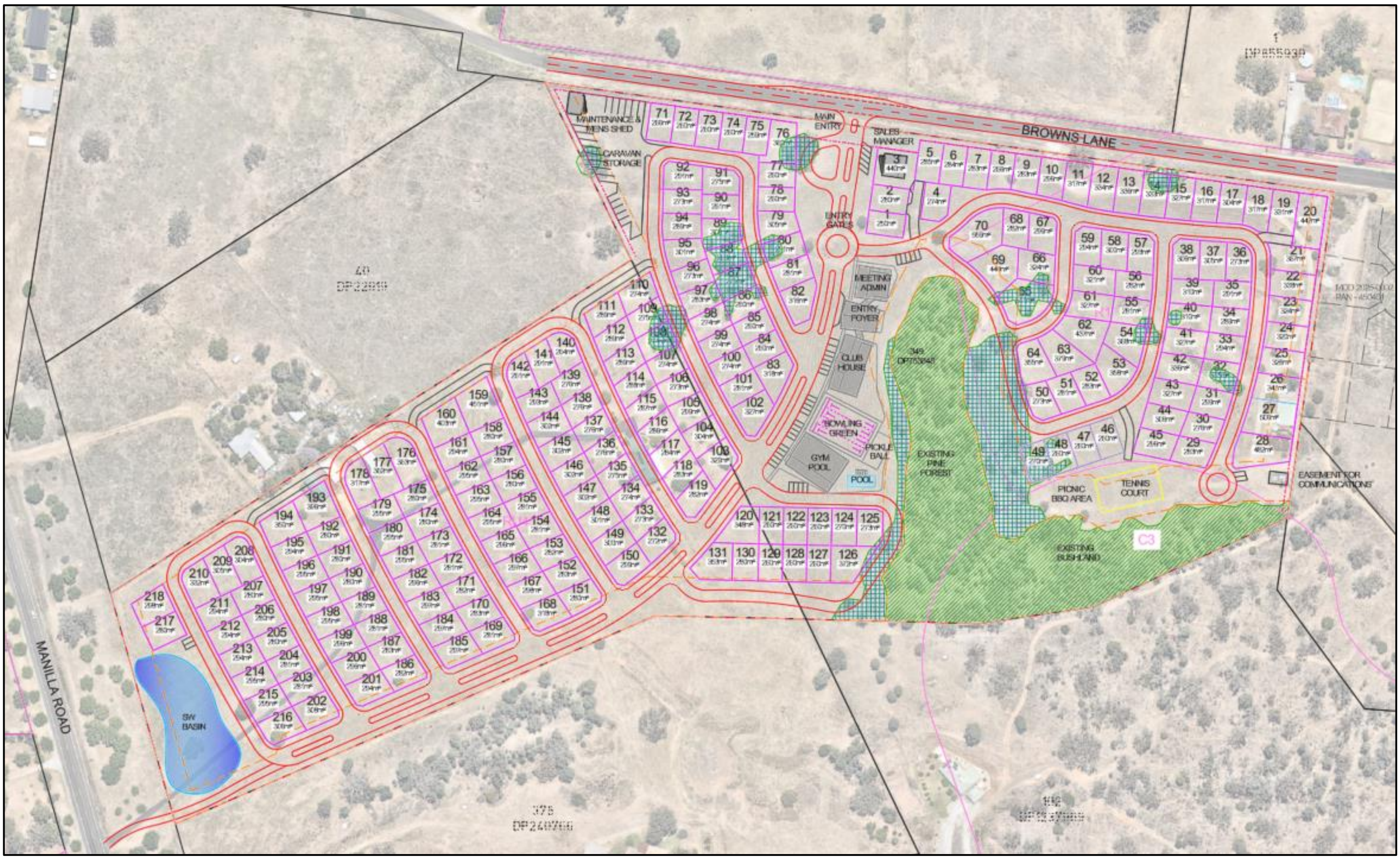

STORMWATER MANAGEMENT PLAN

Proposed Manufactured Housing Estate Browns Lane, Tamworth

On behalf of Browns Lane Developments Pty Ltd

September 2024

Document No. 5668 Browns Lane Tamworth MHE SWMP

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EXECUTIVE SUMMARY

Browns Lane Developments Pty Ltd has engaged Land Dynamics Australia to prepare a concept Stormwater Management Plan (SWMP) for the development application of Lot 349 DP753848 and Lot 39 DP22919 in Tamworth. The preliminary design of the development anticipates approximately 218 residential lots, an internal road network, a stormwater system, and associated services and community facilities.

The purpose of this SWMP is to examine the stormwater quantity requirements for the proposed development by analysing the pre and post-development hydrology. This includes determining the detention capacity needed to mitigate the impact of the proposed development on existing stormwater networks.

The hydrological analysis undertaken herein modelled catchments in pre and post-development conditions, simulating storm events up to and including the 1% Annual Exceedance Probability (AEP), with durations ranging from 5 minutes to 6 hours. Results indicate an increase in post-development peak stormwater flow rates compared to pre-development conditions. To address this, an end-of-line detention basin has been integrated into the design to reduce peak flows to be neutral or beneficial on the downstream stormwater network.

This report demonstrates that the proposed stormwater management system meets the *Engineering Design Minimum Standards Version 2 (2023)* set by Tamworth Regional Council.

CONTENTS

1.0 INTRODUCTION

Land Dynamics Australia has prepared this report on behalf of Browns Lane Developments Pty Ltd for submission to Tamworth Regional Council. The proposed development, located on Lot 349 DP753848 and Lot 39 DP22919 in Tamworth, is assessed regarding its impact on stormwater quantity by comparing the pre and post-development conditions. As the proposed subdivision falls within the jurisdiction of Tamworth Regional Council, this report intends to support the development application.

At this preliminary stage, the proposed development is of a manufactured housing estate with approximately 218 residential lots, community facilities, an internal road network, services, and a stormwater management system. The development layout is presented in Figure 1-1 and Appendix A, with further design details provided in Section 3.

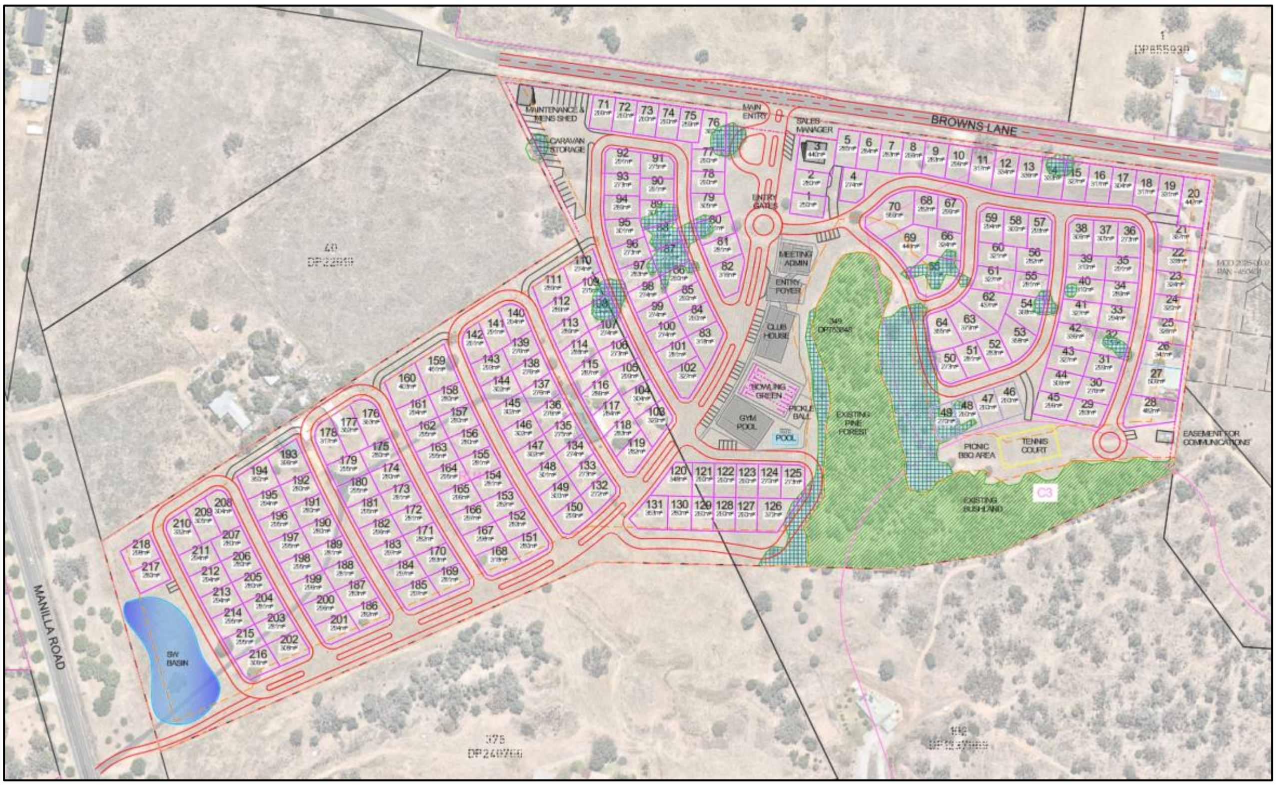

Figure 1-1: Proposed development layout.

This report has been written to introduce the site's existing conditions in Section 2 before outlining the proposed development in Section 3. Then, in Section 4, the hydrological modelling is discussed, including the management of increased stormwater runoff, with conclusions presented in Section 5.

Please note that this SWMP provides preliminary information on stormwater quantity control. The results herein are subject to further refinement and detailed design at the construction certificate stage of the development.

2.0 EXISTING SITE CHARACTERISTICS

2.1 Existing Site Description

The proposed development site is located approximately 6.5km northwest of Tamworth (Figure 2-1) in Oxley Vale, NSW (New South Wales), and adjoins Browns Lane and Manilla Road. As illustrated in Figure 2-2, the site covers Lot 349 DP753848 and Lot 39 DP22919, with a total area of approximately 13ha. The current site condition consists of slashed grass with sparse tree coverage in some areas. The zoning for the site is a combination of R1 (General Residential), RU4 (Primary Production Small Lots), and C3 (Environmental Management), as illustrated in Figure 2-3. Notably, the C3 zone includes an existing pine forest.

Figure 2-1: Proposed development locality sketch

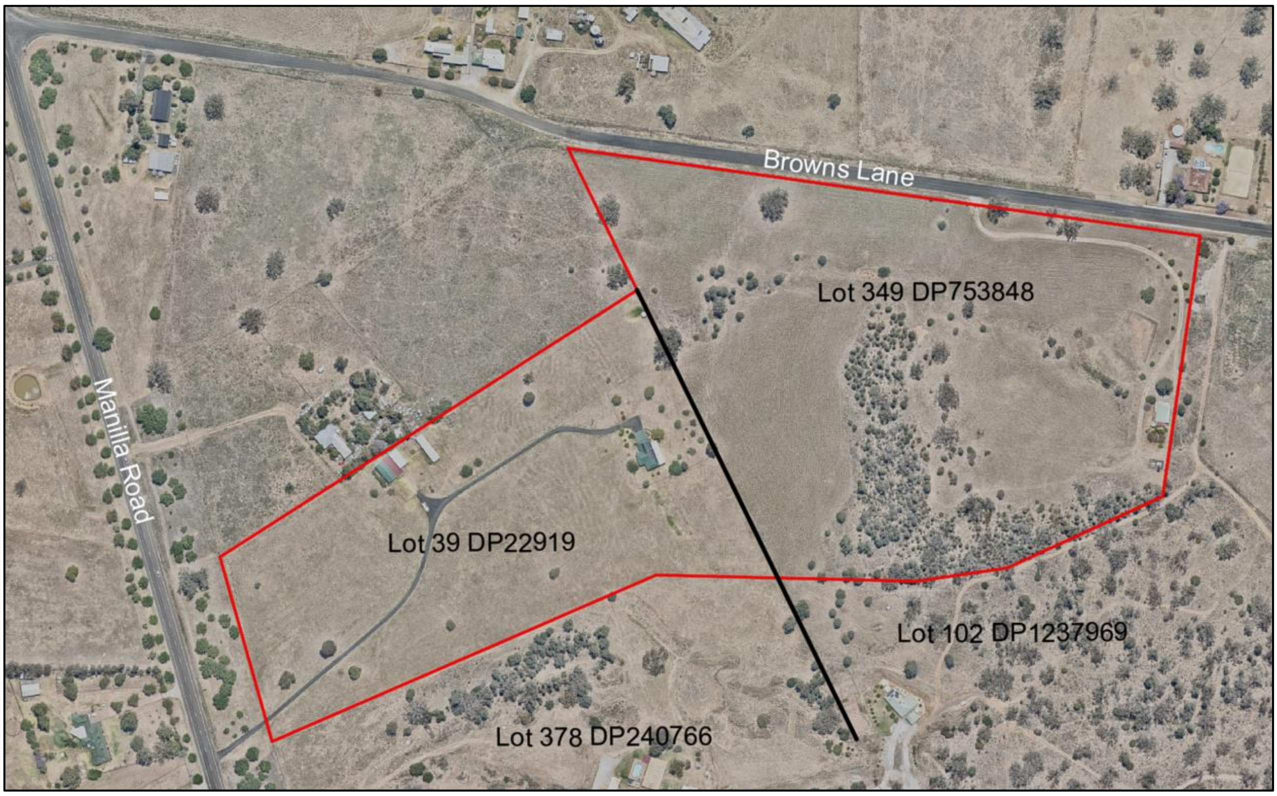

Figure 2-2: Development site lot and DP number (aerial imagery source: Nearmap).

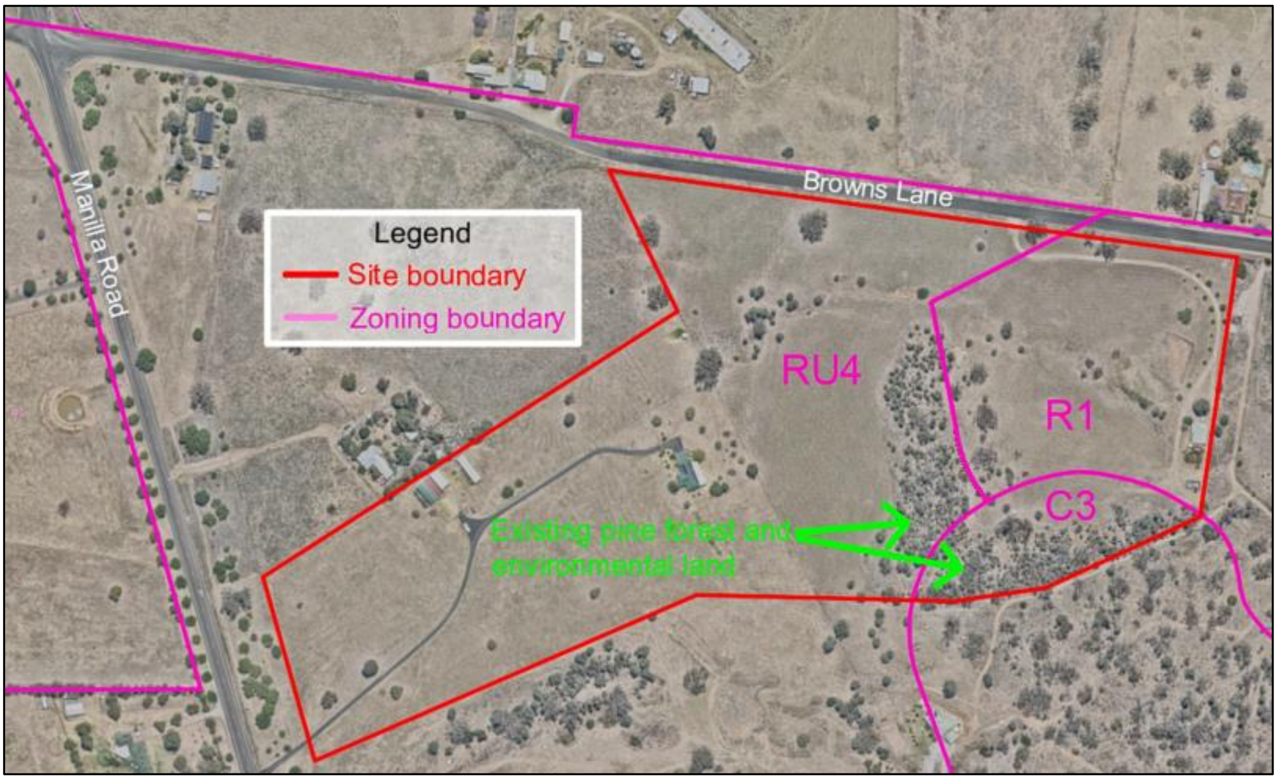

Figure 2-3: Site locality map, site boundaries, zoning boundaries, and environmental land (aerial imagery source: Nearmap).

3.0 PROPOSED DEVELOPMENT

The proposed development includes constructing approximately 218 manufactured housing lots, with sizes ranging from 250 to 650m^2. The design preserves the existing pine forest and environmental areas, integrating them as architectural features alongside a community hub that will include social facilities and sports and recreation spaces. To support the new lots and community amenities, an internal road network, services, and a stormwater management system have been incorporated into the design.

As the development will increase impervious surface area, resulting in higher peak stormwater flow rates, an end-of-line detention basin has been designed to mitigate the impact and meet the stormwater management requirements set by Tamworth Regional Council. The proposed layout of the development, including the detention basin, is illustrated in Figure 3-1 and Appendix A.

The basin has been designed as a combined retained and embankment system to optimise visual appeal, improve safety, and minimise the basin's footprint. The basin utilises the site's natural slope, with a retaining structure on the downhill side and an embankment on the uphill side, blending it into the landscape. Indicative plans of the basin are provided in Appendix B and C to illustrate the design.

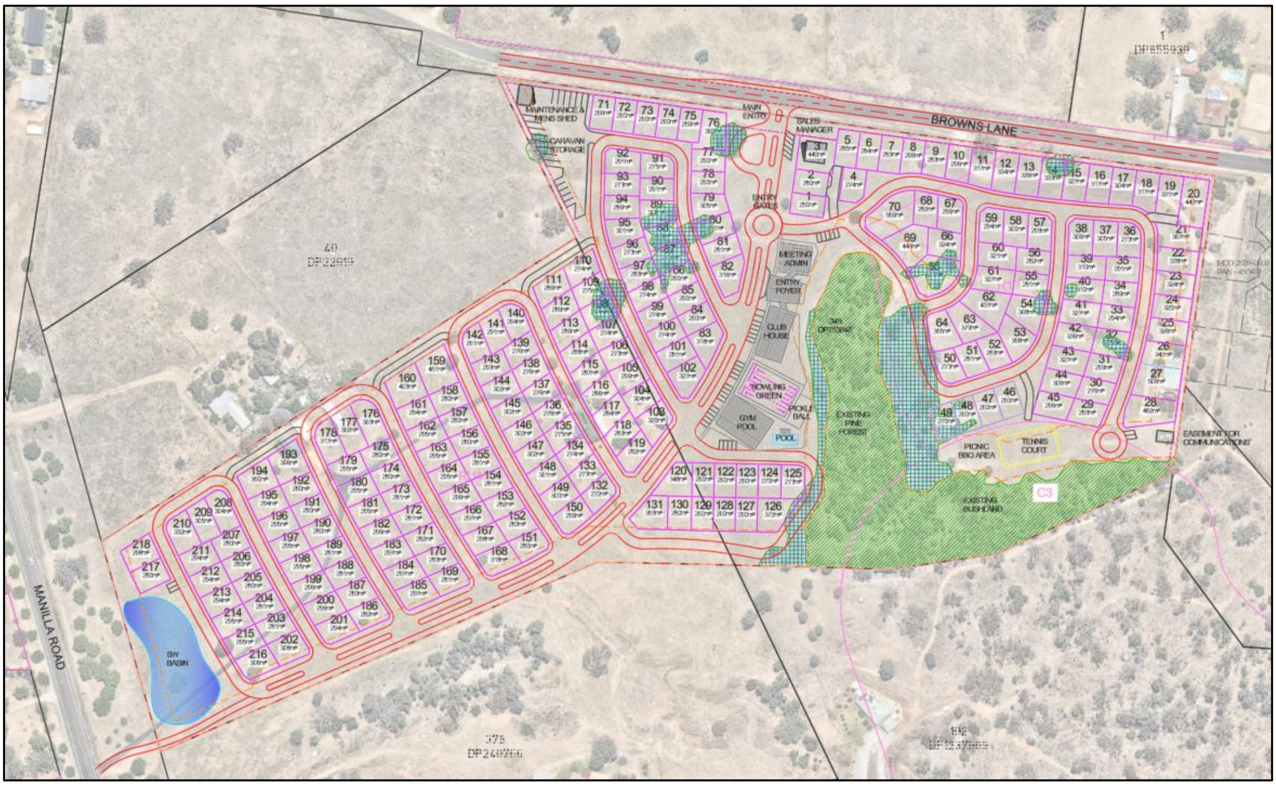

Figure 3-1: *Proposed Development Layout*

4.0 STORMWATER QUANTITY MANAGEMENT

The proposed Browns Lane development is located in Tamworth, within the New England region of NSW, to the west of the New England Tablelands. This area experiences a humid subtropical climate but can be comparatively dry to the Tablelands (Office of Environment and Heritage, 2014). It has hot summers and mild winters with rainfall spread throughout the year, but the warmer months tend to receive the most (Office of Environment and Heritage, 2014). This section addresses how the site's stormwater runoff will be managed for the proposed development to accommodate local rainfall patterns.

4.1 Stormwater Quantity Management Objectives and Methodology

The stormwater quantity management objectives, as outlined in Tamworth Regional Council's *Engineering Design Minimum Standards Version 2 (2023)*, are to:

- Attenuate post-development peak discharge flowrates to match pre-development levels for all storm events, up to and including the 1% AEP event;
- Ensure that only the low-flow outlet discharges water during minor storm events;
- Design a safe detention basin and outlet network considering:
    - Adequate freeboard;
    - Spillway capacity in the absence of a low-flow network;
    - Overland flow depth and velocity;
    - Battered embankments and fencing;
    - Ensuring that failure does not result in significant property damage or risk human life.
- Ensure the basin remains dry under normal conditions.

A hydrological analysis was carried out to meet these requirements using Watercom's DRAINS software. The simulations were run in accordance with the Australian Rainfall and Runoff Guidelines 2019 (ARR2019), utilising rainfall data from the Bureau of Meteorology and catchment-specific rainfall parameters from the ARR2019 datahub for the proposed development site.

The analysis commenced by identifying the existing stormwater catchments and their characteristics to calculate peak flow rates. This was followed by assessing the catchments in the post-developed (unmitigated) scenario and comparing the resulting flow rates. The difference in peak flow rates between the pre and post-development conditions and the Council's requirements informed the design of the detention basin for the proposed development (the mitigated scenario).

The analysis considered both a minor storm event of 10% AEP and a major storm event of 1% AEP while considering sensitivity to a 0.5% AEP storm event, in line with Section 3.5.6 of Tamworth Regional Council's

Engineering Design Minimum Standards Version 2 (2023). While Council typically recommends a 5% AEP minor storm for residential subdivisions, this report adopts a 10% AEP minor storm. A 10% AEP minor storm is more appropriate for the proposed manufactured housing estate development, given it's increased impervious area. Therefore, the development is considered more comparable to a commercial or industrial subdivision rather than a traditional residential subdivision. Storm durations from 5 minutes to 6 hours were also considered.

In this stormwater analysis, different loss models were used because one model type does not represent the catchment's pre and post-development conditions. Given its size, grade, and uniformity, the RAFTS storage routing model was applied to the undeveloped catchment. Conversely, the Initial Loss Continuing Loss (ILCL) model was used to represent the post-developed urban environment.

4.2 Existing Site Topography, Drainage, and Hydrological Modelling

According to the NSW Government's SEED maps, the proposed development site does not fall within any designated flood zones. The site topography is characterised by a high point along the eastern boundary with a reduced level (RL) of 451m and a low point near its connection to Manilla Road, at an RL of approximately 401m.

The site slopes at an average gradient of 7%, draining approximately 12.7ha in a south-westerly direction towards an open channel drainage system along Manilla Road. The remainder of the site drains towards Lot 102 DP1237969, connecting with the natural watercourse on Lot 378 DP240766, also flowing towards Manilla Road. The watershed ridge, marked in Figure 4-1 with a yellow line, separates these two catchments. The catchment south of this ridge is excluded from the following hydrological assessment, given this area will remain unchanged as a vegetated zone in the proposed development.

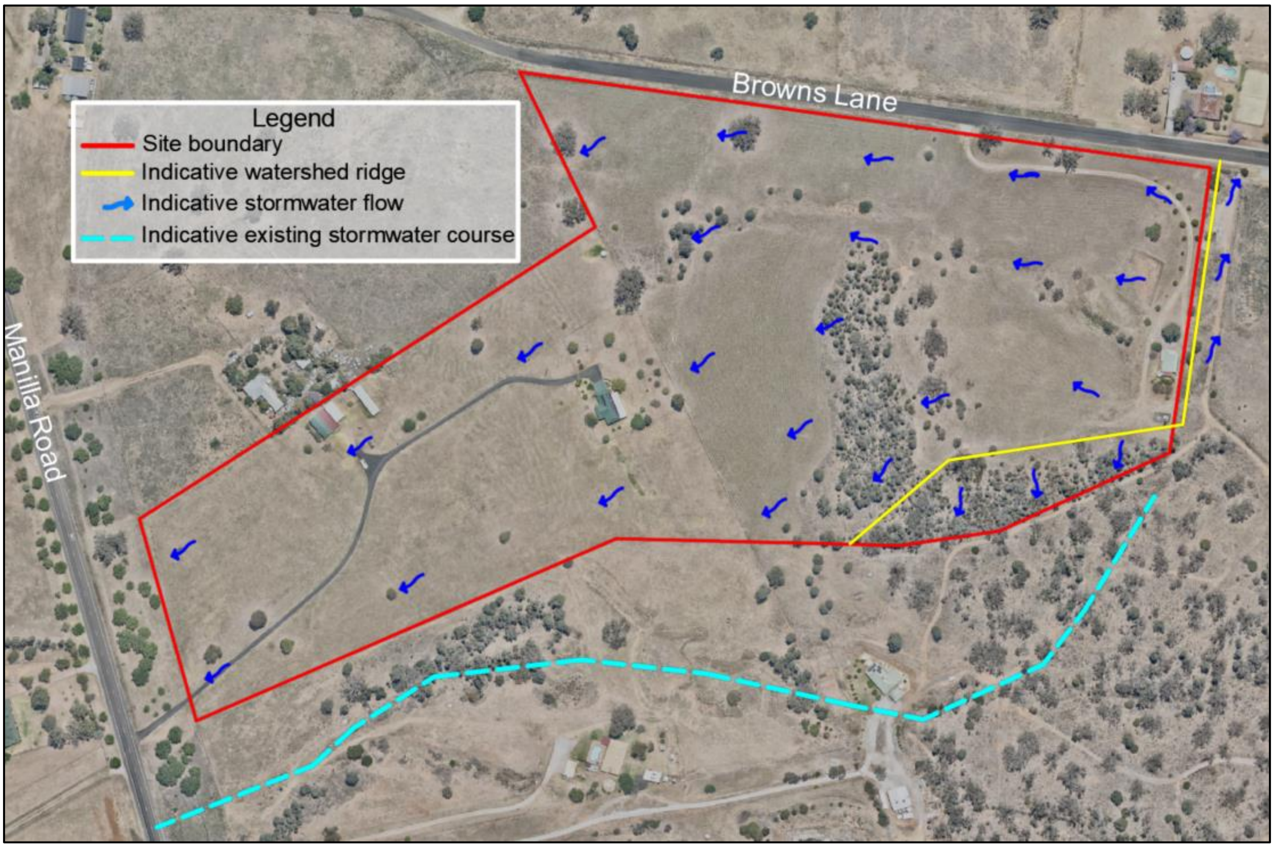

Figure 4-1: Existing stormwater overland flow and key topographic features (aerial imagery source: Nearmap).

As illustrated in Figure 4-1, the highest point of the site, located along the north-east edge, is close to the ridge of the hill, indicated by the yellow line running perpendicular to Browns Lane. Thus, no upstream catchments affect the proposed development site; therefore, this assessment does not consider upstream catchments.

Given the site's uniform characteristics, a single lumped catchment was used for hydrological modelling of the existing site, assuming the area to be 100% pervious. To simulate this, the RAFTS storage routing model was used within the DRAINS software, employing a Manning's 'n' value of 0.05. This modelling approach was cross-checked against the Tamworth Regional Council's *Predeveloped Stormwater Calculator 2023* spreadsheet, as shown in Table 4-1. The results show close alignment, validating the use of the RAFTS model. However, it should be noted that the Council's calculator is limited to a slope of 5%, whereas the actual slope of the Browns Lane site is approximately 7%. Consequently, the RAFTS model was rerun with the correct 7% slope to accurately estimate the undeveloped peak stormwater flow rates entering the open channel drainage system along Manilla Road, and the results are displayed in Table 4-2.

Table 4-1: Comparison of peak flowrates for the undeveloped site (using a 5% slope)

Hydrological model	Minor storm peak flowrate exiting the site (m^3/s)	Major storm peak flowrate exiting the site (m^3/s)
DRAINS RAFTS model (5% slope)	1.42	2.76
Tamworth Regional Council's *Predeveloped stormwater calculator 2023* (5% slope)	1.36	2.65

Table 4-2: Peak flowrate for the undeveloped site (using a 7% slope)

Hydrological model	Minor storm peak flowrate exiting the site (m^3/s)	Major storm peak flowrate exiting the site (m^3/s)
DRAINS RAFTS model (7% slope)	1.63	3.15

4.3 Proposed Developed Site Drainage and Hydrological Modelling

Stormwater runoff generated from each proposed dwelling's roof and other impervious surfaces will be directed into the stormwater pits and pipes. The stormwater infrastructure then discharges the collected flows towards the end-of-line detention basin. This post-development catchment plan is illustrated in Appendix D.

An ILCL model was used to simulate the hydrological response of the developed site's urban catchments. Based on the preliminary design layout, lumped catchment areas were defined and categorised into similar land-use types, such as roads, residential lots, community areas, and vegetated zones, which drain towards Manilla Road through the site boundary. Table 4-3 summarised the estimated areas of each catchment and the assumed impervious percentages, which were conservatively estimated for the analysis. The configuration of the DRAINS model used for this assessment is illustrated in Figure 4-2.

Table 4-3: Assumed Post-developed Catchment Properties

Post-developed catchments	Area (ha)	Impervious (%)
Lots	7.1	80
Road Reserve	3.8	90
Community Hub	0.4	80
Pine forest	1.4	0

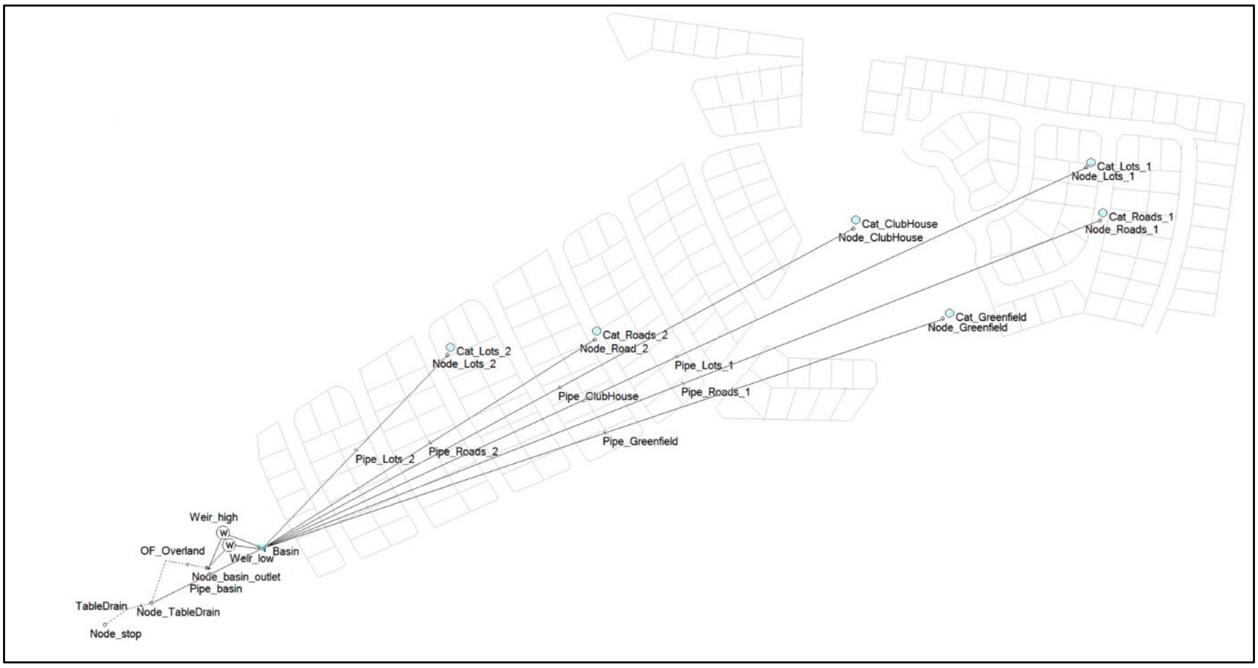

Figure 4-2: DRAINS model configuration.

4.4 DRAINS Results and Commentary

The model discussed in Section 4.3, representing the proposed developed site, was also run without the end-of-line detention basin. In this scenario, stormwater was discharged directly to the existing stormwater network, simulating the unmitigated development condition. The results for peak flow rates under the undeveloped, unmitigated post-developed, and mitigated post-developed scenarios are summarised in Table 4-4 for both the minor (10% AEP) and major (1% AEP) storm events. Additionally, the hydrograph depicting peak stormwater discharge into the existing drainage system along Manilla Road during the major storm event is illustrated in .

Table 4-4: Comparison of pre and post-development flowrates

Stage	Peak Flow Rate for Annual Exceedance Probability (m^3/s)	
	10% AEP	1% AEP
Pre-developed	1.63	3.15
Unmitigated post-developed	3.38	5.60
Mitigated post-developed	1.24	3.05

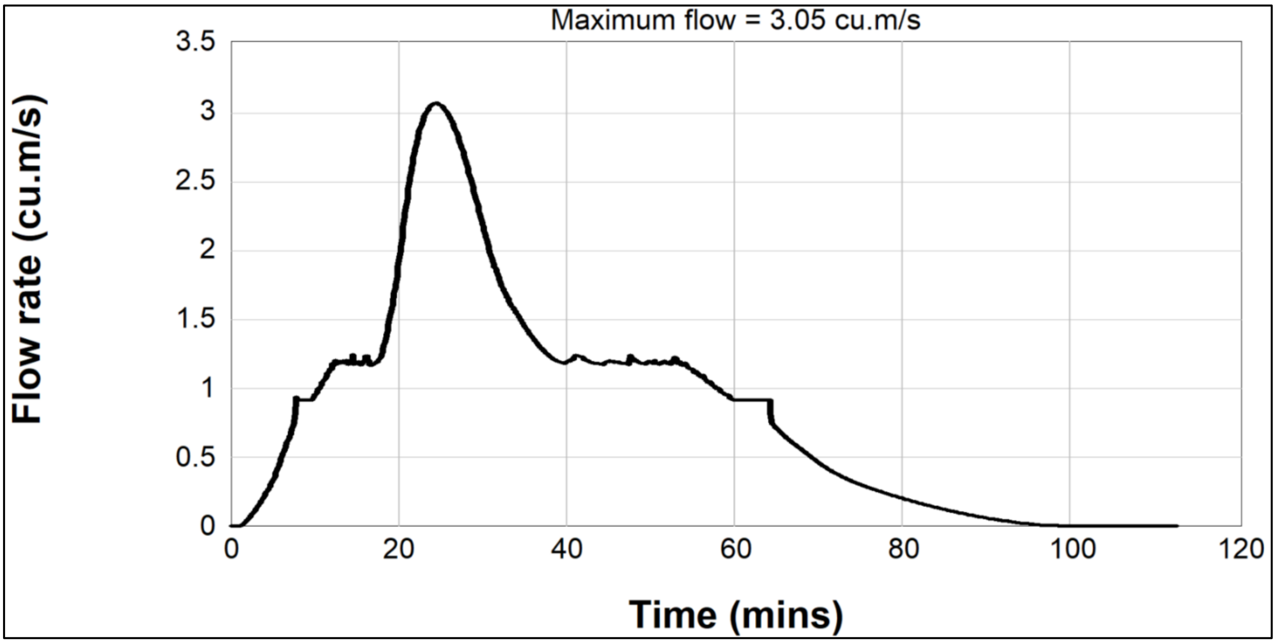

Figure 4-3: Post-developed mitigated 1% AEP discharge to existing stormwater network.

The results presented in Table 4-4 demonstrate that the proposed development, with the inclusion of the end-of-line detention basin, can effectively attenuate peak flow rates to levels below those observed in the pre-developed condition. However, the installation of the detention basin is essential in achieving these outcomes. Further details about the design and function of the detention basin are provided in Section 4.5.

As required by Tamworth Regional Council's *Design Minimum Standards Version 2 (2023)*, the sensitivity of the design to 0.5% AEP events was considered, and the stormwater management system proposed can accommodate such events.

4.5 Basin Details

The proposed detention basin is located at the site's natural low point, along the southwestern boundary near Manilla Road. The basin is designed with a surface area of approximately 2,400m^2 and a volume of around 3,600m^3. It is to be constructed with a combined retaining wall and earth embankment structure. The embankment slopes are to be graded at 1(V):4(H), and the basin floor will have a 1% gradient to ensure water flows towards the low-flow outlet, maintaining a dry basin under normal conditions.

Stormwater discharge from the basin is managed through two primary systems: a low-flow outlet and a spillway. The low-flow system comprises 3x525mm diameter concrete pipes discharging into the table drain along Manilla Road. The spillway features a two-tier weir system designed to flatten the discharge hydrograph, reducing peak flow rates. The spillway can discharge a 1% AEP event even if the low-flow system is fully blocked, with water flowing overland into the table drain. Both the outlet pipes and spillway are to be equipped with erosion control measures and designed in detail as part of the construction certificate stage. Basic specifications of the detention system are provided in Table 4-5, with further details illustrated in the indicative plan and section layouts in Appendices B and C.

Table 4-5: Basic properties of the detention system

Property	Value
Basin depth (m)	2.4
Basin footprint (m^2)	2400
Basin volume (m^3)	3600
Basin bottom RL (m)	399.9
Retaining wall crest RL (m)	402.3
Low weir crest RL (m)	401.5
Low weir length (m)	1.75
High weir crest RL (m)	401.8
High weir length (m)	8.25
Internal pipe diameter (mm)	525
Number of pipes	3
Pipe slope (%)	0.5%

The design storm results for the detention basin are summarised in Table 4-6. A plot illustrating the 1% AEP flood levels in the basin is illustrated in Figure 4-4, demonstrating that a minimum freeboard of 300mm is achieved.

Table 4-6: Detention basin performance under design storms

Property	10% AEP results	1% AEP results	1% AEP results (blocked low-flow)
Critical storm	25 minutes	25 minutes	25 minutes
Peak water depth (m)	1.41	2.07	2.26
Peak water RL (m)	401.31	401.97	402.16
Peak discharge (m^3/s)	1.24	3.08	3.85
Peak pipe discharge (m^3/s)	1.26	1.27	0.0
Peak weir discharge (m^3/s)	0.0	1.89	3.85
Overland peak flow depth (m)	0.0	0.10	0.16
Overland peak flow velocity (m/s)	0.0	1.3	1.7
Overland flow v.d product	0.0	0.13	0.26

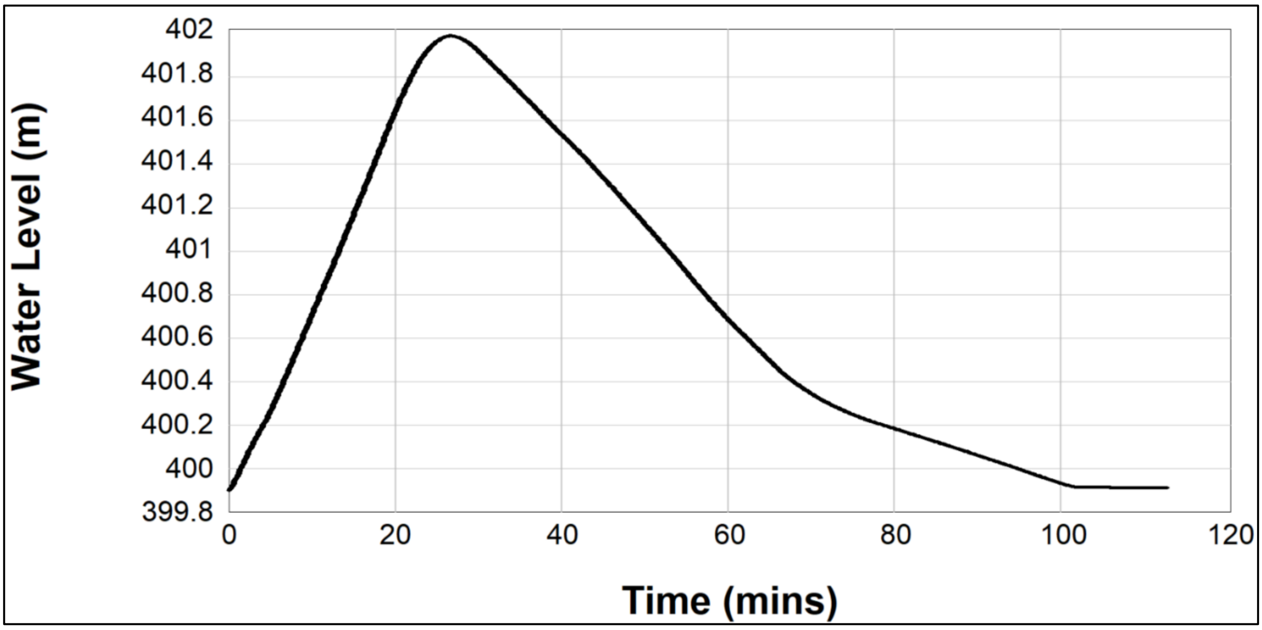

Figure 4-4: Basin flood levels in 1% AEP storm event.

Ownership of the basin will remain with Browns Lane Developments Pty Ltd, and it will not be transferred to Council. Therefore, a maintenance and management plan is not included in this report.

4.6 Basin Risk Assessment

Per Clause 4 of the *Dams Safety Regulation 2019*, the proposed detention basin does not meet the criteria for declaration as a dam, as its wall crests are less than 15m in height. Additionally, there is no reasonable threat to property, economic assets, or human life in the unlikely event of failure. The basin's crest is approximately 0.3m higher than the natural surface; therefore, failure with a full basin would result in a discharge of approximately 750m^3 of water overland. Moreover, if failure were to occur during a major storm event, the peak discharge overland would be 2.1m^3/s. Given the large width of the flow path, this is considered acceptable, especially with the lack of downstream property or infrastructure at risk. This risk assessment follows the guidelines outlined in *ISO 31000 (2018) Risk Management* where applicable.

5.0 CONCLUSION

Land Dynamics Australia has prepared this report on behalf of Browns Lane Developments Pty Ltd for submission to Tamworth Regional Council to support the development application for the proposed development on Lot 349 DP753848 and Lot 39 DP22919 in Tamworth. The report assesses the impact of the development on stormwater quantity by comparing the pre and post-development conditions.

The proposed development will increase the site’s impervious area, resulting in higher peak stormwater discharge flow rates. To mitigate this, an end-of-line detention basin is proposed to capture and store stormwater runoff from the entire subdivision. The basin will attenuate peak discharge flow rates, ensuring they are either neutral or beneficial to downstream infrastructure and property. As a result, the proposed development will not place additional strain on Tamworth Regional Council’s existing stormwater network.

It should be noted that the findings in this report are based on the preliminary design. Calculations, simulations, and diagrams presented herein are subject to detailed design as part of the construction certificate stage.

6.0 REFERENCES

ISO. (2018). *International standard: Risk management guidelines.* ISO.

NSW Government. (2023, January). Dam Safety Regulation 2019. Sydney, NSW, Australia.

Office of Environment and Heritage. (2014). *New England North West Climate Change snapshot.* Sydney: NSW Government Office of Environment and Heritage.

Tamworth Regional Council. (2023). *Engineering Design Minimum Standards.* Tamworth: Tamworth Regional Council.

APPENDIX A – PROPOSED DEVELOPMENT LAYOUT

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C	PRELIMINARY DA PLAN UPDATES	21.08.24	LL	CM	GB	
D	PRELIMINARY DA PLAN UPDATES	02.09.24	LL	JOK	GB	
E	DA SUBMISSION	5.11.24	CM	CM	GB	

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PROJECT: LIFESTYLE COMMUNITY
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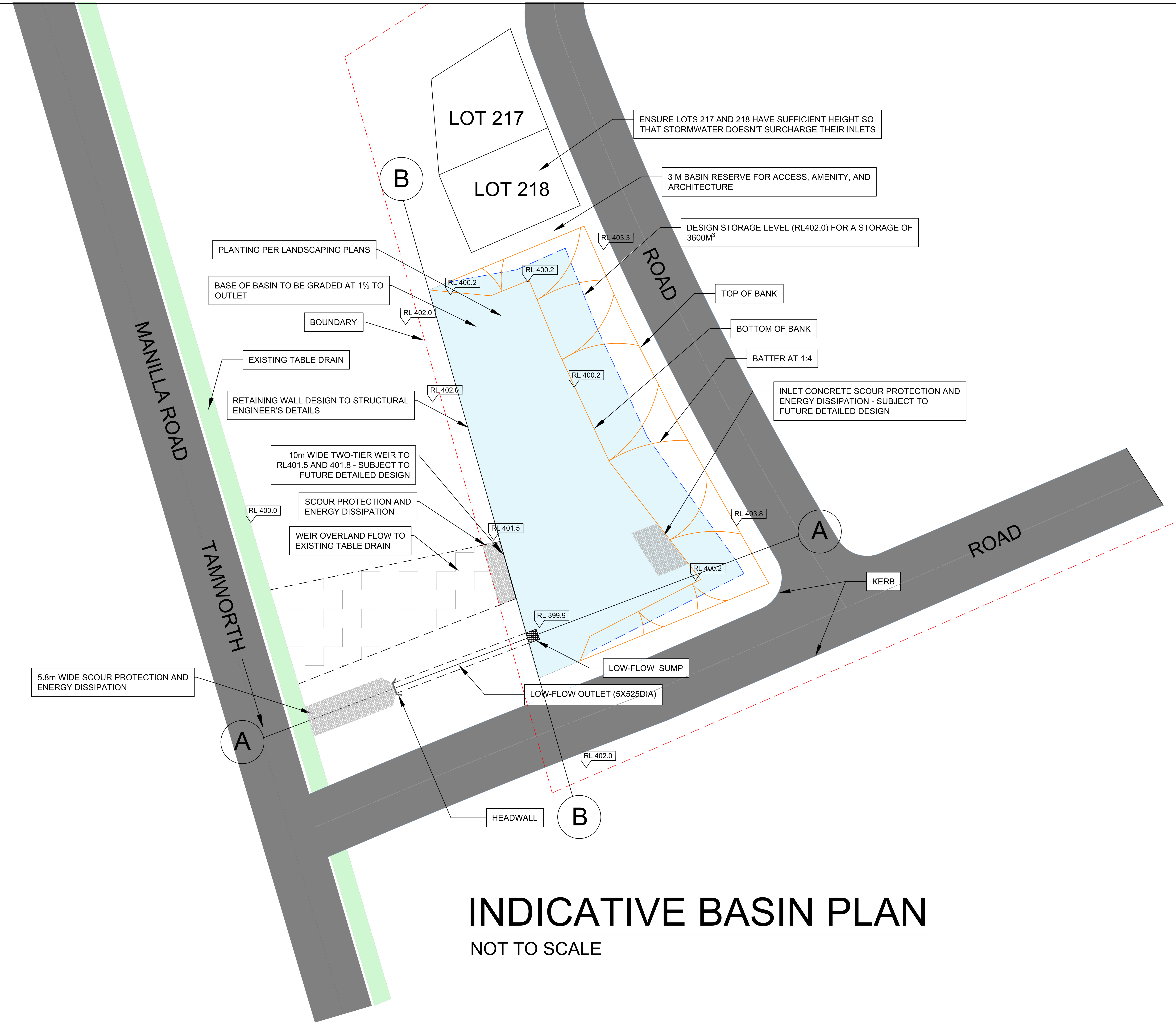
APPENDIX B – INDICATIVE BASIN PLAN



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BROWNS LANE, TAMWORTH

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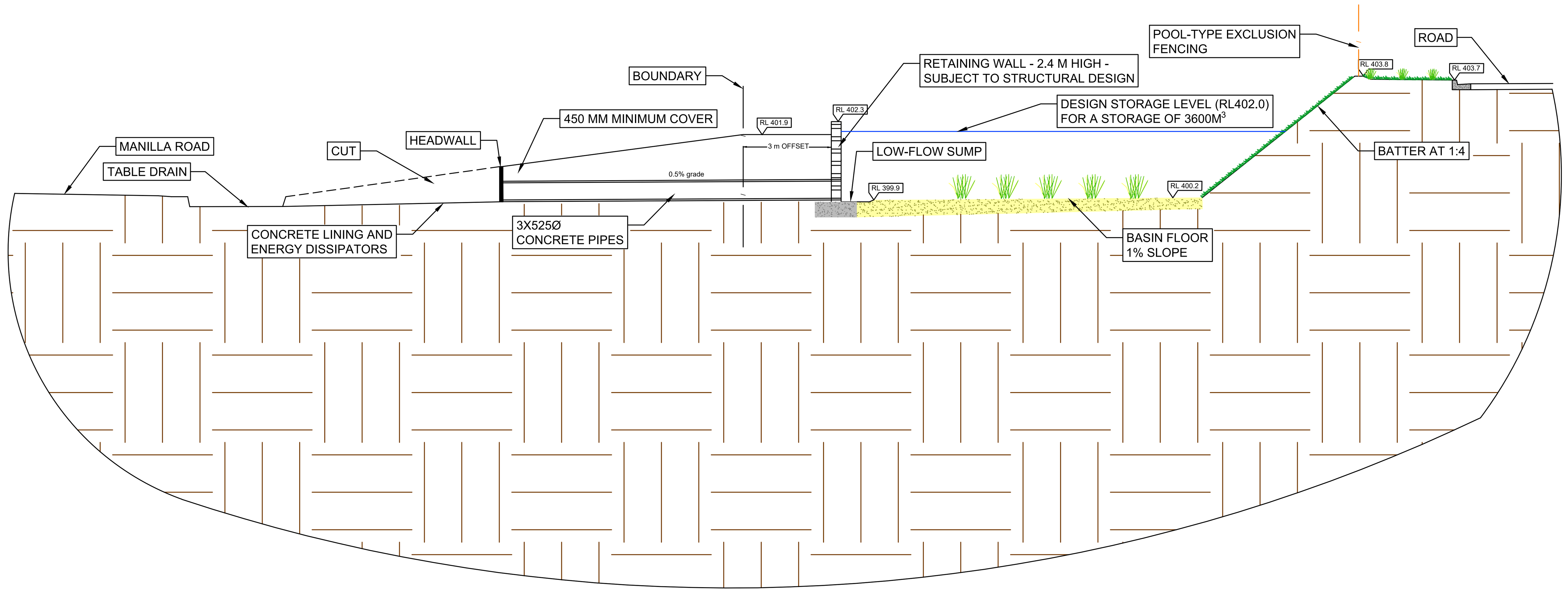
APPENDIX C – INDICATIVE BASIN SECTION



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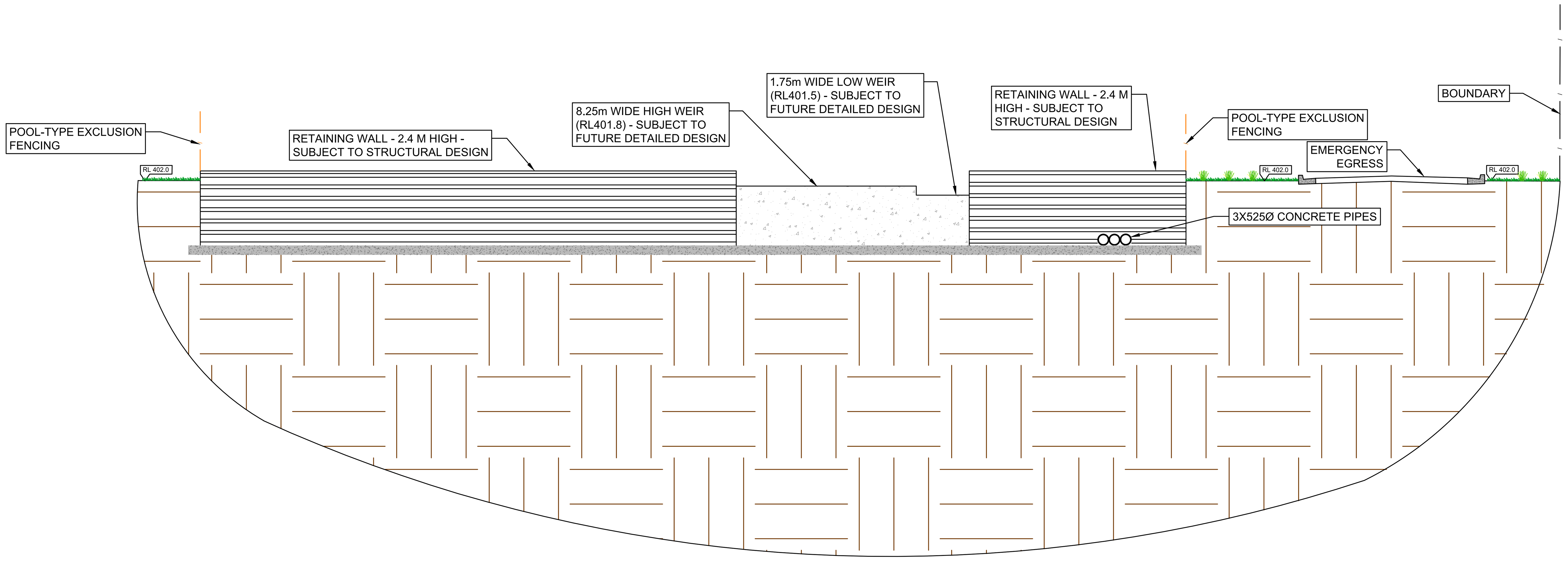

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APPENDIX D – POST-DEVELOPMENT CATCHMENT PLAN

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