Great Barrier Reef Discharge Standards as described in the Reef 2050 Water Quality Improvement Plan, with compliance demonstrated via MUSIC modelling. MUSIC modelling results presented in Section 5.4, show that the proposed water quality treatment infrastructure will result in a net improvement in the quality of water discharging from the site.
  - During construction, an Erosion and Sediment Control (ESC) plan will be developed and implemented minimising sediment export.
  - Infiltration measures will include adequate pre-treatment (e.g. vegetated swales) to avoid clogging and to protect groundwater quality.
  - Together, these measures reduce pollutant loads at the boundary and avoid unacceptable water-quality impacts to any downstream wetlands or buffers.
- **PO5** (Wetlands not used for stormwater treatment).
  - All stormwater treatment devices are sited outside mapped wetlands and their buffers; wetlands are not used for detention, polishing, or conveyance as part of the treatment train. Discharges will be released to constructed conveyance or upland areas with energy dissipation prior to any natural features, ensuring wetlands are not utilised for stormwater treatment, consistent with the Code.

6 FLOOD ASSESSMENT

6.1 Overview

The proposed site is partially inundated during regional flood events within the Tully River catchment. Additionally, multiple defined watercourses traverse the site, requiring a detailed assessment of existing flood constraints.

To support the local flood assessment for the development, a rain-on-grid hydraulic model has been developed using TUFLOW. The model is configured to simulate direct rainfall-runoff interactions across the terrain and incorporates hydrodynamic processes to assess flood behaviour. The hydrologic analysis was conducted in accordance with Australian Rainfall and Runoff 2019 (ARR2019) guidelines, utilising the TUFLOW ARR tool. Key design rainfall parameters include:

- Design Rainfall Data sourced from ARR2019 and BOM 2016 IFD, incorporating all ten (10) ARR2019 temporal patterns to evaluate peak discharge variability.
- Rainfall losses adopted from ARR2019 Data Hub, with an Initial Loss of 43 mm and a Continuing Loss of 4.9 mm/hr.
- Design rainfall was implemented as a direct rainfall boundary in the hydraulic model, enabling a rain-on-grid approach.

In the absence of stream gauge data, estimated peak flows were validated using the Rational Method. A range of design storms including the 10%, 1%, 0.2% and 0.5% AEP events were assessed hydraulically in the TUFLOW model to quantify the local flood extent to inform the proposed development. The subsequent sections of this report provide detailed insights into the catchment modelling undertaken as part of this site-specific study.

6.1.1 Model Extent and Topography

As outlined in Section 3.1, the site is located within the Tully River Drainage Basin, a hydrologically active region of the Wet Tropics. The topography generally slopes south toward the Tully River, which plays a key role in local drainage and flood dynamics, and southeast toward Babinda Creek, a tributary of the Tully River. To the north, the terrain rises steeply beyond 100 mAHD, forming part of the mountain ranges adjacent to Mount Bartle Frere. These mountains receive high rainfall and generate significant runoff, contributing to floodplain inundation during extreme events. Major roads, including Tully Gorge Road and the proposed road network, traverse these elevated areas and may influence surface water flow and drainage patterns.

The Tully River catchment, covering approximately 1,675 km^2, drains primarily to the Pacific Ocean, with additional contributions from the Hull River and smaller tributaries. Given the region's high rainfall and complex topography, the site is subject to dynamic hydrodynamic processes, including floodplain inundation, overland flow, and potential backwater effects from downstream constraints. These factors will be critical in assessing site-specific flooding constraints.

6.2 Hydraulic Model Setup

The model was developed using two TUFLOW methods to accurately simulate the catchment dynamics. A rain-on-grid approach was applied to represent the catchment. To support the local flood assessment for the development, a TUFLOW hydraulic model (build 2023-01-AE) utilising the HPC (Highly Parallelized Computations) solution scheme was adopted. TUFLOW is a 1D-2D linked hydraulic model that solves the depth-averaged shallow water equations. A range of design storms including the 10%, 5%, 2%, 1%, 0.2% and 0.5% AEP events were assessed hydraulically in the TUFLOW model to quantify the local flood extent to inform the proposed development.

6.2.1 Base Case Model

The following represents a summary of the setup of the TUFLOW hydraulic model, with the hydraulic model setup illustrated in Figure 6-1.

- Detailed grid resolution of 2m to adequately reflect the topography surrounding the site.
- Model topography is based on LiDAR collected in 2014.
- Two large HQ downstream boundaries with relatively flat slope of 0.001% for the hydraulic model was positioned approximately 1km downstream of the investigation area to ensure boundary conditions did not affect the model results at the area.
- Topography modifiers were applied to the model to represent channels through Tully George Road, Sandy Creek Road and Syndicate Road at culvert locations. This approach was adopted as the culverts are non-critical structures for the investigation area. However, satellite imagery confirms their existence, indicating they were constructed to facilitate the free movement of flow.

6.2.2 Surface Roughness

Floodplain roughness was represented using a Manning's "n" roughness coefficient assigned to various land uses and spatial areas throughout the model based on aerial imagery. These are presented in Table 6-1. A depth-varying Manning's n over a building footprint has been used to realistically represent the effects of buildings on overland flow during flooding. The waterways identified as waterway barrier works under the *Fisheries Act 1994* have been adopted in the model to represent Manning's roughness for waterways, as shown in Figure 6-1.

Table 6-1 Manning's "n" roughness coefficient used in model

Land Use	Manning's "n" roughness coefficient
Grass	0.04
Medium Vegetation	0.07
Road	0.02
Watercourse	0.05
Bare Soil	0.03
Buildings	0.02 at shallow depths (< 0.03 m) 0.3 at significant depths, (> 0.1 m)

6.2.3 Catchment Hydrology

The hydrological analysis was conducted using the ARR&R (2019) Datahub and BOM 2016 IFD data. The hydrological model simulated all ten (10) temporal patterns for each duration to ensure comprehensive analysis. Rainfall hydrographs for the specific area were extracted using the ARR TUFLOW tool, enabling accurate representation of local rainfall-runoff dynamics. Key design rainfall parameters include:

- Design Rainfall Data sourced from ARR2019 and BOM 2016 IFD, incorporating all ten (10) ARR2019 temporal patterns to evaluate peak discharge variability.
- Rainfall losses adopted from ARR2019 Data Hub, with an Initial Loss of 43 mm and a Continuing Loss of 4.9 mm/hr.
- Design rainfall was implemented as a direct rainfall boundary in the hydraulic model, enabling a rain-on-grid approach.

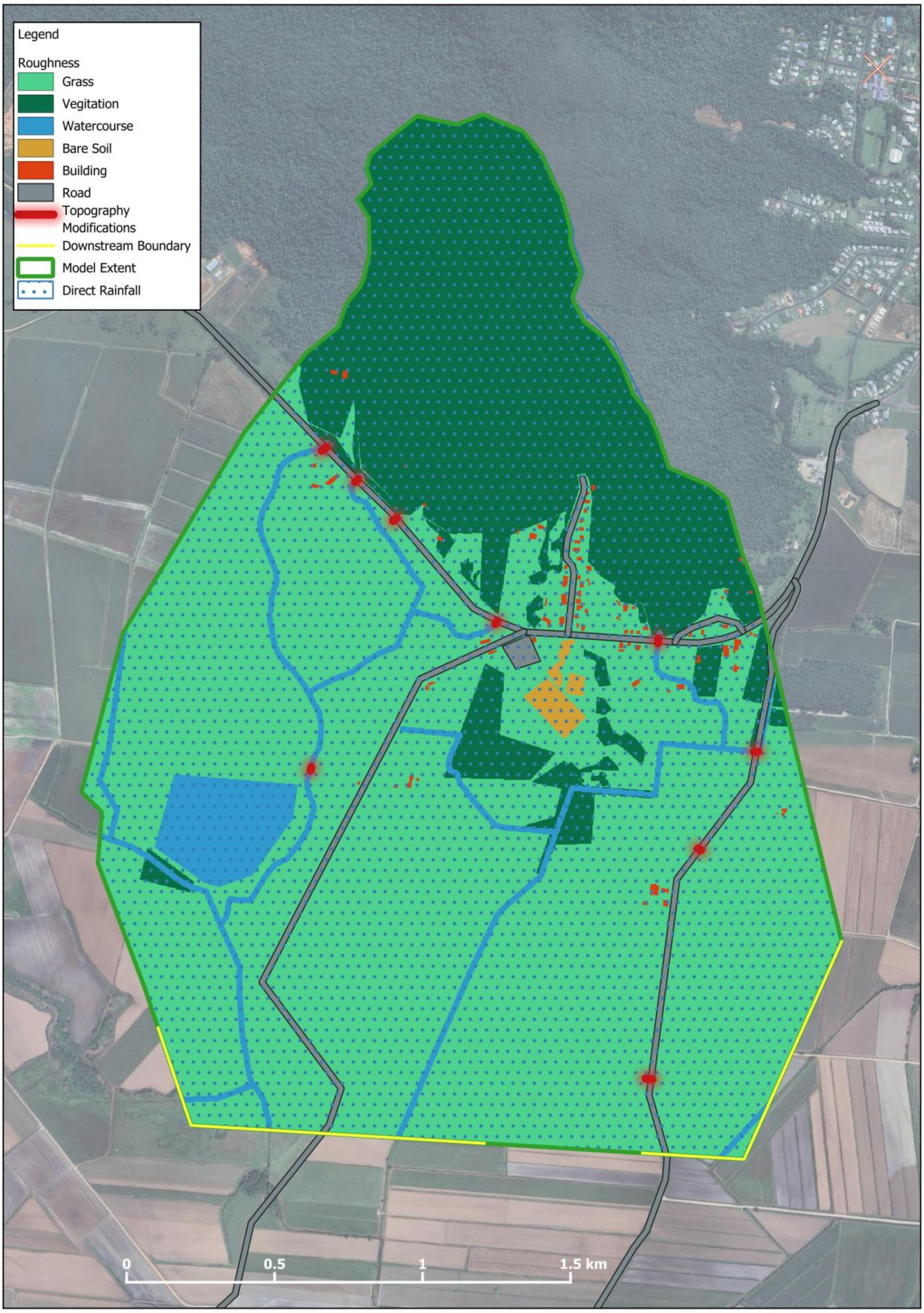


Figure 6-1 TUFLOW Model Layout

6.2.4 Validation of the Direct Rainfall Hydrology

This site-specific investigation involves an ungauged local catchment, and as such, no site-based data is available for calibrating runoff. Consequently, the TUFLOW direct rainfall modelling has been validated using the Rational Method, in accordance with the guidelines outlined in the Queensland Urban Drainage Manual (QUDM, 2008). Validation was conducted upstream of the Tully George Road before flows are impacted by the road itself, focusing on the primary drainage path to the north, which intersects the central area of the investigation area. The Rational Method parameters are summarised below and a comparison of discharges to the direct rainfall hydraulic model presented in Table 6-2.

- Stream length of 1.11 km
- Total catchment area of 33 ha.
- Fraction Imperviousness of 0.10 with medium soil permeability and dense vegetated coverage.

Table 6-2 Rational Method Comparison

Design Event	Rational Q (m^3/s)	TUFLOW Peak Flow (m^3/s)
1% AEP	8.86	7.7

The TUFLOW direct rainfall results are within 20% of the Rational Method results for the 1% AEP event. These flow comparisons are considered acceptable for the purposes of this study and accordingly the direct rainfall model was considered a reasonable representation of the investigation area hydrology.

6.3 Result Processing

For the direct rainfall modelling of the investigation area, the median grid for each duration was generated, followed by calculation of a max–max envelope in accordance with ARR2019 Guidelines. This process was applied across all flood events and all hydraulic variables, including peak water level, velocity, and depth. Within the infrastructure area of the site, the median temporal pattern analysis indicated notable variability. Critical storm durations ranged from 15–45 minutes for rare events and 30–45 minutes for more frequent events, confirming that shorter duration events generally represent the most critical scenarios for local flooding at the site.

Table 6-3 Critical Depth Durations

Scenario	Critical Duration
0.2% AEP	30-45 Minutes
0.5% AEP	30-45 Minutes
1% AEP	15-45 Minutes
2% AEP	15-45 Minutes
5% AEP	15-45 Minutes
10% AEP	15-45 Minutes

6.4 GIS Mapping

Appendix B provides the GIS mapping of the peak flood depth and velocity for the 10%, 5%, 2%, 1%. 0.5% and 0.2% AEP events. The flood inundation extents based on the TUFLOW model results for the 1% AEP event is presented in Figure 6-2. A 50mm depth cutoff has been applied to the depth mapping to filter out artifacts from the direct rainfall modelling approach.

6.5 Local Flood Assessment Results

The results of the assessment are summarised as follows:

- Overland flow approaching the site from the north (originating near Mount Tyson) is conveyed via culverts beneath Tully George Road. Downstream of the culverts, the flow diverges, with a portion directed east of the site and another portion flows west of the site toward Sandy Creek Road. Western flows are guided through natural topographic depressions, bypassing an agricultural dam located on a neighbouring lot. The water continues through agricultural land southeast of the site and ultimately discharges into the Tully River. These flows do not break out east of Sandy Creek Road and are not considered to pose a flood risk to the Subject Property.
- Flows travelling along the eastern side of the site traverse the site itself. A portion of this flow is intercepted by an irrigation channel running westward from Syndicate Road. This channel appears to break out just northeast of the proposed site, redirecting flows into a wetland area located immediately south of the developed section.
- The wetland functions as an ephemeral watercourse and is considered an ecologically significant feature in the context of the site. It receives not only redirected flow from the irrigation channel but also overland sheet flow from the north.
- The wetland system drains via the irrigation channel located east of the site. A secondary flow path branches into the site lot and discharges into a smaller additional downstream wetland area before continuing south. This path intersects with another smaller irrigation channel approximately 0.57 km south of the site, which also captures minor sheet flow from the western portion of the site.
- Flood modelling indicates the presence of shallow overland sheet flow across portions of the proposed BESS site. Flow depths are generally less than 0.15 m, with some areas of localised ponding evident along the southern boundary adjacent to the irrigation channel. These conditions are anticipated to be mitigated through site development works, including filling, grading, and re-leveling of the affected areas during construction.
    - This shallow sheet flow can be managed by appropriate site stormwater infrastructure which can be addressed during detailed design.
- Flow velocities across the proposed infrastructure areas of the site are generally low, remaining below 0.5 m/s.

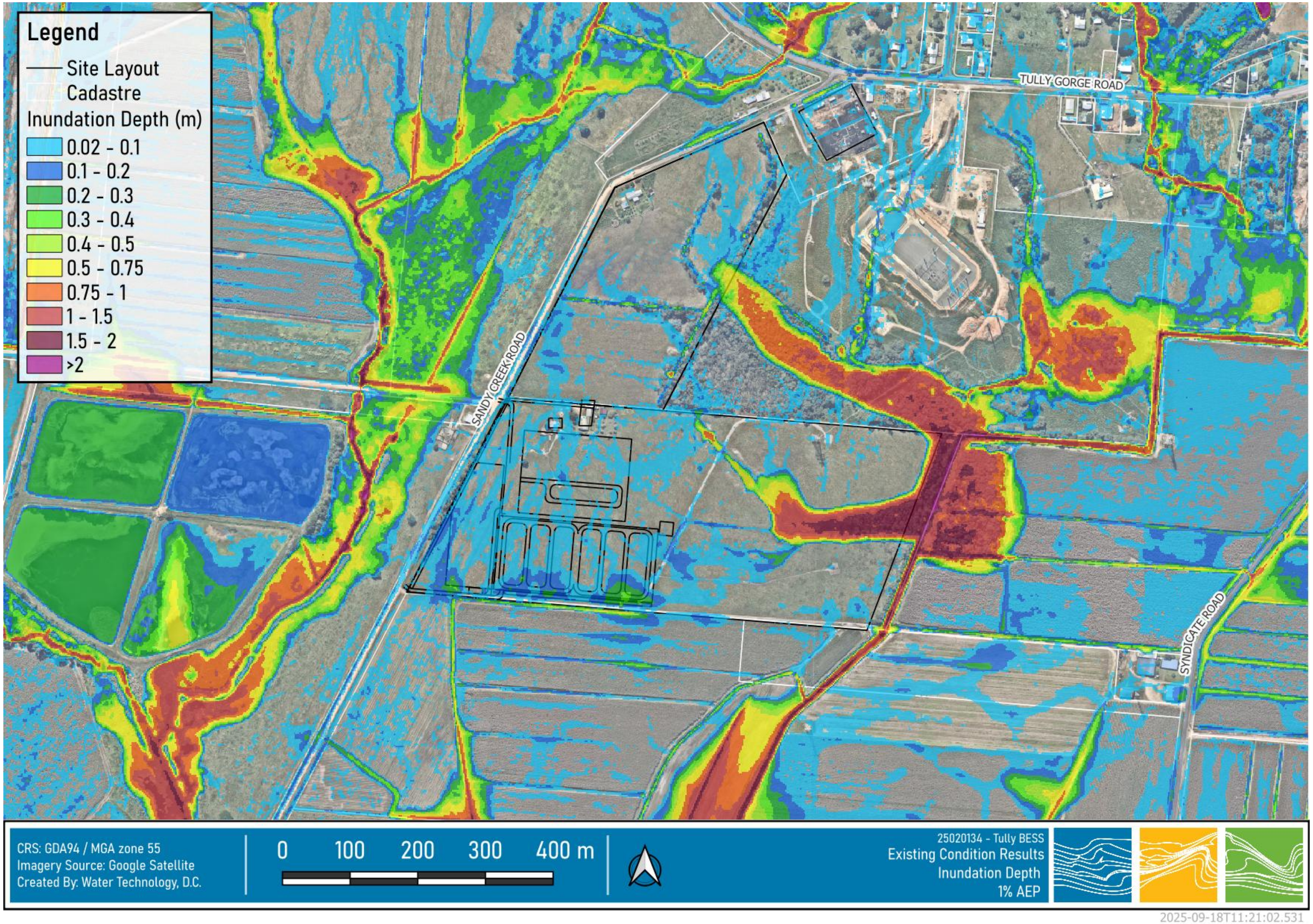


Figure 6-2 1% AEP Inundation Depth

6.6 Regional Flood Results

The regional flood model result grids were obtained from Cassowary Coast Regional Council and analysed to assess the potential impacts of regional flooding on the proposed site. The regional model is critical as it represents large-scale flood behaviour associated with the Tully River and its interaction with the site. Figure 6-4, Figure 6-5 and Figure 6-6 present the Q100 (1% AEP), Q200 (0.5% AEP), and Q500 (0.2% AEP) peak flood depths.

The results indicate that the site is only minimally affected in the 1% AEP event, with minor flood fringe inundation observed along the southern boundary. This inundation is consistent with localised pooling of water identified in the local model. Maximum flood depths in this event were recorded at 0.30 m in the southwest corner and 0.23 m in the southeast corner of the site.

Table 6-4 summarises the water levels and depths for these reference points (locations shown in Figure 6-3). It should be noted that ground levels at the reference points are approximately 11.23 m AHD at the western corner and 11.49 m AHD at the eastern corner.

More significant inundation occurs under the 0.5% AEP and 0.2% AEP events, which extend further across the site and have greater potential to impact the planned infrastructure. These peak water levels should be considered when designing earthworks levels to site sensitive infrastructure (i.e. substations) to ensure they meet local planning requirements.

Table 6-4 Regional Flood Depths at Key Reporting Locations

Event	Reporting Point	Water Level (m AHD)	Depth (m)
Q100	A	11.75	0.40
	B	11.74	0.23
Q200	A	12.16	0.81
	B	12.11	0.60
Q500	A	12.71	1.36
	B	12.63	1.12

The site is located on the outer edge of the Tully River floodplain, and only a small portion of the development footprint—approximately 5,000 m²—overlaps the 1% AEP (Q100) flood extent, representing a minor fraction of the overall site area. Within this overlap, modelled flood depths are generally less than 0.1 m, indicating shallow, low-velocity inundation.

Given the limited encroachment, minimal fill requirements, and the fact that the majority of infrastructure is located outside the Q100 extent, the proposed works are not expected to cause any measurable change to flood storage or conveyance. The shallow inundation depth combined with the absence of significant earthworks in the flood-affected zone means flood behaviour will remain effectively unchanged.

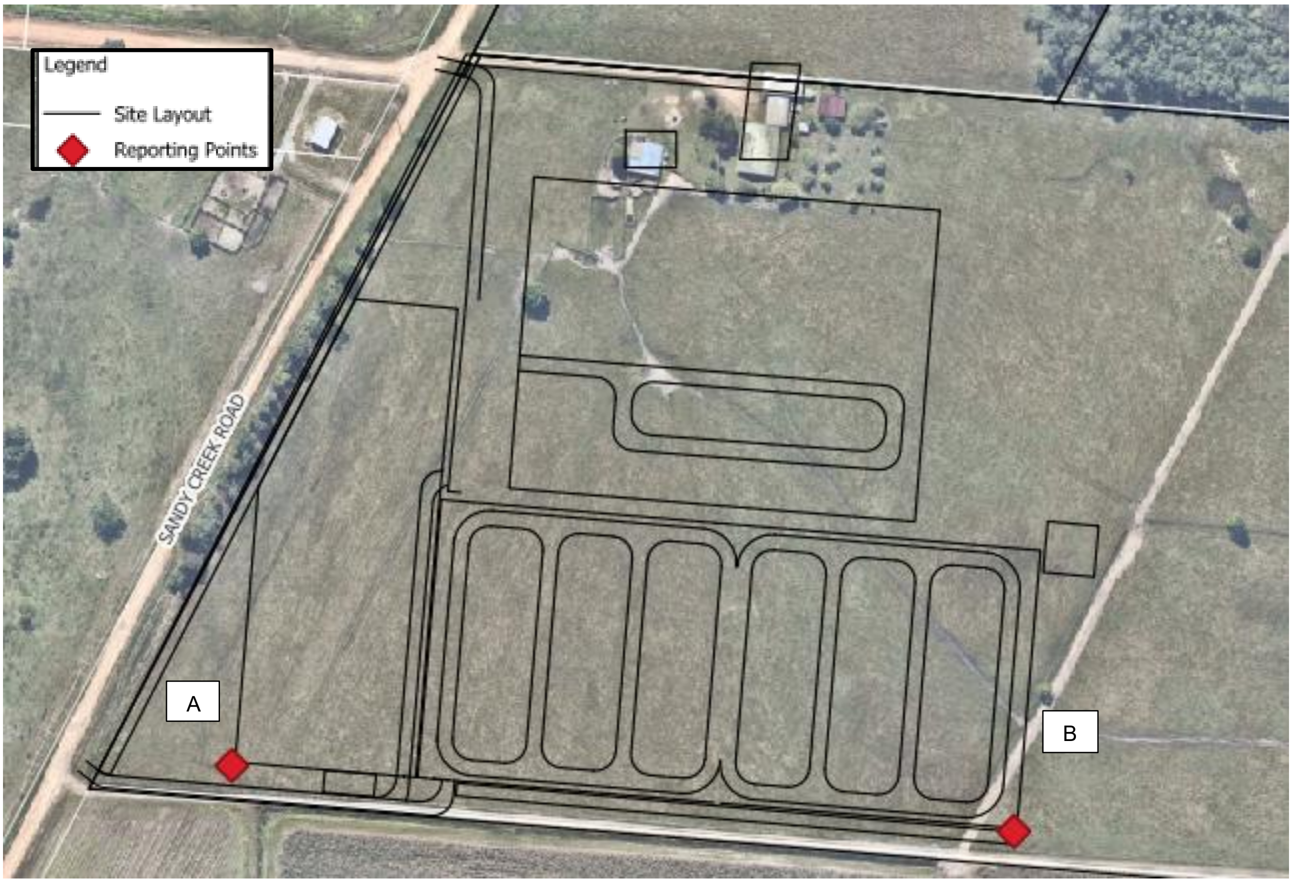


Figure 6-3 Key Reporting Locations

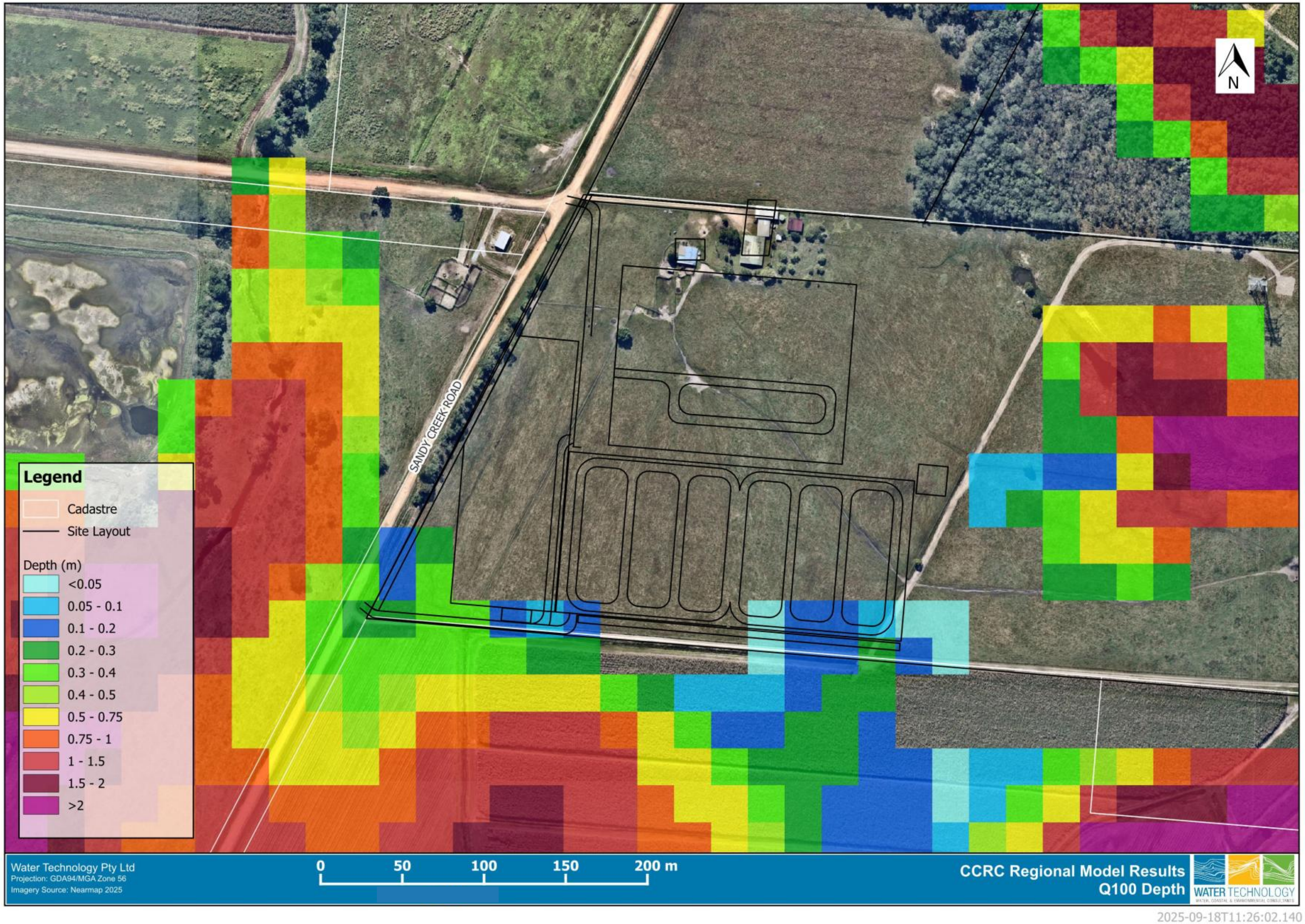


Figure 6-4 Q100 Regional Flood Results

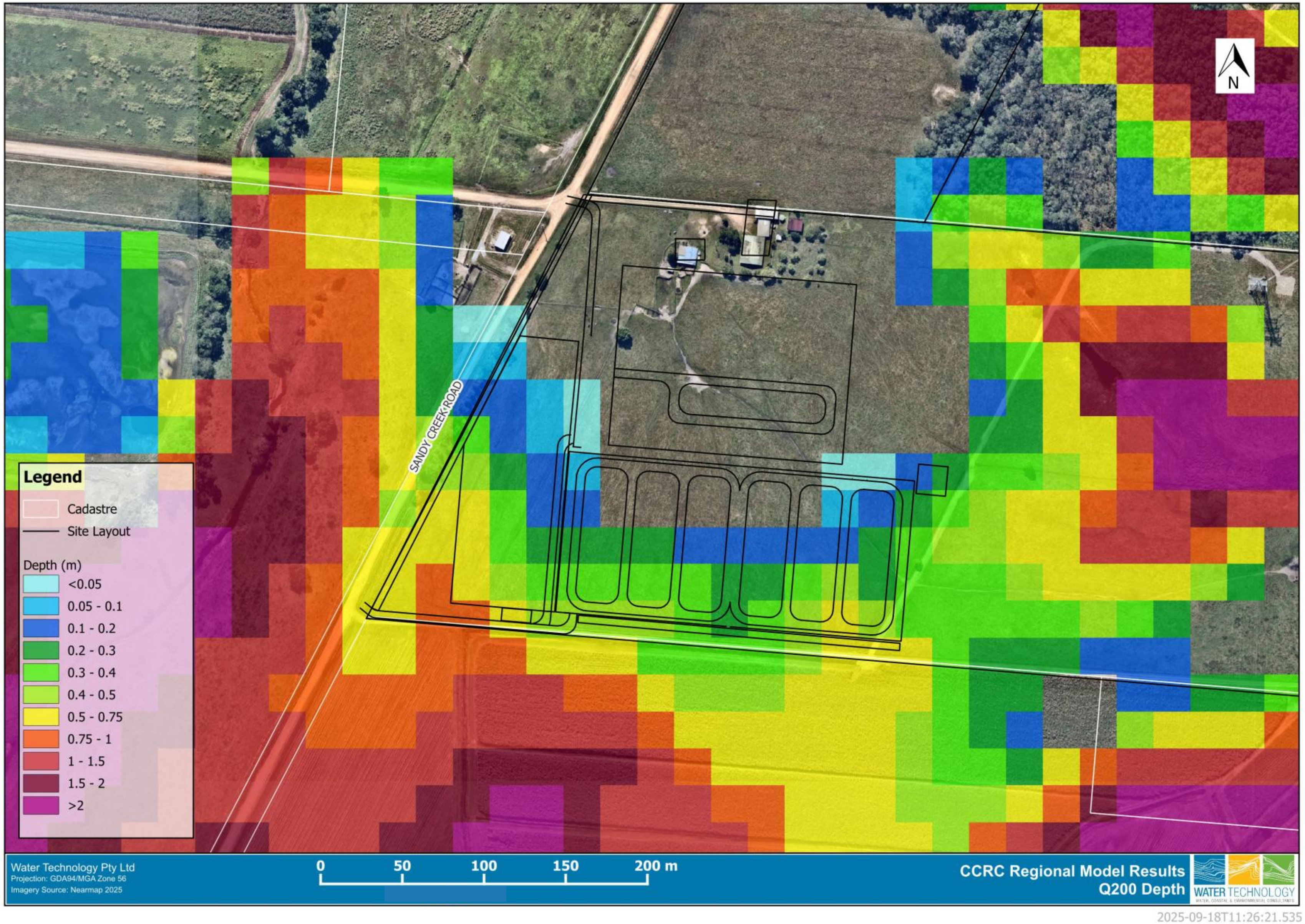


Figure 6-5 Q200 Regional Flood Results

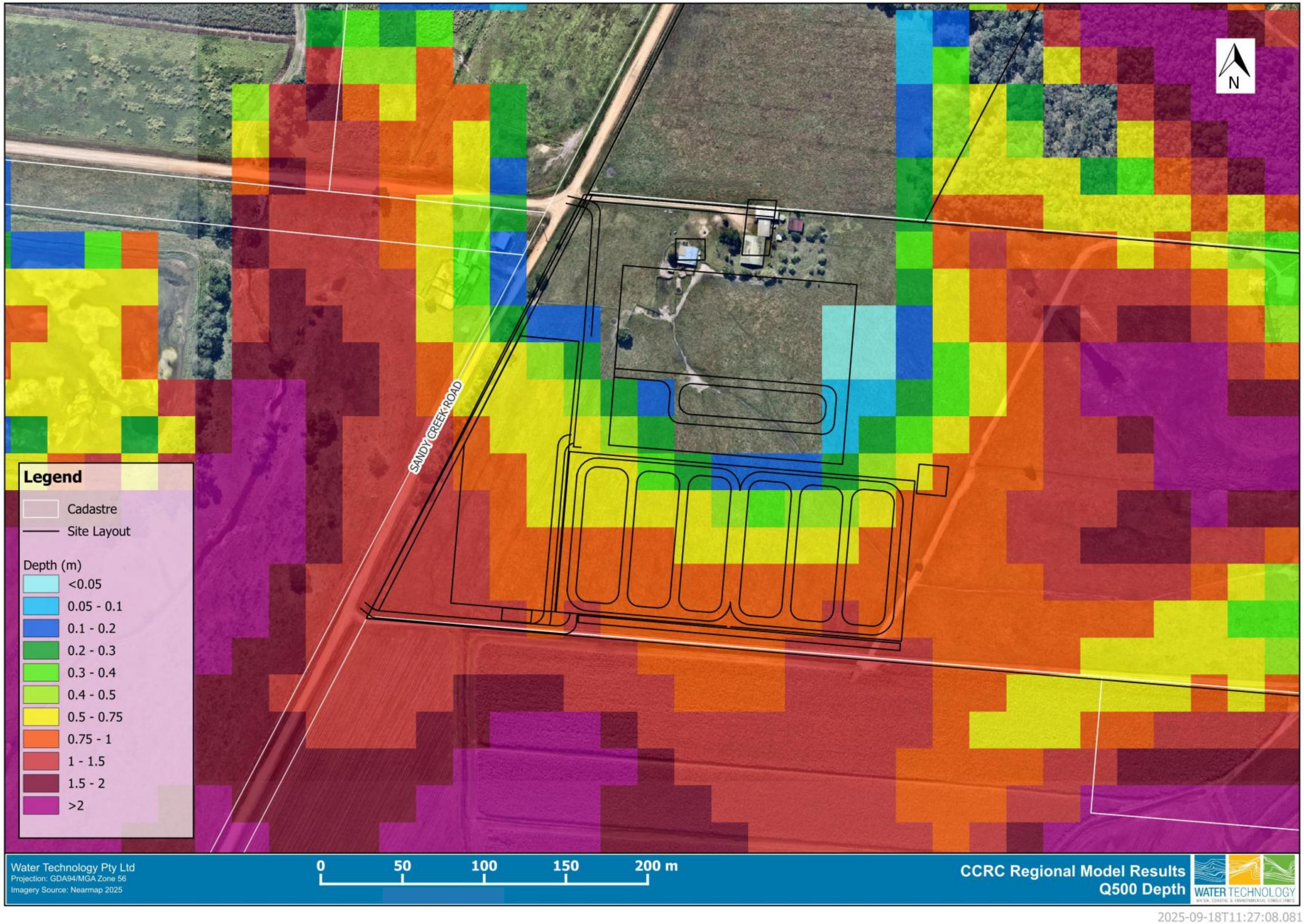


Figure 6-6 Q500 Regional Flood Results

6.7 Waterways and Fish Passage

Figure 6-8 illustrates the proposed development layout against the Department of Agriculture and Fisheries *Queensland waterways for waterway barrier works* spatial layer. This spatial layer classifies waterways defined by the *Fisheries Act* to assist in determining whether proposed barrier works are assessable or accepted (DAF, 2021). Waterways receive a fish passage attribute, a number between 1 and 5 which is additionally colour coded for easy reference. The classification does not indicate the relative importance of the fish habitat, rather it has been determined by several characteristics including stream order, stream slope and tidal influence.

- Waterways classified as 1 (low) (green) or 2 (medium) (amber) are typically in the upper reaches of a catchment where fish are typically smaller with stronger swimming abilities.
- Waterways classified as 3 (high) (red), 4 (major) (purple), or 5 (tidal) (grey) typically are host to a wider range of fish sizes and swimming abilities.

Figure 6-7 illustrates the assessment process matrix provided by DAF (2021) in the *Queensland waterways for waterway barrier works* spatial data layer: Guide to determining waterways Version 2.0 (April 2021). There were no waterway crossings identified for this project.

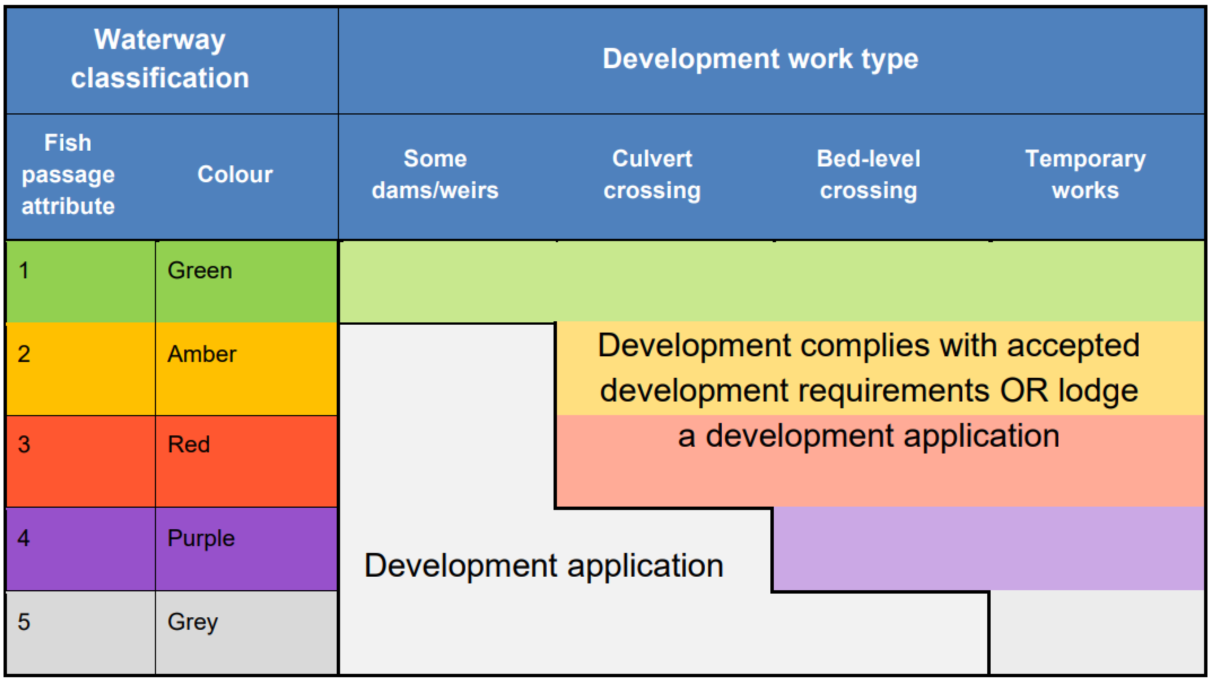


Figure 6-7 Assessment process matrix regarding waterway classification and proposed development work

Figure 6-8 Crossing Locations

7 SUMMARY

Water Technology was engaged by Attexo to prepare a Stormwater Management Plan (SMP) and Flood Assessment (FA) for the proposed Tully BESS facility located at Tully, Queensland. The SMP described modelling to quantity potential changes to runoff quality from the BESS and to undertake conceptual sizing of mitigation measures to meet relevant Water Quality Objectives (WQO's) for the development in respect of pollutant load reductions relative to the undeveloped site. Based on the modelling outcomes, the following measures are recommended to mitigate the potential impacts on stormwater quality:

- In Catchment A, a vegetated swale at least 150 m long to convey stormwater runoff from the developed site area to the end-of line treatment device and an end-of-line BRB with a minimum filter area of 800 m². It is proposed that the BRB will be located at the downslope end of the southern boundary, adjacent to the proposed location of the temporary construction area. A 235 m long vegetated swale will also be required to divert clean water runoff along the western boundary of the site.
- In Catchment B, vegetated swales with a combined length of 360 m in to convey stormwater runoff from the developed site area to the end-of line treatment device and end end-of-line BRB with a minimum filter area of 200 m². It is proposed that the BRB will be located to the east of the subcatchment, adjacent to the battery container.

Modelling demonstrated that the proposed stormwater quality management measures achieved the WQO's and provide an overall net improvement relative to baseline conditions. That is, the development returns a net improvement in the runoff water quality discharging from site.

The proposed stormwater treatment infrastructure ensures the proposed development complies with the requirements of PO3 to PO5 of State Code 9 Great Barrier Reef wetland protection areas by:

- **PO3** (Hydrology): Minimising earthworks, using pervious surfaces, and incorporating vegetated swales and bioretention basins to maintain natural flow paths and support infiltration, helping preserve surface and groundwater hydrology.
- **PO4** (Water quality): Implementing a WSUD treatment train designed to meet SPP and Reef 2050 water quality objectives, supported by MUSIC modelling and robust ESC measures during construction.
- **PO5** (Wetlands): Locating all stormwater treatment devices outside mapped wetlands and buffers, ensuring wetlands are not used for detention or treatment.

Appropriate measures for the safe handling and storage of chemical and hazardous materials at the project site during the construction and operational phases should be included in the Final Stormwater Management Plan, Construction Management Plan and/ or Emergency Response Plan as required.

The FA described modelling to characterise existing local flood behaviour at the site. The assessment found:

- Overland flow from the north is conveyed via culverts beneath Tully George Road before diverging east and west of the site, ultimately draining to the Tully River without posing a flood risk to the Subject Property.
- Flows along the eastern boundary interact with an irrigation channel and an adjacent wetland system, which functions as an ephemeral watercourse and receives both channel breakout and minor sheet flow from the north.
- Within the proposed BESS site, modelling indicates shallow sheet flow (<0.15 m) and localised ponding near the southern boundary, which is expected to be mitigated through construction earthworks and site grading. Flow velocities are generally low, remaining below 0.5 m/s.

The regional flood model results indicate that the site is only minimally affected in the 1% AEP event, with minor flood fringe inundation observed along the southern boundary. These impacts are consistent with localised pooling identified in the local model. More significant inundation occurs under the 0.5% AEP and 0.2% AEP events, which extend further across the site and have greater potential to impact the planned infrastructure. The regional flood levels should be considered when designing earthworks levels to site sensitive infrastructure (i.e. substations) to ensure they meet local planning requirements.

The site is located on the outer edge of the Tully River floodplain, and only a small portion of the development footprint—approximately 5,000 m²—overlaps the 1% AEP (Q100) flood extent, representing a minor fraction of the overall site area. Within this overlap, modelled flood depths are generally less than 0.1 m, indicating shallow, low-velocity inundation.

Given the limited encroachment, minimal fill requirements, and the fact that the majority of infrastructure is located outside the Q100 extent, the proposed works are not expected to cause any measurable change to flood storage or conveyance. The shallow inundation depth combined with the absence of significant earthworks in the flood-affected zone means flood behaviour will remain effectively unchanged.

Overall, the assessments described in this SMP and FA demonstrate that the proposed development, including the mitigation measures described above, returns a no-worsening of existing conditions with respect to flood as well as providing an improvement in stormwater runoff quality. Detailed design of the management and mitigation measures described conceptually within this report will be required to ensure the final design provides the intended outcomes.

APPENDIX A
WET TROPICS REGION: TULLY CATCHMENT WATER QUALITY TARGETS

WET TROPICS REGION

Tully catchment water quality targets

Catchment profile

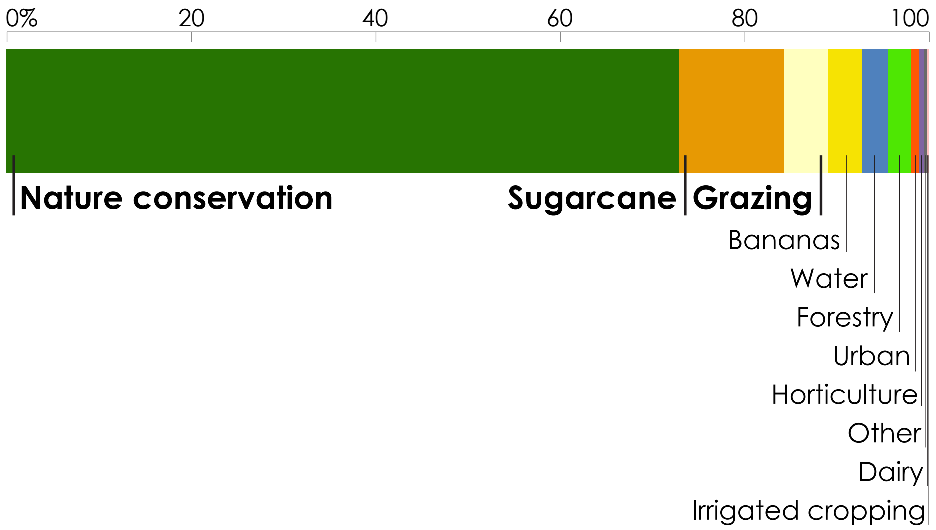
Under the Reef 2050 Water Quality Improvement Plan, water quality targets have been set for each catchment that drains to the Great Barrier Reef. These targets (given over the page) consider land use and pollutant loads from each catchment.

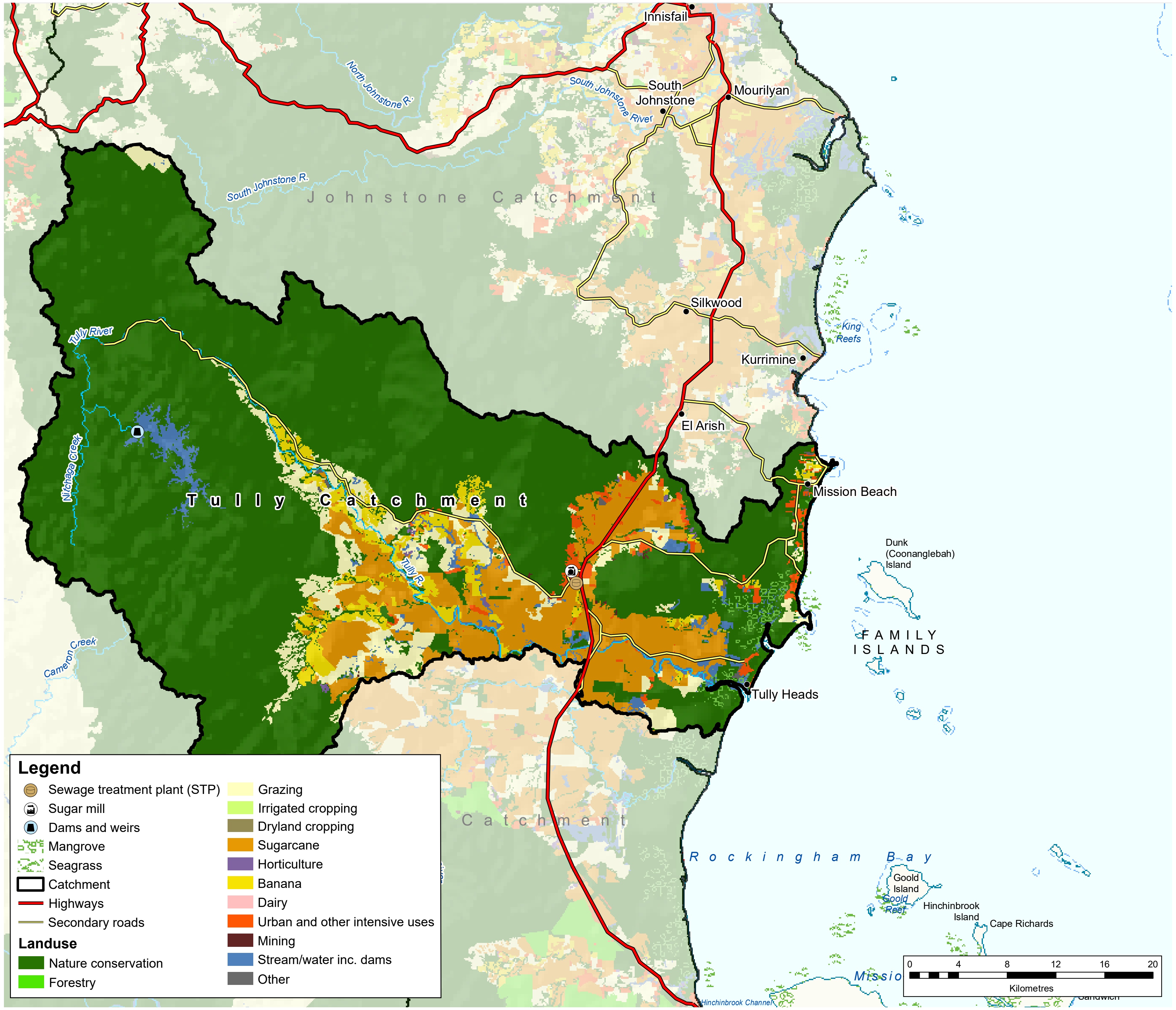
The Tully catchment covers 1683 km^2 (8% of the Wet Tropics region). Rainfall averages 2763 mm a year, which results in river discharges to the coast of about 3527 GL each year.

The Tully catchment is located in the southern section of the Wet Tropics region. The majority of the catchment is drained by the Tully River, with the remaining area captured by the Hull River and a number of smaller coastal creeks. The upper reaches of the Tully River are fed by streams emerging from rainforests of the Wet Tropics World Heritage Area in the coastal mountain ranges. The Koombooloomba Dam is also located in the upper catchment area. The lowland floodplains of the Tully catchment have intensive agricultural land use, principally of sugarcane, grazing and banana crops. Small pockets of urban areas are present, which include the township of Tully at the foot of the mountain range and several smaller coastal localities, including Hull Heads, Tully Heads and Mission Beach.

Land uses in the Tully catchment

The main land uses are nature conservation (73%), sugarcane (11%), and grazing (5%).





2025 water quality targets and priorities

End-of-catchment anthropogenic load reductions required from 2013 baseline				Pesticides
Dissolved inorganic nitrogen (DIN)	Fine sediment	Particulate phosphorus (PP)	Particulate nitrogen (PN)	
50% 190 tonnes	**20%** 17 kilotonnes	**20%** 23 tonnes	**20%** 68 tonnes	To protect at least **99%** of aquatic species at the end of catchment

The 2025 targets aim to reduce the amounts of fine sediments, nutrients (nitrogen and phosphorus) and pesticides flowing to the reef. Each target for sediment and nutrients is expressed as: (a) the percentage load reduction required compared with the 2013 estimated load of each pollutant from the catchment; and (b) the load reductions required in tonnes. Progress made since 2013 will count towards these targets. Previously reported progress between 2009 and 2013 has already been accounted for when setting the targets. The pesticide target aims to ensure that concentrations of pesticides at the end of each catchment are low enough that 99% of aquatic species are protected. The targets are ecologically relevant for the Great Barrier Reef, and are necessary to ensure that broadscale land uses have no detrimental effect on the reef's health and resilience.

A high percentage reduction target may not necessarily mean it is the highest priority. The priorities (ranked by colour) reflect the relative risk assessment priorities for water quality improvement, based on an independent report, the 2017 Scientific Consensus Statement. The priorities reflect scientific assessment of the likely risks of pollutants damaging coastal and marine ecosystems.

Water quality relative priority

- Very high
- High
- Moderate
- Low
- Minimal
- Not assessed

Modelled water quality pollutant loads

The Tully catchment contributes high loads of anthropogenic dissolved inorganic nitrogen, mostly from sugarcane. There are also small loads of fine sediment.

Dissolved inorganic nitrogen

Most anthropogenic dissolved inorganic nitrogen (DIN) loads come from sugarcane, bananas and urban areas.

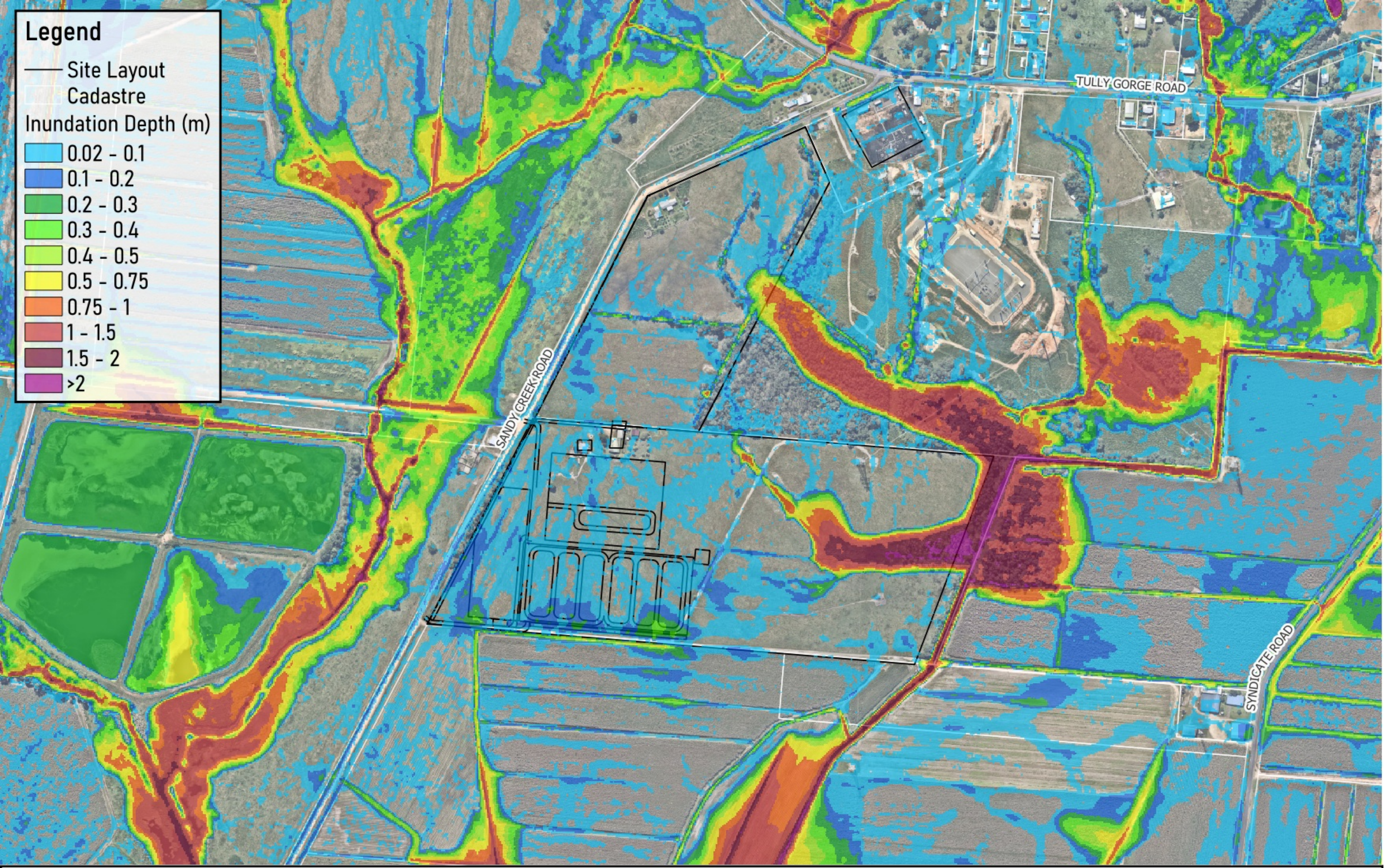
Fine sediment

Most anthropogenic fine sediment loads come from sugarcane, streambank erosion, grazing and bananas.

Types of sediment erosion

Most sediment erosion comes from hillslopes and streambanks in the Tully catchment.

APPENDIX B
FLOOD DEPTH AND VELOCITY MAPS

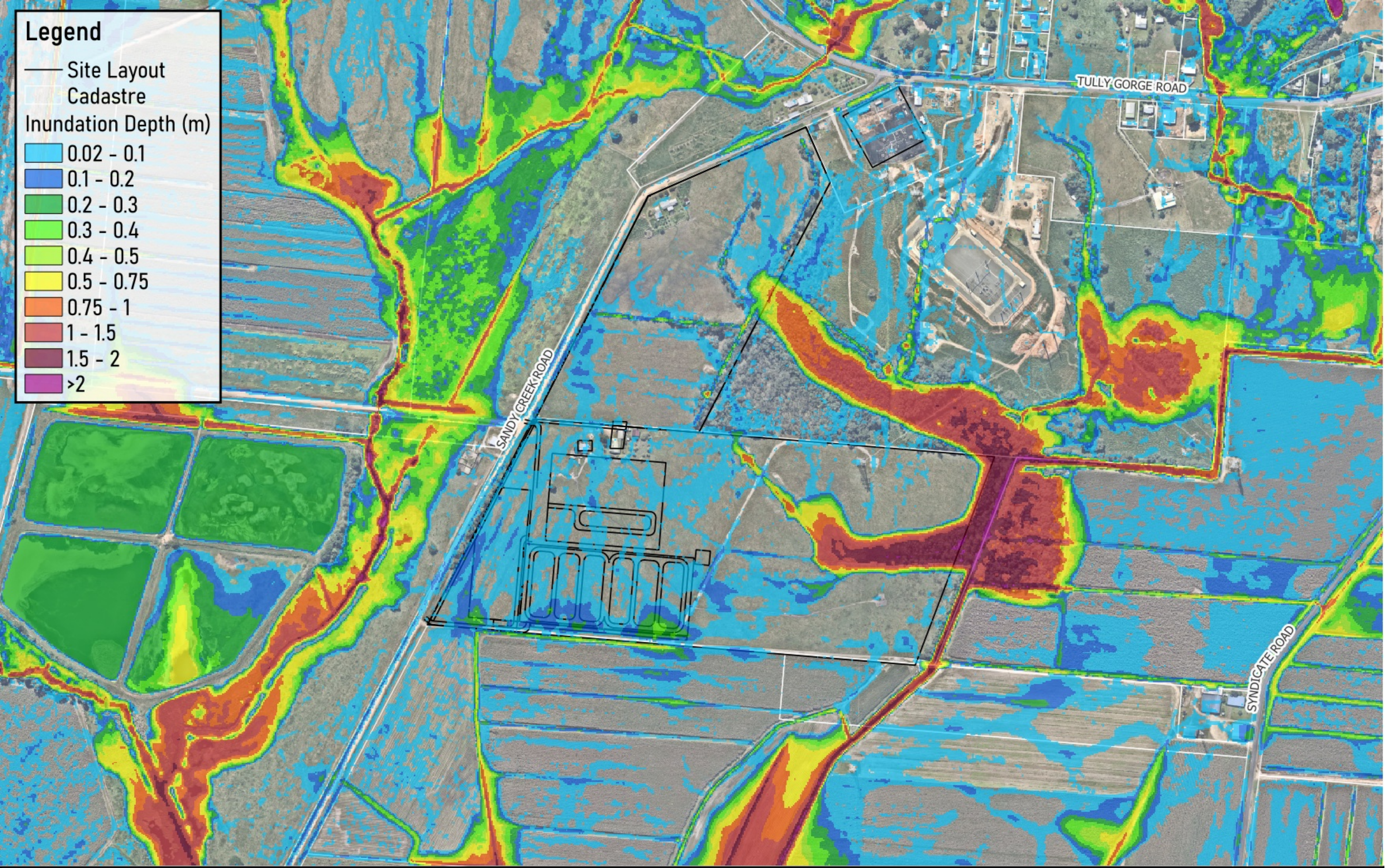


CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Depth
0.2% AEP

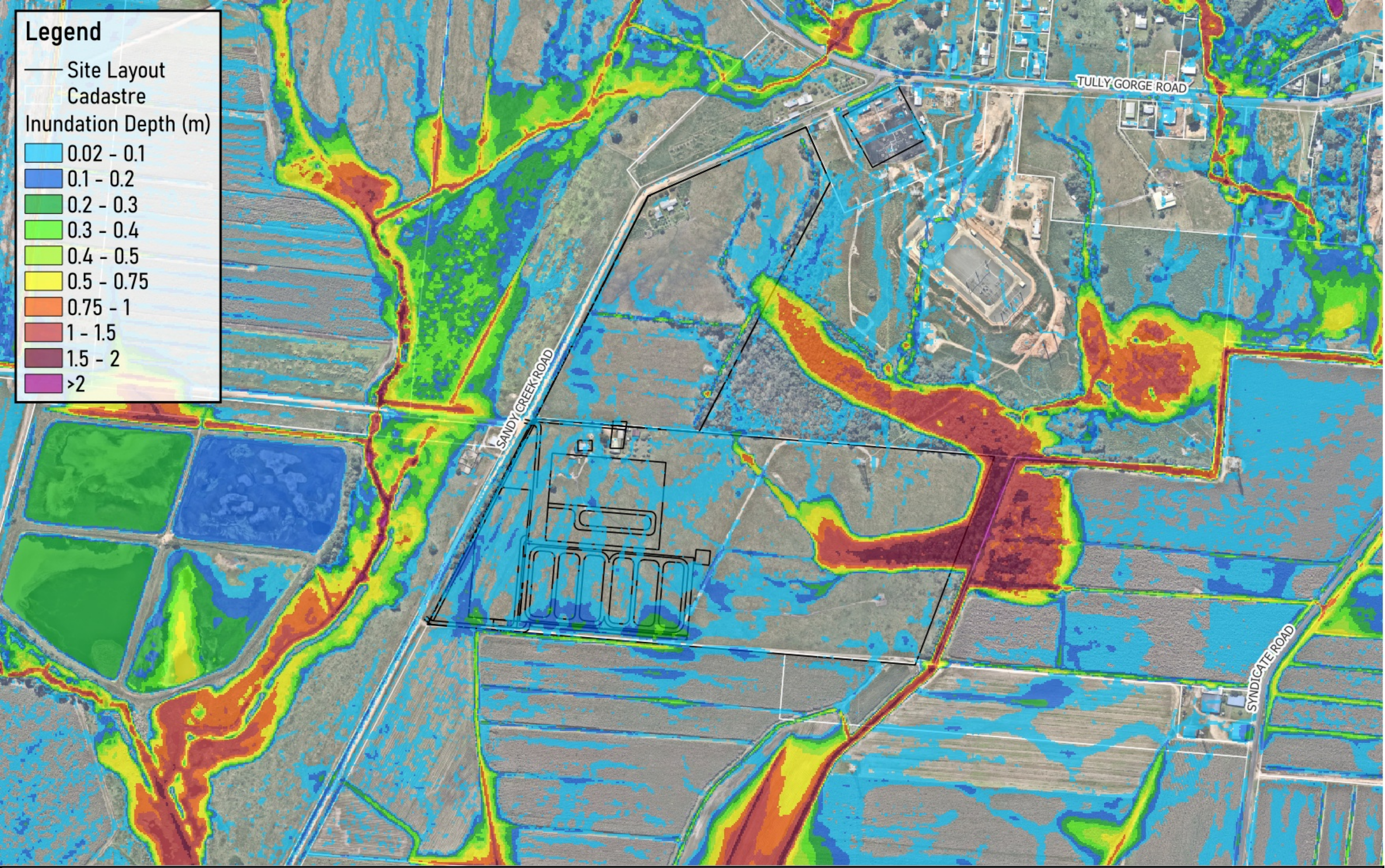
2025-09-18T11:24:44.115



CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

25020134 - Tully BESS
Existing Condition Results
Inundation Depth
0.5% AEP

2025-09-18T11:24:45.315

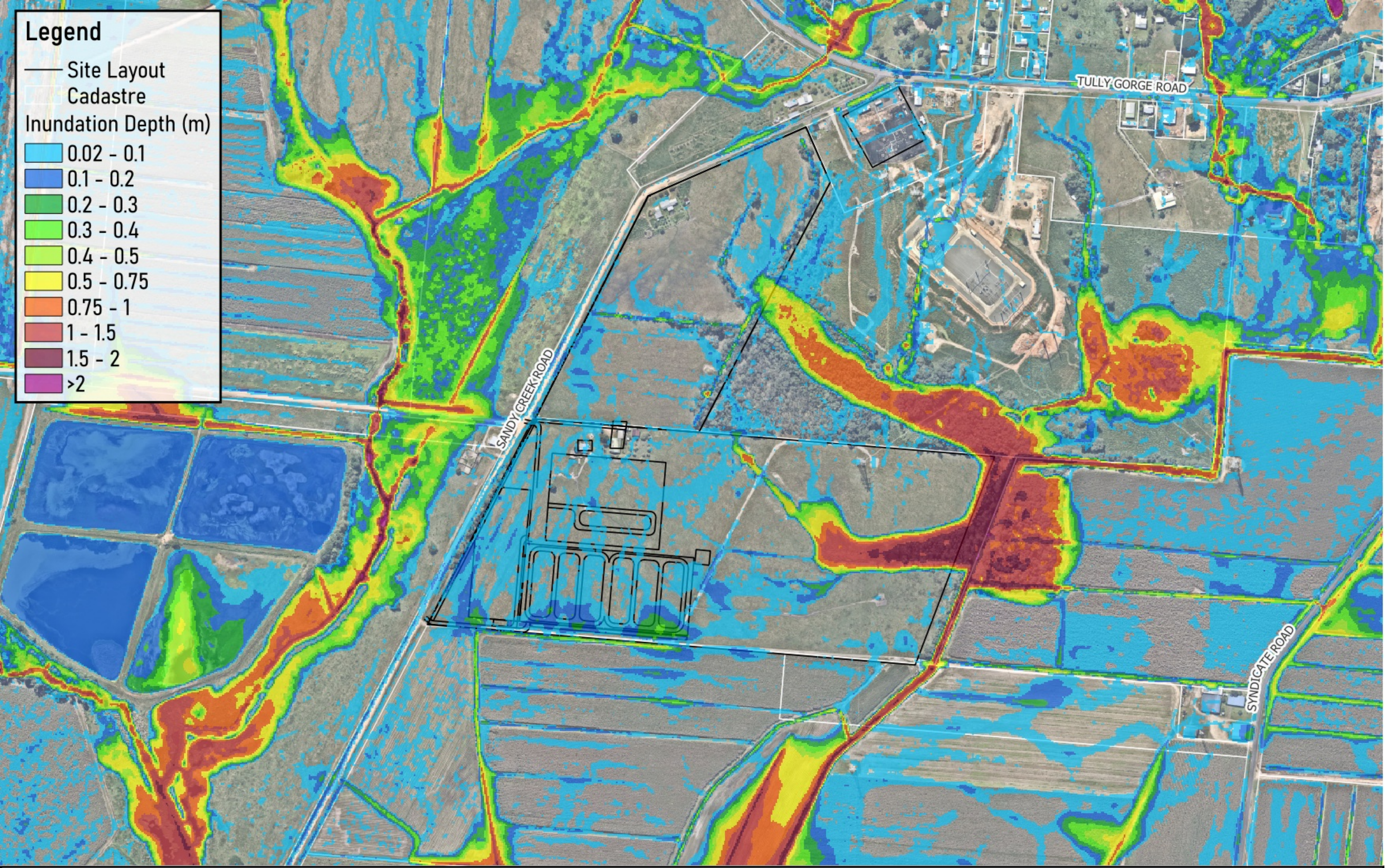


CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Depth
1% AEP

2025-09-18T11:24:46.404

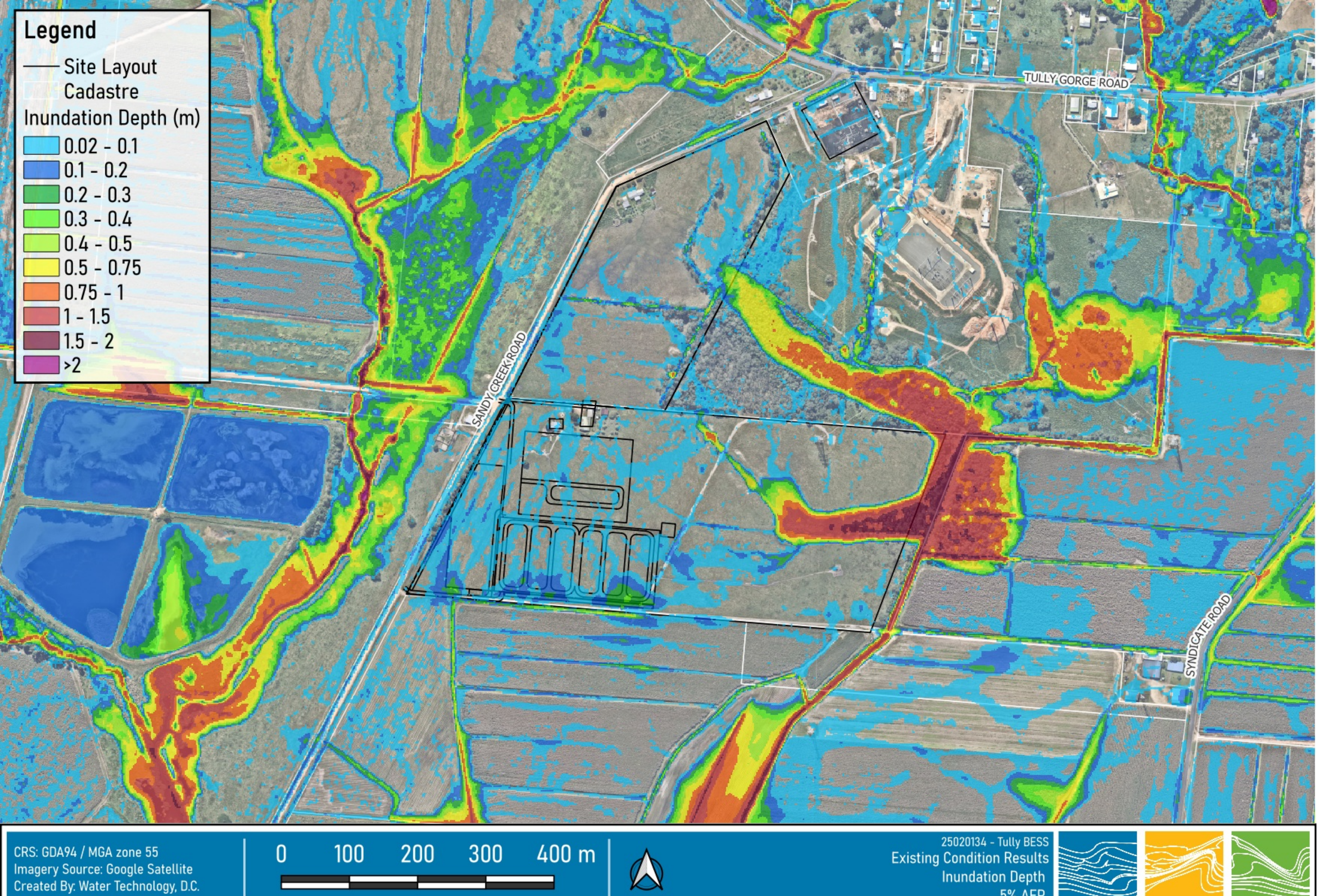


CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Depth
2% AEP

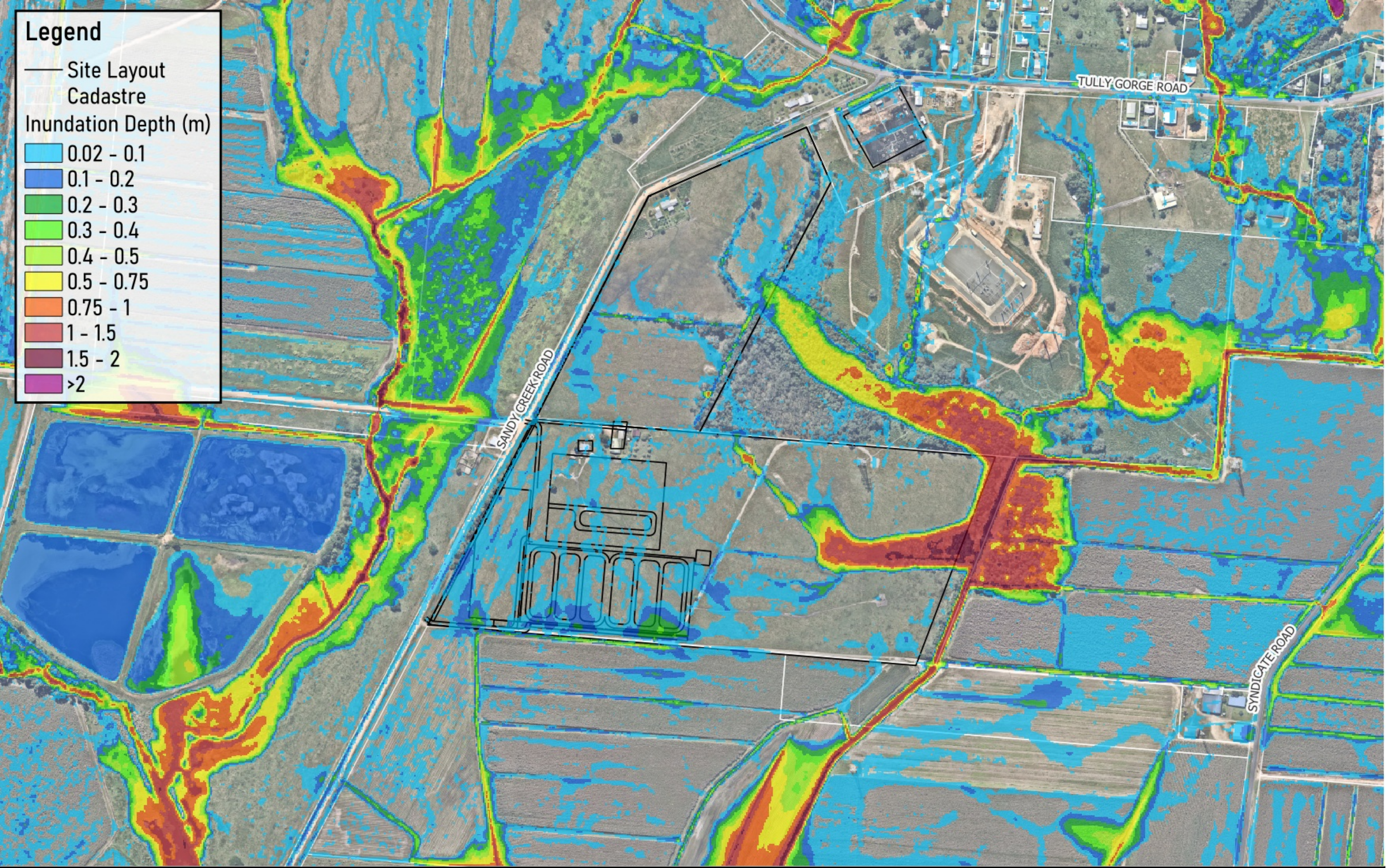
2025-09-18T11:24:47.593



CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

25020134 - Tully BESS
Existing Condition Results
Inundation Depth
5% AEP

2025-09-18T11:24:48.714

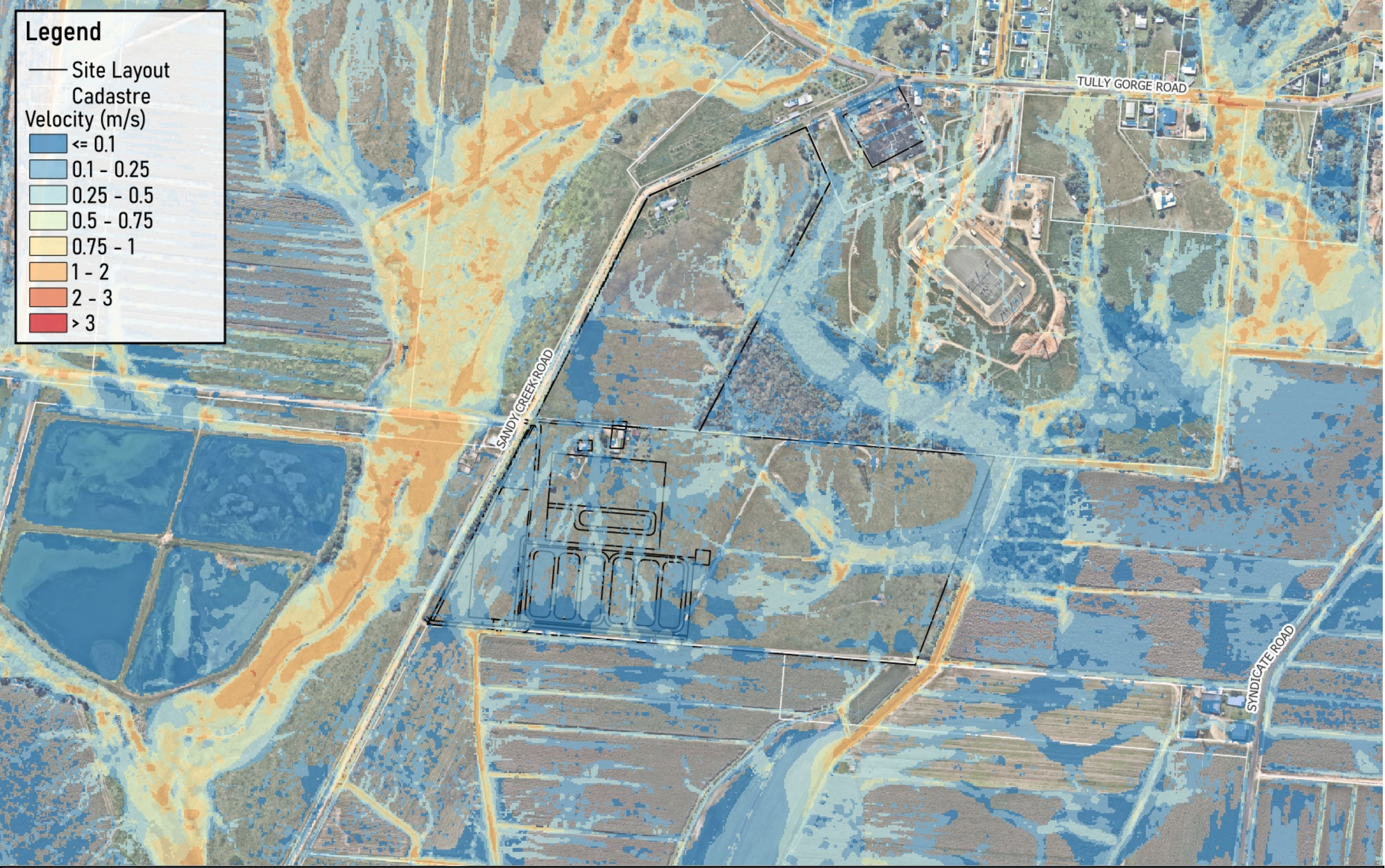


CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Depth
10% AEP

2025-09-18T11:24:49.791



CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

25020134 - Tully BESS
Existing Condition Results
Inundation Velocity
0.2% AEP

2025-09-18T11:24:50.856

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

25020134 - Tully BESS
Existing Condition Results
Inundation Velocity
0.5% AEP

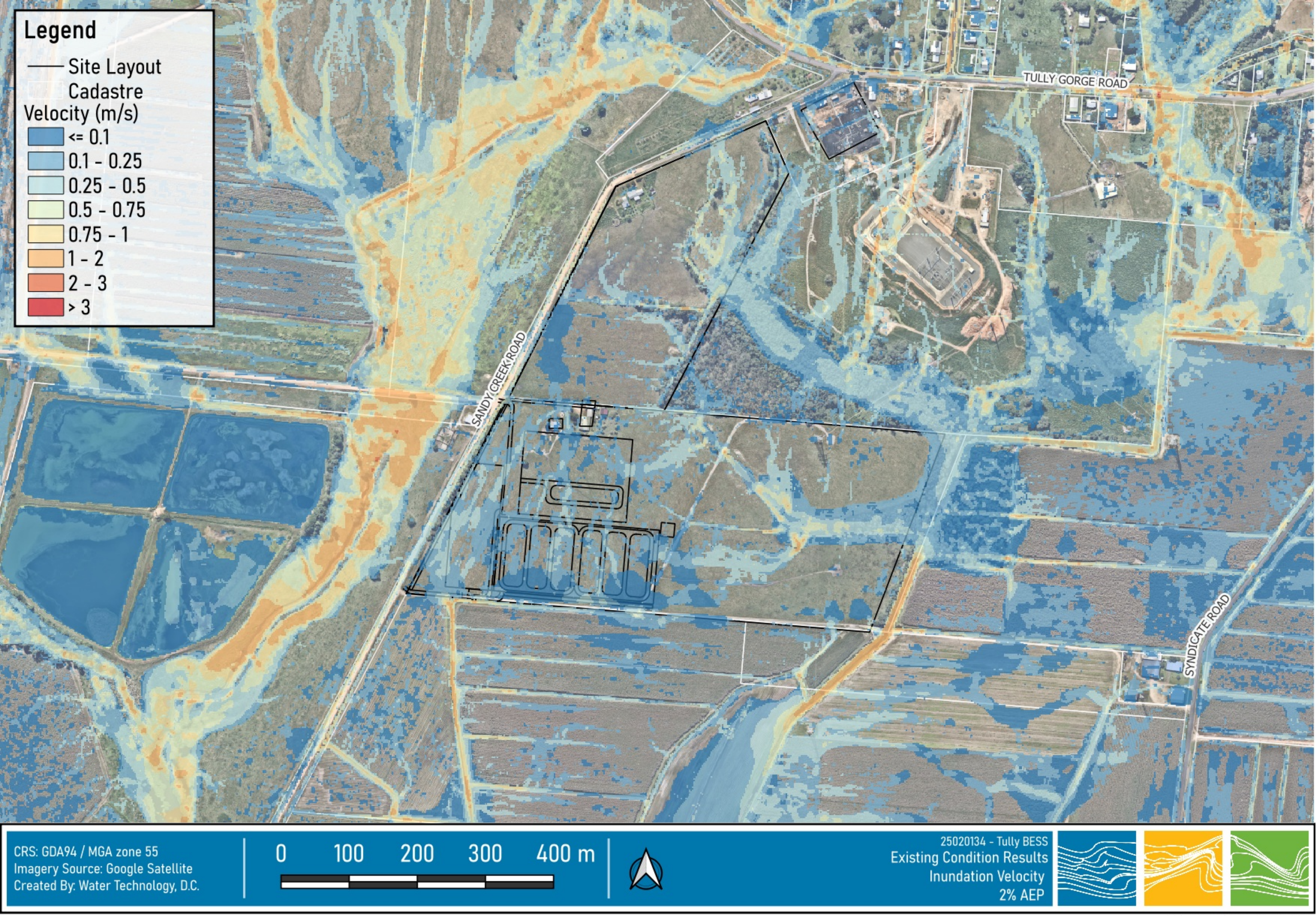
2025-09-18T11:24:51.945

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Velocity
1% AEP

2025-09-18T11:24:53.072



2025-09-18T11:24:54.097

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

25020134 - Tully BESS
Existing Condition Results
Inundation Velocity
5% AEP

2025-09-18T11:24:55.153

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Velocity
10% AEP

2025-09-18T11:24:56.216

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Height
0.2% AEP

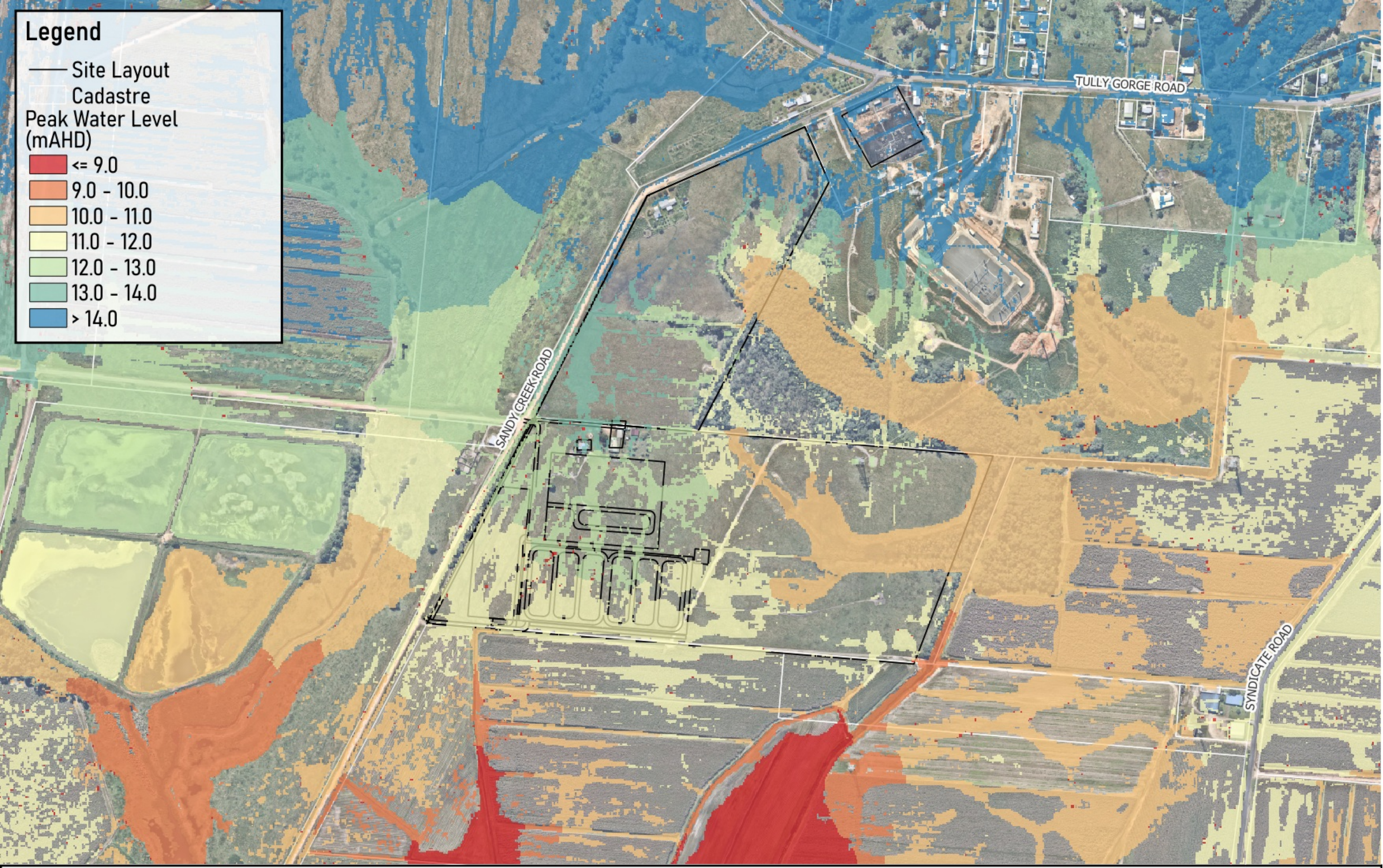
2025-09-18T11:24:57.293

2025-09-18T11:24:58.372

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

25020134 - Tully BESS
Existing Condition Results
Inundation Height
1% AEP

2025-09-18T11:24:59.410



CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

25020134 - Tully BESS
Existing Condition Results
Inundation Height
2% AEP

2025-09-18T11:25:00.465

2025-09-18T11:25:01.591

2025-09-18T11:25:02.618

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Melbourne
15 Business Park Drive
Notting Hill VIC 3168
Telephone (03) 8526 0800

Sydney
Suite 3, Level 1, 20 Wentworth Street
Parramatta NSW 2150
Telephone (02) 9354 0300

Brisbane
Level 5, 43 Peel Street
South Brisbane QLD 4101
Telephone (07) 3105 1460

Adelaide
1/198 Greenhill Road
Eastwood SA 5063
Telephone (08) 8378 8000

Perth
Level 1, 21 Adelaide Street
Fremantle WA 6160
Telephone (08) 6555 0105

New Zealand
7/3 Empire Street
Cambridge New Zealand 3434
Telephone +64 27 777 0989

Wangaratta
First Floor, 40 Rowan Street
Wangaratta VIC 3677
Telephone (03) 5721 2650

Geelong
51 Little Fyans Street
Geelong VIC 3220
Telephone (03) 8526 0800

immera
7 Joel South Road
well VIC 3380
ephone 0438 510 240

Gold Coast
Suite 37, Level 4, 194 Varsity Parade
Varsity Lakes QLD 4227
Telephone (07) 5676 7602

watertech.com.au

Appendix F

Bushfire Hazard Assessment and Management Plan

BUSHFIRE HAZARD ASSESSMENT AND MANAGEMENT PLAN

Tully Battery Energy Storage System (BESS)

Prepared for RWE Renewables Australia Pty Ltd
C/- Attexo

September 2025

BUSHFIRE PLANNING

Meridian
Urban

ACKNOWLEDGEMENT OF COUNTRY

Meridian Urban acknowledges the Traditional Custodians of the lands and waters where we live and work.

As resilience practitioners we have a responsibility in listening to and elevating Indigenous voices through our practice, and meaningfully engaging in processes of reconciliation. We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers, and pay our respect to Elders past and present.

Meridian Urban's 'Reflect' Reconciliation Action Plan (RAP) details our commitments to advancing cultural change, active participation and inclusive and informed approaches, with a focus on increasing economic and social equity for Aboriginal and Torres Strait Islander peoples and supporting First Nations self-determination. A copy of our RAP can be viewed online at meridianurban.com.

Meridian Urban

QUALITY STATEMENT

PROJECT MANAGER	PROJECT TECHNICAL LEAD
Laura Gannon	Laura Gannon
PREPARED BY	
Amy Adamson	18/09/2025
REVIEWED BY	
Laura Gannon	18/09/2025
APPROVED FOR ISSUE BY	
Laura Gannon	18/09/2025

REVISION SCHEDULE

Rev No.	Date	Description	Prepared by	Reviewed by	Approved by
A	30/06/2025	Final	AA	LG	LG
B	11/09/2025	Final (updated layout)	AA	LG	LG
C	18/09/2025	Final (minor amendments)	AA	LG	LG

FPAA NSW BPAD Accreditation No. 33131

Member Planning Institute of Australia
Member Fire Protection Association of Australia
Member International Association of Wildland Fire
Member Natural Hazard Mitigation Association (USA)
Member of Association of Fire Ecology

Tully Battery Energy Storage System (BESS)

Bushfire hazard assessment and management plan

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 Introduction

Meridian Urban has been commissioned by RWE Renewables Australia Pty Ltd (RWE) C/- Attexo to provide a bushfire hazard assessment and associated bushfire management plan for a proposed Battery Energy Storage System (BESS) at Tully, in the Cassowary Coast Local Government Area.

This report supports a development application to Cassowary Coast Regional Council.

Part of the site is mapped as Bushfire Prone Area (High potential bushfire intensity and potential impact buffer) in both the Cassowary Coast Regional Council Planning Scheme (planning scheme) and the interactive mapping system that supports the State Planning Policy 2017 (SPP 2017).

This bushfire hazard assessment and management plan includes assessment against the relevant planning instruments being the planning scheme and SPP 2017 Natural hazards, risk and resilience (bushfire) State interest. The assessment has regard to the relevant SPP 2017 guidance material including Bushfire Resilient Communities Technical Reference Guide prepared by Queensland Fire and Emergency Services (QFES) (now Queensland Fire Department – QFD).

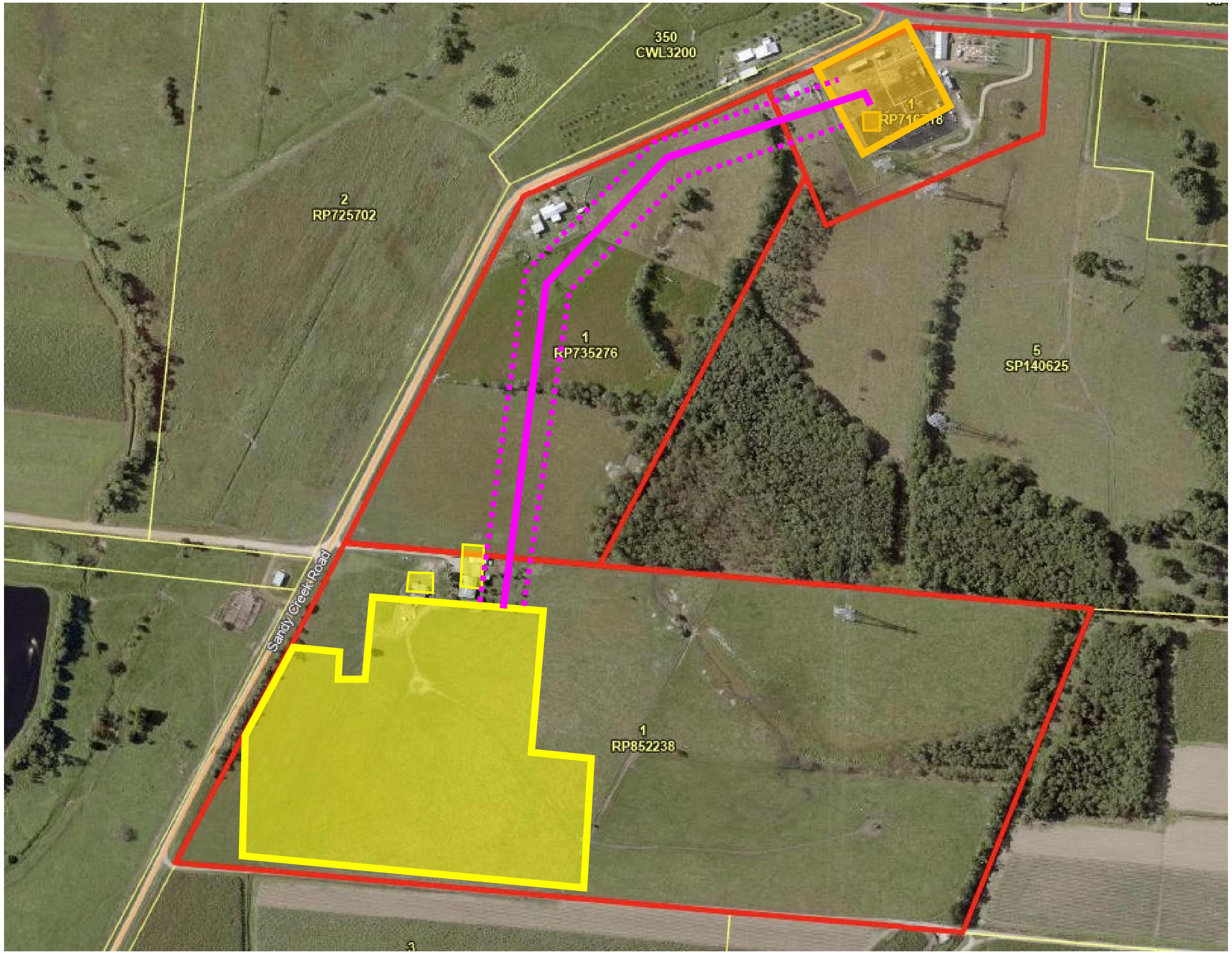
2 Site and Locality Context

This section of the report provides a description of the site and the locality.

2.1 Overview of the Site Details

Table 1 - Site Details

Site Address	Sandy Creek Road, Tully
RP Description	Lot 1 on RP852238 Lot 1 on RP735276 Lot 1 on RP716718 **(Figure 1)**
Lot Area	Lot 1 on RP852238 – 20.6ha Lot 1 on RP735276 – 8.094ha Lot 1 on RP716718 – 2.704ha Total – 31.4ha
Development Footprint	Approximately 9ha **(Figure 1)**
Local Government	Cassowary Coast Regional Council
Tenure	Freehold Easements for high voltage powerlines across the rear of the site
Current Land Use	Dwelling houses and ancillary structures
Local Brigade	Tully Auxiliary Station



Legend

- BESS footprint and temporary construction area footprint
- New electricity infrastructure
- Tully substation
- Site boundary

Figure 1 - Lot boundaries and Development Footprint
(Source: Queensland Globe 2025 and RWE)

2.2 Description of the Site

The proposed BESS site will be located on the western half of Lot 1 on RP852238. Lot 1 is relatively flat with a gentle slope from the west down to an unnamed tributary of Tully River (Sandy Creek) toward the eastern, rear boundary of the lot.

The site contains little vegetation, with only scattered vegetation following drainage / waterway corridors at the rear of the site.

The site has frontage to Sandy Creek Road along its western boundary and is not currently connected to a reticulated water supply.

A high voltage powerline traverses the rear of the site, connecting with a substation fronting Tully Gorge Road to the north of the site (Lot 1 on RP716718).

2.3 Description of the Locality

The site is approximately 4km (via Tully Gorge Road) to the south-west of the centre of Tully township and approximately 145km south of Cairns via the Bruce Highway.

The immediate surrounding land is predominately used for farming purposes, with the exception of the existing Tully substation, referred to above, and a new substation immediately to the east.

To the north and north-west of the site, across Tully Gorge Road, is a large expanse of heavily vegetated and elevated area, forming part of the Tully Gorge National Park and the Japoon National Park.

Sandy Creek Road provides access to the surrounding farming land and Tully Gorge Road provides access to Tully Gorge and the National Park area.

Refer to **Figure 2** for the context of the site in the locality.

Figure 2 - The Locality

(Source: Qld Globe, 2025)

3 Proposed Development

The proposed development is for a Battery Energy Storage System (BESS) and associated infrastructure on Lot 1 on RP852238. The BESS is intended to take electricity from the grid in periods of low demand, and feed back into the grid at periods of high demand.

The BESS is proposed on land in proximity to the existing Tully 132 kV substation (Lot 1 on RP716718) and a new Tully 275 kV substation (Lot 5 on SP140625). The BESS will be connected to the existing substation (Lot 1 on RP716718) via a transmission connection, consisting of overhead transmission line. The transmission connection traverses the adjoining Lot 1 on RP735276 to the north of the BESS site to connect with the substation.

The BESS and associated infrastructure will comprise a total development footprint of approximately 9ha and consists of:

- Up to 188 battery units (approx. 2.5ha), associated infrastructure, inverters, MV transformers, internal access roads, hardstand and security fencing
- Switching station comprising a 132/33 kV high voltage transformer, air insulated switchgear, an auxiliary transformer, two 33 kV switch rooms and potentially harmonic filters. The switch rooms will include the switchgear and a site office.
- Two vehicle access points to Sandy Creek Road, carparking and a perimeter road
- temporary construction and permanent operations and maintenance (O&M) area adjacent to Sandy Creek Road including operations and maintenance building, yard, parking areas and required office buildings, water tanks and storage sheds
- construction laydown area
- perimeter security fencing / gates
- grid connection via overhead transmission line traversing the adjoining Lot 1 on RP735276 and connecting to Lot 1 on RP716718
- landscape buffer / screen planting along the frontage and part-way along the side boundaries of Lot 1 on RP852238.

Access to the BESS site will be via new and upgraded crossovers to Sandy Creek Road. The development will be provided with static-on site water supply, the capacity of which will be as per the recommendations of this report.

The BES site is largely cleared of vegetation, with only scattered trees and shrubs will be removed during the construction phase of the project. The existing dwelling and structures on Lot 1 on RP852238 may be utilised as operations and management area at some point in the future.

The BESS will be operational 24 hours a day, every day of the year. The primary operation of the premises will be undertaken from a remote operations control centre, with physical monitoring and maintenance of the facility undertaken periodically. Planned maintenance activities will likely include:

- Monthly inspections (electricity, civil and environmental)
- Vegetation management (in line with various management plans)
- Other activities as defined in the O&M management plans
- During fire danger period weekly inspections of the APZ, access road, water supply, signage and building protection systems.

Corrective maintenance activities will likely include:

- Testing and replacement of faulty plant components (fuses, etc)
- Any other corrective actions within the O&M scope.

The proposed development layout is included in **Appendix A.**

4 Understanding Bushfire Hazard

Bushfires have long remained a fundamental characteristic of the Australian bush landscape. There remains a number of common factors which are associated with bushfire events, and these include the incidence of fire weather, availability of fuel along with its type, structure and continuity or fragmentation, and development at the bushland interface.

4.1 Bushfire Attack

Bushfire attack refers to the various methods in which bushfire may impact upon life and property and principally encompasses:

- Direct flame contact
- Ember and firebrand attack
- Radiant heat flux
- Fire-driven wind
- Smoke.

During the progression of a bushfire event, these methods either exclusively or in concert interact **(Figure 3)**. It is estimated that approximately 80 to 90 per cent of buildings lost to bushfire in Australia are located within 100m of the bushland interface, hence the relevance of statutory provisions and recommendations implemented across Australia which respond to various types of buildings within 100m of adjacent classifiable vegetation.

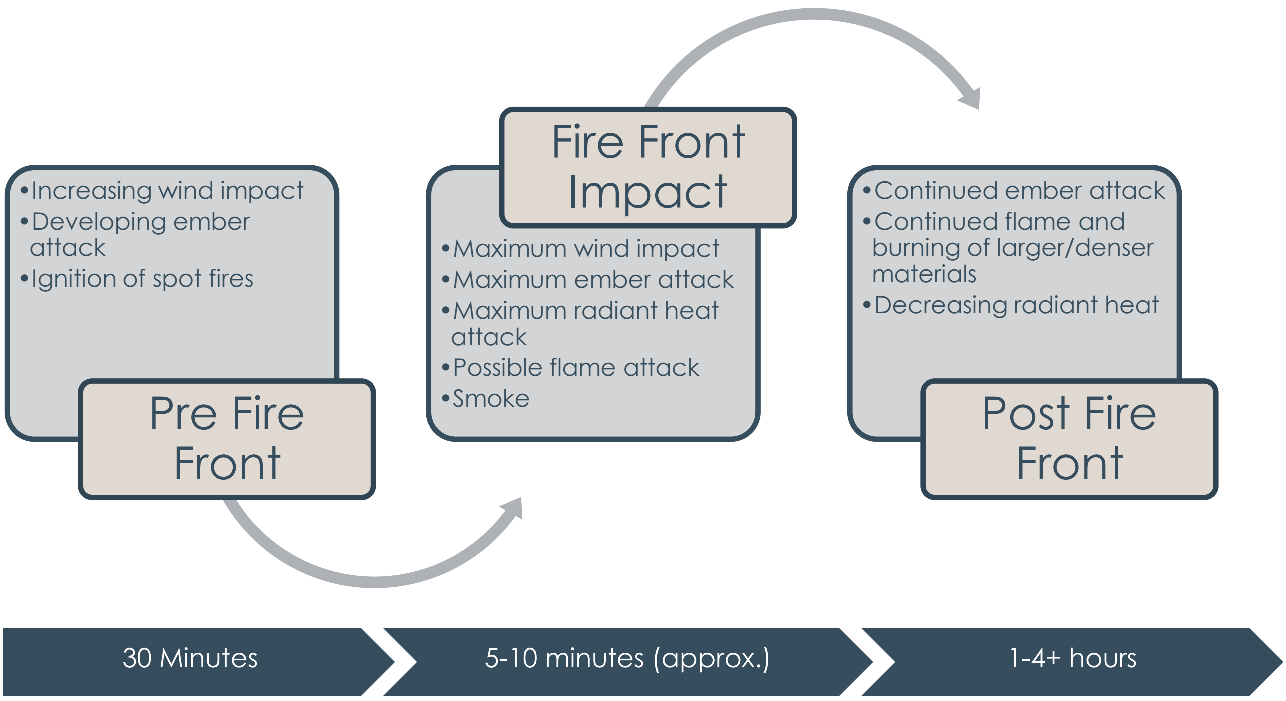


Figure 3 – The Typical Phases of Bushfire Attack

(Derived from Ramsay & Rudolph, 2003)

4.1.1 Direct Flame Contact

Direct flame attack refers to flame contact from the main fire front, where the flame which engulfs burning vegetation is one and the same as that which assumes contact with the building. It is estimated that only 10 to 20 per cent of buildings lost to bushfire occur as a direct result of flame attack based on research conducted by the CSIRO.

4.1.2 Ember and Firebrand Attack

The convective forces of bushfire raise burning embers into the atmosphere on prevailing winds and deposit them to the ground ahead of the fire front. Typically, ember attack occurs prior to the arrival of the fire front and continues during the impact of the fire front and for several hours afterwards, thus it is the longest lasting impact of bushfire attack. Firebrands occur in a very similar manner but relate to larger items of debris that may still be carried by the wind when alight, such as candle and ribbon barks.

In essence, building loss via ember attack relates largely to the vulnerabilities and peculiarities of each building, its distance from the classifiable vegetation and whether an occupant (or the like) is present to actively defend it. It is estimated by the CSIRO that approximately 80 to 90 per cent of buildings lost by bushfire are lost as a result of ember attack either in isolation or in combination with radiant heat impact.

4.1.3 Radiant Heat Flux

Exposure to radiant heat remains one of the leading threats to infrastructure assets associated with bushfire events **(Figure 4)**. Measured in kilowatts per m², radiant heat is the heat energy released from the fire front which radiates to the surrounding environment, deteriorating rapidly over distance. Radiant heat can pre-heat materials making them more susceptible to ignition, or can cause non-piloted ignition of certain materials if the energy transmitted reaches a threshold level. Radiant heat can also damage building materials, reducing the ability for the structure or asset to withstand.

Radiant heat flux (kW/m²)	Potential effects
Greater than 40	• unpiloted ignition of timber walls and fences
	• direct flame contact likely
	• extreme levels of radiant heat
29–40	• failure of toughened glass
	• direct flame contact possible, extreme levels of radiant heat
	• unpiloted ignition of some timber species after prolonged exposure (e.g. several minutes)[29]
19	• failure of screened float glass
16	• blistering of skin with > 5 seconds exposure
12.5	• failure of plain glass
	• piloted ignition of dry timber elements after prolonged exposure (e.g. several minutes)[30]
10	• fabrics inside a building could ignite spontaneously with long exposure
	• critical limit for emergency services – firefighters cannot operate
	• life threatening with < 1 minute exposure in protective clothing.
7	• fatal to an unprotected person after exposure for several minutes
4.7	• firefighter in protective clothing will feel pain (60 seconds exposure)
3	• firefighters can operate for a short period (10 minutes)
2	• pain is felt on bare skin after 1 minute exposure (non-fatal)
	• firefighters with protective clothing can withstand this exposure level for a few minutes however, they are likely to experience rise in core body temperature
1	• maximum for indefinite skin exposure
0.5	• direct sunlight at noon on a bright sunny day

Figure 4 – The Effects of Radiant Heat

(Source: Queensland Fire and Emergency Services, 2019)

4.1.4 Fire Driven Wind

The convective forces of bushfire typically result in strong to gale force fire-driven winds, which in itself can lead to damage. The typical effects of fire driven wind include the conveyance of embers, damage from branches and debris hitting the assets, as well as direct damage to vulnerable components. Fire driven wind is not a form of bushfire attack that is currently addressed by planning and building provisions, beyond those required for wind loads generally.

4.1.5 Smoke

Smoke emission remains a secondary effect of bushfire and is one which is typically not addressed by bushfire hazard assessment, or by planning and building provisions. Irrespective, it is important to note the potentially severe impact of smoke emission on the human respiratory system. It can lead to difficulties in breathing, severe coughing, blurred or otherwise compromised vision, and can prove fatal. It is also important to note that toxic smoke can occur during bushfire, particularly where buildings or materials are ignited.

4.2 Vegetation Communities

Fuel load and arrangement represents a considerable component in dictating to a large degree the behaviour of fire in terms of intensity, rate of spread and flame height, and typically relates top dead plant material less than 6mm thick, and live plan material thinner than 3mm. On this basis, it stands to reason that different vegetation groups yield very different fire behaviour and intensity by virtue of their characteristics and fuel load output. The characteristics are not necessarily related to ecological values but remain a function of the propensity for certain groups of vegetation to ignite and sustain fire due to fuel load and arrangement, it can guide estimates on how quickly fire might spread and the likely fire behaviour and intensity which may occur.

Vegetation type, density and arrangement can further influence fire behaviour and intensity. Vertical and horizontal continuity is also a significant element. Thus, vegetation forms a critical element of analysis throughout this report.

4.3 Topography and Aspect

Topography (effective slope) and to a lesser degree, aspect, are also factors which influence fire behaviour and intensity. Topography influences the rate of spread, doubling for every 10 degrees of upslope and slowing by half for every 10 degrees downslope, as a general rule. Aspect can also affect bushfire behaviour where areas with northerly and / or westerly aspects experience a higher level of solar access than those areas with a southern or eastern aspect. Notwithstanding, in times of drought and below average rainfall moisture levels in soil and vegetation in more sheltered areas with southerly and easterly aspects can also decrease substantially giving rise to significantly higher fuel abundance where the preceding fire regime has been less frequent or intense.

4.4 Fire Weather

It remains important to understand the influence of fire weather with regard to how it can affect bushfire risk levels on a daily, weekly or seasonal basis.

In Queensland hot-air fire wind is typically generated by west, north-west and south-westerlies which are prevalent during the fire season which for Far North Queensland generally extends from July to February, annually. However, intense fire conditions can occur on different wind and at different times of the year depending on monsoonal seasons, changes to relative humidity and preceding drought conditions.

Notwithstanding the above, it is noted bushfires do not always conform to widely-accepted characteristics. Other fire weather conditions must also be contemplated such as preceding weather conditions such as low rainfall, heatwave, drought, air temperature and relative humidity. If the area has been subject to drought or low rainfall for a period of time, vegetation health tends to deteriorate with increased leaf drop, curing and drying. This contributes to increased ground fuel loads and general increased ignition susceptibility. Prolonged dry periods also reduce soil moisture content.

Air temperatures and extended periods of higher than average air temperatures also contribute to fire weather. In conjunction, low relative humidity (i.e. low air moisture content) is also a contributing factor to increased fire weather.

In concert, all of the above factors can impact on the ability for fire to propagate, and alter behaviour and intensity characteristics and as such, fire weather is a significant component of bushfire hazard. Whilst an assessment of vegetation types, fuel loads, effective slope and other factors can be readily undertaken, fire weather can fluctuate across days, weeks and seasons and can have a significant impact on the potential for bushfire threat as well as influence bushfire behaviour and intensity.

The Forest Behaviour Index (FBI) is a new method to readily advise the community of the likely ability of fire suppression based on fire weather, which is used to inform[1] the Fire Danger Rating (FDR) System at **Figure 5**. This has replaced the Forest Fire Danger Index (FFDI) insofar as it relates to fire danger ratings, but continues to be used for bushland hazard assessment, at the time this report was written.

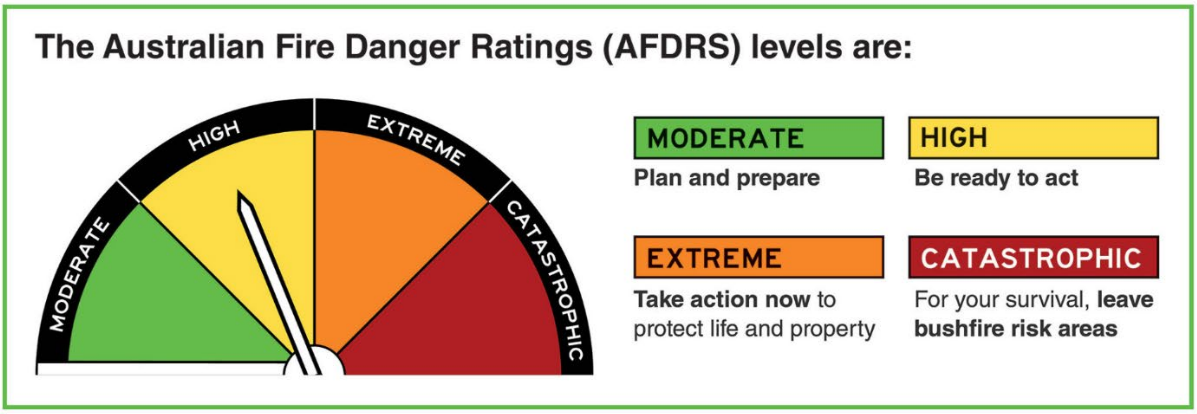


Figure 5 – Australian fire danger rating system

(Source: AFAC, 2022)

[1] Via the 'fire behaviour index'

5 Bushfire Regulatory Context

This section of the report sets out an overview of the regulatory context for the assessment of bushfire hazard relevant to the development and site.

This report supports a development application to the relevant assessing authority, being Cassowary Coast Regional Council, for a Development Permit for a Material change of use for an Undefined use and Major electricity infrastructure.

In this instance, the relevant statutory planning instruments include:

- **Cassowary Coast Regional Council Planning Scheme 2015:**
  - Bushfire hazard code.
- **State Planning Policy 2017**:
  - Natural Hazards, Risk and Resilience State Interest, including:
    - State Interest Policies.
    - Assessment benchmarks.
    - Supporting Technical Reference Guide 'Bushfire Resilience Communities 2019.'

Guidance has also been sought from:

- Renewable Energy Facilities Design Guidelines and Model Requirements, prepared by the Victoria Country Fire Authority, Version 4 August 2023
- Large -scale battery energy storage systems, AFAC Guideline, version 1.0 5 February 2025 Doctrine ID: 3105

Commentary is also provided on any relevant Building Assessment Provisions that may be applicable to subsequent building applications, for information and guidance purposes only.

5.1 Planning Scheme

5.2 Relevant Planning Scheme

The site is within the Cassowary Coast Regional Council Planning Scheme 2015 area. The current version of the planning scheme version 4 effective 16 December 2019.

5.3 Bushfire Hazard Overlay Map

Part 8.1(7)(c) of the planning scheme identifies the Bushfire Hazard Overlay as an overlay for the planning scheme. The overlays are mapped in Schedule 2 (Mapping) of the planning scheme.

Figure 6 is an extract from the Bushfire hazard overlay map as it pertains to the site, as well as the area surrounding the development footprint out to 150m (shown indicatively with the blue dashed line).

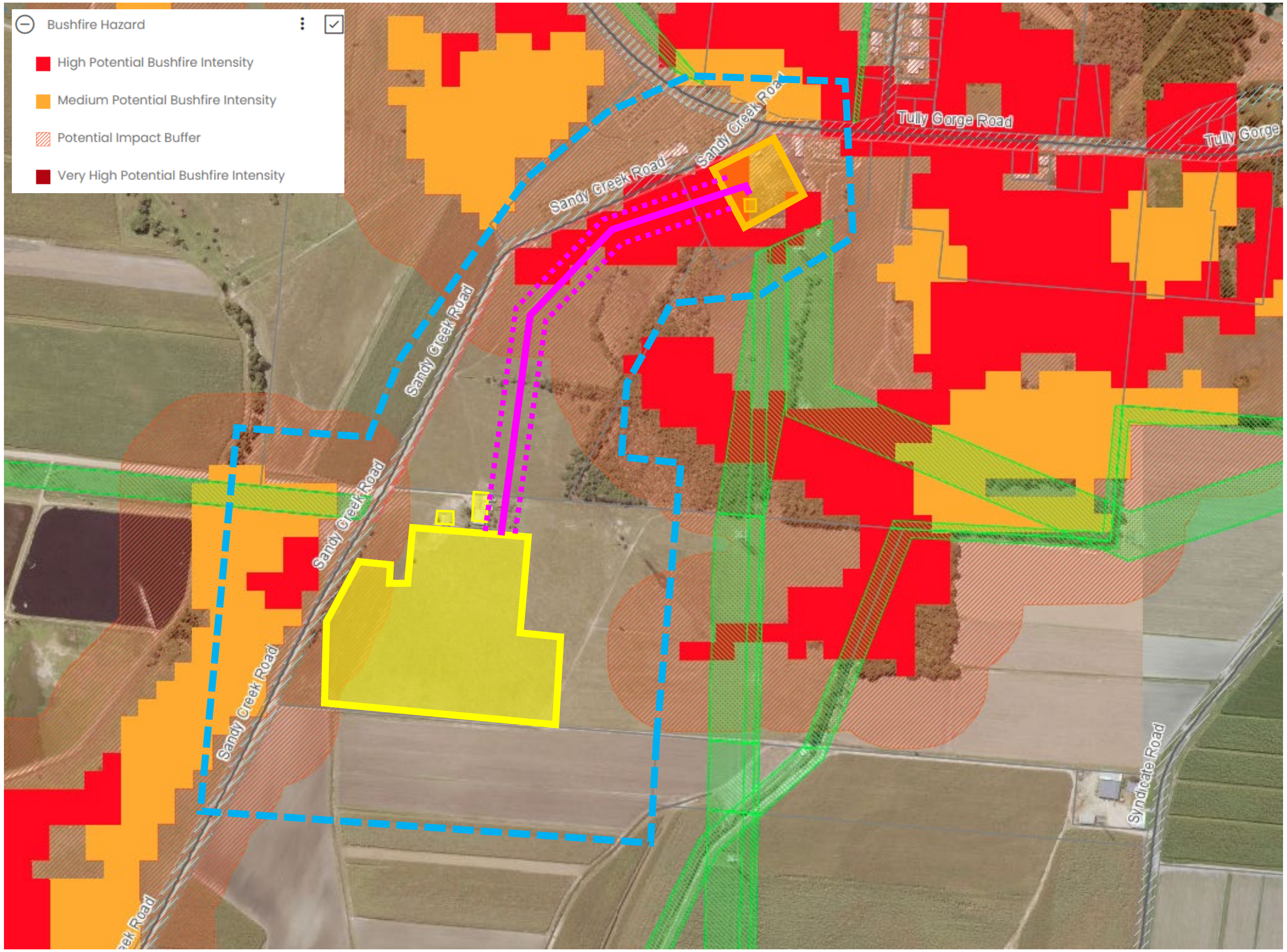


Figure 6 - Extract from the Bushfire Hazard Overlay Map
(Source: Cassowary Coast Planning Scheme 2015)

Based on this Council mapping, the majority of the BESS site is outside the mapped bushfire hazard area, with only the far western portion of the footprint within the Potential impact buffer. The broader area contains patches of High potential bushfire intensity towards the north-east and east, associated with the vegetated waterway / drainage areas in this location. The transmission connection also crosses the Potential impact buffer area and a patch of High potential bushfire intensity to the north of the BESS site.

Land to the south-west, west and north-west is also mapped predominately Medium potential bushfire intensity area and Potential impact buffer.

Bushfire hazard is also mapped as present across the wider locality **(Figure 7),** particularly some of the elevated and vegetated land to the north and north-west of the site, which extends into the Tully Gorge National Park. Various patches are also present throughout the agricultural areas surrounding the site. The accuracy of this mapping is discussed later in Section 6.2 of this report.

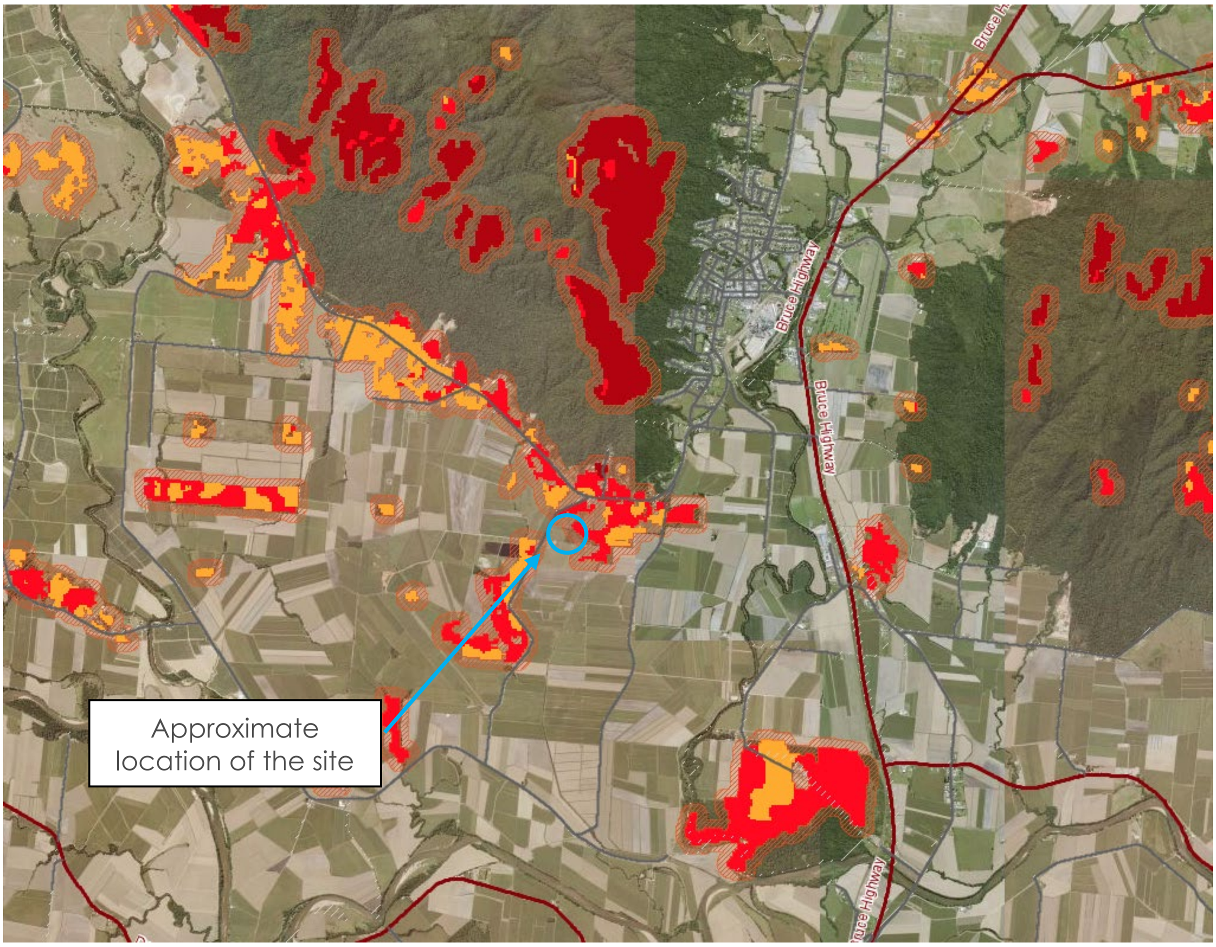


Figure 7 - Bushfire Hazard in the Wider Locality

(Source: Cassowary Coast Planning Scheme 2015)

5.4 Bushfire Hazard Code

The Bushfire hazard code is identified is a relevant assessment benchmark for any assessable material change of use and reconfiguring a lot in the Very high, high or medium potential bushfire intensity area of the planning scheme. Whilst the BESS site itself is outside this area, the grid connection does pass through an area of High potential bushfire intensity.

The planning scheme does not explicitly identify the Bushfire hazard code as an assessment benchmark for assessable development in the potential impact buffer (which affects part of the BESS site). This is likely due to the age of the planning scheme (prepared under the now superseded State Planning Policy 2014) and is inconsistent with the approach taken in the State Planning Policy 2017, which applies the assessment benchmarks of the SPP to all bushfire prone areas, including the potential impact buffer.

Therefore, assessment of the whole development (including the BESS site and grid connection) has been carried out against the Bushfire hazard code in **Appendix B.**

This assessment relies on the outcomes of the bushfire hazard assessment and recommendations of the bushfire management plan as described in Sections 6 to 8 of this report.

This assessment demonstrates the development complies with the Bushfire hazard code.

5.5 State Planning Policy 2017

The Cassowary Coast Planning Scheme 2015 (section 2.1) states that the State Planning Policy (SPP), including those aspects relevant to Natural hazards, risk and resilience, is reflected in the planning scheme. However, it does not specify which version of the SPP is reflected.

Given the scheme was initially drafted under the SPP 2014, it is likely the scheme reflects the now superseded SPP. As noted in section 5.4 above, this is evident in the exclusion of the potential impact buffer from the trigger for the Bushfire hazard overlay code.

Therefore, a complete assessment against the SPP 2017 has also been carried out below.

5.5.1 State-wide Bushfire Prone Areas Map

The SPP 2017 is underpinned by the State-wide bushfire prone area mapping. An extract of that mapping relevant to the site is provided in **Figure 8.**

As is evident, the SPP Bushfire Prone Area mapping is consistent with the Bushfire Hazard Overlay mapping in the planning scheme.

Figure 8 - Extract of the SPP Bushfire Prone Areas Map

(Source: State Planning Policy Interactive Mapping System, 2025)

5.5.2 State Interest Policies and Assessment Benchmarks

For the purpose of this report the Natural Hazards, Risk and Resilience State Interest Policy statements (4),(5) and (6) and Assessment Benchmarks (3), (4), (5), (6) and (7) of the SPP have been assessed in **Table 2.** This assessment relies on the outcomes of the bushfire hazard assessment and recommendations of the bushfire management plan as described in **Sections 6 to 9** of this report.

Table 2 - SPP State interest policy compliance assessment

SPP Natural Hazards Assessment Benchmark	Compliance Statement
State interest policy (4) and Assessment benchmark (3) Development avoids natural hazard areas, or where it is not possible to avoid the natural hazard area, development mitigates the risks to people and property to an acceptable or tolerable level.	**Complies –** The majority of the BESS site is outside the mapped bushfire prone area, with only a portion of the western part of the facility within the Potential impact buffer. Notwithstanding the mapping, the area to the west of the site is not considered hazardous, as there is currently very limited vegetation cover in this area (the accuracy of the mapping is discussed further in Section 6 of this report). Similarly, the grid connection passes through an area of mapped High potential bushfire intensity towards the existing sub-station site. Again, this mapping is not accurate and this area is not considered hazardous as there is little to no vegetation. On this basis, the BESS site and grid connection is considered to be wholly outside a bushfire prone area. Notwithstanding, the BESS site and part of the grid connection are within 150m of vegetation that (based on the verified regional ecosystems provided) has the potential to become hazardous as it reaches remnant status to the east. In this instance, a suite of mitigation measures are recommended to contribute toward tolerable risk to people and property. These mitigation measures include: • The siting of the BESS site far as possible from the hazardous vegetation and within areas not mapped as Bushfire Prone Area • The provision of further separation through asset protection zones • Use of the perimeter track around the BESS facility • Access and egress from the BESS site away from the hazardous vegetation • Static water supply
State interest policy (5)(a) Assessment benchmark (4) Development supports and does not hinder disaster management response or recovery capacity and capabilities.	**Complies –** Disaster management response and recovery capacity and capabilities is supported by the proposed development through the provision of: • Sufficient water supply is to be available through on-site static water supply. • Separation between the vulnerable components of the proposed

SPP Natural Hazards Assessment Benchmark	Compliance Statement
	development (i.e. the BESS site) and the hazardous vegetation to provide access for emergency services. • Emergency management procedures to support operations.
State interest policy (5)(b) Assessment benchmark (5) Development directly, indirectly and cumulatively avoids an increase in the severity of the natural hazard and the potential for damage on the site or to other properties.	**Complies -** The proposal does not include any known changes to the vegetation hazard class adjacent to the development footprint (through rehabilitation or revegetation) that would increase the severity of bushfire or potential for damage on the site or other properties. Notwithstanding, the vegetation hazard assessment has been carried out assuming the adjoining regrowth vegetation to the east of the site is likely to reach remnant status.
State interest policy (5)(c) and Assessment benchmark (6) Risks to public safety and the environment from the location of hazardous materials and the release of these materials as a result of a natural hazard are avoided.	**Complies –** The risk to public safety and the environment from the storage of hazardous materials on site, namely the battery system itself, can be mitigated through the siting of these components as far as practicable from the hazardous vegetation, the provision of asset protection zones and suitable operational procedures for emergency events.
State interest policy (5)(d) Assessment benchmark (7) The natural processes and the protective function of landforms and the vegetation that can mitigate risks associated with the natural hazard are maintained or enhanced.	**Not applicable -** The natural processes and surrounding landforms will not be affected by the proposal in a way that would increase risk associated with bushfire hazard.
State interest policy (6) Community infrastructure is located and designed to maintain the required level of functionality during and immediately after a natural hazard event.	**Complies -** Community infrastructure in the context of bushfire hazard is not explicitly defined in the State Planning Policy. However, a definition is provided in the Example planning scheme assessment benchmarks guidance material that supports the SPP. Examples of community infrastructure for essential services include educational establishment, emergency services and hospital. Other infrastructure that may perform an important role and be required to function during and immediately after a bushfire hazard event may also be considered community infrastructure including showgrounds and sports facilities. The Cassowary Coast planning scheme (Bushfire hazard code PO4 and AO4.1) includes provisions about community infrastructure, which includes substation and power station. Whilst the BESS itself is not a major switch yard, power station or substation, as an energy storage system it

SPP Natural Hazards Assessment Benchmark	Compliance Statement
	functions similar to those uses and therefore the functionality of the facility during and immediately after a bushfire event should be considered. It is acknowledged that immediately after a bushfire event the operation of the facility will be at the direction of the operators and will be subject to a number of factors that sit outside a planning assessment (i.e. direction from emergency services, safety, protection of infrastructure, staffing etc.). Notwithstanding, it is considered that the various mitigation measures recommended in this report, including separation from hazardous vegetation, provision of water supply and operational procedures will support the functionality of the facility during and immediately after a bushfire event, as far as practicable through planning considerations. Compliance with Policy (6) is therefore achieved.

5.5.3 Bushfire Resilient Communities 2019

The 'Bushfire Resilient Communities – Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire' (October 2019)' (BRC) supports the SPP and associated SPP guidance material.

It provides technical guidance and the policy positions of Queensland Fire Department (QFD) and is relevant to making or assessing development applications. The technical guidance includes procedures for undertaking a Bushfire Hazard Assessment and preparing a Bushfire Management Plan.

Assessment against the relevant policy positions of BRC (as per Section 2 of that document) are provided below.

- ***Policy 4 – Disaster management capacity and capabilities are maintained to mitigate the risks to people and property to an acceptable and tolerable level.***

  Response: Refer to response to SPP assessment benchmark 4.

- ***Policy 6 – Vulnerable uses are not located in the bushfire prone area unless there is an overwhelming community need for the development of a new or expanded service, there is no suitable alternative location and site planning can appropriately mitigation the risk.***

  Response: Vulnerable uses in the context of bushfire hare not explicitly defined in BRC or the State Planning Policy. Similar to community infrastructure, they are defined in the Example planning scheme assessment benchmarks guidance material that supports the SPP. Again, that definition does not include a BESS.

  Notwithstanding, other uses could be considered vulnerable uses in the context of bushfire due to their vulnerabilities to the effects of bushfire, their economic or community value or their likelihood of explosion / combustion if exposed to radiant heat or ember attack. A BESS could be considered one such use. In this instance, this report has considered the BESS a vulnerable use.

As noted above, the BESS and grid connection are located outside the bushfire prone area, based on the verified vegetation classes and on-ground vegetation status. Adequate separation is also provided between the BES site and adjoining vegetation that may have the potential to become hazardous.

Sections 6-9 of this report further demonstrate that site planning can appropriately mitigate the risk to people and property associated with the use to a tolerable level.

- ***Policy 7 – Revegetation and rehabilitation avoids an increase in the exposure or severity of bushfire hazard.***

  Response: Refer to response to SPP assessment benchmark 5.

- ***Policy 8 – Development does not locate buildings or structures used for storage or manufacture of materials that are hazardous in the context of a bushfire within a bushfire prone area unless there is no suitable alternative location.***

  Response: Refer to response to SPP assessment benchmark 6.

- ***Policy 9 – The protective function of vegetation arrangements that can mitigate bushfire risk are maintained.***

  Response: Refer to response to SPP assessment benchmark 7.

- ***Policy 10 – Community infrastructure for essential services are not located in bushfire prone areas unless there is an overwhelming community need for the development of a new or expanded service and there is no suitable alternative location, and further, the infrastructure can be demonstrated to function effectively during and immediately after a bushfire event.***

  Response: See response to BRC Policy 6 and SPP Policy 6 above.

5.6 Building Assessment Provisions

Whilst this report supports a planning application, it is relevant to note that a subsequent building application may be required for parts of the proposal. Certain building applications are subject to additional requirements (building assessment provisions) where in a bushfire prone area. It is not within the scope of this report to address the building assessment provisions. The following advice is provided to assist with consideration of potential building assessment provisions.

5.6.1 Designated Bushfire Prone Area for Building Purposes

A planning scheme may designate all, or part, of its area as a designated bushfire prone area for the purposes of the assessment of building applications under the *Building Act 1975*. Designation will trigger certain building applications to be assessed against the building assessment provisions that apply to a building in bushfire prone areas, including the Building Code of Australia (BCA). The BCA is the document called the National Construction Code (NCC) (volume 1 and 2, including Qld appendixes).

The BCA / NCC bushfire provisions are applicable to Class 1 (dwelling), Class 2 (more than one dwelling), Class 3 (residential building providing long-term or transient accommodation), select Class 9 (health-care building, early childhood centre, primary or secondary school (or similar educational establishment) and residential care building) and associated Class 10a structures.

The Cassowary Coast Planning Scheme does not state that land identified in the Bushfire hazard overlay map is designated bushfire prone area for the purposes of the BCA.

Notwithstanding, the use is assumed to not involve a Class 1, Class 2, Class 3 or select Class 9 building. Therefore further commentary on the BCA is not provided.

6 Bushfire Hazard Assessment

6.1 Methodology

This Bushfire Hazard Assessment has been conducted in accordance with Part 5 of the Bushfire Resilient Communities guidance material supporting the implementation of the State Planning Policy, prepared by QFES (now QFD).

Section 5 of the Bushfire Resilient Communities Technical Reference Guideline articulates the process for undertaking a bushfire hazard assessment. The process includes the three stages illustrated below **(Figure 9)**. The reliability assessment is provided at Section 6.2 and the hazard assessment in Section 6.3. The separation and radiant heat discussions are provided at Section 9 of this report.

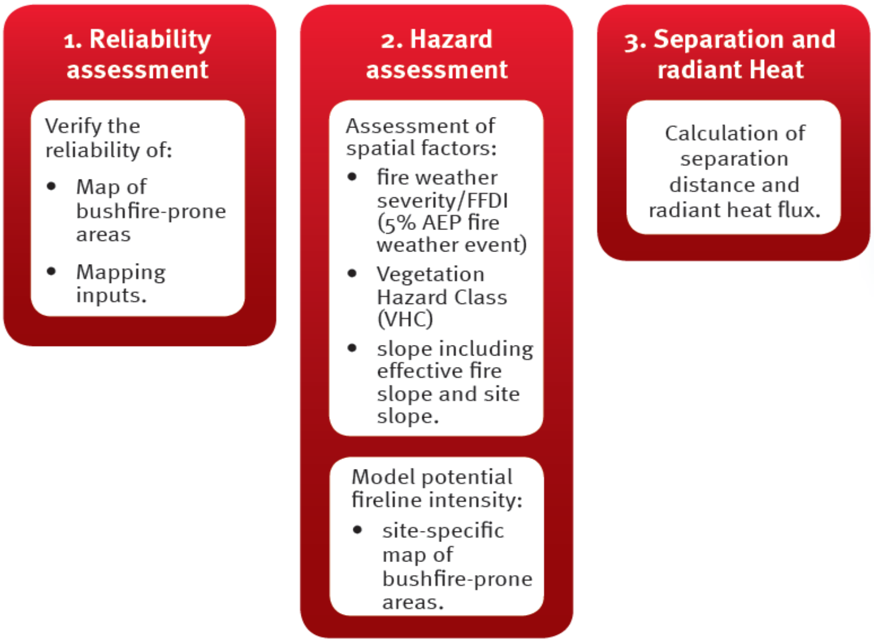


Figure 9 – Overview of the Bushfire Hazard Assessment process as per Bushfire Resilient Communities

(Source: Queensland Fire and Emergency Services, 2019)

A range of instruments and documents have been utilised to perform a desktop analysis. These instruments include:

- State-wide bushfire prone area mapping
- Proposal plans
- Verified regional ecosystem data provided by the project ecologist
- Aerial imagery (Queensland Globe)
- QFD Bushfire Resilient Communities MapViewer and guideline
- State Planning Policy July 2017
- Bushfire Resilient Communities Guideline
- Cassowary Coast Planning Scheme:
    - Bushfire hazard code

6.2 Reliability Assessment

Section 5.3 of the BRC allows for a reliability assessment to be undertaken as the first stage of a Bushfire Hazard Assessment to determine whether the site's observed characteristics are consistent with the inputs used to create the state-wide bushfire prone area mapping (and in this instance the planning scheme mapping) previously discussed in **Section 5.3** of this report.

Having regard to vegetation hazard classes, topography and fire weather severity inputs used to inform the current state-wide bushfire prone area mapping, the site's observed and verified characteristics (discussed at Section 6.3.2) **are not** considered 'generally consistent'[2] with the state-wide bushfire prone area mapping. Of particular note:

- the bushfire prone area to the north-west, west and south-west of the BESS site does not reflect the observed site's characteristics, most notably this area is largely cleared of vegetation and is better identified as VHC 38.5 Cropping and horticulture which has very low potential fuel loads and is not hazardous vegetation.
- some patches immediately adjacent to the BESS site within Lot 1 on RP852238 and Lot 1 on RP735276 are largely cleared of vegetation and have been verified as non-remnant vegetation. This area is unlikely to reach regrowth or remnant status due to the ongoing agricultural land uses, unless actively rehabilitated (which it is understood is not proposed as part of this project).
- areas of regrowth vegetation to the north-east of the BESS site that are currently excluded from the BPA mapping have the potential to become remnant vegetation due to their proximity to a waterway corridor and other remnant vegetation. For the purposes of this bushfire hazard assessment, these areas have been included as hazardous vegetation based on their verified REs.

This is covered in more detail in the following hazard assessment in Section 6.3.

6.3 Hazard Assessment

6.3.1 Fire Weather

The QFD Bushfire Resilient Communities MapViewer includes Forest Fire Danger Index (FFDI) mapping which is climate-adjusted for a 5 per cent annual exceedance probability (AEP) fire weather event as at 2050. BRC MapViewer identifies this area of Far North Queensland as subject to an **FFDI of 50.**

6.3.2 Vegetation Communities

Vegetation classification is important for a number of reasons, namely it is an indicator of the level of fire intensity and fire behaviour associated with specific types of vegetation and it also indicates the fuel loads which may exist in certain locations. The vegetation communities within 150m of the development footprint form the basis of this assessment, as per that required by the Bushfire Resilient Communities Guideline process for undertaking a bushfire hazard assessment.

Areas of non-remnant vegetation which have not yet reached maturity are assessed as mature communities, accounting for the future hazard profile of lands within 150m of the development footprint. This is particularly relevant to the areas to the north-east of the BESS site.

[2] Terminology as used by the Bushfire Resilient Communities reliability assessment methodology at Section 5.3.1 of that document.

Desktop Vegetation Assessment

Figure 10 below identifies the current extent of mapped vegetation communities, illustrated via VHC tiles mapping in the QFD BRC MapViewer. The BESS and grid connection footprint and immediate surrounds (within 150m) contain mapped:

- BVG 9-15 Eastern eucalypt woodlands to open forests (**VHC 9.1** Moist to dry eucalypt open forests on coastal lowlands and ranges)
- BVG 21 – 22 Melaleuca open woodlands on depositional plains:
    - **VHC 21.3** Shrubland associated with Melaleuca dry woodlands on sandplains or depositional plains)
    - **VHC 22.1** Melaleuca open forests on seasonally inundated lowland coastal swamps
- BVG 38 Cropping and horticulture (**VHC 38.5** Cropping and horticulture).

As is evident, areas of VHC 9.1 and 21.3 to the north-west, west and south-west of the BESS site are not reflective of the vegetation on the ground. This area is more appropriately VHC 38.5.

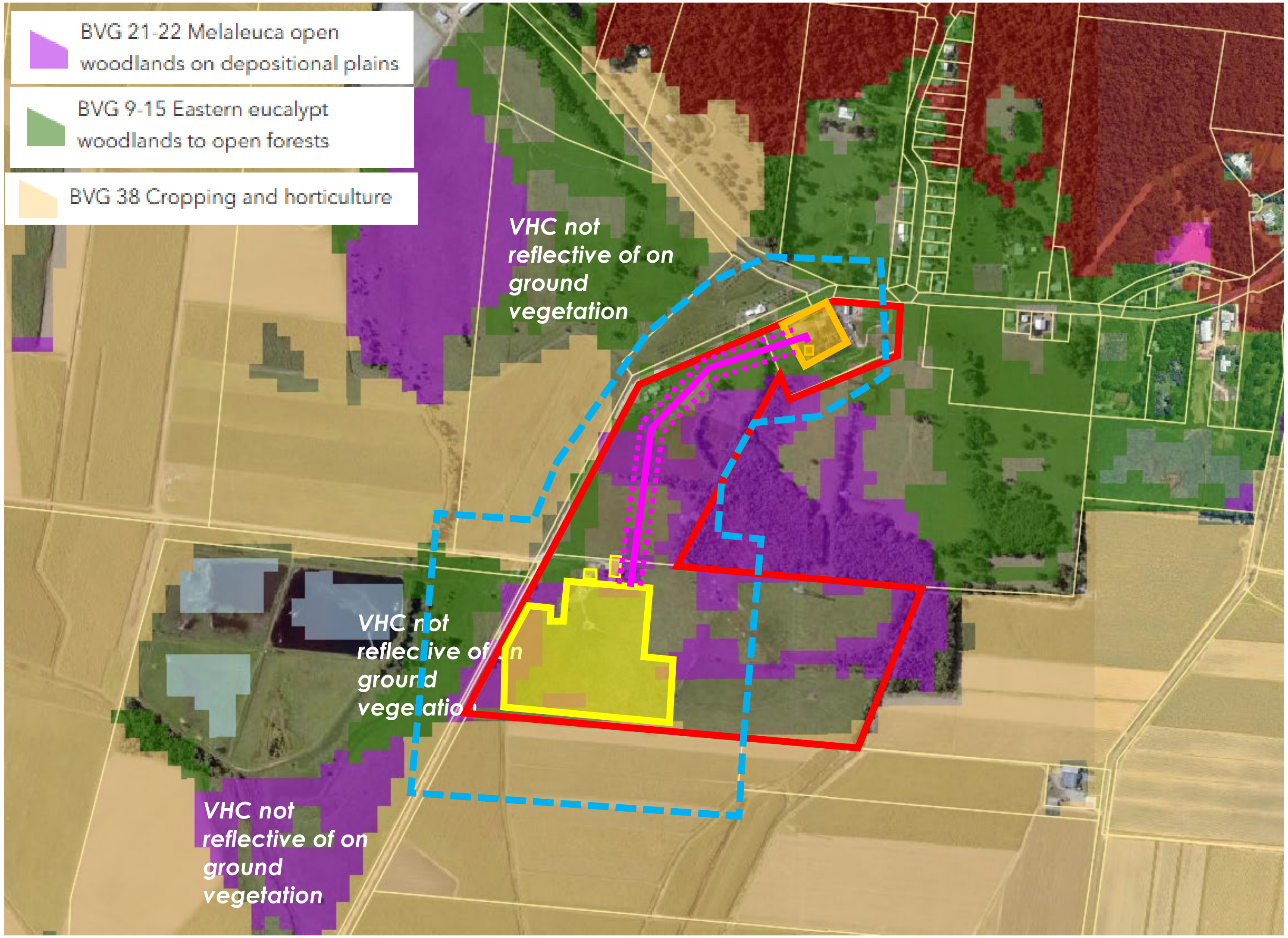


Figure 10 – BRC MapViewer Vegetation Hazard Class (VHC) Tiles

(Source: QFD, 2025)

The State Government regional ecosystem mapping for the site is shown in **Figure 11.** The regional ecosystems (all identified as regrowth vegetation) within 150m of the site include:

- 7.3.8d
- 7.3.5a
- 7.3.7a.

Notably, the regrowth regional ecosystems to the west of the site are beyond 150m from the BESS footprint. Those within 150m of the grid connection to the north-west of the existing Tully substation are unlikely to reach remnant status in the near future, due to the ongoing use of the land for agricultural and other purposes. These regional ecosystems have therefore been excluded from this assessment.

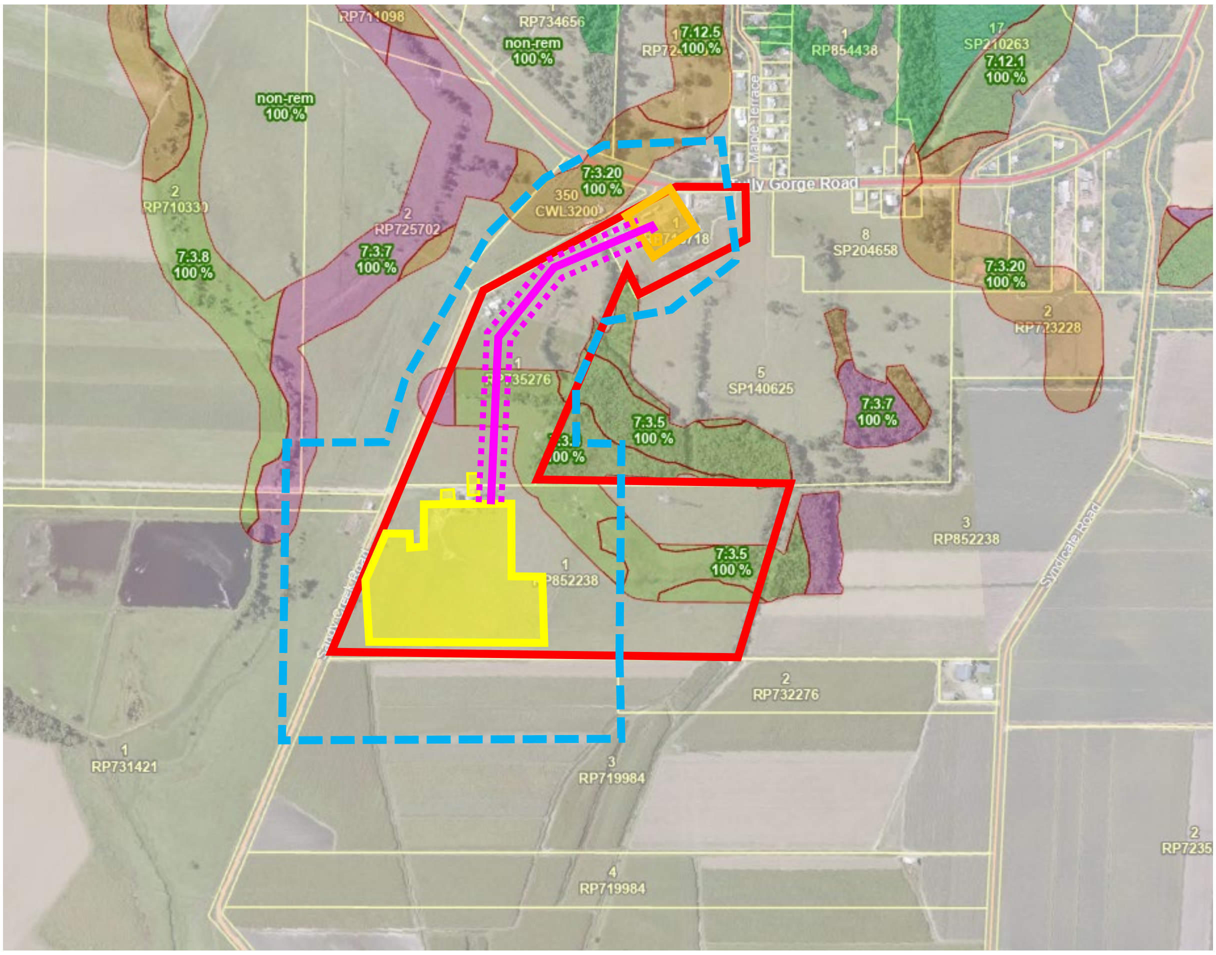


Figure 11 – Regional Ecosystem Mapping

(Source: Qld Globe, 2025)

Verified Vegetation Assessment

The regional ecosystems in immediate proximity to the BESS site have been verified by the project ecologist as shown in **Figure 12**. The verified regional ecosystems include:

- 7.3.5 (both remnant and regrowth areas)
- 7.3.7a (regrowth areas).

A considerable amount of the mapped area has been identified as non-remnant vegetation.

Where verification of vegetation has not occurred within the 150m buffer, it is assumed for the purposes of this assessment the regional ecosystems are consistent with the two RE's verified above or the State RE mapping.

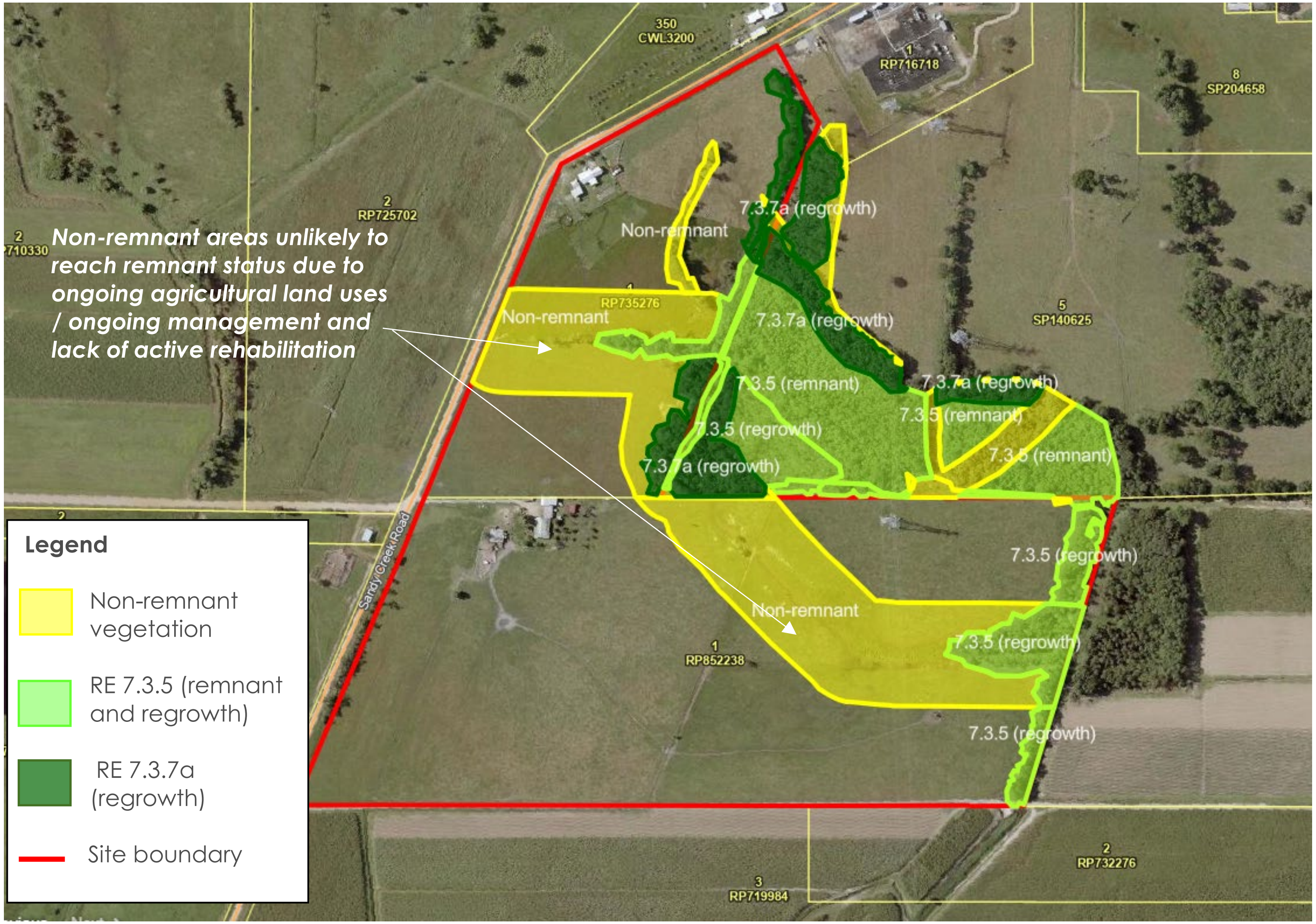


Figure 12 – Verified Regional Ecosystem Mapping

Source: Attexo

The Vegetation Hazard Class (VHC) conversion and associated potential fuel loads for the mapped and verified REs are set out in the table following **(Table 3)**, pursuant to Part 6 of the BRC.

Table 3 - Vegetation Communities within the site and within 150m of the BESS footprint (remnant and non-remnant)

RE	RE Description	RE Structure Code	VHC	VHC Description	Understorey (Surface + Near Surface) Potential Fuel Load (t/ha)	Total Potential Fuel Load (t/ha)
7.3.8d	Melaleuca viridiflora, Lophostemon suaveolens and Allocasuarina littoralis open shrubland, on poorly drained alluvial plains	Open Forest	21.3	Melaleuca dry open forests on sandplains or depositional plains	6.6	7.5
7.3.5a	Melaleuca quinquenervia open forest, woodland and shrubland, on poorly drained alluvial plains	Closed Forest	22.1	Melaleuca open forests on seasonally inundated lowland coastal swamps	23.4	28.4
7.3.5*	Melaleuca quinquenervia and/or Melaleuca cajuputi subsp. platyphylla closed forest to shrubland on poorly drained alluvial plains	Closed Forest	22.1	Melaleuca open forests on seasonally inundated lowland coastal swamps	23.4	28.4
7.3.7a*	Eucalyptus pellita and Corymbia intermedia open forest to woodland, on poorly drained alluvial plains and swamps	Open Forest	9.1	Moist to dry eucalypt open forests on coastal lowlands and ranges	21.0	24.2

*Regional ecosystems verified on site by the project ecologist.

The vegetation which potentially constitutes a hazard within 150m of the BESS footprint is confirmed to be dominated by a mix of remnant and non-remnant vegetation and is dominated by VHC 22.1, with some areas of VHC 9.1, when aligned with the verified regional ecosystem data. Areas currently mapped by BRC Mapviewer as VHC 21.3 have been verified as the potential to become VHC 9.1.

VHC 22.1 has the higher total potential fuel load of 28.4 t/ha. The remaining vegetation (VHC 9.1) has a total potential fuel load of 24.2 t/ha.

Photographs of VHCs have been provided by the project ecologist in **Figure 13** and **Figure 14**.

Figure 13 - RE 7.3.5

Figure 14 - RE 7.3.7a

Pursuant to the vegetation structural classes assessment of Part 6 of the Bushfire Resilient Communities Guideline, the vegetation (within 150m of the BESS footprint) is characterised broadly as Trees closed – mid dense, as per **Table 4.**

Table 4 - Assessment of Vegetation Structure in accordance with Part 6 of the BRC

RE	Life Form and Height	Vegetation structure class	Dominant life form	Density
7.3.5 7.3.7a	Trees Medium 10-30m	Trees closed – mid dense	Trees	Closed to mid-dense

6.3.3 Effective Slope and Site Slope

Effective slope relates to the topography beneath classified vegetation, as this influences fire speed and rate of spread – namely, that the speed of fire doubles for every 10 degrees incline.

An effective slope assessment has been conducted based on 1m contour data provided by Attexo and Qld Globe (for a distance of 150m from the BESS footprint) in **Figure 15**.

The effective slope assessment demonstrates the mapped hazardous vegetation to the **north-east** is approximately 1 degree downslope of the proposed BESS footprint.

The overall site slope (the slope within the BESS footprint itself) is approximately 1 degree from the northern extent down to the southern extent of the footprint.

It is noted that the overall site slope within the development footprint will likely be subject to some cut and fill to accommodate the new BESS.

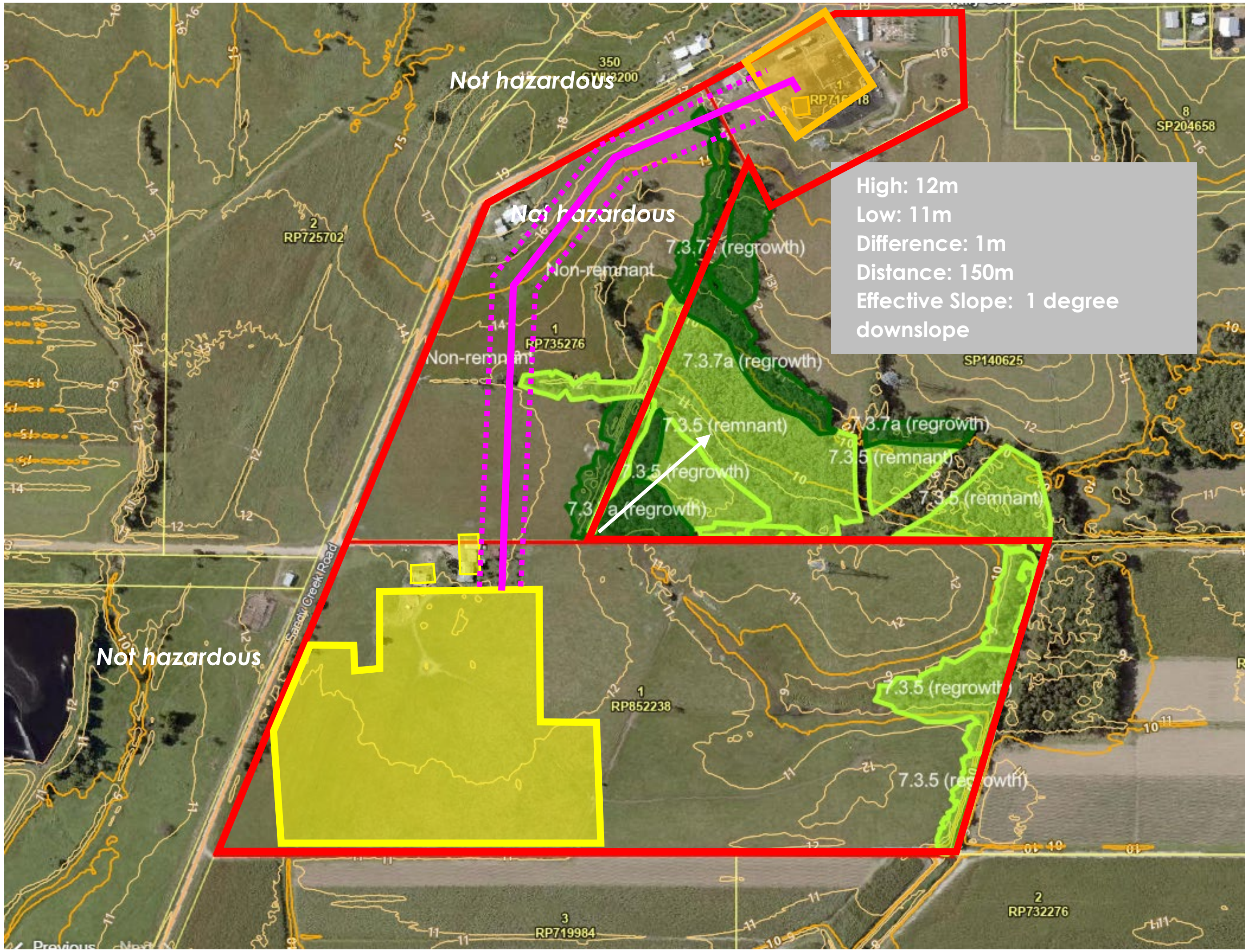


Figure 15 - Effective Slope Assessment

Source: Attexo and Qld Globe, 2025

6.3.4 Aspect

Aspect can affect bushfire behaviour where slopes with northerly and/or westerly aspects experience a higher level of solar access than those areas with a southern or eastern aspect. This generally translates to drier fuels with lower moisture content and increased dead/drying/curing material.

Notwithstanding, in times of drought and below average rainfall, moisture levels in soil and vegetation in more sheltered areas with southerly and easterly aspects can also decrease substantially giving rise to significantly higher fuel abundance where the preceding fire regime has been less frequent or intense. Thus, aspect is of only partial consequence in this respect and this is reflected by the current SPP mapping methodology and information made publicly available by QFD.

The nearby hazardous vegetation generally maintains a north-easterly aspect.

6.3.5 Fire History

In relation to historical fire activity in the area, ignitions have occurred in the general region.

A review of fire scar mapping using the Queensland Globe platform identifies wildfire or hazard reduction burns on the site and in the immediate area over the last 20 years, including an event to the north east in 2010 **(Figure 16).**

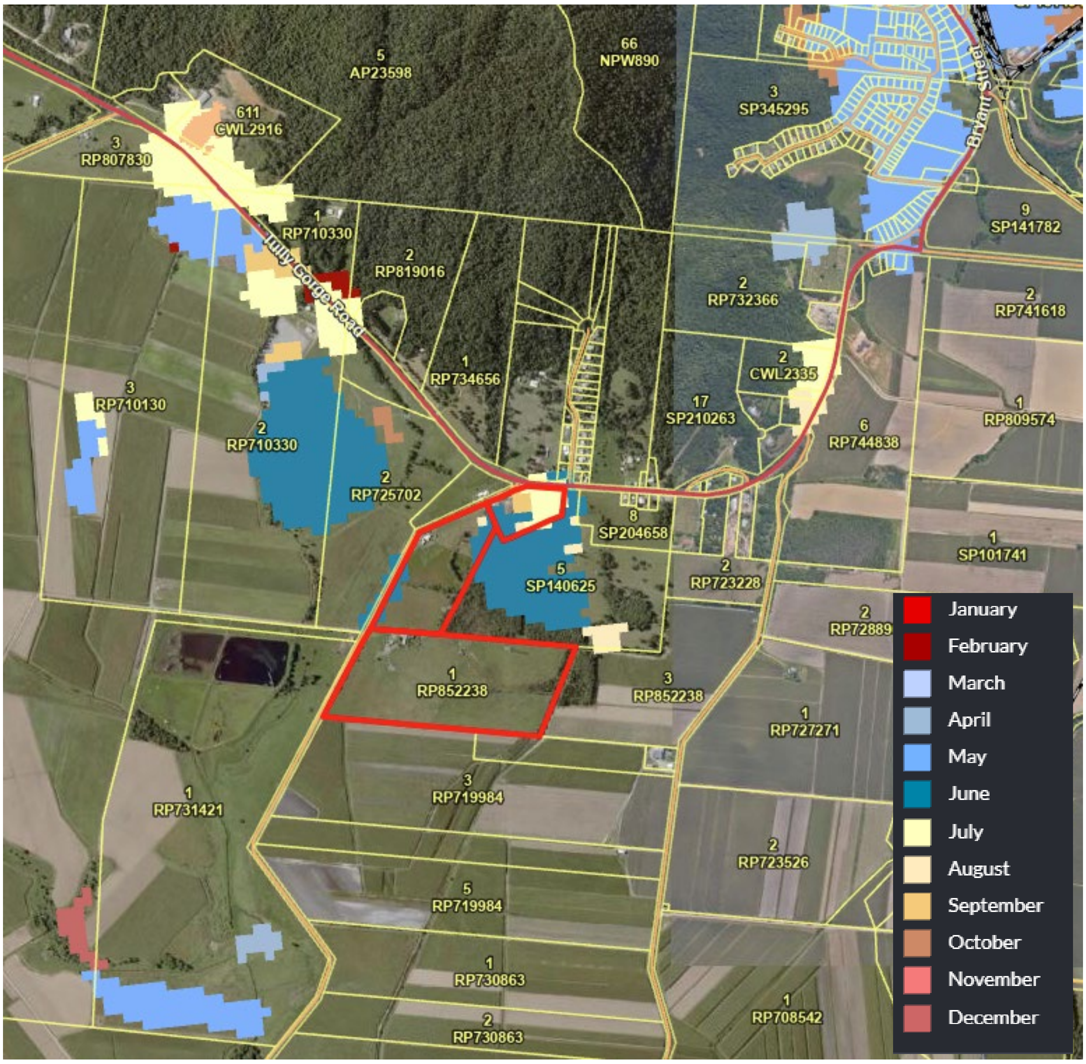


Figure 16 - Historical Fire Scar Mapping within the Site and Locality

(Source: Queensland Globe, 2025)

6.3.6 Ignition Sources

Likely ignition sources in the area include ignition from rural and agricultural activities including burning and harvesting of sugar cane, slashing and use of power tools. Other general ignitions may include roadside ignition (potentially caused by cigarette butts thrown from vehicles) and arcing powerlines, noting high voltage lines are located to the east of the BESS site. Ignitions may also occur from activities associated with the nearby substation activities.

Fire risk and ignitions associated with the BESS facility itself such as electrical hazards, chemical hazards, explosions and fire spread between batteries is an issue for a fire engineering safety plan and will not be addressed by this report.

7 Qualitative Assessment: Bushfire Behaviour Assessment, Extent of Hazard and Bushfire Intensity

This section of the report provides commentary on bushfire behaviour on and around the site and fireline intensity within proximity to the development footprint.

7.1 Fire runs and disruptions

In terms of fire runs, due to the nature of the surrounding landscape fire runs are more likely from the north-east of the BESS facility, from the direction of mapped hazardous vegetation. Grass fire however may occur from any direction, due to the extent of surrounding agricultural land.

The terrain in the immediate area is generally flat, with a gentle slope down to the north-east towards the waterway / drainage corridor. Consequently the vegetation in this area is slightly (1 degree) downslope of the BESS footprint. This downslope is unlikely to have a significant effect on fire behaviour.

Beyond this, the land further to the north is steeply sloping and heavily vegetated, however this vegetation is separated from the site by cleared areas and Tully Gorge Road, and is largely mapped as low bushfire intensity due to the vegetation communities in this area.

Wind conditions in any event are likely to have a substantial effect on fire behaviour.

7.2 Fireline intensity

It is appropriate to consider the potential fireline intensity of vegetation within 150m of the development footprint for each of the vegetation classes identified and using the highest effective slope metric observed.

There are two verified vegetation hazard classes identified within 150m the site: VHC 22.1 and VHC 9.1, with VHC 22.1 being the dominant VHC.

The corresponding fireline intensity, as informed by the VHC, fuel loads, fire weather (FFDI) and effective slope) are High potential bushfire intensity for VHC 22.1 (**Figure 17**) and Medium potential bushfire intensity for VHC 9.1 (**Figure 18**).

This is not entirely consistent with the State Bushfire Prone Area mapping due to inconsistencies with the type and extent of verified vegetation communities (as discussed in section 6 of this report).

RE code	RE Label	Vegetation Hazard Class	Potential Fuel Load (t/ha)	Fire Weather Severity (FFDI)	Maximum Landscape Slope (degrees)	Potential Fireline Intensity (kw/m) *	Potential Bushfire Intensity *
7.3.5	Melaleuca quinquenervia and/or Melaleuca cajuputi subsp. platyphylla closed forest to shrubland on poorly drained alluvial plains	22.1	28.4	50	1	26,790	High

Cells in yellow can be modified

* From: Leonard, J., Newnham, G., Opie, K., and Blanchi, R. (2014) A new methodology for state-wide mapping of bushfire prone areas in Queensland. CSIRO, Australia.

For further information or advice on the use of this tool contact sdu@qfes.qld.gov.au

Figure 17 - Fireline intensity verification - QFD Fireline Intensity Calculator prepared by CSIRO (RE 7.3.5 and VHC 22.1)

RE code	RE Label	Vegetation Hazard Class	Potential Fuel Load (t/ha)	Fire Weather Severity (FFDI)	Maximum Landscape Slope (degrees)	Potential Fireline Intensity (kw/m) *	Potential Bushfire Intensity *
7.3.7a	Eucalyptus pellita and Corymbia intermedia open forest to woodland, on poorly drained alluvial plains and swamps	9.1	24.2	50	1	19,452	Medium

Cells in yellow can be modified

* From: Leonard, J., Newnham, G., Opie, K., and Blanchi, R. (2014) A new methodology for state-wide mapping of bushfire prone areas in Queensland. CSIRO, Australia.

For further information or advice on the use of this tool contact sdu@qfes.qld.gov.au

Figure 18 - Fireline intensity verification - QFD Fireline Intensity Calculator prepared by CSIRO (RE 7.3.7a and VHC 9.1)

8 Bushfire Risk Analysis

In addition to examining potential bushfire behaviour, the consideration of bushfire risk is important. As per the Queensland Emergency Risk Management Framework (QERMF) prepared by QFD, this involves the consideration of:

- Likelihood
- Consequence
- Vulnerability.

The QERMF Framework is illustrated in **Figure 19.**

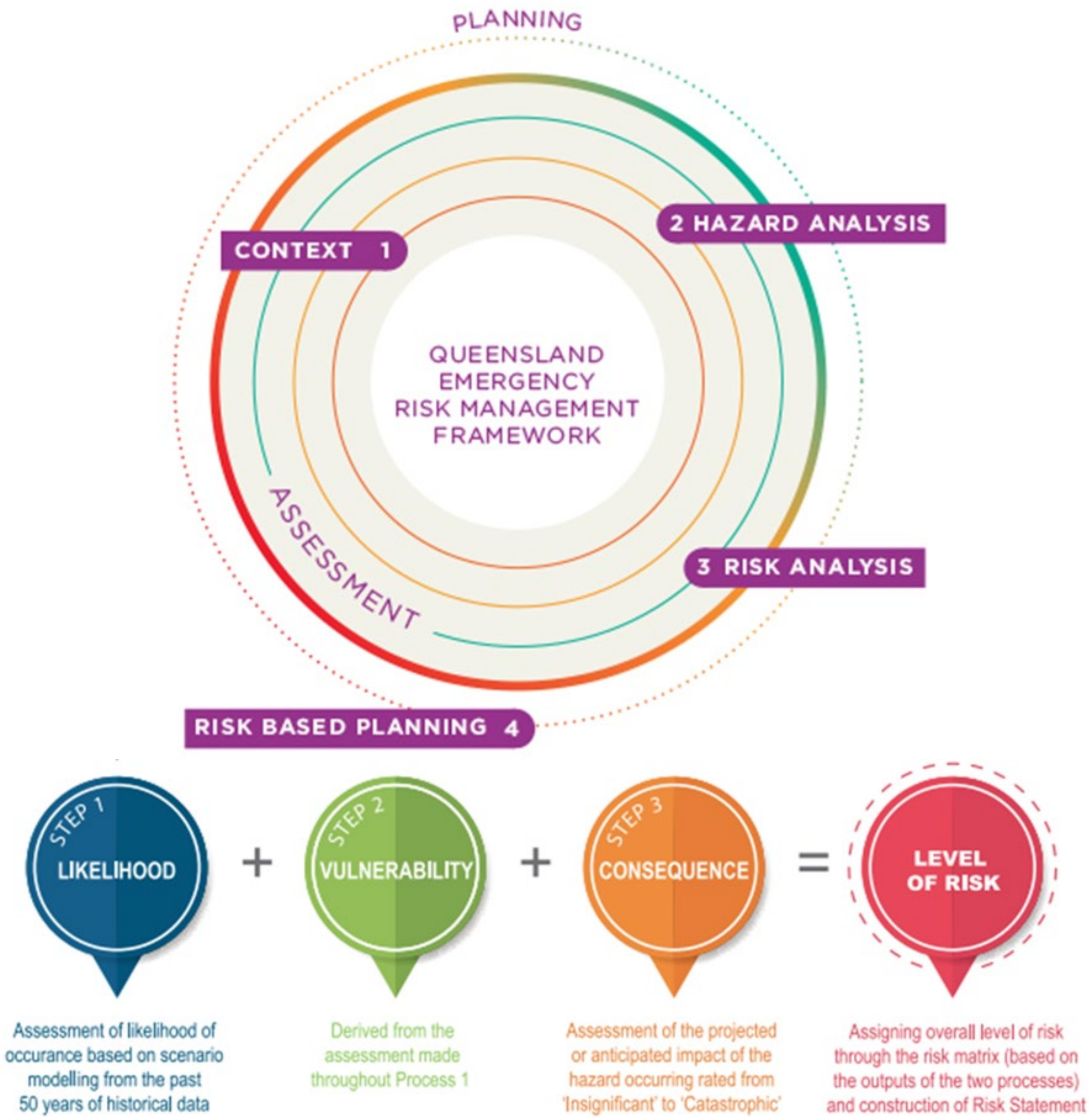


Figure 19 - QERMF Overview

From a risk vulnerability perspective, the proposed BESS facility and associated infrastructure is susceptible to radiant heat and flame contact. In addition, it also maintains a level of ignition probability.

Table 5 outlines the assessment of the untreated bushfire risk associated with the proposed facility.

Table 5 - Assessment of likelihood, vulnerability and consequence in accordance with the QERMF

LIKELIHOOD:	Likely
VULNERABILITY:	Low
CONSEQUENCE:	
People	Minor
Financial and economic	Minor
Community and social	Insignificant
Public administration	Insignificant
Environment	Minor

The QERMF provides a fit-for-purpose risk matrix which incorporates the assessment of vulnerability, in addition to likelihood and consequence factors. The QERMF risk matrix is provided in **Table 6.**

Table 6 - Risk matrix as per Appendix 4 of the QERMF

	Likelihood (X)	Rare (1)					Unlikely (2)					Possible (3)					Likely (4)					Almost Certain (5)				
	Vulnerability (Y)	V.Low (1)	Low (2)	Mod (3)	High (4)	Extr (5)	V.Low (1)	Low (2)	Mod (3)	High (4)	Extr (5)	V.Low (1)	Low (2)	Mod (3)	High (4)	Extr (5)	V.Low (1)	Low (2)	Mod (3)	High (4)	Extr (5)	V.Low (1)	Low (2)	Mod (3)	High (4)	Extr (5)
Consequence (Z)	INSIGNIFICANT (1)	VL1	VL2	VL3	L4	L5	VL2	VL3	L4	L5	L6	VL3	L4	L5	L6	M7	L4	L5	L6	M7	M8	L5	L6	M7	M8	H9
	MINOR (2)	VL2	VL3	L4	L5	L6	VL3	L4	L5	L6	M7	L4	L5	L6	M7	M8	L5	L6	M7	M8	H9	L6	M7	M8	H9	H10
	MODERATE (3)	VL3	L4	L5	L6	M7	L4	L5	L6	M7	M8	L5	L6	M7	M8	H9	L6	M7	M8	H9	H10	M7	M8	H9	H10	H11
	MAJOR (4)	L4	L5	L6	M7	M8	L5	L6	M7	M8	H9	L6	M7	M8	H9	H10	M7	M8	H9	H10	H11	M8	H9	H10	H11	E12
	CATASTROPHIC (5)	L5	L6	M7	M8	H9	L6	M7	M8	H9	H10	M7	M8	H9	H10	H11	M8	H9	H10	H11	E12	H9	H10	H11	E12	E13

Key: V.L= Very low; L = Low; M = Medium; H = High; E = Extreme

Scale: 1 (lowest) to 13 (highest)

Table 3 - Risk Matrix

Having regard to the assessment of likelihood (of impact), vulnerability and consequence for the proposed BESS facility and associated infrastructure (without treatment), the overall risk level is as follows:

OVERALL RISK:	**Low (L6)**

The bushfire management provisions contained in the following sections of this report provide a risk management approach to maintain a tolerable / low overall risk for the facility.

9 Bushfire Management and Mitigation

There are a number of options available to address and mitigate the risk to the proposed BESS and associated infrastructure. This includes opportunities to reduce the likelihood and severity of bushfire hazard affecting subject site through a suite of mitigation and management measures.

These measures include:

- Asset protection zones
- Building construction
- Access and egress
- Water supply and fire-fighting infrastructure
- Hazardous material storage
- Rehabilitation / revegetation
- Bushfire management during construction
- Operational procedures.

9.1 Asset Protection Zones

Stage 3 of the Bushfire Resilient Communities Technical Reference Guide for undertaking a bushfire hazard assessment requires an assessment of radiant heat exposure and required separation, or asset protection, to mitigate the use from potential bushfire hazard threat.

An asset protection zone (APZ) is an area which surrounds a building, structure or infrastructure and is intended to be maintained in perpetuity in a no or low fuel condition. An APZ can:

- limit radiant heat exposure, the transmissivity of which diminishes over distance
- avoids flame contact
- in some cases, provide working areas for fire-fighting and defence around facilities by reducing the impact of radiant heat
- provide access around facilities
- mitigate risk of ignition from the proposed facility.

9.1.1 APZ Calculation

Queensland does not currently have specific guidance for the recommended asset protection zone width for Battery Energy Storage Facilities. The Bushfire Resilient Communities technical reference guide recommends the adoption of a 1,200 flame temperate and 10kW/m^2 radiant heat threshold for vulnerable uses and essential infrastructure assets generally. As discussed previously in Section 5 of this report, a BESS facility and associated infrastructure may be considered essential infrastructure. Therefore, both the 1,200 flame temperate and the 10kW/m^2 radiant heat threshold has been recommended in this instance.

FLAMESOL calculations are provided in **Figure 20** and **Figure 21** to demonstrate the required separation (APZ) from the development footprint and hazardous vegetation to achieve a 10 kW/m^2 radiant heat flux level. This APZ distances are a function of fire weather, fuel load and topography. The highest fuel load (VHC 22.1) is adopted for the purposes of calculating the APZ.

Based on these calculations it is recommended that a **48.1m** wide APZ is provided along the northern and eastern sides of the BESS facility. A 10m wide APZ is also recommended along the western and southern sides of the BES, including the temporary construction areas to accommodate for grass fire. The adjoining road reservation can form part of this APZ where necessary.

The recommended APZs are shown in the Bushfire Management Plan included in **Appendix C.**

FLAMESOL
FPA AUSTRALIA

Calculated March 18, 2025, 4:07 pm (MDc v.4.9)

VHC 22.1

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	50	Rate of spread	1.5 km/h
Vegetation Classification	Forest	Flame length	13.18 m
Understorey fuel load	23.4 t/ha	Flame angle	66 °, 72 °, 76 °, 79 °, 80 ° & 85 °
Total fuel load	28.4 t/ha	Elevation of receiver	5.74 m, 5.9 m, 5.87 m, 5.75 m, 5.65 m & 4.64 m
Vegetation height	n/a	Fire intensity	22,073 kW/m
Effective slope	1 °	Transmissivity	0.86, 0.842, 0.8169999999999999, 0.794, 0.782 & 0.728
Site slope	1 °	Viewfactor	0.414, 0.3074, 0.2072, 0.1407, 0.1142 & 0.0307
Flame width	100 m	Minimum distance to < 40 kW/m²	15.6 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	20.9 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	29.9 m
Flame temperature	1,200 K	Minimum distance to < 12.5 kW/m²	41.1 m
		Minimum distance to < 10 kW/m²	48.1 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Figure 20 - Flamesol Calculation for VHC 22.1

FLAMESOL
FPA AUSTRALIA

Calculated March 18, 2025, 4:10 pm (MDc v.4.9)

VHC 9.1

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	50	Rate of spread	1.35 km/h
Vegetation Classification	Forest	Flame length	11.67 m
Understorey fuel load	21.0 t/ha	Flame angle	66 °, 72 °, 77 °, 80 °, 81 ° & 85 °
Total fuel load	24.2 t/ha	Elevation of receiver	5.09 m, 5.22 m, 5.21 m, 5.09 m, 4.99 m & 4.01 m
Vegetation height	n/a	Fire intensity	16,879 kW/m
Effective slope	1 °	Transmissivity	0.865, 0.848, 0.824, 0.8, 0.788 & 0.732
Site slope	1 °	Viewfactor	0.4121, 0.3059, 0.2059, 0.1393, 0.1132 & 0.0305
Flame width	100 m	Minimum distance to < 40 kW/m²	13.9 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	18.6 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	27 m
Flame temperature	1,200 K	Minimum distance to < 12.5 kW/m²	37.6 m
		Minimum distance to < 10 kW/m²	44.2 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Figure 21 - Flamesol Calculation for VHC 9.1

With regard to the proposed overhead grid connection. It is recommended the infrastructure is located more than 14.6m from the nearest hazardous vegetation to the east. This is based on a 1,090K flame temperature and 29kW/m2 radiant heat threshold on the basis that such infrastructure **(Figure 22)**. The current infrastructure corridor of 20m will achieve adequate separation. It is assumed this corridor will be maintained in a low fuel state. The existing narrow vegetation corridors can be retained, however it is recommended these are not actively revegetated or rehabilitated in a manner that would increase the fuel load.

FLAMESOL
FPA AUSTRALIA

Calculated June 30, 2025, 4:35 pm (MDc v.4.9)

Electricity Infrastructure

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	50	Rate of spread	1.5 km/h
Vegetation Classification	Forest	Flame length	13.18 m
Understorey fuel load	23.4 t/ha	Flame angle	54 °, 64 °, 72 °, 77 °, 78 ° & 84 °
Total fuel load	28.4 t/ha	Elevation of receiver	5.14 m, 5.66 m, 5.89 m, 5.89 m, 5.81 m & 5.01 m
Vegetation height	n/a	Fire intensity	22,073 kW/m
Effective slope	1 °	Transmissivity	0.875, 0.857, 0.832, 0.807000000000001, 0.794 & 0.73
Site slope	1 °	Viewfactor	0.5989, 0.4428, 0.2998, 0.2032, 0.1651 & 0.0449
Flame width	100 m	Minimum distance to < 40 kW/m²	10.8 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	14.6 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	21.4 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	30.4 m
		Minimum distance to < 10 kW/m²	36.2 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Figure 22 - Flamesol Calculation for overhead electricity infrastructure

9.1.2 Activities within the APZ

All ongoing activities and permanent infrastructure and buildings associated with the BESS facility is not to occur within the APZ, including any fuel, water and materials storage.

Vehicle parking areas, perimeter roads / tracks may occur within the APZ.

The potential use of the existing dwellings / structures within the APZ for O&M area in the future (as shown on the proposal plan) is noted. These dwellings are adequately separated from the nearest hazardous vegetation to allow for this use. The proposed infrastructure corridor (40m) for the grid connection will also ensure those dwelling remain separated from hazardous vegetation.

9.1.3 Ground Treatments and Landscaping within the APZ

As the APZ area is already largely cleared of vegetation, no further understorey clearing is required. It is recommended that the APZ is maintained as mown grass, rock cover or bare earth.

Individual tree specimens can be retained, provided canopies are separated at maturity.

Any landscaping within the APZ should adopt the principles and species selection in accordance with the provisions set out in Section 8 of the Bushfire Resilient Communities technical reference guide. These principles include:

- *landscape design that reduces vulnerability to bushfire attack* – this includes layout of landscaped areas that avoid continuous vegetation
- *plant selection that avoids or minimises opportunities for ignition of landscaping features* (see Figure 20 on p.47-28 of BRC for the characteristics of low flammability species)
- *long-term landscaping management arrangements that reduce exposure to bushfire attack* (regular mowing, removing accumulated leaf litter and woody debris, clearing understorey vegetation).

The proposal includes landscaping / screening planting along the Sandy Creek Road frontage and part way along the side boundaries of Lot 1 on RP852238. This planting is considered acceptable given the separation from existing hazardous vegetation and the narrow width (2m to 5m). It is recommended that the species selection is in accordance with BRC (section 8) as noted above.

9.1.4 Fencing and Retaining Walls

Fencing materials can have a considerable impact on the propagation of fire. Likewise, some fencing materials can alleviate exposure to radiant heat.

Any fencing or barriers within the APZ must not be constructed from timber. Instead, fencing and barrier materials, including the proposed noise wall, must be fire resistant. Steel mesh fencing can be used.

In addition, any retaining walls required should be constructed of fire resistant or fire retardant material such as concrete, stone, masonry or the like and not constructed from timber.

9.2 Building Construction

It is noted the BESS facility and associated infrastructure includes both temporary and permanent buildings. It is assumed the buildings will not be a Class 1, Class 2, Class 3 or select Class 9 building and therefore are unlikely to have building construction requirements (i.e. BAL design requirements) imposed at building approval stage.

Given the intended location of the proposed buildings on the western side of the facility and away from nearby hazardous vegetation, no recommendations are made regarding any (voluntary) BAL construction standards for those buildings.

9.3 Access and Egress

Access and egress are significant in terms of a range of aspects of bushfire prevention and ability for firefighting. Road design must cater for emergency access and egress in times of potential bushfire emergency events.

It is understood that access to the facility is to be provided directly to Sandy Creek Road via a newly constructed / upgraded access points. The access points should be conditioned to be capable of providing access for firefighting and other emergency vehicles.

The site has direct access to a local road network of an adequate standard to accommodate emergency service vehicles, as well as evacuating personnel. That local network connects with the Bruce Highway (a state-controlled road) a short distance from the site and is not subject to a significant amount of exposure to bushfire hazard.

9.4 Water Supply and Fire-Fighting Infrastructure

It is understood that the site is currently connected to a reticulated water supply and the O&M building as a minimum will be connected to reticulated water supply. Notwithstanding, reticulated supply with sufficient pressure and capacity, particularly during a bushfire event, is not guaranteed. Therefore a dedicated static supply is recommended.

Queensland does not currently provide specific guidance for static water supply for bushfire fire-fighting purposes for a BESS facility. The recommendations provided below are informed and adopted from the general static water supply guidance provided by BRC and the Renewable Energy Facilities Design Guidelines and Model Requirements (v4, Aug 2023), prepared by the State of Victoria Country Fire Authority.

It is recommended the static water supply:

- provides for a minimum 40,000L dedicated solely for bushfire fighting purposes
- is located at the vehicle access point to the facility – in proximity to Sandy Creek Road access
- positioned at least 10 metres from any infrastructure (i.e. sub-station, switch rooms, battery containers)
- positioned so that any hoses and equipment is capable of reaching all external areas of the facility
- are either below ground or constructed of non-flammable materials such as concrete or steel that is not likely to fail when exposed to excessive heat
- provided with a 50mm male camlock fitting for emergency fire service use (or as otherwise instructed by QFD)
- is provided with clear access within 6 metres of the tank for a medium rigid vehicle (15 tonne fire appliance)
- is clearly identified by directional signage at the street frontage.

This is to be established during construction and maintained in perpetuity. A program must be put in place through operational strategies to ensure the tanks are checked and filled on a regular basis.

The above recommendations are in addition to any on-site static water supply requirements for operational purposes, such as building fire, electrical and chemical fires within the facility and do not override any other requirements set out in Australian Standards.

9.5 Hazardous Material Storage

If hazardous chemicals or materials are stored on the site, they should be:

- Stored furthest from the hazardous vegetation as possible – in this instance, ideally on the western side of the facility
- Stored in screened areas and screening is constructed of fire resistant materials
- Stored in areas separated from buildings and other use areas.

9.6 Rehabilitation / Revegetation

At this stage no details of any required or proposed rehabilitation / revegetation on the site has been provided. If any rehabilitation or revegetation occurs, the recommendations of this report may change.

9.7 Bushfire Management During Construction

The abovementioned bushfire management and mitigation measures are recommended during the operation of the facility and apply in perpetuity. Separate bushfire measures are recommended during the construction period of the project. Adoption of the measures provided below are expected to reduce, to a tolerable level, both the risk of bushfire ignition by construction and the threat that bushfire in the wider area poste to the site and people during construction.

The recommended bushfire protection measures during the construction phase include:

- Temporary buildings for construction should be located as close as possible to Sandy Creek Road access, to limit exposure and aid in efficient evacuation
- Temporary vehicle access for construction is provided directly to Sandy Creek Road and is of an adequate standard to accommodate emergency service vehicles
- Access to water supply for fire suppression and /or protection of structures or equipment is provided.

As the BESS site and recommended APZ is already largely cleared of vegetation, no specific recommendations are provided regarding the timing / staging of vegetation clearing during the construction phase.

The above recommendations should be incorporated into any construction emergency management plans for the site.

9.8 Operational Procedures

It is expected that various operational procedures including work place health and safety plans and evacuation plans will be implemented for the facility. Bushfire, including the relevant recommendations of this report and those additional recommendations set out below, must be included in these procedures.

9.8.1 Activities on Adjoining Land

It is recommended that the operator engages with adjoining property owners regarding harvesting of cane, including the burning of cane, in proximity to the property boundaries. It is recommended that burning or any activities that could cause potential ignitions does not occur in proximity to the site. If burning is required, the presence of the Rural Fire Brigade may be required to reduce the risk of ignitions at the BESS site. Consultation should be carried out with the local brigade accordingly.

9.8.2 Evacuation Procedures

Evacuation of the facility post-construction is likely to be limited to a small number of persons.

Ideally, fire weather conditions and current warnings are considered prior to any staff attending the facility during the fire season. Operational plans will be required to identify evacuation requirements, which should consider evacuation to the township of Tully. Ideally, workers are not permitted on site on ‘Extreme’ and ‘Catastrophic’ fire danger days, and any other day where a fire event is occurring within approximately 20 kilometres of the site.

10 Conclusion & Recommendations

This report considers the bushfire hazard profile and mitigation measures required for a new Battery Energy Storage System (BESS) and associated infrastructure.

Based upon this detailed analysis, it is considered that the proposed development offers the ability to implement a suite of measures that contribute to mitigating the threat of bushfire hazard and reducing the risk to people and property to a tolerable level.

The following recommendations are made by this report:

1. **Asset Protection Zone:** A **48.1m** wide APZ is provided along the northern and eastern sides of the BESS facility. A 10m wide APZ is also recommended along the western and southern sides of the BESS to accommodate for grass fire. The treatment and ongoing management of the APZ is set out in further detail in the report. The overhead grid connection should be located a minimum of 14.6m clear of any hazardous vegetation.

2. **Water supply:** A static water supply provides for a minimum of 40,000L dedicated solely for bushfire fighting purposes. The recommended location and design of the static water supply is set out in further detail in the report.

3. **Access and egress:** Direct access to the BESS facility is provided to Sandy Creek Road.

4. **Hazardous materials and chemical storage:** Are located away from the hazardous vegetation.

5. **Bushfire management during construction:** the recommended bushfire management measures are adopted during the construction phase of the project.

6. **Operational procedures:** incorporate the relevant bushfire recommendations of this report.

APPENDICES

Meridian Urban

Appendix A – Proposed Development Plan

Appendix B - Assessment against the Bushfire Hazard Code

Bushfire Hazard Code

Overall Outcomes

Purpose and Overall Outcome	Response
2. The purpose of the code will be achieved through the following overall outcomes:	
(a) development is designed to: (i) avoid or minimise the risk of loss of life from bushfire; (ii) minimise the damage to property from bushfire; (iii) assist emergency services in responding to any bushfire threat.	**Complies –** This report demonstrates that the BESS facility and associated infrastructure appropriately avoids the bushfire prone area and various mitigation measures, including adequate separation, can be adopted to minimise risk to people and property to a tolerable level. These measures include appropriate access and fire-fighting infrastructure for emergency services.

Identified requirements and assessment benchmarks

Performance outcomes	Acceptable outcomes	Response
Avoidance		
PO1 Development avoids areas of very high, high or medium potential bushfire intensity where practicable.	**AO1.1** Development is not located in an area of very high, high or medium potential bushfire intensity. *Note—A site-specific bushfire hazard assessment will be necessary to demonstrate that a proposed development site is low bushfire risk despite being mapped as an area of very high, high or medium potential bushfire intensity.*	**Complies –** The BESS facility is located outside the mapped area of very high, high and medium potential bushfire intensity. The western portion of the BESS footprint is partially is affected by the Potential impact buffer, however as discussed in this report that mapping is not an accurate reflection of the site characteristics or vegetation present in this area. Similarly, the grid connection passes through an area of mapped High potential bushfire intensity, but again the mapping is not reflective of the on ground vegetation status.
Mitigation		
PO2 Development maintains the safety of people and property by mitigating the risk of bushfire through: (a) lot design;	**AO2.1** One water tank with fire brigade fittings is provided within 100 metres of each Class 1, 2, 3 or 4 building where the development: (a) involves new or existing buildings with a gross floor area greater than 50m2;	**Not applicable –** The proposal does not include any Class 1, 2, 3 or 4 buildings.

Performance outcomes	Acceptable outcomes	Response
(b) including firebreaks that provide adequate access for fire-fighting and other emergency vehicles; (c) providing adequate road access for safe evacuation and fire-fighting and other emergency vehicles; (d) providing an adequate and accessible water supply for fire-fighting purposes.	(b) is located in an area not serviced by a reticulated water supply; (c) where a water tank is provided for the purpose of household water supply.	
	AO2.2 Lots created for a residential activity are designed so that their size and shape allow for efficient emergency access to buildings for fire-fighting appliances (e.g. by avoiding long narrow lots with long access drives to buildings).	**Not applicable –** The proposal is not for a residential subdivision.
	AO2.3 Where development will result in multiple buildings or lots: (a) firebreaks are provided by a perimeter road that separates lots from areas of bushfire hazard and that road has: (i) a minimum cleared width of 20 metres; (ii) a constructed road width and weather standards complying with Planning Scheme Policy SC6.3 FNQROC Development Manual, or (b) fire maintenance trails are located as close as practicable to the boundaries of the lots and the adjoining bushfire hazard, and the fire maintenance trails: (i) have a minimum cleared width of 6 metres; (ii) have a formed width and gradient, and erosion control devices complying with Planning Scheme Policy SC6.3 FNQROC Development Manual; (iii) have vehicular access at each end;	**Response to AO2.3 and 2.4: Complies with PO2 –** The recommendations of this report include an asset protection zone around the perimeter of the facility to provide separation between the facility and nearby hazardous vegetation, as well as a separation to mitigate against grassfire. This separation has been determined in accordance with the methodology set out in BRC. The proposed APZ will also facilitate access for fire fighting vehicles. The facility also incorporates a perimeter road / track around the batteries.

Performance outcomes	Acceptable outcomes	Response
	(iv) provide passing bays and turning areas for fire-fighting vehicles; (v) are either located on public land or within an access easement that is granted in favour of the Queensland Fire and Rescue Service.	
	AO2.4 Where development will result in multiple buildings or lots, cleared firebreaks at least 6 metres wide are provided adjacent to vegetation within the site to allow the burning of sections and access for bushfire response.	
	AO2.5 New roads are designed and constructed as follows: (a) in accordance with Planning Scheme Policy SC6.3 FNQROC Development Manual; (b) to have a maximum gradient of 12.5%; (c) no cul-de-sacs are created, unless the road is a perimeter road isolating the development from a bushfire hazard.	**Not applicable –** No new roads are proposed or required as part of the development.
Firebreaks		
PO3 The establishment of firebreaks minimises impacts on areas of environmental significance.	**AO3.1** The establishment of a firebreak in accordance with PO2, AO2.3 and AO2.4 above must not involve the clearing of native vegetation unless a site-specific bushfire hazard assessment demonstrates that the bushfire hazard is very high, high or medium on that site.	**Complies –** The recommended APZ set out in this report does not require the clearing of native vegetation as it is located in existing cleared areas of the site.
Community Infrastructure		
PO4 Development for community infrastructure in the form of emergency services, an emergency shelter, air services, hospital, educational	**AO4.1** Development for community infrastructure as identified in PO4:	**Complies –** Whilst the definition of community infrastructure does not explicitly include a BESS facility, it does include a substation, which has a similar function. As noted in response to AO1.1 above, the

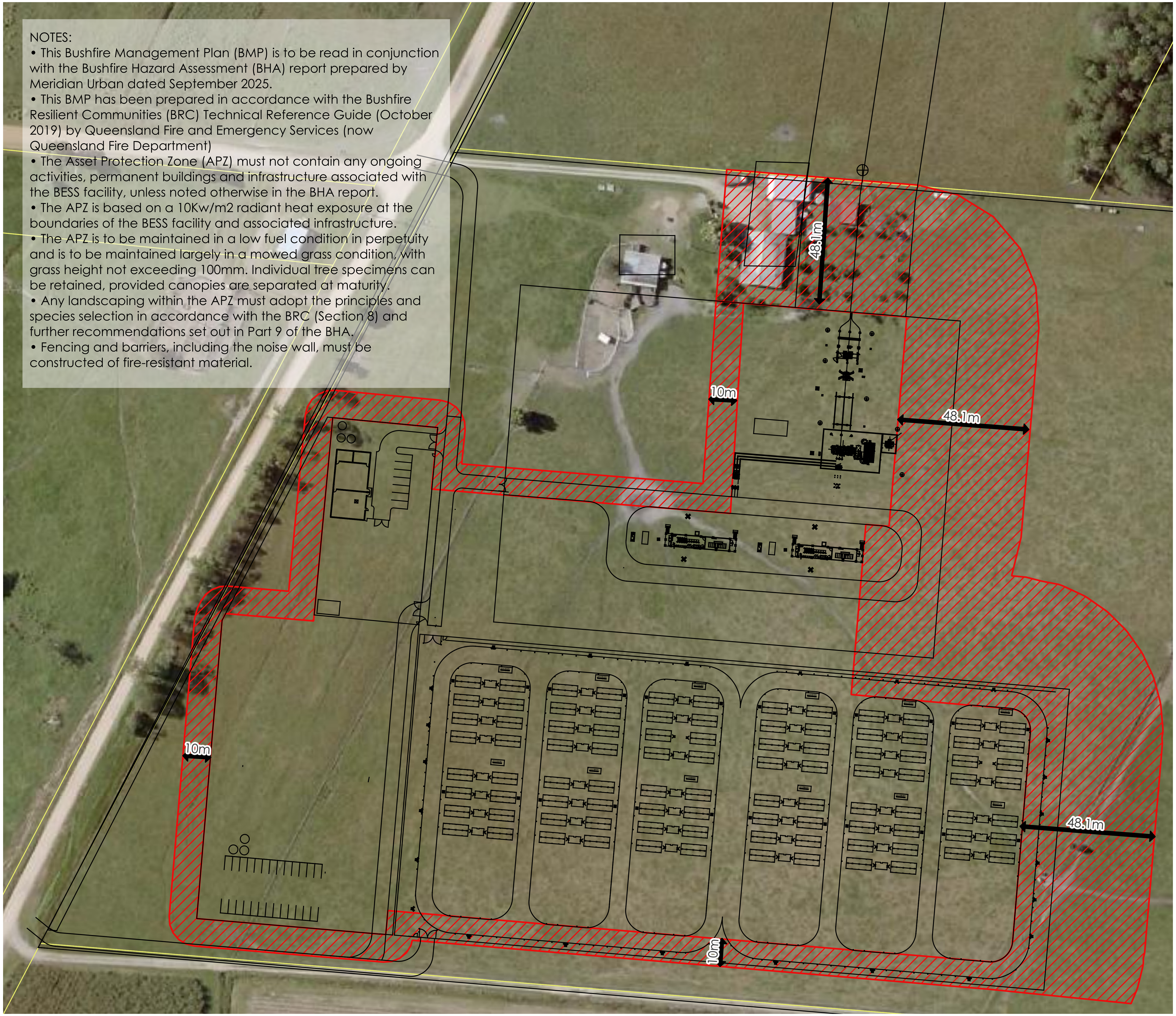
Performance outcomes	Acceptable outcomes	Response
establishment, substation, a power station, telecommunications facility or utility installation or stores of valuable records or items of historic or cultural significance, is able to function effectively during and immediately after bushfire events.	(a) is not located on land in an area of very high, high or medium potential bushfire intensity; or (b) does not involve any new building work other than extending the gross floor area of an existing building by less than 20m2; or (c) is designed to function effectively during and immediately after bushfire events. *Note—For AO4.1(a), a site-specific bushfire hazard assessment is necessary to demonstrate that although the site is mapped as an area of area of very high, high or medium potential bushfire intensity, the bushfire risk is low on that site.* *Note—To comply with AO4.1(c), the development application will need to include a comprehensive Bushfire Management Plan and the development must be able to comply with this Plan.*	BESS facility and associated infrastructure is located outside of verified areas of very high, high and medium potential bushfire intensity. A bushfire hazard assessment and bushfire management plan are provide in this report and demonstrate compliance with AO4.1.
Bushfire Management Plan		
PO5 Development complies with a bushfire management plan where the development: (a) is in an area of very high or high potential bushfire intensity; or (b) involves the manufacture or bulk storage of hazardous materials.	No acceptable outcome prescribed.	**Complies –** Whilst the development footprint is not within an area of very high or high potential bushfire intensity, a bushfire management plan has been prepared due to the proximity of the development to areas confirmed as high and medium potential bushfire intensity. That bushfire management plan is included in **Appendix C** and based on the recommendations set out in this report.

Appendix C – Bushfire Management Plan

RWE TULLY BATTERY ENERGY STORAGE SYSTEM (BESS)

Bushfire Management Plan

NOTES:
- This Bushfire Management Plan (BMP) is to be read in conjunction with the Bushfire Hazard Assessment (BHA) report prepared by Meridian Urban dated September 2025.
- This BMP has been prepared in accordance with the Bushfire Resilient Communities (BRC) Technical Reference Guide (October 2019) by Queensland Fire and Emergency Services (now Queensland Fire Department)
- The Asset Protection Zone (APZ) must not contain any ongoing activities, permanent buildings and infrastructure associated with the BESS facility, unless noted otherwise in the BHA report.
- The APZ is based on a 10Kw/m2 radiant heat exposure at the boundaries of the BESS facility and associated infrastructure.
- The APZ is to be maintained in a low fuel condition in perpetuity and is to be maintained largely in a mowed grass condition, with grass height not exceeding 100mm. Individual tree specimens can be retained, provided canopies are separated at maturity.
- Any landscaping within the APZ must adopt the principles and species selection in accordance with the BRC (Section 8) and further recommendations set out in Part 9 of the BHA.
- Fencing and barriers, including the noise wall, must be constructed of fire-resistant material.



LEGEND

- BESS Site Layout
- Asset Protection Zone (10Kw/m2)
- Dimensions

0 25 50 m

Project No: 24-130 Map No: 1 of 1

Coordinate System: GDA 2020 MGA Zone 55
Printed at: A3
Creation Date: 19/03/2025

Meridian Urban Pty Ltd

T 0422 224 810

E info@meridianurban.com

Brisbane | Sydney

meridianurban.com

Meridian Urban