

MURCHS CORNER BATTERY ENERGY STORAGE SYSTEM (BESS)

ADVERTISED PLAN

FLOOD ASSESSMENT REPORT

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

DECEMBER 2025

Prepared For
EBARE Pty Ltd

Kulweeron Cemetery Reserve

COPYRIGHT AND NON-DISCLOSURE NOTICE

The contents and layout of this report are subject to copyright owned by SWM Consulting Pty Ltd. The report may not be copied or used without our prior written consent for any the purpose other than the purpose indicated in this report.

The sole purpose of this report and the associated services performed by SWM is to provide information required in accordance with the scope of services set out in the contract between SWM and the Client. That the scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of data and other relevant information.

In preparing this report, SWM has assumed that all data, reports and any other information provided to us by the Client, on behalf of the Client, or by third parties is complete and accurate, unless stated otherwise.

PROJECT DETAILS

Report Details

Murchs Corner Battery Energy Storage System (BESS) – Flood Assessment

This copied document to be made available for the sole purpose of enabling its consideration and review as prepared by planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Prepared For EBARE Pty Ltd

Prepared By SWM Consulting Pty Ltd

Written By PM, MM, AS

Document Name 25-1274

Document Control

Version	Author	Reviewer	Description	Report Date
D01	PM, MM	AS	Draft	11/09/2025
R01	PM, MM	AS	Final	20/10/2025
R01-B	AS	AS	Final	04/12/2025

ACKNOWLEDGEMENT OF COUNTRY

SWM Consulting acknowledges and pays our respect to the Aboriginal and Torres Strait Islander Peoples as the Traditional Custodians of Country throughout Australia. We acknowledge the Traditional Custodians of the land, water and skies upon which this work was conducted. We pay our respects to all First Nations Peoples their Elders past, present and emerging. We acknowledge the contributions of Indigenous Peoples, and respect the knowledge, skills and lived experiences as we continue to learn from them, and their care for Country. To incorporate reconciliation in our everyday life we recommend:

- Listening to First Nations stories and voices
- Taking a cultural tour of your area or workplace.
- When you create content, events, or spaces, make sure to think of things from an Indigenous perspective to create a safe environment.
- Following and supporting BLAK businesses, influencers and organisations on social media.
- Planting a native or bush tucker garden and learn about the cultural significance of the plants.
- Engaging with local artists and support their work.
- Learning and memorising the key dates that affect Indigenous peoples.

We encourage you to consider how you might incorporate these actions into your life and remember that its many small things that lead to big change.

TABLE OF CONTENTS

1	Introduction.....	4			
1.1	Background.....	4		3.3.2	RORB Parameters – Kc and m..... 18
1.2	Objectives and Scope of Project.....	5		3.3.3	Design Temporal Patterns..... 19
1.3	Study Area.....	6		3.3.4	Rainfall Losses..... 19
1.4	Approvals Process.....	6		3.3.5	Pre-Burst Depths..... 19
1.5	Guidelines.....	7		3.3.6	Adopted RORB Design..... 21
1.6	Assumptions, Inclusions and Exclusions.....	8		3.3.7	Peak Flow Summary..... 21
				3.3.8	Verification Analysis..... 22
2	Data Review.....	10			
2.1	Previous studies.....	10		4	Hydraulic Model Build..... 24
2.2	Topography.....	11		4.1	Overview..... 24
2.3	Aerial Imagery.....	11		5	Flood Modelling Results..... 26
2.4	Engineering drawing and key hydraulic structures.....	12		5.1	Overview..... 26
2.5	Rainfall Data.....	12		5.2	Flood Depths..... 26
3	Hydrology.....	13		5.3	Flood Velocities..... 26
3.1	Overview.....	13		5.4	Flood Water Surface Elevations (Flood Heights)..... 26
3.2	Catchment Delineation.....	14		5.5	Flood Extents..... 27
3.2.1	Reaches and Nodes.....	16		5.6	Flood Hazard Product..... 27
3.2.2	Fraction Impervious (FI).....	16		5.7	Flood Hazard Classification..... 27
3.3	Design Hydrology.....	18		6	Flood Impact Assessment..... 28
3.3.1	Rainfall Depths.....	18		7	Summary and Conclusions..... 28

This copied document to be made available
 for the sole purpose of enabling
 its consideration and review as
 part of a planning process under the
 Planning and Environment Act 1987.
 The document must not be used for any
 purpose which may breach any
 copyright

8	References	29
---	------------------	----

LIST OF FIGURES

APPENDICES

Appendix A	Topography
Appendix B	Hydraulic Model Build
Appendix C	Estimated 1% AEP Flood Mapping

LIST OF TABLES

Table 3-1	Adopted Fraction Impervious (Fi) Values by Land Use Type	17
Table 3-2	Adopted Fraction Impervious (Fi) Values by Land Use Type	17
Table 3-3	kc sensitivity analysis – at outlet	18
Table 3-4	Adopted Design Temporal Pattern per Sub-Catchment (for estimated 1% AEP event)	21
Table 3-5	Derived Peak Flows per Sub-Catchment.....	22
Table 3-6	Comparison of peak flows from multiple methods.....	23
Table 4-1	Key Modelling Parameters	24
Table 4-2	Adopted Roughness Values	25

Figure 1-1	Project Area	5
Figure 3-1	Hydrological Analysis Approach	14
Figure 3-2	Sub catchment delineation Vs. RORB model.....	15
Figure 3-3	Continuing Loss Regions	20
Figure 6-1	Proposed Development and Estimated Flood Extent	28

This copied document to be made available
 for the sole purpose of enabling
 its consideration and review as
 part of a planning process under the
 Planning and Environment Act 1987.
 The document must not be used for any
 purpose which may breach any
 copyright

LIST OF ABBREVIATIONS

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ARR	Australian Rainfall and Runoff
BoM	Bureau of Meteorology
DELWP	Department of Land, Water and Planning
DEM	Digital Elevation Model
FIA	Flood Impact Assessment
GPU	Graphical Processing Unit
HPC	High-Performance-Computing
KM	Kilometres
LiDAR	Light Detection and Ranging
m	metre
m/s	metre/second
QGIS	Quantum Geographic Information System

This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright

ADVERTISED PLAN

1 INTRODUCTION

1.1 BACKGROUND

SWM Consulting was engaged EBARE Pty Ltd (referred to as 'the client') to undertake a Flood Impact Assessment (FIA) for the proposed Battery Energy Storage System (BESS), located at 2977 Hamilton Highway Darlington VIC 3271 (referred to as the 'project area') as shown in Figure 1-1.

The proposed development comprises the following key infrastructure components:

- BESS compounds (batteries, inverters and transformer units)
- On-site terminal station and associated electrical infrastructure
- Operation & maintenance building – inclusive of control room
- Construction laydown area (temporary) and permanent hardstand for infrastructure
- Retention basin
- Asset protection zone
- Internal access track

The purpose of this assessment is to evaluate the potential flooding impacts associated with the proposed development and to ensure the design aligns with applicable floodplain management objectives and statutory requirements.

This report outlines the adopted hydrologic and hydraulic assessment methodology, presents the analysis undertaken, and summarises the key findings relevant to flood risk and site development feasibility.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

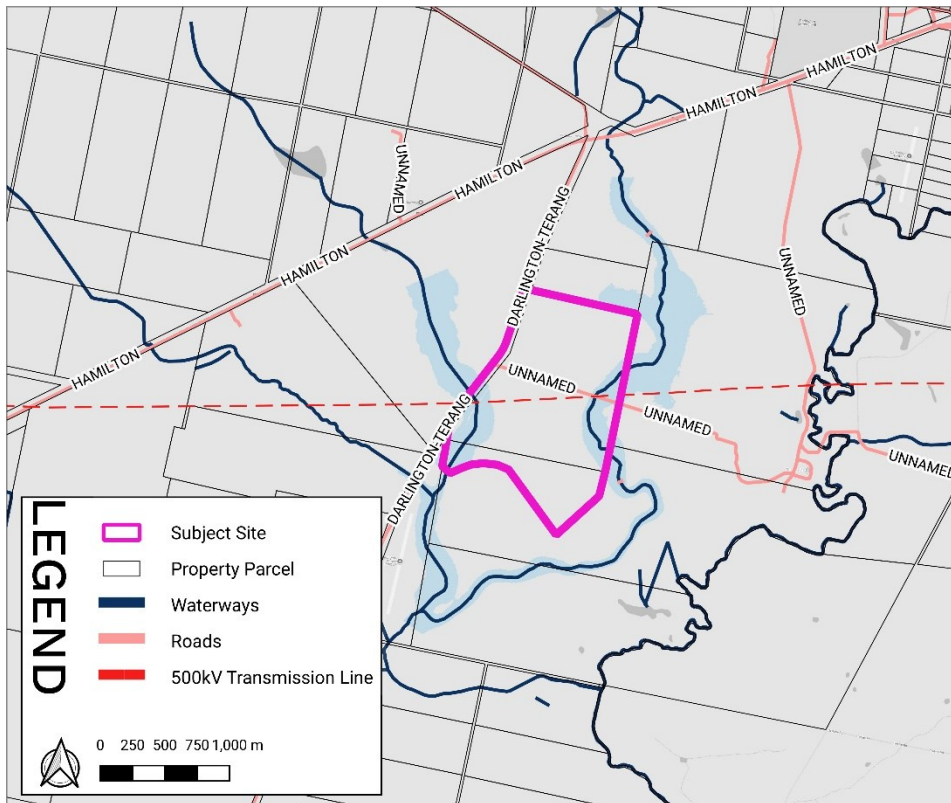


Figure 1-1 Project Area

1.2 OBJECTIVES AND SCOPE OF PROJECT

The scope of this Flood Impact Assessment was defined in close collaboration with the client to address the key objectives of:

- Evaluating the potential flooding impacts associated with the proposed development
- Ensuring compliance with floodplain management guidelines and statutory requirements.
- Supporting the planning, design, and approval process for the BESS.

To achieve these objectives, the assessment was structured into four primary tasks including:

1. **Project Management and Data Review:** Coordination with stakeholders, collation of relevant background information, and review of available data.
2. **Hydrologic Analysis:** Estimation of design flood flows using industry-standard methods consistent with Australian Rainfall and Runoff 4.2 (ARR19) guidelines.
3. **Hydraulic Analysis:** Development and application of a hydraulic model to simulate existing and developed conditions, quantify flood behaviour, and assess changes to flood levels, velocities, and flow distribution.
4. **Impact Assessment and Reporting:** Evaluation of the proposed development's impacts on flood behaviour, identification of mitigation requirements, and preparation of this technical report to inform the planning approval process.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

1.3 STUDY AREA

The project area is located at 2977 Hamilton Highway, Darlington VIC 3271, approximately 70 km northwest of Colac and 4 km southwest of Darlington. It lies within the traditional lands, waters, and skies of the Eastern Maar People.

The project area falls under the jurisdiction of the Glenelg Hopkins Catchment Management Authority (GHCMA) and the Moyne Shire Council. The land is zoned Farming Zone (FZ) under the Moyne Planning Scheme. This zoning is relevant as planning permits are required for earthworks that alter the rate of flow or discharge point of water across a property boundary.

The property is situated within a predominantly rural landscape, with surrounding land use primarily consisting of broadacre farming and grazing. Adjoining properties to the north, east, south, and west are similarly used for agricultural purposes. The Darlington-Terang Road forms the northern and western boundary of the site, providing direct access and connectivity to surrounding townships.

The project area lies within the Emu Creek catchment, a significant tributary of the Hopkins River. Surface water from the site drains towards local depressions and minor drainage lines, which ultimately converge into Emu Creek. The catchment forms part of the larger Hopkins River basin, managed by the Glenelg Hopkins CMA, with waters eventually discharging to the Southern Ocean at Warrnambool.

1.4 APPROVALS PROCESS

The planning permit process for renewable energy development in Victoria involves a range of technical assessments addressing key environmental, planning, and risk-based considerations. These typically include assessment of noise, visual impact, biodiversity, heritage, water (including flood risk), traffic, land use compatibility, hazard and risk, and cumulative impacts.

As part of the planning and approval pathway, developments located on flood-prone land must demonstrate compliance with the relevant Victorian guidelines and floodplain management principles, including those outlined in the GHCMA's Floodplain Development Guidelines and DELWP's Planning for Floodplain Management in Victoria (2016).

The following key principles must be addressed in flood-prone land assessment:

- Protect human life and health and provide safety from flood hazards.
- Minimise flood damage to buildings, infrastructure and assets.
- Reduce reliance on emergency services during flood events
- Maintain the conveyance and temporary storage capacity of floodplains; and
- Protect and enhance the environmental values of waterway and floodplain ecosystems.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

To gain statutory approval, the development must meet standard floodplain management objectives including:

- No net loss of floodplain storage
- No adverse impacts to surrounding or downstream properties
- Appropriate design measures to withstand flood conditions and
- Demonstrated safe access and egress during the 1% Annual Exceedance Probability (AEP) flood event.

**ADVERTISED
PLAN**

1.5 GUIDELINES

The following guidelines and technical reference were used to inform the hydrologic and hydraulic assessment for this project. These documents represent industry best practice and are consistent with regulatory requirements for flood impact assessment in Victoria.

- Australian Rainfall and Runoff – 4.2 (Geoscience Australia, 2019)
 - The national guideline for flood estimation including contemporary approaches to two-dimensional hydraulic modelling.
- ARR Data Hub – Vic region specific (Geoscience Australia, 2019)
 - Source of design rainfall data, temporal patterns, losses, and other catchment-specific hydrologic parameters relevant to the site.
- Guidelines for Development in Flood Affected Areas (Department of Environmental, Land, Water and Planning [DELWP], 2019)
 - Provides floodplain development principles and assessment requirements under Victoria's planning framework.
- TUFLOW User Manual (BMT, 2018)
 - Technical guidance for hydraulic modelling using the TUFLOW platform, adopted for simulating flood behaviour at the site.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

- RORB Hydrologic Modelling Manual (Deakin University, latest edition)
 - Manual for applying the RORB model for rainfall-runoff estimation in Victorian Catchment.
- Hydraulic Design of Waterway Structures (AusRoads, 2019)
 - Design guidance for assessing flow conveyance, culvert sizing, and infrastructure interaction with waterway hydraulics.
- Austroads Guide to Road Design (AusRoads, 2023)
 - National guideline for the hydraulic design of roads and associated drainage infrastructure, including flood immunity considerations.

1.6 ASSUMPTIONS, INCLUSIONS AND EXCLUSIONS

The following assumptions, inclusions, and exclusions were applied in undertaking this Surface Water Assessment:

- Road and culvert Representation:
 - Road alignments were defined from aerial imagery, while culvert locations and details were incorporated using data supplied by the client from their culvert assessments.
- Topographic Data Accuracy:
 - It is assumed that the LiDAR dataset source from the Victorian Government's open data platform is current and accurately reflects existing ground surface conditions across the site and surrounding catchment.
- Site Access and Ground Truthing:

No physical site visit was undertaken as part of this assessment. The analysis was based on entirely on available desktop data, including LiDAR, aerial imagery, planning overlays, and design documentation provided by the client.

ADVERTISED PLAN

- Inclusion:
 - The assessment includes hydrologic and hydraulic modelling of the pre-conditions to determine any changes in flood behaviour within and surrounding the site. It also includes evaluation against floodplain management objectives and relevant guidelines.
- Exclusions:
 - This assessment does not include detailed hydraulic structure survey, ground-level verification, or analysis of the condition or capacity of existing road culverts and drainage assets outside the site boundary. Any required upgrades to infrastructure or third-party assets fall outside the scope of this assessment.

These assumptions and limitations are considered appropriate for the current stage of development and are consistent with standard practice for planning-level flood assessment

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

2 DATA REVIEW

2.1 PREVIOUS STUDIES

Several previous studies and publicly available dataset were reviewed to inform this assessment, including:

- **Emu Creek / Mt Emu Creek Flood Studies (GHCMA)** – Detailed investigations of flood behaviour along Emu Creek and Mt Emu Creek, including mapped flood extents, hydrological modelling, and hydraulic behaviour. These are directly relevant as the project area lies within the Emu Creek catchment.
- **Glenelg Hopkins CMA Flood Mapping Portal** – Provides property-scale mapping of 1% AEP flood extents, depths, and overlays for the Emu Creek catchment.
- **Water Monitoring Data (WaterWatch / GHCMA)** – Historical streamflow and flood gauge records for Mt Emu Creek at Darlington, providing observed data for validating modelled flood behaviour.
- **Integrated Water Management and Catchment Plans (GHCMA)** – Provide broader catchment management context, including flood mitigation priorities and land-use planning considerations.

The Emu Creek / Mt Emu Creek flood studies and GHCMA Flood Mapping Portal were reviewed as the most relevant sources for the site, with the Hamilton Flood Investigation providing regional context.

ADVERTISED PLAN

While these references were consulted, the estimated 1% AEP flood extents were not available for the subject catchment. Available mapping indicates that surrounding land is low-lying and flood-prone, particularly adjacent to Emu Creek.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

2.2 TOPOGRAPHY

Topographic data for the study area was sourced from multiple publicly available platforms to support the hydrologic and hydraulic assessments.

An initial 10m resolution Digital Elevation Model (DEM) was obtained from the ELVIS Elevation Portal and used to undertake preliminary catchment delineation and model development. While this resolution provides a general understanding of the broader catchment and topographic features, it lacks the detail necessary to fully resolve critical hydraulic features such as road embankment, channels, and overland flow paths.

To improve the resolution of terrain within the surrounding the site, a 1m resolution LiDAR-derived DEM was subsequently retrieved from the Cep16 Darlington Dataset through the Vicmap Digital Elevation Data provider. This finer-resolution model was used to refine the hydraulic model in the vicinity of the proposed development, enabling more accurate characteristic of topographic variation and flow behaviour.

Given that the project area is predominately rural in nature, the combination of broader-scale (10m) and finer-scale (1m) terrain data is considered appropriate for this level of assessment. The 1m LiDAR data has been prioritised for use within and near the site boundary, while the 10m DEM supports regional catchment delineation and boundary conditions where LiDAR was not available.

2.3 AERIAL IMAGERY

High-resolution aerial imagery was obtained from readily available online sources, including the Spatial Imagery Subscription Plan (SISP). This imagery was used to assess existing land use, drainage characteristic, and surface conditions across the project area and surrounding catchment.

The aerial imagery supported:

- Identification of drainage lines, farm dams, waterway corridors, and other natural features.
- Confirmation of the predominately rural/agricultural land use context of the site.
- Verification of site access track, vegetation cover, and existing infrastructure and
- Supplementation of terrain analysis and model setup during hydrologic and hydraulic assessment.

The imagery was cross-reference with topographic data and planning overlays to inform catchment delineation and validated model assumptions.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

2.4 ENGINEERING DRAWING AND KEY HYDRAULIC STRUCTURES

No detailed engineering drawings or asset information for existing drainage structures at the site (e.g., bridges or headwalls) were available at the time of this assessment. Client assessed culvert information was supplied. Other features, such as roads and road crossings were identified from aerial imagery or inferred from terrain data and were represented in the model using standard open-channel or orifice-type structures, assuming unobstructed, free-flowing conditions.

**ADVERTISED
PLAN**

2.5 RAINFALL DATA

Design rainfall data used in this assessment was sourced from the Bureau of Meteorology (BoM) and the Australian Rainfall and Runoff Data Hub (ARR Data Hub, 2019). This information was used to estimate design peak flows for a range of storm duration and frequencies relevant to the site.

Key rainfall data inputs included:

- Intensity-Frequency-Duration (IFD) data for the site location
- The Aerial temporal patterns for storm burst shapes, derived from the ARR Data Hub for a rural Victorian Catchment.
- Design event durations ranging from 12hour to 72 hours to capture the full range of possible catchment responses.

Rainfall inputs were applied within the RORB hydrologic model to simulate runoff generation for the estimated 1% AEP flood event. The model adopted ARR4.2-recommended design methodologies, including use of multiple storm bursts per AEP to identify the critical duration at each reporting location.

The adopted LiDAR is shown in Appendix A.

3 HYDROLOGY

3.1 OVERVIEW

A new RORB hydrologic model (version 6.54) was developed to estimate design peak flows and generate hydrograph for use in the hydraulic assessment of the proposed development site. The hydrologic model was developed in accordance with the latest industry standards outlined in Australian Rainfall and Runoff (ARR4.2 – 2019), Book 4, Chapter 2, and was supported by CatchmentSim for catchment delineation.

The model outputs were used to generate design hydrographs, which served as inflow boundaries for the hydraulic model. A combination of ensemble event analysis and routing methodology was used to identify the critical storm durations and assess flood impact at the site.

Key steps in the hydrologic modelling process include:

- Catchment delineation using CatchmentSim and LiDAR-derived DEMs
- Estimation of RORB routing parameters (Kc and m) based on catchment size, slope and regional calibration data.
- Application of ARR4.2 (2019) design inputs, including
 - Design rainfall IFDs and temporal patterns.
 - Initial and continuing loss values from the ARR Data Hub
- Simulation of multiple temporal patterns for each AEP to identify critical duration

ADVERTISED PLAN

- Generation of design hydrographs and hyetograph using ensemble event analysis across a range of storm durations and frequencies.
- Integration of RORB-derived hydrograph into a temporal pattern ensemble spreadsheet, used to determine peak flows and hydrograph shapes for input into the hydraulic model.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

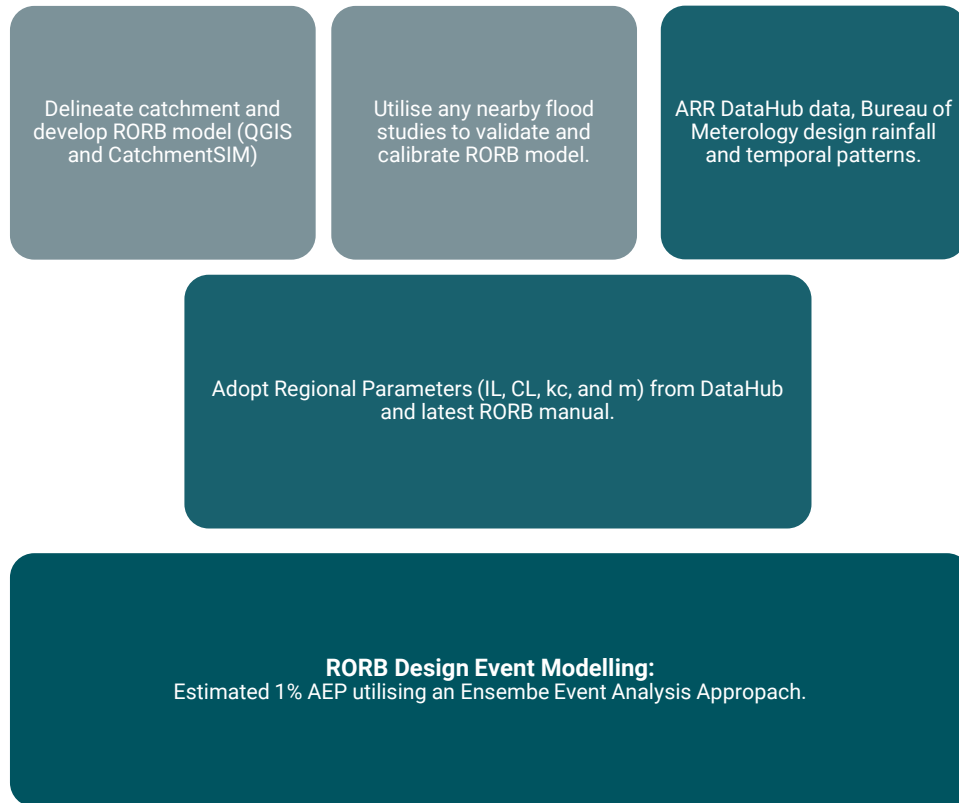


Figure 3-1 Hydrological Analysis Approach

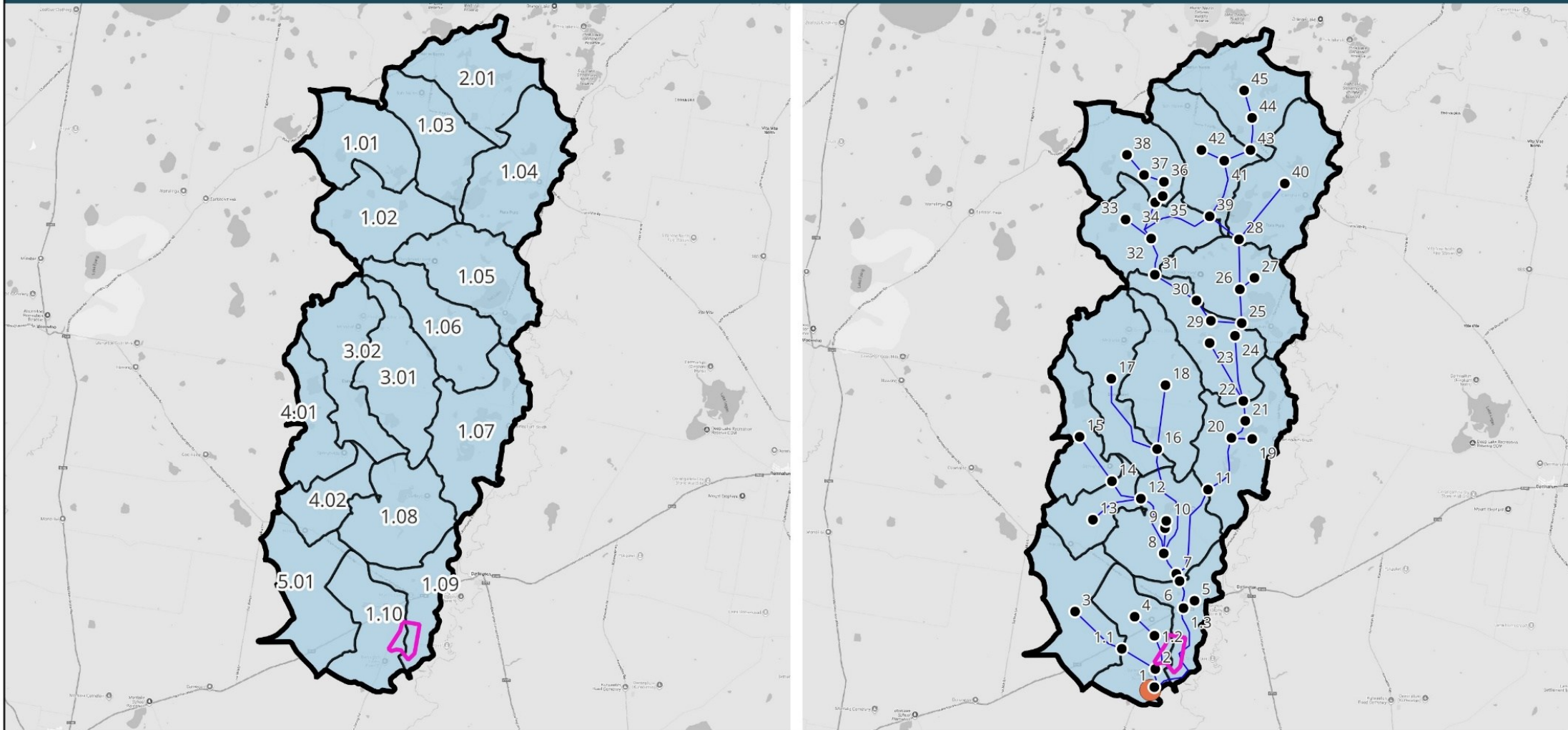
3.2 CATCHMENT DELINEATION

Catchment delineation for the hydrologic assessment was undertaken using CatchmentSIM, based on a 10m resolution Digital Elevation Model (DEM) sourced from ELVIS Elevation Portal. This process enabled the definition of stream network, sub-catchment boundaries, flow paths, and outlet locations across the study area.







Three key catchment areas were identified as part of this process.

- A total upstream contributing area of approximately 320.9km², calculated at the model outlet location, downstream of the proposed development (Refer to Figure 3-2– Total catchment and sub catchments).

The catchment layout was used to define the reach structure of the RORB model, with sub-catchments sized to reflect variability in hydrologic response (e.g. Slope, land use, drainage density). These sub-catchments were configured to capture both the broader upstream catchment inflows and the local runoff generated within the site vicinity.



LEGEND

-  SUBJECT SITE
-  SUB CATCHMENTS
-  CATCHMENT
-  OUTLET
-  NODES
-  REACHES

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Figure 3-2 Sub catchment delineation Vs. RORB model

ADVERTISED PLAN

0 5 10 15 20 25 km



ADVERTISED PLAN

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

3.2.1 Reaches and Nodes

The RORB model provides five (5) reach classifications to represent flow paths and drainage infrastructure within a catchment, these include:

- Type 1 – Natural channel
- Type 2 – Excavated and unlined,
- Type 3 – Lined channel or pipe,
- Type 4 – Drowned reach, and
- Type 5 – Dummy reach (used for zero-length connections or calibration adjustments)

For this assessment, all reaches within the catchment were modelled as Type 1 – Natural to reflect the predominately rural and undeveloped nature of the landscape, where overland occurs through opens, unmodified drainage paths such as creeks, swales, and natural depression.

Nodes were placed at:

- The centroids of each sub-catchments, to represent runoff inflows; and
- Junctions between reaches, allowing the model to compute accumulated flows and routing between sub-catchments.

This network layout was developed to accurately represent the catchment's hydrologic behaviour and enable calculation of design peak flows at key locations, both upstream and downstream of the project area. The RORB model layout is as shown in Figure 3-2.

3.2.2 Fraction Impervious (FI)

The fraction impervious (FI) for each sub-area was estimated on a combination of planning zone data, aerial imagery interpretation, and available proposed development drawings. This approach allows for refinement of FI estimate to reflect existing and proposed surface conditions within the modelled catchment.

Adopted FI values were guided by Table 32: Catchment Fraction of Various Types from AM STA 6200 – Flood Mapping Project Specification. Table 3-1 below summarises the FI values used in the model, alongside their indicative ranges from STA 6200.

These FI values were used as inputs into the RORB model to compute Runoff volume and peak discharge from each sub-catchment under design storm conditions.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

Table 3-1 Adopted Fraction Impervious (Fi) Values by Land Use Type

Land Use	Adopted Fraction Impervious Values	Range
Rural Zone	0.1	0.05 - 0.2
Environmental Rural Zone – Rural area with specific environmental considerations	0.1	0.05 - 0.2
Rural living zone – Residential use in rural environment	0.2	0.1- 0.3

Note: FI values were adjusted locally where aerial imagery suggested land use variation from planning zone classification (e.g. undeveloped parcels or vegetated reserves)

The adopted FI values for sub catchments for this assessment are listed below in Table 3-2.

Table 3-2 Adopted Fraction Impervious (Fi) Values by Land Use Type

Sub catchment	Observed Land Use Characteristics	Estimated FI
1.01	Mostly cleared farmland, some tree cover along waterway	0.03
1.02	Mostly open pasture/grazing	0.03
1.03	Open cropping with few visible roads/buildings	0.03
1.04	Mix of cleared land and vegetated ridges	0.03
1.05	Cleared farmland, some riparian vegetation	0.03
1.06	Includes small town or dense structures (light development)	0.06
1.07	Agricultural with minimal development	0.03
1.08	Rural	0.03
1.09	Slight increase in visible tracks/structures	0.04
1.1	Has some semi-developed zones (denser farm blocks, roads)	0.05
2.01	Open grazing/cropping, discussed earlier	0.03
3.01	Sparse structures, predominantly farmland	0.03
3.02	Agricultural with little development	0.03
4.01	Typical rural area, some dense paddocks	0.03
4.02	Few roads visible	0.03
5.01	Low-density rural with moderate vegetation	0.03

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

3.3 DESIGN HYDROLOGY

The design hydrology was based on the full analysis approach consistent with ARR-4.2 guidelines. The analysis runs 10 temporal patterns and 12hours to 168hours for the catchment.

3.3.1 Rainfall Depths

Rainfall depth for the catchment was extracted from ARR Data Hub. Pre-burst depths and areal temporal patterns were also sourced from ARR Data Hub (-38.045,142.995). The Intensity-Frequency-Duration (IFD) rainfall depths were sourced from the Bureau of Meteorology (BoM) online IFD tool.

3.3.2 RORB Parameters – Kc and m

The non-linear routing parameters, Kc and m, influence the timing and attenuation of flood peaks. The exponent m was set to 0.8, which is consistent with typical values adopted across rural Victorian Catchment.

To determine an appropriate Kc value, a sensitivity analysis was undertaken using three commonly applied methods in Victoria:

- Equation 7.6.16 (ARR, BKVILL) – for regions with MAR < 800mm
- Pearse et al. (2002) – empirical values derived from historical calibration of ungauged Victorian catchments.

- Aus wide Dyer (1994) – empirical kc values developed for application across Australian catchments.
- Aus wide Yu (1989) – nationwide kc values derived from regional analysis of catchments.
- Peak flows were assessed at catchment outlet, which represents the largest contributing area upstream of the hydraulic model extent is the most sensitive to routing effects.

Table 3-3 kc sensitivity analysis – at outlet

Kc source	kc	Duration (hrs)	Peak Flow (m ³ /s)
Pearse et al. (2002)	26.30	12	114.19
ARR Eqn 7.6.16 (MAR < 800)	20.86	12	155.75
Aus wide Dyer (1994)	23.98	12	124.58
Aus wide Yu (1989)	16.14	12	156.84

The Pearse et al. Value (Kc –26.30) was found to produce a peak flow of 114.19m³/s which closely aligns with RFFE for this study area.

Accordingly, the Pearse et al. (2002) Kc value of 26.30 was adopted as the final routing parameters for all design simulations.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

Note: This approach ensure consistency with past industry practice for Victoria while balancing conservative and representative flow estimates for hydraulic model.

3.3.3 Design Temporal Patterns

Design temporal patterns were selected in accordance with ARR4.2 methodology (Book 3 – Chapter 6) to simulate realistic storm burst shapes and variability in rainfall intensity over time. These patterns were applied to the estimated 1%AEP flood event to evaluate the impact of storm structures on catchment response.

A range of design storm durations was assessed, including 12, 24, 36, 48, 96, 120, 144 and 168 hours, reflecting the large catchment area (> 75km²) and the need to identify critical duration events that generate peak flows at key locations.

For each duration, an ensemble of 10 temporal patterns was adopted to capture the variation in rainfall intensity distribution across time. For catchments exceeding 75km², the areal temporal patterns from the ARR Data Hub were used instead of points patterns to better represent spatial variability in rainfall across the catchment.

The final selection of design temporal patterns for input into the hydraulic model was based on the temporal pattern closes to the ensemble mean (median peak flow).

3.3.4 Rainfall Losses

Rainfall loss parameters are a critical input to hydrologic modelling, as they influence the volume of effective rainfall and, consequently, peak runoff. ARR4.2 recommends reviewing losses from previous calibrated studies where available (Book 5 – Flood Hydrograph Estimation). In the absence of suitable local studies, ARR4.2 recommends the use of ARR Data Hub values, which are regionally derived and consistent with contemporary best practice.

- Initial Loss – 22mm
- Continuing Loss - 4.7mm/hr

3.3.5 Pre-Burst Depths

The project area, as shown Figure 3-3 Continuing Loss Regions, falls within Continuing Loss Region 3, as defined in the ARR Data Hub (2019). The ARR Data Hub provides nationally consistent grids of Initial Loss (IL) and Continuing Loss (CL) values, which vary depending on the adopted loss region. These values are intended for direct use in hydrologic modelling without modification, unless local calibration data is available.

For this study, Loss Region 3 values were adopted directly from the ARR Data Hub. Pre-burst rainfall losses were incorporated in line with ARR2019 guidance, using percentile rainfall data supplied through

ADVERTISED PLAN

the Data Hub. This ensures the adopted losses are consistent with the latest ARR methodology and regionalisation approach.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

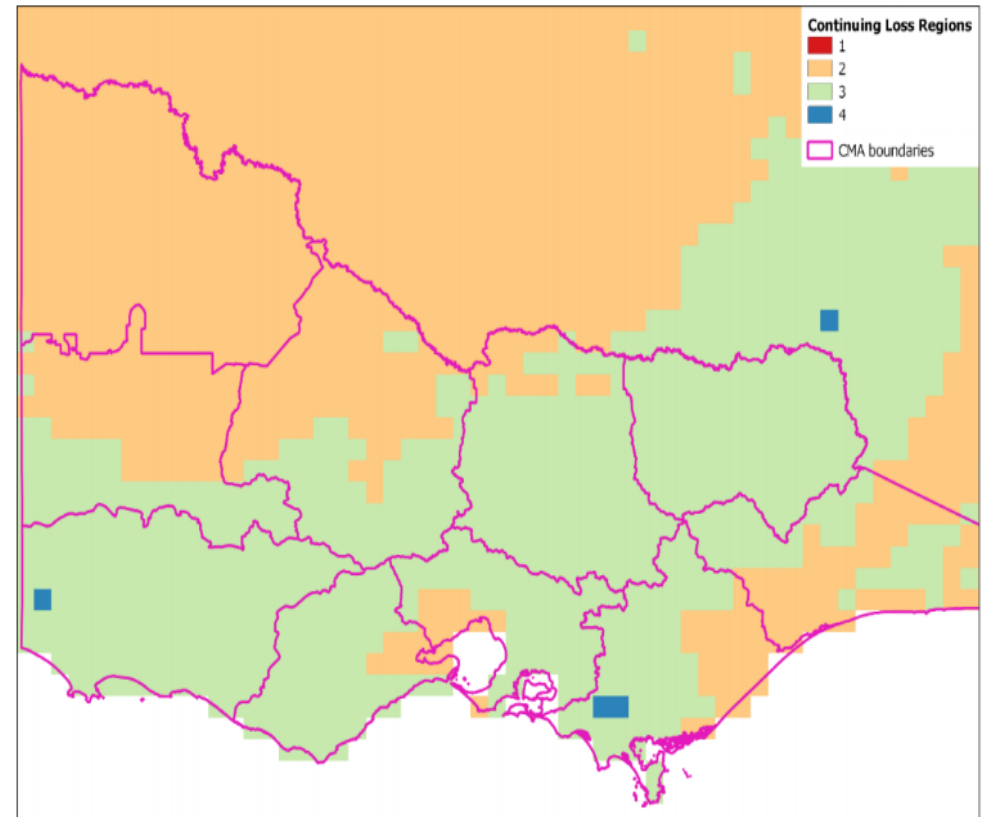


Figure 3-3 Continuing Loss Regions

**This copied document to be made available
 for the sole purpose of enabling
 its consideration and review as
 part of a planning process under the
 Planning and Environment Act 1987.
 The document must not be used for any
 purpose which may breach any
 copyright**

ADVERTISED PLAN

3.3.6 Adopted RORB Design

Hydrographs derived from the RORB hydrologic model were incorporated into the hydraulic model using the following methods:

- Boundary Condition (BC) inflow boundaries – Used for sub-catchments that discharge into the model domain from outside.

A full range of design storm duration was assessed in accordance with ARR4.2, from 12 to 168 hours. For each sub-catchment, 10 ensemble temporal patterns were tested per duration. The adopted temporal patterns for each-area were selected based on the patterns closest to the mean (with bias factor 2.0) as outlined Section 3.3.3.

Table 3-4 Adopted Design Temporal Pattern per Sub-Catchment (for estimated 1% AEP event)

Inflows to the Tuflow model	Sub-catchments ID with associated Temporal patterns	
	Storm Duration	Temporal Pattern
Inflow 1.1	12h	TP5
Inflow 1.2	12h	TP7
Inflow 1.3	12h	TP1

All derived hydrographs were input into the hydraulic model, with peak flood levels, depths, velocities and hazard categories assessed for each duration. The maximum flow from all temporal patterns per duration was extracted to ensure worst-case impacts were captured at the site.

3.3.7 Peak Flow Summary

Peak flows for each sub-catchment (representing the 12-hour duration and associated temporal patterns) are summarised in Table 3-5 below.

Note: Other temporal patterns may yield slightly higher or lower flows than listed; however, the maximum across all patterns for each duration was used in the final design).

These hydrographs formed the basis of inflow conditions for the hydraulic modelling undertaken in subsequent section of this report.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

Table 3-5 *Derived Peak Flows per Sub-Catchment*

Flow locations	Peak Flows (m3/s)	Storm Duration (hrs)	Temporal Pattern
Inflow 1.1	21.87	12	TP5
Inflow 1.2	25.86	12	TP7
Inflow 1.3	109.76	12	TP1

3.3.8 Verification Analysis

To validate the RORB-derived peak flows, comparisons were made with results from multiple independent hydrologic estimation methods, including:

- Regional Flood Frequency Estimation (RFFE) model
- Hydrologic Recipes (Refer to Equation 1)
- Rational Method

Validation was undertaken at the outlet of the catchment the 12-hour duration and temporal pattern 1 (TP1). This location was selected as it represents the largest inflow catchment contributing to the hydraulic model domain and thus generates the largest peak discharge. As such, verifying the RORB outputs at this location provides confidence in both the derived and the adopted routing parameters (e.g. kc values).

The hydrologic recipe method estimates peak flow at ungauged location by referencing a nearby gauged catchment. The Equation used is provided below.

Equation 1

$$Q_c = \left(\frac{A_c}{A_g}\right)^{0.7}$$

Where:

A_c = Area of candidate catchment

Q_c = Discharge of candidate catchment

A_g = Area of gauge catchment

Q_g = Discharge of gauge catchment

ADVERTISED PLAN

Table 3-6 Comparison of peak flows from multiple methods

Method	Estimated Peak Flow (m ³ /s)
RORB (Kc = 26.3)	114.19
RFFE – Upper 95% Quantile	114.00
Hydrologic Recipes – Rural east	380.84
Rational (Adam’s Method)	66.19
Rational (VicRoads)	66.14
Average (excluding RORB output)	156.79

Table 3-6 presents a comparison of estimated peak flows derived from multiple hydrological methods. The RORB model (RORB, Kc = 26.3) predicts a peak flow of 114.19 m³/s, closely aligned with the RFFE upper 95% quantile estimate of 114.00 m³/s. In contrast, empirical hydrologic recipes for rural eastern catchments suggest a higher peak flow of 380.84 m³/s. Rational method estimates, both using Adam’s and VicRoads coefficients, are significantly lower at approximately 66 m³/s. The lower values obtained from the Rational method are consistent with the nature of the catchment, which is predominantly farmland with multiple farm dams, drained wetlands, lakes that likely reduce runoff and peak flows. Excluding the RORB output, the average peak flow across methods is 156.79 m³/s, reflecting a high estimate when considering catchment characteristics and storages.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

4 HYDRAULIC MODEL BUILD

4.1 OVERVIEW

The hydraulic model was developed using TUFLOW, which is one of the most widely adopted 2D hydraulic modelling software platform in Australia. The model was constructed to be fit for purpose following guidance in Melbourne Water’s “AM STA 6200 Flood Mapping Project Specification (August 2021).

A detailed 1D/2D Link model was established to simulate the hydraulic behaviour of the study area during the 1% AEP flood event. The model leverages high-resolution terrain data, appropriate hydrologic inputs, and boundary conditions to represent flooding mechanism with high confidence.

The estimated 1%AEP scenario under existing condition was used for flood impact assessment and design input. Key modelling parameters are summarised in Table 4-1 below.

Table 4-1 Key Modelling Parameters

Key Modelling Parameters	
Model Build	
Model Solver	2023-03-AE (Single Precision)
Model Engine	GPU HPC
Projection	GDA2020 MGA54
Domains	1D/2D domain used.
Events	Estimated 1% AEP flood event

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright.

Scenarios	Existing and developed
Terrain	1-metre LiDAR, see Data Review
Cell Wet/Dry Depth (m)	0.002
Start Time (h)	0.0
End Time (h)	40.0
2D Domain	Entire Catchment, No Exclusions (See Appendix B)
Code Boundary	
Grid Size (m)	5000, 10000
Cell Size (m ²)	5
2D Timestep (s)	0.5
Manning’s Values	See Table 4-2
Model Inflows	2d BC and 2d SA – Hydrographs (QT condition for BC)
Model Outflows	2d BC – HQ boundary Condition
Z Shapes	Terrain modifiers were structures
Results	
Warnings/Checks prior to simulation	0 / 0
Warnings/Checks during simulation	0 / 0
2D Negative Depths	0
Final Cumulative Mass Error	0.23%

ADVERTISED PLAN

Roughness values (Manning's n) were assigned to surface type across the model domain based on aerial imagery interpretation, site context, previous modelling studies, and guidance provided in Melbourne Water's AM STA 6200 Flood Mapping Project Specification (August 2021).

These values were selected to reflect realistic hydraulic resistance for each land cover type and ensure appropriate flood behaviour representation in the model. The adopted Manning's n value is summarised in Table 4-2 below, with reference to AM STA 6200 recommended ranges.

Table 4-2 Adopted Roughness Values

Land Use	Adopted Manning's n	AM STA 6200 Range
Open Pervious Area – Minimal Vegetation (Grassed)	0.040	0.030 – 0.050
Paved Road, Carpark and Driveways	0.020	0.020 – 0.030
Waterway and Channels – Vegetated	0.045	0.040 – 0.100

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

5 FLOOD MODELLING RESULTS

5.1 OVERVIEW

The flood assessment was modelled to reflect the existing site, local areas, and on-ground flooding characteristics derived from the available LiDAR data as well as information supplied by the client. The scenario was adopted following a comprehensive review, and validation analysis of the modelling inputs and outputs. This was cross-checked against SWM Consulting's rigorous quality assurance and control procedures.

Hydraulic modelling results indicate that the project area (proposed development area) is partially impacted by flooding during the estimated 1% AEP flood event under current climatic conditions.

The project area is traversed by two unnamed waterways; one traverses a small area on the western side of the site next to Darlington-Terang Road and the second (known as Mt Fyans Drain) traverses a small area on the eastern portion of the site. Hydraulic output shows that overland flow paths and inundation extent only encroach upon the project area during the estimated 1%AEP event in areas along the western and eastern boundaries and along the northern boundary where water has escaped the confines of the eastern unnamed waterway.

Figures provided in Appendix C illustrate the flood flow patterns across the hydraulic modelling extent, including key overland flow paths, localised ponding, and general flood behaviour throughout the study area.

5.2 FLOOD DEPTHS

The estimated 1% AEP flood depths within the project area range from 0.00 to 3.20 metres. The largest flood depths are located within the dam located in the unnamed waterway at the western property boundary. Depths in the waterway along the eastern boundary get up to 1.70m.

5.3 FLOOD VELOCITIES

The estimated 1% AEP flood velocities within the project area range from 0.0 to 3.10 metres/second (m/s). The highest velocities are located at the western property boundary as the overland flows enter the dam along the unnamed waterway. The flood velocities across the trafficable area are below threshold considered safe for cars & buildings.

5.4 FLOOD WATER SURFACE ELEVATIONS (FLOOD HEIGHTS)

The estimated 1% AEP flood water surface elevations reflect the underlying topography. The flood heights range from 144.87 m AHD at the western property boundary to 139.05 m AHD at the eastern property boundary.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright.

**ADVERTISED
PLAN**

5.5 FLOOD EXTENTS

The estimated 1% AEP flood extents reflect the underlying topography. Flows are found to mainly be contained within the confines of the waterways and water storages.

5.6 FLOOD HAZARD PRODUCT

The estimated 1% AEP flood hazard across the trafficable site is larger than 0.4m²/s though mainly contained within the channel and banks. The flood hazard is the product of flood depth x flood velocity, provided the highest hazard are found within the deepest section of the channels with no major impact at and across the subject, the calculated hazards are deemed acceptable.

5.7 FLOOD HAZARD CLASSIFICATION

Flood hazard classification across the two waterways in the site are between H1 and H5. The site not within the waterways are free from flood waters and therefore don't have a flood hazard classification.

**ADVERTISED
PLAN**

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

6 FLOOD IMPACT ASSESSMENT

The proposed development comprises the following key infrastructure components:

- BESS compounds (batteries, inverters and transformer units)
- On-site terminal station and associated electrical infrastructure
- Construction laydown area (temporary) and permanent hardstand for infrastructure

The location of these and the estimated 1% AEP Flood Extent are depicted in Figure 6-1. This figure shows the proposed development at the site is outside the estimated flood extent and will not impact the flood behaviour either on site or in the surrounding area.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

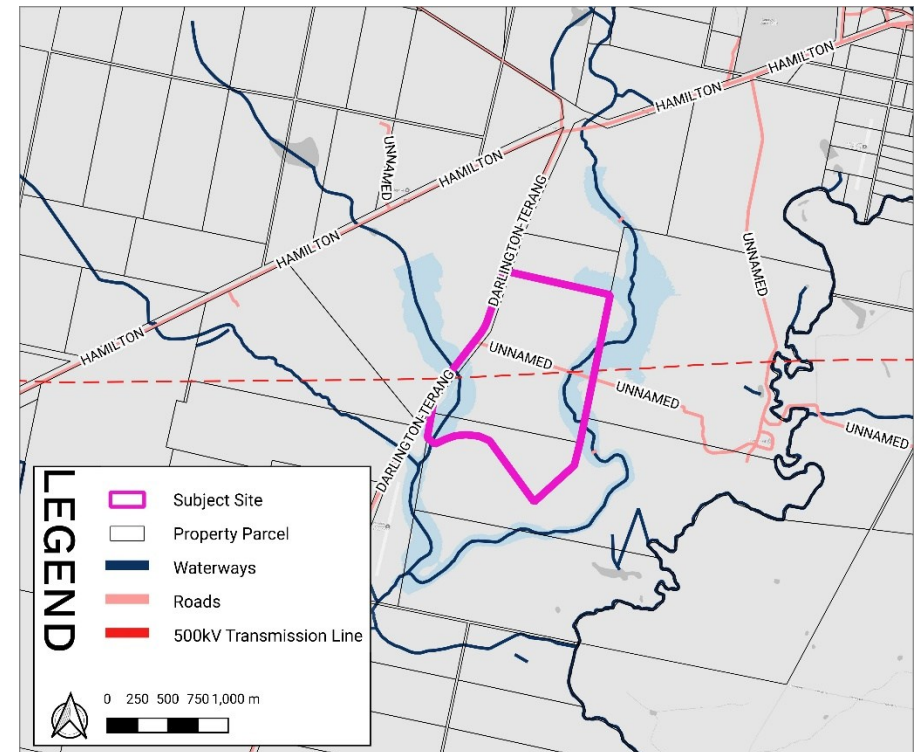


Figure 6-1 Proposed Development and Estimated Flood Extent

ADVERTISED PLAN

7 SUMMARY AND CONCLUSIONS

SWM Consulting was engaged by EBARE Pty Ltd to undertake a Flood Impact Assessment for the future site of a proposed commercial development located at **Murchs Corner Battery Energy Storage System (BESS)**.

The proposed development consists of:

- Battery Energy Storage (BESS) modules, inverters and transformers.
- Internal access roads, and access / egress locations.
- Underground cabling infrastructure
- On-site substation.
- Permanent Operations and Maintenance (O&M) Facility.
- Water storage (including firefighting water supply and fire water runoff containment);
- Temporary construction compound, laydown, and work areas.
- Security fencing; and
- Car parking.

The assessment responds to flood risk concerns associated with the potential acquisition and development of the site. The estimated 1% AEP event was modelled under both existing and developed conditions to evaluate flood risk and accessibility impacts.

Key Findings include:

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

The development site is largely flood immune in the estimated 1%AEP event.

Flood depths, velocities, and hazards across the broader modelling extent are considered moderate, with no adverse impacts generated by the proposed development.

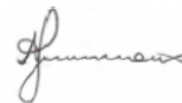
Hazard classification at overtopping locations ranges from H1 to H2, which are generally acceptable for access under the estimated 1%AEP event but may become unsafe during rarer or future climate event.

- The proposed site layout does not increase flood risk to surrounding areas, and drainage from the site can be managed within the surrounding catchment network.

In conclusion, SWM Consulting considers the site viable for acquisition and development, subject to the above considerations being resolved through ongoing consultation and design refinement.

Please do not hesitate to contact SWM if you require further clarification.

Yours sincerely,



Alex Simmons – Founder | Technical Lead

8 REFERENCES

Smith, G. and Wasko, C. (2012). *Australian Rainfall and Runoff, Revision Project 15: Two Dimensional Simulations in Urban Areas – Representation of Buildings in 2D Numerical Flood Models.* Engineers Australia, Barton, ACT, February 2012.

DELWP (2019). *Guidelines for Development in Flood Affected Areas.* Engineers Australia, The State of Victoria Department of Environment, Land, Water and Planning 2018.

Melbourne Water (2021), AM STA 6200 Flood Mapping Projects Specification. Flood Information and Flood Services Team, The State of Victoria.

Australian Rainfall and Runoff Revision Project 10 – Appropriate Safety Criteria for People April 2010.

http://arr.ga.gov.au/_data/assets/pdf_file/0005/40487/ARR_Project_10_Stage1_Report_Final.pdf

Australian Rainfall and Runoff Revision Project 10 – Appropriate Safety Criteria for Vehicles February 2011

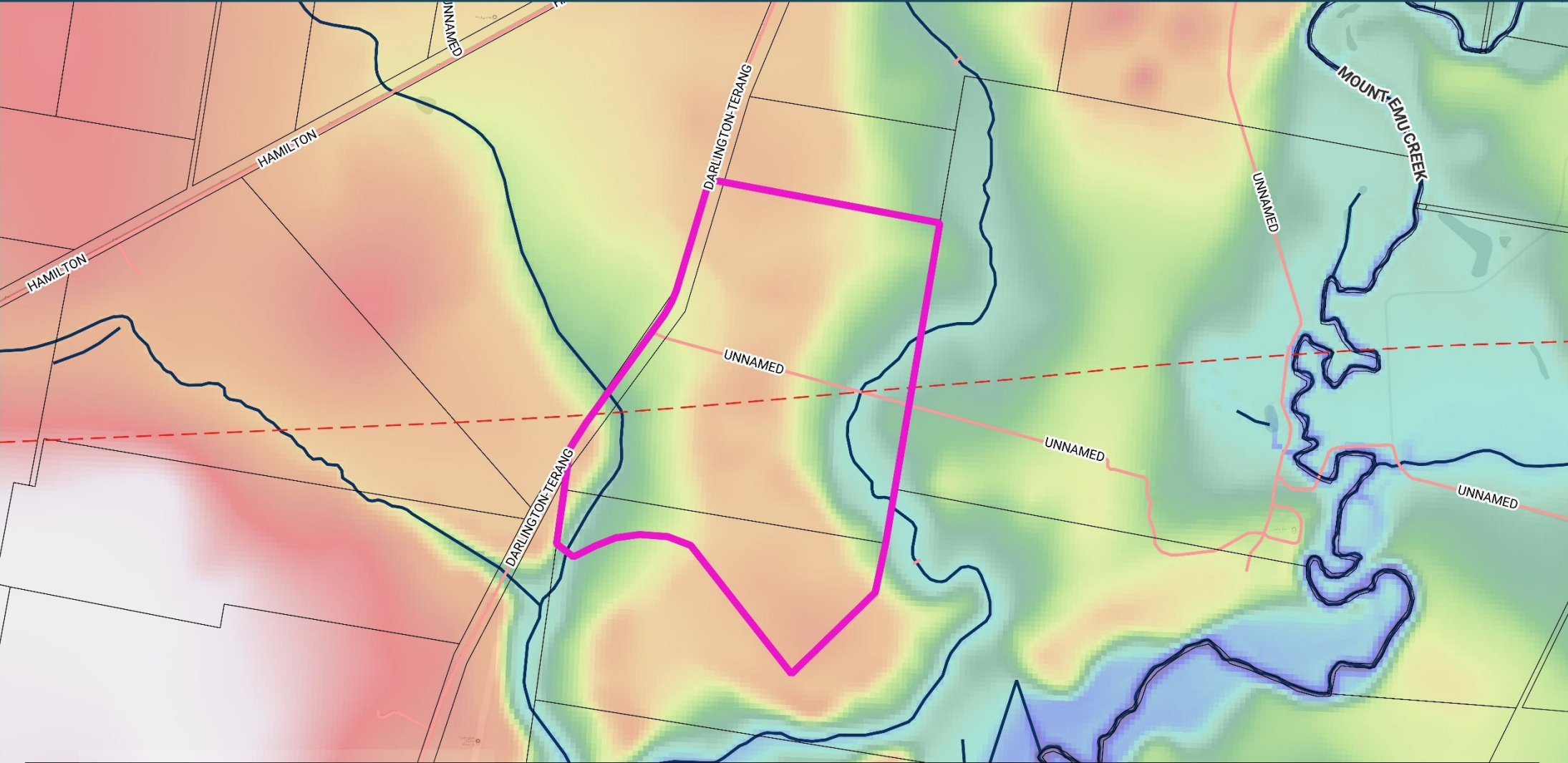
http://arr.ga.gov.au/_data/assets/pdf_file/0004/40486/ARR_Project_10_Stage2_Report_Final.pdf

This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose other than each any
copy right






APPENDIX A

TOPOGRAPHY

This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright

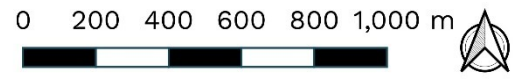


LEGEND

	PROJECT AREA		PROPERTY PARCEL
	TOPOGRAPHY (m AHD)		ROADS
	157.949		WATERWAYS
	132.006		

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

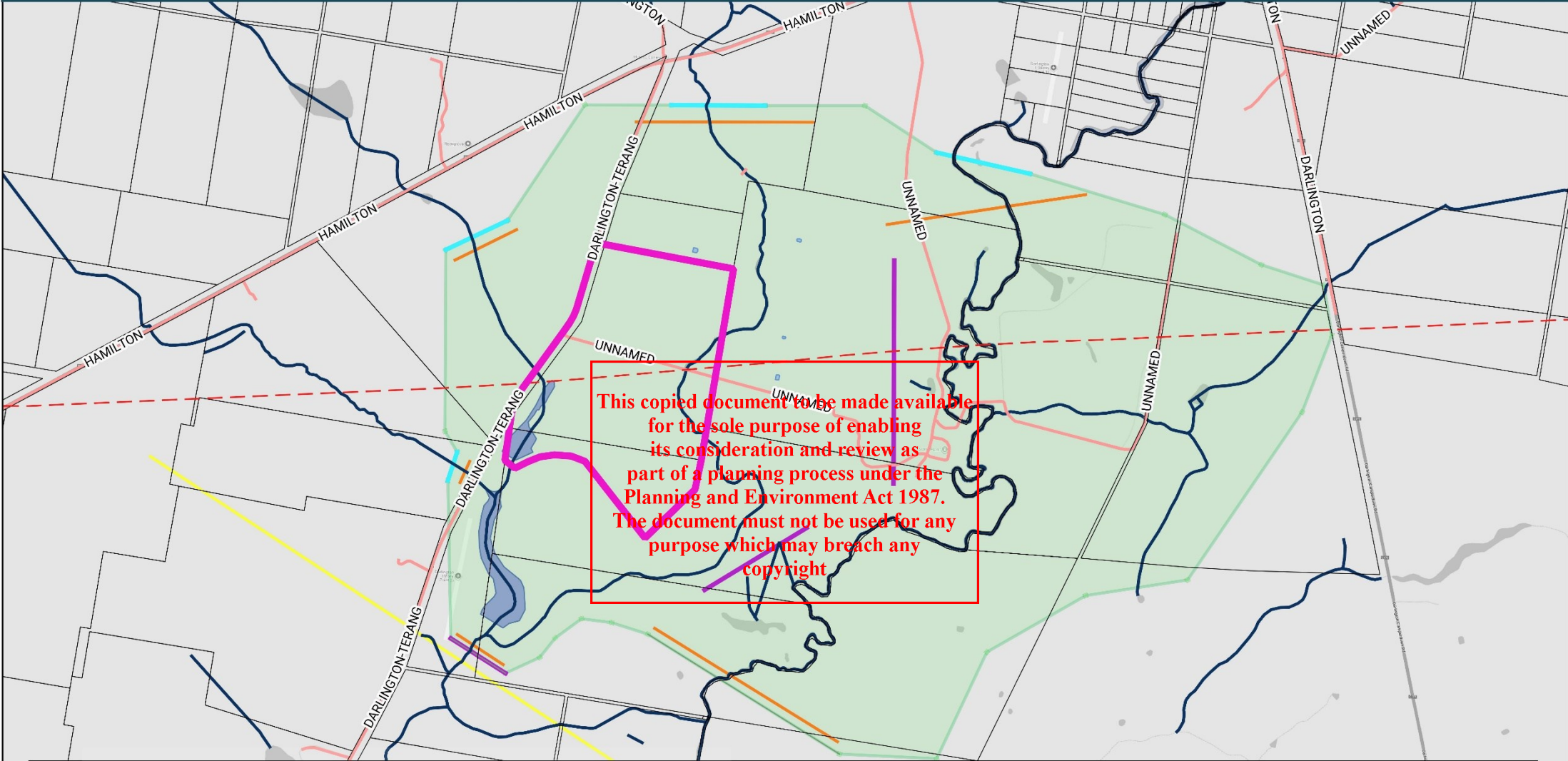
ADVERTISED PLAN
















APPENDIX B

HYDRAULIC MODEL BUILD

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright




This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

LEGEND	 PROJECT AREA	HYDRAULIC ROUGHNESS	 ROADS
	 HYDRAULIC EXTENT	 WETLAND EMERGENT VEGETATION	 PROPERTY PARCEL
	 HYDRAULIC LOCATION	 500kV Transmission Line	 ROADS
	 PO LINES	 WATERWAYS	
	 INFLOW		
	 OUTFLOW		
	 INITIAL WATER LEVELS		

ADVERTISED PLAN

0 500 1,000 1,500 2,000 m



APPENDIX C

ESTIMATED 1% AEP FLOOD MAPPING

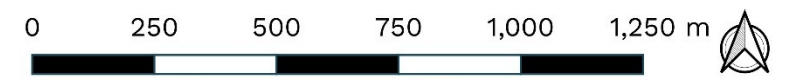
This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright



LEGEND

- | | |
|----------------------------------|-------------------------|
| ESTIMATED 1% AEP FLOOD DEPTH (m) | ROADS |
| <= 0.05 | PROPERTY PARCELS |
| 0.05 - 0.1 | WATERCOURSE & WATERWAYS |
| 0.1 - 0.3 | |
| 0.3 - 0.5 | |
| 0.5 - 1.0 | |
| >= 1.0 | |

ADVERTISED PLAN





This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

LEGEND

- | | | | |
|--|---------------------------------------|--|-------------------------|
| | PROJECT AREA | | ROADS |
| | ESTIMATED 1% AEP FLOOD VELOCITY (m/s) | | PROPERTY PARCELS |
| | <= 0.50 | | WATERCOURSE & WATERWAYS |
| | 0.5 - 1.0 | | |
| | 1.0 - 2.0 | | |
| | >=2.0 | | |

ADVERTISED PLAN

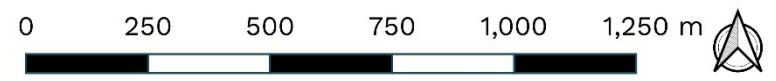




LEGEND

- PROJECT AREA
- ESTIMATED 1% AEP FLOOD EVENT
- FLOOD EXTENT
- FLOOD CONTOURS (m AHD)
- ROADS
- PROPERTY PARCELS
- WATERCOURSE & WATERWAYS

ADVERTISED PLAN



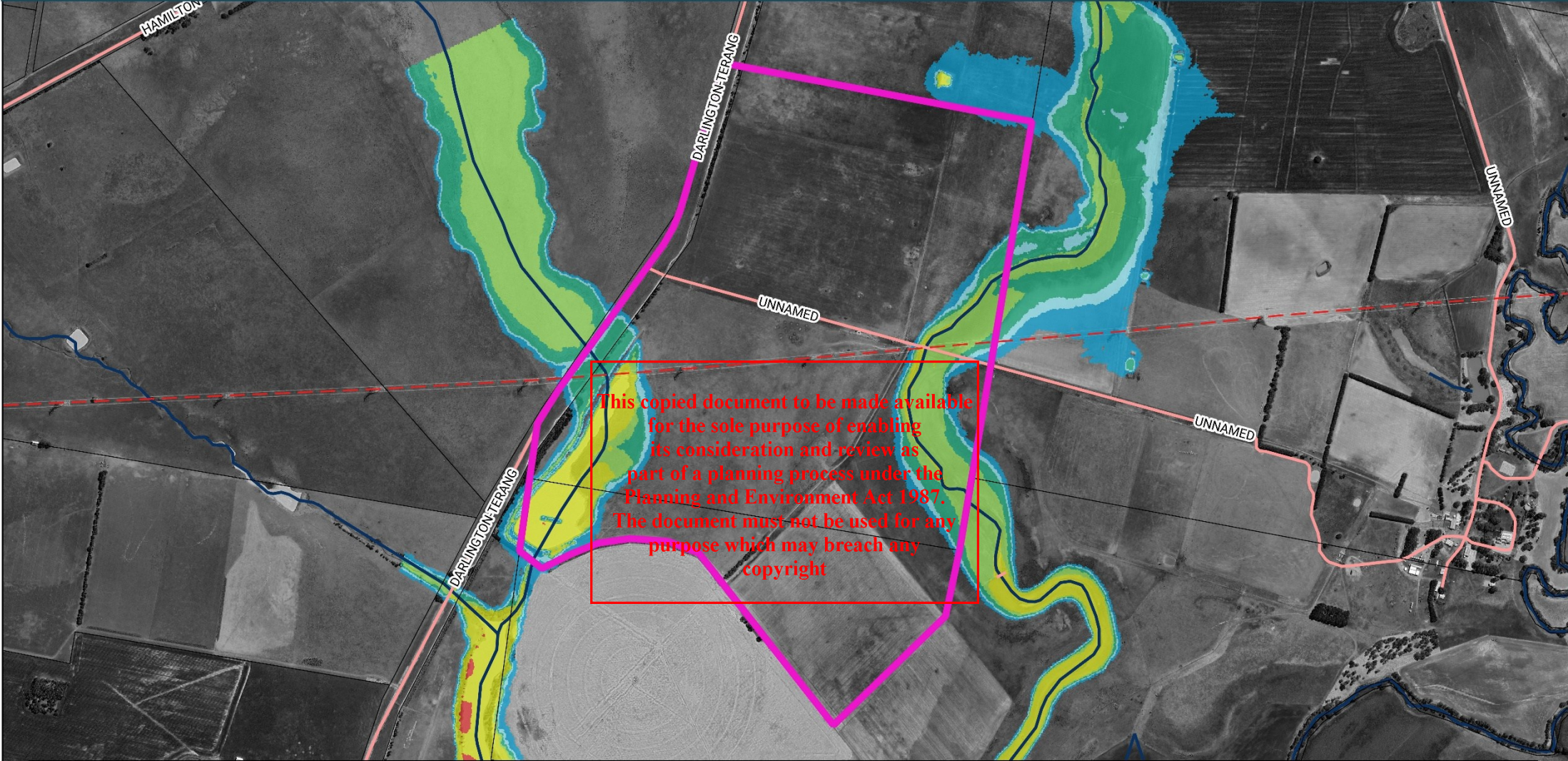


LEGEND

- PROJECT AREA
- ROADS
- PROPERTY PARCELS
- WATERCOURSE & WATERWAYS
- ESTIMATED 1% AEP FLOOD HAZARD (m²/s) <=0.3
- 0.3 - 0.4
- >=0.4

**ADVERTISED
 PLAN**





LEGEND

PROJECT AREA

ESTIMATED 1% AEP HAZARD CLASSIFICATION

- H1 - Generally safe for vehicles, people and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children, and the elderly
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

ROADS

PROPERTY PARCELS

WATERCOURSE & WATERWAYS

ADVERTISED PLAN

0 250 500 750 1,000 1,250 m

