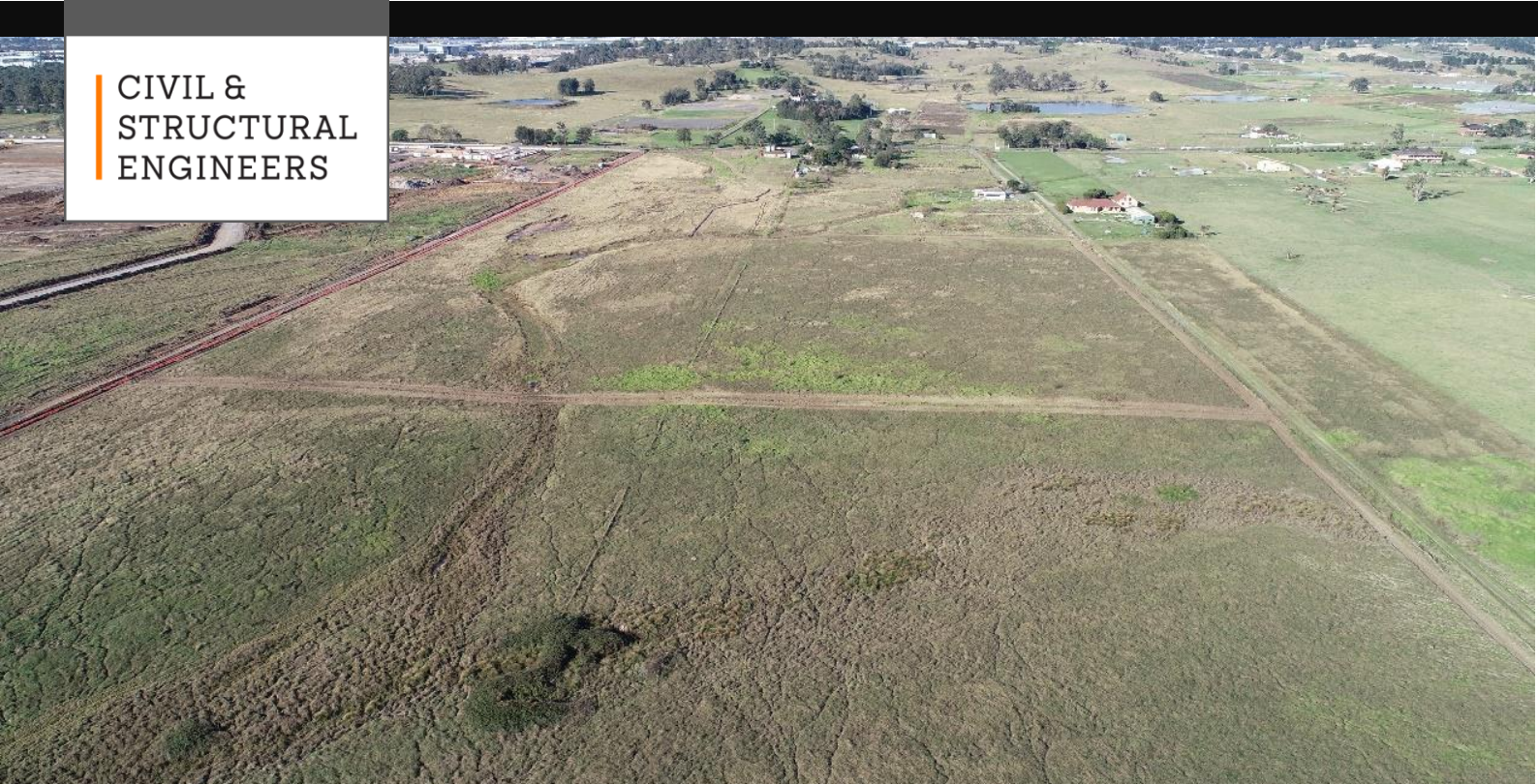


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**CIVIL &
STRUCTURAL
ENGINEERS**



CIVIL ENGINEERING REPORT INCORPORATING WATER CYCLE MANAGEMENT STRATEGY

DEVELOPMENT SITE

**YIRIBANA LOGISTICS ESTATE WEST
771 -797 & 754-786 MAMRE RD,
KEMPS CREEK, NSW**

Prepared for:

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Rev: E

DOCUMENT VERIFICATION	
Project Title	'Yiribana Logistics Estate West' - 771 Mamre Road, Kemps Creek
Document Title	Civil Engineering Report Incorporating Water Cycle Management Strategy
Project No.	Co14429.00
Description	Report for proposed industrial subdivision development
Client Contact	The GPT Group – Mr Alex Cassaniti

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Prepared by	Mark Wilson	
Checked by	Mark Wilson Mitchell Cross	
Issued by	Mark Wilson	
File Name	14429.00-03e.rpt	

Document History

Date	Revision	Issued to	No. Copies
02 Dec. 2022	DRAFT	The GPT Group, Mr Matt Jordan	PDF
20 Dec. 2022	A	The GPT Group, Mr Matt Jordan	PDF
24 July 2023	DRAFT_B	The GPT Group, Mr Matt Jordan	PDF
25 July 2023	B	The GPT Group, Mr Matt Jordan	PDF
28 July 2023	C	The GPT Group, Mr Matt Jordan	PDF
22 Dec 2023	D	The GPT Group, Mr Alex Cassaniti	PDF
02 Feb 2024	E	The GPT Group, Mr Alex Cassaniti	PDF

EXECUTIVE SUMMARY

The GPT Group (GPT - the Applicant) is seeking to establish a state-of-the art logistics park – “Yiribana Logistics Estate West” - located at 771 & 783-797 Mamre Road, Kemps Creek. The Applicant is proposing to develop the land for industrial development within the Mamre Road Precinct.

The Proposal will be submitted to and assessed by Penrith City Council. This Water and Hydrology Assessment has been prepared by Costin Roe Consulting to support the preparation of the Development Application submission and to assess the Proposal’s impact on the surrounding environment in relation to soils and water including stormwater and stormwater management for both construction and operational phases of the development.

Proposal overview

The proposed development is for an industrial estate, earthworks and infrastructure for industrial development of two buildings over an area of 5.7 Ha. Infrastructure works will include bulk earthworks, provision of services, road & intersection construction, and stormwater management and has been completed in accordance with the Development Masterplan.

The preliminary masterplan layout provided by The GPT Group shows development lots will vary between 2.2 Ha and 2.4 Ha in size. Siting of the development lots will be sympathetic to the topography of the land, access and flood planning requirements.

Access to all lots would be made via the precinct collector road currently being constructed on the SSD-9522 development (The Yards Estate) which abuts the northern boundary of the property. The new access road and associated intersection will be constructed to be consistent with the Mamre Road Precinct Development Control Plan (MRP DCP) 2021.

Purpose of this assessment

This engineering report has been prepared to address the engineering requirements of Council and MRP DCP as they related to water and hydrology, including:

- Stormwater Management including stormwater quantity and quality during operation;
- Flooding; and
- Stormwater Management, including Erosion & Sediment Control during construction.

Construction impacts

During the construction phase, a Sediment and Erosion Control Plan will be in place to ensure the downstream drainage system and receiving waters are protected from sediment laden runoff.

Operational impacts

During the operational phase of the development, the proposed stormwater quality treatment system incorporating the use of a treatment train of gross pollutant traps (GPT’s) and bio-retention filtration is proposed to mitigate any increase in stormwater pollutant load generated by the development. Best management practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

Consultation and coordination of civil engineering and stormwater strategies has been completed with respective landowners to the north and east of the project and their respective civil engineering consultants. This includes discussion and coordination with the

developers of the Yards Estate (Frasers Property Australia and Altis Property Partners), Gibb Group and the private landowner to the south.

The stormwater management solution considers discharge from the development site consistent with best practice, the MRP DCP and DPE MUSIC Modelling Toolkit (MARV and FDC targets) for both the current proposed development, and the final stormwater management targets. The design does not currently include any allowances in relation to the precinct wetland system being contemplated by Sydney Water due to the details of this system still being consolidated and unknown at time of writing. The designs and assessments have been consulted with Sydney Water, noting the trunk drainage arrangement has been reviewed and agreed in principle with Sydney Water.

Further it has been confirmed that the development meets flood and overland flow planning requirements. The development does not impact or encroach on existing flood affected areas (as confirmed in TUFLOW flooding assessment completed by Costin Roe Consulting). The modelling shows that local post development flows from the site, in conjunction with the flood management measures to be adopted in the flooding assessment demonstrates that the site discharge will not adversely affect any land, drainage system or watercourse as a result of the development.

Conclusion

The hydrological assessment of the local site drainage confirms that recommended water quality and quantity measures will ensure that no adverse impacts result on receiving waterways as a result of the development.

The detail contained in this report provides sufficient information to show the consent authority that legal points of discharge and a suitable stormwater management strategy is available for the development and the requirements associated with the strategy. It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

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1 INTRODUCTION & SCOPE

1.1 Introduction

Costin Roe Consulting Pty Ltd has been commissioned by The GPT Group to undertake a *Civil Engineering Report & Water Cycle Management Strategy* (WCMS) to accompany a Development Application (DA) to Penrith City Council for the Stage 1 industrial development of the land.

This report presents a civil engineering assessment of a property bounded by Lot 23 Lot 24 DP258414 Mamre Road, Erskine Park. The development will be referred to '*The Yiribana logistics Estate West*' in this report.

This report provides an assessment of the civil engineering characteristics of the development site and technical considerations of the following aspects:

- Earthworks & Geotechnical;
- Roads and Access;
- Water Cycle Management Strategy (WCMS).

The WCMS comprises several key areas of stormwater and water management which are provided below. These key areas have been established with the aim to reduce impacts from the development on the surrounding environment and neighbouring properties. The water cycle management strategy identifies the management measures required to meet the targets set. The key water cycle management areas assessed in this report are:

- Storm Water Quantity;
- Storm Water Quality;
- Water Supply and Reuse;
- Flooding; and
- Erosion and Sediment Control

This engineering analysis is based on development for industrial warehouse and logistic facilities consistent with industrial estates in the surrounding areas, the MRP DCP, The Sydney Water Precinct Scheme Plan and indicative Masterplan provided by The GPT Group.

Revision B of this report has been prepared to align the designs with the trunk drainage arrangement agreed in principle with Sydney Water during consultation, and to address items included in the Penrith City Council request for information letter dated 19 June 2023.

1.2 Consultation

Consideration to the anticipated development levels, road and drainage requirements on the adjacent sites to the north, east and south contemplated by adjoining landowner/ developers Fraser Property Australia/ Altis Property Partners (north), and the private landowner to the south, and Gibb Group. This has been made through consultation, where possible, with these respective parties throughout the concept design development and DA assessment.

Consultation with landowners Fraser Property Australia (north) has been completed in the form of meetings between the developers and their Civil Engineering Consultants, and the sharing of information between the parties. The shared information has been used to

coordinate alignments of road connections, drainage connections, interfacing of levels on boundaries and ensuring coordination of strategy pertaining to stormwater managements and overall civil works.

Reference to the civil engineering drawings included in **Appendix A** shows overlays and coordination of the various DA designs submitted for approval by the respective landowners.

Consultation has also been completed with stakeholders including Penrith City Council and Sydney Water.

1.3 DCP Compliance

This report supports the EIS for the proposal and submission to Penrith City Council, noting the land is subject to the requirements of the *Mamre Road Precinct Development Control Plan* (MRP DCP) which was adopted in December 2021.

Table 1.1 provides a summary of the *Mamre Road Precinct Development Control Plan* which relate to water and hydrology, and where these have been addressed in this report.

Table 1.1. MRP DCP Compliance Table

Provisions	Response	Compliance
2.4 Integrated Water Cycle Management		
Waterway health and Water Sensitive Urban Design <i>Development applications must demonstrate compliance with the stormwater quality targets in Table 4 and the stormwater flow targets during construction and operation phases in Table 5 and Table 6 at the lot or estate scale to ensure the NSW Government's waterway objectives (flow and water quality) for the Wianamatta-South Creek catchment are achieved (see Appendix D). Where the strategy for waterway management is assessed at an estate level, the approval should include for individual buildings within the estate, which may be the subject of future applications.</i>	Refer Section 5.1 and 6.3 of this report where stormwater management and stream health are discussed. We note additional site-specific requirements for this site to meet the FDC and MARV and water quality targets set out in the MRP DCP and Table 5.1 of this report.	Yes
<i>The stormwater flow targets during operation phase (Table 5) include criteria for a mean annual runoff volume (MARV) flow-related option and a flow duration-related option. Applicants must demonstrate compliance with either option.</i>	Refer Section 5.1 and 6.3 of this report where stormwater management and stream health are discussed. We note additional site-specific requirements for this site to meet the FDC and MARV and water quality targets set out in the MRP DCP and Table 5.1 of	Yes

Provisions	Response	Compliance
	this report.	
<i>Development applications must include a Water Management Strategy (WMS) detailing the proposed Water Sensitive Urban Design (WSUD) approach, how the WMS complies with stormwater targets (i.e. MUSIC modelling), and how these measures will be implemented, including ongoing management and maintenance responsibilities. Conceptual designs of the stormwater drainage and WSUD system must be provided to illustrate the functional layout and levels of the WSUD systems to ensure the operation has been considered in site levels and layout.</i>	A detailed WMS is included in the report as defined in Section 5.1 and further discussed in Sections 5, 6 & 7 of this report. Technical information pertaining to the MUSIC modelling is included in Appendix B. All management and maintenance responsibility remains with the applicant.	Yes
<i>The design and mix of WSUD infrastructure shall consider ongoing operation and maintenance. Development applications must include a detailed lifecycle cost assessment (including capital, operation/maintenance, and renewal costs over 30 years) and Maintenance Plan for WSUD measures.</i>	A mix of WSUD infrastructure has been proposed for the estate including bio-retention, storage pond, proprietary filters, roofwater reuse tanks and a detention tank. Refer Section 5 and further discussed in Sections 5, 6 & 7 of this report. A draft maintenance plan is provided in Section 7.5 and Appendix D.	Yes
<i>WSUD infrastructure may be adopted at a range of scales (i.e. allotment, street, estate, or sub-precinct scale) to treat stormwater, integrate with the landscape and maximise evaporative losses to reduce development flow runoff. Vegetated WSUD measures, naturalised trunk drainage and rainwater/stormwater reuse are preferred. Acceptable WSUD measures to retain stormwater within the development footprint and subdivision are shown in Table 7.</i>	A mix of WSUD infrastructure has been proposed for the estate including bio-retention, storage pond, proprietary filters, roofwater reuse tanks and a detention tank. Technical information pertaining to the MUSIC modelling is included in Appendix B. Refer Section 5 and further discussed in Sections 5, 6 & 7 of this report.	Yes
<i>Development must not adversely impact soil salinity or sodic soils and shall balance the needs</i>	Assessments of salinity and sodic soils are included in	Yes

Provisions	Response	Compliance
<i>of groundwater dependent ecosystems.</i>	submission. Refer to separate report by the geotechnical and environmental consultants. The development proposes a detailed surface water runoff system and subsoil system as per the recommendation of the reporting completed by Costin Roe Consulting	
<i>Infiltration of collected stormwater is generally not supported due to anticipated soil conditions in the catchment. All WSUD systems must incorporate an impervious liner unless a detailed Salinity and Sodidity Assessment demonstrates infiltration of stormwater will not adversely impact the water table and soil salinity (or other soil conditions).</i>	Impervious liners are proposed for the bio-retention elements. An infiltration rate of 0.01mm/day is included in the pond node based on the Wiannamatta Technical Guidelines for Achieving WSUD and MUSIC modelling document.	Yes
<i>Where development is not serviced by a recycled water scheme, at least 80% of its non-potable demand is to be supplied through allotment rainwater tanks.</i>	Reuse is currently proposed to achieve 80% reuse. The current assessment and measures do not contemplate the regional scheme being proposed by Sydney Water.	Yes
<i>Where a recycled water scheme (supplied by stormwater harvesting and/or recycled wastewater) is in place, development shall: Be designed in a manner that does not compromise waterway objectives, with stormwater harvesting prioritised over reticulated recycled water;</i>	The proposed rainwater reuse system will be completed in conjunction with the requirements for water quality and stream health as set out in the MRP DCP and Section 5.1 of this report.	Yes
<i>Bring a purple pipe for recycled water to the boundary of the site, as required under Clause 33G of the WSEA SEPP. Not top up rainwater tanks with recycled water unless approved by Sydney Water; and</i>	Provision of services to the site are provided in the estate designs and infrastructure report prepared by others. The inclusion of purple pipe will be integrated into the detail design of the development	N/A
<i>Design recycled water reticulation to standards required by the operator of the recycled water</i>	Detail design will be completed	To future

Provisions	Response	Compliance
scheme.	to the relevant standards.	detail
Trunk Drainage Infrastructure <i>Indicative naturalised trunk drainage paths are shown in Figure 4.</i>	Trunk Drainage systems for the estate have been allowed for consistent with the MRP DCP and the arrangement as consulted and agreed with Sydney Water. There are two flow paths considered for this site. The southernmost flow path, which has associated RE1 zoning is proposed to be realigned. Modelling and engineering drawings reflect how this can be effectively relocated in accordance with the MRP DCP. It is noted that the trunk drainage connection between Mamre Road and the South Creek Floodplain on the north of the site is provided in the form of a naturalised open channel flow path. Modelling has confirmed the 1% AEP flows can be accommodated safely on the site in accordance with the DCP requirements.	Yes
<i>Naturalised trunk drainage paths are to be provided when the:</i> <i>Contributing catchment exceeds 15ha; or</i>	Trunk Drainage systems for the estate have been allowed for consistent with the MRP DCP and the arrangement as consulted and agreed with Sydney Water as discussed above. There are two flow paths considered for this site. The southern most flow path, which has associated RE1 zoning is proposed to be realigned. Modelling and	Yes

Provisions	Response	Compliance
	engineering drawings reflect how this can be effectively relocated in accordance with the MRP DCP. It is noted that the trunk drainage connection between Mamre Road and the South Creek Floodplain on the north of the site is provided in the form of a naturalised open channel flow path. Modelling has confirmed the 1% AEP flows can be accommodated safely on the site in accordance with the DCP requirements.	
<i>1% AEP overland flows cannot be safely conveyed overland as described in Australian Rainfall and Runoff – 2019;</i> <i>unless otherwise agreed by the consent authority.</i>	Trunk Drainage systems for the estate have been allowed for consistent with the MRP DCP and the arrangement as consulted and agreed with Sydney Water. There are two flow paths considered for this site. The southernmost flow path, which has associated E2 zoning is proposed to be realigned. Modelling and engineering drawings reflect how this can be effectively relocated in accordance with the MRP DCP. It is noted that the trunk drainage connection between Mamre Road and the South Creek Floodplain on the north of the site is provided in the form of a naturalised open channel flow path. Modelling has confirmed the 1% AEP flows can be accommodated safely on the site in accordance with the DCP requirements.	Yes
<i>The design and rehabilitation of naturalised trunk drainage paths is to be generally in accordance</i>	Trunk Drainage systems for the estate have been allowed for	Yes

Provisions	Response	Compliance
<i>with NRAR requirements (refer to Section 2.3) that replicates natural Western Sydney streams. An example of a naturalised trunk drainage path is shown in Figure 3.</i>	consistent with the MRP DCP and the arrangement as consulted and agreed with Sydney Water. There are two flow paths considered for this site. The southernmost flow path, which has associated RE1 zoning is proposed to be realigned. Modelling and engineering drawings reflect how this can be effectively relocated in accordance with the MRP DCP. It is noted that the trunk drainage connection between Mamre Road and the South Creek Floodplain on the north of the site is provided in the form of a naturalised open channel flow path. Modelling has confirmed the 1% AEP flows can be accommodated safely on the site in accordance with the DCP requirements. Allowance for riparian zone rehabilitation to the southern drainage path FP2 is documented by the landscape architect.	
<i>Naturalised trunk drainage paths shall be designed to:</i> <i>Contain the 50% AEP flows from the critical duration event in a low flow natural invert;</i>	A low flow channel has been considered for the two trunk drainage paths.	Yes
<i>Convey 1% AEP flows from the critical duration event with a minimum 0.5m freeboard to applicable finished floor levels and road/driveway crossings; and</i>	Conveyance of the 1% flow with freeboard has been completed. Refer to Section 5, 6 and 7 of this report and associated drawings in Appendix A.	Yes

Provisions	Response	Compliance
<i>Provide safe conveyance of flows up to the 1% AEP flood event.</i>	Conveyance of the 1% flow with freeboard has been completed. Refer to Section 8 of this report and associated drawings in Appendix A .	Yes
<i>Where naturalised trunk drainage paths traverse development sites, they may be realigned to suit the development footprint, provided that they: Comply with the performance requirements for flow conveyance and freeboard;</i>	Realignment of the northern flow path FP1 is proposed. Assessment of the realignment of trunk drainage for Flow Path FP2 has been completed including engineering design and TUFLOW flood assessments.	Yes
<i>Are designed to integrate with the formed landscape and permit safe and effective access for maintenance;</i>	Access to flow paths has been provided at strategic locations. Refer to drawings in Appendix A .	N/A
<i>Do not have adverse flood impacts on neighbouring properties; and</i>	Provision or assessment of trunk drainage systems has been completed via TUFLOW flood modelling. Refer to Section 8 of this report.	Yes
<i>Enter and leave the development site at the existing points of flow entry and exit.</i>	Trunk drainage lines enter and exit the site at their existing locations.	Yes
<i>Trunk drainage paths shall remain in private ownership with maintenance covenants placed over them to the satisfaction of Council (standard wording for positive covenants is available from Council). Easements will also be required to benefit upstream land.</i>	Ownership of trunk drainage systems are noted to remain with the proponent.	Yes
<i>Where pipes/ culverts are implemented in lieu of naturalised trunk drainage paths, they must remain on private land and not burden public roads, unless otherwise accepted by Council.</i>	Ownership of the portion of trunk drainage systems which are piped are noted to remain with the proponent.	Yes
<i>High vertical walls and steep batters shall be avoided. Batters shall be vegetated with a</i>	Batters, where utilised are designed at 1v:4h maximum, as	Yes

Provisions	Response	Compliance
<i>maximum batter slope 1V:4H. Where unavoidable, retaining walls shall not exceed 2.0m in cumulative height.</i>	required of the DCP.	
<i>Raingardens and other temporary water storage facilities may be installed online in naturalised trunk drainage paths to promote runoff volume reductions.</i>	Raingardens are proposed as offline systems. There are no online systems proposed in relation to trunk drainage designs.	Yes
<i>Subdivision and development are to consider the coordinated staging and delivery of naturalised trunk drainage infrastructure. Development consent will only be granted to land serviced by trunk drainage infrastructure where suitable arrangements are in place for the delivery of trunk infrastructure (to the satisfaction of the relevant Water Management Authority).</i>	Staging of infrastructure will be completed such that development and construction of other adjoining areas are not impacted by the proposed development.	Yes
<i>Stormwater drainage infrastructure, upstream of the trunk drainage, is to be constructed by the developer of the land considered for approval.</i>	Noted.	N/A
<i>All land identified by the Water Management Authority as performing a significant drainage function and where not specifically identified in the Contributions Plan, is to be covered by an appropriate "restriction to user" and created free of cost to the Water Management Authority.</i>	Appropriate restrictions will be agreed during and/or post approval between the proponent and relevant authority as required.	Yes
<i>All proposed development submissions must clearly demonstrate via 2-dimensional flood modelling that: Overland flow paths are preserved and accommodated through the site;</i>	Provision for, and assessment of, flooding and conveyance of upstream drainage systems has been completed in Section 8 and Appendix E of this report. The completed flood impact assessment confirms acceptable outcomes in accordance with the MRP DCP.	Yes
<i>Runoff from upstream properties (post development flows) are accommodated in the trunk drainage system design;</i>	Runoff from upstream properties has been accounted for in the design. Refer to pre and post development catchment plans included in the drawing set in Appendix A .	Yes

Provisions	Response	Compliance
<i>Any proposed change in site levels or drainage works are not to adversely impact and upstream or downstream, or cause a restriction to flows from upstream properties;</i>	Provision for, and assessment of, flooding and conveyance of upstream drainage systems has been completed in Section 8 and Appendix E of this report. The completed flood impact assessment confirms acceptable outcomes in accordance with the MRP DCP	Yes
<i>There is no concentration of flows onto an adjoining property; and</i>	The proposed design does not concentrate flows onto adjoining properties. Refer Section 8 and Appendix E of this report. The completed flood impact assessment confirms acceptable outcomes in accordance with the MRP DCP.	Yes
<i>No flows have been diverted from their natural catchment to another.</i>	The proposed design does not divert catchments. Refer Section 8 and Appendix E of this report. The completed flood impact assessment confirms acceptable outcomes in accordance with the MRP DCP.	Yes
2.5 Flood Prone Land		
<i>A comprehensive Flood Impact Risk Assessment (FIRA) (prepared by a qualified hydrologist and hydraulic engineer) is to be submitted with development applications on land identified as fully or partially flood affected. The FIRA should utilise Council's existing data and data arising from the Wianamatta (South) Creek Catchment Flood Study⁵ to provide an understanding of existing flooding condition and developed conditions consistent with the requirements of the NSW Flood Prone Land Policy and Floodplain Development Manual. The FIRA shall determine:</i>	A comprehensive FIRA has been prepared by Costin Roe Consulting (being qualified hydrologist and hydraulic engineers) and has been submitted with development applications. Costin Roe Consulting has prepared numerous flood impact assessments in the area including that for The Yards Estate (SSD-9522) immediately north of this project, and for	Yes

Provisions	Response	Compliance
- Flood behaviour for existing and developed scenarios for the full range of flooding including the 5% Annual Exceedance Probability (AEP), 1% AEP, 0.5% AEP, 0.2% AEP and Probable Maximum Flood (PMF); - Flood Function (floodways, flood fringe and flood storage areas); - Flood Hazard; and - Flood constraints, including evacuation constraints (if applicable).	The GPT Groups partner estate, Yiribana West which is currently being assessed by DPIE as SSD-10272349. Refer Section 8 and Appendix E of this report. The completed flood impact assessment confirms acceptable outcomes in accordance with the MRP DCP.	
The FIRA shall adequately demonstrate to the satisfaction of the consent authority that: - Development will not increase flood hazard, flood levels or risk to other properties; - Development has incorporated measures to manage risk to life from flooding; - For development located within the PMF, an Emergency Response Plan is in place; - Structures, building materials and stormwater controls are structurally adequate to deal with PMF flow rates and velocities (including potential flood debris); - Development siting and layout maintains personal safety during the full range of floods and is compatible with the flood constraints and potential risk; - The impacts of sea level rise and climate change on flood behaviour has been considered; - Development considers Construction of Buildings in Flood Hazard Areas and accompanying handbook developed by the Australian Building Codes Board (2012); and - Fencing does not impede the flow of flood waters/overland flow paths.	A comprehensive FIRA has been prepared by Costin Roe Consulting. Refer Section 8 and Appendix E of this report. The completed flood impact assessment confirms acceptable outcomes in accordance with the MRP DCP.	Yes
Flood Constraints New development in floodways, flood fringe and/or flood storages or in high hazard areas in the 1% AEP flood event considering climate change is not permitted.	All buildings are sited 500mm above the 1% AEP design flood level.	Yes.

Provisions	Response	Compliance
<i>Development applications are to consider the depth and nature of flood waters, whether the area forms flood storage, the nature and risk posed to the development by flood waters, the velocity of floodwaters and the speed of inundation, and whether the development lies in an area classed as a 'floodway', 'flood fringe area' or 'flood storage area'.</i>	A comprehensive FIRA has been prepared by Costin Roe Consulting. Refer Section 8 and Appendix E of this report. The site is noted to be clear of the 1% AEP associated with South Creek, and meets flood planning requirements associated with flood fringe, flood storage and floodway requirements. The completed flood impact assessment confirms acceptable outcomes in accordance with the MRP DCP.	N/A
Subdivision		
<i>Subdivision of land below the flood planning level will generally not be supported.</i>	No development is proposed below the flood planning level.	Yes
<i>Subdivision must comply with Designing safer subdivisions guidance on subdivision design in flood prone areas 2007 (Hawkesbury-Nepean Floodplain Management Steering Committee).</i>	The subdivisions meets the requirements of the <i>Designing safer subdivisions guidance on subdivision design in flood prone areas 2007 (Hawkesbury-Nepean Floodplain Management Steering Committee)</i> .	Yes
New Development		
<i>Finished floor levels shall be at 0.5m above the 1% AEP flood.</i>	All buildings are sited 500mm above the 1% AEP design flood level.	Yes
<i>Flood safe access and emergency egress shall be provided to all new and modified developments consistent with the local flood evacuation plan, in consultation with Council and the State Emergency Services (SES).</i>	Egress during flood and overland flow conditions are available. Flood safety has been considered with review of the SES and local flood subplan for the area. Refer Section 8 and Appendix E of this report.	Yes

Provisions	Response	Compliance
	We note that SES does not consult with individual and/or private developers.	
Storage of Potential Pollutants <i>Potential pollutants stored or detained on-site (such as on-site effluent treatment plants, pollutant stores or on-site water treatment facilities) shall be stored above the 1% AEP flood. Details must be provided as part of any development application.</i>	All buildings and storage areas are sited 500mm above the 1% AEP design flood level.	N/A
Overland Flow Flooding <i>Development should not obstruct overland flow paths. Development is required to demonstrate that any overland flow is maintained for the 1% AEP overland flow with consideration for failsafe of flows up to the PMF.</i>	The proposed development allows for the conveyance of upstream flows as required of the DCP.	N/A
<i>Where existing natural streams do not exist, naturalised drainage channels are encouraged to ensure overland flows are safely conveyed via vegetated trunk drainage channels with 1% AEP capacity plus 0.5m freeboard. Any increase in peak flow must be offset using onsite stormwater detention (OSD) basins.</i>	A comprehensive FIRA has been prepared by Costin Roe Consulting. Refer Section 8 and Appendix E of this report. Generally, trunk drainage paths are proposed to be naturalised open channels (as agreed with Sydney Water and consistent with the Sydney Water drainage scheme plan). An estate detention and stormwater management system is noted to be proposed in the infrastructure design. Refer drawings by our office included in Appendix A.	N/A
<i>OSD is to be accommodated on-lot, within the development site, or at the subdivision or estate level, unless otherwise provided at the catchment level to the satisfaction of the relevant consent authority.</i>	As discussed in Section 5.1 and 6 of this report a detention system is noted to be proposed in the design utilising a tanked OSD system. Refer noted sections of the report and drawings by our	Yes

Provisions	Response	Compliance
	office included in Appendix A .	
<i>Stormwater basins are to be located above the 1% AEP.</i>	As discussed in Section 4.1 and 6 of this report an estate detention system is noted to be proposed in the infrastructure design. The stormwater basin is noted to be clear of the 1% AEP associated with South Creek floodplain. Refer noted sections of the report and drawings by our office included in Appendix A .	Yes
<i>Post-development flow rates from development sites are to be the same or less than predevelopment flow rates for the 50% to 1% AEP events.</i>	As discussed in Section 5.1 and 6 of this report an estate detention system is noted to be proposed which attenuates runoff from the development to the noted pre-development flow rates.	Yes
<i>OSD must be sized to ensure no increase in 50% and 1% AEP peak storm flows at the Precinct boundary or at Mamre Road culverts. OSD design shall compensate for any local roads and/or areas within the development site that does not drain to OSD.</i>	As discussed in Section 5.1 and 6 of this report an estate detention system is noted to be proposed which attenuates runoff from the development to the noted pre-development flow rates.	Yes
<i>Filling of Land At or Below the Flood Planning Level Earthworks up to the PMF must meet the requirements of Clauses 33H and 33J of the WSEA SEPP as well as Sections 2.5 and 4.4 of this DCP.</i>	Filling of land below the 1% AEP is not proposed. Refer Section 3.6 and 5.7 in relation to SEPP Clauses.	N/A
4.4 Earthworks and Retaining Walls		
4.4.1 Development on Sloping Sites		
<i>Level transitions must be managed between lots and not at the interface to the public domain.</i>	Level transitions have been managed between lots and not at the interface to the public domain.	Yes

Provisions	Response	Compliance
<i>Finished ground levels adjacent to the public domain or public road shall be no greater than 1.0m above the finished road level (or public domain level).</i>	Refer to Section 3.3 of this report and drawings in Appendix A . Finished ground levels are generally less than 1m to the adjacent roads towards the southern part of the development site. Refer below for areas of the site where level differences are greater than 1.0m.	Yes
<i>Where a level difference must exceed 1.0m and adjoins the public domain or public road, the retaining wall must be tiered. Each retaining wall tier element shall be no more than 2.0m. A 1.5m wide deep soil zone with suitable landscaping is to be provided between each tier. An indicative tiered retaining wall is shown in Figure 23. The maximum cumulative height of any retaining walls adjoining the public domain is 6.0m.</i>	Refer to Section 3.3 and Figure 3.1 of this report, and drawings in Appendix A . Tiered landscaped retaining walls are proposed to Warehouse 1 and 3 whereby level differences exceed 1.0m.	Yes
<i>The toe (fill retaining wall) or top (cut retaining wall) of all retaining walls are to be setback 2.0m into the property boundary and the setback is to be suitably landscaped.</i>	Walls on boundaries are set back at a minimum of 2m as noted. Refer to Section 3.3 and Figure 3.1 .	Yes

2 DEVELOPMENT SITE

2.1 Location

The proposed development is located in the suburb of Kemps Creek on Mamre Road on Lots 23 & 24 of DP258414 as shown in **Figure 2.1**.

The site is bounded on The Yards Estate (Fraser's/Atlas JV – SSD 9522) to the north, east by Mamre Road and undeveloped industrial zoned land to the south.

South Creek is noted to be present, and forms, the western boundary of the site. We note the mainstream channel of South Creek is approximately 750m west of the IN1 zoned land proposed for development (refer **Figure 2.2**).

The site is located on the western side of Mamre Road approximately 0.65km south of the intersection of Mamre Road and Bakers Lane. The nearest residential receivers are approximately 1km west of the development land in the Twin Creeks residential estate on the western side of South Creek.



Figure 2.1 Locality Plan

2.2 Existing Site

The property is currently comprising rural-residential use. The existing semi-rural residential dwellings are located on the eastern portion of the site and include a dwelling with detached sheds, carports and other minor structures. Otherwise, the majority of the site is undeveloped pasture and grassed fields.

The site is noted to be located within an area comprising rural/agricultural use, however nearby to existing and future industrial development areas, and noted as being recently rezoned by the NSW DPIE as a mix of IN1 General Industrial, RE1 Public Recreation and SP2 Infrastructure – refer **Figure 2.2**.

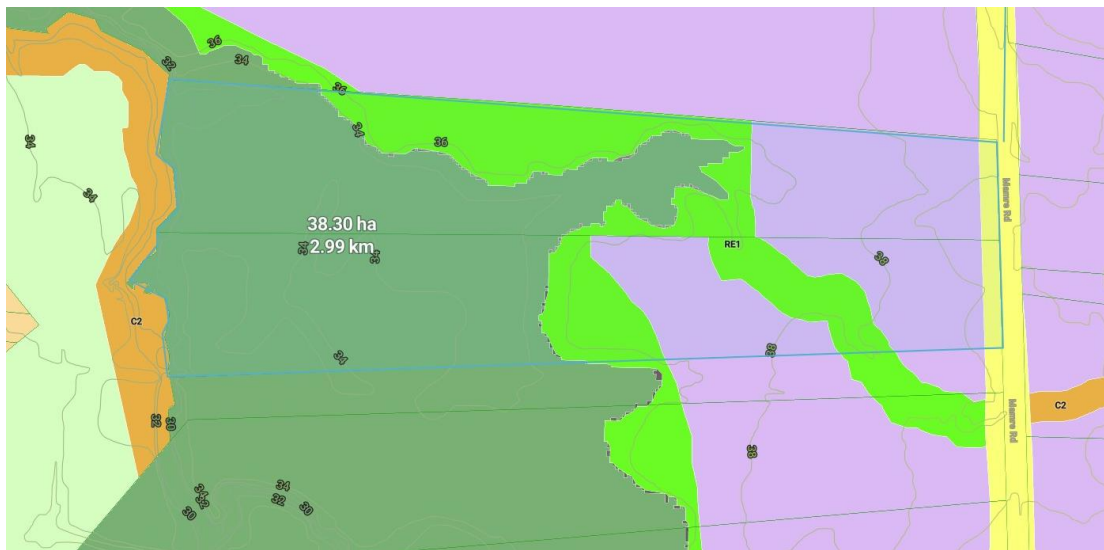


Figure 2.2. Land Zoning

The site is four sided and regular in shape. The Mamre Road frontage is 280m wide. The area of the properties is approximately 38.4 Ha, however much of this land is not available for development based on the land zoning and Mamre Road floodplain. The IN1 Zoned land has an area of 10.4 Ha and development is currently proposed on 5.8Ha of the IN1 zoned land as part of the Stage 1 development.

The site falls from east to west, with local falls toward one of two watercourses on the land. The northern of the two flow paths (*Flow Path FP1*) carries overland flow from an upstream catchment of approximately 33 Ha, whilst the southern flow path (*Flow Path FP2*) carries a much larger catchment of 126 Ha. Refer **Figure 5.1** and drawings in **Appendix A** for catchments.

Detail survey is not available for the site, however Lidar survey obtained by Boxall Surveys shows the maximum height of the property is RL 41.0m AHD (adjacent Mamre Road) and the lowest part of the site (in South Creek) is RL 29.0m AHD. The lowest level in the development are/ IN1 Zoned land is RL 35.5m AHD.

2.3 Proposed Development

The proposed development is for an industrial estate, earthworks and infrastructure for future industrial development over an area of 5.4 Ha, and construction of the buildings on Lot 1A and 1B. As noted, the IN1 Zoned land has an area of 10.4 Ha and development is currently proposed on 5.4 Ha of the IN1 zoned land as part of the Stage 1 development.

The Masterplan Layout is shown in **Figure 2.3**. Infrastructure works will include bulk earthworks, provision of services, road & intersection construction, and stormwater management.

The preliminary masterplan layout provided by The GPT Group and prepared by SBA shows two development lots, circa 2.2-2.4Ha in size. Siting of the development lots will be sympathetic to the topography of the land, access and flood planning requirements.

Access to all lots would be made via an extension of the collector road on the north of the property which is currently being constructed as part of The Yards Estate by Frasers Property/

3 SITE WORKS

3.1 Soil and Geological Conditions

Initial assessments relating to soil have been undertaken by PSM (geotechnical investigation – PSM4443-002L dated 25 May 2021).

As referenced in the investigation by PSM the 1:100 000 Geological Series Penrith Geological Survey of NSW Sheet 9030 (DMR 19834) indicates that the site is present within the following natural geological and soil landscapes:

- Geology:
 - (Qal) fluvial fine-grained sand, silt and clay in areas
 - (Rwb) Bringelly Shale of the Wianamatta Group comprising shale, carbonaceous claystone/claystone laminite - comprising fine to medium grained lithic sandstone with rare coal and tuff.
- Landscape: Gently undulating rises on Wianamatta Group shales. Local relief to 30 m, slopes usually >5%. Broad rounded crests and ridges with gently inclined slopes.
- Soils: Red and brown podzolic soils on crests, shallow to moderately deep (>100 cm), hardsetting with mottled texture, grading to yellow podzolic soils on lower slopes and in drainage lines.
- Limitations: Potential for localised seasonal waterlogging, water erosion/surface movement, and can consist of moderately reactive highly plastic subsoil.

3.2 Bulk Earthworks

Bulk earthworks will be required to facilitate the development of the estate for industrial use. The earthworks will be undertaken to provide large flat building pads, facilitate site access from the proposed estate road, to drain the site stormwater via gravity, and to keep building levels above the 1 in 100-year ARI flood level with a minimum freeboard of 500mm.

A preliminary assessment has been completed to provide an order of magnitude estimate of the earthwork's volumes and considerations for access, drainage and ensure that there is no excess spoil removal from the property. A variance on the quoted levels is noted to allow for minor variations in the quoted levels, at detail and post approval phase, which may result from introduction of the allowances noted above which are not fully known at EIS stage. The existing and proposed levels are shown on the Costin Roe drawings in **Appendix A**.

Earthworks and retaining wall construction will be required for the development to incorporate the architectural layout and drainage requirements of the development, and to facilitate a large flat area for the proposed warehouse buildings. Consideration has been made for interfacing with existing and under construction levels to the north on the common boundary of the Frasers Property/ Altis Land.

Soil Erosion and Sediment Control measures, including sedimentation basins are to be placed in accordance with submitted drawings and the *Soil and Water Management Plan* in **Appendix C** of this report.

An earthwork design and volume estimate assessment has been completed for the site. The estimated volumes are shown on drawing **Co14429.00-DA30**. It is noted that levels shown on the drawings are subject to variance of +/-1000mm to account for unknowns in geotechnical

conditions and final detail design considerations. This is to ensure that excessive export or import is not required in the final design arrangement.

The earthworks volume estimates are as follows in **Table 3.1**:

Item	Lower Bound (-15%)	Apparent Volume (m ³)	Upper Bound (+15%)
Cut	-3145	-3700	-4,255
Fill	+95,838	+112,750	+129,663
Topsoil Strip	-12,240	-14,400	-16,560
Detailed Excavation	-7,650	-9,000	-10,350
Diff. (fill over cut)	+85,043	+100,050	+115,058

Table 3.1. Earthwork Volume Estimates

3.3 Retaining Walls

The civil engineering objective is to minimise retaining walls within the constraints of the masterplan layout, allowable grading to suit industrial development and batters in landscaped areas where possible.

Retaining walls will be required along the west boundaries at the interface of developed land and undeveloped land, and between development lots.

Retaining in these areas are a maximum of 3m in height. Location and indicative heights of retaining walls are shown on drawing **Co14429.00-DA51**.

Level differences along the property frontages (i.e. fronting public domain), where required, will comprise a stepped arrangement, in accordance with *Section 4.4* of the *MRP DCP* and generally in accordance with *Figure 23* of the *MRP DCP*, as shown in Costin Roe Consulting **Figure 3.1**.

The MRP DCP allows for a maximum 6m high wall, set 2m from the boundary with landscaped screening for those fronting public domain and roadways.

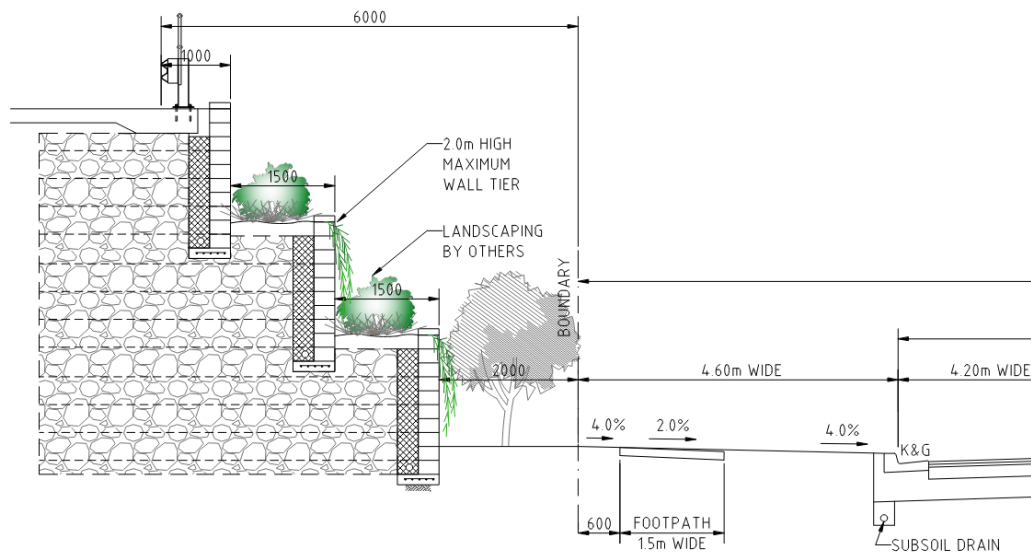


Figure 3.1. General Arrangement for Walls Adjacent Public Domain

3.4 Embankment Stability

To assist in maintaining embankment stability permanent batters in clay will be no steeper than 3-horizontal to 1-vertical while temporary batters will be no steeper than 2-horizontal to 1-vertical. Steeper batters in shale can be considered subject to geotechnical advice.

Batters within public domain will be limited to 1v:4h.

Permanent batters will also be adequately vegetated or turfed which will assist in maintaining embankment stability.

Stability of batters and reinstatement of vegetation shall be in accordance with the submitted drawings and the Soil and Water Management Plan in **Appendix C** of this report.

3.5 Supervision of Earthworks

All geotechnical testing and inspections performed during the filling operations will be undertaken to Level 1 geotechnical control, in accordance with AS3798-2007.

3.6 SEPP (WSEA) Clause 33H Earthworks

Consideration to the requirements of SEPP (WSEA) Clause 33H Earthworks has been made in the impact assessment. Review and confirmation specific matters included in Clause 33H(3) has been made for Items (a) through (j) as follows.

- a) *the likely disruption of, or detrimental effect on, existing drainage patterns and soil stability in the locality,*

A detailed flood assessment has been completed in relation to flooding considerations – refer report **Section 8** and **Appendix E** of this report.

Refer **Sections 5, 6, 7 & 8** of this report and associated drawings in **Appendix A** which set out stormwater management for the site. The proposed strategy incorporates management of site runoff and upstream drainage paths managing quantity and quality and ensuring acceptable impacts in accordance with various council and NSW government policy.

Consideration to stability of soil has been made during and post construction.

b) the effect of the proposed development on the likely future use or redevelopment of the land,

the proposed development (being industrial warehouse distribution development) is consistent with the land zoning. Future redevelopment of similar industrial developments would be able to be undertaken.

c) the quality of the fill or the soil to be excavated, or both,

Geotechnical and environmental assessments have been undertaken for the site and reviews and discusses suitability for use as engineered fill, foundations and other development requirements. The report shows that with due consideration to the design requirements that development would be able to be made over the development footprint.

d) the effect of the proposed development on the existing and likely amenity of adjoining properties,

Adjoining properties to the north, south, east and west are noted to comprise land zoned for industrial use, hence similar amenity to these frontages is achieved.

e) the source of fill material and the destination of excavated material,

There is no excavated material to be removed from the site. Import of fill is required and is expected to be sourced from a variety of locations which will need to be confirmed as part of the Construction Management Plan for the development during Construction Certificate stage of the development.

f) the likelihood of disturbing relics,

A heritage and aboriginal impact study has been undertaken. Refer to separate reports and management measures relating to aboriginal heritage.

g) the proximity to and potential for adverse impacts on a waterway, drinking water catchment or environmentally sensitive area,

A detailed flood assessment has been completed in relation to flooding considerations and confirmation of acceptable impacts as included in this report. Assessments relating to discharge to water has been made in the Ecologist report (refer separate report). Refer

Section 6, 7 & 8 of this report for details of water quantity, water quality and stream erosion index assessments which confirm acceptable impacts relating to stormwater management.

- h) appropriate measures proposed to avoid, minimise or mitigate the impacts of the development,*

Appropriate measures during and following development have been made in relation to earthworks, erosion and sediment controls during construction/ earthworks per Landcom Blue Book.

- i) the proximity to and potential for adverse impacts on a heritage item, an archaeological site, or a heritage conservation area,*

A heritage and aboriginal impact study has been undertaken. Refer to separate reports.

- j) the visual impact of earthworks as viewed from the waterways.*

Refer separate visual impact report by Site Image in relation to visual amenity.

4 ESTATE ROADS & ACCESS

4.1 Introduction

Integration with the broader transport strategy for the precinct is required including the Mamre Road upgrade and MRP DCP. Access to the proposed development will be made via extension of the currently under construction collector road on The Yards Estate (SSD-9522) which is on the north of the property.

The current posted speed limit for Mamre Road is 80km/hr. Surrounding local road networks are confirmed in the MRP DCP to be posted at 50km/hr. The corresponding design speeds for the estate road in development is 50km/hr.

The proposed road alignments will need to be designed to meet the MRP DCP requirements (refer **Figures 4.1 to 4.3**). The proposed road layout will incorporate best practice for both horizontal and vertical alignments with empathy to the landform. Road layouts currently proposed are consistent with those proposed in the MRP DCP and per the Landowners Group (LOG) which have been consulted with Council and the DPIE. A road layout plan has been provided which shows the connectivity and a preliminary long section between the site, The Yards Estate to the north, and Mamre Road intersections to the south of the development site.

A conceptual layout plan and long section for connection of the roadway between The Yards Estate on the north, to Mamre Road on the south, has been included in the application. This drawing (refer **Co11492.00-C51** in **Appendix A**) demonstrates that access and continuation between the development and Mamre Road can be achieved. The indicative design layout has drawn on public information regarding the Frasers/ Altis development and the Gibb Group development site, and the current TfNSW design information pertaining to the Mamre Road upgrade.

Interim cul-de-sac turning heads have been provided at the south of the property and concept plans for the conversion of the cul-de-sac which is currently being constructed within The Yards Estate north of the development site.

4.2 Internal Road Design Requirements

The estate road will need to be designed and constructed as an industrial road consistent with the agreed cross section and hierarchy in the Mamre Road Precinct DCP. The proposed road widths are noted to differ from and are greater in width than those included in the Penrith City Council *Development Control Plan 2014, Part C10 Transport, Access and Parking*. The road cross section, as adopted, include a 25.6m overall reserve widths as per the *Type 2 Collector Road* hierarchy included in **Figure 4.1**, and arrangements shown in **Figure 4.2**.

Road Type & Traffic Volume	Parking Lane Provision	Dedicated Travel Lanes	Verge Width (Footpath Pedestrian)	Total Road Reserve	Number of lanes	1.5m Footpath or 2.5m Shared Path
Type 2 – Collector Road	8.4m (2 x 4.20m)	7.0m (2 x 3.5m)	5.6m & 4.6m	25.6m	2 travel/ 2 parking lane	2.5m & 1.5m

Table 4.1. Estate Road Cross Section - MRP DCP 2021



Figure 12. Road network hierarchy in the Mamre Road Precinct.

Figure 4.1. MRP DCP Road Hierarchy (source: MRP DCP 2021 Figure 12)

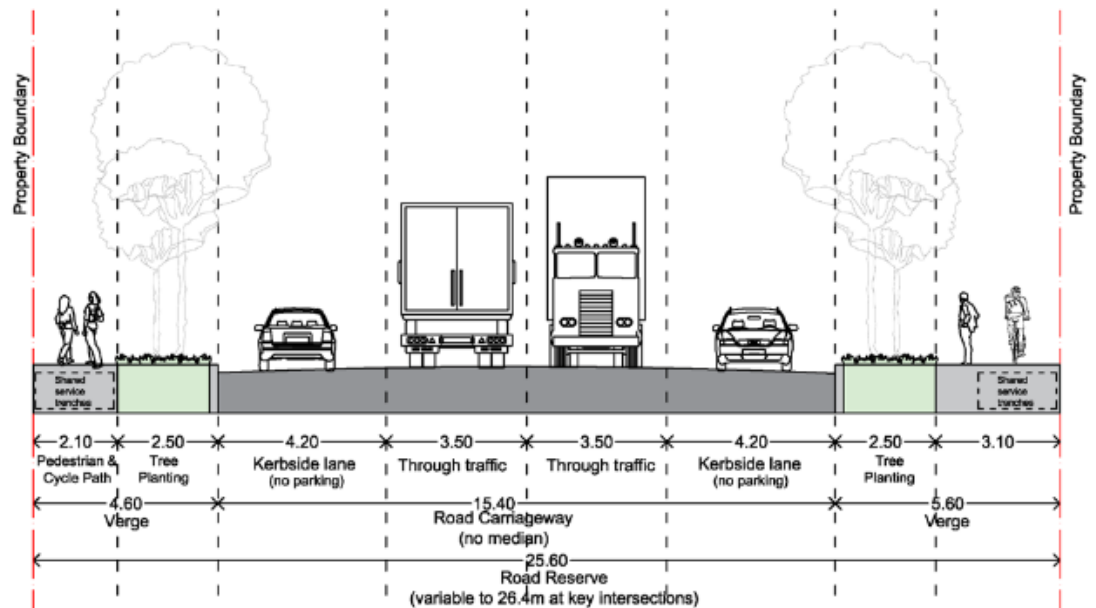


Figure 14. Typical Collector Road (Type 2)

Figure 4.2. MRP DCP Industrial Collector Road Cross Section

4.3 General Requirements

All roads will have concrete kerb and gutter and carriageway surface finished with asphaltic concrete as per the requirements of Penrith City Council.

The design for the proposed pavement for internal roads is to be based on *Austrroads Pavement Design – A Guide to the Structural Design of Road Pavements*. Council DCP requires the pavement design to be based on a minimum traffic loading of 1×10^7 ESA, or AADT for the overall estate (noting precinct modelling has been completed by ASON for the whole of the MRP and has specific AADT for the distributor road). This loading is typical of an industrial road and would meet the needs of the estate, depending on the final traffic studies being undertaken for the precinct DCP. The final adopted traffic loading will be based on the DCP.

We recommend that further review of the proposed pavement construction specification and design loading allowance be undertaken for the internal roads when this becomes available.

In accordance with the estate master plan and council requirements, a 1.5m pedestrian path will need to be located on one side of the road cross section with a 2.5m shared path on the other as included in **Table 4.1** and **Figure 4.2**.

5 WATER CYCLE MANAGEMENT STRATEGY & DRAINAGE METHODOLOGY

5.1 Key Areas and Objectives

Water Cycle Management (WCM) is a holistic approach that addresses competing demands placed on a region's water resources, whilst optimising the social and economic benefits of development in addition to enhancing and protecting the environmental values of receiving waters.

Developing a WCMS at the DA stage of the land development process provides guidance on urban water management issues to be addressed for the estate and future development sites. This assists urban rezoning and estate infrastructure planning for the industrial development proposed on the land.

This WCMS has been prepared to inform Council that the development is able to provide and integrate WCM measures into the stormwater management strategy for the estate and for future development sites in the estate. It presents guiding principles for WCM for the estate which includes establishing water management targets and identifying management measures required for future building developments to meet these targets.

WCM measures have been included in the WCMS and engineering design, which are set out in this report and the associated drawings. The key WCM elements and targets which have been adopted in the design, in accordance with the MRP DCP and DPIE *Technical Guidance for Achieving Wianamatta South Creek Stormwater Management Targets*, are included in **Table 5.1**.

Table 5.1. WCM Targets

Element	Target	Reference																								
Water Quantity	Maintaining or improving the volume of stormwater and peak flows from this site. "demonstrate that there will be no increase in runoff from the site as a result of the development for all storms up to and including the 100-year Average Recurrence Interval (ARI) event for all storm durations".	Final MRP DCP2021																								
Waterway and Stream Health	<table><tr><th></th><th>Target</th></tr><tr><td colspan="2">Option 1: Mean Annual Runoff Volume (MARV) Approach</td></tr><tr><td>MARV</td><td>≤ 2 ML/ha/year at the point of discharge to the local waterway</td></tr><tr><td>90%ile flow</td><td>1000 to 5000 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>50%ile flow</td><td>5 to 100 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>10%ile flow</td><td>0 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td colspan="2">Option 2: Flow Duration Curve Approach</td></tr><tr><td>95%ile flow</td><td>3000 to 15000 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>90%ile flow</td><td>1000 to 5000 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>75%ile flow</td><td>100 to 1000 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>50%ile flow</td><td>5 to 100 L/ha/day at the point of discharge to the local waterway</td></tr><tr><td>Cease to flow</td><td>Cease to flow to be between 10% to 30% of the time</td></tr></table>		Target	Option 1: Mean Annual Runoff Volume (MARV) Approach		MARV	≤ 2 ML/ha/year at the point of discharge to the local waterway	90%ile flow	1000 to 5000 L/ha/day at the point of discharge to the local waterway	50%ile flow	5 to 100 L/ha/day at the point of discharge to the local waterway	10%ile flow	0 L/ha/day at the point of discharge to the local waterway	Option 2: Flow Duration Curve Approach		95%ile flow	3000 to 15000 L/ha/day at the point of discharge to the local waterway	90%ile flow	1000 to 5000 L/ha/day at the point of discharge to the local waterway	75%ile flow	100 to 1000 L/ha/day at the point of discharge to the local waterway	50%ile flow	5 to 100 L/ha/day at the point of discharge to the local waterway	Cease to flow	Cease to flow to be between 10% to 30% of the time	Final MRP DCP2021
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Cease to flow	Cease to flow to be between 10% to 30% of the time																									
Water	Load-based pollution reduction targets based on an untreated urbanised catchment or total resultant concentration per the	Final MRP																								

Element	Target	Reference										
Quality	Wianamatta MUSIC Modelling Toolkit: <u>Opt1 or Opt2</u> <table><tr><td>Gross Pollutants</td><td>90% <u>or</u> <16kg/ha/yr</td></tr><tr><td>Total Suspended Solids</td><td>90% <u>or</u> <80kg/ha/yr</td></tr><tr><td>Total Phosphorus</td><td>80% <u>or</u> <0.3kg/ha/yr</td></tr><tr><td>Total Nitrogen</td><td>65% <u>or</u> <3.5kg/ha/yr</td></tr><tr><td>Total Hydrocarbons</td><td>90%</td></tr></table>	Gross Pollutants	90% <u>or</u> <16kg/ha/yr	Total Suspended Solids	90% <u>or</u> <80kg/ha/yr	Total Phosphorus	80% <u>or</u> <0.3kg/ha/yr	Total Nitrogen	65% <u>or</u> <3.5kg/ha/yr	Total Hydrocarbons	90%	DCP2021
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Total Phosphorus	80% <u>or</u> <0.3kg/ha/yr											
Total Nitrogen	65% <u>or</u> <3.5kg/ha/yr											
Total Hydrocarbons	90%											
Flooding	Buildings and road set 500mm above 1% AEP. No affectation to upstream downstream or adjoining properties as a result of development based on specific impact criteria.	NSW Floodplain Development Manual. MRP DCP2021										
Water Supply	Reduce Demand on non-potable water uses. Provide minimum 100,000L rainwater tanks per development or 80% reduction of non-potable uses.	MRP DCP2021										
Construction Stormwater Management & Erosion and Sediment Control	Table 2 Construction phase stormwater quality targets <table><tr><th>Parameter</th><th>Target (reduction in mean annual load from unmitigated development)</th></tr><tr><td>Total suspended solids (TSS) and pH</td><td> All exposed areas greater than 2,500 m² are to be provided with sediment controls that are designed, implemented and maintained to a standard that would achieve treatment of at least 80% of the average annual runoff volume of the contributing catchment (i.e. 80% hydrological effectiveness) to 50 mg/L TSS or less, and pH in the range (6.5–8.5) No release of coarse sediment is permitted for any construction or building site Sites less than 2,500 m² are required to comply with the requirements of the Blue Book </td></tr></table> <table><tr><th>Parameter</th><th>Target (reduction in mean annual load from unmitigated development)</th></tr><tr><td>Oil, litter and waste contaminants</td><td>No release of oil, litter or waste contaminants</td></tr><tr><td>Stabilisation</td><td> Prior to completion of works for the development, and prior to removal of sediment controls, all site surfaces are to be effectively stabilised including all drainage systems An effectively stabilised surface is defined as one that does not or is not likely to result in visible evidence of soil loss caused by sheet, rill or gully erosion or lead to sedimentation and water contamination </td></tr></table>	Parameter	Target (reduction in mean annual load from unmitigated development)	Total suspended solids (TSS) and pH	All exposed areas greater than 2,500 m² are to be provided with sediment controls that are designed, implemented and maintained to a standard that would achieve treatment of at least 80% of the average annual runoff volume of the contributing catchment (i.e. 80% hydrological effectiveness) to 50 mg/L TSS or less, and pH in the range (6.5–8.5) No release of coarse sediment is permitted for any construction or building site Sites less than 2,500 m² are required to comply with the requirements of the Blue Book	Parameter	Target (reduction in mean annual load from unmitigated development)	Oil, litter and waste contaminants	No release of oil, litter or waste contaminants	Stabilisation	Prior to completion of works for the development, and prior to removal of sediment controls, all site surfaces are to be effectively stabilised including all drainage systems An effectively stabilised surface is defined as one that does not or is not likely to result in visible evidence of soil loss caused by sheet, rill or gully erosion or lead to sedimentation and water contamination	MRP DCP2021
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A summary of the how each of the WCM objectives will be achieved are described below. Reference to the relevant sections of the report should be made for further and technical details relating to the WCM measures:

- **Stormwater Quantity Management (Refer Section 6)**

The intent of this criterion is to reduce the impact of urban development on existing drainage system by limiting post-development discharge within the receiving waters to the pre-development peak, and to ensure no affectation of upstream, downstream or adjacent properties.

Attenuation of stormwater runoff from the Stage 1 development is proposed to be managed via an estate level basin. The intention is for no water quantity measures (other than rainwater reuse) to be provided on individual development lots. This will mean that future building developments can be assessed, approved and constructed without the need for site specific detention, based on the provision of the estate detention basin. There is one proposed basin, prior to discharge to the watercourse on the west of the Stage 1 development area. These basins provide water storage and reuse during construction and to assist with complying with the overall MRP DCP Stream Health objectives.

Sizing of the detention systems has been completed using DRAINS modelling software in accordance with the MRP DCP for the 50% AEP to the 1% AEP storm for various durations. The modelling accounts for the drainage system provided for the adjacent sites and conveyance of upstream catchments around the site.

Refer to **Section 6** of the document for detailed sizing of detention systems.

- **Waterway Health (refer Section 6.3)**

A MUSIC assessment for discharge from the development has been completed based the stormwater flow (MARV and FDC) targets set out in *Table 6* of the MRP DCP. The assessment has utilised the MUSIC modelling Toolkit provided by NSW EES to confirm the flow duration and mean annual runoff volumes objectives have been met.

The assessment is explored further in **Section 6.3**. The assessment confirms the objectives have been achieved for the current level of proposed development.

Further technical confirmation of EES MUSIC Modelling Toolkit can be found in **Appendix F**

- **Stormwater Quality Management (Refer Section 7)**

There is a need to target pollutants that are present in stormwater runoff to minimise the adverse impact these pollutants could have on downstream receiving waters.

The required pollutant reductions are included in **Table 5.1** of this document and MUSIC modelling has been completed to confirm the reduction objectives can be met for the estate.

A series of Stormwater quality improvement devises (SQID's) have been incorporated in the design of the estate. The proposed management strategy will include the following measures:

- Primary treatment of the whole of the development catchment (including roads and development sites) will be made via a gross pollutant trap (G.P.T.). Three GPT's are

proposed as shown on drawing will be located upstream of the stormwater management basin.

- Tertiary treatment of the development catchment will be made via bio-retention and proprietary filters. Bio-retention treatment will be provided within the stormwater management basins and are sized to treat the whole of the estate catchment. Refer to drawings **Co14429.00-DA40 to DA44**.
- Some treatment will also be present by provision of rainwater reuse tanks on development sites through reuse and settlement within the tanks. Allowance for this treatment is noted to not be included in MUSIC modelling produced for the development.

Reference to **Section 7** of this document should be made for detailed Stormwater Quality modelling and measures.

- *Water Demand Reduction/ Rainwater Reuse (refer Section 7.6)*

Rainwater reuse measures will be provided as part of future building development designs. Rainwater reuse will be required to reduce demand on non-potable uses by at 80%. The reduction in demand will target non-potable uses such as toilet flushing and irrigation. **Refer Section 7.6.**

- *Flood Management (refer Section 8)*

The proposed development considered flooding and large rainfall events in relation to runoff from upstream properties east of Mamre Road from the north-east and south-east, and integration of trunk drainage channels and corridors in the design. The trunk drainage systems have been provided in accordance with the agreed arrangement with Sydney Water.

Consideration to flood requirements has been made per the MRP DCP.

Refer **Section 8** and **Appendix E** for details.

The following measures have been incorporated in the design:

- All buildings are sited 500mm above the 1% AEP design flood level of South Creek.
- Requirements of the MRP DCP and trunk drainage alignments have been achieved in relation to flooding/ overland flow affected areas;
- Realignment of Flow Path FP1 as an open channel which collects runoff from Mamre Road and eastern Mamre Road catchments. FP1 will comprise a naturalised open channel which is located north of Warehouse 2 between Mamre Road and the north-south collector road.
- Conveyance and local realignment of Flow Path FP2 within the site. It is noted that a future planning application will be prepared to formalise realignment of the RE1 corridor.
- Stormwater detention measures have been included to manage pre and post development runoff as discussed above and in **Section 8**; and
- Overland flow paths to manage runoff in large storm events have been made including achieving at least 500mm freeboard to building levels from the flow paths.

- *Stormwater Management During Construction (refer Section 9)*

A construction stormwater management plan and associated erosion and sediment control measures is proposed based on ICEA White Book, *Landcom Blue Book* and MRP DCP

requirements. The management measures take a staged approach from initial site establishment, construction stages and the period between the completion of the estate infrastructure works and development of individual lots. Measures include implementation of High Efficiency Sediment Basins to ensure the construction phase water quality targets can be achieved.

5.2 Existing Drainage System & Overland Flows

The site is currently undeveloped rural land with undulating and floodplain topography which has been described in **Section 2.2**. There is no formal drainage currently on the site however several local depressions, natural gullies and farm dams are present. There are also several dams which are used for the currently rural farming operations on the land which lie in relation to the natural gullies.

The site is affected by overland flow from minor upstream catchments to the north-east of the site (Flow Path FP1) and a larger catchment and flow path from the south-east (Flow Path FP2). Flow Path FP1 conveys flows from a catchment of approximately 33 Ha onto the site, via existing culvert crossing in Mamre Road, then following a path in a south-westerly direction before joining with Flow Path FP2 which carries runoff from a 126Ha catchment.

Existing twin 600mm RCP's are located at the low point on Mamre Road and drain runoff from the property west toward South Creek through existing gully within rural properties on the western side of Mamre Road. This has been shown on drawing **Co14429.00-DA42** and **Figure 5.1** below. Conveyance of these flows has been included in the estate infrastructure stormwater design.

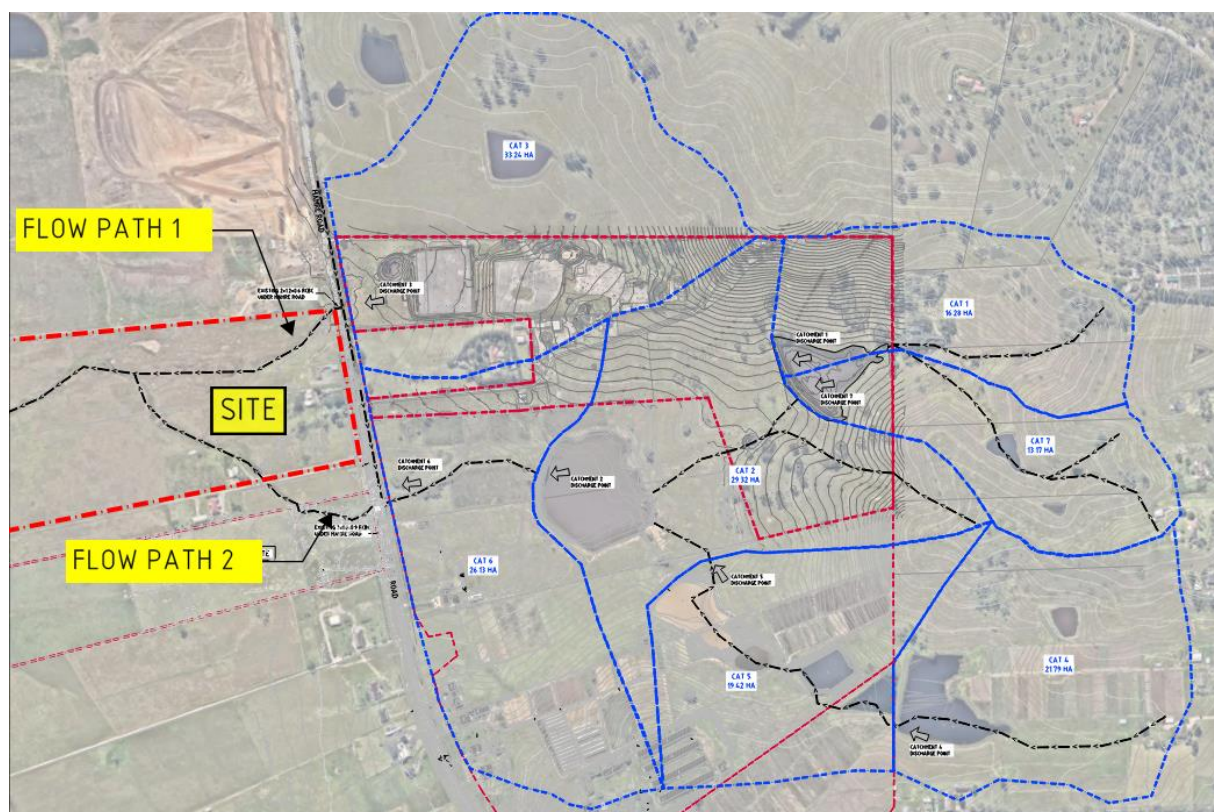


Figure 5.1. Site Catchments and external Contributing Catchment.

5.3 Proposed Estate Drainage System

As per general engineering practice and the guidelines of PCC, the proposed stormwater drainage system for the estate development will comprise a minor and major system to safely and efficiently convey collected stormwater run-off from the development to the legal point of discharge.

The minor system is to consist of a piped drainage system which has been designed to accommodate the 1 in 20-year ARI storm event (Q20). This results in the piped system being able to convey all stormwater runoff up to and including the Q20 event. The major system will be designed to cater for storms up to and including the 1 in 100-year ARI storm event (Q100). The major system will employ the use of defined overland flow paths, such as roads and open channels, to safely convey excess run-off from the site.

The design of the stormwater system for this site will be based on relevant national design guidelines, Australian Standard Codes of Practice, the standards of PCC and accepted engineering practice. Runoff from buildings will generally be designed in accordance with *AS3500.3 National Plumbing and Drainage Code Part 3 – Stormwater Drainage*.

Overall site runoff and stormwater management will generally be designed in accordance with the Institution of Engineers, Australia publication "*Australian Rainfall and Runoff*" (2019 Edition), Volumes 1 and 2 (AR&R).

Water quality and re-use are to be considered in the design to ensure that any increase in the detrimental effects of pollution are mitigated, the MRP DCP Water Quality Objectives are met and that the demand on potable water resources is reduced.

The proposed drainage system will be required to convey the overland flow from upstream catchments east of the property through the site.

The legal point of discharge is a point specified by Council where stormwater from a property can be discharged. The legal point of discharge is usually Council's stormwater infrastructure (where available), the street kerb and channel for smaller developments or downstream receiving waters like an existing stream or gully, lake, pond or waterbody.

Legal discharge for the site is via the existing watercourse which drains to South Creek.

The drainage system proposed can be described as follows:

- Road drainage system designed to the 5% AEP (1 in 20yr ARI);
- Stub connections for all development lots connecting to road drainage.
- All road drainage and development site drainage directed to the stormwater management basin;
- Stormwater management basins comprising stormwater detention to limit post development runoff to pre-development runoff, and to address MARV/ FDC flow requirements and bio-retention system to complete final stormwater polishing.
- Flow Path FP1 will be realigned to be conveyed from Mamre Road frontage at the north-east corner of the development as an open channel. A culvert will be required where the flow path crosses the estate road. The channel will then join Flow Path FP2 on the north-west of the development zone and adjacent to the Phase 2 road culvert crossing;

- Flow Path FP2 is proposed to be realigned upstream of the proposed road. This is required to enable an effective crossing of the roadway in addition to improving the efficiency of the site for development.
- Stormwater management systems proposes integration of bio-retention elements and water storage/ retention elements and stormwater detention tanks with proprietary filtration.

5.4 Hydrologic Modelling and Analysis

5.4.1 General Design Principles

The design of the stormwater system for this site will be based on relevant national design guidelines, Australian Standard Codes of Practice, Penrith City Council and accepted engineering practice.

Runoff from buildings will generally be designed in accordance with *AS 3500.3 National Plumbing and Drainage Code Part 3 – Stormwater Drainage*.

Overall site runoff and stormwater management will generally be designed in accordance with the Institution of Engineers, Australia publication “Australian Rainfall and Runoff” (2019 Edition), Volumes 1 and 2 (AR&R).

Storm events for the 2 to 100 Year ARI events have been assessed.

5.4.2 Minor/ Major System Design

The piped stormwater drainage (minor) system has been designed to accommodate the 20-year ARI storm event (Q20). Overland flow paths (major) which will convey all stormwater runoff up to and including the Q100 event have also been provided which will limit major property damage and any risk to the public in the event of a piped system failure.

5.4.3 Rainfall Data

Rainfall intensity Frequency Duration (IFD) data used as a basis for DRAINS modelling for the 2 to 100 Year ARI events, was taken from The Bureau of Meteorology Online IFD Tool.

5.4.4 Runoff Models

In accordance with the recommendations and standards of Penrith City Council, the calculation of the runoff from storms of the design ARI has been calculated with the catchment modelling software DRAINS for internal drainage only. Refer **Section 8** for discussion pertaining to overland flow runoff models.

Detailed hydraulic assessment of the internal drainage system will be calculated at detail/ construction certificate stage.

The design parameters for the DRAINS model are to be based on the recommendations as defined by council and parameters for the area and are included in **Table 5.2** as follows.

Table 5.2. DRAINS Parameters

Model	Model for Design and analysis run		
	ILSAX Hydrological Model Rainfall	ARR2019	
	Soil Type-Normal	3.0	
	Paved (Impervious) Area Depression Storage	1	mm
	Supplementary Area Depression Storage	1	mm
	Grassed (Pervious) Area Depression Storage	5	mm
AMC	Antecedent Moisture Condition (ARI=1-5 years)	2.5	
AMC	Antecedent Moisture Condition (ARI=10-20 years)	3.0	
AMC	Antecedent Moisture Condition (ARI=50-100 years)	3.5	
	Sag Pit Blocking Factor (Minor Systems)	0.5	
	On Grade Pit Blocking Factor (Minor Systems)	0.2	
	Sag Pit Blocking Factor (Major Systems)	0.5	
	On Grade Pit Blocking Factor (Major Systems)	0.2	

5.5 Hydraulics

5.5.1 General Requirements

Hydraulic calculations will be carried out utilising DRAINS modelling software during the detail design stage to ensure that all surface and subsurface drainage systems perform to or exceed the required standard.

5.5.2 Freeboard

The calculated water surface level in open junctions of the piped stormwater system will not exceed a freeboard level of 150mm below the finished ground/ grate level, for the peak runoff from the Minor System runoff.

The calculated water surface for the peak runoff from the Major System runoff will not exceed a freeboard level of 300mm below the finished floor level of the building/ development pads.

5.5.3 Public Safety

For all areas subject to pedestrian traffic, the product (dV) of the depth of flow d (in metres) and the velocity of flow V (in metres per second) will be limited to 0.4, for all storms up to the 100-year ARI.

For other areas, the dV product will be limited to 0.6 for stability of vehicular traffic (whether parked or in motion) for all storms up to the 100-year ARI.

5.5.4 Inlet Pit Spacing

The spacing of inlets throughout the site will be such that the depth of flow, for the Major System design storm runoff, will not exceed the top of the kerb (150mm above gutter invert).

5.5.5 Overland Flow (development lots)

Dedicated flow paths have been designed to convey all storms up to and including the 100-year ARI. These flow paths will convey stormwater from the site to the detention systems prior to discharge.

5.6 **External Catchment and Flooding**

There are several external catchments which affect the development site as described in **Section 5.2** and shown in **Figure 5.1**, and further assessed via 2-dimensional flood modelling in **Section 8** and **Appendix E** of this report.

Council has advised (in their pre-DA minutes) that consideration to overland flow which enters the site from the north-east and south-east corners of the property in addition to flooding associated with the South Creek floodplain. Further consultation has been completed with Sydney Water to ensure the requirements of the Mamre Road Trunk Drainage Scheme plan have been achieved. The design arrangement is based on agreed arrangements with Sydney Water.

An assessment of overland flow and flooding has been made in **Section 8** and **Appendix E** of this report. Refer to these sections for detailed discussion on overland flow and flooding. Overall, once the above factors are duly considered, it can be confirmed that the works can commence without affectation of upstream, downstream or adjoining properties in relation to overland flow.

5.7 **SEPP (WSEA) Clause 33L Stormwater, water quality and water sensitive design**

Consideration to the requirements of *SEPP (WSEA) Clause 33L Stormwater, water quality and water sensitive design* has been made in the impact assessment.

Review and confirmation specific matters included in Clause 33L(2) has been made for Items (a) through (f) as follows:

a) water sensitive design principles are incorporated into the design of the development,

An integrated stormwater management plan which integrates WSUD principles (including detention systems, bio-retention basins, irrigation, misting, rainwater reuse and other measures) has been proposed for the development.

Reference to WSUD objectives in **Section 5.1** should be made in conjunction with **Section 6** (*Water Quantity Management*), **Section 7** (*Stormwater Quality Reuse and Maintenance*) and **Section 8** (*Flooding and Overland Flow*), and associated drawings in **Appendix A** should be made pertaining to the proposed stormwater management for the development.

b) riparian, stormwater and flooding measures are integrated,

Stormwater and flooding measures have been integrated in the proposed management system in accordance with the MRP DCP and NSW Floodplain Development Manual.

Reference to **Section 6** (*Water Quantity Management*), **Section 7** (*Stormwater Quality Reuse and Maintenance*) and **Section 8** (*Flooding and Overland Flow*), and associated drawings in Appendix A should be made pertaining to the proposed stormwater management and flood management measures proposed for the development.

- c) *the stormwater management system includes all reasonable management actions to avoid adverse impacts on the land to which the development is to be carried out, adjoining properties, riparian land, native bushland, waterways, groundwater dependent ecosystems and groundwater systems,*

Stormwater management systems have been proposed based on relevant local and state government policy, and MRP DCP. The proposed measures result in acceptable impacts based on industry best practice and noted policy.

Reference to **Section 6** (*Water Quantity Management*), **Section 7** (*Stormwater Quality Reuse and Maintenance*) and **Section 8** (*Flooding and Overland Flow*), and associated drawings in Appendix A should be made pertaining to the proposed stormwater management and flood management measures proposed for the development.

- d) *if a potential adverse environmental impact cannot be feasibly avoided, the development minimises and mitigates the adverse impacts of stormwater runoff on adjoining properties, riparian land, native bushland, waterways, groundwater dependent ecosystems and groundwater systems,*

Stormwater management systems have been proposed based on relevant local and state government policy, and MRP DCP. The proposed measures result in acceptable impacts based on industry best practice and noted policy.

Reference to **Section 6** (*Water Quantity Management*), **Section 7** (*Stormwater Quality Reuse and Maintenance*) and **Section 8** (*Flooding and Overland Flow*), and associated drawings in **Appendix A** should be made pertaining to the proposed stormwater management and flood management measures proposed for the development.

- e) *the development will have an adverse impact on—*
 - (i) *the water quality or quantity in a waterway, including the water entering the waterway, and*
 - (ii) *the natural flow regime, including groundwater flows to a waterway, and*
 - (iii) *the aquatic environment and riparian land (including aquatic and riparian species, communities, populations and habitats), and*
 - (iv) *the stability of the bed, banks and shore of a waterway,*

The proposed stormwater management proposed measures to ensure stream health based on the stream flow objectives proposed by NSW EES and now included in the MRP DCP and subsequent South Creek/ Wiannamatta MUSIC Modelling Toolkit. Reference to **Section 6.3** should be made for confirmation of Stream Health metrics.

- f) *the development includes measures to retain, rehabilitate and restore riparian land.,*

There are no riparian corridors influenced by the development.

Further expansion relating to subclause (2)(a), the water sensitive design principles set out in Clause 33L(3) has been made for Items (a) through (d) as follows:

- a) protection and enhancement of water quality, by improving the quality of stormwater runoff from catchments,*

Stormwater runoff is proposed to be managed by water quality systems including bio-retention basins.

Reference to **Section 7** (*Stormwater Quality Reuse and Maintenance*) and associated drawings in **Appendix A** should be made pertaining to the proposed stormwater quality management measures proposed for the development.

- b) minimisation of harmful impacts of development on water balance and on surface and groundwater flow regimes,*

Stormwater management systems have been proposed based on relevant local and state government policy, and MRP DCP. The proposed measures result in acceptable impacts based on industry best practice and noted policy.

Reference to **Section 6** (*Water Quantity Management*), **Section 7** (*Stormwater Quality Reuse and Maintenance*) and **Section 8** (*Flooding and Overland Flow*), and associated drawings in **Appendix A** should be made pertaining to the proposed stormwater management and flood management measures proposed for the development.

- c) integration of stormwater management systems into the landscape in a manner that provides multiple benefits, including water quality protection, stormwater retention and detention, public open space, habitat improvement and recreational and visual amenity*

Integration of stormwater management systems has been made within landscape setbacks and landscaped areas. Reference to drawings in **Appendix A** should be made pertaining to the proposed stormwater management system location and integration into landscape zones proposed for the development.

- d) retention, where practical, of on-site stormwater for use as an alternative supply to mains water, groundwater or river water*

Reuse of rainwater is proposed for non-potable uses (irrigation and toilet flushing) as set out in **Section 7.4**.

6 WATER QUANTITY MANAGEMENT

6.1 Water Quantity Management Objectives

The MRP DCP sets the requirements pertaining to stormwater quantity management and discharge. These requirements address both peak flow runoff (consistent with the principles of traditional of water quantity management or “On-site Detention (OSD)”), flow duration and mean annual runoff volumes (MARV). The measures adopted in the precinct are to ensure the cumulative effect of development does not have a detrimental effect on the existing stormwater infrastructure and watercourses located within their LGA downstream from the precinct.

The pre and post development peak flow requirements and the Flow Duration Curve (FDC), MARV metrics are included in **Table 5.1** of this report.

Peak flow management assessments are included in **Section 6.2**.

Stream health and overall discharge, including MARV and FDC, are included in **Section 6.3**.

6.2 Peak Flow Quantity Management

6.2.1 Methodology

A hydrological analysis was undertaken to estimate the impact of the development of the site on peak flows at the downstream extent of the site. Modelling of stormwater runoff was considered for the pre-existing case and for the operational phase of the development.

DRAINS has been used to assess the site detention discharge and storage relationship.

In order to assess the existing and operational phase peak discharges from the development site, a DRAINS hydrological model was used to estimate peak flows from catchments on the site for various storm durations for Q2 year ARI to Q100 year ARI events.

6.2.2 Existing & Post Development Peak Flows

Table 6.1 to Table 6.2 show the existing and developed flows at the downstream boundary for the existing catchments on the property.

Table 6.1. Q2, Q20 & Q100 ARI Peak Flows

ARI	Design Storm Duration	Peak Flow (m ³ /s)		
		Undeveloped	Developed	
		Site	Site (no atten.)	Site (+ atten.)
2	30	0.312	1.070	0.181
	60	0.427	0.887	0.204
	120	0.430	1.020	0.211
20	30	1.060	1.900	0.267
	60	1.170	1.600	0.562
	120	1.230	1.820	0.621
100	30	1.510	2.340	0.806
	60	1.630	2.000	1.233
	120	1.590	2.260	1.422

The post development (with site attenuation) flows can be seen to be lower than the pre-developed flows. The required detention storage for the development site is discussed in the following section.

6.2.3 Proposed Peak Flow Management Storages and Hydrology

As previously discussed, detention storage on the development site is required to reduce local outflows. The proposed site layout allows for provision of a detention tank, in combination with an offline pond and bio-retention basin. The ultimate discharge location will be to *Flow Path FP2*.

Several combinations of storages and outlet arrangements tested in the model. The adopted arrangement models the tank configuration shown in **Table 6.2** and the proposed layout can also be observed on drawing **Co14429.00-DA41**.

Table 6.2 OSD Detention Characteristics (Post Developed)

ARI	Duration	Peak Flow (m³/s)					Depth (mm)	Storage (m³)
		Discharge Location	No Atten.	With attenuation				
				Low	High	Total		
2	120 min	Basin 1	1.120	0.211	0	0.211	1090	1035
20	60 min	Basin 1	1.600	0.292	0.270	0.562	1830	1742
100	60 min	Basin 1	2.00	0.309	0.924	1.233	2000	1900

The hydrologic analysis shows that, with the provision of the active storage for stormwater detention, within the stormwater management basins specified above, the post development peak flows from the site will be attenuated to less than pre-development as required of the MRP DCP and Council. We note that water quality and stream health requirements are co-located with the OSD provisions, as further discussed below.

6.3 Stream Health Assessment (MARV and FDC)

6.3.1 Stream Health Introduction

Stream health has been assessed for this development based on the requirements set in *Section 2.4* of the Final MRP DCP. The assessment is based on the current development extent (earthworks, infrastructure for future industrial development over an area of 5.4 Ha, and construction of the buildings on Lot 1A and 1B). The future precinct-wide system (wetland or similar), which is anticipated to be implemented by Sydney Water (now announced as the waterway manager for South Creek) has not currently been considered in the assessment.

The Flow Duration Curve (FDC)/ Mean Annual Runoff Volume (MARV) alternate proposed by EES in their MUSIC modelling Toolkit dated 21 September 2022 and included in *Section 2.4* of the MRP DCP has been assessed in MUSIC.

The proposed additional stream flow measures are included in **Table 6.4**, and achieved values (per MUSIC modelling), are included and compared with a *Section 2.4* and Table 6 of the Final MRP DCP.

MUSIC model parameters and model layout are included in **Appendix B**. Refer also to drawing **Co14429.00-DA47** for WSUD plan which confirms the irrigation areas and WSUD elements for the proposed development.

6.3.2 MARV Assessment – Estate Solution

Assessment of estate discharge against the two waterway discharge target options [*presented in both the MRP DCP and the Technical guidance for achieving Wianamatta-South Creek stormwater management targets (Sep 2022)*] has been completed (refer **Table 5.1** of this report for the Operational phase targets included in the MUSIC Toolkit).

The model is based on the proposed application for approval of the estate and construction of the two proposed building developments. The estate basins are proposed to contain dead storage (or stormwater retention) which will be utilised for estate-level irrigation or removed from the system via trickle discharge or other evaporative uses. Staged discharge relationships are proposed to enable discharge at the required FDC rates. The discharge controls are noted on the drawings in **Appendix A**, while the irrigation, re-use and usage allowances are detailed below.

- 600ml/year/m² as PET-Rain for landscape irrigation.
- 15L/person/day for toilet flushing.
- 5mm/day as daily re-use demand for dust suppression of exposed pads

The above regime for the landscaped & undeveloped area for the site gives the following yearly outdoor water demand:

Basin 1 Irrigated Area (0.6kL/year/m ²)	15,000m ²	9000 kL/year
RWT 1A Irrigated Area (0.6kL/year/m ²)	1,450m ²	870 kL/year
RWT 1B Irrigated Area (0.6kL/year/m ²)	1,150m ²	700 kL/year

6.3.3 MARV and FDC Storage and Reuse Sizing

MARV and FDC management basins have been designed, using MUSIC software to assess the discharge and usage metrics and compliance with the MRP DCP controls. The model includes the calculated base water usages and water balance within the estate.

The use of rainwater & stormwater reduces the mains water demand and the volume of stormwater runoff. By collecting the rainwater run-off from the site, storage basins provide a valuable water source suitable for landscape irrigation and dust suppression for the development.

Table 6.3A. Management System Key Parameters

System	Catchment (m ²)	Perm. Pool Vol. (m ³ / kL)	Extended Detention Depth	Surface Area (m ²)
Basin 1 - Bio	52,200	0	0.3	200
Basin 1 - Pond	52,200	500	1.0	500

Table 6.3B. Management System Key Parameters

System	Catchment (m ²)	Storage Vol. Actual (m ³ / kL)	Storage Vol. Modelled (m ³ / kL)	Surface Area (m ²)
1 RWT	3,650	120kL	108kL modelled	40
2 RWT	4,080	120kL	108kL modelled	40

Figure 6.2 shows the MUSIC model Flow Duration Curve for the estate stormwater management strategy, while **Table 6.4** provides confirmation of target requirements and those achieved for both permitted alternates. The distribution of flows in the lower frequency events reduces significantly as frequency increases. With reference to **Appendix F**, the modelling indicates that the flow metric targets are met.

We note that the final configuration and sizing of the stormwater management systems and rainwater tanks is subject to detail design considerations and optimum site utilisation.

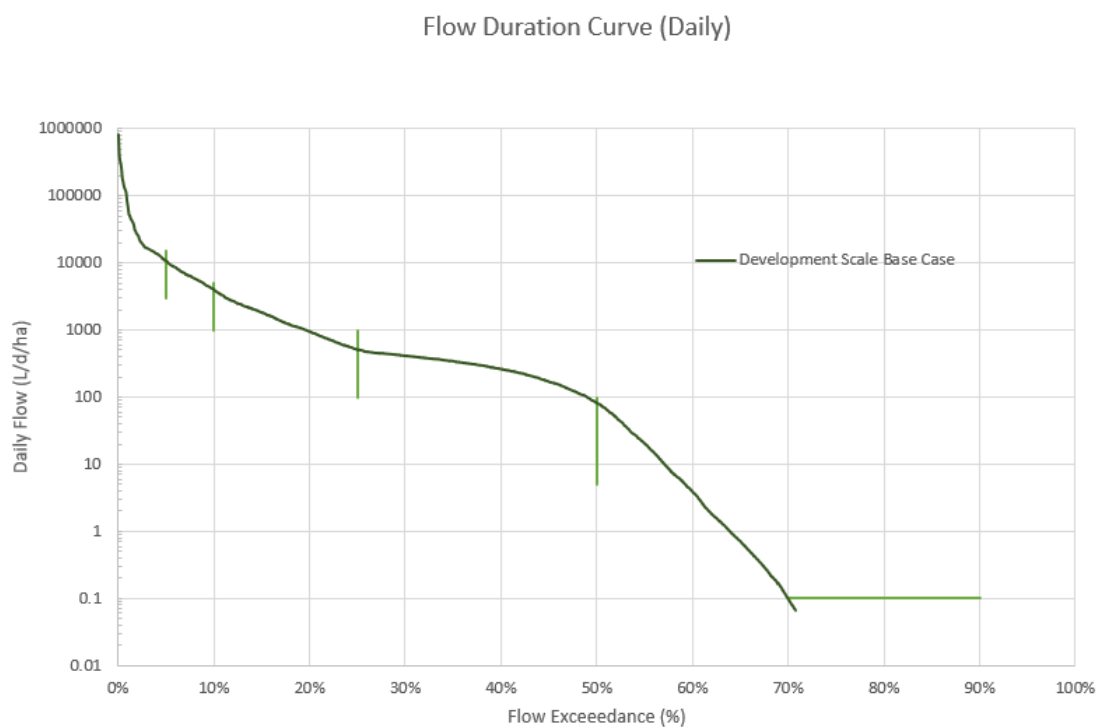


Figure 6.2. MUSIC Model Flow Duration Curve

Table 6.4. Confirmation of Estate MARV /FDC

Objective	Required Parameter	Result – Alternative 1	Result – Alternative 2
Mean Annual Runoff Volume (MARV)	<=2.0 ML/ha/year	N/A	1.37 ML/ha/year
95%ile flow	3000 to 15000 L/ha/day	10,768 L/ha/day	N/A
90%ile flow	1000 to 5000 L/ha/day	4,022 L/ha/day	
75%ile	100 to 1000 L/ha/day	512 L/ha/day	
50%ile flow	5 to 100 L/ha/day	83 L/ha/day	
10%ile flow	0 L/ha/day	N/A	0 L/ha/day
Cease to Flow	10-30%	29%	N/A

As demonstrated in **Table 6.4**, the requirements of MRP DCP have been met for both Alternative 1 & 2 MARV/FDC requirements. Refer to drawing **Co14429.00-DA47** for WSUD plan which confirms the irrigation areas and WSUD elements for the proposed development.

6.3.4 Sydney Water Regional Scheme

Sydney Water proposes to implement a regional stormwater scheme for the Mamre Road Precinct (refer **Figure 6.3**). The system includes a series of systems including trunk drainage corridors, storage basins, wetlands, reuse reticulation as shown, in a strategic sense, in their Mamre Road Precinct Stormwater Scheme Plan.

As noted throughout consultation and response letter, the intent for the GPT Group to connect to the regional scheme has been considered in the design. Future infrastructure designs, including purple pipe network, will be completed at detail design stage which will provide reticulation for recycled water. Discharge of stormwater is made to trunk waterways of which we understand the Sydney Water regional system will collect runoff for management in the scheme.

Dead water storage and reuse elements included in the current design (as set out in Sections 6.3 of this report) would become redundant at the time of the regional system coming online. This would take the form of decommissioning of irrigation and reuse systems, and eliminating the dead storage elements from the provided storage systems.

The intent for decommissioning is agreed, however details of the arrangement would be progressed and provided in conjunction with further information from Sydney Water on the form and function of the regional system in the future.

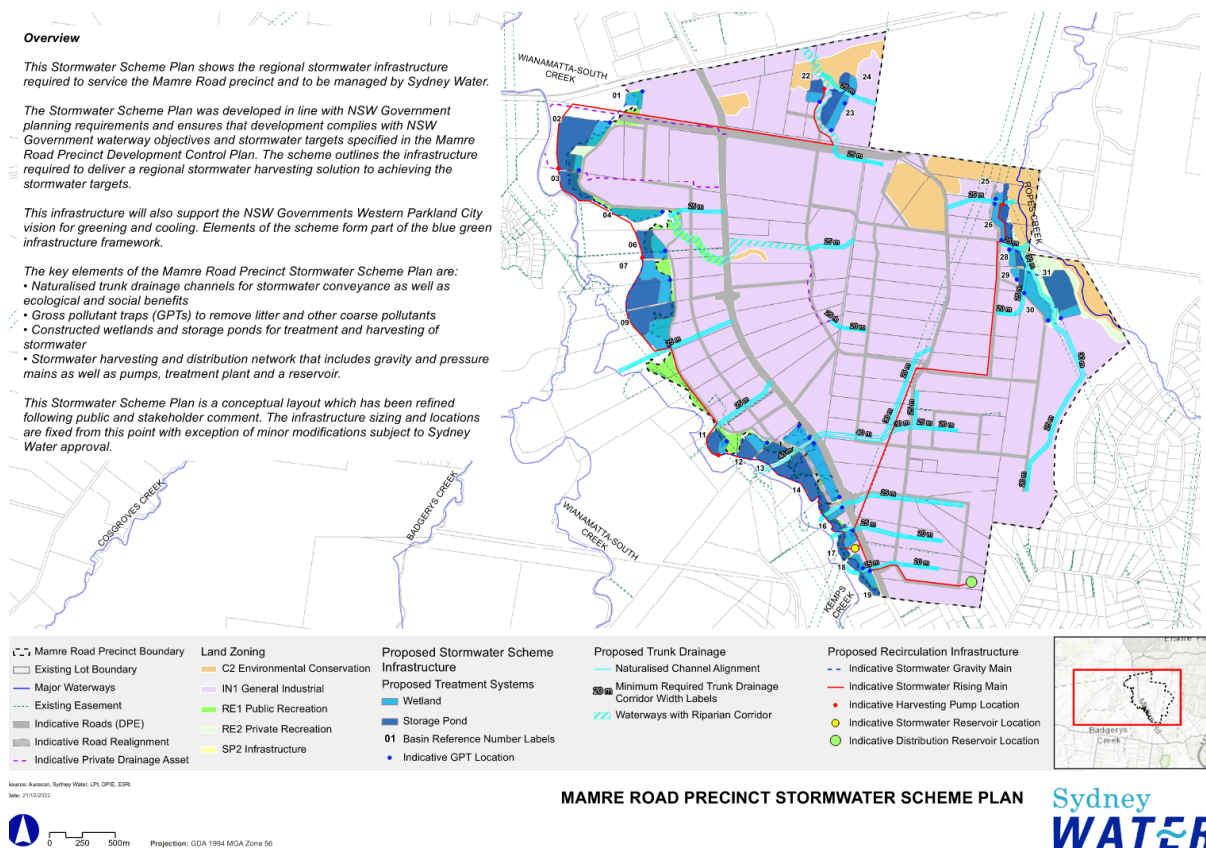


Figure 6.3. Mamre Road Precinct Stormwater Scheme Plan (Sydney Water)

7 STORMWATER QUALITY, REUSE AND MAINTENANCE

7.1 Stormwater Quality Objectives

There is a need to provide a design which incorporates the principles of Water Sensitive Urban Design (WSUD) and to target pollutants that are present in the stormwater so as to minimise the adverse impact these pollutants could have on receiving waters and to also meet the requirements specified in the MRP DCP.

The requirements for stormwater quality to be performed for the entire estate catchment. The reduction objectives noted in **Section 5.1** and **Table 5.1** of this report are presented in terms of annual percentage pollutant reductions on a developed catchment based on the controls included in the *MRP DCP 2021*.

Assessment of compliance of the water quality objectives has been made using MUSIC as set out in the following sub-sections of the report.

7.2 Proposed Stormwater Treatment System

Developed impervious areas including roof, hardstand, car parking, roads and other extensive impervious areas are required to be treated by the Stormwater Treatment Measures (STM's). The STM's shall be sized according to the whole catchment area of the development. The STM's for the development shall be based on a treatment train approach to ensure that all the objectives above are met.

Components of the treatment train for the development are as follows:

- Primary treatment to development lots and proposed roads are via a SQIDEP approved GPT. Pre-treatment of the stormwater will assist in mitigating the potential for early onset sedimentation of the bio-retention systems;
- Tertiary treatment to the catchment will be provided by combination of 100 Full Height Atlan Filters and a bio-retention system within the proposed estate management basins. As noted, the effective performance of bio-retention systems combined with on-site detention systems is described in detail in **Section 6.2 and 6.3** of this report.

7.3 Stormwater Quality Modelling

The MUSIC model was chosen to model water quality. By simulating the performance of stormwater management systems, MUSIC can be used to predict if the proposed systems and changes to land use are appropriate for their catchments and capable of meeting specified water quality objectives (CRC 2002). The water quality constituents modelled in MUSIC, of relevance to this report, include Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

The pollutant retention criteria set out in the MRP DCP and nominated in **Section 5.1** of this report were used as a basis for assessing the effectiveness of the selected treatment trains.

The parameters used in the MUSIC model are presented in **Appendix B**. **Figure 7.1** below shows the MUSIC model layout.

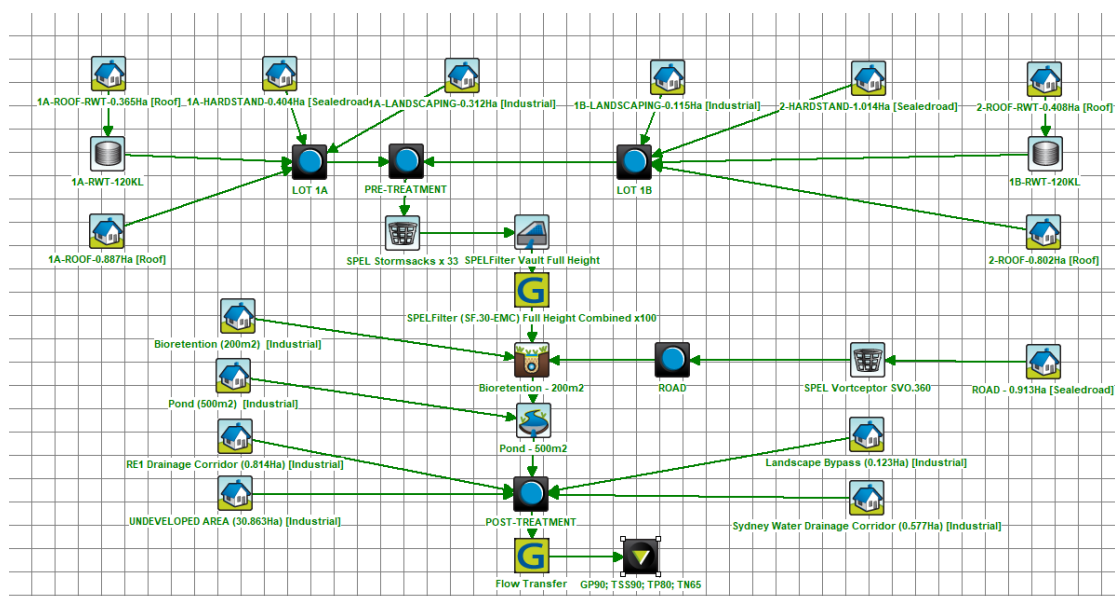


Figure 7.1. MUSIC model layout

Table 7.1 shows the results of the MUSIC analysis. The reduction rate is expressed as a percentage and compares the post-development pollutant loads without treatment versus post-development loads with treatment.

Table 7.1. MUSIC analysis results - % reductions

Pollutant (per Kg)	Source	Residual Load	Target per Ha	Result per Ha	Target Met Y/N
Total Suspended Solids (kg/yr)	6630	1970	<80	52.25	Y
Total Phosphorus (kg/yr)	12.8	5.11	<0.3	0.135	Y
Total Nitrogen (kg/yr)	87.3	38.9	<3.5	1.03	Y
Gross Pollutants (kg/yr)	876.	49.3	<16	1.311	Y

MUSIC modelling has been performed to assess the effectiveness of the selected treatment trains and to ensure that the pollutant retention requirements of Section 2.4 of MRP DCP have been met.

The modelling shows that treatment objectives included in the MRP DCP are noted to be met by the precinct for GP's, TSS, TP and TN. Overall, the proposed water quality system is robust and provides adequate water quality outcomes.

Given the expected low source loadings of hydrocarbons and oil/grease and removal efficiencies of the treatment devices we consider that the requirements of the Penrith City Council and the MRP DCP have been met. Further discussion on hydrocarbons can be found in **Appendix B**.

7.4 Stormwater Harvesting

Stormwater harvesting refers to the collection of stormwater from the developments internal stormwater drainage system for re-use in non-potable applications. Stormwater from the stormwater drainage system can be classified as either rainwater, where the flow is from roof areas only, or stormwater where the flow is from all areas of the development.

Rainwater harvesting is not proposed for the estate development, however future individual development lots will require re-use for non-potable applications. Internal uses include such applications as toilet flushing while external applications will be used for irrigation. The aim is to reduce the water demand for the development and to satisfy the requirements of the MRP DCP. Objectives have been set out in **Section 5.1** of this document.

In general terms the rainwater harvesting system will be an in-line tank for the collection and storage of rainwater. At times when the rainwater storage tank is full rainwater can pass through the tank and continue to be discharged via gravity into the stormwater drainage system. Rainwater from the storage tank will be pumped for distribution throughout the development in a dedicated non-potable water reticulation system.

Rainwater tanks for future development lots and application will need to have harvesting systems sized with reference to the NSW Department of Environment and Conservation document *Managing Urban Stormwater: Harvesting and Reuse*, using either a simple water balance analysis to balance the supply and demand, based on the base water demands and the requirement of the MRP DCP, or via MUSIC.

The objectives, as included in **Section 5.1**, are to provide a reduction in non-potable water demand with a minimum demand reduction of 80% based on a rainwater balance assessment.

7.5 Maintenance and Monitoring

It is important that each component of the stormwater system and water quality treatment train is properly operated and maintained. In order to achieve the design treatment objectives, an indicative maintenance schedule has been prepared and included as **Appendix D** to assist in the effective operation and maintenance of the various water quality components.

Inspection frequency may vary depending on site specific attributes and rainfall patterns in the area. In addition to the below nominated frequency it is recommended that inspections are made following large storm events.

It is reiterated that the landowner will retain ownership and management of all estate basins.

8 FLOODING AND OVERLAND FLOW

8.1 Introduction

The site has been identified by Penrith City Council as being affected by overland flow from the existing watercourses (*Flow Path 1* and *2* – refer **Figure 5.1**) which enter the site on the east on the Mamre Road boundary. The site is also noted to be within the South Creek flood plain on the west of the development site.

We note that the site is clear of the 1% AEP flood extent associated with South Creek. The site is also noted to contribute to one of the sub-catchments of South Creek and ultimately runoff from the property drains to South Creek.

An overland flow and flood assessment has been completed for the development approval submission in relation to the north-eastern flow path. The following sections of the report describe the catchment description, flood description and proposed flood management.

Detailed technical information pertaining to the TUFLOW modelling and output completed by our office is included in **Appendix E**.

8.2 Catchment Description & Existing Flood Behaviour

The contributing upstream catchments of FP1 and FP2 are approximately 33Ha and 126Ha respectively. These catchments are shown in **Figure 5.1** and also as **Figure E2.1**.

The catchment comprises rural land use and >90% pervious surfaces. Future development is noted to require detention and as such has been modelled as per existing impervious surface breakdown.

Penrith Council is noted to have undertaken a regional assessment of local tributaries Penrith Overland Flow “*Overview Study – Flood Analysis for Central Urban (Zone 1), Northern Rural (Zone 2), Southern Rural (Zone 3)*” – Cardno 2006. The site is located within the Southern Rural (Zone 3) and an excerpt of the flood model output is shown in **Figure 8.2a** and also **Figure E1.1** of **Appendix E**.

Councils’ assessment shows overland flow is present along the watercourses and their confluence with South Creek Floodplain. The modelling shows the flood extent to be limited to the gully and dams local to watercourses.

Figure 8.2b shows the 1% AEP flood levels and extent per Councils South Creek 2014 study completed by Advisian. It is noted that the western boundary of the IN1 Zoning is based on the 1% AEP flood level of RL 35.3m AHD

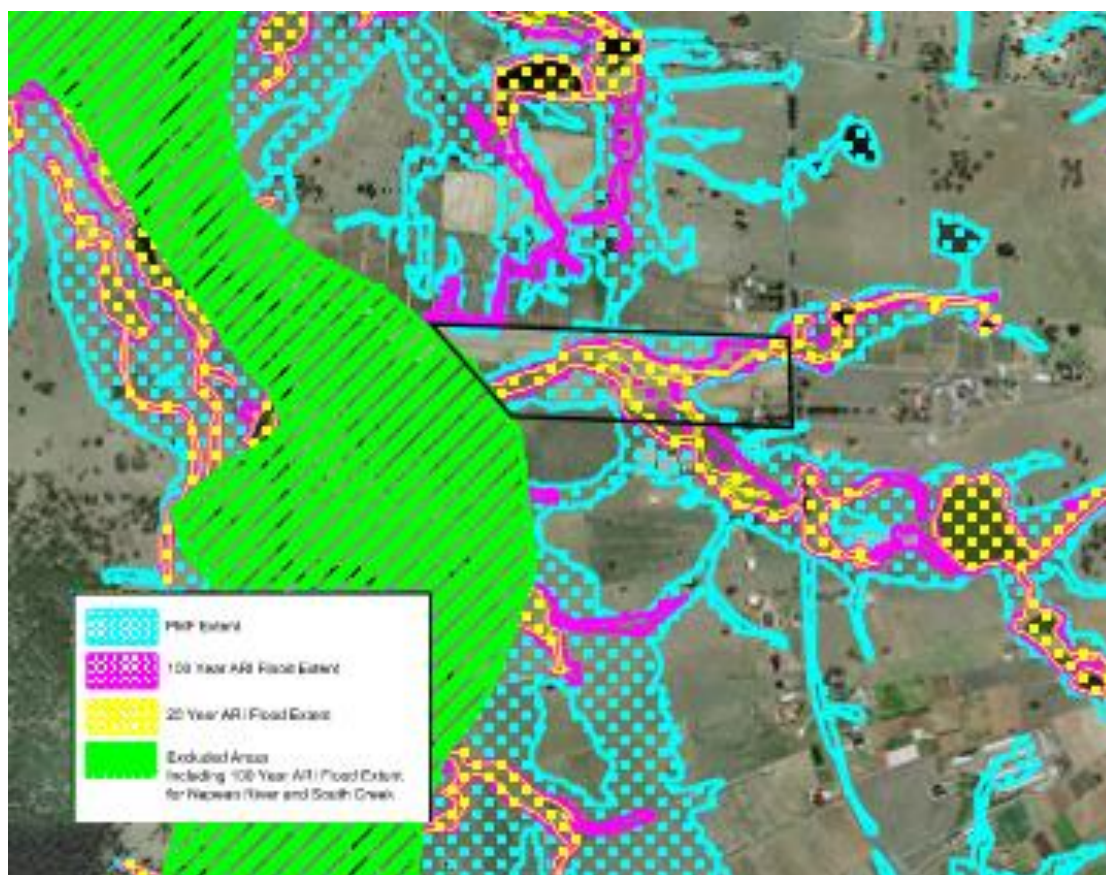


Figure 8.2a. Excerpt of Figure 6.1k of Cardno 2006 Study



Figure 8.2b. Excerpt of Figure 6.42 of 2014 South Creek Study

Sydney Water also completed a flood/ overland flow assessment which was included in their *Mamre Road Flood, Riparian Corridor and Integrated Water Cycle Management Strategy (2020)*. Reference to **Figure 8.3** below shows excerpts from the noted document and the site.

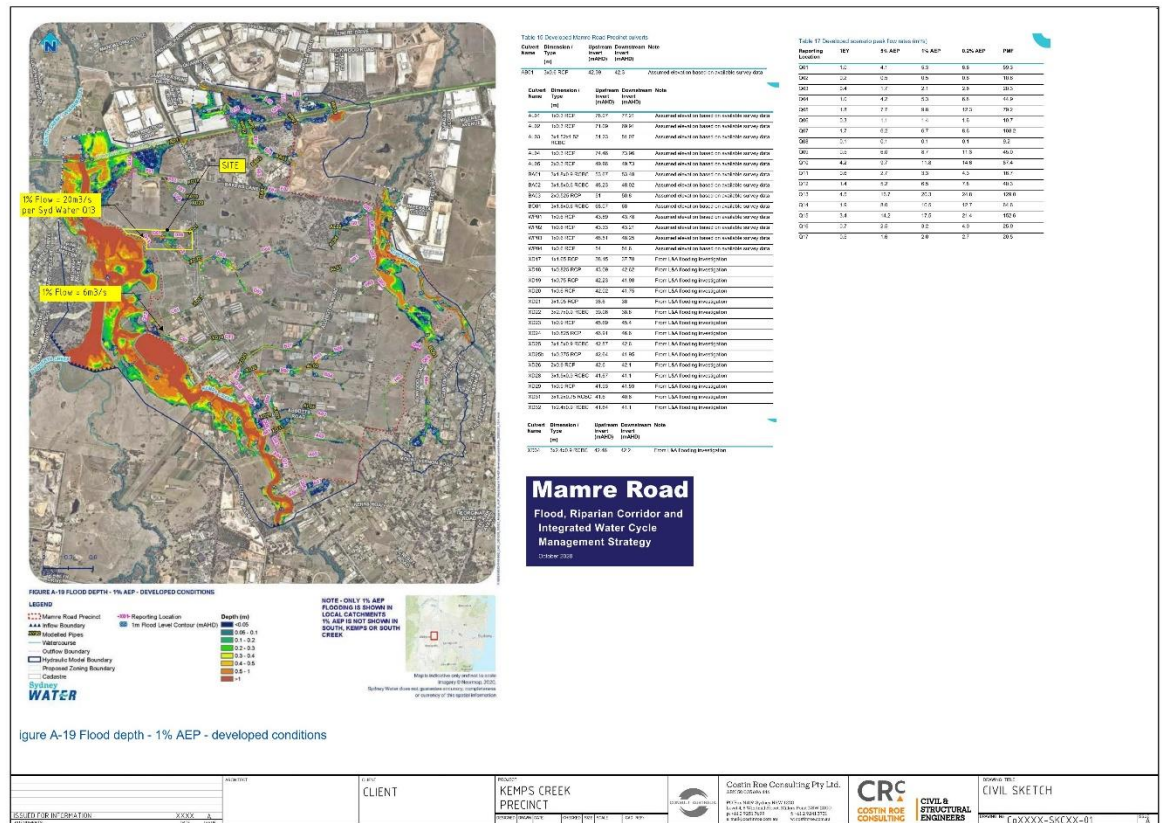


Figure 8.3. Sydney Water Mamre Road Flood, Riparian Corridor and Integrated Water Cycle Management Strategy

8.3 Proposed Overland Flow Management Strategy

Council requires an assessment of the pre and post development overland flow conditions for the 1% AEP storm event. Further that the overland flows from the upstream catchment are able to be conveyed through the site without affection of upstream, downstream or adjacent properties in the 1% AEP.

A TUFLOW model has been prepared for the assessment as set out in the following sections of the report. The proposed management strategy involves conveying overland flow through the development site within an open channel in Stage 1, then via culverts in Stage 2. The final conveyance arrangement will be subject to the precinct layout and trunk drainage strategy for the precinct.

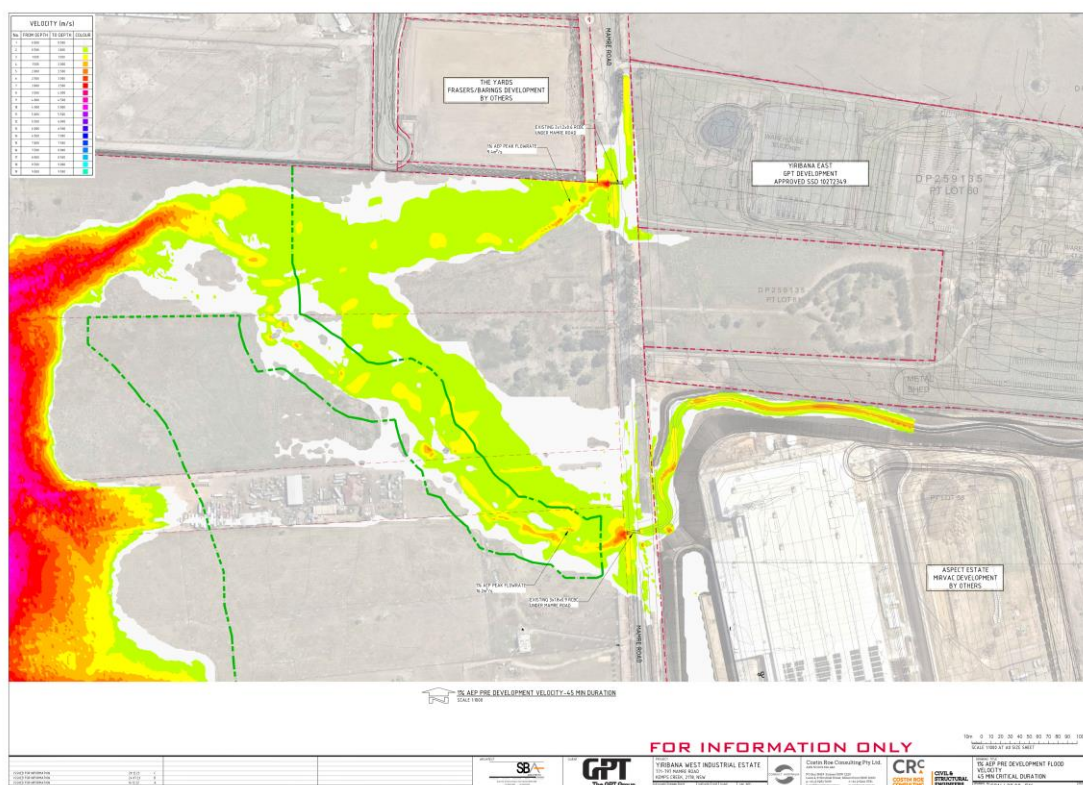


Figure 8.5: 1% AEP Pre-developed Velocity

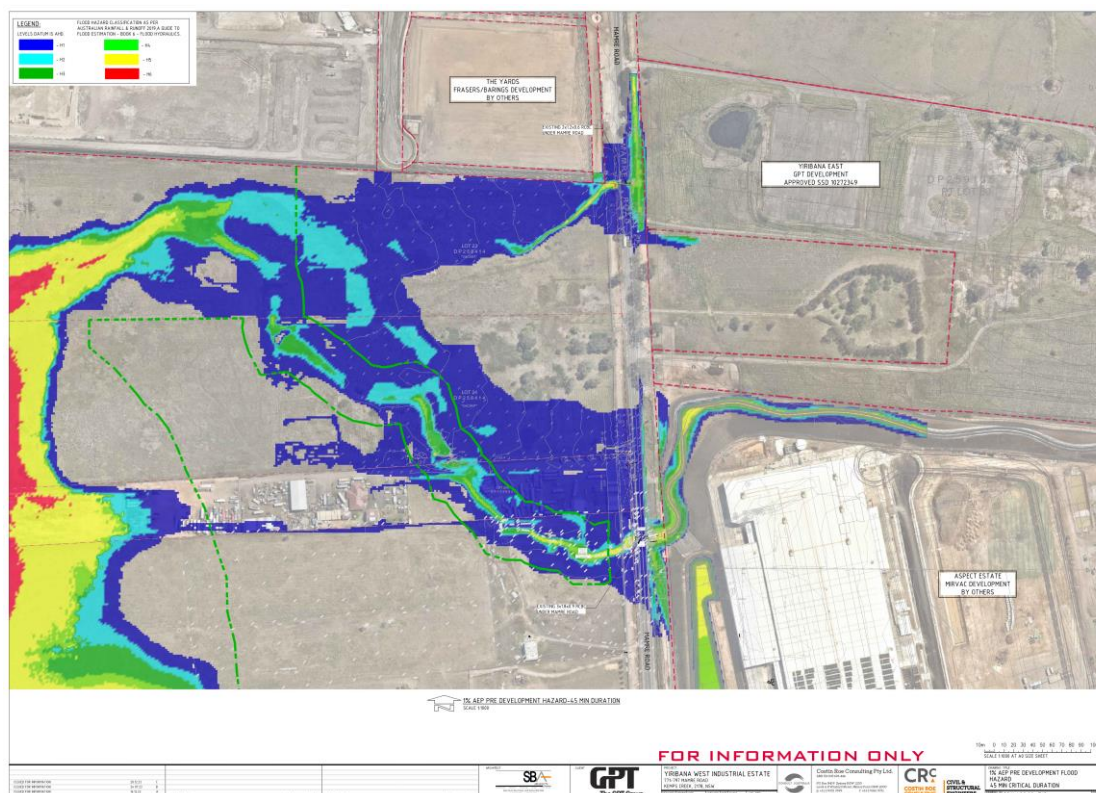


Figure 8.6: 1% AEP Pre-developed Flood Hazard Categorisation

8.4.3 Post-Development 1% AEP

Reference to **Figure 8.7** shows the post-developed 1% AEP output for depth and levels. **Figure 8.8** shows velocity and **Figure 8.9** show true hazard categorisation. It is noted that flood conveyance is proposed along the southern side of Warehouse 1 fire access trail during the 1% AEP flood event. Flood conveyance through the fire access trail is to limit off-site impacts during the post-development scenario. The post development scenario does not consider the future Flow Path 2 extension further south towards Mamre Road and that flood waters follow existing naturalised overland flow paths. In future works and extension of the Flow Path 2 channel to Mamre Road, the fire trail would expect to become flood immune with the channel conveying the 1% AEP flow. Floodway warning signage is to be provided along the fire access trail until such time that the full length of the channel is constructed up to Mamre Road and the fire access trail is flood free.

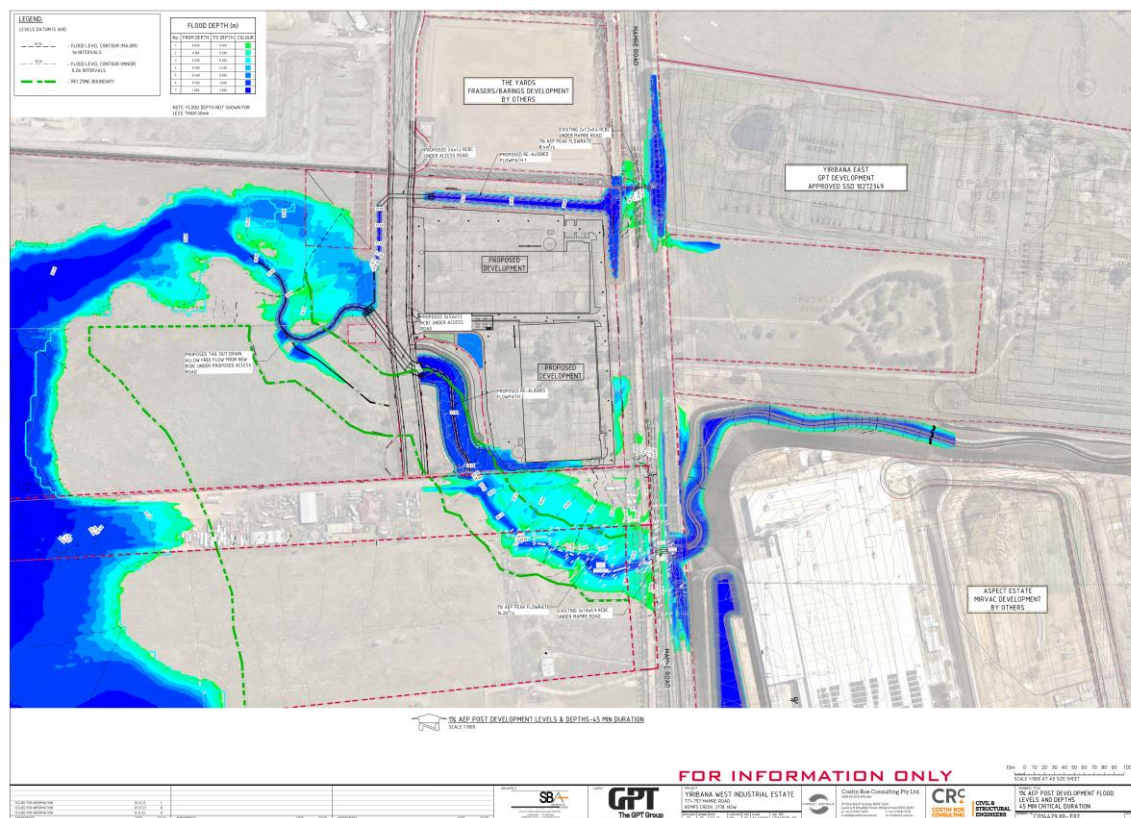


Figure 8.7: 1% AEP Post-developed Level and Depth Output

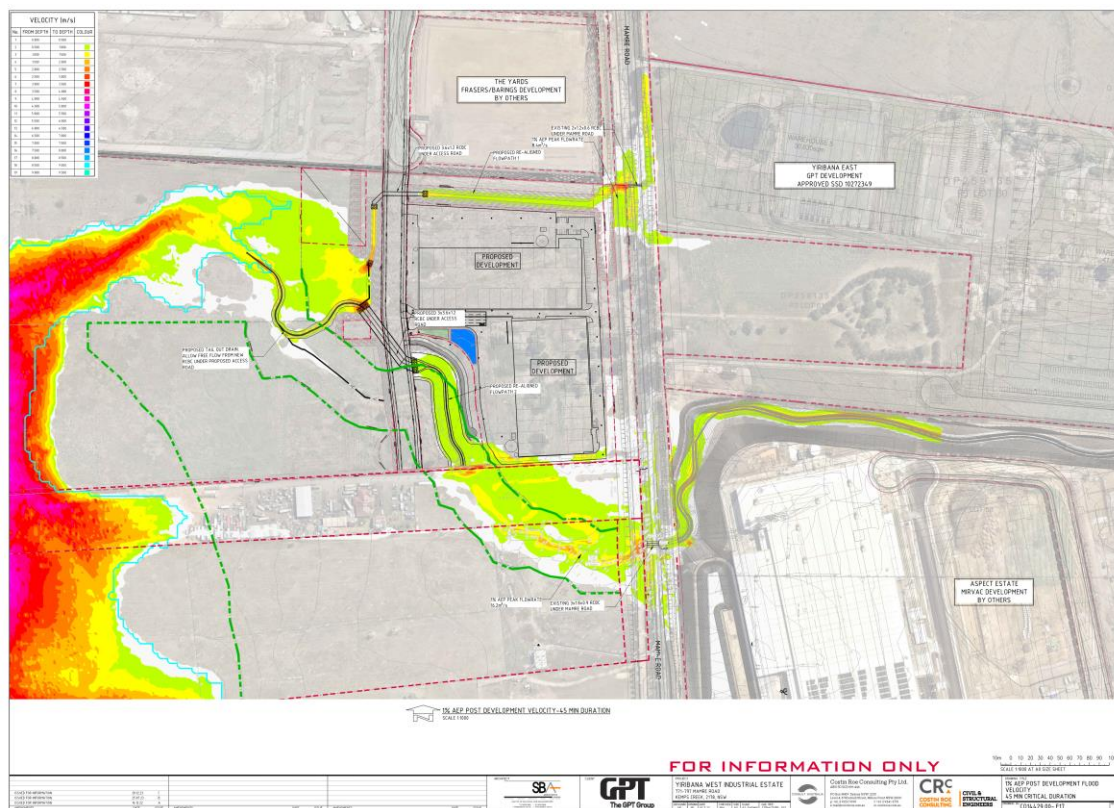


Figure 8.8: 1% AEP Post-developed Velocity

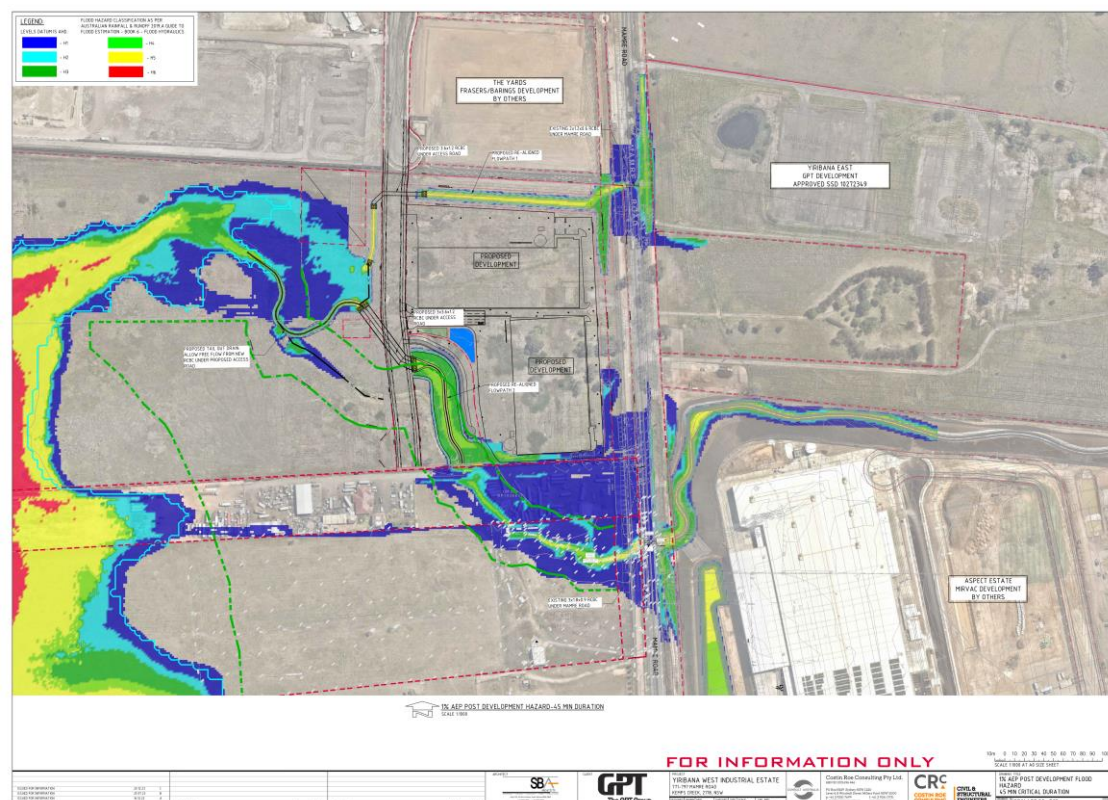


Figure 8.9: 1% AEP Post-developed Flood Hazard Categorisation

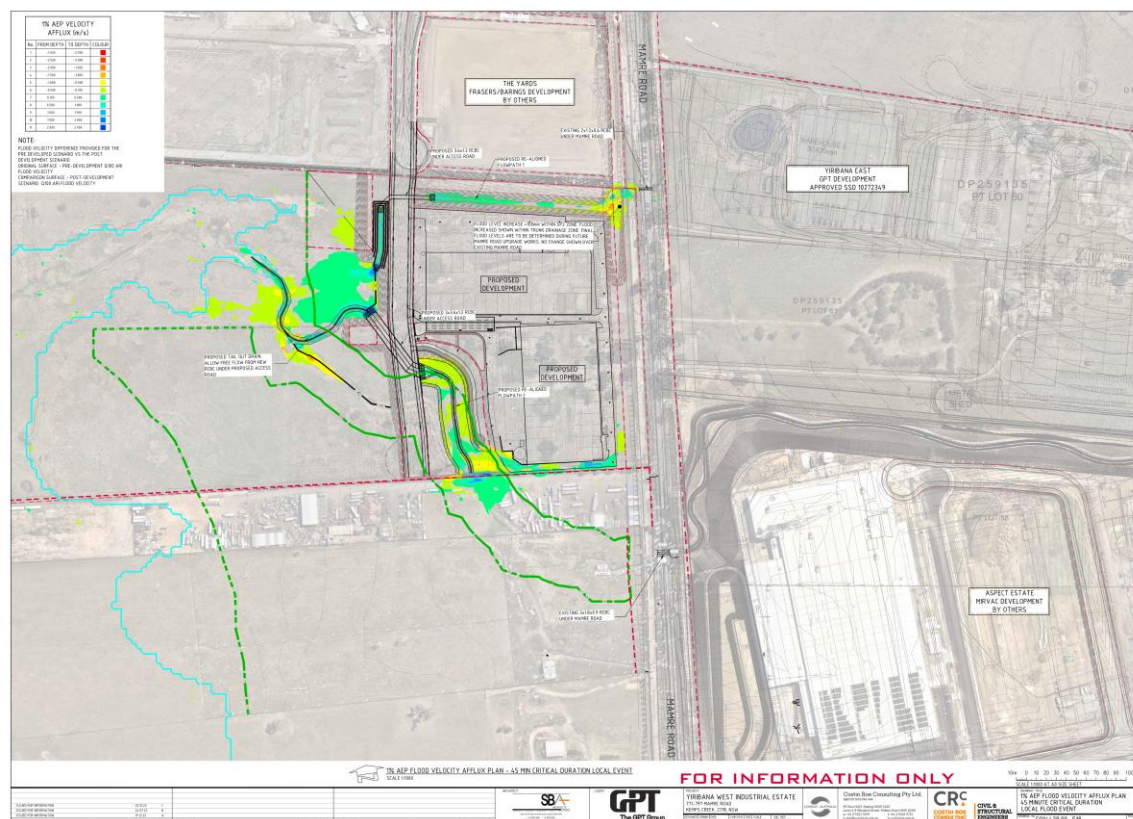


Figure 8.11: 1% AEP Post Developed Flood Velocity Afflux

8.5 Flood Planning and Hazard Categorisation

The minimum floor level to be a minimum of 0.5m above 1% Annual Exceedance Probability flood level. The flood planning level (FPL) for the development is based on a minimum floor level of 1% AEP flood level plus 0.5m of freeboard.

For this site the proposed development requires a minimum FPL of RL 39.90m AHD, based on a 1% AEP level of 39.40m to the existing adjacent flow path to the property on the south-east of the site.

Flood hazard categories are broken down into high and low hazard for each hydraulic category. High hazard areas are defined as those where there is a possible danger to personal safety and the potential for significant structural damage. Able-bodied adults would have difficulty in wading to safety. With low hazard areas, should it be necessary, a truck could evacuate people and their possessions, and able-bodied adults would have little difficulty in wading to safety.

Flood hazard criteria and mapping has been completed for the 1% AEP and PMF post development conditions as per criteria set out in the *Australian Rainfall and Runoff (2019)*, *A Guide to Flood Estimation – Book 6 – Flood Hydraulics* and Figure 6.7.9 as included as **Figure 8.12** below. Refer **Section 8.5** and **Appendix E** for hazard mapping.

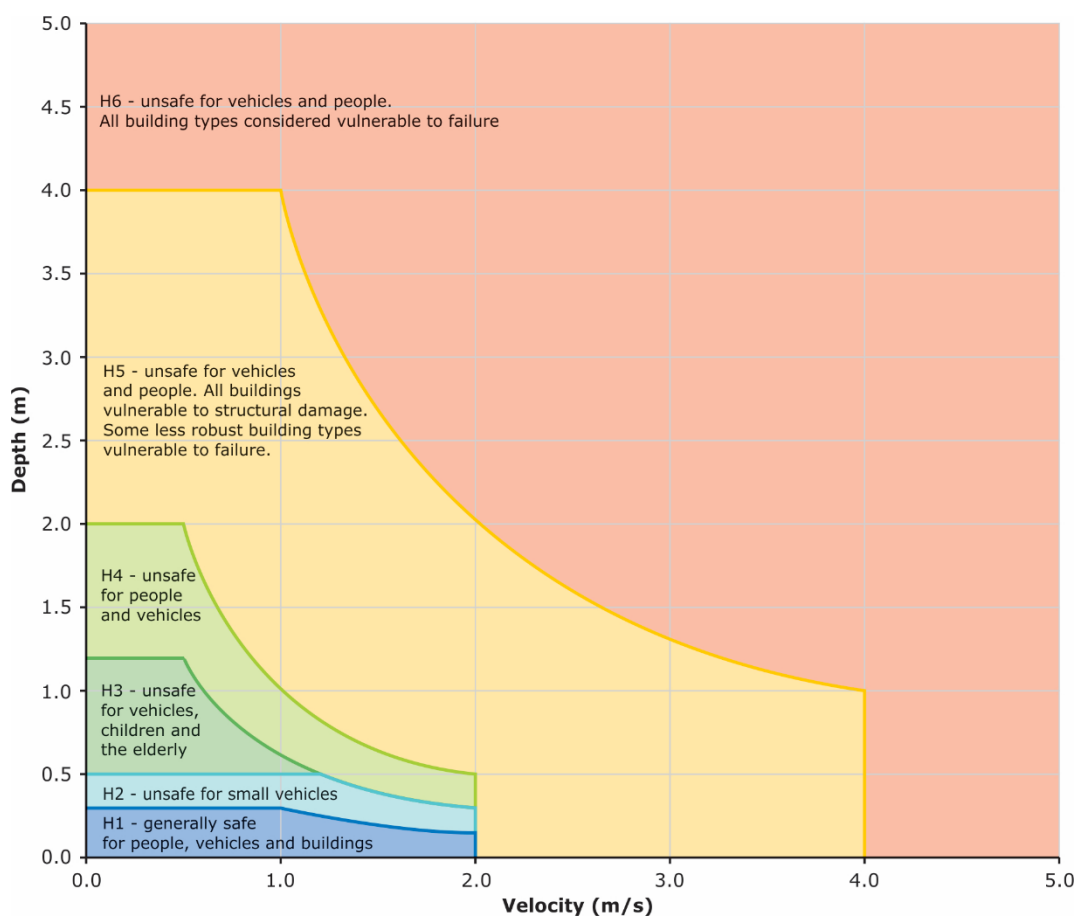


Figure 6.7.9. Combined Flood Hazard Curves (Smith et al., 2014)

Table 6.7.3. Combined Hazard Curves - Vulnerability Thresholds (Smith et al., 2014)

Hazard Vulnerability Classification	Description
H1	Generally safe for vehicles, people and buildings.
H2	Unsafe for small vehicles.
H3	Unsafe for vehicles, children and the elderly.
H4	Unsafe for vehicles and people.
H5	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.

Table 6.7.4. Combined Hazard Curves - Vulnerability Thresholds Classification Limits (Smith et al., 2014)

Hazard Vulnerability Classification	Classification Limit (D and V in combination)	Limiting Still Water Depth (D)	Limiting Velocity (V)
H1	$D \cdot V \leq 0.3$	0.3	2.0
H2	$D \cdot V \leq 0.6$	0.5	2.0
H3	$D \cdot V \leq 0.6$	1.2	2.0
H4	$D \cdot V \leq 1.0$	2.0	2.0
H5	$D \cdot V \leq 4.0$	4.0	4.0
H6	$D \cdot V > 4.0$	-	-

Figure 8.12. Adopted Hazard Criteria and Provisional Flood Hazard Chart (Australian Rainfall and Runoff 2019)

8.6 Confirmation of MRP DCP Section 2.5 Requirements

With reference to **Section 8.5** and modelling results contained in **Appendix E** we provide confirmation in **Table 8.1** that the criteria set out in *Section 2.5* of the MRP DCP2021 for filling within flood affected land for the 1% AEP event.

Table 8.1. Confirmation of MRP DCP2021 Criteria (1% AEP)

DCP Criteria	"Interim" Post Development Scenario Confirmation (1% AEP Event)
<i>Criteria 1</i> Flood levels are not increased by more than 10mm on surrounding properties by the proposed filling.	The development proposes conveyance of flows up to the 1% AEP meeting the MRP DCP's limit on off-site affectation. Refer confirmation in Section 8.5. Localised flood increases are contained on site within dedicated trunk drainage systems and are not considered to affect adjacent properties. Flood level increase criteria is considered to be met.
<i>Criteria 2</i> Downstream velocities are not increased by more than 10% by the proposed filling	Velocity assessment shows limited change to velocity and increase in velocity in and around proposed drainage infrastructure and inlets where it would be anticipated that velocity would change. Velocity changes in Mamre Road are associated with other developments in the precinct and are shown for information only and should be ignored in relation to the subject development. Velocity change criteria is considered to be met.
<i>Criteria 3</i> Proposed filling does not redistribute flows by more than 15%	Flow conveyance is based on meeting existing inlet and outlet positions for overland flows and trunk drainage pathways defined in the Sydney Water Precinct Scheme Plan. As such there is no redistribution of flow proposed or resultant from the development. Flow distribution criteria is considered to be met.
<i>Criteria 4</i> The potential for cumulative effects of possible filling proposals in that area is minimal	The development ensures that there is no offsite impacts as demonstrated via modelling. Further, future developments proposed to coordinate

DCP Criteria	"Interim" Post Development Scenario Confirmation (1% AEP Event)
	conveyance of flows within dedicated precinct drainage systems. The development does not propose filling within 1% AEP affected land associated with the South Creek Floodplain. There is limited or no potential for cumulative impacts as part of this development. Cumulative effect criteria is considered to have been met.
<i>Criteria 5</i> There are alternative opportunities for flood storage.	The overland flow is noted to be confined to existing gully and farm dams. The proposed development includes for detention storage for all catchments which could act as flood storage for some events. Generally, as a conveyance area, flood storage is not required, however as noted above some storage will be available. Flood storage criteria is considered to have been met.
<i>Criteria 6</i> The development potential of surrounding properties is not adversely affected by the filling proposal	The development ensures that there is limited and acceptable offsite changes. Further, future developments proposed to coordinate conveyance of flows within dedicated precinct drainage systems. There is limited or no potential for adverse effect on future development potential of surround properties as a result of the proposed development.
<i>Criteria 7</i> The flood liability of buildings on surrounding properties is not increased	The flood liability of surrounding developments is not affected by the development proposal. surrounding buildings or properties.
<i>Criteria 8</i> No local drainage flow/runoff problems are created by the filling	We confirm that no local drainage flow/runoff problems are created by the proposed filling. All local tributaries and flow paths will either operate in a similar manner to the existing regime or form part of the overall stormwater management system for the estate.

DCP Criteria	"Interim" Post Development Scenario Confirmation (1% AEP Event)
<i>Criteria 9</i> The filling does not occur within the drip line of existing trees	Filling is proposed within the development land. It is expected that trees within development land will be affected by the civil works and future industrial development, consistent with the nature of the future development and zoning of the land. This is also noted to be consistent with the zoning of the land and discussion with the agencies.

8.7 Climate Change Sensitivity Assessment

An assessment has been undertaken for the effect of climate change on the development. The assessment takes into consideration potential effect from increased rainfall intensity and sea level rise.

An assessment of the 0.2% AEP and 0.5% AEP was included as a proxy for the effect of climate change and is considered a conservative assessment for a 10% increase in flow to the 1% AEP event. Modelling has been undertaken for the 0.2% AEP and 0.5% AEP and flood afflux results are shown in **Figures 8.13 & 8.14**. Afflux results show minimal flood level change on the western side of the Mamre Road in the 0.5% AEP and 0.2% AEP when compared to the 1% AEP event. There is minor increase in flood afflux within. This assessment shows that the proposed stormwater drainage system and existing overland flow paths would have sufficient capacity to manage the increased peak flows and water volume with minor increase in peak water level at areas surrounding the flow diversion culverts under the proposed development lot. We confirm the increase in rainfall intensities will achieve the required minimum 0.5m freeboard to the proposed development levels in relation to overland flow paths from external & local catchments.

Overall, flood immunity of the proposed development sites would not be compromised given a large available freeboard amount much larger than minimum 0.5m values generally adopted.

The site is situated well upstream from any tidally influenced receiving waters including expected potential sea level rise of 0.4m. We confirm the development will not affect or be affected by potential sea level rise.

Figure 8.13: 0.5% AEP Post Developed Flood Level Afflux

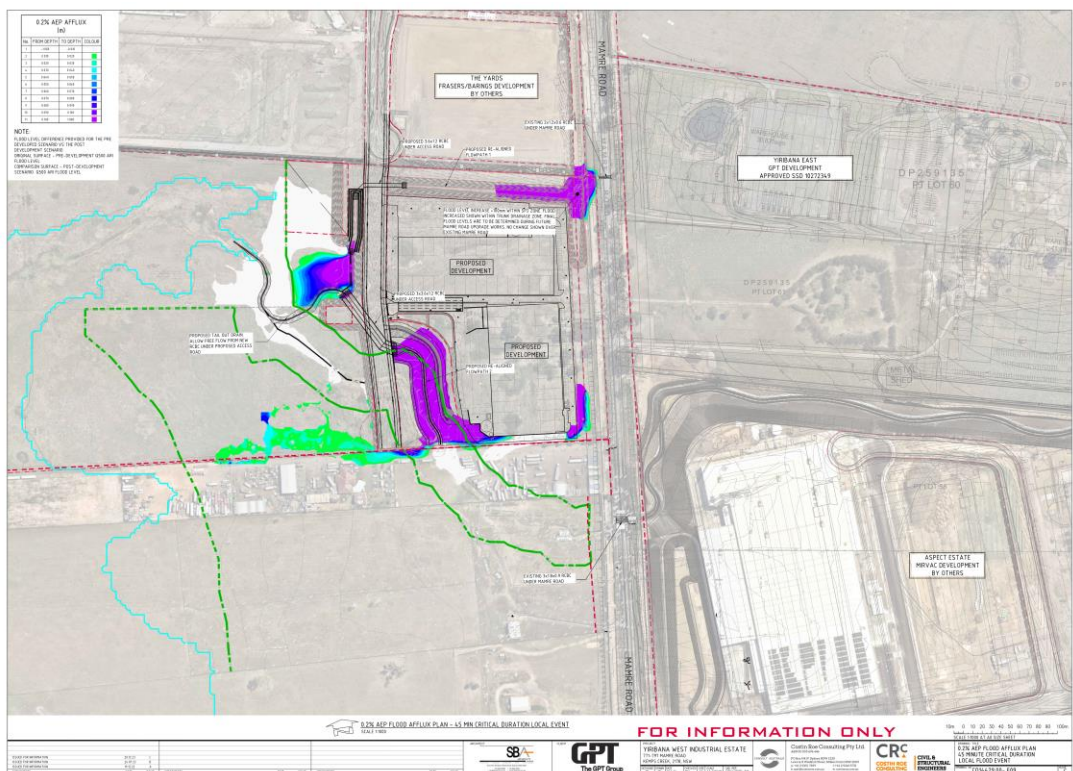


Figure 8.14: 0.2% AEP Post Developed Flood Level Afflux

8.8 Flood Assessment Conclusion

A TUFLOW hydrodynamic flood model has been completed and the pre and post development flood events assessed for flooding as a result of a 1% AEP rainfall event within the catchment.

The assessment of the 1% AEP event confirms that conveyance paths are available to the South-East side of the proposed estate development. There is negligible effect on flood water local to the development. The TUFLOW Modelling completed by Costin Roe Consulting and confirmation of DCP Criteria in **Section 8.7** confirms there is no affectation of upstream, downstream or adjoining properties.

9 CONSTRUCTION SOIL AND WATER MANAGEMENT

9.1 Soil and Water Management General

Without any mitigation measures and during typical construction activities, site runoff would be expected to convey a significant sediment load. A *Soil and Water Management Plan* (SWMP) and *Erosion and Sediment Control Plan* (ESCP), or equivalent, would be implemented for the construction of the Proposal.

The SWMP and ESCPs would be developed in accordance with the principles and requirements of:

- *The MRP DCP 2021*
- *Best Practice Erosion and Sediment Control* document International Erosion Control Association (ICEA) Australasia – “The White Book”.
- *Managing Urban Stormwater – Soils & Construction Volume 1 (‘Blue Book’)*(Landcom, 2004).
- *DPIE Technical Guidance for Achieving Wianamatta South Creek Stormwater Management Targets*

In accordance with the principles included in the *Blue Book* and the *White Book*, a number of controls have been incorporated into a preliminary Staged ESCP (refer to accompanying Drawings in **Appendix A**) and draft SWMP in **Appendix C**. The Staged ESCP considers initial site establishment, requirements during construction of roads and infrastructure and estate earthworks, completion of estate works and the period between this and development of individual lots.

Section 1 provides a summary of the construction works for the Proposal. While all construction activities have the potential to impact on water quality, the key activities are:

- Erosion and sediment control installation.
- Grading of existing earthworks to suit building layout, drainage layout and pavements.
- Stormwater and drainage works.
- Service installation works.
- Building construction works.

The sections below outline the proposed controls for management of erosion and sedimentation during construction of the Proposal. The staged approach is noted to consider initial site establishment, construction of the estate and the period between completed of the estate infrastructure works and development of individual lots in the estate as included in the ESCP drawings **Appendix A**.

It would be anticipated that a final SWMP and ESCP would form part of the Construction Environmental Management Plan (CEMP) for the project

9.2 Typical Management Measures

Sediment Basins

Sediment basins have been sized and located to ensure sediment concentrations in site runoff are within acceptable limits as defined in **Table 5.1** and the MRP DCP. Preliminary basin sizes have been calculated in accordance with the ICEA White Book and are based high efficiency sedimentation (HES) basins.

Traditional batch type sediment basins are typically wet basins which have a limited capacity based on a 5-day 85th percentile rainfall event (for this area approximately 32mm of rainfall). These basins are pumped out following a rainfall event, and settling within the basin, when suspended solids concentrations of less than 50 mg/L have been achieved. During prolonged periods of rainfall these types of basins regularly overtop with sediment laden water and as such are not able to meet the MRP DCP construction water quality requirements.

High Efficiency Sediment (HES) basins work on a continuous-flow basis rather than the batch process that traditional sediment basins operate by as described above. This means that treatment and discharge in a HES Basin occurs throughout the rainfall event rather than only at the end of an event. This continuous-flow approach offers many advantages; the main one being that a much greater volume of runoff can be treated for a given basin size, compared to traditional batch basins.

Sediment Fences

Sediment fences are located around the perimeter of the site to ensure no untreated runoff leaves the site. They have also been located around the existing drainage channels to minimise sediment migration into waterways and sediment basins.

Stabilised Site Access

For the proposal, stabilised site access is proposed at one location at the entry to the works area. This will limit the risk of sediment being transported onto Mamre Road and other public roads.

9.3 Other Management Measures

Other management measures that will be employed are expected to include:

- Minimising the extent of disturbed areas across the site at any one time.
- Progressive stabilisation of disturbed areas or previously completed earthworks to suit the proposal once trimming works are complete.
- Regular monitoring and implementation of remedial works to maintain the efficiency of all controls.

It is noted that the controls included in the preliminary ESCP are expected to be reviewed and updated as the design, staging and construction methodology is further developed for the Proposal.

10 CONCLUSION

This Civil Engineering Report has been prepared to support the Development Application for a Proposed Development at Mamre Road, Kemps Creek, NSW.

A civil engineering strategy for the site has been developed which provides a best practice solution within the constraints of the existing landform and proposed development layout. Within this strategy a stormwater quantity and quality management strategy has been developed to reduce both peak flows and pollutant loads in stormwater leaving this site. The stormwater management for the development has been designed in accordance with the DPE MRP DCP 2021, and *Technical Guidelines for Achieving Wianamatta-South Creek Stormwater Management Targets 2022* (DPE).

The hydrological assessment proves local post development flows from the site will be less than pre-development flows and demonstrates that the site discharge will not adversely affect any land, drainage system or watercourse as a result of the development.

During the construction phase, a Sediment and Erosion Control Plan will be in place to ensure the downstream drainage system and receiving waters are protected from sediment laden runoff.

During the operational phase of the development, a treatment train incorporating the use of a primary and tertiary water quality treatment systems is proposed to mitigate any increase in stormwater pollutant load generated by the development. MUSIC modelling results indicate that the proposed STM are effective in reducing pollutant loads in stormwater discharging from the site and meet the requirements of Council's pollution reduction targets. Best management practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

Stream health, per the MARV/FDC metrics included in the MRP DCP have been confirmed for the current proposed development and construction of the estate roads in a staged manner.

It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

11 REFERENCES

- Mamre Road Precinct Development Control Plan – 2021 (NSW DPIE)
- NSW Government (2005). *Floodplain Development Manual*.
- Technical Guidelines for Achieving Wianamatta-South Creek Stormwater Management Targets 2022 (DPE).
- Managing Urban Stormwater: Harvesting and Reuse – 2006 (NSW DEC);
- Managing Urban Stormwater: Source Control – 1998 (NSW EPA);
- Managing Urban Stormwater: Treatment Techniques – 1997 (NSW EPA);
- Landcom (2004). *Managing Urban Stormwater – Soils and Construction* – 4th Edition.
- Penrith City Council – DCP 2013 (Part C3); and
- Water Sensitive Urban Design – “Technical Guidelines for Western Sydney” by URS Australia Pty Ltd, May 2004

Appendix A

DRAWINGS BY COSTIN ROE CONSULTING

*YIRIBANA WEST LOGISTICS ESTATE
771-797 MAMRE ROAD, KEMPS CREEK, NSW, 2178
CIVIL DRAWING SET FOR DEVELOPMENT APPLICATION*

DRAWING LIST:

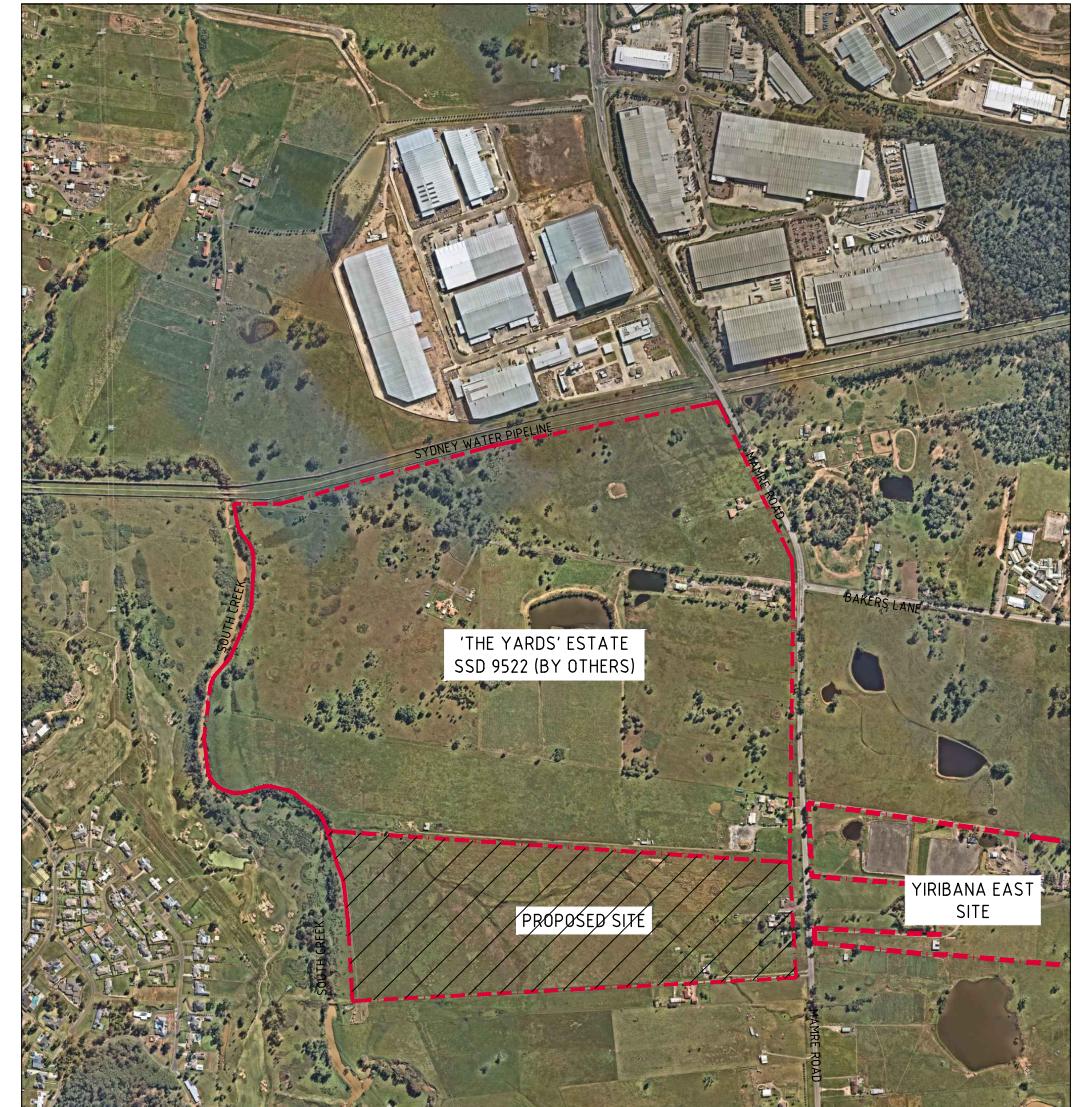
DRAWING NO.	DRAWING TITLE
CO14429.00-DA10	DRAWING LIST & GENERAL NOTES
CO14429.00-DA11	GENERAL NOTES - SHEET 2
CO14429.00-DA21	EROSION & SEDIMENT CONTROL PLAN - STAGE 1
CO14429.00-DA22	EROSION & SEDIMENT CONTROL PLAN - STAGE 2
CO14429.00-DA25	EROSION & SEDIMENT CONTROL DETAILS - SHEET 1
CO14429.00-DA26	EROSION & SEDIMENT CONTROL DETAILS - SHEET 2
CO14429.00-DA30	CUT/FILL PLAN
CO14429.00-DA40	DRAWING KEY PLAN
CO14429.00-DA41	CONCEPT STORMWATER DRAINAGE PLAN-SHEET 1
CO14429.00-DA42	CONCEPT STORMWATER DRAINAGE PLAN-SHEET 2
CO14429.00-DA43	CONCEPT STORMWATER DRAINAGE PLAN-SHEET 3
CO14429.00-DA44	CONCEPT STORMWATER DRAINAGE PLAN-SHEET 4
CO14429.00-DA45	CONCEPT STORMWATER DRAINAGE DETAILS-SHEET 1
CO14429.00-DA46	CONCEPT STORMWATER DRAINAGE DETAILS-SHEET 2
CO14429.00-DA47	WATER SENSITIVE URBAN DESIGN MANAGEMENT PLAN
CO14429.00-DA48	STORMWATER BASIN PLAN
CO14429.00-DA49	WATER QUALITY CATCHMENT PLAN
CO14429.00-DA50	ROADWORKS LONG SECTION & TYPICAL SECTIONS & DETAILS
CO14429.00-DA51	ROADWORKS MASTERPLAN
CO14429.00-DA52	RE1 CHANNEL RE-ALIGNMENT LONGSECTION & TYPICAL CROSS SECTION
CO14429.00-DA55	TYPICAL SECTIONS-SHEET 1
CO14429.00-DA56	TYPICAL SECTIONS-SHEET 2
CO14429.00-DA71	PRE DEVELOPMENT STORMWATER CATCHMENT PLAN
CO14429.00-DA72	POST-DEVELOPMENT STORMWATER CATCHMENT PLAN
CO14429.00-MP01	CONCEPT STORMWATER DRAINAGE AND WATER QUALITY MASTERPLAN-OPTION 1
CO14429.00-MP02	CONCEPT STORMWATER DRAINAGE AND WATER QUALITY MASTERPLAN-OPTION 2

GENERAL NOTES:

- G1 THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
- G2 ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT AND CURRENT STANDARDS AUSTRALIA CODES AND WITH THE BY-LAWS AND ORDINANCES OF THE RELEVANT BUILDING AUTHORITIES EXCEPT WHERE VARIED BY THE PROJECT SPECIFICATION.
- G3 ALL DIMENSIONS SHOWN SHALL BE VERIFIED BY THE BUILDER ON SITE.
ENGINEER'S DRAWINGS SHALL NOT BE SCALED FOR DIMENSIONS.
ENGINEER'S DRAWINGS ISSUED IN ANY ELECTRONIC FORMAT MUST NOT BE USED FOR DIMENSIONAL SETOUT.
REFER TO THE ARCHITECT'S DRAWINGS FOR ALL DIMENSIONAL SETOUT INFORMATION.
- G4 DURING CONSTRUCTION THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED. TEMPORARY BRACING SHALL BE PROVIDED BY THE BUILDER TO KEEP THE WORKS AND EXCAVATIONS STABLE AT ALL TIMES.
- G5 UNLESS NOTED OTHERWISE ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES.
- G6 ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH ACCEPTABLE SAFETY STANDARDS & APPROPRIATE SAFETY SIGNS SHALL BE INSTALLED AT ALL TIMES DURING THE PROGRESS OF THE JOB.
- G7 ALL WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH PENRITH CITY COUNCIL'S ENGINEERING CONSTRUCTION SPECIFICATION FOR CIVIL WORKS

ELECTRONIC INFORMATION NOTES:

1. THE ISSUED DRAWINGS IN HARD COPY OR PDF FORMAT TAKE PRECEDENCE OVER ANY ELECTRONICALLY ISSUED INFORMATION, LAYOUTS OR DESIGN MODELS.
2. THE CONTRACTOR'S DIRECT AMENDMENT OR MANIPULATION OF THE DATA OR INFORMATION THAT MIGHT BE CONTAINED WITHIN AN ENGINEER-SUPPLIED DIGITAL TERRAIN MODEL AND ITS SUBSEQUENT USE TO UNDERTAKE THE WORKS WILL BE SOLELY AT THE DISCRETION OF AND THE RISK OF THE CONTRACTOR.
3. THE CONTRACTOR IS REQUIRED TO HIGHLIGHT ANY DISCREPANCIES BETWEEN THE DIGITAL TERRAIN MODEL AND INFORMATION PROVIDED IN THE CONTRACT AND/OR DRAWINGS AND IS REQUIRED TO SEEK CLARIFICATION FROM THE SUPERINTENDENT.
4. THE ENGINEER WILL NOT BE LIABLE OR RESPONSIBLE FOR THE POSSIBLE ON-GOING NEED TO UPDATE THE DIGITAL TERRAIN MODEL. SHOULD THERE BE ANY AMENDMENTS OR CHANGES TO THE DRAWINGS OR CONTRACT INITIATED BY THE CONTRACTOR.



FOR DEVELOPMENT APPLICATION

[illegible]

1. DURING THE EXECUTION OF WORKS, THE CONTRACTOR SHALL MAINTAIN THE INTEGRITY OF EXISTING SERVICES. THE CONTRACTOR SHALL REPAIR ANY DAMAGE CAUSED TO THE EXISTING SERVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE RELEVANT SERVICE AUTHORITY, AT NO COST TO THE PRINCIPAL.
2. WHERE IT IS NECESSARY TO REMOVE, DIVERT OR CUT INTO ANY EXISTING SERVICE, THE CONTRACTOR SHALL GIVE AT LEAST THREE (3) DAYS NOTICE OF ITS REQUIREMENTS TO THE SUPERINTENDENT, WHO WILL ADVISE WHAT ARRANGEMENTS SHOULD BE MADE FOR THE ALTERATION OF SAID EXISTING WORKS.
3. EXISTING SERVICES HAVE BEEN PROVIDED ON THE SUPPLIED DATA. THE ACCURACY IS NOT GUARANTEED. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO ESTABLISH THE LOCATION AND LEVEL OF ALL EXISTING SERVICES PRIOR TO COMMENCING WORK. ALL CLEARANCES AND APPROVALS SHALL ALSO BE OBTAINED FROM THE RELEVANT SERVICE AUTHORITY PRIOR TO THE COMMENCEMENT OF WORK.
4. ALL NEW AND EXHUMED SERVICES THAT CROSS EXISTING AND FUTURE ROADS/PAVEMENTS WITHIN THE SITE SHALL BE BACKFILLED WITH DGB20 MATERIAL TO SUBGRADE LEVEL AND COMPACTED TO 98% STANDARD DENSITY RATIO. SUBJECT TO PRIOR APPROVAL FROM RELEVANT AUTHORITY.
5. ON COMPLETION OF SERVICES INSTALLATION, ALL DISTURBED AREAS SHALL BE RESTORED TO ORIGINAL, INCLUDING KERBS, FOOTPATHS, CONCRETE AREAS, GRAVEL AREAS, GRASSED AREAS AND ROAD PAVEMENTS.
6. WORKS TAKEN WHEN EXCAVATING UTILITY SERVICES. NO MECHANICAL EXCAVATION TO BE UNDERTAKEN OVER SERVICES. LIAISE WITH RELEVANT AUTHORITY. THE CONTRACTOR SHALL ALLOW FOR THE CAPPING OFF, EXCAVATION AND REMOVAL IF REQUIRED OF ALL EXISTING SERVICES IN AREAS AFFECTED BY THE WORKS WITHIN THE CONTRACT AREA AS SHOWN ON THE DRAWINGS UNLESS DIRECTED OTHERWISE BY THE SUPERINTENDENT. ALL TO REGULATORY AUTHORITY STANDARDS AND APPROVAL.
7. THE CONTRACTOR IS TO MAINTAIN EXISTING STORMWATER DRAINAGE FLOWS THROUGH THE ROADS AT ALL TIMES. MAKE DUE ALLOWANCE FOR ALL SUCH FLOWS AT ALL TIMES.
8. PRIOR TO COMMENCEMENT OF ANY WORKS THE CONTRACTOR SHALL OBTAIN THE SUPERINTENDENT'S APPROVAL OF THE PROGRAM FOR THE RELOCATION/CONSTRUCTION OF TEMPORARY SERVICES.
9. CONTRACTOR SHALL CONSTRUCT TEMPORARY SERVICES AS REQUIRED TO MAINTAIN EXISTING SUPPLY TO BUILDINGS REMAINING IN OPERATION DURING WORKS TO THE SATISFACTION AND APPROVAL OF THE SUPERINTENDENT. ONCE DIVERSION IS COMPLETE AND COMMISSIONED THE CONTRACTOR SHALL REMOVE ALL SUCH TEMPORARY SERVICES AND MAKE GOOD TO THE SATISFACTION OF THE SUPERINTENDENT.
10. INTERRUPTION TO SUPPLY OF EXISTING SERVICES SHALL BE DONE SO AS NOT TO CAUSE ANY INCONVENIENCE OR DAMAGE TO THE ADJACENT RESIDENCES. CONTRACTOR TO GAIN APPROVAL OF THE SUPERINTENDENT FOR TIME OF INTERRUPTION.
11. THE CONTRACTOR SHALL UNDERTAKE A DIAL BEFORE YOU DIG (DBYD 1100) SERVICES SEARCH BEFORE THE COMMENCEMENT OF ANY WORKS.

1. ALL EARTHWORKS SHALL BE COMPLETED GENERALLY IN ACCORDANCE WITH THE GUIDELINES SPECIFIED BY THE GEOTECHNICAL REPORT 'PSM44-043-002L' PROVIDED BY PS DATED 25.05.21.
2. EXISTING LEVELS ARE BASED ON INFORMATION PROVIDED BY BOXALL SURVEYORS T1222-004 DATED 28.10.2022.
3. STRIP ANY TOP SOIL OR DELETERIOUS MATERIAL AND DISPOSE OF FROM SITE OR STORE AS DIRECTED.
4. COMPLETE CUT TO FILL EARTHWORKS TO ACHIEVE THE REQUIRED LEVELS AS INDICATED ON THE DRAWINGS WITHIN A TOLERANCE OF +0mm/-10mm THROUGH BUILDING PADS/PAVEMENTS AND -0mm/-20mm ELSEWHERE.
5. TO STEEP BATTERS TO RECEIVE FILL BY CONSTRUCTING BENCHING TO FACILITATE FILL PLACEMENT AND COMPACTION.
6. AREAS TO RECEIVE FILL (THAT ARE NOT ON BENCHMARK BATTERS) AND AREAS IN CUT SHALL BE PROOF ROLLED TO IDENTIFY ANY SOFT HEAVING MATERIAL. SOFT MATERIAL SHALL BE BOXED OUT AND REMOVED PRIOR TO FILL PLACEMENT. PROOF ROLLING TO BE INSPECTED BY A GEOTECHNICAL ENGINEER OR THE EARTHWORKS DESIGNER.
7. SITE WON FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HALF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HALF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
8. IMPORTED FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HALF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HALF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
9. ALL ENGINEERED FILL PARTICLES SHALL BE ABLE TO BE INCORPORATED WITHIN A SINGLE SIEVE. FURTHER LESS THAN 30% OF PARTICLES SHALL BE RETAINED ON THE 37.5 mm SIEVE. ENGINEERED FILL SHALL BE ABLE TO BE TESTED IN ACCORDANCE WITH THE STANDARD COMPACTION METHOD (IS:12895 & II) OR HALF TEST METHOD (IS:12895 & I). THESE METHODS REQUIRE LESS THAN 20% RETAINED ON THE 37.5 mm SIEVE. WHERE BETWEEN 20% AND 30% OF PARTICLES ARE RETAINED ON THE 37.5 mm SIEVE THE ABOVE TEST METHODS SHALL STILL BE ADOPTED AND TEST REPORTS ANNOTATED APPROPRIATELY. THESE REQUIREMENTS MUST BE MET BY THE MATERIAL AFTER PLACEMENT AND COMPACTION.
10. ALL THE EARTHWORKS UNDERTAKEN AND THE SUBGRADE CONDITION IN THE CUT AREAS (IN THE STATED PERIOD) ARE DOCUMENTED IN THE REPORTS AND HAVE BEEN UNDERTAKEN IN ACCORDANCE WITH THE SPECIFICATION (EG. COSTIN ROE SITE PREPARATION NOTES IN DWG C014021.00-DA100)
11. PRIOR TO ANY EARTHWORKS, EROSION CONTROL AS OUTLINED IN THE EROSION AND SEDIMENTATION CONTROL PLAN SHALL BE COMPLETED.
12. EXISTING ROCK, IF ANY, SHALL BE REMOVED BY HEAVY ROCK BREAKING OR RIPPING.
13. MATCH EXISTING LEVELS AT BATTER INTERFACE.
14. CONTRACTOR TO MATCH EXISTING LEVELS AT THE INTERFACE OF EARTHWORKS AND EXISTING SURFACE AT BATTER LOCATIONS OR WHERE NO RETAINING WALLS ARE PRESENT. ANY DISCREPANCY BETWEEN DESIGN AND EXISTING LEVELS TO BE REFERRED TO THE ENGINEER FOR DIRECTION OR ADJUSTMENTS TO DESIGN LEVELS.
15. DURING EARTHWORKS THE CONTRACTOR IS TO ENSURE ALL AREAS ARE FREE DRAINING & WILL NOT RETAIN WATER DURING RAINFALL. PROVIDE TEMPORARY MEASURES AS REQUIRED TO ENSURE FREE FLOWING RUNOFF THROUGH MANAGED DRAINAGE PATHS, DIVERSION DRAINS OR OTHER SUITABLE DISPOSAL METHOD AS AGREED DURING THE WORKS. REFER ANY CONCERNS TO THE ENGINEER. REFER TO EROSION AND SEDIMENT CONTROL DRAWINGS AND NOTES.

1. EXISTING SITE LEVELS AND DETAILS BASED ON A PLAN OF SURVEY '11220-004' BY 'BOXALL SURVEYORS PTY. LTD.' DATED 28.10.2022.

1. TRAFFIC CONTROLS TO COMPLY WITH AS 1742.3-2002
2. TRAFFIC CONTROL PLANS TO BE SUBMITTED AND CERTIFIED BY AN ACCREDITED WORK SITE OPERATIVE.
3. AS PART OF THE TRAFFIC CONTROL PLAN ENSURE THAT PEDESTRIANS ARE CATERED FOR.
4. AFTER-HOURS TRAFFIC CONTROL THROUGH THE WORKSITE HAVE TO BE CATERED FOR.

ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH PENRITH CITY COUNCIL STANDARDS AND SPECIFICATIONS:

1. ALL STORMWATER WORKS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS3500-3:2003 PLUMBING AND DRAINAGE, PART 3: STORMWATER DRAINAGE.
2. THE MINOR (PIPED) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 20 YEAR STORM EVENT AND THE MAJOR (OVERLAND) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 100 YEAR STORM EVENT.
3. PIT SIZES SHALL BE AS INDICATED IN THE SCHEDULE WHILE PIPE SIZES AND DETAILS ARE PROVIDED ON PLAN.
4. EXISTING STORMWATER PIT LOCATIONS AND INVERT LEVELS TO BE CONFIRMED BY SURVEY PRIOR TO COMMENCING WORKS ON SITE.
5. ALL STORMWATER PIPES ≥ 75 mm OR GREATER SHALL BE CLASS 2 (WITH HS2 SUPPORT) REINFORCED CONCRETE WITH RUBBER JOINTS UNLESS NOTED OTHERWISE.
6. ALL PIPES UP TO AND INCLUDING $\phi 300$ TO BE uPVC GRADE SN80.
7. PIPE CLASS NOMINATED ARE FOR IN-SERVICE LOADING CONDITIONS ONLY. CONTRACTOR IS TO MAKE ANY NECESSARY ADJUSTMENTS REQUIRED FOR CONSTRUCTION CONDITIONS.
8. ALL CONCRETE PITS GREATER THAN 1000mm DEEP SHALL BE REINFORCED USING N12-200 EACH WAY CENTERED IN WALL AND BASE. LAP MINIMUM 300mm where REQUIRED. ALL CONCRETE FOR PITS SHALL BE $f_{c'}$ 25 MPa. PRECAST PITS MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
9. IN ADDITION TO ITEM 9 ABOVE, ALL CONCRETE PITS GREATER THAN 3000mm DEEP SHALL HAVE WALLS AND BASE THICKNESS INCREASED TO 200mm.
10. PIPES SHALL BE LAID AS PER PIPE LAYING DETAILS. PARTICULAR CARE SHALL BE TAKEN TO ENSURE THAT THE PIPE IS FULLY AND EVENLY SUPPORTED. RAM AND PACK FILLING AROUND AND UNDER BACK OF PIPES AND PIPE FAUCETS, WITH NARROW EDGED RAMMERS OR OTHER SUITABLE TAMPING DETAILS.
11. CONCRETE PIPES UNDER, OR WITHIN THE ZONE OF INFLUENCE OF PAVED AREAS SHALL BE LAID USING HS2 TYPE SUPPORT, AS A MINIMUM, IN ACCORDANCE WITH AS 3725. AGGREGATE BACKFILL SHALL NOT BE USED FOR PIPE BEDDING AND OR HAUNCH/SIDE SUPPORT.
12. WHERE PIPE LINES ENTER PITS, PROVIDE 2m LENGTH OF STOCKING WRAPPED SLOTTED $\phi 100$ uPVC TO EACH SIDE OF PIPE.
13. ALL SUBSOIL DRAINAGE LINES SHALL BE $\phi 100$ SLOTTED uPVC WITH APPROVED FILTER WRAP Laid IN 300mm wide GRANULAR FILTER UNLESS NOTED OTHERWISE. LAY SUBSOIL LINES TO MATCH FALLS OF LAND AND/OR 1 IN 200 MINIMUM. PROVIDE CAPPED CLEANING EYE (RODDING POINT) AT UPSTREAM END OF LINE AND AT 30m Max. CTS. PROVIDE SUBSOIL LINES TO ALL PAVEMENT/ LANDSCAPED INTERFACES, TO REAR OF RETAINING WALLS (AS NOMINATED BY STRUCTURAL ENGINEER) AND AS SHOWN ON PLAN.
14. ALL PIPE GRADES 1 IN 200 MINIMUM UNDO.
15. PROVIDE STEEL IRONS IN PITS DEEPER THAN 1000mm.
16. MIN. 600 COVER TO PIPE OVERT BENEATH ROADS & MIN. 400 COVER BENEATH LANDSCAPED AND PEDESTRIAN AREAS.
17. PIPES IN UNTRAFFICABLE PAVEMENTS SHALL BE CLASS D 'HEAVY DUTY'. THOSE LOCATED IN ROAD-TRAFFICABLE AREAS SHALL BE CLASS B 'MEDIUM DUTY' UNDO.
18. PROVIDE CLEANING EYES (RODDING POINTS) TO PIPES AT ALL CORNERS AND T-JUNCTIONS WHERE NO PITS ARE PRESENT.
19. DOWN PIPES (DP) TO BE AS PER HYDRAULIC ENGINEERS DETAILS WITH CONNECTOR TO MATCH DP SIZE UNDO ON PLAN. PROVIDE CLEANING EYE AT GROUND LEVEL.
20. PIPE LENGTHS NOMINATED ON PLAN OR LONGSECTIONS ARE MEASURED FROM CENTER OF PITS TO THE NEAREST 0.5m and DO NOT REPRESENT ACTUAL LENGTH. THE CONTRACTOR IS TO ALLOW FOR THIS.

1. LEVELS DATUM IS AUSTRALIAN HEIGHT DATUM (A.H.D.)
2. GRADING REQUIREMENTS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS2890.1, AS2890.2 AND AS2890.6.
3. ALL CONTOUR LINES & SPOT LEVELS INDICATE FINISHED PAVEMENT LEVELS U.N.O. ON PLAN.
4. CONTOUR INTERVALS
 - THE MINOR CONTOUR INTERVAL IS 0.1m.
 - THE MAJOR CONTOUR INTERVAL IS 0.5m.
5. HARDESTAD GRADING
 - MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%).
 - GRADING OF ON-GRADE DOCKS TO BE 1:100 (1%) FALL AWAY FROM THE DOCK FACE FOR A LENGTH OF 15m U.N.O.
 - GRADING OF TRUCK CIRCULATION ZONES TO BE MINIMUM AS NOTED ABOVE, 3-4% NOMINAL AND MAX. 5%.
6. CAR PARKING AREA GRADES
 - MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%), DESIRABLE MINIMUM GRADE 1:50 (2%).
 - MAXIMUM PAVEMENT GRADE IS TO BE 1:20 (5%) IN CARPARKING AREAS AND 1:25 (4%) ELSEWHERE.
 - DISABLED ACCESS PARKING ZONES AND SHARED SPACE TO BE MAXIMUM OF 1:33 (3%) IN ASPHALT PAVEMENT AND MAXIMUM OF 1:40 (2.5%) IN CONCRETE PAVEMENT.
 - CARPARK RAMP GRADES TO BE MAX 1:5 WITH 2.5m SMOOTH TRANSITION AT TOP AND BOTTOM U.N.O.
7. TRUCK RAMP GRADES
 - MAXIMUM B+DOUBLE OR 19.0m AV RAMP GRADES ARE TO BE 1:8.3 (12%) U.N.O. ON PLAN
 - PROVIDE MINIMUM 4.0m LONG TRANSITION WHERE CHANGES OF GRADE EXCEED 1:20 (5%) AT A SAG U.N.O.
 - PROVIDE MINIMUM 3.0m LONG TRANSITION WHERE CHANGE OF GRADE EXCEED 1:20 (5%) AT A SAG U.N.O.
 - TRANSITIONS ARE TO PROVIDE A SMOOTH CONTINUOUS CIRCULAR AND TANGENTIAL CHANGE IN GRADE TO ENSURE NO SHARP OR ACUTE CHANGES IN GRADE ARE PRESENT.
8. WHERE FIRE BRIGADE ACCESS IS REQUIRED, MAXIMUM RAMP GRADIENTS ARE TO BE 1:6 (16.6%). DESIRABLE RAMP GRADIENTS ARE TO BE 1:8 (12.5%) WITH 7m TRANSITION TOP AND BOTTOM U.N.O. ON PLAN.
9. PERMANENT BATTER SLOPES ARE TO HAVE A MAXIMUM GRADE OF 1V:3H U.N.O. BASED ON GEOTECHNICAL ASSESSMENT. PROVIDE MINIMUM 0.5m BERM BETWEEN THE BACK OF KERB OR PAVEMENT EDGES AND THE TOP OR TOE OF A BATTER.
10. ALL BATTER SLOPE WITH GRADES AT OR EXCEEDING 1V:6H ARE TO BE TURFED IMMEDIATELY OR APPROPRIATE EROSION CONTROL IS TO BE PROVIDED TO THE SATISFACTION OF THE ENGINEER.
11. ALL TOPPATHS ARE TO FALL AWAY FROM THE BUILDING AT 2.5% NOMINAL GRADE.
12. ALL PAVEMENTS ARE TO BE SET AT 30mm BELOW THE FINISHED FLOOR LEVEL OF THE WAREHOUSE AND OFFICE AREAS. PROVIDE LOCAL FEATHERING AT DOORWAYS OR ROLLER SHUTTERS TO PROVIDE FLUSH FINISH AS REQUIRED.
13. WHERE NEW AND EXISTING INTERFACING ARE REQUIRED, MATCH EXISTING LEVELS AND PROVIDE SMOOTH INTERFACE BETWEEN NEW AND EXISTING GRADIENTS. REFER ANY CONCERNS TO THE ENGINEER.

1. ALL COMPONENTS AND INSTALLATION SHALL COMPLY WITH AS4678 AND THE STANDARDS REFERRED TO THEREIN.
2. MINIMUM HEIGHT (H) TO GEOGRID REINFORCEMENT LENGTH (L) TO BE 1.0.
3. MINIMUM BEARING CAPACITY OF FOUNDATION (BASED ON MINIMUM H/L RATIO OF 1.0) TO BE AS FOLLOWS :
 - a. H MAX. 2.0m = 100 kPa
 - b. H MAX. 3.5m = 150 kPa
 - c. H MAX. 5.0m = 200 kPa
4. BEFORE COMMENCEMENT OF CONSTRUCTION THE FOUNDATION SHALL BE INSPECTED AND VERIFIED BY A QUALIFIED GEOTECHNICAL ENGINEER.
5. WHERE MINIMUM BEARING IS NOT ACHIEVABLE OR NOT MEETING DESIGN REQUIREMENT, THE FOUNDATION MATERIAL IS TO BE EXCAVATED AND REPLACED WITH APPROVED MATERIAL PLACED IN ACCORDANCE WITH THE FILLING SPECIFICATION TO A MINIMUM COMPACTION OF 100% SMDD AND PLACED WITHIN 2% OF OMC.
6. MINIMUM SURCHARGE LOADS TO BE APPLIED AS FOLLOWS U.N.O. ON PLAN:
 - a. LIVE LOAD = 20 kPa
 - b. DEAD LOAD = 5 kPa
 - c. CONSTRUCTION TRAFFIC LIVE LOAD = 10 kPa
7. THE GEOGRIDS SHALL BE OF THE TYPE AND INDEX STRENGTH NOMINATED ON THE DRAWINGS. THE MINIMUM GEOGRIDS SHALL BE A SINGLE LENGTH IN THE DIRECTION OF DESIGN TENSION, NOT LAPPED, MAKING PROVISION FOR CONNECTION TO THE FACING ACROSS THE WHOLE WIDTH OF THE FACING AND PROVIDING FOR THE SPECIFIED ANCHORAGE WITHIN THE DESIGNATED ANCHORAGE ZONE. GEOGRIDS SHALL COVER THE WHOLE OF THE PLAN AREA BEHIND THE WALL FOR THE SPECIFIED ANCHORAGE LENGTH AND SHALL BE LAPPED WITH ADJACENT SECTIONS IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
8. MINIMUM WALL EMBEDMENT AT THE TOE OF THE WALL TO BE 300mm.
9. DESIGN LIFE OF STRUCTURE IS TO BE 100 YEARS.
10. SELECT BACKFILL MATERIAL WITHIN THE REINFORCED SOIL BLOCK SHALL BE SOUND GRANULAR MATERIAL OF NATURAL OR INDUSTRIAL ORIGIN, NON-EXPANSIVE, FREE FROM ORGANIC OR OTHER DELETERIOUS MATERIAL CONFORMING TO THE PHYSICAL, CHEMICAL AND ELECTROCHEMICAL LIMITS AS SPECIFIED AND SHALL NOT BE SUBJECT TO BREAKDOWN UNDER COMPACTION. THE SELECT BACKFILL MATERIAL IS TO HAVE THE FOLLOWING PARAMETERS:
 - a. MINIMUM INTERNAL FRICTION, $\phi = 34^\circ$
 - b. EFFECTIVE COHESION, $C' = 0$ kPa
 - c. UNIT WEIGHT = 21 kN/m^3
 - d. ρ_r BETWEEN 4. AND 9.
11. SELECT BACKFILL IS TO BE PLACED AND COMPACTED IN LAYERS NOT MORE THAN 300mm (LOOSE) COMPACTION TO NOT LESS THAN 100% SMDD WILL BE ACHIEVED AND MATERIAL PLACED WITHIN 2% OF OMC. DENSITY TESTING SHALL BE PERFORMED IN EACH COMPACTED LIFT IN ACCORDANCE WITH AS3798.
12. PROVIDE A DRAINAGE LAYER DIRECTLY BEHIND THE FACING UNITS IN A MINIMUM 300mm wide 12-20mm AGGREGATE LAYER. FACING UNIT VOIDS TO BE FILLED WITH AGGREGATE. PROVIDE 100mm DRAINAGE AG. DRAIN IN GEOTEXTILE SOCK AT TOE OF WALL FACING AND CONNECT TO MINIMUM SYSTEM AT 30m MAX. SPACING.
13. THE NEED FOR A CHIMNEY DRAIN OR DRAINAGE AT THE REAR OF THE MASS SOIL BLOCK IS TO BE CONFIRMED BY THE GEOTECHNICAL ENGINEER AND DESIGNER FOLLOWING PREPARATION OF THE FOUNDATION AND PRIOR TO CONSTRUCTION OF THE MASS SOIL BLOCK.
14. CONSTRUCTION EQUIPMENT WEIGHING MORE THAN 500kg STATIC WEIGHT IS TO BE KEPT BACK 15m FROM THE REAR FACE OF THE WALL FACING UNITS. COMPACTION OF THE SELECT FILL MATERIAL WITHIN THE 15m STRIP ADJACENT TO THE WALL SHALL BE ACHIEVED BY LIGHT MECHANICAL TAMPERS (VIBRATING PLATE, TRENCH COMPACTOR OR SIMILAR) TO GIVE THE SAME DENSITY AS IN THE REMAINDER OF THE SELECT FILL.
15. ALL DESIGN AND CONSTRUCT WALL SYSTEM TO BE COMPLETED IN ACCORDANCE WITH THESE NOTES.
 - a. TOP OF WALL HEIGHTS ARE NOTED TO ALIGN WITH FINISHED PAVEMENT HEIGHTS. THE CONTRACTOR AND THEIR DESIGN AND CONSTRUCT WALLING CONTRACTORS ARE TO ENSURE THAT ALL WALL STRAPS ARE INSTALLED BELOW THE DESIGN EARTHWORKS SUBGRADE. CONTRACTOR TO ALLOW FOR WALL STRAPS TO BE GRADED AWAY FROM THE FACE OF THE WALL OR OTHERWISE INSTALLED TO SUIT EARTHWORKS DESIGN LEVELS AND GRADES.
16. **DIFFERENTIAL SETTLEMENT NOTE:**

FUTURE BUILDING AND SERVICE DESIGNERS TO CONSIDER DIFFERENTIAL SETTLEMENT OF REINFORCED EARTH WALL BLOCK AND GENERAL FILL AREAS. PARTICULAR ATTENTION TO BE GIVEN TO HEAVY LOADED AREAS, OR DIFFERING LOADED AREAS INCLUDING SPRINKLER TANK AND TRUCK PAVEMENT AREAS) AND WHERE SIGNIFICANT CHANGES IN OVERALL WALL HEIGHT OR FILL AMOUNTS ARE EXPERIENCED. IT IS THE RESPONSIBILITY OF THE FUTURE DESIGNERS TO ENSURE APPROPRIATE DESIGN CONSIDERATION TO DIFFERENTIAL SETTLEMENT ARE MADE DEPENDING ON THE DESIGN ELEMENT AND INTERACTION WITH RETAINED ELEMENTS AND GENERAL FILL MATERIAL.

1. ALL COMPONENTS AND INSTALLATION SHALL COMPLY WITH AS4678 AND THE STANDARDS REFERRED TO THEREIN.
2. MINIMUM BEARING CAPACITY OF FOUNDATION TO BE AS FOLLOWS :
 - a. H MAX. 2.0m = 100 kPa
 - b. H MAX. 3.5m = 150 kPa
 - c. H MAX. 5.0m = 200 kPa
3. BEFORE COMMENCEMENT OF CONSTRUCTION THE FOUNDATION SHALL BE INSPECTED AND VERIFIED BY A QUALIFIED GEOTECHNICAL ENGINEER.
4. WHERE MINIMUM BEARING IS NOT ACHIEVABLE OR NOT MEETING DESIGN REQUIREMENT, THE FOUNDATION MATERIAL IS TO BE EXCAVATED AND REPLACED WITH APPROVED MATERIAL PLACED IN ACCORDANCE WITH THE FILLING SPECIFICATION TO A MINIMUM COMPACTION OF 100% SMD AND PLACED WITHIN 2% OF OMC.
5. MINIMUM SURCHARGE LOADS TO BE APPLIED AS FOLLOWS U.N.O.
 - a. LIVE LOAD = 20 kPa
 - b. DEAD LOAD = 5 kPa
 - c. CONSTRUCTION TRAFFIC LIVE LOAD = 10 kPa
6. MINIMUM WALL EMBEDMENT AT THE TOE OF THE WALL TO BE 300mm MINIMUM UNLESS NOTED OTHERWISE.
7. DESIGN LIFE OF STRUCTURE IS TO BE 100 YEARS.
8. TIED WALLS ARE TO BE TEMPORARILY PROPPED AT TOP UNTIL SUCH TIME THE TOP OF WALL IS TIED TO THE SLAB AND 28-DAY CONCRETE STRENGTH HAS BEEN ACHIEVED.
9. CONSTRUCTION EQUIPMENT WEIGHING MORE THAN 500KG STATIC WEIGHT IS TO BE KEPT BACK 150mm FROM THE REAR FACE OF THE WALL. FACING UNITS, COMPACTION OF THE SELECT FILL MATERIAL WITHIN THE 150mm STRIP ADJACENT TO THE WALL SHALL BE ACHIEVED BY LIGHT MECHANICAL TAMPERS (VIBRATING PLATE, TRENCH COMPACTOR OR SIMILAR) TO GIVE THE SAME DENSITY AS IN THE REMAINDER OF THE SELECT FILL.
10. ALL DESIGN AND CONSTRUCT WALL SYSTEMS TO BE COMPLETED IN ACCORDANCE WITH THESE NOTES.

1. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE DUST CONTROL MEASURES ARE APPLIED AND MAINTAINED IN ACCORDANCE WITH THE GOVERNING AUTHORITIES REQUIREMENTS.
2. THE APPLICATION OF LIQUID BASED DUST SUPPRESSION MEASURES MUST BE SUCH THAT SETTLED LADEN RUNOFF RESULTING FROM SUCH MEASURES DOES NOT CREATE A TRAFFIC OR ENVIRONMENTAL HAZARD. (EG UTILISING SEDIMENT CONTROLS)
3. DUST GENERATION ASSOCIATED WITH WIND EROSION TO BE CONTROLLED USING WATER TRUCKS, DUST SUPPRESSING FOG, MIST GENERATORS, SEALANT PLACED OVER THE SOIL, SURFACE ROUGHENING OR RE-VEGETATION.
4. THE FOLLOWING ACTIVITIES SHALL BE ADOPTED, IF NECESSARY, TO MANAGE DUST CONTROL ON SITE:
 - LIMITING THE AREA OF SOIL DISTURBANCE AT ANY GIVEN TIME
 - REPLACING TOPSOIL AFTER COMPLETION OF EARTHWORKS.
 - PROGRAMMING WORK TO MINIMISE THE LIFE OF STOCKPILES.
 - TEMPORARILY STABILISING LONG-TERM STOCKPILES.
 - GRAVELLING UNSEALED ACCESS AND HAUL ROADS.
 - MINIMISING TRAFFIC MOVEMENT ON EXPOSED SURFACES.
 - LIMITING VEHICULAR TRAFFIC TO 15km/h.
 - RETAINING EXISTING VEGETATION AS WIND BREAKS.
 - UTILISING A WATER CART WITH POTABLE WATER OR SEDIMENT CONTROL BASIN WATER
5. OIL, LANDFILL GAS CONDENSATE OR ANY CONTAMINATED LEACHATE IS NOT TO BE USED FOR DUST SUPPRESSION.

ALL SEDIMENT CONTROL WORK INCLUDING DIVERSION BANKS, CATCH DRAINS, DIVERSION DRAINS AND SEDIMENT FENCES SHALL BE COMPLETED IN ACCORDANCE WITH THE STAGED PLANS PRESENTED AND SHALL FACILITATE A STAGED CONSTRUCTION METHODOLOGY.

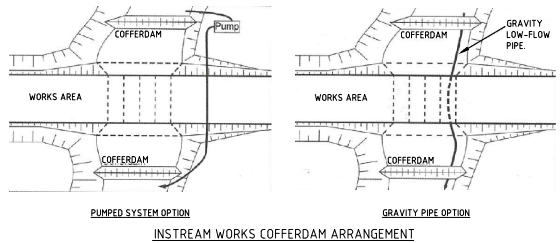
1. ALL EROSION SEDIMENT CONTROLS SHALL BE COMPLETED IN ACCORDANCE WITH THE 'SOILS AND CONSTRUCTION, MANAGING URBAN STORMWATER - THE BLUE BOOK' BY LANDCOM.
2. SEDIMENT FENCES AND SEDIMENT FENCE RETURNS SHALL BE ERRECTED CONVEX TO THE CONTRA TO POND WATER.
3. STRAW BALE BARRIERS & GEOFABRIC FENCES OR SEDIMENT FENCES ARE TO BE CONSTRUCTED TO TOE OF BATTER, PRIOR TO COMMENCEMENT OF EARTHWORKS, IMMEDIATELY AFTER CLEARING OF VEGETATION AND BEFORE REMOVAL OF TOP SOIL.
4. ALL TEMPORARY EARTH BERMS, DIVERSION AND SEDIMENT BASIN EMBANKMENTS ARE TO BE MACHINE COMPACTED, SEEDED AND MULCHED FOR TEMPORARY VEGETATION COVER AS SOON AS THEY HAVE BEEN FORMED. REFER TO TABLE 1 FOR APPROVED STABILISATION METHODS.
5. CLEAN NON-SITE WATER IS TO BE DIVERTED AWAY FROM DISTURBED GROUND AND INTO THE DRAINAGE SYSTEM OVER STABLE SURFACES.
6. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING AND PROVIDING ON GOING ADJUSTMENT TO EROSION CONTROL MEASURES AS REQUIRED DURING CONSTRUCTION.
7. ALL SEDIMENT TRAPPING STRUCTURES AND DEVICES ARE TO BE INSPECTED AFTER STORMS OF 5mm OR GREATER WITHIN A 24 HOUR PERIOD FOR STRUCTURAL DAMAGE OR CLOGGING, TRAPPED MATERIAL IS TO BE REMOVED TO A SAFE, APPROVED LOCATION.
8. THE SITE IS TO BE INSPECTED FOLLOWING A RAINFALL EVENT OF 5mm OR GREATER WITHIN A 24 HOUR PERIOD FOR EVIDENCE OF EROSION AND RESPOND WITH INCREASED CONTROL IF REQUIRED.
9. ALL FINAL EROSION PREVENTION MEASURES INCLUDING THE ESTABLISHMENT OF GRASSING ARE TO BE MAINTAINED UNTIL THE END OF THE DEFECTS LIABILITY PERIOD.
10. ALL EARTHWORKS AREAS SHALL BE ROLLED ON A REGULAR BASIS TO SEAL THE EARTHWORKS.
11. ALL FILL AREAS ARE TO BE LEFT WITH A BUND AT THE TOP OF THE SLOPE AT THE END OF EACH DAY'S EARTHWORKS TO DIRECT WATER TO A STABLE OUTLET OVER THE BATTER OR INTERNALLY TOWARDS SEDIMENT CONTROL. THE HEIGHT OF THE BUND SHALL BE A MINIMUM OF 200mm.
12. ALL CUT AND FILL SLOPES ARE TO BE SEEDED AND HYDROMULCHED WITHIN 10 DAYS OF COMPLETION OF FORMATION.
13. AFTER PERMANENT STABILISATION OF THE SITE IS COMPLETE (I.E. BY TOPSOILING, PAVING ETC) AND THE SITE IS DEEMED TO BE STABLE IN THE OPINION OF A SUITABLY QUALIFIED PERSON ALL TEMPORARY WORK SUCH AS SEDIMENT FENCE, DIVERSION DRAINS ETC SHALL BE REMOVED.
14. ALL STOCKPILES ARE TO BE SUITABLY COVERED AND STABILIZED TO THE SATISFACTION OF THE SITE MANAGER TO PREVENT WIND AND WATER EROSION.
15. ANY AREA THAT IS NOT APPROVED BY THE CONTRACT MANAGER FOR CLEARING OR DISTURBANCE OF THE CONTRACTOR'S ACTIVITIES SHALL BE CLEARLY MARKED AND SIGNS POSTED, FENCED OFF OR OTHERWISE APPROPRIATELY PROTECTED AGAINST ANY SUCH DISTURBANCE.
16. ALL STOCKPILE SITES SHALL BE SITUATED IN AREAS INDICATED ON THE APPROVED EROSION AND SEDIMENTATION CONTROL PLAN OR APPROVED FOR SUCH USE BY THE SITE MANAGER. A BUFFER ZONE SHALL EXIST BETWEEN STOCKPILE SITES AND ANY STREAM OR FLOW PATH IN ACCORDANCE WITH THE CSWMP. ALL STOCKPILES SHALL BE ADEQUATELY PROTECTED FROM EROSION AND CONTAMINATION OF THE SURROUNDING AREA BY USE OF THE MEASURES IN THE APPROVED ESP.
17. ACCESS AND EXIT AREAS SHALL INCLUDE TRUCK SHAKER GRID OR OTHER METHODS APPROVED BY THE SITE MANAGER FOR THE REMOVAL OF SOIL MATERIALS FORM MOTOR VEHICLES.
18. THE CONTRACTOR IS TO ENSURE RUNOFF FROM ALL AREAS WHERE THE NATURAL SURFACE IS DISTURBED BY CONSTRUCTION, INCLUDING ACCESS ROADS, DEPOT AND STOCKPILE SITES, SHALL BE FREE OF SEDIMENTS BEFORE IT IS EITHER DISCHARGED TO STABLE AREAS OR DIRECTED TO NATURAL WATERCOURSES.
19. THE CONTRACTOR SHALL PROVIDE AND MAINTAIN SLOPES, CROWNS AND DRAINS ON ALL EXCAVATIONS AND EMBANKMENTS TO ENSURE SATISFACTORY DRAINAGE AT ALL TIMES. WATER SHALL NOT BE ALLOWED TO POND ON THE WORKS UNLESS SUCH PONDING IS PART OF AN APPROVED ESP / SWMP.

1. DRAIN PONDS OF WATER & DISCHARGE CLEAN WATER TO STORMWATER DRAINAGE SYSTEM (AS PER NOTES 2 & 3) - REFER TO STORMWATER PLAN FOR LOCATIONS.
2. DEWATERING TO BE PERFORMED IN SUCH A MANNER AS TO REMOVE CLEAN WATER WITHOUT REMOVING OR DISTURBING SILT, SEDIMENT OR OTHER ORGANIC MATERIAL FROM THE BASE OF THE PONDS.
3. DISCHARGE OF WATER FROM PONDS TO HAVE A PH RANGE OF 6.5-8.5 AND TSS - 50mg/L. PONDS TO BE DOSED WITH GYPSUM (APPROX 30mg PER CUBIC METRE) TO ACCELERATE SETTLEMENT OF SUSPENDED SOLIDS.
4. REMOVE ALL SILT, ORGANIC AND WATER LOGGED MATERIAL FROM BASE OF POND (NOM. DEPTH 0.5-1m) AND DISPOSE OF IN ACCORDANCE WITH THE ACCEPTABLE PRACTICE.
5. EXPOSE NATURAL SITE SLOPS AND COMPACT SUBGRADE IN ACCORDANCE WITH THE SITE PREPARATION NOTES (REFER DRG. DA10) REMOVING ANY SOFT ZONES AS REQ'D.
6. PLACE AND COMPACT FILL AS PER SITE PREPARATION NOTES ON DRAWING DA11.
7. INFORMATION PROVIDED ON THIS DRAWING SHALL BE USED TO GUIDE THE DEVELOPMENT OF THE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN THAT SHALL BE IMPLEMENTED DURING CONSTRUCTION

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE ADEQUATE INSPECTIONS AND MAINTENANCE ARE CARRIED OUT DURING SITE WORKS. DAILY AND WEEKLY INSPECTION CHECKLISTS HAVE BEEN PROVIDED IN THE COSTIN ROE SOIL AND WATER MANAGEMENT PLAN (SWMP)
Co14429.00-03b.rpt.

AS NOTED, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE ADEQUATE MAINTENANCE OF EROSION & SEDIMENT CONTROL MEASURES ARE UNDERTAKEN DURING THE WORKS PERIOD. DAMAGED, DISLODGED OR FAULTY ESC MEASURES ARE TO BE IMMEDIATELY RECTIFIED AND THE SURROUNDING AREA IS TO BE REMEDIATED AS PER NOTES ON THIS DRAWING, THE SWMP AND THE LANDCOM 'BLUE BOOK'.

1. SEDIMENT FENCES AND SEDIMENT FENCE RETURNS TO BE ERRECTED PRIOR TO THE COMMENCEMENT OF ANY WORK. SEDIMENT FENCES TO REMAIN UNTIL COMPLETION OF INSTREAM WORK IN THESE LOCATION TO PROTECT EXISTING DOWNSTREAM PROPERTIES AND ROAD PAVEMENT. (REFER TO DA25 FOR DETAILS).
2. UNDERTAKE WORK DURING A PERIOD OF DRY-FORECASTED WEATHER.
3. PROTECT DISTURBED AREA WITH COFFERDAMS AS REQUIRED.
4. PROVIDE DRY LOW FLOOD DIVERSION FOR PROPOSED DIVERSION SYSTEM MAY BE INSTALLED AT THE BASE OF CHANNEL TO DIVERT CLEAN WATER FROM UPSTREAM BASEFLOW.
5. UNDERTAKE ALL INSTREAM WORK IN THE SPECIFIED SECTION OF THE CHANNEL IN ACCORDANCE WITH APPROVED PLANS AND IMMEDIATELY PLANT TO STABILISE THE WORKS.
6. PLANT WITH APPROPRIATE SPECIES, AT A DENSITY THAT WOULD NATURALLY OCCUR.



																					DRAWING TITLE GENERAL NOTES-SHEET 2					
ISSUED FOR DEVELOPMENT APPLICATION			25.07.23			C			PROJECT YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW			Costin Roe Consulting Pty Ltd. ABN 50 003 696 446			PO Box N419 Sydney NSW 1520 Level 4 & 5 Windmill Street, Murrumbidgee NSW 2500 P +61 2 9241 7699 F +61 2 9241 5751 e mail@costinroe.com.au w costinroe.com.au						DRAWING NO. C014429.00-DA11					
ISSUED FOR DEVELOPMENT APPLICATION			26.12.22			B			ARCHITECT SB ARCHITECTS Suite 702, 45 Mount Street, North Sydney NSW 2060 P +61 2 9550 4444 F +61 2 9550 4444 e mail@sbarchitects.com.au w sbarchitects.com.au			CLIENT														
AMENDMENTS FOR INFORMATION ONLY			30.11.22			A			DESIGNED DATE 01 OCT 22			CHECKED DATE 01 OCT 22			SCALE AS SHOWN			CADD DATE 01 OCT 22								
AMENDMENTS			DATE			ISSUE			AMENDMENTS			DATE			ISSUE			AMENDMENTS			DATE			ISSUE		

STAGED CONSTRUCTION NOTE:

STAGE 1 - INITIAL SITE ESTABLISHMENT AND INSTALLATION OF SEDIMENT & EROSION CONTROL MEASURES AS NOTED ON PLAN. REFER TO DRAWING C014429.00-DA21

STAGE 2 - MAJORITY OF STORMWATER INFRASTRUCTURE COMPLETED. PADS BENCHED & RETAINING WALLS CONSTRUCTED. STORMWATER FROM DEVELOPED LOTS DIVERTED TO RETENTION BASIN. STORMWATER FROM UNDEVELOPED PADS DIVERTED TO SEDIMENT BASINS. REFER TO DRAWING C014429.00-DA22

NOTE:

REFER TO DRAWING DA11 FOR ALL EROSION AND SEDIMENT CONTROL NOTES.

SEDIMENTATION BASIN NOTE:

ALL SEDIMENT BASINS ARE TO BE HIGH EFFICIENCY SEDIMENT (HES) BASINS IN ACCORDANCE WITH THE ICEA WHITE BOOK. REFER TO DRAWINGS C0194429.00-DA25 & DA26 FOR DETAILS.

APPROXIMATE AREA OF DISTURBED SITE = 6.67ha

AUTO DOSER

1. PROVIDE AS EITHER FLOC BOX OR IFOD-RAIN TO MANUFACTURERS SPECIFICATION.
2. DOSER AND SUPPLY OF FLOCCULANT TO BE PROVIDED ON LEVEL PAD 4m x 4m WITHIN 10m OF DOSING POINT.
3. ALL-WEATHER ACCESS TRACK TO BE PROVIDED TO DOSER.
4. FLOCCULANT PROVIDED AS TURBICLEAR (ACH). IF ALTERNATIVE FLOCCULANT USED THEN THE BASIN SIZE IS TO BE INCREASED ACCORDING TO JAR SETTLEMENT TEST (REFER TO TABLE BELOW)

JAR SETTLEMENT AFTER 15 MIN.	MULTIPLICATION FACTOR TO SETTLING ZONE VOLUME
(mm)	VOLUME
50	x3
75	x2
100	x1.5
150	x1

EACH BASIN IS TO HAVE A MARKER PLACED AS PER THE DETAIL TO INDICATE WHEN SEDIMENT IS TO BE REMOVED. REMOVED SEDIMENT IS TO BE CLASSED AND DEWATERED PRIOR TO REMOVAL FROM SITE.

ALLOWANCE TO BE MADE DURING BENCHING OF SITE TO ENSURE RUN-OFF IS DIRECTED TO SEDIMENTATION BASINS.

NOTES:

1. ASSUME TYPE B SOIL

LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY BOXAL SURVEYORS DATED 02.09.20.

- SHEET-FLOW DIRECTION
- SITE BOUNDARY
- CATCHMENT BOUNDARY
- DIRTY WATER DIVERSION DRAIN
- CLEAN WATER DIVERSION DRAIN
- SEDIMENT FENCING
- 1 IN 100 YEAR ARI FLOOD EXTENT
- SEDIMENT BASIN (REFER TO PLAN)

HIGH EFFICIENCY SEDIMENT (HES) BASIN SCHEDULE

BASIN ID	SETTLING ZONE (INCL SEDIMENT STORAGE)				FOREBAY			
	VOL (M3)	LENGTH (M)	WIDTH (M)	DEPTH (M)	VOL (M3)	LENGTH (M)	WIDTH (M)	DEPTH (M)
BASIN 1	2763	70.00	23.30	2.00	213	11.60	18.30	1.00

DISCHARGE CRITERIA:

PARAMETER	TARGET (REDUCTION IN MEAN ANNUAL LOAD FROM UNMITIGATED DEVELOPMENT)
TOTALSUSPENDED SOLIDS (TSS) AND PH	ALL EXPOSED AREAS GREATER THAN 2,500 M ² ARE TO BE PROVIDED WITH SEDIMENT CONTROLS THAT ARE DESIGNED, IMPLEMENTED AND MAINTAINED TO A STANDARD THAT WOULD ACHIEVE TREATMENT OF AT LEAST 80% OF THE AVERAGE ANNUAL RUNOFF VOLUME OF THE CONTRIBUTING CATCHMENT (I.E. 80% HYDROLOGICAL EFFECTIVENESS) TO 50 mg/L TSS OR LESS, AND PH IN RANGE (6.5-8.5). NO RELEASE OF COARSE SEDIMENT IS PERMITTED FOR ANY CONSTRUCTION OR BUILDING SITE. SITES LESS THAN 2,500M ² ARE REQUIRED TO COMPLY WITH THE REQUIREMENTS OF THE BLUE BOOK.
OIL, LITTER AND WASTE CONTAMINANTS	NO RELEASE OF OIL, LITTER OR WASTE CONTAMINANTS
STABILISATION	PRIOR TO COMPLETION OF WORKS FOR THE DEVELOPMENT, AND PRIOR TO REMOVAL OF SEDIMENT CONTROLS, ALL SITE SURFACES ARE TO BE EFFECTIVELY STABILISED SURFACE IS DEFINED AS ONE THAT DOES NOT OR IS NOT LIKELY TO RESULT IN VISIBLE EVIDENCE OF SOIL LOSS CAUSED BY SHEET, RILL OR GULLY EROSION OR LEAD TO SEDIMENTATION AND WATER CONTAMINATION.



EROSION AND SEDIMENT CONTROL PLAN-STAGE 1
1:500 SCALE

FOR DEVELOPMENT APPLICATION

5m 0 10 20 30 40 50m
SCALE 1:500 AT A0 SHEET SIZE

ISSUED FOR DEVELOPMENT APPLICATION ISSUED FOR DEVELOPMENT APPLICATION AMENDMENTS										25.07.23 19.12.22										B 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2. DOSER AND SUPPLY OF FLOCCULANT TO BE PROVIDED ON LEVEL PAD 4m x 4m WITHIN 10m OF DOSING POINT.
3. ALL-WEATHER ACCESS TRACK TO BE PROVIDED TO DOSER.
4. FLOCCULANT PROVIDED AS TURBICLEAR (ACH). IF ALTERNATIVE FLOCCULANT USED THEN THE BASIN SIZE IS TO BE INCREASED ACCORDING TO JAR SETTLEMENT TEST (REFER TO TABLE BELOW)

JAR SETTLEMENT AFTER 15 MIN.	MULTIPLICATION FACTOR TO SETTLING ZONE VOLUME
(mm)	
50	x3
75	x2
100	x1.5
150	x1

EACH BASIN IS TO HAVE A MARKER PLACED AS PER THE DETAIL TO INDICATE WHEN SEDIMENT IS TO BE REMOVED. REMOVED SEDIMENT IS TO BE CLASSED AND DEWATERED PRIOR TO REMOVAL FROM SITE.

ALLOWANCE TO BE MADE DURING BENCHING OF SITE TO ENSURE RUN-OFF IS DIRECTED TO SEDIMENTATION BASINS.

NOTES:

1. ASSUME TYPE B SOIL

THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING AND PROVIDING ON GOING ADJUSTMENT TO EROSION CONTROL MEASURES AS REQUIRED DURING CONSTRUCTION. ADJUSTMENTS TO ESC MEASURES ARE TO BE MADE IN ACCORDANCE WITH THE GENERAL REQUIREMENTS OF THE CSMF

HIGH EFFICIENCY SEDIMENT (HES) BASIN SCHEDULE

BASIN ID	SETTLING ZONE (INCL SEDIMENT STORAGE)				FOREBAY			
	VOL (M3)	LENGTH (M)	WIDTH (M)	DEPTH (M)	VOL (M3)	LENGTH (M)	WIDTH (M)	DEPTH (M)
BASIN 2	1561.00	55.00	18.30	2.00	120	9.00	13.30	1.00
BASIN 3	1400.00	50.00	16.70	2.00	108	9.20	11.70	1.00

DISCHARGE CRITERIA:

PARAMETER	TARGET (REDUCTION IN MEAN ANNUAL LOAD FROM UNMITIGATED DEVELOPMENT)
TOTAL SUSPENDED SOLIDS (TSS) AND PH	ALL EXPOSED AREAS GREATER THAN 2,500 M ² ARE TO BE PROVIDED WITH SEDIMENT CONTROLS THAT ARE DESIGNED, IMPLEMENTED AND MAINTAINED TO A STANDARD THAT WOULD ACHIEVE TREATMENT OF AT LEAST 80% OF THE AVERAGE ANNUAL RUNOFF VOLUME OF THE CONTRIBUTING CATCHMENT (I.E. 80% HYDROLOGICAL EFFECTIVENESS) TO 50 mg/L TSS OR LESS, AND PH IN RANGE (6.5-8.5). NO RELEASE OF COARSE SEDIMENT IS PERMITTED FOR ANY CONSTRUCTION OR BUILDING SITE. SITES LESS THAN 2,500 M ² ARE REQUIRED TO COMPLY WITH THE REQUIREMENTS OF THE BLUE BOOK.
OIL, LITTER AND WASTE CONTAMINANTS	NO RELEASE OF OIL, LITTER OR WASTE CONTAMINANTS
STABILISATION	PRIOR TO COMPLETION OF WORKS FOR THE DEVELOPMENT, AND PRIOR TO REMOVAL OF SEDIMENT CONTROLS, ALL SITE SURFACES ARE TO BE EFFECTIVELY STABILISED. SURFACE IS DEFINED AS ONE THAT DOES NOT OR IS NOT LIKELY TO RESULT IN VISIBLE EVIDENCE OF SOIL LOSS CAUSED BY SHEET, RILL OR GULLY EROSION OR LEAD TO SEDIMENTATION AND WATER CONTAMINATION.

LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY BOXAL SURVEYORS DATED 02.09.20.

- SHEET-FLOW DIRECTION
- SITE BOUNDARY
- CATCHMENT BOUNDARY
- DIRTY WATER DIVERSION DRAIN
- CLEAN WATER DIVERSION DRAIN
- SEDIMENT FENCING
- 1 IN 100 YEAR ARI FLOOD EXTENT
- SEDIMENT BASIN (REFER TO PLAN)

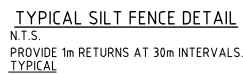


EROSION AND SEDIMENT CONTROL PLAN-STAGE 2
1:500 SCALE

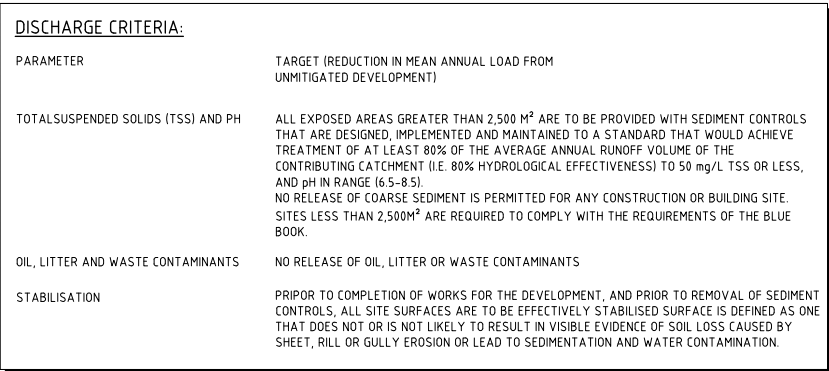
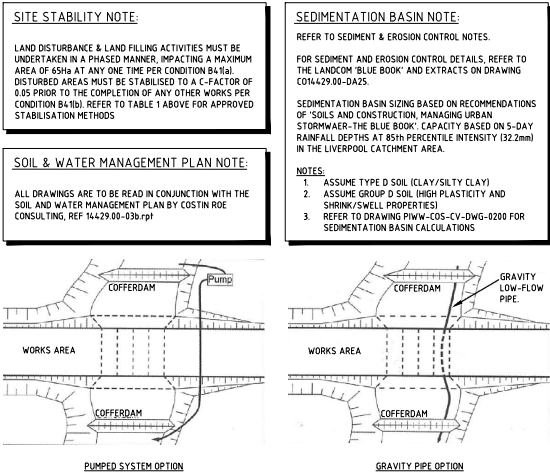
FOR DEVELOPMENT APPLICATION

5m 0 10 20 30 40 50m
SCALE 1:500 AT A0 SHEET SIZE

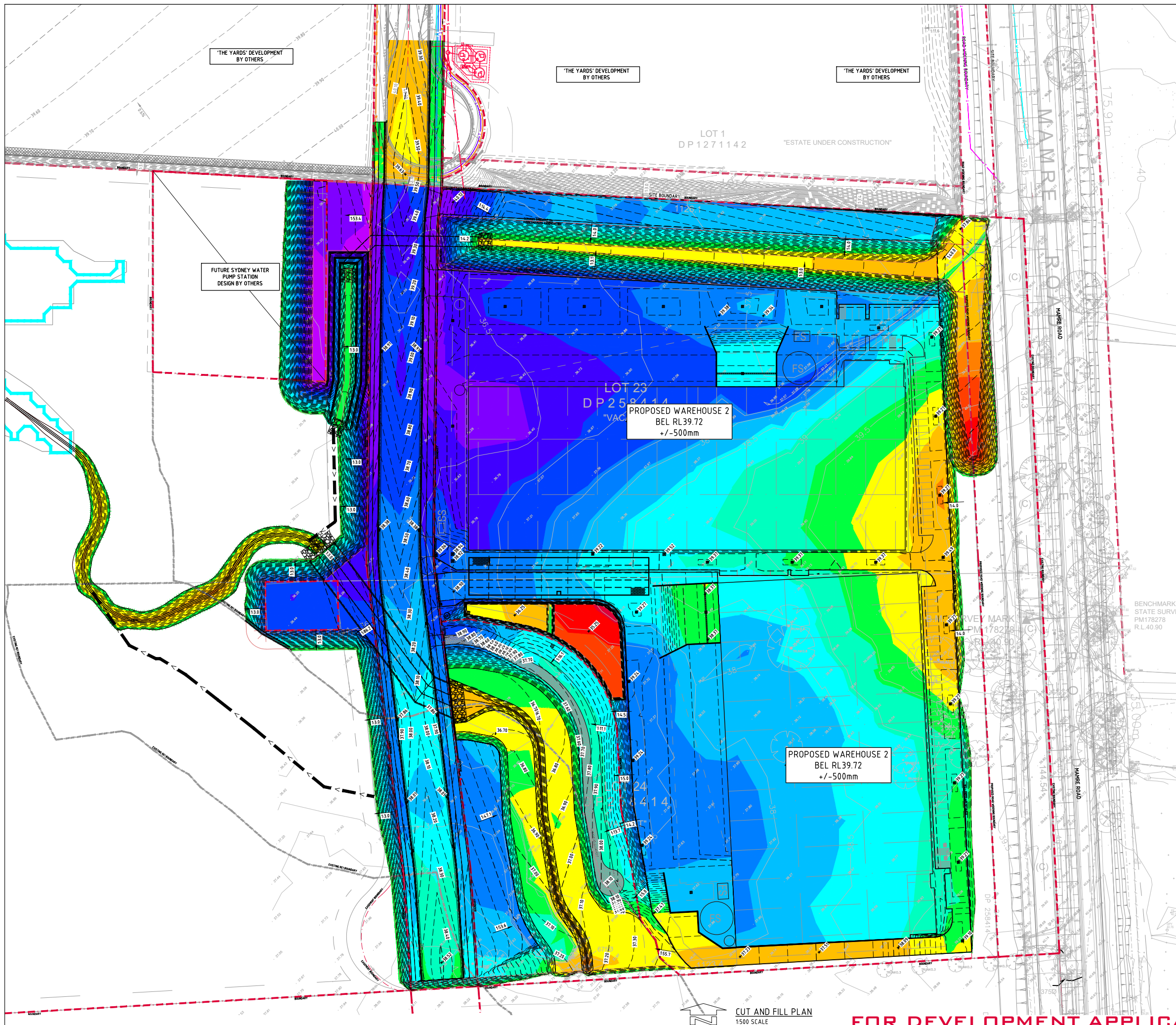
ISSUED FOR DEVELOPMENT APPLICATION		25.07.23	B	ARCHITECT		PROJECT		CLIENT		CONSULTANT		DRAWING TITLE	
AMENDMENTS		19.12.22	A	DATE		YIRIBANA WEST INDUSTRIAL ESTATE		GPT		CONSULT AUSTRALIA		EROSION AND SEDIMENT CONTROL PLAN	
						771-797 MAMRE ROAD		The GPT Group		PO Box N419 Sydney NSW 1220		STAGE 2	
						KEMPS CREEK, 2178, NSW				Level 4, 4 Woodmill Street, Millers Point NSW 2000			
										p: +61 2 9251 7699			
										e: mail@costinroe.com.au			
										w: costinroe.com.au			
												DRAWING NO	
												C014429.00-DA22	
												TABLE	
												A	

[illegible]

LAND USE	LIMITATION	REMARKS
CONSTRUCTION AREAS	LIMITED TO 5 (PREFERABLE 2) METRES FROM THE EDGE OF ANY ESSENTIAL CONSTRUCTION ACTIVITY AS SHOWN ON ENGINEERING PLANS.	ALL SITE WORKERS SHOULD CLEARLY RECOGNISE THESE AREAS THAT, WHERE APPROPRIATE, ARE IDENTIFIED WITH BARRIER FENCING (UPSLOPE) AND SEDIMENT FENCE (DOWNSLOPE) OR SIMILAR MATERIALS.
ACCESS CORRIDORS	LIMITED TO A MAXIMUM WIDTH OF 7 METERS	THE SITE MANAGER WILL DETERMINE AND MARK THE LOCATION OF THESE ZONES ON SITE, THEY CAN VARY IN POSITION SO AS TO BEST CONSERVE EXISTING VEGETATION AND PROTECT DOWNSTREAM AREAS WHILE BEING CONSIDERATE OF THE NEEDS EFFICIENT WORKS ACTIVITIES. ALL SITE WORKERS WILL CLEARLY RECOGNISE THESE BOUNDARIES.
REMAINING LANDS, INCLUDING REVEGETATION AREA	ENTRY PROHIBITED EXCEPT FOR ESSENTIAL MANAGEMENT WORKS	THINNING OF GROWTH MIGHT BE NECESSARY, FOR EXAMPLE, FOR FIRE REDUCTION OR WEED REMOVAL.



FOR DEVELOPMENT APPLICATION



DEPTH RANGE			
No.	FROM DEPTH	TO DEPTH	COLOUR
1	-3.000	-2.500	Red
2	-2.500	-2.000	Orange
3	-2.000	-1.500	Yellow
4	-1.500	-1.000	Light Green
5	-1.000	-0.500	Green
6	-0.500	0.000	Light Blue
7	0.000	0.500	Blue
8	0.500	1.000	Dark Blue
9	1.000	1.500	Very Dark Blue
10	1.500	2.000	Black
11	2.000	2.500	White
12	2.500	3.000	Light Grey
13	3.000	3.500	Medium Grey
14	3.500	4.000	Dark Grey
15	4.000	4.500	Black

SITE PREPARATION NOTES:
REFER TO DRAWING DA11 FOR SITE PREPARATION NOTES

EARTHWORKS VOLUMES	
TOPSOIL VOLUME:	
CUT	= - 14 400 m ³
EARTHWORKS VOLUMES:	
CUT	= - 36 200 m ³
FILL	= + 111 300 m ³
ALLOWANCE FOR DETAILED EXCAVATION (1250m ³ /Ha)	= - 9 000 m ³
BALANCE	= +96 200m ³ (IMPORT)
EARTHWORK VOLUMES ARE APPROXIMATE ONLY & ARE CALCULATED ASSUMING A MINIMAL TOPSOIL STRIP OF 200mm. NO ALLOWANCE HAS BEEN MADE FOR EROSION AND SEDIMENT CONTROL, BULKING, COMPACTION OF FILLED SOILS.	
REFER TO DRAWINGS DA20TO DA26 FOR EROSION AND SEDIMENT CONTROL PLANS.	
THE EXISTING SURFACE IS BASED ON SURVEY & DESIGN INFORMATION PROVIDED. THIS SURVEY IS MOST CURRENT HOWEVER IT MAY NOT ACCURATELY REFLECT ACTUAL GROUND LEVELS OR STOCKPILES ETC ON SITE. IT IS THE CONTRACTORS RESPONSIBILITY TO CONFIRM VOLUMES AND ALLOWANCES FOR EARTHWORKS.	

LEGEND
LEVELS DATUM IS AHD.

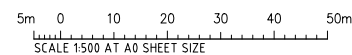
EXISTING SITE LEVELS AND DETAILS BASED ON A PLAN OF SURVEY '11220-004' BY 'BOXALL SURVEYORS PTY. LTD.' DATED 28.10.2022.

— 6.0 — - EXISTING CONTOUR
— 14.9 — - EXISTING SPOT HEIGHT
— 30.50 — - B.E.L. CONTOUR (MAJOR - 0.5m)
— 30.40 — - B.E.L. CONTOUR (MINOR - 0.1m)

PAVEMENT ——— PAVEMENT FFL ———
BASE/ SUBBASE COURSES ——— SUBGRADE ———
NOMINATED B.E. LEVEL

DEPTH OF PAVEMENT. REFER TO STRUCTURAL PLANS FOR DETAILS.

NOMINATED B.E.L. DETAIL
N.T.S.



CUT AND FILL PLAN
1500 SCALE

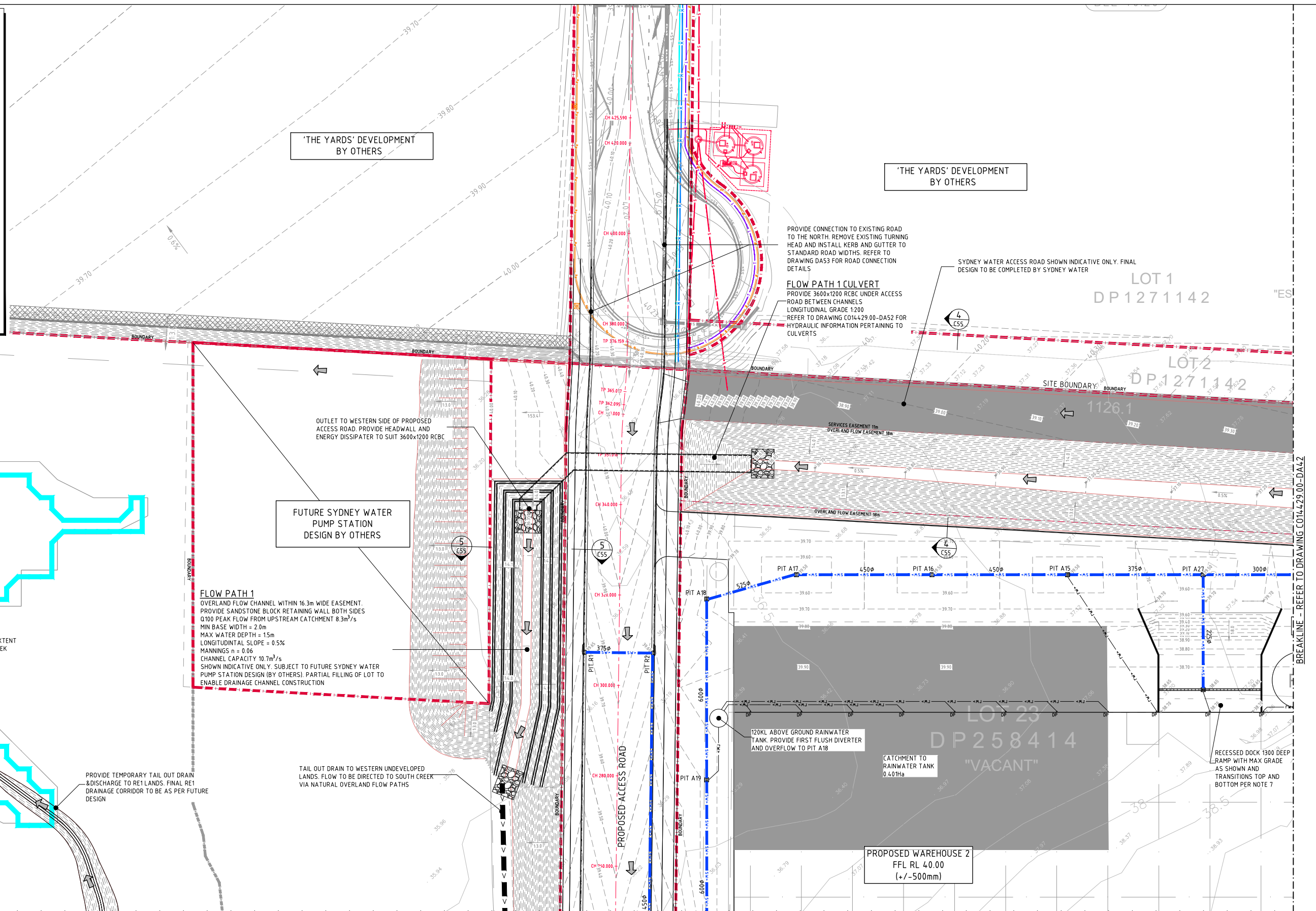
FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION				ARCHITECT				CLIENT				PROJECT				COSTIN ROE CONSULTING PTY LTD.				CRC				DRAWING TITLE			
ISSUED FOR DEVELOPMENT APPLICATION				SBA				GPT				YIRIBANA WEST INDUSTRIAL ESTATE				PO Box 1419 Sydney NSW 1220				CIVIL & STRUCTURAL ENGINEERS				CUT AND FILL PLAN			
ISSUED FOR DEVELOPMENT APPLICATION				771-797 MAMRE ROAD				KEMPS CREEK, 2178, NSW				DESIGNED/DRAWN/DATE				Level 4 & 8 Woodfield Street, Millers Point NSW 2000				E-MAIL				DRAWING No			
ISSUED FOR DEVELOPMENT APPLICATION				19.12.22				19.12.22				MC MC OCT 22				p: +61 2 9251 7699				E: +61 2 9241 3731				C014429.00-DA30			
ISSUED FOR INFORMATION				06.12.22				A				CAD REF: C01429.00-DA30				w: costinroe.com.au				w: costinroe.com.au				E			
AMENDMENTS				DATE				ISSUE				AMENDMENTS				DATE				ISSUE				AMENDMENTS			

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY
INFORMATION PROVIDED BY BOXAL SURVEYORS DATED 02.09.20.

-  - SJP, SEALED JUNCTION PIT
-  - KIP, KERB INLET PIT
-  - SGGP, SINGLE GRATED GULLY PIT
-  - OVERLAND FLOW DIRECTION
-  - PROPOSED DRAINAGE LINE
-  - EXISTING DRAINAGE LINE
-  - FINISHED PAVEMENT CONTOUR (MAJOR)
0.5m INTERVALS
-  - FINISHED PAVEMENT CONTOUR (MINOR)
0.1m INTERVALS
-  - FINISHED PAVEMENT SPOT HEIGHT
-  - EXISTING SEWER MAIN
-  - EXISTING WATER MAIN
-  - EXISTING RECYCLED WATER MAIN
-  - EXISTING UNDERGROUND ELECTRICAL
-  - EXISTING TELECOMMUNICATIONS (NBN)



CONCEPT CIVIL WORKS PLAN-SHEET 1
1:300 SCALE

FOR DEVELOPMENT APPLICATION

3m 0 5 10 15 20 25 30m
SCALE 1:300 AT A0 SHEET SIZE

ISSUED FOR DEVELOPMENT APPLICATION			17.07.23	F	ISSUED FOR DEVELOPMENT APPLICATION			02.02.24	K	 SB ARCHITECTS Level 10/100, St James Street, Sydney NSW 2008 Ph: 02 9239 6600 Email: info@sbarchitects.com.au	 GPT The GPT Group	CLIENT PROJECT YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW	 CONSULT AUSTRALIA	Costin Roe Consulting Pty Ltd. ABN 50 003 696 446 PO Box 1419 Sydney NSW 1220 Level 4, 4 Warrindli Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au w: costinroe.com.au	 CRC CIVIL & STRUCTURAL ENGINEERS Costin Roe Consulting Pty Ltd	DRAWING TITLE CONCEPT CIVIL WORKS PLAN SHEET 1
ISSUED FOR DEVELOPMENT APPLICATION			17.08.23	E	REVISED NOTE AS CLOUED			21.02.23	J							
ISSUED FOR DEVELOPMENT APPLICATION			24.04.23	D	REVISED CHANNEL			21.02.23	J							
ISSUED FOR DEVELOPMENT APPLICATION			20.12.22	C	REVISION AS CLOUED			17.11.23	I							
ISSUED FOR INFORMATION			08.12.22	B	REVISED OP LOCATION			21.02.23	H							
ISSUED FOR INFORMATION			08.12.22	A	REVISED OP LOCATION			20.07.23	G							
AMENDMENTS			DATE	ISSUE	AMENDMENTS			DATE	ISSUE	AMENDMENTS			DATE	ISSUE	DRAWING NO. C014.429.00-DA.41	ISSUE

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY
INFORMATION PROVIDED BY BOXAL SURVEYORS DATED 02.09.20.

-  - SJP, SEALED JUNCTION PIT
-  - KIP, KERB INLET PIT
-  - SGGP, SINGLE GRATED GULLY PIT
-  - OVERLAND FLOW DIRECTION
-  - PROPOSED DRAINAGE LINE
-  - EXISTING DRAINAGE LINE
-  - FINISHED PAVEMENT CONTOUR (MAJOR 0.5m INTERVALS)
-  - FINISHED PAVEMENT CONTOUR (MINOR 0.1m INTERVALS)
-  - FINISHED PAVEMENT SPOT HEIGHT
-  - EXISTING SEWER MAIN
-  - EXISTING WATER MAIN
-  - EXISTING RECYCLED WATER MAIN
-  - EXISTING UNDERGROUND ELECTRICAL
-  - EXISTING TELECOMMUNICATIONS (INBNT)

PIT No.	GRATE RL	TYPE	SIZE	COMMENT
PIT A1	39.55	SGGP	900x900	⊕
PIT A2	39.55	SGGP	900x900	⊕
PIT A3	39.55	SGGP	900x900	⊕
PIT A4	39.55	SGGP	900x900	⊕
PIT A5	39.55	SGGP	900x900	⊕
PIT A6	39.75	SGGP	900x900	⊕
PIT A7	39.65	SGGP	1200x1200	900sq RISER ⊕
PIT A8	39.65	SGGP	1200x1200	900sq RISER ⊕
PIT A9	39.65	SGGP	1200x1200	900sq RISER ⊕
PIT A10	39.80	SJP	1200x1200	900sq RISER
PIT A11	39.50	SGGP	1200x1200	900sq RISER ⊕
PIT A12	39.15	SJP	1200x1200	900sq RISER
PIT A13	39.13	SJP	1200x1200	900sq RISER
PIT A14	39.50	SGGP	900x900	⊕
PIT A15	39.50	SGGP	900x900	⊕
PIT A16	39.50	SGGP	900x900	⊕
PIT A17	39.50	SGGP	900x900	⊕
PIT A18	39.90	SGGP	900x900	⊕
PIT A19	39.90	SGGP	900x900	⊕
PIT A20	39.55	SGGP	900x900	⊕
PIT A21	39.55	SGGP	900x900	⊕
PIT A22	39.55	SGGP	900x900	⊕
PIT A23	39.55	SGGP	900x900	⊕
PIT A24	39.55	SGGP	900x900	⊕
PIT A25	39.30	SGGP	900x900	⊕
PIT A26	37.30	BJP	900x900	
PIT A27	38.30	SJP	1500x1500	900sq RISER
PIT A28	38.25	SJP	1500x1500	900sq RISER
PIT A29	39.20	SGGP	900x900	⊕

⊕ -DENOTES PIT TO BE FITTED WITH ATLAN
STORMWATER STORMSACK

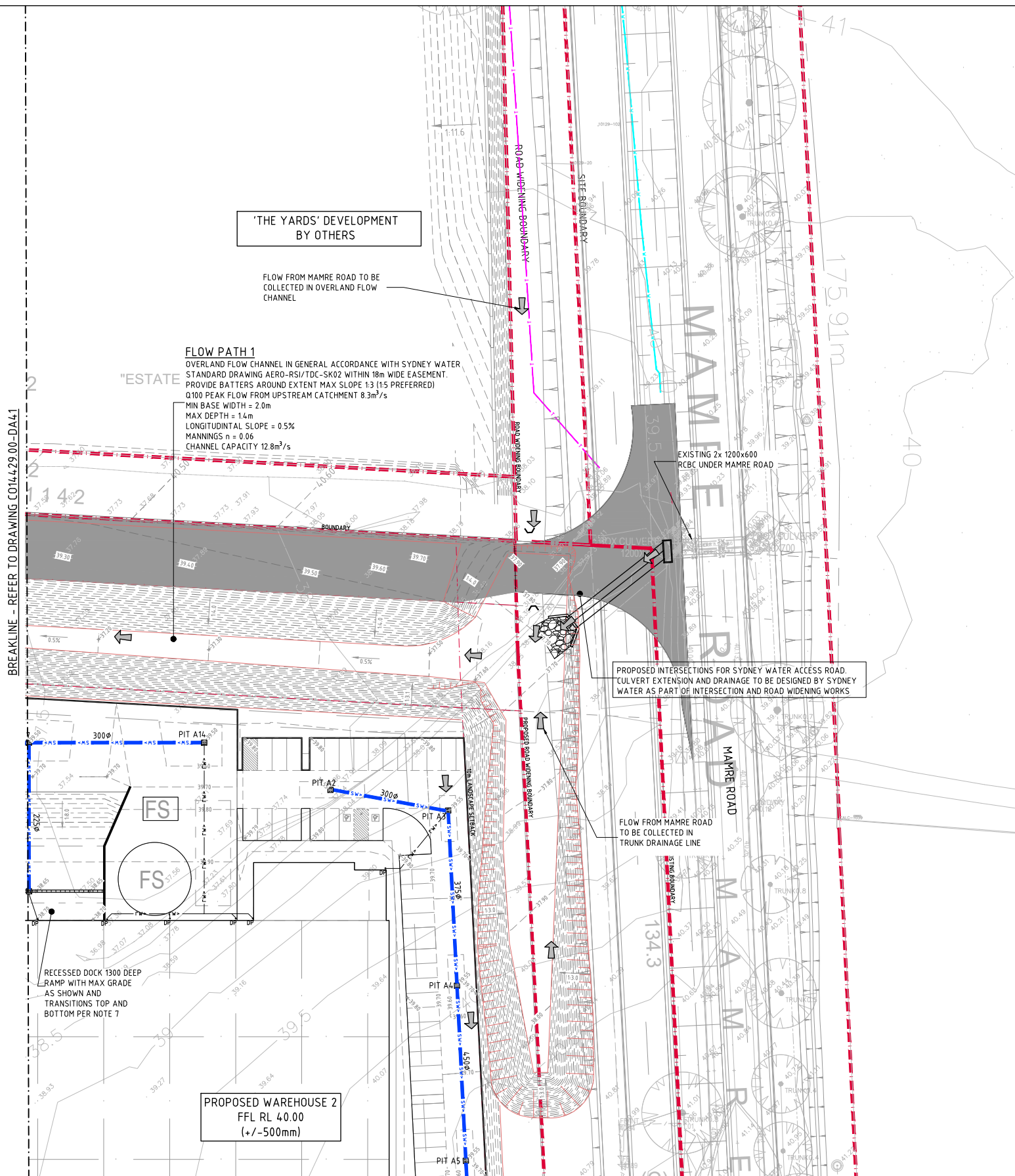
PIT No.	GRATE RL	TYPE	SIZE	COMMENT
PIT B1	NOT USED			⊕
PIT B2	NOT USED			⊕
PIT B3	NOT USED			⊕
PIT B4	39.15	SGGP	900x900	⊕
PIT B5	39.50	SGGP	900x900	⊕
PIT B6	39.50	SGGP	900x900	⊕
PIT B7	39.50	SGGP	900x900	⊕
PIT B8	39.55	SGGP	900x900	⊕
PIT B9	38.65	SGGP	900x900	⊕

⊕ -DENOTES PIT TO BE FITTED WITH ATLANTIS
STORMWATER STORMSACK

PIT No.	GRATE RL	TYPE	SIZE	COMMENT
PIT R1	39.67	KIP	900x900	
PIT R2	39.66	KIP	900x900	
PIT R3	39.13	KIP	900x900	
PIT R4	38.84	KIP	900x900	
PIT R5	38.84	KIP	900x900	
PIT R6	38.84	KIP	900x900	
PIT R7	38.60	KIP	900x900	
PIT R8	38.60	KIP	900x900	
PIT R9	39.14	KIP	900x900	

- LEVELS DATUM IS AUSTRALIAN HEIGHT DATUM (A.H.D.)
2. GRADING REQUIREMENTS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS2890.1, AS2890.2 & AS2890.6.
3. ALL CONTOUR LINES & SPOT LEVELS INDICATE FINISHED PAVEMENT LEVELS U.N.O. ON PLAN. CONTOUR INTERVALS
 - THE MINOR CONTOUR INTERVAL IS 0.1m.
 - THE MAJOR CONTOUR INTERVAL IS 0.5m.
5. HARDSTAND GRADING
 - MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%).
 - GRADING OF ON-GRADE DOCKS TO BE 1:100 (1%) FALL AWAY FROM THE DOCK FACE FOR A LENGTH OF 15m U.N.O.
 - GRADING OF TRUCK CIRCULATION ZONES TO BE MINIMUM AS NOTED ABOVE, 3-4% NOMINAL AND MAX. 5%.
6. CAR PARKING AREA GRADES
 - MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%), DESIRABLE MINIMUM GRADE 1:50 (2%).
 - MAXIMUM PAVEMENT GRADE IS TO BE 1:20 (5%) IN CARPARKING AREAS AND 1:25 (4%) ELSEWHERE.
 - DISABLED ACCESS PARKING ZONES AND SHARED SPACE TO BE MAXIMUM OF 1:33 (3%) IN ASPHALT PAVEMENT AND MAXIMUM OF 1:40 (2.5%) IN CONCRETE PAVEMENT.
 - CARPARK RAMP GRADES TO BE MAX 1:5 WITH 2.5m SMOOTH TRANSITION AT TOP AND BOTTOM U.N.O.
7. TRUCK RAMP GRADES
 - MAXIMUM B+DOUBLE OR 19.0m A/V RAMP GRADES ARE TO BE 1:8.3 (12%) U.N.O. ON PLAN.
 - PROVIDE MINIMUM 4.0m LONG TRANSITION WHERE CHANGES OF GRADE EXCEED 1:20 (5%) AT A CREST U.N.O.
 - PROVIDE MINIMUM 3.0m LONG TRANSITION WHERE CHANGE OF GRADE EXCEED 1:20 (5%) AT A SAG U.N.O.
 - TRANSITIONS ARE TO PROVIDE A SMOOTH CONTINUOUS CIRCULAR AND TANGENTIAL CHANGE IN GRADE TO ENSURE NO SHARP OR ACUTE CHANGES IN GRADE ARE PRESENT.
8. WHERE FIRE BRIGADE ACCESS IS REQUIRED, MAXIMUM RAMP GRADIENTS ARE TO BE 1:6 (16.6%). DESIRABLE RAMP GRADIENTS ARE TO BE 1:8 (12.5%) WITH 7m TRANSITION TOP AND BOTTOM U.N.O. ON PLAN.
9. PERMANENT BATTER SLOPES ARE TO HAVE A MAXIMUM GRADE OF 1V:3H U.N.O. BASED ON GEOTECHNICAL ASSESSMENT. PROVIDE MINIMUM 0.5m BERM BETWEEN THE BACK OF KERB OR PAVEMENT EDGES AND THE TOP OR TOE OF A BATTER.
10. ALL BATTER SLOPE WITH GRADES AT OR EXCEEDING 1V:6H ARE TO BE TURFED IMMEDIATELY OR APPROPRIATE EROSION CONTROL IS TO BE PROVIDED TO THE SATISFACTION OF THE ENGINEER.
11. ALL FOOTPATHS ARE TO FALL AWAY FROM THE BUILDING AT 2.5% NOMINAL GRADE.
12. ALL PATENTS ARE TO BE SET AT 300mm BELOW THE FINISHED FLOOR LEVEL OF THE WAREHOUSE AND OFFICE AREAS. PROVIDE LOCAL FEATHERING AT DOORWAYS OR ROLLER SHUTTERS TO PROVIDE FLUSH FINISH AS REQUIRED.
13. WHERE NEW AND EXISTING INTERFACING IS REQUIRED, MATCH EXISTING LEVELS AND PROVIDE SMOOTH INTERFACE BETWEEN NEW AND EXISTING GRADIENTS. REFER ANY CONCERNS TO THE ENGINEER.

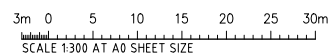
1. ALL STORMWATER WORKS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS3500.3 PLUMBING AND DRAINAGE, PART 3: STORMWATER DRAINAGE.
2. THE MINOR (PIPED) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 20 YEAR ARI STORM EVENT AND THE MAJOR (OVERLAND) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 100 YEAR ARI STORM EVENT.
3. ALL FINISHED PAVEMENT LEVELS SHALL BE AS INDICATED ON FINISHED LEVELS PLANS DA1.1 TO DA4.4.
4. PIT SIZES SHALL BE AS INDICATED IN THE SCHEDULE WHILE PIPE SIZES AND DETAILS ARE PROVIDED ON PLAN.
5. EXISTING STORMWATER PIT LOCATIONS AND INVERT LEVELS TO BE CONFIRMED BY SURVEY PRIOR TO COMMENCING WORKS ON SITE.
6. ALL STORMWATER PIPES WITH NON-PRIVATE PROPERTY Ø375 OR GREATER SHALL BE CLASS 2 (WITH H2 SUPPORT) REINFORCED CONCRETE WITH RUBBER RING JOINTS UNLESS NOTED OTHERWISE.
7. ALL STORMWATER PIPES WITHIN THE PUBLIC DOMAIN Ø375 OR GREATER SHALL BE CLASS 3 UNDER KERB LINE AND CLASS 4 UNDER ROAD CROSSING (WITH H2 SUPPORT) REINFORCED CONCRETE WITH RUBBER RING JOINTS UNLESS NOTED OTHERWISE.
8. ALL PIPES UP TO AND INCLUDING Ø300 TO BE UPVC GRADE S8B UNDO.
9. PIPE CLASS NOMINATED ARE FOR IN-SERVICE LOADING CONDITIONS ONLY. CONTRACTOR IS TO MAKE ANY NECESSARY ADJUSTMENTS REQUIRED FOR CONSTRUCTION CONDITIONS.
10. ALL CONCRETE PITS GREATER THAN 1000mm DEEP SHALL BE REINFORCED USING N12-200 EACH WAY CENTERED IN WALL AND BASE. LAP MINIMUM 300mm WHERE REQUIRED. ALL CONCRETE FOR PITS SHALL BE Fc<25 MPa. PRECAST PITS MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
11. IN ADDITION TO ITEM 9 ABOVE, ALL CONCRETE PITS GREATER THAN 3000mm DEEP SHALL HAVE WALLS AND BASE THICKNESS INCREASED TO 200mm.
12. PIPE SHALL LAID IN PERMISSIBLE LAYING DEPTHS. PARTICULAR CARE SHALL BE TAKEN TO ENSURE THAT THE PIPE IS FULLY AND EVENLY SUPPORTED. RAM AND PACK FILLING AROUND AND UNDER BACK OF PIPES AND PIPE FAUCETS, WITH NARROW EDGED RAMMERS OR OTHER SUITABLE TAMPING DETAILS.
13. CONCRETE PIPES UNDER, OR WITHIN THE ZONE OF INFLUENCE OF PAVED AREAS SHALL BE LAID USING H25 TYPE SUPPORT, AS A MINIMUM, IN ACCORDANCE WITH AS 3725. AGGREGATE BACKFILL SHALL NOT BE USED FOR PIPE BEDDING AND OR HAUNCH/SIDE SUPPORT.
14. WHERE PIPE LINES ENTER PITS, PROVIDE 2m LENGTH OF STOCKING WRAPPED SLOTTED Ø100 UPVC TO EACH SIDE OF PIPE.
15. ALL SUBSOIL DRAINAGE LINES SHALL BE Ø100 SLOTTED UPVC WITH APPROVED FILTER WRAP LAID IN 300mm wide GRANULAR FILTER UNLESS NOTED OTHERWISE. LAY SUBSOIL LINES TO MATCH FALLS OF LAND AND/OR IN 200 MINIMUM. PROVIDE CAPPED CLEANING EYE (RODDING POINT) AT UPSTREAM END OF LINE AND AT 30m MAX. ITS. PROVIDE SUBSOIL LINES TO ALL PAVEMENT / LANDSCAPED INTERFACES, TO REAR OF RETAINING WALLS (AS NOMINATED BY STRUCTURAL ENGINEER) AND AS SHOWN ON PLAN.
16. WHERE SUBSOIL DRAINAGE PASSES UNDER A PAVEMENT OR A SLAB, UNSLOTTED UPVC ARE TO BE PROVIDED UNLESS NOTED OTHERWISE.
17. ALL PIPE GRADES IN 200 MINIMUM UNDO.
18. PROVIDE STEP IRONS IN PITS DEEPER THAN 1000mm.
19. MIN. 600 COVER TO PIPE OBVERT BENEATH ROADS & MIN. 400 COVER BENEATH LANDSCAPED AND PEDESTRIAN AREAS.
20. PIT COVERS IN TRAFFICABLE PAVEMENT SHALL BE CLASS D 'HEAVY DUTY', THOSE LOCATED IN NON-TRAFFICABLE AREAS SHALL BE CLASS B 'MEDIUM DUTY' UNDO.
21. PROVIDE CLEANING EYES (RODDING POINTS) TO PIPES AT ALL CORNERS AND T-JUNCTIONS WHERE NO PITS ARE PRESENT.
22. DOWN PIPES (DP) TO BE AS PER HYDRAULIC ENGINEERS DETAILS WITH CONNECTOR TO MATCH DP SIZE UNDO ON PLAN. PROVIDE CLEANING EYE AT ROAD LEVEL.
23. PIPE LENGTHS NOMINATED ON PLAN OR LONGSECTIONS ARE MEASURED FROM CENTER OF PIT TO THE NEARLY 0.5m AND DO NOT REPRESENT ACTUAL LENGTH. THE CONTRACTOR IS TO ALLOW FOR THIS.
24. WHERE CONNECTION TO EXISTING/INGROUND DRAINAGE SYSTEMS, OPEN SWALES, CHANNELS OR ANY OTHER EXISTING SYSTEM, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION AND INVERT ON SITE AT THE BEGINNING OF THE CONSTRUCTION PERIOD. REFER ANY VARIANCE FROM DOCUMENTATION OR SURVEYS TO THE ENGINEER FOR CLARIFICATION.



BREAKLINE - REFER TO DRAWING C014429.00-DA44



CONCEPT CIVIL WORKS PLAN-SHEET 2
1:300 SCALE



FOR DEVELOPMENT APPLICATION

[illegible]

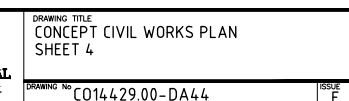
BREAKLINE - REFER TO DRAWING C014429.00-DA444

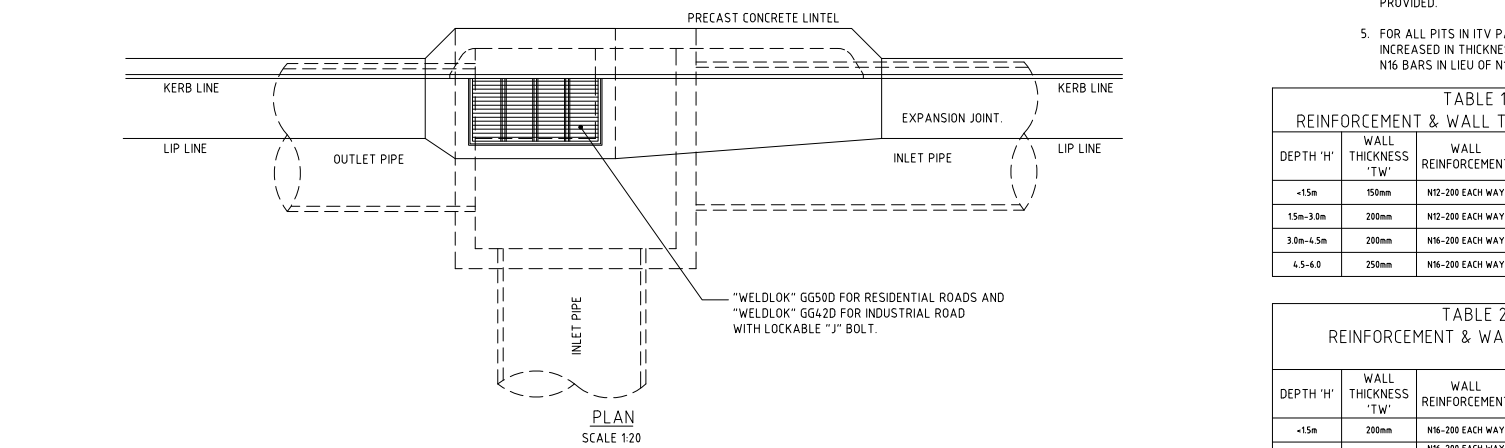
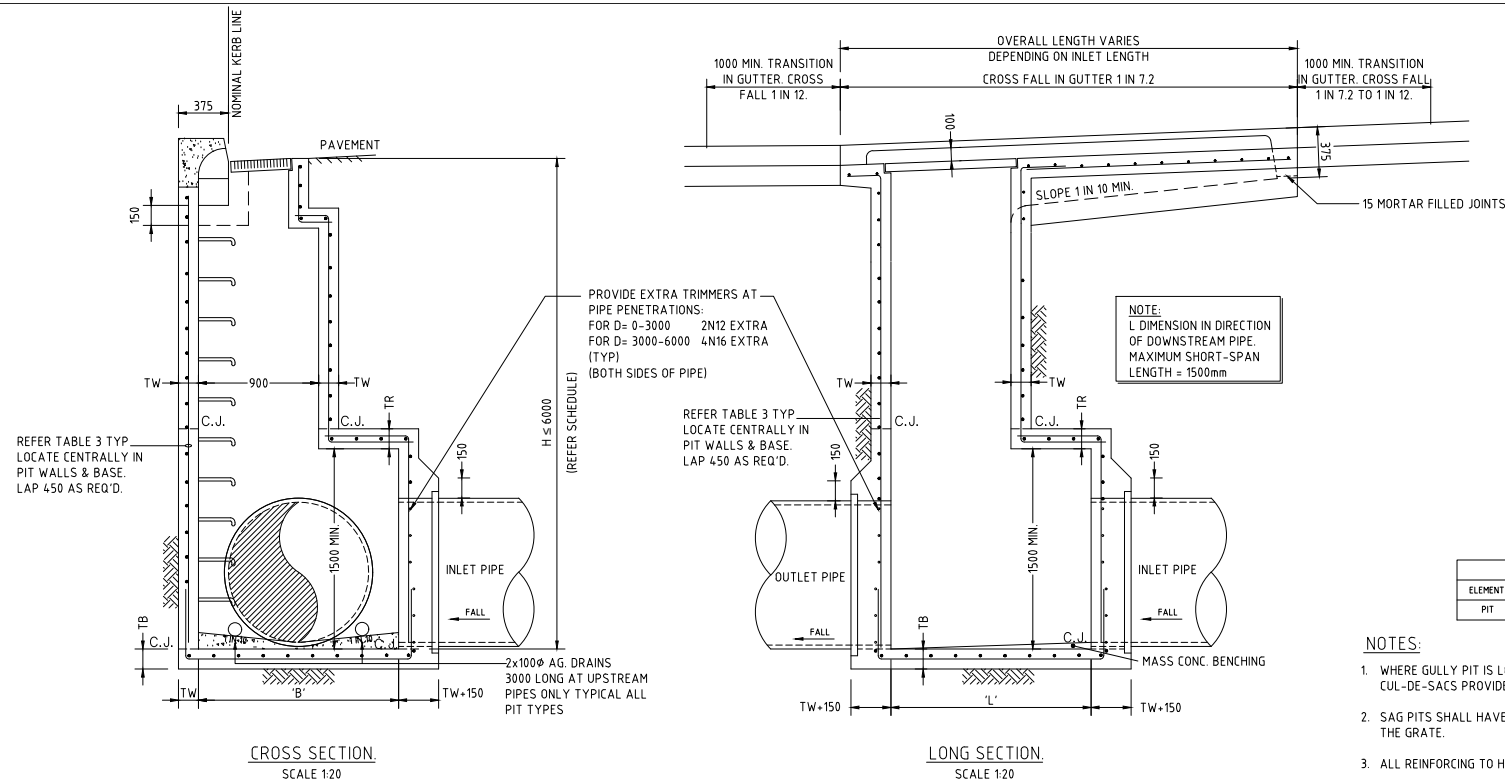
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BREAKLINE - REFER TO DRAWING C014429.00-DA43

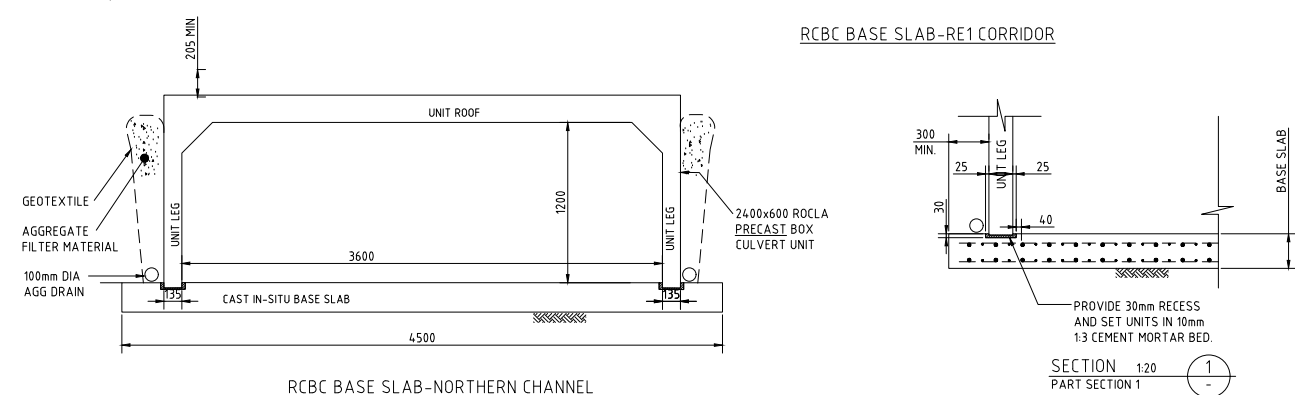
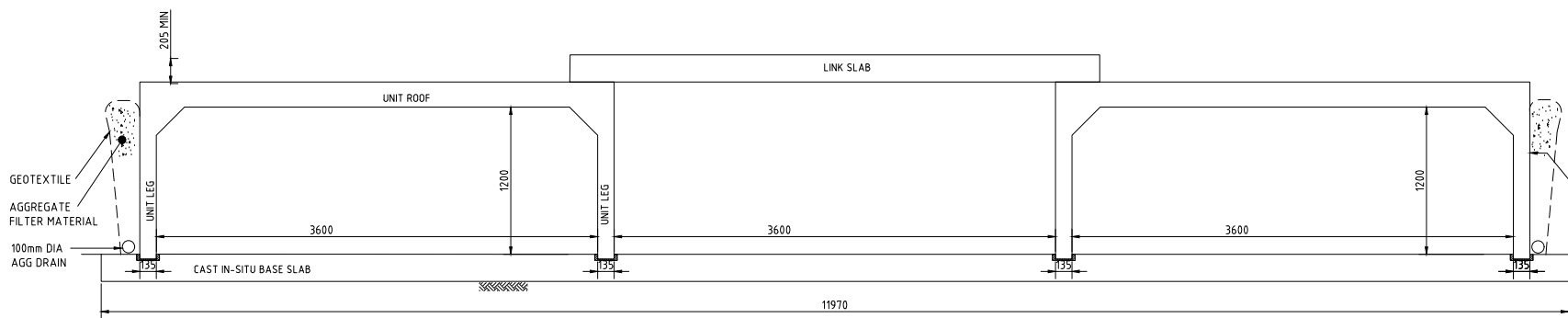


FOR DEVELOPMENT APPLICATION





TAPERED KERB INLET PIT - KIP
SUBSOIL NOT SHOWN FOR CLARITY.



NOTES:

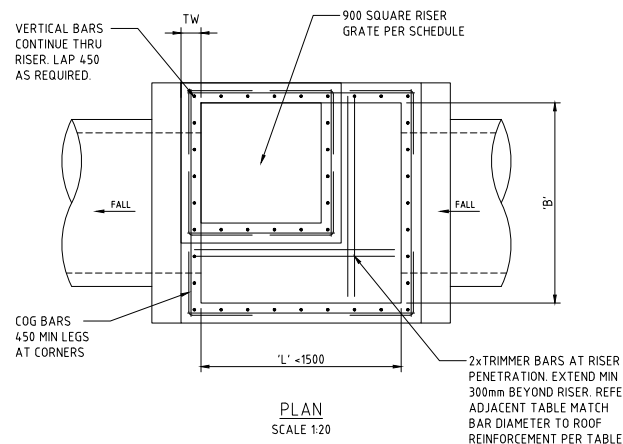
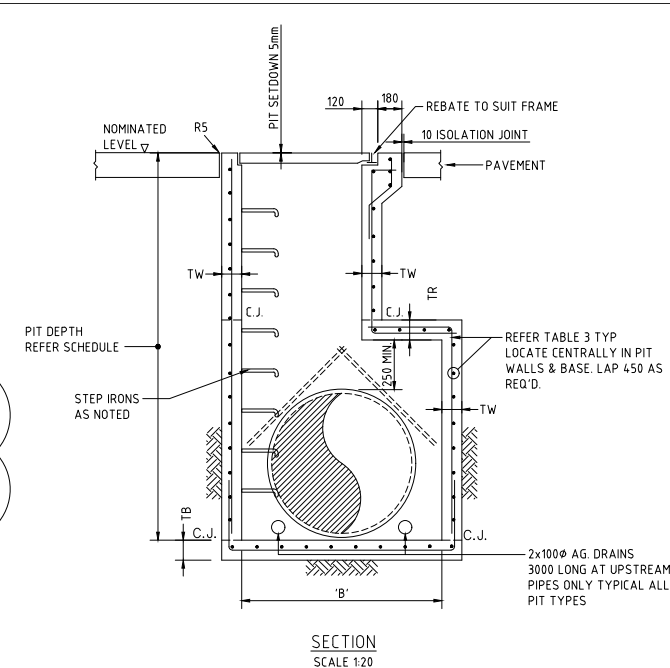
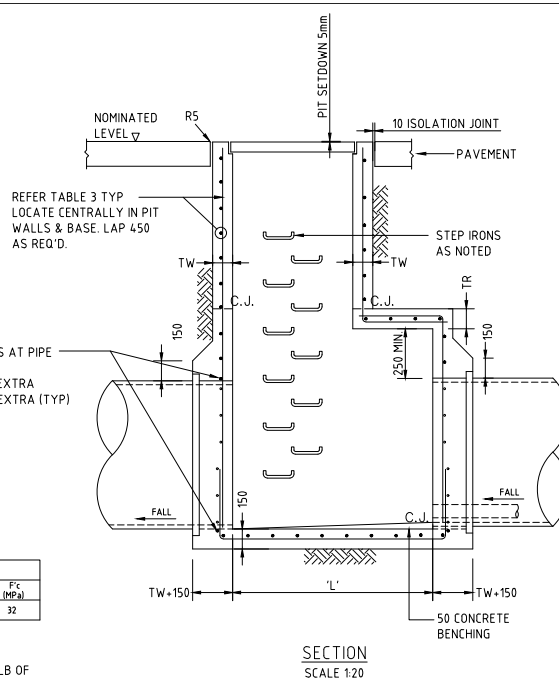
- WHERE GULLY PIT IS LOCATED ON KERB RETURNS OR BULB OF CUL-DE-SACS PROVIDE CURVED PRECAST CONCRETE LINTELS.
- SAG PITS SHALL HAVE LINTEL PLACED CENTRALLY ABOUT THE GRATE.
- ALL REINFORCING TO HAVE 30 MIN. CLEAR CONCRETE COVER.
- FOR PITS DEEPER THAN 1200mm STEP IRONS SHALL BE PROVIDED.
- FOR ALL PITS IN ITV PAVEMENT AREAS, PIT WALLS ARE TO BE INCREASED IN THICKNESS BY 50mm AND REINFORCEMENT TO BE N16 BARS IN LIEU OF N12

DEPTH 'H'	WALL THICKNESS 'TW'	WALL REINFORCEMENT	ROOF THICKNESS 'TR'	ROOF REINFORCEMENT	BASE THICKNESS 'TB'	BASE REINFORCEMENT
<1.5m	150mm	N12-200 EACH WAY	150mm	N12-200 EACH WAY	150mm	N12-200 EACH WAY
1.5m-3.0m	200mm	N12-200 EACH WAY	200mm	N12-200 EACH WAY	200mm	N12-200 EACH WAY
3.0m-4.5m	200mm	N16-200 EACH WAY	200mm	N16-200 EACH WAY	200mm	N12-200 EACH WAY
4.5-6.0	250mm	N16-200 EACH WAY	250mm	N16-200 EACH WAY	250mm	N16-200 EACH WAY

DEPTH 'H'	WALL THICKNESS 'TW'	WALL REINFORCEMENT	ROOF THICKNESS 'TR'	ROOF REINFORCEMENT	BASE THICKNESS 'TB'	BASE REINFORCEMENT
<1.5m	200mm	N16-200 EACH WAY	250mm	N16-200 EACH WAY TOP & BTM	200mm	N16-200 EACH WAY
>1.5m	250mm	N16-200 EACH WAY INNER & OUTER FACE	250mm	N16-200 EACH WAY TOP & BTM	250mm	N16-200 EACH WAY

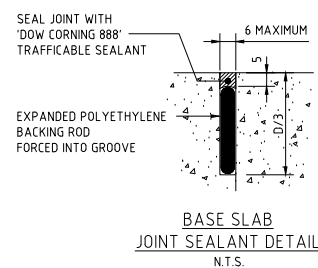
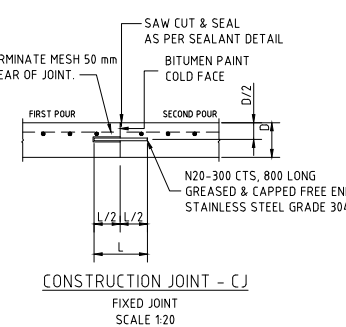
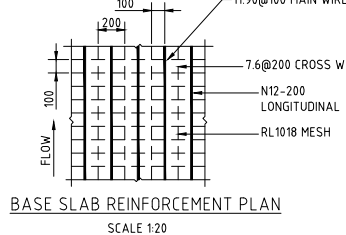
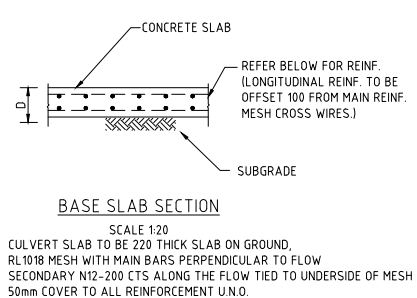
PROVIDE EXTRA TRIMMERS AT PIPE PENETRATIONS FOR D= 0-3000 2N12 EXTRA FOR D= 3000-6000 4N16 EXTRA (TYP)

ELEMENT	SUMP	AGGREGATE	CEMENT	ADMIXTURE	P.C.
PIT	80	20	GP	NIL	32

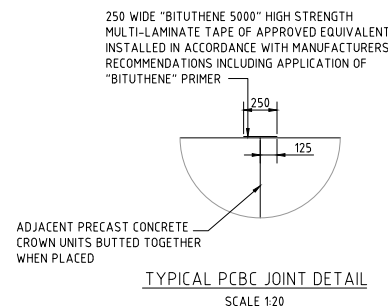


TAPERED SINGLE GRATED GULLY PIT - SGGP

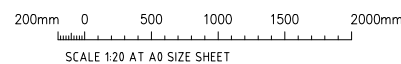
SUBSOIL NOT SHOWN FOR CLARITY.



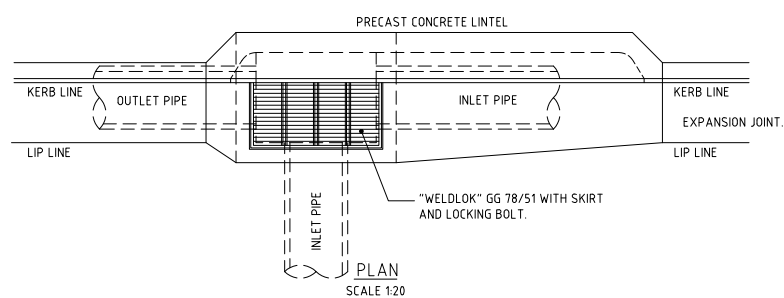
NOTE: JOINT SEALANT IS TO BE USED AND INSTALLED IN ACCORDANCE WITH RMS QA SPECIFICATION B312.



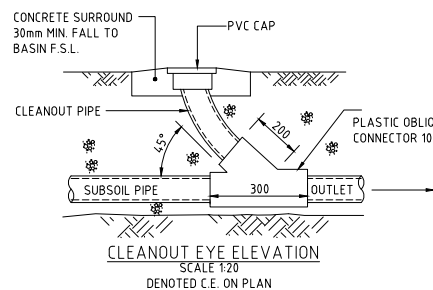
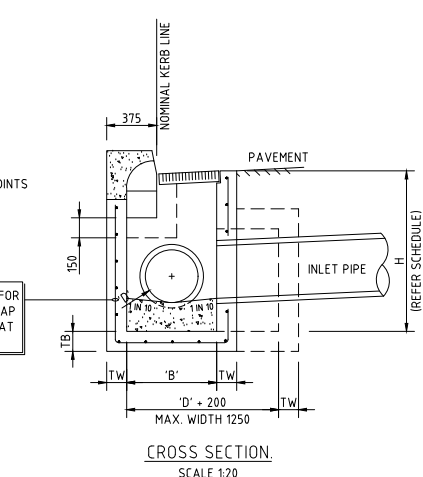
PRE-CAST BOX CULVERT JOINT DETAILS TO BE IN ACCORDANCE WITH FAIRFIELD CITY COUNCIL STANDARDS AND REQUIREMENTS



FOR DEVELOPMENT APPLICATION



KARB INLET PIT - KIP



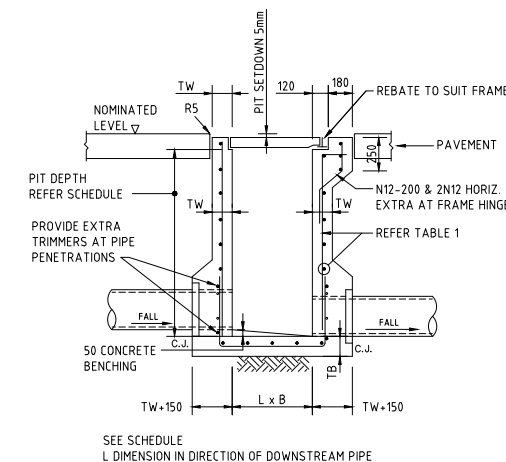
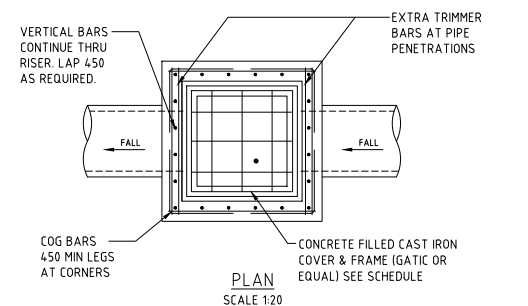
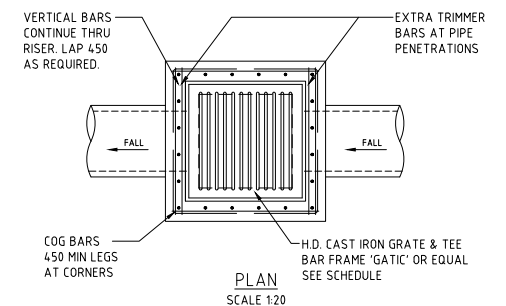
SCALE 1:20

DEPTH 'H'	WALL THICKNESS 'TW'	WALL REINFORCEMENT	BASE THICKNESS 'TB'	BASE REINFORCEMENT
< 1.0m	150mm	-	150mm	-
1.0m-3.0m	150mm	N12-200 EACH WAY	150mm	N12-200 EACH WAY
3.0m-4.5m	200mm	N12-200 EACH WAY	200mm	N12-200 EACH WAY
4.5-6.0	200mm	N16-200 EACH WAY	200mm	N16-200 EACH WAY

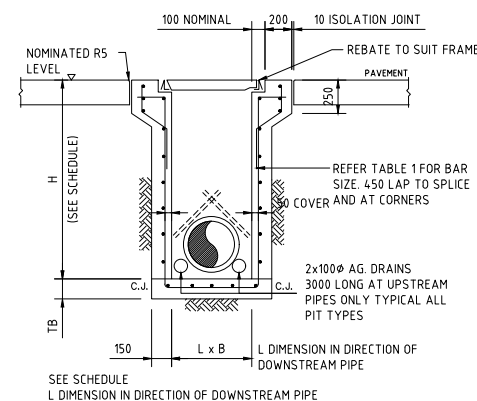
CONCRETE QUALITY					
ELEMENT	SLUMP	AGGREGATE (MAX. SIZE)	CEMENT TYPE	ADMIXTURE	F'c (MPa)
PIT	80	20	GP	NIL	32

NOTES:

1. WHERE GULLY PIT IS LOCATED ON KERB RETURNS OR BULB OF CUL-DE-SACS PROVIDE CURVED PRECAST CONCRETE LINTELS.
2. SAG PITS SHALL HAVE LINTEL PLACED CENTRALLY ABOUT THE GRATE.
3. ALL REINFORCING TO HAVE 30 MIN. CLAER CONCRETE COVER.
4. FOR PITS DEEPER THAN 1200mm CLIMB RAILS SHALL BE PROVIDED.



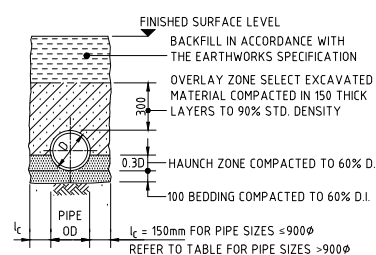
SECTION



SECTION

SINGLE GRATED GULLY PIT - SGGP

SEALD PIT - SP

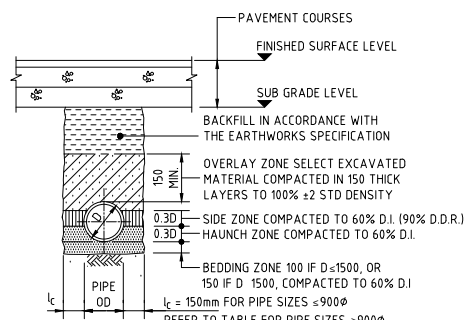


TYPE H1 SUPPORT TO CONCRETE PIPES AT LANDSCAPED AREAS
SCALE 1:20

BEDDING & HAUNCH MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
2.36	100 TO 50
0.60	90 TO 50
0.30	60 TO 10
0.15	25 TO 0
0.075	10 TO 0

SIDE ZONE WIDTH	
PIPE SIZE (mm)	l_c (mm)
$\leq 900\phi$	150
1050 ϕ	175
1200 ϕ	200
1350 ϕ	225
1500 ϕ	250
1650 ϕ	275
1800 ϕ	300

ENGINEER TO SPECIFY TRENCH
WIDTHS FOR PIPE SIZES
GREATER THAN 1800 ϕ



TYPE HS2 SUPPORT TO CONCRETE PIPES UNDER PAVEMENT
SCALE 1:20
D ≤ 1350, MAX FILL = 4.0m
D > 1350, MAX FILL = 3.0m

BEDDING & HAUNCH MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
2.36	100 TO 50
0.60	90 TO 50
0.30	60 TO 10
0.15	25 TO 0
0.075	10 TO 0

SIDE ZONE WIDTH	
PIPE SIZE (mm)	ℓ (mm)
$\leq 900\phi$	150
1050 ϕ	175
1200 ϕ	200
1350 ϕ	225
1500 ϕ	250
1650 ϕ	275
1800 ϕ	300

ENGINEER TO SPECIFY TRENCH
WIDTHS FOR PIPE SIZES
GREATER THAN 1800 ϕ

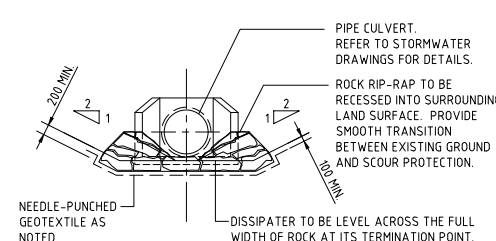
SIDE ZONE MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
75.0	100
9.5	100 TO 50
2.36	100 TO 50
0.60	50 TO 15
0.075	25 TO 0

SELECT FILL MATERIAL IN ACCORDANCE WITH
TABLE 1 AS 3725

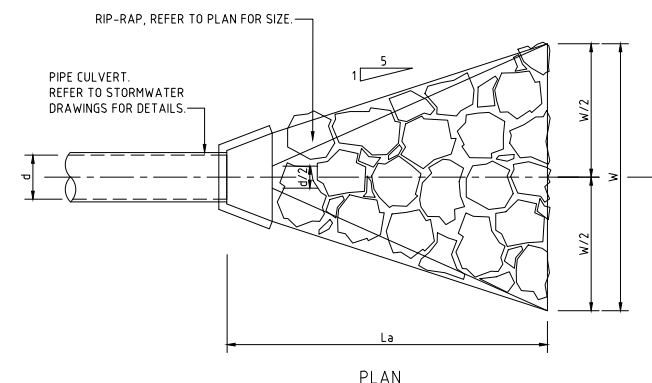
DISSIPATER NOTES :

1. ALIGN STRUCTURE EVENLY WITH BANK.
2. LOCATE STRUCTURE AT INVERT LEVEL OF STREAM AND POINT IN A DOWNSTREAM DIRECTION.
3. PIPE TO REST ON, AND BE PACKED IN, BY RIP-RAP (SIZE AS NOTED).
4. DISCHARGE INTO STREAM WHERE BEDROCK IS PRESENT, OTHERWISE SCOUR PROTECT AS REQUIRED.
5. SCOUR PROTECT THE OPPOSITE BANK AS REQUIRED. SCOUR PROTECTION TO BE PROVIDED WHERE OPPOSITE BANK IS WITHIN 12-14 TIMES THE PIPE DIAMETER.
6. RIP-RAP TO CONSIST OF ANGULAR RUN-OF-QUARRY ROCK (#50 = 150mm MINIMUM) AS NOTED ON THE PLAN. RIP-RAP TO BE MINIMUM THICKNESS OF 150mm RIP LAYER TO BE 1:6x AVERAGE ROCK SIZE (#50).
7. RIP-RAP IS TO BE PLACED OVER A 200mm LAYER OF 10mm COBBLES OVER NEEDLE-PUNCHED GEOTEXT A6.4.
8. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE FINISHED RIP-RAP SURFACE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS.
9. GAPS IN RIP-RAP TO BE HAND PACKED WITH TOPSOIL & PLANTED WITH NATIVE SEDGES & RHUS TO PROVIDE. THE INTENT IS FOR THERE TO BE NO VOIDS BETWEEN RIP-RAP BOULDERS.
10. ENSURE THE FINISHED ROCK SURFACE BLENDS WITH THE SURROUNDING GROUND LEVELS. NO OVERALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.
11. ENSURE THAT STORMWATER FROM SURROUNDING GROUND IS FREE TO ENTER THE STRUCTURE WITHOUT CAUSING UNDESIRABLE PONDING OR SCOUR.

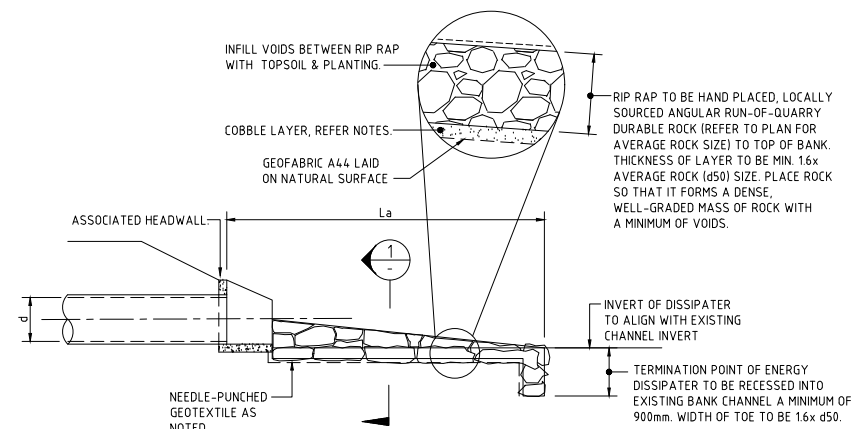
DISSIPATER SCHEDULE				
DISCHARGE POINT	d	La	W	RIP-RAP (d50)
OUTLET TYPE 1	1200	5000	5000	300
OUTLET TYPE 2	3.6x1.2 RCBC	6000	10000	400
OUTLET TYPE 3	2x225ø	3000	1500	200



SECTION 1:50 1

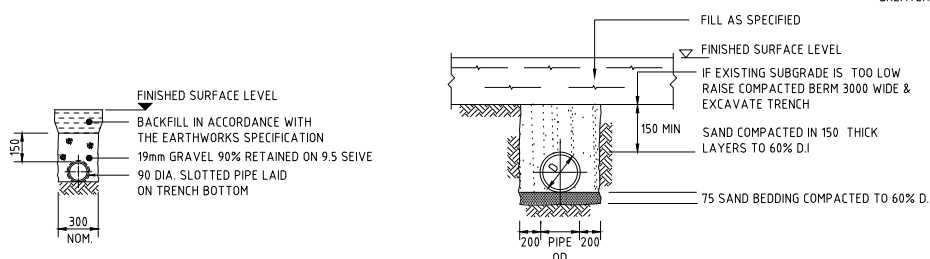


PLAN

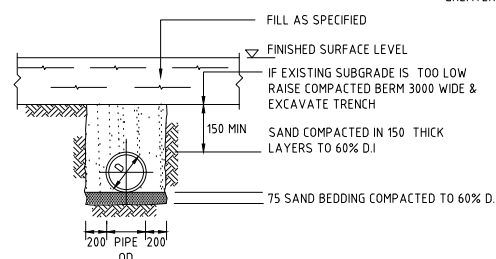


SECTIONAL ELEVATION

STORMWATER OUTLET DISSIPATER WITH HEADWALL
SCALE 1:50



SUPPORT TO AGRICULTURAL DRAIN
FOR USE UNDER CAR PARK PAVEMENTS/LANDSCAPED AREAS
SCALE 1:20



SUPPORT TO uPVC PIPES

FOR DEVELOPMENT APPLICATION

[illegible]

- - DENOTES DRAINAGE
- - DENOTES BASIN CATCHMENT BOUNDARY
- - APPROXIMATE EXTENT OF POTENTIAL LANDSCAPE IRRIGATION AREA TO BASIN 1
- - DENOTES BASIN 1 (TEMPORARY RAINWATER REUSE)
- - APPROXIMATE EXTENT OF POTENTIAL LANDSCAPE IRRIGATION AREA TO LOT 1 TANK
- - APPROXIMATE EXTENT OF POTENTIAL LANDSCAPE IRRIGATION AREA TO LOT 2 TANK
- - DENOTES BIO-RETENTION BASIN
TOTAL AREA = 2,130m²
- - DENOTES WAREHOUSE 1 RAINWATER TANK FOR ON-LOT NON-POTABLE RE-USE
- - DENOTES WAREHOUSE 2 RAINWATER TANK FOR ON-LOT NON-POTABLE RE-USE
- - DENOTES GROSS POLLUTANT TRAP INDICATIVE LOCATION ONLY

THIS PLAN DEPICTS THE STORMWATER MANAGEMENT MEASURES
REQUIRED TO SATISFY THE MAMRE ROAD DCP STORMWATER FLOW AND
QUALITY REQUIREMENTS FOR THE STAGE 1 SUBMISSION ONLY.

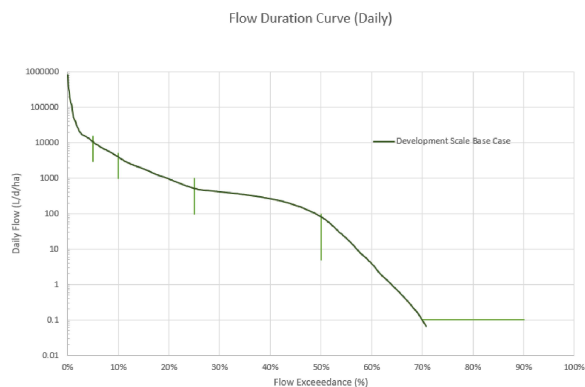
THE STORMWATER HARVESTING, MANAGEMENT AND RE-USE MEASURES SHOWN ON THIS PLAN ARE THOSE REQUIRED TO SATISFY THE STORMWATER FLOW AND OPERATIONAL STORMWATER QUALITY REQUIREMENTS OF THE MAMRE ROAD DCP.

FURTHER INFORMATION IS PRESENTED IN THE COSTIN ROE SOIL AND WATER MANAGEMENT REPORT

Catchment	Area (Ha)	Source Node	% Impervious	Stormwater Treatment
1-ROOF	0.887	Roof	100	AtlanFilter
2-ROOF	0.802	Roof	100	AtlanFilter
1-ROOF-RWT	0.365	Roof	100	Rainwater Tank + AtlanFilter
2-ROOF-RWT	0.408	Roof	100	Rainwater Tank + AtlanFilter
1 HARDSTAND	0.404	Sealed Road	100	StormSack + AtlanFilter
2-HARDSTAND	1.014	Sealed Road	100	StormSack + AtlanFilter
1A-LANDSCAPING	0.312	Industrial	10	StormSack + AtlanFilter
1B-LANDSCAPING	0.115	Industrial	10	StormSack + AtlanFilter
ROAD	0.913	Sealed Road	70	Vortceptor + BioRetention
UNDEVELOPED AREA	31.088	Industrial	0	Bypass
BIORETENTION	0.020	Bioretention	0	BioRetention
POND	0.050	Pond	0	Pond
RE1 DRAINAGE CORRIDOR	0.814	Industrial	10	Bypass
LANDSCAPE BYPASS	0.123	Industrial	10	Bypass
SYDNEY WATER DRAINAGE CORRIDOR	0.577	Industrial	10	Bypass
Total	37.892			

ESTATE SOLUTION RAINWATER REUSE DEMAND:
 BASIN 1 - 9,000kL/YR = 15,000m² of IRRIGATED AREA
 LOT 1 TANK - 870kL/YR = 1,450m² of IRRIGATED AREA
 LOT 2 TANK - 700kL/YR = 1,150m² of IRRIGATED AREA

REUSE RATES ABOVE BASED ON THE FOLLOWING:
 50% OF AVAILABLE LANDSCAPED AREA IRRIGATED AT 0.6kL/ha/yr (AREA
 NOTED ABOVE 151 /PERSON/DAY TOILET FLUSHING



FLOW DURATION CURVE - ACCESS LP STAGE 1

FLOW DURATION CURVE TARGETS						
INDICE	LOWER BOUND L/ha/day	UPPER BOUND L/ha/day	OPTION 1 - MARV RESULTS (L/HA/DAY)	COMPLIES WITH DCP?	OPTION 2 - FDC RESULTS (L/HA/DAY)	COMPLIES WITH DCP?
95	3800	15000	10768	YES	N/A	-
90	1000	5000	4022	YES	4022	YES
75	100	1000	512	YES	512	YES
50	5	100	83	YES	83	YES
10	0	0	N/A	-	0	YES
CEASE TO FLOW	10%	30%	29	YES	N/A	-
MARV	≤2.0 ML/ha/yr		N/A	-	137	YES

FLOW DURATION CURVE TARGETS

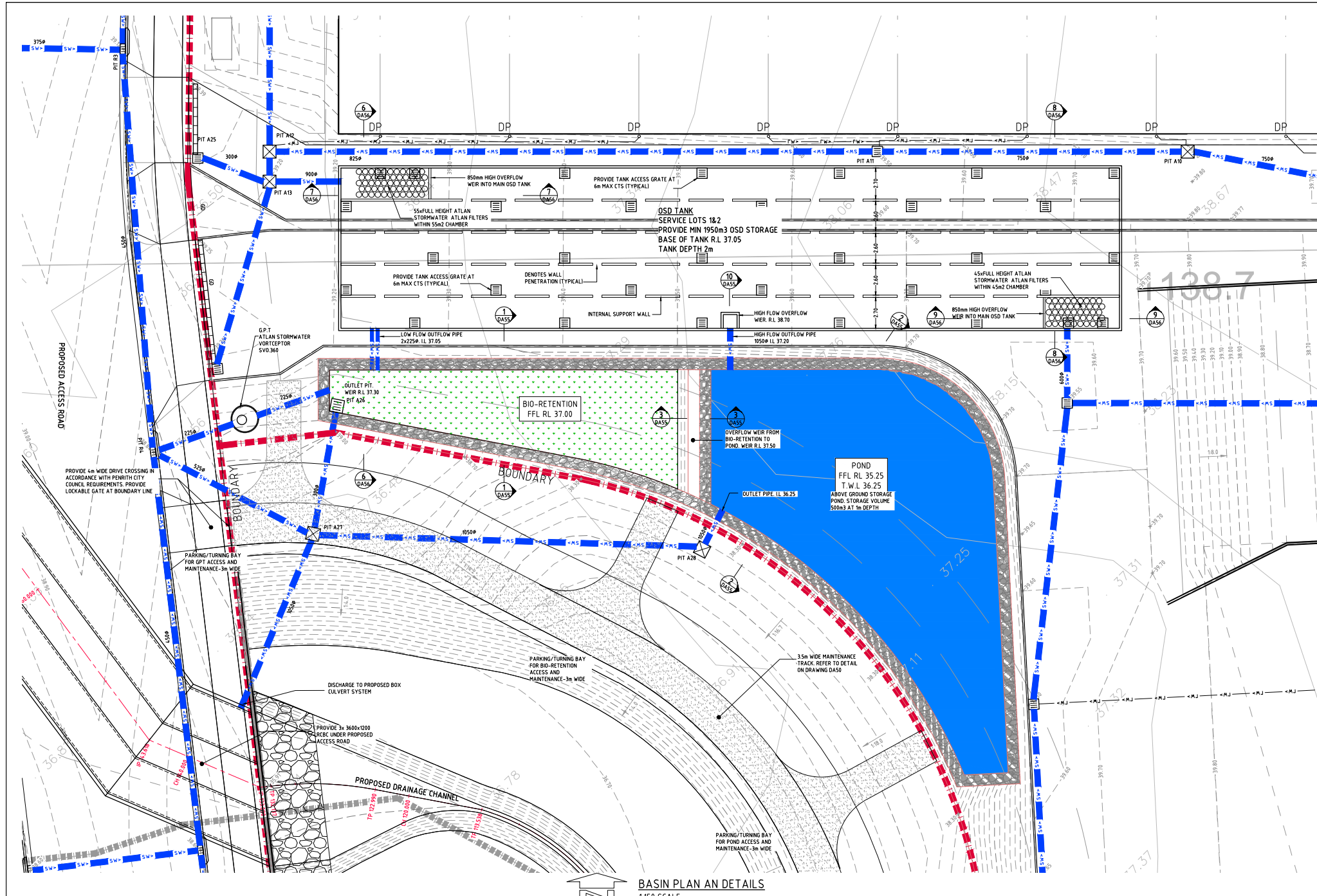


WATER SENSITIVE URBAN DESIGN MANAGEMENT PLAN
1:500 SCALE

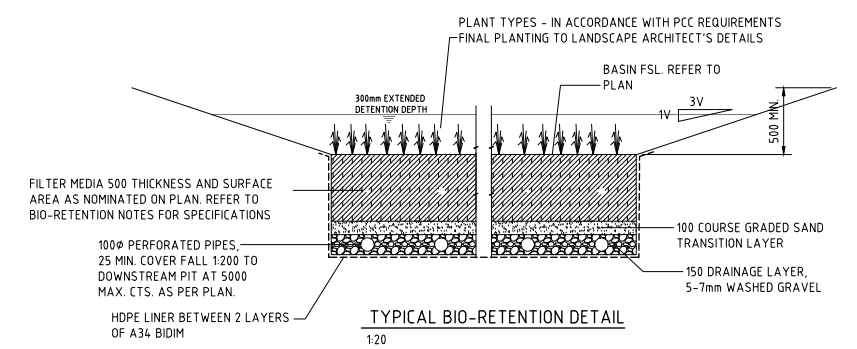
5m 0 10 20 30 40 50m
SCALE 1:500 AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

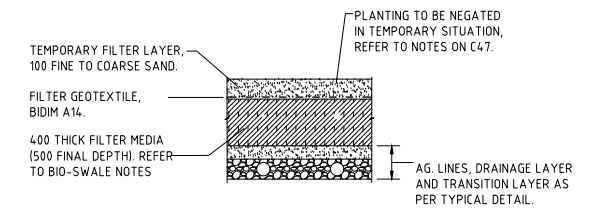
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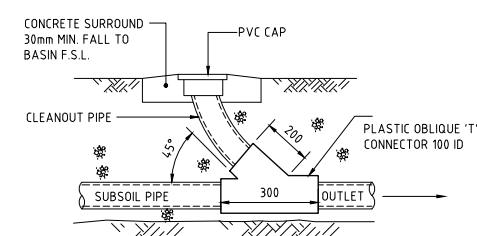
BASIN PLAN AND DETAILS
1:150 SCALE



TYPICAL BIO-RETENTION DETAIL
1:20



BIO-RETENTION CONSTRUCTION DETAIL
SCALE 1:20
TEMPORARY DETAIL FOR USE DURING CONSTRUCTION
& SITE STABILISATION PERIOD - REFER TO NOTES
FOR IMPLEMENTATION PERIODS.



CLEANOUT EYE ELEVATION
SCALE 1:20
DENOTED C.E. ON PLAN

BIO-RETENTION NOTES:
FILTER MEDIA TO BE LOAMY SAND WITH A PERMEABILITY NOT LESS THAN 200mm/hr. FILTER MEDIA TO BE FREE OF RUBBISH, DELETERIOUS MATERIAL, TOXICANTS, DECLARED PLANTS AND LOCAL WEEDS, AND IS TO NOT BE HYDROPHOBIC.

FILTER MEDIA TO HAVE THE FOLLOWING COMPOSITION RANGE:

CLAY & SILT (<0.05mm)	<3%
VERY FINE SAND (0.05-0.15mm)	5-30%
FINE SAND (0.15-0.25mm)	10-30%
MEDIUM TO COARSE SAND (0.25-1.00mm)	40-60%
COARSE SAND (1.0-2.0mm)	7-10%
FINE GRAVEL (2.0-3.4mm)	<3%

FILTER MEDIA THAT DOES NOT MEET THE FOLLOWING CRITERIA SHALL BE REJECTED:

- ORGANIC MATTER CONTENT TO BE IDEALLY WITHIN 1% TO 3% (W/W) AND TO BE NO GREATER THAN 5%(W/W).
- PH TO BE BETWEEN 5.5 AND 7.5
- PHOSPHOROUS CONTENT TO BE NO GREATER THAN 35mg/kg

FILTER MEDIA TO BE ASSESSED BY QUALIFIED HORTICULTURALIST TO ENSURE CAPABILITY OF SUPPORTING PLANT LIFE.

DRAINAGE LAYER TO BE CLEAN GRAVEL 5-7mm.

PROVIDE 100mm TOPSOIL AND TEMPORARY EROSION PROTECTION (JUTEMASTER OR EQUIV) TO SWALE BATTER SLOPES AND ADJACENT LANDSCAPED AREAS. NOTE THAT NO TOPSOIL IS TO BE PLACED OVER FILTRATION MEDIA. PROVIDE SILT FENCE TO TOP OF BANK UNTIL SUCH TIME AS THIS STABILISING AND VEGETATION HAS BEEN COMPLETED.

BIO-RETENTION TO BE PARTIALLY INSTALLED, FOLLOWING COMPLETION OF THE ROAD, WITH THE TOP 75-100mm OF FILTER MEDIA REPLACED WITH A FINE TO COARSE SAND UNDERLAIN WITH A GEOTEXTILE LAYER (REFER TO DETAIL). FOLLOWING COMPLETION OF THE UPSTREAM DEVELOPMENT AND SITE STABILISATION, THE SAND IS TO BE REMOVED, REPLACED WITH FILTER MATERIAL AND PLANTED OUT. REFER TO TEMPORARY BIO-BASIN DETAIL.

PRIOR TO PLANTING, THE TOP 100mm OF THE BIORETENTION FILTER MEDIA IS TO BE AMELIORATED WITH APPROPRIATE ORGANIC MATTER, FERTILISER AND TRACE ELEMENTS TO AID PLANT ESTABLISHMENT AS PER THE TABLE BELOW:

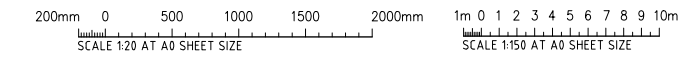
CONSTITUENT	QUANTITY (kg/m ² OF FILTER AREA)
GRANULATED POULTRY MANURE FINES	50
SUPERPHOSPHATE	2
MAGNESIUM SULPHATE	3
POTASSIUM SULPHATE	2
TRACE ELEMENT MIX	1
FERTILISER NPK (16.4.14)	4
LIME	20

BIO-RETENTION BASIN TO BE IN ACCORDANCE WITH PENRITH CITY COUNCIL WSUD GUIDELINES

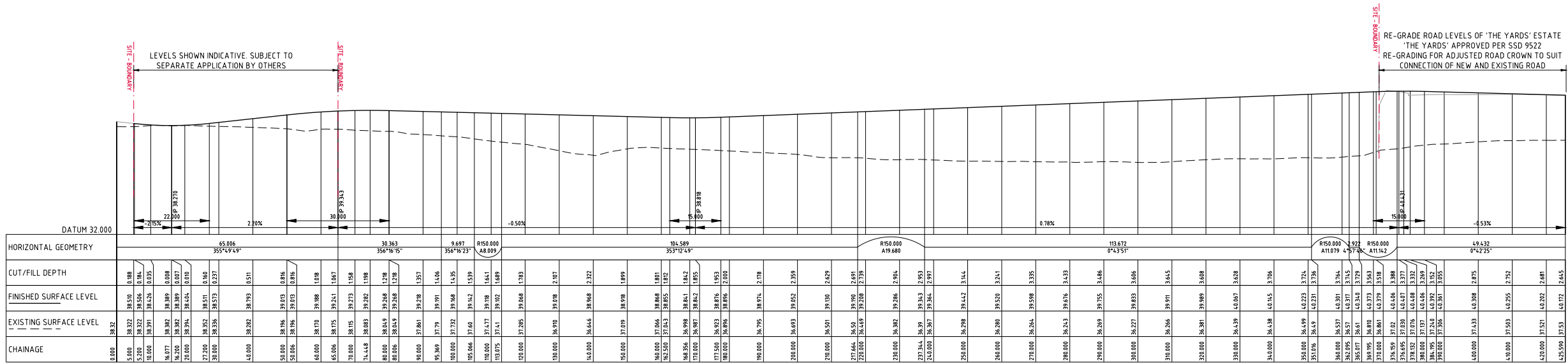
LEGEND:
LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY BOXAL SURVEYORS DATED 02.09.20.

- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- SGGP, SINGLE GRATED GULLY PIT
- OVERLAND FLOW DIRECTION
- PROPOSED DRAINAGE LINE
- EXISTING DRAINAGE LINE
- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- FINISHED PAVEMENT SPOT HEIGHT
- EXISTING SEWER MAIN
- EXISTING WATER MAIN
- EXISTING RECYCLED WATER MAIN
- EXISTING UNDERGROUND ELECTRICAL
- EXISTING TELECOMMUNICATIONS (NBN)



FOR DEVELOPMENT APPLICATION



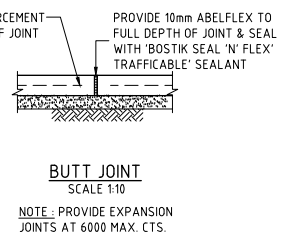
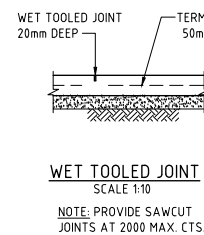
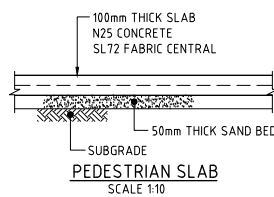
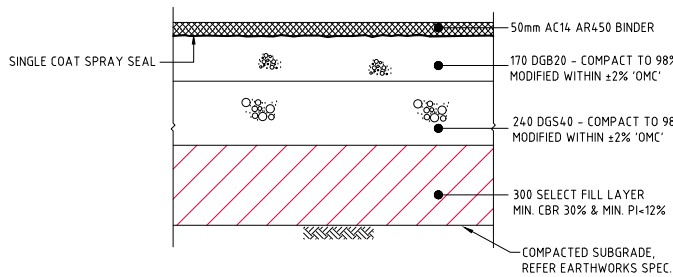
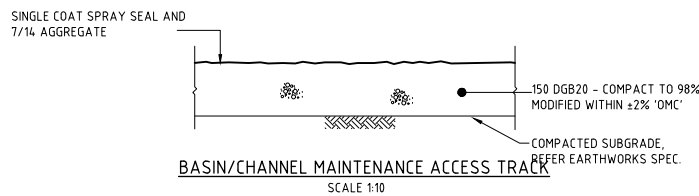
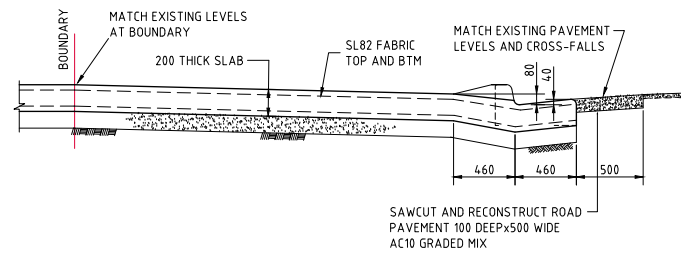
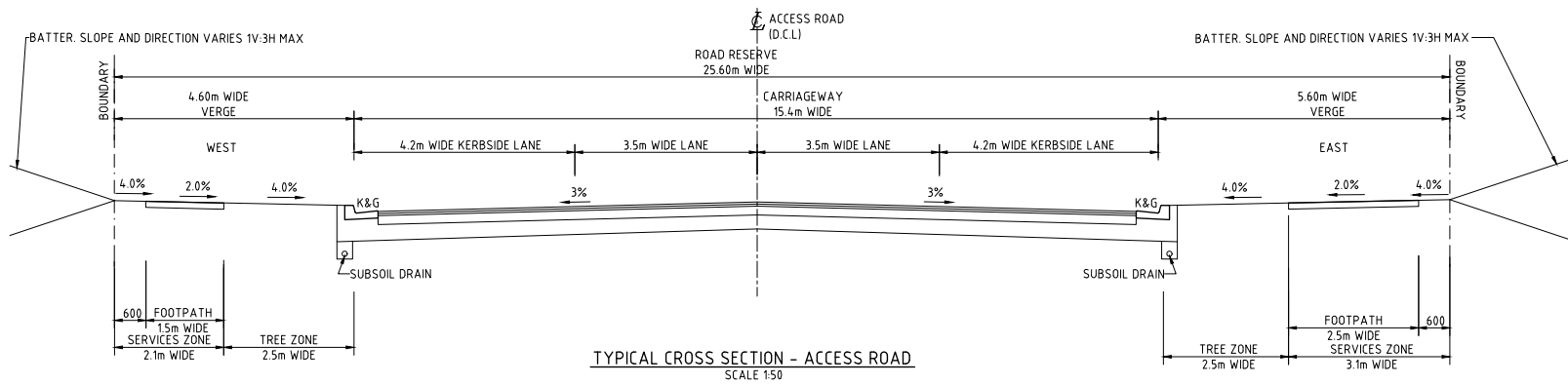
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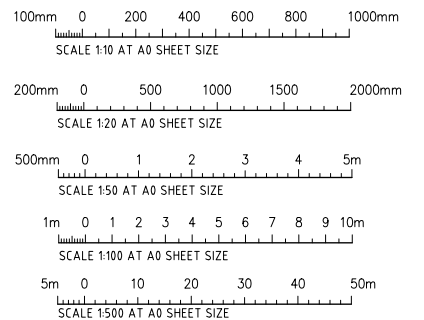
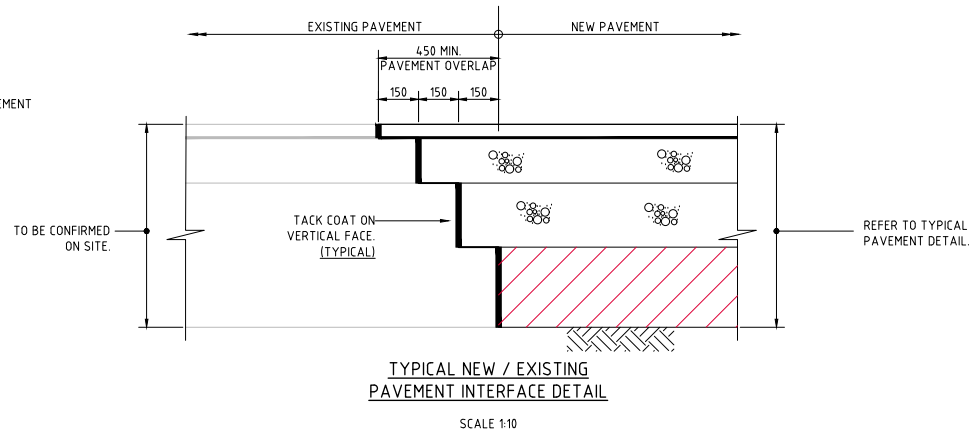
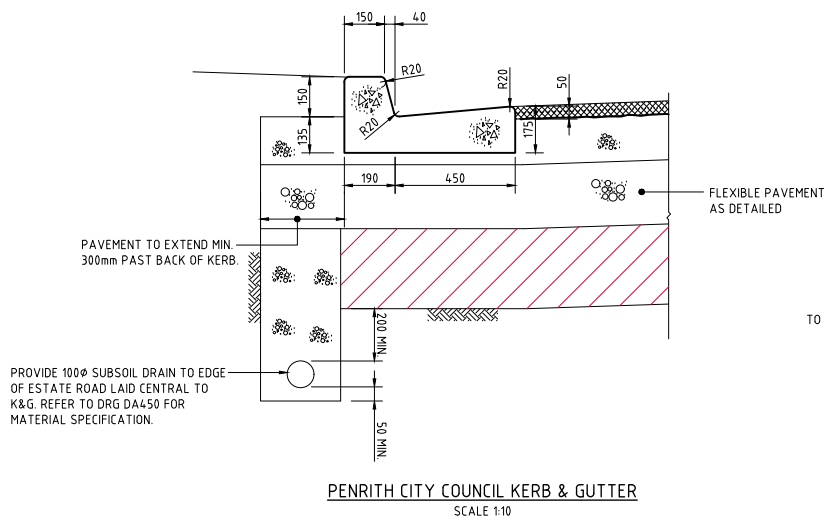
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LONGITUDINAL SECTION - CL ACCESS ROAD

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:40

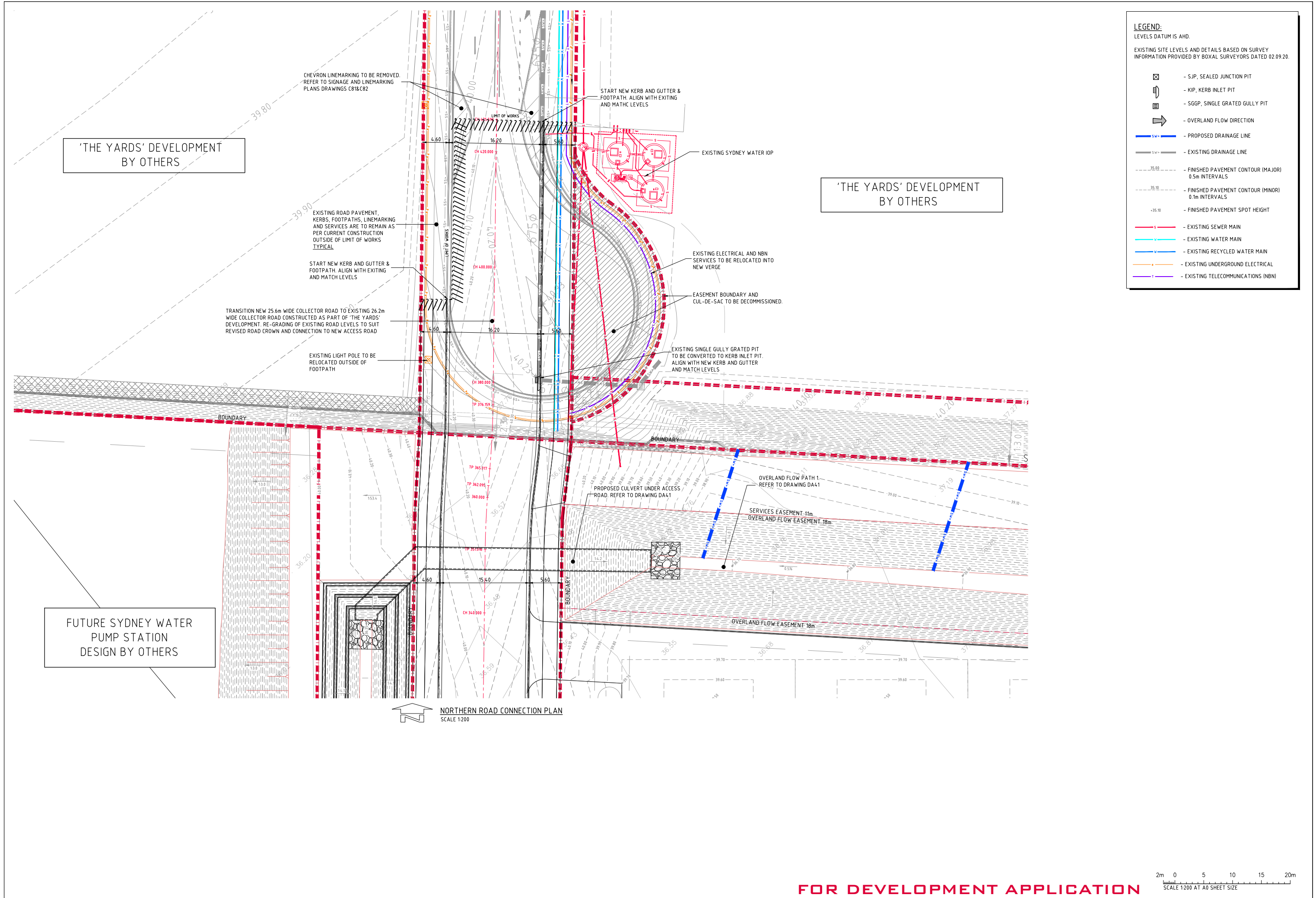


PEDESTRIAN SLAB DETAILS



FOR DEVELOPMENT APPLICATION

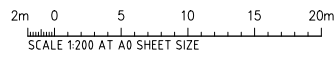
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ISSUED FOR DEVELOPMENT APPLICATION	18.07.23	E						771-797 MAMRE ROAD			PO Box 9419 Sydney NSW 1220	DRAWING No	C014429.00-DA50
ISSUED FOR DEVELOPMENT APPLICATION	19.12.22	D						KEMPS CREEK, 2178, NSW			Level 4, 4 Woodmill Street, Millers Point NSW 2000	TABLE	F
ISSUED FOR INFORMATION	30.11.22	C									p: +61 2 9251 7699		
ISSUED FOR INFORMATION	17.11.22	B									e: mail@costinroe.com.au		
ISSUED FOR INFORMATION	26.10.22	A									e: +61 2 9241 3731		
AMENDMENTS	DATE	ISSUE	AMENDMENTS	DATE	ISSUE	AMENDMENTS	DATE	ISSUE	AMENDMENTS	DATE	ISSUE		

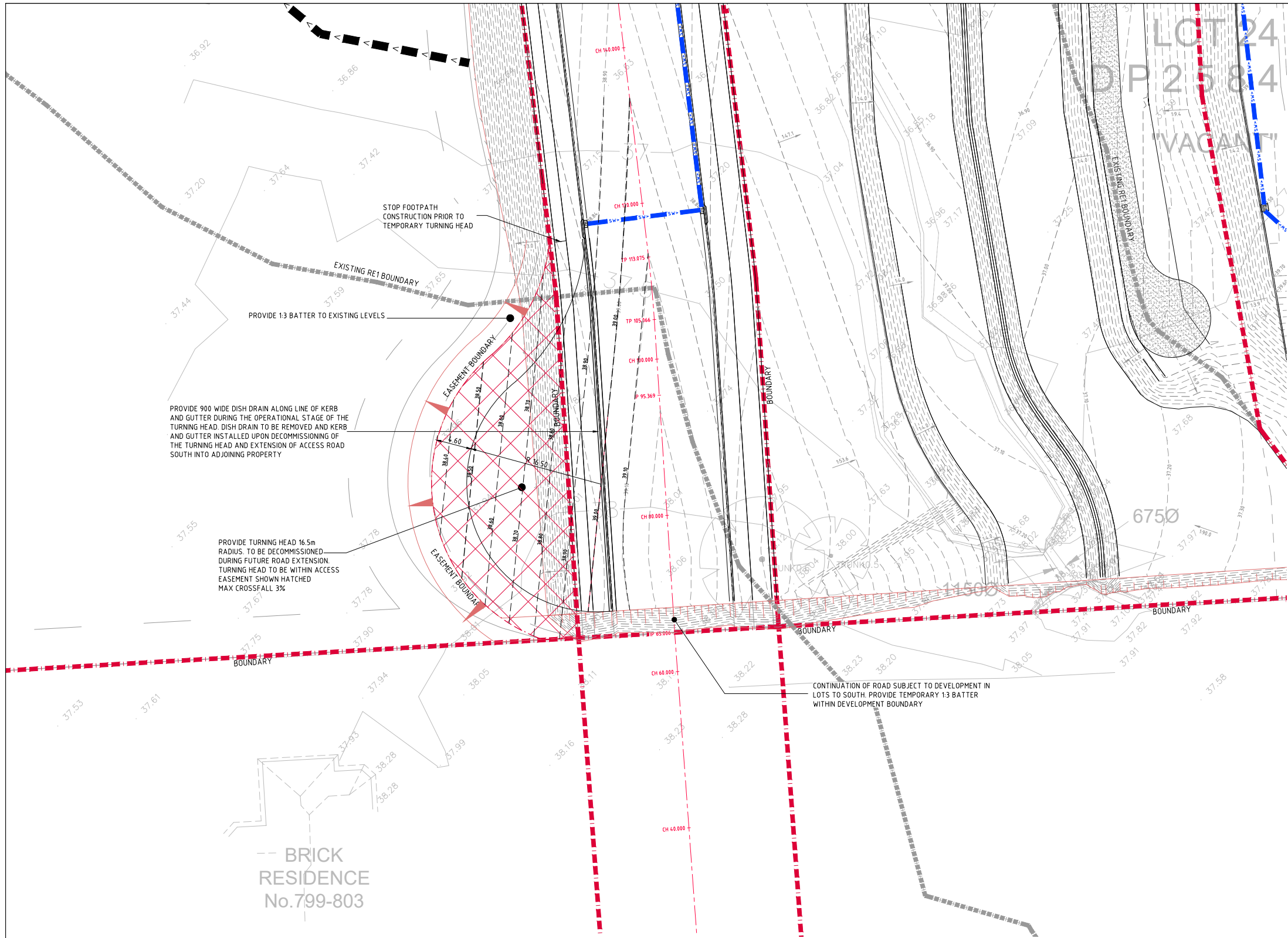


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- KIP, KERB INLET PIT
- SGGP, SINGLE GRATED GULLY PIT
- OVERLAND FLOW DIRECTION
- PROPOSED DRAINAGE LINE
- EXISTING DRAINAGE LINE
- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- FINISHED PAVEMENT SPOT HEIGHT
- EXISTING SEWER MAIN
- EXISTING WATER MAIN
- EXISTING RECYCLED WATER MAIN
- EXISTING UNDERGROUND ELECTRICAL
- EXISTING TELECOMMUNICATIONS (NBN)



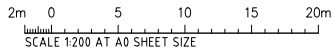


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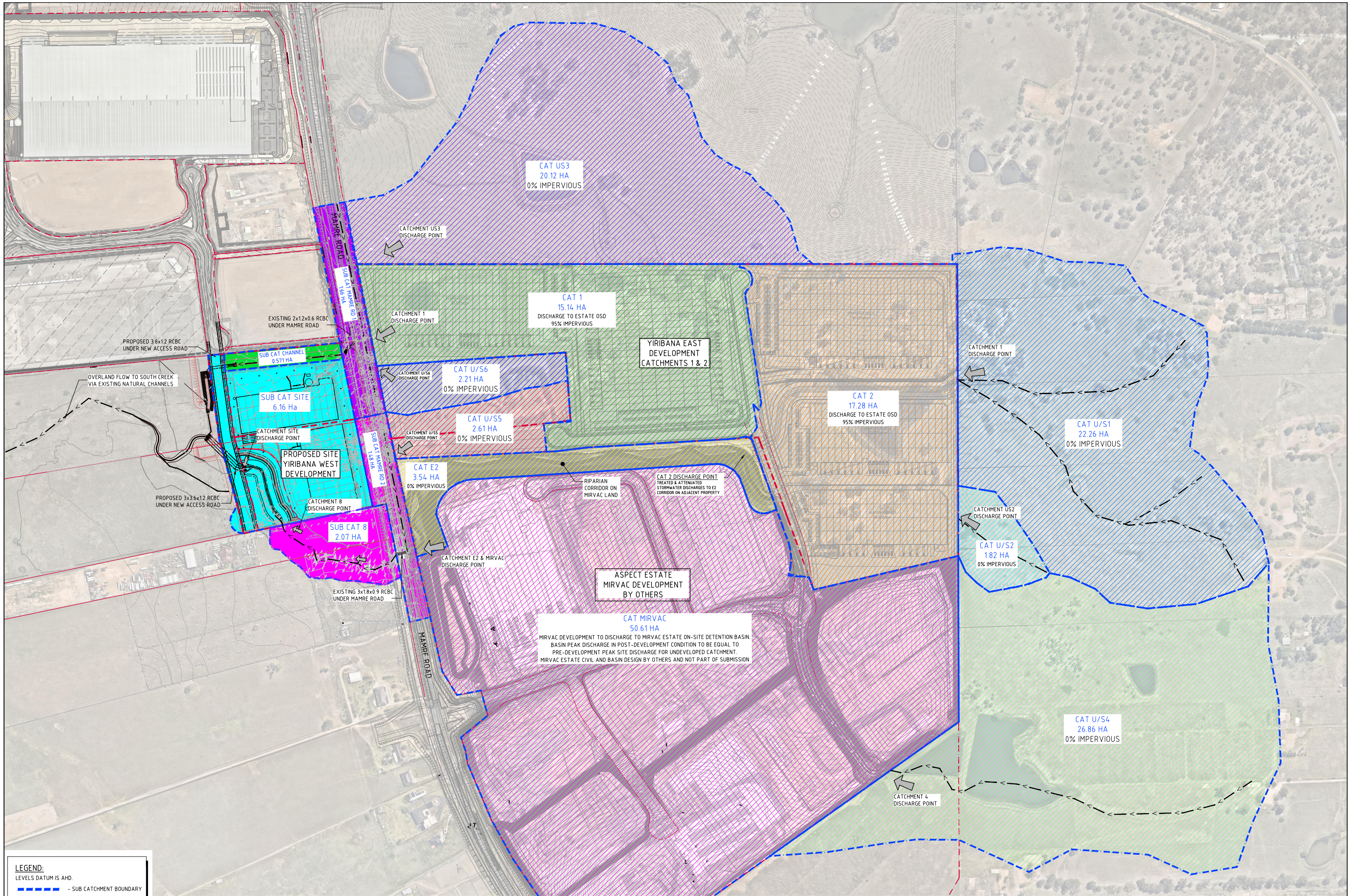
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- SGGP, SINGLE GRATED GULLY PIT
- OVERLAND FLOW DIRECTION
- PROPOSED DRAINAGE LINE
- EXISTING DRAINAGE LINE
- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- FINISHED PAVEMENT SPOT HEIGHT
- EXISTING SEWER MAIN
- EXISTING WATER MAIN
- EXISTING RECYCLED WATER MAIN
- EXISTING UNDERGROUND ELECTRICAL
- EXISTING TELECOMMUNICATIONS (NBN)

 SOUTHERN TURNING HEAD & ROAD CONNECTION PLAN
SCALE 1:200



[illegible]

																PROJECT YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW				Costin Roe Consulting Pty Ltd. ABN 50 003 056 446 PO Box N419 Sydney NSW 1220 Level 4, 8 Windmill Street, Millers Point NSW 2000 t: +61 2 9261 7659 f: +61 2 9241 3773 e: mail@costinroe.com.au w: costinroe.com.au				DRAWING TITLE TYPICAL SECTIONS-SHEET 2			
ISSUED FOR DEVELOPMENT APPLICATION												02.02.24		A													
AMENDMENTS												DATE		ISSU#		AMENDMENTS		DATE		ISSU#		AMENDMENTS		DATE		ISSU#	



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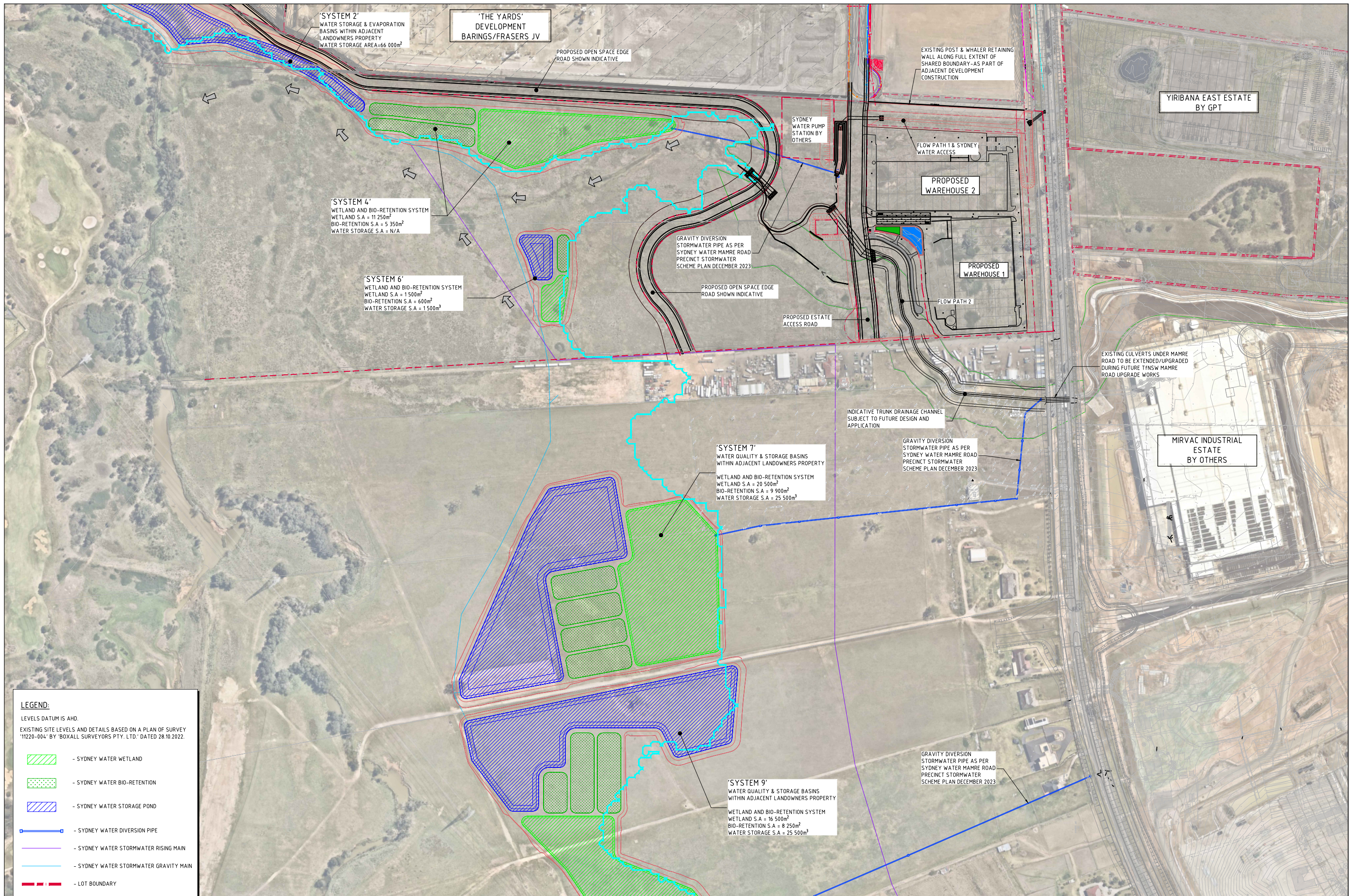
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RAFTS MODEL POST DEVELOPMENT CATCHMENT PLAN
SCALE 1:2000

FOR DEVELOPMENT APPLICATION

20m 0 50 100 150 200m
SCALE 1:2000 AT A0 SIZE SHEET

ISSUED FOR DEVELOPMENT APPLICATION				ARCHITECT				CLIENT				PROJECT				CONSULTANT				DRAWING TITLE			
ISSUED FOR DEVELOPMENT APPLICATION				SB				GPT				YIRIBANA WEST INDUSTRIAL ESTATE				Costin Roe Consulting Pty Ltd.				RAFTS MODEL POST DEVELOPMENT			
ISSUED FOR DEVELOPMENT APPLICATION				18.12.23				771-797 MAMRE ROAD				PO Box 2419 Sydney NSW 1220				CRC				STORMWATER CATCHMENT PLAN			
ISSUED FOR DEVELOPMENT APPLICATION				25.07.23				KEMPS CREEK, 2178, NSW				Level 4 & 5 Woodhill Street, Millers Point NSW 2000				CIVIL & STRUCTURAL ENGINEERS				DRAWING No			
AMENDMENTS				19.12.22				DESIGNED DRAWN DATE				p: +61 2 9251 7699				C014429.00-DA72				C			
AMENDMENTS				DATE				CHECKED SIZE SCALE				E: +61 2 9241 3731											
AMENDMENTS				DATE				AS SHOWN				w: costinroe.com.au											



LEGEND:

LEVELS DATUM IS AHD.
EXISTING SITE LEVELS AND DETAILS BASED ON A PLAN OF SURVEY
'11220-004' BY 'BOXALL SURVEYORS PTY. LTD.' DATED 28.10.2022.

- SYDNEY WATER WETLAND
- SYDNEY WATER BIO-RETENTION
- SYDNEY WATER STORAGE POND
- SYDNEY WATER DIVERSION PIPE
- SYDNEY WATER STORMWATER RISING MAIN
- SYDNEY WATER STORMWATER GRAVITY MAIN
- LOT BOUNDARY
- 1% AEP FLOOD EXTENT



CONCEPT STORMWATER DRAINAGE AND WATER QUALITY MASTERPLAN-OPTION 1
1:1500 SCALE

FOR INFORMATION ONLY

15m 0 15 30 45 60 75 90 105 120 135 150m
SCALE 1:1500 AT A0 SHEET SIZE

ISSUED FOR INFORMATION	31.01.24	A
AMENDMENTS	DATE	ISSUE

AMENDMENTS	DATE	ISSUE

AMENDMENTS	DATE	ISSUE

ARCHITECT	CLIENT
SBA ARCHITECTS	GPT The GPT Group
Suite 101, 40 Market Street, North Sydney NSW 1585 t: 02 9550 1234 f: 02 9550 1235 e: info@sba.com.au w: www.sba.com.au	

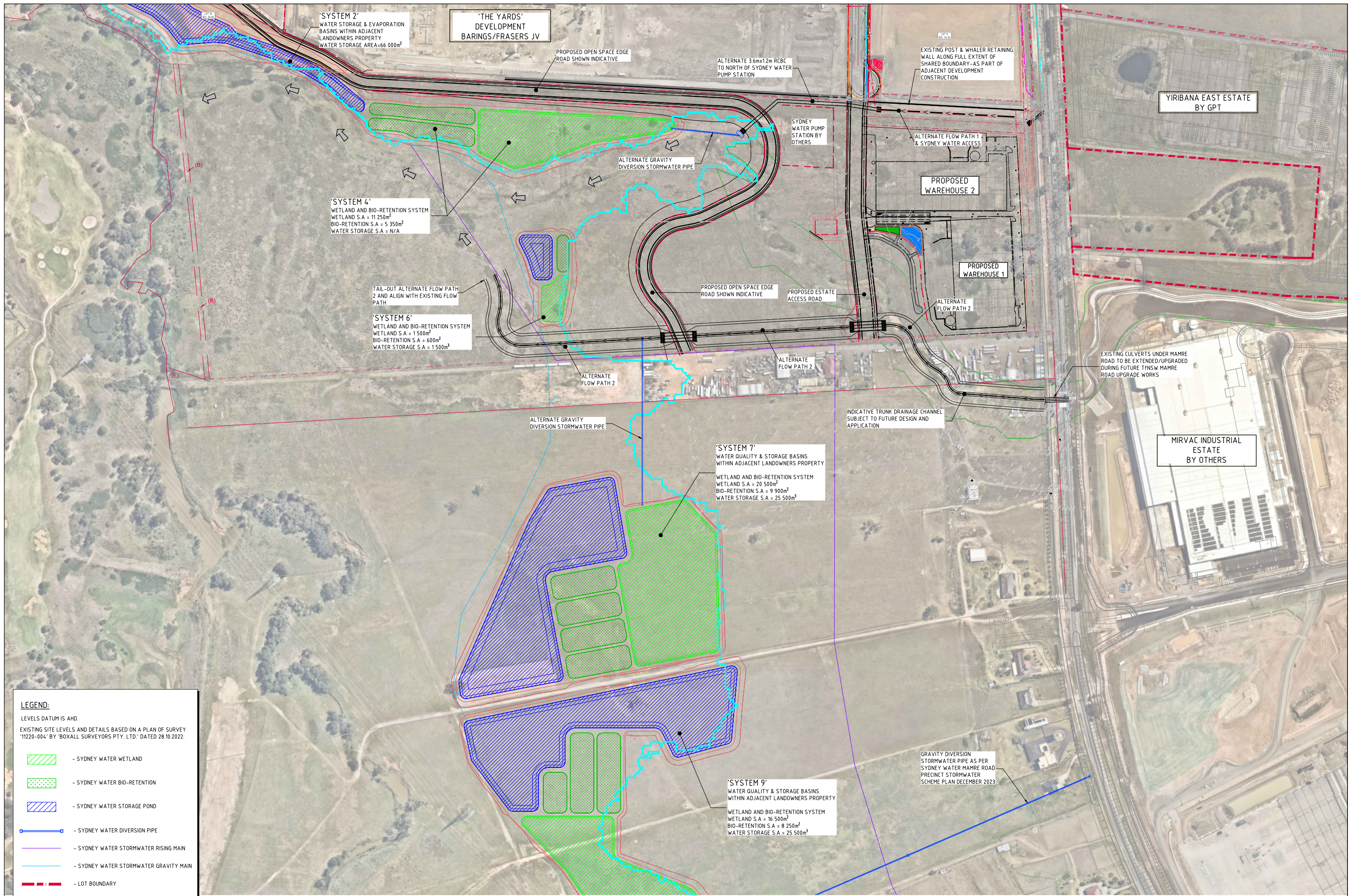
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YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW	MC	MC	OCT 22	MW	A0	AS SHOWN		C01429.00-MP01

CONSULTANT	PROJECT
CRC COSTIN ROE CONSULTING	YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW
PO Box 1419 Sydney NSW 1220 Level 4, 8 Woodville Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au w: costinroe.com.au	

CONSULTANT	PROJECT
CRC COSTIN ROE CONSULTING	YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW
PO Box 1419 Sydney NSW 1220 Level 4, 8 Woodville Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au w: costinroe.com.au	

CONSULTANT	PROJECT
CRC COSTIN ROE CONSULTING	YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW
PO Box 1419 Sydney NSW 1220 Level 4, 8 Woodville Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au w: costinroe.com.au	

DRAWING TITLE	DRAWING NO.	REVISION
CONCEPT STORMWATER DRAINAGE AND WATER QUALITY MASTERPLAN OPTION 1	C01429.00-MP01	B



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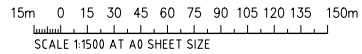
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EXISTING SITE LEVELS AND DETAILS BASED ON A PLAN OF SURVEY '11220-004' BY 'BOXALL SURVEYORS PTY. LTD.' DATED 28.10.2022.

- SYDNEY WATER WETLAND
- SYDNEY WATER BIO-RETENTION
- SYDNEY WATER STORAGE POND
- SYDNEY WATER DIVERSION PIPE
- SYDNEY WATER STORMWATER RISING MAIN
- SYDNEY WATER STORMWATER GRAVITY MAIN
- LOT BOUNDARY
- 1% AEP FLOOD EXTENT



CONCEPT STORMWATER DRAINAGE AND WATER QUALITY MASTERPLAN-OPTION 2
1:1500 SCALE

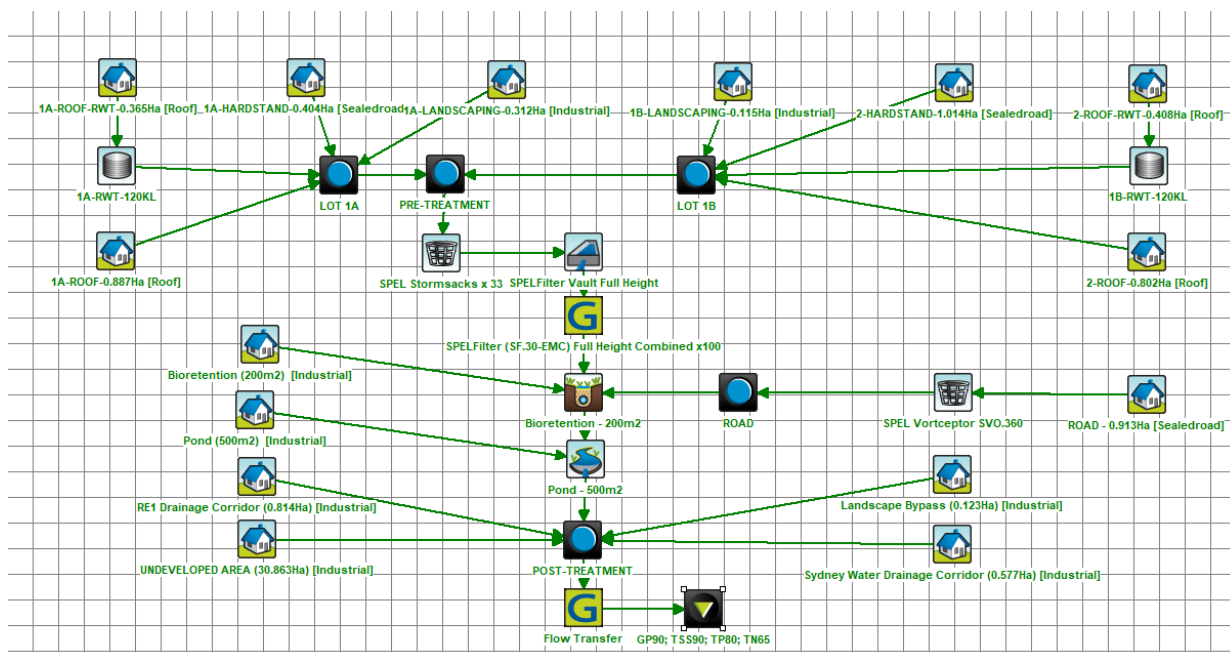
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				771-797 MAMRE ROAD				The GPT Group				PO Box 1419 Sydney NSW 1220				Level 4, 48 Woodmill Street, Millers Point NSW 2000				COSTIN ROE CONSULTING															
				KEMPS CREEK, 2178, NSW								p: +61 2 9251 7699 f: +61 2 9241 3731				e: mail@costinroe.com.au w: costinroe.com.au																			
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Appendix B

MUSIC MODEL CONFIGURATION & PARAMETERS



B.1 Introduction

The MUSIC model was chosen to model water quality. This model, released by the Cooperative Research Centre for Catchment Hydrology (CRCCH), is a standard industry model for this purpose. MUSIC (the Model for Urban Stormwater Improvement Conceptualisation) is suitable for simulating catchment areas of up to 100 km² and utilises a continuous simulation approach to model water quality.

By simulating the performance of stormwater management systems, MUSIC can be used to predict if the proposed systems and changes to land use are appropriate for their catchments and capable of meeting specified water quality objectives (CRC 2002). The water quality constituents modelled in MUSIC, of relevance to this report, include Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

The pollutant retention criteria set out in the MRP DCP and nominated in **Section 5.1** of this report were used as a basis for assessing the effectiveness of the selected treatment trains.

The stream health measures relevant to this report are MARV and FDC.

The MUSIC model “14429.00-DA_Rev3.sqz” was set up to examine the effectiveness of the water quality treatment train and to predict if Council’s requirements have been achieved.

Modelling parameters used are based on those nominated in the Department of Planning and Environment *Technical guidance for achieving Wianamatta–South Creek stormwater management targets*.

B.2 Rainfall Data

As per the recommendation of *Technical guidance for achieving Wianamatta–South Creek stormwater management targets*, six-minute pluviographic data for the Sydney Meteorological Office Station was sourced from the Bureau of Meteorology (BOM) as nominated below. Evapo-transpiration data for the period was sourced from the Sydney Monthly Areal PET data set supplied with the MUSIC software.

Input	Data Used
Rainfall Station	67113 Penrith Lakes AWS
Rainfall Period	1999 – 2008 (10 years)
Mean Annual Rainfall (mm)	691
Evapo- transpiration	Table 43 of <i>Technical guidance for achieving Wianamatta–South Creek stormwater management targets</i>
Model Time step	6 minutes

B.3 Rainfall Runoff Parameters

Parameter	Value
Rainfall Threshold	1.0
Soil Storage Capacity (mm)	150
Initial Storage (% capacity)	30
Field Capacity (mm)	130
Infiltration Capacity Coefficient a	175
Infiltration Capacity exponent b	2.5
Initial Depth (mm)	10

Daily Recharge Rate (%)	25
Daily Baseflow Rate (%)	1.4
Daily Seepage Rate (%)	0.0

B.4 Pollutant Concentrations & Source Nodes

Pollutant concentrations for source nodes are based on the MUSIC file that contains climate data and source nodes as provided in the MUSIC modelling toolkit which accompanies the *Technical guidance for achieving Wianamatta–South Creek stormwater management targets*.

The MUSIC model has been setup with a treatment train approach based on the pollutant concentrations in the provided base MUSIC model discussed above.

The relevant stormwater catchment sizes are listed below in **Table B.2** and their configuration within the MUSIC model.

Catchment	Area (Ha)	Source Node	% Impervious	Stormwater Treatment
1-ROOF	0.887	Roof	100	AtlanFilter
2-ROOF	0.802	Roof	100	AtlanFilter
1-ROOF-RWT	0.365	Roof	100	Rainwater Tank + AtlanFilter
2-ROOF-RWT	0.408	Roof	100	Rainwater Tank + AtlanFilter
1 HARDSTAND	0.404	Sealed Road	100	StormSack + AtlanFilter
2-HARDSTAND	1.014	Sealed Road	100	StormSack + AtlanFilter
1A-LANDSCAPING	0.312	Industrial	10	StormSack + AtlanFilter
1B-LANDSCAPING	0.115	Industrial	10	StormSack + AtlanFilter
ROAD	0.913	Sealed Road	70	Vortceptor + BioRetention
UNDEVELOPED AREA	31.088	Industrial	0	Bypass
BIORETENTION	0.020	Bioretention	0	BioRetention
POND	0.050	Pond	0	Pond
RE1 DRAINAGE CORRIDOR	0.814	Industrial	10	Bypass
LANDSCAPE BYPASS	0.123	Industrial	10	Bypass
SYDNEY WATER DRAINAGE CORRIDOR	0.577	Industrial	10	Bypass
Total	37.892			

Table B.2. Music Model Source Nodes

B.5 Treatment Nodes

Bio-Retention system and SQIDEP (GPT) and, Atlan Storm Sacks, and Atlan Filter nodes have been used in the modelling of the development.

It is noted that the bio-retention node, within the flood storage basin, has been modelled in MUSIC to simulate treatment during low flow and non-flood scenario. The bio-retention node allows for a high flow bypass which would operate when flows from the site are greater than 100 l/s. This flow is based on the 1 in 3-month flow from the site and would simulate a conservative model for the site during the period when the flood basin operates and would not provide treatment to the site. It is noted that the model is conservative in that the flood basin is not expected to operate until flood events which are greater than 1 in 5-year ARI which would mean that possible higher treatment of stormwater from the site. This is considered a suitable and conservative modelling approach for the treatment of stormwater from this site.

B.6 Results

Table B.3 shows the results of the MUSIC analysis. The reduction rate is expressed as a percentage and compares the post-development pollutant loads without treatment versus post-development loads with treatment.

Pollutant (per Kg)	Source	Residual Load	Target per Ha	Result per Ha	Target Met Y/N
Total Suspended Solids (kg/yr)	6630	1970	<80	52.25	Y
Total Phosphorus (kg/yr)	12.8	5.11	<0.3	0.135	Y
Total Nitrogen (kg/yr)	87.3	38.9	<3.5	1.03	Y
Gross Pollutants (kg/yr)	876.	49.3	<16	1.311	Y

Table B.3. MUSIC analysis results

The model results indicate that, through the use of the STM in the treatment train, pollutant load reductions for Total Suspended Solids, Total Phosphorous, Total Nitrogen and Gross Pollutants will meet the requirements of the MRP DCP for the developed catchment. Refer to **Section 7** for further discussions pertaining to confirmation of Water Quality.

Refer to **Section 6.3** and **Appendix F** pertaining to Stream Health (MARV/FDC) items.

B.7 Modelling Discussion

MUSIC modelling has been performed to assess the effectiveness of the selected treatment trains and to ensure that the pollutant retention requirements of the MRP DCP have been met.

The MUSIC modelling has shown that the proposed treatment train of STM will provide stormwater treatment which will meet MRP DCP requirements in an effective and economical manner.

Hydrocarbon and oil & grease removal cannot be modelled with MUSIC software. As an industrial estate with users for individual development sites not known, the exact levels of hydrocarbons would not be known however given the expected use of the site as a warehouse

distribution centre these pollutants would not be expected to be large. Potential sources of hydrocarbons and/or oil & grease which drain to the stormwater system would be limited to leaking engine sumps or for accidental fuel spills/leaks and leaching of bituminous pavements (car parking only). The potential for these pollutants is low and published data from the CSIRO indicates that average concentrations from industrial sites are in the order of 10mg/L and we would expect source loading from this site to be near to or below this concentration.

Given the expected low source loadings of hydrocarbons and oil/grease and removal efficiencies of the treatment devices and bio-retention systems we consider that the requirements of the MRP DCP have been met.

Appendix C

DRAFT SOIL AND WATER MANAGEMENT PLAN

C.1 Introduction

An erosion and sediment control plan (ESCP) is shown on drawing **Co14429.00-DA20** with details on **DA25**. These are conceptual plans only providing sufficient detail to clearly show that the works can proceed without undue pollution to receiving waters. A detailed plan will be prepared once consent is given and before works start.

The Staged ESCP considers initial site establishment, requirements during construction of roads and infrastructure and estate earthworks, completion of estate works and the period between this and development of individual lots.

C.2 General Conditions

1. The ESCP will be read in conjunction with the engineering plans, and any other plans or written instructions that may be issued in relation to development at the subject site.
2. Contractors will ensure that all soil and water management works are undertaken as instructed in this specification and constructed following the guidelines stated in:
 - a. *The MRP DCP 2021*
 - b. *Best Practice Erosion and Sediment Control* document International Erosion Control Association (ICEA) Australasia – “The White Book”.
 - c. *Managing Urban Stormwater – Soils & Construction Volume 1 (‘Blue Book’)*(Landcom, 2004).
 - d. *DPIE Technical Guidance for Achieving Wianamatta South Creek Stormwater Management Targets*
3. All subcontractors will be informed of their responsibilities in minimising the potential for soil erosion and pollution to down slope areas.

C.3 Land Disturbance

1. Where practicable, the soil erosion hazard on the site will be kept as low as possible and as recommended in Table C.1.

Table C.1 Limitations to access

Land Use	Limitation	Comments
Construction areas	Limited to 5 (preferably 2) metres from the edge of any essential construction activity as shown on the engineering plans.	All site workers will clearly recognise these areas that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope), or similar materials.
Access areas	Limited to a maximum width of 5 metres	The site manager will determine and mark the location of these zones onsite. They can vary in position so as to best conserve existing vegetation and protect downstream areas while being considerate of the needs of efficient works activities. All site workers will clearly recognise these boundaries.
Remaining lands	Entry prohibited except for essential management works	

C.4 Erosion Control Conditions

1. Clearly visible barrier fencing shall be installed as shown on the plan and elsewhere at the discretion of the site superintendent to ensure traffic control and prohibit unnecessary site disturbance. Vehicular access to the site shall be limited to only those essential for construction work and they shall enter the site only through the stabilised access points.
2. Soil materials will be replaced in the same order they are removed from the ground. It is particularly important that all subsoils are buried and topsoils remain on the surface at the completion of works.
3. Where practicable, schedule the construction program so that the time from starting land disturbance to stabilisation has a duration of less than six months.
4. Notwithstanding this, schedule works so that the duration from the conclusion of land shaping to completion of final stabilisation is less than 20 working days.
5. Land recently established with grass species will be watered regularly until an effective cover has properly established and plants are growing vigorously. Further application of seed might be necessary later in areas of inadequate vegetation establishment.
6. Where practical, foot and vehicular traffic will be kept away from all recently established areas

7. Earth batters shall be constructed in accordance with the Geotechnical Engineers Report or with as low a gradient as practical but not steeper than:
 - 2H:1V where slope length is less than 7 metres
 - 2.5H:1V where slope length is between 7 and 10 metres
 - 3H:1V where slope length is between 10 and 12 metres
 - 4H:1V where slope length is between 12 and 18 metres
 - 5H:1V where slope length is between 18 and 27 metres
 - 6H:1V where slope length is greater than 27 metres
8. All earthworks, including waterways/drains/spillways and their outlets, will be constructed to be stable in at least the design storm event.
9. During windy weather, large, unprotected areas will be kept moist (not wet) by sprinkling with water to keep dust under control. In the event water is not available in sufficient quantities, soil binders and/or dust retardants will be used or the surface will be left in a cloddy state that resists removal by wind.

C.5 Pollution Control Conditions

1. Stockpiles will not be located within 5 metres of hazard areas, including likely areas of high velocity flows such as waterways, paved areas and driveways. Silt/ sediment fences and appropriate stabilisation of stockpiles are to be provided as detailed on the drawings.
2. Sediment fences will:
 - a) Be installed where shown on the drawings, and elsewhere at the discretion of the site superintendent to contain the coarser sediment fraction (including aggregated fines) as near as possible to their source.
 - b) Have a catchment area not exceeding 720 square meters, a storage depth (including both settling and settled zones) of at least 0.6 meters, and internal dimensions that provide maximum surface area for settling, and
 - c) Provide a return of 1 metre upslope at intervals along the fence where catchment area exceeds 720 square meters, to limit discharge reaching each section to 10 litres/second in a maximum 20-year t_c discharge.
3. Sediment removed from any trapping device will be disposed in locations where further erosion and consequent pollution to down slope lands and waterways will not occur.
4. Water will be prevented from directly entering the permanent drainage system unless it is relatively sediment free (i.e. the catchment area has been permanently landscaped and/or likely sediment has been treated in an approved device). Nevertheless, stormwater inlets will be protected.
5. Temporary soil and water management structures will be removed only after the lands they are protecting are stabilised.

C.6 Waste Management Conditions

Acceptable bind will be provided for any concrete and mortar slurries, paints, acid washings, lightweight waste materials and litter. Clearance service will be provided at least weekly.

C.7 Site Inspection and Maintenance

1. A self-auditing program will be established based on a Check Sheet. A site inspection using the Check Sheet will be made by the site manager:
 - At least weekly.
 - Immediately before site closure.
 - Immediately following rainfall events in excess of 5mm in any 24-hour period.

The self-audit will include:

- Recording the condition of every sediment control device
 - Recording maintenance requirements (if any) for each sediment control device
 - Recording the volumes of sediment removed from sediment retention systems, where applicable
 - Recording the site where sediment is disposed
 - Forwarding a signed duplicate of the completed Check Sheet to the project manager/developer for their information
2. In addition, a suitably qualified person will be required to oversee the installation and maintenance of all soil and water management works on the site. The person shall be required to provide a short monthly written report. The responsible person will ensure that:
 - The plan is being implemented correctly
 - Repairs are undertaken as required
 - Essential modifications are made to the plan if and when necessary

The report shall carry a certificate that works have been carried out in accordance with the plan.

3. Waste bins will be emptied as necessary. Disposal of waste will be in a manner approved by the Site Superintendent.
4. Proper drainage will be maintained. To this end drains (including inlet and outlet works) will be checked to ensure that they are operating as intended, especially that,
 - No low points exist that can overtop in a large storm event
 - Areas of erosion are repaired (e.g. lined with a suitable material) and/or velocity of flow is reduced appropriately through construction of small check dams or installing additional diversion upslope.
 - Blockages are cleared (these might occur because of sediment pollution, sand/soil/spoil being deposited in or too close to them, breached by vehicle wheels, etc.).

5. Sand/soil/spoil materials placed closer than 2 meters from hazard areas will be removed. Such hazard areas include and areas of high velocity water flows (e.g. waterways and gutters), paved areas and driveways.
6. Recently stabilised lands will be checked to ensure that erosion hazard has been effectively reduced. Any repairs will be initiated as appropriate.
7. Excessive vegetation growth will be controlled through mowing or slashing.
8. All sediment detention systems will be kept in good, working condition. In particular, attention will be given to:
 - a) Recent works to ensure they have not resulted in diversion of sediment laden water away from them
 - b) Degradable products to ensure they are replaced as required, and
 - c) Sediment removal, to ensure the design capacity or less remains in the settling zone.
9. Any pollutants removed from sediment basins or litter traps will be disposed of in areas where further pollution to down slope lands and waterways should not occur.
10. Additional erosion and/or sediment control works will be constructed as necessary to ensure the desired protection is given to down slope lands and waterways, i.e. make ongoing changes to the plan where it proves inadequate in practice or is subjected to changes in conditions at the work site or elsewhere in the catchment.
11. Erosion and sediment control measures will be maintained in a functioning condition until all earthwork activities are completed and the site stabilised
12. Litter, debris and sediment will be removed from the gross pollutant traps and trash racks as required.

**EROSION AND SEDIMENT CONTROL
WEEKLY SITE INSPECTION SHEET**

LOCATION
INSPECTION OFFICER **DATE**
SIGNATURE

Legend: ☐ OK ☐ Not OK N/A Not applicable

Item	Consideration	Assessment
1	Public roadways clear of sediment.	
2	Entry/exit pads clear of excessive sediment deposition.	
3	Entry/exit pads have adequate void spacing to trap sediment.	
4	The construction site is clear of litter and unconfined rubbish.	
5	Adequate stockpiles of emergency ESC materials exist on site.	
6	Site dust is being adequately controlled.	
7	Appropriate drainage and sediment controls have been installed prior to new areas being cleared or disturbed.	
8	Up-slope "clean" water is being appropriately diverted around/through the site.	
9	Drainage lines are free of soil scour and sediment deposition.	
10	No areas of exposed soil are in need of erosion control.	
11	Earth batters are free of "rill" erosion.	
12	Erosion control mulch is not being displaced by wind or water.	
13	Long-term soil stockpiles are protected from wind, rain and stormwater flow with appropriate drainage and erosion controls.	
14	Sediment fences are free from damage.	
15	Sediment-laden stormwater is not simply flowing "around" the sediment fences or other sediment traps.	
16	Sediment controls placed up-slope/around stormwater inlets are appropriate for the type of inlet structure.	
17	All sediment traps are free of excessive sediment deposition.	
18	The settled sediment layer within a sediment basin is clearly visible through the supernatant prior to discharge such water.	
19	All reasonable and practicable measures are being taken to control sediment runoff from the site.	
20	All soil surfaces are being appropriately prepared (i.e. pH, nutrients, roughness and density) prior to revegetation.	
21	Stabilised surfaces have a minimum 70% soil coverage.	
22	The site is adequately prepared for imminent storms.	
23	All ESC measures are in proper working order.	

Appendix D

STORMWATER SYSTEM MAINTENANCE SCHEDULE

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
SWALES/ LANDSCAPED AREAS			
Check density of vegetation and ensure minimum height of 150mm is maintained. Check for any evidence of weed infestation	Six monthly	Maintenance Contractor	Replant and/or fertilise, weed and water in accordance with landscape consultant specifications
Inspect swale for excessive litter and sediment build up	Six monthly	Maintenance Contractor	Remove sediment and litter and dispose in accordance with local authorities' requirements.
Check for any evidence of channelisation and erosion	Six monthly/ After Major Storm	Maintenance Contractor	Reinstate eroded areas so that original, designed swale profile is maintained
Weed Infestation	Three Monthly	Maintenance Contractor	Remove any weed infestation ensuring all root ball of weed is removed. Replace with vegetation where required.
Inspect swale surface for erosion	Six Monthly	Maintenance Contractor	Replace top soil in eroded area and cover and secure with biodegradable fabric. Cut hole in fabric and revegetate.
INLET & JUNCTION PITS			
Inside of pits	Six Monthly	Maintenance Contractor	Remove grate and inspect internal walls and base, repair where required. Remove any collected sediment, debris, litter.

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
Outside of pits	Four Monthly/ After Major Storm	Maintenance Contractor	Clean grate of collected sediment, debris, litter and vegetation.
PROPRIETARY TREATMENT DEVICES (SQIDEP GPT's)			
Refer to Manufacturers Operation and Maintenance Manuel	Annually	Maintenance Contractor	Refer to Manufacturers Operation and Maintenance Manuel
BIORETENTION BASIN			
Check all items nominated for SWALES/ LANDSCAPED AREAS above	Refer to SWALES/ LANDSCAPED AREAS section above	Refer to SWALES/ LANDSCAPED AREAS section above	Refer to SWALES/ LANDSCAPED AREAS section above
Check for sediment accumulation at inflow points	Six monthly/ After Major Storm	Maintenance Contractor	Remove sediment and dispose in accordance with local authorities' requirements.
Check for erosion at inlet or other key structures.	Six monthly/ After Major Storm	Maintenance Contractor	Reinstate eroded areas so that original, designed profile is maintained
Check for evidence of dumping (litter, building waste or other).	Six monthly	Maintenance Contractor	Remove waste and litter and dispose in accordance with local authorities' requirements.
Check condition of vegetation is satisfactory (density, weeds, watering, replating, mowing/ slashing etc)	Six monthly	Maintenance Contractor	Replant and/or fertilise, weed and water in accordance with landscape consultant specifications
Check for evidence of prolonged	Six monthly/ After Major	Maintenance Contractor	Remove sediment and dispose in accordance

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
ponding, surface clogging or clogging of drainage structures	Storm 5-10 years		with local authorities' requirements. Replace filter media & planting – refer to appropriately qualified engineer or stormwater specialist
Check stormwater pipes and pits	Six monthly/ After Major Storm	Maintenance Contractor	Refer to INLET/JUNCTION PIT section.
FUTURE RAINWATER TANK			
Check for any clogging and blockage of the first flush device	Monthly	Maintenance Contractor	First flush device to be cleaned out
Check for any clogging and blockage of the tank inlet -leaf/litter screen	Six monthly	Maintenance Contractor	Leaves and debris to be removed from the inlet leaf/litter screen
Check the level of sediment within the tank	Every two years	Maintenance Contractor	Sediment and debris to be removed from rainwater tank floor if sediment level is greater than the maximum allowable depth as specified by the hydraulic consultant
STORMWATER SYSTEM			
General Inspection of complete stormwater drainage system	Bi-annually	Maintenance Contractor	Inspect all drainage structures noting any dilapidation in structures and carry out required repairs.

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
OSD SYSTEM			
Inspect and remove any blockage from orifice	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen to inspect orifice.
Inspect trash screen and clean	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen if required to clean it.
Inspect flap valve and remove any blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate. Ensure flap valve moves freely and remove any blockages or debris.
Inspect pit sump for damage or blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate & screen. Remove sediment/ sludge build up and check orifice and flap valve are clear.
Inspect storage areas and remove debris/ mulch/ litter etc likely to block screens/ grates.	Six Monthly	Maintenance Contractor/ Owner	Remove debris and floatable materials.
Check attachment of orifice plate and screen to wall of pit	Annually	Maintenance Contractor	Remove grate and screen. Ensure plate or screen mounted securely, tighten fixings if required. Seal gaps if required.
Check orifice diameter is correct and retains sharp edge.	Five yearly	Maintenance Contractor	Compare diameter to design (see Work-as-Executed) and ensure edge is not pitted or damaged.
Check screen for corrosion	Annually	Maintenance Contractor	Remove grate and screen and examine for rust or corrosion, especially at corners or

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
			welds.
Inspect overflow weir and remove any blockage	Six monthly	Maintenance Contractor/ Owner	Ensure weir is free of blockage.
Inspect walls for cracks or spalling	Annually	Maintenance Contractor	Remove grate to inspect internal walls, repair as necessary.
Check step irons	Annually	Maintenance Contractor	Ensure fixings are secure and irons are free from corrosion.

Appendix E

COSTIN ROE CONSULTING FLOOD AND OVERLAND FLOW ASSESSMENT

E.1 INTRODUCTION

E.1.1 Introduction

This Appendix to **Section 8** is provided to confirm technical parameters adopted in the *Overland Flow Assessment* for the proposed industrial estate development. The *Study Area* has been identified by Penrith City Council, as being affected by overland flow from an external catchment on the north-east of the property.

The scope and primary objectives of the overland flow assessment, are as follows:

- Determine the design flows generated by the contributing external catchments for a range of storms (1%, 0.5%, 0.2% AEP & PMF); Hydrology would be based on RAFTS modelling for overland flow paths and the South Creek Flood Study 2014 for flows within South Creek;
- Assess the pre-development overland flow path through the development site for the 1% AEP storm event;
- Assess the post-development levels on the effect of overland flow through the development site for the 1% AEP storm event so that potential impacts on the development can be assessed and mitigated;
- Confirm that there is adverse impact to upstream, downstream and adjacent properties as a result of the development; and
- Confirm flood planning levels applicable to the development.

Appendix E provides technical detail to the summary and conclusions discussed in the **Section 8** of this report.

E.1.2 Survey/ DTM

Survey is required to define the physical attributes of the floodplain topography including the channel cross sections and the associated floodplain levels.

The pre-development scenario survey has been compiled based on a detail site survey for areas within the site, and for areas external to the site where detail survey is not available, digital terrain information has been obtained through government sources in the form of ALS survey. The on-ground survey information was completed in and around the study area to properly define the existing overland flow path cross section and features.

For assessment of the post-development scenario, the proposed development levels and drainage system (where appropriate) were then added to the pre-developed survey surface to create a post developed surface to use in the TUFLOW model and scenario modelling. This DTM was imported to the TUFLOW model to simulate land filling and proposed compensation areas in and around the flood affected land.

The surveys and design surfaces were used as the basis for the digital terrain model (DTM) used in the hydraulic modelling of the pre and post development scenario respectively.

E.2 CATCHMENT INVESTIGATION & HYDROLOGY

E.2.1 Contributing Catchment Definition

The contributing catchment comprises rural land use with approximately >90% pervious surfaces. The area has recently been rezoned by DPIE as part of the Mamre Road Precinct of the Badgerys Creek Airport Aerotropolis.

Future developments will need to match pre-development flows through detention. As such our assessment has been based on modelling the existing rural pervious land use.

For the pre-development and post development condition, the upstream catchment has been divided into 8 catchments that drain through the site. A total catchment size of 159.35 Ha on the eastern side of Mamre Road drains through the proposed site, with an additional local 9.97Ha catchment on the western side of Mamre Road. These catchments are shown below in **Figures E2.1 and E2.2**.

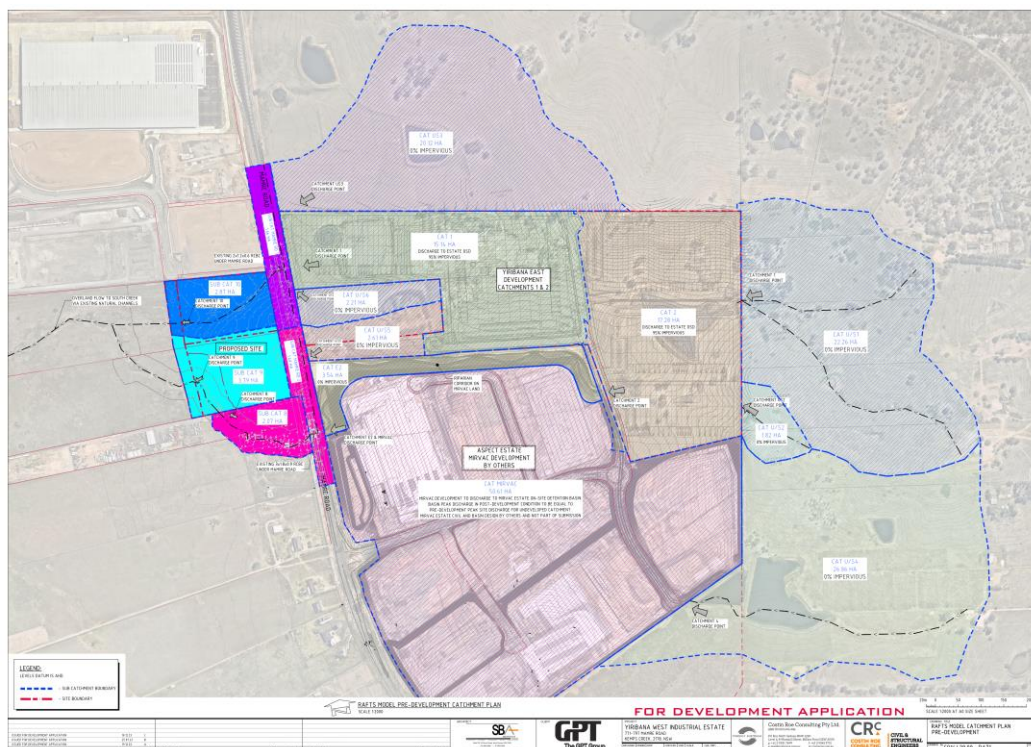


Figure E2.1. Pre-Development Contributing Catchment.

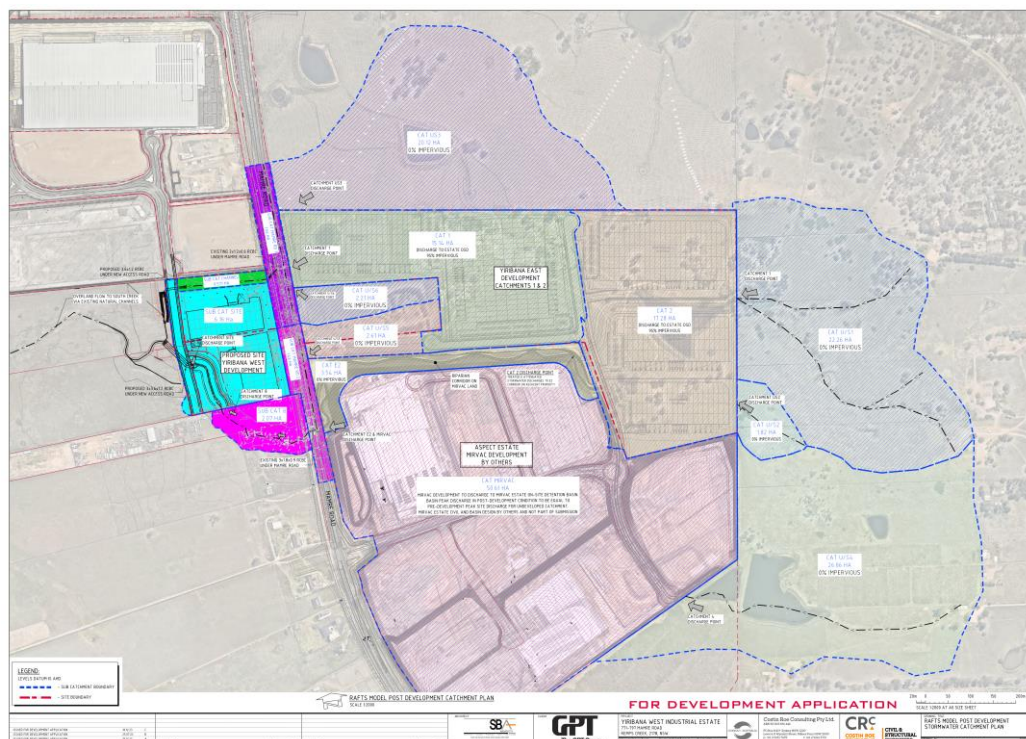


Figure E2.2. Post Development Contributing Catchment.

E.2.2 Hydrological Assessment of Existing Catchment

Flood hydrographs were assessed using a RAFTS model based on the contributing catchment. The inflow hydrograph was extrapolated from the RAFTS model for the 1%, 0.5%, 0.2% AEP & PMF events as shown in **Figures E1 to Figure E60**. Rainfall intensities and temporal patterns were derived from the Bureau of Meteorology online IFD tool and Australian Rainfall and Runoff. It was determined that the critical storm duration which produces peak flows for the contributing catchments is the 45 minute storm duration. This is consistent with the critical duration storm used in the Penrith Overland Flow Study by Cardno (2006).

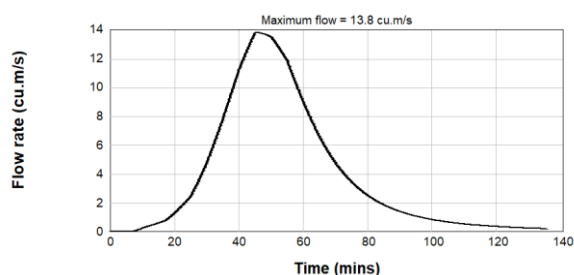


Figure E1: Pre-Development 1% AEP Inflow Hydrograph - Catchment 1

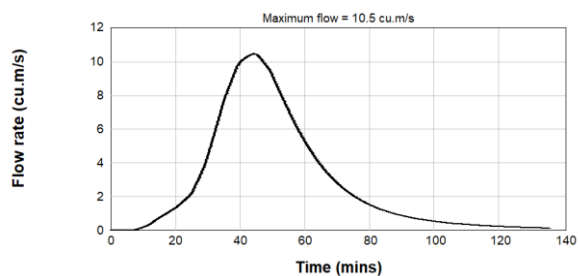


Figure E2: Pre-Development 1% AEP Inflow Hydrograph - Catchment 2

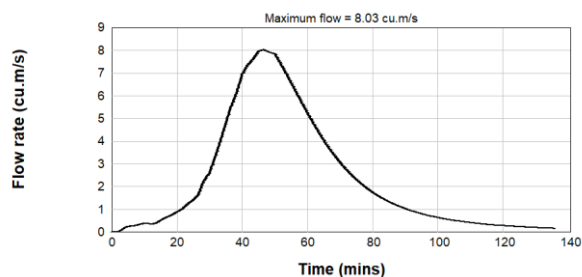


Figure E3: Pre-Development 1% AEP Inflow Hydrograph - Catchment 3

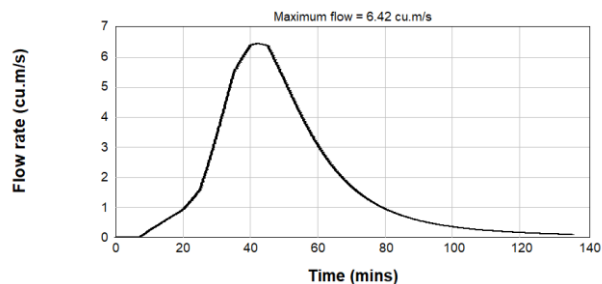


Figure E4: Pre-Development 1% AEP Inflow Hydrograph - Catchment 4

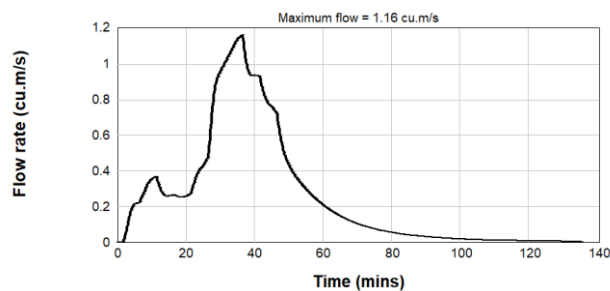


Figure E5: Pre-Development 1% AEP Inflow Hydrograph - Catchment 5

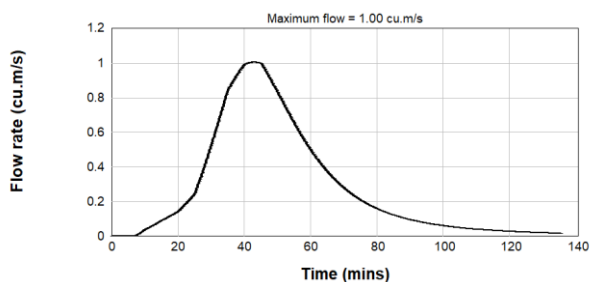


Figure E6: Pre-Development 1% AEP Inflow Hydrograph - Catchment 9

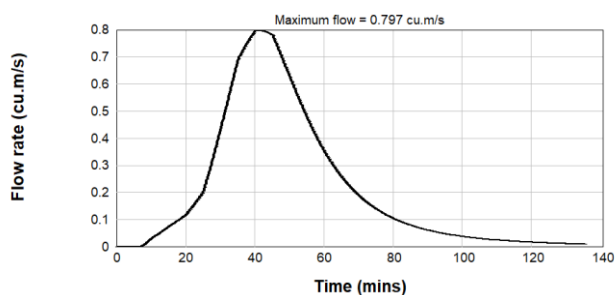


Figure E7: Pre-Development 5% AEP Inflow Hydrograph - Catchment 10

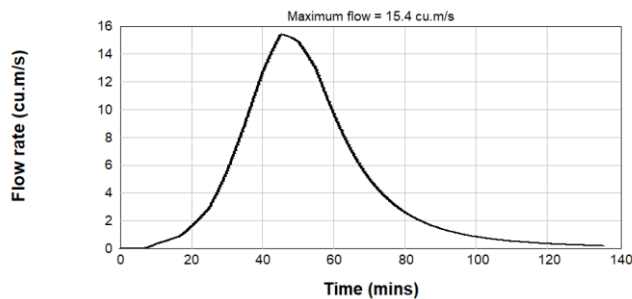


Figure E8: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 1

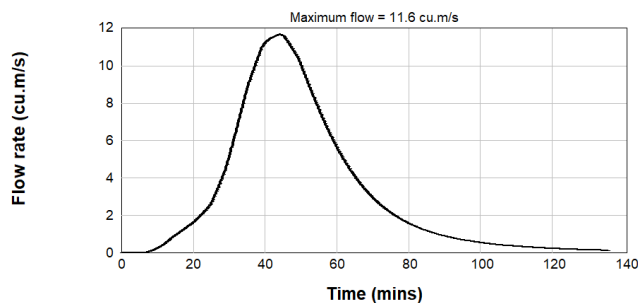


Figure E9: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 2

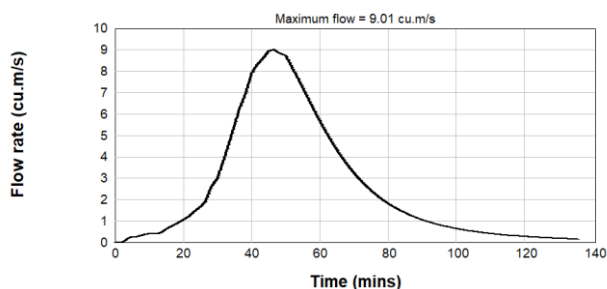


Figure E10: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 3

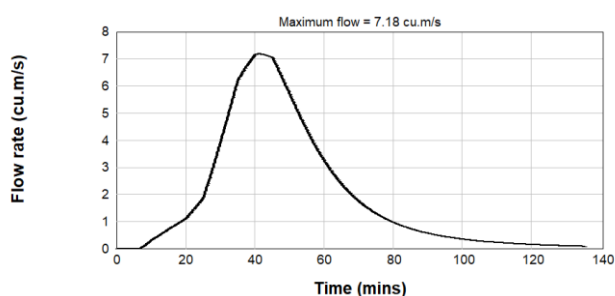


Figure E11: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 4

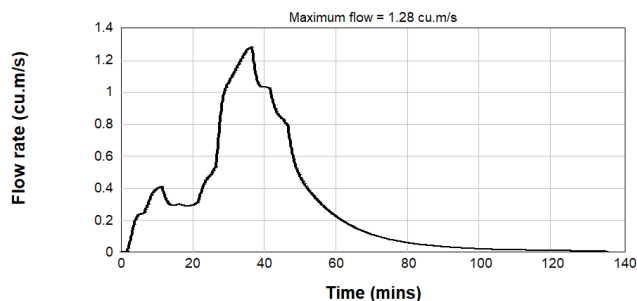


Figure E12: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 5

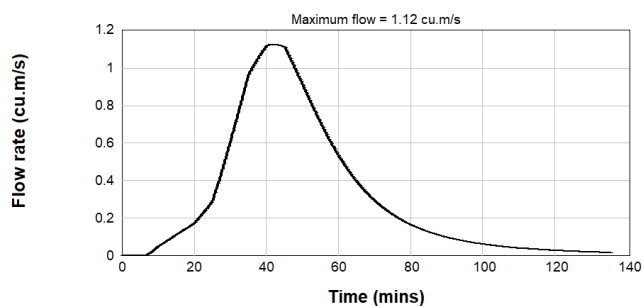


Figure E13: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 9

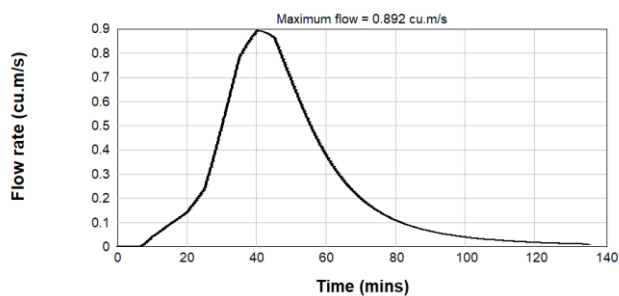


Figure E14: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 10

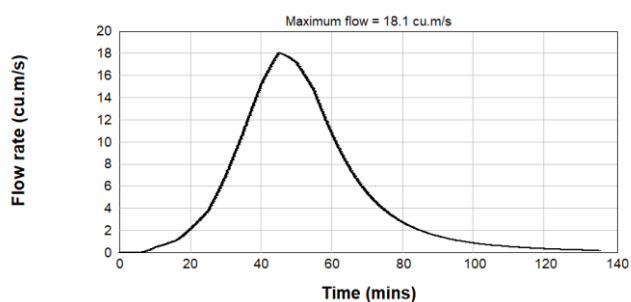


Figure E15: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 1

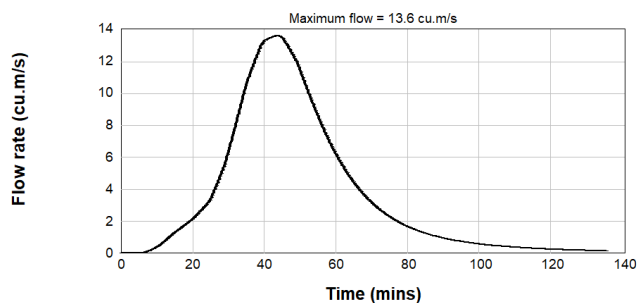


Figure E16: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 2

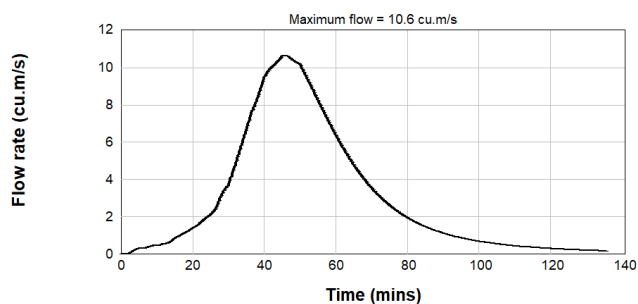


Figure E17: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 3

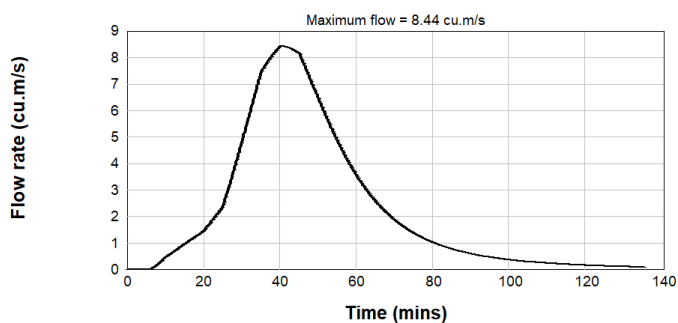


Figure E18: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 4

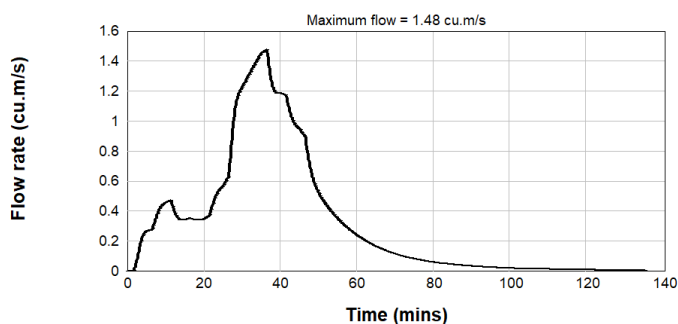


Figure E19: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 5

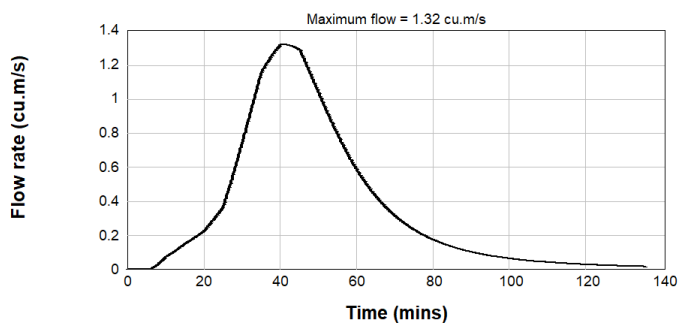


Figure E20: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 9

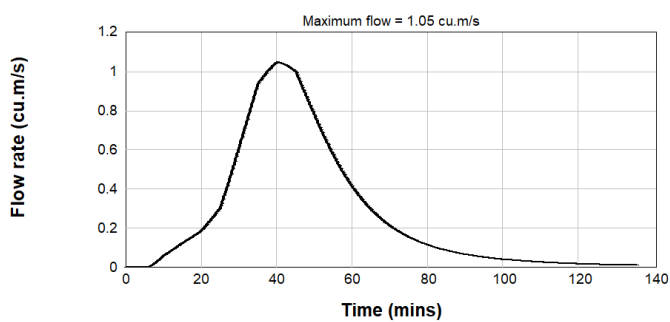


Figure E21: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 10

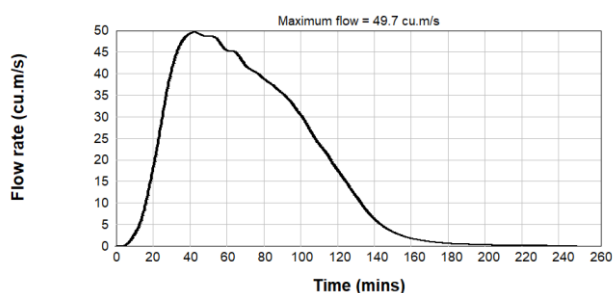


Figure E22: Pre-Development PMF Inflow Hydrograph - Catchment 1

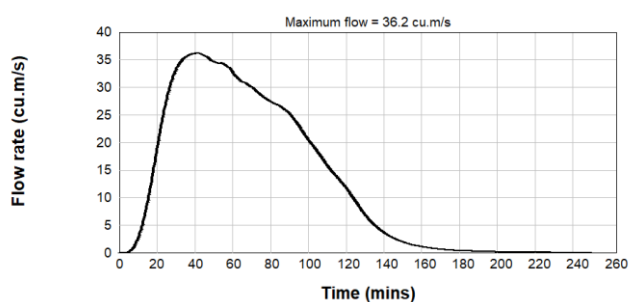


Figure E23: Pre-Development PMF Inflow Hydrograph - Catchment 2

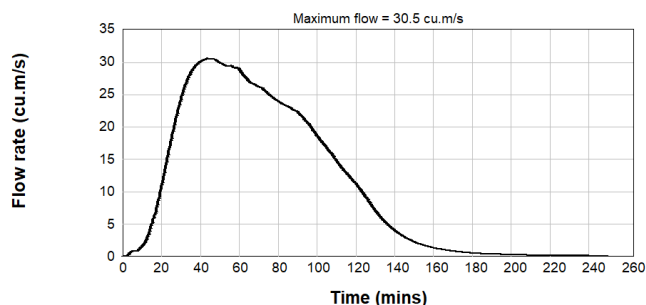


Figure E24: Pre-Development PMF Inflow Hydrograph - Catchment 3

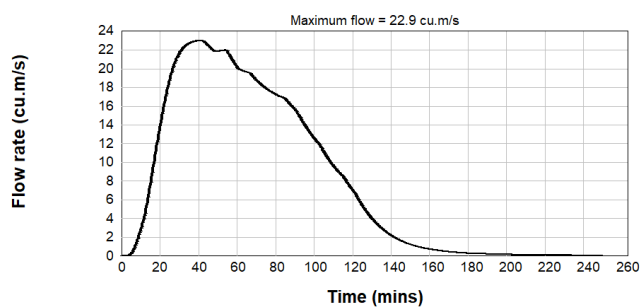


Figure E25: Pre-Development PMF Inflow Hydrograph - Catchment 4

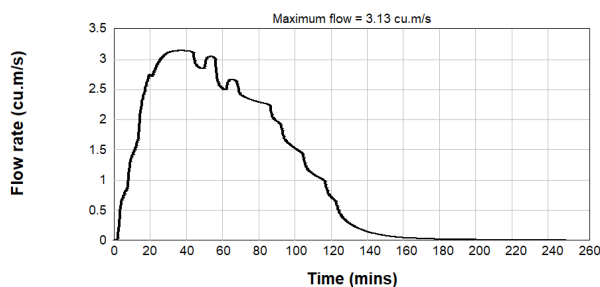


Figure E26: Pre-Development PMF Inflow Hydrograph - Catchment 5

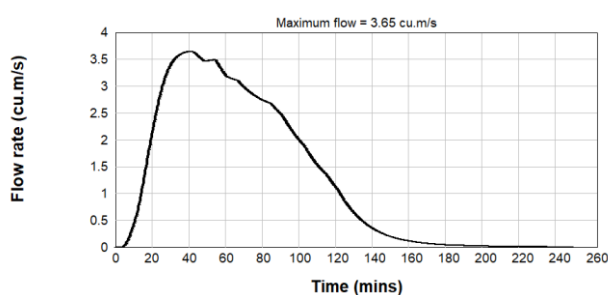


Figure E27: Pre-Development PMF Inflow Hydrograph - Catchment 9

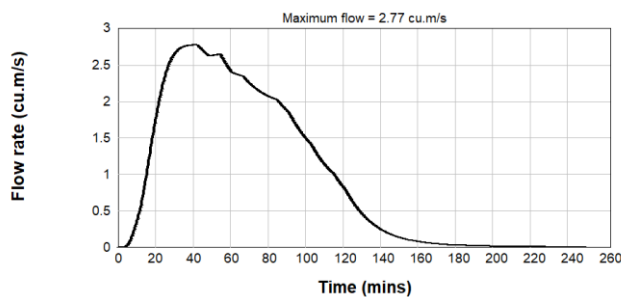


Figure E28: Pre-Development PMF Inflow Hydrograph - Catchment 10

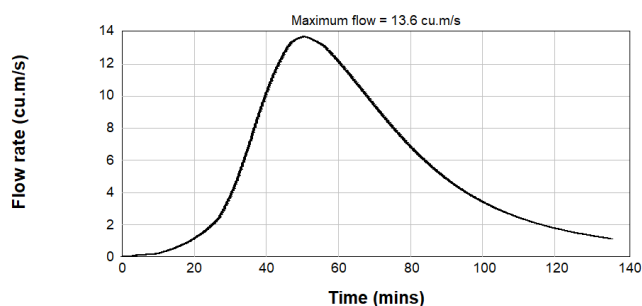


Figure E29: Post Development 1% AEP Inflow Hydrograph - Catchment 1

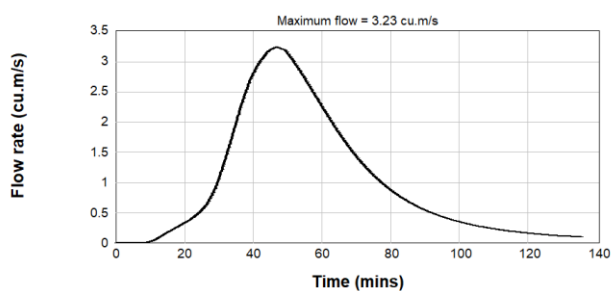


Figure E30 Post Development 1% AEP Inflow Hydrograph - Catchment 2

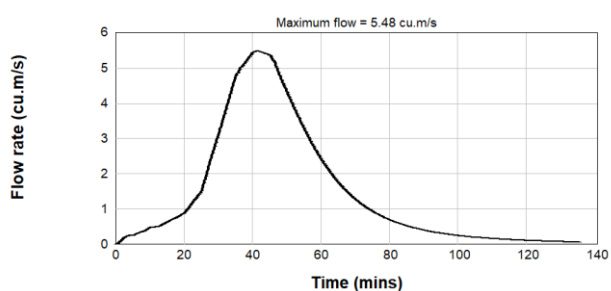


Figure E31: Post Development 1% AEP Inflow Hydrograph - Catchment 3

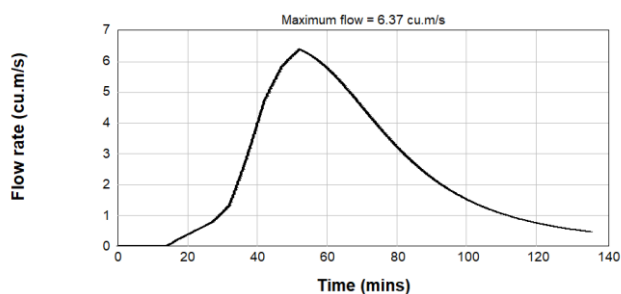


Figure E32: Post Development 1% AEP Inflow Hydrograph - Catchment 4

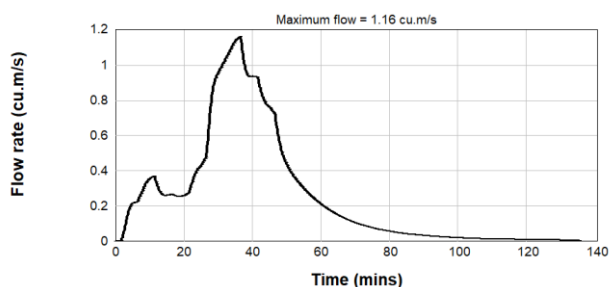


Figure E33: Post Development 1% AEP Inflow Hydrograph - Catchment 5

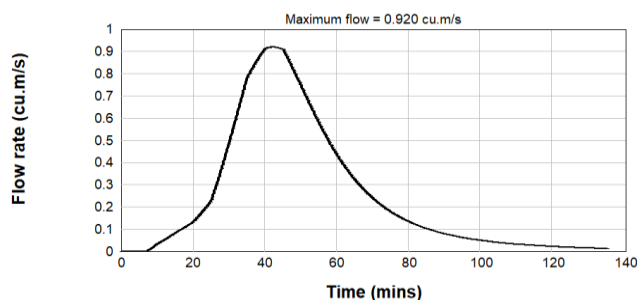


Figure E34: Post Development 1% AEP Inflow Hydrograph - Catchment Bypass 1

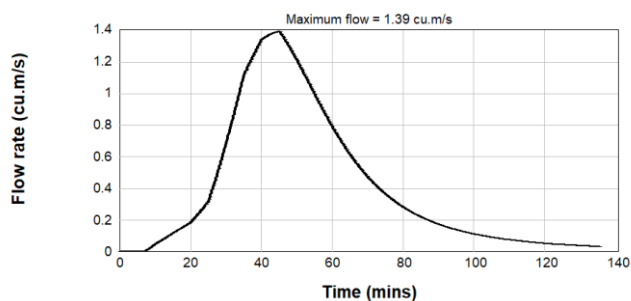


Figure E35: Post Development 1% AEP Inflow Hydrograph - Catchment Site

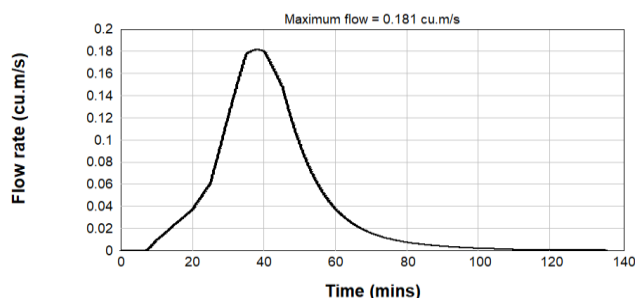


Figure E36: Post Development 1% AEP Inflow Hydrograph - Catchment Channel

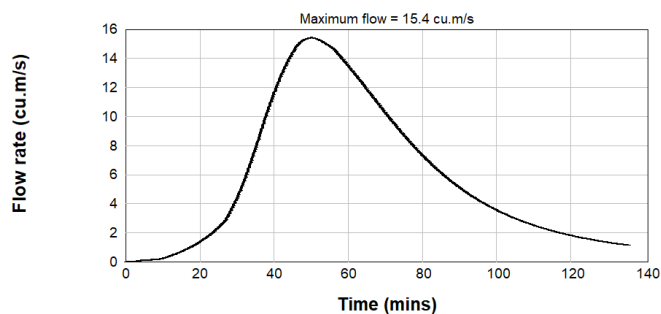


Figure E37: Post Development 0.5% AEP Inflow Hydrograph - Catchment 1

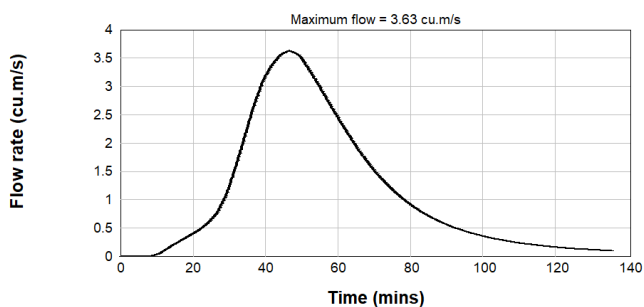


Figure E38: Post Development 0.5% AEP Inflow Hydrograph - Catchment 2

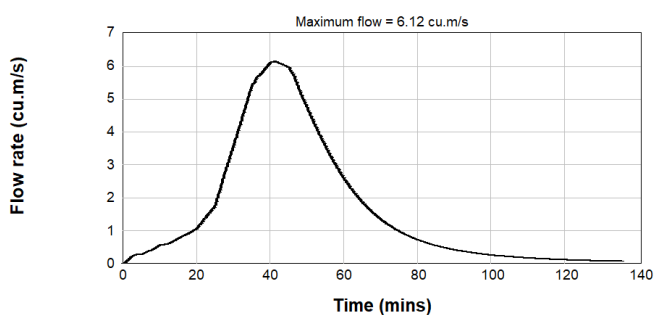


Figure E39: Post Development 0.5% AEP Inflow Hydrograph - Catchment 3

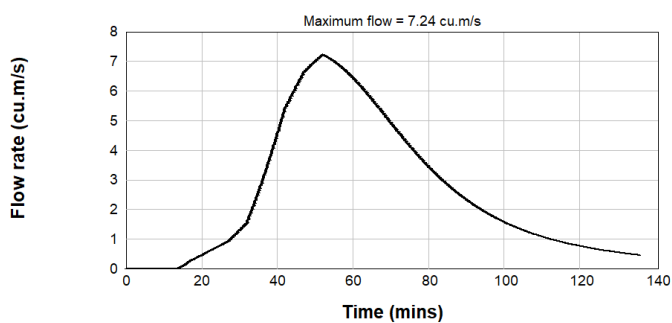


Figure E40: Post Development 0.5% AEP Inflow Hydrograph - Catchment 4

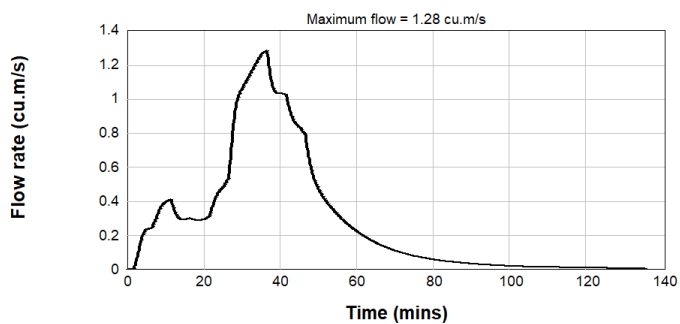


Figure E41: Post Development 0.5% AEP Inflow Hydrograph - Catchment 5

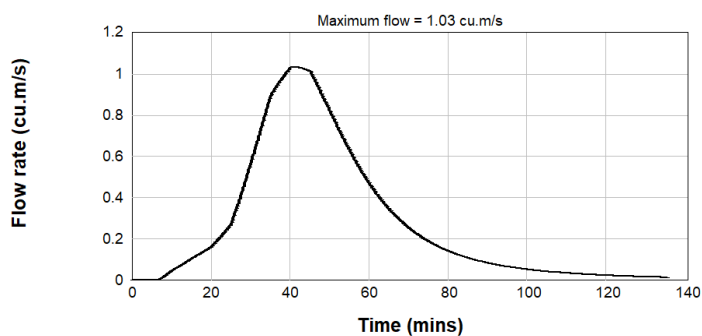


Figure E42: Post Development 0.5% AEP Inflow Hydrograph - Catchment Bypass 1

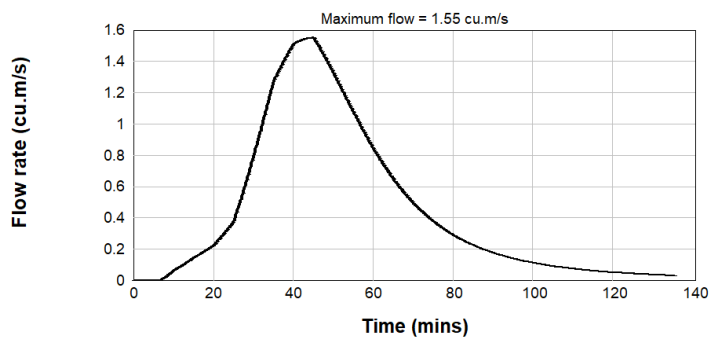


Figure E43: Post Development 0.5% AEP Inflow Hydrograph - Catchment Site

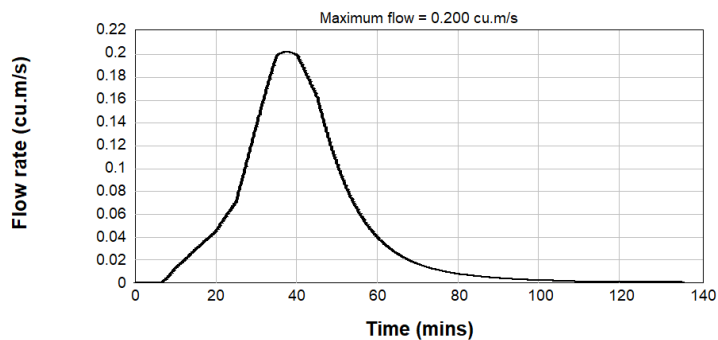


Figure E44: Post Development 0.5% AEP Inflow Hydrograph - Catchment Channel

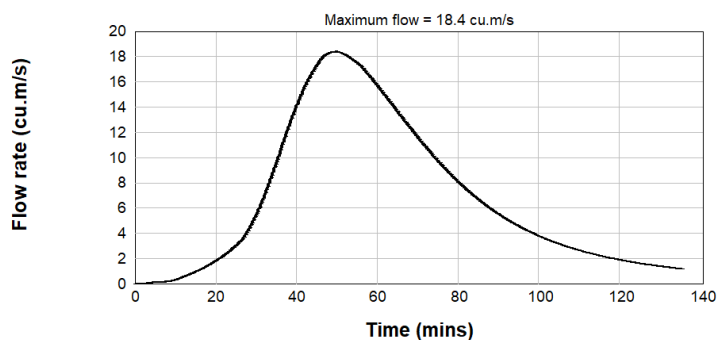


Figure E45: Post Development 0.2% AEP Inflow Hydrograph - Catchment 1

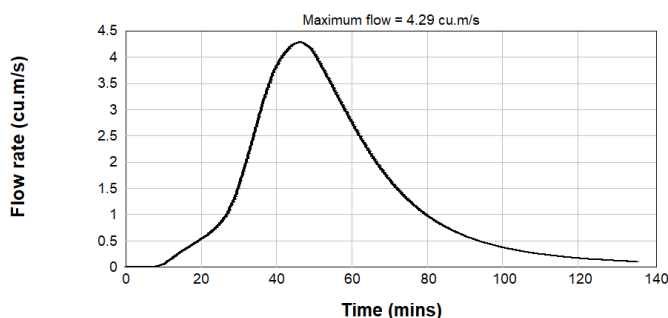


Figure E46: Post Development 0.2% AEP Inflow Hydrograph – Catchment 2

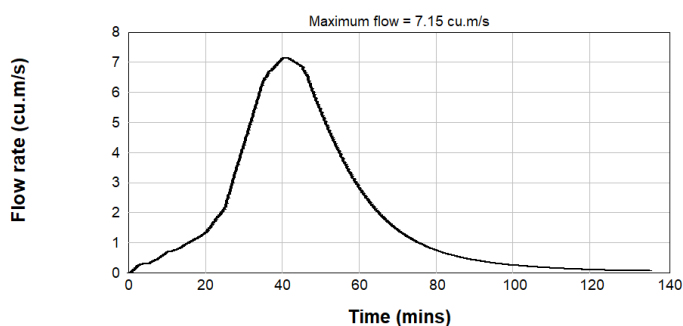


Figure E47: Post Development 0.2% AEP Inflow Hydrograph - Catchment 3

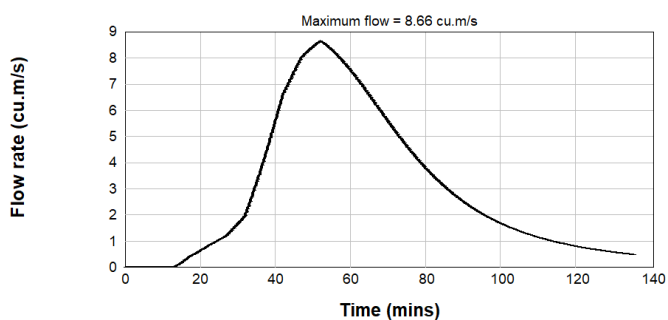


Figure E48: Post Development 0.2% AEP Inflow Hydrograph - Catchment 4

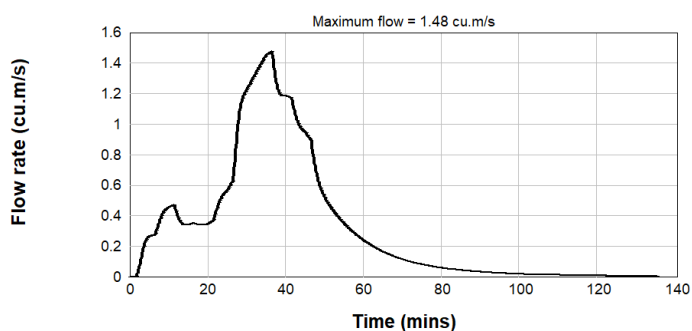


Figure E49: Post Development 0.2% AEP Inflow Hydrograph - Catchment 5

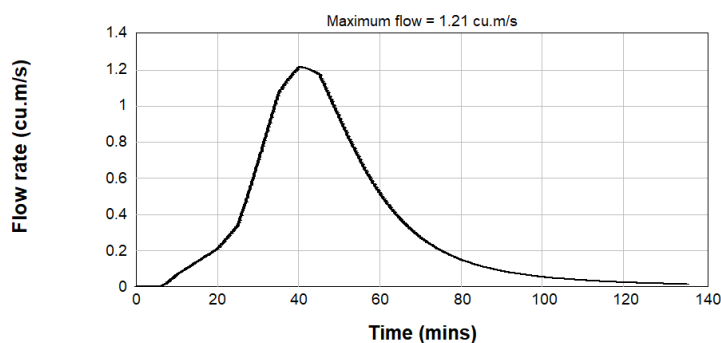


Figure E50: Post Development 0.2% AEP Inflow Hydrograph - Catchment Bypass 1

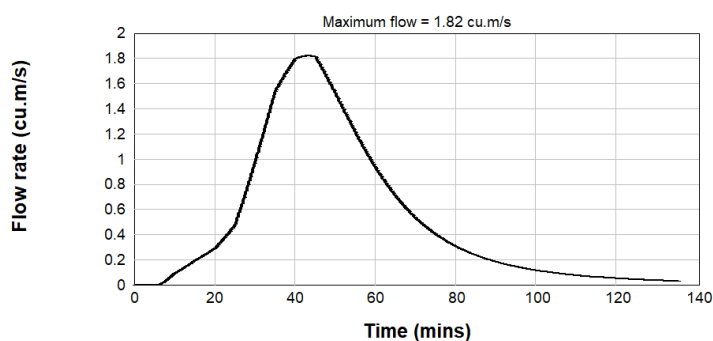


Figure E51: Post Development 0.2% AEP Inflow Hydrograph - Catchment Bypass 1

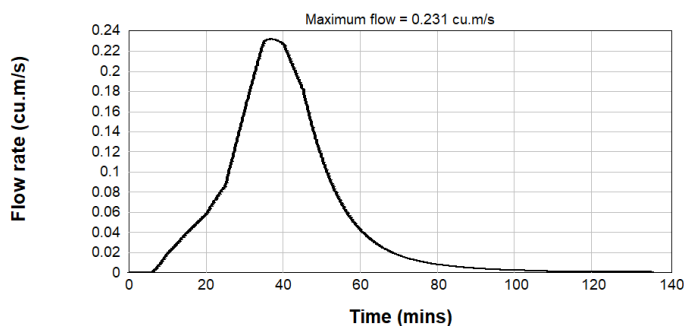


Figure E52: Post Development 0.2% AEP Inflow Hydrograph - Catchment Channel

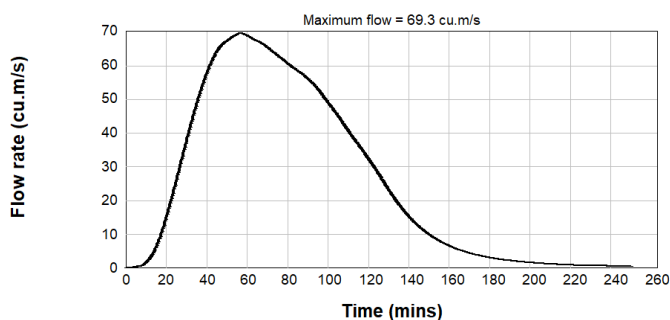


Figure E53: Post Development PMF Inflow Hydrograph - Catchment 1

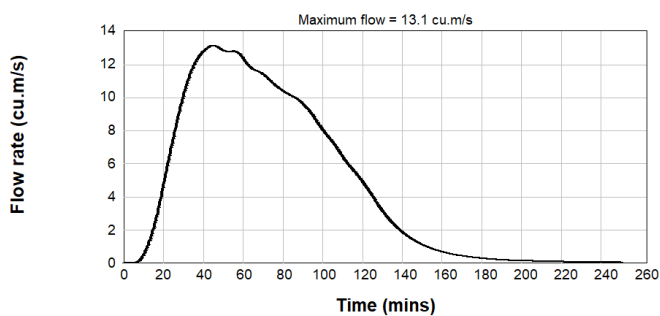


Figure E54: Post Development PMF Inflow Hydrograph - Catchment 2

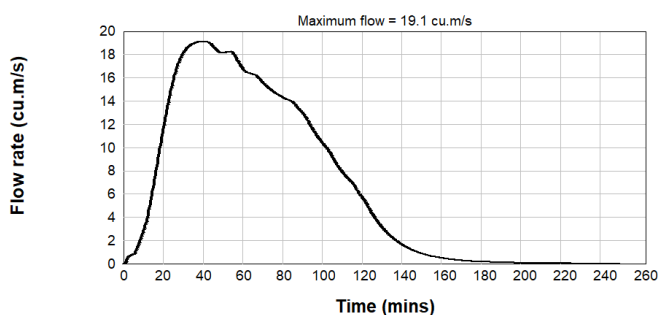


Figure E55: Post Development PMF Inflow Hydrograph - Catchment 3

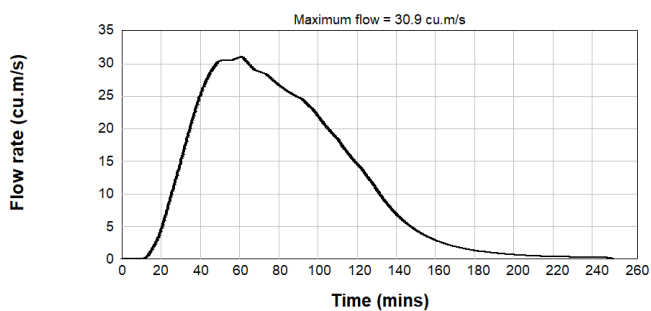


Figure E56: Post Development PMF Inflow Hydrograph - Catchment 4

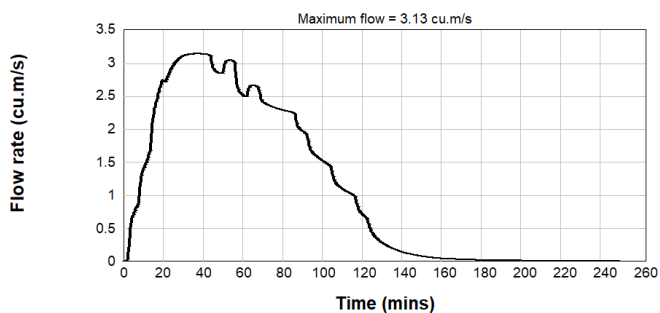


Figure E57: Post Development PMF Inflow Hydrograph - Catchment 5

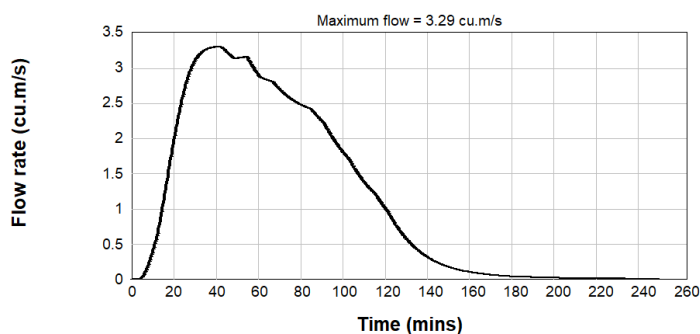


Figure E58: Post Development PMF Inflow Hydrograph - Catchment Bypass

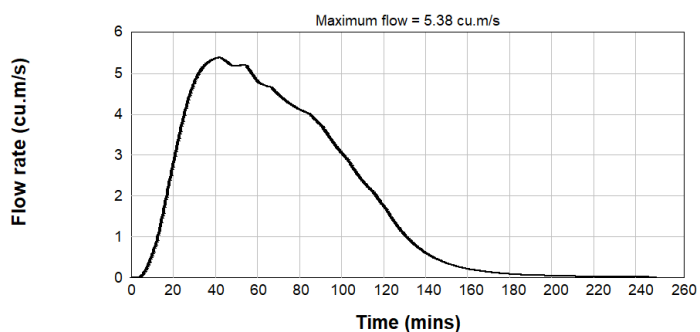


Figure E59 Post Development PMF Inflow Hydrograph - Catchment Site

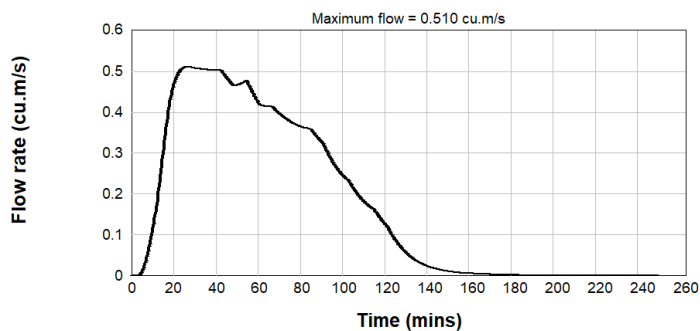


Figure E60: Post Development PMF Inflow Hydrograph - Catchment Channel

E.3 HYDRODYNAMIC MODEL DEVELOPMENT

E 3.1 Extent and Topography

Hydraulic modelling for this study was undertaken using the TUFLOW engine via the XPStorm-2D Software Platform. The modelled system is based on a 2D approach for the existing cases. The DTM was developed based on detailed survey and LiDAR data as discussed in **Section 8** of this report.

The water levels and flows are resolved on a rectangular grid. The TUFLOW model is based on a 3m grid cell size, which is an appropriately small cell size to define overland flow behaviour and the difference in the behaviour between modelled scenarios.

The model extent is shown in **Figure E3.1** of this report. The model begins approximately 500m upstream of the development and extending approximately 500m downstream of the development.

E.3.2 Boundary Conditions

Inflow Boundaries

Design inflow hydrographs for the model have been included at the location approximately 500m upstream of the site eastern boundary. Flows are based on hydrology as discussed in **Section 5.2** of this report.

The upstream boundary was located sufficiently upstream of the development to ensure the extent of predicted impacts from the development would be covered and any modelling iterations would be resolved clear of the development affectation zone.

Downstream Water Level Boundaries

The model extent has been continued for a distance of approximately 500m downstream of from the site northern boundary to a point north-west where the overland flow path converges with the South Creek floodplain . The downstream water level boundary has been modelled using the boundary South Creek flood levels provided by Worley Parsons. The modelled downstream boundary levels are provided in the **Table E3.1**.

AEP (%)	Downstream Boundary Level (m)
5	35.1
1	35.3
0.5	35.5
0.2	35.8
PMF	37.0

Table E3.1. Downstream Boundary Water Surface Levels

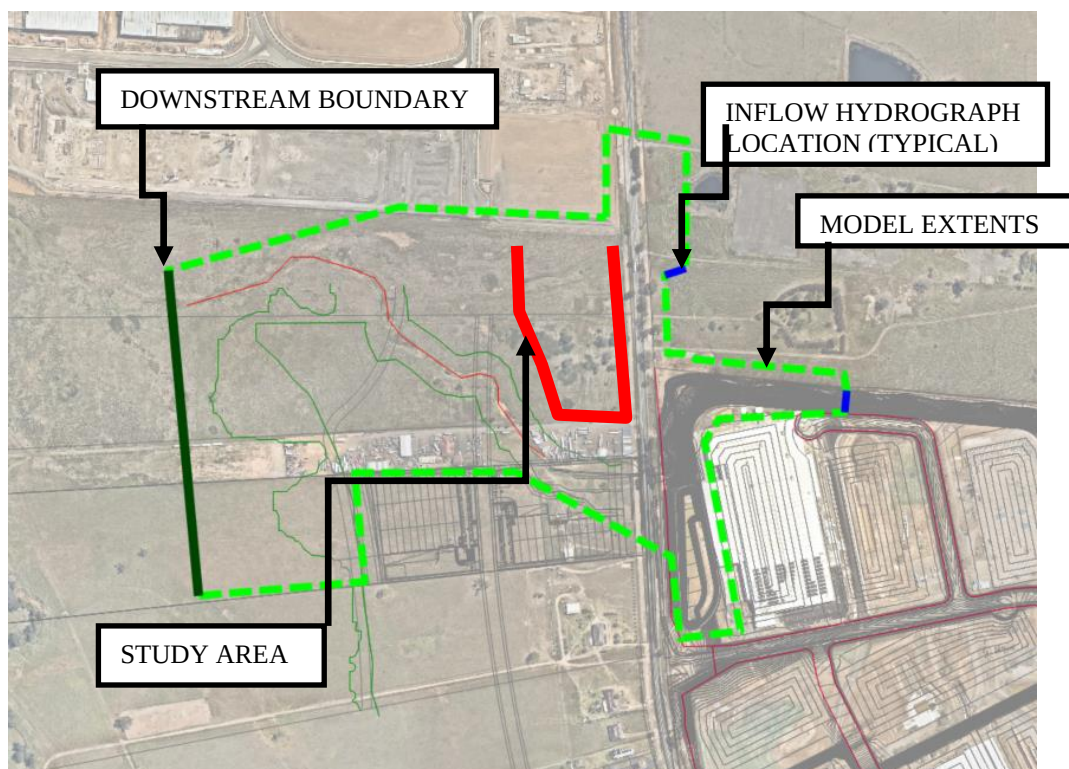


Figure E3.1: Pre-Development Model Extent and Model Boundary Locations

E.3.3 Channel and Floodplain Roughness

Roughness values adopted in the model are contained in **Table E2** below. These are generally consistent with previous studies completed within the Penrith Council area and have been adopted in this overland flow study.

Table E2. Adopted TUFLOW Element Roughness Values

Model Element	Description	Roughness Parameter Value
1	Trees / Vegetation	0.08
2	Grassed (Default)	0.04
3	Ponds	0.025
4	Roads	0.025
5	Hardstand	0.012
6	Buildings	(blockout)
7	Vegetated Channel	0.08

A figurative representation of where the above roughness values have been applied can be found in **Figures E3.2 & E3.3**.

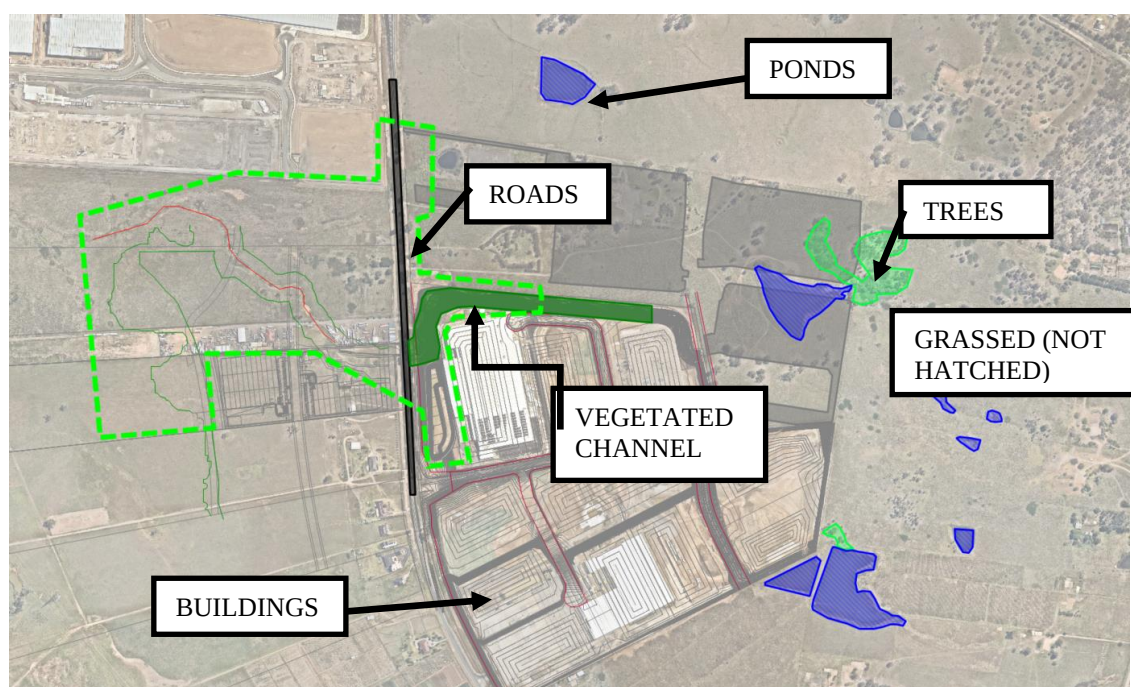
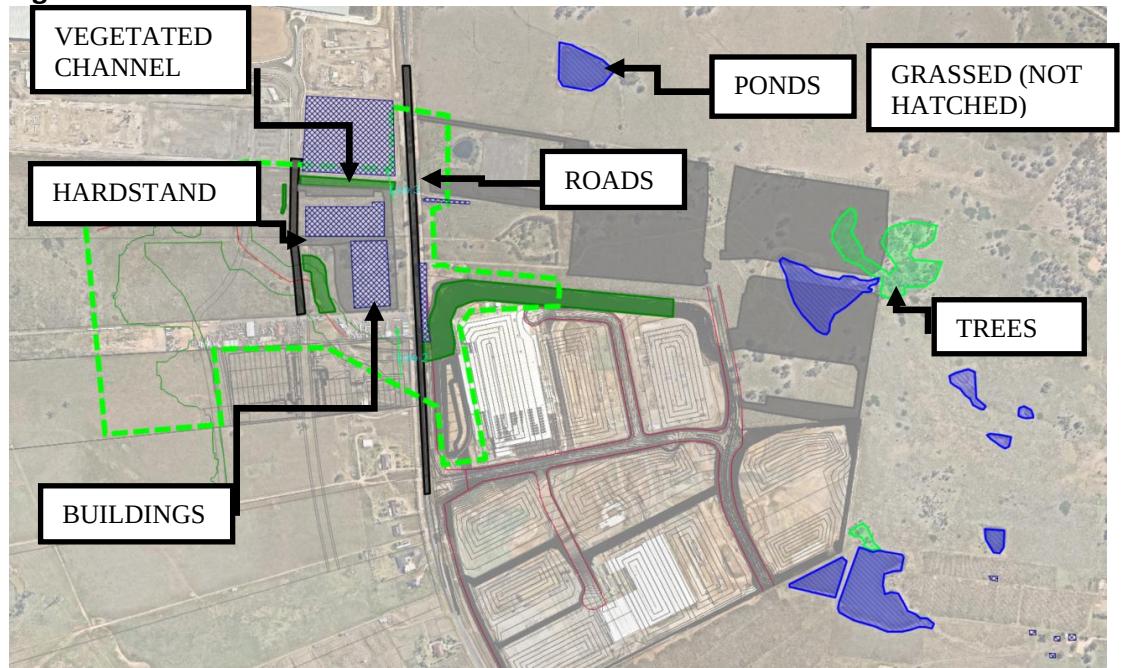


Figure E3.2: Manning's Roughness Surface Areas (Pre-Development)

Figure



E3.3: Manning's Roughness Surface Areas (Post-Development)

E.3.4 Model Validation

Model validation has been completed by comparing results of the TUFLOW modelling against the results contained in the Penrith Council study from 2006. Model parameters were adjusted as required to achieve acceptable agreement between the two model output. The process for the validation was as follows:

- Establish hydrology, peak flows and hydrograph for modelled events;
- Establish TUFLOW Model using defined parameters;
- Compare results of TUFLOW modelling with the Penrith Council Figures including flood depths, flood levels, flood extents and hydraulics. The comparison is made at the peak of the predicted parameters;
- Adjust roughness factors to align TUFLOW flood extent to align with the Penrith Council Results.

Hydrology and peak flows were established as described in **Section E.2.2** of this report.

A number of trial models and iterations of the TUFLOW model were performed. Adjustment of roughness parameters were used to align the flood levels with those compiled in the council figures.

The comparison of the flood level results shows good alignment of those produced in the TUFLOW model when compared with those of the council figures. Flood water levels were seen to have a difference less than 0.1m and generally in the order of 0.025-0.05m through the study area. The predicted flood extent is consistent between the two models for the flood event modelled.

Given the differences in modelling techniques, parameters, predicted model accuracy ($\pm 0.2\text{m}$) and model components these differences are considered acceptable for the base model and for continuation of post-developed scenario modelling.

E.3.5 Proposed Overland Flow Management Strategy

Flows from within the development sites have been only considered in the sizing of the stormwater system and erosion control for the development sites. The proposed buildings will be set at the 1% AEP level plus 0.5m freeboard per council policy.

Penrith City Council require that flows from the upstream catchment to be conveyed through the site. Council also requires proof that the proposed development does not increase the flood risk to the surrounding properties. Further, the TUFLOW modelling and assessment confirms there is negligible impact on upstream, downstream and/ or adjoining sites as a result of the proposed developments.

As part of the Stage 1 development, conveyance is proposed via an underground culvert system and open channel. In the Stage 2 development, when surrounding development sites are also developed, runoff from the upstream catchment is expected to comprise inground system which follows proposed precinct roads and trunk drainage defined in the Mamre Precinct DCP. This flood assessment does not consider the surrounding sites to be fully developed with temporary open channels in place in lieu of an in-ground drainage system.

E.5 FLOOD ASSESSMENT DISCUSSION

This Appendix to the *Civil Engineering Report* for 771 Mamre Road, Kemps Creek, NSW, has been prepared to assess the effect of flooding on the proposed development, and also to confirm no affectation on upstream downstream or adjoining properties. Further the assessment was also completed to ensure that sufficient flood conveyance are available, post development, during the 1%, 0.5%, 0.2% AEP and PMF flood event.

A TUFLOW hydrodynamic flood model has been completed and the pre and post development flood events assessed for the 1%, 0.5%, 0.2% AEP and PMF rainfall event.

This Appendix confirms the technical input and detailed output completed as part of the assessment. **Appendix E** is to be read in conjunction with **Section 8** of this report.

Appendix E2

FLOOD ASSESSMENT FIGURES

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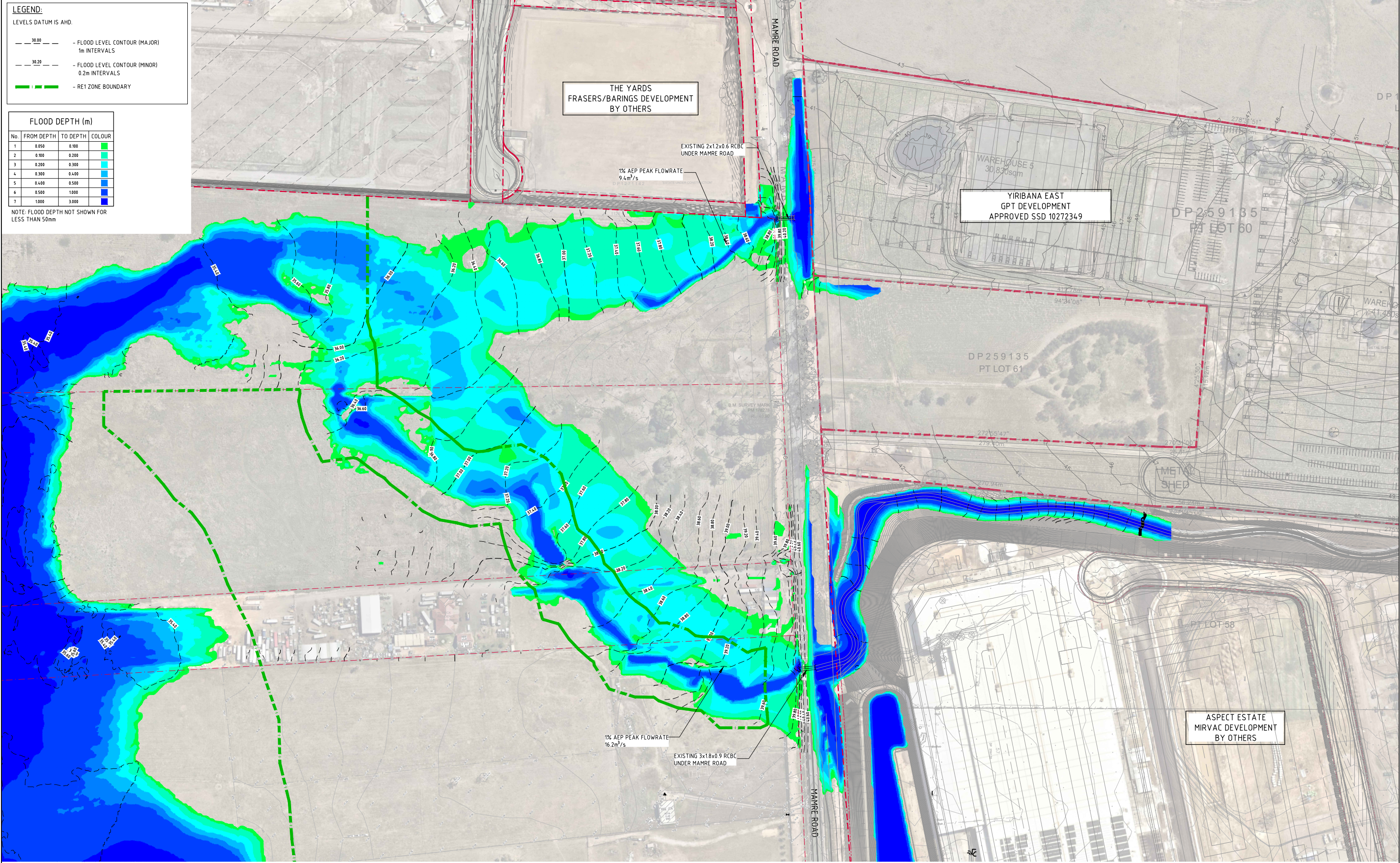
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1m INTERVALS

— 38.20 — - FLOOD LEVEL CONTOUR (MINOR)
0.2m INTERVALS

— — — - RE1 ZONE BOUNDARY

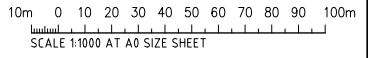
FLOOD DEPTH (m)			
No.	FROM DEPTH	TO DEPTH	COLOUR
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2	0.100	0.200	Light Green
3	0.200	0.300	Yellow
4	0.300	0.400	Orange
5	0.400	0.500	Red
6	0.500	1.000	Dark Red
7	1.000	3.000	Blue

NOTE: FLOOD DEPTH NOT SHOWN FOR LESS THAN 50mm

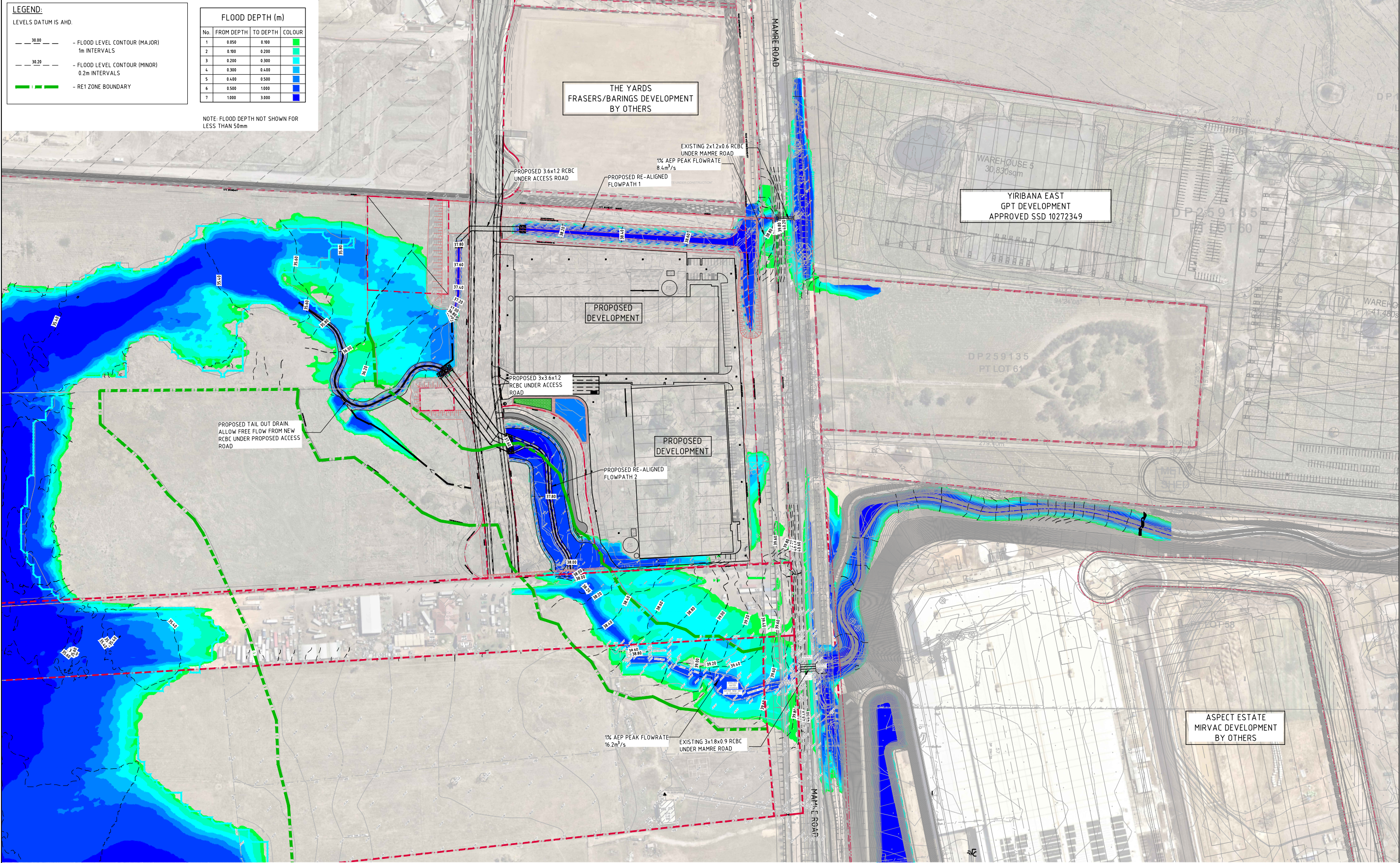


 1% AEP PRE DEVELOPMENT LEVELS & DEPTHS-45 MIN DURATION
SCALE 1:1000

FOR INFORMATION ONLY



								PROJECT YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW				CUSTOMER GPT The GPT Group				ARCHITECT SBA ARCHITECTS 112 Pitt Street, Sydney NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au w: costinroe.com.au				CONSULTANT CONSULT AUSTRALIA Costin Roe Consulting Pty Ltd. ABN 50 003 696 446 PO Box 2419 Sydney NSW 1220 Level 4 & 8 Woodville Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au w: costinroe.com.au				CRC COSTIN ROE CONSULTING CIVIL & STRUCTURAL ENGINEERS				DRAWING TITLE 1% AEP PRE DEVELOPMENT FLOOD LEVELS AND DEPTHS 45 MIN CRITICAL DURATION DRAWING No. C014429.00-F01			
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ISSUED FOR INFORMATION				16.12.22				A																							
AMENDMENTS				DATE				ISSUE				AMENDMENTS				DATE				ISSUE											



 1% AEP POST DEVELOPMENT LEVELS & DEPTHS-45 MIN DURATION
SCALE 1:1000

FOR INFORMATION ONLY

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ISSUED FOR INFORMATION				25.07.23				B			
ISSUED FOR INFORMATION				16.12.22				A			
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FLOOD LEVEL CONTOUR (MAJOR)
1m INTERVALS

38.20

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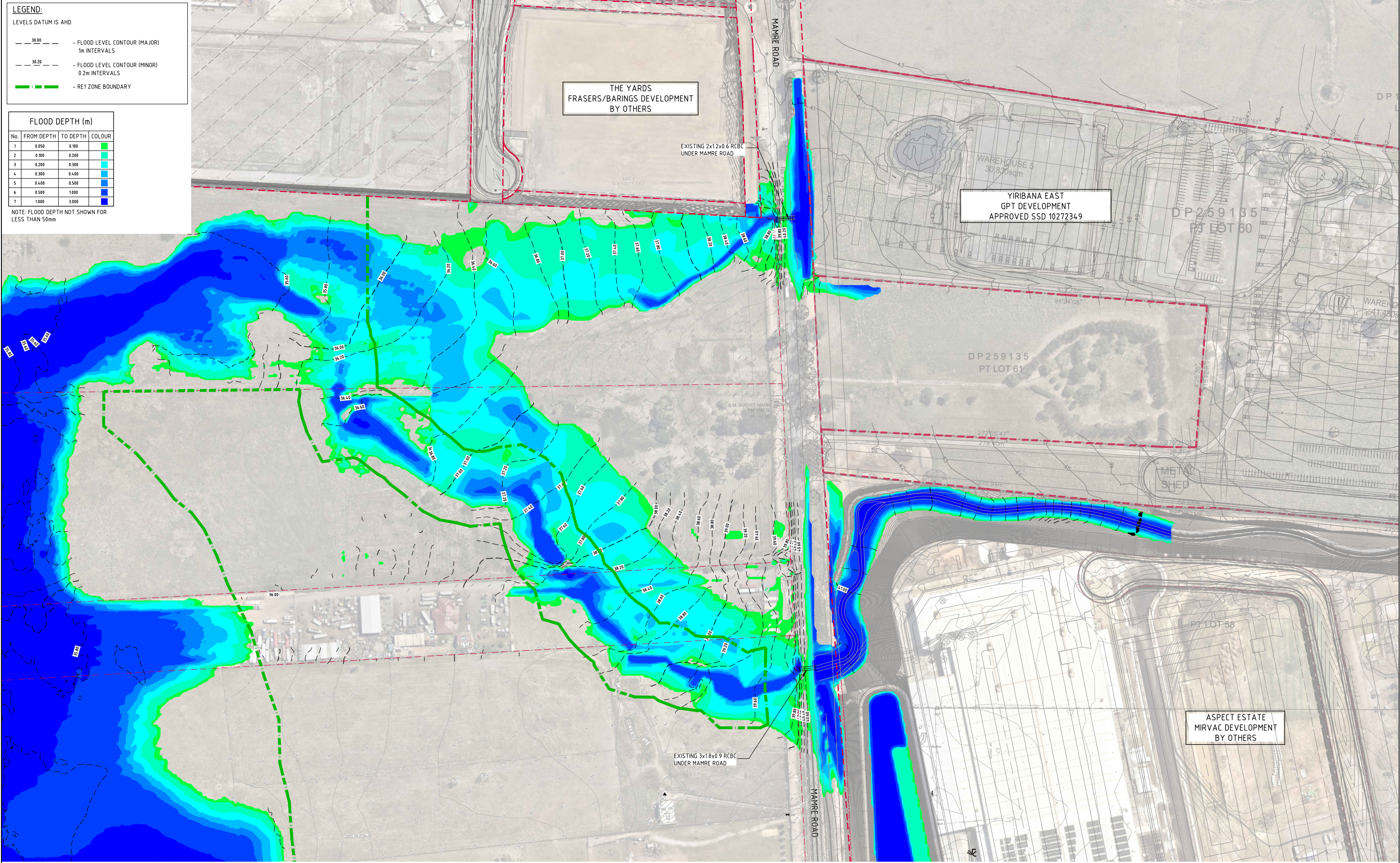
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RE1 ZONE BOUNDARY

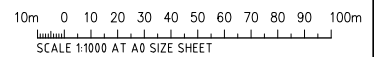
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3	0.200	0.300	
4	0.300	0.400	
5	0.400	0.500	
6	0.500	1.000	
7	1.000	3.000	

NOTE: FLOOD DEPTH NOT SHOWN FOR LESS THAN 50mm

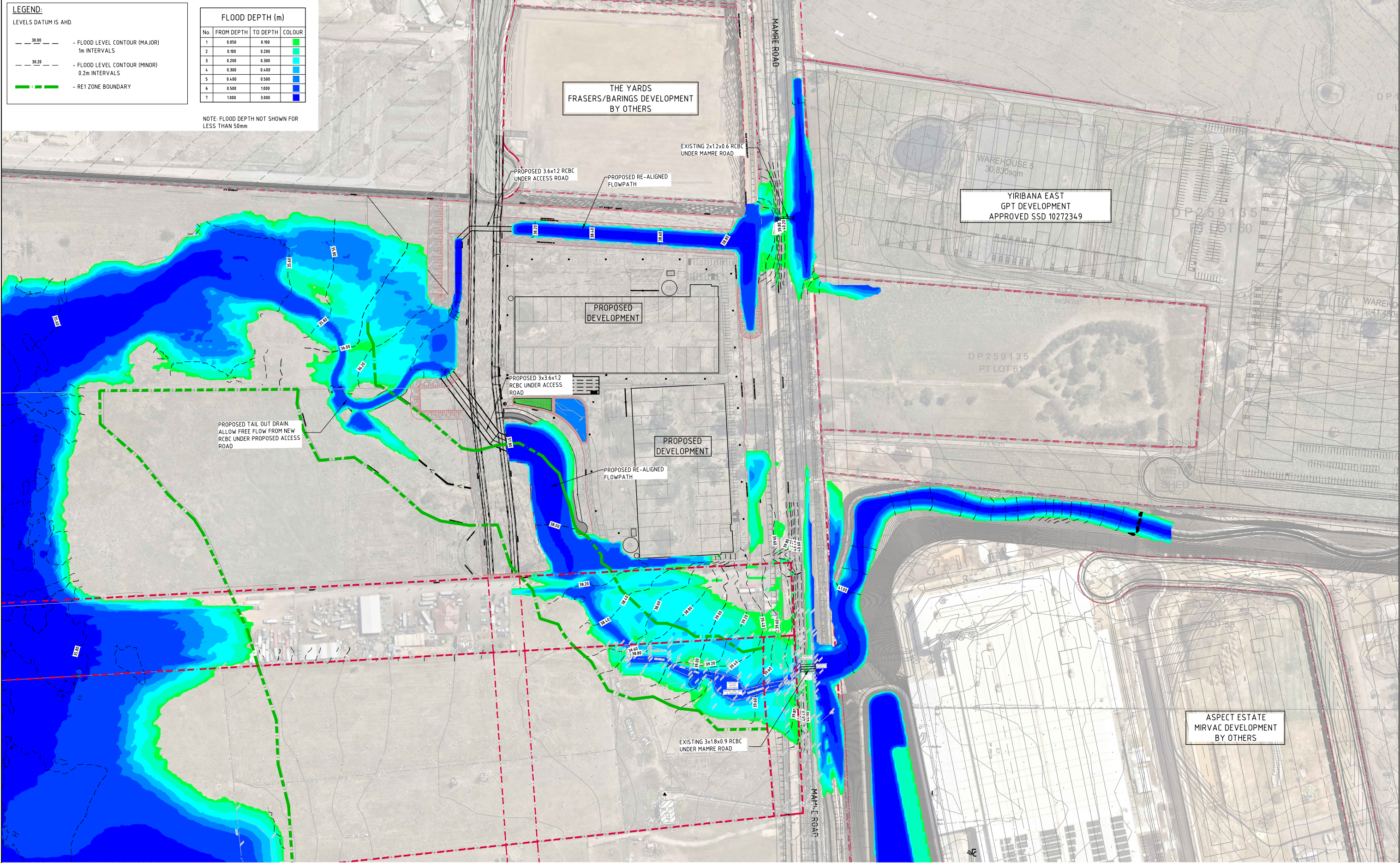


 0.5% AEP PRE DEVELOPMENT LEVELS & DEPTHS-45 MIN DURATION
SCALE 1:1000

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						PROJECT YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW			ARCHITECT  SBA ARCHITECTS Scale 1:50, 40 Stuart Street, North Sydney NSW 2060 +61 2 9251 7699 +61 2 9251 7699 mail@sbarchitects.com.au www.sbabrarchitects.com.au			CUSTOMER  GPT The GPT Group			PROJECT YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW			CONSULTANT  COSTIN ROE CONSULTING PTY LTD. ABN 50 003 696 446 PO Box 2419 Sydney NSW 1220 Louis & R Woodhill Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au w: costinroe.com.au Costin Roe Consulting Pty Ltd.			CRC  COSTIN ROE CONSULTING CIVIL & STRUCTURAL ENGINEERS			DRAWING TITLE 0.5% AEP PRE DEVELOPMENT FLOOD LEVELS AND DEPTHS 45 MIN CRITICAL DURATION DRAWING No. C01429.00-F04		
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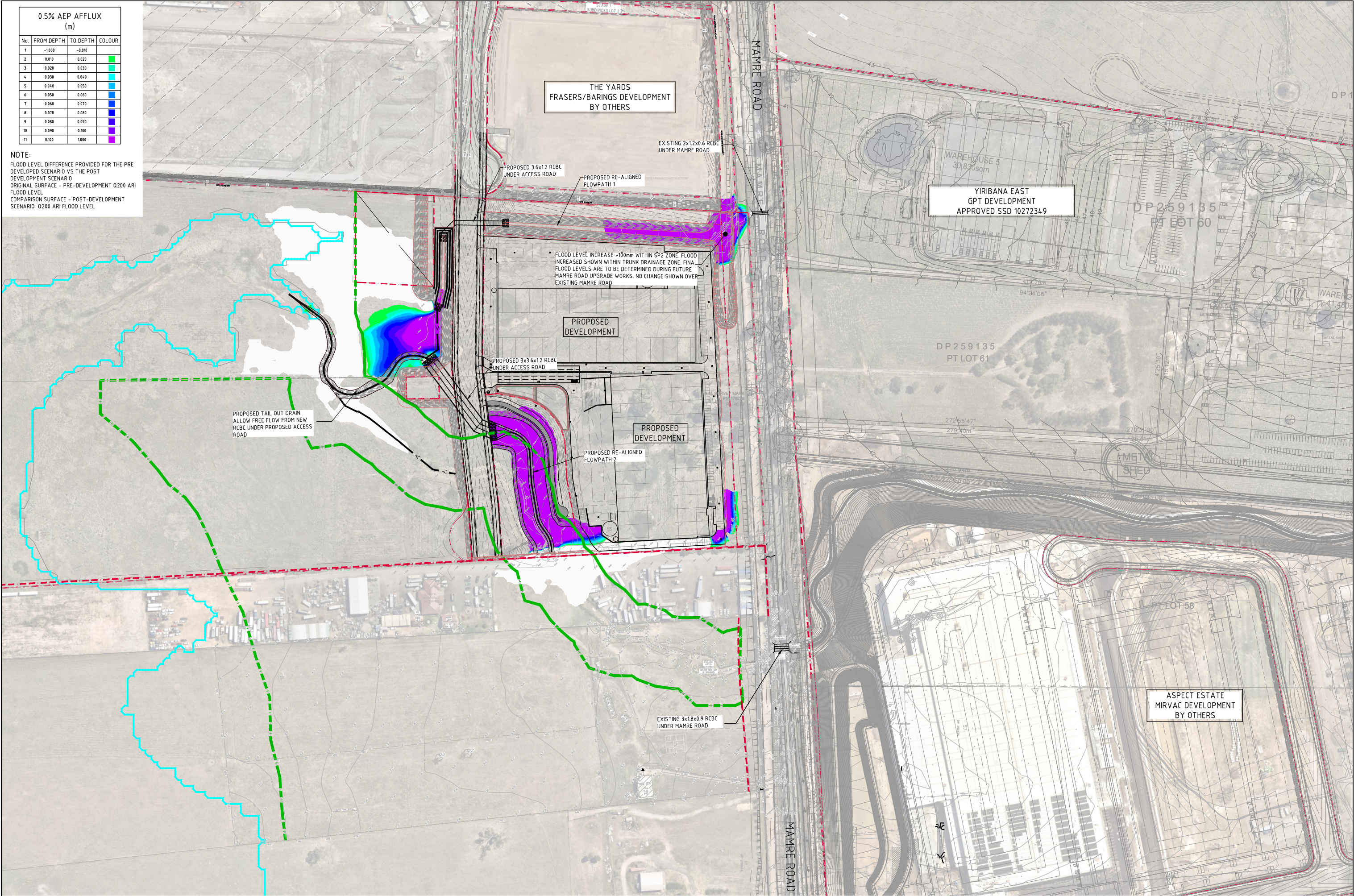
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ISSUED FOR INFORMATION			16.12.22			A																				
AMENDMENTS			DATE			ISSUE			AMENDMENTS			DATE			ISSUE			AMENDMENTS			DATE			ISSUE		

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5	0.040	0.050	Dark Blue
6	0.050	0.060	Dark Blue
7	0.060	0.070	Dark Blue
8	0.070	0.080	Dark Blue
9	0.080	0.090	Dark Blue
10	0.090	0.100	Dark Blue
11	0.100	1.000	Dark Blue

NOTE:
FLOOD LEVEL DIFFERENCE PROVIDED FOR THE PRE DEVELOPED SCENARIO VS THE POST DEVELOPMENT SCENARIO
ORIGINAL SURFACE - PRE-DEVELOPMENT Q200 ARI FLOOD LEVEL
COMPARISON SURFACE - POST-DEVELOPMENT SCENARIO Q200 ARI FLOOD LEVEL



0.5% AEP FLOOD AFFLUX PLAN - 45 MIN CRITICAL DURATION LOCAL EVENT
SCALE 1:1000

FOR INFORMATION ONLY

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771-797 MAMRE ROAD				KEMPS CREEK, 2178, NSW				COSTIN ROE CONSULTING			
PO Box 2419 Sydney NSW 1220				Level 4 & 5 Woodhill Street, Millers Point NSW 2000				CRC			
p: +61 2 9251 7699				e: mail@costinroe.com.au				CIVIL & STRUCTURAL ENGINEERS			
e: mail@costinroe.com.au				w: costinroe.com.au				DRAWING TITLE			
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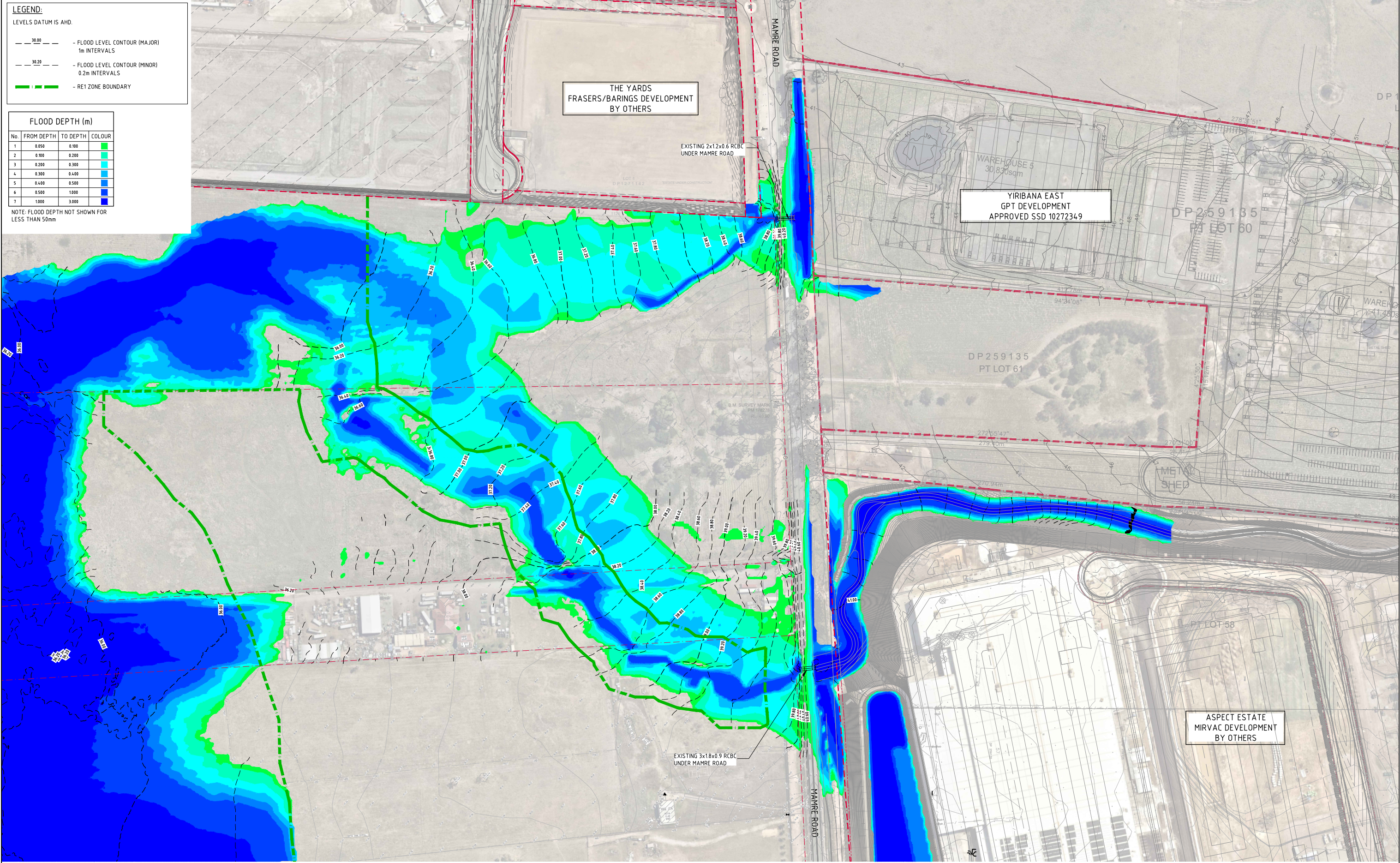
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1m INTERVALS

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0.2m INTERVALS

— — — - RE1 ZONE BOUNDARY

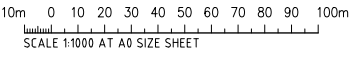
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2	0.100	0.200	Light Green
3	0.200	0.300	Yellow
4	0.300	0.400	Orange
5	0.400	0.500	Red
6	0.500	1.000	Dark Red
7	1.000	3.000	Blue

NOTE: FLOOD DEPTH NOT SHOWN FOR LESS THAN 50mm

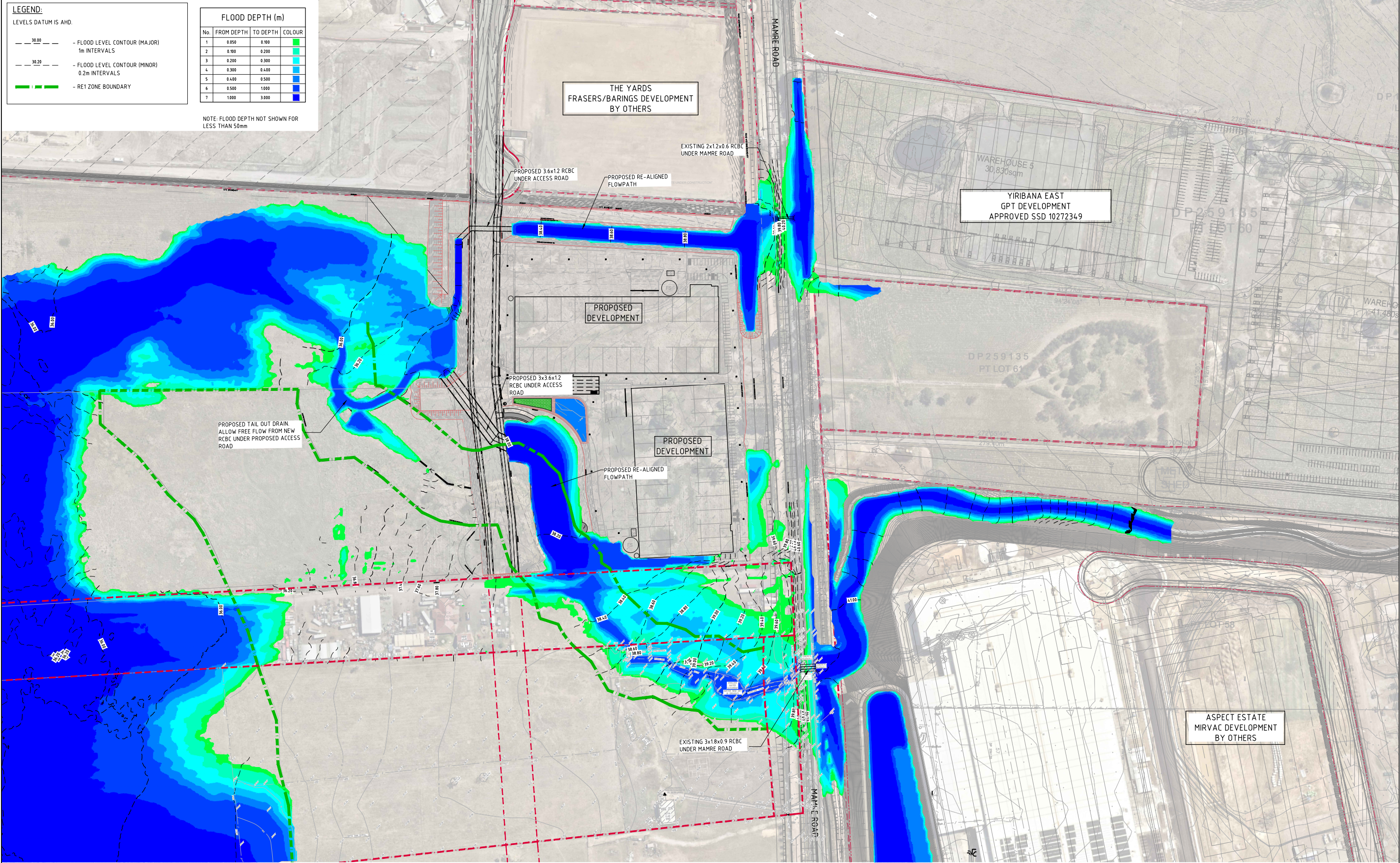


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SCALE 1:1000

FOR INFORMATION ONLY



						ARCHITECT  SBA ARCHITECTS Suite 101, 45 Mount Street, North Sydney NSW 1585 Tel: 02 9550 1234 E: info@sba.com.au W: www.sba.com.au			CLIENT  GPT The GPT Group			PROJECT YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW			 CONSULT AUSTRALIA Costin Roe Consulting Pty Ltd. ABN 90 003 099 444 PO Box 2419 Sydney NSW 1220 Level 4, 8 Woodville Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au w: costinroe.com.au			 CRC COSTIN ROE CONSULTING CIVIL & STRUCTURAL ENGINEERS			DRAWING TITLE 0.2% AEP PRE DEVELOPMENT FLOOD LEVELS AND DEPTHS 45 MIN CRITICAL DURATION																					
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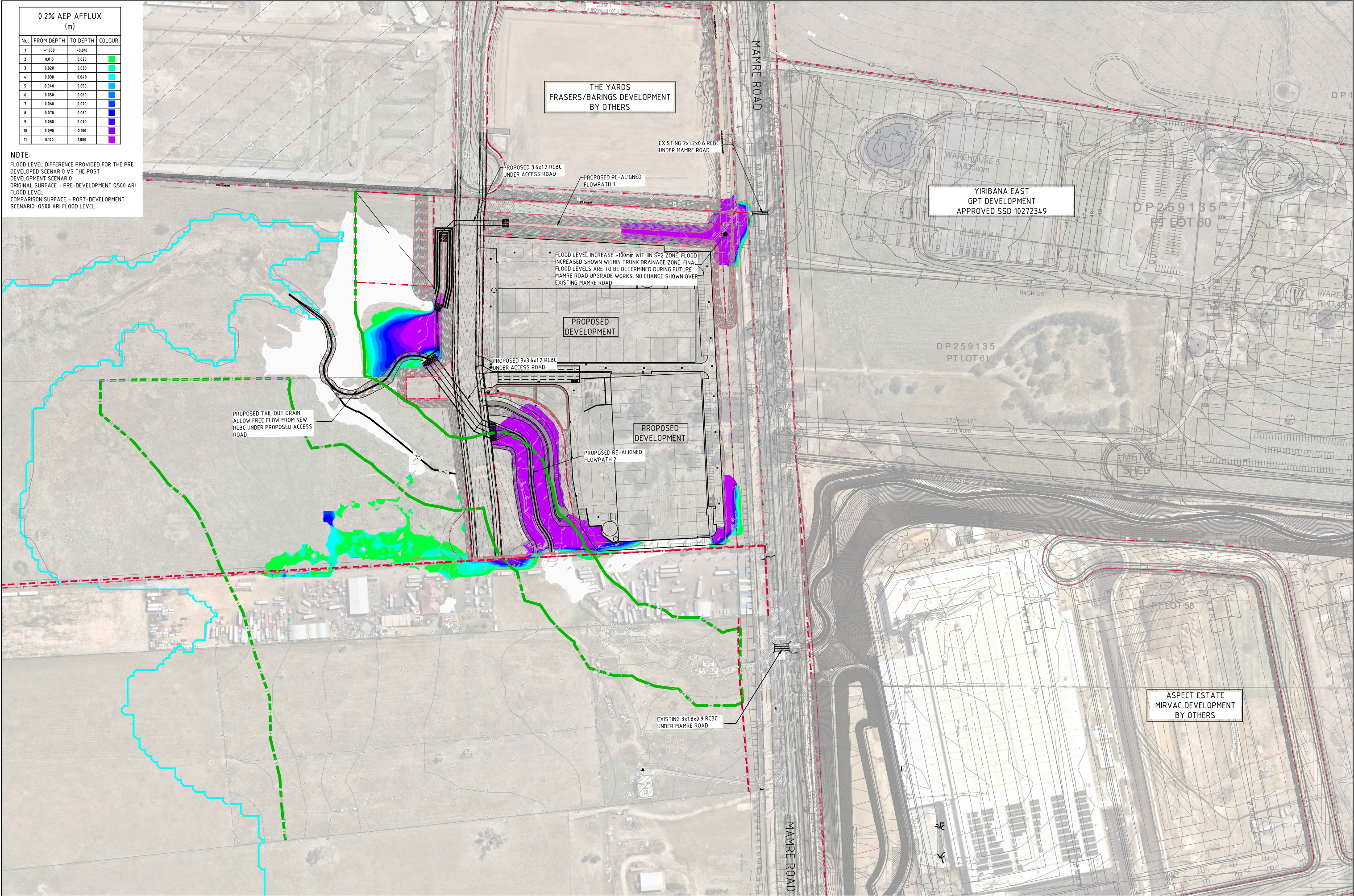
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0.2% AEP AFFLUX (m)			
No.	FROM DEPTH	TO DEPTH	COLOUR
1	-1.000	-0.910	
2	0.010	0.020	
3	0.020	0.030	
4	0.030	0.040	
5	0.040	0.050	
6	0.050	0.060	
7	0.060	0.070	
8	0.070	0.080	
9	0.080	0.090	
10	0.090	0.100	
11	0.100	1.000	

NOTE:
FLOOD LEVEL DIFFERENCE PROVIDED FOR THE PRE DEVELOPED SCENARIO VS THE POST DEVELOPMENT SCENARIO
ORIGINAL SURFACE - PRE-DEVELOPMENT 0500 ARI FLOOD LEVEL
COMPARISON SURFACE - POST-DEVELOPMENT SCENARIO 0500 ARI FLOOD LEVEL



0.2% AEP FLOOD AFFLUX PLAN - 45 MIN CRITICAL DURATION LOCAL EVENT
SCALE 1:1000

FOR INFORMATION ONLY

10m 0 10 20 30 40 50 60 70 80 90 100m
SCALE 1:1000 AT A0 SIZE SHEET

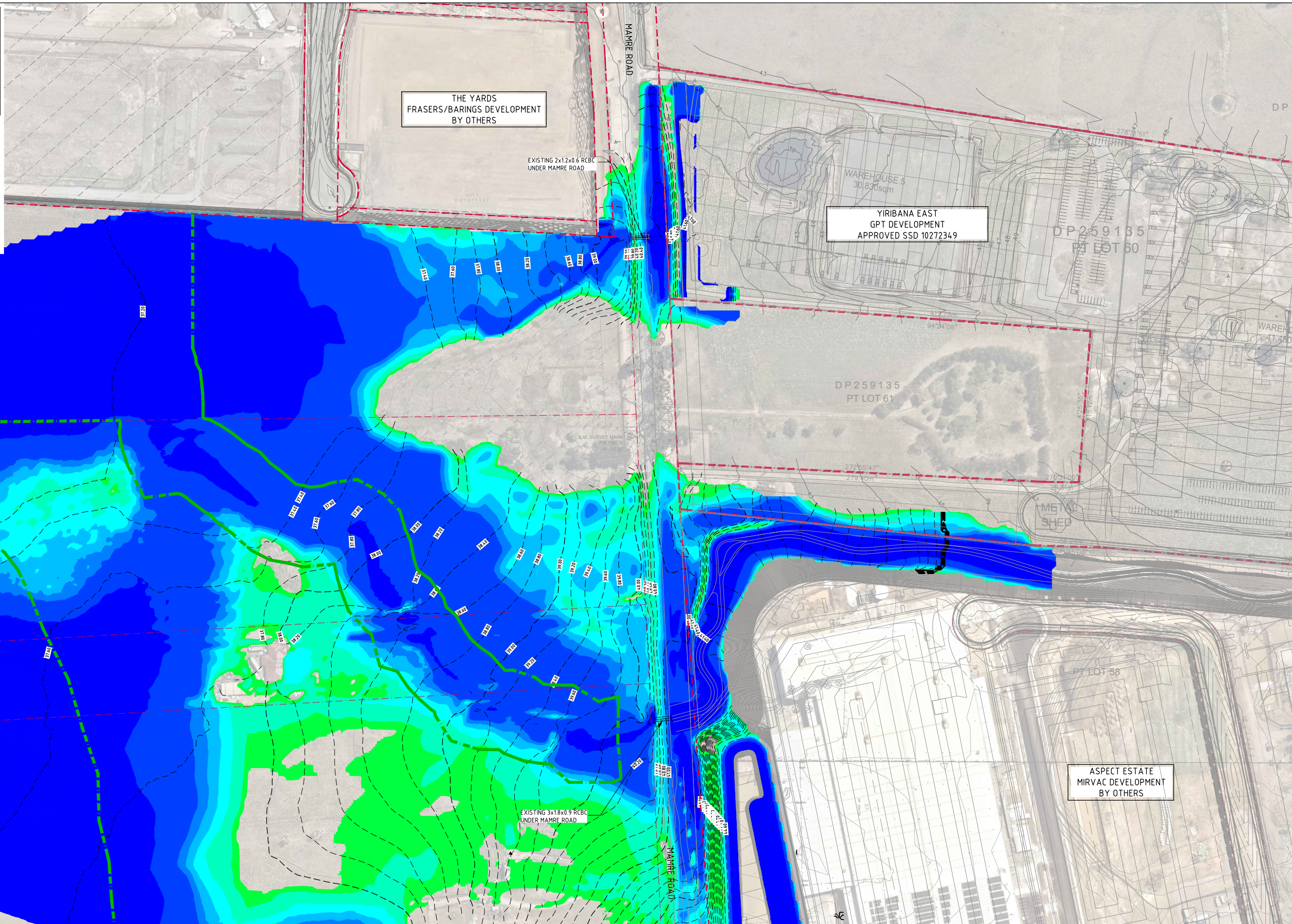
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ISSUED FOR INFORMATION				24.07.23				B			
ISSUED FOR INFORMATION				19.12.22				A			
AMENDMENTS				DATE	ISSUE	AMENDMENTS	DATE	ISSUE	AMENDMENTS	DATE	ISSUE
ARCHITECT				SB				CLIENT			
PROJECT				YIRIBANA WEST INDUSTRIAL ESTATE				DESIGNED			
771-797 MAMRE ROAD				KEMPS CREEK, 2178, NSW				DRAWN			
DATE				OCT 22				CHECKED			
MC				MC				SCALE			
				AS SHOWN				CAD REF			
				C01429.00 - F09				CONSULT			
Costin Roe Consulting Pty Ltd.				CRC				DRAWING TITLE			
ABN 50 003 696 446				CIVIL & STRUCTURAL ENGINEERS				0.2% AEP FLOOD AFFLUX PLAN			
PO Box 2419 Sydney NSW 1220				4 Levels & 4 Woodhill Street, Millers Point NSW 2000				45 MINUTE CRITICAL DURATION			
p: +61 2 9251 7699				e: mail@costinroe.com.au				LOCAL FLOOD EVENT			
e: mail@costinroe.com.au				w: costinroe.com.au				DRAWING No			
								C01429.00 - F09			
								TRUCK			
								C			

LEVELS DATUM IS AHD.

 30.00 — - FLOOD LEVEL CONTOUR (MAJOR)
1m INTERVALS
 **30.20** — - FLOOD LEVEL CONTOUR (MINOR)
0.2m INTERVALS
 — RE1 ZONE BOUNDARY

FLOOD DEPTH (m)			
No.	FROM DEPTH	TO DEPTH	COLOUR
1	0.050	0.100	
2	0.100	0.200	
3	0.200	0.300	
4	0.300	0.400	
5	0.400	0.500	
6	0.500	1.000	
7	1.000	3.000	

NOTE: FLOOD DEPTH NOT SHOWN FOR LESS THAN 50mm

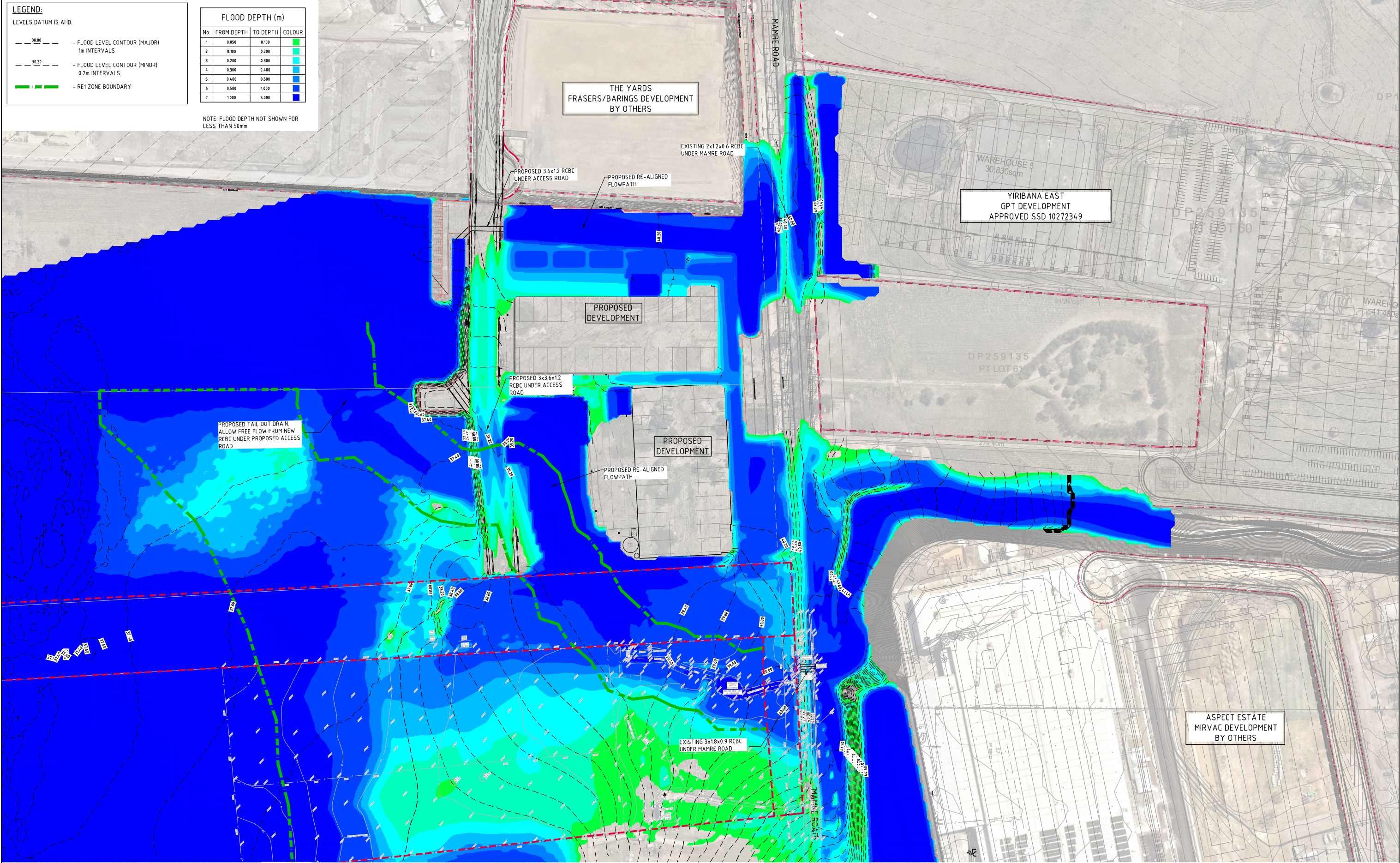


PMF PRE DEVELOPMENT LEVELS & DEPTHS-45 MIN DURATION
SCALE 1:1000

FOR INFORMATION ONLY

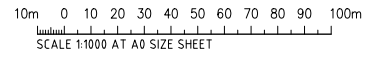
10m 0 10 20 30 40 50 60 70 80 90 100m
SCALE 1:1000 AT A0 SIZE SHEET

												ARCHITECT  Suite 102, 80 Mount Street, North Sydney NSW 1585 M: 02 9339 1122 E: info@sbarchitects.com.au						CLIENT  The GPT Group						PROJECT YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMPS CREEK, 2178, NSW  Costin Roe Consulting Pty Ltd. PO BOX 003 096 446 PO Box N419 Sydney NSW 1220 Level 4 of Windmill Street, Millers Point NSW 2000 p: +61 2 9252 7699 e: mail@costinroe.com.au w: costinroe.com.au						 						DRAWING TITLE PMF PRE DEVELOPMENT FLOOD LEVELS AND DEPTHS 45 MIN CRITICAL DURATION DRAWING No C014.29.00-F10 ISSUE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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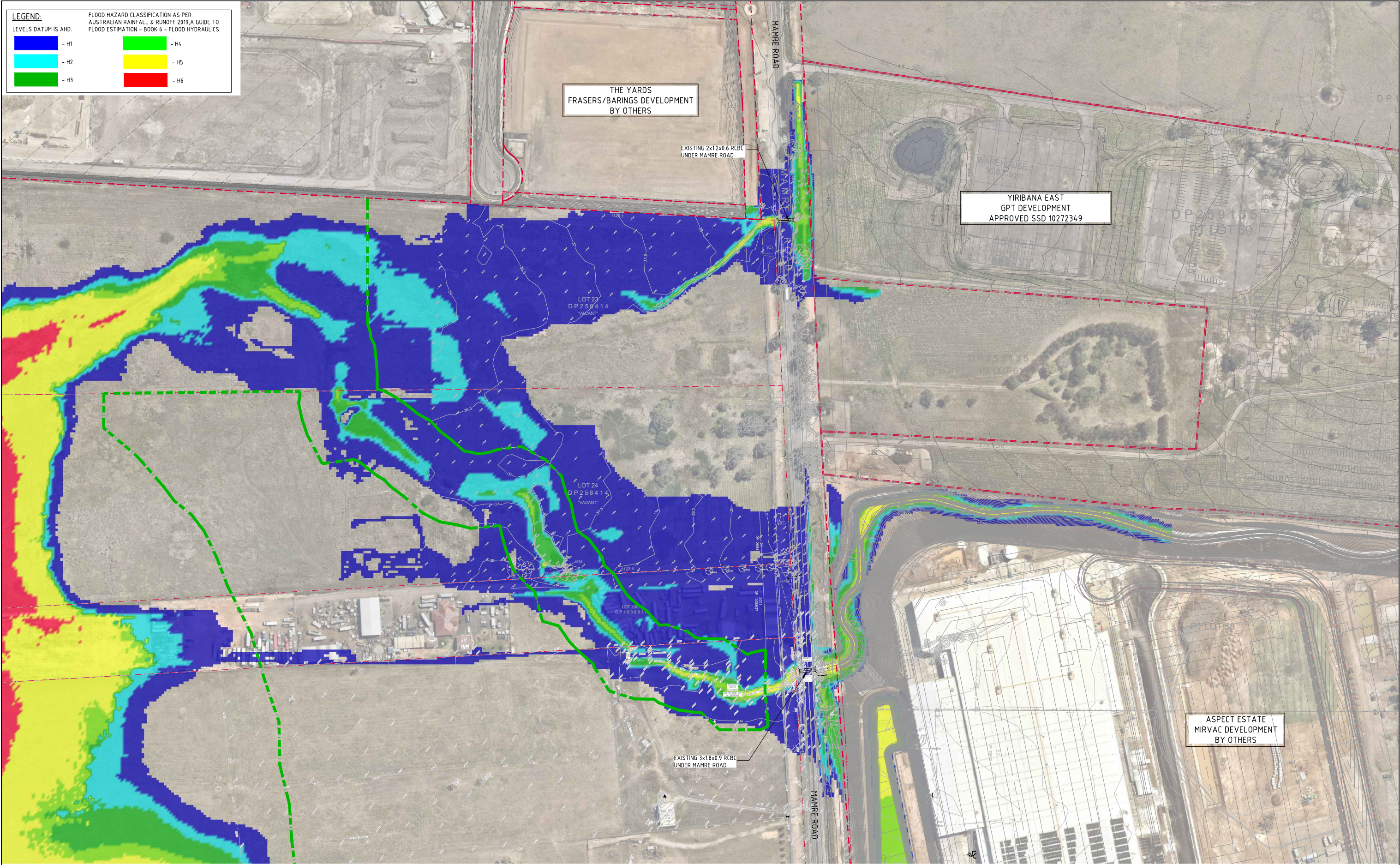


PMF POST DEVELOPMENT LEVELS & DEPTHS-45 MIN DURATION
SCALE 1:1000

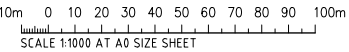
FOR INFORMATION ONLY



ISSUED FOR INFORMATION				25.12.23				C			
ISSUED FOR INFORMATION				25.07.23				B			
ISSUED FOR INFORMATION				16.12.22				A			
AMENDMENTS				DATE	ISSUE	AMENDMENTS	DATE	ISSUE	AMENDMENTS	DATE	ISSUE
ARCHITECT				SBA				CLIENT			
PROJECT				YIRIBANA WEST INDUSTRIAL ESTATE				DESIGNED			
771-797 MAMRE ROAD				KEMPS CREEK, 2178, NSW				DRAWN			
DATE				OCT 22				CHECKED			
SCALE				AS SHOWN				CADD REF.			
COSTIN ROE CONSULTING				CONSULT AUSTRALIA				COSTIN ROE CONSULTING PTY LTD.			
PO Box 2419 Sydney NSW 1220				Level 4 & 8 Woodhill Street, Millers Point NSW 2000				P.O. Box 2419 Sydney NSW 1220			
p: +61 2 9251 7699				e: mail@costinroe.com.au				p: +61 2 9251 7699			
w: costinroe.com.au				w: costinroe.com.au				w: costinroe.com.au			
DRAWING TITLE				PMF POST DEVELOPMENT FLOOD				DRAWING No			
LEVELS AND DEPTHS				45 MIN CRITICAL DURATION				C01429.00 - F11			
COSTIN ROE CONSULTING				CIVIL & STRUCTURAL ENGINEERS				C			

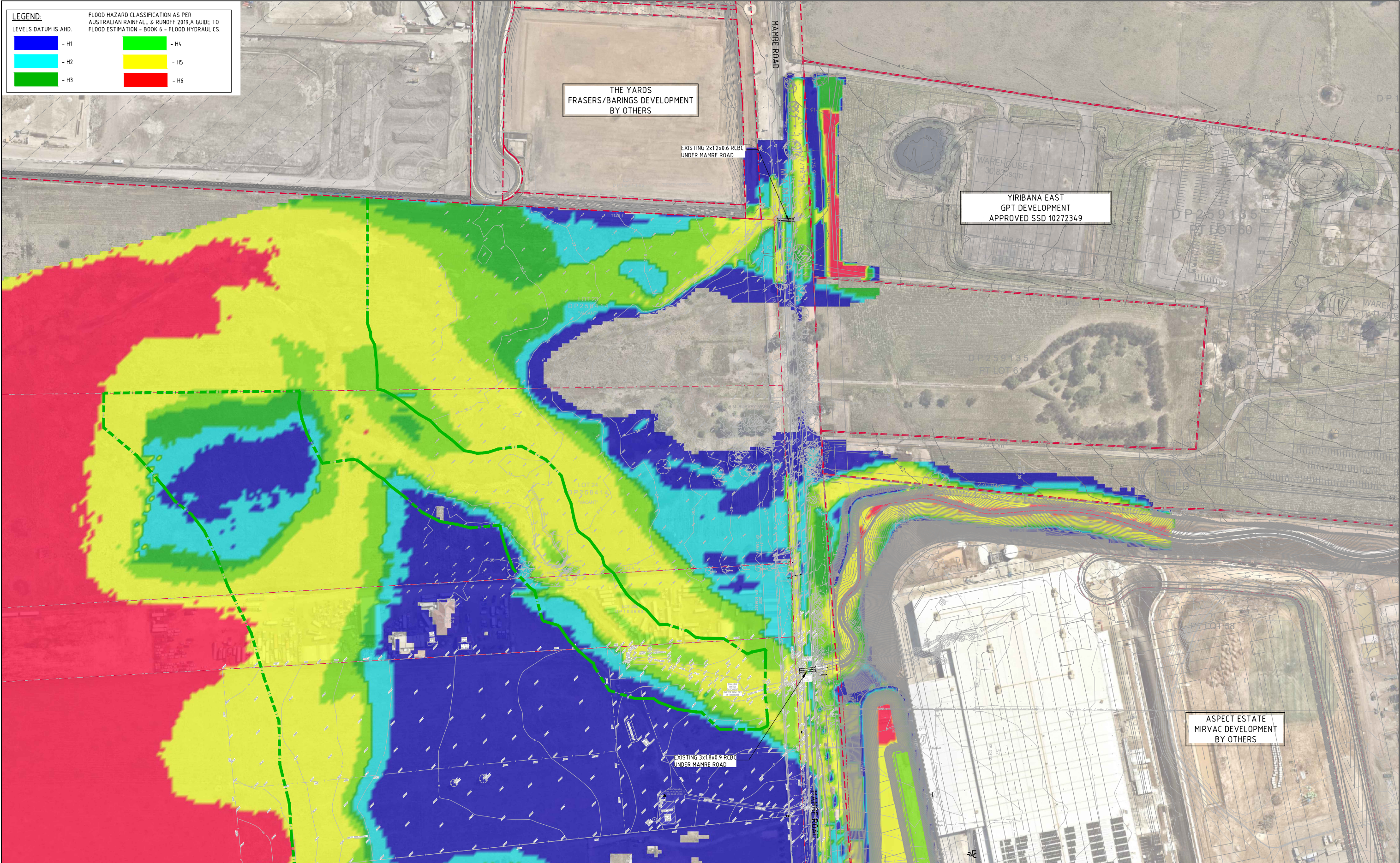


 1% AEP PRE DEVELOPMENT HAZARD-45 MIN DURATION
SCALE 1:1000



FOR INFORMATION ONLY

						ARCHITECT			CLIENT			PROJECT			DRAWING TITLE					
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ISSUED FOR INFORMATION			20.10.23			C						YIRIBANA WEST INDUSTRIAL ESTATE			1% AEP PRE DEVELOPMENT FLOOD					
ISSUED FOR INFORMATION			24.07.23			B						771-797 MAMRE ROAD			HAZARD					
ISSUED FOR INFORMATION			16.12.22			A						KEMPS CREEK, 2178, NSW			45 MIN CRITICAL DURATION					
AMENDMENTS			DATE			ISSUE			AMENDMENTS			DATE			ISSUE			AMENDMENTS		

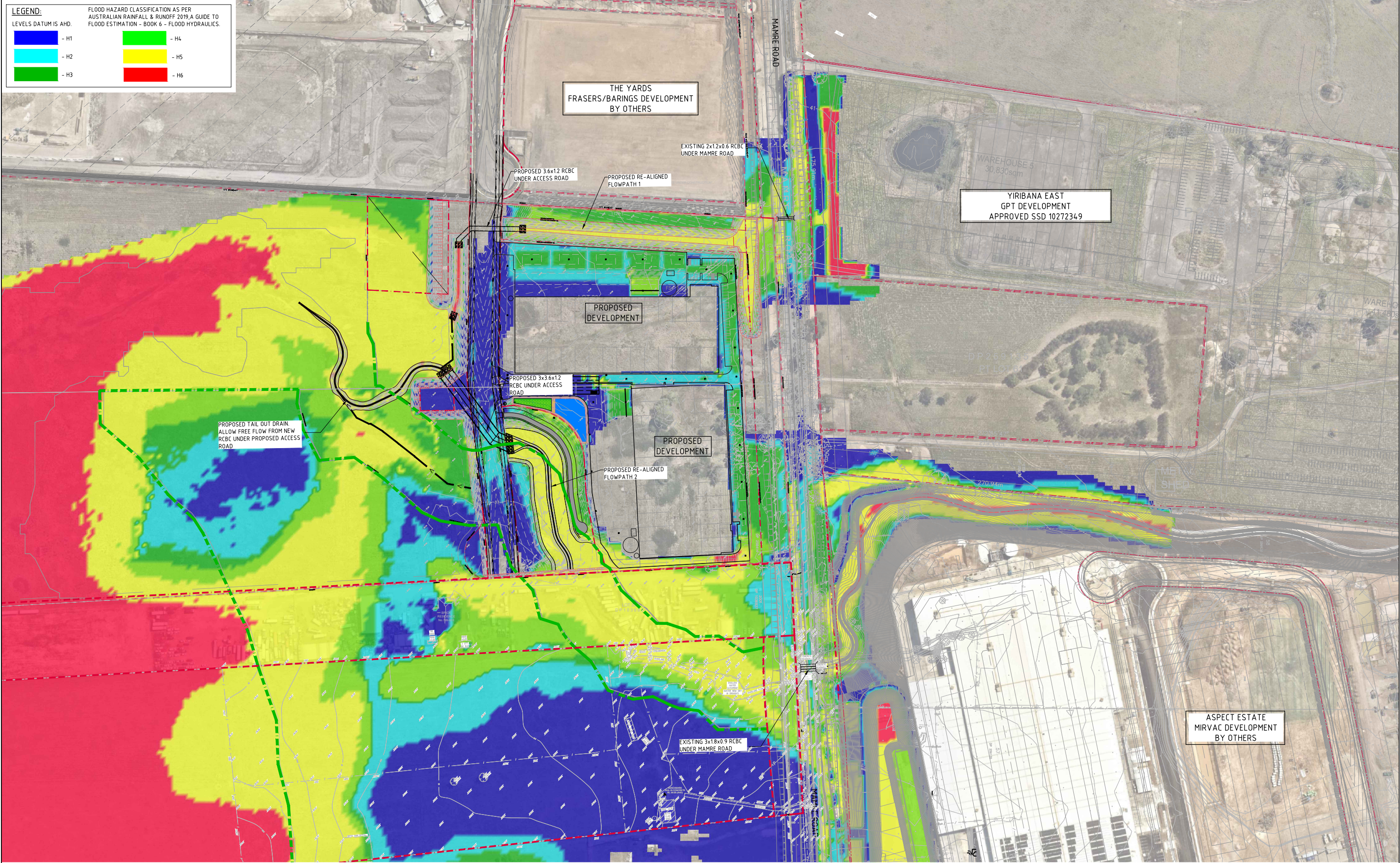


PMF PRE DEVELOPMENT HAZARD-45 MIN DURATION
SCALE 1:1000

FOR INFORMATION ONLY

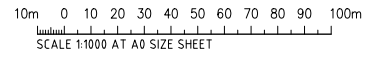
10m 0 10 20 30 40 50 60 70 80 90 100m
SCALE 1:1000 AT A0 SIZE SHEET

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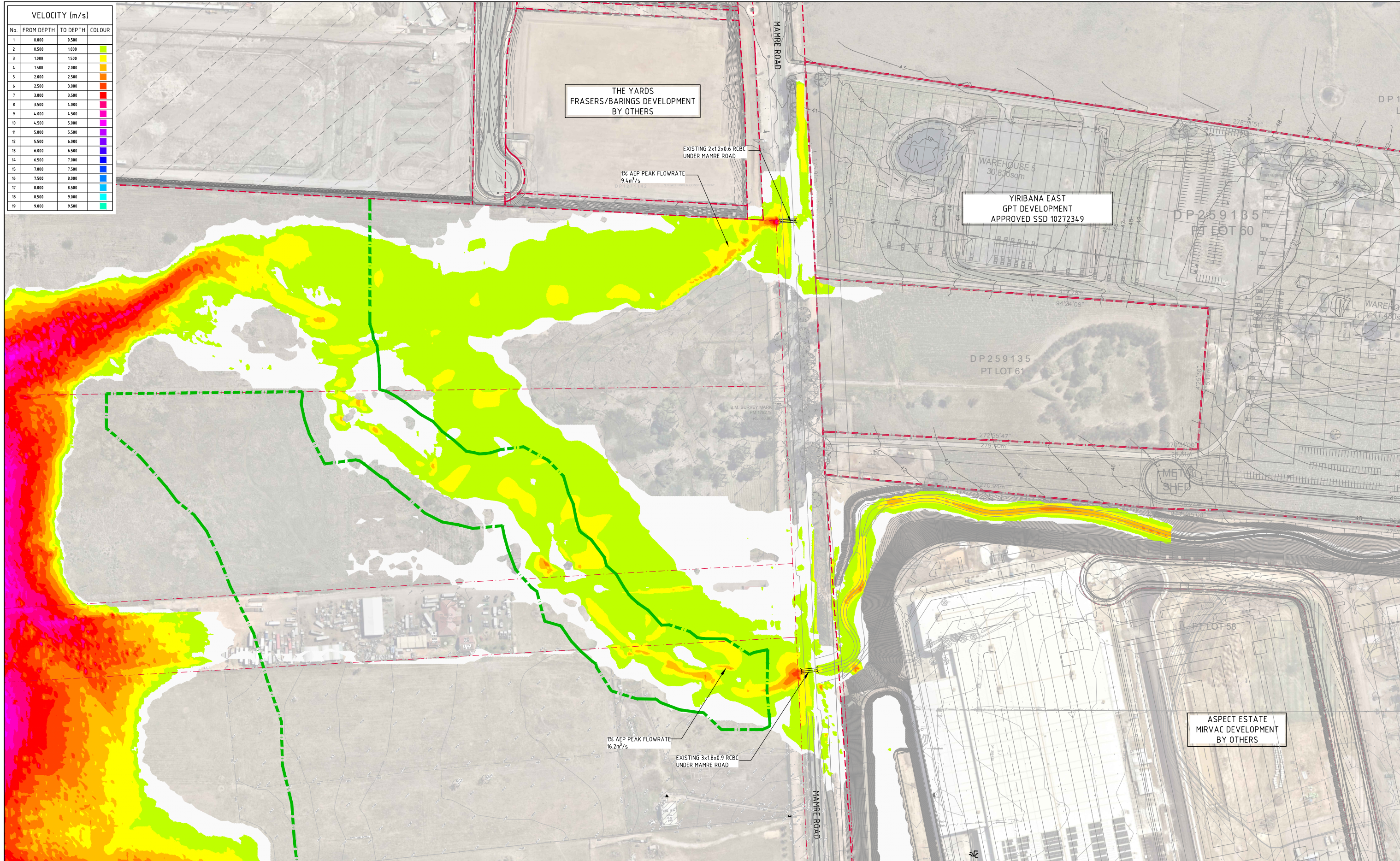
 **PMF POST DEVELOPMENT HAZARD-45 MIN DURATION**
SCALE 1:1000

FOR INFORMATION ONLY



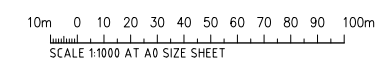
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ISSUED FOR INFORMATION				16.12.22				A			
AMENDMENTS				DATE	ISSUE	AMENDMENTS	DATE	ISSUE	AMENDMENTS	DATE	ISSUE
PROJECT: YIRIBANA WEST INDUSTRIAL ESTATE 771-797 MAMRE ROAD KEMP'S CREEK, 2178, NSW											
ARCHITECT: 				CLIENT: 				CONSULTANT: 			
DESIGNED: MC				CHECKED: MW				DRAWN: AS SHOWN			
DATE: OCT 22				SCALE: A0				CAD REF: C01429.00 - F15			
COSTIN ROE CONSULTING PTY LTD. ABN 50 003 696 446 PO Box 2419 Sydney NSW 1220 Level 4 & 8 Woodhill Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au w: costinroe.com.au				DRAWING TITLE: PMF POST DEVELOPMENT FLOOD HAZARD 45 MIN CRITICAL DURATION DRAWING No: C01429.00 - F15				CIVIL & STRUCTURAL ENGINEERS			

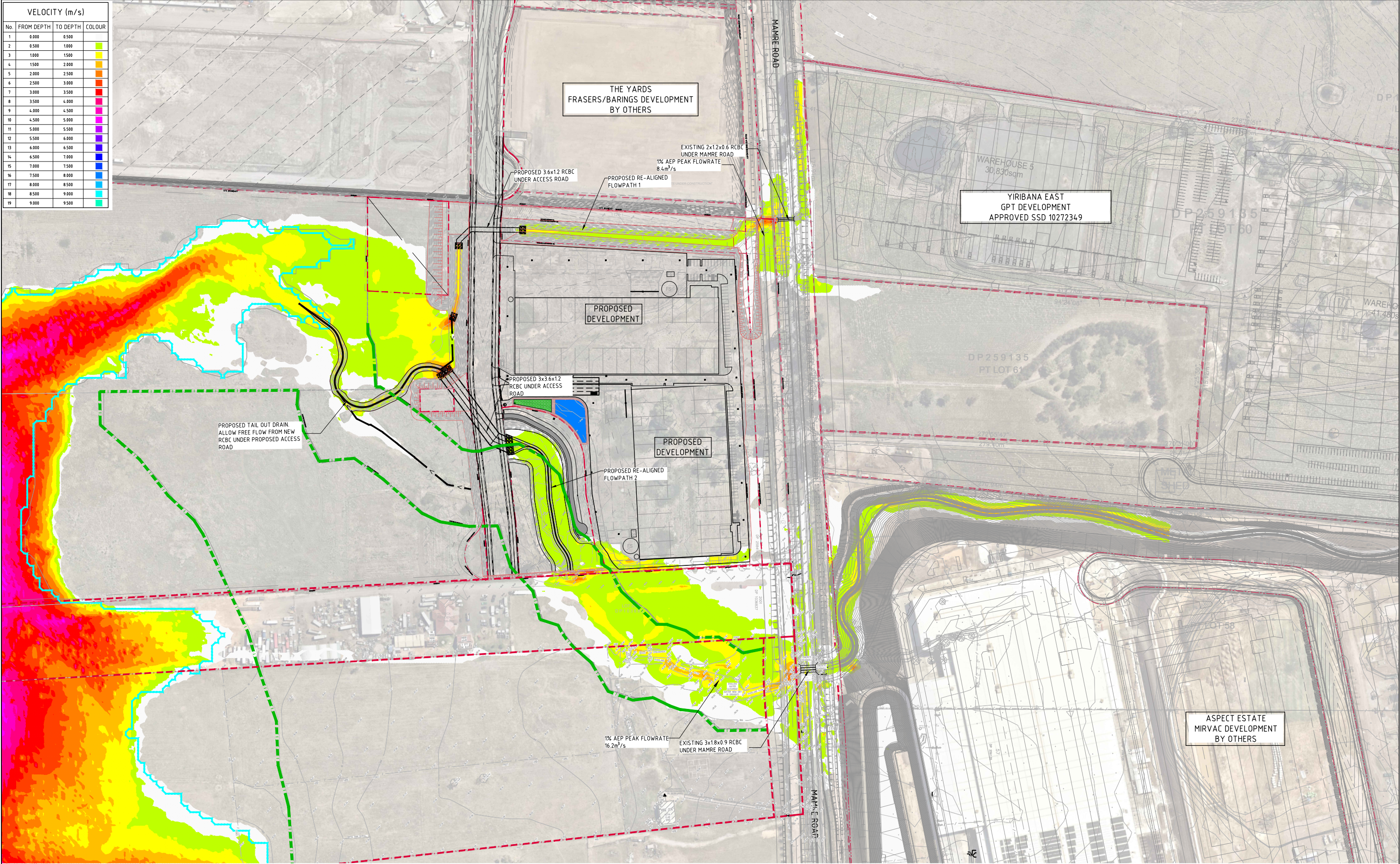
VELOCITY (m/s)			
No.	FROM DEPTH	TO DEPTH	CLOUR
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2	0.500	1.000	
3	1.000	1.500	
4	1.500	2.000	
5	2.000	2.500	
6	2.500	3.000	
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8	3.500	4.000	
9	4.000	4.500	
10	4.500	5.000	
11	5.000	5.500	
12	5.500	6.000	
13	6.000	6.500	
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15	7.000	7.500	
16	7.500	8.000	
17	8.000	8.500	
18	8.500	9.000	
19	9.000	9.500	



 1% AEP PRE DEVELOPMENT VELOCITY-45 MIN DURATION
SCALE 1:1000

FOR INFORMATION ONLY

[illegible]



 1% AEP POST DEVELOPMENT VELOCITY-45 MIN DURATION
SCALE 1:1000

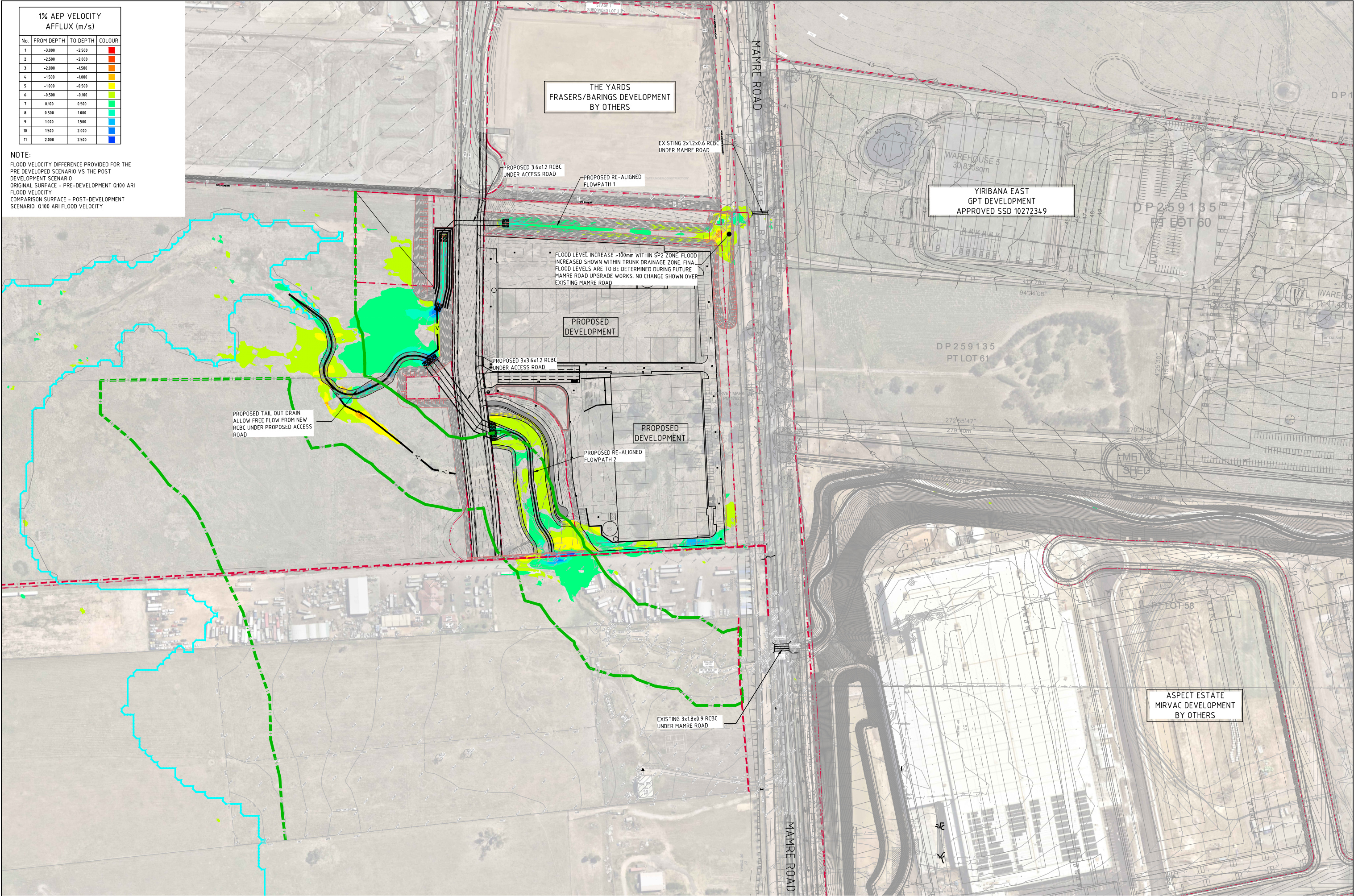
FOR INFORMATION ONLY

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										 Suite 702, 40 Stuart Street, North Sydney NSW 1585 t: 02 9387 4444 f: 02 9387 4445 e: info@sbaarchitects.com.au w: www.sbaarchitects.com.au																																																																																																													
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1% AEP VELOCITY AFFLUX (m/s)			
No.	FROM DEPTH	TO DEPTH	COLOUR
1	-3.000	-2.500	Red
2	-2.500	-2.000	Orange
3	-2.000	-1.500	Yellow
4	-1.500	-1.000	Light Green
5	-1.000	-0.500	Green
6	-0.500	-0.100	Light Blue
7	0.100	0.500	Blue
8	0.500	1.000	Dark Blue
9	1.000	1.500	Very Dark Blue
10	1.500	2.000	Black
11	2.000	2.500	White

NOTE:
FLOOD VELOCITY DIFFERENCE PROVIDED FOR THE
PRE DEVELOPED SCENARIO VS THE POST
DEVELOPMENT SCENARIO
ORIGINAL SURFACE - PRE-DEVELOPMENT Q100 ARI
FLOOD VELOCITY
COMPARISON SURFACE - POST-DEVELOPMENT
SCENARIO Q100 ARI FLOOD VELOCITY



1% AEP FLOOD VELOCITY AFFLUX PLAN - 45 MIN CRITICAL DURATION LOCAL EVENT
SCALE 1:1000

FOR INFORMATION ONLY

10m 0 10 20 30 40 50 60 70 80 90 100m
SCALE 1:1000 AT A0 SIZE SHEET

ISSUED FOR INFORMATION				28.12.23				C			
ISSUED FOR INFORMATION				24.07.23				B			
ISSUED FOR INFORMATION				19.12.22				A			
AMENDMENTS				DATE	ISSUE	AMENDMENTS	DATE	ISSUE	AMENDMENTS	DATE	ISSUE
ARCHITECT				SB				CLIENT			
PROJECT				YIRIBANA WEST INDUSTRIAL ESTATE				DESIGNED			
771-797 MAMRE ROAD				KEMPS CREEK, 2178, NSW				CHECKED			
DATE				OCT 22				SCALE			
MC				AS SHOWN				CAD REF			
CONSULT				C01429.00 - F18				CONSULT			
Costin Roe Consulting Pty Ltd.				CRC				DRAWING TITLE			
ABN 50 003 696 446				1% AEP FLOOD VELOCITY AFFLUX PLAN				45 MINUTE CRITICAL DURATION			
PO Box 2419 Sydney NSW 1220				LOCAL FLOOD EVENT				DRAWING No			
Level 4 & 8 Woodhill Street, Millers Point NSW 2000				C01429.00 - F18				C			
p: +61 2 9251 7699											
e: mail@costinroe.com.au											
w: costinroe.com.au											

Appendix F

EES MUSIC MODELLING TOOLKIT RESULTS ESTATE MODEL

Development Area	37.761 ha	Area of MUSIC catchments							
Targets Alternative 1				Targets Alternative 2					
Indice	Result	Comply	Target	Indice	Result	Comply	Target		
95%ile	10768	Yes	3000 to 15000 L/ha/day	MARV (ML/ha/yr)	1.37	Yes	≤ 2		
90%ile	4022	Yes	1000 to 5000 L/ha/day	90%ile	4022	Yes	1000 to 5000 L/ha/day		
75%ile	512	Yes	100 to 1000 L/ha/day	50%ile	83	Yes	5 to 100 L/ha/day		
50%ile	83	Yes	5 to 100 L/ha/day	10%ile	0	Yes	0 L/ha/day		
Cease to Flow	29%		10-30%						

Flow Duration Curve (Daily)

