DALTON CONSULTING ENGINEERS

Tragowel BESS, Kerang
HYDROLOGY AND STORMWATER MANAGEMENT TRANSMISSION CONNECTION ASSESSMENT

April 2026

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FOR

Green Switch AUSTRALIA

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Executive Summary

This report presents the hydrology, flooding and stormwater management strategy for the proposed Tragowel Battery Energy Storage System (BESS). The proposed utility installation is located at Crown Allotment 3 (PT) Parish of Kerang, Lot 1 on Title Plan 601295P in Tragowel, Victoria.

The primary landholding for the proposed Tragowel BESS encompasses 23 ha, divided into four (4) paddocks. Within this broader landholding, the proposed Tragowel BESS will be situated within the largest paddock, with a total area of 12.3 ha. The Proposed BESS Development Area within the selected paddock will occupy approximately 7 ha. An additional 8 ha of land to the north of the 23-ha paddock, located within the Kerang Solar Plant, has been evaluated for the underground transmission corridor. Together, the 12.3-ha paddock, including the 7-ha Proposed BESS Development Area, and the additional 8 ha allocated for the underground transmission corridor, form the 'Project Site', as referred to throughout this document.

The Project Site is in Tragowel, approximately 7 km south of Kerang and 60 km southeast of Swan Hill. The Kerang Terminal Station is located 2.4 km north-west of the Project Site. The Project Site is located within Gannawarra Shire and the North Central Catchment Management Authority (CMA) region and is proposed to have a BESS utility installation.

The BESS project is proposed to have a 200 MW/800 MWh capacity. The project includes:

- BESS components including batteries, inverters, and transformer units
- Switch rooms and control building
- Transmission connection infrastructure, with underground transmission preferred
- Substation and associated electrical infrastructure
- Operations and maintenance building
- Access points and internal roads
- Water storage systems and fire-fighting infrastructure
- Security fencing and monitoring systems
- Earthworks/benching
- Stormwater detention
- Landscaping/screening.

The Project Site is located within the Loddon River floodplain and is generally flat with an average elevation of 78.3 m AHD. Grades are approximately 0.001 m/m (west to east). The Proposed BESS Development Area naturally grades east to the Piangil Railway Line embankment, and there is no existing outlet from the Proposed BESS Development Area to a waterway. The lack of an existing outlet and the location within a floodplain inform the developed condition stormwater management, as detailed in Section 6.

The investigations undertaken for the proposed utility installation:

- Describe the Proposed BESS Development Area's risk of flooding and include the finished levels of assets set by the CMA.

- Demonstrate how a cut-fill balance can be achieved. On-site excavation depths will likely be controlled by groundwater depth. Groundwater conditions are discussed in Sections 3.6 and 6.1.6.
- Show how the proposed layout retains overland flow paths and floodplain volumes.
- Discuss impacts to on-site infiltration and surface water quality, including water quality in adjacent land and waterways.
- Include details of how polluted or contaminated runoff can be managed.

In the developed condition:

- The BESS units within the Proposed BESS Development Area will be raised above natural surface levels to protect the utility installation from riverine flooding in accordance with CMA requirements. The required elevation will be provided by a combination of earthworks and an elevated platform (gantry) supported on concrete piles on which the battery units will be located.
- The battery units will be placed at a minimum level of 79.75 m AHD, higher than the CMA's requirement of 79.7 m AHD.
- The substation and control building areas will be filled to a level of 80.62 m AHD, higher than the CMA's requirement of 79.7 m AHD.
- A vegetated swale will be constructed along the southern edge of the Proposed BESS Development Area. The swale will:
    - Provide overland flow path for runoff from the BESS in major events.
    - Provide floodplain storage to compensate for a portion of the Proposed BESS Development Area being filled.
    - Direct stormwater from the Proposed BESS Development Area to intercept dams and detention basins that provide on-site detention (OSD).
    - Provide a source of fill material.
    - Provide stormwater quality treatment in excess of statutory requirements.
    - Outlet to the north-west via a pumped connection.
- Creation of fill pads and construction of the elevated platform (gantry) will ensure protection of the utility installation from external flows.
- An underground transmission corridor to the Kerang Terminal Station generally follows the alignment of the Piangil Railway Line (Melbourne-Swan Hill). The underground transmission corridor is included in the figures in this report.

Drone footage of the Project Site in the existing condition can be accessed via the following QR Code:

The report demonstrates that the proposed utility installation can be developed with minimal impact on existing hydrological conditions. The conceptual stormwater management plan allows for CFA requirements for containment of firefighting runoff to be achieved. The proposed stormwater management provides green engineering solutions that treat stormwater to improve downstream water quality beyond statutory requirements.

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1. Introduction

This report presents the hydrology, flooding and stormwater management strategy for the proposed Tragowel Battery Energy Storage System (BESS). The proposed utility installation is located at Crown Allotment 3 (PT) Parish of Kerang, Lot 1 on Title Plan 601295P in Tragowel, Victoria.

The primary landholding for the proposed Tragowel BESS encompasses 23 ha, divided into four (4) paddocks. Within this broader landholding, the proposed Tragowel BESS will be situated within the largest paddock, with a total area of 12.3 ha. The Proposed BESS Development Area within the selected paddock will occupy approximately 7 ha. An additional 8 ha of land to the north of the 23-ha paddock, located within the Kerang Solar Plant, has been evaluated for the underground transmission corridor. Together, the 12.3-ha paddock, including the 7-ha proposed BESS development area, and the additional 8 ha allocated for the underground transmission corridor, form the 'Project Site', as referred to throughout this document.

The Project Site is in Tragowel, approximately 7 km south of Kerang and 60 km southeast of Swan Hill. The Kerang Terminal Station is located 2.4 km north-west of the Project Site. The Project Site is located within Gannawarra Shire and the North Central Catchment Management Authority (CMA) region and is proposed to have a BESS utility installation. The BESS project is proposed to have a 200 MW/800 MWh capacity. The project includes:

- BESS components including batteries, inverters, and transformer units
- Switch rooms and control building
- Transmission connection infrastructure, with underground transmission preferred
- Substation and associated electrical infrastructure
- Operations and maintenance building
- Access points and internal roads
- Water storage systems and fire-fighting infrastructure
- Security fencing and monitoring systems
- Earthworks/benching
- Stormwater detention
- Landscaping/screening.

This report comprises a hydrology investigation and stormwater management strategy (SWMS) for the proposed utility installation. This report:

- Describes the Proposed BESS Development Area's risk of flooding and includes the finished levels of assets set by the CMA.
- Demonstrates how a cut-fill balance can be achieved. Excavation depths within the Proposed BESS Development Area will likely be controlled by groundwater depth. Groundwater conditions are discussed in Sections 3.6 and 6.1.6.
- Discusses how groundwater considerations have informed the location of the underground transmission corridor connecting the Proposed BESS Development Area to the Kerang Terminal Station.
- Shows how the proposed layout retains overland flow paths and floodplain volumes.

- Discusses impacts to infiltration and surface water quality within the Proposed BESS Development Area, including water quality in adjacent land and waterways.
- Includes details of how polluted or contaminated runoff can be managed.

2. Project Site Overview

2.1 Location

The proposed utility installation is located at Crown Allotment 3 (PT) Parish of Kerang, Lot 1 on Title Plan 601295P in Tragowel, Victoria. The primary landholding for the proposed Tragowel BESS encompasses 23 ha, divided into four (4) paddocks. Within this broader landholding, the proposed Tragowel BESS will be situated within the largest paddock, with a total area of 12.3 ha. The Proposed BESS Development Area within the selected paddock will occupy approximately 7 ha. An additional 8 ha of land to the north of the 23-ha paddock, located within the Kerang Solar Plant, has been evaluated for the underground transmission corridor. Together, the 12.3-ha paddock, including the 7 ha of the Proposed BESS Development Area, and the additional 8 ha allocated for the underground transmission corridor, form the 'Project Site', as referred to throughout this document.

The Project Site is in Tragowel, approximately 7 km south of Kerang and 60 km southeast of Swan Hill. The Kerang Terminal Station is located 2.4 km north-west of the Proposed BESS Development Area. The Project Site is located within Gannawarra Shire and the North Central Catchment Management Authority (CMA) region. As the Project Site is located within Gannawarra Shire, the Infrastructure Design Manual (IDM) is the relevant guiding document for flow calculations and concept drainage design. The North Central CMA is the responsible authority for setting flood levels and approving major event stormwater management.

The Project Site is located within the proposed Northwest Renewable Energy Zone (REZ). The Northwest REZ is designated under the Draft 2025 Victorian Transmission Plan. The plan is currently under consultation. As the REZ development plan progresses and attracts further investment, there will be significant growth in renewable energy generation, transmission, and storage throughout the Northwest region. An overview of the investigation area is shown in Figure 1.

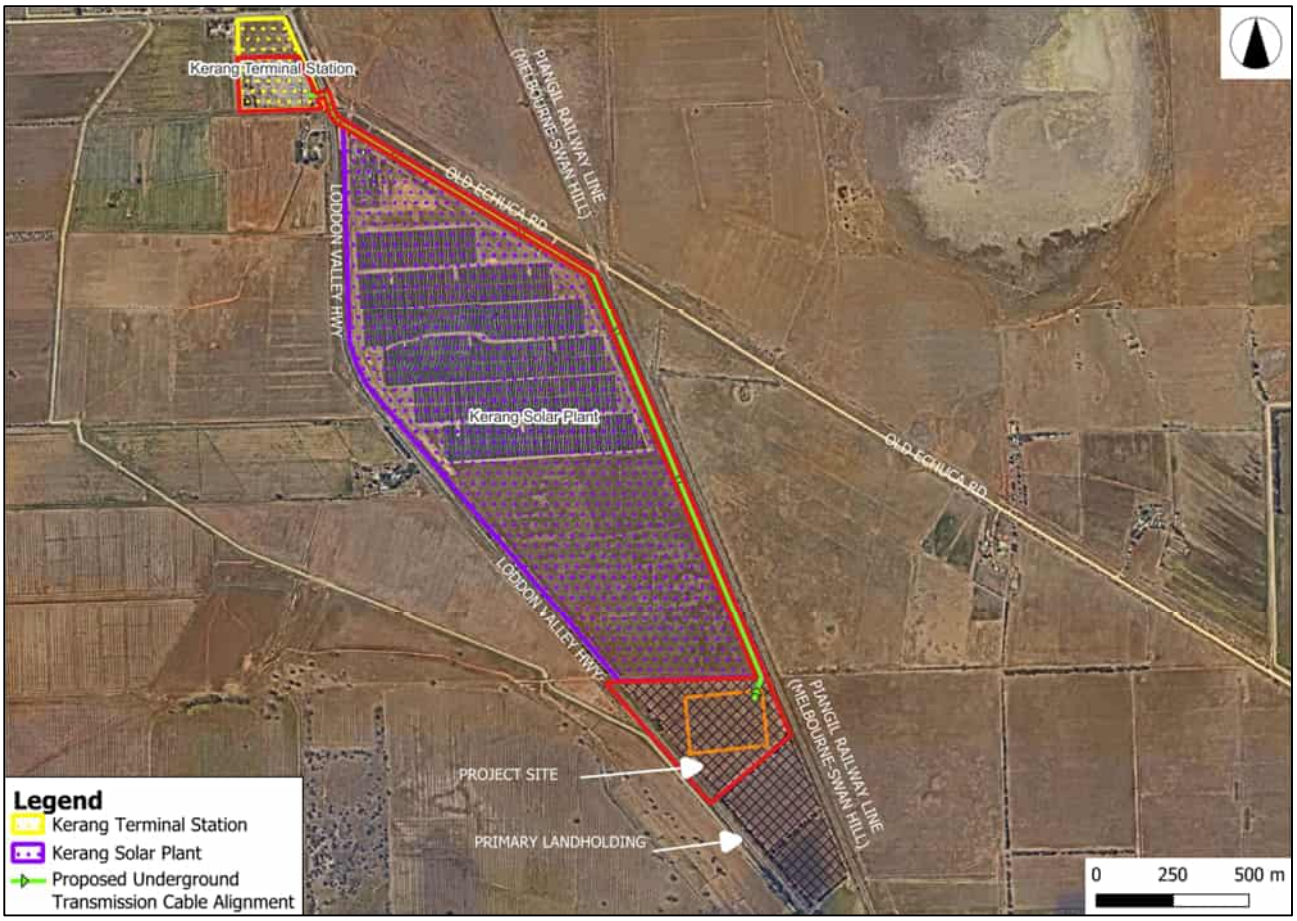

Figure 1: Project Site Overview

2.2 Existing Land Use

Currently, the Proposed BESS Development Area is rural and is zoned as Farming Zone (FZ). The Proposed BESS Development Area is currently used for grazing sheep and the production of fodder, hay and silage. The Piangil Railway Line (Melbourne-Swan Hill) is adjacent to the eastern boundary. Figure 1 shows the Project Site and Figure 2 shows the Proposed BESS Development Area in the existing condition.

Clause 35.07-4 (Schedule) FZ notes that any earthworks, which change the rate of flow or the discharge of water across a property boundary, or which increase the discharge of saline ground water trigger a permit condition. In this instance, the Proposed BESS Development Area has no outlet or connection to a waterway, as detailed in Section 2.4. The earthworks will change the rate of flow and discharge of water across the property boundary to the north. The stormwater management strategy for the proposed utility installation presented in Section 6 has been developed to minimise the change in flows resulting from the project and ensure that changes to flows are not significant and are effectively managed. If stormwater reuse is possible, as mentioned in Section 6.1.2, further mitigation of changes in the flow regime as a result of the development can be achieved.

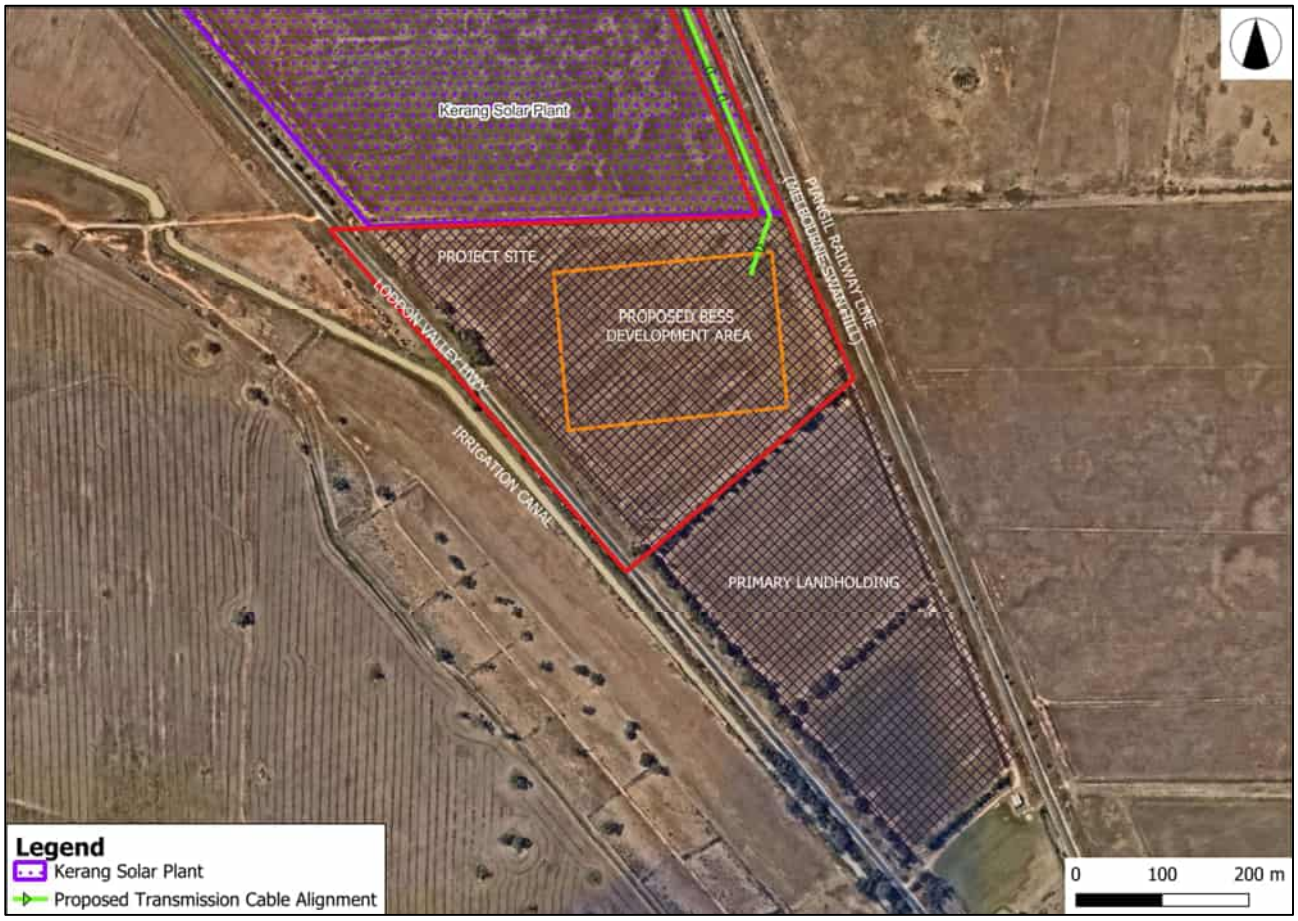

Figure 2: Proposed BESS Development Area in Existing Condition

2.3 Existing Planning Overlays

The primary landholding has two overlays in the existing condition. The siting of the utility installation has been undertaken to minimise impacts and respect the existing planning overlays.

An Environmental Significance Overlay (ESO4) is in place across the entire Project Site (refer to Figure 3). The ESO states flooding is a major issue at the proposed location of the utility installation and lists permit requirements to manage flood storage and flood protection for future development. The requirements of the North Central CMA for maintaining flood storage by balancing cut and fill and for providing flood protection through the finished level of assets have been incorporated into the proposed development proposal, see Section 4. CMA advice is included as Appendix A.

A Specific Controls Overlay (SCO2) is in place across the entire Project Site (refer to Figure 3). This overlay marks the area as part of the Goulburn-Murray Water Connections Project. The SCO2 does not impact hydrology.

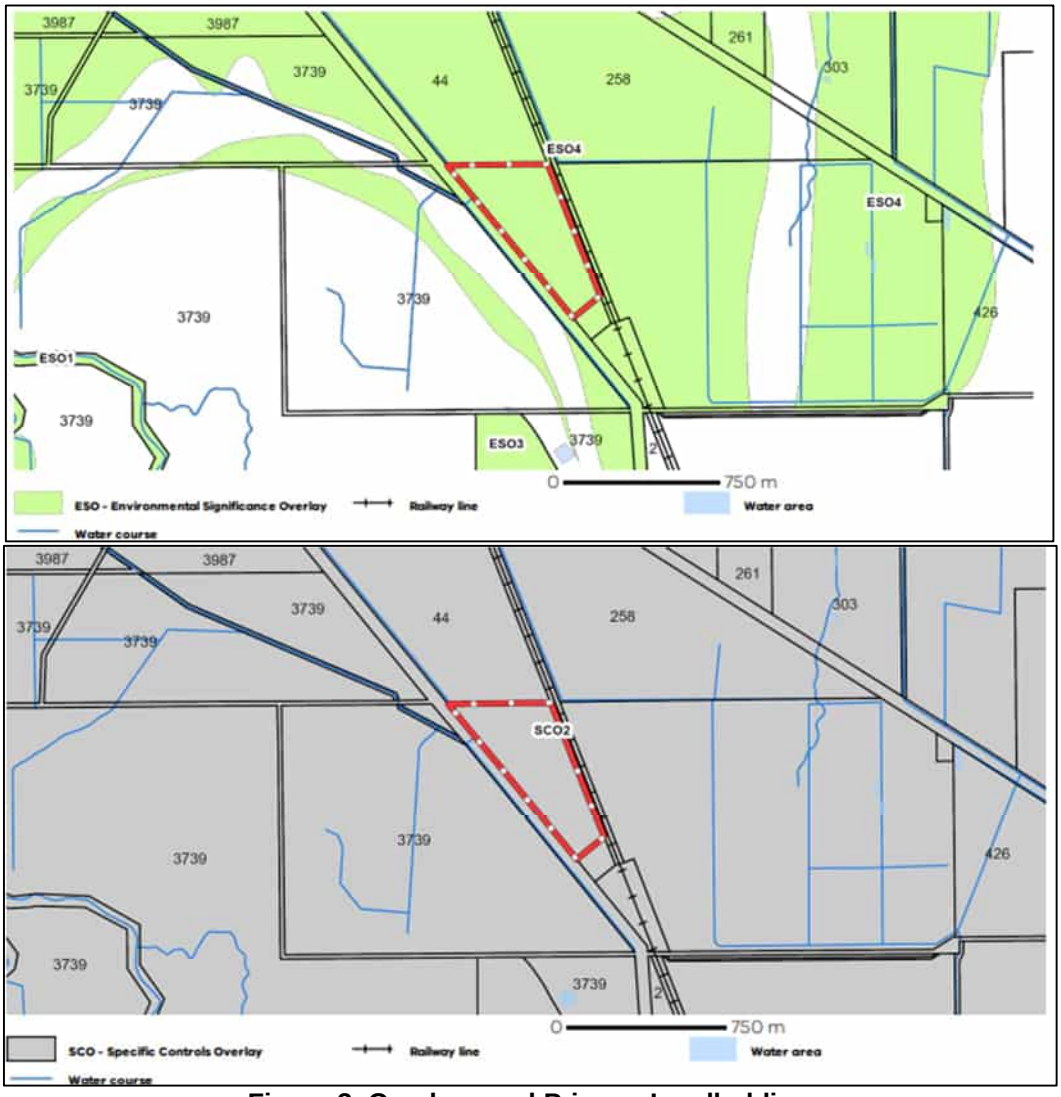

Figure 3: Overlays and Primary Landholding

2.4 Existing Topography

In the existing condition, the Proposed BESS Development Area is generally flat with an average elevation of 78.3 m AHD. Grades across the Proposed BESS Development Area are approximately 0.001 m/m (west to east). The Proposed BESS Development Area grades from the south-west to the north-east and is located within the Loddon River floodplain.

The Loddon Valley Highway along the western boundary has a crest elevation of between 78.50 and 79.45 m AHD adjacent to the Project Site, and the Piangil Railway Line (Melbourne-Swan Hill) embankment along the eastern boundary has a crest elevation of 79.15 m AHD.

There is no outlet from the Proposed BESS Development Area to a waterway. The land naturally grades to the east to the railway embankment. Existing agricultural irrigation practices are to flood the paddocks and allow water to soak into the soil. The lack of an existing outlet and the location of the Proposed BESS Development Area within a floodplain inform the developed condition stormwater management. The natural grade of the land directs water to pond at the east, as shown in a historic aerial image from December 2022 included as Figure 4.

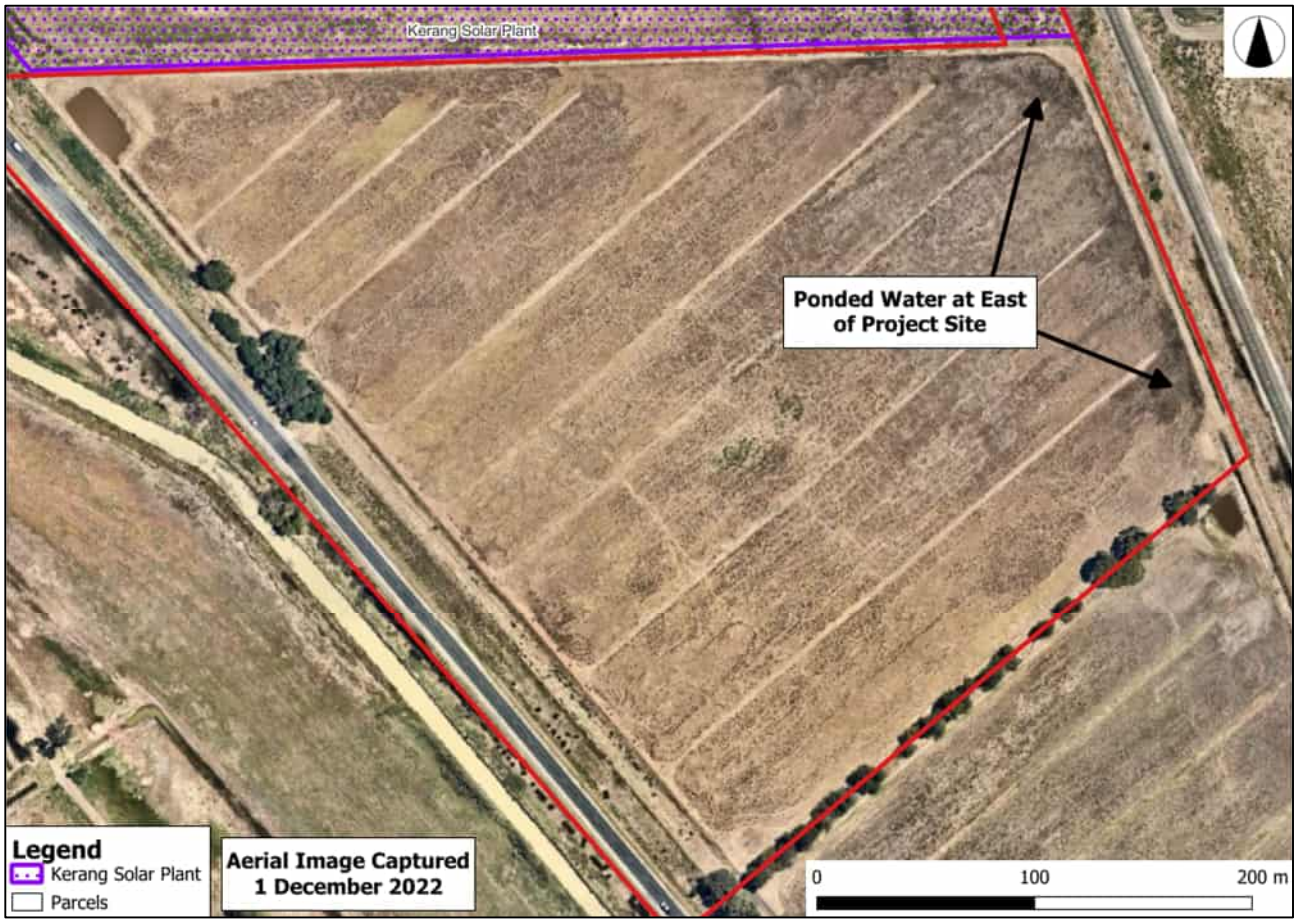

Figure 4: Historic Water Ponding at East of Project Site

As shown in the aerial image, there are existing swales along the western and eastern boundaries of the Project Site. Both swales collect surface water from the south and/or irrigation inflows. Neither

swale provides conveyance beyond the Project Site. Aerial imagery also shows two existing dams at the northwest and southwest. The capacity and function of these dams are currently unknown, although it is likely that they are used for agricultural purposes. Further investigation related to the ecological significance of the dams should be undertaken during detailed design. The contours shown in Figure 5 and Figure 6 are based on Survey data completed by Northern Land Solutions in October 2024. The survey data is included as Appendix B.

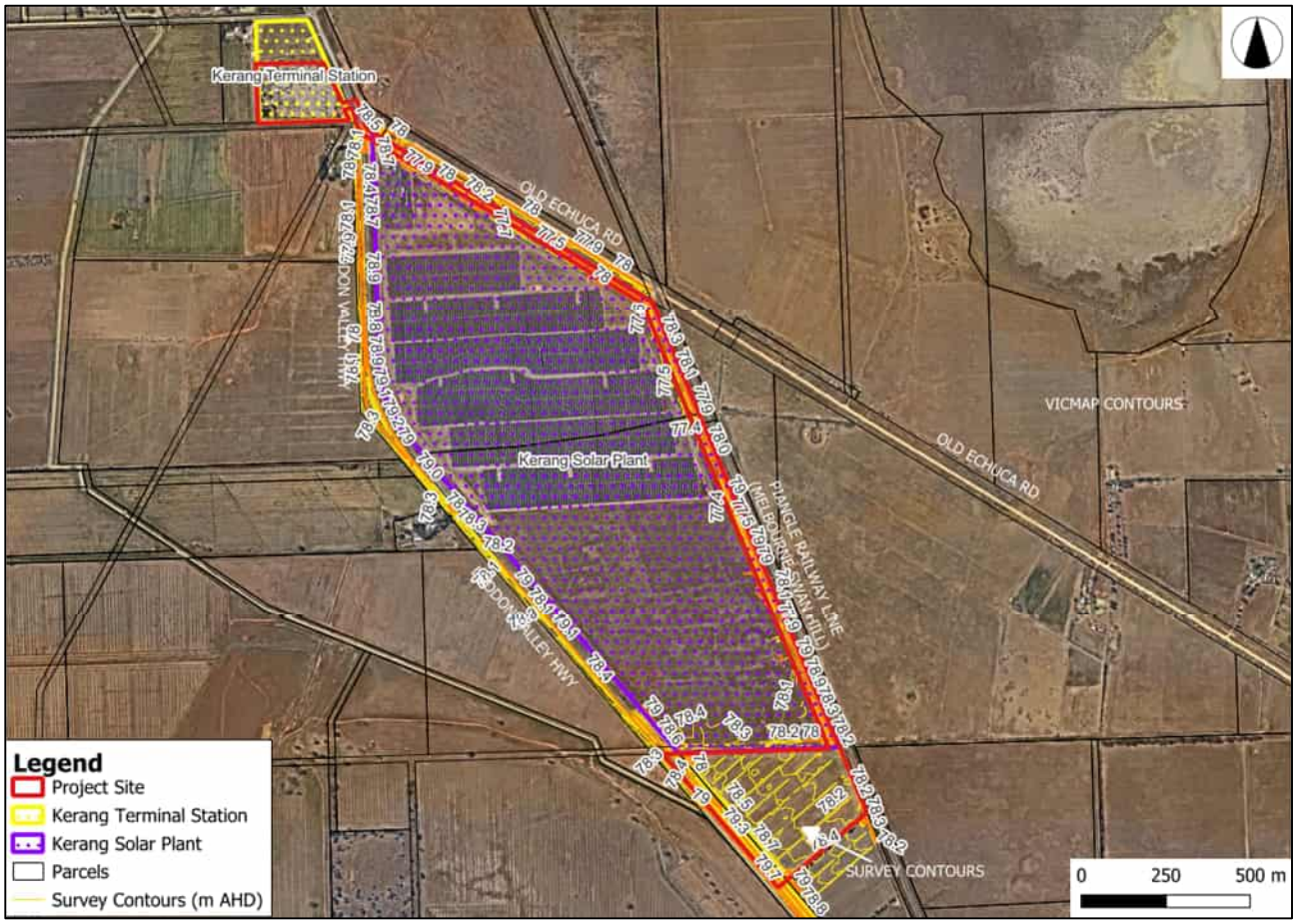

Figure 5: Existing Topography

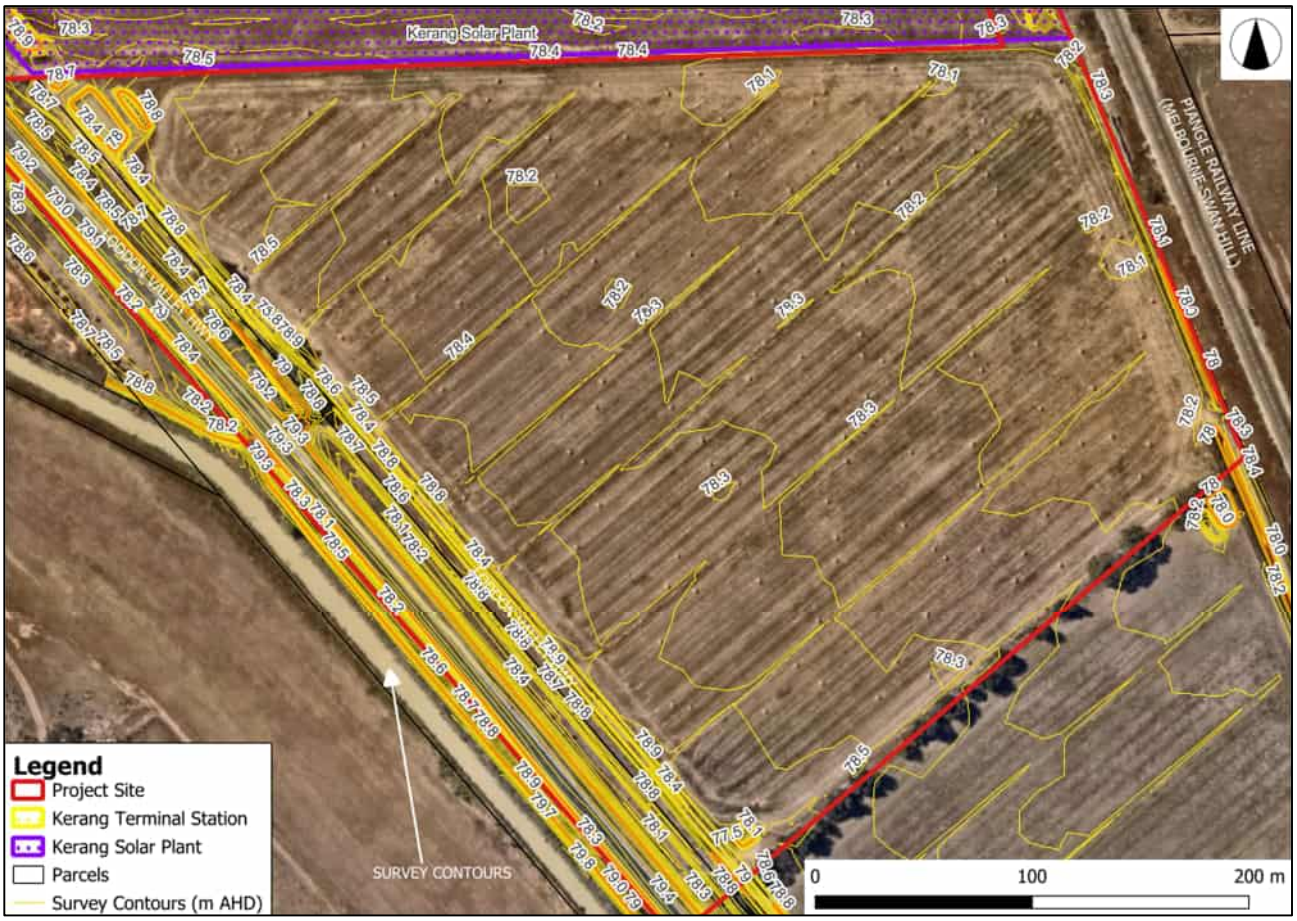

Figure 6: Proposed BESS Development Area Survey Contours

3. Existing Condition Hydrology Investigation

Owing to the flat grades at the Project Site and within the surrounding area of the Loddon River floodplain, the Proposed BESS Development Area is not isolated from external catchments. Discussions with the North Central CMA (See Section 4) indicate that flooding from the Loddon River enters the Proposed BESS Development Area from the west and south. Additional details of existing fluvial (riverine) flooding, including flood levels, are included in Section 4.

Advice received from the North Central CMA and included as Appendix A indicates that fluvial (riverine) flooding enters the Proposed BESS Development Area when the Loddon Valley Highway and adjacent irrigation channel are overtopped.

3.1 Catchments

The Project Site is very flat and is part of the overarching Loddon River system (see Figure 7). The Proposed BESS Development Area drains overland to the north-east via sheet flow, where it ponds without a natural outlet in the existing condition. Small existing farm dams at the Proposed BESS Development Area are believed to supply irrigation water and be filled by pumping (see Figure 8).

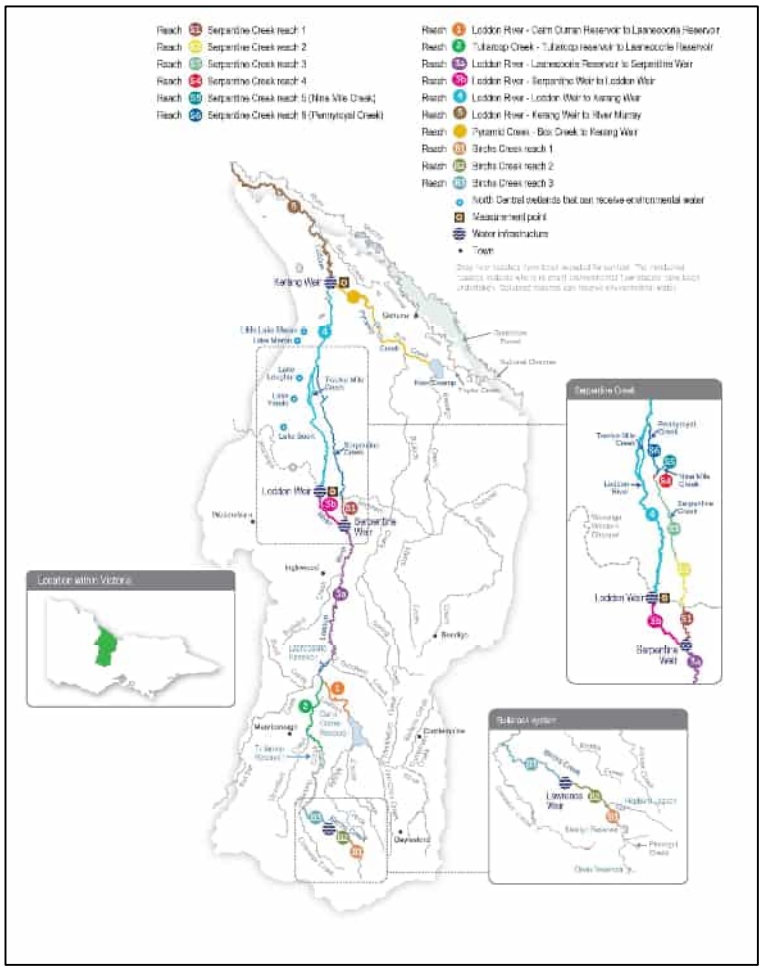

Figure 7: Existing Loddon River System Catchment (Victorian Environmental Holder, 2025)

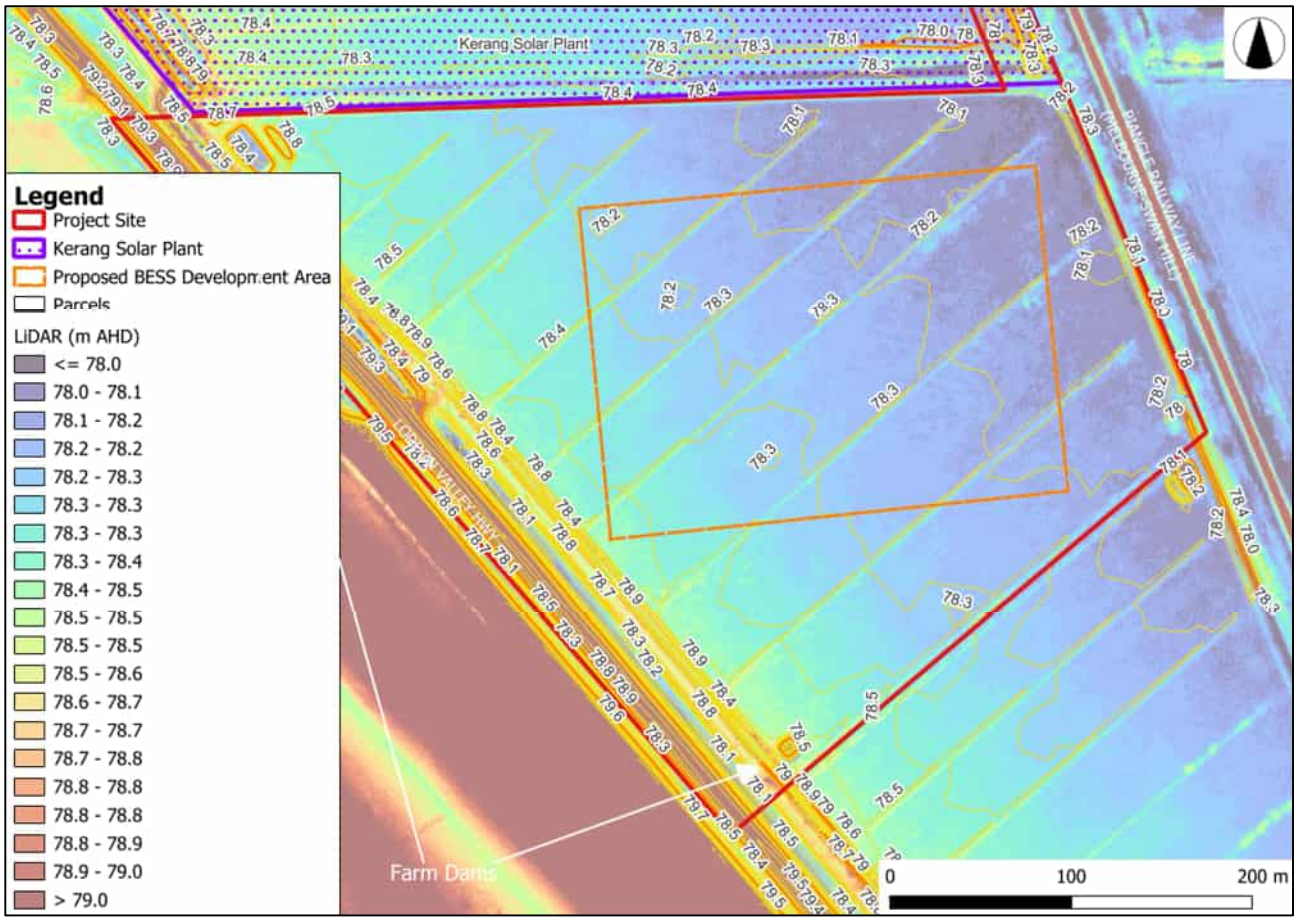

Figure 8: Proposed BESS Development Area Existing Elevations

3.2 Peak Flows

For the purposes of this report, peak minor flows have been defined based on IDM requirements as 10% Annual Exceedance Probability (AEP) flows, and peak major flows have been defined as 1% AEP flows. The peak flow calculations include the climate change adjustment from *Australian Rainfall and Runoff 2019 version 4.2* (Engineers Australia, 2024).

3.2.1 Proposed BESS Development Area Peak Flows

Peak flows have been calculated for the 7 ha of the Proposed BESS Development Area. Peak flows have also been calculated for the largest paddock within the primary landholding of 12.3 ha. The Proposed BESS Development Area is within the 12.3 ha of the largest paddock.

The two catchments have been selected as the Proposed BESS Development Area will be where development results in changes to the existing flow regime that must be mitigated, as detailed in Section 6.1.2. The largest paddock has been considered as the berms around its boundary hydraulically isolate it, and the Proposed BESS Development Area within it, in storm events that do not result in the Loddon River flooding. Peak existing flows are shown in Table 1. Complete drainage calculations are included in Appendix C. Both existing catchments included in Table 1 have the same

characteristics in the existing condition. The difference in peak flows is a result in the difference in area between the catchments.

Table 1: Existing Peak Flows

Location	Upstream Catchment Area (ha)	Existing 10% AEP Flow (m^3/s)	Existing 10% AEP Flow (m3/s) Climate change SSP5 to 2060	Existing 1% AEP Flow (m^3/s)	Existing 1% AEP Flow (m3/s) Climate change SSP5 to 2060
Proposed BESS Development Area	7	0.3	0.4	0.4	0.6
Largest paddock within primary parcel (contains Proposed BESS Development Area)	12.3	0.4	0.6	0.5	0.9

3.3 Potential for Fluvial/Riverine Flooding

The Project Site is part of the Loddon River floodplain. Owing to the flat grades at the Proposed BESS Development Area and within the surrounding Loddon River floodplain, the Project Site is not isolated from external catchments. Discussions with the North Central CMA indicate that flooding from the Loddon River enters the Proposed BESS Development Area from the west and south when irrigation infrastructure along the Loddon Valley Highway is overtopped. Additional details of existing fluvial (riverine) flooding, including flood levels, are included in Section 4. Complete CMA advice is included in Appendix A. The CMA have advised that the Project Site flooded during the January 2011 Loddon River flood event.

A discussion of how the proposed development will address the CMA requirements is included in Section 4.

3.4 Overland Flow Paths

Aerial imagery does not identify a single point outlet from the Proposed BESS Development Area. The land naturally slopes down to the east, and a swale, used to convey irrigation water, is located along the eastern edge of the Proposed BESS Development Area that ends at the north-eastern boundary. The railway embankment and end of the swale contain overland flows within the Proposed BESS Development Area.

3.5 Losses and Permeability

The Proposed BESS Development Area is used for sheep grazing. The land is compacted from its agricultural use. While defining permeability is outside the scope of this report, the existing land use within the Project Site does not allow for substantial soil permeability. Rainfall losses are impacted by the permeability of the soil and the existing vegetation.

3.6 Groundwater Assessment

An assessment of existing groundwater conditions was undertaken by SWM Consulting during preparation of the FIA Report (SWM, February 2025). The desktop study utilised publicly available

information provided by the Victorian Department of Energy, Environment, and Climate Action (DEECA). The desktop investigation noted that the closest recorded groundwater depth is at a bore located approximately 1.6 km north-east of the Project Site along Old Echuca Road near Dry Lake. The water level at this gauge was recorded in 2016. The gauge indicated a bore water level of 74.32 m AHD in 2016, suggesting that groundwater is between 2.5 m to 4.0 m below natural surface elevation.

Phil Dyson of the North Central CMA provided a separate assessment of groundwater conditions at the Project Site by email 25 March 2025. The CMA has access to additional groundwater information. The CMA suggested that groundwater could range from 1 to 2 m below natural surface elevation. The email is included with CMA correspondence in Appendix A.

The level of groundwater at the Proposed BESS Development Area is likely to vary locally and seasonally. Further groundwater assessment is outside the scope of the hydrology investigation. It is recommended that a geotechnical engineer be engaged to undertake a detailed groundwater analysis at the Project Site, including the underground transmission corridor, during detailed design to ensure that the designs of underground cabling and concrete foundation piles are appropriate for the groundwater conditions. The depth of groundwater will impact the depth of cut possible in the developed condition. See Section 6.1.6 for additional discussion regarding the underground transmission corridor and the impact of groundwater.

4. CMA Floodplain Requirements

Communication with the CMA was undertaken by email, online meetings, and phone calls. The CMA provided written advice regarding design requirements within the ESO4 overlay 21 August 2025. CMA requirements are included as Appendix A to this report.

Generally, the CMA require:

- Finished floor levels of all buildings and critical infrastructure to be set no lower than 79.7 m AHD.
- No obstruction of flood flows for reduction in flood storage. Flood conveyance in all directions and a cut-fill balance are required.
- Safe access must be provided, even during periods of prolonged flooding.
- The proposed development must be sited on a fill pad set no lower than 79.4 m AHD. (See Section 4.4)
- The design of the fill pad to be such that it is protected it from wave action erosion during prolonged periods of inundation. (See Section 4.4)
- Preparation of a flood response plan.
- Achievement of best practice stormwater guidelines.

4.1 Design Finished Levels

The CMA have advised that the finished floor level of all buildings and critical infrastructure must be constructed no lower than 79.7 m AHD. As shown in Section 5, the conceptual design of the proposed utility installation provides additional elevation of assets above this level.

4.2 Flood Obstruction

The CMA have advised that flood conveyance must be provided from south to north as well as from east to west. As shown in Section 5, the conceptual design of the development incorporates a raised platform (gantry) and minimises fill to maintain flood conveyance.

The CMA have advised that a floodplain cut-fill balance must be achieved relative to the January 2011 flood level of 78.6 m AHD. As shown in Section 6.2.2, the cut-fill balance can be achieved by the development.

4.3 Safe Access

The CMA have advised that safe vehicular access to the proposed utility installation is required, even during extended inundation events. To provide safe vehicular access, appropriate flood depth and velocities must be maintained on access roads. The detailed design of the access roads will ensure safe access to the Project Site in the developed condition.

4.4 Fill Pad Requirements

A fill pad is an engineer-designed, constructed platform generally made of compacted soil and/or crushed rock. The purpose of the fill pad requirement by the CMA is to elevate the proposed utility installation above the flood level so that assets, such as batteries, are protected during times when the Proposed BESS Development Area floods.

The CMA have advised that fill pads within the Proposed BESS Development Area should be filled to a minimum level of 79.4 m AHD. Furthermore, the side slopes of the pads should provide erosion protection against wave action likely to occur during extended periods of inundation. The CMA advice has assumed a design for the development where a single fill pad will be created and 300 mm of freeboard to flood levels will be provided above the fill pad by footings or slabs.

The fill pad proposed for the substation area of the Proposed BESS Development Area is proposed to be raised to a level of 80.62 m AHD, as detailed in Section 5. Complete engineering drawings (by others) showing the extent and levels of fill to be placed are included in Appendix D. During detailed design, the sides of the embankment should be designed to withstand wave action in accordance with CMA requirements.

The proposed design for the BESS, see Section 5, has adopted an elevated platform on top of a fill pad within the battery storage area to reduce the amount of fill required. As shown in Section 5, a lower fill pad for the battery storage area is proposed with the required level of assets to be provided by the raised platform (gantry). The design presented in Section 5 incorporates a lower fill pad that does not achieve the CMA fill level requirements. The lower fill pad has been intentionally selected to ensure that the CMA requirements for not obstructing flood flows or reducing flood storage are achieved. The proposed design has been developed to satisfy the CMA's floodplain management intentions.

During detailed design, the sides and top of the fill pad under the battery storage should be designed to withstand wave action and complete inundation so that it is not eroded during times when the Proposed BESS Development Area floods.

4.5 Other Requirements

A flood response plan can be prepared during detailed design. Best practice stormwater guidelines will be achieved through compliance with IDM design standards.

5. Proposed Project

The conceptual project layout plan (development plan) is shown in Figure 9 and a larger image is included as Appendix D. A stormwater management plan including drainage and stormwater management assets is included as Figure 11. As shown in Figure 9, the Proposed BESS Development Area comprises approximately 7 ha. The proposed development is a utility installation including:

- BESS components including batteries, inverters, and transformer units
- Switch rooms and control building
- Transmission connection infrastructure, with underground transmission preferred
- Substation and associated electrical infrastructure
- Operations and maintenance building
- Access points and internal roads
- Water storage systems and fire-fighting infrastructure
- Security fencing and monitoring systems
- Earthworks/benching
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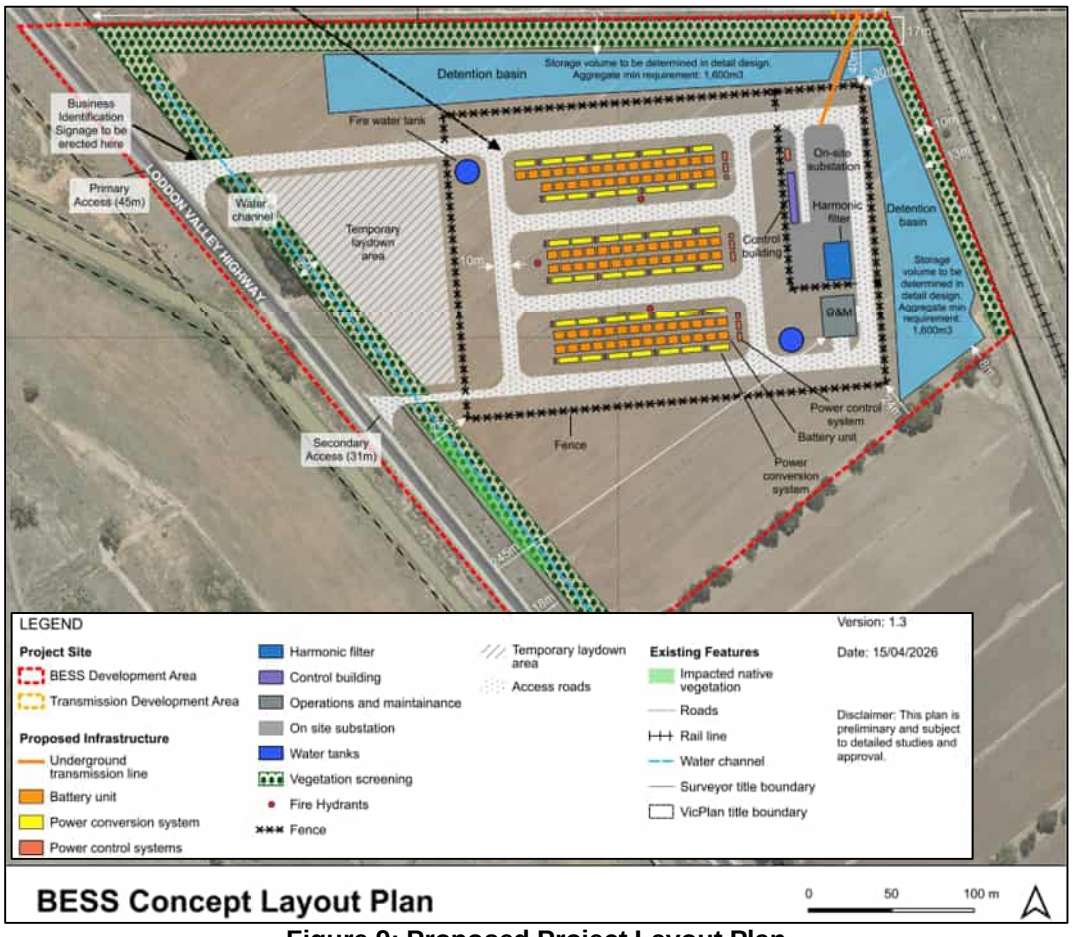

Figure 9: Proposed Project Layout Plan

As shown in Figure 10, the project plan also includes preliminary earthworks design showing finished levels. Preliminary earthworks plans are included in Appendix D.

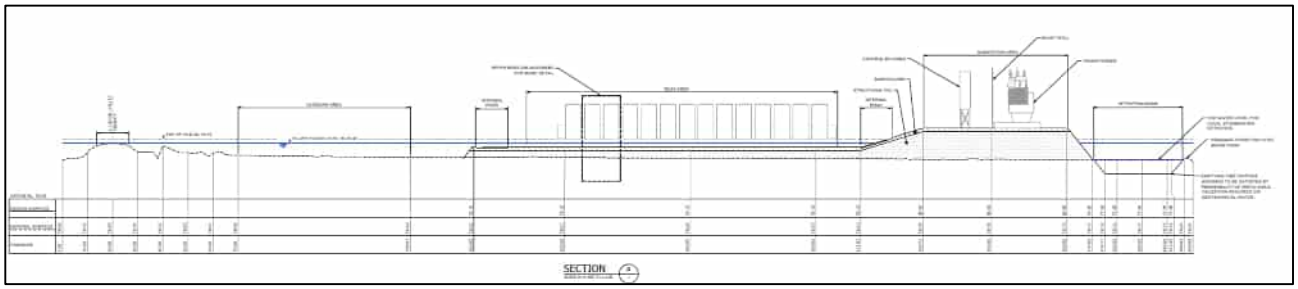

Figure 10: Preliminary Design Cross-section

6. Stormwater Management

Stormwater can be effectively managed at the Proposed BESS Development Area in the developed condition. Management of stormwater can both protect the installation from major fluvial flooding and ensure that there are minimal changes to existing flow regimes. Opportunities exist for integrated water management and green infrastructure to be incorporated into the design of the proposed utility installation. An overview stormwater management plan for the Proposed BESS Development Area during typical conditions is included in Figure 11. Stormwater management during riverine flooding and inundation is detailed in Section 6.2. The components of stormwater management are discussed in this section of the report.

Figure 11: Stormwater Management Overview Plan – Typical Conditions

6.1 Typical Conditions

Typical conditions refer to times when the Proposed BESS Development Area is not experiencing inundation from fluvial (riverine) flooding of the Loddon River. Stormwater management in typical conditions is focused on directing stormwater away from the proposed assets, reducing peak outflows, and providing stormwater quality treatment.

6.1.1 Typical Conditions – Grading

The proposed developed condition grading ensures stormwater runoff in typical conditions is directed to detention and treatment. The Proposed BESS Development Area will be graded to fall to the proposed vegetated swale and proposed on-site detention (OSD) basin storages shown in Figure 11. The preliminary earthworks plans included in Figure 10 and Appendix D detail the proposed grading.

6.1.2 Typical Conditions – Detention (Retention) Storages

Two detention basins (storages) are proposed in the developed condition. For stormwater management, it is suggested that the basins provide retention storage and be connected to function as a single retarding basin. However, the basins will fulfill multiple stormwater management purposes, beyond retention of peak flows, as described in 6.1.4 and 6.2.2. The basins are proposed at the north and east of the Proposed BESS Development Area, as shown in Figure 11. The size, dimensions and location of the basins will be finalised during detailed design.

The available storage provided by the detention basins allows them to retain peak stormwater flows. Sizing of the volume required to reduce peak outflows to those experienced in the existing condition for the 1% AEP event has been undertaken using Boyd's Method. Complete drainage calculations are included in Appendix C.

- A storage volume of approximately 1,100 m^3 is required to limit 1% AEP outflows from the 7-ha developed area to those from 7 ha of undeveloped area.
- A storage volume of 1,600 m^3 is required to limit 1% AEP outflows from the 7-ha developed area to those from 7 ha of undeveloped area when accounting for climate change.

Note that additional storage volume is required to manage the cut-fill balance, as detailed in Section 6.2.2. Therefore, it is possible to provide detention whilst accounting for climate change at no additional cost to the project. Exact detention volume requirements should be confirmed during detailed design.

The Proposed BESS Development Area is not adjacent to or hydraulically connected to any existing waterways. Existing surface contours indicate that it is most appropriate for pumped outflows from the development's storages to be directed north into the Kerang Solar Plant facility. The pumped outlet can be located adjacent to the underground transmission corridor alignment. It is suggested that the design of the pumped outflow incorporate methods to disperse flows so that concentrated outflows from the storage does not contribute to downstream erosion.

The proposed storages provide an opportunity for stormwater reuse, and it is recommended that the project liaise with adjacent landowners to see if it is possible for stormwater to be repurposed for agricultural use. Reuse of stormwater will further minimise the impact of the proposed development.

6.1.3 Typical Conditions – Vegetated Swale

A vegetated swale is proposed to direct runoff from the fill pad within the Proposed BESS Development Area to the proposed detention basins (storages). The swale provides a green engineering solution to reduce stormwater runoff volumes and provides treatment in excess of

regulatory requirements, as detailed in 6.1.5. The swale is included in the preliminary earthworks cross-section shown in Figure 10 and Appendix D.

6.1.4 Typical Conditions – Intercept Dam

The detention basins (storages) also serve an important role in surface water management. As all runoff from the Proposed BESS Development Area is isolated from external flows, water quality from the developed area can be managed. The retention storages allow for stormwater to be disconnected from the surrounding hydrological system by disconnecting the outlet pump.

In case of an environmental incident, the pump from the storages can be stopped—keeping any contaminated runoff on-site and separate to downstream waterways. In this way, the retention storages will function as intercept dams. This achieves Country Fire Authority (CFA) requirements for containing runoff on-site.

6.1.5 Typical Conditions – Stormwater Quality Treatment

Stormwater quality treatment to achieve Best Practice Environmental Management Guidelines (BPEMG) standards is not applicable to the proposal, since the proposed development is a utility installation.

The proposed stormwater management provides an opportunity to integrate stormwater quality treatment into the project at minimal additional cost. The vegetated swale that will collect and convey stormwater from the BESS will be vegetated. The vegetated conveyance swale and passage through the Detention basins (storages) will provide stormwater quality treatment.

MUSIC modelling was undertaken to define conceptually the amount of treatment that can be provided by the swale and detention basins. Rainfall data from the Walpeup Research rain gauge for 2011 to 2021 was adopted. The average annual rainfall in this data set is 350 mm. The MUSIC model schematic is shown in Figure 12. During detailed design, the exact treatment performance of the proposed swale can be assessed once grading and swale dimensions are finalised. Conceptual stormwater quality treatment results are shown in Table 2. If stormwater is able to be reused for agricultural purposes, additional stormwater quality treatment will be provided, and the reuse and subsequent treatment can be modelled in MUSIC to quantify the treatment.

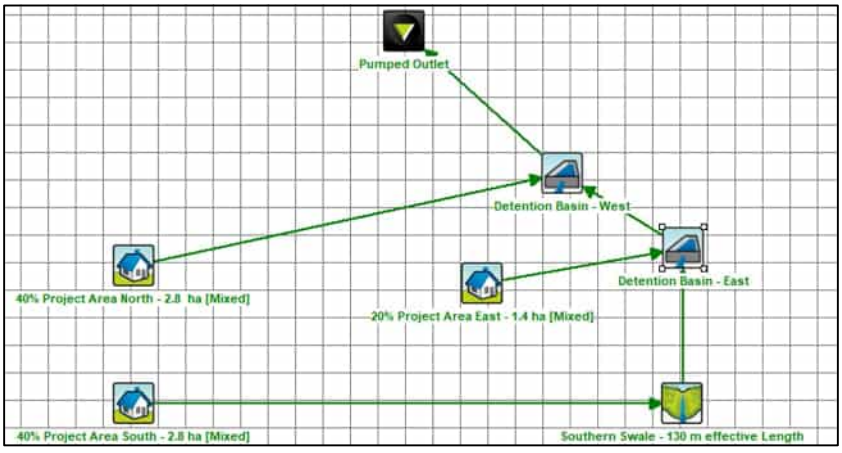

Figure 12: MUSIC Modelling Schematic

Table 2: Stormwater Quality Treatment

Pollutant	BPEM Target reduction %	Pollutant Reduction %
Total Suspended Solids (TSS)	80%	80%
Total Phosphorus (TP)	45%	60%
Total Nitrogen (TN)	45%	30%

6.1.6 Typical Conditions – Infiltration and Groundwater

The majority of the Proposed BESS Development Area's surface is proposed to be crushed rock. A crushed rock surface allows continued permeability. In addition, the proposed use of overland flow paths and a vegetated swale for conveyance of internal stormwater promotes infiltration and minimises impacts of the development on existing groundwater conditions.

As shown in Figure 9 and Figure 11, an underground transmission corridor to the Tragowel Substation is proposed. The alignment of the underground transmission corridor has been based on managing the impacts of groundwater on the design of the asset. The design of the underground transmission corridor will require additional investigations in the detailed design phase because the design will be impacted by groundwater levels. As a generic solution, it is possible to provide the necessary cover requirements to the underground transmission corridor by providing berm protection that allows an underground transmission cable to be laid in the corridor above both flood and water table impacts, as shown diagrammatically in Figure 13. Note that higher levels of groundwater (water table), including the 1-2 m below surface estimated by the CMA, will require further design responses. It is possible that marine cabling may be required to protect assets within the underground transmission corridor from high groundwater levels.

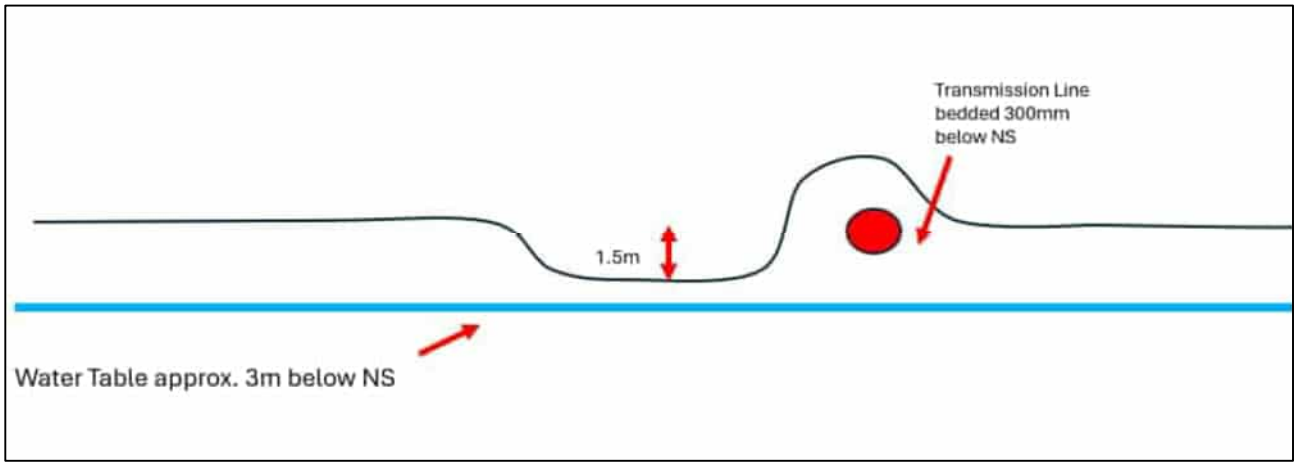

Figure 13: Indicative Underground Transmission Corridor Design Response to Groundwater

It is recommended that a geotechnical professional be engaged to monitor existing groundwater conditions and to provide a detailed assessment of existing and proposed groundwater conditions to inform the detailed design of the proposed development and underground transmission connection.

6.2 Inundation Conditions

Inundations conditions refer to times when the Proposed BESS Development Area is inundated by external fluvial (riverine) flooding from the Loddon River. In these conditions, the design will achieve the specific floodplain management outcomes required by the North Central CMA.

6.2.1 Inundation Conditions –Protection of Assets

The proposed grading ensures the proposed utility installation is protected from floodwater in inundation conditions. As shown in Figure 10 and Appendix D, the battery storage area and substation area will be elevated to a level of 79.75 m AHD. This is above the 79.7 m AHD required by the North Central CMA.

6.2.2 Inundation Conditions – Cut-Fill Balance

The proposed grading achieves the North Central CMA requirements for balancing floodplain cut-fill in the developed condition. Based on the preliminary earthworks plans included as Appendix D, approximately 15,640 m^3 of fill will be placed to the 78.6 m AHD level used by the CMA to assess cut-fill balance. An equal or greater volume of cut must be provided by the development.

The cut to balance the fill will be made in the proposed detention basins. The exact cut volume and cut-fill balance will be prepared during detailed design.

6.2.3 Inundation Conditions – Flood Conveyance

The grading achieves the North Central CMA requirements for providing floodplain conveyance from south to north and west to east. The innovative plan for using elevated platforms (gantries) to raise the battery storages above the relevant flood level minimises fill and allows for flood conveyance.

6.2.4 Inundation Conditions – Erosion Protection

The design of the proposed fill pads will include protection from wave action associated with prolonged inundation in accordance with North Central CMA requirements.

6.3 Peak Flows

Stormwater runoff from the Proposed BESS Development Area will be directed by a vegetated swale to two detention basins that provide retention storage and serve as intercept dams.

Rational method computations have been used to calculate developed condition peak flows. Post-development peak flows are show in Table 3. Complete Rational Method peak flow calculations for the Proposed BESS Development Area and the largest paddock within the primary parcel that contains it are included in Appendix C.

The peak flows shown in Table 3 will be reduced by the proposed detention basins (storages) so that existing condition peak flows are not exceeded. The maximum outflows shown in Table 3 are outflows from the Proposed BESS Development Area after development.

Table 3: Developed Peak Flows

	Proposed BESS development area	Largest paddock within primary parcel (contains proposed BESS development)
Upstream Area (ha)	7	12.3
Developed 10% AEP Flow (m^3/s)	0.8	0.9
Developed 10% AEP Flow – Climate Change SSP5 to 2060 (m^3/s)	1.2	1.3
Maximum Developed 10% AEP Outflow from Detention Basin (m^3/s)	0.3	0.4
Maximum Developed 10% AEP Outflow from Detention Basin – Climate Change SSP5 to 2060 (m^3/s)	0.4	0.6
Developed 1% AEP Flow –(m^3/s)	1.6	1.7
Developed 1% AEP Flow – Climate Change SSP5 to 2060 (m^3/s)	2.5	2.7
Maximum Developed 1% AEP Outflow from Detention Basin (m^3/s)	0.4	0.5
Maximum Developed 1% AEP Outflow from Detention Basin – Climate Change SSP5 to 2060 (m^3/s)	0.6	0.9

Conclusion

This report presents the investigations related to flooding, hydrology, and stormwater management, for the Tragowel BESS. This report summarises multiple investigations.

The project team liaised with the North Central CMA. The following design considerations are proposed to mitigate flood risk and impact:

- No assets (including batteries) will be located lower than 79.75 m AHD, exceeding CMA requirements.
- The design incorporates a raised platform (gantry) allows for flow conveyance when the Proposed BESS Development Area is inundated.
- The design includes detention storages that serve multiple stormwater management functions including reducing peak outflows to those experienced in the existing condition and achieving the cut-fill balance required by the CMA.

The proposed BESS layout can be accommodated while stormwater management in typical and inundated conditions is achieved.

In the developed condition, the Proposed BESS Development Area will be graded to drain to proposed detention basins that will serve as retarding basins and intercept dams. A pumped overland outlet will discharge to the adjacent property north of the Proposed BESS Development Area. Peak outflows will not exceed those in the existing condition.

External flows that enter the Proposed BESS Development Area from the west of the Loddon Valley Highway during major flood events will be conveyed through the Proposed BESS Development Area. An elevated platform, or gantry, will support the battery storage units and ensure they are protected from floodwater. The Project Site is within the Loddon River floodplain, and external flows will only enter during major flood events.

The proposed grading of the Proposed BESS Development Area and methodology for managing internal and external stormwater has been developed to allow stormwater quality treatment to be provided through green engineering methods. The vegetated swale and proposed retarding basins that serve as intercept dams will manage runoff from the proposed utility installation, but they will also provide an integrated water management benefit as they provide stormwater quality treatment beyond statutory requirements.

This report demonstrates that flood protection can be achieved by the project as assets can be raised above the design flood level. Additionally, stormwater can be managed in the developed condition to achieve Council and CMA standards.

Appendices

Appendix A CMA Advice and Requirements

NCCMA Ref: NCCMA-F-2024-00667
Date: 21 August 2025

ADVERTISED PLAN

Michael Thompson
Julia Baumann
Dalton Consulting Engineers

Dear Julia,

Floodplain Management Advice

Development Description:	**Tragowel Battery Energy Storage System (BESS)**
Street Address:	**Loddon Valley Highway, Tragowel Vic 3579**
Cadastral Location:	**Lot 1 TP601295, Parish Of Kerang**
Applicant:	**Julia Baumann**

Thank you for your enquiry of 22 May 2025 seeking flood advice for the above property.

Flood Information

Flood levels for the 1% AEP probability (100 year ARI) have not been determined for this area under the *Water Act 1989*. However, information available at North Central CMA indicates that in the event of a 1% AEP flood event it is likely that the entire property will be subject to inundation.

North Central CMA also advises that this property may be afforded protection by an irrigation channel from flood events up to and including the 1% AEP flood. The condition of these works is unknown and there is currently no formal arrangement for the management of these works as mitigation infrastructure.

Development Advice

North Central CMA would require further information before we could provide advice and/or consent for the proposed Battery Energy Storage System. Detailed plans and computations must be provided detailing how the following can be achieved:

1. *The proposed development must be sited on a fill pad constructed no lower than 79.4 metres AHD. This level has been estimated based on a 0.3 metre freeboard above the adjacent railway line. The railway line is expected to act as a hydraulic control for the site in the case that the irrigation channel to the west of the site, which is not designed or managed for a flood mitigation purpose, were to fail. It also provides an allowance for climate change.*
2. *The embankment of the fill pad must be appropriately designed to protect against erosion due to wave action and prolonged inundation which are likely to impact this site.*
3. *The finished floor level of any buildings and any critical infrastructure must be constructed no lower than 79.7 metres AHD.*
4. *Any new development must not obstruct flood flows or reduce flood storage.*

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www.nccma.vic.gov.au

a. *The development must preserve flood conveyance from the south to north as well as west to east.*
b. *A cut and fill balance must be achieved for land within the flood prone area of the site. The storage assessment should be based on the estimated January 2011 flood level of 78.6 metres AHD, not the potential flooding originating from the west in the event that the irrigation channel fails or overtops. Any proposed cut must be self-draining so that the area of cut is actively available for storage during a flood event. The area of cut must also be located in areas which are subject to flooding for the full range of flood events expected to affect the site being filled.*

5. *Any new development must achieve best practice stormwater guidelines.*
6. *Any new development must achieve safe access or detail suitable arrangements based on the need for access to the site during prolonged flooding.*
7. *A flood response plan must be prepared to the satisfaction of North Central CMA and the Responsible Authority.*

Please note, this document does not constitute approval or otherwise of any development at this location.

Should you have any queries, please do not hesitate to contact me on **(03) 5440 1896**. To assist the CMA in handling any enquiries please quote **NCCMA-F-2024-00667** in your correspondence.

Yours sincerely,

Nathan Treloar

Nathan Treloar
Waterways and Floodplain Officer
CC: Julia Baumann, Dalton Consulting Engineers
Grant Speldewinde, MAD3 Engineering

Information contained in this correspondence is subject to the definitions and disclaimers below.

Attached: Definitions and Disclaimers

Definitions and Disclaimers

1. The area referred to in this letter as the 'proposed development location' is the land parcel(s) that, according to the Authority's assessment, represent(s) the location identified by the applicant. The identification of the 'proposed development location' on the Authority's GIS has been done in good faith and in accordance with the information given to the Authority by the applicant(s) and/or local government authority.
2. While every endeavour has been made by the Authority to identify the proposed development location on its GIS using VicMap Parcel and Address data, the Authority accepts no responsibility for or makes no warranty with regard to the accuracy or naming of this proposed development location according to its official land title description.
3. **AEP** as Annual Exceedance Probability – is the likelihood of occurrence of a flood of given size or larger occurring in any one year. AEP is expressed as a percentage (%) risk and may be expressed as the reciprocal of ARI (Average Recurrence Interval).

   Please note that the 1% probability flood is not the probable maximum flood (PMF). There is always a possibility that a flood larger in height and extent than the 1% probability flood may occur in the future.
4. **ARI** as Average Recurrence Interval - is the likelihood of occurrence, expressed in terms of the long-term average number of years, between flood events as large as or larger than the design flood event. For example, floods with a discharge as large as or larger than the 100-year ARI flood will occur on average once every 100 years.
5. **AHD** as Australian Height Datum - is the adopted national height datum that generally relates to height above mean sea level. Elevation is in metres.
6. No warranty is made as to the accuracy or liability of any studies, estimates, calculations, opinions, conclusions, recommendations (which may change without notice) or other information contained in this letter and, to the maximum extent permitted by law, the Authority disclaims all liability and responsibility for any direct or indirect loss or damage which may be suffered by any recipient or other person through relying on anything contained in or omitted from this letter.
7. This letter has been prepared for the sole use by the party to whom it is addressed and no responsibility is accepted by the Authority with regard to any third party use for the whole or any part of its contents. Neither the whole nor any part of this letter or any reference thereto may be included in any document, circular or statement without the Authority's written approval of the form and context in which it will appear.
8. The flood information provided represents the best estimates based on currently available information. This information is subject to change as new information becomes available and as further studies are carried out.

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www.nccma.vic.gov.au

Julia Baumann

From: Nathan Treloar <nathan.treloar@nccma.vic.gov.au>
Sent: Tuesday, March 25, 2025 9:48 AM
To: Julia Baumann
Cc: Alex Simmons; Symon Grasby
Subject: RE: [#24101-Tragowel BESS] Tragowel BESS Proposed Layout Plan

Follow Up Flag: Follow up
Flag Status: Completed

Hi Julia

Please find groundwater information below, received from my colleague Phil Dyson.

> I have had a look at the range of bores present in that area. There are several, but in particular bores 125741, 20298, 6433, and 40292. All four are within the immediate area you describe.
>
> The bad news is depth to groundwater ranges from 1 to 2 metres from the surface almost all of the time. At present given the wet conditions established by the October 22 floods, heavy rainfall in late 2023/2024, and La Nina conditions generally over the past three years we could expect depths to reflect the current shallow watertables now found across most of Tragowel Plains a little further to the south.
>
> Groundwater salinity is likely to be extremely high, of the order of 30,000 uS/cm or greater.
>
> I hope this information is useful, it is taken largely from the Visualising Victorias Groundwater database, and from experience gained through the current CMA bore monitoring network.
>
> Regards Phil

Phil Dyson
Project Manager
Phil.Dyson@nccma.vic.gov.au
Ph: 5440 1886 M: +61 408 580 830
North Central CMA

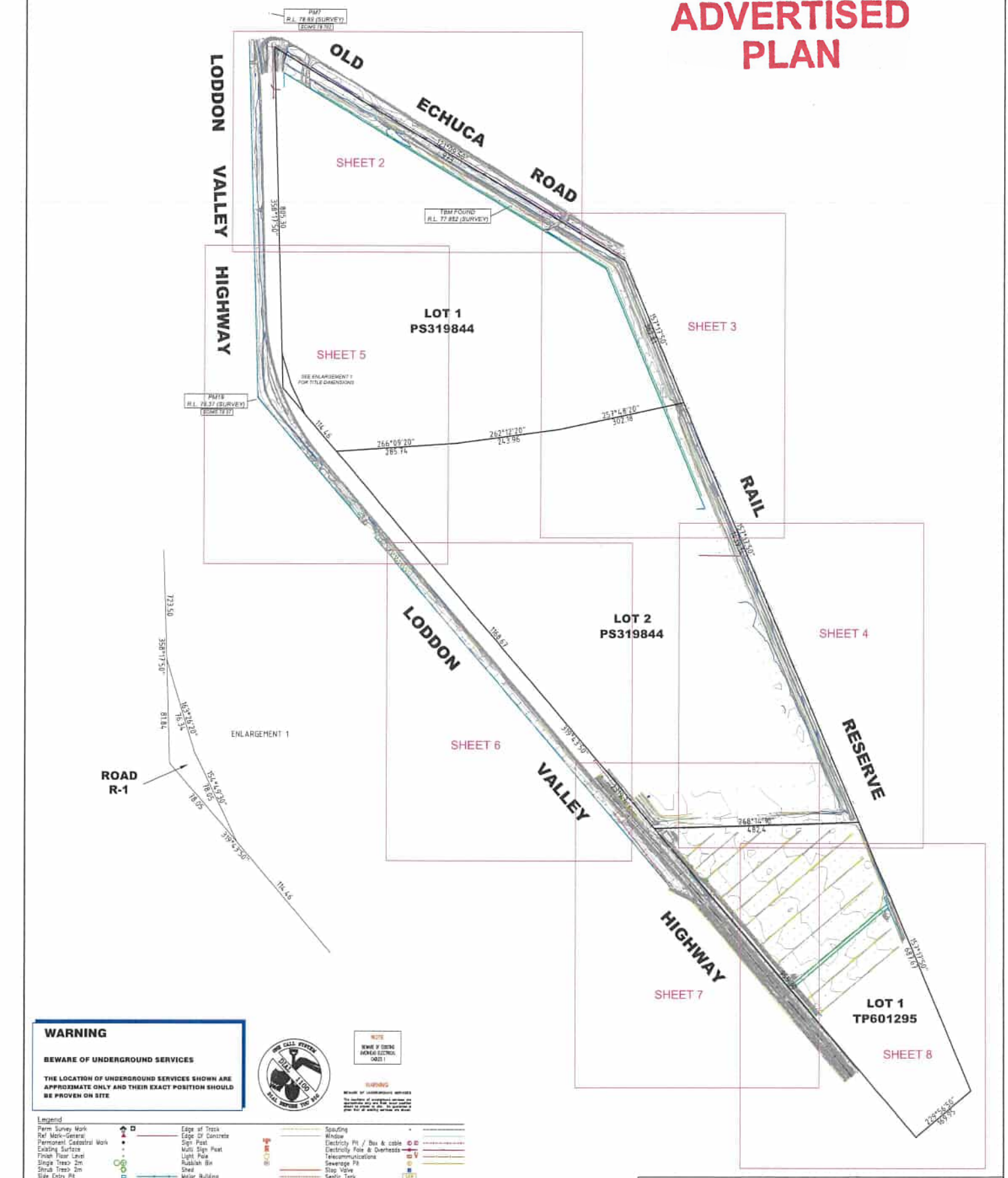
Regards,

Nathan Treloar
Project Manager Waterways and Floodplain
Ph: 5440 1878 M: +61 417 131 093
North Central CMA

From: Julia Baumann <JuliaB@dceng.com.au>
Sent: Wednesday, 26 February 2025 4:39 PM
To: Nathan Treloar <nathan.treloar@nccma.vic.gov.au>

Appendix B Feature and Level Survey

ADVERTISED PLAN



WARNING

BEWARE OF UNDERGROUND SERVICES

THE LOCATION OF UNDERGROUND SERVICES SHOWN ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE

Legend

Perm Survey Mark	Edge of Track	Spouting	
Ref Mark-General	Edge Of Concrete	Window	
Permanent Cadastral Mark	Sign Post	Electricity Pit / Box & cable	
Existing Surface	Multi Sign Post	Electricity Pole & Overheads	
Finish Floor Level	Light Pole	Telecommunications	
Single Tree> 2m	Rubbish Bin	Sewerage Pit	
Shrub Tree> 2m	Shed	Stop Valve	
Side Entry Pit	Major Building	Septic Tank	
Junction Pit	Verandah	Fire Plug / Hydrant	
Grated Pit Lid	Weatherboard Building	Man Hole	
General Service Pit Lid	Retaining Wall	Water Meter & Main	
Centre Of Bitumen	Top of Bank	Water Tap/Connection	
Edge Of Bitumen	Top of Bank	Gate	
Edge of Shoulder	Steep Batter / Bank	Fence	
Back Of Kerb/Channel	Change of Grade	Title	
Pedestrian Path	Apex	Easement	
Edge of Paving	Parapet	OCDB Linework	
Driveway	Ridge Line		

MGA NORTH ZONE 55

JOB TITLE
FEATURE, LEVEL AND RE-ESTABLISHMENT SURVEY
44 OLD ECHUCA ROAD, KERANG

SURVEY DATE	CLIENT:	SHEET NUMBER	SURVEYORS REF:	VERSION
10/10/2024	GREENSWITCH AUSTRALIA – SYMON GRASBY	1 of 8	23 2726	1

REV	DATE	DESIGN REVIEW	RD'G PM'R	APP'D PM'R	REVISIONS	DRN	CHK'D	APP

TITLE REFERENCES
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CROWN ALLOTMENT: ---
SECTION: ---
PLAN REFERENCE: PS319844, TP601295
VOL/FOL: ---
PLAN NO.

NOTES
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4) SURVEY CONDUCTED USING RTK GNSS

SCALE OF METRES
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P: (03) 5033 9035
F: (03) 5033 9036
M: 0400 815 329
E: wsc@northernlandsolutions.com.au
W: www.northernlandsolutions.com.au

DATUM DETAILS: AUSTRALIAN HEIGHT DATUM VIDE KERANG PM 19 R.L. 78.37

SURVEYED: G.K. R.W.	DRAWN: G. KAYLOCK
DESIGNED: N/A	CHECKED: W.J. PYE
SURVEY MARKED: W.J. PYE	APPROVED: W.J. PYE

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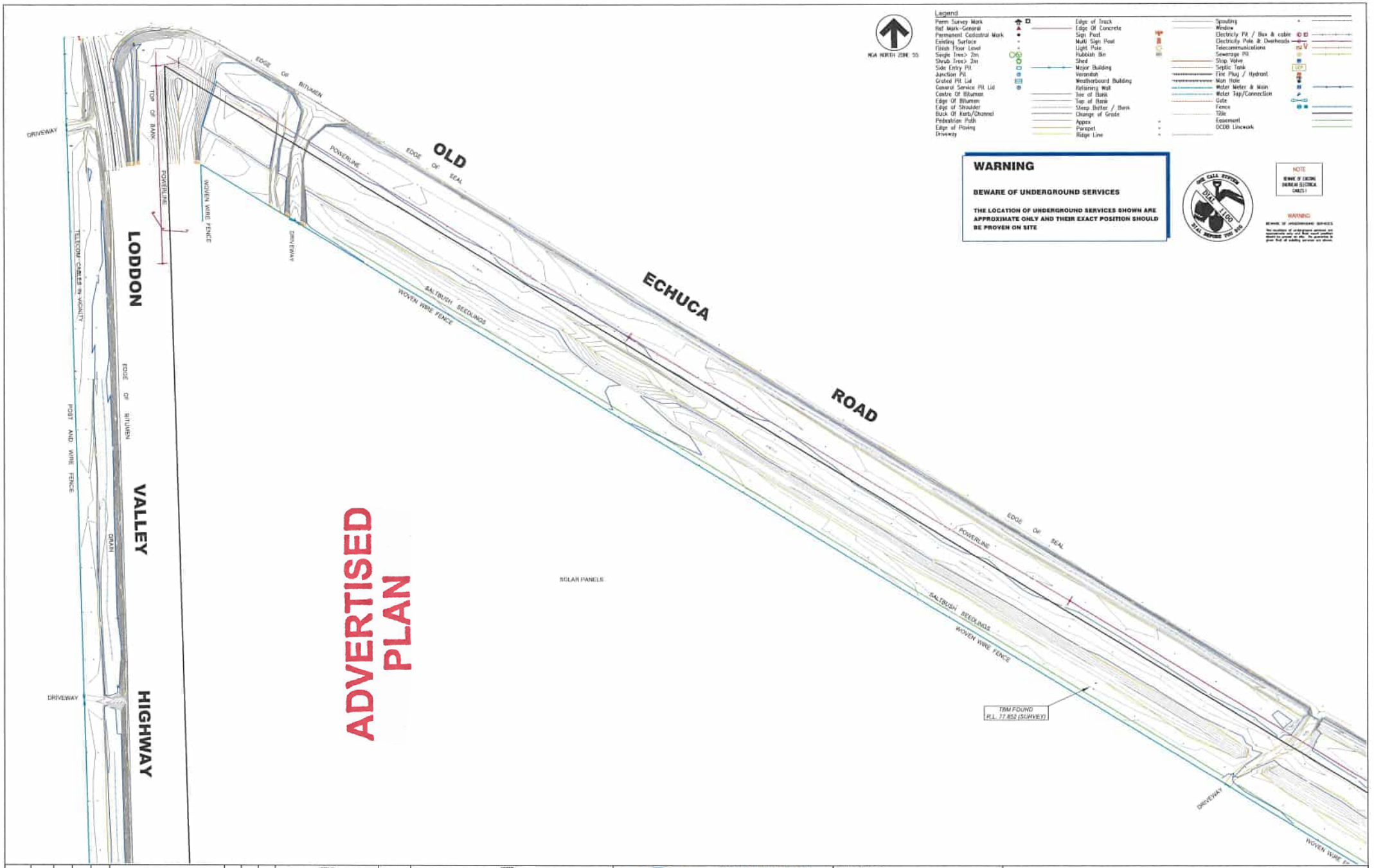

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JOB TITLE
FEATURE, LEVEL AND RE-ESTABLISHMENT SURVEY 44 OLD ECHUCA ROAD, KERANG

SURVEY DATE	CLIENT:	SHEET NUMBER	SURVEYORS REF:	VERSION
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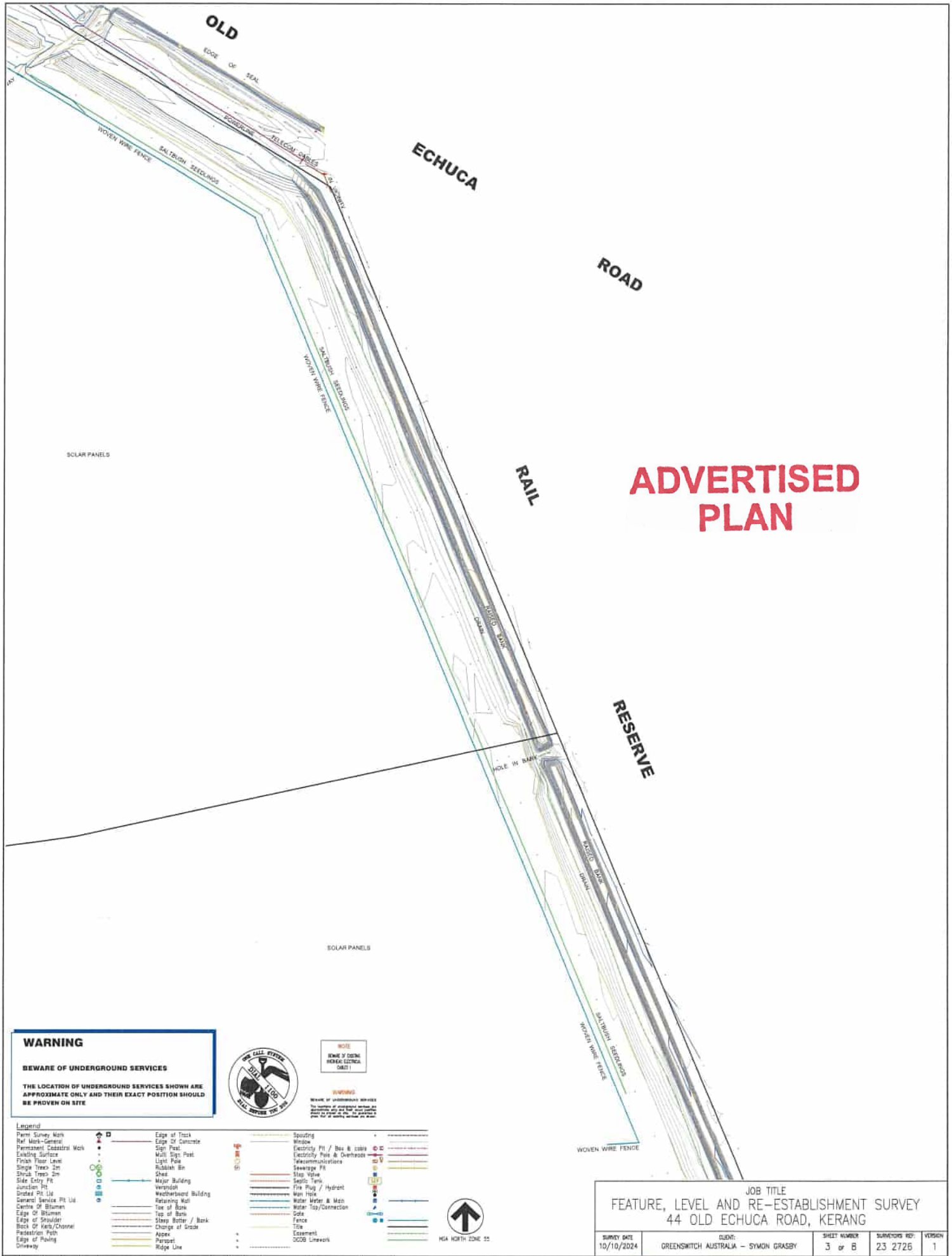

ADVERTISED PLAN

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Perm. Survey Mark	Edge of Track	Spouting	
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Shrub Tree> 2m	Shed	Stop Valve	
Side Entry Pit	Major Building	Septic Tank	
Junction Pit	Verandah	Fire Plug / Hydrant	
Grated Pit Lid	Weatherboard Building	Man Hole	
General Service Pit Lid	Retaining Wall	Water Meter & Main	
Centre Of Bitumen	Toe of Bank	Water Tap/Connection	
Edge Of Bitumen	Top of Bank	Gate	
Edge of Shoulder	Steep Batter / Bank	Fence	
Back Of Kerb/Channel	Change of Grade	Title	
Pedestrian Path	Apex	Easement	
Edge of Paving	Parapet	DCDB Linework	
Driveway	Ridge Line		

NOTE
BEWARE OF EXISTING OVERHEAD ELECTRICAL CABLES !

WARNING
BEWARE OF UNDERGROUND SERVICES
The locations of underground services are approximate only and their exact position should be proven on site. It is guidance is given that all existing services are shown.

GDA NORTH ZONE 55

JOB TITLE
FEATURE, LEVEL AND RE–ESTABLISHMENT SURVEY
44 OLD ECHUCA ROAD, KERANG

SURVEY DATE	CLIENT:	SHEET NUMBER	SURVEYORS REF:	VERSION
10/10/2024	GREENSWITCH AUSTRALIA – SYMON GRASBY	3 of 8	23 2726	1

REV	DATE	DESIGN REVIEW	REV'D PMCR	APP'D PMCR	REVISIONS	DRN	CHKD	APP

TITLE REFERENCES
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SECTION: ---
PLAN REFERENCE: PS319844, TP851289
VOL/FOL: ---
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DESIGNED	N/A	CHECKED	W.J. PYE
SURVEY APPROVED	W.J. PYE	APPROVED	W.J. PYE

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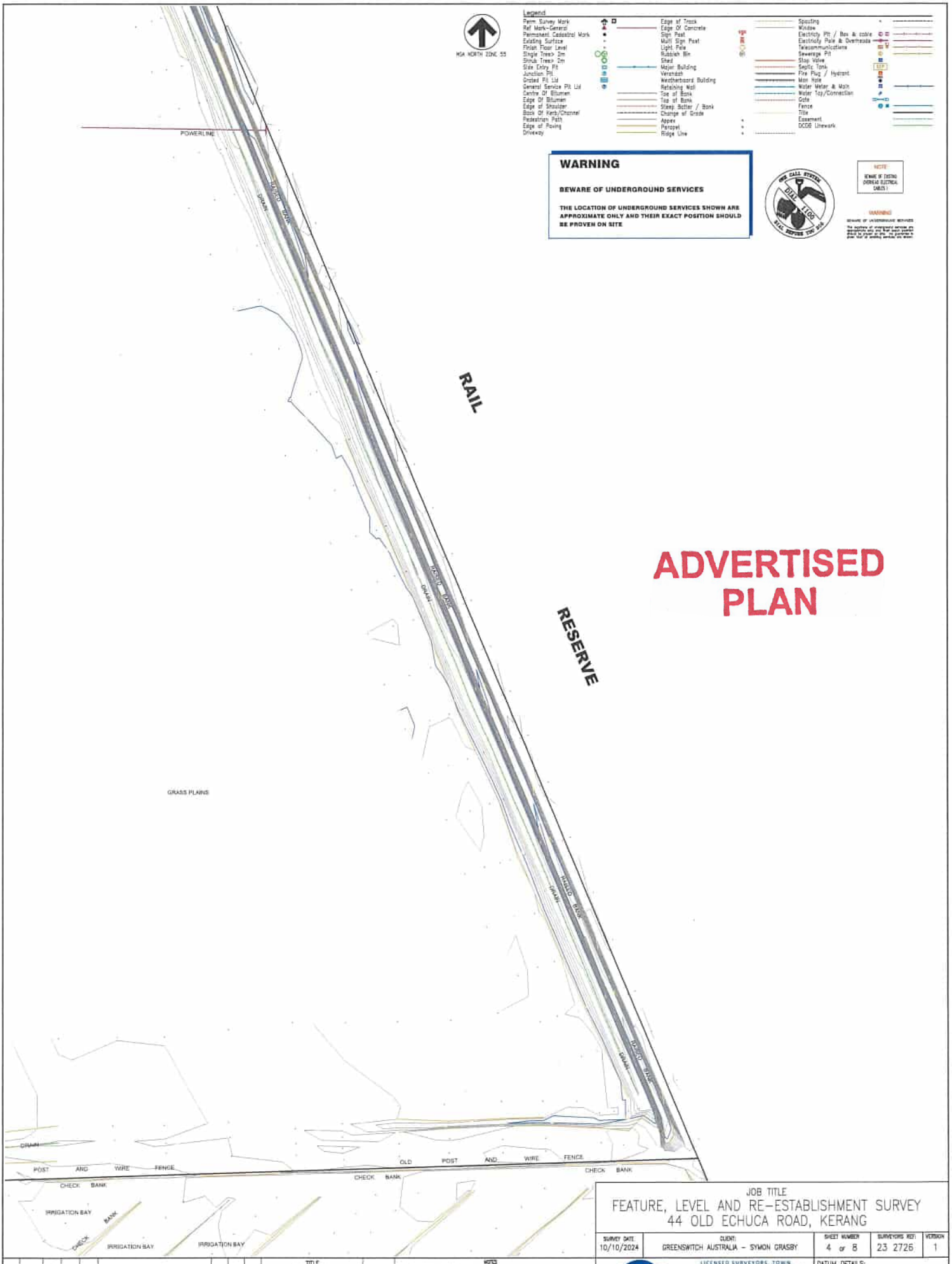

JOB TITLE

FEATURE, LEVEL AND RE-ESTABLISHMENT SURVEY 44 OLD ECHUCA ROAD, KERANG

SURVEY DATE	CLIENT	SHEET NUMBER	SURVEYORS REF:	VERSION
10/10/2024	GREENSWITCH AUSTRALIA – SYMON GRASBY	4 or 8	23 2726	1

TITLE REFERENCES

PARISH: KERANG
CROWN ALLOTMENT: ---
SECTION: ---
PLAN REFERENCE: PS319844, TP801285
VOL/FOL: ---

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3) CONTOUR INTERVALS: 1 METRES SHOWN BLUE AND 0.1 METRES SHOWN GREY
4) SURVEY CONDUCTED USING RTK GNSS

SCALE OF METRES
4 0 8 16 24 32 40

REV	DATE	DESIGN REVIEW	REV'D PM/CR	APP'D PM/CR	REVISIONS	DRN	CHK'D	APP

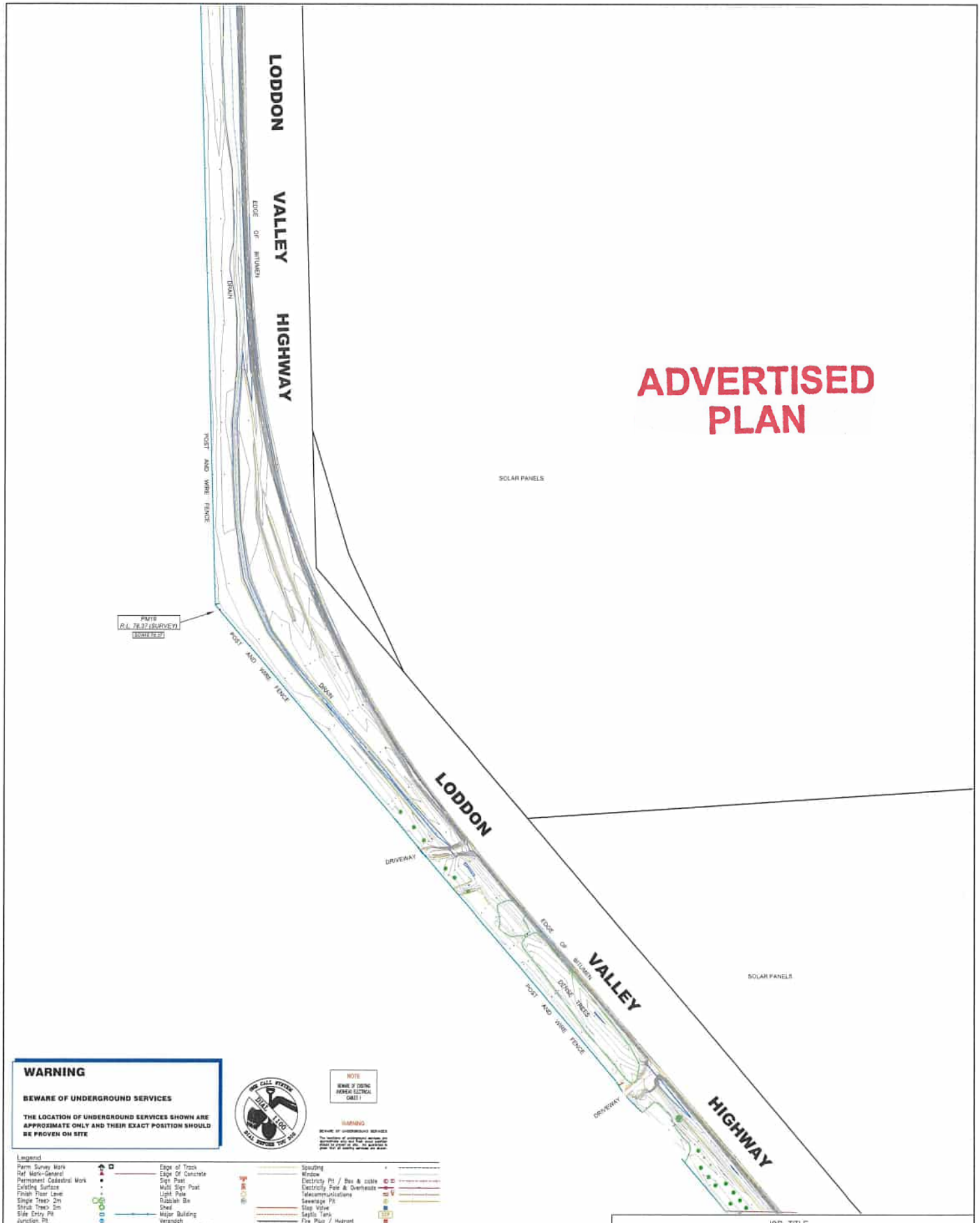
NORTHERN LAND SOLUTIONS

LICENSED SURVEYORS, TOWN PLANNING & LAND DEVELOPMENT CONSULTANTS
LL 2/8 Campbell Street
PO Box 1954 Swan Hill 3585
P: (03) 5033 0615
F: (03) 5033 0616
M: 0429 815 226
E: wes@northernlandsolutions.com.au
W: www.northernlandsolutions.com.au

DATUM DETAILS: AUSTRALIAN HEIGHT DATUM VIDE KERANG PM 19 R.L. 78.37		
SURVEYED	G.K. R.W.	DRAWN G. KAYLOCK
DESIGNED	N/A	CHECKED W.J. PYE
EARTH WORKS	W.J. PYE	APPROVED W.J. PYE

0 1 2 3 4 5 6 7 8 9 10 cm
FULL SIZE ON ORIGINAL

A1



JOB TITLE
FEATURE, LEVEL AND RE-ESTABLISHMENT SURVEY
44 OLD ECHUCA ROAD, KERANG

SURVEY DATE	CLIENT:	SHEET NUMBER	SURVEYORS REF:	VERSION
10/10/2024	GREENSWITCH AUSTRALIA – SYMON GRASBY	5 of 8	23 2726	1

REV	DATE	DESIGN REVIEW	REV'S PMCR	APP'D PMCR	REVISIONS	DRN	CHKD	APP

TITLE REFERENCES
PARISH: KERANG
CROWN ALLOTMENT: ---
SECTION: ---
PLAN REFERENCE: PS319844, TP881295
VOL/FOL: ---
PLAN NO:

NOTES
1) DATE OF PLAN 17/10/2024
2) LEVELS SHOWN THUS 00.00 ARE TO THE AUSTRALIAN HEIGHT DATUM
3) CONTOUR INTERVALS: 1 METRES SHOWN BLUE AND 0.1 METRES SHOWN GREY
4) SURVEY CONDUCTED USING RTK GNSS

SCALE OF METRES
0 8 16 24 32 40

NORTHERN LAND SOLUTIONS
LICENSED SURVEYORS, TOWN PLANNING & LAND DEVELOPMENT CONSULTANTS
L1 270 Campbell Street
PO Box 1854 Swan Hill 3585
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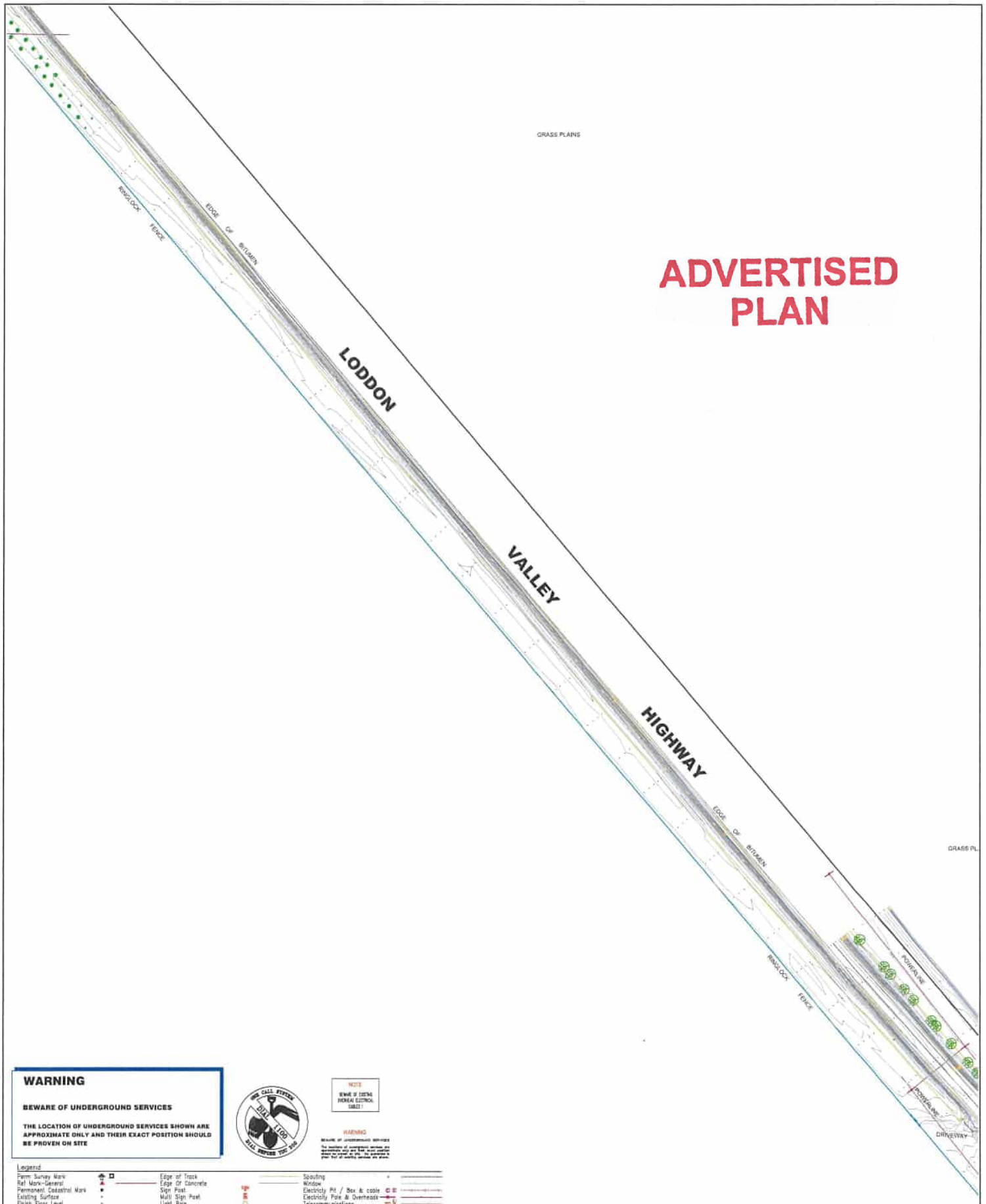
M: 0499 815 326
E: wsl@northernlandsolutions.com.au
W: www.northernlandsolutions.com.au

DATUM DETAILS: AUSTRALIAN HEIGHT DATUM VIDE KERANG PM 19 R.L. 78.37

SURVEYED	G.K. R.W.	DRAWN	G. KAYLOCK
DESIGNED	N/A	CHECKED	W.J. PYE
SURVEY MANAGER	W.J. PYE	APPROVED	W.J. PYE

0 1 2 3 4 5 6 7 8 9 10 cm
FULL SIZE ON ORIGINAL

A1



WARNING

BEWARE OF UNDERGROUND SERVICES

THE LOCATION OF UNDERGROUND SERVICES SHOWN ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE

NOTE
BEWARE OF EXISTING OVERHEAD ELECTRICAL CABLES !

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The locations of underground services are approximate only and their exact position should be proven on site. No guarantee is given that all existing services are shown.

Legend

Perm Survey Mark	Edge of Track	Spouting	
Ref Mark-General	Edge Of Concrete	Window	
Permanent Coastal Mark	Sign Post	Electricity Pit / Box & cable	
Existing Surface	Multi Sign Post	Electricity Pole & Overheads	
Finish Floor Level	Light Pole	Telecommunications	
Single Tree> 2m	Rubbish Bin	Sewerage Pit	
Shrub Tree> 2m	Shed	Stop Valve	
Side Entry Pit	Major Building	Septic Tank	
Junction Pit	Verandah	Fire Plug / Hydrant	
Grated Pit Lid	Weatherboard Building	Man Hole	
General Service Pit Lid	Retaining Wall	Water Meter & Main	
Centre Of Bitumen	Top of Bank	Water Tap/Connection	
Edge Of Bitumen	Top of Bank	Gate	
Edge of Shoulder	Steep Batter / Bank	Fence	
Back Of Kerb/Channel	Change of Grade	Title	
Pedestrian Path	Apex	Easement	
Edge of Paving	Parapet	DCDB Linework	
Driveway	Ridge Line		

MGA NORTH ZONE 55

JOB TITLE
FEATURE, LEVEL AND RE-ESTABLISHMENT SURVEY
44 OLD ECHUCA ROAD, KERANG

SURVEY DATE	CLIENT:	SHEET NUMBER	SURVEYORS REF:	VERSION
10/10/2024	GREENSWITCH AUSTRALIA - SYMON GRASBY	6 or 8	23 2726	1

REV	DATE	DESIGN REVIEW	REV'D PM/CR	APP'D PM/CR	REVISIONS	DRN	CHK'D	APP

TITLE REFERENCES

PARISH: KERANG
CROWN ALLOTMENT: ---
SECTION: ---
PLAN REFERENCE: PS319844, TP881293
VOL/FOL: ---

PLAN NO.

NOTES
1) DATE OF PLAN 17/10/2024
2) LEVELS SHOWN THUS 0.0 ARE TO THE AUSTRALIAN HEIGHT DATUM
3) CONTOUR INTERVALS: 1 METRES SHOWN BLUE AND 0.1 METRES SHOWN GREY
4) SURVEY CONDUCTED USING RTK GNSS

SCALE OF METRES
0 4 8 16 24 32 40

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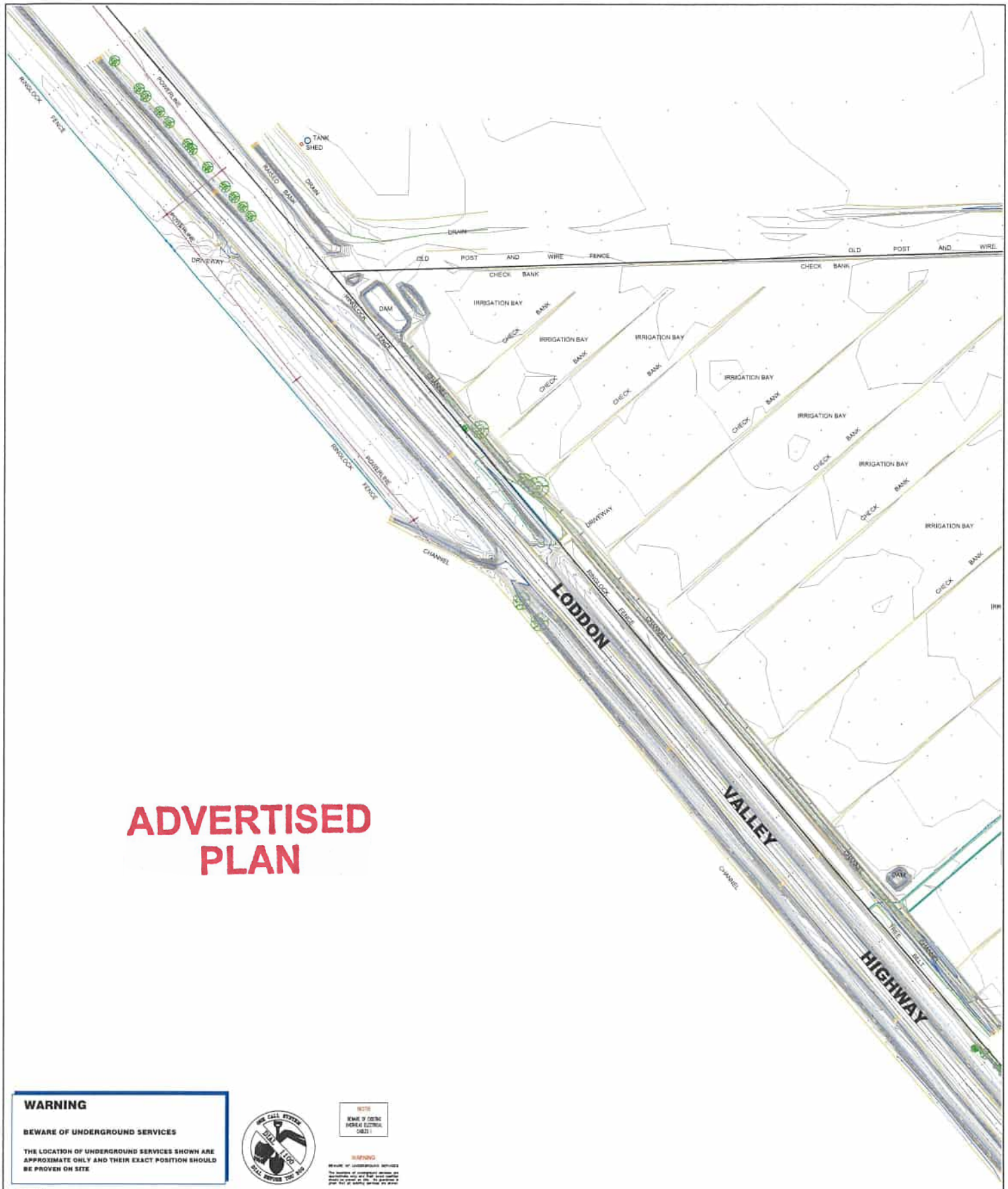
E: nls@northernlandsolutions.com.au
W: www.northernlandsolutions.com.au

DATUM DETAILS:
AUSTRALIAN HEIGHT DATUM VIDE KERANG PM 19 R.L. 78.37

SURVEYED	G.K. R.W.	DRAWN	G. KAYLOCK
DESIGNED	N/A	CHECKED	W.J. PYE
SURVEY MANAGER	W.J. PYE	APPROVED	W.J. PYE

0 1 2 3 4 5 6 7 8 9 10 cm
FULL SIZE ON ORIGINAL

A1



ADVERTISED PLAN

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Existing Surface	Multi Sign Post	Electricity Pole & Overheads	
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Single Tree> 2m	Rubbish Bin	Sewerage Pit	
Shrub Tree> 2m	Shed	Stop Valve	
Side Entry Pit	Major Building	Septic Tank	
Junction Pit	Verandah	Fire Plug / Hydrant	
Grated Pit Lid	Weatherboard Building	Man Hole	
General Service Pit Lid	Retaining Wall	Water Meter & Main	
Centre Of Bitumen	Toe of Bank	Water Tap/Connection	
Edge Of Bitumen	Top of Bank	Gate	
Edge of Shoulder	Steep Batter / Bank	Fence	
Back Of Kerb/Channel	Change of Grade	Title	
Pedestrian Path	Apex	Easement	
Edge of Paving	Parapet	DCDB Linework	
Driveway	Ridge Line		

MGA NORTH ZONE 55

JOB TITLE
FEATURE, LEVEL AND RE-ESTABLISHMENT SURVEY 44 OLD ECHUCA ROAD, KERANG

SURVEY DATE	CLIENT:	SHEET NUMBER	SURVEYORS REF:	VERSION
10/10/2024	GREENSWITCH AUSTRALIA – SYMON GRASBY	7 of 8	23 2726	1

REV	DATE	DESIGN REVIEW	REV'D PMCR	APP'D PMCR	REVISIONS	DRN	CHKD	APP

TITLE REFERENCES
PARISH: KERANG
CROWN ALLOTMENT: ---
SECTION: ---
PLAN REFERENCE: PS318844, TP801293
VOL/FOL: ---
PLAN NO.

NOTES
1) DATE OF PLAN 17/10/2024
2) LEVELS SHOWN THUS 50.0 ARE TO THE AUSTRALIAN HEIGHT DATUM
3) CONTOUR INTERVALS: 1 METRES SHOWN BLUE AND 0.1 METRES SHOWN GREY
4) SURVEY CONDUCTED USING RTK GNSS

SCALE OF METRES
4 0 8 16 24 32 40

NORTHERN LAND SOLUTIONS
LICENSED SURVEYORS, TOWN PLANNING & LAND DEVELOPMENT CONSULTANTS

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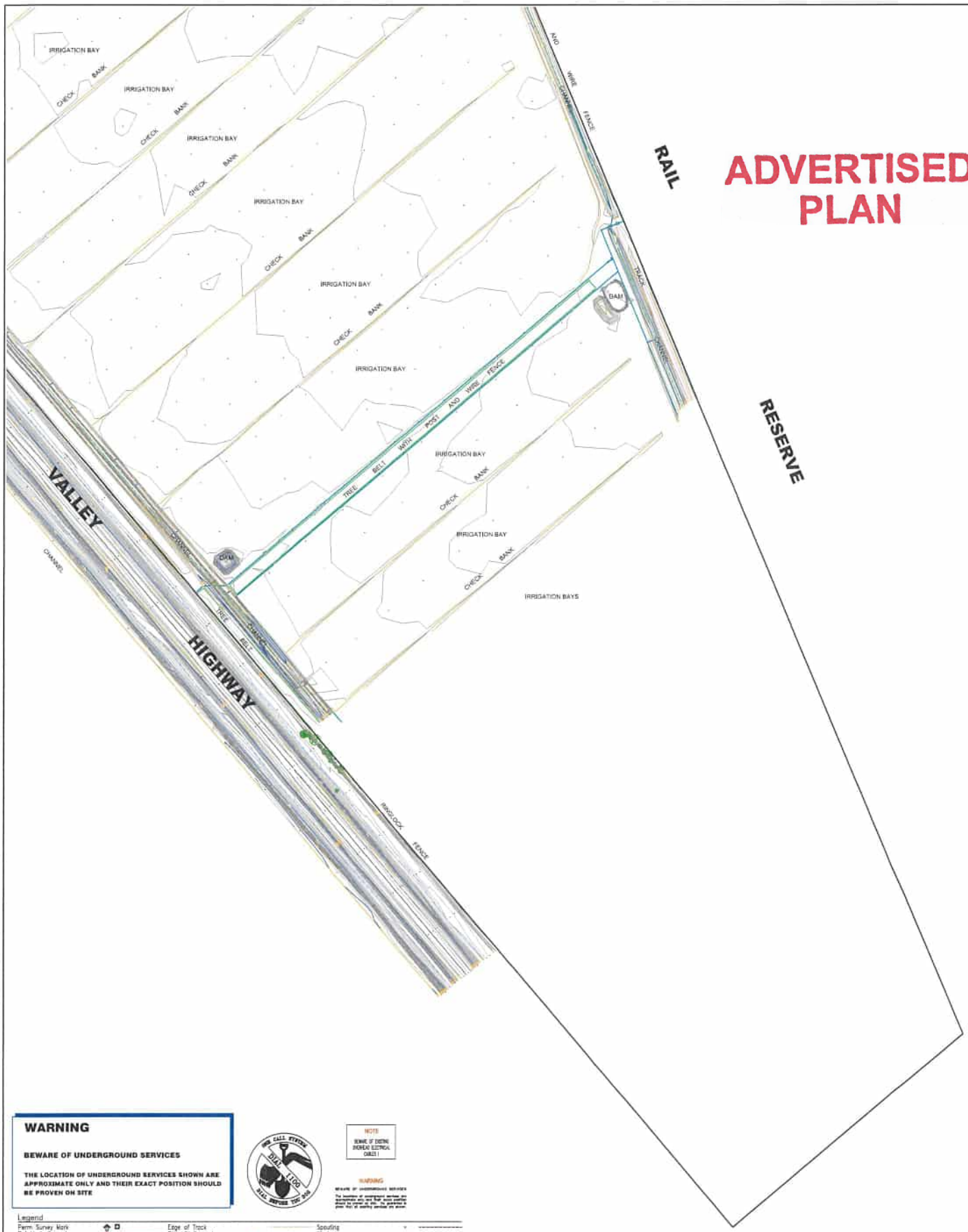
M: 0409 015 329
E: mail@northernlandsolutions.com.au
W: www.northernlandsolutions.com.au

DATUM DETAILS: AUSTRALIAN HEIGHT DATUM VIDE KERANG PM 19 R.L. 78.37

DRAWN	G.K. R.W.	DESIGN	G. KAYLOCK
REVIEWED	N/A	CHECKED	W.J. PYE
SURVEY MARKED	W.J. PYE	APPROVED	W.J. PYE

0 1 2 3 4 5 6 7 8 9 10 cm
FULL SIZE ON ORIGINAL

A1



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BEWARE OF UNDERGROUND SERVICES

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Ref. Mark–General	Edge Of Concrete	Window	
Permanent Cadastral Mark	Sign Post	Electricity Pit / Box & cable	
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Shrub Tree> 2m	Shed	Stop Valve	
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Grated Pit Lid	Weatherboard Building	Man Hole	
General Service Pit Lid	Retaining Wall	Water Meter & Main	
Centre Of Bitumen	Toe of Bank	Water Tap/Connection	
Edge Of Bitumen	Top of Bank	Gate	
Edge of Shoulder	Steep Batter / Bank	Fence	
Back Of Kerb/Channel	Change of Grade	Title	
Pedestrian Path	Approx	Easement	
Edge of Paving	Parapet	DCDB Linework	
Driveway	Ridge Line		

MGA NORTH ZONE 55

JOB TITLE
FEATURE, LEVEL AND RE–ESTABLISHMENT SURVEY
44 OLD ECHUCA ROAD, KERANG

SURVEY DATE	CLIENT:	SHEET NUMBER	SURVEYORS REF:	VERSION
10/10/2024	GREENSWITCH AUSTRALIA – SYMON GRASBY	8 of 8	23 2726	1

REV	DATE	DESIGN REVIEW	REV'D PMCR	APP'D PMCR	REVISIONS	DRN	CHKD	APP

TITLE REFERENCES
PARISH: KERANG
CROWN ALLOTMENT: ---
SECTION: ---
PLAN REFERENCE: PS318944, TP851283
VOL/FOL: ---
PLAN NO.

NOTES
1) DATE OF PLAN 17/10/2024
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3) CONTOUR INTERVALS: 1 METRES SHOWN BLUE AND 0.1 METRES SHOWN GREY
4) SURVEY CONDUCTED USING RTK GNSS

SCALE OF METRES
4 2 0 10 20 30 40

NORTHERN LAND SOLUTIONS

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M: 0409 025 226
E: swa@northernlandsolutions.com.au
W: www.northernlandsolutions.com.au

DATUM DETAILS:
AUSTRALIAN HEIGHT DATUM VIDE KERANG PM 19 R.L. 78.37

DRAWN	G.K. R.W.	CHKD	G. KAYLOCK
SURVEYED	N/A	DESIGNED	W.J. PYE
SURVEY ADVISED	W.J. PYE	APPROVED	W.J. PYE

0 1 2 3 4 5 6 7 8 9 10 cm
FULL SIZE ON ORIGINAL

A1

Appendix C Drainage Calculations

DALTON CONSULTING ENGINEERS

Stormwater Calculations

Tragowel BESS

Revision B - December 2025

Green Switch AUSTRALIA

DALTON CONSULTING ENGINEERS
Level 3, 678 Victoria Street
Richmond VIC 3121
T +61 3 9813 7400
E info@dceng.com.au
W dceng.com.au
ABN 78 429 221 049

MAJOR STORM EVENT HYDROLOGY COMPUTATIONS

PROJECT DETAILS	
Job Description:	Hogsnest BESS
Job Number:	24155
Compiled by:	Baumann
Date:	18-12-25
Council:	OTHER
Design Standard	QM
Minor Storm Frequency 1:	10% AEP
Minor Storm Frequency 2:	
Major Storm Frequency:	1% AEP
Climate Change Pathway	RCP8.5
Climate Change Year	2060
Blockage Factor (%):	1

Allows for design life of the facility

C10	0.2

RAINFALL DATA					
Source	Australian Government - Bureau of Meteorology: Design Rainfall Data System (2016)				
Easting:	786172.73	Northing:	8035756.54	Zone:	56H
Date:	13-12-24				

CATCHMENT DETAILS (ALL AREAS IN HECTARES)						
		Sub-Catch 1	Sub-Catch 2	Sub-Catch 3	Sub-Catch 4	Sub-Catch 5
Name		Rural	BESS			
Fraction Imp. (f)		0.1	0.5			
C Minor 1		0.226	0.526			
C Minor 2		0.226	0.526			
C Major		0.272	0.632			

CATCHMENT	DESCRIPTION	ATCHMENT AREA					Total (ha)	Composite Fimp	Minor 1/27	MSUD Ae	Minor 1 Ae	Minor 2 Ae	Major Ae
A	Project Area EXG	7.000					7.000	0.100	1	1.585	1.585		1.902
B	Project Area DEV		7.000				7.000	0.500	1	3.691	3.691		4.417
C	Paddock EXG	12.300					12.300	0.100	1	2.786	2.786		3.343
D	Paddock DEV	5.300	7.000				12.300	0.328	1	4.881	4.881		5.857
AF													
AQ													
AR													
AS													
AT													
AU													
AW													
AX													
Total (ha)		24.600	14.000										

VELOCITY EQUATION

$$T_c = t_i + L/(v/60)$$

KINEMATIC WAVE EQUATION

$$To\, I^{0.4} = 6.94\frac{(L \times n)^{0.6}}{S^{0.3}}$$

Where:
- T = Overland Flow Time (min)
- I = Rainfall Intensity, (mm/hr)
- L = Length of flow path, (m)
- n = Manning
- S = Slope, (m/m)

Section	Description	Catchment Summary	Total Rural (Ha)	Total BESS (Ha)					Total Area (Ha)	Catchment Characteristics						
										Length (m)	U/S Height (m)	D/S Height (m)	Surface	n	Slope (m/m)	Slope %
1	Project Area EXG	A	7.000	0.000					7.000	350	78.6	78	Grass Channel	0.035	0.002	0.30%
2	Project Area DEV	B	0.000	7.000					7.000	250	79.15	78	Earth Channel	0.025	0.005	0.50%
3	Paddock EXG	C	12.300	0.000					12.300	450	78.6	78	Grass Channel	0.035	0.001	0.30%
4	Paddock DEV	D	5.300	7.000					12.300	350	79.15	78	Earth Channel	0.025	0.003	0.40%

V (10% AEP)	V ()	V (1% AEP)	Initial T(min)	Calculated Minor 1 Tc	Calculated Minor 2 Tc	Calculated Major Tc
0.40	0.80	0.40	7.00	31.58	14.29	31.58
0.60	0.80	0.60	5.00	11.94	10.15	11.94
0.40	0.80	0.40	7.00	25.75	16.38	25.75
0.50	0.80	0.50	5.00	16.67	12.29	16.67

Tc^{AF}	Calculated Minor 1 Tc	Calculated MINOR 1 Tc CC ADJUSTED	Tc^{AX}	Calculated Minor 2 Tc	Calculated MINOR 2 Tc CC ADJUSTED	Tc^{AX}	Calculated Major Tc	Calculated MAJOR Tc CC ADJUSTED
210.87	50.00	43.00	210.87	AFCT STORM EVEN	AFCT STORM EVEN	210.87	36.00	31.00
104.73	20.00	17.00	104.73	AFCT STORM EVEN	AFCT STORM EVEN	104.73	15.00	12.00
264.39	70.00	55.00	264.39	AFCT STORM EVEN	AFCT STORM EVEN	264.39	50.00	43.00
141.77	30.00	25.00	141.77	AFCT STORM EVEN	AFCT STORM EVEN	141.77	22.00	18.00

Minor 1 Time of Concentration	
Minor 1 Method	Adopted Minor 1 Tc
Velocity	21.58
Velocity	11.94
Velocity	25.75
Velocity	16.67

Major Time of Concentration	
Major Method	Adopted Major Tc
Kinematic Wave	36.00
Kinematic Wave	15.00
Kinematic Wave	50.00
Kinematic Wave	22.00

	MINOR				MAJOR			
	10% AEP		10% AEP with CC		1% AEP		1% AEP with CC	
Ae (ha)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)	Ae (ha)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)
1.39	59.01	0.3	83.80	0.4	1.90	73.67	0.4	116.62	0.6
3.69	41.55	0.4	115.60	1.2	4.42	127.06	1.6	202.66	2.5
2.79	51.60	0.4	73.27	0.6	3.34	59.13	0.5	93.46	0.9
4.86	67.09	0.9	95.17	1.3	5.86	101.99	1.7	163.05	2.7

CLIMATE CHANGE FACTORS		
Rainfall Factors	Choose SSP Scenario:	SSP5-8.5
	Time Horizon	2060

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.20	1.18	1.17	1.16	1.14	1.13	1.13	1.12	1.11	1.11
2040	1.26	1.24	1.22	1.20	1.18	1.17	1.16	1.15	1.14	1.14
2050	1.34	1.31	1.29	1.26	1.24	1.23	1.21	1.20	1.18	1.18
2060	1.42	1.38	1.35	1.32	1.29	1.28	1.26	1.24	1.22	1.21
2070	1.52	1.47	1.43	1.40	1.36	1.34	1.31	1.29	1.27	1.26
2080	1.63	1.57	1.52	1.48	1.43	1.40	1.37	1.35	1.33	1.31
2090	1.77	1.69	1.64	1.58	1.52	1.49	1.45	1.42	1.39	1.37
2100	1.86	1.77	1.71	1.64	1.58	1.54	1.50	1.47	1.43	1.41

Time (min)	2030	2040	2050	2060	2070	2080	2090	2100
0	1.2	1.26	1.34	1.42	1.52	1.63	1.77	1.86
60	1.2	1.26	1.34	1.42	1.52	1.63	1.77	1.86
90	1.18	1.24	1.31	1.38	1.47	1.57	1.69	1.77
120	1.17	1.22	1.29	1.35	1.43	1.52	1.64	1.71
180	1.16	1.2	1.26	1.32	1.4	1.48	1.58	1.64
270	1.14	1.18	1.24	1.29	1.36	1.43	1.52	1.58
360	1.13	1.17	1.23	1.28	1.34	1.4	1.49	1.54
540	1.13	1.16	1.21	1.26	1.31	1.37	1.45	1.5
720	1.12	1.15	1.2	1.24	1.29	1.35	1.42	1.47
1080	1.11	1.14	1.18	1.22	1.27	1.33	1.39	1.43
1440	1.11	1.14	1.18	1.21	1.26	1.31	1.37	1.41

PASTE TEMPERATURE CHANGE DATA HERE

Temperature Changes (Relative to 1961-1990 Baseline)				
Year	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP5-8.5
2030	1.20	1.20	1.20	1.30
2040	1.30	1.40	1.50	1.60
2050	1.40	1.70	1.80	2.10
2060	1.50	1.90	2.20	2.50
2070	1.50	2.10	2.50	3.00
2080	1.50	2.20	2.90	3.50
2090	1.50	2.40	3.30	4.10
2100	1.40	2.50	3.60	4.50

The baseline IFDs should be adjusted to account for climate change as follows:

Parameter	Current	Future (Years 2070 & 2100)
IFD	Scale using Datahub SSP3-7.0 factors for Year 2030	Scale using ARR v4.2 Datahub SSP-based factors for SSP2-4.5, SSP3-7.0, and SSP5-8.5

PASTE CLIMATE CHANGE FACTOR DATA HERE

SSP1-2.6

CLIMATE CHANGE FACTORS SSP1 - 2.6

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.10	1.10
2040	1.21	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.11	1.11
2050	1.22	1.20	1.18	1.17	1.15	1.15	1.14	1.13	1.12	1.11
2060	1.23	1.21	1.20	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2070	1.24	1.22	1.20	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2080	1.23	1.21	1.20	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2090	1.23	1.21	1.20	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2100	1.22	1.20	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.12

SSP2-4.5

CLIMATE CHANGE FACTORS SSP2 - 4.5

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.10	1.10
2040	1.22	1.20	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.12
2050	1.27	1.24	1.23	1.21	1.19	1.18	1.17	1.16	1.15	1.14
2060	1.30	1.27	1.25	1.23	1.21	1.20	1.19	1.18	1.16	1.16
2070	1.33	1.30	1.28	1.26	1.24	1.22	1.21	1.19	1.18	1.17
2080	1.37	1.33	1.31	1.28	1.26	1.24	1.22	1.21	1.20	1.19
2090	1.40	1.36	1.34	1.31	1.28	1.26	1.24	1.23	1.21	1.20
2100	1.41	1.37	1.35	1.32	1.29	1.27	1.25	1.24	1.22	1.21

SSP3-7.0

CLIMATE CHANGE FACTORS SSP3 - 7.0

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.10	1.10
2040	1.23	1.21	1.20	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2050	1.29	1.26	1.24	1.22	1.20	1.19	1.18	1.17	1.16	1.15
2060	1.35	1.32	1.30	1.27	1.25	1.23	1.22	1.20	1.19	1.18
2070	1.42	1.38	1.35	1.32	1.29	1.28	1.26	1.24	1.22	1.21
2080	1.50	1.45	1.42	1.38	1.35	1.33	1.30	1.28	1.26	1.25
2090	1.59	1.53	1.49	1.44	1.40	1.38	1.35	1.33	1.30	1.29
2100	1.66	1.59	1.55	1.50	1.45	1.42	1.39	1.37	1.34	1.32

SSP5-8.5

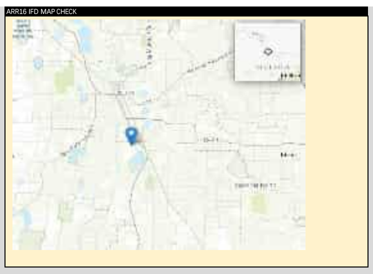
CLIMATE CHANGE FACTORS SSP5 - 8.5

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.20	1.18	1.17	1.16	1.14	1.13	1.13	1.12	1.11	1.11
2040	1.26	1.24	1.22	1.20	1.18	1.17	1.16	1.15	1.14	1.14
2050	1.34	1.31	1.29	1.26	1.24	1.23	1.21	1.20	1.18	1.18
2060	1.42	1.38	1.35	1.32	1.29	1.28	1.26	1.24	1.22	1.21
2070	1.52	1.47	1.43	1.40	1.36	1.34	1.31	1.29	1.27	1.26
2080	1.63	1.57	1.52	1.48	1.43	1.40	1.37	1.35	1.33	1.31
2090	1.77	1.69	1.64	1.58	1.52	1.49	1.45	1.42	1.39	1.37
2100	1.86	1.77	1.71	1.64	1.58	1.54	1.50	1.47	1.43	1.41

RAINFALL DATA							
Source	Australian Government - Bureau of Meteology, Design Rainfall Data System (2016)						
Easting	766172.73	Northing	6035756.54	Zone	54H	Date	13-12-24

Website: ://data.arr-software.org/

ARR16 IFD MAP CHECK



Annual Exceedance Probability (AEP) Coefficients	4EY	2EY	1EY	0.2EY	50% AEP#	20% AEP*	10% AEP	5% AEP	2% AEP	1% AEP	0.2% AEP
C0	-3.79E-01	-3.27E-02	2.66E-01	8.57E-01	4.25E-01	8.37E-01	1.07E+00	1.27E+00	1.50E+00	1.66E+00	
C1	9.02E-01	8.60E-01	8.01E-01	7.66E-01	7.90E-01	7.66E-01	7.54E-01	7.45E-01	7.20E-01	7.01E-01	
C2	-1.39E-01	-6.44E-02	1.40E-02	4.65E-02	2.49E-02	4.65E-02	5.57E-02	6.25E-02	8.82E-02	1.09E-01	
C3	2.06E-02	-1.51E-02	-4.78E-02	-5.61E-02	-5.09E-02	-5.61E-02	-5.75E-02	-5.80E-02	-6.70E-02	-7.43E-02	
C4	-1.87E-03	5.24E-03	1.11E-02	1.13E-02	1.13E-02	1.13E-02	1.10E-02	1.06E-02	1.20E-02	1.31E-02	
C5	7.446183e-05	-5.61E-04	-1.03E-03	-9.34E-04	-1.02E-03	-9.34E-04	-8.60E-04	-7.82E-04	-8.80E-04	-9.68E-04	
C6	-8.99E-07	2.0375084e-05	3.4677498e-05	2.7514763e-05	3.3063443e-05	2.7514792e-05	2.3560971e-05	1.9639425e-05	2.2487811e-05	2.519483e-05	

NOTE:
The coefficients can be applied to estimate the design rainfall depth for a full range of durations from 1 minute to 7 days.
It is recommended that only three significant figures are used when undertaking calculations using design rainfalls generated in this way.
The 50% AEP IFD does not correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD does not correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

CONSTANTS

Council	C'10
CARDINIA	0.11508008
CASEY	0.11508008
HUME	0.16031382
MELTON	0.15445632
WHITTLESEA	0.16031382
WYNDHAM	0.15445632
OTHER	0.15163471

Zone	Frac. Impervious
Rural	0.1
BESS	0.5
Lot 600-1000sq.m	0.6
Lot 1000-4000sq.m	0.3
Major Roads	0.8
Local Roads	0.7
Drainage Reserve	0.25
Open Space	0.25
Schools	0.7
Mixed Use Zone	0.7
Industrial	0.9
Medium Density	0.9
Health/Community	0.7
Impervious	1

Pit Type	
SEP	
GEP	

	Frequency Factor
4EY	0.80
2EY	0.80
1EY	0.80
0.2EY	0.95
50% AEP	0.85
20% AEP	0.95
10% AEP	1.00
5% AEP	1.05
2% AEP	1.15
1% AEP	1.20
0.2% AEP	1.30
No Minor	0

Surface	n
Smooth Concrete	0.013
Asphalt	0.015
Road Reserve	0.02
Earth Channel	0.025
Grass Channel	0.035
OTHER	

Pipe Type	Mannings
PE	0.01
PP	0.01
PVC	0.01
RC	0.013
VC	0.015

Co-Ordinate Type	
Easting	Latitude
Northing	Longitude

Y or N?
Y
N

1or 2?
1
2

Tc Method
Velocity
Kinematic Wave
Friends
Bransby Williams
Ramser Kirpich
Characteristic Time
User Defined

Design Standard
EDCM
IDM
MW
Other

Storm
Minor 1
Minor 2
Major
Overland

Climate Change Design Decision
MINOR PIPES SIZED FOR CC
MINOR PIPES NOT SIZED FOR CC

Pipe Sizes	No. of Pipes
225	1
300	2
375	3
450	4
525	5
600	
675	
750	
825	
900	
1050	
1200	
1350	
1500	
1650	
1800	

Slope - Pipe Flow Velocity Tables
0.5
0.8
1
1.2
1.5
1.8
2
2.2
2.5
3

Slope - Overland Flow Velocity Tables	
Slope (%)	Velocity (m/s)
0.10%	0.300000
0.20%	0.400000
0.30%	0.450000
0.40%	0.500000
0.50%	0.600000
0.60%	0.650000
0.70%	0.700000
0.80%	0.750000
0.90%	0.800000
1.00%	0.800000
1.10%	0.850000
1.20%	0.900000
1.30%	0.950000
1.40%	0.950000
1.50%	1.000000
1.60%	1.050000
1.70%	1.050000
1.80%	1.100000
1.90%	1.100000
2.00%	1.150000
2.10%	1.200000
2.20%	1.200000
2.30%	1.250000
2.40%	1.250000
2.50%	1.300000
2.60%	1.300000
2.70%	1.350000
2.80%	1.350000
2.90%	1.400000
3.00%	1.400000
3.10%	1.450000
3.20%	1.450000
3.30%	1.450000
3.40%	1.500000
3.50%	1.500000
3.60%	1.550000
3.70%	1.550000
3.80%	1.550000
3.90%	1.600000
4.00%	1.600000
4.10%	1.650000
4.20%	1.650000
4.30%	1.700000
4.40%	1.700000
4.50%	1.700000
4.60%	1.750000
4.70%	1.750000
4.80%	1.750000
4.90%	1.800000
5.00%	1.800000
5.50%	1.900000
6.00%	1.950000
6.50%	2.050000
7.00%	2.150000
7.50%	2.200000
8.00%	2.300000
8.50%	2.350000
9.00%	2.400000
9.50%	2.500000
10.00%	2.550000

IFD INTENSITIES - NO CLIMATE CHANGE ADJUSTMENT

Duration (mins)	4EY	2EY	1EY	0.2EY	50% AEP	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP	0.2% AEP	No Minor
1	41.072	58.067	78.255	141.406	91.816	138.634	174.408	212.803	269.219	317.092	60.000	0
2	36.120	50.883	67.700	120.976	79.166	118.604	148.601	180.678	226.846	265.597	30.000	0
3	31.954	45.443	60.897	109.007	71.255	106.869	133.946	162.892	204.760	239.961	20.000	0
4	28.799	41.250	55.659	99.930	65.188	97.971	122.913	149.591	188.398	221.114	15.000	0
5	26.346	37.915	51.424	92.581	60.279	90.765	113.983	138.836	175.149	205.833	12.000	0
6	24.378	35.189	47.906	86.439	56.192	84.744	106.511	129.830	164.010	192.946	10.000	0
7	22.759	32.910	44.924	81.201	52.721	79.609	100.126	122.123	154.440	181.839	8.571	0
8	21.397	30.972	42.357	76.665	49.728	75.162	94.586	115.426	146.093	172.123	7.500	0
9	20.232	29.298	40.120	72.690	47.114	71.264	89.722	109.535	138.728	163.529	6.667	0
10	19.222	27.835	38.149	69.170	44.808	67.814	85.408	104.305	132.169	155.858	6.000	0
11	18.335	26.544	36.396	66.028	42.755	64.733	81.551	99.621	126.282	148.960	5.455	0
12	17.548	25.393	34.826	63.202	40.914	61.963	78.077	95.398	120.962	142.717	5.000	0
13	16.845	24.359	33.410	60.644	39.251	59.455	74.929	91.566	116.127	137.035	4.615	0
14	16.211	23.425	32.125	58.317	37.741	57.173	72.060	88.071	111.710	131.837	4.286	0
15	15.636	22.575	30.953	56.188	36.363	55.086	69.434	84.869	107.656	127.062	4.000	0
16	15.111	21.799	29.878	54.231	35.098	53.168	67.018	81.921	103.921	122.658	3.750	0
17	14.630	21.086	28.889	52.427	33.934	51.399	64.788	79.197	100.465	118.581	3.529	0
18	14.187	20.428	27.975	50.756	32.857	49.761	62.722	76.671	97.259	114.794	3.333	0
19	13.777	19.819	27.127	49.204	31.858	48.240	60.802	74.322	94.273	111.266	3.158	0
19.5	13.584	19.532	26.726	48.469	31.385	47.519	59.891	73.208	92.856	109.591	3.077	0
20	13.397	19.254	26.339	47.759	30.929	46.822	59.011	72.131	91.486	107.971	3.000	0
22	12.712	18.234	24.915	45.142	29.249	44.257	55.768	68.160	86.430	101.989	2.727	0
23	12.402	17.773	24.269	43.954	28.487	43.093	54.295	66.354	84.129	99.265	2.609	0
24	12.110	17.339	23.662	42.836	27.770	41.996	52.907	64.652	81.960	96.697	2.500	0
25	11.836	16.931	23.091	41.782	27.095	40.963	51.599	63.047	79.913	94.271	2.400	0
26	11.577	16.546	22.551	40.786	26.458	39.987	50.362	61.529	77.977	91.976	2.308	0
27	11.332	16.181	22.040	39.844	25.855	39.062	49.191	60.092	76.142	89.802	2.222	0
28	11.100	15.836	21.557	38.950	25.283	38.186	48.080	58.728	74.402	87.738	2.143	0
29	10.880	15.509	21.098	38.101	24.741	37.354	47.025	57.433	72.747	85.776	2.069	0
30	10.671	15.198	20.661	37.294	24.226	36.563	46.022	56.200	71.173	83.909	2.000	0
31	10.471	14.902	20.246	36.526	23.735	35.810	45.066	55.026	69.673	82.129	1.935	0
32	10.281	14.620	19.850	35.793	23.267	35.091	44.154	53.905	68.241	80.431	1.875	0
33	10.100	14.350	19.473	35.094	22.820	34.406	43.284	52.835	66.874	78.809	1.818	0
34	9.926	14.093	19.112	34.425	22.394	33.750	42.452	51.812	65.566	77.257	1.765	0
35	9.760	13.847	18.766	33.785	21.985	33.123	41.655	50.833	64.314	75.771	1.714	0
36	9.601	13.611	18.435	33.172	21.594	32.522	40.892	49.894	63.114	74.346	1.667	0
37	9.448	13.384	18.118	32.584	21.219	31.945	40.160	48.994	61.963	72.980	1.622	0
38	9.301	13.167	17.814	32.020	20.860	31.392	39.458	48.129	60.857	71.668	1.579	0
39	9.160	12.959	17.522	31.478	20.514	30.860	38.782	47.299	59.795	70.407	1.538	0
40	9.024	12.758	17.240	30.956	20.181	30.349	38.133	46.500	58.773	69.194	1.500	0
41	8.893	12.565	16.970	30.454	19.862	29.857	37.508	45.731	57.790	68.026	1.463	0
42	8.767	12.379	16.709	29.971	19.553	29.383	36.906	44.990	56.842	66.901	1.429	0
43	8.645	12.199	16.458	29.505	19.256	28.927	36.326	44.275	55.928	65.816	1.395	0
44	8.528	12.026	16.216	29.056	18.970	28.486	35.766	43.586	55.047	64.769	1.364	0
45	8.414	11.859	15.982	28.622	18.693	28.061	35.225	42.921	54.195	63.759	1.333	0
46	8.304	11.697	15.756	28.203	18.426	27.650	34.703	42.278	53.373	62.782	1.304	0
47	8.198	11.541	15.537	27.797	18.168	27.252	34.198	41.656	52.578	61.838	1.277	0
48	8.095	11.389	15.326	27.405	17.918	26.868	33.709	41.055	51.809	60.925	1.250	0
49	7.995	11.243	15.121	27.026	17.676	26.496	33.237	40.473	51.064	60.041	1.224	0
50	7.898	11.101	14.923	26.659	17.442	26.136	32.779	39.909	50.344	59.185	1.200	0
55	7.455	10.452	14.019	24.982	16.373	24.492	30.690	37.337	47.054	55.279	1.091	0
60	7.070	9.890	13.236	23.531	15.448	23.070	28.882	35.111	44.208	51.902	1.000	0
65	6.730	9.396	12.550	22.263	14.638	21.826	27.302	33.165	41.721	48.950	0.923	0
70	6.429	8.959	11.944	21.142	13.922	20.728	25.907	31.448	39.526	46.346	0.857	0
75	6.158	8.568	11.404	20.145	13.285	19.750	24.665	29.919	37.574	44.031	0.800	0
80	5.915	8.217	10.920	19.251	12.713	18.874	23.552	28.550	35.826	41.959	0.750	0
85	5.693	7.899	10.482	18.445	12.197	18.083	22.549	27.316	34.251	40.091	0.706	0
90	5.491	7.609	10.084	17.713	11.728	17.365	21.638	26.196	32.823	38.399	0.667	0
95	5.306	7.345	9.721	17.045	11.300	16.711	20.809	25.176	31.522	36.859	0.632	0
100	5.136	7.101	9.387	16.434	10.907	16.112	20.049	24.242	30.332	35.450	0.600	0
105	4.978	6.877	9.080	15.872	10.546	15.560	19.350	23.384	29.239	34.156	0.571	0
110	4.831	6.669	8.796	15.352	10.212	15.051	18.706	22.592	28.231	32.963	0.545	0
115	4.695	6.475	8.533	14.871	9.902	14.580	18.109	21.859	27.298	31.859	0.522	0
120	4.568	6.295	8.288	14.424	9.614	14.141	17.554	21.179	26.432	30.835	0.500	0
125	4.448	6.126	8.059	14.007	9.345	13.733	17.037	20.545	25.626	29.882	0.480	0
130	4.336	5.969	7.845	13.618	9.094	13.351	16.554	19.952	24.874	28.993	0.462	0
135	4.231	5.820	7.644	13.253	8.858	12.993	16.102	19.398	24.170	28.161	0.444	0
140	4.131	5.680	7.455	12.910	8.636	12.657	15.678	18.878	23.509	27.381	0.429	0
145	4.037	5.549	7.277	12.587	8.427	12.340	15.278	18.389	22.888	26.648	0.414	0
150	3.948	5.424	7.109	12.283	8.230	12.042	14.902	17.928	22.304	25.958	0.400	0
155	3.864	5.306	6.950	11.996	8.044	11.760	14.547	17.493	21.752	25.307	0.387	0
160	3.784	5.194	6.799	11.723	7.867	11.494	14.210	17.081	21.230	24.691	0.375	0
165	3.707	5.087	6.656	11.465	7.700	11.241	13.891	16.692	20.736	24.109	0.364	0
170	3.635	4.986	6.520	11.221	7.540	11.000	13.589	16.322	20.268	23.557	0.353	0
175	3.565	4.889	6.391	10.988	7.389	10.772	13.301	15.970	19.823	23.032	0.343	0
180	3.499	4.797	6.267	10.766	7.244	10.555	13.028	15.636	19.400	22.533	0.333	0
185	3.435	4.709	6.149	10.554	7.106	10.347	12.767	15.317	18.997	22.059	0.324	0
190	3.375	4.624	6.037	10.352	6.975	10.149	12.518	15.013	18.612	21.606	0.316	0
195	3.316	4.543	5.929	10.159	6.849	9.960	12.280	14.723	18.245	21.174	0.308	0
200	3.260	4.466	5.825	9.974	6.728	9.779	12.052	14.445	17.894	20.761	0.300	0
205	3.207	4.391	5.726	9.797	6.612	9.605	11.834	14.179	17.558	20.365	0.293	0
210	3.155	4.320	5.631	9.627	6.501	9.439	11.625	13.924	17.237	19.987	0.286	0
215	3.105	4.251	5.540	9.465	6.394	9.279	11.425	13.680	16.928	19.624	0.279	0
220	3.057	4.185	5.452	9.308	6.292	9.125	11.232	13.445	16.632	19.276	0.273	0
225	3.011	4.121	5.367	9.157	6.193	8.978	11.047	13.220	16.348	18.942	0.267	0
230	2.966	4.060	5.286	9.012	6.098	8.836	10.869	13.003	16.074	18.620	0.261	0
235	2.923	4.000	5.207	8.873	6.006	8.699	10.697	12.794	15.811	18.311	0.255	0
240	2.882	3.943	5.131	8.738	5.917	8.567	10.532	12.593	15.558	18.013	0.250	0
245	2.841	3.888	5.058	8.608	5.832	8.439	10.373	12.399	15.313	17.726	0.245	0
250	2.802	3.834	4.987	8.483	5.749	8.317	10.219	12.212	15.078	17.450	0.240	0
255	2.765	3.782	4.918	8.362	5.670	8.198	10.070	12.032	14.850	17.183	0.235	0
260	2.728	3.732	4.852	8.245	5.592	8.083	9.927	11.857	14.631	16.925	0.231	0
265	2.693	3.683	4.788	8.131	5.518	7.972	9.788	11.688	14.419	16.676	0.226	0
270	2.658	3.636	4.725	8.022	5.445	7.864	9.653	11.525	14.213	16.435	0.222	0
275	2.625	3.590	4.665	7.915	5.375	7.760	9.523	11.367	14.015	16.202	0.218	0
280	2.593	3.546	4.607	7.812	5.307	7.659	9.397	11.214	13.822	15.976	0.214	0
285	2.561	3.503	4.550	7.712	5.241	7.561	9.275	11.066	13.636	15.758	0.211	0
290	2.530	3.461	4.495	7.616	5.177	7.466	9.156	10.922	13.455	15.546	0.207	0
295	2.501	3.420	4.441	7.522	5.115	7.374	9.041	10.783	13.280	15.341	0.203	0
300	2.472	3.380	4.389	7.430	5.054	7.284	8.930	10.647	13.110	15.141	0.200	0
305	2.444	3.342	4.338	7.341	4.995	7.197	8.821	10.516	12.945	14.948	0.197	0
310	2.416	3.304	4.289	7.255	4.938	7.113	8.716	10.388	12.784	14.760	0.194	0
315	2.389	3.268	4.241	7.171	4.883	7.031	8.613	10.264	12.629	14.578	0.190	0
320	2.363	3.232	4.194	7.090	4.828	6.951	8.513	10.143	12.477	14.400	0.188	0
325	2.338	3.197	4.149	7.010	4.775	6.873	8.416	10.026	12.330	14.228	0.185	0
330	2.313	3.164	4.105	6.933	4.724	6.797	8.322	9.911	12.186	14.060	0.182	0
335	2.289	3.131	4.061	6.857	4.674	6.723	8.230	9.800	12.047	13.897	0.179	0
340	2.265	3.098	4.019	6.784	4.625	6.651	8.140	9.691	11.911	13.738	0.176	0
345	2.242	3.067	3.978	6.712	4.577	6.580	8.053	9.586	11.779	13.583	0.174	0
350	2.220	3.036	3.938	6.642	4.531	6.512	7.968	9.483	11.650	13.432	0.171	0
355	2.198	3.006	3.899	6.574	4.485	6.445	7.884	9.382	11.524	13.285	0.169	0
360	2.176	2.977	3.860	6.507	4.441	6.380	7.803	9.284	11.401	13.141	0.167	0
365	2.155	2.948	3.823	6.442	4.398	6.316	7.724	9.189	11.281	13.001	0.164	0
370	2.135	2.920	3.786	6.379	4.355	6.254	7.647	9.095	11.165	12.865	0.162	0
375	2.115	2.893	3.751	6.317	4.314	6.193	7.571	9.004	11.051	12.732	0.160	0
380	2.095	2.866	3.716	6.256	4.273	6.134	7.498	8.915	10.939	12.601	0.158	0
385	2.076	2.840	3.681	6.197	4.234	6.076	7.426	8.828	10.830	12.474	0.156	0
390	2.057	2.814	3.648	6.139	4.195	6.019	7.355	8.743	10.724	12.350	0.154	0
395	2.038	2.789	3.615	6.083	4.157	5.963	7.286	8.660	10.620	12.229	0.152	0
400	2.020	2.765	3.583	6.027	4.120	5.909	7.219	8.579	10.519	12.110	0.150	0
405	2.003	2.740	3.552	5.973	4.084	5.856	7.153	8.499	10.419	11.994	0.148	0
410	1.985	2.717	3.521	5.920	4.048	5.804	7.088	8.421	10.322	11.881	0.146	0
415	1.968	2.694	3.491	5.868	4.013	5.753	7.025	8.345	10.227	11.770	0.145	0
420	1.952	2.671	3.461	5.817	3.979	5.703	6.963	8.270	10.134	11.661	0.143	0
425	1.935	2.649	3.432	5.767	3.946	5.654	6.903	8.197	10.043	11.555	0.141	0
430	1.919	2.627	3.404	5.718	3.913	5.606	6.843	8.126	9.953	11.450	0.140	0
435	1.903	2.606	3.376	5.670	3.881	5.559	6.785	8.056	9.866	11.348	0.138	0
440	1.888	2.584	3.349	5.623	3.849	5.513	6.728	7.987	9.780	11.248	0.136	0
445	1.873	2.564	3.322	5.577	3.818	5.467	6.672	7.920	9.696	11.150	0.135	0
450	1.858	2.544	3.296	5.532	3.788	5.423	6.617	7.854	9.614	11.054	0.133	0
455	1.843	2.524	3.270	5.487	3.758	5.380	6.563	7.789	9.533	10.960	0.132	0
460	1.829	2.504	3.244	5.444	3.728	5.337	6.511	7.726	9.454	10.868	0.130	0
465	1.815	2.485	3.220	5.401	3.700	5.295	6.459	7.663	9.376	10.778	0.129	0
470	1.801	2.466	3.195	5.359	3.672	5.254	6.408	7.602	9.300	10.689	0.128	0
475	1.787	2.448	3.171	5.318	3.644	5.214	6.358	7.542	9.226	10.602	0.126	0
480	1.774	2.430	3.147	5.277	3.617	5.174	6.309	7.483	9.152	10.516	0.125	0
485	1.761	2.412	3.124	5.238	3.590	5.135	6.261	7.426	9.080	10.432	0.124	0
490	1.748	2.394	3.101	5.199	3.563	5.097	6.214	7.369	9.009	10.350	0.122	0
495	1.735	2.377	3.079	5.160	3.538	5.059	6.167	7.313	8.940	10.269	0.121	0
500	1.722	2.360	3.057	5.123	3.512	5.022	6.122	7.258	8.872	10.190	0.120	0
505	1.710	2.343	3.035	5.085	3.487	4.986	6.077	7.204	8.805	10.112	0.119	0
510	1.698	2.327	3.014	5.049	3.463	4.950	6.033	7.151	8.739	10.035	0.118	0
515	1.686	2.310	2.993	5.013	3.438	4.915	5.989	7.099	8.674	9.960	0.117	0
520	1.674	2.295	2.972	4.978	3.415	4.880	5.947	7.048	8.611	9.886	0.115	0
525	1.663	2.279	2.952	4.943	3.391	4.846	5.905	6.998	8.548	9.813	0.114	0
530	1.651	2.263	2.932	4.909	3.368	4.813	5.864	6.949	8.487	9.742	0.113	0
535	1.640	2.248	2.912	4.876	3.345	4.780	5.823	6.900	8.426	9.671	0.112	0
540	1.629	2.233	2.893	4.843	3.323	4.748	5.783	6.852	8.367	9.602	0.111	0
545	1.618	2.219	2.874	4.810	3.301	4.716	5.744	6.805	8.308	9.534	0.110	0
550	1.608	2.204	2.855	4.778	3.280	4.685	5.705	6.759	8.251	9.467	0.109	0
555	1.597	2.190	2.837	4.747	3.258	4.654	5.667	6.713	8.194	9.401	0.108	0
560	1.587	2.176	2.818	4.716	3.237	4.623	5.630	6.668	8.138	9.336	0.107	0
565	1.576	2.162	2.800	4.685	3.217	4.593	5.593	6.624	8.084	9.273	0.106	0
570	1.566	2.148	2.783	4.655	3.196	4.564	5.557	6.581	8.030	9.210	0.105	0
575	1.556	2.135	2.765	4.626	3.176	4.535	5.521	6.538	7.976	9.148	0.104	0
580	1.547	2.121	2.748	4.596	3.156	4.506	5.486	6.496	7.924	9.087	0.103	0
585	1.537	2.108	2.731	4.568	3.137	4.478	5.451	6.454	7.873	9.027	0.103	0
590	1.527	2.095	2.715	4.539	3.118	4.450	5.417	6.413	7.822	8.968	0.102	0
595	1.518	2.083	2.698	4.511	3.099	4.423	5.383	6.373	7.772	8.910	0.101	0
600	1.509	2.070	2.682	4.484	3.080	4.396	5.350	6.333	7.722	8.853	0.100	0
605	1.500	2.058	2.666	4.457	3.061	4.369	5.317	6.294	7.674	8.796	0.099	0
610	1.491	2.045	2.650	4.430	3.043	4.343	5.285	6.256	7.626	8.741	0.098	0
615	1.482	2.033	2.634	4.404	3.025	4.317	5.253	6.218	7.579	8.686	0.098	0
620	1.473	2.021	2.619	4.378	3.008	4.292	5.222	6.180	7.532	8.632	0.097	0
625	1.464	2.010	2.604	4.352	2.990	4.267	5.191	6.143	7.487	8.579	0.096	0
630	1.456	1.998	2.589	4.327	2.973	4.242	5.161	6.107	7.441	8.526	0.095	0
635	1.447	1.987	2.574	4.302	2.956	4.217	5.131	6.071	7.397	8.475	0.094	0
640	1.439	1.975	2.560	4.277	2.939	4.193	5.101	6.035	7.353	8.424	0.094	0
645	1.431	1.964	2.545	4.253	2.923	4.169	5.072	6.000	7.309	8.373	0.093	0
650	1.423	1.953	2.531	4.229	2.906	4.146	5.043	5.966	7.267	8.324	0.092	0
655	1.415	1.942	2.517	4.205	2.890	4.123	5.014	5.932	7.225	8.275	0.092	0
660	1.407	1.932	2.503	4.182	2.874	4.100	4.986	5.898	7.183	8.226	0.091	0
665	1.399	1.921	2.490	4.159	2.859	4.077	4.958	5.865	7.142	8.179	0.090	0
670	1.391	1.911	2.476	4.136	2.843	4.055	4.931	5.832	7.101	8.132	0.090	0
675	1.384	1.900	2.463	4.113	2.828	4.033	4.904	5.800	7.061	8.085	0.089	0
680	1.376	1.890	2.450	4.091	2.813	4.011	4.877	5.768	7.022	8.040	0.088	0
685	1.369	1.880	2.437	4.069	2.798	3.989	4.851	5.736	6.983	7.994	0.088	0
690	1.361	1.870	2.424	4.048	2.783	3.968	4.825	5.705	6.944	7.950	0.087	0
695	1.354	1.860	2.411	4.026	2.768	3.947	4.799	5.675	6.906	7.906	0.086	0
700	1.347	1.851	2.398	4.005	2.754	3.927	4.774	5.644	6.869	7.862	0.086	0
705	1.340	1.841	2.386	3.984	2.740	3.906	4.749	5.614	6.832	7.819	0.085	0
710	1.333	1.831	2.374	3.964	2.726	3.886	4.724	5.585	6.795	7.777	0.085	0
715	1.326	1.822	2.362	3.943	2.712	3.866	4.699	5.556	6.759	7.735	0.084	0
720	1.319	1.813	2.350	3.923	2.698	3.846	4.675	5.527	6.724	7.694	0.083	0
725	1.312	1.804	2.338	3.903	2.685	3.827	4.651	5.498	6.688	7.653	0.083	0
730	1.306	1.795	2.326	3.884	2.671	3.807	4.628	5.470	6.654	7.613	0.082	0
735	1.299	1.786	2.315	3.864	2.658	3.788	4.604	5.442	6.619	7.573	0.082	0
740	1.293	1.777	2.303	3.845	2.645	3.769	4.581	5.415	6.585	7.533	0.081	0
745	1.286	1.768	2.292	3.826	2.632	3.751	4.559	5.388	6.552	7.495	0.081	0
750	1.280	1.759	2.281	3.807	2.619	3.732	4.536	5.361	6.518	7.456	0.080	0
755	1.273	1.751	2.270	3.789	2.606	3.714	4.514	5.334	6.486	7.418	0.079	0
760	1.267	1.742	2.259	3.770	2.594	3.696	4.492	5.308	6.453	7.381	0.079	0
765	1.261	1.734	2.248	3.752	2.581	3.679	4.470	5.282	6.421	7.343	0.078	0
770	1.255	1.726	2.237	3.734	2.569	3.661	4.448	5.257	6.390	7.307	0.078	0
775	1.249	1.717	2.227	3.716	2.557	3.644	4.427	5.231	6.358	7.270	0.077	0
780	1.243	1.709	2.216	3.699	2.545	3.626	4.406	5.206	6.327	7.235	0.077	0
785	1.237	1.701	2.206	3.682	2.533	3.609	4.385	5.181	6.297	7.199	0.076	0
790	1.231	1.693	2.196	3.664	2.521	3.592	4.365	5.157	6.266	7.164	0.076	0
795	1.225	1.685	2.185	3.647	2.510	3.576	4.344	5.133	6.236	7.129	0.075	0
800	1.220	1.678	2.175	3.631	2.498	3.559	4.324	5.109	6.207	7.095	0.075	0
805	1.214	1.670	2.166	3.614	2.487	3.543	4.304	5.085	6.178	7.061	0.075	0
810	1.208	1.662	2.156	3.597	2.475	3.527	4.285	5.061	6.149	7.028	0.074	0
815	1.203	1.655	2.146	3.581	2.464	3.511	4.265	5.038	6.120	6.995	0.074	0
820	1.197	1.647	2.136	3.565	2.453	3.495	4.246	5.015	6.092	6.962	0.073	0
825	1.192	1.640	2.127	3.549	2.442	3.480	4.227	4.992	6.064	6.929	0.073	0
830	1.186	1.633	2.117	3.533	2.432	3.464	4.208	4.970	6.036	6.897	0.072	0
835	1.181	1.625	2.108	3.518	2.421	3.449	4.189	4.948	6.008	6.866	0.072	0
840	1.176	1.618	2.099	3.502	2.410	3.434	4.171	4.926	5.981	6.834	0.071	0
845	1.171	1.611	2.090	3.487	2.400	3.419	4.152	4.904	5.954	6.803	0.071	0
850	1.165	1.604	2.081	3.472	2.389	3.404	4.134	4.882	5.928	6.772	0.071	0
855	1.160	1.597	2.072	3.457	2.379	3.389	4.116	4.861	5.901	6.742	0.070	0
860	1.155	1.590	2.063	3.442	2.369	3.375	4.098	4.840	5.875	6.712	0.070	0
865	1.150	1.583	2.054	3.427	2.359	3.360	4.081	4.819	5.849	6.682	0.069	0
870	1.145	1.577	2.045	3.413	2.349	3.346	4.063	4.798	5.824	6.652	0.069	0
875	1.140	1.570	2.037	3.398	2.339	3.332	4.046	4.778	5.799	6.623	0.069	0
880	1.135	1.563	2.028	3.384	2.329	3.318	4.029	4.757	5.774	6.594	0.068	0
885	1.130	1.557	2.020	3.370	2.319	3.304	4.012	4.737	5.749	6.566	0.068	0
890	1.126	1.550	2.011	3.356	2.310	3.290	3.995	4.717	5.724	6.537	0.067	0
895	1.121	1.544	2.003	3.342	2.300	3.276	3.979	4.698	5.700	6.509	0.067	0
900	1.116	1.537	1.995	3.328	2.291	3.263	3.962	4.678	5.676	6.481	0.067	0
905	1.112	1.531	1.986	3.315	2.281	3.250	3.946	4.659	5.652	6.454	0.066	0
910	1.107	1.525	1.978	3.301	2.272	3.236	3.930	4.639	5.629	6.426	0.066	0
915	1.102	1.518	1.970	3.288	2.263	3.223	3.914	4.620	5.605	6.399	0.066	0
920	1.098	1.512	1.962	3.275	2.254	3.210	3.898	4.602	5.582	6.373	0.065	0
925	1.093	1.506	1.955	3.261	2.245	3.198	3.882	4.583	5.559	6.346	0.065	0
930	1.089	1.500	1.947	3.248	2.236	3.185	3.867	4.565	5.536	6.320	0.065	0
935	1.084	1.494	1.939	3.236	2.227	3.172	3.851	4.546	5.514	6.294	0.064	0
940	1.080	1.488	1.931	3.223	2.218	3.160	3.836	4.528	5.492	6.268	0.064	0
945	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
950	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
955	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
965	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
975	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
980	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
985	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
990	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
995	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
1000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0

TABULATION OF KINEMATIC WAVE $TI^{0.4}$

Duration (mins)	4EY	2EY	1EY	0.2EY	50% AEP	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP	0.2% AEP
1	4.420	5.077	5.720	7.247	6.098	7.190	7.882	8.535	9.377	10.011	5.144
2	8.397	9.631	10.796	13.618	11.493	13.510	14.786	15.988	17.511	18.652	7.796
3	11.993	13.807	15.522	19.593	16.529	19.438	21.276	23.008	25.213	26.864	9.943
4	15.339	17.710	19.965	25.231	21.268	25.032	27.409	29.650	32.516	34.666	11.817
5	18.503	21.404	24.179	30.590	25.765	30.349	33.243	35.973	39.476	42.109	13.510
6	21.525	24.929	28.204	35.714	30.062	35.432	38.825	42.024	46.142	49.241	15.071
7	24.432	28.316	32.069	40.637	34.189	40.316	44.189	47.843	52.554	56.101	16.532
8	27.242	31.585	35.798	45.387	38.171	45.029	49.365	53.458	58.741	62.723	17.911
9	29.968	34.752	39.408	49.984	42.024	49.590	54.375	58.893	64.730	69.132	19.222
10	32.623	37.830	42.913	54.446	45.766	54.017	59.238	64.168	70.543	75.351	20.477
11	35.213	40.830	46.325	58.787	49.407	58.324	63.968	69.300	76.195	81.399	21.682
12	37.746	43.759	49.653	63.019	52.958	62.522	68.579	74.301	81.704	87.291	22.844
13	40.228	46.624	52.905	67.152	56.427	66.622	73.081	79.184	87.080	93.041	23.968
14	42.663	49.431	56.087	71.194	59.821	70.633	77.483	83.958	92.335	98.661	25.057
15	45.055	52.185	59.207	75.153	63.147	74.560	81.794	88.632	97.478	104.159	26.117
16	47.407	54.890	62.267	79.035	66.410	78.412	86.020	93.213	102.518	109.546	27.148
17	49.722	57.550	65.274	82.846	69.615	82.192	90.167	97.708	107.462	114.830	28.153
18	52.003	60.168	68.231	86.590	72.765	85.907	94.241	102.124	112.317	120.016	29.136
19	54.253	62.747	71.140	90.273	75.865	89.560	98.247	106.464	117.087	125.112	30.096
19.5	55.366	64.022	72.579	92.092	77.397	91.365	100.226	108.607	119.443	127.628	30.569
20	56.472	65.289	74.006	93.897	78.918	93.156	102.189	110.734	121.779	130.123	31.037
22	60.828	70.271	79.617	100.985	84.892	100.188	109.895	119.079	130.945	139.909	32.864
23	62.968	72.716	82.366	104.455	87.818	103.631	113.666	123.161	135.427	144.692	33.752
24	65.084	75.131	85.081	107.879	90.708	107.028	117.386	127.188	139.847	149.409	34.625
25	67.177	77.519	87.763	111.259	93.562	110.382	121.058	131.161	144.207	154.061	35.483
26	69.249	79.881	90.414	114.598	96.382	113.694	124.685	135.085	148.511	158.651	36.328
27	71.300	82.218	93.036	117.898	99.170	116.968	128.267	138.960	152.762	163.184	37.160
28	73.332	84.532	95.629	121.160	101.928	120.204	131.809	142.790	156.961	167.662	37.980
29	75.344	86.822	98.195	124.387	104.656	123.405	135.310	146.576	161.111	172.086	38.788
30	77.339	89.091	100.736	127.579	107.357	126.572	138.773	150.320	165.214	176.459	39.585
31	79.316	91.339	103.252	130.738	110.031	129.707	142.200	154.024	169.273	180.784	40.372
32	81.277	93.567	105.744	133.866	112.680	132.810	145.593	157.689	173.288	185.063	41.148
33	83.222	95.776	108.214	136.964	115.304	135.883	148.951	161.318	177.262	189.297	41.915
34	85.151	97.967	110.662	140.032	117.904	138.928	152.278	164.912	181.197	193.488	42.672
35	87.066	100.140	113.089	143.073	120.482	141.944	155.574	168.471	185.093	197.637	43.421
36	88.966	102.295	115.495	146.087	123.038	144.934	158.839	171.998	188.952	201.747	44.161
37	90.852	104.434	117.882	149.075	125.573	147.899	162.076	175.492	192.776	205.818	44.893
38	92.725	106.557	120.251	152.038	128.087	150.838	165.286	178.957	196.566	209.852	45.617
39	94.585	108.665	122.601	154.976	130.582	153.754	168.468	182.391	200.323	213.851	46.334
40	96.432	110.757	124.934	157.892	133.058	156.646	171.625	185.798	204.048	217.814	47.043
41	98.267	112.835	127.249	160.785	135.516	159.516	174.757	189.176	207.742	221.745	47.745
42	100.090	114.899	129.549	163.656	137.955	162.364	177.864	192.528	211.406	225.643	48.441
43	101.901	116.950	131.832	166.505	140.378	165.192	180.948	195.854	215.041	229.509	49.129
44	103.702	118.987	134.100	169.335	142.784	167.999	184.009	199.155	218.648	233.346	49.812
45	105.491	121.012	136.353	172.144	145.174	170.786	187.048	202.432	222.227	237.153	50.488
46	107.270	123.023	138.591	174.934	147.548	173.554	190.065	205.685	225.781	240.931	51.158
47	109.038	125.023	140.815	177.705	149.906	176.303	193.062	208.915	229.308	244.681	51.823
48	110.797	127.011	143.025	180.458	152.250	179.034	196.039	212.122	232.811	248.405	52.481
49	112.545	128.988	145.222	183.193	154.579	181.748	198.996	215.308	236.289	252.102	53.135
50	114.284	130.953	147.406	185.911	156.895	184.444	201.933	218.473	239.744	255.773	53.783
55	122.843	140.621	158.142	199.257	168.273	197.685	216.351	234.000	256.685	273.772	56.948
60	131.193	150.046	168.598	212.231	179.348	210.557	230.358	249.074	273.119	291.222	60.000
65	139.356	159.254	178.803	224.876	190.154	223.102	244.000	263.746	289.104	308.187	62.952
70	147.348	168.266	188.783	237.224	200.717	235.353	257.313	278.056	304.686	324.717	65.814
75	155.185	177.099	198.559	249.304	211.061	247.337	270.330	292.040	319.903	340.853	68.596
80	162.878	185.769	208.148	261.140	221.204	259.079	283.076	305.727	334.789	356.631	71.304
85	170.439	194.288	217.566	272.751	231.163	270.599	295.575	319.141	349.371	372.082	73.946
90	177.877	202.667	226.826	284.156	240.953	281.914	307.846	332.306	363.675	387.233	76.525
95	185.200	210.917	235.939	295.370	250.584	293.039	319.906	345.238	377.721	402.106	79.049
100	192.415	219.045	244.916	306.406	260.069	303.988	331.770	357.956	391.528	416.721	81.519
105	199.530	227.059	253.764	317.276	269.418	314.773	343.452	370.474	405.113	431.096	83.941
110	206.549	234.966	262.492	327.991	278.637	325.404	354.963	382.804	418.489	445.247	86.317
115	213.478	242.773	271.108	338.561	287.736	335.890	366.313	394.959	431.670	459.189	88.650
120	220.322	250.484	279.616	348.993	296.720	346.239	377.513	406.949	444.668	472.933	90.943
125	227.085	258.104	288.024	359.295	305.597	356.461	388.570	418.782	457.493	486.491	93.198
130	233.771	265.638	296.336	369.475	314.372	366.560	399.492	430.469	470.154	499.873	95.417
135	240.384	273.091	304.557	379.538	323.049	376.544	410.287	442.016	482.661	513.089	97.602
140	246.926	280.465	312.691	389.491	331.635	386.418	420.960	453.430	495.021	526.147	99.756
145	253.402	287.765	320.743	399.338	340.132	396.188	431.519	464.719	507.241	539.056	101.878
150	259.813	294.994	328.715	409.085	348.544	405.857	441.967	475.887	519.329	551.821	103.972
155	266.162	302.154	336.612	418.736	356.877	415.432	452.309	486.941	531.290	564.451	106.038
160	272.452	309.248	344.436	428.294	365.132	424.915	462.552	497.885	543.129	576.950	108.077
165	278.685	316.279	352.191	437.765	373.313	434.311	472.698	508.724	554.853	589.325	110.091
170	284.863	323.249	359.879	447.151	381.422	443.623	482.752	519.463	566.465	601.581	112.080
175	290.988	330.160	367.502	456.455	389.464	452.854	492.716	530.105	577.971	613.722	114.047
180	297.062	337.015	375.063	465.682	397.439	462.008	502.596	540.655	589.374	625.754	115.991
185	303.086	343.816	382.564	474.833	405.350	471.086	512.394	551.115	600.679	637.679	117.914
190	309.062	350.563	390.007	483.911	413.201	480.093	522.112	561.490	611.889	649.504	119.815
195	314.993	357.260	397.394	492.919	420.991	489.030	531.754	571.781	623.007	661.230	121.697
200	320.878	363.907	404.727	501.860	428.725	497.900	541.323	581.992	634.038	672.862	123.560
205	326.720	370.506	412.007	510.735	436.403	506.705	550.820	592.127	644.983	684.402	125.404
210	332.520	377.058	419.237	519.546	444.027	515.447	560.248	602.186	655.845	695.854	127.231
215	338.279	383.566	426.417	528.296	451.598	524.128	569.610	612.173	666.628	707.221	129.040
220	343.998	390.029	433.549	536.987	459.119	532.750	578.906	622.090	677.334	718.506	130.832
225	349.678	396.450	440.635	545.620	466.591	541.315	588.141	631.940	687.965	729.710	132.608
230	355.321	402.830	447.676	554.196	474.015	549.824	597.314	641.723	698.524	740.837	134.368
235	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
240	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
245	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
250	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
255	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
260	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
265	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
270	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
275	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
280	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
285	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
290	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
295	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
305	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
310	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
315	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
320	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
325	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
330	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
335	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
340	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
345	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
350	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
355	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
360	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
365	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
370	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
375	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
380	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
385	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
390	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
395	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
400	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
405	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
410	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
415	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
420	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
425	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
430	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
435	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
440	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
445	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
450	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
455	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
460	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
465	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
470	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
475	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
480	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
485	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
490	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
495	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
505	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
510	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
515	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
520	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
525	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
530	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
535	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
540	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
545	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
550	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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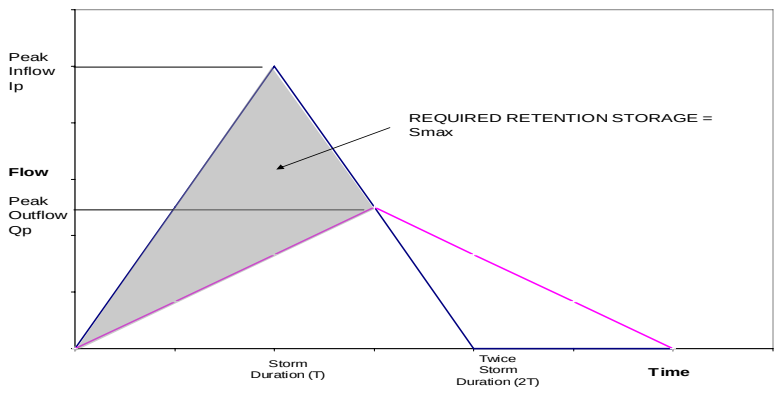
560	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
565	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
570	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
575	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
580	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
585	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
590	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
595	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
600	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
605	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
610	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
615	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
620	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
625	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
630	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
635	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
640	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
645	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
650	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
655	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
660	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
665	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
670	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
675	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
680	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
685	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
690	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
695	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
700	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
705	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
710	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
715	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
720	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
725	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
730	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
735	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
740	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
745	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
750	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
755	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
760	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
765	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
770	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
775	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
780	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
785	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
790	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
795	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
800	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
805	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
810	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
815	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
820	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
825	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
830	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
835	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
840	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
845	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
850	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
855	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
860	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
865	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
870	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
880	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
885	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
890	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
895	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
900	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
905	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
915	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
920	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
925	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
930	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
935	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
940	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
945	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
950	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
955	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
965	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
975	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
980	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
985	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
990	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
995	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Project reference	24101
Project Name	Tragowel BESS
Date	18-12-25
Resource	J Baumann
Description	1% Detention Storage

Catchment Area	7	ha
C (1%)	0.63	
Effective area	4.41	ha
Max outflow	0.4	m^3/s



STORAGE

Based on Boyds Formula:

$$Smax = v1(1 - \frac{Qp}{Ip})$$

Where….

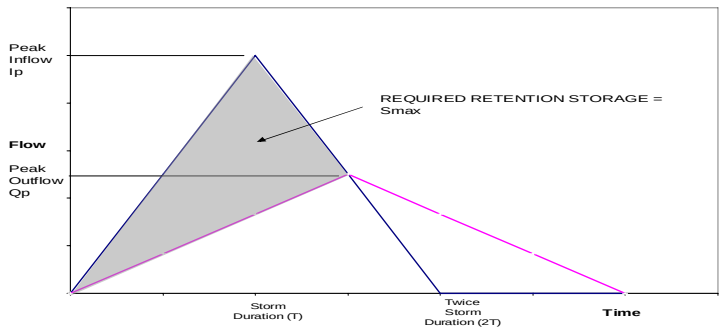
Smax =	Max Volume of Temporary Storage (cu,m)
V1 =	Co-Efficient of Runoff
I =	Volume of Inflow Flood (cu.m)
Ip =	Peak Discharge of Inflow Hydrograph (cu.m/s)
Qp =	Peak Discharge of Outflow Hydrograph (cu.m/s)

1,130 m^3 of storage required

Duration (min)	1% intensity (mm/hr)	Ip	Qp	V1	Smax
1	317.092	3.884375095	0.4	233.0625	210
2	265.597	3.25356519	0.4	390.4278	340
3	239.961	2.93952513	0.4	529.1145	460
4	221.114	2.708643765	0.4	650.0745	550
5	205.833	2.521451002	0.4	756.4353	640
6	192.946	2.363591949	0.4	850.8931	710
7	181.839	2.227529522	0.4	935.5624	770
8	172.123	2.108509516	0.4	1012.085	820
9	163.529	2.003229462	0.4	1081.744	870
10	155.858	1.909263297	0.4	1145.558	910
11	148.960	1.824763103	0.4	1204.344	940
12	142.717	1.748284679	0.4	1258.765	970
13	137.035	1.678676983	0.4	1309.368	1000
14	131.837	1.615008034	0.4	1356.607	1020
15	127.062	1.556513237	0.4	1400.862	1040
16	122.658	1.502558211	0.4	1442.456	1060
17	118.581	1.452611421	0.4	1481.664	1070
18	114.794	1.406223616	0.4	1518.722	1090
19	111.266	1.363012128	0.4	1553.834	1100
19.5	109.591	1.342493075	0.4	1570.717	1100
20	107.971	1.322648706	0.4	1587.178	1110
22	101.989	1.249369891	0.4	1649.168	1120
23	99.265	1.215993636	0.4	1678.071	1130
24	96.697	1.184532765	0.4	1705.727	1130
25	94.271	1.154821195	0.4	1732.232	1130
26	91.976	1.126711928	0.4	1757.671	1130
27	89.802	1.100074342	0.4	1782.12	1130
28	87.738	1.074791939	0.4	1805.65	1130
29	85.776	1.050760457	0.4	1828.323	1130
30	83.909	1.027886275	0.4	1850.195	1130
31	82.129	1.006085078	0.4	1871.318	1130
32	80.431	0.985280704	0.4	1891.739	1120
33	78.809	0.965404174	0.4	1911.5	1120
34	77.257	0.946392848	0.4	1930.641	1110
35	75.771	0.928189708	0.4	1949.198	1110
36	74.346	0.91074273	0.4	1967.204	1100
37	72.980	0.894004341	0.4	1984.69	1100
38	71.668	0.877930949	0.4	2001.683	1090
39	70.407	0.862482529	0.4	2018.209	1080
40	69.194	0.84762226	0.4	2034.293	1070
41	68.026	0.833316209	0.4	2049.958	1070
42	66.901	0.819533046	0.4	2065.223	1060
43	65.816	0.806243801	0.4	2080.109	1050
44	64.769	0.793421639	0.4	2094.633	1040
45	63.759	0.781041667	0.4	2108.812	1030
46	62.782	0.769080757	0.4	2122.663	1020
47	61.838	0.757517396	0.4	2136.199	1010
48	60.925	0.746331537	0.4	2149.435	1000
49	60.041	0.735504485	0.4	2162.383	990
50	59.185	0.725018775	0.4	2175.056	980
55	55.279	0.677173541	0.4	2234.673	910
60	51.902	0.635799327	0.4	2288.878	850
65	48.950	0.599638729	0.4	2338.591	780
70	46.346	0.56774383	0.4	2384.524	700
75	44.031	0.539385831	0.4	2427.236	630

Project reference	24101
Project Name	Tragowel BESS
Date	18-12-25
Resource	J Baumann
Description	1% Detention Storage--Climate Change

Catchment Area	7	ha
C (1%)	0.63	
Effective area	4.41	ha
Max outflow	0.6	m^3/s



STORAGE

Based on Boyds Formula:

$$Smax = v1(1 - \frac{Qp}{Ip})$$

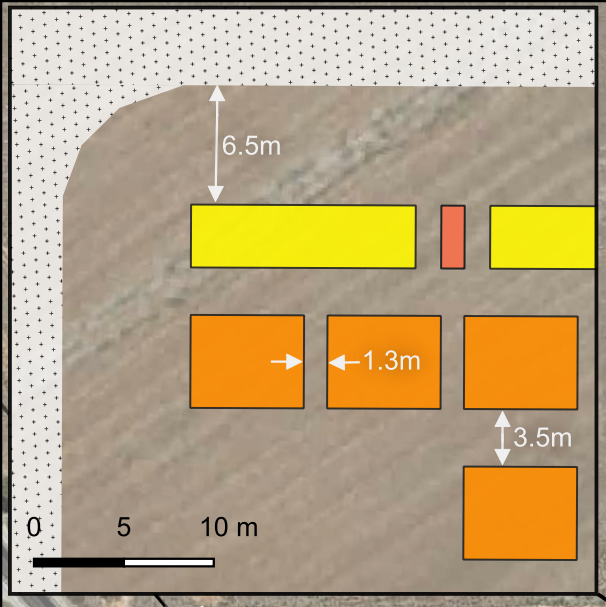
Where….

Smax =	Max Volume of Temporary Storage (cu,m)
V1 =	Co-Efficient of Runoff
I =	Volume of Inflow Flood (cu.m)
Ip =	Peak Discharge of Inflow Hydrograph (cu.m/s)
Qp =	Peak Discharge of Outflow Hydrograph (cu.m/s)

1560 m^3 of storage required

Duration (min)	1% intensity (mm/hr) Adjusted for climate change	Ip	Qp	V1	Smax
1	450.270	5.515812635	0.6	330.9488	290
2	377.148	4.620062569	0.6	554.4075	480
3	340.745	4.174125685	0.6	751.3426	640
4	313.982	3.846274146	0.6	923.1058	780
5	292.282	3.580460423	0.6	1074.138	890
6	273.984	3.356300568	0.6	1208.268	990
7	258.212	3.163091921	0.6	1328.499	1080
8	244.415	2.994083512	0.6	1437.16	1150
9	232.211	2.844585837	0.6	1536.076	1210
10	221.319	2.711153882	0.6	1626.692	1270
11	211.524	2.591163606	0.6	1710.168	1310
12	202.658	2.482564244	0.6	1787.446	1360
13	194.589	2.383721315	0.6	1859.303	1390
14	187.209	2.293311409	0.6	1926.382	1420
15	180.428	2.210248796	0.6	1989.224	1450
16	174.174	2.133632659	0.6	2048.287	1470
17	168.384	2.062708217	0.6	2103.962	1490
18	163.007	1.996837535	0.6	2156.585	1510
19	157.998	1.935477222	0.6	2206.444	1520
19.5	155.620	1.906340166	0.6	2230.418	1530
20	153.319	1.878161163	0.6	2253.793	1530
22	144.825	1.774105245	0.6	2341.819	1550
23	140.956	1.726710963	0.6	2382.861	1550
24	137.309	1.682036527	0.6	2422.133	1560
25	133.865	1.639846097	0.6	2459.769	1560
26	130.607	1.599930937	0.6	2495.892	1560
27	127.519	1.562105565	0.6	2530.611	1560
28	124.588	1.526204554	0.6	2564.024	1560
29	121.802	1.492079849	0.6	2596.219	1550
30	119.151	1.459598511	0.6	2627.277	1550
31	116.624	1.428640811	0.6	2657.272	1540
32	114.212	1.3990986	0.6	2686.269	1530
33	111.908	1.370873927	0.6	2714.33	1530
34	109.704	1.343877844	0.6	2741.511	1520
35	107.594	1.318029386	0.6	2767.862	1510
36	105.572	1.293254676	0.6	2793.43	1500
37	103.632	1.269486164	0.6	2818.259	1490
38	101.768	1.246661947	0.6	2842.389	1470
39	99.978	1.224725191	0.6	2865.857	1460
40	98.255	1.203623609	0.6	2888.697	1450
41	96.597	1.183309017	0.6	2910.94	1430
42	94.999	1.163736926	0.6	2932.617	1420
43	93.458	1.144866198	0.6	2953.755	1410
44	91.972	1.126658727	0.6	2974.379	1390
45	90.537	1.109079166	0.6	2994.514	1370
46	89.151	1.092094675	0.6	3014.181	1360
47	87.810	1.075674702	0.6	3033.403	1340
48	86.514	1.059790783	0.6	3052.197	1320
49	85.258	1.044416369	0.6	3070.584	1310
50	84.043	1.029526661	0.6	3088.58	1290
55	78.497	0.961586428	0.6	3173.235	1190
60	73.701	0.902835045	0.6	3250.206	1090
65	69.509	0.851486996	0.6	3320.799	980
70	65.812	0.806196238	0.6	3386.024	870
75	62.525	0.76592788	0.6	3446.675	750

Appendix D Development Plans



Vegetation screening

482m

21m

30m

17m

40m

30m

Detention basin

Storage volume to be determined in detail design.
Aggregate min requirement: 1,600m3

10m

13m

Business Identification Signage to be erected here

Fire water tank

On-site substation

Primary Access (45m)

LODDON VALLEY HIGHWAY

Water channel

Temporary laydown area

10m

Harmonic filter

Control building

Detention basin

Storage volume to be determined in detail design. Aggregate min requirement: 1,600m3

O&M

8m

Power control system

24m

Battery unit

Secondary Access (31m)

26m

Fence

Power conversion system

245m

18m

4.1m

BESS Concept Layout Plan

0 50 100 m

2405 - Tragowel BESS

LEGEND

Project Site

- BESS Development Area
- Transmission Development Area

Proposed Infrastructure

- Underground transmission line
- Battery unit
- Power conversion system
- Power control systems
- Harmonic filter
- Control building
- Operations and maintainance
- On site substation
- Water tanks
- Vegetation screening
- Fire Hydrants
- Fence
- Temporary laydown area
- Access roads

Existing Features

- Impacted native vegetation
- Roads
- Rail line
- Water channel
- Surveyor title boundary
- VicPlan title boundary

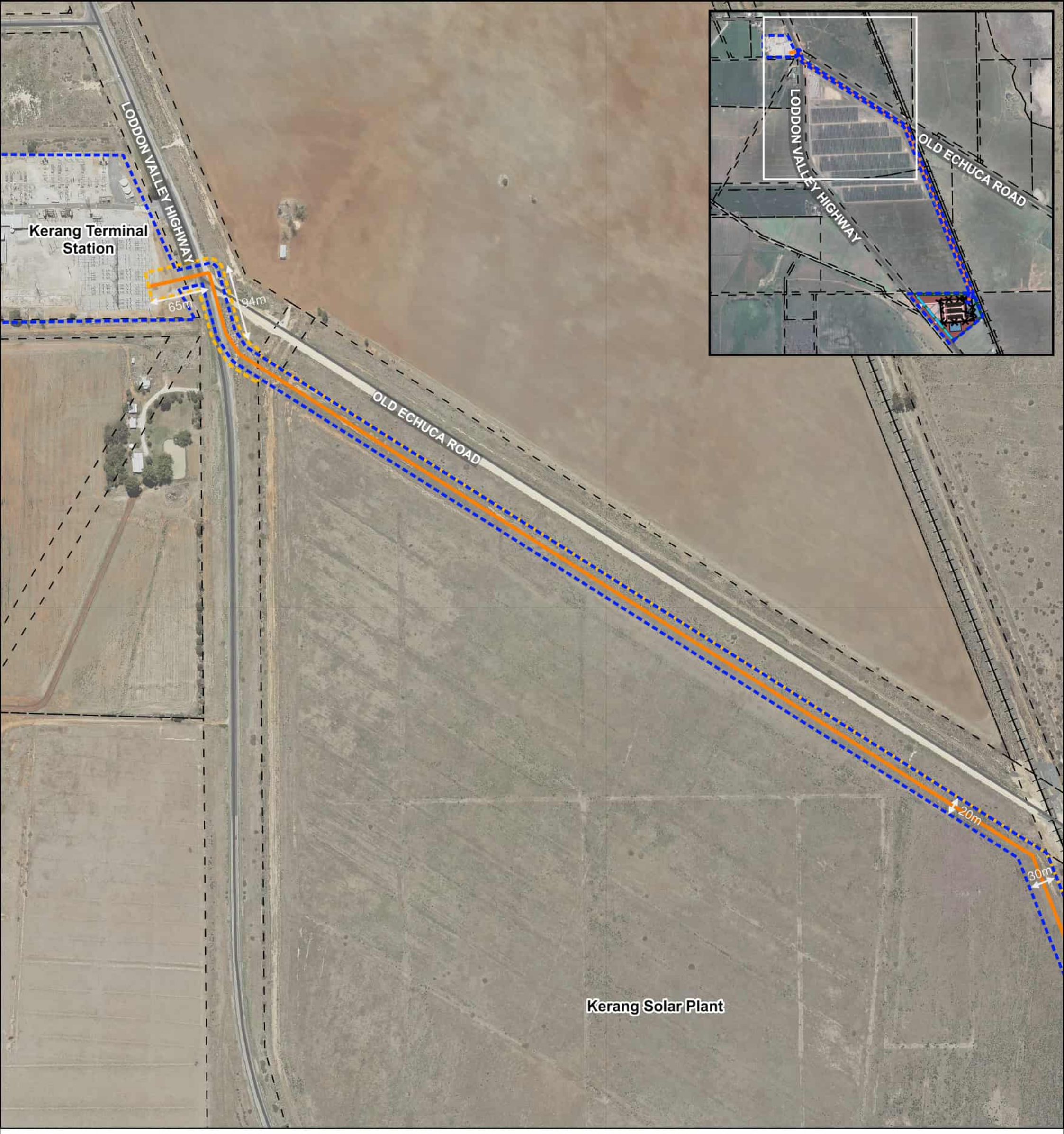
ADVERTISED PLAN

Version: 1.3

Date: 15/04/2026

Disclaimer: This plan is preliminary and subject to detailed studies and approval.

cogency



Transmission route - northern extent

0 100 200 m

2405 - Tragowel BESS

LEGEND

Proposal

- Project Site
- Transmission Development Area
- Transmission Cable Route

Existing Features

- Roads
- Rail line
- Cadastre

Version: 1.3

Date: 14/04/2026

Disclaimer: This plan is preliminary and subject to detailed studies and approval.

ADVERTISED PLAN

cogency

Transmission route - southern extent

0 100 200 m

2405 - Tragowel BESS

LEGEND

- Project Site
- Transmission Cable Route
- BESS Development Area
- Transmission Development Area

Proposed Infrastructure

- Vegetation Screening

Existing Features

- Impacted Native Vegetation
- Roads
- Rail line
- Cadastre

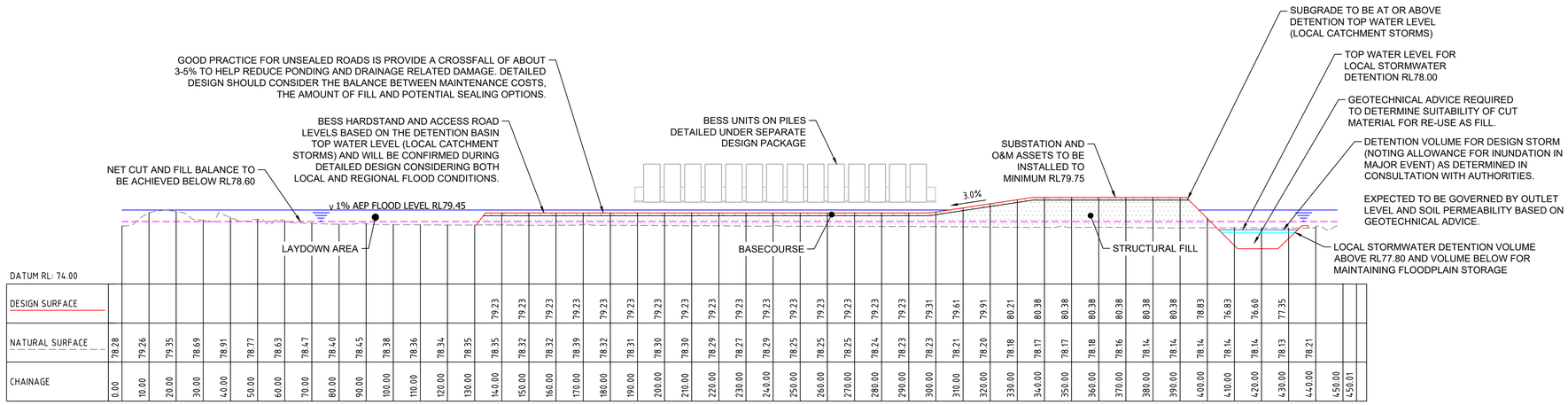
ADVERTISED PLAN

Version: 1.3

Date: 14/04/2026

Disclaimer: This plan is preliminary and subject to detailed studies and approval.

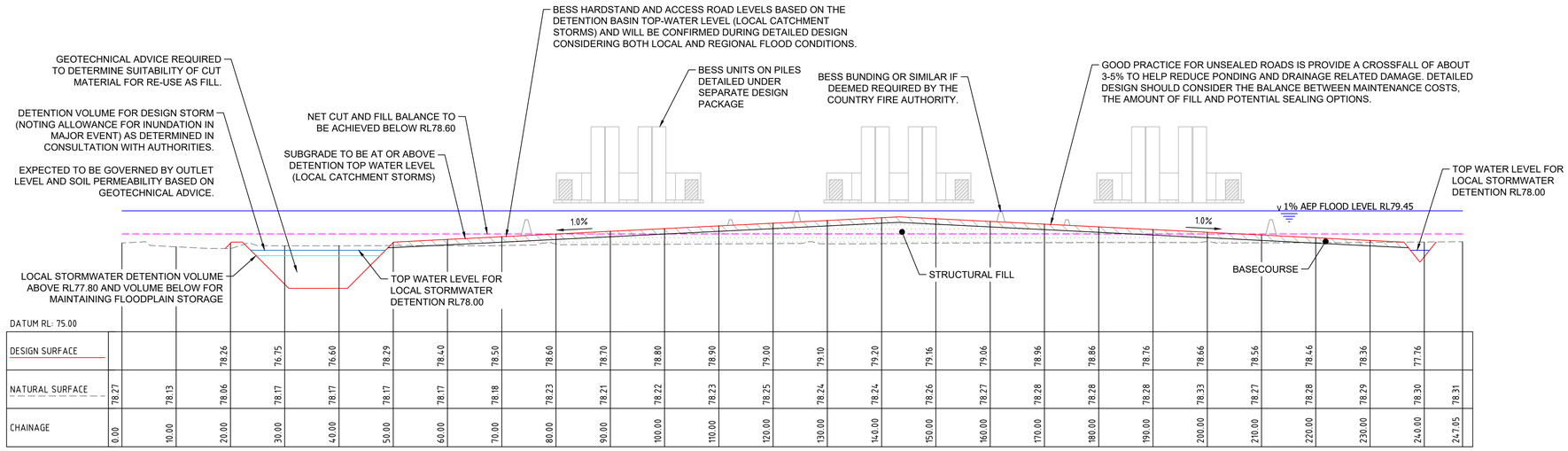
cogency



DATUM RL: 74.00

CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	250.00	260.00	270.00	280.00	290.00	300.00	310.00	320.00	330.00	340.00	350.00	360.00	370.00	380.00	390.00	400.00	410.00	420.00	430.00	440.00	450.00	450.01
NATURAL SURFACE	78.28	79.26	79.35	78.69	78.91	78.77	78.63	78.47	78.40	78.45	78.38	78.36	78.34	78.35	78.35	78.32	78.32	78.39	78.32	78.31	78.30	78.30	78.29	78.27	78.29	78.25	78.25	78.25	78.24	78.23	78.23	78.21	78.20	78.18	78.17	78.17	78.18	78.16	78.14	78.14	78.14	78.14	78.14	78.13	78.21		
DESIGN SURFACE															79.23	79.23	79.23	79.23	79.23	79.23	79.23	79.23	79.23	79.23	79.23	79.23	79.23	79.23	79.23	79.23	79.31	79.61	79.91	80.21	80.38	80.38	80.38	80.38	80.38	80.38	80.38	80.38	76.83	76.60	77.35			

SECTION A
SCALE H=1:1000, V=1:200 — 0001



DATUM RL: 75.00

CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	247.05
NATURAL SURFACE	78.27	78.13	78.06	78.17	78.17	78.17	78.17	78.18	78.23	78.21	78.22	78.23	78.25	78.24	78.24	78.26	78.27	78.28	78.28	78.28	78.33	78.27	78.28	78.29	78.30	78.31
DESIGN SURFACE			78.26	76.75	76.60	78.29	78.40	78.50	78.60	78.70	78.80	78.90	79.00	79.10	79.20	79.16	79.06	78.96	78.86	78.76	78.66	78.56	78.45	78.36	77.76	

SECTION B
SCALE H=1:500, V=1:100 — 0001

ADVERTISED PLAN

LEGEND

(EXISTING)
- 1% AEP FLOOD LEVEL
- NET CUT AND FILL LEVEL
- NATURAL SURFACE

(PROPOSED)
- FINISHED SURFACE
- TOP WATER LEVEL
- FLOODPLAIN STORAGE LEVEL
- SUBBASE SURFACE

10 Meters 8 6 4 2 0 — Scale 1:100
20 Meters 16 12 8 4 0 — Scale 1:200
0 10 20 30 40 50 Meters — Scale 1:500
0 20 40 60 80 100 Meters — Scale 1:1000

APD GLOBAL

CLIENT	REV	DATE	DESCRIPTION	DRAWN	CHECKED	REVIEWED	VERIFIED
potentia energy	A	12/12/2025	PRELIMINARY ISSUE	K.NAVARRO	G.SPELDEWINDE	----	
	B	08/01/2026	DRAWINGS UPDATED	K.NAVARRO	G.SPELDEWINDE	----	
	C	22/04/2026	PRELIMINARY ISSUE	K.NAVARRO	G.SPELDEWINDE	----	

ORIGINATOR	CERTIFIER'S NAME	ENTITY	REG NO.
MAD3 ENGINEERING			

SCALE	AS SHOWN
SIZE	A1
DESIGNED	G.SPELDEWINDE

NOTE:
DIMENSIONS IN METERS
PRINT IN COLOR

TYPE	STATUS
	DRAFT

PROJECT	TRAGOWEL BESS PROJECT
SHEET TITLE	TYPICAL SECTIONS
POTENTIA DRG NO.	TRGWLES-APDE-DRG-CVGN-0004
EXTERNAL DRG NO.	30501-CI-E02