
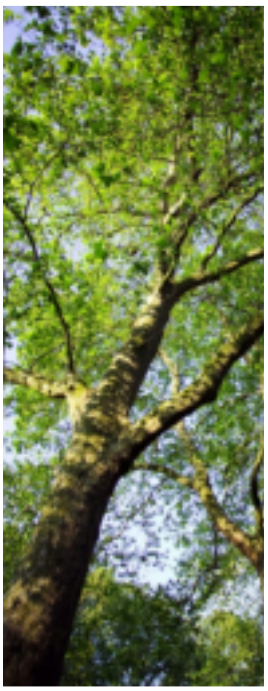


Masters Home Improvement Store - Nepean Green

Stormwater Management Report Nepean Green
Stage 1, Project Application

June 2013

Masters / Parkview Penrith Pty. Ltd.

Mott MacDonald

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C	25/7/12	DR	CA	CA	For Review
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Content

1. Introduction

Parkview Penrith Pty Ltd is proposing to develop Lot 12 DP234581 at Station Street, Penrith. The proposed development works are to be completed over six (6) stages and consist of the construction of a new multi-storey mixed residential / commercial development to be known as 'Nepean Green'.

Mott MacDonald has been commissioned by Parkview / Masters to prepare a Stormwater Management Report to support the Development Application (DA) for the works identified as Stage 1 in the future subdivision of Lot 12 DP234581. The proposed Stage 1 works consist of:

- Demolition of the existing buildings and structures on site;
- Construction of a new commercial home improvement store;
- Partial road construction of a new link road between Station Street and Woodriff Road; and
- Provision of car parking facilities for customers to the new home improvement centre.

The advice as outlined in this report (which should be read in conjunction with the separate Civil Engineering, Infrastructure and Stormwater Report prepared by Mott MacDonald for the Concept Plan Application) and documented on Mott MacDonald drawings MMD-310574-C-DR-MA-XX-0001 to 0040 addresses the following engineering components:

- Water Quality Measures (refer to section 4.1 of this report); and
- Water Quantity (refer to section 4.2 of this report).

2. Site Description and Proposed Works

The subject site is Lot 12 DP234581 located at 164 Station Street, Penrith, approximately 1.2km south west of the Penrith CBD. The proposed works are to be carried out on the northern portion of the site and consist of a new 13,603m^2 commercial home improvement store with associated on-ground hardstand and car parking areas.

The proposed lot and open spaces layout have been taken from the current proposed Development Application documentation.

Figure 2.1 – Site Layout

The proposed development covers an area of approximately 3.68Ha and is bound by:

- Station Street / Penrith Stadium to the west;
- Jamison Road to the south;
- Woodriff Street to the east; and
- existing commercial developments (Centro Nepean) to the north.

There are existing council owned stormwater systems in the adjoining street networks and these will be the proposed discharge points for stormwater flows developed within the site.

3. Erosion and Sediment Control

Prior to any earthworks commencing on the site, erosion and sediment control measures will be put in place generally in accordance with Managing Urban Stormwater: Soils and Construction 4th Edition, March 2004. These measures include:

- Installation of a 1.8m high chain wire fence covered with geo-textile filter fabric, to the perimeter of the work site area, where required;
- The use of sediment diverting methods to minimise sediment in Council's stormwater drainage using sandbagging kerb inlet pits and geo-fabric filter fabric around drop inlet pits;
- The provision of a sediment basin will be required where disturbed areas are greater than 2,500m^2. The sediment basin will be required to be designed in accordance with Urban Stormwater Quality Management Plan (1999) for which stormwater runoff shall be channelled and treated during construction; and
- The provisions of a temporary truck wash down facility to service vehicles exiting the site during the construction stage.

Please refer to Sediment and Erosion Control Plans MMD-310574-C-DR-MA-XX-0010 and MMD-310574-C-DR-MA-XX-0011.

4. Stormwater Management

4.1 Water Quality

Penrith City Councils *Development Control Plan (DCP)* 2010 requires improved water quality of the stormwater flow from the developed site prior to discharge into the authorities' drainage network.

Council also requires the removal of target pollutants from the site during the construction phase as vehicles that may enter or exit could generate various pollutants such as oil and grease. These target pollutants can be identified into five major groups of stormwater pollutants:

- Gross pollutants;
- Coarse, medium and fine sediments;
- Nutrients;
- Heavy metals; and
- Oil and grease.

4.1.1 Water Quality Objective

In accordance with Table C3.2: Pollution Retention Criteria of Penrith City Council's Development Control Plan, we note that the following targets have been set in relation to stormwater quantity:

- Reduction in annual average suspended solids (SS) export load of 50%;
- Reduction in annual average total phosphorus (TP) export load of 45%
- Reduction in annual average total nitrogen (TN) export load of 45%; and
- Reduction in annual average gross pollutant (GP) export load of 70%

In addition to satisfying the requirements and standards of Council, the promotion of sustainable water practices must comply with the protection or enhancement of natural water quality as stated in Penrith City Council's Local Environment Plan.

To demonstrate compliance with these objectives, treatment removal loads were analysed from pre to post development scenarios using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) Version 5.1 software. Model development and results are discussed in section 4.1.3.

4.1.2 Proposed Treatments

Proposed Treatment devices are listed and discussed below:

4.1.2.1 Gross Pollutant Trap (GPT)

"Gross Pollutant Trap" is a term applied to either in-situ, or proprietary units that remove litter, vegetative matter and sediment. Although the numerous units fall under the one umbrella of gross pollutant trap s, the actual mechanics of the different units vary, as do the achievable pollutant removal rates. GPTs come in a range of sizes, with the larger units able to effectively treat large catchment areas and high flow rates. They are usually sized based on their maximum treatable flow being equal to, or greater than the 3-month Annual Recurrence Interval (ARI) storm event (typically 50% of the 1-year ARI storm event) of the upstream catchment.

In developing the MUSIC model for the site, a Humegard / Humeceptor arrangement positioned in series is proposed at the outflow from the new carpark as an end-of-line treatment prior to discharge to Station Street. The GPTs have been positioned to maximise flow and enable easy access for maintenance. The Humegard is to provide primary treatment and target larger gross pollutants and sediments. Treated water will then pass through the proposed Humeceptor (secondary treatment) further downstream, which targets oils and grease, nutrients and fine sediments. A second Humeceptor is also proposed to target oils, grease and fine sediments collected in runoff from the loading dock and hardstand areas on the southern portion of the site prior to discharge to Woodriff Street.

The expected removal rates that were utilised within the water quality modelling process to represent the Humegard / Humeceptor units were modelled based on manufacturer's specifications. The following parameters were input into the MUSIC model:

Table 4.1 – Humeceptor MUSIC Input Parameters

Pollutant	Input	Output	Adopted Rate
Suspended Solids (mg/L)	500.3	100.3	80%
Nitrogen (mg/L)	5.0	3.5	30%
Phosphorus (mg/L)	4.998	3.519	30%
Gross Pollutants (kg/ML)	15.1	14.9	1%

Table 4.2 – Humegard MUSIC Input Parameters

Pollutant	Input	Output	Adopted Rate
Suspended Solids (mg/L)	500.2	250.7	50%
Nitrogen (mg/L)	5.0	4.0	20%
Phosphorus (mg/L)	4.978	4.006	20%
Gross Pollutants (kg/ML)	15	2.2	85%

4.1.2.2 Rainwater Tanks

Roof water from the southern portion of the proposed building (approximately 0.711Ha) has been modelled to discharge directly to rainwater harvesting tanks situated at the south-west corner of the new works. These tanks are to store water for re-use associated with irrigation of the proposed garden centre as well as toilet flushing on site.

Water demand rates for the development have been defined based on assumed re-use rates in order to attain the most efficient water usage on site. A preliminary analysis based on estimated water demand indicates that rainwater tanks totalling around 100kL (2 x 50kL above ground tanks) will be satisfactory.

Table 4.3 - MUSIC Rainwater Tank Inputs

Irrigation Area (m^2)	Irrigation Requirement (mm/m^2/week)	Toilet Flushing Requirement (L/flush)	Weekly Demand (kL)	Daily Demand (kL)
1565*	25	4	46.2	6.6

* Based on assumed irrigation area of 70% of total Garden Centre area

The excess water from the harvesting tanks will discharge into the stormwater network and through the Humeceptor prior to exiting the site. Due to the uncertain nature of the rainwater supply, the tanks will be connected to mains water for “top-ups” in dry weather conditions.

4.1.2.3 Enviropod Pit Inserts

Surface inlet pits within the proposed hardstand / loading dock areas of the site have been designed to be provided with enviropod pit inserts including oil absorbent media. The pit inserts will sit beneath the stormwater pit grates and will collect the gross pollutants, sediments, oils and grease (please refer to pit insert specifications within Appendix D for further information).

4.1.3 Water Quality Modelling – MUSIC Model, Parameters and Methodology

A water quality modeling tool, MUSIC was utilised to simulate urban stormwater systems operating at a range of temporal and spatial scales. MUSIC models the total amounts of gross pollutants and nutrients produced within various types of catchments. It allows the user to simulate the removal rates expected when implementing removal filters to reduce the increased gross pollutant and nutrient levels created by the proposed development.

The following methodology and parameters were incorporated in the MUSIC modeling:

- The MUSIC model was created to assess the effectiveness of water quality treatment nodes which are to be constructed as part of the proposed Stage 1 development works;
- The MUSIC models default pluviograph data for Sydney Observatory 6 minute interval (10 years historical data) was utilised within the model. This time range seemed acceptable since those years had both wet and dry periods and were close to the site.
- A MUSIC model was setup to represent the post developed site. The development area was consolidated into two (2) sub-catchment areas based on the proposed drainage system and lot layout (refer to Appendix C for the catchment plan). From architectural plans the site was then categorised into the following areas;
  - Roof;
  - Road;
  - Hardstand;
  - Carpark; and
  - Landscaped areas.

Table 4.4 – Post-Developed Catchments

Sub-Catchment	Post-Developed Region	Area (Ha)
M1	Roof	0.865
	Road	0.349
	Carpark	1.337
	Landscaping	0.113
Sub-Total		**2.664**
M2	Roof to Rainwater Tank	0.530
	Hardstand	0.347
	Landscaping	0.132
Sub-Total		**1.009**
Total		**3.673**

- Pollutant concentration parameters used within the model were based on the recommended model defaults for different land use categories as specified in the MUSIC Modeling Guidelines for NSW. These are summarised in the following table:

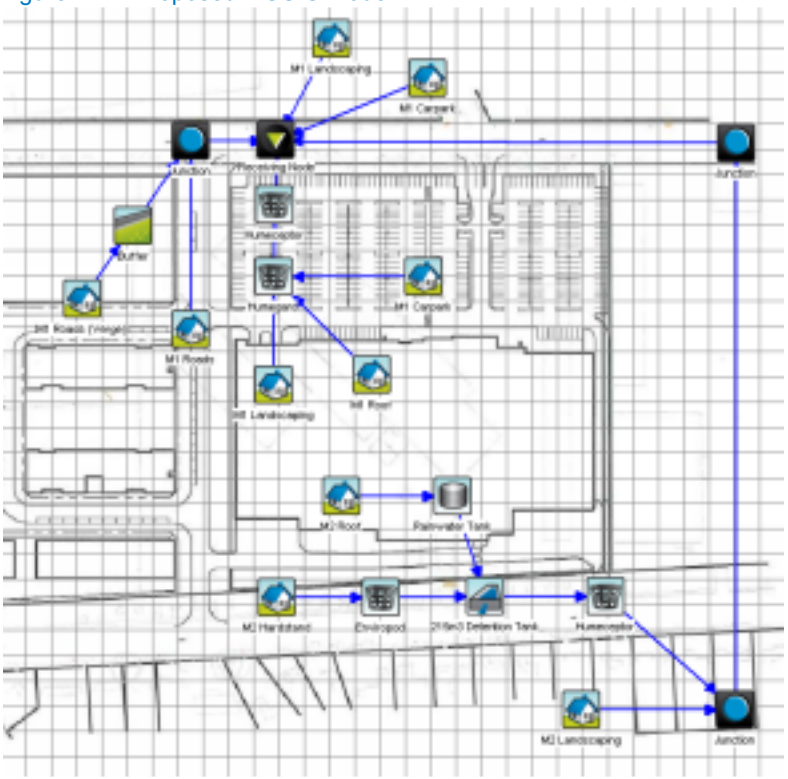
Table 4.5 – Post-Development Areas – MUSIC Node Classification

MUSIC Node	Category
Roof	"Roofs"
Road	"Sealed Roads"
Hardstand	"Sealed Roads"
Carpark	"Sealed Roads"
Landscaping	"Residential"

Source: MUSIC Modelling Guidelines for NSW

- A treatment train was designed to incorporate a series of treatment nodes including Rainwater Tanks, Humegard, Humeceptor, and Pit Inserts. The effectiveness of the proposed treatments is summarised in section 4.1.4.

Figure 4.1 – Proposed MUSIC Model



4.1.4 Results

The following results were achieved within the model:

Table 4.6 – MUSIC Results

Pollutant	Post-Development with no WSUD measures (kg/yr)	Post-Development with WSUD measures (kg/yr)	Removal Rate (%)	Target Removal Rate (%)
Total Suspended Solids	32,200	4,960	85	50
Phosphorus	16.5	8.83	47	45
Nitrogen	107	61.1	43	45
Gross Pollutants	1,080	170	84	70

The results of the MUSIC modelling indicate that the proposed treatment train as detailed in this report will satisfy Council's target pollutant removal rates for total suspended solids, total phosphorus and gross pollutants.

It is noted that the pollutant removal rate for nitrogen is slightly less than the target level required by Council. However, given the nature of the subject site (large commercial development with sealed pavements) we consider the target pollutants to be suspended solids, gross pollutants and hydrocarbons. As such, based on these assumptions and the relatively close value obtained, this level is considered adequate to satisfying Penrith City Council's statutory requirements.

It should also be noted that the type, size and location of the proposed water quality treatment devices for the future residential subdivision on the southern portion of the site will be detailed in separate Development Application proposals as part of Stage 2-6 works.

4.2 Stormwater Quantity

The stormwater drainage for the proposed development has been designed to comply with the following guidelines:

- Penrith City Councils *Development Control Plan DCP* (2010);
- Penrith City Councils *Guidelines for Engineering Works for Subdivisions and Developments* (1997);
- Australian Rainfall and Runoff (2001); and
- Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, March 2004.

4.2.1 Stormwater Drainage

4.2.1.1 On-Site Stormwater Detention (OSD)

Informal discussions with Penrith City Council have indicated that:

1. On-Site Stormwater Detention (OSD) is not required for the subject area; however
2. Post-development flows are not to adversely impact on existing drainage systems in the area.

Based on the above, it is our understanding that:

- If the existing pit and pipe network in the adjoining street network has sufficient capacity to accept minor system stormwater flows (5yr ARI flows as noted in Council's DCP 2010) from the post-developed site, than no OSD is required; and
- If the existing pit and pipe network in the adjoining street network has insufficient capacity to accept minor system stormwater flows from the post-developed site, then either:
    a. OSD is required to restrict post-developed flows to pre-developed levels; or
    b. Upgrade of the receiving (street) pit and pipe network is required.

These assumptions were later confirmed in email correspondence received from Penrith City Council dated 12 July 2012 (refer to Appendix B for details).

A desktop review of Councils existing pit and pipe networks in Station / Woodriff Street indicates that the existing stormwater systems have insufficient capacity to receive increased stormwater flows as a result of the proposed development. As such, OSD will be required for Stage 1 works to restrict the post-developed discharge flow rate to pre-development levels in accordance with Penrith City Council requirements.

4.2.1.2 Major / Minor Drainage System

The major/minor approach to stormwater drainage is the recognised drainage concept for urban catchments within the Penrith City Council local government area.

The minor drainage system is comprised of the below ground pit and pipe network and is designed to control nuisance flooding and enable effective stormwater management for the site. Council's Stormwater Management Guidelines requires that the minor system be designed for a minimum 5 year ARI for all new developments (refer C3.6: Stormwater Management and Drainage from Councils DCP 2010 for details).

The major drainage system incorporates overland flow routes through proposed road, car parking and landscaped areas and is assessed against the 100 year ARI design storm event. The major system also exists to cater for minor system failures. In accordance with council's requirements, the major drainage system is to be designed in a manner that ensures that personal safety is not compromised. Subsequently, all overland flow routes for the site are to be designed so that the maximum velocity-depth product shall not exceed $0.4m^2/s$ as outlined in the NSW Floodplain Development Manual (2005).

For the purposes of this report, DRAINS software is used to calculate flows exiting the site for the proposed scenario. Stormwater piped capacities have been designed to convey the minor (5yr ARI) storm event with safe overland flows for the 100year ARI storm event.

4.2.2 Existing System

Detailed site survey by Dunlop Thorpe & Co. identifies an existing kerb inlet pit in Station Street situated adjacent to north-west corner of the Stage 1 site boundary. Visual site inspections and GIS data received from Penrith City Council indicates the outlet pipe from this pit is 525mm dia. From here, flows are conveyed to a 600 – 750mm dia. trunk stormwater line on the opposite side of Station Street prior to discharge to an open channel / culvert system (approximate 6.3m wide x 2.1m high) on the southern side of Jamison Road.

Visual site inspections and detail site survey also identify an existing pit and pipe network within Woodriff Street to the east of the subject site. The existing pipe diameters for this system are currently unknown.

There is an existing grass-lined drainage swale located centrally within the vacant paddock on the southern portion of the development area (Stage 2 – 6 site area) which drains north-south and conveys surface flows to an outlet at Jamison Road. From here, flows are directed to the pit and pipe network within Jamison Road before discharging into the open channel to the south via an existing 1050mm dia stormwater line.

4.2.3 Proposed System

The DRAINS model for the proposed site was developed based on the following methodology:

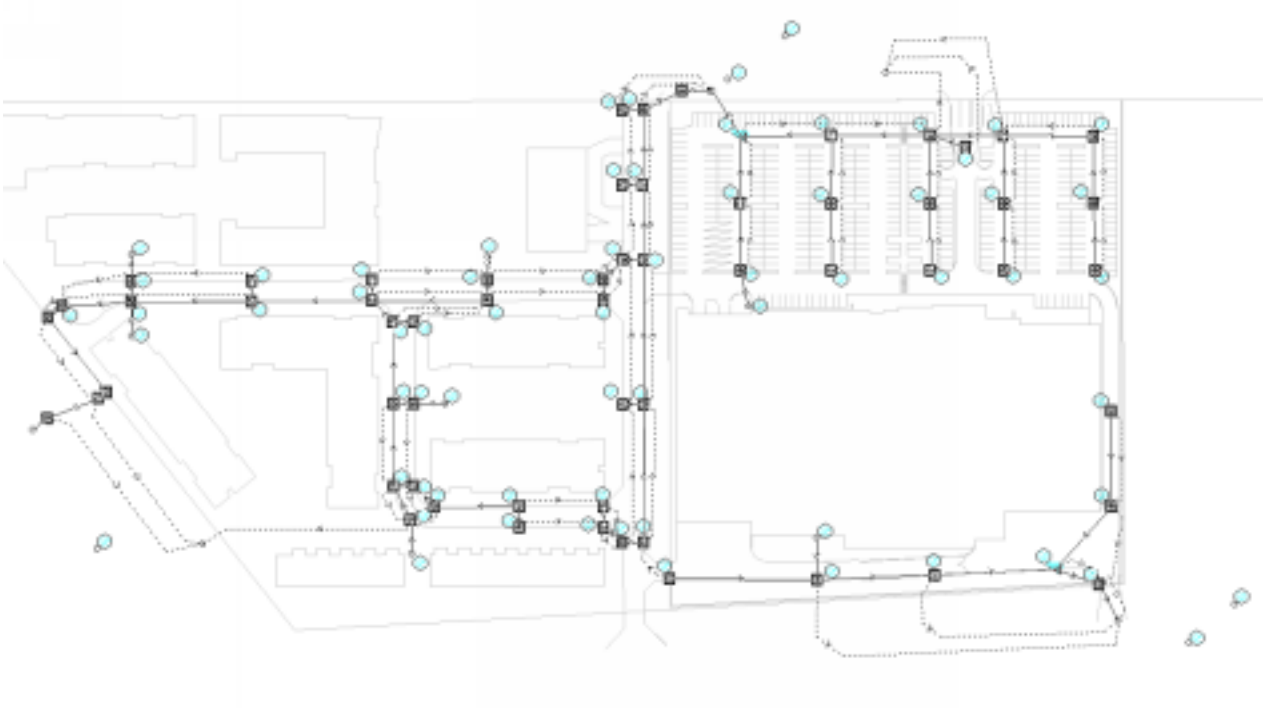
- The Stage 1 site stormwater network is proposed to connect to the existing authorities stormwater networks in Station Street and Woodriff Street. Based on a review of the existing site survey and visual site inspections, approximately 55% (2.084Ha) and 37% (1.387Ha) of the existing site area drains to Station Street and Woodriff Street respectively, while the remaining areas discharge to Jamison Road via the existing grass swale located on the southern portion of the site. As such, a similar catchment split is to be maintained in the proposed scenario to ensure that pre-post conditions are satisfied for the site, with approximately 72% (2.66Ha) of the post-developed Stage 1 area draining to Station Street and 28% (1.01Ha) to discharge to the existing stormwater network in Woodriff Street (refer to Catchment Plan in Appendix C for details);
- The undeveloped catchment areas from future Stages 2-6 have also been considered in the stormwater modelling process so as to verify the capacity of the proposed stormwater network and to ensure that pre-post conditions are maintained for the site. 3.932Ha has been modelled to drain to the existing 1050mm dia. stormwater line in Jamison Road, with runoff from stormwater events greater than the minor system capacity to be conveyed overland to Station Street / Woodriff Street within the proposed new local street network. The catchment areas used to represent the future works were modelled as high-density residential with an effective impervious area of 80% in accordance with Penrith City Council requirements;
- Tailwater conditions have been specified at each discharge location to the authorities drainage network in order to simulate a charged system downstream and to verify the capacity of the internal piped system for stormwater flows generated from the design storm event. The following conditions were specified:
  - Sub-Catchment C1: Jamison Road / Concrete Channel
    5yr ARI = Top water level in channel assumed at 50% capacity (RL27.55); and

100yr ARI = Top water level in channel assumed at 100% capacity with freeboard (RL28.14).

- Sub-Catchment C2: Station Street
  5yr ARI = 150mm below the grate level of the proposed connection point / existing stormwater pit (RL27.57); and
  100yr ARI = Top of kerb level in accordance with general engineering practice (RL27.87).
- Sub-Catchment C3: Woodriff Street
  5yr ARI = 150mm below the grate level of the proposed connection point / existing stormwater pit (RL27.74); and
  100yr ARI = Top of kerb level in accordance with general engineering practice (RL28.04).

- An indicative pit and pipe network was developed for the proposed Stage 1 siteworks (refer civil engineering drawings MMD-310574-C-DR-MA-XX-0020 to 0023);
- Roof water from the southern portion of the proposed new home improvement centre (0.530Ha) is to be directed to 2 x 50kL above-ground rainwater harvesting tanks to supply water for re-use on site. The remaining roof areas (0.865Ha) have been modelled to discharge directly to the proposed pit and pipe network as bypass. Designs for roof drainage are to be undertaken either as siphonic or conventional roof drainage by a certified Hydraulic Engineer during the detail design stage of the project;
- Flows from the site to the discharge point in Station Street are to be controlled via an above ground On-Site Stormwater Detention (OSD) system contained within the new car parking area on the northern portion of the site. Similarly, discharge to Woodriff Street is to be controlled by a proposed below ground OSD system located beneath the hardstand pavement adjacent to the southern boundary;
- All paved and landscaped areas are collected within grated pits and drains. Less than 7% of the total site area drains to the existing stormwater networks in Station / Woodriff Street as bypass. The remaining areas drain to the piped network and through the site OSD systems prior to discharge from the site (refer to Catchment Plan in Appendix C for details);
- For the purposes of modelling, the rainwater tanks are considered full during simulation; and
- 5yr, 10yr, 20yr, 50yr and 100yr ARI events were considered for all standard durations using the premium hydraulic function in DRAINS.

Figure 4.2 – Proposed DRAINS Model



Note: Catchment and Pit labels have not been shown for clarity

4.2.4 Results

4.2.4.1 On-Site Stormwater Detention (OSD)

Iterations were performed in the DRAINS model to determine the OSD volumes required to satisfy pre-post conditions for discharge to the authorities existing stormwater networks in Station Street and Woodriff Street.

The proposed OSD systems have the following parameters:

- OSD System 1 – Station Street:
  - Proposed above-ground OSD is situated within the new customer car parking area on the northern portion of the development site;
  - Storage volume provided is approximately 415m^3 and is contained within the above-ground system;
  - The maximum ponded depth in the car park for the 100yr ARI design storm event is 0.2m (100yr ARI TWL = RL28.70), with approximately 0.8m freeboard to the proposed finished floor level of the new home improvement centre (FFL29.50);

- Flows are controlled from the site to the discharge point via a 350mm dia. orifice plate installed on the outlet of the discharge control pit; and
- Consideration has also been given to stormwater flows which are conveyed from the new local street network / future Stages 2-6 to ensure that pre-post conditions are satisfied for the site.

- OSD System 2 – Woodriff Street:
  - Proposed below-ground OSD is situated beneath the hardstand pavement adjacent to the southern boundary of the development area;
  - Storage volume provided is approximately 215m^3 and is contained within the below-ground system;
  - Flows are controlled via a 375mm dia. choke pipe installed as the outlet of the below-ground tank system; and
  - Consideration has also been given to overland flows which are conveyed from future Stages 2-6 to Woodriff Street during storm events greater than the minor system capacity to ensure that pre-post conditions are satisfied for the site.

Results of the DRAINS analysis are summarised in the following tables:

Table 4.7 – OSD System 1: Pre-Post Comparison

ARI Event	Pre-Developed Peak Discharge Rate (m^3/s)	Post-Developed Peak Discharge Rate (m^3/s)			
		Discharge through OSD System	Discharge from New Local Road / Future Stages 2-6	Site Bypass	Total
5yr	**0.531**	0.260	0.134	0.026	**0.420**
10yr	**0.612**	0.265	0.176	0.031	**0.472**
20yr	**0.719**	0.272	0.324	0.037	**0.633**
50yr	**0.798**	0.277	0.412	0.043	**0.729**
100yr	**0.906**	0.251	0.531	0.050	**0.832**

Table 4.8 – OSD System 2: Pre-Post Comparison

ARI Event	Pre-Developed Peak Discharge Rate (m^3/s)	Post-Developed Peak Discharge Rate (m^3/s)			
		Discharge through OSD System	Overland Flow from Future Stages 2-6	Site Bypass	Total
5yr	**0.324**	0.144	-	0.028	**0.172**
10yr	**0.375**	0.159	-	0.034	**0.193**
20yr	**0.442**	0.180	-	0.040	**0.220**
50yr	**0.500**	0.196	0.021	0.046	**0.263**
100yr	**0.576**	0.304	0.125	0.054	**0.483**

Results of the DRAINS analysis indicate that the post-developed peak discharge rates for the range of storms (5-100yr ARI) do not exceed the pre-developed rates for the worst case storm duration for the site.

4.2.4.2 Pit and Pipe Network

Iterations were performed in the DRAINS model to determine the size of the piped network for the proposed site to satisfy major / minor system requirements in accordance with Penrith City Council standards.

The proposed piped drainage system has been designed to cater for the 1 in 5 year ARI event leading to the outlet to the Council drainage systems in the adjoining street networks. A provision for overland flows for events greater than the 1 in 5 year ARI event has also been considered.

Results indicate that the minor system requirements are satisfied at all pits within the development area and that the piped system sufficiently conveys minor storm flows in accordance with Council requirements.

An iteration was also performed in DRAINS to assess major system flows with a conservative blockage factor of 50% applied to all pits in the development area. Results indicate that all overland flowpaths within the site satisfy the target safety requirements as specified by Penrith City Council / NSW Floodplain Development Manual (refer to Appendix A for results of overland flow assessment).

Appendix A. Overland Flow Assessment

Table A.1 – Safe Overland Flowpath Check (Assuming 50% Blockage)

Overland Flow Path	Max. Depth (m)	Max. Velocity (m/s)	Max. Depth x Velocity	<0.4m²/s
A2	-	-	-	TRUE
A3	-	-	-	TRUE
A4	-	-	-	TRUE
A5	-	-	-	TRUE
A6	-	-	-	TRUE
A7	-	-	-	TRUE
A8	0.188	0.42	0.01	TRUE
B1	0.162	0.32	0.01	TRUE
B2	0.234	0.44	0.01	TRUE
C1	-	-	-	TRUE
C2	0.192	0.41	0.01	TRUE
D1	-	-	-	TRUE
D2	0.170	0.36	0.00	TRUE
E1	0.018	0.64	0.01	TRUE
F1	-	-	-	TRUE
F2	0.183	0.40	0.01	TRUE
G2	0.150	0.94	0.03	TRUE
G3	0.030	0.51	0.02	TRUE
G4	-	-	-	TRUE
G5	0.150	0.91	0.08	TRUE
G6	0.274	1.88	0.16	TRUE
H1	0.031	0.45	0.01	TRUE
H2	-	-	-	TRUE
I2	0.150	1.03	0.12	TRUE
I3	0.121	0.80	0.08	TRUE
I4	0.101	0.69	0.03	TRUE
I5	0.070	0.48	0.03	TRUE
I6	0.215	0.41	0.05	TRUE
I7	0.176	0.41	0.03	TRUE
I8	0.204	0.80	0.02	TRUE
I9	0.204	0.61	0.01	TRUE
J1	0.165	0.94	0.15	TRUE
K1	0.172	0.94	0.16	TRUE
L1	0.172	1.21	0.20	TRUE
L2	0.170	0.74	0.11	TRUE
L3	0.188	0.74	0.12	TRUE
M1	0.168	0.50	0.02	TRUE
N3	0.105	0.68	0.02	TRUE

Overland Flow Path	Max. Depth (m)	Max. Velocity (m/s)	Max. Depth x Velocity	<0.4m^2/s
N4	0.164	0.69	0.09	TRUE
N5	-	-	-	TRUE
N6	-	-	-	TRUE
N7	0.154	0.36	0.01	TRUE
N8	-	-	-	TRUE
N9	0.199	0.32	0.05	TRUE
N10	0.209	0.02	0.00	TRUE
N11	0.199	0.09	0.00	TRUE
N12	0.057	0.66	0.03	TRUE
O1	0.193	0.74	0.12	TRUE
P1	-	-	-	TRUE
Q1	-	-	-	TRUE
R1	0.188	0.93	0.14	TRUE
S1	0.170	0.92	0.14	TRUE
T1	0.154	0.37	0.01	TRUE
U1	0.159	0.73	0.07	TRUE
V1	0.035	0.52	0.02	TRUE
W1	0.058	0.67	0.03	TRUE

Appendix B. Email Correspondence

Reilly, Dean F

From: Caraballo Charlie [ccaraballo@penrithcity.nsw.gov.au]
Sent: Thursday, 12 July 2012 11:06 AM
To: Reilly, Dean F
Cc: Avis, Chris J
Subject: RE: Parkview Penrith - OSD

Hi Dean,

You assumptions are correct from your email below.

Kind Regards,

CHARLIE C. CARABALLO
SENIOR ENGINEER - MAJOR DEVELOPMENTS

E ccaraballo@penrithcity.nsw.gov.au
T (02) 4732 7932 | F (02) 4732 7958 |
PO Box 60, Penrith NSW 2751

PENRITH
CITY COUNCIL

www.penrithishere.com.au
www.penrithcity.nsw.gov.au

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From: Reilly, Dean F [mailto:dean.reilly@mottmac.com.au]
Sent: Tuesday, 10 July 2012 2:25 PM
To: Caraballo Charlie
Cc: Avis, Chris J
Subject: RE: Parkview Penrith - OSD

Hi Charlie,

Thanks for the email. I have spoken to Chris Avis about this, and based on your advice, it is our understanding that:

> If the existing pit and pipe network in the adjoining street network has sufficient capacity to accept minor system stormwater flows (5yr ARI flows as noted in Councils DCP 2010) from the site, than no OSD is required;
> If the existing pit and pipe network in the adjoining street network has insufficient capacity to accept minor system stormwater flows from the site, then either;
> OSD is required; or
> Upgrade of the receiving (street) pit and pipe network is required.

Can you please confirm if our assumptions are correct?

Regards,

Dean

From: Reilly, Dean F
Sent: Monday, 9 July 2012 4:07 PM

To: Avis, Chris J
Subject: FW: Parkview Penrith - OSD
Importance: High

FYI

From: Caraballo Charlie [mailto:ccaraballo@penrithcity.nsw.gov.au]
Sent: Monday, 9 July 2012 3:58 PM
To: Reilly, Dean F
Subject: RE: Parkview Penrith - OSD
Importance: High

Penrith City Council
Civic Centre, 601 High Street, PENRITH NSW 2750
Telephone: (02) 4732 7777 Fax: (02) 4732 7958
e-mail: pencit@penrithcity.nsw.gov.au

Our Ref:
Contact: Charlie Caraballo
Telephone: 4732 7932
Date: 9 July 2012

Dean,

OSD is not required for the subject area. However, post development flows are not to adversley impact on existing drainage systems in the area.

Kind Regards,

Charlie C. Caraballo
Senior Engineer - Major Developments

E ccaraballo@penrithcity.nsw.gov.au
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From: Reilly, Dean F [mailto:dean.reilly@mottmac.com.au]
Sent: Thursday, 5 July 2012 8:57 AM
To: Caraballo Charlie
Subject: Parkview Penrith - OSD

Hi Charlie,

Can you please confirm whether council requires on-site detention (OSD) for the proposed Parkview Penrith development. The street address is 164 Station Street (Lot 12 DP 234581).

Thanks,

Dean Reilly
Civil Engineer
Mott MacDonald
Level 3, 90 Phillip Street, Parramatta NSW 2150 Australia
PO Box 163, Parramatta NSW 2124
www.mottmac.com

T +61 (0)2 9891 5044 | **F** +61 (0)2 9891 5386
E dean.reilly@mottmac.com.au

~~ Following Files were attached ~~
image001.png
image002.jpg
image003.png
~~ Following Files were attached ~~
image001.png
image002.jpg
image003.png

Appendix C. Catchment Plans

NOTE:
EXISTING STORMWATER PIPE DIAMETERS AS SHOWN ON THIS PLAN ARE BASED ON GIS DATA SUPPLIED BY PENRITH CITY COUNCIL AND ARE INDICATIVE ONLY

Ø750 STORMWATER LINE FROM STATION STREET CONNECTS TO EXISTING TRUNK STORMWATER CHANNEL

CONCRETE TRUNK STORMWATER CHANNEL

Ø1050 STORMWATER LINE BENEATH JAMISON ROAD CONNECTS TO EXISTING TRUNK STORMWATER CHANNEL.

EXISTING GRASS SWALE THROUGH CENTRE OF SITE

EXISTING PIPE DIAMETERS IN WOODRIFF STREET CURRENTLY UNKNOWN

4.377Ha
12% IMP
Q_{5YR} = 694 L/s
Q_{100YR} = 1330 L/s

2.084Ha
53% IMP
Q_{5YR} = 531 L/s
Q_{100YR} = 906 L/s

1.387Ha
37% IMP
Q_{5YR} = 0.324 L/s
Q_{100YR} = 0.576 L/s

Legend

- SUB-CATCHMENT BOUNDARY
- 2.084Ha / 53% IMP / Q_{5YR} = 531 L/s / Q_{100YR} = 906 L/s — SUB-CATCHMENT AREA / PERCENTAGE IMPERVIOUS / 5_{YR} ARI PEAK DISCHARGE / 100_{YR} ARI PEAK DISCHARGE
- APPROXIMATE LOCATION OF EXISTING STORMWATER LINE
- EXISTING STORMWATER PITS
- Ø525 — EXISTING STORMWATER PIPE DIAMETER
- C1 — SUB-CATCHMENT LABEL
- EXISTING SITE AREA DRAINING TO JAMISON ROAD
- EXISTING SITE AREA DRAINING TO STATION STREET
- EXISTING SITE AREA DRAINING TO WOODRIFF STREET
- EXISTING CONCRETE TRUNK STORMWATER CHANNEL

Preliminary - Not for Construction

Notes

20 15 10 5 0 20 40
PLAN SCALE 1:800 @ A1

Key to symbols

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	31.05.13	AMP	Issued for information	-	-
P1	28.05.13	AMP	Issued for information	-	-

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W www.mottmac.com.au

Client

Title
Nepean Green Penrith
Infrastructure Sketch
Existing Stormwater
Catchment Plan

Designed	D.Reilly	.	Eng check		.
Drawn	A.Paciben	.	Coordination	D.Reilly	.
Dwg check	D.Reilly	.	Approved	X	.

Scale at A1: 1:800
Status: PRE
Rev: P2

Drawing Number
MMD-310574-C-SK-PV-00-0105

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sln55925

NOTE:
EXISTING STORMWATER PIPE DIAMETERS AS SHOWN ON THIS PLAN ARE BASED ON GIS DATA SUPPLIED BY PENRITH CITY COUNCIL AND ARE INDICATIVE ONLY

STORMWATER FLOW FROM SUB-CATCHMENT C2 TO DISCHARGE TO EXISTING Ø525 STORMWATER LINE IN STATION STREET

PROPOSED ABOVE GROUND OSD STORAGE VOLUME PROVIDED = 415m³

Ø750
Ø750
Ø600
Ø600
Ø525
Ø375
Ø1050
Ø375
Ø375

C1
C2
C3

3.932Ha
80% IMP
Q_{5YR} = 872 L/s
Q_{100YR} = 1070 L/s

2.924Ha
90% IMP
Q_{5YR} = 420 L/s
Q_{100YR} = 832 L/s

1.010Ha
37% IMP
Q_{5YR} = 0.172 L/s
Q_{100YR} = 0.483 L/s

CONCRETE TRUNK STORMWATER CHANNEL

STORMWATER FLOW FROM SUB-CATCHMENT C1 TO DISCHARGE TO EXISTING Ø1050 STORMWATER LINE IN JAMISON ROAD

EXISTING PIPE DIAMETERS IN WOODRIFF STREET CURRENTLY UNKNOWN

PROPOSED BELOW GROUND OSD STORAGE VOLUME PROVIDED = 215m³

STORMWATER FLOW FROM SUB-CATCHMENT C3 TO DISCHARGE TO EXISTING PIT AND PIPE NETWORK IN WOODRIFF STREET.

Legend

- SUB-CATCHMENT BOUNDARY
- 2.084Ha / 53% IMP / Q_{5YR} = 872 L/s / Q_{100YR} = 1070L/s — SUB-CATCHMENT AREA / PERCENTAGE IMPERVIOUS / 5_{YR} ARI PEAK DISCHARGE / 100_{YR} ARI PEAK DISCHARGE
- APPROXIMATE LOCATION OF EXISTING STORMWATER
- EXISTING STORMWATER PITS
- Ø525 — EXISTING STORMWATER PIPE DIAMETER
- C1 — SUB-CATCHMENT LABEL
- PROPOSED SITE AREA DRAINING TO JAMISON ROAD
- PROPOSED SITE AREA DRAINING TO STATION STREET
- PROPOSED SITE AREA DRAINING TO WOODRIFF STREET
- EXISTING CONCRETE TRUNK STORMWATER CHANNEL

Preliminary - Not for Construction

Notes

20 15 10 5 0 20 40
PLAN SCALE 1:800 @ A1

Key to symbols

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P3	07.06.13	AMP	Issued for information	-	-
P2	31.05.13	AMP	Issued for information	-	-
P1	28.05.13	AMP	Issued for information	-	-

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Client

Title
Nepean Green Penrith
Infrastructure Sketch
Proposed Stormwater
Drainage Strategy Plan

Designed	D.Reilly	.	Eng check		.
Drawn	A.Paciben	.	Coordination	D.Reilly	.
Dwg check	D.Reilly	.	Approved	X	.

Scale at A1: 1:800
Status: PRE
Rev: P3

Drawing Number
MMD-310574-C-SK-PV-00-0110

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