# Medical Consulting Rooms, Kingswood

## DA Design

## 45 Orth Street, Kingswood

## Civil Design Report

CLIENT/ Axis Trust

DATE/ 18/04/2024

CODE/ 23-1111

## Commercial in Confidence



## Document Registration

| | |
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# Contents



# Figures

# 1. Introduction

This Civil Design Report has been prepared by AT&L on behalf of Axis Trust in support of the Development Application for the proposed development of Medical Consulting Rooms at 45 Orth Street, Kingswood (the Site).

## 1.1. Site Description

The site is located 2.5km east of the Penrith CBD in Kingswood, is in the Penrith City Council LGA and is bound by existing residential lots to the east, Orth Street to the south, an existing, on-grade Council carpark to the north and Somerset Street and Nepean Hospital to the west. The site is currently a converted residential property containing a medical facility with parking at the rear (north) of the site.

Refer to Figure 1 below for the site location.


*Figure 1: Site Locality (Google Earth)*

The site is approximately 727m$^2$ in area and is located at the intersection of Somerset Street and Orth Street in Kingswood, NSW.

This report is written to comply with the Penrith Development Control Plan (DCP) 2014 and Penrith City Council Stormwater Drainage Guidelines for Building Developments.

# 2. Project Description

The proposed development involves the construction of a two-storey building containing Medical Consulting Rooms including a café and rooftop terrace. An on-grade carpark is proposed for the north half of the site. Refer to Figure 2 for the proposed site layout.

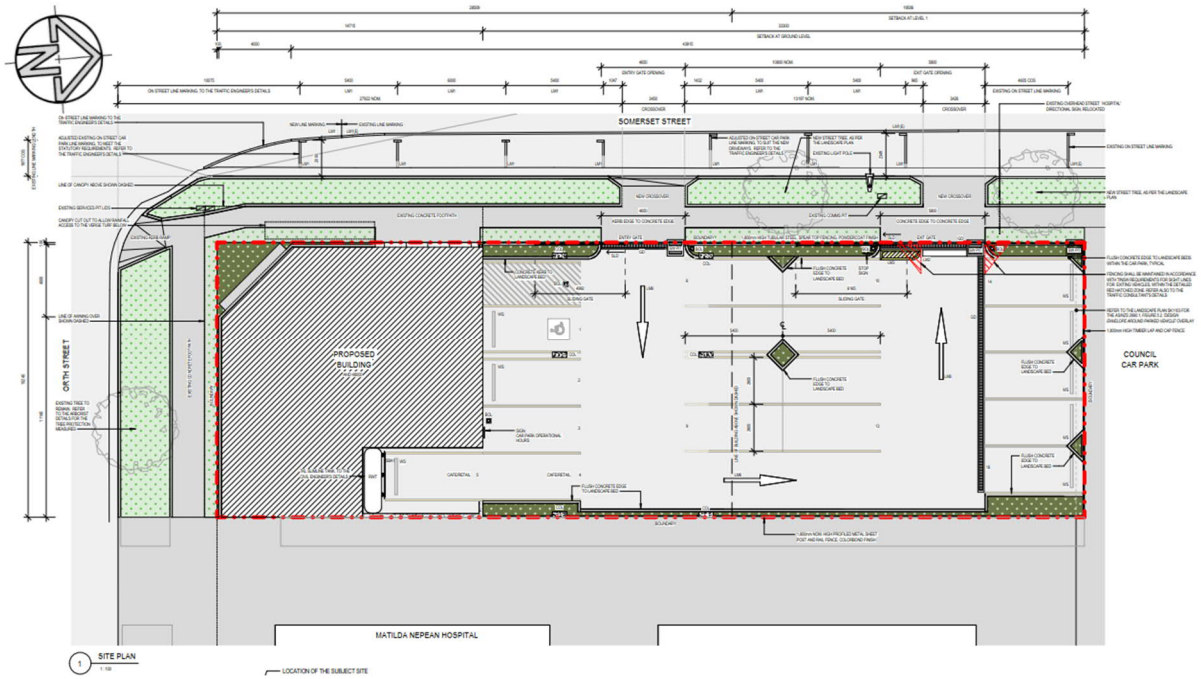


*Figure 2 - Proposed Architectural Layout (BELL Architecture)*

The site generally falls from the south to north. Levels along the Orth Street frontage vary from RL 47.57 to RL 47.86 east to west and RL 47.86 to RL 47.30 south to north along the Somerset Street frontage. Refer to the detailed survey completed by Freeburn Surveyors appended to this report.

## 2.1. Scope of Report

This report addresses the following civil engineering criteria relating to the proposed development:

- Earthworks and retaining walls.
- Flooding.
- Stormwater management including water quantity and water quality.
- Construction phase erosion and sediment control.
- Stormwater operational and maintenance requirements

## 2.2. Supporting Documentation

This report should be read in conjunction with Civil Drawings (AT&L), 23-1111-C000 appended to this report.

## 2.3. Design Criteria

*Table 1: Civil Design Criteria*

| Item | Design Criteria |
|---|---|
| Earthworks | AS 3798-2007 Guidelines on earthworks for commercial and residential developments<br>Penrith Development Control Plan (DCP) 2014 |
| Flooding | NSW Floodplain Development Manual<br>College, Orth and Werrington Creeks Catchment Flood Study Report (Penrith City Council)<br>Penrith Development Control Plan (DCP) 2014 |
| Stormwater Drainage | Australian Rainfall and Runoff (ARR) 2019<br>AS/NZS 3500.3-2015 – Stormwater Drainage<br>Penrith Development Control Plan (DCP) 2014<br>Penrith City Council – Stormwater Drainage Specification for Building Developments |
| On-Site Detention (OSD) | Australian Rainfall and Runoff (ARR) 2019<br>Penrith Development Control Plan (DCP) 2014<br>Penrith City Council – Stormwater Drainage Specification for Building Developments |
| Stormwater Quality | Penrith City Council – Water Sensitive Urban Design (WSUD) Policy<br>Penrith City Council – Water Sensitive Urban Design – Technical Guidelines<br>SEPP (Biodiversity and Conservation) 2021 Chapter 6 Water Catchments, Division 2 Controls, Section 6.6 Water Quality |
| Erosion and Sediment Control | Landcom's Soils and Construction: Managing Urban Stormwater (2004) |

# 3. Earthworks and Retaining Walls

The intent of the proposed development is to create a flat pad for the proposed building and on-grade carparking. The creation of this pad generally allows existing levels to be maintained across the extent of the site.

The cut and fill requirements within the site have been defined through multiple design iterations and careful consideration of the following:

- Stormwater drainage and overland flow management.
- Connectivity to Orth and Somerset Streets
- Matching into existing levels along adjacent lots and public domain.
- Avoiding cut in bedrock sub-surface units.
- Meeting the requirements for the end-use of the site

The proposed surface levels across the site result in minimal earthworks required to facilitate the development. Once demolition is complete a final trim will be completed to obtain bulk earthworks levels.

Batters at a maximum of 1 in 5 will be used to transition to existing levels at site boundaries. Retaining walls <600mm in height will be used where battering is not possible due to the site layout.

# 4. Flooding

The site is located in the Orth Creek catchment which is covered by the *College, Orth and Werrington Creek catchment flood risk management study and plan*, prepared by Catchment Simulations Solutions in October 2021. Figure 3 below presents the flood planning area and confirms that the site is not flood prone and not subject to flood planning criteria.

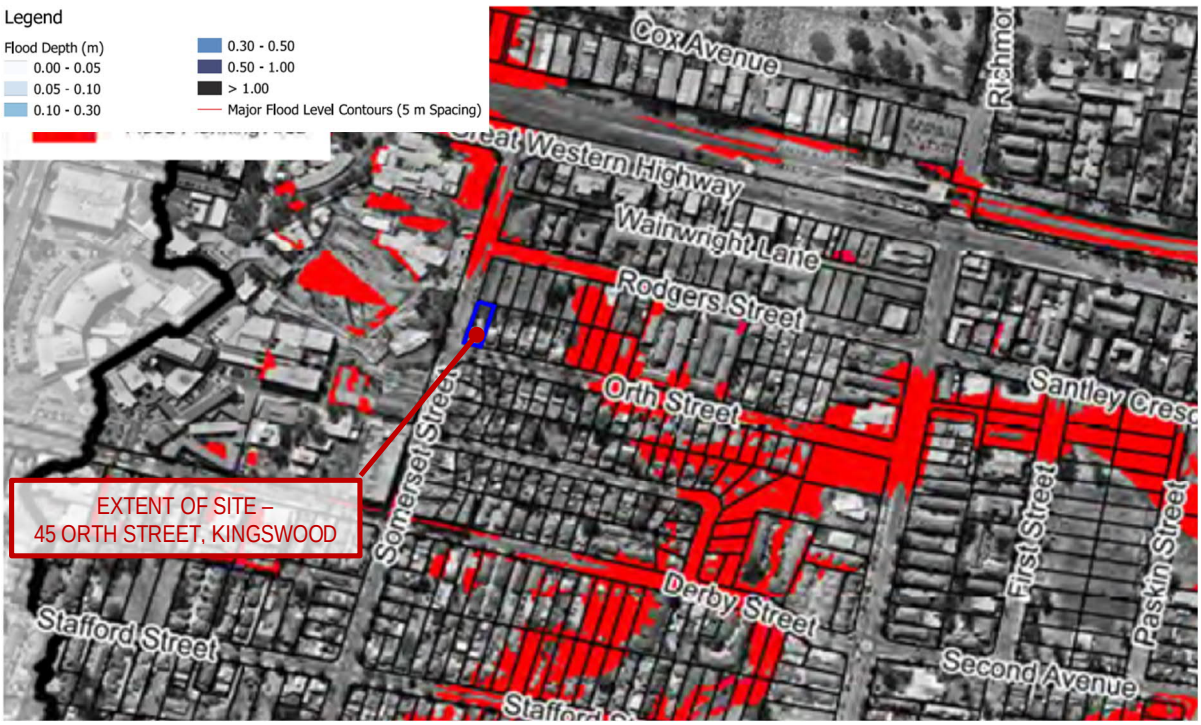


*Figure 3: Flood Planning Area (Catchment Simulation Solutions, Oct 2021)*

# 5. Stormwater Drainage

## 5.1. Stormwater Drainage Design Criteria

Design criteria and requirements for the proposed site stormwater management are outlined in the following documents:

- AS 3500.3 – Plumbing and drainage – Stormwater drainage
- Commonwealth of Australia (Geoscience Australia), *Australian Rainfall and Runoff*, 2019.
- Penrith Development Control Plan (DCP) 2014
- Penrith City Council – Stormwater Drainage Specification for Building Developments

An extract of the prescriptive controls adopted for the site are summarised in Table 2.

*Table 2: General stormwater drainage design criteria*

| Stormwater Component | Design Criteria |
|---|---|
| Hydrology | ▪ Time of concentration values 5 minutes (minimum) and 20 minutes (maximum).<br>▪ Design Storm events: 20% AEP, 10% AEP, 5% AEP, 2% AEP and 1% AEP. |
| Minor and Major System | ▪ Minor system: 10% AEP conveyed by way of pit and pipe drainage.<br>▪ Major system: 1% AEP conveyed by way of pit and pipe drainage and overland flow. |
| Pipes | ▪ Minimum pipe diameter (road reserve): 375mm<br>▪ Minimum pipe diameter (private drainage system): 150mm<br>▪ Minimum pipe grade: 1% (desirable), 0.5% (absolute minimum)<br>▪ Minimum pipe cover: 450mm (grassed area), 600mm (under carriageway)<br>▪ Where minimum cover cannot be achieved due to physical constraints the pipe class shall be suitably increased.<br>▪ All pipes in road reserves will be Reinforced Concrete Pipes (RCP) or Fibre Reinforced Cement (FRC) equivalent.<br>▪ Pipes discharging to an overland flow path shall adopt a minimum tailwater level equivalent to respective overland flow level.<br>▪ A hydraulic grade line HGL design method shall be adopted for all road pipe drainage design. |
| Pits | ▪ Minimum pit freeboard: 150mm from HGL to surface level in the minor event.<br>▪ Where trapped low points are unavoidable and potential for flooding private property is a concern, an overland flow path capable of carrying the total 1% AEP storm event has been provided. Alternatively, the pipe and inlet system has been upgraded to accommodate the 1% AEP storm event.<br>▪ Maximum pit spacing: 40 metre intervals.<br>▪ Blockage factors of 20% and 50% shall be adopted for on-grade and sag pits respectively. |
| Gutter flow widths | ▪ Maximum flow width: 2.0m |
| Overland flow paths | ▪ Velocity x depth product shall not exceed 0.4 $m^2/s$ for all storms up to and including the 1% AEP event. |

## 5.2. Existing Site Stormwater Drainage

Dial Before You Dig records received from Penrith City Council show that the site does not currently have a direct connection to Council's stormwater drainage network. Figure 4 below presents the surrounding Council stormwater network.


*Figure 4: Stormwater map – DBYD, Penrith City Council*

## 5.3. Proposed Site Stormwater Drainage

The proposed drainage network within the property has been designed in accordance with Penrith City Council guidelines and to safely convey major and minor flows to the adjacent public domain. The following criteria have been adopted for the proposed drainage system:

- Major system (overland flow paths): 1% AEP
- Minor system (pit and pipe network): 10% AEP.

The site is divided into two catchments with the following configurations and 10% AEP flow rates as shown in Figure 5 below.

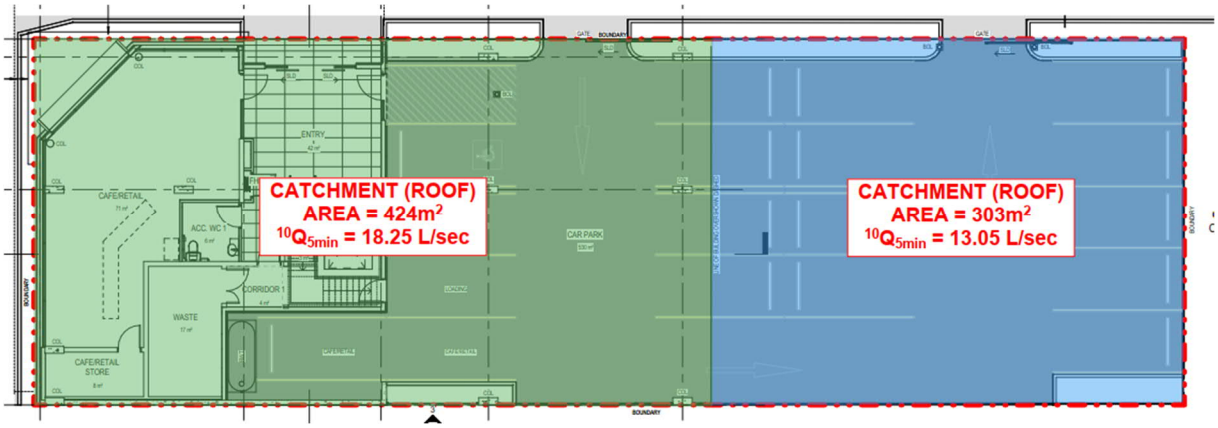


*Figure 5: Post development catchment plan*

- Catchment 1 discharges from the roof water drainage system to the proposed rainwater reuse tank which overflows to the proposed bio retention system.
- Catchment 2 discharges from the on-grade carpark through the bio retention system to a proposed kerb inlet pit in the eastern kerb of Somerset Street.

Since the site is does not have an existing frontage to Council's stormwater drainage system an extension will have to be constructed from the existing pit at the corner of Somerset and Rodgers Streets shown in Figure 4.

The stormwater extension will consist of kerb inlet pits every 40m minimum and DN375 reinforced concrete pipe laid at 1.0% minimum.

# 6. On Site Detention (OSD)

The proposed development will comply with *Penrith City Council's Stormwater Drainage Specification for Building Developments* in relation to exemption from on-site detention requirements.

Figure 6 below presents the Kingswood OSD map extract which shows developments in the Kingswood area that are required to provide OSD. This confirms that the proposed development is not required to provide On-Site Detention.

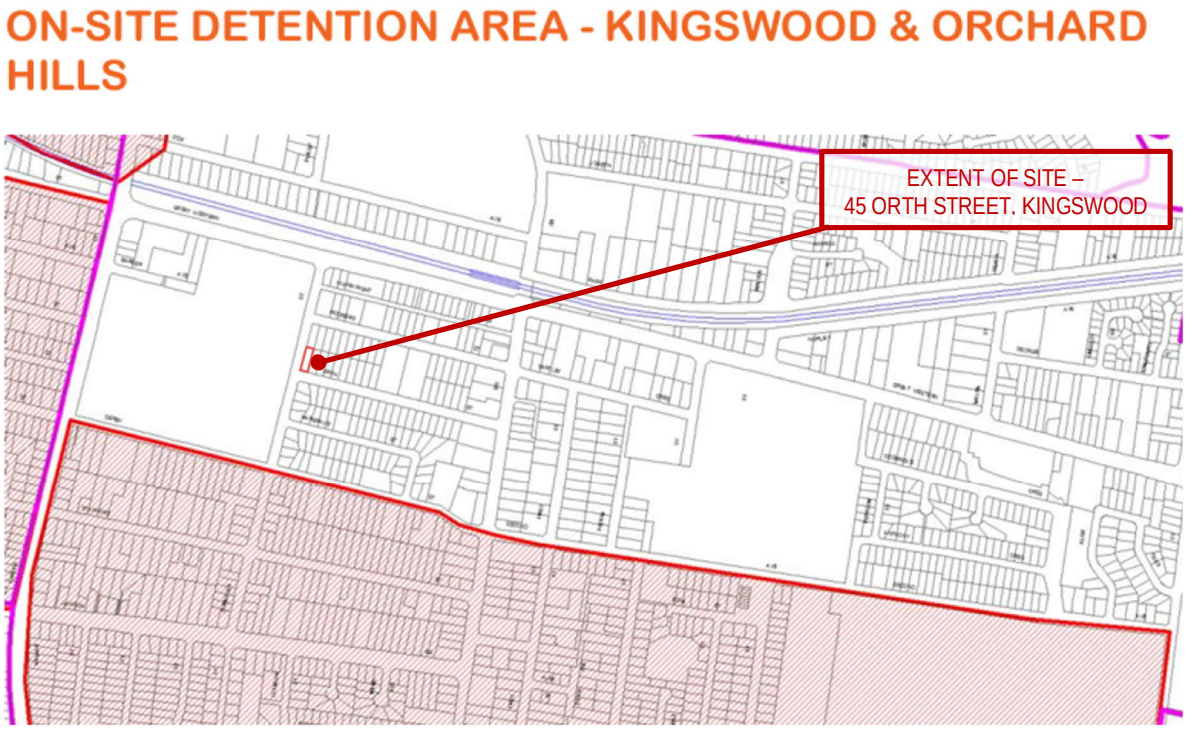


*Figure 6: On-Site Detention Area – Kingswood and Orchard Hills (Penrith City Council)*

# 7. Water Sensitive Urban Design (WSUD)

Water Sensitive Urban Design has been provided for the proposed development in accordance with Penrith City Council's Deemed-to-Comply Toolkit. Whilst the proposed development is zoned *B4 – Business / Mixed Use* this is a similar land use to Industrial / Commercial developments for the purpose of Water Sensitive Urban Design.

Figure 7 below presents the sizing requirements for a standard raingarden nominated in Section 3.2.1 of the Deemed-to - Comply Toolkit.

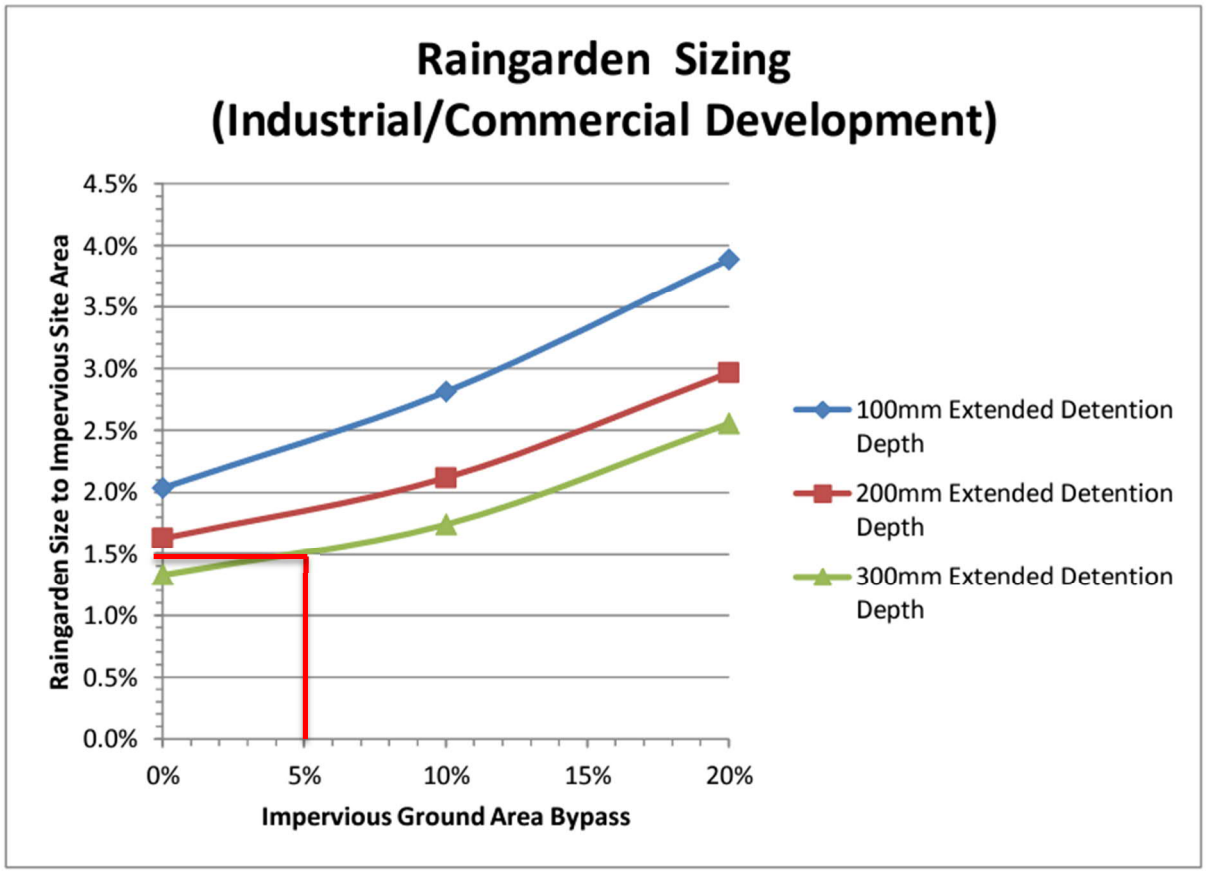


*Figure 7: Raingarden Sizing (Industrial/Commercial Development)*

A maximum 5% impervious area bypass has been allowed for in calculating the raingarden area. Based on an impervious ground floor area of 693m$^2$ and a raingarden size of 1.5% of impervious area for a 300mm extended detention depth, the proposed development requires a raingarden with a minimum area of 10.4m$^2$.

This area will be provided in landscape zones fronting Somerset Street and constructed in accordance with Section 4.1 of the Deemed-to-Comply Toolkit and Penrith City Council WSUD Bioretention Standard Drawings.

## 7.1. WaterNSW Water Quality Objectives

For consent authorities, the Environmental Planning and Assessment Act (EP&A Act) 1979 provides the necessary framework for environmental impact and planning assessment within NSW. As such, the State Environmental Planning Policy (SEPP) (Biodiversity and Conservation) 2021 applies. As per SEPP Chapter 6, Division 2, Section 6.6 Water quality and quantity states the following:

*"6.6 Water quality and quantity*

*(1). In deciding whether to grant development consent to development on land in a regulated catchment, the consent authority must consider the following—*

*(a). whether the development will have a neutral or beneficial effect on the quality of water entering a waterway,*

*(b). whether the development will have an adverse impact on water flow in a natural waterbody,*

*(c). whether the development will increase the amount of stormwater run-off from a site,*

*(d). whether the development will incorporate on-site stormwater retention, infiltration or reuse,*

*(e). the impact of the development on the level and quality of the water table,*

*(f). the cumulative environmental impact of the development on the regulated catchment,*

*(g). whether the development makes adequate provision to protect the quality and quantity of ground water.*

*(2). Development consent must not be granted to development on land in a regulated catchment unless the consent authority is satisfied the development ensures—*

*(a). the effect on the quality of water entering a natural waterbody will be as close as possible to neutral or beneficial, and*

*(b). the impact on water flow in a natural waterbody will be minimised.*

*(3). Subsections (1)(a) and (2)(a) do not apply to development on land in the Sydney Drinking Water Catchment.*

*Note— Part 6.5 contains provisions requiring development in the Sydney Drinking Water Catchment to have a neutral or beneficial effect on water quality."*

The site is situated within the Hawkesbury Nepean Catchment, so the requirements of subsections (1)(a) and (2)(a) of the SEPP 2011 Biodiversity and Conversation apply to the development.

In determining, whether the development will have a neutral or beneficial effect (NorBE) on the site, the SEPP refers to Water Quality Assessment Guidelines published by WaterNSW. The criteria to satisfy the above can be demonstrated by demonstrating a 10% improvement in total suspended solids (TSS), total phosphorus (TP) and total nitrogen (TN) and an equal or less gross pollutant load compared to the pre-development scenario.

As mentioned in Section 7, the site utilises raingardens as a treatment device for all stormwater run-off and will meet the NorBE requirements. MUSIC modelling has been undertaken for the pre- and post-developed scenarios and results demonstrating NorBE has been documented in Appendix B and Table 8, respectively.

## 7.2. WSUD Modelling – MUSIC Model

The Model for Urban Stormwater Improvement Conceptualisation (MUSICX) was used to evaluate pollutants loads from the site.

A conceptual view of the MUSIC model used in this report can be found In Appendix B

MUSIC model input parameters for this site included rainfall-runoff, base-flow concentration and storm-flow concentration parameters. The parameters used for the catchment area(s) can be seen in Table 3, 4 & 5.

| Parameter | Unit | Figure |
|---|---|---|
| Rainfall Threshold | mm/day | 1.40 |
| Soil Storage Capacity | mm | 105.00 |
| Initial Storage | % of Capacity | 30.00 |
| Field Capacity | mm | 70.00 |
| Infiltration Capacity Coefficient | a | 150.00 |
| Infiltration Capacity Coefficient | b | 3.5 |
| Initial Depth (Ground Water) | mm | 10.00 |
| Daily Recharge Rate | % | 25.00 |
| Daily Baseflow Rate | % | 10.00 |
| Daily Seepage Rate | % | 0.00 |

*Table 3: Rainfall Runoff Parameters – Roof Catchment Areas*

| Parameter | Unit | Figure |
|---|---|---|
| Rainfall Threshold | mm/day | 1.40 |
| Soil Storage Capacity | mm | 105.00 |
| Initial Storage | % of Capacity | 30.00 |
| Field Capacity | mm | 70.00 |
| Infiltration Capacity Coefficient | a | 150.00 |
| Infiltration Capacity Coefficient | b | 3.5 |
| Initial Depth (Ground Water) | mm | 10.00 |
| Daily Recharge Rate | % | 25.00 |
| Daily Baseflow Rate | % | 10.00 |
| Daily Seepage Rate | % | 0.00 |

*Table 4 - Rainfall-Runoff Parameters - Sealed Road Catchment Areas*

| Parameter | Unit | Figure |
|---|---|---|
| Rainfall Threshold | mm/day | 1.40 |
| Soil Storage Capacity | mm | 105.00 |
| Initial Storage | % of Capacity | 30.00 |
| Field Capacity | mm | 70.00 |
| Infiltration Capacity Coefficient | a | 150.00 |
| Infiltration Capacity Coefficient | b | 3.5 |
| Initial Depth (Ground Water) | mm | 10.00 |
| Daily Recharge Rate | % | 25.00 |
| Daily Baseflow Rate | % | 10.00 |
| Daily Seepage Rate | % | 0.00 |

*Table 5 - Rainfall-Runoff Parameters - Landscape Catchment Areas*

## 7.3. MUSIC Results

MUSIC modelling results for each stage are presented as mean annual loads at the receiving node indicate that adopted target reductions (as per the Water-Sensitive Urban Design (WSUD) Policy) are achieved, as shown in Table 9. MUSIC Link results are contained within Appendix C.

*Table 6 – Pre-Development MUSIC Results*

| Pollutant | Sources (Kg/yr) | Residual Load (Kg/yr) | Reduction Achieved (%) |
|---|---|---|---|
| Total Suspended Solids | 13.9285 | 13.9285 | 0 |
| Total Phosphorus | 0.03548 | 0.03548 | 0 |
| Total Nitrogen | 0.3218 | 0.3218 | 0 |
| Gross Pollutants | 2.65 | 2.65 | 0 |

*Table 7 – Post-Development MUSIC Results*

| Pollutant | Sources (Kg/yr) | Residual Load (Kg/yr) | Reduction Achieved (%) | Target Reduction (%) |
|---|---|---|---|---|
| Total Suspended Solids | 63.3184 | 4.8344 | 92.37 | 85 |
| Total Phosphorus | 0.1277 | 0.0265 | 79.24 | 60 |
| Total Nitrogen | 0.8228 | 0.2689 | 67.31 | 45 |
| Gross Pollutants | 9.8273 | 0.0000 | 100.00 | 90 |

*Table 8 – NorBE*

| NorBE | Pre-Development Load (Kg/yr) | Post-Development Load (Kg/yr) | % Pre. Vs Post Reduction |
|---|---|---|---|
| Total Suspended Solids | 13.9285 | 4.8344 | 65.3 |
| Total Phosphorus | 0.03548 | 0.0265 | 25.3 |
| Total Nitrogen | 0.3218 | 0.2689 | 16.4 |
| Gross Pollutants | 2.65 | 0.0000 | 100.0 |

# 8. Erosion and Sediment Control

## 8.1. Construction Phase Sedimentation and Erosion Control

An Erosion and Sediment Control Plan (ESCP) has been prepared in accordance *with Landcom's Soils and Construction: Managing Urban Stormwater (2004)* otherwise known as The Blue Book.

## 8.2. Sources of Pollution

The activities and aspects of the works that have potential to lead to erosion, sediment transport, siltation and contamination of natural waters include:

- Earthworks undertaken immediately prior to rainfall periods.
- Work areas that have not been stabilised.
- Extraction of construction water from waterways during low rainfall periods.
- Clearing of vegetation and the methods adopted, particularly in advance of construction works.
- Stripping of topsoil, particularly in advance of construction works.
- Bulk earthworks and construction of pavements.
- Stockpiling of excavated materials.
- Storage and transfer of oils, fuels, fertilisers and chemicals.
- Maintenance of plant and equipment.
- Ineffective implementation of erosion and sediment control measures.
- Inadequate maintenance of environmental control measures; and
- Time taken for the rehabilitation / revegetation of disturbed areas.

## 8.3. Potential Impacts

The major potential impacts on the riparian environment relate to erosion of distributed areas or stockpiles and sediment transportation. Potential adverse impacts from erosion and sediment transportation can include:

- Loss of topsoil.
- Increased water turbidity.
- Decreased levels of dissolved oxygen.
- Changed salinity levels.
- Changed pH levels.
- Smothering of stream beds and aquatic vegetation.
- Reduction in aquatic habitat diversity.
- Increased maintenance costs; and
- Decrease in waterway capacity leading to increased flood levels and durations.

## 8.4. Design of Erosion and Sediment Control Measures

Suitable erosion and sediment controls shall be provided by the Contractor and maintained throughout all stages of works, including at completion of the bulk earthworks.

All design, documentation, installation and maintenance of sediment and erosion controls will be in accordance with the requirements of:

- *Protection of the Environment Operations Act*
- Penrith City Council's guidelines and specifications
- *Managing Urban Stormwater: Soils and Construction*, Landcom, (4th Edition) (The "Blue Book") Volume 1 and Volume 2

With the proposed site being less than 2,500m$^2$ in disturbed area, temporary sediment basins are not required to be incorporated into the ESCP.

## 8.5. Construction Methodology

The following construction methodology will be followed to minimise the impact of sedimentation due to construction works:

- Diversion of "clean" water away from the disturbed areas and discharge via suitable scour protection.
- Diversion of sediment-laden water into temporary sediment control basins to capture the design storm volume and undertake flocculation (if required).
- Provision of construction traffic shaker grids and wash-down to prevent vehicles carrying soils beyond the site.
- Provision of silt fences to filter and retain sediments at source; and

## 8.6. Site Inspection and Maintenance

The inspection and maintenance requirements outlined in this section must be carried out while either earthworks or quarrying is being conducted, and all areas re-established.

The Contractor will be required to inspect the site after every rainfall event and at least weekly, and will:

- Inspect and assess the effectiveness of the ESCP and identify any inadequacies that may arise during normal work activities or from a revised construction methodology. Construct additional erosion and sediment control works as necessary to ensure the desired protection is given to downstream lands and waterways.
- Ensure that drains operate properly and to affect any repairs.
- Remove spilled sand or other materials from hazard areas, including lands closer than 5 metres from areas of likely concentrated or high velocity flows especially waterways and paved areas.
- Remove trapped sediment whenever less than design capacity remains within the structure.
- Ensure rehabilitated lands have affectively reduced the erosion hazard and to initiate upgrading or repair as appropriate.
- Maintain erosion and sediment control measures in a fully functioning condition until all construction activity is completed and the site has been rehabilitated; and
- Remove temporary soil conservation structures as the last activity in the rehabilitation.

## 8.7. Conclusion

The erosion control measures proposed for the site will comply with the requirements of Penrith City Council DCP and *Managing Urban Stormwater, Soil and Construction Volume 1 (2004)*.

The proposed ESCP will ensure that the best management practice is applied to the development site in controlling and minimising the negative impacts of soil erosion.

# 9. Operation and Maintenance

On-going maintenance of the stormwater infrastructure system described in this report needs to be undertaken on a regular basis to ensure that the system operates efficiently and as required by the design.

The stormwater infrastructure requiring maintenance is as follows:

- Stormwater drainage pit and pipe network ranging from DN150 to DN225 to convey local stormwater runoff to Somerset Street.
- Raingardens located along the western edge of the site.
- Subsoil drainage in garden beds and raingardens.

## 9.1. Inspection and maintenance procedures

The following maintenance schedule nominates the necessary roles and responsibilities of the asset owner to effectively inspect and maintain the whole of the stormwater infrastructure system to ensure the safe operation of the stormwater management system as intended by the approved engineering design.

Every inspection and maintenance activity should be recorded in a checklist along with a brief description and photos of the assets inspected. The checklist should also include the date, location, asset ID and person conducting the inspection or maintenance. A sample checklist has been provided in this section for information.

| Maintenance Action | Frequency | Responsibility | Procedure |
|---|---|---|---|
| Inspect bio retention gardens | Three monthly AND after heavy rainfall | Land owner | Visually inspect bio retention garden by completing included *biofiltration maintenance checklist* (FAWB, 2009)<br><br>DO NOT enter the bio retention garden |
| Inspect pit grates, frames and lintels for blockages and damage | Three monthly AND after heavy rainfall | Land owner | Lift grate on pit using manual handling techniques and visually inspect the pit for rubbish and debris. Remove any build up in the base of the pit.<br><br>Visually inspect the grate and frame for rust and corrosion, step irons, lintels and pit walls and base for damage.<br><br>DO NOT enter pits |
| Flush subsoil drainage system | Annually | Land owner | Flush subsoil drainage lines behind kerbs and within bio retention gardens using clear outs to ensure effective operation. |

| Maintenance Action | Frequency | Responsibility | Procedure |
|---|---|---|---|
| Inspect stormwater pipe network for blockages / damage | Every 3 years | Land owner | Complete a CCTV inspection of the stormwater drainage system to monitor for blockages and damages to pipework. |
| Replace bio filter media | Every 5-7 years depending on wear and tear | Council | Remove and replace bio filter media within bio retention gardens every 5-7 years (or as nominated by the bio filter manufacturer).<br>Reconstruct in accordance with Council standards. |

Regular maintenance of the stormwater drainage system and particularly the Water Sensitive Urban elements of the system will prolong the lifespan of these products and reduce the operational cost of replacement throughout the lifespan of the stormwater system.

Adherence to this Operational Environmental Management Plan is recommended to ensure that the stormwater drainage system operates as intended in the design. It is the responsibility of the owner and operator of the system nominated above to monitor and maintain the stormwater system to the satisfaction of the Local Authority.

Refer to sample checklist for biofiltration system maintenance and inspection from the Facility of Advancing Water Biofiltration below. This checklist should be filled out and filed each time the person responsible conducts inspection or maintenance.

## 9.2. Sample biofiltration maintenance checklist

| BIOFILTRATION SYSTEM MAINTENANCE CHECKLIST | | | | |
|---|---|---|---|---|
| **Inspection frequency:** | 1 – 6 monthly | **Date of visit:** | | |
| **Location:** | | | | |
| **Description:** | | | | |
| **Asset ID:** | | | | |
| **Site visit by:** | | | | |
| **INSPECTION ITEMS** | | **Y** | **N** | **Action required (details)** |
| Sediment accumulation at inflow points? | | | | |
| Litter within system? | | | | |
| Erosion at inlet or other key structures? | | | | |
| Traffic damage present? | | | | |
| Evidence of dumping (eg. building waste)? | | | | |
| Vegetation condition satisfactory (density, weeds, etc.)? | | | | |
| Watering of vegetation required | | | | |
| Replanting required? | | | | |
| Mowing/slashing required? | | | | |
| Clogging of drainage points (sediment or debris)? | | | | |
| Evidence of overly long periods of ponding? | | | | |
| Damage/vandalism to structures present? | | | | |
| Surface clogging visible? | | | | |
| Drainage system inspected? | | | | |
| Resetting of system required? | | | | |
| Weir/up-turn pipe is clear of debris (if applicable)? | | | | |
| Water level in submerged zone as designed (if applicable)? | | | | |
| **COMMENTS** | | | | |

# Appendix A

## Water Sensitive Urban Design Development Application Checklist

## 7. CHECKLISTS

### Development Application Checklist (lodged with DA)

**Water Sensitive Urban Design**
**Development Application Checklist**

| | | | |
|---|---|---|---|
| **Site/ Project Name** | 45 ORTH STREET, KINGSWOOD | | |
| **Lot and DP Number:** | LOT 186, DP 14333 | **DA Number:** | DA23/1092 |

| | ***Information Required with DA Submission:*** | **Y** | **N** |
|---|---|---|---|
| **1** | Has a Water Sensitive Urban Design Strategy been submitted as part of the development application? | Y | |
| **2** | Is a BASIX Certificate required? If so,<br>Yes - Attach certificate with DA | | N |
| **3** | Has the digital version of MUSIC and report on the MUSIC model using data prescribed outlined in Council's Technical Guideline been attached?<br><br>Have water conservation requirements, stormwater quality retention criteria (TSS 85%, TP 60%, and TN 45%) and water quantity / drainage requirements been met and documented in the WSUD Strategy?<br><br>If relevant, have the Water Conservation, Quantity and quantity targets been achieved? | Y<br><br>Y<br><br>Y | |
| **4** | Does WSUD Strategy contain the following information?<br>• Review of the **WSUD principles** and ensure that these are considered throughout development of the WSUD strategy.<br>• Confirmation of the **WSUD objectives** that are relevant to the development application.<br>• Confirmation of the **WSUD targets** for potable water conservation, stormwater quality management and stormwater quality management that are relevant to the development application.<br>• Complete a **site analysis** to evaluate the site characteristics that potentially will impact on the feasibility of WSUD for the site.<br>• **WSUD measures** that would be appropriate for the development considering the development scale, site characteristics, stormwater quality management function and stormwater quantity management function.<br>• A **preliminary WSUD strategy** that positions the selected WSUD measures in appropriate locations and arranges the measures in an appropriate series.<br>• **Numerical modelling** utilising MUSIC software to evaluate appropriate sizes of the WSUD measures.<br>• **Concept designs** of the WSUD measures.<br>• **WSUD strategy report** that summarises the methodology and WSUD outcomes, and provide this with the development application for the site. | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y | |
| **5** | Have the conceptual plans of the proposed stormwater treatment measures been included on the plans? (Detailed engineering plans will be required for the construction certificate) | Y | |



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| | | | |
|---|---|---|---|
| **6** | Has a Draft Operation and Maintenance Plan which includes details on the following been provided?<br>• Site description (area, imperviousness, land use, annual rainfall, topography etc)<br>• Site access description<br>• Likely pollutant types, sources and estimated loads<br>• Locations, types and descriptions of measures proposed<br>• Operation and maintenance responsibility (council, developer or owner)<br>• Inspection methods<br>• Maintenance methods (frequency, equipment and personnel requirements including Work Health and Safety requirements)<br>• Landscape and weed control requirements<br>• Operation and maintenance costs<br>• Waste management and disposal options, and<br>• Reporting. | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y | |
| **7** | Has an electronic version of the MUSIC modelling bee submitted? | Y | |



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# Appendix B

## MUSIC Model and Results

# Rainwater Re-Use Demand

Node Water Balance

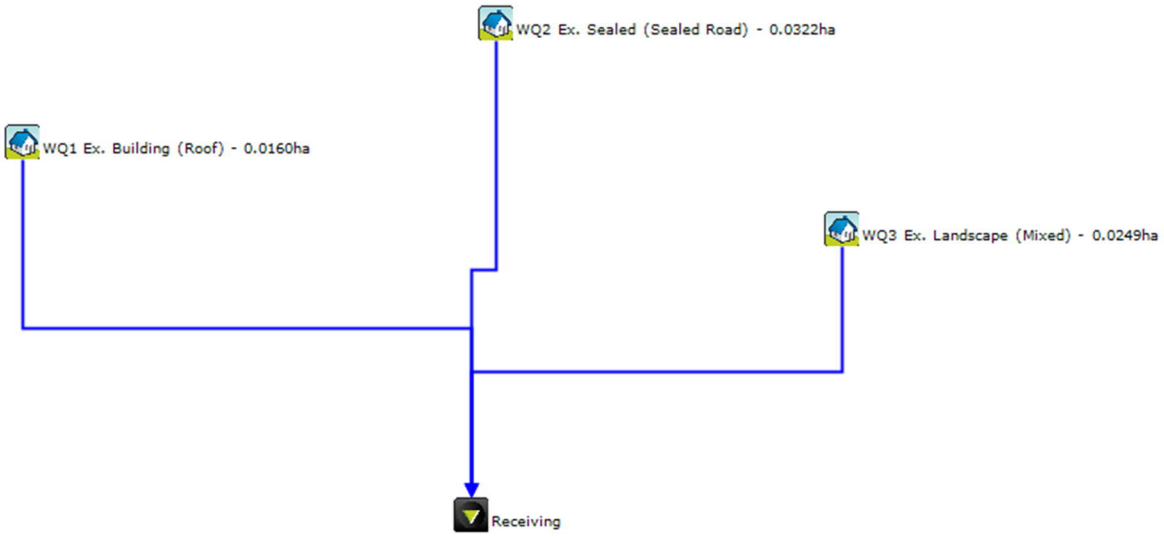
(1) Post Dev : Node Water Balance : RWT

| | Flow ML/y | TSS kg/y | TP kg/y | TN kg/y | GP kg/y |
|---|---|---|---|---|---|
| Flow In | 0.188 | 4.908 | 0.029 | 0.411 | 5.27 |
| ET Loss | 0 | 0 | 0 | 0 | 0 |
| Infiltration Loss | 0 | 0 | 0 | 0 | 0 |
| Low Flow Bypass Out | 0 | 0 | 0 | 0 | 0 |
| High Flow Bypass Out | 0 | 0 | 0 | 0 | 0 |
| Pipe Out | 0.113 | 2.223 | 0.016 | 0.233 | 0 |
| Weir Out | 0.006 | 0.12 | 0.001 | 0.012 | 0 |
| Reuse Supplied | 0.07 | 0.902 | 0.009 | 0.121 | 0 |
| Reuse Requested | 0.085 | 0 | 0 | 0 | 0 |

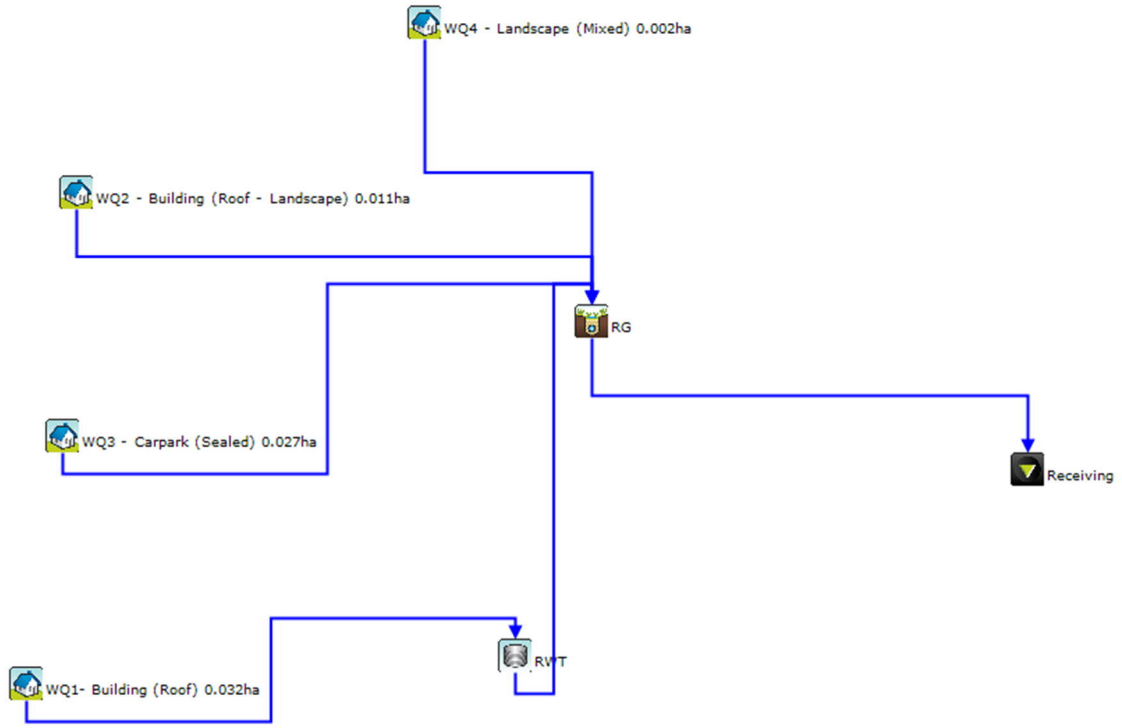
| | Flow % | TSS % | TP % | TN % | GP % |
|---|---|---|---|---|---|
| % Reuse Demand Met | 81.785 | N/A | N/A | N/A | N/A |
| % Load Reduction | 36.884 | 52.277 | 40.92 | 40.497 | 100 |

# MUSICX Model

Pre-Development




Post-Development



# MUSICX Results

Pre-Development

Treatment Train Effec

(1) Pre Dev : Treatment Train Effectiveness : Receiving

| | Sources | Residual Load | % Reduction |
|---|---|---|---|
| Flow (ML/yr) | 0.1503 | 0.1503 | 0 |
| Gross Pollutants (kg/yr) | 2.65 | 2.65 | 0 |
| Total Nitrogen (kg/yr) | 0.3218 | 0.3218 | 0 |
| Total Phosphorus (kg/yr) | 0.03548 | 0.03548 | 0 |
| Total Suspended Solids (kg/yr) | 13.93 | 13.93 | 1.275E-14 |

Post-Development

Treatment Train Effec

(1) Post Dev : Treatment Train Effectiveness : Receiving

| | Sources | Residual Load | % Reduction |
|---|---|---|---|
| Flow (ML/yr) | 0.363 | 0.2736 | 24.64 |
| Total Suspended Solids (kg/yr) | 63.32 | 4.834 | 92.36 |
| Total Phosphorus (kg/yr) | 0.1277 | 0.0265 | 79.24 |
| Total Nitrogen (kg/yr) | 0.8228 | 0.2689 | 67.31 |
| Gross Pollutants (kg/yr) | 9.827 | 0 | 100 |

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