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CIVIL ENGINEERING REPORT

DEVELOPMENT APPLICATION

PROPOSED SHOPPING CENTRE

AUSTRAL NSW

November 2024
Revision 3.0

henry&hymas

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Preface

Henry & Hymas have been engaged by Fabcot Pty Ltd to prepare this Civil Engineering Report (The Report) to satisfy civil engineering matters in support of the Development Application for the Proposed Commercial/Retail Development located in Austral North.

This Report aims to provide a summary of key civil engineering design elements of the proposed development:

- General site locality, topography and existing characteristics;
- Stormwater management – water quality and quantity;
- Bulk earthworks;
- Sediment and Erosion.

This Report has been prepared in conjunction with a set of Civil Engineering Drawings which show the general proposed civil and stormwater design for the development. The drawings are available for review in Appendix A of this Report.

The following principles have been adopted as part of the design process:

- Consideration of design intent in relation to functionality, expectations and requirements of the end user.
- Compliance with relevant Council and authority standards and policies.
- Design coordination with the project team.
- A design philosophy sympathetic to the site constraints, environment, terrain, and landform.
- Retention of existing infrastructure where suitable.

The civil engineering component of the aforementioned project has been designed in accordance with the following Council codes and policies:

- Liverpool City Council Development Control Plan (DCP).
- Liverpool City Council OSD Standards.
- Liverpool City Council WSUD Technical Guidelines.

The proposed development is located within the larger Austral and Leppington North growth precincts. As part of the larger growth precinct, additional development controls apply to the development. Key documentation relating to the context of the site within the Austral and Leppington North growth precincts will be addressed where required. Documents applicable to the civil engineering design, and referenced in the report, are available for review on the NSW Planning Portal website via the link listed below:

https://www.planning.nsw.gov.au/Plans-for-your-area/Priority-Growth-Areas-and-Precincts/South-West-Growth-Area/Austral-and-Leppington-North

1. Site overview

1.1 Development Proposal

The development approval seeks approval for the proposed Retail/Commercial development "Austral North Woolworths". The proposed works will cover the entirety of the existing site, generally comprising the following:

- Construction of a 3 storey mixed use development comprising ground floor retail and parking, commercial/office space and basement carparking.
- Construction of associated site works including landscaping and stormwater infrastructure

An excerpt of the architectural concept plans is shown below in Figure 1. Refer to the Architectural drawings prepared by Clarke Hopkins Clarke (CHC) included in Appendix B for a full-size copy of the architectural concept.

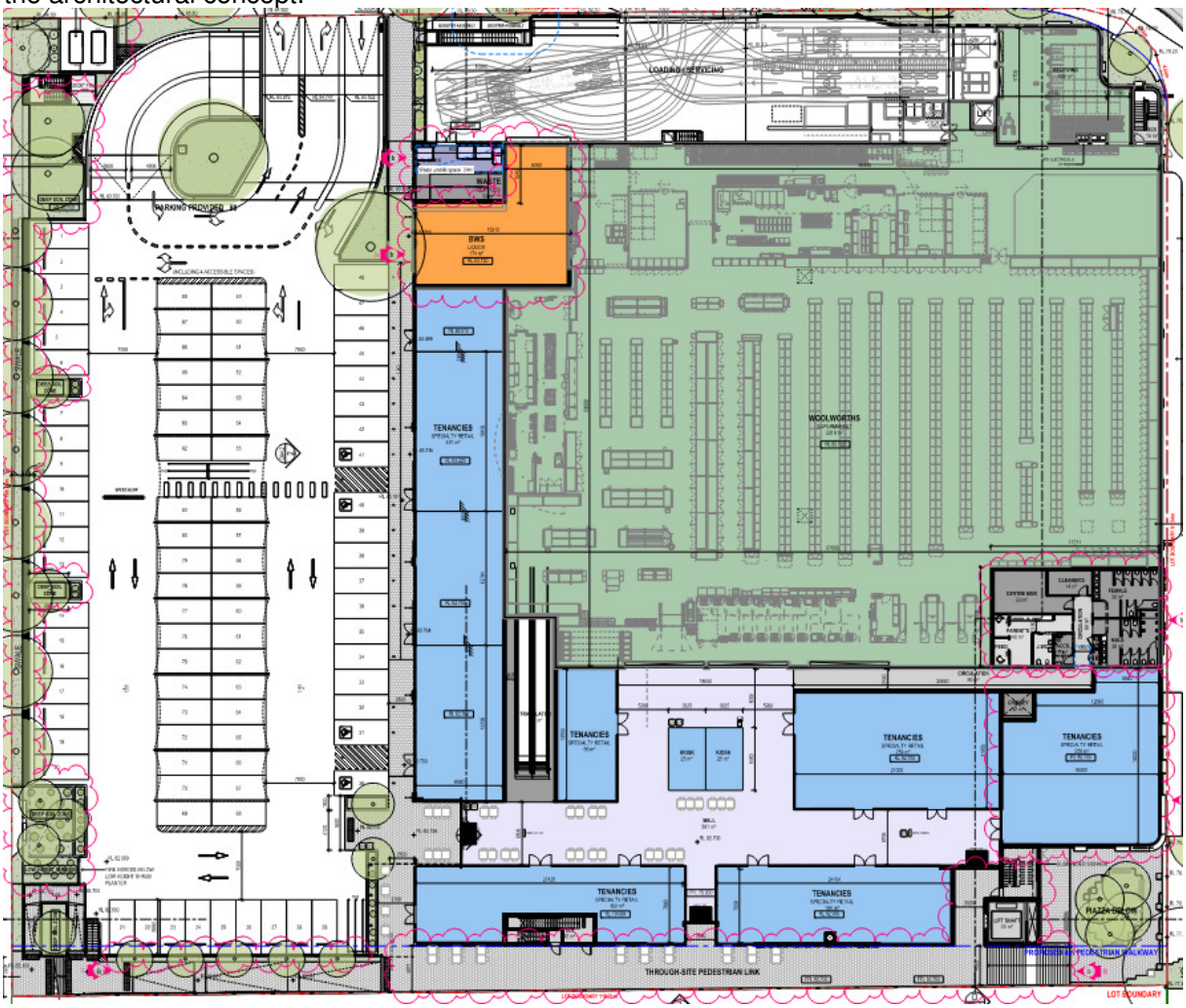

Figure 1: Architectural concept – Ground level by Carke Hopkins Clarke (2024)

1.2 Site Description and Location

The site is located at 495 Fourth Avenue, Austral NSW 2179. The legal description of the site is Lot 121 DP: 1220414. The site has a total area 1.1918 hectares and is located within the municipality of the Liverpool Local Government Area.

The site has two (2) street frontages:

- Fourth Avenue (western boundary).
- Gurner Avenue (northern boundary).

Undeveloped lots are located towards the east of the site whilst the existing primary school, Al Faisal College is located to the north of the intersection of Fourth Avenue and Gurner Avenue. A rural residential development is located towards the south. Further rural developments are located towards the east of the site, however it is expected to be, in part, redeveloped at a later stage as part of the Al Faisal Secondary School works to be approved under a separate SSDA. The surrounding development is generally shown on the nearmaps image below, Figure 2.

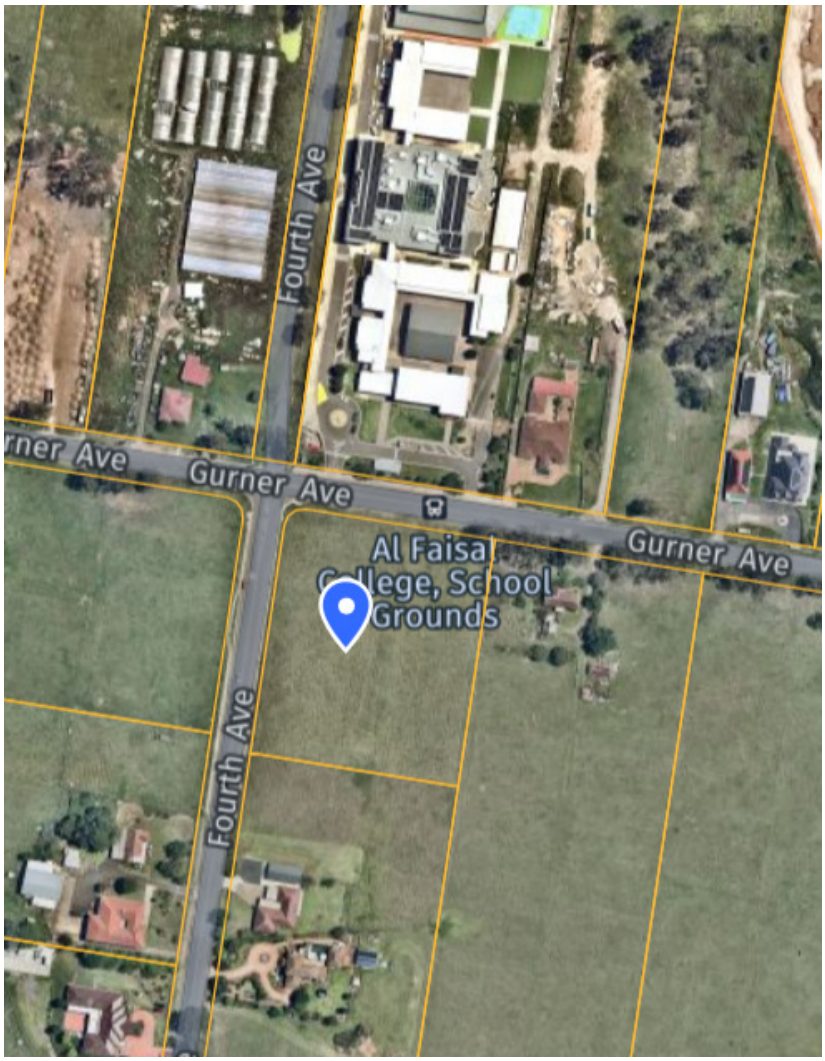

Figure 2: Surrounding Development (Source: Nearmap March 2023)

The existing site is split into two catchments grading towards a north-eastern and north-western direction:

- West Catchment: Consists entirely of previous surfacing spanning 5193m^2. The catchment falls approximately 8m at a 7% grade, draining towards Gurner Avenue. Stormwater runoff is captured by the Gurner Road drainage system and discharges towards to an existing channel located adjacent to the nearby school running in a northerly direction.
- East Catchment: Consists entirely of pervious landscaping spanning 6725m^2. The catchment falls approximately 8m at a 6% grade towards Gurner Street. Stormwater is captured by the Gurner Street table drain and drains towards an unformalised drainage corridor which is proposed to be formalised as part of future precinct works, the context of which is further discussed in Section 3.2.1.

For more information, refer to the pre-development catchment plan C250. The topography of the site is shown in topographical feature survey included in Appendix D of this report.

2. Bulk Earthworks

Cut and fill earthworks are required to achieve the grades and levels required to produce a serviceable and suitable development that achieves vehicular and pedestrian access from the proposed development and Fourth and Gurner Avenue. The cut and fill quantities for the site result in a site export/spoil of material in the order of 40,752m3. The distribution of cut and fill throughout the site is shown on civil engineering drawings 231125_DA_BE01, Appendix A. A smaller-scale figure is shown below, Figure 3. Green represents filling and red represents cutting.

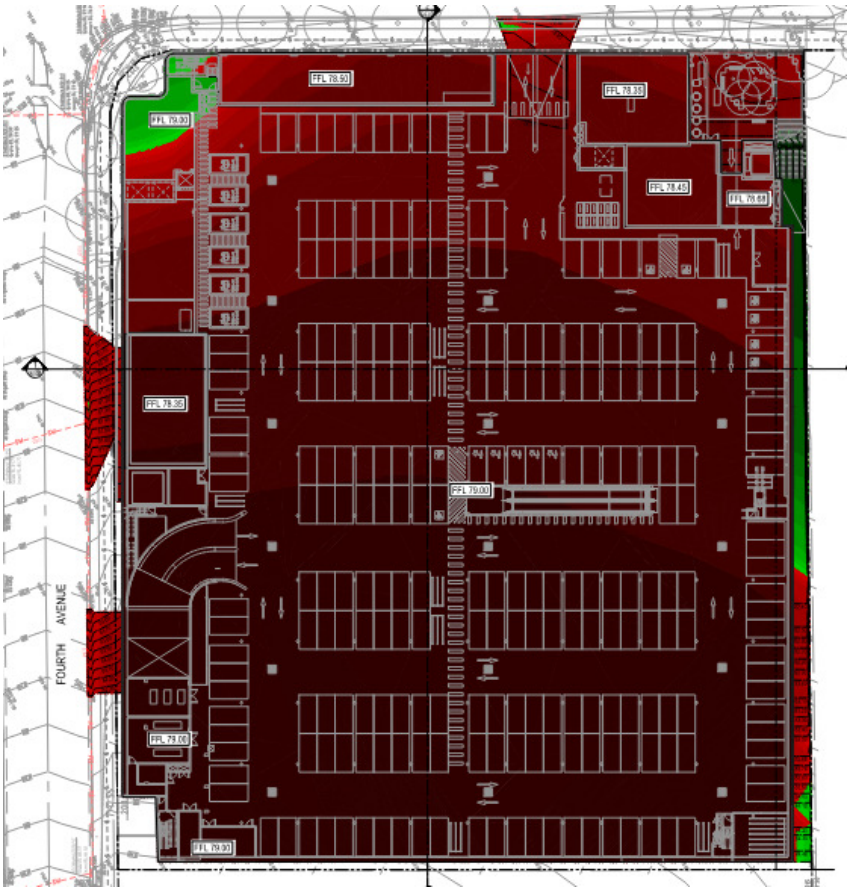

Figure 3: Bulk Earthworks Cut/Fill Plan

3. Stormwater Management

3.1 Introduction

The proposed stormwater management system has been designed to reduce the overall impact of the development on the existing onsite and surrounding stormwater systems and flow regime. The proposed stormwater management system responds to the architectural layout and incorporates the natural topography and site constraints to produce a cost-effective layout that meets best industry practices and water quality and quantity objectives.

The stormwater management system for the proposed development has been designed to collect all concentrated flows from the proposed impervious areas as well as stormwater runoff generated by pervious areas such as landscaping. In accordance with Council guidelines, the in-ground stormwater pipe network has been designed to cater for the 20 year ARI storm event. The system has also been designed in such a way that stormwater run-off generated by the 100 year ARI storm event will be conveyed via piped and overland flow paths with no impact on the subject development or surrounding developments/infrastructure. In the event of a total system blockage/failure, site grading is such that overland flow will be directed away from habitable areas with no impact on proposed or surrounding habitable areas.

The proposed stormwater system for the development will be designed in accordance and in consideration of the following:

- Institution of Engineers, Australia publication "Australian Rainfall and Runoff" (2019 Edition), Volumes 1 and 2 (AR&R).
- AS 3500.3: National Plumbing and Drainage Code Part 3 – Stormwater Drainage.
- Liverpool City Council's relevant planning policies and control plans, specifically: "Liverpool City Council's OSD Standards" (2021)

Urban developments have the potential to increase gross pollutants, sediments, and nutrient concentrations in stormwater runoff. To limit the impact on the downstream water quality, water quality measures at the pollutant source and end of line treatments have been provided, refer to Chapter 3.3 and Chapter 3.4 for additional details.

3.2 Water Quantity

3.2.1 Regional Masterplan Context

As previously mentioned, a significant portion of the existing site is currently serviced by an unformalised drainage corridor to the east of the site. As part of the Growth Centre Precincts DCP 2015 - Schedule 1 Austral & Leppington North Precincts, and the Austral & Leppington North Precincts Infrastructure Delivery Plan the unformalised drainage corridor is proposed to be formalised into a drainage channel with an end of line stormwater management basin. The proposed drainage system is denoted Drainage System B25 and Regional Basin B25.

The entire site is located within the catchment of Regional Basin 25. General planning and high-level design of the surrounding regional drainage system was undertaken by Cardno. The planning document is available for review in the NSW Department of Planning portal website and is identified as the *Austral & Leppington North Precincts, Water Cycle Management*, prepared by Cardno for the Department of Planning & Infrastructure, December 2012.

Detailed design of the Drainage System B25 and Regional Basin B25 was undertaken by SMEC, refer to Figure 4 for more information. The document is available by request from Liverpool City Council's Floodplain and Stormwater Engineers.

In general, the engineering objectives for the site's stormwater management systems are to create a system that safely collects and conveys stormwater run-off whilst meeting the unique water quality and quantity consideration of the growth precinct. The proposed stormwater system for the proposed shopping centre is specifically designed to respond to the following.

- Respond to the nature of the development and create a safe environment for patrons during a storm event.
- Be consistent with the architectural and growth centre ILP layout.
- Promote sustainable water management practices and be consistent with Water Sensitive Urban Design objectives of the client, Liverpool City Council and the Greater Growth Region.
- Incorporating the natural topography.
- Incorporate and respond to existing site constraints e.g. existing and future infrastructure etc.
- Remain consistent with the regional stormwater masterplan detailed in the Austral & Leppington North Precincts Water Cycle Management, prepared for the Department of Planning & Infrastructure, December 2012 and detailed design of the regional drainage system and basin produced for Liverpool Council by SMEC in 2019.

In accordance with Liverpool City Council and regional growth centre guidelines, the proposed stormwater pipe network will need to be designed and sized to wholly convey rainfall-induced run-off from to the 20-year storm event. It should be noted that the extent of the proposed basement encompasses the majority of the site, as such surface run off is proposed to be collected by a suspended stormwater network, to be designed by hydraulic engineers during the detailed design period.

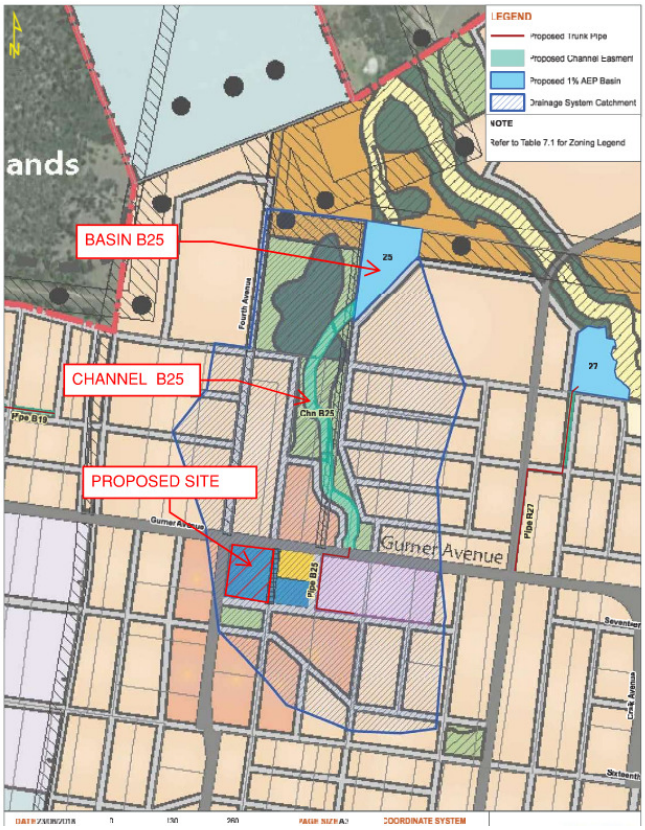

Figure 4: Excerpts of SMEC's basin 25 design drawings

3.2.2 Proposed temporary On-Site Stormwater Detention (OSD) System

From a review of the planning document *Austral & Leppington North Precincts, Water Cycle Management*, prepared for the Department of Planning & Infrastructure by Cardno, dated December 2012 and detailed design drawings of the Regional Basin 25 and Drainage System B25 (undertaken by SMEC) it is understood that undetailed run-off from the developed regional catchment has been catered for in the design of Drainage System and Regional Basin (B25).

Although the conveyance of stormwater and provision of On-site Stormwater Detention (OSD) event is catered for by proposed Regional Basin 25 and Drainage System B25, it is understood the drainage system is not currently constructed and potentially won't be constructed for several years (report date 06/2024). As such, and following consultation with Liverpool City Council's Floodplain and Stormwater Engineers, it was determined temporary OSD will need to be provided to control the peak stormwater flows from the sites by detaining stormwater on-site.

As the overall timeline and staging of the site's construction in respect to the downstream region basin (B25) is unknown, it was determined that temporary On-site Stormwater Detention (OSD) is to be provided to detain post-development flows to within equal or less magnitude to the predeveloped up until the 100 year storm event.

The proposed east/west catchment split of the site will differ than pre-existing conditions with an additional 6461m^2 draining towards the west catchment. Minor redistribution of run-off within the regional sub catchments is required as drainage within Gurners Road is currently undeveloped and an adequate stormwater connection is not available for the east draining catchment. A suitable stormwater connection is present for the western catchment. It should be noted both catchments drain to the Future Regional Basin 25 and Drainage System 25 and the overall regional catchment is maintained. The below table summarises the differences between the eastern and western catchment under pre and post development scenarios.

		West Catchment	East Catchment
Pre (m^2)	**Developed**	5,193	6,725
Post (m^2)	**Developed**	11,654	264

Table 1: Eastern/Western pre vs post development catchment areas

It is understood that with an increase in catchment area draining to the west a larger OSD storage volume than what is typically required will be needed to detain flows to less than that produced by the pre developed catchment area. A 472m^3 OSD tank is proposed to mitigate the impact of an increased catchment and ensure that post developed flows do not exceed pre developed flows in all storms up to the 100 year ARI event. Flows from the proposed OSD tank are to be discharged towards an existing kerb inlet pit located on intersection of Fourth Avenue. Refer civil engineering drawings in Appendix A for the specific configuration of the OSD and the stormwater connection to public infrastructure.

Refer to the Table 2 page over which summarises the pre-development and post-development run-off flow rates.

ARI	Pre-Development (L/s) West Catchment	Post-Development (detained) (L/s) West Catchment	Pre-Development (L/s) East Catchment	Post-Development (undetained)(L/s) East Catchment
5	81	81	105	8
10	111	89	144	10
20	138	97	179	12
50	171	110	221	14
100	200	107	259	16

Table 2: Pre and post development run-off flow rates.

3.3 Water Quality

3.3.1 Regional Masterplan Context

From a review of the *Austral & Leppington North Precincts, Water Cycle Management*, prepared for the Department of Planning & Infrastructure by Cardno, dated December 2012 and Drainage System B25 (undertaken by SMEC) it is understood that water quality has been catered for in the design of the downstream Regional Basin 25 and Drainage System B25. Expansive water treatment systems are proposed within the Regional Basin 25 with the vast majority of stormwater pollutant managed by the bioretention filter system incorporated in the base of the basin, an excerpt of SMECs basin layout plan design drawings is shown below in Figure 5. The biorientation filter is protected from sediments and clogging by a proposed Gross Pollutant Trap (GPT) located at the entry to the system.

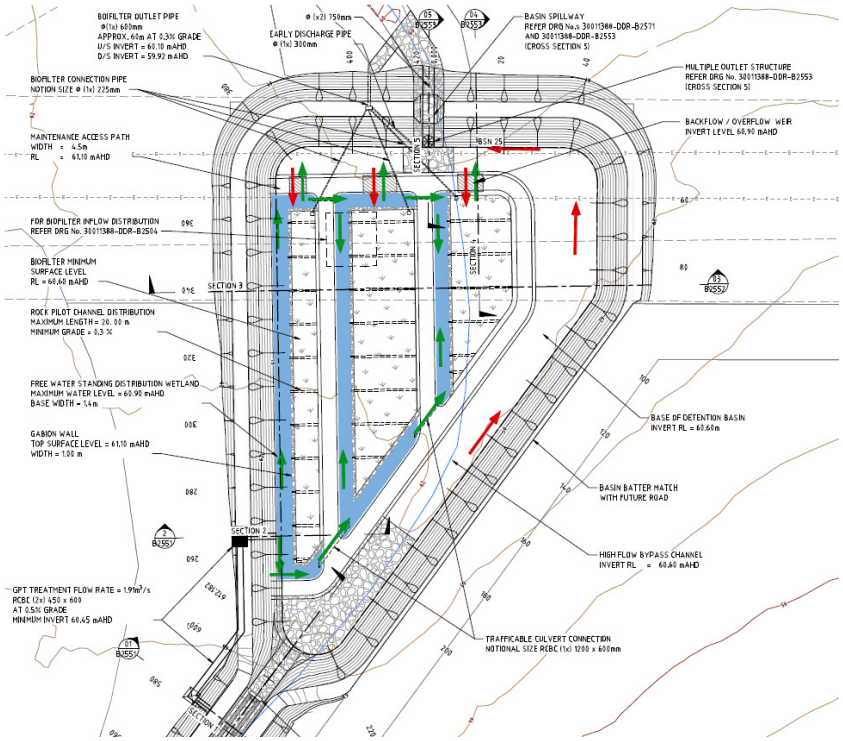

Figure 5: Excerpt of SMEC's design drawings for Proposed Regional Basin (B25).

Similarly with OSD, although the water quality requirements for the developments are catered for by proposed Regional Basin 25 and Drainage System B25, it is understood the drainage system is not currently constructed and potentially won't be constructed for several years (report date 06/2024). As such, it is proposed temporary water quality treatment will need to be provided to

facilitate stormwater pollutant removal for the development until such at a date where the downstream system is constructed.

As the overall timeline and staging of the site's construction in respect to the downstream region basin (B25) is unknown, it was determined that Stormwater Quality Improvement Devices (SQIDS) are to be provided to fulfil the post development pollutant reduction targets (from Liverpool Council's DCP chapter 6 Water Cyle Management) at any given stage of the project until the downstream channel and basin infrastructure (channel and basin B25) is delivered. The SQIDS may be decommisioned once the downstream regional basin B25 is constructed.

3.3.2 Treatment Train Approach

Pollution and contamination dislodged or inherent to and in stormwater and stormwater run-off from urban developments have the potential to damage the ecology and health of local creeks and waterways. As such stormwater quality improvement devices (SQIDs) that aim to minimise pollution during construction and operation of the development have been incorporated into the overall stormwater management design. These devices have been sized, specified and designed in accordance with Liverpool City Council DCP, and Liverpool City Council's Water Sensitive Urban Design Standards. A summary of the implements SQIDs can be seen in Chapter 3.4

The performance of the stormwater quality improvement devices (SQIDs) in mitigating pollution from urban development can be assessed by simulating a post developed pollutant reduction rate for the stormwater system. In accordance with Liverpool City Council's DCP, development subject to water quality requirements must achieve a minimum percentage reduction of the post developed average annual loads of pollutants in accordance with the Table 3 below:

Pollutant	% Post Development Reduction Target Liverpool Council
Litter / Gross pollutants	90
Total Suspended Solids	85
Total Phosphorous	65
Total Nitrogen	45

Table 3: Post developed pollutant reduction targets

To better determine the conceptual design of the water quality treatment trains and to ensure the treatment trains satisfy the reduction parameters outlined in Table 3, a Model for Urban Stormwater Improvement Conceptualisation (MUSIC) was developed.

The MUSIC model was set up with the in-built rainfall station, time period data, evapotranspiration data, source node data, treatment node data and run-off parameters provided by the MUSIC link system, using the Liverpool City Council's MUSIC link feature. A schematic of the MUSIC model can be viewed below in Figure 6. The schematic illustrates the interrelationship between source nodes (catchments) and treatment nodes (water quality treatment measures) for the catchment. The MUSIC modelling catchment plan and detailed catchment plan relating to the site-specific topography used for the MUSIC model schematic layout are documented in civil engineering drawings available in Appendix A.

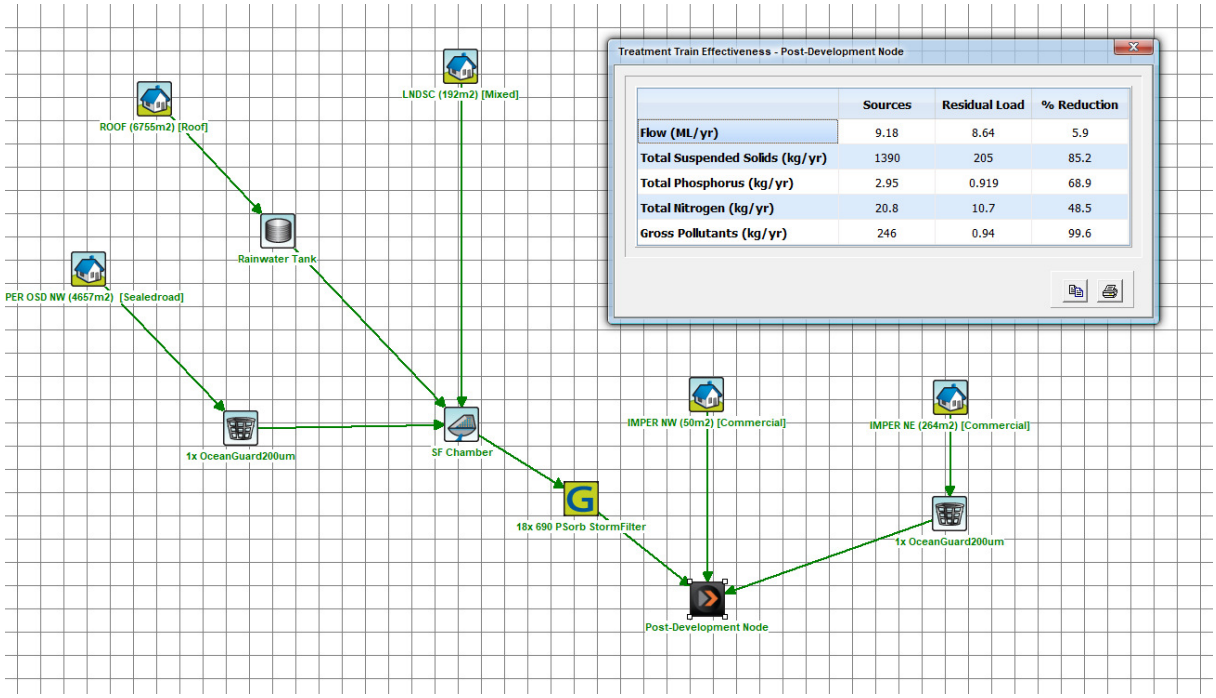

Figure 6: Schematic of MUSIC Model

The resultant reduction in post developed pollutants calculated by the simulation is presented in Table 4 below. With the implementation of the following stormwater quality improvement (SQIDs) devices, the resultant post developed pollutant loads have been reduced below the reduction target for all targeted pollutants.

Pollutant	% Post Development Reduction Target Liverpool City Council	Resultant % Post Development Reduction Obtained
Litter / Gross pollutants	90	99.6
Total Suspended Solids	85	85.2
Total Phosphorous	65	68.9
Total Nitrogen	45	48.5

Table 4: Resultant post developed pollutant reduction targets obtained

3.4 Stormwater quality improvement devices (SQIDs)

Primary Treatment - Pit Baskets

As part of an effective treatment train for the site system, selected areas of the development or targeted removal zones (TRZs), will be pre-treated via passive screening pit baskets. To form a site-wide primary treatment system the TRZ for the development encompasses all external areas not beneath roofs and exposed to surface run-off. Target zones, mostly comprising of highly trafficked and hardstand areas that are subject to higher instances of pollution and litter and stand most to benefit from effective pre-treatment and have been modelled individually in MUSIC to confirm overflow capacities of the basket inserts are accurately considered.

The pit basket proposed to be used is the “200-micron mesh Oceanguard” pit basket filter by Ocean Protect. Pit baskets to be fitted with the “Oceanguard” bit basket are noted on drawing 231125_DA_C200. A detailed of the pit baskets is provide on civil engineering drawings 231125_DA_C201.

The maintenance of the pit baskets is important to ensure the effective removal of pollutants. As such, a maintenance schedule will be required to be detailed at the Construction Certificate stage. For this submission we have provided the generic maintenance schedule as prepared by Ocean Protect, refer to Appendix C.

Secondary treatment – Filter cartridges
To meet the water quality requirements, and to achieve a successful implement a treatment train approach, a media filtration chamber is located at the end of the major stormwater drainage lines. The media filtration (PSorb Stormfilter cartridges by Ocean Protect) targets the removal of gross pollutants, suspended solids, targeted nutrients and hydrocarbons within the stormwater run-off generated by the developed site areas and is proposed to be used in this development.

Media filtration will be incorporated into the stormwater system by the addition of a Stormfilter chamber to be incorporated within the OSD tank. The Stormfilter chamber is proposed to house eighteen (18) x 690mm PSorb filter cartridges. Internal site stormwater will be directed to the filter chamber as shown on the civil engineering plan 231125_DA_C101, and 231125_DA_C201.

The maintenance of the filter cartridges is important to ensure the effective removal of pollutants. As such, a maintenance schedule will be required to be detailed at the Construction Certificate stage. For this submission we have provided the generic maintenance schedule as prepared by Ocean Protect, refer Appendix C.

3.4 Rainwater Reuse

To assist with water conservation, water reuse is encouraged for all new developments as outlined in Liverpool Council's DCP. A 15KL rainwater tank has been proposed to cater for the entirety of the site's roof area (6755 m^2). Stored rainwater is proposed to be reused for toilet flushing purposes and landscaping irrigation. The following reuse rates have been calculated as per NSW Music Modelling standards:

- Rainwater usage of 0.1 kL/day per toilet or urinal.
- Toilet Flushing (assumed 20 toilets): 0.1 x no. toilets = 0.1 x 20 toilets= 2KL/day
- External landscape watering 0.4kL/year/m2 for irrigation modelled as PET-Rain.
- Landscaping Irrigation: 0.4 x Landscaped area = 0.4 x 190m^2 = 76KL/year

Preliminary water quality MUSIC modelling was performed in accordance with Liverpool Council MUSIC link feature, MUSIC modelling guidelines and the above assumptions listed above. The preliminary MUSIC modelling established:

- The 15kL rainwater tank satisfies 67.44% of non-potable demand for internal and external site reuse (defined above).

4. Sediment and Erosion Control

During construction, appropriate sediment and erosion control measures need to be implemented to ensure that downstream receiving waters are not adversely impacted because of construction activities. The engineering drawings 231125_DA_SE01 and 231125_DA_SE02 (refer to Appendix A) by Henry & Hymas outline appropriately designed and detailed measures to mitigate against this risk. These measures have been designed in accordance with the requirements of the publication "Landcom – Managing Urban Stormwater - Soils and Construction, Volume 1, 4th Edition March 2004" and Liverpool Council's requirements.

5. Conclusion

In general, the engineering objectives of civil design and stormwater management elements mentioned above are to create a system that is based on the architectural layout and incorporates the natural topography and site constraints to produce a cost-effective and appropriate drainage system that meets Council's requirements as well as best industry practices and governing water quality and quantity objectives.

We trust the information provided in this report satisfies matters relating to bulk earthworks and stormwater matters such as On-site Stormwater Detention, Water Quality and water reuse.

APPENDIX A – Civil Engineering Drawings by Henry & Hymas

APPENDIX B – Architectural Drawings by Clarke Hopkins Clarke

APPENDIX C – Indicative Maintenance Manuals for SQIDs

APPENDIX D – Feature Survey