167 Northumberland Street Liverpool
Civil Stormwater Management Report

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Contents

1. Introduction

This Civil Stormwater Management Report supports the proposed development at 167 Northumberland Street development in Liverpool. Refer to Figure 1 for location of the proposed development.

AT&L have been engaged by Meriton Group to prepare a Development Application (DA) Civil Stormwater Management Report on the civil and stormwater management requirements for the proposed development.

This report is written to comply with the Liverpool Council Development Control Plan (DCP).

Figure 1 - Locality Plan (Courtesy of Nearmap)

The site is approximately 0.156 Ha in area and consists of an existing mixed-use building, main pedestrian site access is via Northumberland Street to the East and pedestrian/vehicular access is via the Laurantus Serviceway from the West.

2. Project Description

The proposed development involves the construction of one building purposed for a mixed-use development (Retail and Hotel uses). The building comprises 33 storeys and 3 levels of under-ground car parking. Refer to Figure 2 for Architectural site layout for the proposed mixed-building layout.

This proposed development will be surrounded by:

- 159-161 Northumberland Street to the North;
- Northumberland Street to the East;
- 179 Northumberland Street to the South; and
- Laurantus Serviceway to the West.

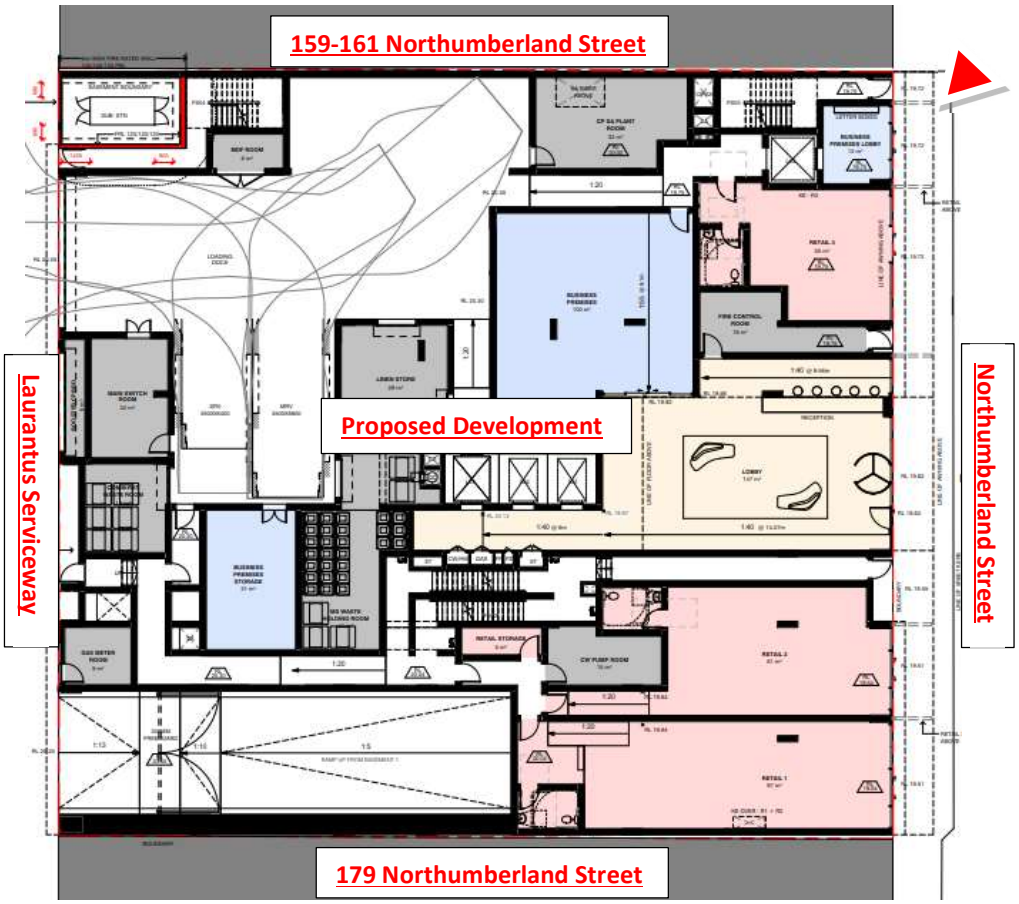

Figure 2 - Proposed Architectural Layout (Courtesy of PTW)

The site generally falls from the western boundary at RL20.30 to the south-eastern boundary at RL 19.50. Refer to the survey drawings within Appendix A for all features on site along with existing contour levels.

2.1. Scope of Report

This report outlines the design criteria for:

- Stormwater infrastructure;
- How stormwater is managed across the site;
- Identification of existing utility infrastructure; and
- How the future development will be serviced.

Refer to Appendix B for the Civil Development Application Civil Works Package Drawings.

This report has been prepared to satisfy the requirements and conditions of the following documents:

- Liverpool Development Control Plan 2008 (DCP);
- Liverpool City Council's Development Design Specification: Stormwater Drainage Design (2003);
- Liverpool City Council's On-Site Stormwater Detention Technical Specification
- OEH's Managing Urban Stormwater: Soils and Construction Guideline.

This civil infrastructure report includes:

- Stormwater Management:
- Piped and Overland Flows;
- On Site Detention (OSD);
- Water Sensitive Urban Design (WSUD)
- Dial Before you Dig (DBYD) information (Appendix E); and
- Infrastructure Services, including:
    - Sewer;
    - Water Supply (Potable);
    - Electricity
    - Gas and
    - Telecommunications.

3. Stormwater Management

3.1. Existing Stormwater Drainage

The existing site discharges directly to Northumberland Street via a kerb outlet located near the eastern boundary of the site, which is the directed into the existing system within Northumberland Street.

In addition to this, there is also an existing pit and pipe network located at the south-east end of the Laurantus Serviceway near the intersection with Northumberland Street, which is the directed into the existing system within Northumberland Street. The network within Lauarantus Serviceway does not collect any water from the site in its current arrangement

3.2. Proposed Site Stormwater Drainage

All proposed stormwater drainage from the development will be designed in accordance with Liverpool City Council requirements.

All stormwater is proposed to connect into the existing 375 diameter Council owned stormwater pipe within Laurantus Serviceway in the South-west corner of the site.

Whilst the development proposes no increase to impervious areas from the existing site, OSD has been provided to ensure the discharge from the site is at a rate which Council's existing drainage system is capable of accommodating. The OSD system is designed in accordance with Liverpool City Council's OSD policy. Refer to the Civil Drawings in Appendix B for layout and details for the proposed stormwater network across the site. The internal hydraulics is designed by others.

Stormwater generated within the proposed site will be treated to comply with Liverpool Council DCP water treatment rates using proprietary treatment devices.

3.3. Hydrology

- Pipe drainage shall be designed to accommodate the 10-year ARI storm event (10% AEP);
- The combined piped and overland flow paths shall be designed to accommodate the 100-year ARI storm event;
- Where trapped low points are unavoidable and potential for flooding private property is a concern, an overland flowpath capable of carrying the total 100-year ARI storm event shall be provided. Alternatively, the pipe and inlet system may be upgraded to accommodate the 100 year ARI storm event;
- Rainfall intensities shall be as per the Intensity-Frequency-Duration from BOM or Council's Drainage Design Criteria Handbook;
- Times of concentration for each sub catchment shall be determined using the kinematic wave equation. Minimum time of concentration is 5 mins and the maximum is 20 mins. Runoff coefficients shall be calculated in accordance with AR&R. The fraction impervious shall be determined from analysis of the sub catchments;
- Runoff coefficients shall be calculated in accordance with the ARR&R. The fraction impervious shall be determined from analysis of the sub-catchments;

- Flow width in gutter shall not exceed 2.5m for the minor design storm event.
- Velocity depth ratios shall not exceed 0.4 for all storms up to and including the 100 year ARI event.
- Bypass from any pit on grade shall not exceed 15% of the total flow at the pit;
- Blockage factors of 10% and 30% shall be adopted for kerb inlet and grated pits respectively; and
- All pits deeper than 1.8m to be reinforced.

3.4. Hydraulics

- A hydraulic grade line HGL design method shall be adopted for all road pipe drainage design. The HGL shall be shown on all drainage long sections;
- The minimum pipe size shall be 375mm diameter RCP (external) and 150mm uPVC (internal);
- Maximum spacing between pits shall not exceed 75m;
- All pipes shall be Rubber Ring Jointed unless noted otherwise;
- The minimum cover over pipes shall be 450mm in grassed areas and 600mm within carriageways;
- Where minimum cover cannot be achieved due to physical constraints the pipe class shall be suitably increased;
- All trafficable pipes shall be a minimum Class 3 Reinforced Concrete Pipes or Fibre Reinforced Cement equivalent;
- The pipe friction coefficients to be adopted shall be:

Table 1 - Pipe Details

Materials	Mannings – n	Colebrook-White – k	Min. Pipe Class
RCP	0.012	0.3	3
FRC	0.011	0.15	3

- All pipes classes shall be designed for the ultimate service loads and where applicable, construction loads will be designed for;
- Pipes discharging to the overland flow path shall adopt a minimum tailwater level equivalent to respective overland flow level;
- Pit Loss coefficients shall be calculated in accordance with Missouri Charts;
- A minimum 150mm freeboard shall be maintained between pit HGL and pit surface levels;
- Overland flowpaths shall maintain a minimum of 300mm freeboard to all habitable floor levels; and
- Pits deeper than 1.2m shall contain step irons at 300 mm centers.

3.5. Modelling Software

DRAINS modelling software has been utilised to design to the OSD system for the development in accordance with the Liverpool Council DCP. Refer to details in Appendix C.

MUSIC modelling software has been used to evaluate pollutant loads from the developed lot. MUSIC Link Report incorporating MUSIC data files and results are attached in Appendix D.

4. On Site Detention (OSD)

4.1. Council Requirements & Recommendations

As discussed within Section 3.2, OSD will be provided to ensure the discharge from the site is at a rate which Council's existing drainage system is capable of accommodating.

The proposed development falls within the Liverpool City Council with the following criteria to be applied:

- Design Storms – 5, 20 and 100 year ARI;
- Permitted Site Discharge (PSD) – Existing site conditions for low recurrence interval (5-year ARI,) a medium recurrence interval (10, 20 or 50 year ARI) and the upper value (100-year ARI); and
- The rate of stormwater runoff (both pipes and overland flow) from the post-developed site is not to exceed the rate of runoff from the pre-developed site for the above storm events.

4.2. DRAINS analysis

A DRAINS model has been prepared to accurately analyse the proposed stormwater system connection to the existing stormwater system. The grate level of the downstream existing pit has been adopted as the 100-year ARI tailwater level and 150mm below the grate level has been adopted as tailwater level for all other storm events. OSD tank has been designed to mitigate peak flows from the 5-year ARI storm event up to and including 100-year ARI storm event.

Table 2 – Proposed OSD Tank Volumes

ARI (Year)	Pre-Development Flow (m^3/s)	Post-Development Flow (m^3/s)
5	0.058	0.055
20	0.073	0.069
100	0.091	0.081

4.3. Proposed OSD Tank Details

The proposed OSD tank will be located within the building footprint in the basement as the proposed WSUD will be built in-line within the proposed tanks. The outlet pipes from the tank will discharge into the proposed stormwater network within Laurantus Serviceway, ultimately discharging to Northumberland Ave.

Table 3 – Proposed OSD Tank Volumes

Catchment to Tank (ha)	OSD Volume (Min.) (m^3)	Primary Outlet	Secondary Outlet
1,562 m^2	10m^3	375mm dia pipe to Laurantus Serviceway	Emergency Overflow Pit Surcharge

4.4. Water Sensitive Urban Design (WSUD)

Water Sensitive Urban Design (WSUD) encompasses all aspects of urban water cycle management, including water supply, wastewater and stormwater management. WSUD is intended to minimise the impacts of development upon the water cycle and to achieve more sustainable forms of urban development.

As discussed within section 3.2 all stormwater runoff from the development will be directed into the OSD tank located within the building footprint.

Proprietary treatment devices situated within a Water Quality Chamber located within the proposed OSD tank will treat the water prior to discharging from the site. These devices have been modelled as 690 Stormfilter cartridges by Ocean Protect. By utilising these treatment devices, stormwater draining from the building will meet the required Liverpool Council DCP treatment rates before discharge into the Laurantus Serviceway stormwater network.

A summary of the required number and position of the treatment devices is indicated within the stormwater drainage plans within Appendix B.

Refer to Table 6 below for final treatment rates.

4.5. WSUD Modelling - Music Model

The MUSIC Model for Urban Stormwater Improvement Conceptualisation (MUSIC, Version 6.2.0) 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 E.

4.5.1. Catchment Areas and Music Parameters

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 4 and 5.

Table 4 - Rainfall-Runoff Parameters - Roof Catchment Areas

Parameter	Unit	Figure
Rainfall Threshold	mm/day	0.30
Soil Storage Capacity	mm	108.00
Initial Storage	% of Capacity	30.00
Field Capacity	mm	73.00
Infiltration Capacity Coefficient	a	250.00
Infiltration Capacity Coefficient	b	1.30
Initial Depth (Ground Water)	mm	10.00
Daily Recharge Rate	%	60.00
Daily Baseflow Rate	%	45.00
Daily Seepage Rate	%	0.00

Table 5 - Rainfall-Runoff Parameters - Mixed Catchment Areas

Parameter	Unit	Figure
Rainfall Threshold	mm/day	1.00
Soil Storage Capacity	mm	170.00
Initial Storage	% of Capacity	30.00
Field Capacity	mm	70.00
Infiltration Capacity Coefficient	a	210.00
Infiltration Capacity Coefficient	b	4.7
Initial Depth (Ground Water)	mm	10.00
Daily Recharge Rate	%	50.00
Daily Baseflow Rate	%	5.00
Daily Seepage Rate	%	0.00

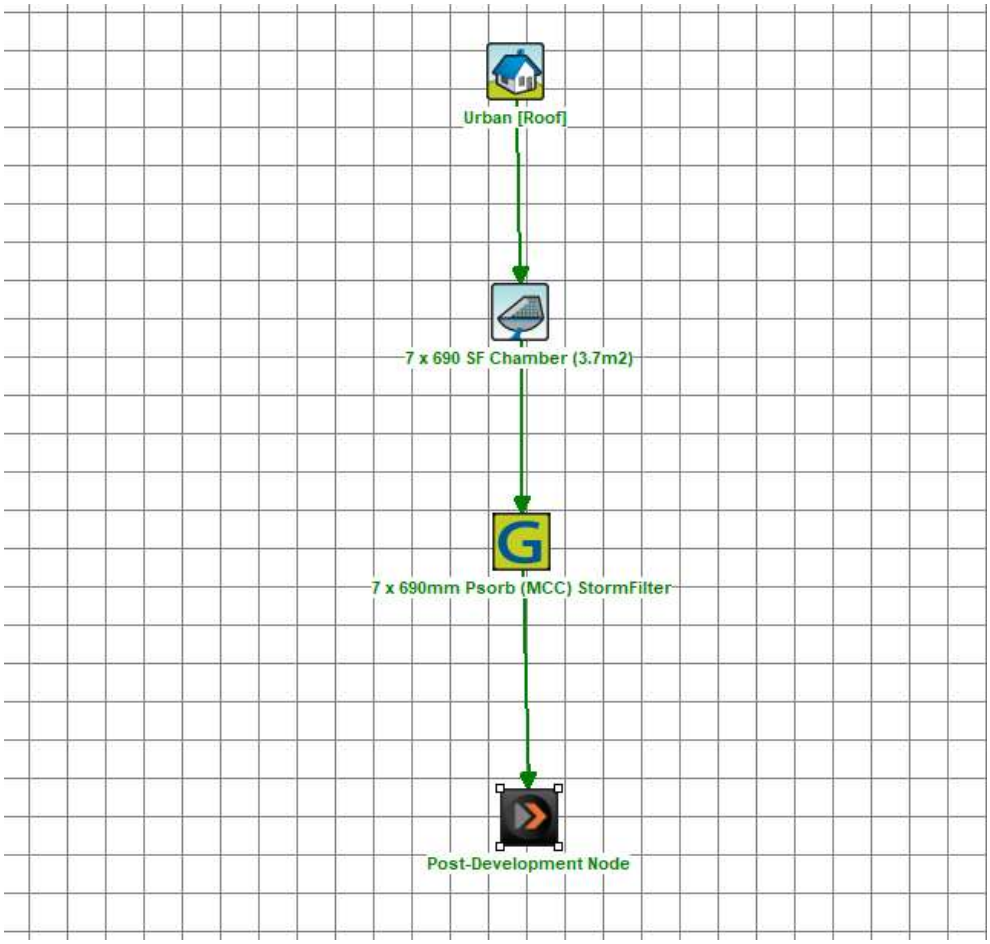

Figure 3 - MUSIC Treatment Train

4.5.2. Results

MUSIC modelling results are presented as mean annual loads at the receiving node indicate that adopted target reductions are achieved, as shown in Table 6.

Table 6 - Pollutant Loads

Pollutant	Sources (Kg/yr)	Residual Load (Kg/yr)	Reduction (%)	Target Reduction (%)
Total Suspended Solids	33.8	4.9	85.5	85
Total Phosphorus	0.194	0.0377	80.5	65
Total Nitrogen	2.84	1.36	52.0	45
Gross Pollutants	35.5	0	100	90

5. Sedimentation and Erosion Control

5.1. Sedimentation and Erosion Control (Construction)

Soil and Water Management Plans (SWMP) has been prepared in accordance with the NSW Department of Housing Publication titled: Managing Urban Stormwater- Soils and Construction (2004) and the relevant LCC guidelines for the whole site.

5.2. 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;
- Works within drainage paths, including depressions and waterways;
- 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.

5.3. 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.

5.4. 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 catch drains to carry sediment-laden water to sediment basins;
- Provision of silt fences to filter and retain sediments at source; and
- Where future construction and building works are not proposed, the rapid stabilisation of disturbed and exposed ground surfaces with hydro-seeding.

5.5. 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 SWMP 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 effect 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.

5.6. Conclusion

The erosion control measures proposed for the site will comply with the requirements of Liverpool City Council and The Department of Environment, Climate Change and Water (DECC).

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

6. Services

This development will incorporate full servicing for all buildings within the proposed site.

6.1. Sydney Water

6.1.1. Water Supply

From Dial Before You Dig (DBYD) information obtained there is an existing 150mm uPVC (Unplasticized Polyvinyl Chloride) potable water main owned and operated by Sydney Water along the western verge of Northumberland Street fronting the eastern boundary of the site. There is also a 250 CICL (Cast Iron Concrete Lined) potable water main main owned and operated by Sydney Water along the southern verge of Elizabeth Street.

It is expected that the 150mm uPVC watermain will need to be upgraded to a 250mm watermain from Elizabeth Street to the north to the proposed development.

Flow and pressure enquiries will be obtained from Sydney Water to determine the upgrades required to ensure the service has sufficient capacity to service the proposed development.

Advice will need to be sought with a Sydney Water Water Services Coordintor (WSC) on connection into the water main or any others within the vicinity of the site. Refer to DBYD records within Appendix D.

A Section 73 Notice of Requirements will be sought from Sydney Water to obtain approval to connection into this main.

6.1.2. Sewerage

From DBYD information there is an existing 150mm diameter VC (Vitrified Clay) sewer pipe owned and operated by Sydney Water running south to north within the Laurantus Serviceway servicing the existing site. There is also a 375 PVC (Polyvinyl chloride) sewer pipe owned and operated by Sydney Water running west to east along the northern boundary of Moore Street.

It is expected that the existing 150uPVC sewer main will not have the capacity to service the proposed development and a sewer main will be constructed within Northumberland St to connect to the existing 375 PVC within Moore Street. Refer to Civil Drawings in Appendix A for proposed services layout.

Advice will need to be sought with a Water Services Co-ordinator (WSC) on the proposed main, and with respect to connection into the sewer main or any others within the vicinity of the site. Refer to DBYD records within Appendix D.

A Section 73 Notice of Requirements will be sought from Sydney Water to obtain approval to connection into this main.

6.2. Communications

DBYD records indicate an existing telecommunications and NBN fibre optic cables within the Eastern verge of Northumberland Street to the east of the site.

Refer to DBYD records within Appendix D for details.

Confirmation will need to be sought with the telecommunications authorities for all connections.

6.3. Gas

DBYD records indicate that there is an existing 7 kPa gas network main along the western verge of Northumberland Street. Refer to DBYD records within Appendix D for details.

Approval will need to be sought from Jemena as owners of these gas mains for all connections into their network.

6.4. Electrical

From DBYD records there are existing electrical ducts owned by Endeavour Energy within the western verge of Northumberland Street to the east of the site and within Laurantus Serviceway to the west of the site. Refer to DBYD records within Appendix D for details.

Advice will need to be sought from a Level 3 Accredited Service Provider (ASP) on servicing during detailed design. Refer to ASP consultants for the detailed design.

6.5. Conclusion

This section demonstrates that services including sewer, water, power, telecommunications and gas can be made available to the site.

7. Conclusion

As highlighted within this report, all civil works and stormwater drainage for the development of 167 Northumberland Ave, Liverpool has been designed in accordance with the Liverpool City Council Development Control Plan and Stormwater Specifications.

Appendix A

Detailed Site Survey

Appendix B

Civil Development Application Drawings

Appendix C

DRAINS Model / Results Spreadsheet

Appendix D

MUSIC Link Report

Appendix E

Dial Before You Dig (DBYD)

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