APPENDIX N WATER RESOURCES IMPACT ASSESSMENT

ENGENY

X-ELIO
Canyonleigh Battery Energy Storage System

Water Resources Impact Assessment

BNTL00206_0022-REP-001-3

17 APRIL 2026

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Rev	Date	Description	Author	Reviewer	Project Mgr.	Approver
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Signatures:						

EXECUTIVE SUMMARY

OVERVIEW

X-Elio Aus2 Pty Ltd (the Applicant) proposes to develop the Canyonleigh Battery Energy Storage System (The Project). The Project will involve the construction, operation, and decommissioning of a Battery Energy Storage System (BESS) with an estimated storage capacity of up 300 MW / 1,200 MWh. The Project is located at Lot 2341 DP 622834 and Lot 12 DP 727493, approximately 10.5 km south-west from the town of Canyonleigh and lies entirely within the Goulburn-Mulwaree Council Local Government Area (LGA) in New South Wales (NSW).

The Project is State Significant Development (SSD) and therefore requires an environmental impact statement (EIS) to be prepared under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979*. This Water Resources Impact Assessment (WRIA) supports the SSD application as an appendix of the EIS for the Project and provides an assessment of the potential impacts to surface water as a result of the Project. The WRIA documents the assessment methods and results, initiatives to avoid and minimise surface water and groundwater impacts, and additional mitigation and management measures proposed to address residual impacts not able to be avoided.

BASELINE CHARACTERISTICS

Surface Water Context

The Project is located within the Wollondilly River sub catchment of the Hawkesbury Nepean catchment. The Wollondilly River flows in a generally north-east direction adjacent to Assessment Area along its west, north, and east boundaries. The confluence of the Wollondilly River and Paddys River is approximately 12 km downstream and to the north-east of the Assessment Area. The Wollondilly River catchment also lies within the Sydney Drinking Water catchment.

All drainage lines within the Assessment Area drain to the Wollondilly River, and the drainage lines that interact with the Development Footprint of the Assessment Area are non-perennial. Eleven 1st, three 2nd, and one small section (approximately 7.8 m) of 3rd Strahler Order watercourses are mapped within the Assessment Area. Of which, five 1st, two 2nd, and the one 3rd Strahler Order sections were considered to have associated waterfront land when assessed in accordance with Natural Resource Access Regulator criteria.

The local catchment has undulating topography, with elevations ranging between 605 mAHD to 650 mAHD.

Groundwater Context

The Project exists within the Lachlan Fold Belt MDB Groundwater Source, which is managed by the Water Sharing Plan (WSP) for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020.

There are no groundwater bores within the Assessment Area (BoM, 2024), however, nineteen exist within a 5 km radius. Of these, the shallowest standing water level is 1.8 m for GW104238, which is approximately 3.2 km from the Assessment Area.

The Assessment Area does not include any areas mapped as having subterranean or aquatic groundwater dependent ecosystems (GDEs) as determined from national studies (BoM, 2019). However, low and moderate potential terrestrial GDEs are identified within the Assessment Area.

Flooding

Detailed flood modelling of the undeveloped Assessment Area was undertaken as part of the WRIA. The hydraulic modelling was undertaken using rain-on-grid (RoG) modelling techniques.

The flood modelling indicates that flooding within the Assessment Area is typically confined to the 1st and 2nd Strahler Order watercourses, with only minor potential impacts on the proposed infrastructure.

Water Supply

It is understood that potable water and amenities will be supplied by on site rainwater tanks, with additional water needs met through external water imports.

The Applicant has negotiated with surrounding Councils (Goulbourn Mulwaree and Yass Valley) for potable and non-potable water supply. Goulbourn Mulwaree Council has confirmed that non-potable water could be taken (when available) from existing standpipes at Marulan (175 Brayton Road, out the front of the Marulan water treatment plant) and at Goulburn (corner of River St and Wheeo Rd, across the road from the Goulburn WTP). Yass Valley Council have also confirmed they can service the water supply (potable and non-potable), if required.

POTENTIAL IMPACTS

Watercourse Characteristics

The proposed works will not involve significant modification or realignment of any natural watercourses traversing the Project Area, resulting in no impacts to stream ordering and no change to waterfront land classification.

Flooding

The flood model was used to simulate the developed conditions for the 5% Annual Exceedance Probability (AEP), 1% AEP and the Probable Maximum Flood (PMF) events. Results indicate that predicted flooding increases within the Assessment Area associated with the Project infrastructure in the 5% AEP and 1% AEP flood events are typically minor and with appropriate design and erosion controls present negligible erosion or inundation risks. Additionally, impacts of the proposed infrastructure are localised and do not extend downstream beyond the Assessment Area.

A climate change sensitivity analysis was undertaken by modelling a medium-term (2050 climate horizon) 1% AEP climate change scenario and the 0.2% AEP design flood events under existing conditions. The climate change sensitivity modelling indicates that there is generally little difference in flood extent across the Assessment Area for the two climate change scenarios.

Surface Water Quality

Construction, operation, and decommissioning phases pose potential risks to surface water and groundwater quality, including:

- Soil erosion and sedimentation.
- Spill of hydrocarbons or other chemicals associated with general vehicle usage, construction activities and maintenance.
- Release of concrete by-products (dust, slurry, water).
- Discharge/spill of wastewater.

These risks can cause harm to aquatic life, contaminate watercourses, contaminate stock and domestic drinking water, and impact crops/ irrigation. It is considered that with the implementation of mitigation measures such as implementation of a Construction Erosion and Sediment Control Plan (CESCP), storage and handling of hydrocarbons/chemicals in accordance with relevant standards and guidelines, and wastewater management systems, impacts on surface water quality during these phases will be negligible.

In addition to this, a neutral or beneficial effect on water quality (NorBE) is demonstrated to be achievable for the Project, with the implementation of appropriate stormwater treatment measures (i.e. GPT pits, vegetated swales, and bioretention areas).

Groundwater Quality

Potential impacts to groundwater quality during construction and operation activities may result from spill of wastewater, hydrocarbons or other pollutants used to support transportation and site activities. The risk of these spills impacting groundwater quality is considered moderate due to the potentially low depth between the surface and groundwater (Section 2.4). With standard management practices that will be put in place the risk of impact is considered to be reduced to an acceptable level.

Cumulative Impacts

The cumulative impact assessment for the Project, in accordance with State Significant Project guidelines, acknowledges the potential cumulative effects arising from the incremental influence of multiple energy projects within the vicinity of the Project. Although individual impacts from specific projects may be minor or negligible, the collective influence can be more significant over time. The Project is located within proximity (~50 km) to seven known energy projects, including BESS, wind, and solar installations, and has undergone an assessment considering potential cumulative impacts. These identified projects have a combined area of approximately 9,700 ha (including this Project), which is around 0.0002% of the total Wollondilly River catchment area.

Based on the outcomes of this assessment, potential interactions with common surface water receptors, including the Wollondilly River, are considered low, and will be mitigated through appropriate design, construction/demolition phase environmental management plans/procedures and operational phase environmental management plans/procedures. Water quality, flooding, and surface water supply impacts are expected to be negligible due to the small, combined area of the projects, adherence with NSW water take licensing requirements, and the minor scale of operational water demands.

MITIGATION AND MANAGEMENT MEASURES

Detailed environmental studies have been undertaken for the Project design. Consideration of the outcomes of these studies in the design and management measures for all phases of the Project will minimise the potential for impacts on groundwater and surface water resources. The potential impacts associated with the Project and a summary of the proposed mitigation measures are provided in Table 1. It should be emphasised that the majority of the proposed mitigation measures are consistent with best practices for the development of battery energy storage systems.

TABLE 1: SUMMARY OF POTENTIAL IMPACTS AND MITIGATION MEASURES

Potential Impacts	Mitigation Measure	Project Implementation Stage
WATERCOURSE CHARACTERISTICS		
Filling Of Streams for Infrastructure / Water Crossings	Consider the following mitigation measures in the Project detailed design: • Limit water crossing to existing access tracks where possible. • Arrange Project infrastructure such that stream disturbance and modifications (filling / diversions) are limited to minor watercourses. In the event construction of waterway crossings is required, these will be designed, constructed and maintained to consider DPE *Guidelines for instream works on waterfront land* (DPE, 2022) and *Guidelines for riparian corridors on waterfront land* (DPE, 2022).	Detailed design
Flooding		
Impacts To In-Stream and Overland Flooding	Consider the following mitigation measures in the Project detailed design stage to minimise impacts to flooding where possible: • Minimise filling of substation, switching station sites and on-site facilities. • Minimise extent of Project infrastructure within the 1% AEP flood extent. • Design to manage flood impacts and flow conveyance at watercourse crossings (if any). • Design appropriate stormwater treatment measures (e.g. vegetated swales, bioretention areas).	Detailed design
Impacts On the Project Design Due To Predicted Flooding	Optimisation of the Project design during detailed design to ensure: • Permanent ancillary infrastructure (O&M facility, substation, and BESS areas) is located above the flood planning level (1% AEP with 500 mm freeboard).	Detailed design
Impacts To Site Personnel During a Flood Event	Floodplain management planning to determine site management protocols during flood events that could impact construction or access areas, including: • Suitable early warning and communication protocols. • Triggers for shutdown, evacuation and recovery. • Emergency response and support. Flooding isolation during construction and operations will be managed through development of a flood emergency response plan. This Emergency Response Plan will: • Consider emergency response in rare events. • Be developed in accordance with existing community emergency management arrangements for flooding. • Be developed in consultation with Goulbourn-Mulwaree Council and NSW SES.	Post Approval / Pre-construction

Potential Impacts	Mitigation Measure	Project Implementation Stage
Increased Stormwater Runoff from Vegetation Clearing and Filling for Infrastructure	Increased stormwater runoff during operations (due to clearing of vegetation and hardstand for infrastructure) will be managed through an appropriately designed stormwater management system (SMS). The SMS will consider: • Location of site infrastructure away from existing watercourses or areas subject to high levels of overland flow. • Diversion of upstream flows around site infrastructure as required, to minimise scouring and erosion. • Inspection and monitoring regimes to maintain stormwater and erosion and sediment control structures.	Construction
Water Quality		
Sedimentation of Downstream Watercourses	Sedimentation will be managed through the development of an appropriately designed stormwater management system. As well as ongoing monitoring and maintenance through operation and decommissioning of additional controls if identified as required. The total area of disturbance at any time should be minimised where possible and progressive rehabilitation and stabilisation strategies implemented throughout construction. During construction, the following management measures will be considered to minimise the potential for mobilisation of sediment or dust: • Locate stockpiles away from drainage lines, or areas subject to high levels of overland sheet flow and minimise stockpile size. • Develop and implement area specific erosion and sediment control measures including bunding and diversion drains as required. • Use stockpile stabilisation techniques such as covering. • All runoff from disturbed areas to pass through an appropriate sediment trap prior to discharging to the receiving environment. • Concrete washout to be undertaken in a lined bunded area.	Construction, Decommissioning
Contaminant Spills	Prior to commencing construction activities, a Construction Environment Management Plan (CEMP) will be developed to identify site specific controls and procedures to minimise the potential for hydrocarbons and other contaminants being discharged into the environment. This CEMP should consider: • Storage of hydrocarbons and other liquid chemicals within above ground, bunded areas away from watercourses or areas subject to high levels of overland sheet flow. • Re-fuelling of construction vehicles and equipment to be limited to designated areas, with adequate spill management controls. • Maintain an emergency spill kit and relevant emergency spill response procedures. • Transport and dispose of any hydrocarbons and chemicals captured (or materials contaminated with hydrocarbons or chemicals) during Project construction and operation of the substations and switchyards at an appropriately licenced facility. • Ongoing monitoring and maintenance.	Construction, Operation, Decommissioning

Potential Impacts	Mitigation Measure	Project Implementation Stage
Surface Water and Groundwater Quality Impacts	The CEMP will consider the following management measures to minimise the potential impacts to surface water and groundwater quality within and surrounding the Project Area: • Develop and implement a suitable monitoring regime of all stormwater and erosion and sediment control structures, particularly following large flow events.	Construction, Decommissioning
Water Supply		
Water Licences to Meet Demands	All required water licensing and approvals will be coordinated with associated landholders, regulators and/or suppliers (e.g. Council, others) if that source is needed to support water supply arrangements for during construction and operation.	Post Approval (Construction, Operation, Decommissioning)
Wastewater Management		
Discharge of Wastewater or Effluent from Site	Design and implement a wastewater treatment system that: • Is appropriately sized for the Project infrastructure and operations. • Be designed and operated in accordance with best practices, as detailed in: – Designing and Installing On-Site Wastewater Management Systems, A WaterNSW Current Recommend (WaterNSW, 2023). – AS/NZS 1547:2012 Onsite domestic wastewater management' and the Department of Local Government's (1998) 'Environment & Health Protection Guidelines: On-site Sewage Management for Single Households' (the 'Silver Book').	Detailed design

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1. INTRODUCTION

1.1 Overview

Engeny Australia Pty Ltd (Engeny) has been engaged by Environmental Resource Management Australia Pty Ltd (ERM) on behalf of X-Elio Aus2 Pty Ltd (the Applicant) to prepare a Water Resources Impact Assessment (WRIA) for the Canyonleigh Battery Energy Storage System (BESS) (the Project).

The water resources impacts and proposed mitigation measures for the proposed construction, operation and decommissioning phases of the Project are addressed in this report in accordance with relevant regulatory requirements and guidelines.

This report has been prepared to support a State Significant Development (SDD) Development application under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (SSD- 62199230), as part of the Environmental Impact Statement (EIS) for the Project.

1.2 Relevant Policies, Guidelines and Legislation

The following policies, guidelines and legislation have been considered in this assessment:

- *NSW Aquifer Interference Policy.*
- *Water Management Act 2000.*
- *Water Management (General) Regulation 2025.*
- *Water Management (Water Supply Authorities) Regulation 2025.*
- *Water Sharing Plans.*
- *Guidelines for instream works on waterfront land* (DPE, 2022).
- *Goulburn Mulwaree Local Environmental Plan 2009.*
- *Waterfront Land e-tool (NRAR, 2020).*
- *NSW Water Quality and River Flow Objectives.*
- *Australian and New Zealand guidelines for fresh and marine water quality* (Australian and New Zealand Governments and Australian state and territory governments, 2018) (ANZG).
- *Australian and New Zealand guidelines for fresh and marine water quality* (Australian and New Zealand Environment and Conservation Council, 2000) (ANZECC 2000).
- *Managing Urban Stormwater: Soils & Construction Volume 1 (Landcom 2004), Volume 2A, 2C and 2D* (DECC, 2008).
- *Using MUSIC in Sydney Drinking Water Catchment, A WaterNSW Current Recommended Practice* (WaterNSW, 2023)
- Part 6.5 of *State Environmental Planning Policy (Biodiversity & Conservation) 2021* (2021)
- *Renewable Energy Planning Framework* (DPIE, 2025) *and Large-scale Solar Energy Guideline* (DPHI, 2024).
- *Controlled Activities – Guidelines for Instream Works on Waterfront Land* (DPE, 2022).
- *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge, 2003).
- *Policy & Guidelines for Fish Habitat Conservation & Management* (DPI, 2013).
- *Flood Risk Management Manual* (DPE, NSW, 2023).
- *Floodplain Risk Management Guide* (OEH, 2019).
- *Flood Impact and Risk Assessment – Flood Risk Management Guideline LU01* (DPE, NSW, 2023).

1.2.1 SEARs and Agency Advice

The relevant Secretary's Environmental Assessment Requirements (SEARs) and agency submissions to SEARs, including where each is addressed in this report, are listed in Table 1.1 and Table 1.2 respectively.

TABLE 1.1: SEARS AND WHERE ADDRESSED

SEAR	Issue	Section Addressed in this Report
Water	an assessment of the likely impacts of the development (including flooding and flood modelling) on surrounding watercourses (including their Strahler Stream Order), groundwater resources and surface water movements, and measures proposed to monitor, reduce and mitigate these impacts including water management, having regard to the Solar Guideline;	Sections 6 – Surface Water Impact Assessment Section 7 – Groundwater Impact Assessment
	a site water balance for the development;	Section 3 – Proposed Water Management
	details of water requirements and supply arrangements for construction and operation (including consultation with suppliers);	Section 3.1.2 – Water Supply
	a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom, 2004) and *Managing Urban Stormwater: Soils and construction – Volume 2A manual* (Landcom, 2008);	Section 6.3 – Erosion and Sedimentation Control
	assessing the impacts of the development, including any changes to flood risk and overland flows on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required;	Section 6.1.3 – Flooding Section 9 – Mitigation and Management Measures
	where the project involves works within 40 metres of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land and key fish habitat, and how the activities are to be designed and implemented in accordance with the DPI Guidelines for *Controlled Activities on Waterfront Land* (2018) and (if necessary) *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (DPI 2003), and *Policy & Guidelines for Fish Habitat Conservation & Management* (DPE, 2013); and	Section 6.1.2 – Waterfront Land
	Flood Risk: identification of any flood risk on site having regard to adopted flood studies, the potential effects of climate change and any relevant provisions of the NSW Flood Risk Management Manual: • where the development could alter flood behaviour, affect flood risk to the existing community or expose its users to flood risk, provide a flood impact and risk assessment (FIRA) prepared in accordance with the *Flood Impact and Risk Assessment – Flood Risk Management Guide LU01*. • detailed design solutions and operational procedures to mitigate flood risk where required.	Section 4.4 – Developed Flood Behaviour Section 6.1.3 - Flooding

TABLE 1.2: RELEVANT REGULATORY SUBMISSION TO SEARS AND WHERE ADDRESSED

Regulator	Reference and Issue	Section Addressed in this Report
NSW DCCEEW Water Group– Water Take and Licensing	A detailed and consolidated site water balance.	Section 3 – Proposed Water Management
	Description of all works/activities that may intercept, extract, use, divert or receive surface water and/or groundwater. This includes the description of any development, activities or structures that will intercept, interfere with or remove groundwater, both temporary and permanent.	Section 3 – Proposed Water Management
	Details of all water take for the life of the project and post closure where applicable. This is to include water taken directly and indirectly, and the relevant water source where water entitlements are required to account for the water take. If the water is to be taken from an alternative source confirmation should be provided by the supplier that the appropriate volumes can be obtained.	Section 3 – Proposed Water Management
	Details of Water Access Licences (WALs) held to account for any take of water where required, or demonstration that WALs can be obtained prior to take of water occurring. This should include an assessment of the current market depth where water entitlement is required to be purchased. Any exemptions or exclusions to requiring approvals or licenses under the Water Management Act 2000 should be detailed by the proponent.	Section 2.8.4 – NSW Licensing and Approvals
NSW DCCEEW Water Group – Water Impacts	A description of groundwater conditions that provides an understanding of groundwater level across the site under a range of wet and dry conditions.	Section 2.4 – Groundwater Context
	Assessment of impacts on surface and ground water sources (both quality and quantity) including flooding, related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, groundwater dependent ecosystems, and ground water levels; including measures proposed to reduce and mitigate these impacts.	Section 6 – Surface Water Impact Assessment Section 7 – Groundwater Impact Assessment
	Proposed surface and groundwater monitoring activities and methodologies	Section 9 – Mitigation and Management Measures To be further addressed in the ESCP and CEMP for the Project.
NSW DCCEEW Water Group – Assessment against Policy and Guidelines	Identification and impact assessment of all works/activities located on waterfront land including an assessment against *Guidelines for Controlled Activities on Waterfront Land* (DPE 2022).	Section 2.2.3. – Waterfront Land Section 6.1.2 – Waterfront Land
	Assessment of project against relevant policies and guidelines.	Throughout document.
NSW DCCEEW BCS – Water and Soils	The EIS must map and describe background conditions for any water resource likely to be affected by the development, including: (a) Existing surface and groundwater. (b) Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations. (c) Water Quality Objectives (*as endorsed by the NSW Government*) including groundwater as appropriate that represent the community's uses and values for the receiving waters. (d) Where locally derived indicators and guideline values are not available for the relevant Water Quality Objectives, the EIS must refer to the	Section 2 – Baseline Characteristics

Regulator	Reference and Issue	Section Addressed in this Report
	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018).	
	The EIS must assess the impacts of the project on water quality, including: (a) The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the project protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction (a) Identification of proposed monitoring of water quality or required changes to existing monitoring programs (b) How the development meets the objects of the Coastal Management Act 2016 and management objectives of relevant Coastal Management Areas defined under this Act (c) Consistency with any relevant certified Coastal Management Program (or Coastal Zone Management Plan)	Section 5 – Water Quality Modelling Section 6 – Surface Water Impact Assessment Section 7 – Groundwater Impact Assessment *Note: The Project is located a significant distance from the coast (approximately 75 km) and it is considered that the potential effects of coastal processes and hazards including sea level rise and climate change on the proposed development and arising from the proposed development are negligible. There are also no Coastal Management Programs relevant to the proposed development.*
	The EIS must assess the impact of the project on hydrology, including: (a) Water balance including quantity, quality and source (b) Effects to downstream rivers, wetlands, estuaries, marine waters (including protected areas) and floodplain areas (c) Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems (d) Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches) (e) Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water (f) Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options (g) Identification of proposed monitoring and hydrological attributes.	Section 3 – Proposed Water Management Section 6 – Surface Water Impact Assessment Section 7 – Groundwater Impact Assessment Section 9 – Mitigation and Management Measures
NSW DCCEEW BCS – Flooding	The EIS shall include a flood impact and risk assessment (FIRA). As a minimum the FIRA must: (a) Consider the relevant provisions of the NSW Flood Risk Management Manual (2023) and associated guides, and existing council and government studies, information and requirements. (b) Identify and describe existing flood behaviour on the site and its surrounding areas for the full range of events, including 5% Annual Exceedance Probability (AEP), 1% AEP, PMF and 0.5% AEP or 0.2% AEP	Section 4 – Flood Modelling Section 6 – Surface Water Impact Assessment Section 9 – Mitigation and Management Measures

Regulator	Reference and Issue	Section Addressed in this Report
	and provide an assessment of the compatibility of the development and its users with flood behaviour. This may require flood modelling where existing flood information is not available. (c) Determine and describe changes in post development flood behaviour, impacts of flooding on existing community and on the development and its future community for full range of events, 5% AEP, 1% AEP, PMF and 0.5% AEP or 0.2% AEP. This will typically require flood modelling. (d) Consider impacts of climate change due to both sea level rise and increase in rainfall intensities considering relevant Council and government advice. The 0.5% AEP or 0.2% AEP events can be used to provide an understanding of the scale of change of flood behaviour relative to the 1% AEP event. (e) Propose and assess the effectiveness of management measures required to minimise the impacts and risks of flooding to the development and its users and existing community. Note: • The scope of a FIRA must be consistent with the Draft EHG FIRA Guide, which is being finalised currently. • The FIRA will need to be tailored to suit the project being considered, whilst maintaining consistency with the FIRA guide. Note: • Flood modelling is to be undertaken by a suitably qualified engineer consistent with Council's requirements and Australian rainfall and Runoff and is to consider the influence of oceanic conditions in coastal areas. • Flood behaviour includes flood volume, extent, depth, level, velocity, duration, rate of rise, flood function and flood hazard. • Impacts include those on different elements at risk such as the existing community, property, floor levels, access etc due to changes to flood behaviour and risks to the community including emergency management response for the community	
NSW DCCEEW BCS – Flooding and Coastal Hazards	The EIS must address the following project-specific requirements for flood risk: (a) The EIS must assess the potential impact of flooding for the full range of events up to and including the PMF: • On the proposed facility. • On public safety including accesses to the proposed facility and waterway crossings. (b) The EIS must detail: • The storage levels of any hazardous materials. • The structural integrity of any proposed storage buildings/ structures in events up to and including the PMF. • An assessment of impacts, risks and controls associated with inundation of the facility or structures containing hazardous materials including any off-site impacts in large to extreme flood up to the PMF.	Section 4 – Flood Modelling Section 6 – Surface Water Impact Assessment Section 9 – Mitigation and Management Measures

Regulator	Reference and Issue	Section Addressed in this Report
	(c) The EIS should: • Demonstrate how the facility can continue to operate to avoid the potential for shutdown of power supply and/or power storage as a result of flooding. • Address any flow on effects and risks of shutdown such as impacts to the telecommunications network. (d) The EIS must assess the hydrological impacts of the proposed development on the environment including erosion potential, off-site flooding and how that will be mitigated.	
WaterNSW	Reference to the Neutral or Beneficial Effect on Water Quality Assessment Guideline (2022) and associated current recommended practices and requirements for assessment.	Section 5.3 – NorBE Assessment
Goulburn Mulwaree Council	There are many other infrastructure and renewable energy projects proposed and being delivered in the region, which is having a cumulative impact on housing, labour availability, the economy and socially in relation to the community's exposure to numerous rounds of consultation.	Section 8 – Cumulative Impacts
	Potential impacts on waterways and water quality, liaise with Water NSW.	Section 6 – Surface Water Impact Assessment

1.2.2 Goulbourn Mulwaree Local Environmental Plan 2009 – Flood Planning Provisions

The Goulbourn Mulwaree Local Environmental Plan 2009 (GM LEP) includes flood planning provisions. The LEP flood planning provisions relevant to this WRIA are listed in Table 1.3, including where/ how each is addressed in this report.

TABLE 1.3: RELEVANT FLOOD PLANNING PROVISIONS OF GM LEP

LEP Section	Planning Provision	Section Addressed in this Report/ How Addressed
5.21 Flood Planning	(1) The objectives of this clause are as follows -	
	(a) to minimise the flood risk to life and property associated with the use of land,	Section 4 – Flood Modelling, Section 6.1.3 Flooding • Permanent infrastructure, except for roads, are to be raised above the flood planning level. • Modelling does not indicate any flood impacts to surrounding properties.
	(b) to allow development on land that is compatible with the flood function and behaviour on the land, taking into account projected changes as a result of climate change,	Section 4 – Flood Modelling, Section 6.1.3 Flooding • Climate change has been addressed, as per latest ARR guidelines. • Additionally, the flood planning levels include a 0.5 m freeboard above the 1% AEP flood levels, allowing for potential future flood increases.
	(c) to avoid adverse or cumulative impacts on flood behaviour and the environment,	Section 4 – Flood Modelling, Section 6.1.3 Flooding • The flooding impacts observed from the proposed infrastructure are considered negligible, as they do not extend beyond the Assessment Area and any impacts within the Assessment Area will be mitigated in detailed design. • As impacts are not observed beyond the Assessment Area, no cumulative flooding related impacts are predicted.

LEP Section	Planning Provision	Section Addressed in this Report/ How Addressed
	(d) to enable the safe occupation and efficient evacuation of people in the event of a flood.	Section 4.5 Flood Emergency Management and Planning • Flood Emergency Response Plan to be developed during post approval/ pre-construction, which will provide measures for safe occupation and efficient evacuation.
	(2) Development consent must not be granted to development on land the consent authority considers to be within the flood planning area unless the consent authority is satisfied the development—	
	(a) is compatible with the flood function and behaviour on the land, and	Section 4 – Flood Modelling, Section 6.1.3 Flooding • Permanent infrastructure, except for roads, are to be raised above the flood planning level and therefore outside of the flood planning area.
	(b) will not adversely affect flood behaviour in a way that results in detrimental increases in the potential flood affectation of other development or properties, and	Section 4 – Flood Modelling, Section 6.1.3 Flooding • Flood results do not show detrimental increases in flood behaviour within or outside of the Project Area.
	(c) will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the event of a flood, and	Section 4.5 Flood Emergency Management and Planning • Flood Emergency Response Plan to be developed during post approval/ pre-construction, which will provide measures for safe occupation and efficient evacuation.
	(d) incorporates appropriate measures to manage risk to life in the event of a flood, and	Section 4 – Flood Modelling, Section 6.1.3 Flooding • Permanent infrastructure, except for roads, are to be raised above the flood planning level and therefore outside of the flood planning area. • Flood Emergency Response Plan to be developed prior to the commencement of construction.
	(e) will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses	Section 4 – Flood Modelling, Section 6.1.3 Flooding • The flooding results do not indicate adverse flooding impacts beyond the Assessment Area. • Detailed design also expected to consider these aspects
	(3) In deciding whether to grant development consent on land to which this clause applies, the consent authority must consider the following matters—	
	(a) the impact of the development on projected changes to flood behaviour as a result of climate change,	Section 4 – Flood Modelling, Section 6.1.3 Flooding • Climate change modelling as per latest ARR guideline recommendations has been included in the existing WRIA.
	(c) whether the development incorporates measures to minimise the risk to life and ensure the safe evacuation of people in the event of a flood,	Section 4.5 Flood Emergency Management and Planning • Permanent infrastructure, except for roads, are to be raised above the flood planning level and therefore outside of the flood planning area. • Flood Emergency Response Plan to be developed prior to the commencement of construction.
	(d) the potential to modify, relocate or remove buildings resulting from development if the surrounding area is impacted by flooding or coastal erosion.	The potential for modifying, relocating or removing building associated with the Project will be considered during detailed design.
5.22 Special Flood Considerations	(1) The objectives of this clause are as follows—	
	(a) to enable the safe occupation and evacuation of people subject to flooding,	Section 4.5 Flood Emergency Management and Planning • Flood Emergency Response Plan to be developed prior to the commencement of construction, which will provide measures for safe occupation and efficient evacuation.

LEP Section	Planning Provision	Section Addressed in this Report/ How Addressed
	(b) to ensure development on land is compatible with the land's flood behaviour in the event of a flood,	Section 4 – Flood Modelling, Section 6.1.3 Flooding • Permanent infrastructure, except for roads, are to be raised above the flood planning level and therefore outside of the flood planning area.
	(c) to avoid adverse or cumulative impacts on flood behaviour,	Section 4 – Flood Modelling, Section 6.1.3 Flooding • The flooding impacts observed from the proposed infrastructure are considered negligible, as they do not extend beyond the Assessment Area and any impacts within the Assessment Area will be mitigated in detailed design. • As impacts are not observed beyond the Assessment Area, no cumulative flooding related impacts are predicted.
	(d) to protect the operational capacity of emergency response facilities and critical infrastructure during flood events,	Section 4.5 Flood Emergency Management and Planning • Flood Emergency Response Plan to be developed prior to the commencement of construction, which will cover this planning provision.
	(e) to avoid adverse effects of hazardous development on the environment during flood events.	Section 4 – Flood Modelling, Section 6.1.3 Flooding • The hazardous components of the Project (i.e., BESS and Substation) are to be raised above the flood planning level.
	(2) This clause applies to—	
	(a) for sensitive and hazardous development—land between the flood planning area and the probable maximum flood, and	Section 4.5 Flood Emergency Management and Planning • Flood Emergency Response Plan to be developed prior to the commencement of construction, which will provide measures for safe occupation and efficient evacuation.
	(b) for development that is not sensitive and hazardous development—land the consent authority considers to be land that, in the event of a flood, may— (i) cause a particular risk to life, and (ii) require the evacuation of people or other safety considerations.	
	(3) Development consent must not be granted to development on land to which this clause applies unless the consent authority has considered whether the development—	
	(a) will affect the safe occupation and efficient evacuation of people in the event of a flood, and	Section 4.5 Flood Emergency Management and Planning • Flood Emergency Response Plan to be developed prior to the commencement of construction, which will provide measures for safe occupation and efficient evacuation.
	(b) incorporates appropriate measures to manage risk to life in the event of a flood, and	
	(c) will adversely affect the environment in the event of a flood.	Section 4 – Flood Modelling, Section 6.1.3 Flooding • The flooding impacts observed from the proposed infrastructure are considered negligible, as they do not extend beyond the Assessment Area.

1.2.3 Other Guidelines

The *Large-scale Solar Energy Guideline* (DPIE, 2022) (Solar Energy Guideline) provides clear and consistent guidance on how to measure and assess key environmental impacts of large-scale solar energy projects in NSW, declared as SSD. While the Project is not a solar energy project,

the Solar Energy Guideline has been considered in the absence of any BESS specific guidelines being published by the Department of Planning, Housing and Infrastructure (DPHI). Key assessment issues covered by the Solar Energy Guideline include:

- Landscape and visual impacts.
- Agricultural land use.
- Infrastructure contributions, benefit sharing and agreements.
- Waste management and circular design.
- Decommissioning and rehabilitation.
- Glint and glare.

Several other assessment issues related to water resources are also identified in Section 5.7 of the Solar Energy Guideline for careful consideration. Table 1.4 lists the considerations relevant to this assessment and where each is addressed in this report.

TABLE 1.4: SOLAR ENERGY GUIDELINE REQUIREMENTS RELEVANT TO WATER RESOURCES

Issue	Assessment	Section addressed in this report
Water Management	Surface water-related impacts, such as flooding, discharge/run-off and erosion, must be assessed. Appropriate mitigation measures, such as sediment controls, must be proposed where warranted.	Section 6.1.3 - Flooding Section 6.3 – Erosion and Sedimentation Control Section 9 – Mitigation and Management Measures
	Applicants should consult with landholders regarding potential surface water related impacts of the project on neighbouring properties and any mitigation measures.	Section 6 – Surface Water Impact Assessment
	Any assessment of surface water-related impacts must be informed by a soil survey that considers the potential for erosion.	Refer to EIS Section 2.6 – Soil, Vegetation and Land Use
	If there is any water take associated with the project, the applicant should identify the source of water (both potable and non-potable) and may need to acquire water access licences if the project is approved.	Section 3.1.2 - Water Supply Section 2.8 -Water Regulatory Framework
Cumulative Impacts	Any cumulative impacts from any other developments (proposed, approved and operative), especially biodiversity, socio-economic and construction traffic impacts must be assessed in accordance with the department's Cumulative Impact Assessment Guidelines for State Significant Projects (July 2021, or its latest version).	Section 8 - Cumulative Impacts

1.3 Project Overview

The Applicant proposes to construct, operate, maintain and decommission the Canyonleigh BESS, an energy storage development located at 962 Canyonleigh Road, Brayton, New South Wales (NSW), that is comprised of two allotments (Lot 2341 DP 622834 and Lot 12 DP 727493). The Project is situated approximately 30 km northeast of Goulburn, within the Goulburn Mulwaree Local Government Area (LGA).

The BESS facility will have an estimated installed storage capacity of up to 300 Megawatts (MW) / 1,200 Megawatt hour (MWh). The Project will include electrical reticulation infrastructure, including an onsite substation, switching station and internal transmission and feeder lines as well as permanent associated and ancillary infrastructure and temporary construction facilities. Connection to the electricity grid is proposed via the existing Transgrid Marulan Substation, which sits at the junction of several 330kV and 132kV transmission lines.

The existing land uses surrounding the Project Area are predominantly agricultural and used for grazing native pastures and modified pastures. The Project Area is zoned RU2 – Rural Landscape under the Goulburn Mulwaree Local Environmental Plan 2009 (Goulburn LEP).

Table 1.5, Figure 1.1 and Figure 1.2 summarise the key indicative Project components and specifications.

TABLE 1.5: INDICATIVE PROJECT DESIGN – COMPONENTS AND SPECIFICATIONS

Item	Details
BESS	One large scale BESS with 300 MW / 1,200 MWh storage capacity. Located on Lot 2341 DP 622834 and Lot 12 DP 727493.
Electrical Reticulation Infrastructure	The Project will connect to the existing Transgrid 330 kV Marulan Substation located on Lot 2341 DP 622834. New proposed step-up substation will connect from 33 kV to 330 kV underground feeder/connection line, which leads to existing Marulan substation.
Access	The Project will be accessed via three site access points, located on Canyonleigh Road.
On-site Supporting Infrastructure	• Temporary construction and laydown area, • Permanent Operations & Maintenance (O&M) facility including, – A control room. – Storage facilities. – Supervisory Control and Data Acquisition (SCADA) facilities. – Car parking. – Basic office and associated amenities; and – Utilities and waste facilities. • New and/or upgraded internal access roads, • New and/or upgraded drainage system, and • Security fencing and lighting.
Off-site Supporting Infrastructure	• Waste and wastewater disposal facilities. • Existing public road and communications network. • External road upgrades: – Canyonleigh Road between the intersection with Brayton Road and the site access will be resurfaced where required and in consultation with Goulburn Mulwaree Council, – Brayton Road / Canyonleigh Road intersection will require a Basic Right Turn treatment to access Canyonleigh Road from Brayton Road, including a temporary hardstand and temporary signage relocation, – Installation of sealed hardstand and mountable kerb at the intersection of Botany Road / Bunnerong Road (Matraville, NSW) • Quarries for construction material (as required).

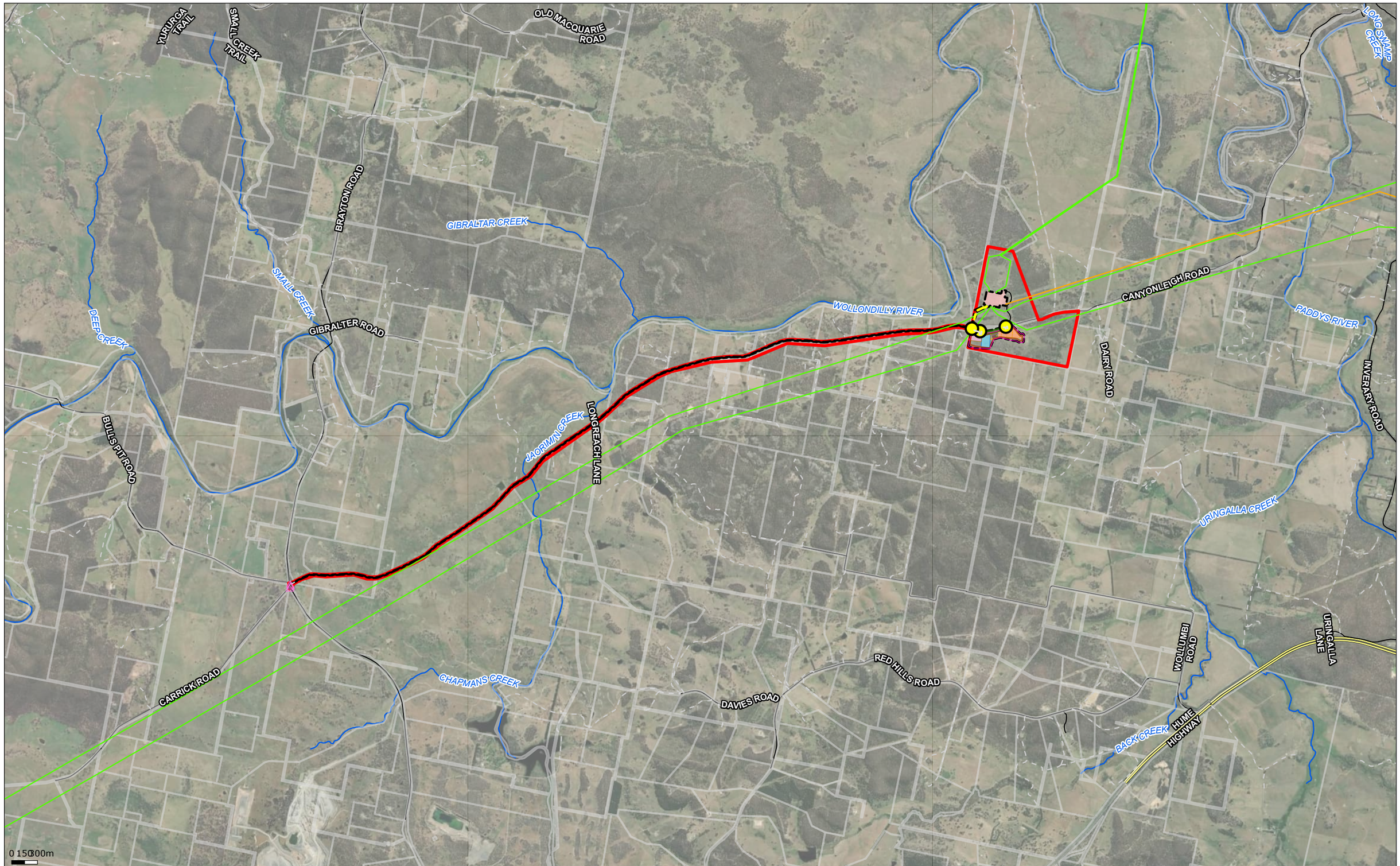
1.4 Project Terminology

Technical terminology used throughout the report are detailed and defined in Table 1.6.

TABLE 1.6: PROJECT TERMINOLOGY

Term	Definition
Project	A BESS as described in Section 1.3 to which the Application applies**.**
Project Area	Red boundary shown on key figures to which the Application applies (unless otherwise stipulated).
Development Footprint	The area of land that will be subject to alteration during the construction, operation and decommissioning of Project infrastructure.

Term	Definition
Assessment Area	The Project Area, excluding the external road upgrades (i.e., only the BESS works located on Lot 2341 DP 622834 and Lot 12 DP 727493)
Applicant	X-Elio Aus2 Pty Ltd.
Application	Application for Development Consent under Part 4.7 of the EP&A Act; and Determination under Part 9 of the EPBC Act.



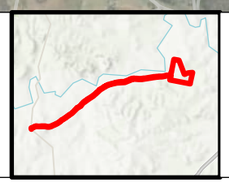
Legend

- Light/ power pole
- Traffic sign
- Traffic signal
- Access Roads - Earthworks
- Site Access
- Indicative 330kV Connection
- Fence
- Tree Protection Area

Transmission Lines (kV)

- 500kV
- 330kV
- 132kV
- 66kV

- Platform
- Water Tank
- Laydown Area
- BESS Battery Containers
- BESS Area
- O&M Control Building
- Parking Slots
- Storage Containers
- Substation
- Site Access
- Internal Roads
- Development Footprint
- Existing substation
- Project Area
- O&M Facility
- Cadastre
- Primary Road
- Road
- Track-Vehicular
- Major Watercourse
- Minor Watercourse



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Date: 16/12/2025

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Project Layout
Map 1 of 7

Canyonleigh BESS

X-Elio Aus2

ERM

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WOLLONDILLY RIVER

CANYONLEIGH ROAD

DAIRY ROAD

0 150 300m

Legend

- Light/ power pole
- Traffic sign
- Traffic signal
- Access Roads - Earthworks
- Site Access
- Indicative 330kV Connection
- Fence
- Tree Protection Area

Transmission Lines (kV)

- 500kV
- 330kV
- 132kV
- 66kV

- Platform
- Water Tank
- Laydown Area
- BESS Battery Containers
- BESS Area
- O&M Control Building
- Parking Slots
- Storage Containers
- Substation
- Site Access
- Internal Roads
- Development Footprint
- Existing substation
- Project Area
- O&M Facility
- Cadastre
- Primary Road
- Road
- Track-Vehicular
- Major Watercourse
- Minor Watercourse

Coordinate System:
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Project Layout
Map 2 of 7

Canyonleigh BESS

X-Elio Aus2

ERM

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WOLLONDILLY RIVER

CANYONLEIGH ROAD

0 150 300m

Legend

- Light/ power pole
- Traffic sign
- Traffic signal
- Access Roads - Earthworks
- Site Access
- Indicative 330kV Connection
- Fence
- Tree Protection Area

Transmission Lines (kV)

- 500kV
- 330kV
- 132kV
- 66kV
- Platform
- Water Tank
- Laydown Area
- BESS Battery Containers
- BESS Area
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- Site Access
- Internal Roads
- Development Footprint
- Existing substation
- Project Area
- O&M Facility
- Cadastre
- Primary Road
- Road
- Track-Vehicular
- Major Watercourse
- Minor Watercourse

Coordinate System:
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Project Layout
Map 3 of 7

Canyonleigh BESS

X-Elio Aus2

ERM

0711340_EIS_R3.aprx

GIBRALTAR CREEK

WOLLONDILLY RIVER

CANYONLEIGH ROAD

0 150 300m

Legend

- Light/ power pole
- Traffic sign
- Traffic signal
- Access Roads - Earthworks
- Site Access
- Indicative 330kV Connection
- Fence
- Tree Protection Area

Transmission Lines (kV)

- 500kV
- 330kV
- 132kV
- 66kV

- Platform
- Water Tank
- Laydown Area
- BESS Battery Containers
- BESS Area
- O&M Control Building
- Parking Slots
- Storage Containers
- Substation
- Site Access
- Internal Roads
- Development Footprint
- Existing substation
- Project Area
- O&M Facility
- Cadastre
- Primary Road
- Road
- Track-Vehicular
- Major Watercourse
- Minor Watercourse

Coordinate System:
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Project Layout
Map 4 of 7

Canyonleigh BESS

X-Elio Aus2

ERM

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BRAYTON ROAD
GIBRALTER ROAD
SMALL CREEK
GIBRALTAR CREEK
WOLLONDILLY RIVER
JAORWIN CREEK
LONGREACH LANE
CANYONLEIGH ROAD
0 150 300m

Legend

- Light/ power pole
- Traffic sign
- Traffic signal
- Access Roads - Earthworks
- Site Access
- Indicative 330kV Connection
- Fence
- Tree Protection Area

Transmission Lines (kV)

- 500kV
- 330kV
- 132kV
- 66kV
- Platform
- Water Tank
- Laydown Area
- BESS Battery Containers
- BESS Area
- O&M Control Building
- Parking Slots
- Storage Containers
- Substation
- Site Access
- Internal Roads
- Development Footprint
- Existing substation
- Project Area
- O&M Facility
- Cadastre
- Primary Road
- Road
- Track-Vehicular
- Major Watercourse
- Minor Watercourse

Coordinate System:
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Project Layout
Map 5 of 7

Canyonleigh BESS

X-Elio Aus2

ERM

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BULLSPIT ROAD
WOLLONDILLY RIVER
BRAYTON ROAD
LONGREACH LANE
CANYONLEIGH ROAD
CARRICK ROAD
CHAPMANS CREEK
JAORIMIN CREEK
0 150 300m

Legend

- Light/ power pole
- Traffic sign
- Traffic signal
- Access Roads - Earthworks
- Site Access
- Indicative 330kV Connection
- Fence
- Tree Protection Area

Transmission Lines (kV)

- 500kV
- 330kV
- 132kV
- 66kV

- Platform
- Water Tank
- Laydown Area
- BESS Battery Containers
- BESS Area
- O&M Control Building
- Parking Slots
- Storage Containers
- Substation
- Site Access
- Internal Roads
- Development Footprint
- Existing substation
- Project Area
- O&M Facility
- Cadastre
- Primary Road
- Road
- Track-Vehicular
- Major Watercourse
- Minor Watercourse

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Project Layout
Map 6 of 7

Canyonleigh BESS

X-Elio Aus2

ERM

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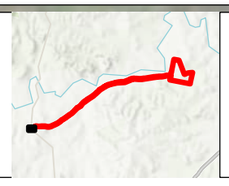
Legend

- Light/ power pole
- Traffic sign
- Traffic signal
- Access Roads - Earthworks
- Site Access
- Indicative 330kV Connection
- Fence
- Tree Protection Area

Transmission Lines (kV)

- 500kV
- 330kV
- 132kV
- 66kV

- Platform
- Water Tank
- Laydown Area
- BESS Battery Containers
- BESS Area
- O&M Control Building
- Parking Slots
- Storage Containers
- Substation
- Site Access
- Internal Roads
- Development Footprint
- Existing substation
- Project Area
- O&M Facility
- Cadastre
- Primary Road
- Road
- Track-Vehicular
- Major Watercourse
- Minor Watercourse



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Project Layout
Map 7 of 7

Canyonleigh BESS

X-Elio Aus2

ERM

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Legend
- Light/ power pole
- Traffic sign
- Traffic signal
- OSOM Enabling Works
- Closest Noise Sensitive Receiver

Sources
Basedata: NSW DCDB/DTDB
Site Boundary: Client Provided

Coordinate System:
GDA 1994 MGA Zone 55
Date: 31/10/2025
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Figure 1.2 Road Upgrades – Botany Road / Bunnerong Road Intersection

Canyonleigh BESS

X-Elio Aus2

ERM

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2. BASELINE CHARACTERISTICS

2.1 Climate

The town of Canyonleigh is situated around 45 km north-east of Goulburn and 125 km to the south-west of Sydney. The Project Area is located 10.5 km south-west from the town of Canyonleigh on Canyonleigh Road. Canyonleigh is located within the Southern Tablelands region of NSW and has a cool temperate climate. Rainfall occurs relatively steadily throughout the year, with minor seasonal fluctuations, with typically higher rainfall in the summer months.

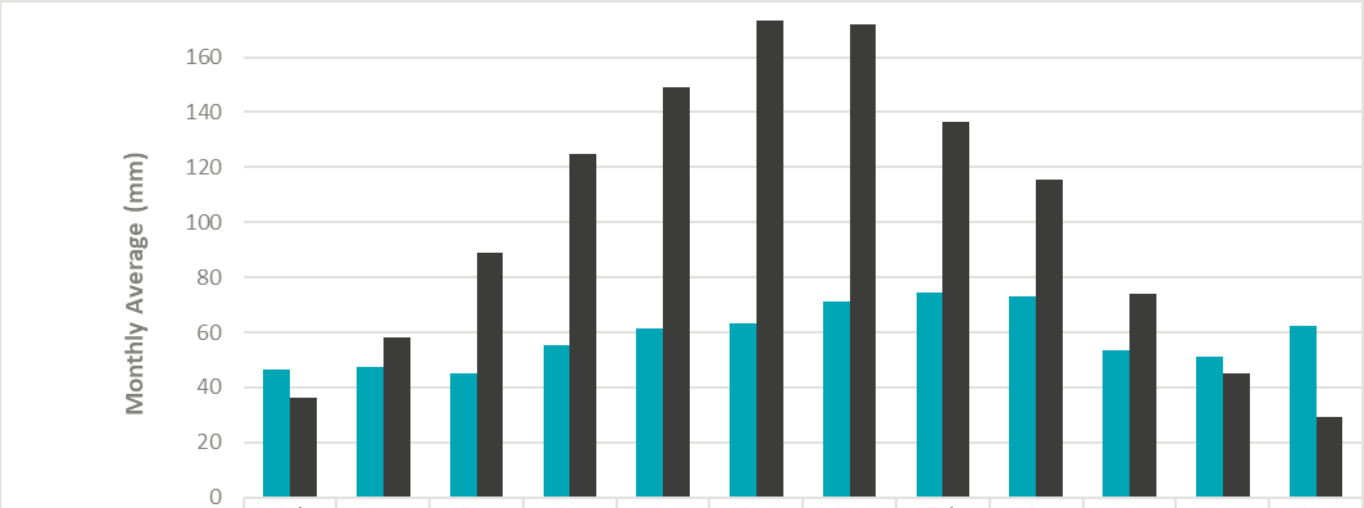
The local climate is generally dry with limited water pooling within dams, waterways, and low points during wet periods observed through Digital Earth Australia (DEA) Water Observation Landsat data (Geoscience Australia, 2023). The pooling that has been observed over the years, has largely occurred outside of the Assessment Area for the Project.

Four Bureau of Meteorology (BoM) operated stations recording rainfall with varying periods of record are located nearby the Project Area (refer to Table 2.1). In addition, a SILO (Synthetic Information for Landholders) data extraction (time series of daily data including observed and interpolated data from 1889 to present), from a point in the approximate centre of the Project Area (-34.60 latitude, 150.05 longitude), has been used to provide representative long-term rainfall and evaporation data. The SILO database interpolates raw rainfall and evaporation data from gauges managed by the BoM to provide spatially and temporarily complete datasets for site specific locations. There is minor variation in average monthly rainfall between the nearby rainfall stations and the SILO data, indicating that the SILO dataset is suitable to be used to represent long-term rainfall data. The SILO dataset indicates average annual rainfall in the Canyonleigh area is approximately 704 mm (January 1889 to December 2024).

Class A evaporation pan data was also obtained from the SILO database. The monthly average rainfall and pan evaporation within the Project Area are presented in Figure 2.1, indicating that monthly evaporation typically exceeds monthly rainfall. However, during May through to August, rainfall and evaporation are approximately equal, which is reflective of the seasonal variation.

TABLE 2.1: NEARBY WEATHER STATIONS AND SILO DATAPOINT

Station	Approximate Proximity to Project Area	Data Range
Big Hill (Glen Dusk) (70119)	7.7 km	1994 - 2025
Marulan (George St) (70063)	11.2 km	1894 - 2025
Moss Vale AWS (68239)	35.2 km	2001 - 2025
Goulburn Airport AWS (70330)	36.4 km	1988- 2025
SILO Datapoint (-34.60, 150.05)	Project Area	1889 - 2024



	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Average Monthly Rainfall (mm)	46.3	47.5	45.0	55.3	61.6	63.5	71.1	74.3	73.1	53.4	50.9	62.3
Average Monthly Evaporation (mm)	36.0	58.0	89.0	124.8	149.1	173.5	172.0	136.5	115.6	74.0	44.9	29.4

(Source: DESI, 2024)

FIGURE 2.1: SILO MONTHLY RAINFALL AND PAN EVAPORATION WITHIN THE PROJECT AREA (1889 – 2024)

2.2 Surface Water Context

2.2.1 Regional Systems

The Project is located within the upper portion of the Hawkesbury Nepean catchment, within the Wollondilly River catchment area, which also lies withing the Sydney Drinking Water catchment. The Wollondilly River flows to the north-east, passing approximately 0.25 km to the west of the Assessment Area and approximately 2 km to the north of the Assessment Area. The Assessment Area is located upstream of the confluence of Paddys River within the Wollondilly River. All flows from the Assessment Area drain via unnamed watercourses to the Wollondilly River.

Downstream of the confluence with Paddys River, the Wollondilly continues to flow in a north-eastly direction, forming the upper watercourse network of the Hawkesbury Nepean catchment, which is part of the Sydney drinking water catchment. The Wollondilly River flows through an elevation range of approximately 580 mAHD near the Assessment Area, moving through a varied landscape before flowing into Lake Burragorang at approximately 110 mAHD, around 60 km downstream of the Assessment Area.

An overview of the Project Area and its proximity to key regional drainage features is provided in Figure 2.2.

2.2.2 Local Systems

The Assessment Area surface elevations range from approximately 585 mAHD to 680 mAHD (refer to Figure 2.3).

The local drainage systems within and around the Assessment Area are moderately defined, shaped by gently sloping topography. The Assessment Area includes Canyonleigh Road, natural vegetation, farmland, and some existing electrical infrastructure. The relatively minor development in the region seems to have had minimal impact on the landform, with the topography largely reflecting natural landforms. Existing farm dams may influence the surrounding flow regimes by capturing runoff during flow events.

All mapped “defined” watercourses within the Assessment Area have been identified from the NSW Government Hydrography spatial dataset (State Government of NSW and Spatial Services (DCS) 2025, accessed from The Sharing and Enabling Environmental Data Portal (SEED)). There are minor Strahler classification watercourses that have been mapped within the Assessment Area.

The *Harvestable Rights (central inland-draining catchments) Order 2022* under the *Water Management Act 2000* defines a minor stream as:

(e) any stream or part of a stream:

(i) identified as a watercourse in the hydroline spatial data, and

(ii) that is a first or second order stream, or part of such a stream, determined in accordance with the Strahler system set out in Schedule 2 to the Water Management (General) Regulation 2018, and

(iii) that does not maintain a permanent flow of water, being a visible flow which occurs on a continuous basis, or which would so occur if there were no water extractions, diversions or obstructions of flows upstream, and

(f) any stream or part of a stream which is not identified as a watercourse in the hydroline spatial data.

There are fifteen mapped hydroline segments (each segment representing a reach to the next confluence) that intersect the Assessment Area. All mapped hydrolines within the Assessment Area are non-perennial streams and include:

- Eleven 1st order.
- Three 2nd order.
- One 3rd order (small section in the south-west corner of the Assessment Area).

Each of these streams are unnamed and flow into the Wollondilly River outside of the boundary of the Assessment Area (refer to Figure 2.3).

Characterisation of the local drainage catchments and flow paths within the Assessment Area was undertaken primarily using the NSW Government Hydrography hydroline dataset (SEED), with confirmation of local topography from the following Digital Elevation Model (DEM) source:

- 2 m DEM, derived from NSW Spatial Services LPI LiDAR data, flown 2018.

There are four small farm dams also mapped within the Assessment Area and identified in the NSW DPI hydroarea dataset and through assessment of aerial imagery. However, none of these dams are located within the Development Footprint (in the Assessment Area).

2.2.3 Waterfront Land

Waterfront land is defined as any river, lake or estuary, and the land within 40 m of the riverbanks, lake shore or estuary mean high-water mark (NRAR, 2020). Waterfront land exists for any watercourse or lake with a defined bed and bank and for any third order or above mapped hydroline. An assessment of waterfront land was undertaken using the NSW Government Hydrography spatial dataset (SEED) and the NSW Spatial Services DEM (2018).

The mapped hydrolines were assessed using the DEM to define partial or fully defined bed and bank as well as the Strahler stream order. The initial assessment of the Assessment Area indicated several watercourses associated with the natural drainage channels throughout the landscape as having potential waterfront land.

When reviewing potential waterfront land in accordance with the Natural Resources Access Regulator (NRAR) Waterfront Land Tool (pdf version) (NRAR, 2022) along the mapped hydrolines:

- Five 1st order and two 2nd order hydroline sections were assessed with having partially or fully defined bed and banks, indicating waterfront land.
- One small section (approximately 7.8 m) of 3rd order or above hydrolines (automatically classed as having waterfront land). Refer to the southwestern boundary of the Assessment Area on Figure 2.4.

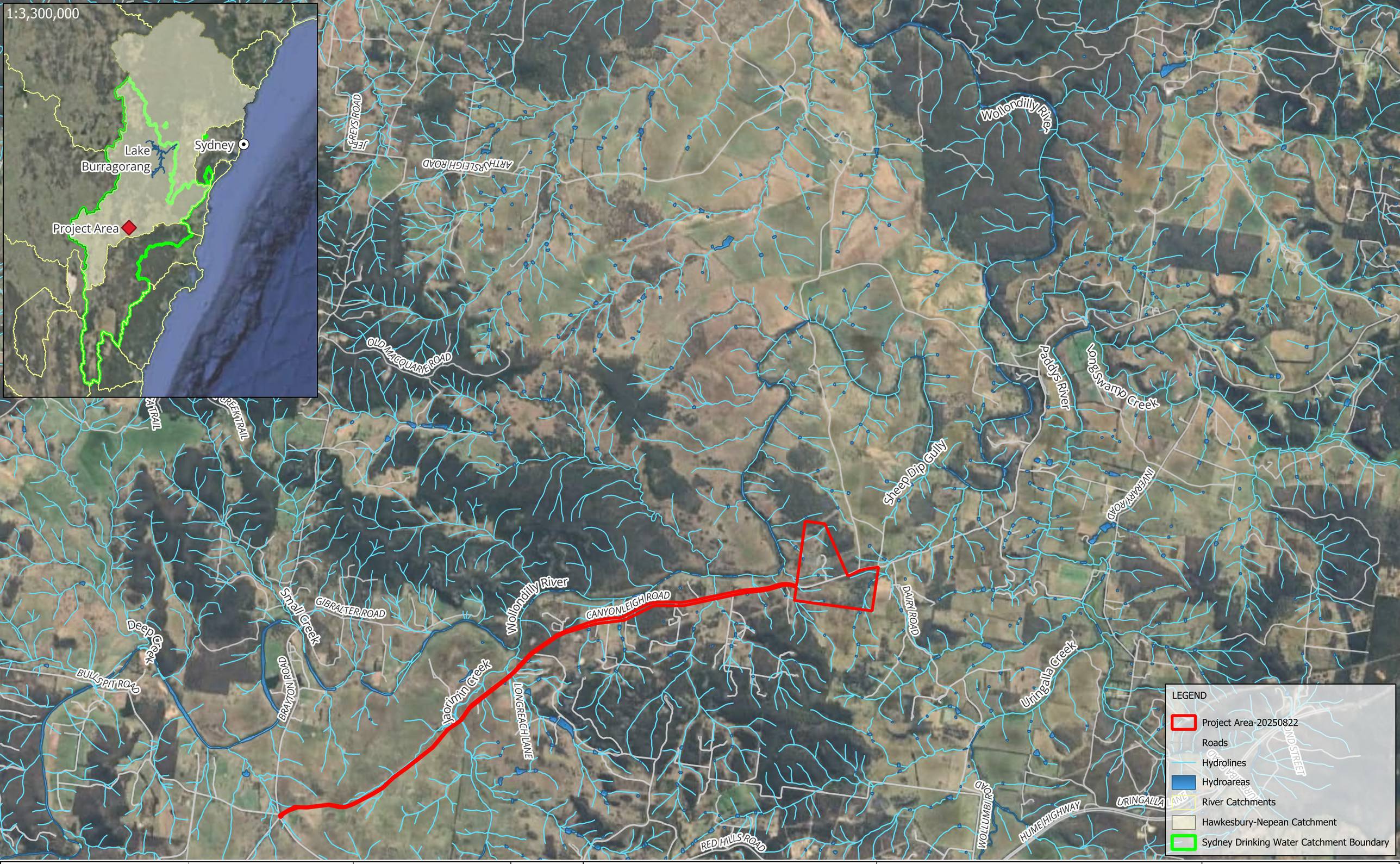
Figure 2.4 provides an overview of the waterfront land assessment and mapping.

The potential impacts of waterfront land on the proposed Project infrastructure are discussed in Section 6.1.2.

Although a Controlled Activity Approval will not be required for works within waterfront land as the Project is SSD, the Applicant proposes to undertake the development in accordance with:

- DPI Guidelines for Controlled Activities on Waterfront Land (2018); and (if necessary).
- Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI 2003).
- Policy & Guidelines for Fish Habitat Conservation & Management (DPI, 2013).

Additionally, a Construction Erosion and Sediment Control Plan (CESCP) will be developed post approval to manage and mitigate any potential impacts on waterfront lands.



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Scale in metres (1:50000 @ A3)

Map Projection: Universal Transverse Mercator (UTM)
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: GDA2020 / MGA zone 56

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Figure 2.2: Regional Drainage Overview

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Date: 27/8/2025

LEGEND

Roads

10m Contours

Strahler Classification Watercourse

1

2

3

Project Area

Waterbodies (Hydroarea)

Elevation (mAHD)

680

572

Sheep Dip Gully

Wollondilly River

Wollondilly River

CANYONLEIGH ROAD

CANYONLEIGH ROAD

DAIRY ROAD

DAIRY ROAD

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Map Projection: Tranverse Mercator
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Figure 2.3: Local Drainage and Elevation Overview

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LEGEND

- Project Area
- Development Footprint
- Area for O&M Building, Storage Containers, and Water Tank
- Access and Internal Roads
- Parking Slots
- BESS Substation
- BESS Area

Strahler Classification Watercourse

- 1
- 2
- 3
- Waterfront Land

Wollondilly River

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
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Figure 2.4: Waterfront Land Overview

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2.3 Flooding

2.3.1 Approach

An assessment of flooding regimes within the Assessment Area has been undertaken for both the existing and developed (i.e. with the Project) scenarios. The methodology is described in detail in Section 4, and includes:

- Review of available nearby flood studies.
- Simulation of design flood events for the 5%, 1%, 0.2% AEP and Probable Maximum Flood (PMF) for the near term (2030) climate horizon with the shared socioeconomic pathway (SSP) 2-4.5.
- Simulation of climate change sensitivity scenario for the 1% AEP, for the medium term (2050) climate forecast with SSP2-4.5.

2.3.2 Flood Behaviour

Detailed mapping of flood conditions including depth, velocity and hazard is provided in Appendix B for the existing conditions and Appendix C for the developed (i.e. with the Project) conditions. The existing flood behaviour is discussed in detail in Section 4.3 and impacts predicted to result from the Project are detailed in Section 6.1.3.

The adopted modelling approach and modelled flood behaviour are discussed in detail in Section 4. Figure 2.3 indicates that the local catchment reporting to the Assessment Area is typically confined to the Assessment Area boundary with small amounts of overland flow occurring through the Assessment Area. There are two semi-defined overland flow paths that interact with the Development Footprint of the Assessment Area (i.e., development excluding the external road upgrade area), with only one of these interacting directly with Project infrastructure.

2.4 Groundwater Context

The *Water Management Act 2000* protects groundwater quality where groundwater works and activities have the potential to degrade groundwater sources and dependent ecosystems. SSDs must address the *Aquifer Interference Policy 2012* where high risk activities requiring a water licence such as dewatering for construction could potentially impact water-dependent assets. However, if the landowner holds existing WALs, they have the lawful right to utilise local groundwater resources in accordance with the WAL and associated works approval conditions.

The Assessment Area and surrounds include areas mapped as having low and moderate potential terrestrial groundwater dependent ecosystems (GDEs) as determined from national studies (BoM, 2019). These are detailed in Section 2.4.1 and mapped in Figure 2.6 and Figure 2.7.

The Project exists within the Hawksbury River catchment, as such the Water Sharing Plan (WSP) for the *Greater Metropolitan Region Groundwater Sources 2023* under the Lachlan Fold Belt Greater Metropolitan Groundwater Source applies.

The Lachlan Fold Belt Greater Metropolitan Groundwater Source covers a broad area within the Hawksbury River region and is the remaining groundwater not identified as the Sydney Basin or sand beds and alluvium sources. This groundwater source lies at a substantial depth and is thus not likely to be highly connected to surface waters for planning purposes.

The nearest alluvial groundwater source is the Hawkesbury Alluvium Groundwater Source located over 110 km northeast of the Assessment Area, under the same WSP. Annual long-term extraction limits for the defined water sources in the aforementioned WSPs are listed in Table 2.2.

The Australian Groundwater Explorer spatial data mapping application for groundwater developed by the BoM (2024) indicates there are no groundwater bores within the Assessment Area. The nearest water supply groundwater bores are GW043366, located approximately 2 km south-east of the Assessment Area, and GW103130, located approximately 2.2 km south-west of the Assessment Area. The standing water level for these bores are 2.4 m and 12 m, respectively.

Table 2.2 provides the details of groundwater bores within the Lachlan Fold Belt Greater Metropolitan groundwater source and within a 5 km radius of the Assessment Area. Figure 2.5 provides an overview of the groundwater bores and groundwater source. These bores are primarily for water supply and irrigation, and one for stock and domestic purposes. The shallowest standing water level is 1.8 m for GW104238.

TABLE 2.2: GROUNDWATER BORE DETAILS

Bore ID	Kilometres from Assessment Area	Use	Drill Depth	Water Bearing Zones (WBZ)	Standing Water Level (m)	Geological Material at WBZ
GW105009	1.8	Stock and Domestic	84 m	40 - 42	7 m	Sandstone
GW109328	1.9	Irrigation	80 m	58 – 72 m	3 m	Claystone
GW043366	2.0	Water Supply	21.3 m	4.5 -4.6 m	2.4 m	Clay
GW103130	2.2	Water Supply	80 m	26 – 27 m	12 m	Granite
GW104238	3.2	Irrigation	68 m	38 – 38.5 m	1.8 m	Shale
GW106667	3.2	Water Supply	57 m	26 – 26.2 m	unknown	Basalt
GW108393	3.3	Irrigation	66 m	3 – 4 m	5.5 m	Clay
GW106236	3.3	Irrigation	43 m	16 – 17 m	9 m	Granite
GW106981	3.4	Irrigation	66 m	29 – 30 m	25 m	Slate
GW104736	3.5	Irrigation	49 m	14 – 15 m	4.6 m	Claystone
GW104877	3.6	Water Supply	31 m	21- 22 m	4 m	Shale
GW102259	3.6	Water Supply	43 m	22 – 23 m	24 m	Sandstone
GW108203	3.6	Water Supply	38 m	16 – 18 m	9 m	Sandstone
GW104824	3.7	Water Supply	36 m	22 – 24 m	15 m	Sandstone
GW104119	3.8	Water Supply	26 m	21 – 22 m	6.5 m	Sandstone
GW109003	3.9	Water Supply	43 m	Unknown	10 m	Unknown
GW109327	3.9	Unknown	66 m	20 – 21 m	1.45 m	Granite
GW104941	4.1	Water Supply	60 m	40 – 41 m	17 m	Siltstone
GW108197	4.2	Irrigation	103 m	9 – 10 m	6 m	Unknown

2.4.1 Groundwater Dependant Ecosystems

The BoM Groundwater Dependent Ecosystem (GDE) Atlas tool was used to gain a high-level understanding of the potential GDEs located at and surrounding the Assessment Area. Figure 2.6 and Figure 2.7 provide the mapped potential terrestrial and aquatic GDEs which surround the Assessment Area (BoM, 2022).

- ***Subterranean*** – There are none identified in the Assessment Area or surrounds.
- ***Terrestrial –*** There are low and moderate potential terrestrial GDEs mapped within the Assessment Area. These areas are identified as potential GDEs due to the presence of the following ecosystem types:
  - Tableland Grassy Box-Gum Woodland (low and moderate potential).
  - Tableland Hiss Grassy Woodland (low and moderate potential).
- ***Aquatic –*** There are no potential aquatic GDEs mapped within the Assessment Area. The nearest potential aquatic GDE is mapped as high potential and occurs approximately 190 m west of the Project, within the Wollondilly River.

Considering the variable groundwater depths identified in Section 2.4 and the distance of the Project from suitable monitoring locations, the potential GDEs identified within and surrounding the Assessment Area may be dependent on the regional groundwater table as well as local groundwater pockets recharged by rainfall and runoff.

2.4.2 Surface-Groundwater Interactions

Potential surface to groundwater interactions could occur through waterways and waterbodies that exist near the Assessment Area and throughout the surrounding landscape, including the perennial Wollondilly River.

Groundwater depths observed and reported in the preceding section, and the low-moderate probability for GDEs within the Assessment Area indicate a low-moderate likelihood of surface-groundwater interactions. Additionally, given the shallow standing groundwater level reported at nearby bores (shallowest at 1.8 m for GW104238) caution should be taken when undertaking surface activities which may interfere with potential groundwater sources in the area. Further, caution is also required when considering the variation in topography, soil types, and geology (discussed further in Sections 2.6.1 and 2.6.2) across the region combined with an absence of groundwater monitoring data near the Assessment Area.

LEGEND

- Roads
- Project Area
- Hydroarea
- Lachlan Fold Belt Greater Metropolitan Groundwater Source
- Groundwater Bores

Groundwater Bores (within 5 km of Project Area & within the relevant groundwater source)

- Irrigation
- Stock and Domestic
- Unknown
- Water Supply

Wollondilly River
Paddys River
Long Swamp Creek
Small Creek
Jaorimin Creek
Chapmans Creek
Back Creek
Uringalla Creek

GW106236
GW104941
GW106981
GW108203
GW104877
GW108197
GW106667
GW108755
GW104238
GW104119
GW109003
GW104736
GW103130
GW105009
GW109328
GW043366
GW104824
GW102259
GW109327

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Figure 2.5: Groundwater Bores

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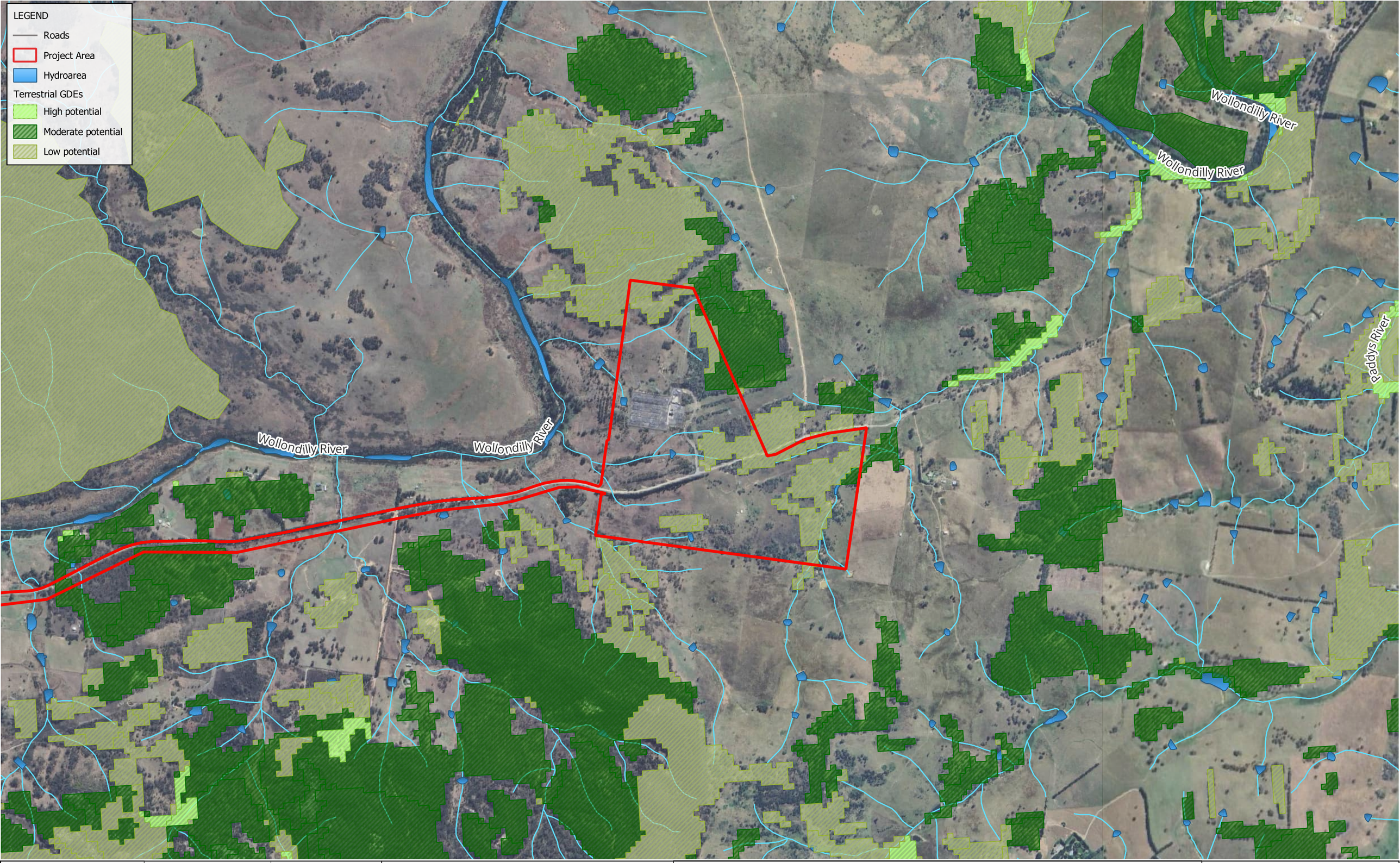

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Figure 2.6: Terrestrial GDEs

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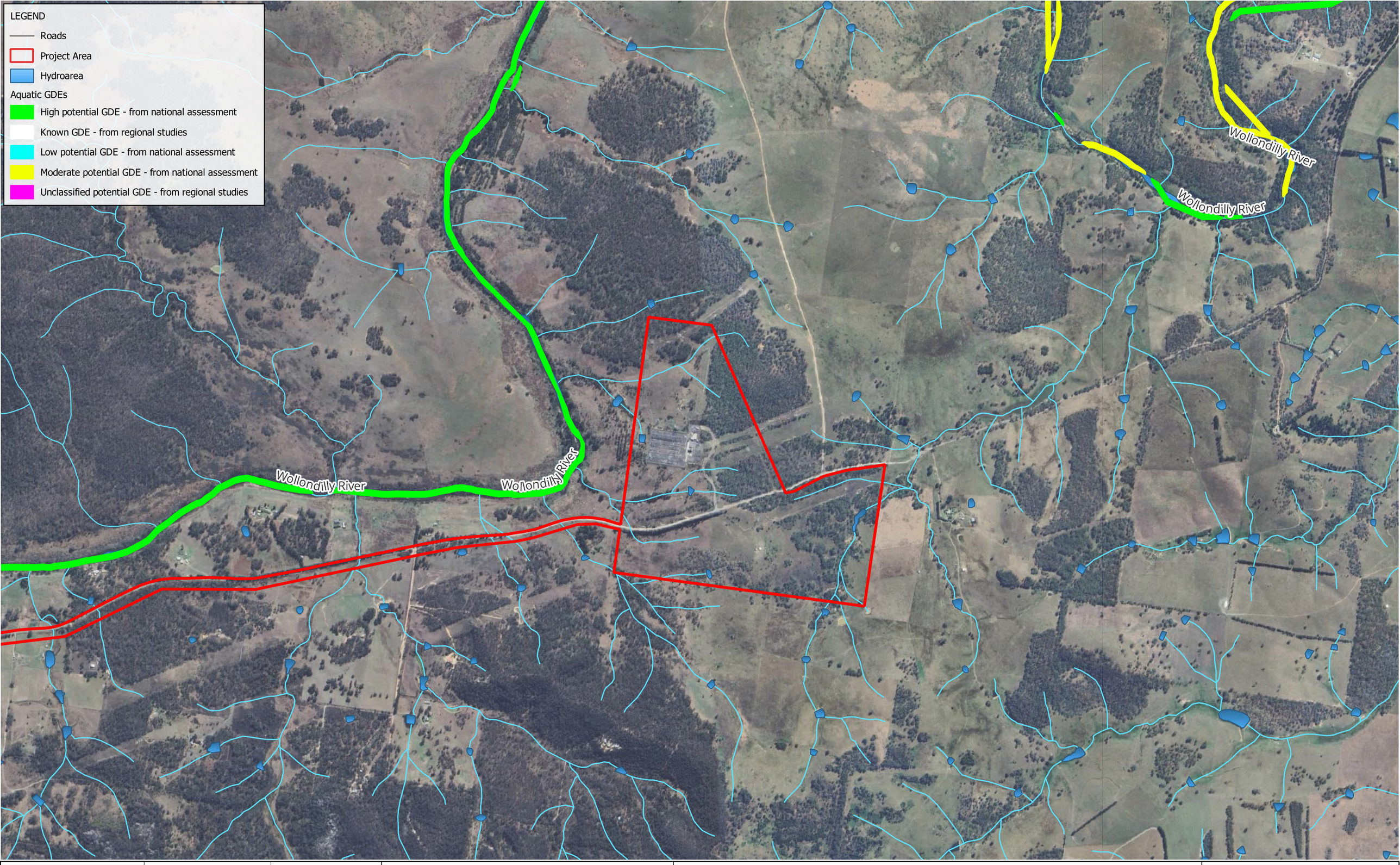

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Scale in metres (1:15,500 @ A3)

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Figure 2.7: Aquatic GDEs

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2.5 Water Quality and Flow Regimes

2.5.1 Water Quality and River Flow Objectives

The NSW Water Quality and River Flow Objectives (as published by the then Office of Environment and Heritage (OEH)) are the agreed environmental values and long-term goals for NSW surface waters (OEH, 2006). The objectives consist of the NSW Water Quality Objectives (WQOs) and the NSW River Flow Objectives (RFOs), which aim to achieve the right water quality for different land uses and improve environmental outcomes for the riverine system.

The Project Area exists within the Upper Hawkesbury- Nepean catchment which does not have published WQOs and RFOs. Non-specific water quality objectives that are to be applied for the Project are discussed further in Section 2.5.2.

2.5.2 Water Quality Objectives

2.5.2.1 Australian and New Zealand 2018 Guidelines

In lieu of specific catchment specific NSW WQOs, the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Governments and Australian state and territory governments, 2018) (ANZG, 2018) can be referenced to inform WQOs relevant to the Project. ANZG 2018 recommends the use of site-specific guideline values, however, in the absence of site-specific water quality data, Default Guideline Values (DGVs) can be applied. It is noted that ANZG 2018 still references the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000) guidelines for a range of water quality aspects including aquatic ecosystem physical and chemical stressors and primary industries (e.g. irrigation, livestock drinking supply). For the purpose of this WRIA, any references to ANZG DGVs shall be considered to include reference to ANZECC 2000 trigger values that are yet to be updated.

Based on the topography of the Project and surrounding catchment, the ANZG DGVs for Upland Rivers (i.e. > 150 mAHD) in south-east Australia provide suitable guidance on acceptable levels of key water quality indicators associated with the Project. Table 2.3 presents the physical and chemical stressors DGVs relevant to the Project.

TABLE 2.3: RELEVANT PHYSICAL AND CHEMICAL STRESSOR DEFAULT GUIDELINE VALUES – ANZECC (2000)

Water Quality Analyte	Guideline	Detail
Chlorophyll-a	<5.0 µg/L	In guidelines for lowland streams (there is no guideline value for upland streams)
pH	6.5 – 8.0 pH units	In guidelines for upland streams.
Dissolved Oxygen (DO)	90 - 110% Saturation	In guidelines for upland streams.
Turbidity	2-25.0 NTU	In guidelines for upland streams.
Ammonium (NH4)	<0.013 mg/L	In guidelines for upland streams.
Oxides of Nitrogen (Nox)	<0.015 mg/L	In guidelines for upland streams.
Total Nitrogen (TN)	<0.250 mg/L	In guidelines for upland streams.
Soluble Reactive Phosphorus (SRP)	<0.015 mg/L	In guidelines for upland streams.
Total Phosphorus (TP)	<0.02 mg/L	In guidelines for upland streams
Salinity (Electrical Conductivity)	0.03 - 0.35 mS/cm	In guidelines for upland streams

2.5.2.2 Managing Urban Stormwater: Soils and Construction Volume 1

Managing Urban Stormwater: Soils and Construction Volume 1 (the 'Blue Book') (Landcom, 2004), *Volume 2A Installation of services* (DECC, 2008) and *Volume 2C Unsealed roads* (DECC, 2008) provide guidance on acceptable practice in NSW to mitigate the impacts of land disturbance activities (involving changes in land uses from rural, open space or bushland settings to other forms) on soils, landforms and receiving waters by focussing on erosion and sediment control. The Blue Book indicates a typically accepted total suspended solids (TSS) concentrations in stormwater discharges during ground disturbance phase works of < 50 mg/L. Notwithstanding Blue Book guidance, an understanding of site-specific receiving water TSS should be established to ensure an appropriate discharge criteria is applied.

2.5.2.3 Neutral or Beneficial Effects on Water Quality Assessment (NorBE)

As the Project Area exists within the Sydney Drinking Water Catchment, Part 6.5 of *State Environmental Planning Policy* (Biodiversity & Conservation) 2021 applies.

This requires that new developments are not granted approval unless the development would have a Neutral or Beneficial Effect (NorBE) on water quality. The NorBE assessment for the Project has been undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC); Section 5 provides an overview of the MUSIC development and the outcomes of the NorBE assessment.

The MUSIC model development and associated NorBE assessment has been undertaken with reference to *Using MUSIC in Sydney's Drinking Water Catchment* (WaterNSW, 2023).

There are two measures of pollutant levels with respect to water quality that are relevant to NorBE - pollutant load and pollutant concentration. Loads are generally a more suitable measure for still waters whereas concentration is generally more suitable for moving water. Both measures must be considered in an acceptable NorBE analysis. Additionally, NorBE must be shown at all times particularly during wet weather. The criteria for meeting NorBE on water quality is detailed in Table 2.4.

TABLE 2.4: NORBE CRITERIA

Measure	Criteria
Pollutant Load	To ensure NorBE is achieved, the modelled pollutant loads for the developed case should aim to achieve 10% less than the pre-development case for: - Total Suspended Solids - Total Phosphorus - Total Nitrogen For gross pollutants, the modelled post-development load only needs to be equal to or less than pre-development load. *Note: This analysis is undertaken by comparing the mean annual pollutant loads of the existing and developed cases.*
Pollutant Concentration	To meet NorBE the concentration of pollutants for the post-development case should always be equal to or less than the concentration for the pre-development case. This is impractical for a risk-based approach and the natural variability of rainfall events. As a result, NorBE is met if the post-development case pollutant concentrations are equal to or less than the predevelopment case concentrations between the 50th and 98th frequency percentiles when runoff occurs. *Note: This can be demonstrated by comparing the cumulative frequency graphs of pollutant concentrations for the pre- and post-development cases.*

2.5.3 Background Regional Surface Water Quality

2.5.3.1 Water NSW – Sydney Drinking Water Audit

The Sydney Drinking Water Catchment Audit is a periodic and statutorily required (Section 42 of the *Water NSW Act 2014*) assessment of the state of the declared catchment about catchment health indicators including water quality, water availability, biodiversity and habitats, and land use and human settlements.

The latest audit was undertaken by Eco Logical Australia (2023) for the period of 2019 – 2022. The Project Area is within the Wollondilly Sub-catchment of this audit, as presented in Figure D.1 of Appendix D. There are five routine water quality monitoring stations in the Wollondilly sub-catchment: E409, E433, E450, E488 and E4112 (refer to Figure D.1). Of these monitoring stations, E433 is closest to the Project Area, approximately 12 km downstream, and saw no exceedances of ANZECC 2000 water quality guideline values for the audit monitoring rounds.

Overall monitoring shows water quality in the sub-catchment to be strongly influenced by the townships of Goulburn, Taralga, Marulan, Wingello and Bundanoon. The mid and lower reaches of the sub-catchment are characterised by bushland and agricultural land uses. Salt springs around Goulburn contribute salt loads to the Wollondilly River.

The key water quality findings of the 2019-2022 Wollondilly River Sub-Catchment audit, with respect with to ANZECC 2000 guideline values (as presented in Table 2.3) are summarised in Table 2.5. Where are monitoring station is note listed, samples remained within guideline range.

TABLE 2.5: SUMMARY OF 2019- 2023 AUDIT – WOLLONDILLY RIVER SUB-CATCHMENT

Method	Key Findings
Compliance During the Audit Period	All samples were outside guidelines for: • E409: – Electrical Conductivity – 2019-20 – Oxidised nitrogen – 2021-22 – Total nitrogen – 2019-22 – Total phosphorus – 2021-22 • E450: – Oxidised nitrogen 2021-22 – Total nitrogen 2020-22 – Total phosphorus 2021-22 • E488: – Electrical Conductivity 2019-20 – Total nitrogen 2020-22
Ten-Year Statistical Trend	Long term statistical trend analysis by WaterNSW for the period 2011-2021 found that chlorophyll-a levels at site E450 were more frequently outside ANZECC benchmarks in recent years (i.e., worsening).
Comparison Of Audit Period to Pre-Audit Period	Analytes with median values outside guidelines during the audit period and in the preceding years, that were the same or worse during the audit period were as follows: • E409: – Dissolved oxygen – Ammoniacal nitrogen – Total nitrogen • E450 and E488: – Total nitrogen

2.5.4 Other Factors Influencing Water Quality

2.5.4.1 NSW River Styles Framework

The River Styles Framework (Macquarie University, 2025) is an approach to geomorphologically inform river management. It guides the description of river morphology, interpretation of behaviour, assessment of condition, prediction of river recovery potential and prioritisation of river management. NSW River Styles mapping is used to identify rare and threatened river forms across the state.

No watercourses have been classified according to the NSW River Styles Framework, within the Assessment Area. However, watercourses adjacent to the Assessment Area (i.e. the Wollondilly River and unnamed tributaries) are characterised by 'moderate' geomorphic conditions and the classifications are summarised in Table 2.6. This suggests existing disturbance within the watercourses, which may contribute to lower water quality and ecological function.

TABLE 2.6: NSW RIVER STYLES CLASSIFICAITON

Watercourse	River Style	Geomorphic Stream Condition	Potential To Recover from Its Current Condition	Priority for River Management
Wollondilly River	Partly confined, bedrock margin-controlled, discontinuous floodplain, fine-grained bed	Moderate	Moderate recovery potential	Strategic - Type 3, Moderate condition and linking or threatening conservation or high recovery reaches
Tributaries adjacent to Project (one to south-west and one to east)	Laterally unconfined, discontinuous channel, valley fill, fine-grained	Moderate	Moderate recovery potential	Medium priority rehabilitation

2.5.4.2 The River Condition Index (RCI)

The NSW River Condition Index (RCI) is the primary long term reporting tool for assessing riverine condition. It is used to combine a range of indicators into a single condition score. The indicators include riparian vegetation, geomorphic condition, hydrologic stress, biodiversity, catchment disturbance and water quality.

The RCI was developed using the Framework for the Assessment of River and Wetland Health (FARWH) approach, which is an accepted Australian wide approach. The FARWH method uses existing data collection activities across Australia and converts them into a standardised and nationally comparable representation of river health.

Under the RCI, the Project is located in the Hawkesbury-Nepean catchment with an overall RCI classification of 'very poor'. The sub catchment covering the Assessment Area has a Water Quality Sub Index classification of 'moderate'.

2.6 Soils, Vegetation and Land Use

2.6.1 Soils

Soil landscapes, soil type mapping and acid sulphate soils mapping were sourced from SEED.

The Assessment Area primarily contains the Marulan (mly) soil landscape type, with areas of Jaqua (jqz) soil landscape. The existing Marulan substation and its surrounds are classified as Disturbed Terrain (xxz); these landscapes are all characterised as being heavily cleared, with limited land capabilities, widespread sheet erosion and localised gully erosion (DPIE, 2025).

The primary Australian Soil Classification (ASC) soil type identified within the Assessment Area were Sodosols (refer to Figure 2.8). Kurosols (natic) are also mapped to the southwestern and southeastern sides of the Assessment Area. Kurosols and sodosols are generally susceptible to erosion and waterlogging, with poor drainage and typically sodic A and/or B horizons. It is noted that in the area of the existing Marulan substation is located, and its immediate surrounds, are mapped as not assessed for ASC. Given the surrounding soil type, it is reasonable to assume continuity of Sodosols in this area.

There are no mapped acid sulphate soils in the Assessment Area or surrounds. Given the elevation of the Assessment Area (>585 mAHD) and the distance from the coast (>72 km) acid sulphate soils are not expected for the area.

2.6.2 Vegetation

Aerial imagery sourced from Google Maps and NSW Six Maps were reviewed to infer typical vegetation types within the Assessment Area. The aerial imagery indicates grassland with minimal trees dominates the Assessment Area and immediate downstream extents. Pockets of dense vegetation (i.e. trees) are also observed; however, these areas remain outside of the Development Footprint.

The mapped GDEs within the Assessment Area, and surrounds, are summarised in Section 2.4.1.

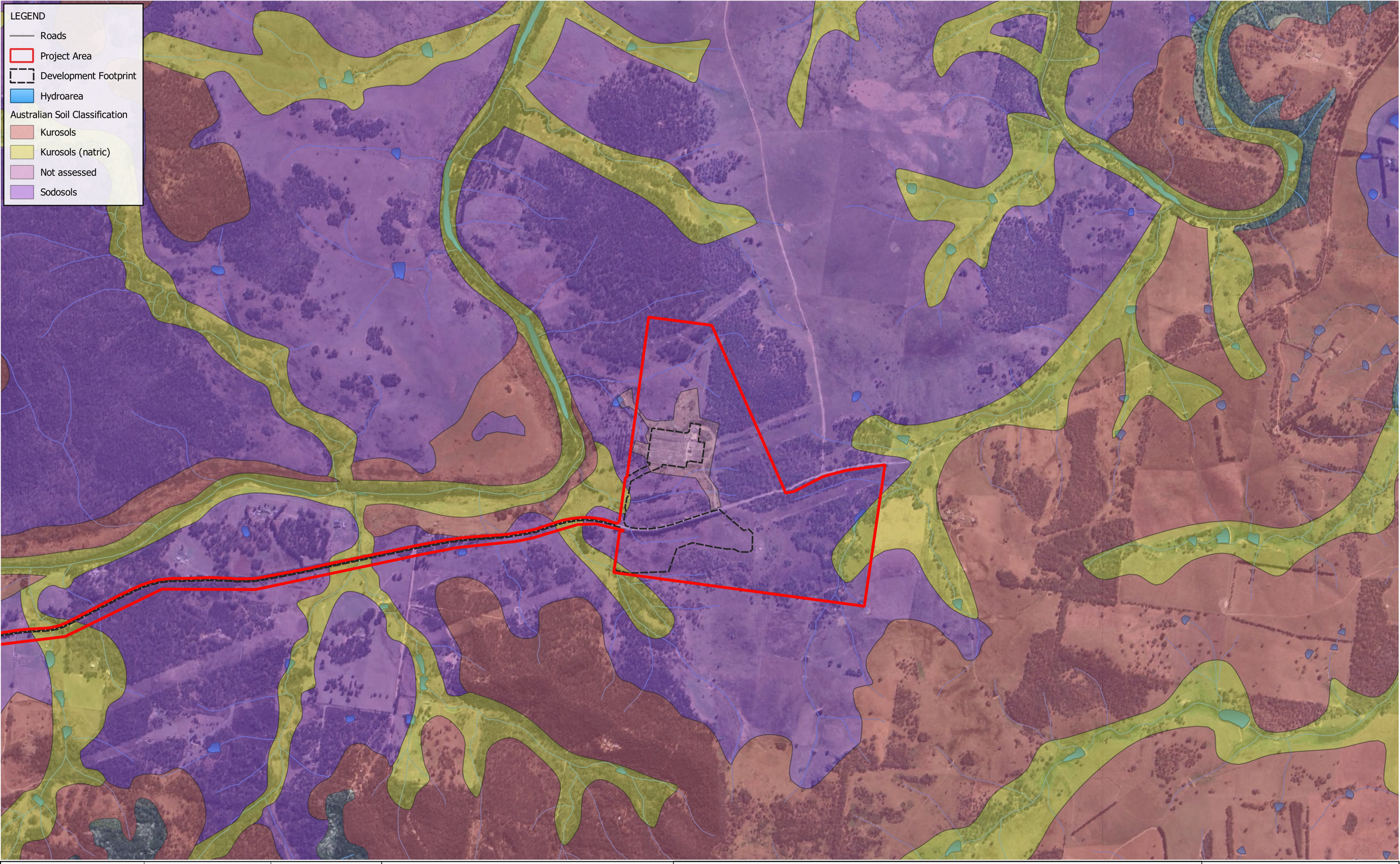
2.6.3 Land Use

The Hawksbury-Nepean catchment predominately supports agricultural activities (e.g. grazing, forestry and horticulture).

Land uses within and immediately surrounding the Assessment Area are largely grazing and native vegetation. Land use mapping (DCCEEW, 2017) shows the following within the Assessment Area, grazing native vegetation, grazing modified pastures, transport and communication, and electricity substations and transmission (existing Marulan substation area).

The Assessment Area, and immediate surrounds, are zoned as rural landscape (RU2). Areas zoned for primary production (RU1) are located approximately 4.5 km to the southwest and approximately 3.5 km to the northeast of the Assessment Area. An environmental management (C3) area is also located approximately 3 km to the Assessment Areas south.

The nearest National Parks and Wildlife Service owned land is located approximately 11 km north of the Project at Kerrawary Nature Reserve, which borders the Wollondilly River (DCCEEW, 2000).



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380 0 380 m

Scale in metres (1:15,500 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Figure 2.8: Australian Soil Classification

Canyonleigh BESS
Water Resources Impact Assessment

Engeny does not give any warranty nor accept any liability in relation to the completeness or accuracy of the maps, which may be inherently reliant upon the completeness and accuracy of the input data and the agreed scope of works.

Job Number: BNTL00206
Revision: 0
Drawn: GC
Checked: SS
Date: 6 /11 /2025

2.7 Published Studies

The Project Area is located within the upper portion of the Hawkesbury Nepean catchment, within the Wollondilly River catchment area. This catchment also overlaps with the Sydney Drinking Water catchment (refer to Figure 2.2). The Project Area is located within the Goulburn-Mulwaree Council Local Government Area (LGA); and is on the boundary of the Upper Lachlan Shire Council LGA. The Project Area is not covered by any existing flood studies undertaken by council.

Published studies in the area are summarised in Table 2.7.

TABLE 2.7: PUBLISHED STUDIES

Relevant LGA	Source	Dataset(s)	Applicability
Goulburn-Mulwaree	*Goulburn Mulwaree Local Environmental Plan 2009*	No maps available for this LEP.	The Project Area falls within this plan's jurisdiction.
Goulburn-Mulwaree	*Goulburn Mulwaree Development Control Plan 2009*	Section 3.8 – Flood affected lands	Defines the flood planning area and flood planning level.
Goulburn-Mulwaree	*Goulburn Floodplain Risk Management Study and Plan*	Flood Modelling for Goulburn and surrounding areas.	No interaction with Project Area
Goulburn-Mulwaree	*Wollondilly and Mulwaree Rivers Flood Study*	Flood Modelling for the Wollondilly and Mulwaree Rivers (upstream of Project).	No interaction with Project Area
Goulburn-Mulwaree	*Marulan Flood Study*	Flood Modelling for the town of Marulan and surrounding areas	No interaction with Project Area
Goulburn-Mulwaree	*Marulan Floodplain Risk Management Study and Plan*	Flood Modelling for the town of Marulan and surrounding areas	No interaction with Project Area
Upper Lachlan Shire	*Lachlan River (Condobolin) Floodplain Risk Management Study and Plan*	Flood Modelling for the Lachlan River, at Condobolin and surrounding areas	No interaction with Project Area
Upper Lachlan Shire	*The Villages of Crookwell, Gunning, Collector and Taralga Floodplain Risk Management Study and Plan*	Flood Modelling for Gunning, Crookwell, Taralga, and Collector, in the Upper Lachlan Shire Council	No interaction with Project Area

2.8 Water Regulatory Framework

2.8.1 Water Sharing Plans

Water Sharing Plans (WSPs) are established under the *Water Management Act 2000* and are the primary legislative tool for water access and sharing in NSW. WSPs apply to water sources in the plan area and set the rules for how water is shared and allocated.

The key purpose of a WSP is to:

- Provide water users with an understanding of when and how water will be available for extraction.
- Protect the fundamental environmental health of the water source.
- Ensure the water source is sustainable in the long-term.

The WSPs applicable to the Project Area are summarised in Table 2.8.

TABLE 2.8: APPLICABLE WATER SHARING PLAN AREAS

Area / Zone	Plan
Surface Water Sharing Plan	*Greater Metropolitan Region Unregulated River Water Sources 2023*
Surface Water Source	Lower Wollondilly River Water Source
Groundwater Sharing Plan	*Greater Metropolitan Region Groundwater Sources 2023*
Groundwater Source	Lachlan Fold Belt Greater Metropolitan Groundwater Source

Annual long-term extraction limits for the defined water sources are listed within the preceding WSPs. Extraction is not compliant if within the assessment period, being the average annual extraction over 5 years, extraction is more than 105% of the extraction limit. This compliance trigger determines if the aquifer access licences for the following water year reduces the total extractable amount of water to return the subsequent total water extraction to the extraction limit. WALs are further discussed in Section 2.8.3.2.1.

2.8.2 Existing Local Water Sources

It is understood that there are no surface water WALs or works approvals associated with the Project Area. However, one harvestable rights dam exists within the Project Area and may support the existing land use activities. There are no groundwater bores within the Project Area (refer to Section 2.4).

Project water sourcing options are further discussed in Section 3.1.2.

2.8.3 NSW Water Licensing and Approvals

The NSW state government controls the use and flow of all water in rivers, lakes, and aquifers. Some landholders can take water without a license, under basic land holder rights provisions (refer to Section 2.8.3.1). You may need a water access licence or a water supply work and/or water use approval to take water from a river, lake or aquifer (refer to Section 2.8.3.2). Approvals can also be required for flood works that are likely to have an effect on the flow of water (refer to Section 2.8.3.3), and works within waterfront land (refer to Section 2.8.3.4).

The *Water Management Act 2000* applies to all regions where there is a WSP in operation.

The following sections discuss:

- Basic landholder rights, including the maximum harvestable right for the Applicant and associated land holdings.
- Water Access Licences, Water Use Approvals, and Water Supply Works, including those currently held by the Applicant and associated land holdings.
- Requirements for Flood Works and Controlled Activity Approvals, including what applies to the Project.

2.8.3.1 Basic Landholder Rights

There are three types of basic landholder rights (BLR) in NSW (*Water Management Act 2000*):

- Domestic and stock rights – allows take and use of water for domestic consumption and non-intensive stock watering without the need for a water access licence (WAL) or water use approval. A water supply work approval (i.e. for a bore or dam, etc) is required.
- Harvestable rights – allows landholders to capture and store a proportion of the rainfall runoff from their landholding in one or more harvestable rights dams, without requiring a WAL, water use approval or water supply work approval.
- Native title rights- allows take and use of water in the exercise of native title rights (under the *Commonwealth Native Title Act 1993*), without requiring a WAL, water use approval or water supply work approval (unless the work is a dam or bore).

2.8.3.1.1 Harvestable Rights

Harvestable Rights provisions for the capture and reuse of surface water runoff generated within a property, is subject to the following rules:

(1) The maximum harvestable rights dam capacity (MHRDC) must be estimated based on landholdings (owned and leased) that are contiguous (generally omits public roads and easements).

(2) Harvestable rights cannot be transferred between water sources – i.e. water captured within a water source must be covered by a harvestable right in that source.

(3) Water captured from higher order (3rd order and above) watercourses and above, or within 40 m of a 3rd order watercourse (measured perpendicular from the top of bank), or on any floodplain, or on or within 3 km upstream of any Ramsar wetland, must be covered by a WAL, regardless of the Harvestable Right, unless an exemption from licensing applies under the WM Act and *Water Management (General) Regulation (2018)*.

Harvestable rights dams do not require a WAL, water use approval or water supply work approval. However, if a harvestable rights dam also stores and/or captures water taken under another right or licence this dam is known as a Mixed-rights dam. Mixed-rights dams may require a WAL and water supply work approval prior to construction.

2.8.3.1.2 Maximum Capacity of Harvestable Rights Dams – Method of Calculation

WaterNSW provides a tool to estimate harvestable rights, based on location and property area of the contiguous landholding [1]. This method uses a simple average annual unit runoff rate. The volume of water a landholder can capture and store under harvestable rights is expressed as a maximum harvestable right dam capacity (MHRDC) for a landholding. The combined volume of all dams (or parts thereof) that capture and store harvestable rights water cannot exceed the MHRDC.

There are three different harvestable rights orders applying to three different regions in NSW. These are:

- Coastal-draining catchments.
- Central inland-draining catchments.
- Western division order.

The Project lies within a coastal draining catchment and to calculate the maximum capacity of harvestable rights on a landholding the method outlined in Schedule 1 of the Harvestable Rights (coastal-draining catchments) Order 2023 dated 27 September 2023 should be used. This method is summarised, as follows:

(1) Identify the location of the landholding area.

(2) Identify the total size of the landholding in hectares (being only that part within the harvestable rights area).

(3) Calculate the capacity for a harvestable rights dam or dams which represents up to 10% of the average annual regional rainfall runoff on the landholding – multiply (1) by the harvestable rights multiplier (Type 1).

[1] www.waternsw.com.au/customer-service/water-licensing/blr/harvestable-rights-dams/maximum-harvestable-right-calculator

The MHDRC for the Project landholding is determined as follows:

- 130.60 ha of contiguous landholdings (by associated landowners) and an average regional runoff of 0.07 ML/ha/year.
- MHRDC is **10.45 ML**. (Source: https://www.waternsw.com.au/customer-services/water-licensing/maximum-harvestable-rights-calculator).

2.8.3.2 Water Access Licences, Water Use Approvals, and Water Supply Works

2.8.3.2.1 Water Access Licence (WALs)

In WSP areas, a WAL authorises the holder of the WAL to take water from a water source.

There are a number of exemptions for WALs specified in the *Water Management (General) Regulation 2018*. Exemption categories include landholders, public authorities, and general exemptions.

The Applicant currently holds no WALs.

A summary of the WALs issued for the water sources in which the Project lies is included in Table 2.9 and Table 2.10.

TABLE 2.9: LOWER WOLLONGILLY RIVER WATER SOURCE – TOTAL WALS 2024/2025

Access Licence Category	No. of WAL(s)	Total Share Component	Cumulative AWD
Domestic and stock	4	23	1
Domestic and stock [domestic]	2	2	1
Domestic and stock [stock]	1	5	1
Domestic and stock [town water supply]	2	269	1
Unregulated river	78	5111	1

TABLE 2.10: LACHLAN FOLD BELT GREATER METROPOLITAN GROUNDWATER SOURCE – TOTAL WALS 2024/2025

Access Licence Category	No. of WAL(s)	Total Share Component	Cumulative AWD
Aquifer	175	8023.5	1
Aquifer [town water supply]	2	100	1

2.8.3.2.2 Water Supply Work and/or Use Approvals

Water supply work and/or water use approvals allow you to use water from a river, lake, or groundwater source, and to construct infrastructure to do this.

A water supply work approval allows construction and use of works to take water (e.g. pumps, bores, dams, dewatering, etc).

A water supply use approval allows use of water for a particular purpose (e.g. irrigation, power generation, mining, etc).

A water use approval allows you to use water on your land. Examples of water uses that require approval are irrigation, town water supply, power generation and mining.

There is no surface water supply work or use approvals applicable to the Project Area.

2.8.3.3 Flood Works Approval

Flood work approvals allow you to construct and use a work that is situated in or near a river, estuary or lake, or within a floodplain, and is likely to have an effect on the flow of water to or from a river, estuary or lake, or the distribution or flow of floodwater.

WaterNSW issues flood work approvals for private rural landholders and rural industries, whereas NSW Government DPIE Water issues flood work approvals for government agencies, including Councils.

Major projects which are SSD or state significant infrastructure are exempt from flood work approvals.

2.8.3.4 Controlled Activity Approval

Controlled activities refer to work or action done on waterfront land, as defined by the *Water Management Act 2000*. These activities must be designed and implemented in a way to protect our waterways and ensure minimal harm as a result of the work carried out on the land, and include:

- Waterfront land includes the bed of rivers, lakes, or estuaries, as well as land on each side within 40 metres of a riverbank.
- That is within 40 m of the high bank of all watercourses with defined bed and banks as well as ≥ 3rd order NSW Hydrography spatial dataset (SEED) mapped hydrolines.

Controlled activities may include:

- Erecting a building.
- Carrying out works: including the construction of bridges, roads, control measures, sea walls, and more.
- Removing material from waterfront land: including plants, rocks, sand, gravel and more.
- Depositing material on waterfront land: including gravel or fill.
- Any activity which affects the quantity or flow of water in a water source.

Although SSD projects are exempt from requiring Controlled Activity Approvals, where the Project involves a controlled activity, assessment and design will be in accordance with:

- *DPI Guidelines for Controlled Activities on Waterfront Land (2018); and (if necessary)*
- *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI 2003); and*
- *Policy & Guidelines for Fish Habitat Conservation & Management (DPI, 2013).*

3. PROPOSED WATER MANAGEMENT

3.1 Water Balance

Water supply will be required during both construction and operation of the Project, including for:

- Dust suppression.
- Road construction and compaction.
- Vehicle equipment washdown.
- Potable water for site amenities.

3.1.1 Water Demands

Water demand will vary, depending on the stages of construction. The total water demand during construction, presented in Table 3.1, has been estimated based on the current Project layout, as described in Section 1.3. Post-construction water demands will be negligible, primarily consisting of occasional cleaning and potable water demands. A detailed breakdown of the assumptions adopted in the water demand estimation is included in Appendix A.

TABLE 3.1: SITE WATER DEMANDS SUMMARY

Demand	Total Demand (ML)
Consumption (Potable)[1]	2.3
Dust Suppression	0.7
Road Construction / Compaction	1.3
Compound Hardstands	1.9
Vehicle and Equipment Washdown	4.7
Total Construction Demand	**11.0**

[1] Conservatively based on the peak workforce for the full construction period.

The construction water demands are based on the workforce breakdown available at the time of this assessment, which includes a peak workforce of up to approximately 100 full time equivalent (FTE) employees during installation of the BESS. During operation, it is assumed that approximately 5 FTE employees will be required.

The peak raw (non-potable) demand is expected to occur during site set up, due to road construction and compaction. The peak potable water demand is also expected to occur during installation when workforce is at approximately 100 FTE. This results in the following maximum demand rates:

- Maximum daily non-potable construction demand = 18.43 kL/day.
- Maximum daily potable construction demand = 5.00 kL/d.
- Maximum daily operational demand = 0.30 kL/d (potable water for employees only).

The demand volumes and rates presented are estimates based on the information available at the time of this assessment and will be confirmed during detailed design.

3.1.2 Water Supply

The Applicant proposes to purchase water tanks and truck in water to support the construction demands and does not anticipate the need to use existing water sources from within the Project Area. It is understood that a water tank will be maintained on site to capture rainwater for site amenities. Where possible during construction, water will be reused. It is assumed that this will likely be possible for equipment washdown and/ or dust suppression demands.

The Applicant has negotiated with surrounding Councils (Goulbourn Mulwaree and Yass Valley) for potable and non-potable water supply. Goulbourn Mulwaree Council has confirmed that non-potable water may be taken (when available) from existing standpipes at Marulan (175 Brayton Road, out the front of the Marulan water treatment plant) and at Goulburn (corner of River St and Wheeo Rd, across the road from the Goulburn WTP). Yass Valley Council have also confirmed they can service the water supply (potable and non-potable), if required.

Although not anticipated, if the detailed design stage of the Project identifies that additional water may be required to fulfill construction and operation demands, this may be sourced from:

- Reuse water from sediment basins (which may be used during the construction phase to prevent contamination of downstream watercourses). It is important to note that the ability to make use of this water supply will be dependent on available infrastructure (dams) and rainfall.
- Agreements with landholders to source some of the non-potable construction and operation water demands from farm dams (refer to Section 2.8.3.1).
- Agreements with landholders to access water via WALs held by the landholder. The Applicant may enter agreements with landholders that hold existing water access licences (WALs) to source surface or groundwater using the WAL and existing approved water supply work. The following would need to be considered:
  - The type of WAL held by the landholder (e.g., WALs for stock and domestic purposes would not be able to be used).
  - The WAL entitlement (i.e. how much water can be accessed under the WAL).
  - Water security considerations associated with the different types of WALs (e.g., the availability of groundwater would be more consistent than surface water during periods of low rainfall).
  - It is understood that no WALs currently exist within the Project Area.
- Purchasing WALs and entering landholder agreements to apply for approval, construct and register the associated Work Approval(s) required to enable take of water.

3.1.3 Wastewater Management

During construction, wastewater from the site office and temporary construction facilities will be collected and managed through an on-site treatment system. To prevent interaction with natural surface and groundwater systems, the treated wastewater will be contained in tanks on site.

Waste solids generated by the treatment system will be handled by a licensed contractor, who will transport and dispose of at an appropriately licensed facility.

The specifics of the on-site wastewater management system, including its design and capacity, will be determined in the detailed design phase, and should consider best practice guidelines and standards.

Once construction is complete, all temporary wastewater management infrastructure will be decommissioned and removed from the Project Area for rehabilitation.

4. FLOOD MODELLING

4.1 Assessment Methodology

A flood model was developed to model flood behaviour in and around the Assessment Area. The methodology used to develop this model is summarised in subsequent sections of this report. Details on the model development and setup is provided in Section 4.2.

4.1.1 Study Area and Assessment Approach

The main watercourse within the vicinity of the Assessment Area is the Wollondilly River. Several minor flow paths, that are tributaries of the Wollondilly River, are located within the Assessment Area. Modelling of all sub catchments intersecting the Assessment Area has been undertaken using a catchment wide 'Rain-on-Grid' (RoG) modelling approach. The RoG model was developed using the 2D hydraulic modelling software TUFLOW.

Two scenarios have been modelled; existing and developed (i.e. with the Project) scenarios. The existing scenario represents the current conditions of the Assessment Area, whilst the developed scenario includes the proposed Project, using topographic adjustments and material classification changes where proposed infrastructure is to be located.

4.1.2 Key Assumptions

This assessment uses the following assumptions regarding the Assessment Area:

- Permanent ancillary infrastructure (BESS Stations / Substations) will be located above the 1% AEP flood level + 500 mm freeboard and will be achieved by filling of the areas to raise the finished ground levels to at least the 1% AEP + 500 mm level and construction of diversion drains to minimise impacts to downstream flow regimes.
- Drains will be designed, constructed and maintained to convey overland flows around hardstand areas and other ancillary infrastructure to maintain existing flow directions, as required.
- Access tracks that cross non-perennial watercourses will be raised above the watercourse bed to provide a low-level crossing. Culverts or bridges may need to be provided at the crossings to convey flows through the crossing. Appropriate scour protection and design considerations will be provided at crossings and hydraulic structures to minimise the likelihood of erosion and scouring.

4.2 Model Development

Details of key TUFLOW model parameters are tubulated in Table 4.1. The TUFLOW model extent and layout is shown in Figure 4.1.

TABLE 4.1: HYDRAULIC MODEL DEVELOPMENT AND PARAMETERS

Model Parameter	Details
Grid Size	A cells size of 2 m was adopted for the purpose of the assessment.
DEM	The DEM for the Assessment Area and upstream catchment used in the model includes: • 2 m DEM, derived from NSW Spatial Services LiDAR data, flown May 2018.
Timestep & Model Build	The hydraulic models use TUFLOW's Heavily Parallelised Compute (HPC) computational method for calculations of the Shallow Water Equation. A part of this allows for the model to use a variable time step. The model build used for each assessment was the latest available at the time, 2025.0.0.
Assessed Events	The 5%, 1%, and 0.2% AEP rainfall events were assessed, as well as a future climate change scenario in accordance with ARR2019 v4.2. The 0.2% AEP event is used as a proxy for climate change as specified in the SEARs for the Project. This is further enhanced with modelling of a climate change scenario in accordance with ARR2019v4.2. Design rainfall data was sourced from the Australian Rainfall and Runoff (ARR) Data Hub (BoM, 2022).

Model Parameter	Details
	The PMF was modelled using rainfall volumes calculated using the Generalised Short Duration Method (GSDM).
ARR v4.2 - Climate Change Adjustment	In accordance with latest updates to the *Australian Rainfall and Runoff – A Guide to Flood Estimation* (ARR v4.2 Guideline), unadjusted historical observations are no longer a suitable basis to define design rainfall information and must be adjusted to reflect the impacts of rising global temperatures. This is accounted for by adjusting the 2016 Intensity- Frequency- Duration (IFD) curves and ARR losses to represent conditions (i.e. the current climate). The change in design rainfall estimations under the latest ARRv4.2 guidance are sensitive to the climate scenario (i.e., year 2030 versus 2100) and the SSP adopted. The following climate scenarios and SSPs chosen for this assessment are as follows: • *Near Term* – 2030 Horizon at SSP 2-4.5, to reflect current climate conditions. This adjustment was applied to all modelled design events. • *Medium-Term* - 2050 Horizon at SSP 2-4.5, to reflect a medium-term climate change scenario. Simulated for the 1% AEP baseline scenario to provide an understanding of the scale of change of flood behaviour relative to the 1% AEP event. Given the operational timeframe of the Project is 20-30 years the medium-term horizon has been assumed as suitable for the climate change assessment. The adjustment factors applied to the IFD are provided in Table 4.2.
Assessed Durations and Temporal Patterns	For each of the modelled AEP events, durations ranging between 15 minutes and 3 hours were assessed. For each duration, ten temporal patterns were modelled to provide statistical variation to determine the median storm event. The peak of the median duration results was then adopted to be representative of peak flood behaviour. For the PMF event, durations ranging between 30 minutes and 6 hours were assessed. For each duration, the then historical GSDM temporal patterns and the single average variably method (AVM) temporal pattern. The peak of the median duration results was then adopted to be representative of peak flood behaviour.
Aerial Reduction Factors	ARFs were not used for this assessment.
Rainfall Losses	Initial and continuing rainfall losses were sourced from the ARR Data Hub (BoM, 2022), and in accordance with the Floodplain Risk Management Guide (Office of Environment and Heritage, 2019) and Review of ARR Design Inputs for NSW. This assessment has adopted the recommendations of ARR 2019 v4.2, including consideration of adjustment factors to align with latest methodologies. The applied adjustment factors are provided in Table 4.3.
Inflow Boundaries	Design rainfall was spatially distributed across the model terrain within the RoG model boundary. This applies rainfall depths over the model domain at a time interval based of the input temporal pattern.. A steady state inflow condition was applied for the downstream Wollondilly River, which was based of the scaled Flood Frequency Analysis (FFA) detailed in Section 4.2.1.
Downstream Boundary	To allow flow to exit the model domain, TUFLOW boundary conditions were represented in the model. Two different outflow boundary conditions were required for this assessment: • The eastern edge of the Assessment Area has several unnamed non-perennial tributaries that drain east to the Wollondilly River, which is approximately 2 km downstream of the site boundary. Therefore, this direction was modelled using a normal depth outflow condition, with channels grade established as 1.4% from the DEM data. • The remainder of the Assessment Area drains west, also to the Wollondilly River, and required simulation of a tailwater condition for the Wollondilly River. The tailwater condition were adopted based on the 20% AEP flows from the scaled FFA undertaken in accordance with Section 4.2.1.

Model Parameter	Details
Manning's 'n' Roughness	Manning's 'n' roughness classifications for the baseline and developed case modelling is shown on Figure 4.2. Adopted roughness values are presented in Table 4.4. Land use delineation was based on aerial imagery sourced from Google Maps and NSW Six Maps.
1D Network	Hydraulic structures (culverts) located within the model extent have been identified based on a desktop review of aerial imagery, the DEM and survey provided by Transport for NSW (TfNSW) and ERM. Hydraulic structures identified are shown on Figure 4.3 and Figure 4.4.

TABLE 4.2: CLIMATE CHANGE FACTORS – HORIZON RAINFALL IFD ADJUSTMENT FACTORS

Climate Scenario	< 1 h	1.5 h	2 h	3 h	4.5 h	6 h	9 h	12 h	18 h	> 24 h
Near Term (2030) SSP2-4.5	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.1	1.1
Medium Term (2050) SSP2-4.5	1.27	1.24	1.23	1.21	1.19	1.18	1.17	1.16	1.15	1.14

TABLE 4.3: CLIMATE CHANGE FACTORS – RAINFALL LOSS ADJUSTMENT FACTORS

Climate Scenario	Initial Loss	Continuing Loss
Near Term SSP2-4.5	1.02	1.05
Long Term SSP2-4.5	1.03	1.03

TABLE 4.4: MANNING'S VALUES

Land Use Type	Manning's 'n' Value
Grass	0.045
Moderate Vegetation	0.060
Dense Vegetation	0.080
Roads and Other Infrastructure (e.g., solar panel, batteries etc.)	0.020
Buildings	1.000
Waterways	0.035
Waterbodies	0.030

4.2.1 Scaled Flood Frequency Analysis

To define tailwater conditions for the Wollondilly River, a scaled flood frequency analysis (FFA) was undertaken using available gauge data. Based on an analysis of gauges within the vicinity of the Assessment Area (refer to Figure 4.2), the Wollondilly River at Golden Valley gauge was determined as most suitable for the assessment. This gauge has the following key details:

- Wollondilly River at Golden Valley (212271)
  - Located approximately 18 km downstream of the Assessment Area.
  - Active from 1967 to current day (2025).
  - No data from 1988 to 2002.

A FFA generates an estimated peak flow value for different AEP events based of historical data. Historical flow results for gauge 212271 were exported from WaterNSW and the yearly maximum flows (m^3/s) were determined. The historical data was imported into RMC best fit, and the best fit distribution method was determined using the Bayesian analysis approach. The best fit for the data was Log Pearson Type 3 distribution. The estimated peak flows were then scaled down based on the percent difference in the reporting catchments, as follows:

- Total Reporting Catchment to gauge 212271 is 2,695 km^2.
- Reporting Catchment to Project location is 2,326 km^2.
- As such, estimated flows were scaled down by approximately 14 %.

Figure 4.1 presents the results of the Log Pearson Type 3 distribution fit, scaled down for the Project location. From this the estimated 20% AEP flow (178.4 m^3/s) was adopted as a steady state tailwater condition in the model. Based on a review of catchment sizes (local catchment vs Wollondilly River catchment), it is assumed that the 20 % AEP is an appropriate coincident event for the 1 % AEP and 5% AEP events as there is a low probability of the same event occurring in both systems (i.e. a 1% AEP event occurring at the same time for the Projects local catchment and full Wollondilly River catchment is unlikely).

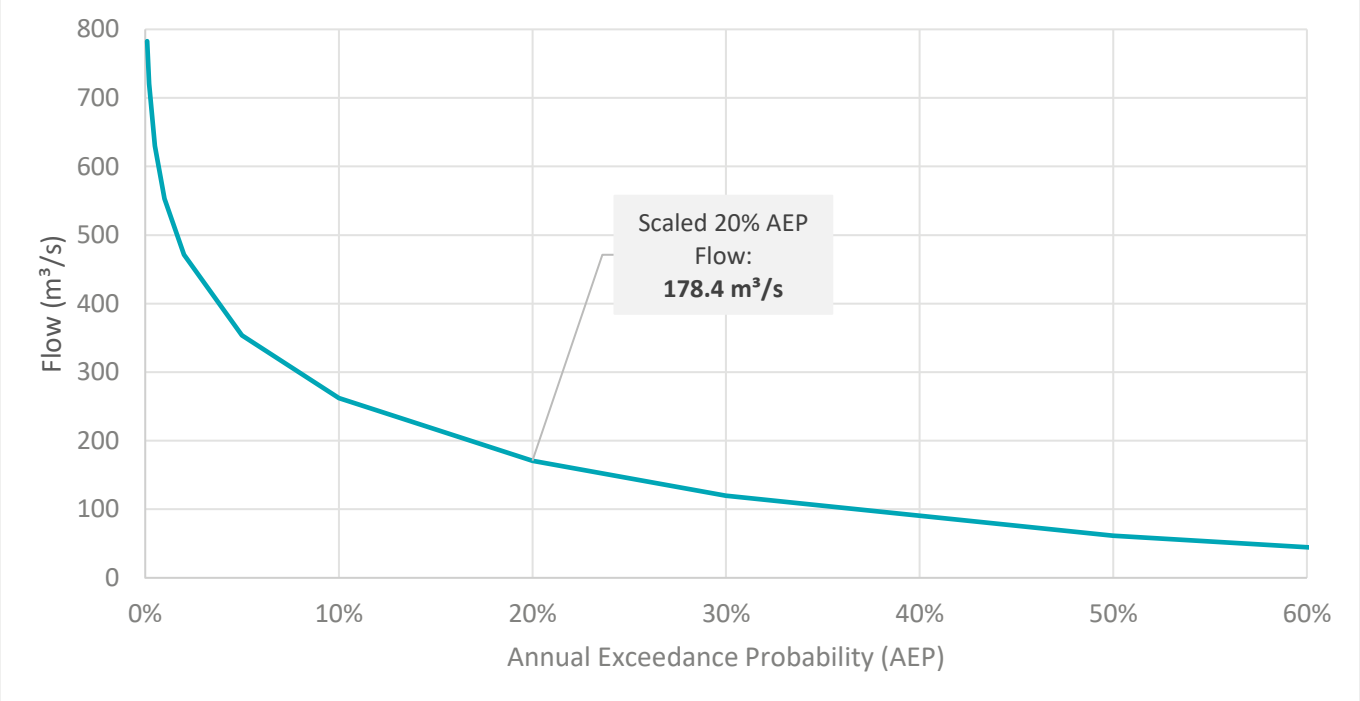

FIGURE 4.1: SCALED FFA RESULTS – WOLLONDILLY AT GOLDEN VALLEY

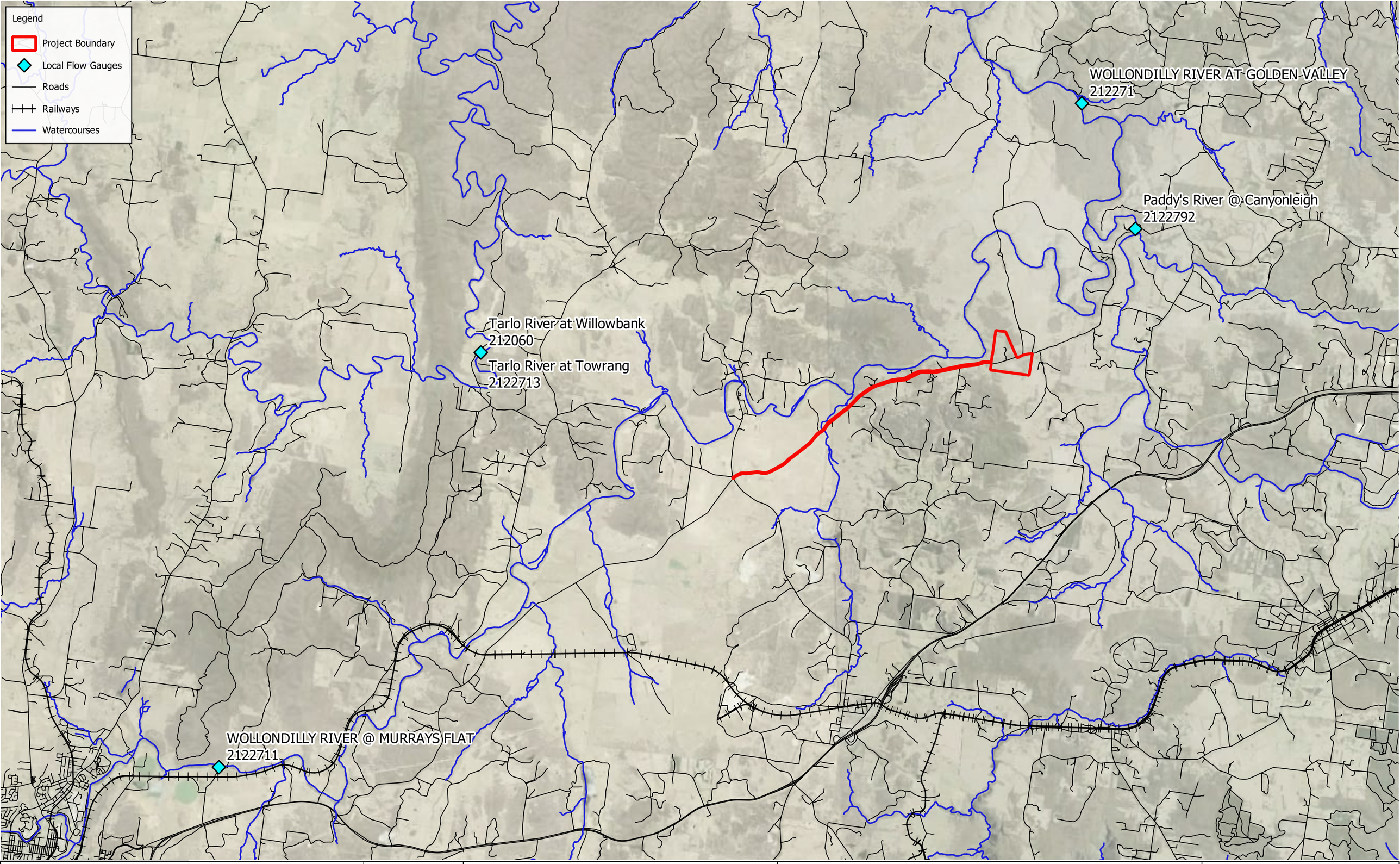

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Figure 4.2: Local Flow Gauges

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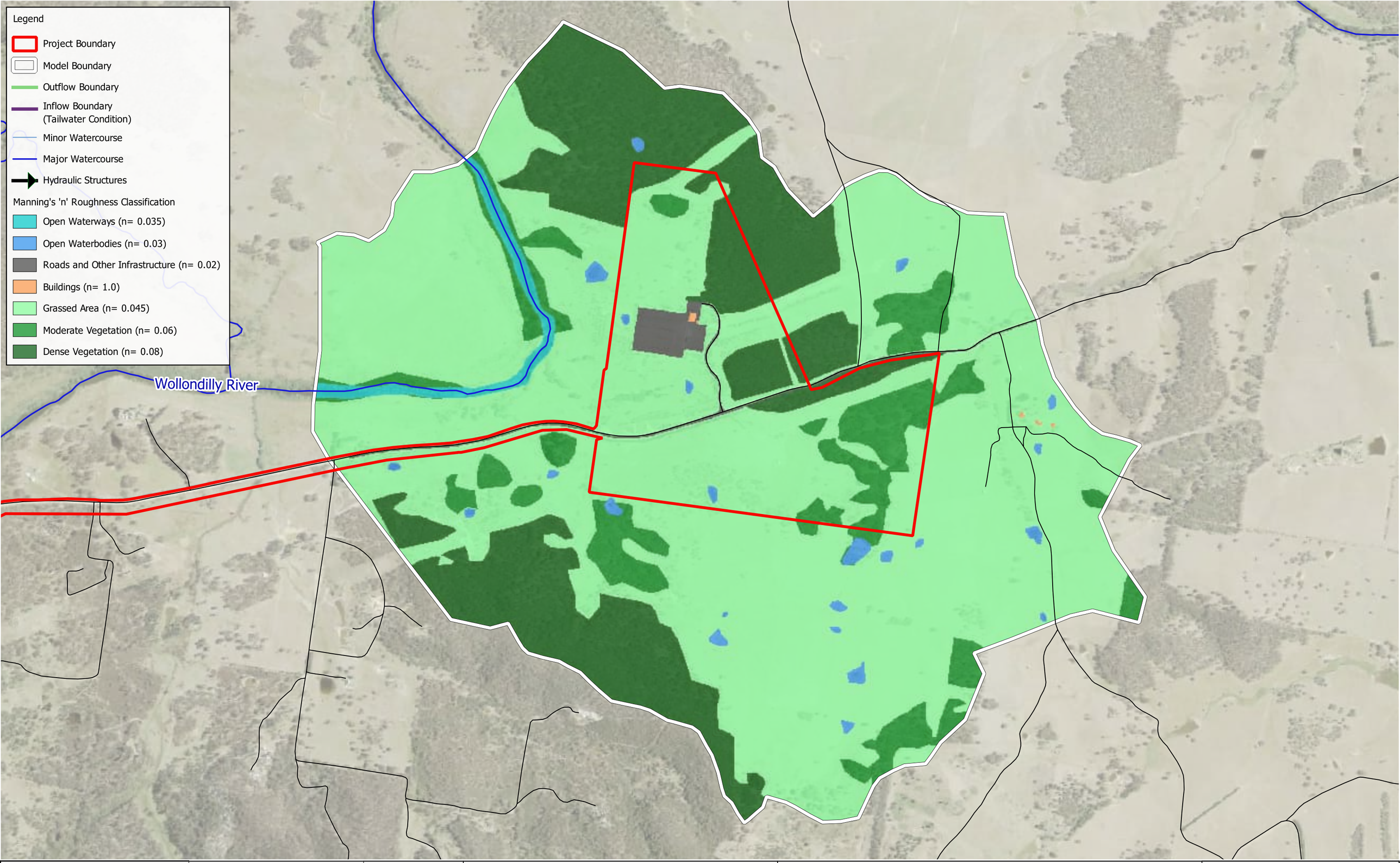

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Figure 4.3: Manning's Roughness - Existing

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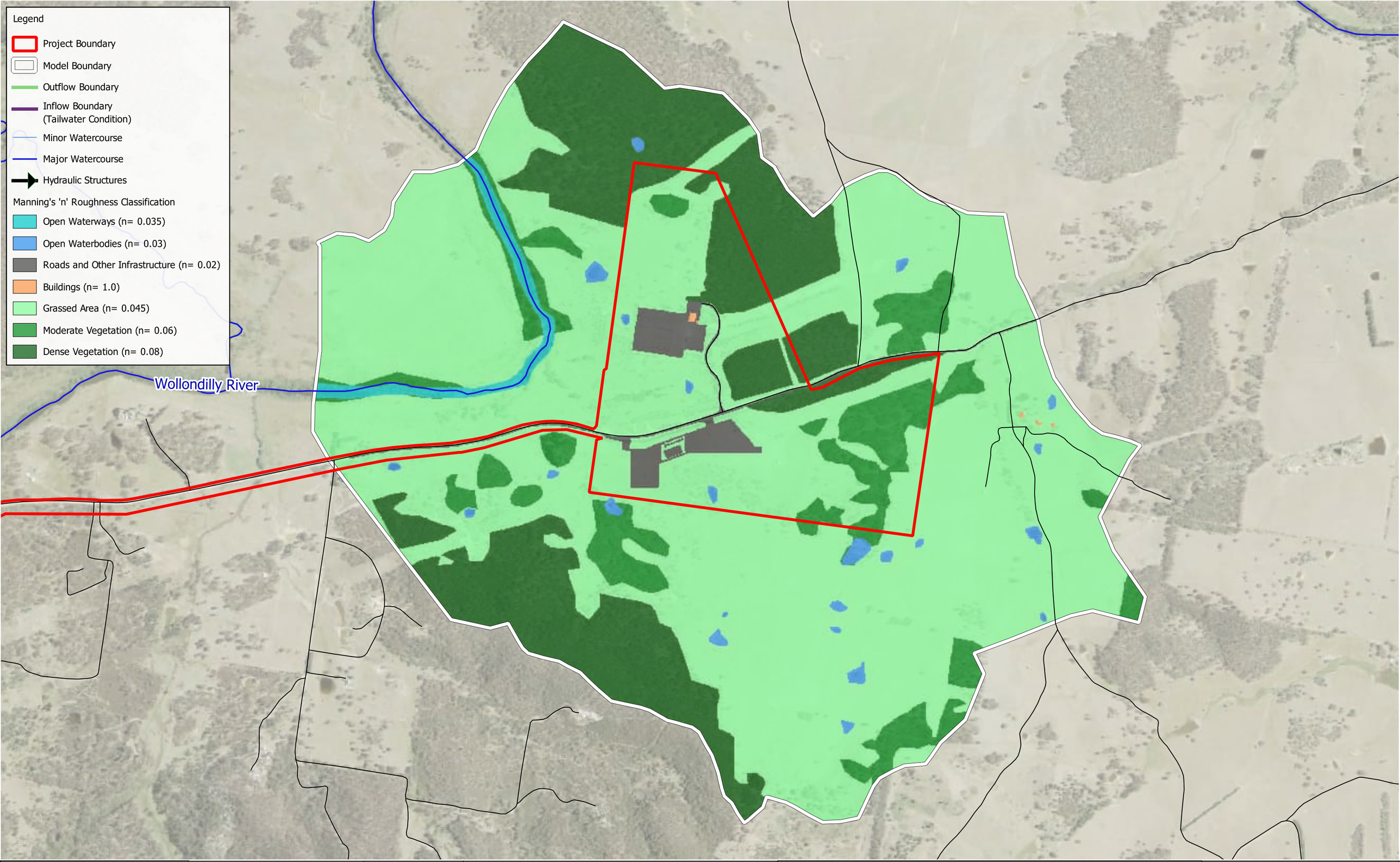

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Figure 4.4: Manning's Roughness - Developed Case

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4.3 Existing Flood Behaviour

Appendix B contains mapping of flood depth, velocity, and hazard categories for the baseline flooding results (i.e. with the Assessment Area undeveloped) for the 5% AEP, 1% AEP, 1% AEP Climate Change Sensitivity, 0.2% AEP, and PMF events. The following is a summary of the baseline results within the Assessment Area.

- Flooding within the Assessment Area occurs within several unnamed drainage channels, all of which report to the Wollondilly River. Three of these unnamed channels interact with the Development Footprint:
  - One central to the Assessment Area interacting with the proposed transmission line location and the access road to the existing Marulan substation.
  - One within the northern extent of the Assessment Area, traversing through the centre of the existing Marulan substation area.
  - One to southern boundary of the Assessment Area overlaying the proposed BESS and associated infrastructure locations.
- Within the flow path interacting with the BESS, and associated infrastructure, areas flood depths range approximately between 0.09 m – 0.18 m, for the 1% AEP. Flood depths up to 0.36 m are observed within the flow path that interacts with the proposed transmission line. For the PMF, flood depths reach 0.50 m in the flow path interacting with the BESS, and associated infrastructure, areas and 0.81 m for the flow path that the proposed transmission line crosses.
- Within the Development Footprint, flood velocities ranging between 0.18 – 2.41 m/s are observed for the 1% AEP. For the PMF, the velocity range increases to 0.45 – 4.36 m/s.
- The general flood hazard curves and categorisation presented in ARR (Ball, et al., 2019) have been adopted (refer to Figure 4.5) and the predominant hazard category for the Assessment Area is low (H1), with higher hazards within defined watercourses and flow paths. For the 1% AEP event, some minor areas of the flow paths within the Development Footprint record hazard categories up to H5 (unsafe for vehicles and people).

4.3.1 Flood Hazard Classification

The general flood hazard curves and categorisation presented in ARR (Ball, et al., 2019) have been adopted (refer to Figure 4.5) to determine the flood hazard categorisation for the Assessment Area. In accordance with the methodology in the *Australian Disaster Resilience Handbook 7 – Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia* (AIDR, 2017), the combined flood hazard curves set hazard thresholds that relate to the vulnerability of the community when interacting with floodwaters. The combined curves are divided into hazard classifications that relate to specific vulnerability thresholds as described in Table 4.5.

From the flood hazard mapping in Appendix B, the predominant hazard category, for the modelled AEP events, for the Assessment Area is low (H1), with higher hazards (up to H5) within defined watercourse and flow paths.

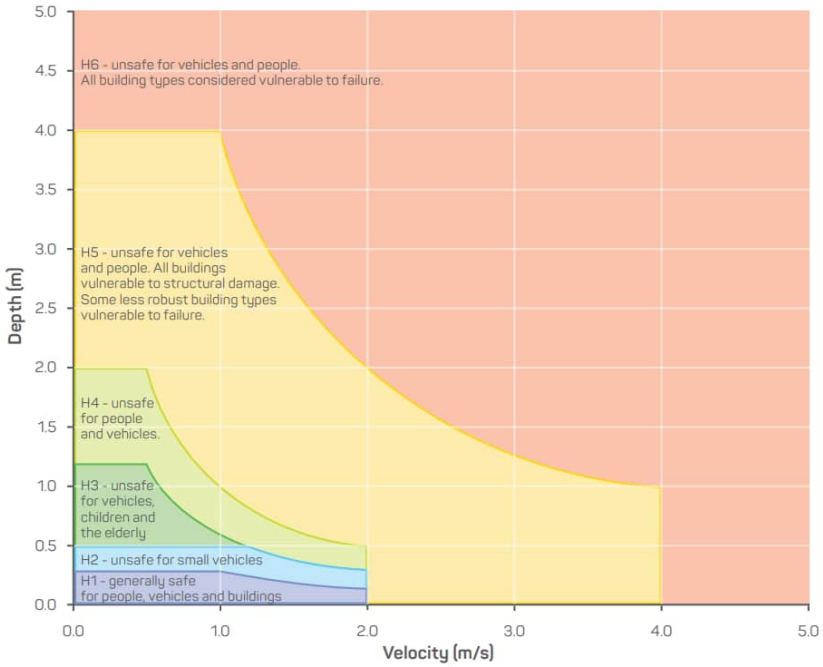

FIGURE 4.5: FLOOD HAZARD CATEGORIES

TABLE 4.5: COMBINED HAZARD CATEGORIES – VULNERABILITY THRESHOLDS AND LIMITS

Hazard Vulnerability Classification	Description	Classification Limit (D and V in Combination) - M^2/S	Limiting Still Water Depth (D) - M	Limiting Velocity (V) - M/S
H1	Generally safe for vehicles, people and buildings.	D*V ≤ 0.3	0.3	2.0
H2	Unsafe for small vehicles	D*V ≤ 0.6	0.5	2.0
H3	Unsafe for vehicles, children and the elderly.	D*V ≤ 0.6	1.2	2.0
H4	Unsafe for vehicles and people.	D*V ≤ 1.0	2.0	2.0
H5	Unsafe for vehicles and people. All building types vulnerable to structural damage. Some less robust building types vulnerable to failure.	D*V ≤ 4.0	4.0	4.0
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.	D*V ≤ 4.0	-	-

4.3.2 Flood Planning Area

The flood planning area for the Assessment Area has been considered by assessing the 1% AEP and adding 500 mm freeboard to the flood levels, in accordance with the recommended methodology in the *Flood risk management manual* (Department of Planning and Environment (DPE), 2023). Due to the assessment using a RoG approach, depths less than 50 mm have not been included in the 1% AEP flood extent. The flood planning area extent within the Assessment Area is provided in Figure 4.6.

4.3.3 Hydraulic Categorisation

Three hydraulic categories of flood prone land are identified, being the floodway, flood storage and flood fringe, and are a distinction used to aid in the process of developing a floodplain risk management plan. The DPE *Floodplain Risk Management Guideline* document definitions and the adopted criteria for each categorisation are summarised in Table 4.6.

TABLE 4.6: HYDRAULIC CATEGORISATION

Category	Definition	Adopted Criteria
Floodway	Are generally areas which convey a significant portion of water during floods and are particularly sensitive to changes that impact flow conveyance. They often align with naturally defined channels.	1% AEP Hazard Category of ≥ 4
Flood Storage	Are areas outside of a floodway and are generally areas that store a significant proportion of the volume of water and where flood behaviour is sensitive to changes that impact the storage of water during a flood.	1% AEP Hazard Category of < 4
Flood Fringe	Are areas within the extent of flooding for the event but which are outside floodways and flood storage areas. Flood fringe areas are not sensitive to changes in either flow conveyance or storage.	PMF extent

Figure 4.7 provides the hydraulic categorisation within the Assessment Area for each of these areas.

4.3.4 Climate Change Assessment

A climate change sensitivity assessment was undertaken to understand the sensitivity of flooding and flood impacts to climate change. Two climate change scenarios were modelled to provide an understanding of the scale of change of flood behaviour relative to the 1% AEP event, including the Near-Term 0.2% AEP design event (typically used as proxies for climate change) and the Medium-Term 1% AEP climate change event, in accordance with the ARR v4.2 Guideline (refer to Table 4.1). A comparison of the flood extents between these events is presented in Figure 4.8 while further detailed flood mapping for the full range of events is provided in Appendix B.

The climate change sensitivity modelling indicates that there is generally little difference in flood extent across the Assessment Area for the two climate change scenarios assessed, including through the major drainage channels. Additional outcomes from the climate change assessment are as follows:

- The difference in flood depth for climate change proxies relative to the 1% AEP is typically less than 0.1 m, which is below the 0.5 m freeboard adopted in setting flood planning levels. This indicates that a climate change scenario would result in the future flood planning reference event (1% AEP plus climate change) not exceeding the current flood planning level (existing 1% AEP plus 500 mm freeboard). This change in depth and extent does not result in inundation of additional buildings or potential ancillary infrastructure locations.
- The increase in inundation during flood events (refer to Figure 4.8) from the 1% AEP (blue) to the 1% AEP Climate Change Scenario (orange) and the 0.2% AEP (red) is shown on the figure with minimal areas that are only inundated by the 1% AEP Climate Change and 0.2% AEP that are not inundated by the 1% AEP.

The small change in flood regime (i.e., flood level or extent) for the agricultural land (grazing and cropping) or crown land is not considered to have a resulting impact on the use of the land under a climate change scenario.

Legend

- Project Area
- Development Footprint
- BESS Areas
- BESS Substation
- Areas for O&M Building, Storage Containers, and Water Tank
- Access and Internal Roads
- Parking Slots
- Model Boundary
- Flood Planning Area

Flood Planning Level (mAHD)

- <= 595
- 595 - 601
- 601 - 606
- 606 - 612
- 612 - 618
- 618 - 623
- 623 - 629
- 629 - 634
- > 634

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Figure 4.6: Flood Planning Area

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Legend

- Project Area
- Development Footprint
- BESS Areas
- Internal and Access Roads
- BESS Substation
- Area for O&M Building, Storage Containers, and Water Tank
- Parking Slots
- Flood Planning Area

Hydraulic Categorisation

- Flood Storage
- Floodway
- Flood Fringe

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Figure 4.7: Hydraulic Categorisation

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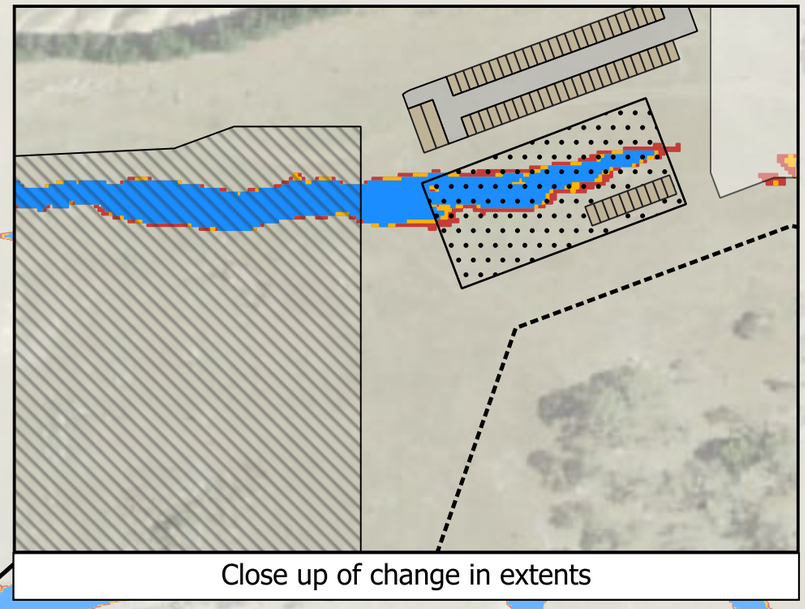
Legend

- Project Boundary
- Model Boundary
- Development Footprint
- BESS Substation
- Area for O&M Building, Storage Containers, and Water Tank
- Access and Internal Roads
- Parking Slots
- BESS Area
- 1% AEP Flood Extent (2030 Climate Horizon)
- 1% AEP Climate Change Scenario FLood Extent (2050 Climate Horizon)
- 0.2% AEP Flood Extent



Close up of change in extents

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Figure 4.8: Climate Change Sensitivity

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4.3.5 Design Flow Validation

The Regional Flood Frequency Estimation (RFFE) Model (ARR, 2024) was used to validate peak flows from the TUFLOW model. The validation was undertaken for the sub catchment within the southern extent of the model, which interacts with the proposed substation and BESS area. This catchment has an area of approximately 0.9 km^2, which is at the lower end of the recommended catchment sizing for RFFE (0.5 – 1,000 km^2).

The results of this RFFE comparison are presented in Table 4.7 and Figure 4.9 and indicate that the TUFLOW model may slightly overestimate peak flows. However, the modelled values for the 1% AEP remain within the RFFE confidence limits, confirming that the model outputs are suitable for larger flow events and for the purposes of the assessment. In the absence of additional available validation data, further refinement or calibration of the model was not undertaken.

TABLE 4.7: RFFE VALIDATION RESULTS

Design Event AEP	Modelled Peak Flow (m³/s)	RFFE Expected Flow (m³/s)	RFFE Lower Confidence Limit (m³/s)	RFFE Upper Confidence Limit (m³/s)
5% AEP	15.0	5.5	2.1	12.7
1% AEP	26.9	11.1	4.0	27.1

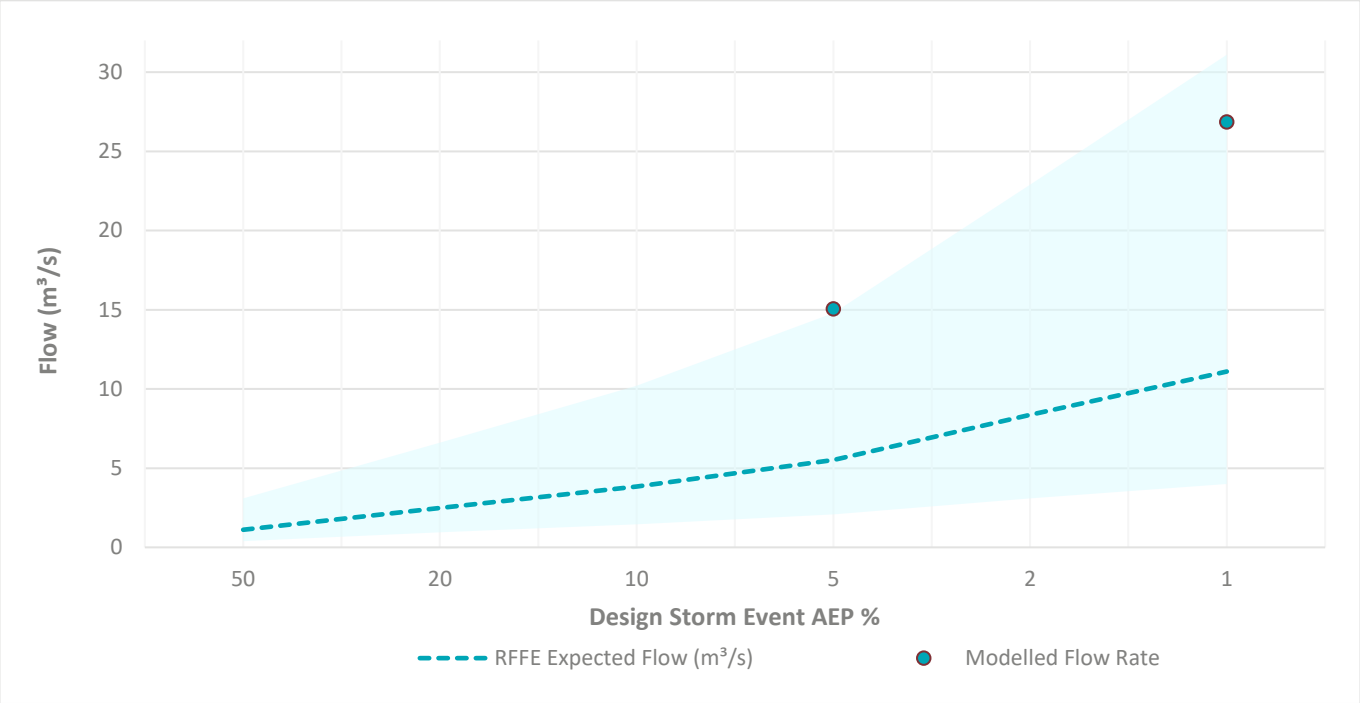


FIGURE 4.9: RFFE FLOW VALIDATION

4.4 Developed Flood Behaviour

Appendix C contains mapping of flood depth, velocity, and hazard categories for the following flood modelling results for the ultimate flooding results (i.e. with the Assessment Area developed) for the 5%, 1% AEP, 0.2% AEP and PMF events.

The changes made to the existing (i.e. baseline) hydraulic model to represent the developed scenario are as follows:

- Change to Mannings 'n' values for infrastructure areas, including for the BESS areas, the substation, the storage container, water tank and O&M building area, and the roads and car parks.
- Key infrastructure conservatively raised to above the Flood Planning Level (existing 1% AEP plus 500 mm freeboard).

The following is a summary of the developed scenario results within the Assessment Area:

- Key infrastructure are not flooded up to and including the PMF event, however, due to the RoG approach and adopted 2 m grid, some minor flows are shown in these areas for the PMF event (refer to figures in Appendix C).
- The inundation shown on the figures is related to local runoff. Allowance has been made in the model for local runoff to drain between the BESS areas, adjacent to the internal roads, and around the substation. Stormwater management will be further refined during detailed design.
- No major changes to flow regimes are observed, only minor flow re-direction is observed to the south of the Assessment Area, in the vicinity of proposed ancillary infrastructure (BESS areas, the storage container, water tank and O&M building area, substation). Refer to decreased and increased flood extents on the afflux figures of Appendix C.
- No impressionable change to flood regimes is observed outside of the Assessment Area (i.e., any flooding impacts of the development remain localised and do not extend significantly downstream). For all modelled events, except the PMF, flood regime change is also maintained within the Development Footprint. For the PMF, a minor decrease in flood depth and velocity is observed to the north of the BESS areas and to the west of the existing Marulan substation access road. This decrease is the result of a reduction in flows reporting across Canyonleigh Road as overland flow is now directed to the west around the BESS areas.
- The proposed infrastructure has led to the following key changes:

– Existing flow paths have been impeded by the proposed infrastructure, which has resulted in changed flow routes, now reporting within the internal road extents and around raised infrastructure areas.

– Increased flood depths, by up to 0.66 m in the 1% AEP, are observed on the eastern side of the BESS substation. Water is observed to be ponding here in a low point before diverting around infrastructure to the north via a new flow path. It is expected that stormwater management here (i.e., channel diversion around infrastructure) will be refined in detailed design.

– Increased flood depths, by up to 0.13 m in the 1% AEP, are observed on the eastern side of the area that has been raised to accommodate the O&M building, the storage containers, and the water tank. The existing flow path has been blocked by the raised area, leading to increased depths and two new flow paths forming as water is diverted to both the north and south around the raised area. It is expected that stormwater management here (i.e., channel diversion around infrastructure) will be refined in detailed design.

– A very minor area of flood depth increase (between 0.01- 0.05 m) is observed to the west of the Assessment Area for the 5% AEP. This increase in depth does not reach the Wollondilly River, and is not observed in any other modelled events.

– Increased velocities, by up to 1.66 m/s in the 1% AEP, are observed just downstream of the BESS areas, to the south of the area raised for the O&M building, the storage containers, and the water tank. This is a result of the existing flow path, which is approximately 24 m wide, being constricted to a width of approximately 8 m and of the additional flow redirected into this flow path.

– Decreased velocities, by up to 1.16 m/s in the 1% AEP, are observed on the eastern side of the substation and the eastern side of the area raised for the O&M building, the storage containers, and the water tank. This result of impeded flows, now ponding behind the raised infrastructure.

- Velocities of flow diverting around the raised infrastructure areas, within internal roads, reach a maximum of approximately 3.21 m/s during the 1% AEP events. For the PMF this increases to approximately 4.12 m/s.
- The predominant flood hazard category has remained as H1. As with the existing modelling, this hazard increases to H5 in and around defined drainage channels. Changes to flood hazards have been reported through the Assessment Area in locations where the existing overland flow has been diverted around the proposed infrastructure. This is particularly noticeable to the north of the substation, where the extent of H5 categorisation has increased.

4.5 Flood Emergency Management and Planning

4.5.1 Evacuation Capacity

The proposed BESS development area is located to the south of Canyonleigh Road, and flood evacuation from the Project is facilitated via access to this road (refer to Figure 4.10). Further, the Project is not predicted to change flood behaviour on this road and therefore the proposed development is not predicted to change existing evacuation route access or location.

However, an increase in evacuees will result from the development, particularly during construction. A Flood Emergency Response Plan (FERP) will be developed for all phases of the Project prior to the commencement of construction and will provide measures for enabling safe occupation and efficient evacuation (with consideration of the higher number of evacuees during the construction phase of the Project) in the event of a flood.

4.5.2 Available Warning Times

As shown on Figure 4.10, inundation of Canyonleigh Road occurs for the modelled AEP events. Given Canyonleigh Road is part of the evacuation route for the Project, indicating that road cut may occur, particularly during larger events. The peak flood hazard categorisation at each of the road cut locations (labelled on Figure 4.10) is presented in Table 4.8. With reference to the hazard vulnerability thresholds, as presented in Table 4.5, results show that:

- Road cut locations 1 and 2 would likely remain trafficable during most modelled events (except the PMF) with hazard categorisations of H1 (generally safe for vehicles, people, and buildings) and H2 (unsafe for small vehicles).
- Road cut location 3 is likely to result in loss of trafficability of this access route, with high hazards (H5- H6) being unsafe for all vehicle types to drive through.

The available warning times (rate of rise and road cut) during construction and operations will be detailed in a FERP. The FERP will be developed in accordance with existing community emergency management arrangements for flooding and in consultation with Goulburn-Mulwaree Council and NSW SES.

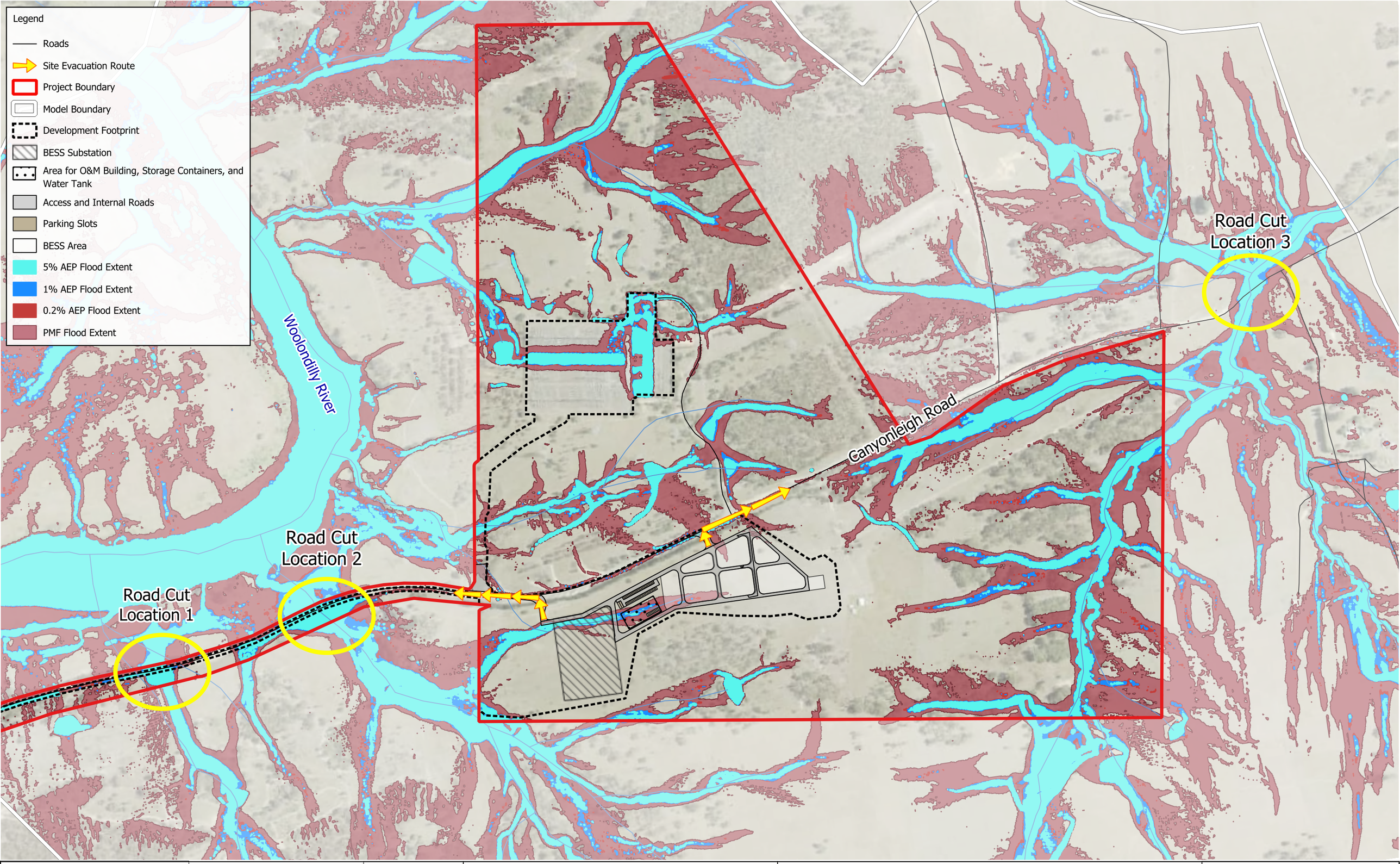
TABLE 4.8: ROAD CUT LOCATIONS – PEAK HAZARD CATEGORIES

Road Cut Location	5% AEP – Peak Hazard	1% AEP – Peak Hazard	0.2% AEP – Peak Hazard	PMF – Peak Hazard
1	H1	H1	H1	H5
2	H1	H2	H2	H5
3	H5	H5	H5	H6

4.5.3 Consistency with Existing Emergency Management

Goulburn Mulwaree LGA Local Flood Emergency Sub Plan (SES, 2021) sets out the multi-agency arrangements for the emergency management of flooding within the Goulburn Mulwaree LGA.

Appendix B indicates that the proposed development has negligible impact on the flood hazard categorisation (i.e., no changes beyond the Assessment Area observed) along Canyonleigh Road and will therefore not likely to have an adverse impact on the NSW SES emergency response arrangements as set out in the *Goulburn Mulwaree LGA Local Flood Emergency Sub Plan* (SES, 2021).



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0 0.14 0.28 km

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Figure 4.10: Site Evacuation & Road Cut Locations

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5. WATER QUALITY MODELLING

5.1 Overview

Stormwater pollutant modelling for the Project has been undertaken using the modelling program MUSIC, version 6.3, developed by the Cooperative Research Centre for Catchment Hydrology.

MUSIC allows for the estimation of average annual stormwater pollutant loads within stormwater, including sediment (as total suspended solids), total nitrogen, total phosphorous, and gross pollutants. The MUSIC model has been developed with reference to 'Using MUSIC in Sydney's Drinking Water Catchment' (Water NSW, 2023) ('the MUSIC Manual').

The parameters used in the MUSIC model development are described in the following sections.

5.2 Model Development

5.2.1 Meteorological Data

As the development is within the Wollondilly River WaterNSW sub-catchment, the WaterNSW meteorological template file for Zone 1 was used in the development of the MUSIC model. The Zone 1 meteorological template contains 6 minute time step data, over a period of five years (1/1/1994 to 31/12/1999), which includes a range of wet and drier years to ensure conditions simulated are realistic. As recommended in the MUSIC Manual and as required for a neutral or beneficial effect (NorBE) on water quality evaluation, the model has adopted a 6 minute timestep.

The mean annual rainfall for the Zone 1 dataset is 721 mm, and the mean annual evapo-transpiration is 1083 mm. Figure 5.1 presents the timeseries of the meteorological data.

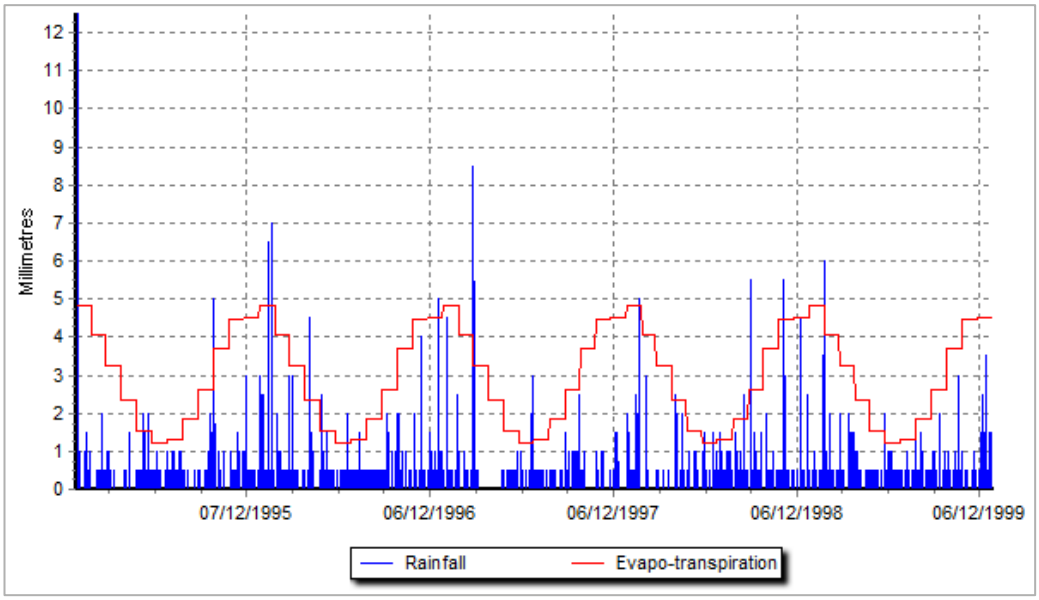

FIGURE 5.1: RAINFALL AND EVAPO-TRANSPIRATION CHART USED IN THE MUSIC MODEL

5.2.2 Model Scenarios

Two scenarios were modelled using MUSIC, described below:

- Existing – represents existing catchment conditions and land uses for areas within the Development Footprint (minus the Marulan substation and access track areas, as minimal ground disturbance is assumed).
- Developed – represents the post development catchment and land uses (incorporating the components of the proposed BESS).

5.2.3 Catchment Areas

The MUSIC Model has been prepared to compare and assess identical catchment areas under different land use in the existing and developed scenarios. The modelled catchment areas were confined to areas of addition ground disturbance for the Project (i.e., Development Footprint minus the existing Marulan substation); and were broken down into two main sub-catchments:

- Catchment A – to the north of the proposed BESS areas.
- Catchment B – the southernmost catchment, in which the BESS areas are proposed.

Although the existing Marulan substation is within the Development Footprint, this location was excluded from the MUSIC model based on the following assumptions:

- There are no changes to land use associated with changes in the Marulan substation and access road,
- The existing Marulan substation stormwater treatment measures are assumed to be adequate.

The scenario catchments are shown in Figure 5.2. Noting that a slight catchment change occurs for the developed scenario, which assumes that all stormwater from BESS infrastructure will be diverted to the Project's south-west. This water management measure is proposed to reduce the number of stormwater quality improvement devices (SQIDs) required to meet NorBE criteria (i.e., if stormwater were to remain north draining SQIDs would also be required for Catchment A).

Catchment areas are presented in Table 5.1 below.

FIGURE 5.2: CATCHMENT AND LAND USE

5.2.4 Source Nodes

An overview of the source node areas for both the existing and developed scenarios is provided in Table 5.1. The source node surface type is directly related to the land use type, as shown in Figure 5.2 above.

TABLE 5.1: SOURCE NODES – FOR PRE AND POST DEVELOPMENT

Catchment	Source Node Surface Type	Feature Area (ha)	
		Existing	Developed
A – North Catchment	Agricultural land	13.6	11.7
	Forest	6.4	6.2
	Urban – unsealed roads	0.7	0.9
	TOTAL AREA	20.7	18.9
B – South Catchment	Agricultural land	8.5	5.1
	Forest	1.2	1.2
	Urban – Unsealed roads	0	2.0
	Urban – Industrial (BESS and substation)	0	3.2
	TOTAL AREA	9.7	11.5
Combined Catchments – TOTAL AREA		**30.4**	**30.4**

5.2.5 Treatment Nodes

A conceptual stormwater treatment train has been included in the post development scenario MUSIC model to treat runoff from the BESS facility and associated infrastructure areas. Stormwater treatment measure requirements to ensure the Project achieves a NorBE on water quality will be confirmed during detailed design.

Table 5.2 provides an overview of the conceptual stormwater treatment train nodes applied in the post-development MUSIC model.

TABLE 5.2: CONCEPTUAL STORMWATER TREATMENT TRAIN NODES

Treatment Measure	MUSIC Treatment Node Details
Grassed Swale	• Length 400 m • 1% bed slope • 1 m base width • 5 m top width • 0.25 m vegetation height • 0 mm/hr exfiltration rates
Gross Pollutant Trap (GPT)	Assumed Humegard HG35 unit of similar with the following efficiency: • 1.54 m^3/s treatable flow rate • 90% Gross Pollutants reduction efficiency • 49% TSS reduction efficiency • 40% TP reduction efficiency • 26% TN reduction efficiency

Treatment Measure	MUSIC Treatment Node Details
Bioretention Area	• 1,600 m² surface area • 1,400 m² filter area • 0.3 m extended detention depth • 0.01 unlined filter media • 100 mm/hr saturated hydraulic conductivity • 0.6 m filter depth • 400 mg/kg TN content of filter me • 40 mg/kg Orthophosphate content of filter media • 0 mm/hr exfiltration rate • System to be vegetation with effective nutrient removal plants, with underdrain present and no submerged zone.

5.2.6 Modelling Parameters

Modelling parameters were determined based on recommendations outlined in the MUSIC Manual. The source nodes used in the existing and post development scenario modelling are outlined in Section 5.2.4. The parameters in the following sections were applied to the source nodes outlined in Section 5.2.4.

5.2.6.1 Rainfall- Runoff Parameters

The MUSIC Manual provides recommended pervious area and groundwater properties based on typical soil types. As such, available soil profile data within the vicinity of the Project were reviewed.

The Australian Soil Classification (ASC) mapping (refer to Figure 2.8, Section 2.6) classifies soil orders within the Assessment Area as Sodosols, Kurosols, or Kurosols (natic). These soil orders were also identified for the Marulan Solar Farm site, approximately 13 km southwest of the Project. Table 5.3 presents the MUSIC parameters adopted for the Marulan Solar Farm, as presented in the Water Cycle Management Study (Premise, 2023).

Further, based on the NSW eSPADE spatial viewer, topsoils with the texture group of sandy loam have been identified within the Assessment Area (survey number 1003638). The recommended parameters for sandy loams (WaterNSW, 2012) are also presented in Table 5.3. As the parameters in the Premise report and as recommended in the MUSIC Manual match, these were adopted in the MUSIC model.

TABLE 5.3: PERVIOUS AREA AND GROUNDWATER PROPERTIES

Surface Type/ Land Use	Soil Order* 1 -Kurosol, 2- Kurosol (natic), 3- Sodosols	Typical Parameters for Sandy Loam Classification#
Pervious Area Properties		
Soil Storage Capacity (mm)	98	98
Initial Storage (%)**	25	25
Field Capacity (mm)	70	70
Infiltration Capacity Coefficient	250	250
Infiltration Capacity Exponent	1.3	1.3
Groundwater Properties		
Initial Depth (mm)**	10	10
Daily Recharge Rate (%)	60	60

Surface Type/ Land Use	Soil Order* 1 -Kurosol, 2- Kurosol (natic), 3- Sodosols	Typical Parameters for Sandy Loam Classification#
Daily Baseflow Rate (%)	45	45
Daily Deep Seepage Rate (%)	0	0

**Soil units/ types were determined in reference to the Australian Soil Classification Scheme mapping.*
#From Table 4.4 and Table 4.5 of the MUSIC Manual.
***MUSIC default values.*

For the impervious areas, rainfall thresholds are to be specified for the various modelled surfaces (land uses). The rainfall thresholds utilised in the MUSIC model are presented in Table 5.4.

TABLE 5.4: RAINFALL THRESHOLDS

Surface Type/ Land Use	Rainfall Threshold (mm)
Urban	1.5
Forest and agricultural	1.0

5.2.6.2 Pollutant Generation Rates

Table 5.5 presents the adopted pollution concentrations for the source nodes adopted in the MUSIC model. The source node surface type is determined by the land use of the defined catchment areas.

TABLE 5.5: ADOPTED POLLUTANT CONCENTRATION FOR SOURCE NODES

Surface Type		Log_{10} TSS (mg/L)		Log_{10} TP (mg/L)		Log_{10} TN (mg/L)	
		Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow
Industrial	Mean	2.15	1.2	-0.6	-0.85	0.3	0.11
	Std. Dev.	0.32	0.17	0.25	0.19	0.19	0.12
Unsealed road	Mean	3.00	1.2	-0.30	-0.85	0.34	0.11
	Std. Dev.	0.32	0.17	0.25	0.19	0.19	0.12
Agricultural	Mean	2.15	1.30	-0.22	-1.05	0.48	0.04
	Std. Dev.	0.31	0.13	0.30	0.13	0.26	0.13
Forest	Mean	1.60	0.78	-1.10	-1.05	-0.05	-0.52
	Std. Dev.	0.20	0.13	0.22	0.13	0.24	0.13

5.2.7 MUSIC Model Layout

An overview of the MUSIC model layout is presented in Figure 5.3.

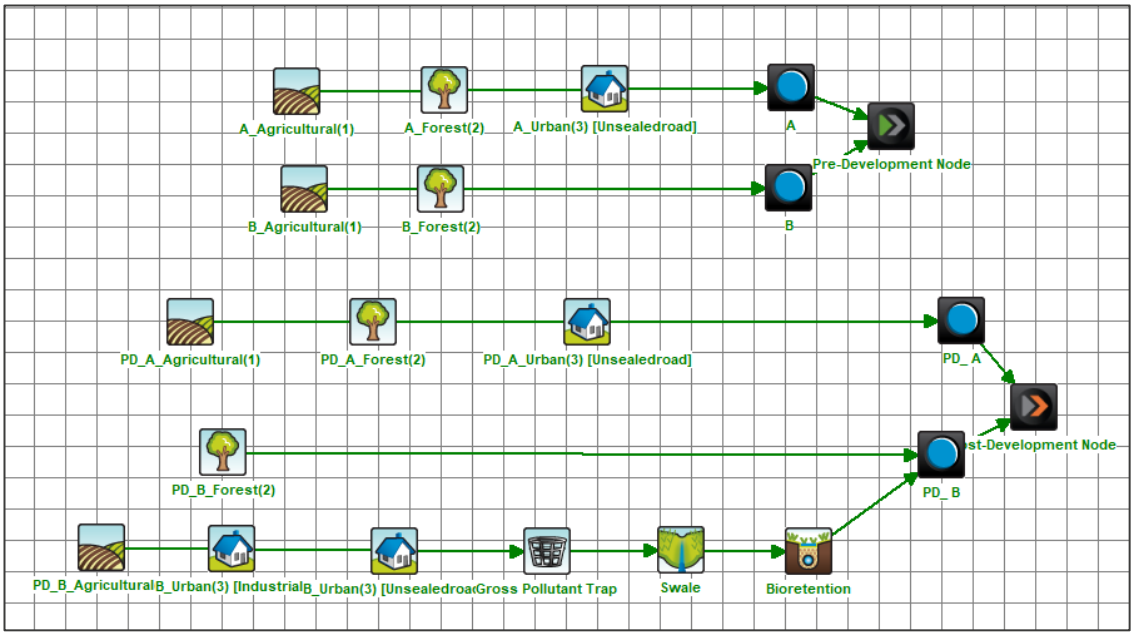

FIGURE 5.3: MUSIC MODEL LAYOUT

5.3 NorBE Assessment

5.3.1 NorBE Criteria

MUSIC results were compared to the NorBe criteria as outlined in Section 2.5.2.3.

5.3.2 MUSIC Model Results

Mean annual pollutant loads are summarised below in Table 5.6. Results are expressed as the sum of the pollutant loads for the north (catchment A) and south (catchment B) catchments. With the proposed treatment train (refer to Section 5.2.5), a NorBE on water quality is achieved for all modelled pollutants.

TABLE 5.6: MEAN ANNUAL LOAD RESULTS

Parameters and Pollutants	Existing	Developed (with treatment)	% Reduction (Existing to Developed)	Neutral or Beneficial Effect
Total suspended solids (kg/yr)	4,480	3,880	13.4	Yes
Total phosphorus (kg/yr)	8.3	6.3	24.5	Yes
Total nitrogen (kg/yr)	47.7	42.70	10.5	Yes
Gross pollutants	89.4	89.4	0	Yes

Flow based cumulative frequency graphs for existing and developed scenario conditions for total phosphorus and total nitrogen concentrations are provided in Figure 5.4 and Figure 5.5**.** To achieve NorBE flow-based pollutant concentrations of phosphorus and nitrogen in the develop scenario must be equal to or less than the existing scenario between the 50th and 98th percentiles.

The results show:

- Phosphorus concentrations for the developed scenario are lower than the existing scenario and achieve compliance with the NorBE requirements between the 50th and 98th percentile.
- Nitrogen concentrations for the developed scenario are lower than the existing scenario from and achieve compliance with the NorBE requirements between the 50th and 98th percentile.

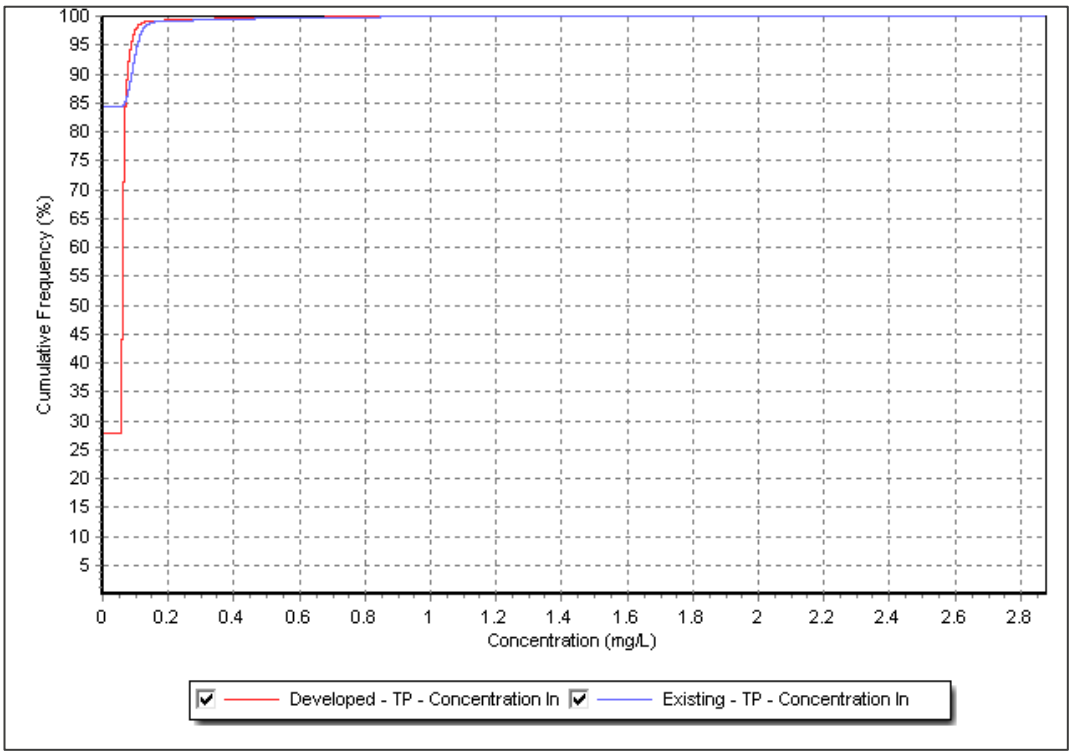

FIGURE 5.4: TOTAL PHOSPHORUS CUMULATIVE FREQUENCY

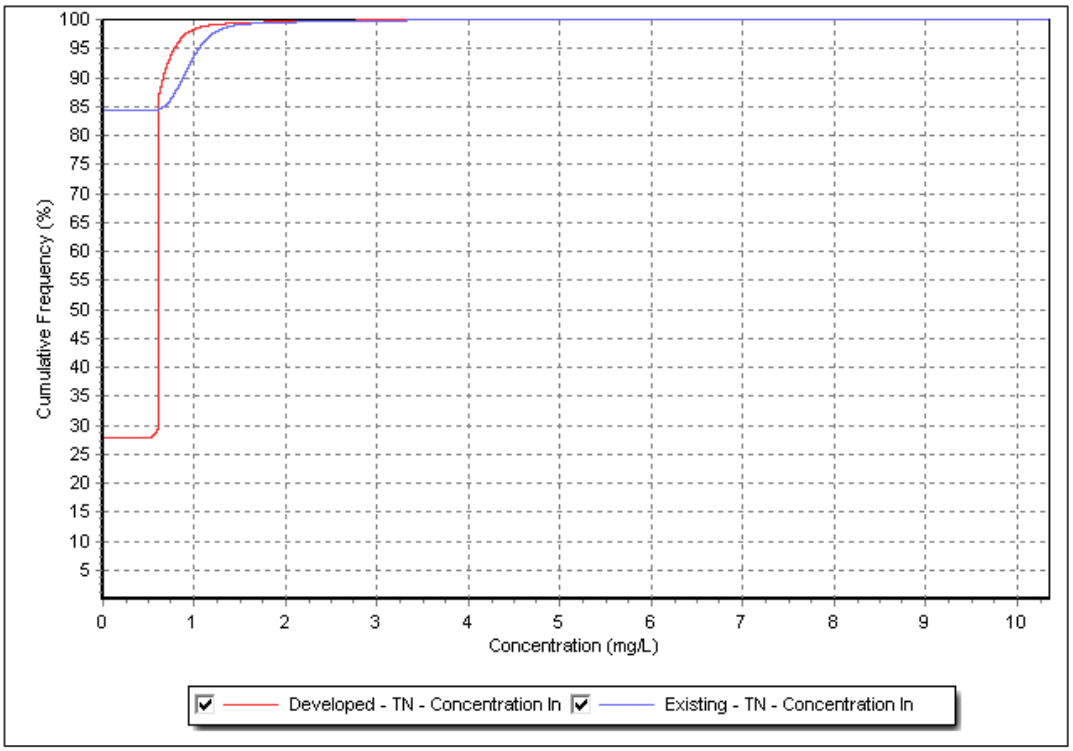

FIGURE 5.5: TOTAL NITROGEN CUMULATIVE FREQUENCY

6. SURFACE WATER IMPACT ASSESSMENT

6.1 Watercourse Characteristics

6.1.1 Flow Regimes

The proposed works will not involve significant modification or realignment of any natural watercourses traversing the Project Area, resulting in no impacts to stream ordering.

The proposed disturbance associated with construction and operation infrastructure (e.g. BESS areas, the substation, O&M building, water tanks, storage containers, and roads) may result in disturbance of minor overland flow paths. Where possible, the proposed roads in addition to existing access tracks will be used during construction and operation of the Project, limiting additional crossings of flow/drainage paths.

Construction of the BESS areas and ancillary infrastructure are proposed within proximity, or on top, of a mapped watercourse, and therefore some changes to flow paths are expected, with the proposed infrastructure being built above the Flood Planning Level. Stormwater drainage systems will be used to manage drainage around the infrastructure and within the internal road extents, and as such, erosion controls will be implemented to minimise scouring and erosion around the infrastructure. These predicted changes to on-site flow paths are considered to be negligible in regard to flow regimes and associated downstream catchment areas.

6.1.2 Waterfront Land

As described in Section 6.1.1, installation of infrastructure is proposed within close proximity and within watercourses (refer to Figure 2.4). Mapping of waterfront land was undertaken for all 3rd order and above watercourses, as well as 1st and 2nd order watercourses, and waterbodies exhibiting defined bed and banks (base on interpretation of topographical survey). The assessment indicated that:

- One watercourse, mapped with waterfront land, falls within the Development Footprint for the Project (Assessment Area only). The proposed transmission line and the access road to the existing Marulan substation are the only items within the waterfront land.
- The mapped watercourse that is located within the vicinity of the BESS areas and ancillary infrastructure does not have any land assess as being waterfront land based on NRAR criteria.

6.1.3 Flooding

During construction, operation and decommissioning of the Project, careful consideration should be given to the impacts of flooding both on the Project itself and any potential changes to flood flows downstream of the Project. Assessment of flood impacts associated with the proposed infrastructure is described in Section 4.4 and Section 6.1.3.1.

6.1.3.1 Ancillary Infrastructure

The flood assessment has considered the impacts of both temporary and permanent ancillary infrastructure. Considering any permanent infrastructure, except for roads, is assumed to be raised above the Flood Planning Level, comments on the impacts for specific Project infrastructure items are listed below:

- **Internal Roads** – The internal roads were not raised above the Flood Planning Level and observe inundation in all modelled flood events. The internal roads see an increase flood depths and velocities due to diversion and ponding around the raised infrastructure. For the 1% AEP observations within the internal roads are as follows:

– Around the BESS areas depths up to 0.12 m, and velocities up to 2.09 m/s are observed.

– To the south of the area raised for the O&M building, the storage containers, and the water tank, depths up to 0.12 m, and velocities up to 2.41 /s are observed.

- To the east and north of the substation depths up to 0.89 m, and velocities up to 3.31 m/s are observed

- **BESS Areas** – The BESS areas were conservatively raised above the Flood Planning Level and are not impacted by flooding.
- **Laydown Area** – The laydown area was not raised above the Flood Planning Level and observes some inundation in all modelled flood events. This inundation is only observed towards the northern extent of the area in the 1% AEP but for the PMF the full area observes minor inundation. It is expected that any construction materials or equipment will be placed to the southeast and away from the inundated areas, prior to any forecasted flood events. The maximum water depth is approximately 0.18 m in the 1 % AEP and 0.35 m in the PMF, and the maximum velocities are 1.94 m/s in the 1% AEP and 3.87 m/s in the PMF.
- **Substation** – The substation was conservatively raised above the Flood Planning Level and is not impacted by flooding. The raised area has resulted in an increased flood extent with water being re-directed along the northern edge of the area. This is considered a minor change to flood regime, as the altered flood path reconnects with the existing channel prior to exiting the Assessment Area. Flood depth increases and decreases also result from the substation raise. For the 1% AEP, the increase by up to 0.66 m and is caused by retention of flows behind the raised area. The peak decrease of 0.15 m (1% AEP) is observed along the western edge of the substation and is caused by the altered flow path. The ponded area upstream of the substation also sees velocity decreases by up to 1.16 m/s in the 1% AEP.
- **Area of the O&M Building, Storage Containers, and Water Tank** – These facilities were conservatively raised above the Flood Planning Level and observed no flood impacts. The raised area has resulted in an increased flood extent with water being re-directed along both the northern and southern edges. Increases to 1% AEP flood depths and velocities are observed to the southeast of this area by up to 0.13 m and 1.16 m/s, respectively.

The impacts observed from the proposed infrastructure are considered negligible, as they do not extend beyond the Assessment Area and as they will be mitigated in detailed design through stormwater drainage design and ESC measures (e.g. rip rap).

6.1.3.2 External Road Upgrades

The external roadworks (i.e., upgrades) were not included in the flood modelling, as this area was added after the model development. However, as the works are minor, no constriction or retention of flows are likely and therefore negligible impacts to flow regimes is expected.

6.1.3.3 Flood Extents

No significant changes to flood extent are observed for any of the modelled events (i.e., 5 % AEP, 1% AEP, 0.2% AEP, and PMF event). The only changes are minor, are contained to the Assessment Area, and are due to re-direction of some flows around raised infrastructure areas. Refer to the 'increased flood extent' (pink areas) on the difference mapping presented in Appendix C.

6.1.3.4 Downstream Flows

To assess the impact of the Project on flood duration, volumes, and rates of rise, the flows off the BESS and ancillary infrastructure area and downstream of the Assessment Area (i.e., to the southwest) were interrogated.

Flows downstream of the Assessment Area, display negligible change with the proposed Project, as shown in Figure 6.1.

The greatest volume change due to the Project is in the PMF where peak flows increase by 0.91 m^3/s (from 211.29 m^3/s to 212.2 m^3/s). This increase in flows is a result of water around the BESS areas now being diverted to the west, rather than to the north across Canyonleigh Road.

Negligible downstream impacts are observed in all modelled AEP events. With only a minor area of increased flood depths observed to the west of the Assessment Area (downstream approximately 150 m) for the 5% AEP event. This impact does not reach the Wollondilly River and is not observed in any other modelled events.

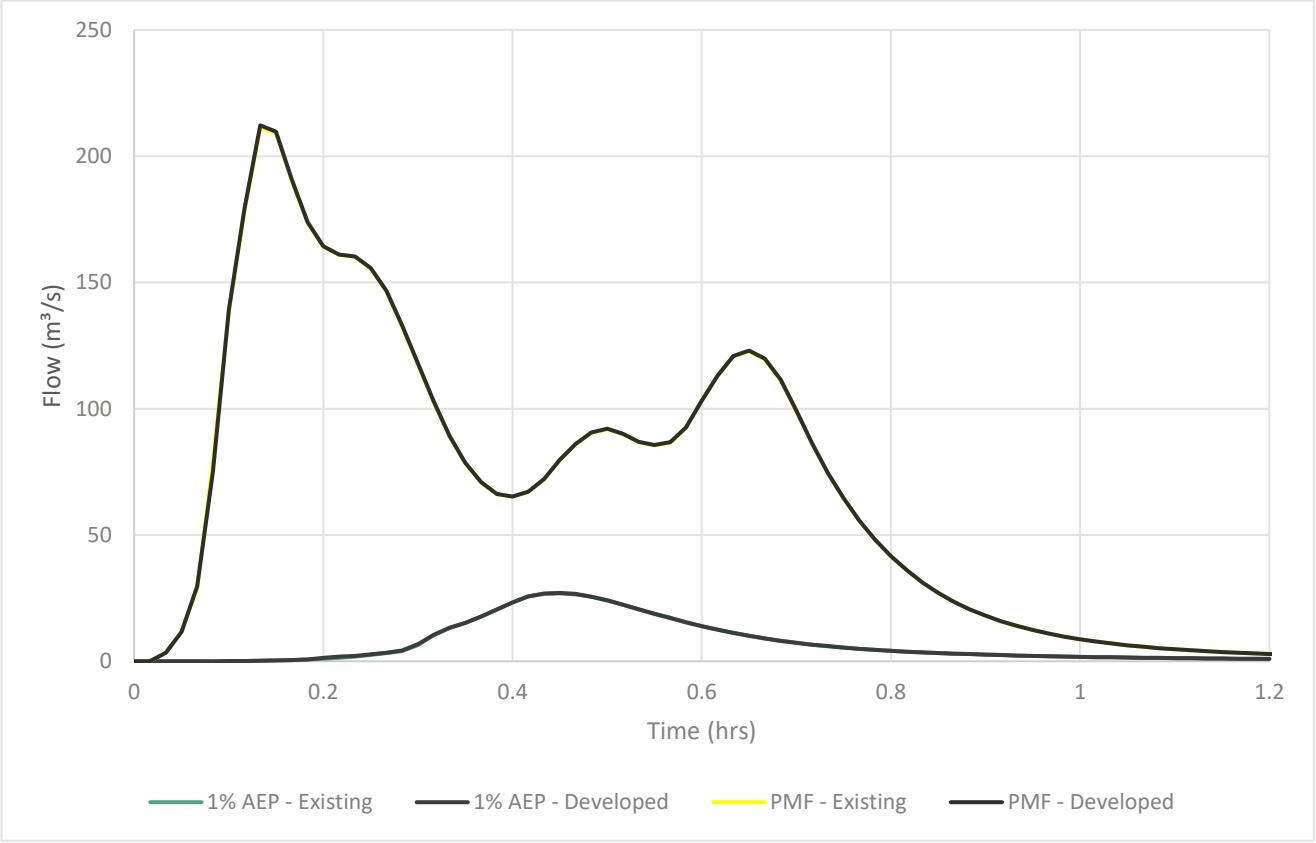

FIGURE 6.1: FLOWS – DOWNSTREAM FLOWS

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6.2 Surface Water Take and Users Water Quality

Several components of the Project introduce potential for impacts to the quality of surrounding surface water. The activities and potential impacts are summarised in Table 6.1 and discussed in further detail in subsequent sections. Potential mitigation measures are discussed in further detail in Section 9.

TABLE 6.1: SURFACE WATER QUALITY IMPACTS

Project Phase	Project Component	Activity	Risk / Impact	Mitigation Measure Overview
Construction	• Establishment of temporary laydown, storage and site facilities areas. • Construction of permanent infrastructure (Substation and BESS)	• Vegetation clearing & ground disturbance. • Earthworks. • Concrete works. • Vehicle movement. • Soil stockpiling.	• Soil erosion and sedimentation of downstream watercourses and crops. • Spill of hydrocarbons or other pollutants used to support transportation and construction activities. • Release of stockpiled materials or concrete by-products (dust, slurry, water) into downstream watercourses and crops.	• Erosion and Sediment Control Plan (ESCP). • Construction Environmental Management Plan (CEMP).
	• Construction / establishment of access tracks.	• Vegetation clearing & ground disturbance. • Earthworks. • Vehicle movement.	• Soil erosion and sedimentation of downstream watercourses and crops. • Spill of hydrocarbons or other pollutants used to support transportation and construction activities.	• Erosion and Sediment Control Plan (ESCP). • Construction Environmental Management Plan (CEMP).
	• Installation of electrical infrastructure.	• Vegetation clearing & ground disturbance. • Earthworks. • Vehicle movement.	• Soil erosion and sedimentation of downstream watercourses and crops. • Spill of hydrocarbons or other pollutants used to support transportation and construction activities.	• Erosion and Sediment Control Plan (ESCP). • Construction Environmental Management Plan (CEMP).
	• Site workers.	• Wastewater from site amenities.	• Discharge / spill of wastewater (treated or untreated) into downstream watercourses and crops.	• Appropriately designed and maintained wastewater management system.
Operation	• Site workers.	• Wastewater from site amenities.	• Discharge / spill of wastewater (treated or untreated) into downstream watercourses and crops.	• Appropriately designed and maintained wastewater management system.

Project Phase	Project Component	Activity	Risk / Impact	Mitigation Measure Overview
	• Use of access tracks.	• Vehicle movement.	• Soil erosion and sedimentation of downstream watercourses and crops. • Spill of hydrocarbons or other pollutants used to support transportation and operation activities.	• Construct and maintain access tracks in accordance with Blue Book Volume 2C: Unsealed roads. • Operational Environmental Management Plan (OEMP).
Decommissioning	• Removal of BESS and ancillary infrastructure.	• Ground disturbance. • Vehicle movement.	• Soil erosion and sedimentation of downstream watercourses and crops. • Spill of hydrocarbons or other pollutants used to support transportation and decommissioning activities.	• Erosion and Sediment Control Plan (ESCP). • Construction Environmental Management Plan (CEMP).

There are several minor watercourses within the Assessment Area with direct hydrological connections to the Wollondily River (downstream watercourse), ultimately discharging into the Wollondilly River. Only two of these watercourses interact with the Development Footprint, both of which are non-perennial. The non-perennial nature of these watercourses (typically have no flow) reduces the potential risk of downstream water quality impacts.

With the mitigation measures tabulated in Table 6.1 and an appropriate stormwater management system design it is therefore considered that the risk of significant downstream surface water quality impacts is low. However, the implementation of strict management and monitoring programs, detailed in the proposed ESCP and CEMP, will be critical to ensure downstream impacts are suitably mitigated and effectively managed.

6.2.1 Construction

During the Project construction phase, potential risks to surface water quality are higher due to greater amounts of ground disturbance and earthworks, vehicle movement, concrete works, and stockpiling, require management. As outlined in Table 6.1, the key risks include:

- Soil erosion and sedimentation.
- Spill of hydrocarbons or other pollutants used to support transportation and installation activities.
- Release of concrete by-products (dust, slurry, water).
- Discharge/spill of wastewater (treated or untreated).
- Release of tannins to downstream watercourses and crops (considered a low risk in context of the vegetation types).

If sediments are exposed to the surrounding environment, they can degrade water quality, affect aquatic habitats, contaminate domestic and stock drinking water, and harm crops through siltation. The impacts and mitigation strategies for the mobilisation and release of sediments during construction activities is further discussed in Section 9.

Surface water contamination resulting from a spill of hydrocarbons or other chemical pollutants, including concrete by-products, can be toxic to aquatic life, contaminate downstream watercourses and have long-term ecological impacts. Spills and contamination may also affect surrounding vegetation and soil, resulting in contamination of shallow groundwater pockets within and surrounding the Assessment Area, potentially harming crops that rely on water from affected sources. Best practice spill management controls can adequately minimise the potential contamination impacts.

Similarly, the discharge or spill of wastewater, whether treated or untreated, into downstream watercourses presents a risk to surface water quality. Untreated wastewater may contain pollutants harmful to aquatic life, while even treated effluent and residual solids can also contain

residual chemicals that can impact the environment. These impacts can be significantly reduced through design, location and implementation of a suitable wastewater management system.

If unmanaged, the overall impact of the above risks could cause detrimental impacts on the ecological balance of watercourses. However, considering the limited connectivity of the Project to adjacent watercourses and through adopting best practice approaches and proposed mitigation measures (Section 9), these impacts are considered negligible. Such mitigation measures include the development of an ESCP and CEMP which will document the specific controls to be implemented (e.g. hydrocarbon storage requirements) during the construction phase.

6.2.2 Operation

As outlined in Table 6.1, potential surface water quality impacts associated with the Project operation phase include:

- Soil erosion and sedimentation associated with vehicle movement, scouring and poor site stabilisation.
- Spill of hydrocarbons or other pollutants used to support transportation and operation of substations.
- Discharge / spill of wastewater.

Operation activities, as well as poor site stabilisation following construction may result in sediments being exposed to the downstream environment. As discussed in Section 6.2.1, this can degrade water quality, affect aquatic habitats, contaminate stock drinking water, and harm crops through siltation. The impacts of the mobilisation and release of sediments during operation activities is further discussed in Section 6.3.

Surface water contamination resulting from a spill of hydrocarbons/ chemicals and wastewater would be managed through the same processes used during construction (refer to Section 9) and are considered negligible with these management measures in place.

6.2.3 Decommissioning

The equipment and process required for Project decommissioning would be similar to the construction phase and therefore result in similar risks to surface water quality due to ground disturbance, vehicle movement, and vegetation management. As outlined in Table 6.1, risks associated with decommissioning and rehabilitation are summarised below:

- Soil erosion and sedimentation.
- Spill of hydrocarbons or other pollutants used to support transportation and decommissioning activities.

Water quality mitigation and management measures required during the construction phase would be informed by the practices used during construction and are further discussed in Section 9. With the proposed management measures in place, overall water quality impacts during decommissioning are expected to be negligible.

6.3 Erosion and Sedimentation Control

6.3.1 Construction

Project construction would require up to 14.8 ha of land disturbance for the installation of the BESS and associated infrastructure. Construction activities involving ground disturbance, earthworks and transporting and stockpiling soil introduce pathways for soils erosion and, in turn, potential movement of sedimentation into downstream water systems.

Impacts associated with the mobilisation of soil include:

- Degradation of the quality of downstream domestic and stock drinking water.
- Increased turbidity and reduced visual clarity of downstream watercourses, impacting aquatic ecosystem health (changes to natural reflectance of water, smothering aquatic life and clogging fish gills).
- Increased sediment build up in downstream watercourses and waterbodies, changing the geomorphology and disturbing natural flow regimes.

- Increased levels of dissolved metals and nutrients become mobilised with the soil, entering watercourses and waterbodies. This can be a threat if high concentrations of undesirable metals and nutrients reach water supplies for aquatic life or domestic, irrigation and livestock users.

Project construction would require area specific erosion and sediment control plans (ESCP) to be developed in accordance with the 'Blue Book' and *Best Practice Erosion and Sediment Control* (IECA, 2008).).

6.3.2 Operation and Decommissioning

Poor site stabilisation during and following construction will lead to impacts associated with the mobilisation of soil, as described in Section 6.3.1. This can be effectively managed through development of an ESCP and ongoing inspections and maintenance, in accordance with the 'Blue Book'. In addition to an ESCP an appropriately design stormwater management system will be developed for the Project during detailed design.

7. GROUNDWATER IMPACT ASSESSMENT

7.1 Groundwater Quality

Potential impacts to groundwater quality during construction and operation activities may result from spill of wastewater, hydrocarbons or other pollutants used to support transportation and site activities. The potential groundwater water quality impacts associated with these activities are the same as the surface water impacts and are summarised in Table 6.1. The risk of these spills impacting groundwater quality is considered moderate due to the potentially shallow groundwater table (Section 2.4). With standard management practices that will be put in place this risk will be lowered to an acceptable level (refer to Section 8).

7.2 Groundwater Levels and Flow Direction

As identified in Section 2.4, the shallowest standing water level of the bores within the vicinity of the Assessment Area is 1.8 m (GW104238, approximately 3.2 km from the Assessment Area). Additionally, the shallowest water bearing zone is identified for GW108393 (approximately 3.3 km from the Project Area) at 3-4 m below the surface. It is understood that the depth of excavations required for infrastructure footings and underground cables will be at a maximum 4 m. Due to shallow water level indicated for bores within the vicinity caution should be taken during construction activities to avoid potential interception of the underlying groundwater table.

7.3 Groundwater Take and Users

Although unlikely, the water sourcing strategy for the construction of the Project may include the construction of new groundwater bores. If this is deemed necessary to support construction, the Applicant will obtain applicable WALs, works approvals and water use approvals prior to any water extraction taking place. The requirement for such activities will be determined during the detailed design stage of the Project.

7.4 Groundwater Dependent Ecosystems

As discussed in 2.6.2, the potential GDEs identified surrounding the Assessment Area are likely dependent on local groundwater pockets recharged by rainfall and runoff, as well as the regional groundwater table. As the Project does not propose to intercept the regional groundwater table, or extract groundwater, any impacts to shallow groundwater pockets would be localised to the Assessment Area and not impact surrounding GDEs.

8. CUMULATIVE IMPACTS

In accordance with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE, 2022), cumulative impacts are a result of incremental, sustained and combined effects of human action and natural variations over time and can be both positive and negative. The accumulation of effects from past, current and future activities can result in cumulative impacts on surface and groundwater resources. When considered in isolation, impacts from specific projects may be considered minor or negligible, however, when multiple projects influence common receivers, the cumulative impact may be more significant.

The Project does not fall within any Renewable Energy Zones (REZ), as listed by the NSW Energy Coorporation (EnergyCo).

8.1 Relevant Projects

A total of 12 known approved and proposed renewables projects were identified as being within a 50 km radius of the Project Area. These include:

- Wattle Creek BESS (SSD-63345458, Planning)
- Wattle Creek Solar Farm (SSD-63344210, Planning)
- Marulan Solar Farm (SSD-13137914, Approved)
- Hanworth BESS (SSD-78179499, Planning)
- Bannaby BESS (SSD – 78810458, Planning)
- Swallow Tail BESS (SSD-78039972, Planning)
- Merino Solar Farm (SSD-59155459, Planning)
- Community-driven Solar Farm (N/A, Construction)
- Gundary Solar Farm (SSD-48225958, Planning)
- Kangaroo Valley BESS (SSD-78593964, Planning)
- Crookwell 2 & 3 Wind Farm (SSD-6695 & DA176 – 9-2004, Operational)
- Willavale BESS (SSD-78100252, Planning)

An additional 9 non-renewable major projects were also identified within the vicinity of the Project Area, these include:

- Marulan Gas-Fires Power Station 1 & 2 and Common Infrastructure (MP07_0175, MP06_0176, MP07_0174, Approved)
- Gunlake Quarry Extension (SSD-7090, Operational)
- Cleary bros Marulan Quarry (SSD-77991709, Planning)
- Marulan South Limestone Mine Continued Operations Project (SSD-7009, Operational)
- Holcim Lynwood Quarry (DA128-5-2005, Operational)
- WSC Quarry Marulan (SSD-82633224, Planning)
- Marulan Quarry (SSD-65146459, Planning)
- Moss Vale Resource Recovery Facility (SSD-45721464, Planning)
- HumeLink (SSI-36656827, Construction)

8.2 Potential Cumulative Impacts

The abovementioned Projects are located within the vicinity of the Project Area, with potential connectivity through watercourses. The key surface water receptor which has been considered in the cumulative impact assessment includes the Wollondilly River, which is fed by tributaries that flow off the Project Area. Proposed Project infrastructure interacts with a non-perennial watercourse that feeds into the

Wollondilly River, however, infrastructure will be suitably designed, constructed and installed to mitigate downstream impacts. Adopting appropriate mitigation and management (refer to Section 9) will minimise the likelihood of measurable cumulative impacts to common downstream surface water receptors. The cumulative impact assessment included a high-level review of the combined renewable Project Areas, against the Wollondilly River catchment area. The combined area (including this Project) of the renewable's projects listed in Section 8.1 is approximately 13,500 ha, which is around 0.0003% of the total Wollondilly River catchment area. Therefore, cumulative impacts to surface water quality and flow are considered negligible, as any increases to flows in the Wollondilly would be insignificant. In addition to this the cumulative impacts to groundwater are also considered to be negligible with the mitigation measures adopted.

The potential for cumulative impacts from the Project and adjacent known projects has been considered as presented in Table 8.1.

TABLE 8.1: IDENTIFICATION OF CUMULATIVE IMPACTS

Category of Impact	Potential Cumulative Impact
Flooding	• Several projects are proposed within the Wollondilly River catchment. The closest proposed projects are the Wattle Creek Solar Farm and Wattle Creek Battery Engeny Storage System, which are located approximately 3 km northwest on the other side of the Wollondilly River. • The likelihood of measurable cumulative flood impacts to receiving waters (i.e., Wollondilly River) from the Project are anticipated to be negligible as the Project infrastructure is located outside of direct channel bed and banks of this waterway and as the flood modelling has not shown impacts extending beyond the Assessment Area (i.e. any impacts of the Project are localised and do not extent to locations of other projects).
Water Quality	• The likelihood of measurable cumulative water quality impacts to common receiving surface water receptors (e.g. the Wollondilly River) from erosion and sedimentation or chemical/wastewater spills during overlapping construction periods is considered negligible provided the recommended mitigation measures are implemented (refer to Section 9).
Surface Water Supply	• Construction water supply will be in accordance with NSW licensing requirements and landholder rights, and therefore not contribute to cumulative impacts on surface water or groundwater take. • Where rainwater is insufficient, potable water use will be supplemented with imported water. Overlapping project timelines may result in a cumulative impact to potable water supply, however, it is expected to be negligible in the context of the regional township water supply capacity. • Operational demands during operation will be limited to small amounts of potable water and expected to be negligible in the context of the regional township water supply capacity.

9. MITIGATION AND MANAGEMENT MEASURES

Detailed environmental studies have been undertaken to inform the Project design, including the surface water and groundwater assessments detailed in this WRIA. The consideration and outcomes of these studies in the design and integration with the approved operations will minimise the potential for impacts on surface water resources.

The proposed mitigation measures for the Project are summarised in Table 9.1.

TABLE 9.1: SUMMARY OF POTENTIAL IMPACTS AND MITIGATION AND MANAGEMENT MEASURES

Potential Impacts	Mitigation Measure	Project Implementation Stage
WATERCOURSE CHARACTERISTICS		
Filling Of Streams for Infrastructure / Water Crossings	Consider the following mitigation measures in the Project detailed design: • Limit water crossing to existing access tracks where possible. • Arrange Project infrastructure such that stream disturbance and modifications (filling / diversions) are limited to minor watercourses. In the event construction of waterway crossings is required, these will be designed, constructed and maintained to consider DPE *Guidelines for instream works on waterfront land* (DPE, 2022) and *Guidelines for riparian corridors on waterfront land* (DPE, 2022).	Detailed design
Flooding		
Impacts To In-Stream and Overland Flooding	Consider the following mitigation measures in the Project detailed design stage to minimise impacts to flooding where possible: • Minimise filling of substation, switching station sites and on-site facilities. • Minimise extent of Project infrastructure within the 1% AEP flood extent. • Design to manage flood impacts and flow conveyance at watercourse crossings (if any). • Design appropriate stormwater treatment measures (e.g. vegetated swales, bioretention areas).	Detailed design
Impacts on the Project Design Due To Predicted Flooding	Optimisation of the Project design during detailed design to ensure: • Permanent ancillary infrastructure (O&M facility, substation, and BESS areas) are located above the flood planning level (1% AEP with 500 mm freeboard).	Detailed design

Potential Impacts	Mitigation Measure	Project Implementation Stage
Impacts to Site Personnel During a Flood Event	Floodplain management planning to determine site management protocols during flood events that could impact construction or access areas, including: • Suitable early warning and communication protocols. • Triggers for shutdown, evacuation and recovery. • Emergency response and support. Flooding isolation during construction and operations will be managed through development of a flood emergency response plan. This Emergency Response Plan will: • Consider emergency response in rare events. • Be developed in accordance with existing community emergency management arrangements for flooding. • Be developed in consultation with Goulbourn-Mulwaree Council and NSW SES.	Post Approval / Pre-construction
Increased Stormwater Runoff from Vegetation Clearing and Filling for Infrastructure	Increased stormwater runoff during operations (due to clearing of vegetation and hardstand for infrastructure) will be managed through an appropriately designed stormwater management system (SMS). The SMS will consider: • Location of site infrastructure away from existing watercourses or areas subject to high levels of overland flow. • Diversion of upstream flows around site infrastructure as required, to minimise scouring and erosion. • Inspection and monitoring regimes to maintain stormwater and erosion and sediment control structures.	Construction
Water Quality		
Sedimentation of Downstream Watercourses	Sedimentation will be managed through the development of an appropriately designed stormwater management system. As well as ongoing monitoring and maintenance through operation and decommissioning of additional controls if identified as required. The total area of disturbance at any time should be minimised where possible and progressive rehabilitation and stabilisation strategies implemented throughout construction. During construction, the following management measures will be considered to minimise the potential for mobilisation of sediment or dust: • Locate stockpiles away from drainage lines, or areas subject to high levels of overland sheet flow and minimise stockpile size. • Develop and implement area specific erosion and sediment control measures including bunding and diversion drains as required. • Use stockpile stabilisation techniques such as covering. • All runoff from disturbed areas to pass through an appropriate sediment trap prior to discharging to the receiving environment. • Concrete washout to be undertaken in a lined bunded area.	Construction, Decommissioning

Potential Impacts	Mitigation Measure	Project Implementation Stage
Contaminant Spills	Prior to commencing construction activities, a Construction Environment Management Plan (CEMP) will be developed to identify site specific controls and procedures to minimise the potential for hydrocarbons and other contaminants being discharged into the environment. This CEMP should consider: • Storage of hydrocarbons and other liquid chemicals within an above ground, bunded areas away from watercourses or area subject to high levels of overland sheet flow. • Re-fuelling of construction vehicles and equipment to be limited to designated areas, with adequate spill management controls. • Maintain an emergency spill kit and relevant emergency spill response procedures. • Transport and dispose of any hydrocarbons and chemicals captured (or materials contaminated with hydrocarbons or chemicals) during Project construction and operation of the substations and switchyards at an appropriately licenced facility. • Ongoing monitoring and maintenance.	Construction, Operation, Decommissioning
Surface Water Quality Impacts	The CEMP will consider the following management measures to minimise the potential impacts to surface water and groundwater quality within and surrounding the Project Area: • Develop and implement a suitable monitoring regime of all stormwater and erosion and sediment control structures, particularly following large flow events.	Construction, Decommissioning
Water Supply		
Water Licences to Meet Demands	All required water licensing and approvals will be coordinated with associated landholders, regulators and/or suppliers (e.g. Council, others) if that source is needed to support water supply arrangements for during construction and operation.	Post Approval (Construction, Operation, Decommissioning)
Wastewater Management		
Discharge of Wastewater or Effluent from Site	Design and implement a wastewater treatment system that: • Is appropriately sized for the Project infrastructure and operations. • Be designed and operated in accordance with best practices, as detailed in: – Designing and Installing On-Site Wastewater Management Systems, A WaterNSW Current Recommend (WaterNSW, 2023). – AS/NZS 1547:2012 Onsite domestic wastewater management' and the Department of Local Government's (1998) 'Environment & Health Protection Guidelines: On-site Sewage Management for Single Households' (the (ANZECC, 2000) 'Silver Book').	Detailed design

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11. QUALIFICATIONS

(g) In preparing this document, including all relevant calculation and modelling, Engeny Australia Pty Ltd (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

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(m) This Report does not provide legal advice.

APPENDIX A: WATER DEMAND ASSUMPTIONS

Canyonleigh BESS Water Demand Calculations

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Demand Type	Assumption Description	Assumption	Units	Total Demand (m3)	Total Demand (ML)
Dust Suppression - General	Spray depth per pass	0.3	mm		
Dust Suppression - Roadways	Total road area	12,953	m2	729	0.7
	Amount of roadway worked at any one time	10%	%		
	Active construction days (18 months, assuming 6 days per week)	469	days		
	Number of passes per day on active work area	4	passes		
Road Construction/Compaction	Total road area	10,835	m2	1,318	1.3
	Water content added to condition initial rip	8%	%		
	Rip depth	500	mm		
	Dry Density	1,600	kg/m3		
	Total Weight for rip	8,668,398	kg		
	Water content added to condition fill	12%	%		
	Fill Depth	300	mm		
	Total Weight for fill	5,201,039	kg		
Compound Hardstands - Battery Energy Storage (BESS), PCS Station, Substations	**Hardstand Area**	33,103	m2	1,907	1.9
	Water content added to condition fill	12%	%		
	Fill Depth	300	mm		
	Dry Density	1,600	kg/m3		
	Total Weight for fill	15,889,563	kg		
Vehicle and Equipment Washdown	Active construction days (18 months, assuming 6 days per week)	469	days	4,693	4.7
	Washdown demand	10,000	L/day		
Potable Water - Peak Rate	Potable Demand	50	L/d/site worker	2,346	2.3
	Active construction days (18 months, assuming 6 days per week)	469	days		
	Active workers	100	FTE		
Total Construction Demand - Peak				10,993	11.0
Potable Water per Year - Operation	Potable Demand	50	L/d/site worker	65	0.1
	Work Days (1 year, 5 days/week)	261	days		
	Active workers	5	FTE		
Annual Operational Demand				65	0.1 ML/yr
					0.3 kL/d

Demand Type	Maximum Daily Rate (kL/d)
Non-Potable (Road Construction & Dust Supression)	18.43
Potable	5.0

APPENDIX B: EXISTING CONDITION FLOOD MODEL RESULTS

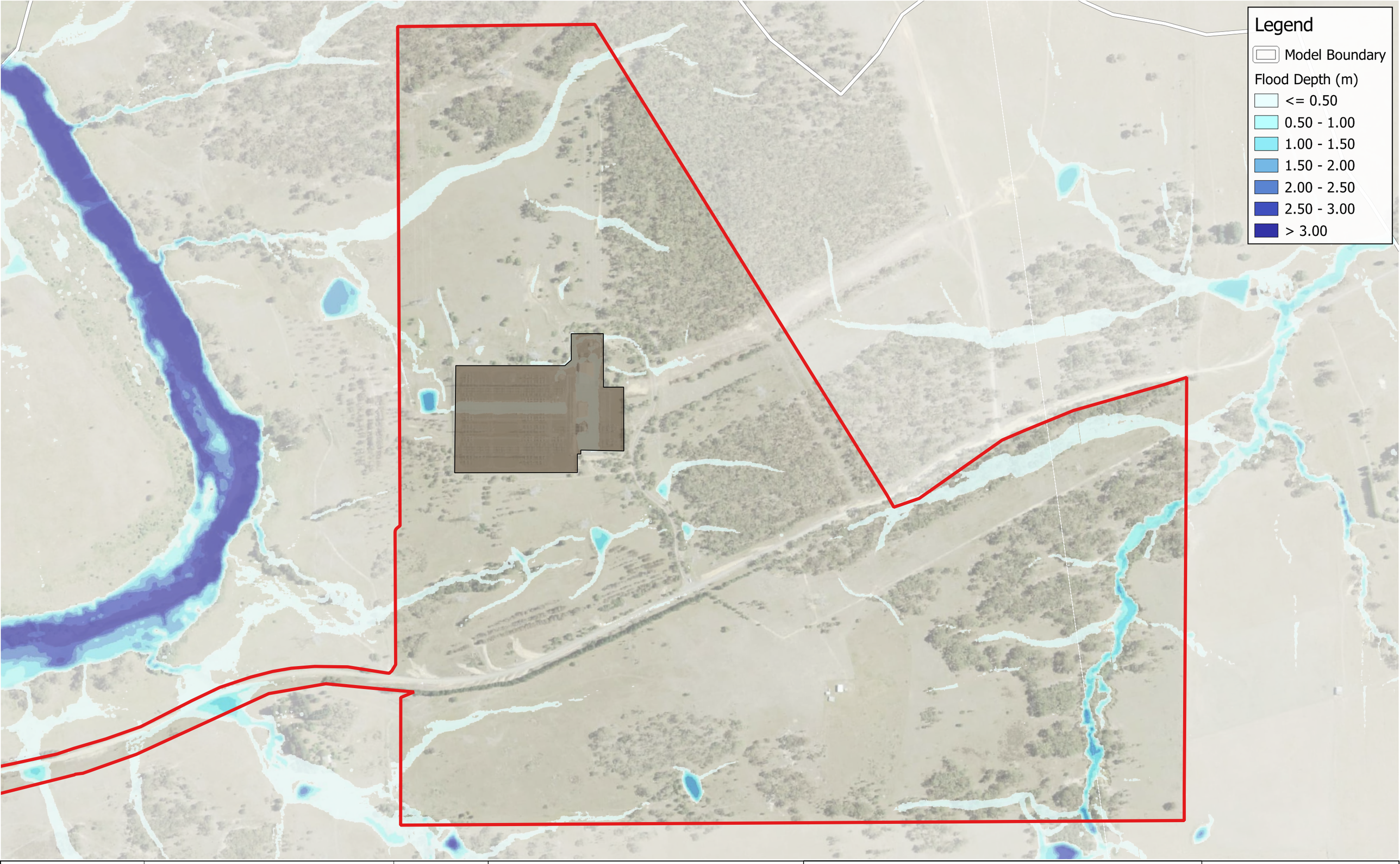

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Figure B1: Existing Conditions - 5% AEP Flood Depth

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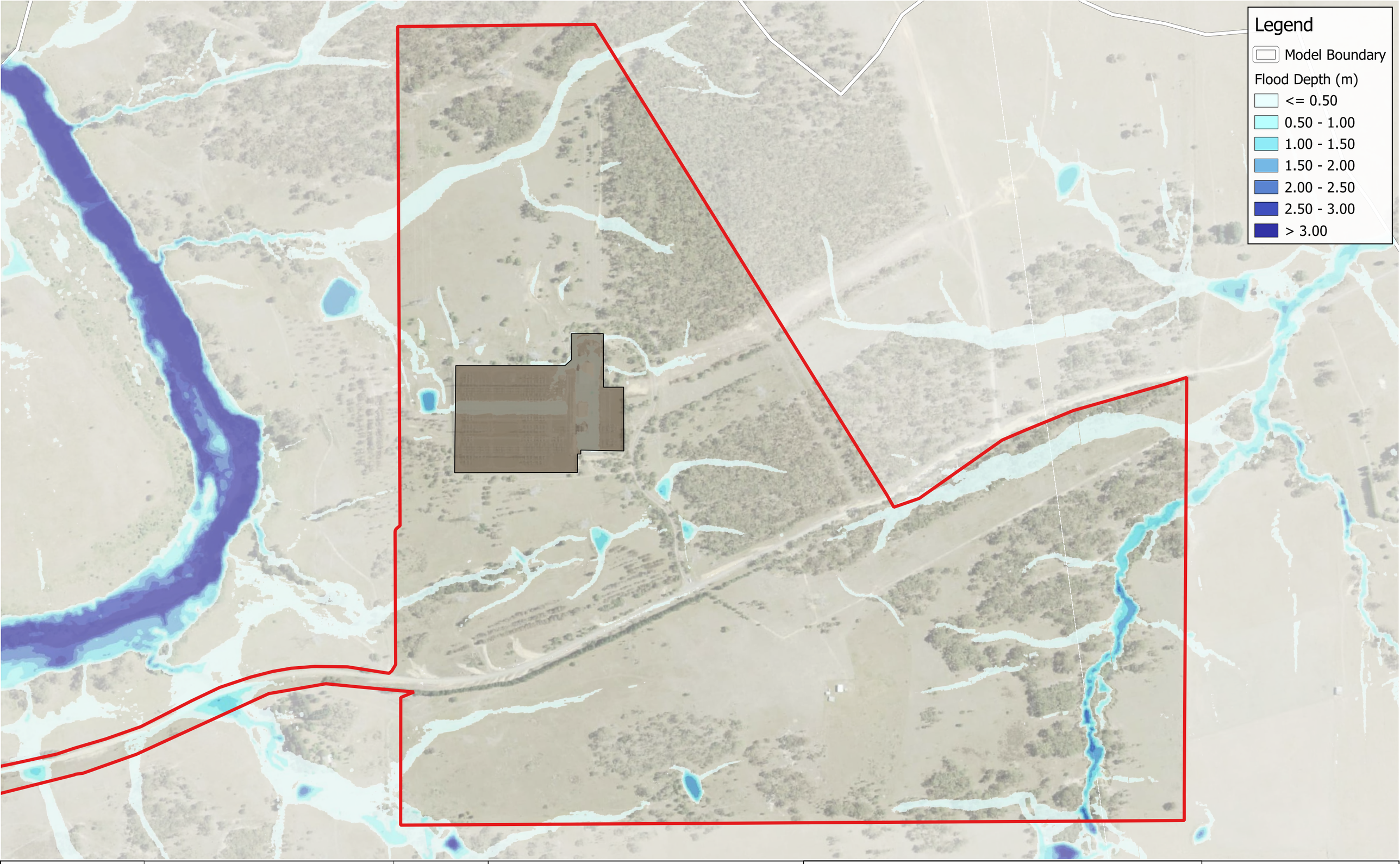

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Figure B2: Existing Conditions - 1% AEP Flood Depth

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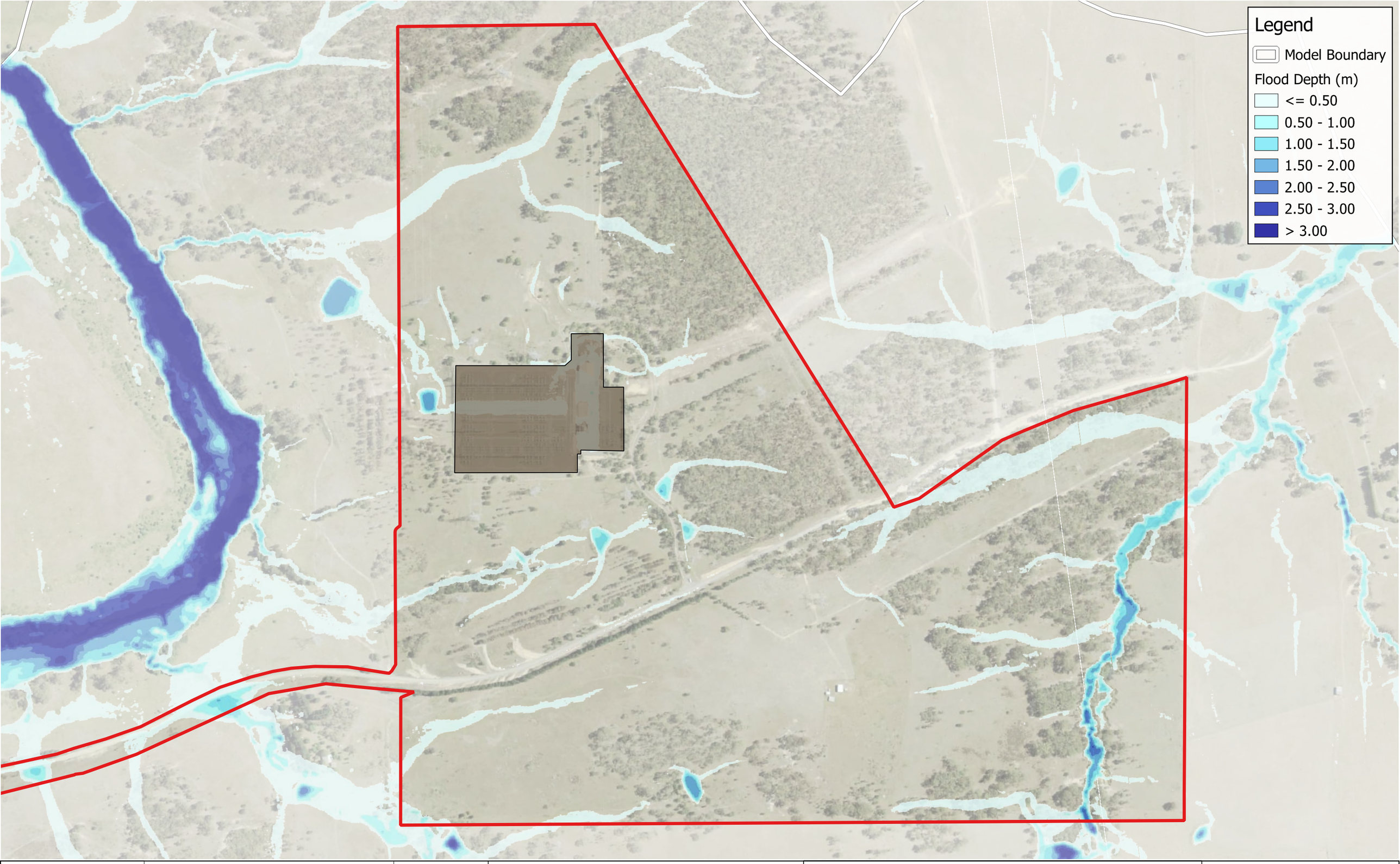

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Figure B3: Existing Conditions - 1% AEP Climate Change Flood Depth

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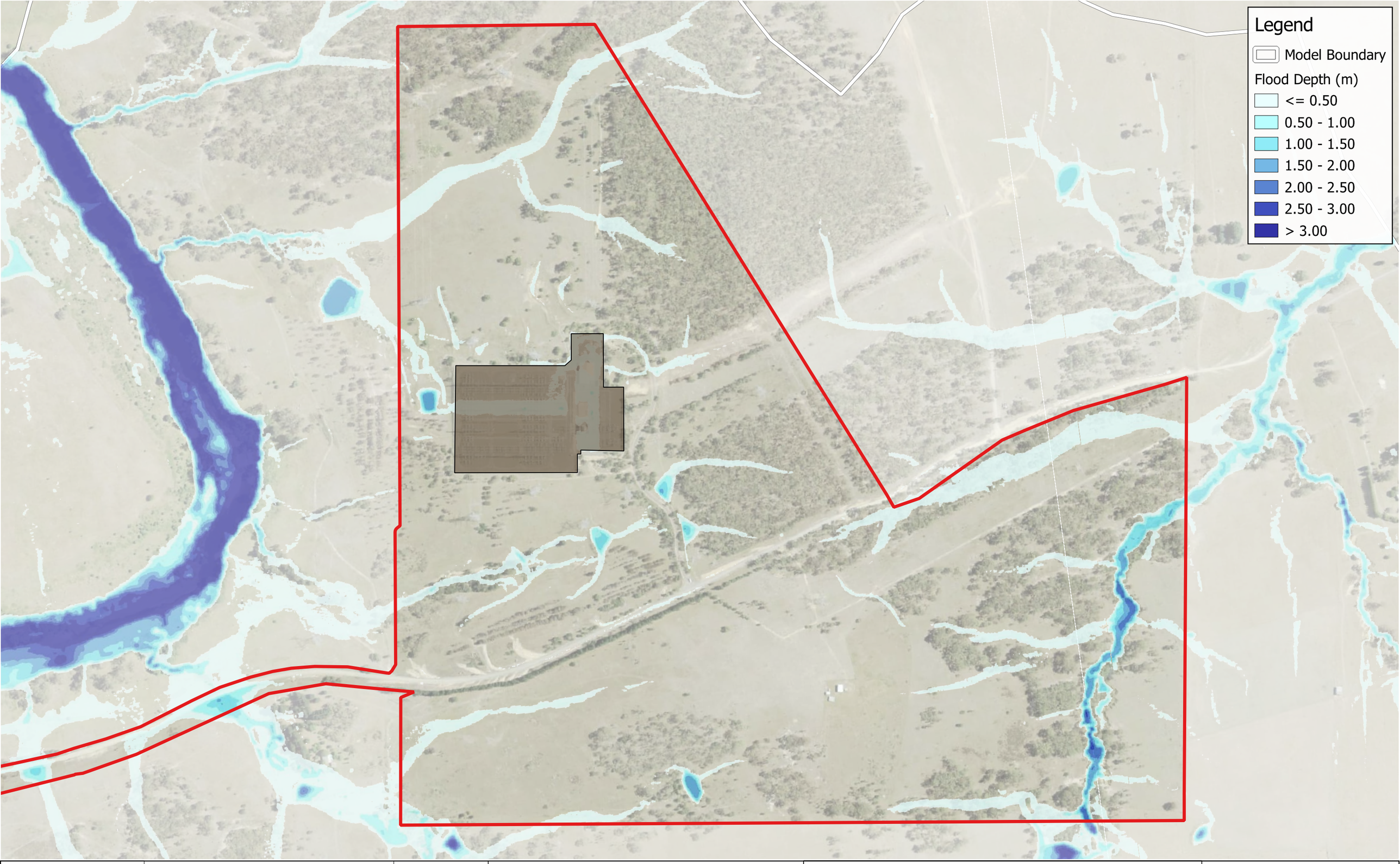

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Figure B4: Existing Conditions - 0.2% AEP Flood Depth

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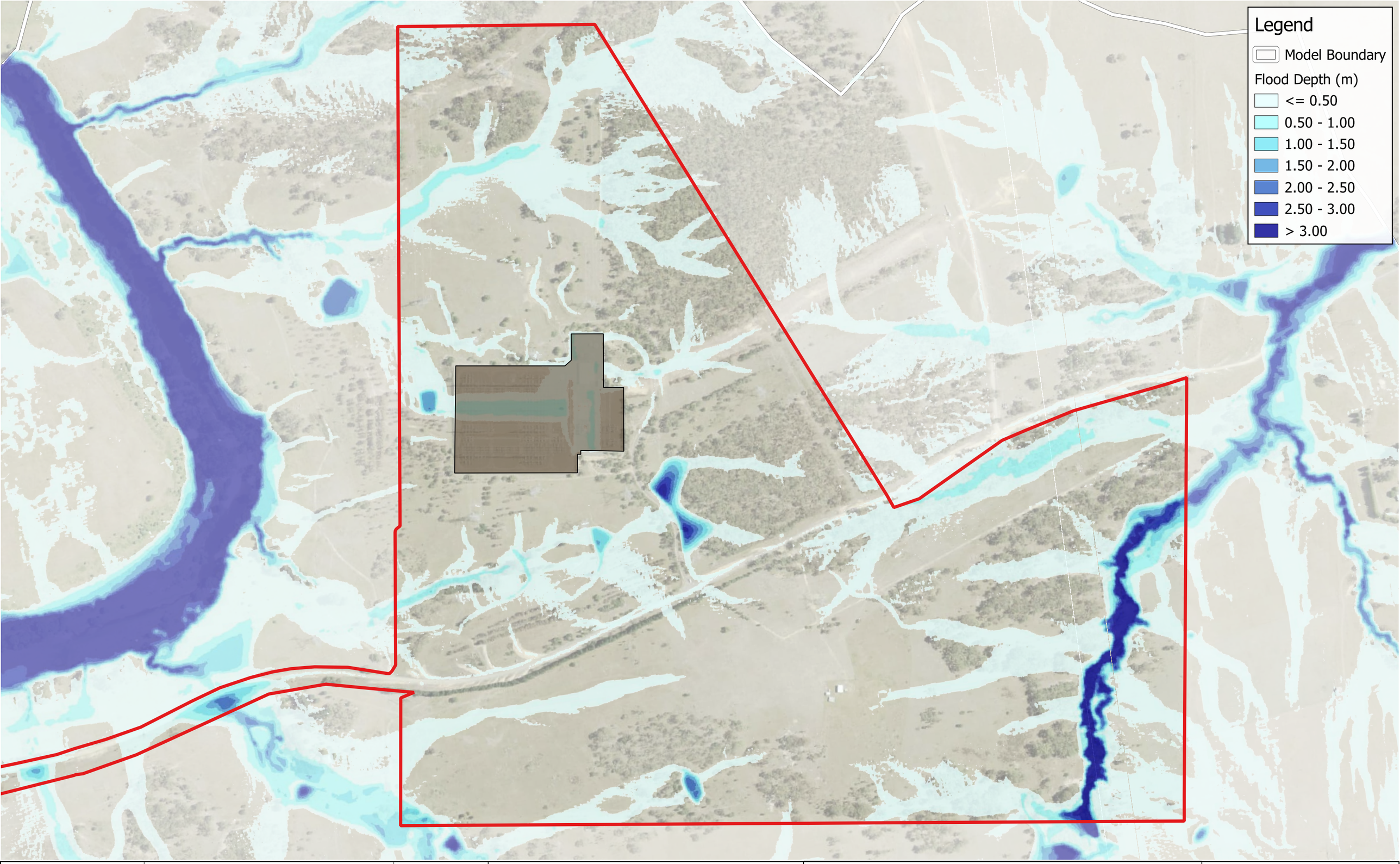

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Figure B5: Existing Conditions - PMF Flood Depth

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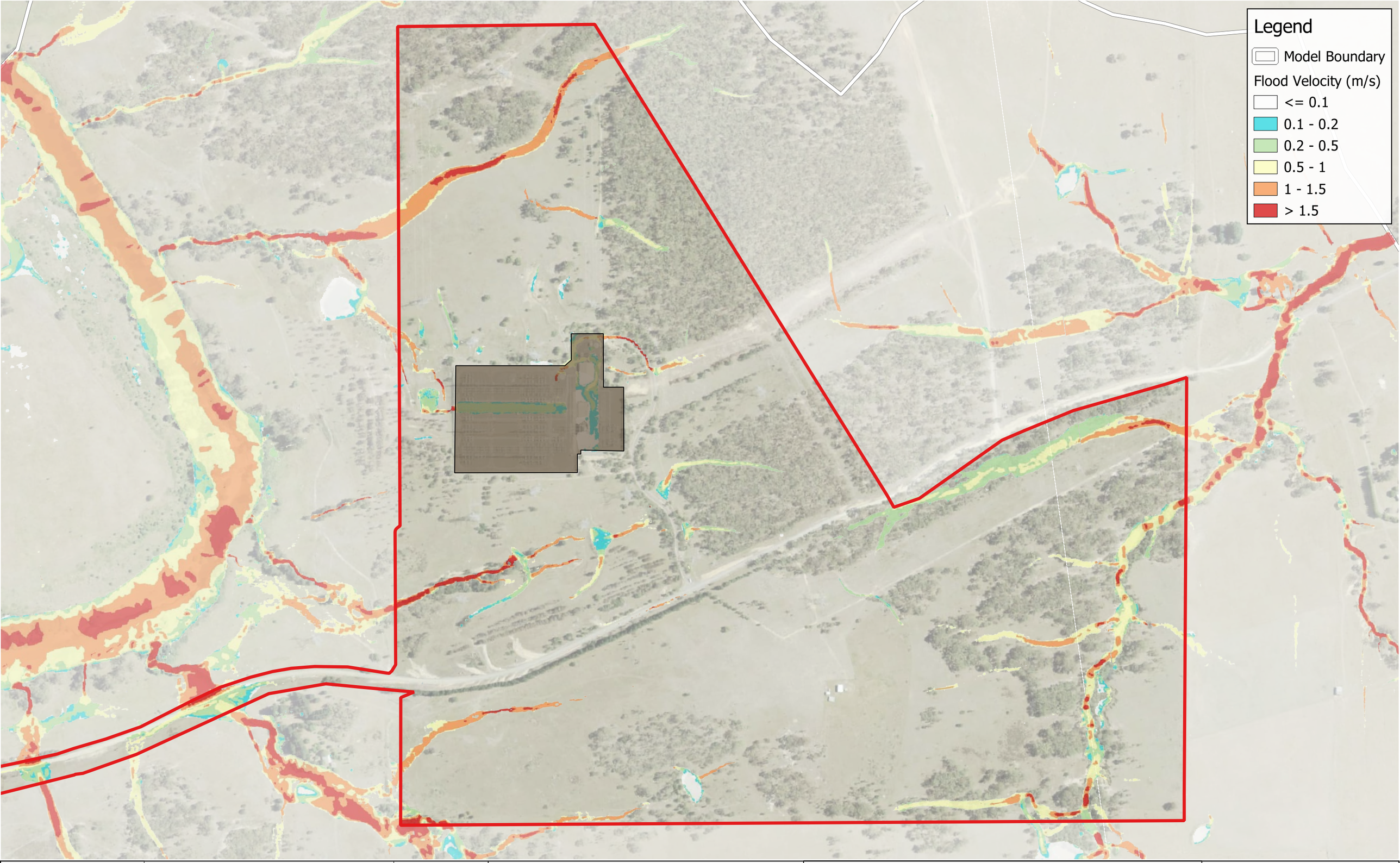

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Figure B6: Existing Conditions - 5% AEP Flood Velocity

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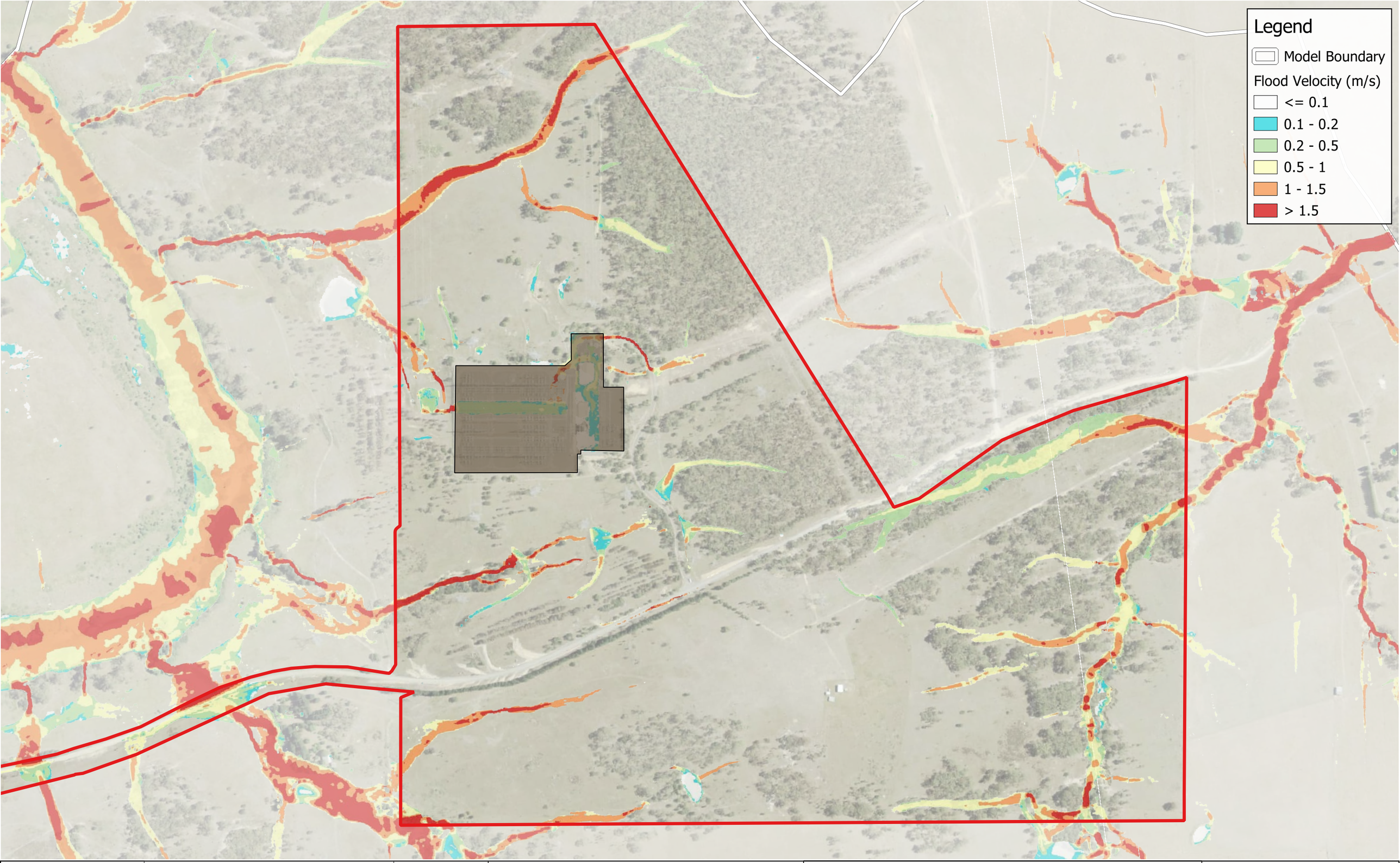

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Figure B7: Existing Conditions - 1% AEP Flood Velocity

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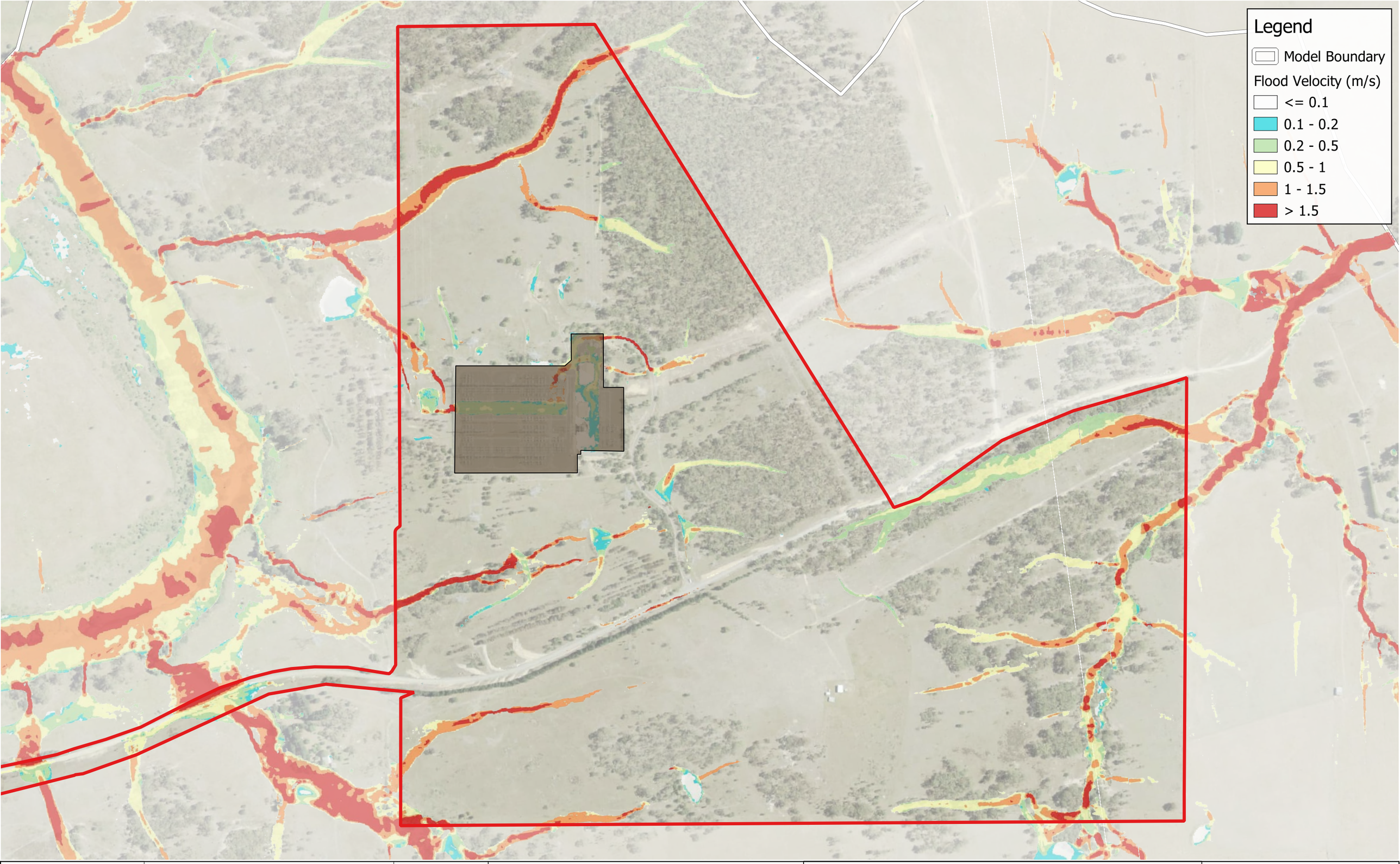

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Figure B8: Existing Conditions - 1% AEP Climate Change Flood Velocity

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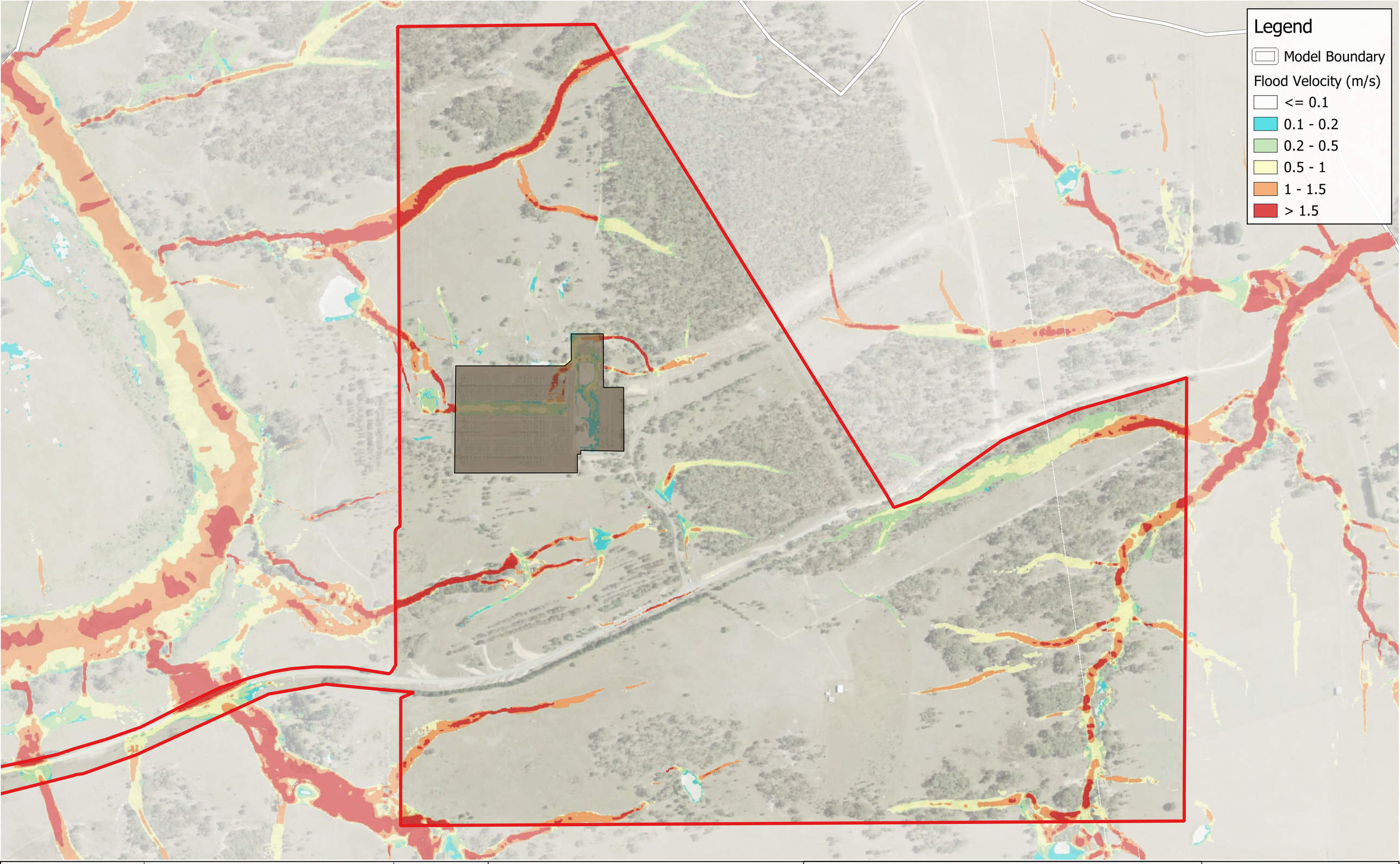

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Figure B9: Existing Conditions - 0.2% AEP Flood Velocity

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Figure B10: Existing Conditions - PMF Flood Velocity

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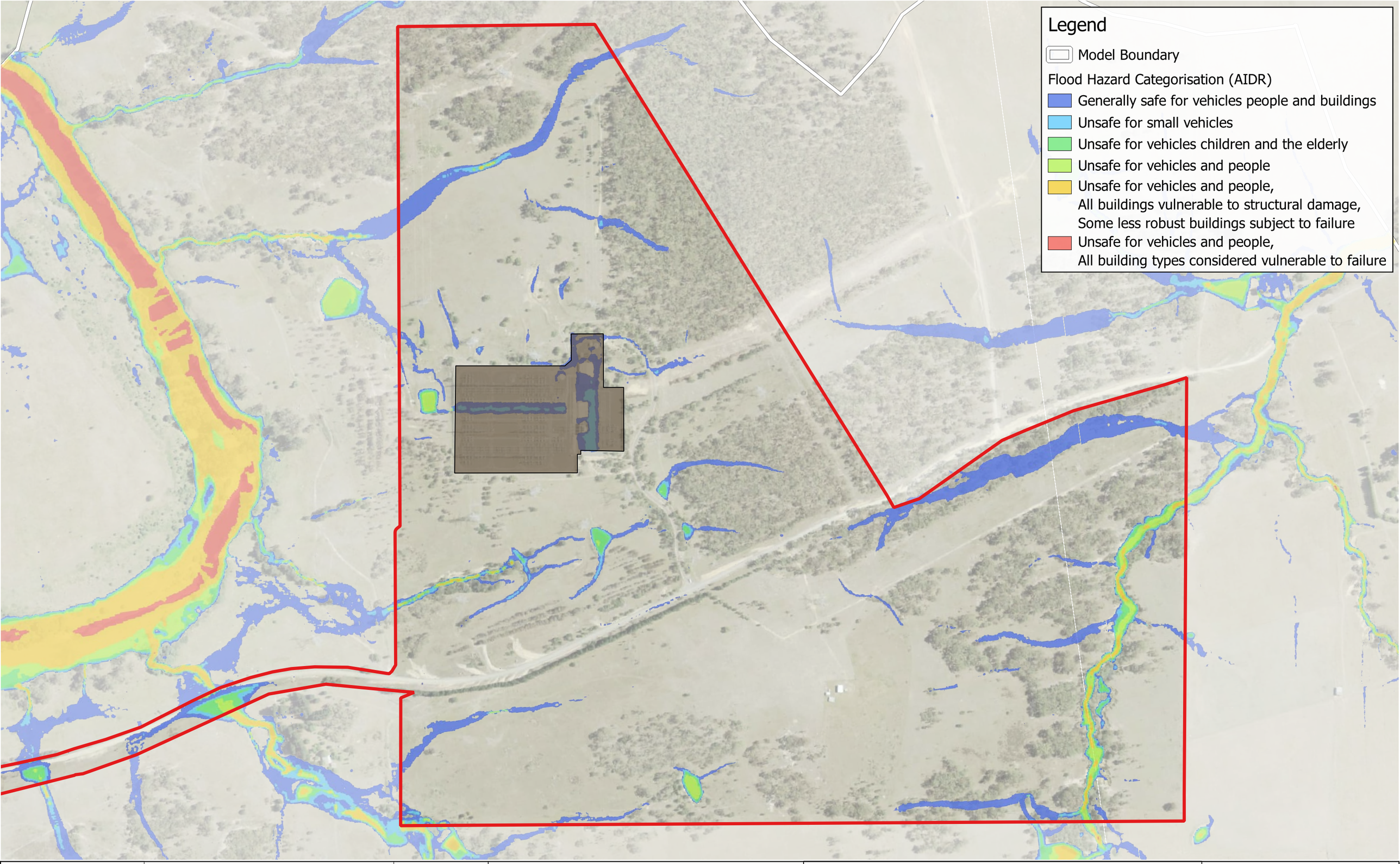

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Canyonleigh BESS WRIA

Figure B11: Existing Conditions - 5% AEP Flood Hazard Categorisation

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Revision: 0
Drawn: AH
Checked: GC
Date: 6 /11 /2025

Legend

Model Boundary

Flood Hazard Categorisation (AIDR)

- Generally safe for vehicles people and buildings
- Unsafe for small vehicles
- Unsafe for vehicles children and the elderly
- Unsafe for vehicles and people
- Unsafe for vehicles and people, All buildings vulnerable to structural damage, Some less robust buildings subject to failure
- Unsafe for vehicles and people, All building types considered vulnerable to failure

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100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
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Grid: Map Grid of Australia, Zone 56

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Figure B12: Existing Conditions - 1% AEP Flood Hazard Categorisation

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Revision: 0
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Checked: GC
Date: 6 /11 /2025

Legend

- Model Boundary

Flood Hazard Categorisation (AIDR)

- Generally safe for vehicles people and buildings
- Unsafe for small vehicles
- Unsafe for vehicles children and the elderly
- Unsafe for vehicles and people
- Unsafe for vehicles and people, All buildings vulnerable to structural damage, Some less robust buildings subject to failure
- Unsafe for vehicles and people, All building types considered vulnerable to failure

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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
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Grid: Map Grid of Australia, Zone 56

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Figure B13: Existing Conditions - 1% AEP Climate Change Flood Hazard Categorisation

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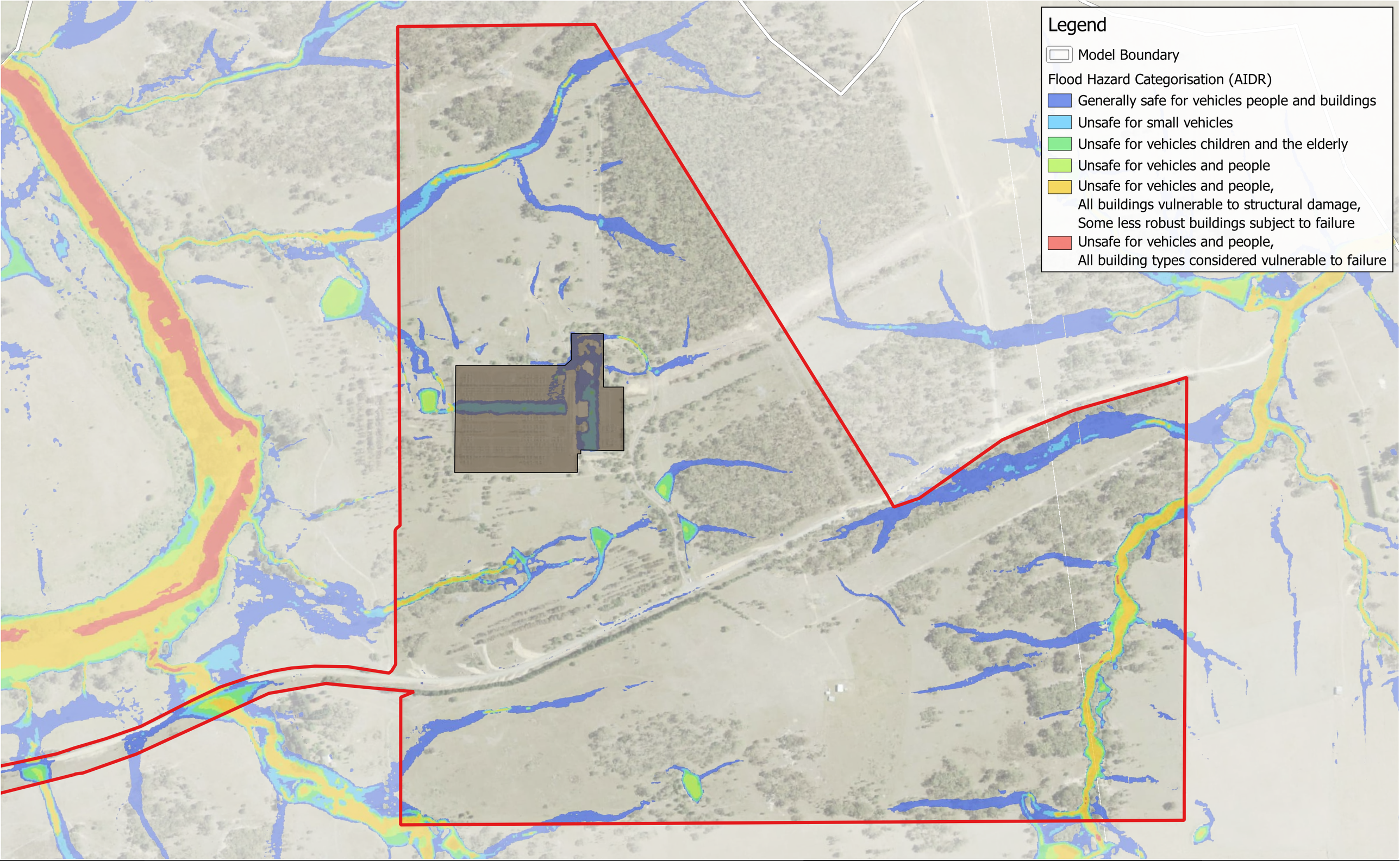

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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
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Grid: Map Grid of Australia, Zone 56

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Figure B14: Existing Conditions - 0.2% AEP Flood Hazard Categorisation

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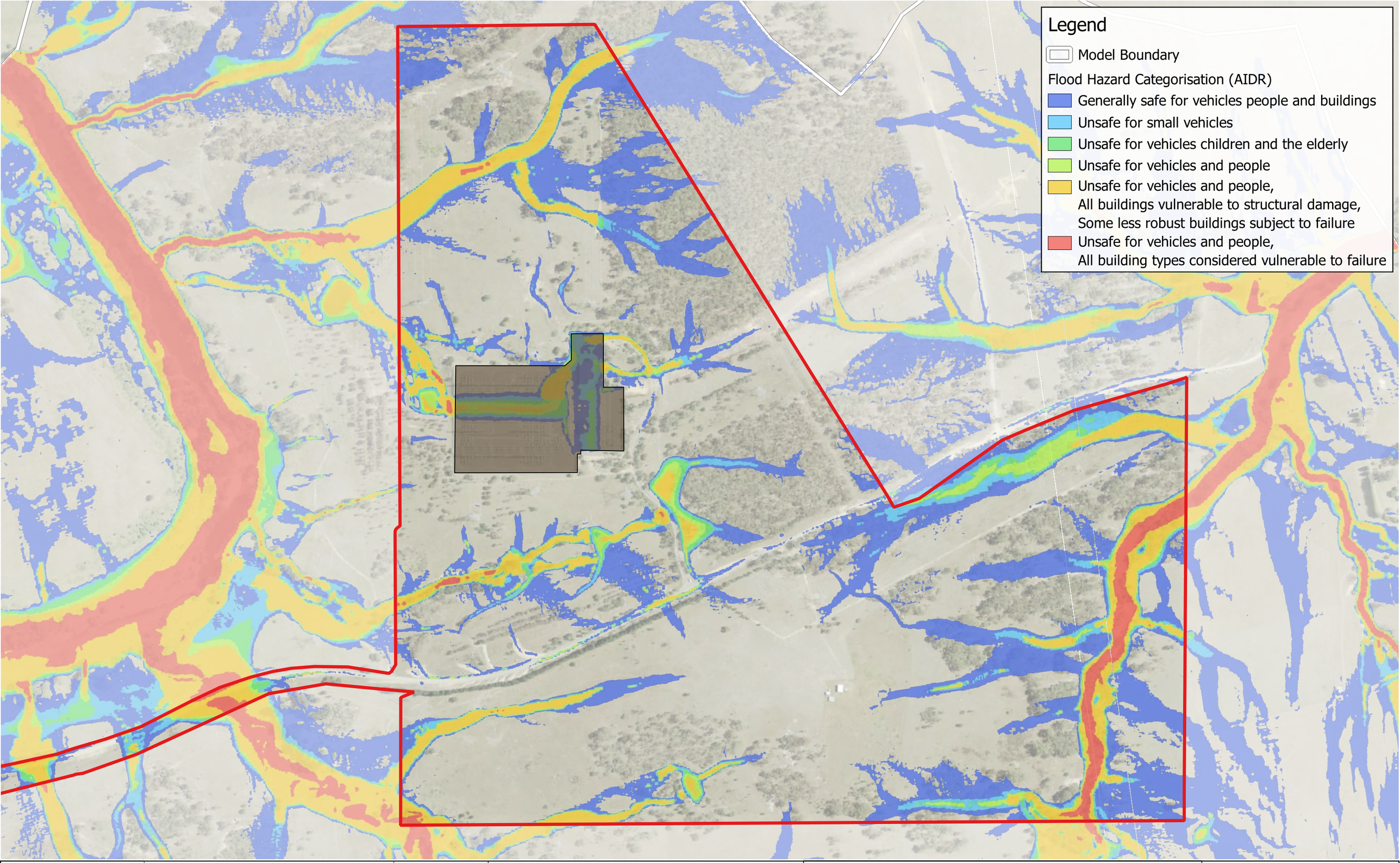

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure B15: Existing Conditions - PMF Flood Hazard Categorisation

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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure B16: Existing Conditions - 5% AEP Depth x Velocity Product

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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
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Grid: Map Grid of Australia, Zone 56

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Figure B17: Existing Conditions - 1% AEP Depth x Velocity Product

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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure B18: Existing Conditions - 1% AEP Climate Change Depth x Velocity Product

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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure B19: Existing Conditions - 0.2% AEP Depth x Velocity Product

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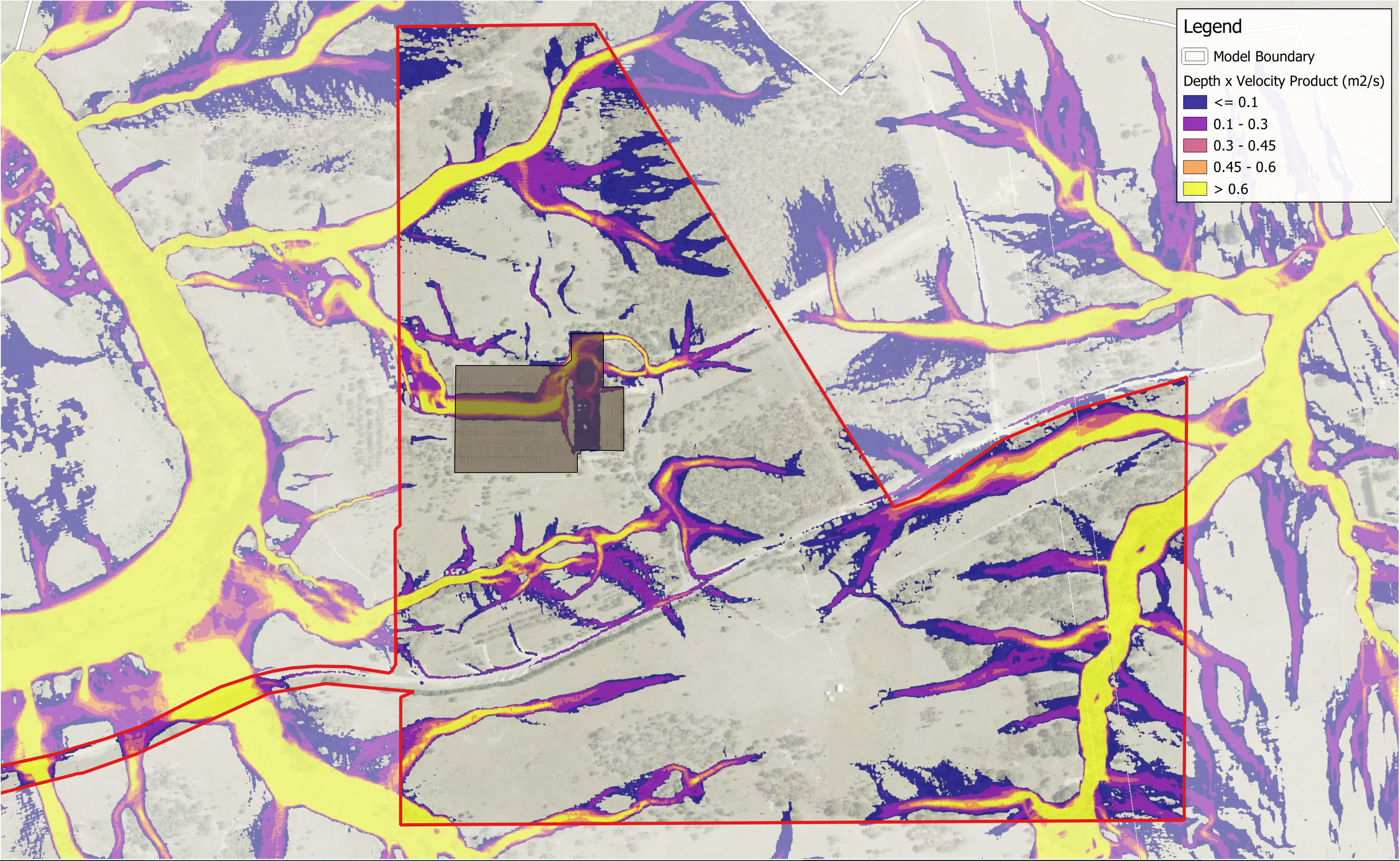

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Canyonleigh BESS WRIA

Figure B20: Existing Conditions - PMF Depth x Velocity Product

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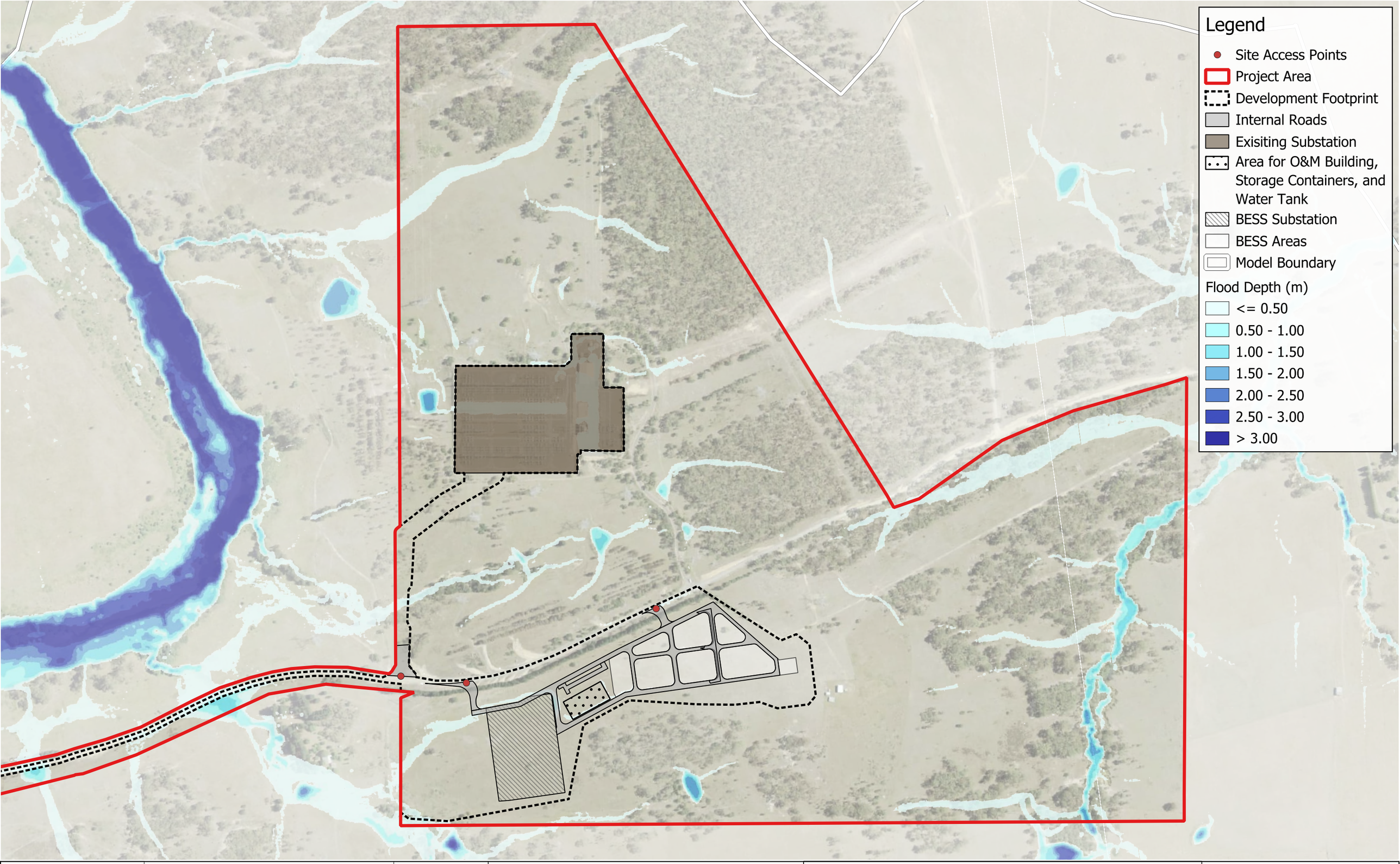
Revision: 0
Drawn: AH
Checked: GC
Date: 6 /11 /2025

APPENDIX C: DEVELOPED CONDITIONS FLOOD MODEL RESULTS



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N

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Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
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Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C1: Developed Conditions - 5% AEP Flood Depth

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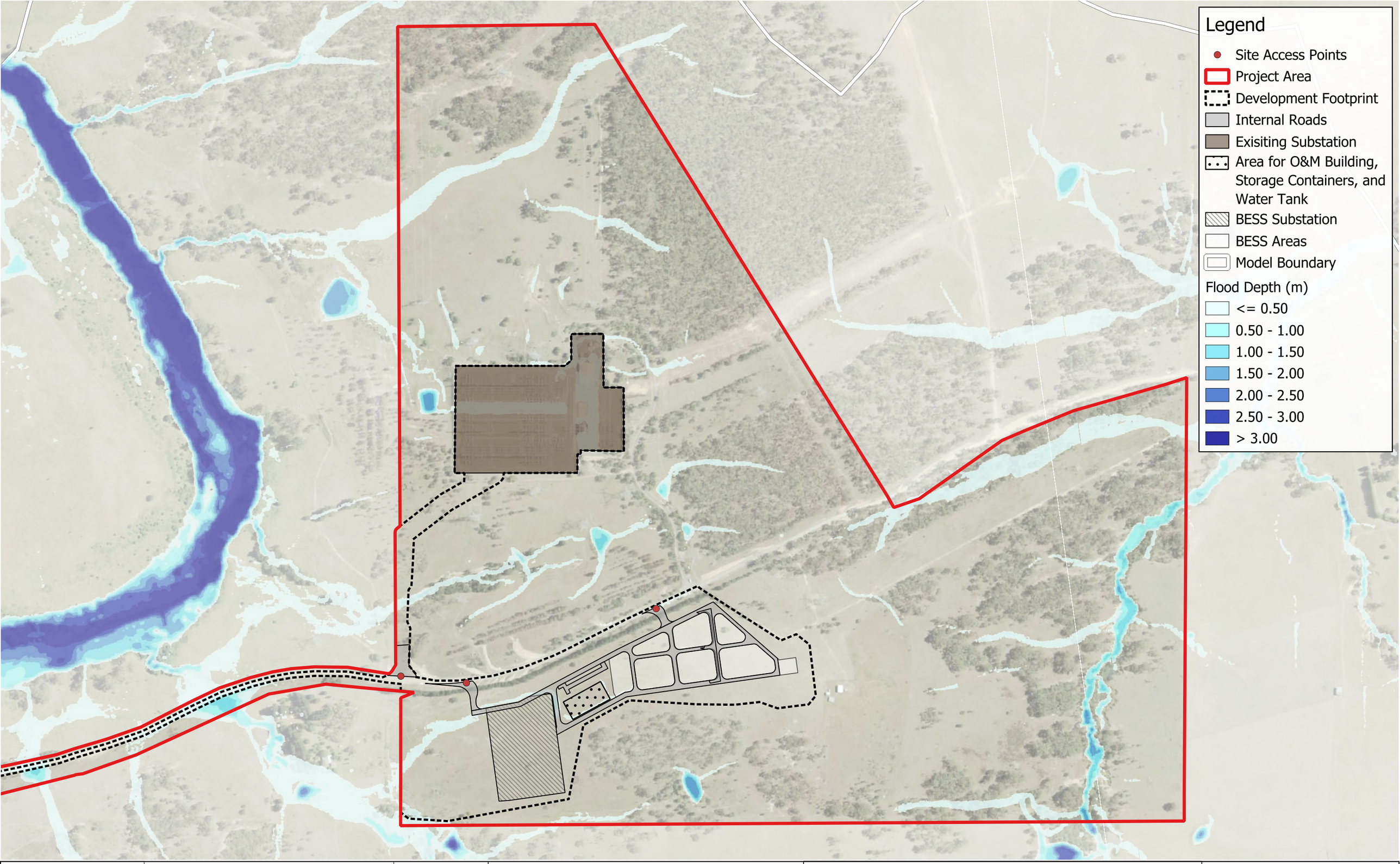

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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C1: Developed Conditions - 5% AEP Flood Depth

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Legend

- Site Access Points
- Project Area
- Development Footprint
- Internal Roads
- Exisiting Substation
- Area for O&M Building, Storage Containers, and Water Tank
- BESS Substation
- BESS Areas
- Model Boundary

Flood Depth (m)

- <= 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- 2.00 - 2.50
- 2.50 - 3.00
- > 3.00

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N

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Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
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Grid: Map Grid of Australia, Zone 56

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Figure C2: Developed Conditions - 1% AEP Flood Depth

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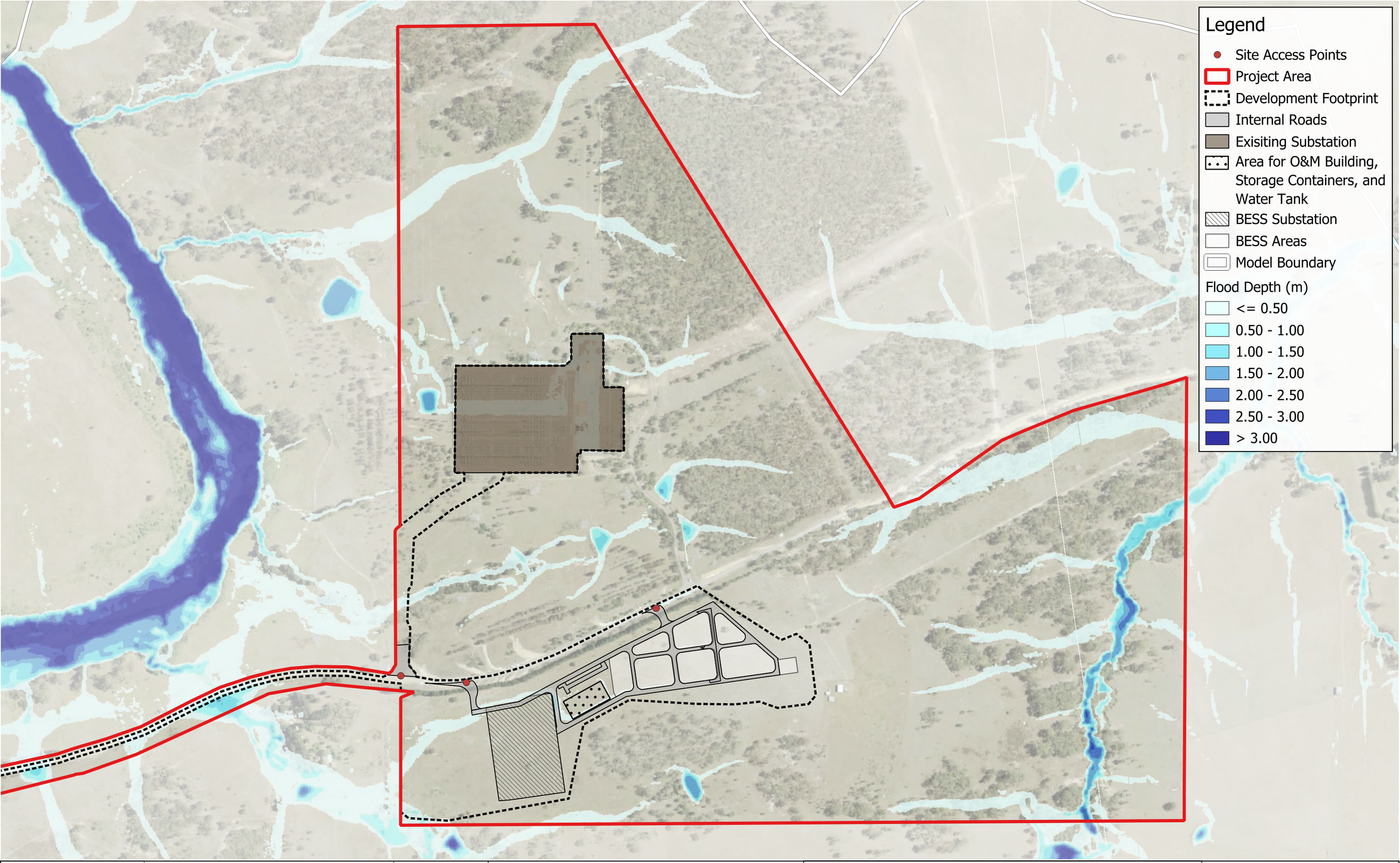
Date: 7 /11 /2025



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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C3: Developed Conditions - 0.2% AEP Flood Depth

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Checked: GC
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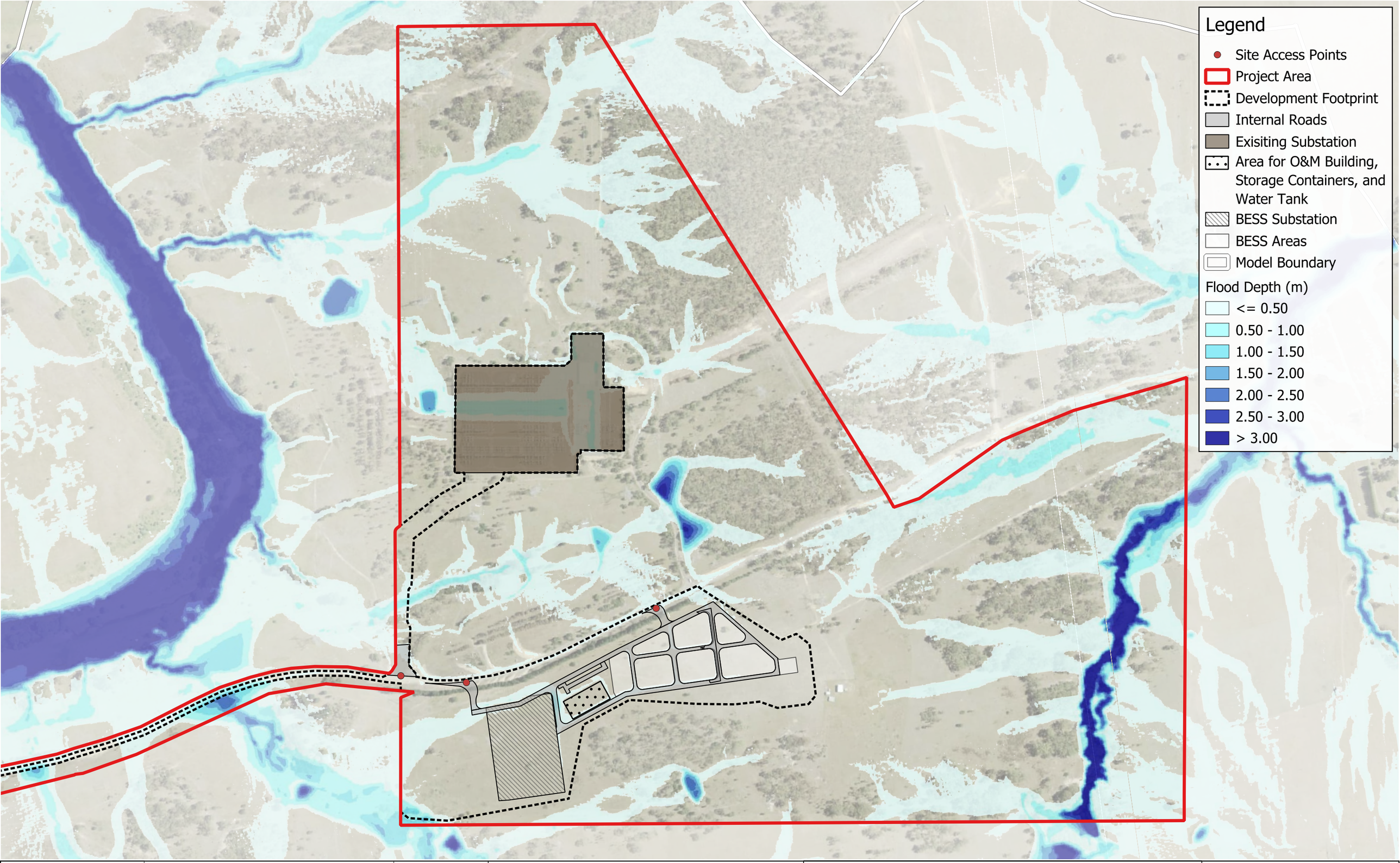

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C4: Developed Conditions - PMF Flood Depth

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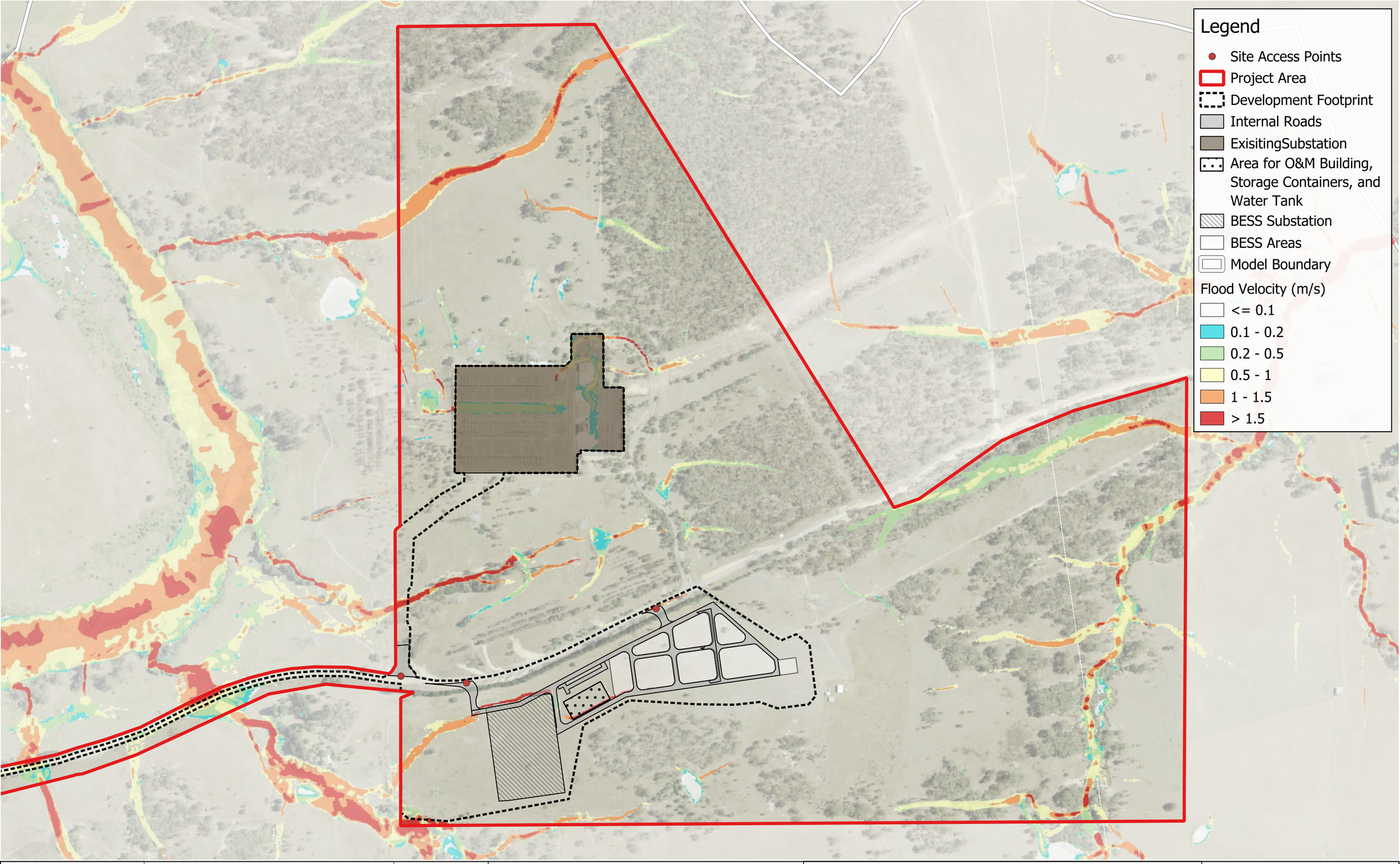
Drawn: AH
Checked: GC
Date: 7 /11 /2025



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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C5: Developed Conditions - 5% AEP Flood Velocity

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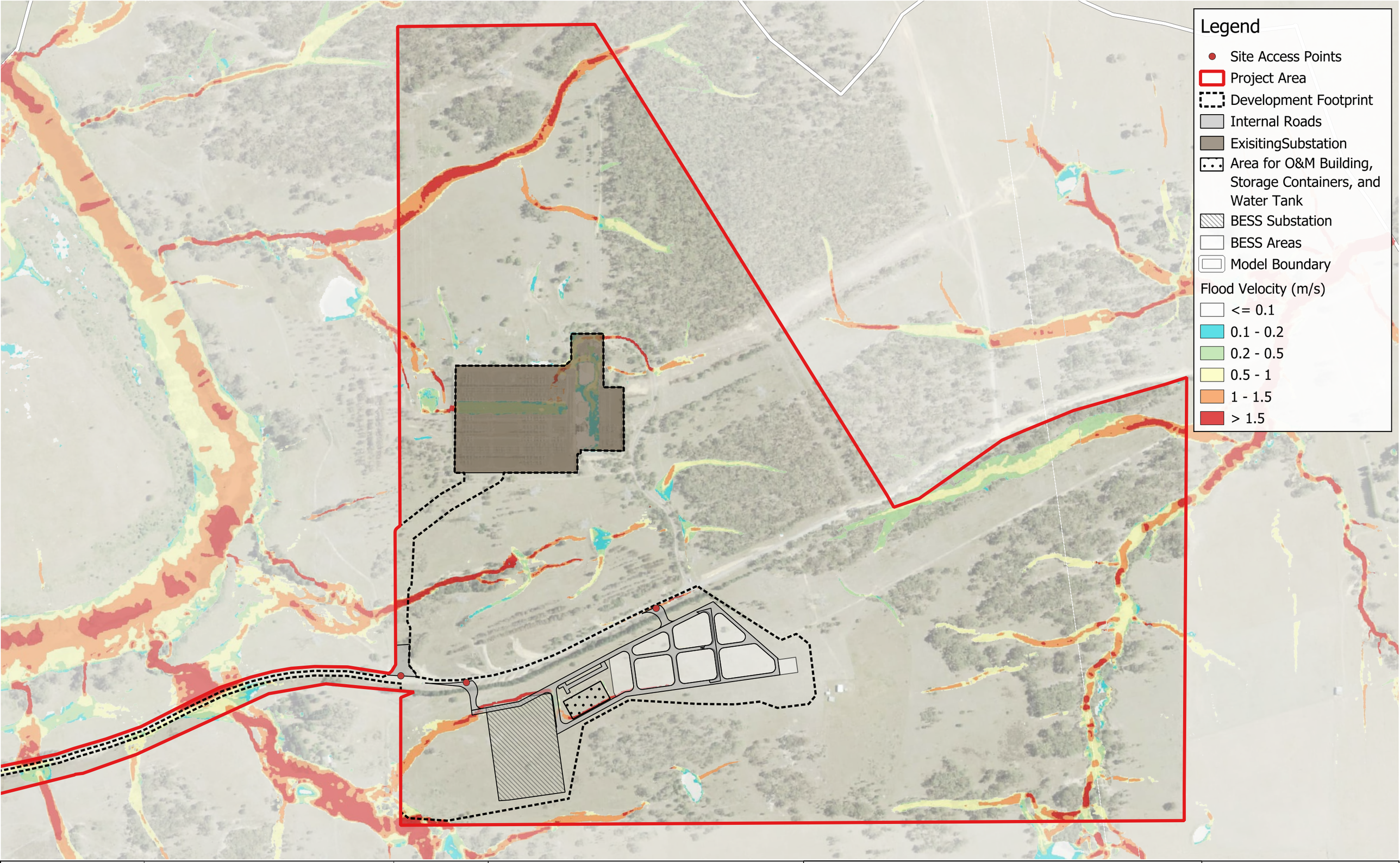
Revision: 0
Drawn: AH
Checked: GC
Date: 7 /11 /2025



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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
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Vertical Datum: Australia Height Datum
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Figure C6: Developed Conditions - 1% AEP Flood Velocity

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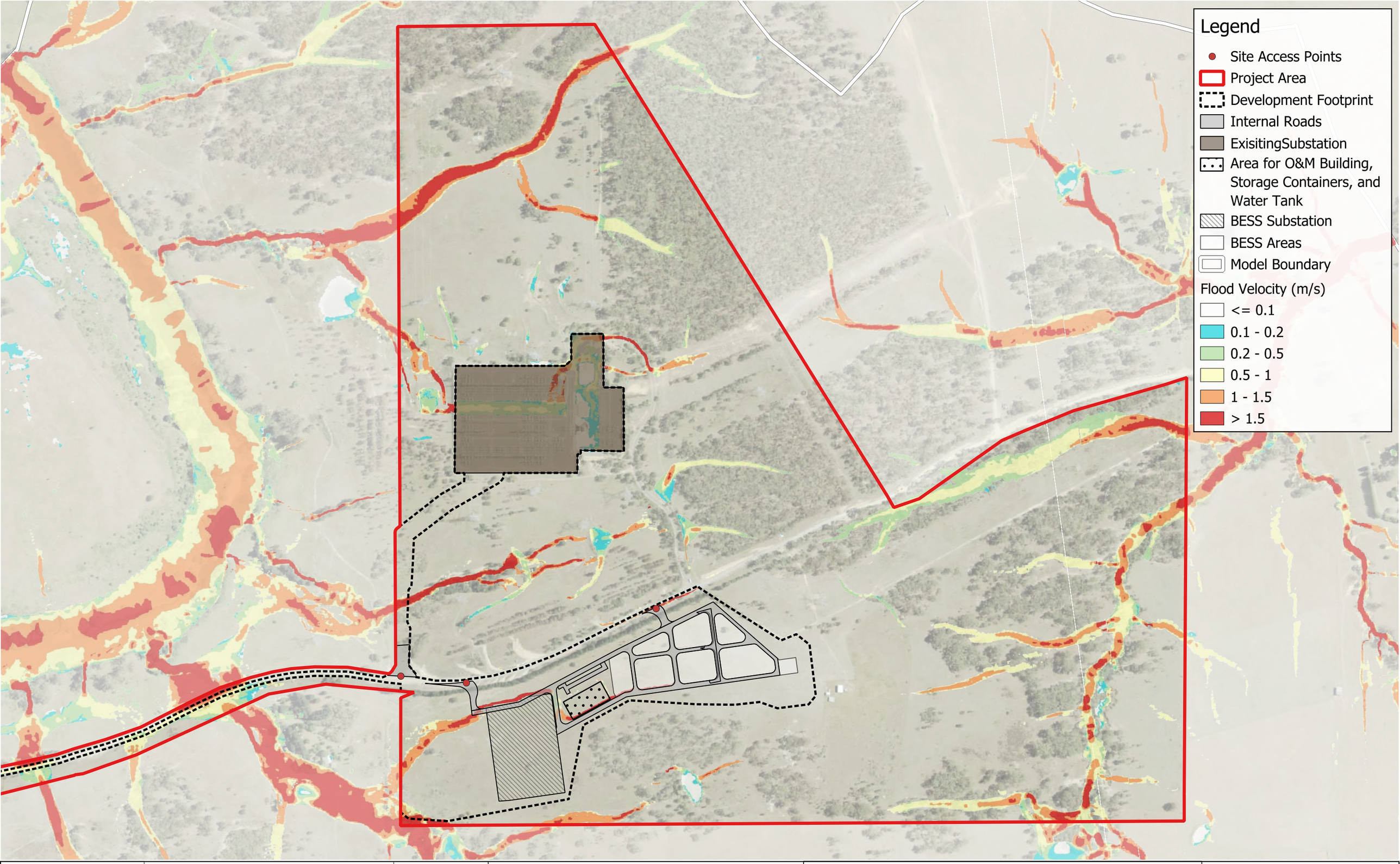
Drawn: AH
Checked: GC
Date: 7 /11 /2025



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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C7: Developed Conditions - 0.2% AEP Flood Velocity

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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C8: Developed Conditions - PMF Flood Velocity

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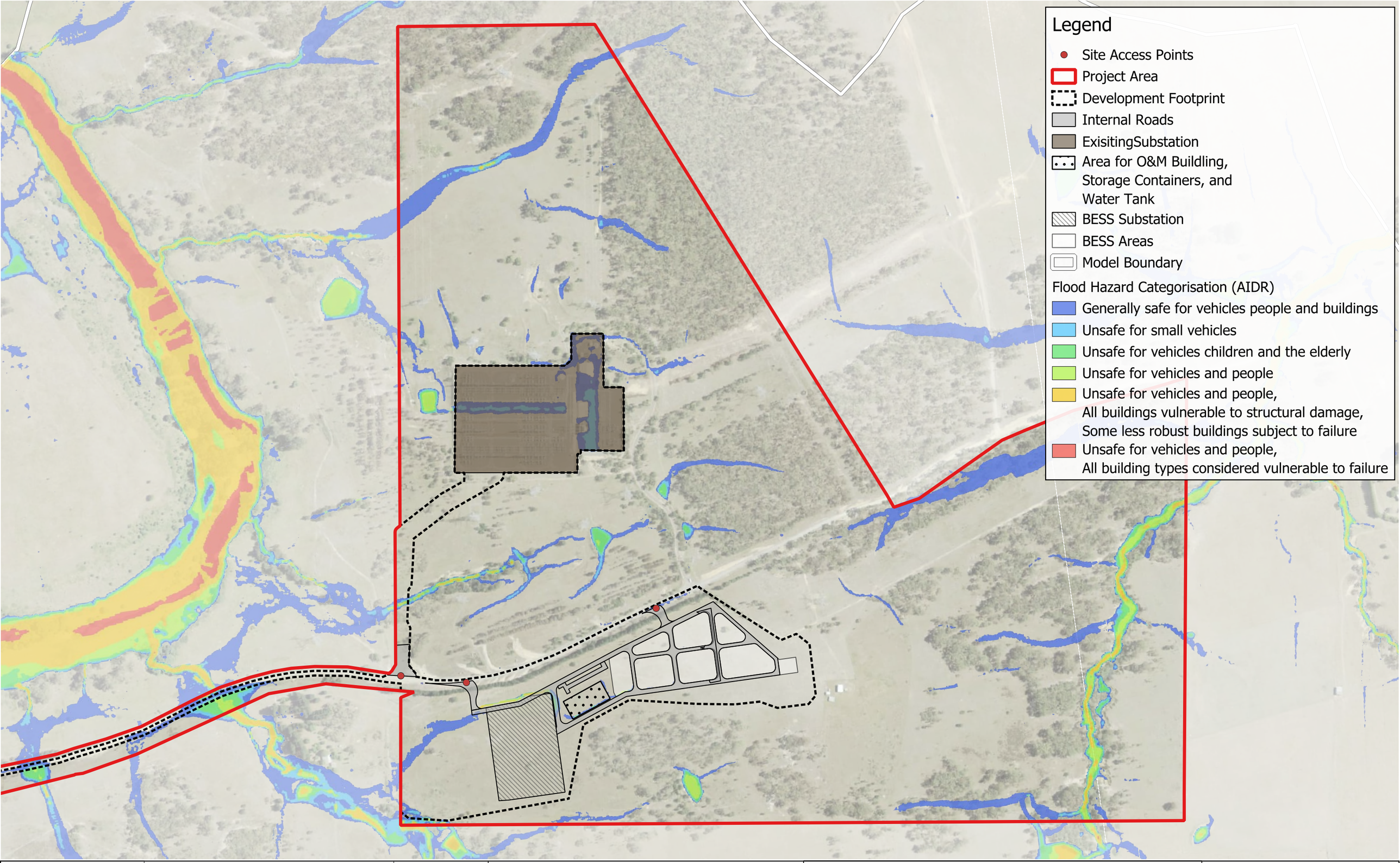

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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C9: Developed Conditions - 5% AEP Flood Hazard Categorisation

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Revision: 0
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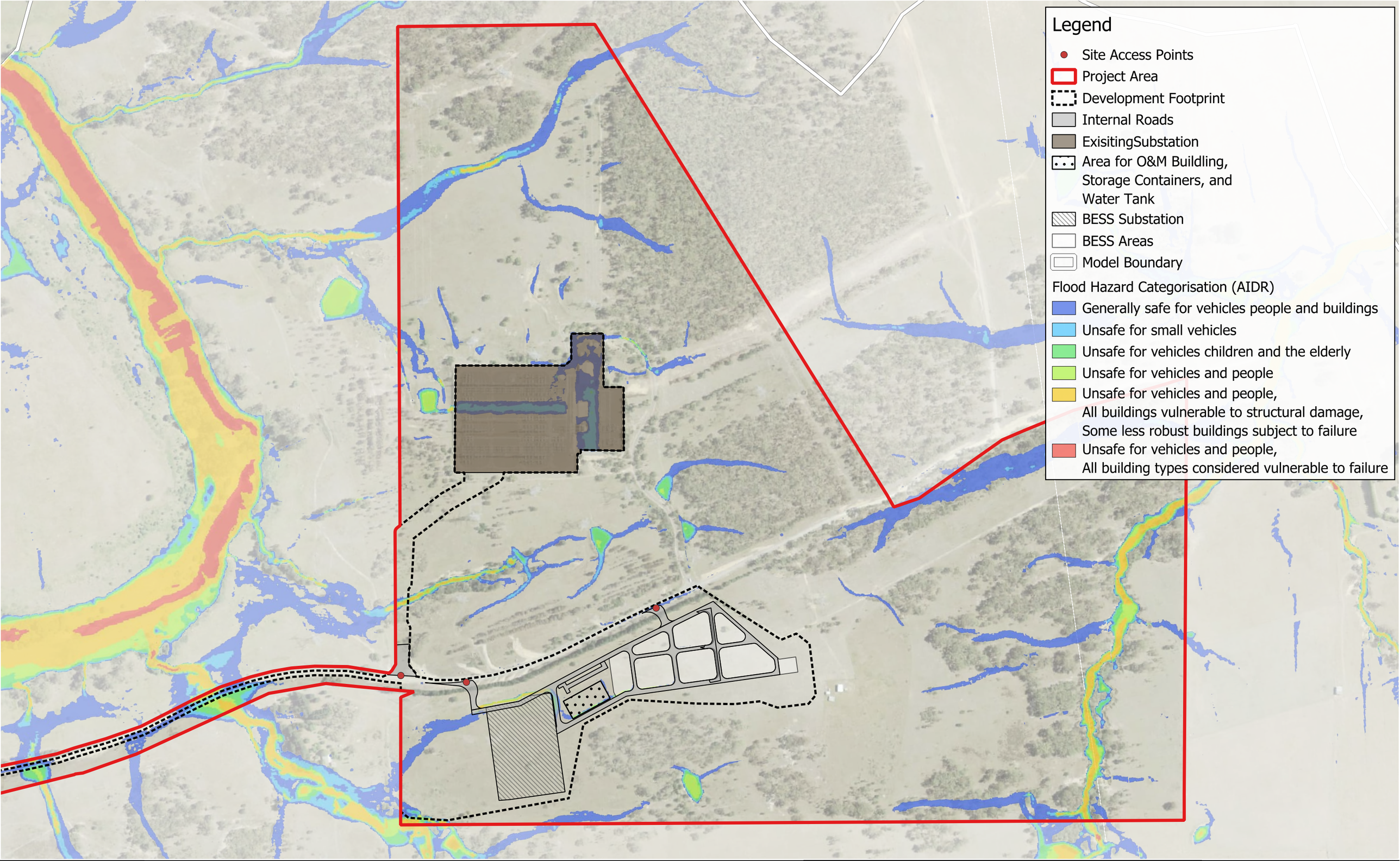

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N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C10: Developed Conditions - 1% AEP Flood Hazard Categorisation

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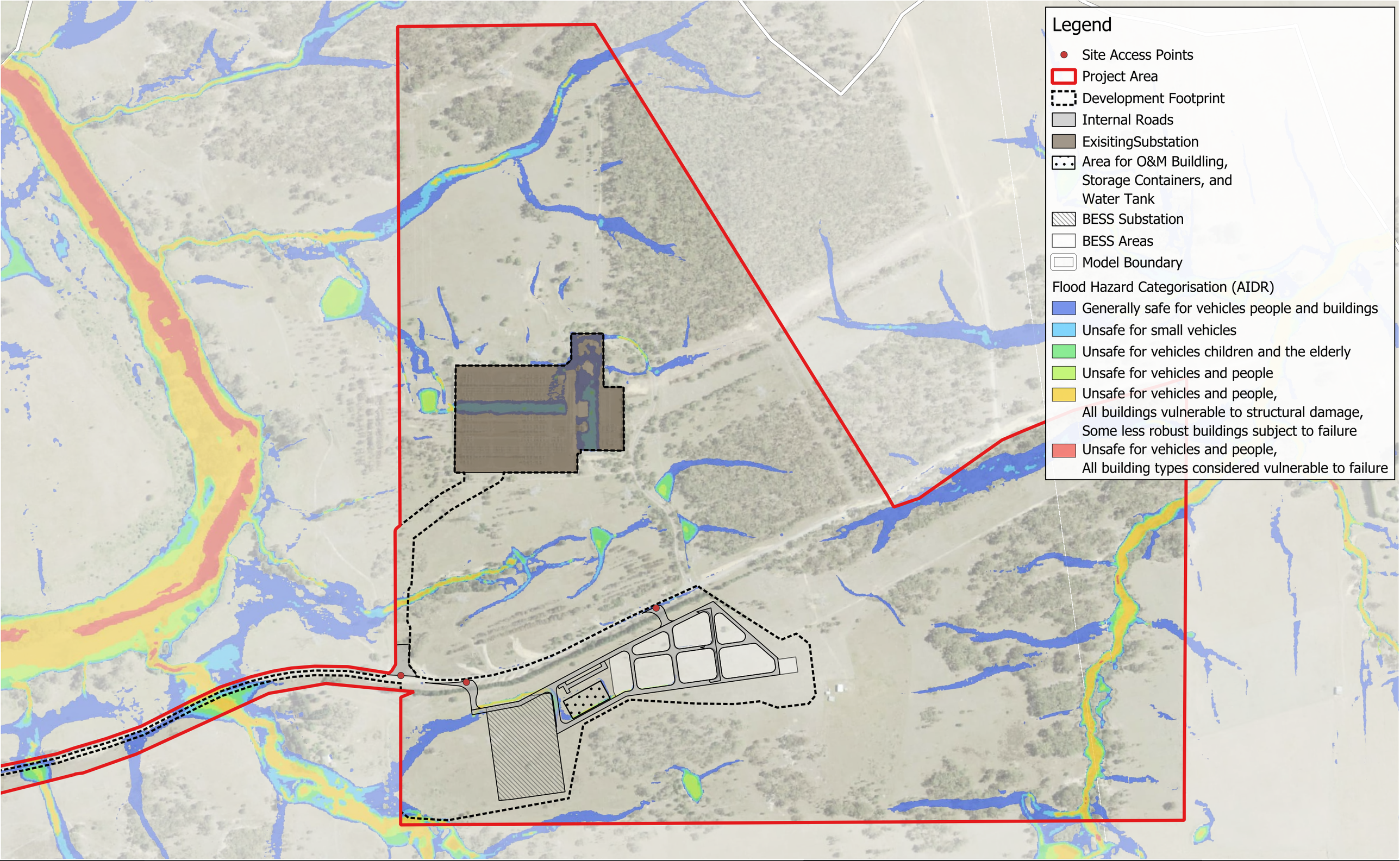
Date: 7 /11 /2025



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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C11: Developed Conditions - 0.2% AEP Flood Hazard Categorisation

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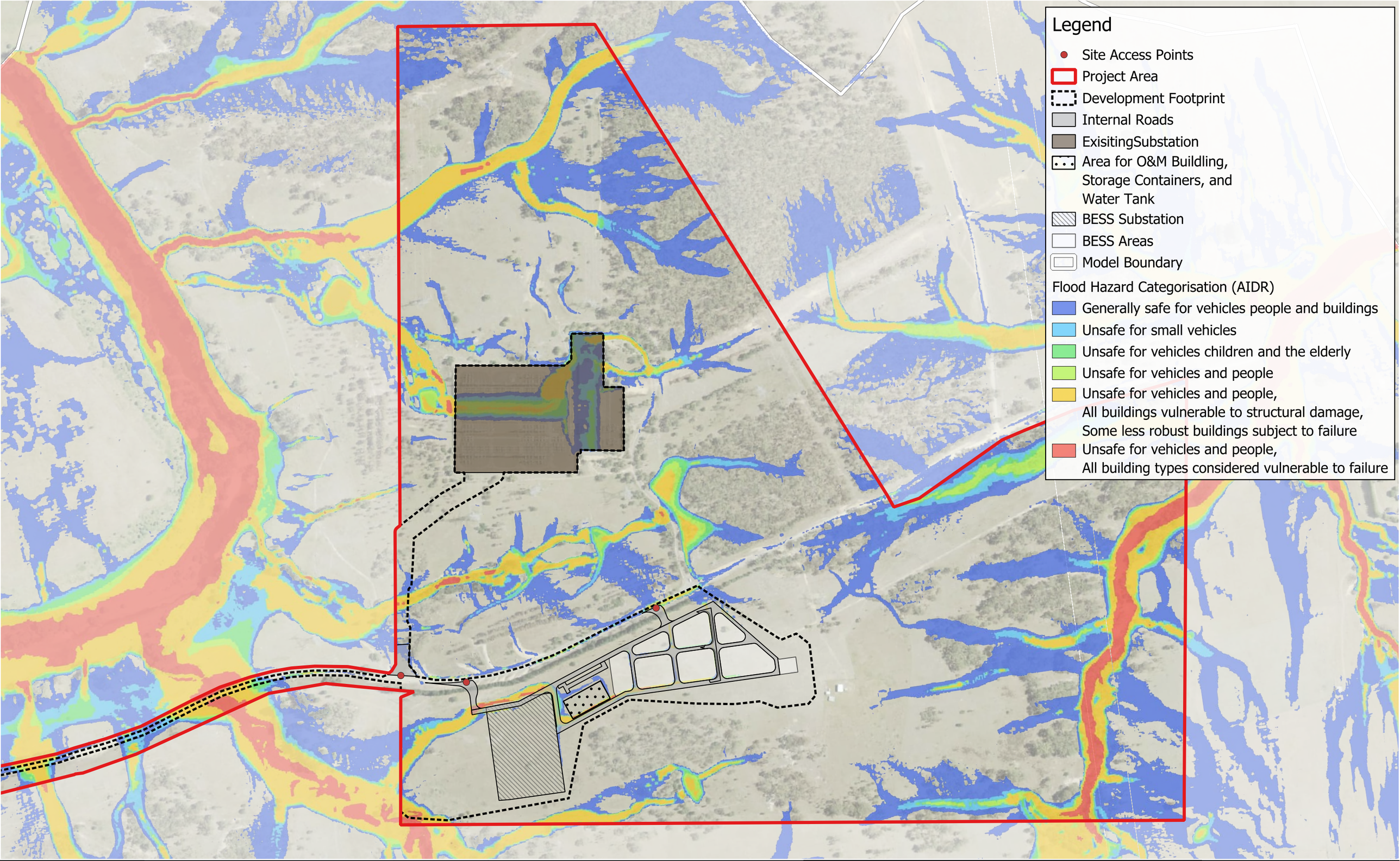

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C12: Developed Conditions - PMF Flood Hazard Categorisation

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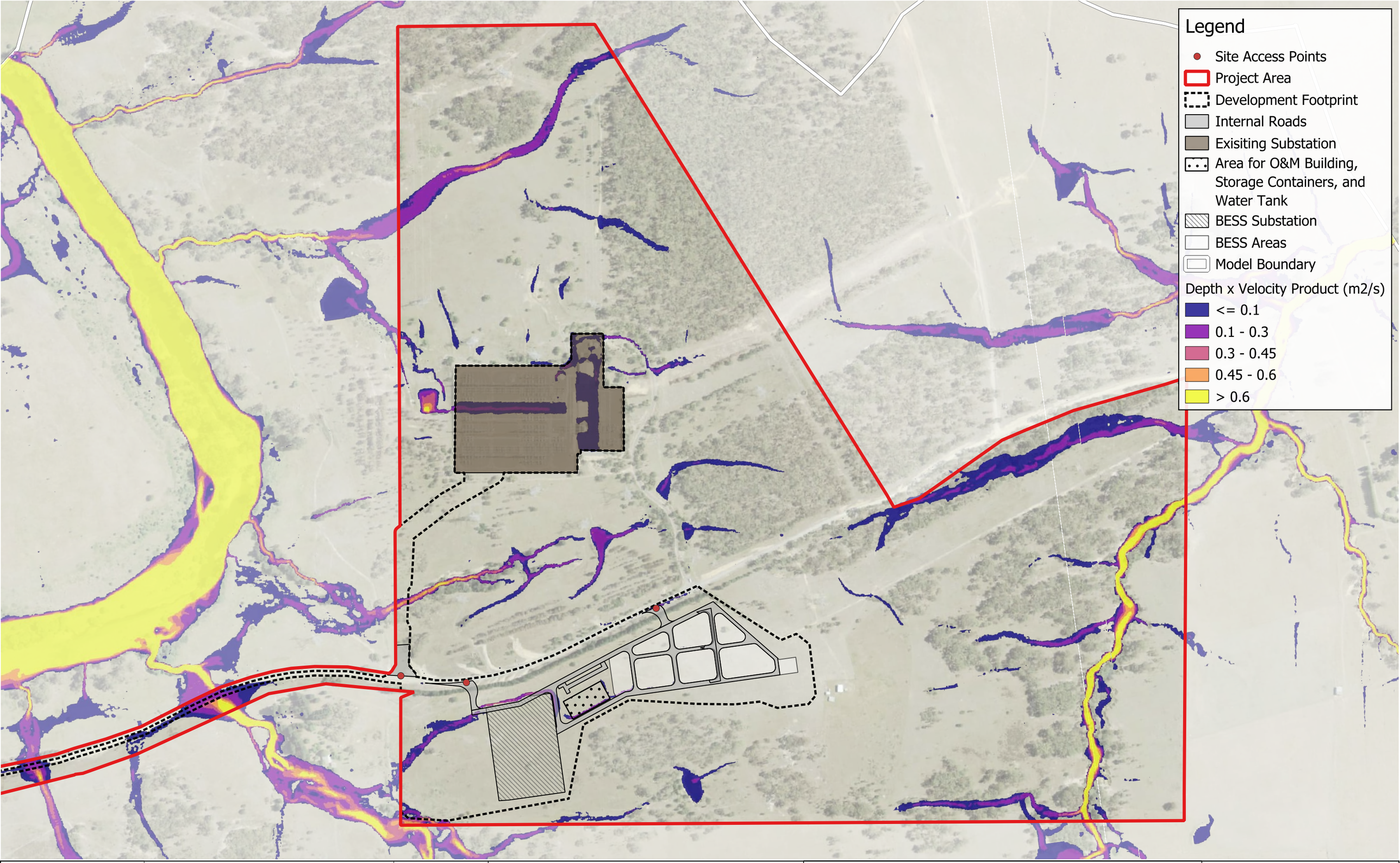

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Canyonleigh BESS WRIA

Figure C13: Developed Conditions - 5% AEP Depth x Velocity Product

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Canyonleigh BESS WRIA

Figure C14: Developed Conditions - 1% AEP Depth x Velocity Product

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100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
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Figure C15: Developed Conditions - 0.2% AEP Depth x Velocity Product

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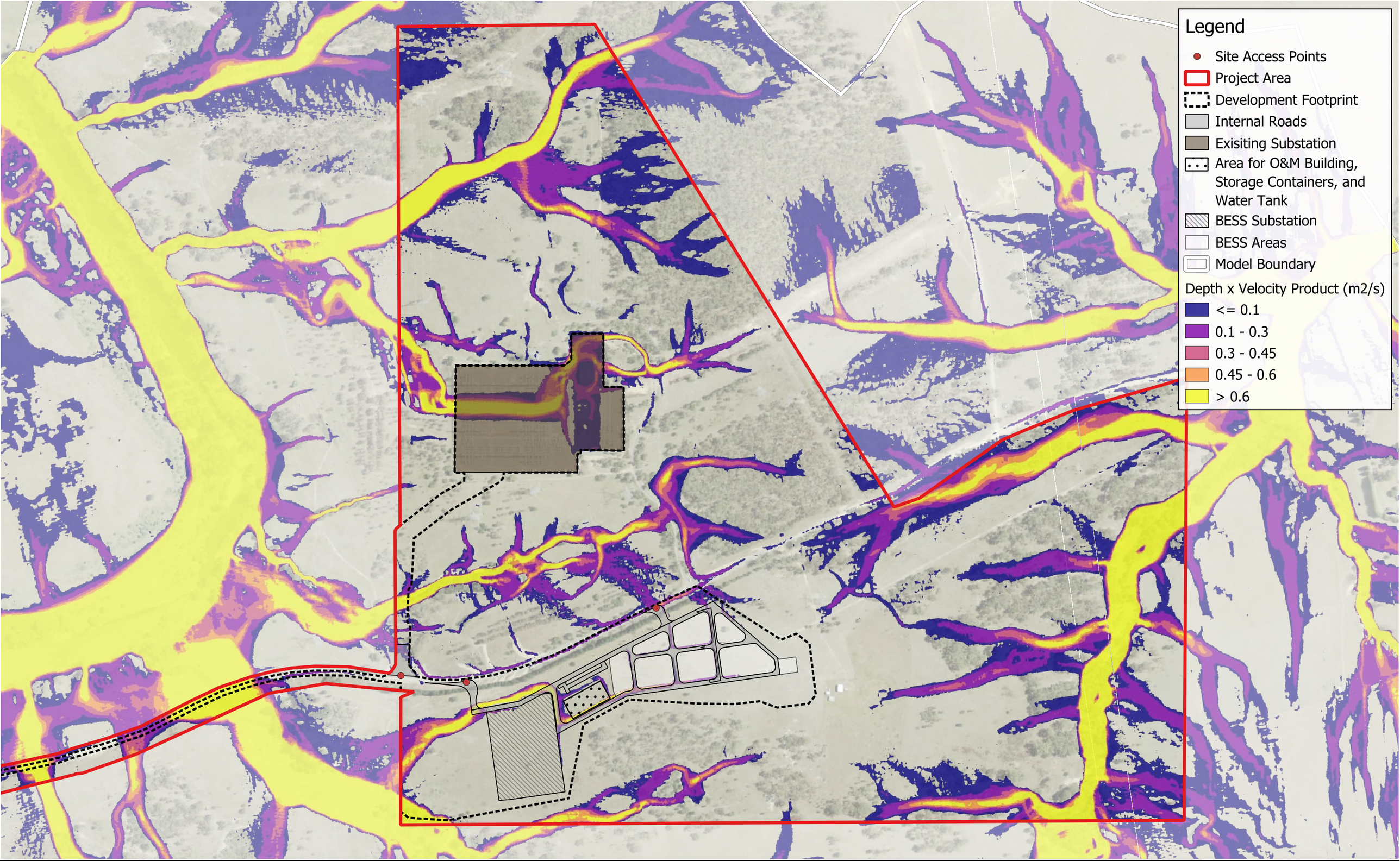

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
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Grid: Map Grid of Australia, Zone 56

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Figure C16: Developed Conditions - PMF Depth x Velocity Product

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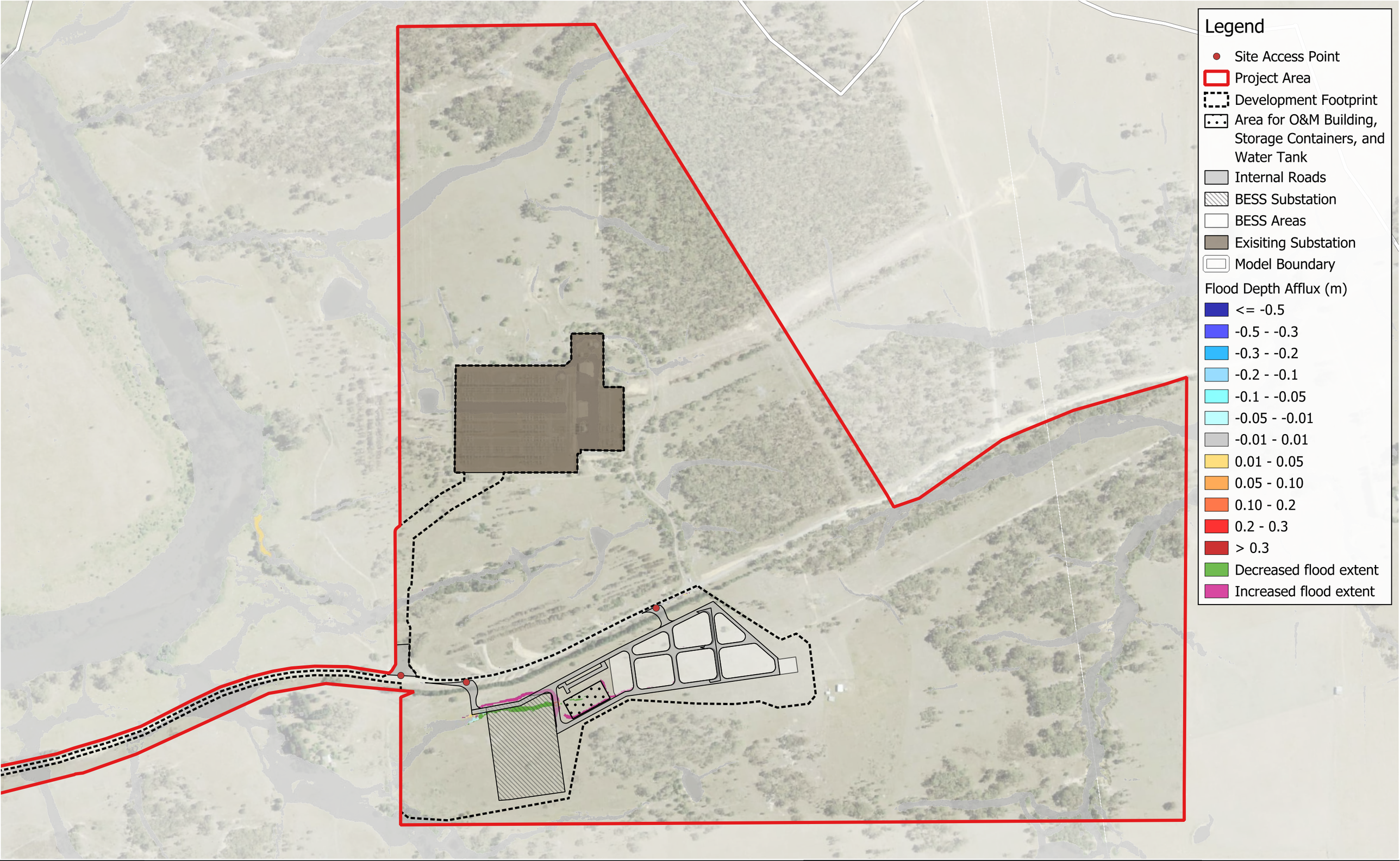
Date: 7 /11 /2025



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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
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Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Canyonleigh BESS WRIA

Figure C17: Developed Conditions - 5% AEP Flood Depth Afflux

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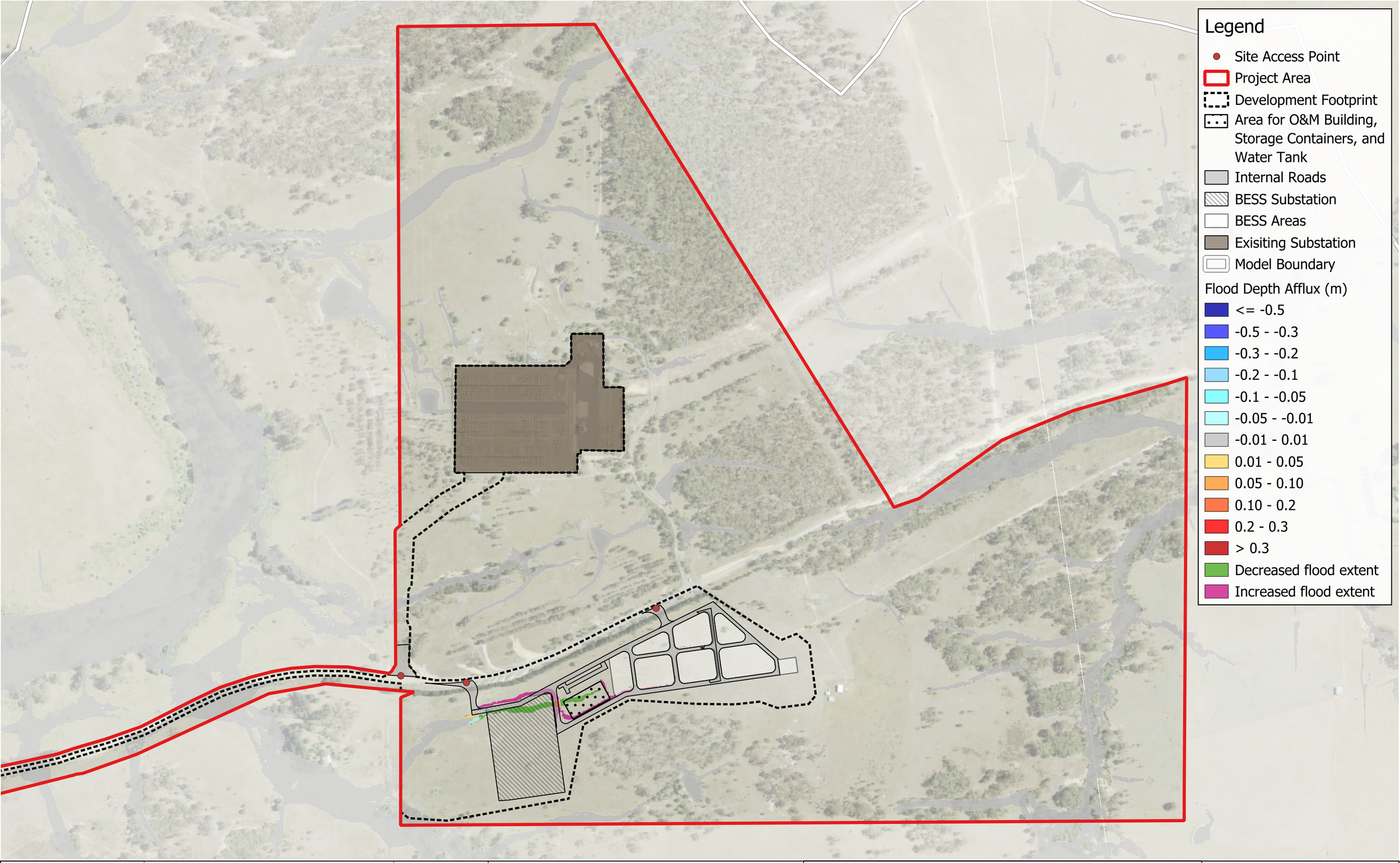

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C18: Developed Conditions - 1% AEP Flood Depth Afflux

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Revision: 0
Drawn: AH
Checked: GC
Date: 7 /11 /2025

Legend

- Site Access Point
- Project Area
- Development Footprint
- Area for O&M Building, Storage Containers, and Water Tank
- Internal Roads
- BESS Substation
- BESS Areas
- Exisiting Substation
- Model Boundary

Flood Depth Afflux (m)

- <= -0.5
- -0.5 - -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.2
- 0.2 - 0.3
- > 0.3
- Decreased flood extent
- Increased flood extent

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Canyonleigh BESS WRIA

Figure C19: Developed Conditions - 0.2% AEP Flood Depth Afflux

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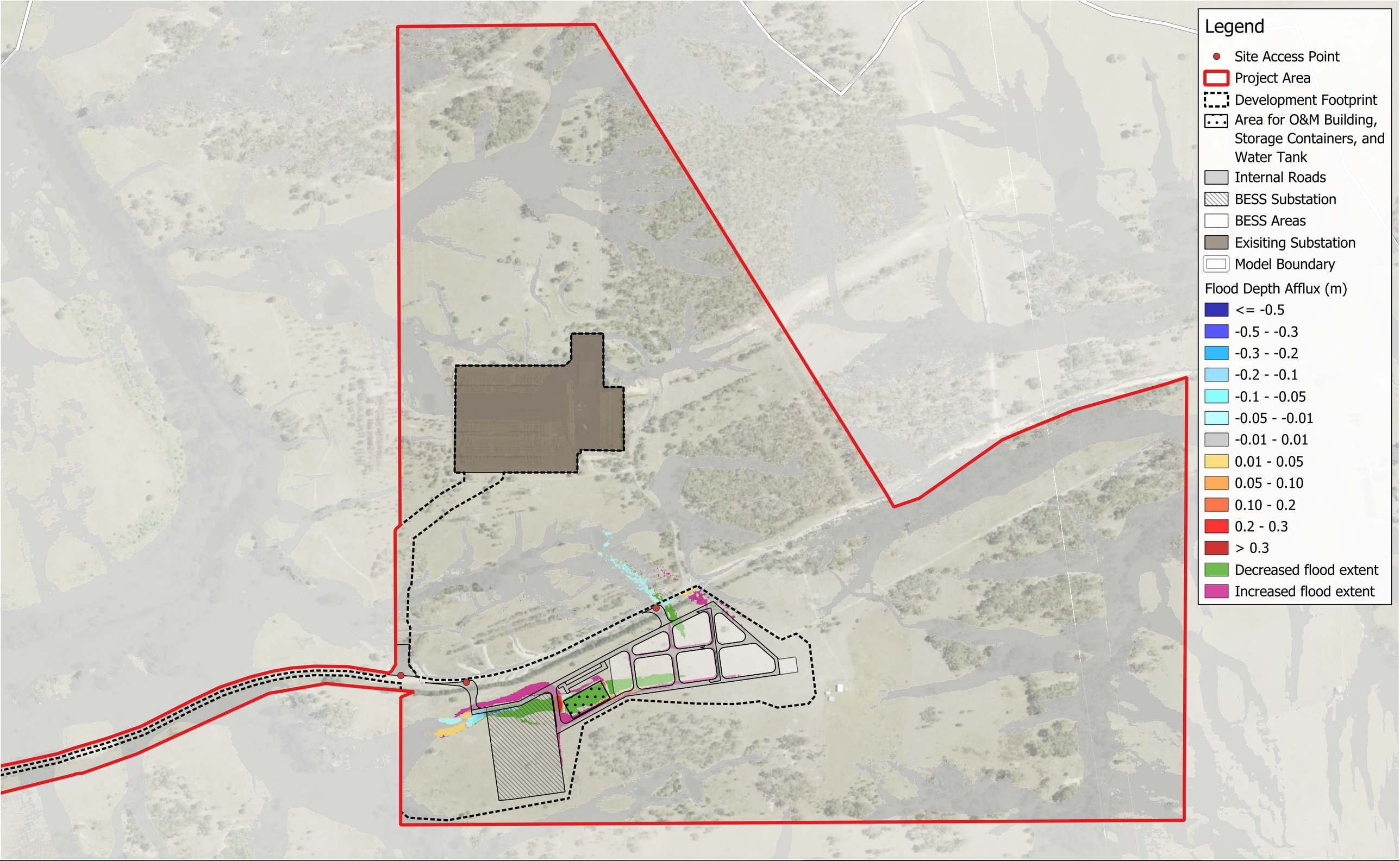

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure C20: Developed Conditions - PMF Flood Depth Afflux

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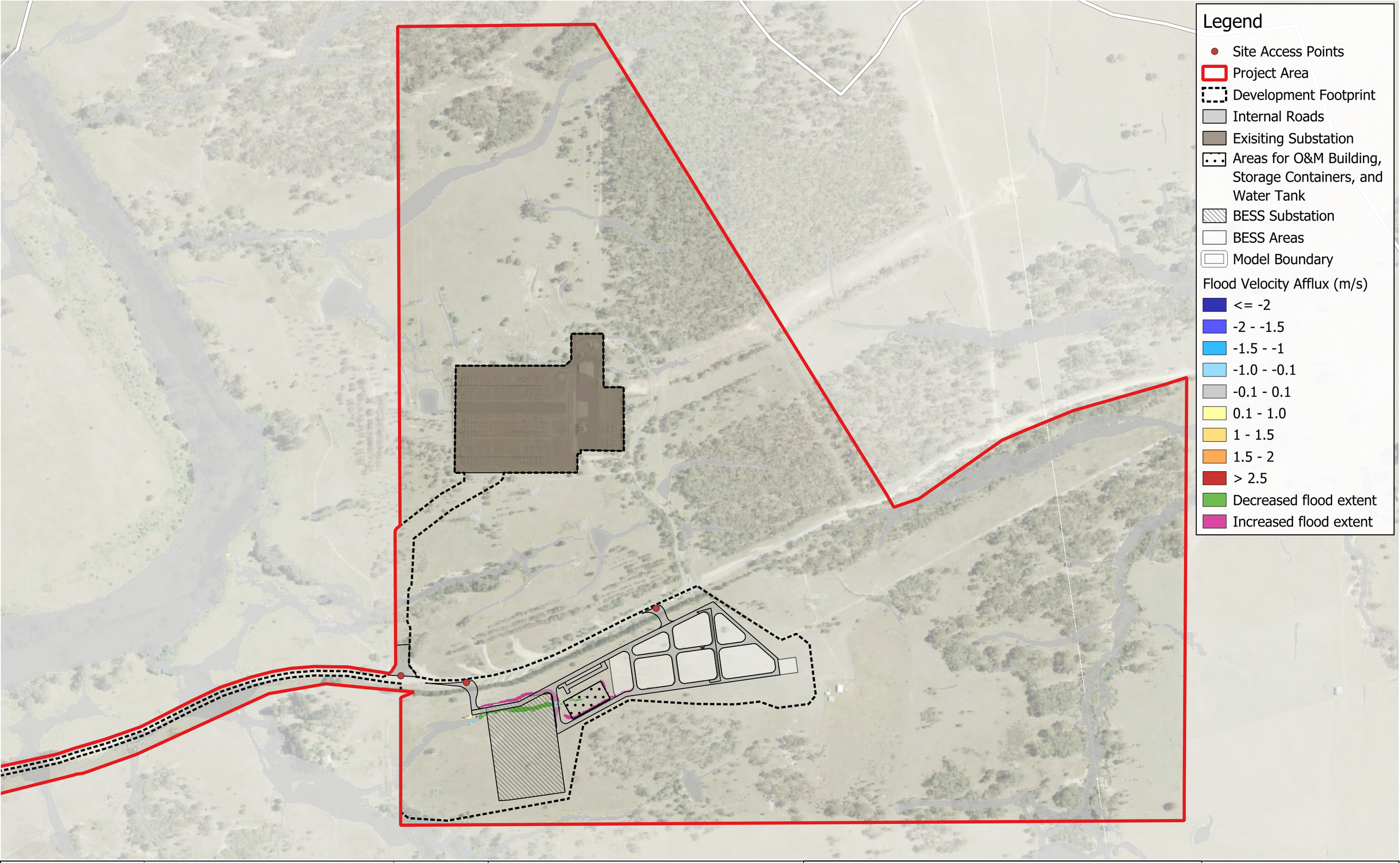
Revision: 0
Drawn: AH
Checked: GC
Date: 7 /11 /2025



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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Canyonleigh BESS WRIA

Figure C21: Developed Conditions - 5% AEP Flood Velocity Afflux

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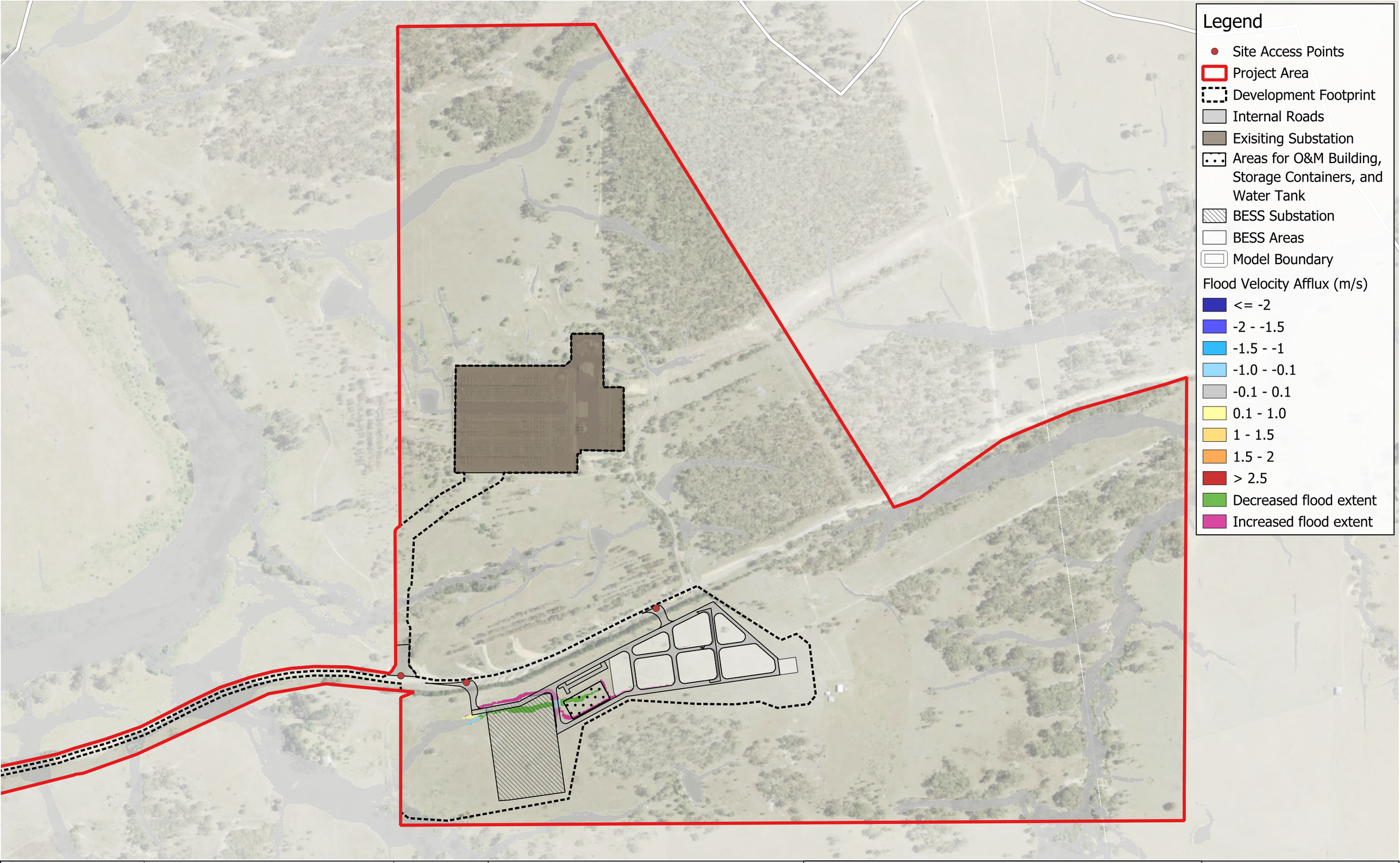
Drawn: AH
Checked: GC
Date: 7 /11 /2025



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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Canyonleigh BESS WRIA

Figure C22: Developed Conditions - 1% AEP Flood Velocity Afflux

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Job Number: BNTL00206_0022
Revision: 0
Drawn: AH
Checked: GC
Date: 7 /11 /2025

Legend

- Site Access Points
- Project Area
- Development Footprint
- Internal Roads
- Exisiting Substation
- Areas for O&M Building, Storage Containers, and Water Tank
- BESS Substation
- BESS Areas
- Model Boundary

Flood Velocity Afflux (m/s)

- <= -2
- -2 - -1.5
- -1.5 - -1
- -1.0 - -0.1
- -0.1 - 0.1
- 0.1 - 1.0
- 1 - 1.5
- 1.5 - 2
- > 2.5
- Decreased flood extent
- Increased flood extent

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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Canyonleigh BESS WRIA

Figure C23: Developed Conditions - 0.2% AEP Flood Velocity Afflux

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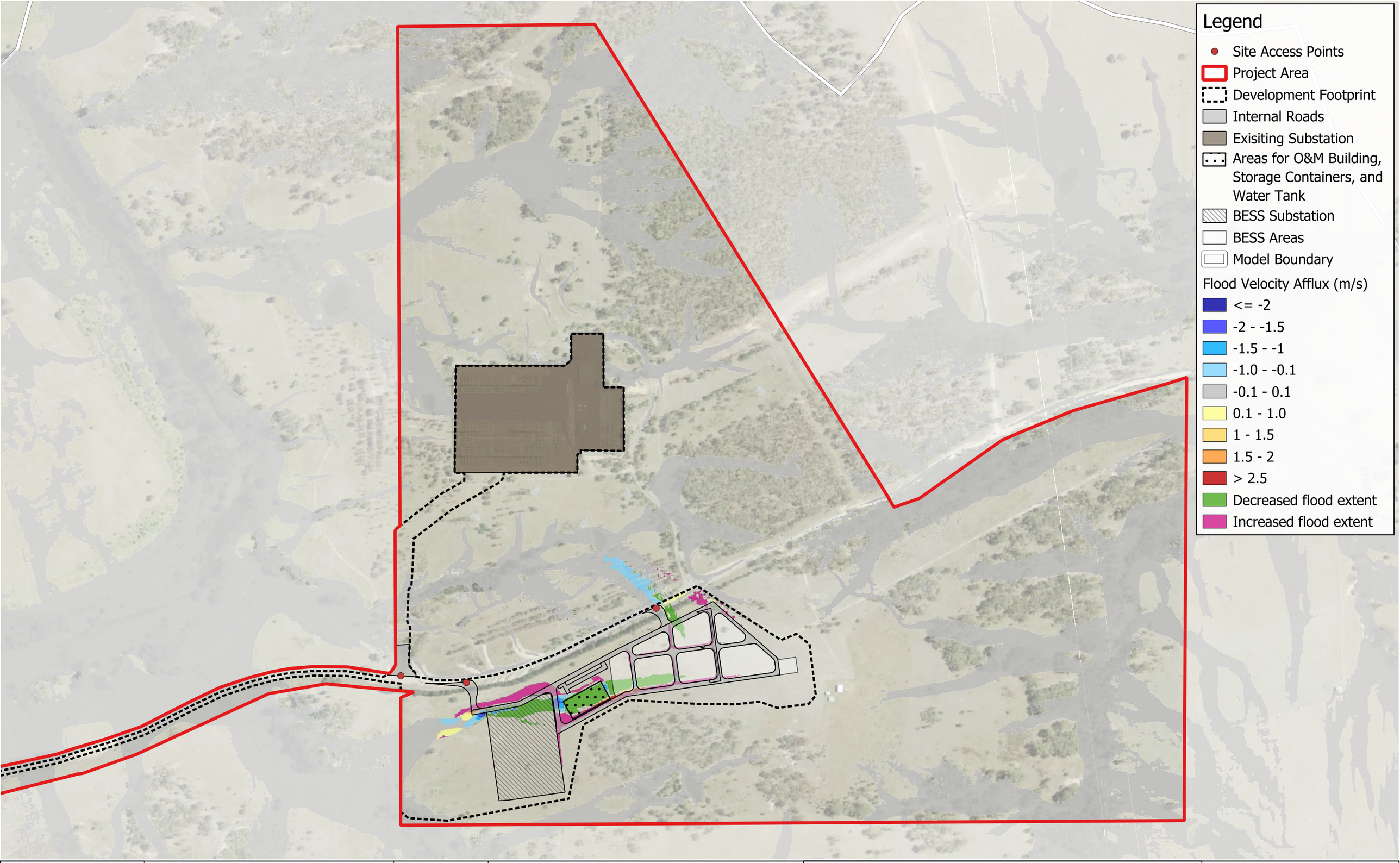
Revision: 0
Drawn: AH
Checked: GC
Date: 7 /11 /2025



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ENGENY X-ELIO

N

100 0 100 m

Scale in metres (1:5,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Canyonleigh BESS WRIA

Figure C24: Developed Conditions - PMF Flood Velocity Afflux

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Job Number: BNTL00206_0022
Revision: 0
Drawn: AH
Checked: GC
Date: 7 /11 /2025

APPENDIX D: SYDNEY DRINKING WATER CATCHMENT AUDIT 2019-2022 – WOLLONDILLY RIVER

FIGURE D.1: WOLLONDILY RIVER SUB-CATCHMENT AREA AND WATER QUALITY MONITORING LOCATIONS (SOURCE: ECO LOGICAL, 2023)