Oakdale West Estate

Kemps Creek

Lot 3C & Lot 5 Civil Report

CLIENT/ GOODMAN

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Commercial in Confidence

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Abbreviations

OWE	Oakdale West Estate
WNSLR	Western North South Link Road
TfNSW	Transport for NSW
OEH	Office of Environment and Heritage
EP	Equivalent Persons
ET	Equivalent Tenancy
IWM	Integrated Water Management
GPS	Goodman Property Services (Aust) Pty Ltd
STP	Sewerage Treatment Plant
SWC	Sydney Water Corporation
WELS	Water Efficiency Labelling
EIS	Environmental Impact Statement
SSDA	State Significant Development Application
RMS	Roads and Maritime Service
EPLR	Erskine Park Link Road

1 Executive Summary

Goodman Property Services (Aust) Pty Ltd is developing the Oakdale West Estate for the purposes of providing a warehouse and distribution complex. The Oakdale West site is a precinct within the wider 'Oakdale' Estate development and forms part of a progressive development designed to make 'Oakdale' a regional distribution park of warehouses, distribution centres and freight logistics facilities.

The Oakdale West project is a staged development including bulk earthworks, civil works, and services infrastructure and stormwater disposal and management. All reports, drawings are approved under a separate application SSD 7348.

For the purpose of this report, it is assumed that the infrastructure stage works are approved and completed. This includes but not limited to; Bulk earthworks, Access Roads, Services, Stormwater Basins, Stormwater system and connection into each lot.

This development application encompasses the planned phase of civil works on the Oakdale West site, specifically on-lot works associated with Lot 3C & Lot 5. The on-lot works include:

- Proposed detailed earthworks to accommodate the building and external levels
- Proposed stormwater (piped) system and connection to drainage stub provided in the infrastructure works.
- Proposed overland flow path to relevant basin, outlined in SSD 7348. Lot 3C drains to Basin 3, while Lot 5 drains to Basin 5
- Proposed hardstand and carpark pavement.
- Proposed Erosion and Sediment control

This report is prepared to satisfy condition C11 with SSD 7348:

Future DAs shall demonstrate the design of the warehouses, offices and hardstand areas are consistent with (or the latest revision of) the:

(a) Civil, Stormwater and Infrastructure Services Report, prepared by At&L, dated October 2018; and
(b) Flood Impact Assessment: Oakdale West Estate, prepared by Cardno, dated 27 March 2017.

This report is to be read in conjunction with AT&L's latest civil report prepared for SSD 7348, which is entitled 'REP005-01-15-272-MOD 7 Civil Report'.

The site is located in the Penrith City Council Local Government area. Under SSD 7348, Precinct based bio-retention basins will be provided as part of the infrastructure works. The basins are designed to both attenuate stormwater flows and treat the nutrients to Penrith City Council treatment rates. The Precinct based Site Detention is designed to mitigate post development flows to pre-developed flows for peak Average Reoccurrence Interval (ARI) events and has been sized to ensure that for all storm events up to and including the 1% AEP event.

2 Introduction

The aim of the report is to assess the potential impacts of the proposed development with respect to Stormwater and has been prepared in accordance with Penrith City Council current design guidelines and the relevant Australian Standards.

2.1 Scope of Report

This report generally discusses the design philosophy behind the following components of the Stormwater Management design for Oakdale West Estate (OWE):

- Stormwater Management
  - Infrastructure Biodiversity and Bioretention Basin
  - Piped and Overland Flows
  - Water Balance across the site
- Erosion and Sediment Control
- Pavement
- Site Services

The proposed Lot 3C is bound by Lot 3B to the north, Bakers Lane to south, Road No.3 (Emporium Avenue) to the east, and the adjoining Emmaus facilities to the west.

The proposed Lot 5 is bound by an existing Transgrid easement and Road No.8 (Tundra Close) to the west, Ropes Creek and Basin to the east. Undeveloped lands existing to the north and south of the proposed Lot 5.

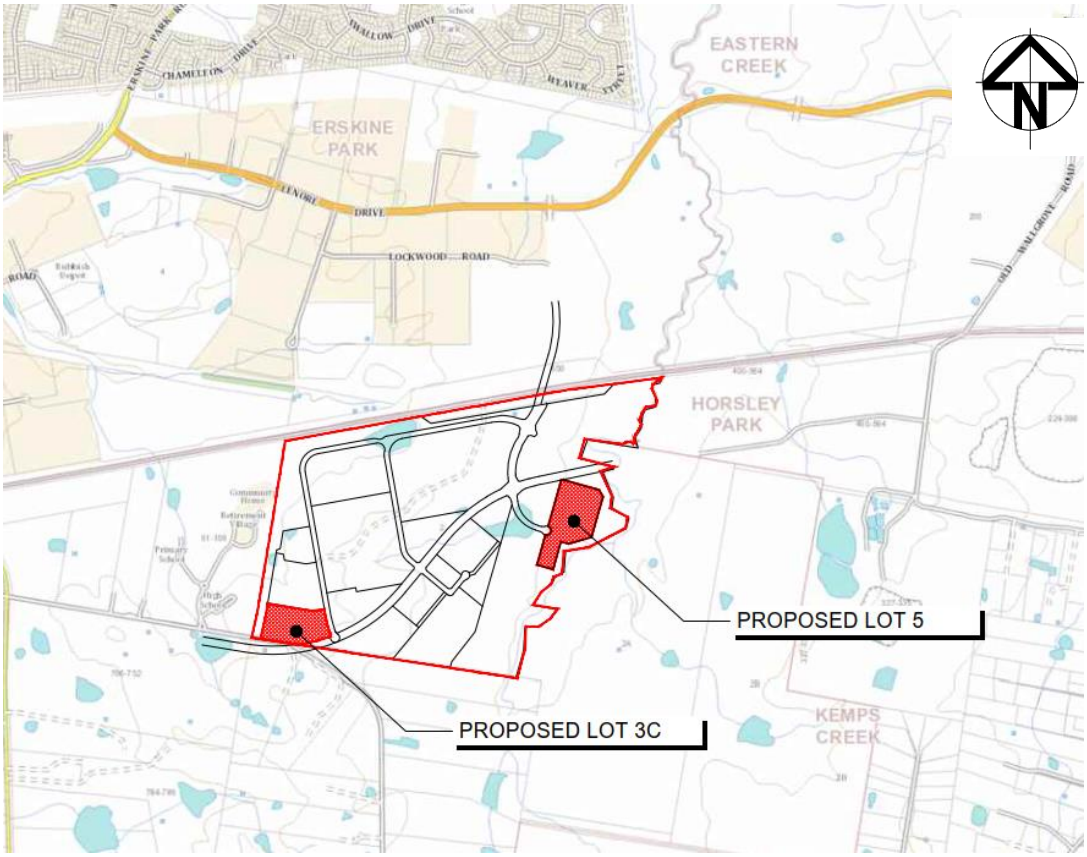

Figure 1 – Locality Plan

3 Stormwater Management

3.1 The Existing Site

For the purpose of this report, it is assumed that the infrastructure stage works are approved and completed. This includes but not limited to; Bulk earthworks, Access Roads, Services, Stormwater Basins, Stormwater system and connections into lots. The works are detailed in Stage 1 consent, SSD 7348.

Refer to Drawing C1087 within Appendix A for a post-development stormwater catchment plan indicating the location of basins and catchments provided in the infrastructure stage.

3.2 Proposed Site Stormwater Drainage

Lot 3C and Lot 5 are a part of a larger catchment which ultimately discharges into Bio-Retention Basin No.3 and Bio-Retention No.5 respectively, as shown in Appendix A. For additional details on Basin 3 and Basin 5, refer to 'REP005-01-15-272-MOD 7 Civil Report'.

- Lot 3C is approximately 4.36Ha. The proposed stormwater discharge point is located to the northeast of Lot 3C. An existing stormwater stub is provided into Lot 3C for connection into Road No.3 stormwater system. A GPT will be provided to capture the gross pollutants generated within Lot 3C before discharging into Road No. 3.
- Lot 5 is approximately 6.01Ha. Multiple proposed stormwater discharge points are proposed within Lot 5, which all drain to Basin No.5, which located directly east and adjacent to Lot 5. Existing stormwater stubs were provided into Lot 5 for connection into Basin 5. GPTs will be provided to capture the gross pollutants generated within Lot 5 before discharging into Basin 5.

Refer to the Civil Drawings for layout and details for the proposed stormwater network across the site.

3.3 Council Requirements, SSD Consent Conditions & Recommendations

This report is prepared to satisfy condition C11 with SSD 7348, which states:

Future DAs shall demonstrate the design of the warehouses, offices and hardstand areas are consistent with (or the latest revision of) the:

(a) Civil, Stormwater and Infrastructure Services Report, prepared by AT&L, dated October 2018; and
(b) Flood Impact Assessment: Oakdale West Estate, prepared by Cardno, dated 27 March 2017.

All estate level stormwater drainage for the OWE development is designed to comply with the following:

- Penrith City Council Design Guidelines for Engineering Works;
- Penrith City Council Water Sensitive Urban Design (WSUD) Policy December 2013; and

- C3 Water Management DCP.

A summary of the design requirements adopted is listed below:

- All stormwater drainage within the Lot 3C and Lot 5 will be the responsibility of Goodman;
- Finished Floor Levels (FFL) of proposed buildings within the precinct (separate approval) to have minimum 500mm freeboard to 1% AEP overland flows; and
- Gross pollutant traps (GPTs) will be installed within Lot 3C and Lot 5 on the final downstream stormwater pits prior to discharging. As these GPT's will be located on-lot, they will be owned and maintained by Goodman. The GPT will capture 90% of Gross Pollutants from Lot 3C and Lot 5 as per the PCC WSUD guidelines.

Rainwater tanks are desirable for re-use for irrigation, toilet and other non-potable water uses. Rainwater tank size is determined in accordance with the Penrith City Council C3 Water Management DCP to meet 80% of non-potable demand for irrigation and toilet flushing. Refer to Section 4 of this report for a more detailed description on rainwater harvest tanks.

3.3.1 Modelling Software

DRAINs modelling software has been used to calculate the Hydraulic Grade Line (HGL) of the estate level stormwater pipes. DRAINs is a computer program used for designing and analysing urban stormwater drainage systems and catchments. It is widely accepted by Council's across NSW as the basis for stormwater design and has been confirmed by Penrith City Council as the preferred stormwater software analysis package.

MUSIC modelling software will be used to evaluate the non-potable water from rainwater tanks once the number to toilets, roof and gutter design, and landscape irrigation needs are finalised. For a detailed description of the MUSIC modelling refer to Section 4 of this report.

3.3.2 Hydrology

- Pipe drainage shall be designed to accommodate the 5% AEP storm event;
- The combined piped and overland flow paths shall be designed to accommodate the 1% AEP 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 1% AEP storm event shall be provided. Alternatively, the pipe and inlet system may be upgraded to accommodate the 1% AEP storm event;
- Rainfall intensities shall be as per the Intensity-Frequency-Duration table in accordance with the Australian Rainfall and Runoff (AR&R) volume 2;
- Times of concentration for each sub catchment shall be determined using the kinematic wave equation;
- Runoff coefficients shall be calculated in accordance with AR&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 1% AEP event;
- Inlet pits to be spaced so that flow width shall not exceed 80l/sec;
- Bypass from any pit on grade shall not exceed 15% of the total flow at the pit; and

- Blockage factors of 20% and 50% shall be adopted for pits on grade and at sags respectively, with these blockage factors in-built to each pit within the DRAINs model.

3.3.3 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;
- Flow Velocities should exceed 0.6m/s for self-cleansing purposes.
- Maximum spacing between pits shall not exceed 75m;
- The minimum pipe grade to adopted shall be:

Nominal Size	Minimum Gradient	Nominal Size	Minimum Gradient
DN 90	1:100	DN 225	1:200
DN 100	1:100	DN 300	1:250
DN 150	1:100	DN 375 or larger	1:300

- 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 shall be Reinforced Concrete Pipes or Fibre Reinforced Cement equivalent;
- The pipe friction coefficients to adopted shall be:

Materials	Mannings – n	Colebrook-White – k	Min. Pipe Class
RCP	0.012	0.6	3
FRC	0.01	0.15	3

Table 1 – Pipe Details

- 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 for the minor storm event;
- Overland flowpaths shall maintain a minimum of 500mm freeboard to all habitable floor levels; and
- Pits deeper than 1.2m shall contain step irons at 300 mm centres.

3.3.4 Catchments

A Stormwater Catchment Plan for Lot 3C and Lot 5, and flow paths into the Bio-retention Basins No. 3 and Basin No. 5 are shown in Appendix A.

3.3.5 Overland Flows

Overland flows within the hardstand area and carparks have been designed to be safely conveyed to inground drainage for all storms above the 5% AEP up to 1% AEP.

All flow widths and velocities are design in accordance with the Penrith City Council Design Guidelines for Engineering Works.

Stormwater pipes from all recessed docks are design for the 1% AEP.

3.3.6 GPT Model Selection

LOT		Min. Required Treatable flow rate (3-month flow L/s)	GPT	GPT Treatable Flow Rate (L/s)
Lot 3C		403 L/s	Rocla – CDS 2018 Or approved equivalent	500-600 L/s
Lot 5	5A	502 L/s	Rocla – CDS 2018 Or approved equivalent	500-600 L/s
	5B	92 L/s	Rocla CDS 1009 Or approved equivalent	100-110 L/s

3.4 Conclusion

As highlighted in the above section, all stormwater drainage within Lot 3C & Lot 5 development has been designed in accordance with the Penrith City Council Engineering Guidelines. This includes design of the stormwater network (pits and pipes) and GPTs.

Finished Floor Levels (FFL) to have minimum 500mm freeboard to 1% AEP overland flows.

4 Water Balance

4.1 General

The water balance was simulated using a water cycle management model as part of the MUSIC Model to allow the evaluation of various elements of the water cycle to be assessed at differing stages in the development.

Penrith City Council WSUD policy (July 2015) stipulates the rainwater tanks to meet 80% of non-potable demand including outdoor use, toilets and laundry.

4.2 Water Balance Objective

Potable water supplies in the Sydney area are in recognised short supply with projected population increases, potential climate change and periods of extended drought and any development in sources of the Sydney region places increasing demands on an already reduced water supply. As a result, government bodies, together with Sydney Water have encouraged sustainable development by the implementation of an integrated approach to water cycle management (potable water, sewage, stormwater and rainwater) to minimise demands of potable water supplies.

Whilst opportunities for Water Reuse include such initiatives as regional stormwater harvesting, black water recycling and recycled water, this development is limited to rainwater collection and reuse on an individual lot by lot basis.

Once the number to toilets, roof and gutter design, and landscape irrigation needs are finalised, we will used MUSIC to establish an estimated tank size for each lot within the development and demonstrated the volume of water reuse possible and provide a more sustainable servicing solution.

4.3 Water Balance End Uses

AT&L has identified the following water demand end uses to be required across the development:

- Toilet and urinal flushing; and
- Landscape watering (outdoor garden use).

The proportion of total water demands for irrigation and toilet flushing within the development could be met with the use of recycled roof water drained directly into a rainwater tank. The tank should be sized to ensure the site meets the requirement to meet the 80% non-potable reuse requirement. This is in accordance with Penrith City Council's WSUD policy.

4.4 Total Site Demands and Non-Potable Re-use Rates

The following rates were adopted from the Penrith City Council WSUD technical Guidelines for Industrial and Commercial developments (Section 4.5):

- 0.1 kL/day per toilet or urinal;
- 0.4 kL/year/m2 as PET-Rain for Sprinklers; and
- 0.3 kL/year/m2 as PET-Rain for Subsurface irrigation.

Lot	Building	No of Toilet and Landscape Area	Demand
Lot 3C	Building 3C1	No of Toilet: 7	0.6 kL/day (Toilet Flushing)
		Landscape Area: 3,148m^2	944.4 kL/yr PET (Landscape)
	Building 3C2	No of Toilet: 18	1.6 kL/day (Toilet Flushing)
		Landscape Area: 3,148m^2	944.4 kL/yr PET (Landscape)
Lot 5	Building 5A (West)	No of Toilet: 18	1.6 kL/day (Toilet Flushing)
		Landscape Area: 1,318m^2	395.4 KL/yr PET (Landscape)
	Building 5A (East)	No of Toilet: 7	0.6 kL/day (Toilet Flushing)
		Landscape Area: 1,318m^2	395.4 kL/yr PET (Landscape)
	Building 5B	No of Toilet: 7	0.6 kL/day (Toilet Flushing)
		Landscape Area: 407m^2	122.1 kL/yr PET (Landscape)

Note: Toilet demand was calculated based on 6-day week.

4.5 Rainwater Reuse

The use of rainwater collected in rainwater tanks from runoff on the roofs of the warehouse roofs provides a valuable alternative to potable water for a variety of non-potable end uses, such as vehicle washing, air conditioning cooling, and toilet flushing and watering.

We have assumed for this development, irrigation and toilet flushing will be plumbed to the rainwater tanks. Other uses such as truck washing maybe considered at the detailed design stage.

A rainwater tank model was constructed to simulate the rainwater tank operations and select the optimal rainwater tank size, in doing so, the following considerations were made:

- Rainfall received;
- Roof area or runoff area;
- Roof Wetting;
- First Flush; and
- Rainwater demands (by end use).

4.6 Rainwater Tank Model Assumptions

The rainwater tank model assumptions built into the scenarios assumed the following.

4.6.1 Rainfall Received

The rainfall runoff that could potentially be captured by the rainfall tank from the roof of each building was simulated individually for the 'dry', 'wet' and 'average' rainfall year within each scenario run.

4.6.2 Roof Wetting, First Flush Diversions and Overflow

While it is assumed that rainfall runoff has the potential to runoff 100% of the area of the roof into the rainwater tank, the proportion of rainfall that actually reaches the rainwater tank is affected by four factors:

- It is assumed that the initial 2mm of rainfall that falls on the roof is considered 'wetting', that is, potential rainfall runoff that is not captured by the rainwater tank, but is rather 'lost runoff' as evaporation or other;
- To prevent sediment and other pollutants entering the rainwater tank, a portion of the initial runoff from the roof is transferred to stormwater, this is known as the 'first flush'. The portion of water diverted as part of the first flush differs for each facility depending on the amount of pollution each roof is susceptible to;
- As the development is located in a predominantly light industrial area, where there may be potential for some roof pollution, a standard first flush volume of 1mm of runoff from across the roof area has been adopted; and
- Any roof runoff that exceeds the rainwater tank capacity is 'overflow' and is directed to the stormwater drainage system.

4.6.3 Rainwater Tank Modelling Results

The use of a rainwater tank was simulated for 'average' rainfall conditions to service both toilets flushing and landscape being:

LOT	Tank (s)	Roof Catchment to Tank (m^2)	Tank Capacity (kL)	Effective volume of Tank (80%) (kL)	% Of Re-used demand met
Lot 3C	Building 3C1 RWT (East)	2,600	150	120	80.3%
	Building 3C2 RWT (West)	4,700	150	120	80.6%
Lot 5	Building 5A RWT (West)	4,500	107	85.6	86.4%
	Building 5A RWT (East)	6,000	50	40	87.8%
	Building 5B RWT	2,000	30	24	84.5%

Note: Above table are suggestions of RWT sizes. RWT model and size to be confirmed in detailed design.

4.7 Conclusion

The use of rainwater harvest tanks and the design basis to size the tanks to ensure as a minimum, 80% of all non-potable water on each lot can be sourced from the tank, demonstrates a commitment to water recycling and minimising the usage of mains water.

This is in line with the industry best practise and the NSW State Government's objective of reducing the amount of potable (drinking) water consumed for non-potable uses.

5 Sedimentation and Erosion Control

5.1 Sedimentation and Erosion Control (Construction)

A Soil and Water Management Plan (SWMP) will be prepared in accordance with the NSW Department of Housing Publication titled: Managing Urban Stormwater – Soils and Construction (2004) for Lot 3C and Lot 5.

The key objective of the SWMP are:

- Acknowledging the activities on a construction site which may contribute to erosion, sedimentation and water quality impacts;
- The implementation of industry best management practices to minimise adverse water quality and sedimentation impacts brought about through construction activities on waterbodies surrounding the work; and
- Establishment of processes that effectively manage erosion, sedimentation and water quality practices during the life of the project.

5.1.1 Design of Sediment and Erosion 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 specifications; and
- Office of Environment and Heritage's 'Managing Urban Stormwater: Soils and Construction. Landcom, (4th Edition) (The "Blue Book") Volume 1 and Volume 2.

Temporary sediment basin in Lot 3C and Lot 5 will be provided within the infrastructure stage associated with the SSD 7348 Stage 1 consent works. The basins are to be maintained throughout the construction phase of the on-lot works, until such time that the site has been suitably stabilised and the sediment basin is no longer required to meet the requirements of the Blue Book.

5.2 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 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;
- Remove temporary soil conservation structures as the last activity in the rehabilitation.
- Inspect the sediment basin during the following periods:
    - During construction to determine whether machinery, falling trees, or construction activity has damaged and components of the sediment basin. If damage has occurred, repair it;
    - After each runoff event, inspect the erosion damage at flow entry and exit points. If damage has occurred, make the necessary repairs;
    - At least weekly during the nominated wet season (if any), otherwise at least fortnightly; and
    - Prior to, and immediately after, periods of 'stop work' or site shutdown.
- Clean out accumulated sediment when it reaches the marker board/post, and restore the original volume. Place sediment in a disposal area or, if appropriate, mix with dry soil on the site;
- Do not dispose of sediment in a manner that will create an erosion or pollution hazard;
- Check all visible pipe connections for leaks, and repair as necessary;
- Check all embankments for excessive settlement, slumping of the slopes or piping between the conduit and the embankment, make all necessary repairs;
- Remove the trash and other debris from the basin and riser; and
- Submerged inflow pipes must be inspected and de-silted (as required) after each inflow event.

5.2.1 Sediment Basin Maintenance

Stormwater within the settling zone should be drained or pumped out within 5 days (design time), if the nominated water quality targets can be met, to the satisfaction of the superintendent. Flocculation should be employed where extended settling is likely to fail to meet the objectives within the 5-day time period.

Flocculation is when flocculating agents are applied to the sediment basins causing the colloidal particles to clump into larger units or 'floc' that can either settle in a reasonable time or be filtered.

Refer to Appendix E4 of the Blue Book for flocculation methodologies and manufacturer's instructions for application rates, regarding the proposed sediment basins.

5.3 Conclusion

The erosion control measures proposed for the site will comply with the requirements of Penrith City Council Engineering Guidelines and in accordance with the latest revision AT&L infrastructure report.

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

Appendix A

Proposed Infrastructure Catchment Plans

Appendix B

AT&L – Drawing List of Civil Works