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EGC CUSTODIAN SERVICES

Allengrove Crescent, North Ryde - Stormwater Management and Flood Assessment

Part 3A Concept Plan Application

301015-02272 – 01-CI-REP-0004

4th May 2011

Infrastructure & Environment
Level 12, 141 Walker Street,
North Sydney NSW 2060
Australia
Telephone: +61 2 8923-6866
Facsimile: +61 2 8923-6877
www.worleyparsons.com
ABN 61 001 279 812

SYNOPSIS

This report has been produced for EGC Custodian Services Pty Ltd in support of the proposed development located at Allengrove Crescent, North Ryde. This report covers and addresses stormwater management and flooding issues raised by the Director General, as part of a Part 3A concept plan submission to the New South Wales Department of Planning.

Disclaimer

PROJECT 301015-02272 - ALLENGROVE CRESCENT, NORTH RYDE - STORMWATER MANAGEMENT AND FLOOD ASSESSMENT

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
1	Final Issue	JNH	FMC	FMC	08-09-10	N/A	
2	Final Incorporating Candalepas Comments	JNH	FMC	FMC	27-09-10		
3	Amendments to Lot numbers	JNH	FMC	FMC	07-10-10		
4	Revised Masterplan	JNH	FMC	FMC	04-05-11		

CONTENTS

1. EXECUTIVE SUMMARY

EGC Custodian Services Pty Ltd proposes to re-develop an existing site, located on the corner of Allengrove Crescent and Lane Cove Road, which currently consists of 16 single residential lots with a free standing dwelling on each of the lots. The site covers an area of approximately 1.24 ha.

The proposed development would consist of the construction of five multi-storey buildings and an underground basement car park with integrated communal open spaces. The development would provide a total of 196 apartments, spread across the five buildings and approximately 273 basement car parking spaces. A plan of the site is shown in **Appendix 1**.

The site is bounded by Epping Road to the north east, Lane Cove Road to the north west, Allengrove Crescent to the south west and private residential properties to the south east.

The site is located within City of Ryde Local Government Area (LGA) and is surrounded by low density housing towards the south, east and west and industrial/commercial space to the north.

The proposed development was identified by the Director General of New South Wales Department of Planning (DoP), now the Department of Planning and Infrastructure, as a significant project. The Director General's Requirements (DGRs) were issued by the former DoP on the 22nd of June 2010. The issues to be addressed in this report for Concept Approval are as follows:

*"**8. Drainage, Stormwater Management and Flooding Potential***

- (8.1) *The EA shall include a Stormwater/Drainage/Flood Study addressing drainage/groundwater/flooding issues associated with the development and the site, including consideration of any required infrastructure upgrades and stormwater/flooding management strategies/mitigation measures for development of the site and adjacent lands.*
- (8.2) *The EA shall address the requirements for additional drainage infrastructure and incorporation of Water Sensitive Urban Design measures.*"

The DGRs will be addressed by adopting standard best practice for managing stormwater quantity, quality and flooding. The City of Ryde Development Control Plans (Councils DCP-2010) will be consulted during the assessment as a guideline.

This report will explore, in concept, how stormwater and flooding issues are to be addressed on-site to mitigate and ensure no adverse impacts to the local and downstream environments.

The site is not believed to be affected by flooding. There are no defined overland flow paths across or through the site and the site is also located some distance and elevation away from any major water ways. Additional details are discussed further in **Section 6**. Adequate drainage and appropriately designed overland flow paths would be constructed across the development to ensure stormwater flows are conveyed safely from the site to Council's existing stormwater infrastructure network.

Stormwater runoff generated across the site would be controlled and reduced with the implementation of on-site detention (OSD). An OSD tank, with a designed discharge control outlet, would be used to control peak flows such that flows generated across the proposed development do not exceed peak flows generated under pre-developed conditions. The discharge controls would be designed to cater for all storm events up to the 100 year average recurrence interval (ARI) storm event. This would ensure no impact to receiving water bodies or impacts to any of Council's existing stormwater infrastructure. The hydrologic modelling undertaken as part of this assessment is discussed in **Section 7**.

Water quality is to be managed on site with the implementation of Water Sensitive Urban Design (WSUD) best practices principles. Adopting these principles, a stormwater treatment train has been developed which incorporates the use of rainwater tanks, litter baskets, OSD tanks and bio-retention basins and swales. Details of each of the stormwater treatment facilities are discussed in **Section 7.3.1** and **8.5.2**. Modelling of the treatment effectiveness of the proposed treatment train and the adopted WSUD principles are discussed in **Section 8**. The modelling results demonstrate that the proposed treatment train is effective at reducing total annual pollutant discharge from the site, with total pollutant levels under proposed conditions matching, if not improving, on pollutant levels generated under existing conditions. As a result, water quality runoff from the development would have no adverse affect on the environment.

The flooding and stormwater management assessments undertaken as part of this concept plan submission clearly demonstrates that the stormwater management strategies proposed for the development can effectively mitigate any stormwater/drainage and flooding impacts to downstream properties and receiving environments.

2. INTRODUCTION

WorleyParsons was engaged by EGC Custodian Services Pty Ltd to address stormwater and flooding as part of a concept plan application, for the proposed development at Allengrove Crescent, North Ryde.

The application seeks approval for a concept plan which includes demolition of existing single dwellings located within the site, and the construction of five multi-story buildings and underground basement car park with integrated communal open space. The proposed development is to provide a total of approximately 196 apartments across the five buildings and approximately 273 basement car parking spaces.

The Director General of NSW Planning provided the issues to be addressed in the application in the Director General's Requirements (refer to **Appendix 2**).

This report addresses the proposed stormwater management and flooding constraints and demonstrates how the development would address issues raised by the Director General. This report also discusses, in brief, the implications the proposed development would have on groundwater and existing infrastructure.

3. EXISTING SITE CONDITIONS

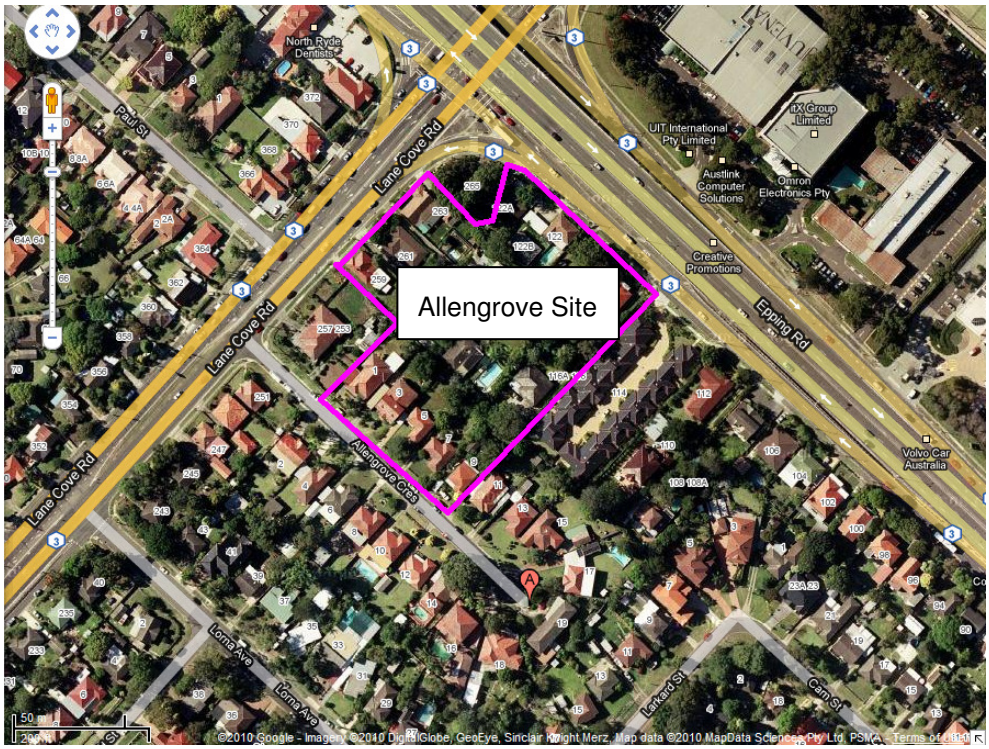
The proposed developed is located on Epping Road, Lane Cove Road and Allengrove Crescent in North Ryde. The site currently consists of 16 separate single lots, each with a free standing residential dwelling, which includes 116a – 122b Epping Road, 259 – 263 Lane Cove Road and 1 – 9 Allengrove Crescent. The site covers an area of approximately 1.24 ha.

The site is bounded by Epping Road to the north east, Lane Cove Road to the North West, Allengrove Crescent to the south west and private residential properties to the south east. A vacant, densely forested lot (currently owned by City of Ryde Council) is located at the north corner of the site, while two privately owned residential lots are located to the west of the site. The site is located south of Macquarie Park and within 400 m of the recently construction Macquarie Park Railway Station.

The site is located within a low density suburban region within the City of Ryde Local Government Area (LGA).

The location of the site is illustrated in **Figure 1**.

Figure 1 – Site Locality Plan



3.1 Topography

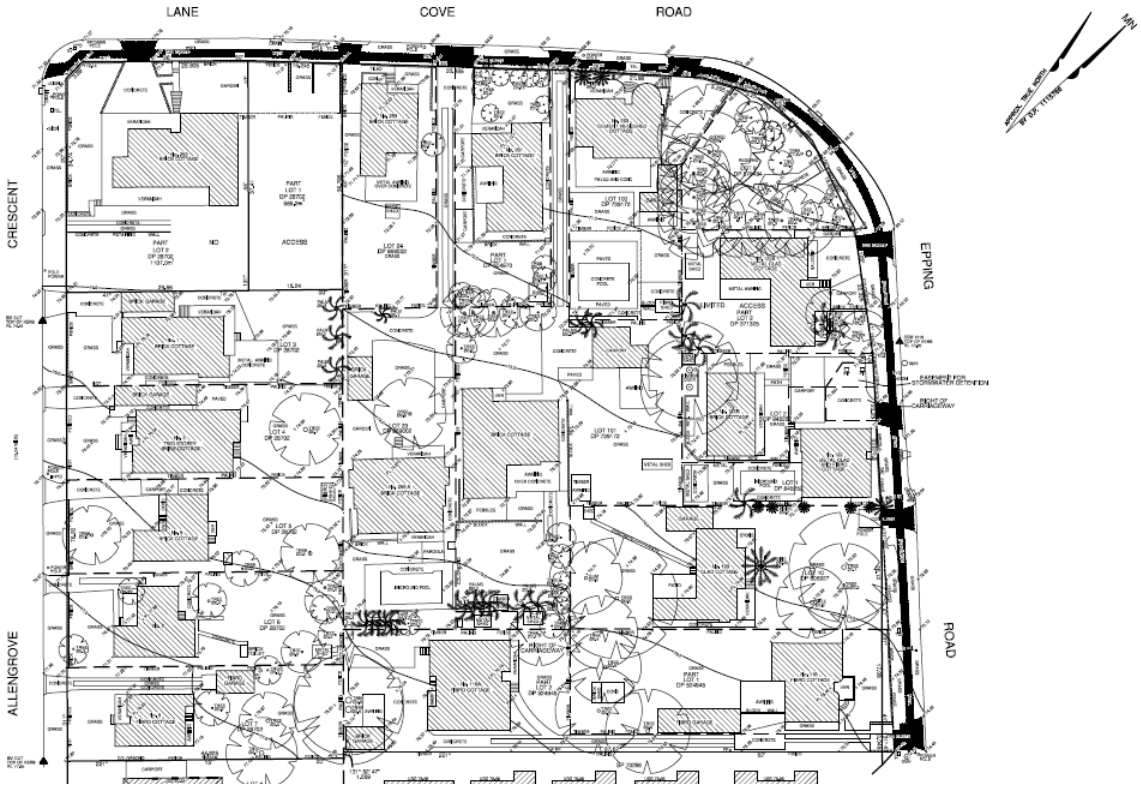
The site is located partially on the crest of a local high point, which slopes to the north of the site towards the intersection of Epping Road and Lane Cove Road. The site slopes uniformly to the north with a grade of approximately 6-7% from a high point of RL 77.8 m AHD to a local low point of RL 69.0 m AHD.

The majority of the site drains diffusely to the north towards the intersection of Epping and Lane Cove Road. The site catchment contributes to the Macquarie Park catchment, where stormwater is conveyed via Council's stormwater pit and pipe network within Lane Cove and Epping Road, and ultimately discharged into Lane Cove River to the north.

There are no defined overland flow paths that traverse across the site or immediately surrounding it.

A plan of the existing topography is illustrated in **Figure 2**.

Figure 2 – Plan of existing topography of site



3.2 Land Use and Site History

The site is currently zoned as R2 (Low Density Residential) under the Ryde Local Environmental Plan 2011. As mentioned earlier the site consists of 16 residential lots, each with a free standing single dwelling and complies with Council's current zoning description.

Based on visual site inspections and review of ortho-photographic maps and survey, the site is estimated to be approximately 54% impervious.

It is understood that the site had once been used for agricultural purposes prior the 1930s and may have been used for vehicle servicing and repairs sometime between the 1980s and 2000s.

3.3 Geotechnical Conditions

A geotechnical assessment for the site was conducted by Jeffery and Katauskas (J&K) in April 2008 with field work undertaken on the 13th of February 2008. The assessment consisted of drilling seven boreholes using hand auger methods 1.25 m – 1.5 m deep with an additional seven Dynamic Cone Penetration tests, 1.25 m – 2.72 deep.

The assessment found the site to be:

- "*topsoil (or fill) comprising silty clay of high plasticity was encountered in all boreholes to depths between 0.2 m and 0.4 m.*";
- "*Residual silty clay was encountered below the topsoil/fill in all boreholes and extend to the borehole termination depths between 1.25 m and 1.5 m. Residual silty clay was generally of high plasticity and very stiff and hard strength.*";
- "*the residual silty clay extends to a maximum depth of about 2 m. Blowcounts of greater than 10 per 100 mm penetration are interpreted to indicate extremely weathered shale or clay with numerous shale and ironstone bands.*"; and
- "*Groundwater seepage was encountered at a depth of 1.35 m and 0.4 m whilst drilling BH1 and BH2 respectively. All boreholes were 'dry' on completion of drilling… Long term groundwater monitoring was not carried out.*"

For more information please refer to the J&K geotechnical report.

4. PROPOSED DEVELOPMENT

The proposed development would consist of the demolition of all existing dwellings located within the site to make way for the construction of five multi storey buildings, linked together via an underground basement car park.

The applicant seeks approval for a concept plan for the proposed development which includes construction of 196 apartments spread across the five buildings and 273 basement car parking spaces. The development would also include the construction of associated civil, stormwater and servicing works.

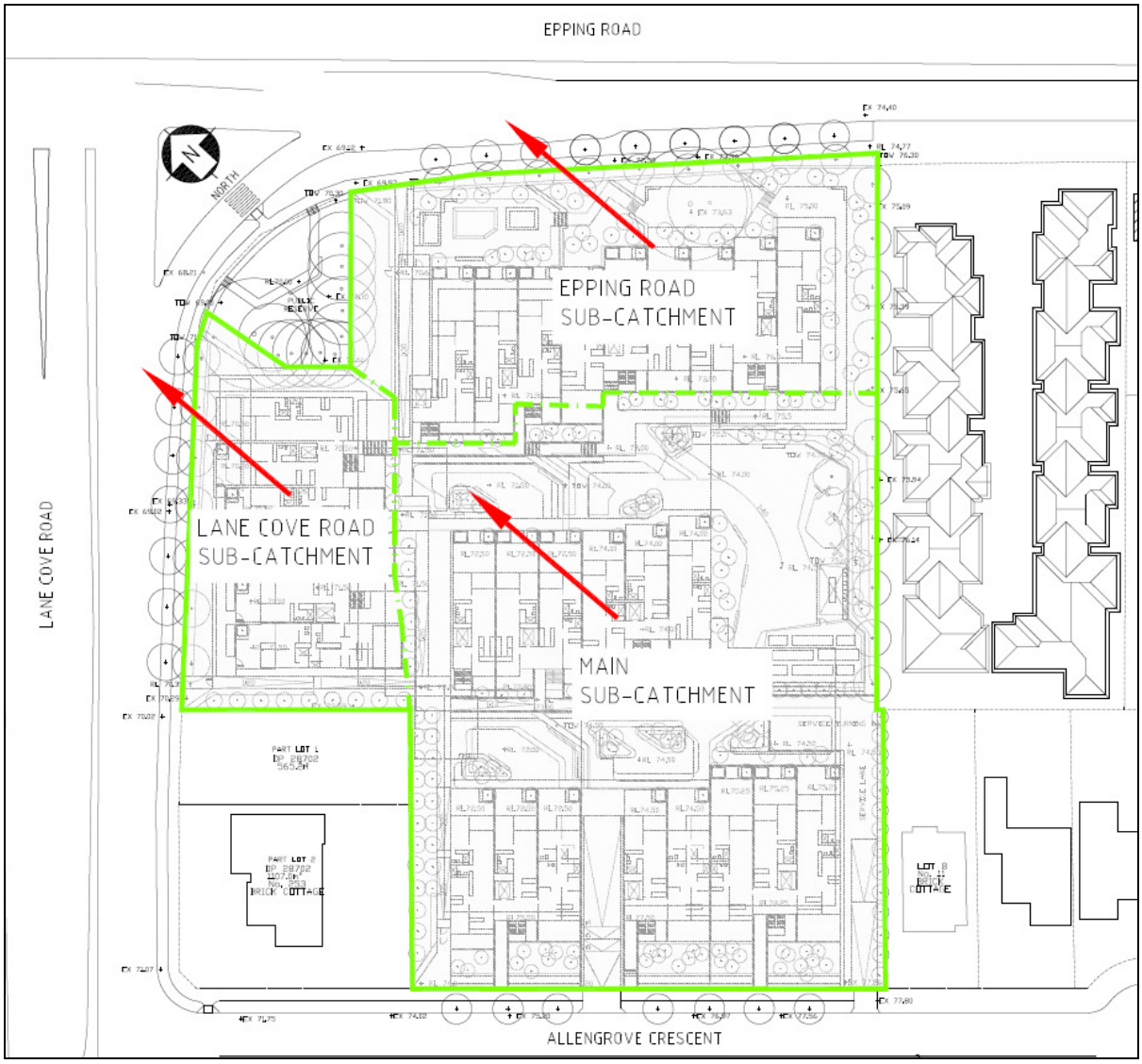
The development would provide communal open space, children playgrounds and communal vegetable gardens. Three communal pedestrian access points would be provided on Lane Cove, Epping Road and Allengrove Crescent, while vehicular access to the underground car park would be provided via an ingress point located along Allengrove Crescent. A second access road has been provided along the south east boundary of the site for maintenance and emergency vehicles from Allengrove Crescent.

4.1 Sub-Catchments

Based on the masterplan and the finished levels of the proposed development, three sub catchments have been identified across the site. These include two small sub-catchments located along the north of the site towards Epping Road (Epping Road Sub-Catchment) and to the west towards Lane Cove Road (Lane Cove Road Sub-Catchment), and a larger sub-catchment located towards the south of the site (Main Sub-Catchment).

An illustration showing the extents of each of the catchments are shown in **Figure 3**.

Figure 3 – Catchment Plan of the Site under Proposed Conditions



5. LEGAL REQUIREMENTS AND OBJECTIVES

The proposed development has been identified by the Director General of New South Wales Department of Planning (DoP) as a significant project. The Director General's Requirements (DGR) were issued by the DoP on the 22nd of June 2010. The issues to be addressed in this report for Concept Approval are as follows:

*"**8. Drainage, Stormwater Management and Flooding Potential***

- (8.1) *The EA shall include a Stormwater/Drainage/Flood Study addressing drainage/groundwater/flooding issues associated with the development and the site, including consideration of any required infrastructure upgrades and stormwater/flooding management strategies/mitigation measures for development of the site and adjacent lands.*
- (8.2) *The EA shall address the requirements for additional drainage infrastructure and incorporation of Water Sensitive Urban Design measures.*"

Council has published a flood study for the Macquarie Park catchment (Macquarie Park Floodplain Risk Management Study Plan – Feb 2011). This flood study was reviewed to confirm whether the site is affected by flooding. For additional details regarding flooding please refer **Section 6**.

To address issues regarding stormwater quantity, standard practices would be adopted that require peak flows generated across the development to match or improve on existing or preferably pre-developed conditions. This is demonstrated and discussed in detail in **Section 7**.

For a development of this nature, where stormwater generated across the site will eventually discharge into a major water way (The Lane Cove River), it is imperative that the proposed development maintains peak runoff rates to ensure no impacts on existing infrastructure or flood levels within the downstream water ways.

Water Sensitive Urban Design (WSUD) best practices would be adopted to address pollutant discharge from the proposed development and, to an extent, water quantity. A stormwater treatment train would be developed to ensure no net impact on total annual pollutant discharge from the proposed site to ensure no adverse impact on local and downstream environments. Details of the pollutant reduction targets are discussed in **Section 8.2.1**.

This report has also consulted Councils DCP (2010) as a guideline to address all issues raised by the Director General.

This report also addresses issues concerning groundwater and impacts to existing infrastructure.

6. FLOODING

The site sits on the crest of a local high point where no defined overland flow paths have been identified within or adjacent to the site.

As mentioned earlier, the site drains towards the north and contributes to the Macquarie Park catchment which discharges into the Lane Cove River. Flooding from the Lane Cove River is unlikely as the river is located approximately 2-3 kilometres to the north east and 50 m below the lowest point of the site.

Two tributaries of Lane Cove River, the first located to the north (Industrial Creek – located approximately 1 km away and 40 m below the lowest point of the site) and the second to the east (Porters Creek– located approximately 0.8 km away and 40 m below the lowest point of the site), have been known to flood and affect nearby residential homes.

A review of flood maps shown in the Macquarie Park Floodplain Risk Management Study Plan (Feb 2011) demonstrate that the simulated flood events, up to the 100 year ARI flood event, do not affect or impact the site.

Since the site is not affected by flooding the Director General's requirements for flooding on site have been addressed (Issue 8.1).

7. HYDROLOGY

A RAFTS rainfall/runoff model was formulated for the hydrological analysis of the Allengrove Crescent development. The model was used to estimate catchment runoff under pre-development and developed catchment conditions for the comparison of the 5, 20 and 100 year ARI storm events. A preliminary estimate of on-site detention requirements was undertaken.

7.1 RAFTS

RAFTS is a program consisting of five discrete modules that simulate the rainfall/runoff routing process, namely:

- A library module;
- A hydrograph generation module;
- A loss module;
- A reservoir routing module; and
- A river/channel routing module.

Intensity Frequency Duration (*IFD*) data for the site was obtained from *Bureau of Meteorology* and is shown in **Table 7-1** below.

Table 7-1 – Adopted IFD values

Storm Event	Duration	Rainfall Intensity
2 year ARI	1 hour storm	37.30 mm/hr
2 year ARI	12 hour storm	8.09 mm/hr
2 year ARI	72 hour storm	2.57 mm/hr
50 year ARI	1 hour storm	72.4 mm/hr
50 year ARI	12 hour storm	17.6 mm/hr
50 year ARI	72 hour storm	5.75 mm/hr

- Location skew (G) 0.00
- Geographical factor (F2) 4.3
- Geographical factor (F50) 15.85

Other input parameters adopted in the formation of the RAFTS model were as follows:

- Manning's 'n' was taken to be 0.02 for impervious areas and 0.03 for pervious areas;

- Initial and continuing losses for pervious areas were modelled as 5 mm and 1 mm/hr respectively; and
- Initial and continuing losses for impervious areas were modelled as 1 mm and 0 mm/hr respectively.

Three scenarios, as outlined below, were analysed to ascertain the hydrological impact of the proposed development to the nearby environment.

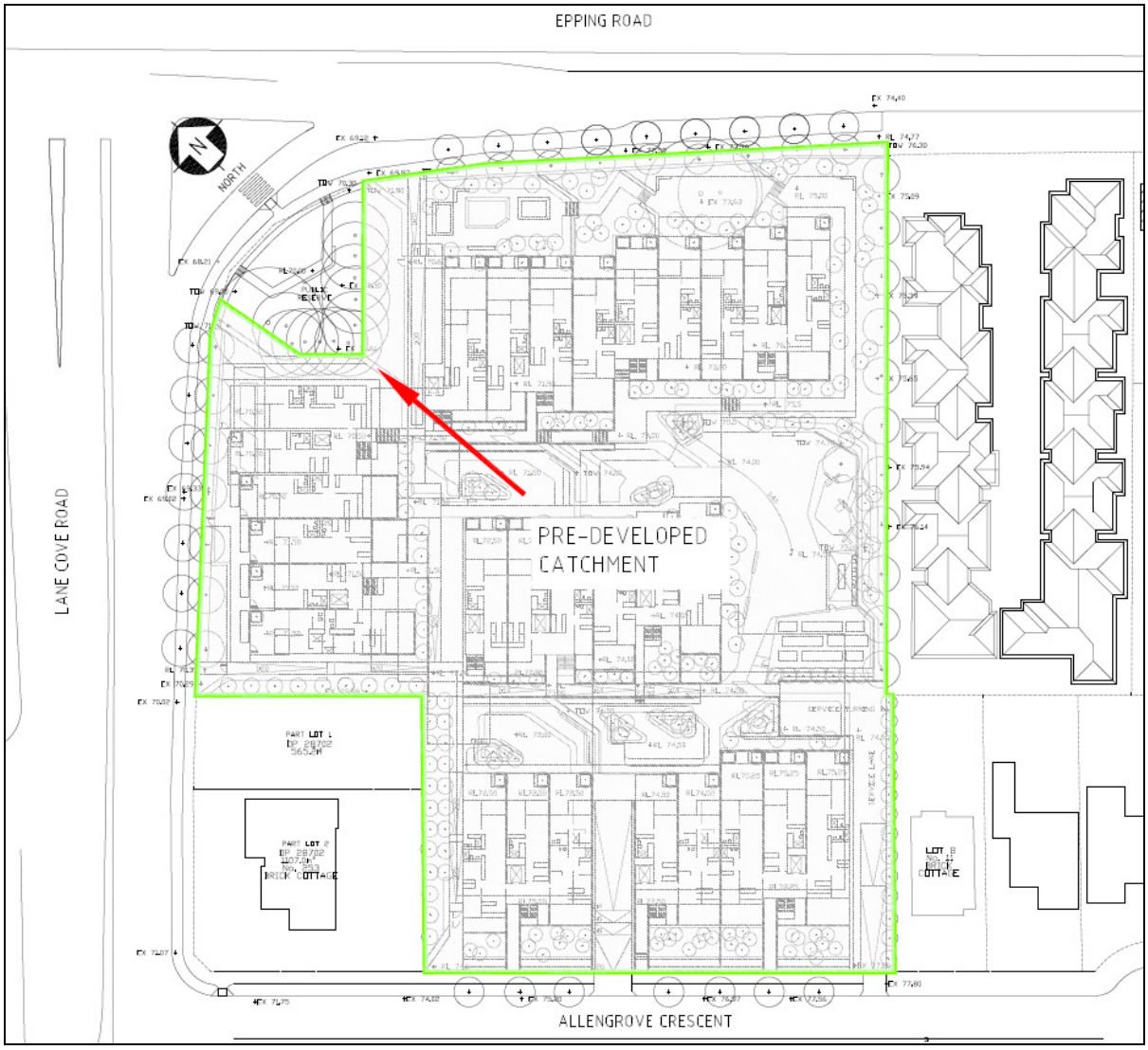
- Pre-developed conditions;
- Proposed developed conditions; and
- Proposed developed conditions with detention.

This analysis ensures the proposed development meets the stormwater quantity requirements discussed in **Section 5**.

7.1.1 Pre-developed Conditions

One catchment was identified for the site under pre-developed conditions. The extent of the catchment is defined by the site boundary shown in **Figure 4**. The area of the pre-developed catchment is the same under existing conditions covering an area of approximately 1.24 ha.

Figure 4 – Catchment Plan of Site under Pre-developed Conditions



The estimated peak 5, 20 and 100 year ARI outflows from the site are summarised in **Table 7-2**. The results below are reported to two decimal places for comparative purposes.

Table 7-2 Estimated Peak Outflows under Pre-developed Conditions

Pre-developed Catchment	Storm event		
Storm Duration	**5 year ARI**	**20 year ARI**	**100 year ARI**
60 min	0.35 m^3/s	0.49 m^3/s	0.60 m^3/s
90 min	**0.37 m^3/s**	**0.51 m^3/s**	**0.63 m^3/s**
120 min	0.36 m^3/s	0.47 m^3/s	0.60 m^3/s

7.1.2 Proposed Conditions (without Detention)

Three sub-catchments were identified within the site under proposed conditions. The extents of the proposed catchments were determined from the proposed development layout, sections and elevations. The proposed catchments are defined in **Figure 3** and the data in **Table 7-3** was used to create a RAFTs model for the site.

Table 7-3 -Proposed Catchment Details

Catchment	Area (ha)	Impervious (%)
Epping Road Sub-catchment	0.332	69%
Lane Cove Road Sub-catchment	0.181	80%
Main Sub-catchment	0.722	65%
Total	**1.235**	**68%**

The estimated peak 5, 20 and 100-year ARI outflows from the site are summarised in **Table 7-4**. The results below are reported to two decimal places for comparative purposes.

Table 7-4 Estimated Peak Outflows under Proposed Conditions without Detention

Total Site	Storm event		
Storm Duration	**5 year ARI**	**20 year ARI**	**100 year ARI**
60 min	0.41 m^3/s	0.54 m^3/s	0.67 m^3/s
90 min	**0.44 m^3/s**	**0.58 m^3/s**	**0.71 m^3/s**
120 min	0.41 m^3/s	0.54 m^3/s	0.68 m^3/s

The results above of the proposed development have been modelled without the implementation of OSD and show a significant increase in peak flows from pre-developed conditions.

7.1.3 Proposed Conditions (with On-Site Detention)

A final scenario has been developed to model the proposed development with OSD. The same sub-catchments identified in **Section 7.1.2** were adopted for this assessment. Effective detention volumes provided by the proposed rainwater tanks and bio-retention basins have not been included in this assessment.

To optimise the effectiveness of the OSD tank, considerations needs to be taken to ensure sufficient drainage can be provided while capturing as much stormwater from upstream as possible. As a result, the proposed OSD tank would be designed to capture stormwater runoff generated within the Main Sub-catchment (**Section 4.1**), the largest of the sub catchments.

The estimated peak 5, 20 and 100-year ARI outflows from the site are summarised in **Table 7-5**. The results below are reported to two decimal places for comparative purposes.

Table 7-5 Estimated Peak Outflows under Proposed Conditions with Detention

Total Site	**Storm event**		
Storm Duration	**5 year ARI**	**20 year ARI**	**100 year ARI**
60 min	0.33 m^3/s	0.42 m^3/s	0.52 m^3/s
90 min	**0.36 m^3/s**	**0.46 m^3/s**	**0.56 m^3/s**
120 min	0.32 m^3/s	0.42 m^3/s	0.51 m^3/s

7.2 Results

The results of the hydrologic assessment illustrate that the implementation of OSD within the proposed development is capable of reducing peak flows to pre-development levels. Overall, the peak flows estimated in this preliminary assessment, under proposed conditions, show a considerable decrease from those generated under pre-developed conditions. Further detailed analysis is required at the project plan and construction certificate stages to ensure the final design achieves the objectives.

It is noted that the RAFTS modelling has not taken into account the effective detention volumes of the proposed rainwater tanks. It is believed that an analysis into the detention capacities of the rainwater tanks in the hydrologic model would further assist in reducing peak flows. This would assist in reducing peak flows discharging from the site.

Further details of the proposed stormwater strategy are discussed in **Section 7.3**.

With improvements in peak flows from the proposed development, compared to those generated under pre-developed conditions, there would be little to no impact on existing surrounding stormwater infrastructure and little to no impact on properties downstream.

7.3 Stormwater Drainage Strategy

A Stormwater Management Concept Plan for the proposed masterplan is illustrated in **Appendix 3**.

Stormwater runoff generated from the site will be collected and piped via an underground stormwater drainage network, as illustrated in the Stormwater Concept Plan. The drainage lines will be designed to convey storms up to the 20 year ARI storm events. It is envisaged at this stage that a majority of the stormwater network on site will comprise of PVC pipes in the range of 100 to 225 mm diameter. Detailed hydraulic modelling will be undertaken at future stages of this development to design the drainage work in more detail.

All stormwater events above the 20 year ARI and up to the 100 year ARI will be conveyed safely via overland flow paths and into Council's stormwater infrastructure. The stormwater network will discharge into Council's existing stormwater network along Epping and Lane Cove Road.

The stormwater drainage strategy would begin with rain water collected from the roofs of the development into rainwater tanks. Collected rainwater will be reused for internal and external non-potable water reuse (ie toilet flushing and irrigation). Overflows from the rainwater tanks as well as runoff from the open space of the site will be directed into an OSD tank via the above described stormwater drainage network.

Gross pollutants will be controlled via grated inlet pits, litter baskets and a trash screen inside the ODS tank.

Peak flows would be controlled within the detention tanks before overflows are discharged out into Councils existing stormwater infrastructure network. Peak flows will be controlled via orifice plates and weir outlets within the tanks. Details of the proposed tanks are discussed in more detail in **Section 7.3.1**.

Stormwater from sub-catchments along Epping Road and Lane Cove Road would be treated by bio-retention basins through filtration. Stormwater from the rooves and open space in each of these sub-catchments would be captured and directed into the bio-retentions via the on-site stormwater network. Details of the filtration system are discussed in more detail in **Section 8.5.2**. Sub-soil drainage will be incorporated to discharge treated stormwater into Council's stormwater network.

During storm events, stormwater will be allowed to pond to an extended detention depth of 0.3 m, before flows are collected via a stormwater high flow pit within the basin. The high flow pit will be connected to Councils stormwater network. An overflow weir would be incorporated into the basins with appropriate energy dissipation devices to ensure safe conveyance of stormwater overflow.

The modelling has demonstrated that the proposed Stormwater Management Concept Plan is capable of reducing peak flows and discusses how stormwater and drainage would best be managed on site. Provided that the stormwater treatment facilities have been designed appropriately, WorleyParsons believes the proposed stormwater management strategy complies with standard practice for management urban stormwater and clearly addresses the issues raised by the Director General (Issue 8.1).

7.3.1 On Site Detention

An On-Site Detention (OSD) tank is proposed as part of the stormwater treatment train. The OSD tanks would be sized and designed to control peak flow rates discharged from the proposed development to match those generated under pre-developed conditions.

The size of the OSD tank would be approximately 150 kL. A discharge control outlet pit would be designed to control peak flows and would include an orifice plate and overflow weir outlet. The proposed OSD tank would be located within the infiltration area outside of the level 1 basement car park foot print, and above the level 2 basement car park level.

Access to the OSD tank, for maintenance purposes, would be provided from the surface via access chambers from the top of the OSD tank. Maintenance for the OSD tank would be required every 6 months (twice a year).

The OSD tank will have to be set at an invert level that provides sufficient cover and drainage. The minimum invert level of the OSD tank would be approximately RL 70 m AHD and would have an internal depth of approximately 1.0 m. The OSD tank could employ a proprietary product such as the Humes StormTrap.

A sump pit and trash screen would be included in the design of the OSD tank and discharge outlet to prevent blockage of the tank system.

It is believed that the existing lots do not currently have any form of on-site detention.

8. WATER SENSITIVE URBAN DESIGN

The water sensitive urban design (WSUD) strategy for the Allengrove development has been formulated to negate any impacts on the Lane Cove River. The Lane Cove River passes through the Lane Cove National Park and ultimately discharges into Sydney Harbour. For this reason, a WSUD approach has been adopted to minimise water quality impacts.

The proposed development includes a range of best practice measures to meet the following WSUD objectives:

- Reduction in potable water consumption through the use of water saving devices (ie. dual flush toilets etc);
- Reduction in wastewater production;
- Utilisation of available rainwater;
- Minimisation of impacts on downstream receiving waters;
- Safe conveyance of stormwater; and
- Integration of water management measures with landscape design into the proposed development.

It is proposed to sustainably minimise reliance on mains water through the introduction of rainwater tanks for water reuse.

Further details of the adopted WSUD strategy integrating with the site's stormwater drainage infrastructure is discussed in detail in **Section 7.3**. WorleyParsons believes the adopted WSUD measures address the WSUD considerations in the DGRs (Issue 8.2).

8.1 Water Resources

It is understood that potable water needs within the existing dwellings of the site are currently provided by local Sydney Water Corporation (SWC) water mains.

8.2 Water Quality

8.2.1 Water Quality Treatment Targets

The NSW Department of Environment, Climate Change and Water (*DECCW formally DECC*) recommend reduction targets in annual runoff pollutant loads for developments of:

- 85% for total suspended solids (TSS);
- 60% for total phosphorous (TP); and
- 45% for total nitrogen (TN).

This guiding principle is generally adopted for new developments (greenfield developments) where significant changes to the landuse and impervious areas are proposed. Since the proposed development involves development of an existing residential area, a stormwater treatment train would be developed to ensure no net impact on total pollutant discharge from the site and ensure no adverse affect on local and downstream environments.

The proposed treatment targets are echoed in Council's DCP 2010, where water quality is to be considered in the design of all stormwater systems to ensure no detrimental impact on downstream environments and waterways.

8.2.2 MUSIC Water Quality Model

MUSIC is a continual-run conceptual water quality assessment model developed by the Cooperative Research Centre for Catchment Hydrology (*CRCCH*). MUSIC can be used to estimate the long-term annual average stormwater volume generated by a catchment as well as the expected pollutant loads. MUSIC is able to conceptually simulate the performance of a group of stormwater treatment measures (*treatment train*) to assess whether a proposed water quality strategy is able to meet specified water quality objectives.

To undertake the water quality assessment component of the Stormwater Management Plan, a long-term MUSIC model was established for the proposed development. The model was used to estimate the annual pollutant load generated under existing state and developed conditions over a period of historical average rainfall.

MUSIC was chosen for this investigation because it has the following attributes:

- It can account for the temporal variation in storm rainfall throughout the year;
- Modelling steps can be as low as 6 minutes to allow accurate modelling of treatment devices;
- It can model a range of treatment devices;
- It can be used to estimate pollutant loads at any location within the catchment; and
- It is based on logical and accepted algorithms.

8.2.3 Input Data

RAINFALL

The nearest rainfall station to the site is located at Macquarie Park (Willandra Village – Station Number 66156), just over 2 kilometres north west of the site. Daily rainfall data only was available for the Macquarie Park station and monthly average rainfalls were obtained from the Bureau of Meteorology for all available years. The mean annual rainfall at Macquarie Park was found to be of the order of 1,150 mm (data period 1971 to 2011).

In order to develop a model that could comprehensively assess the performance of water quality treatment, the use of pluviograph rainfall data (captured at six minute intervals) was considered necessary. The nearest station to the site with similar elevation for which pluvial data was available was from the Sydney Observatory Hill.

Six-minute pluviograph data was used for the 5 year period of rainfall data from 5/01/1962 to 31/12/1966 from the Sydney Observatory Hill, as per the Draft NSW MUSIC Modelling Guidelines (2010) by BMT WBM for the Sydney Metropolitan Catchment Management Authority. The average rainfall for this period is 1,279 mm/yr. As such, this is the best available dataset to represent a 5 year period at North Ryde.

EVAPORATION

Monthly areal potential evapotranspiration values were obtained for North Ryde from the Bureau of Meteorology data and are shown in **Table 8-1**.

Table 8-1 – Monthly Areal Potential Evapotranspiration

Month	Areal Potential Evapotranspiration (*mm*)
January	180
February	135
March	128
April	88
May	58
June	43
July	43
August	58
September	88
October	127
November	152
December	163
Total	**1,265**

SOIL PROPERTIES

Calibration of the runoff-rainfall parameters within the MUSIC model was completed in accordance with the Draft NSW MUSIC Modelling Guidelines (2010) to achieve an appropriate runoff co-efficient for the site. The MUSIC default and adopted rainfall run-off parameters along with the resulting run-off

co-efficient are presented in **Table 8-2**. The changed parameters are based on silty clay across the site and achieve a suitable volumetric runoff co-efficient of 0.30 for the site under natural undeveloped conditions. This is in the range of expected values based on available data for gauged catchments.

Table 8-2 – Adopted MUSIC Soil Parameters

	Default Parameters	Adopted Parameters
Impervious Area Properties		
Rainfall Threshold (mm/day)	1	1
Pervious Area Properties		
Soil Storage Capacity (mm)	120	108
Initial Storage (% of capacity)	30	30
Field Capacity (mm)	80	96
Infiltration Capacity Coefficient (a)	200	180
Infiltration Capacity Exponent (b)	1	3
Groundwater Properties		
Initial Depth (mm)	10	10
Daily Recharge Rate (%)	25	25
Daily Baseflow Rate (%)	5	25
Daily Deep Seepage Rate (%)	0	0
Runoff Co-efficient		
100% Pervious	0.25	0.35
65% Impervious	0.67	0.72

The adopted MUSIC soil parameters yielded a volumetric runoff coefficient (C_v) of 0.35 for the pre-developed site. This C_v value is believed to be acceptable considering the grade of the site and the silty clay layer found across the site (refer to geotechnical report).

POLLUTANT CONCENTRATIONS

The stormwater pollutant input parameters that were used in the modelling were derived from the Draft NSW MUSIC Modelling Guidelines (August 2010). The adopted pollutant concentrations are shown **Table 8-3**.

Table 8-3 – Adopted Pollutant Concentrations

Land Use	Pollutant Concentration (mg/L)					
	Storm Flow Concentration (mg/L)			Base Flow Concentration (mg/L)		
	Suspended Solids	Total Phosphorous	Total Nitrogen	Suspended Solids	Total Phosphorous	Total Nitrogen
Urban	180	0.35	2.8	16	0.14	1.3
Roofs	36	0.13	2.2	-	-	1.3
Roads	200	0.250	2.2	-	-	-

8.3 Existing Conditions

The primary objective is to achieve no adverse impact on pollutant discharge as discussed in **Section 8.2.1**. Therefore, MUSIC modelling of the site will be undertaken for comparative purposes.

8.3.1 Model Inputs

The existing catchment is defined in **Figure 4** and delineated into landuse areas shown in **Table 8-4**.

Table 8-4 – Existing Catchment Data

Site Catchment	Land Use	Area (*ha*)	Impervious (%)
Roof area	Roofs	0.278	100
Open space	Urban	0.947	40
Total		**1.235**	**54**

8.3.2 Model Results

The calibrated MUSIC model was used to simulate pollutant export generated during the 15 year rainfall period using the typical pollutant concentrations contained in **Table 8-3**.

For the purposes of comparing the proposed case with the existing case, the estimated annual exports of pollutants generated by the site are shown in **Table 8-5**.

Table 8-5 – Total Annual Pollutant Export Loads from Site – Existing State

Scenario	Pollutant Load (*kg/yr*)			
	Suspended Solids	Total Phosphorous	Total Nitrogen	Gross Pollutants
Existing Site	1,330	2.81	26.3	246

Results from the MUSIC modelling show average volumetric flows from the existing site to be 10.2 ML/year, yielding a volumetric runoff coefficient (C_v) of 0.72. The high C_v value is a result of the high percentage of impervious area within the site.

8.4 Proposed (No Treatment)

8.4.1 Model Inputs

The existing state model was modified to reflect the proposed conditions. No treatment facilities were implemented in the proposed (*no treatment*) model. The model was modified to reflect the impervious proportions of the catchment as defined in **Table 8-6** and illustrated in **Figure 4**.

Table 8-6 – Proposed Catchment Data

Sub Catchment	Land use	Area (ha)	Impervious (%)
Car park/Roads	Roads	0.053	100
Open Space	Urban	0.847	54
Roof Area	Roof	0.335	100
Total		**1.235**	**68**

8.4.2 Model Results

The estimated annual export of pollutants from the proposed (*no treatment*) site are compared with existing conditions in **Table 8-7**.

Table 8-7 – Annual Pollutant Export Loads – Proposed (No Treatment)

Scenario	Pollutant Load (*kg/yr*)			
	Suspended Solids	Total Phosphorous	Total Nitrogen	Gross Pollutants
Existing	1,330	2.81	26.3	246
Proposed (no treatment)	1,580	3.32	31.2	293

By comparing the pollutants discharged from the proposed site without treatment measures, it is clear that the proposed development is generating an elevated volume of pollutants. This increase is a result of an increase in impervious area across the development (no treatment) and the redistribution of roof, roads/car parking and open space areas and corresponding concentrations associated with these land use areas.

Results from the MUSIC modelling show average volumetric runoff under proposed conditions (no treatment) to be 12.1 ML/year, yielding a C_v of 0.86.

8.5 Proposed (With Treatment)

8.5.1 Model Inputs

The MUSIC model of the proposed site (with treatment) takes into consideration of the use of the proposed rainwater tank and bio-retention basins on site. Details of the proposed stormwater treatment train facilities are discussed further in **Section 8.5.2**.

8.5.2 Stormwater Management Facilities

The concept stormwater treatment strategy for the proposed development would incorporate the use of rainwater tanks, litter baskets, an OSD tank, and bio-retention basins/swales. An illustration of the Stormwater Management Concept Plan can be found in **Appendix 3**.

A stormwater pit and pipe network would be designed for the site such that flows up to the 20 year ARI storm event are conveyed underground in the pits and pipes. Overland flows above the 20 and up to the 100 year ARI would be conveyed safely via overland flow paths. The stormwater network in the site would discharge into Council's existing stormwater infrastructure located along Epping and Lane Cove Road.

Details for each of the treatment facilities are discussed below and should be read with the stormwater management strategy discussed in **Section 7.3**.

RAINWATER TANKS

Rainwater tanks are proposed as part of the concept stormwater treatment train. A total volume of approximately 150kL would be incorporated into the stormwater treatment train and would assist in reducing runoff volume, maximising non-potable supply/reuse and minimising peak flows for frequent storm events.

The following assumptions for the rainwater tank reuse and demands are as follows:

- Equivalent population for one, two and three bedroom apartments of 1.25, 1.74 and 2.5, respectively (based on Australian Bureau of Statistics, ABS – 1301.0 Year book Australia 2007);

- Use of water saving devices, including dual flush toilets and water saving taps etc;
- Daily water consumption for toilets of 27 L/pp/day;
- Daily water consumption for car washing of 0.2 L/pp/day; and
- Daily water consumption for irrigation of 8.3 L/pp/day.

Possible locations for the rainwater tanks include across the roof of each of the buildings, or within the proposed underground basement car park. Overflows from the rainwater tanks would be directed into site drainage network.

LITTER BASKETS

Litter baskets are proposed to be included in the stormwater pits located across the emergency/maintenance access towards to the south east border of the site. This is based on the assumption that concrete lintels to pits and formal kerb and gutter would be included along the emergency/maintenance access road.

The purpose of litter baskets is to target and remove gross pollutants and coarse sediment from stormwater runoff from the site and to prevent gross pollutants and coarse sediment from discharging into Council's stormwater network.

The remaining drainage pits across the site would have grated lids, which would assist in screening large gross pollutants.

BIO-RETENTION BASINS/SWALE

Two bio-retention basins are proposed as part of the stormwater treatment train. Bio-retention Basins 1 and 2 have been proposed for sub-catchments along Epping Road and Lane Cove Road respectively. The main purpose of the bio-retention basins is to remove pollutants from stormwater runoff.

Stormwater would be treated through sub-surface filtration via a filter medium of sandy loam and planted macrophytes. The filter medium would be 1 metre deep and cover a surface area of approximately 50 m^2 for Bio-Retention Basin 1 and Bio-Retention Basin 2. Both of the bio-retention basins would be unlined, allowing for exfiltration, extended detention depth of 300 mm and have sub soil drainage collection lines for discharging treated water into Council's stormwater infrastructure.

The bio-retention basins will have minimum invert levels of RL 68.3 m AHD and 69.8 m AHD for Bio-Retention Basin 1 and Bio-Retention Basin 2, respectively, from the sub soil drainage line. This is required so that adequate drainage into Council's existing stormwater infrastructure is achievable.

A bio-retention swale is also proposed towards the south of the site. The swale is proposed to capture runoff generated from the turning bay for the servicing lane. The swale would cover a length of approximately 10 m, with a filter area 1 metre wide and deep. The swale would be unlined, allowing for exfiltration and have an extended detention depth up to 300 mm.

8.5.3 Model Results

The estimated annual exports of pollutants from the proposed (with treatment) site are compared with the existing and proposed (no treatment) conditions in **Table 8-8**.

Table 8-8 – Annual Pollutant Export Loads – Proposed (With Treatment)

Scenario	Pollutant Load (*kg/yr*)			
	Suspended Solids	Total Phosphorous	Total Nitrogen	Gross Pollutants
Existing Site	1,330	2.81	26.3	246
Proposed (no treatment)	1,580	3.32	31.2	293
Proposed (with treatment)	1,090	2.35	21.9	141

By comparing the volumes of pollutants discharged from the proposed site with treatment measures, it is clear that the proposed development, with treatment, can effectively reduce the volume of pollutants discharged from the site to match if not improve on those generated under existing conditions.

Results from the MUSIC modelling show average volumetric runoff from the re-developed site (with treatment) of 9.5 ML/year, yielding a C_v of 0.67. The modelling demonstrates that the propose stormwater treatment train and drainage strategy can decreased average volumetric flow from the site.

The total volumes of pollutants discharged from the site under developed conditions (with treatment) are significantly lower than those generated under existing conditions. The MUSIC model suggests that the proposed development would improve water quality runoff and hence meets the water quality treatment targets discussed in **Section 8.2.1**.

With improvements in water quality from the proposed development, compared to those generated under existing conditions, there would be no impact on downstream properties or environments. Provided that the proposed stormwater treatment facilities are designed appropriately, WorleyParsons believes the proposed stormwater treatment train complies with standard practice for managing urban stormwater.

9. GROUNDWATER

9.1 Local Groundwater Conditions

As discussed earlier, A geotechnical assessment for the site was conducted by Jeffery and Katauskas (J&K) in April 2008 with field work undertaken on the 13th of February 2008. The assessment found the site to be:

- "*topsoil (or fill) comprising silty clay of high plasticity was encountered in all boreholes to depths between 0.2 m and 0.4 m.*";
- "*Residual silty clay was encountered below the topsoil/fill in all boreholes and extend to the borehole termination depths between 1.25 m and 1.5 m. Residual silty clay was generally of high plasticity and very stiff and hard strength.*";
- "*the residual silty clay extends to a maximum depth of about 2 m. Blowcounts of greater than 10 per 100 mm penetration are interpreted to indicate extremely weathered shale or clay with numerous shale and ironstone bands.*"; and
- "*Groundwater seepage was encountered at a depth of 1.35 m and 0.4 m whilst drilling BH1 and BH2 respectively. All boreholes were 'dry' on completion of drilling… Long term groundwater monitoring was not carried out.*"

Currently, the site is approximately 54% impervious, covered by roof and sealed car park areas, which limits the amount of infiltration into the groundwater system. Under proposed conditions however, the impervious areas will increase from 54% to 68%, which would marginally decrease the amount of infiltration into the local groundwater system. This marginal decrease is not a significant change to the existing situation. Furthermore, the bio-retention systems offer the opportunity to infiltrate water into the subsoil.

As a result, it is assessed that the proposed redevelopment would have no adverse affect on groundwater.

9.2 Local Groundwater Interception

Groundwater could potentially be intercepted by the proposed basement car park. The extent of the impact is dependent on the design of the basement car park.

Should there be any intercepted groundwater in the proposed car park, captured groundwater would be drained or pumped back into the Council stormwater network.

It is worth noting that due to the localised proximity and minor size of the development, in respect to the size of the Macquarie Park catchment, any impacts on regional groundwater water as a direct result of the proposed development would be minimal.

10. SERVICES AND SURROUNDING INFRASTRUCTURE

In additional to Council's stormwater drainage network, other major service trunk lines have been identified along Epping and Lane Cove Road. These include services from Sydney Water Corporation (SWC), Energy Australia, AGL and Telstra.

10.1 Water and Sewer

A 100 mm SWC water main surrounds the site along Lane Cove, Epping Road and Allengrove Crescent. To sufficiently supply potable water to the proposed development would require a 250 mm pipe connection to SWC water mains. Larger 250 mm and 150 mm water mains are found nearby on the opposite sides of Lane Cove and Epping Road.

An existing sewer network currently services all of the existing lots within the site as well as conveying sewage from upstream catchments, particularly from the south and the east. The sewer network drains to a 225 mm pipe that crosses Lane Cove Road and continues west towards a 500 mm concrete sewer main alongside Shrimpton Creek. The existing sewer network is serviced by the North Head Sewage Treatment Plant. The existing sewer network will need to be augmented and relocated to cater for the proposed development.

10.2 Power

Energy Australia is currently servicing the existing lots on the site. A major High Voltage (HV) power trunk line currently runs along underground along Lane Cove Road, while a minor distribution line is found running along Epping Road. It is also noted that overhead power lines were identified visually in Epping, Lane Cove Road and Allengrove Crescent.

Additional loads due to the higher density of the proposed development may require an upgrade or construction of a new substation. Discussions with Energy Australia have identified that power is likely to be available for the proposed development, however may come at a cost to the developer if augmentation is required before Energy Australia's scheduled upgrades.

An investigation at future stages of the development would be required to assess what upgrades, if any, are required.

10.3 Gas

AGL currently provides gas to the existing lots on the site. A 450 mm high pressure gas main has been identified along Epping Road, while a 32 mm gas main has been identified along Allengrove Crescent.

10.4 Telecommunications

Telstra currently services the existing lots on the site. Major telecommunication trunks lines have been identified along Epping and Lane Cove Road and Allengrove Crescent. Additional service suppliers and asset owners such as Optus, Powertel, Pipe Networks and CSIRO have also been identified and are found sharing Telstra's trunk lines.

11. CONSTRUCTION PHASE EROSION AND SEDIMENT CONTROL

In accordance with the best practice state government guideline "Managing Urban Stormwater – Soils and Construction" (*Landcom, 2004*), Erosion and Sediment Control Plans are required for sites of area less than 2,500 m^2 while Soil and Water Management Plans (SWMPs) are required for sites greater than 2,500m^2. The proposed development covers a total area of over 12,000 m^2, therefore a Soil and Water Management Plan would be required.

A detailed SWMP would be completed to accompany further applications for construction and other works.

The soil and water management plan would provide a control strategy for each sub catchment to ensure appropriate runoff quality. These controls would consist of filter fences, run off diversion mounds, a sediment basin and stabilised site access.

12. CONCLUSION

This report has been produced for EGC Custodian Services Pty Ltd in support of the redevelopment of their site located on the corner of Lane Cove Road and Epping Road, North Ryde.

This report has addressed the drainage, stormwater and flooding concerns raised by the Department of Planning in Section 8 of the Director General's Requirements (DGR) (Refer to **Appendix 2**). The DGR's have been addressed by adopting standard practices for management of stormwater quantity, quality and flooding. The City of Ryde Development Control Plans (DCP-2010) were also consulted.

The site is also located some distance and elevation away from any major water ways. There are no defined overland flow paths across or through the site and is not affected by flooding. Adequate drainage and appropriately designed overland flow paths would be constructed across the development to ensure stormwater flows are conveyed safely from the site into Council's existing stormwater infrastructure network.

Stormwater runoff generated across the site would be controlled and reduced with the implementation of on-site detention (OSD). An OSD tank, with a designed discharge control outlet, would be used to control peak flows such that flows generated across the proposed development do not exceed peak flows generated under pre-developed conditions. The discharge controls would be designed to cater for all storm events up to the 100 year average recurrence interval (ARI) storm event. This would result in little to no impact to receiving water bodies or Council's existing stormwater infrastructure.

Water quality is to be managed on site with the implementation of Water Sensitive Urban Design (WSUD) best practice principles. Adopting these principles, a stormwater treatment train has been developed, which incorporates the use of rainwater tanks, litter baskets, an OSD tank and bio-retention basins. Modelling of the treatment effectiveness of the proposed treatment train demonstrates that the proposed treatment train is effective at reducing pollutant discharge off the site and has no adverse affect on total annual pollutant discharge from existing conditions.

The flooding and stormwater management assessments undertaken as part of this concept plan submission to the DoP clearly demonstrate that the proposed development and stormwater management strategies sufficiently mitigate any stormwater/drainage and flooding impacts to downstream properties and receiving environments.

Infrastructure and services from Sydney Water Corporation (SWC), Energy Australia, AGL and Telstra have been identified within the area, and currently service the site. Additional loads due to the higher density of the proposed development may require augmentation and adjustments to local water and sewer mains, power lines, as well as gas and telecommunications, to appropriately service the development. A detailed investigation would need to be undertaken at the next stage of the development to appropriate assess what upgrades, if any, are required.

13. REFERENCES

- Australian Bureau of Statistics, 2007, ABS – 1301.0 Year book Australia 2007;
- Bureau of Meteorology, 1937-1952, Daily Rainfall Data from the Sydney Observatory Hill Rainfall Station;
- City of Ryde Council, 2010, City of Ryde Development Control Plan;
- Bewsher, February 2011, Macquarie Park Floodplain Risk Management Study & Plan;
- BMT WBM, August 2010, Draft NSW MUSIC Modelling Guidelines;
- Jeffery and Katauskas Pty Ltd, April 2008, Report to EGC Custodian Services Pty Ltd on Geotechnical Investigation for Proposed Residential Development at the Allengrove Crescent site, Corner Lane Cove Road and Epping Road, North Ryde, NSW;
- Jeffery and Katauskas Pty Ltd, April 2008, Report to EG Funds Management on Stage 1 Environmental Site Assessment for Proposed Residential Development at Lane Cove Road and Epping Road, North Ryde;
- Landcom, March 2004, Managing Urban Stormwater: Soils and Construction; and
- Watson Buchan Pty Ltd, 2008, Plan Showing levels and details over No. 1-9 Allengrove Crescent, 253-263 Lane Cove Road, 116A-122A Epping Road, North Ryde.

APPENDIX 1 – PLAN OF PROPOSED DEVELOPMENT

EPPING ROAD

LANE COVE ROAD

ALLENGROVE CRESCENT

PART LOT 1
DP 28702
565.2m²

PART LOT 2
DP 28702
1107.0m²
No. 253
BRICK COTTAGE

LOT 8
No. 11
BRICK
COTTAGE

PUBLIC RESERVE

SERVICE LANE

SERVICE TURNING BA

LEGEND

SITE BOUNDARY

NOTE: FOR ADDITIONAL DETAIL, PLEASE REFER TO DRAWINGS PROVIDED BY CANDALEPAS

8 0 8 16 24 32 40m
1:400 (A1) 1:800 (A3)

WorleyParsons
resources & energy

OneWay
to zero harm

ISSUE	DATE	ISSUE DESCRIPTION
A	02-05-11	FINAL ISSUE

NORTH

ALLENGROVE CRESENT, NORTH RYDE
PROPOSED MASTERPLAN

APPENDIX 1

PLOT DATE & TIME: 4/5/2011 5:52:39 PM
SAVE DATE & TIME: 3/5/2011 2:45:08 PM
USER NAME: james.hoang
CTB FILE: __00-WP-Syd-std.ctb
LOCATION: W:_INFRASTRUCTURE\PROJECTS\300105\02272 - ALLENGROVE CRES, NTH RYDE\10 DRAWINGS\SKETCHES\APPENDIX 1 - CONCEPT MASTERPLAN.DWG
Plotter:\\ausydwppr01v\L10SYDRICOH3500RPCS

APPENDIX 2 – DIRECTOR GENERALS REQUIREMENTS

NSW GOVERNMENT Planning

Director-General's Requirements
Section 75F of the *Environmental Planning and Assessment Act 1979*

Application number	MP 10_0037
Project	Concept Plan Application for residential development proposal.
Location	1-9 Allengrove Crescent, 116a – 122b Epping Road, and 259 – 263 Lane Cove Road, North Ryde.
Proponent	Urbis on behalf of EG Funds Management.
Date issued	11 JUNE 2010
Expiry date	If the Environmental Assessment (EA) is not exhibited within 2 years after the date of issue, the applicant must consult further with the Director-General in relation to the preparation of the environmental assessment.

Key issues	The Environmental Assessment (EA) must address the following key issues:
	
	1. Relevant EPI's policies and Guidelines to be Addressed
	• Planning provisions applying to the site, including permissibility and the provisions of all plans and policies are contained in **Appendix A**.
	
	2. Built Form Urban Design/Public Domain
	• The EA shall address the height, bulk and scale of the proposed development within the context of the locality. In particular, detailed envelope / height and contextual studies should be undertaken to ensure the proposal integrates with the local environment. The EA shall also provide the following documents:
	  • Comparable height study to demonstrate how the proposed height relates to the height of the existing/approved developments surrounding the subject site and in the locality;
	  • Visual and view analysis to and from the site from key vantage points; and,
	  • Options for the siting and layout of the building envelopes, massing and articulation, with particular consideration given to the impact upon residential amenity arising from different options.
	• The EA shall address the design quality with specific consideration of the massing, setbacks, building articulation, landscape setting, and public domain, including an assessment against the CPTED Principles.
	• The EA shall consider the interface of the proposed development and public domain and public domain improvements needed to provide a high level of residential and pedestrian amenity.
	
	3. Isolated Sites
	• The proposal should seek to amalgamate with the adjacent properties known as 253-257 Lane Cove Road so that there is a more appropriate and reasonable relationship with future developments in the locality. The EA shall include details outlining negotiations with the owners of the affected properties. In the event that amalgamation is not possible, the EA shall address development potential of the isolated sites if they cannot be included within this proposal.
	
	4. Staging
	• The EA shall include details regarding the staging of the proposed development including the provision and timing of all required infrastructure works, including a schedule of works and infrastructure to be available for each stage.
	
	5. Transport and Accessibility (Construction and Operational)
	• The EA shall address the following matters:

- Demonstrate the provision of minimal levels of on-site car parking for the proposal having regard to local planning controls, RTA guidelines, and the high public transport accessibility of the site, and include opportunities for car sharing.
- Provide an estimate of the trips generated by the proposed development and identify measures to manage travel demand, increase the use of public and non-car transport modes, and assist in achieving the objectives and targets set out in the NSW State Plan 2010;
- Provide a Traffic and Accessibility Impact Study prepared with reference to the RTA's Guide to Traffic Generating Developments and Australian Standards, considering traffic generation including trip generation (daily and peak traffic movements), any required road/intersection upgrades, service vehicle generation and movements, access, loading dock(s), car parking arrangements, and measures to promote public transport usage and pedestrian and bicycle linkages; particularly between the site and Macquarie Park train station and the nearest bus stops and the potential for implementing a location specific sustainable travel plan; and
- Provide an assessment of the implications of the proposed development for non-car travel modes (including public transport, walking and cycling), including an assessment of existing and proposed pedestrian and cycle movements within the vicinity of the subject site;
- Details of the potential impacts on the local road network and in particular, the intersections identified in the RTA response (25 May 2010). Consideration should also be given to the *Macquarie Park 2007 Base Paramics Model,* where appropriate; and
- Consideration of future pedestrian/vehicular/cycle connectivity with adjoining sites and to and from the Macquarie Railway Station.

6. Environmental and Residential Amenity

- The EA must address solar access, acoustic privacy, visual privacy and view loss and demonstrate that the Concept Plan development will achieve a high level of environmental and residential amenity.
- The EA shall address the siting of the development in relation to any existing significant landscaping on site and provide a site tree survey and detailed aborist report.
- The EA should address the issue of noise impacts and provide details of how these will be managed and ameliorated though the design of the building, in compliance with relevant Australian Standards and the Department's *Interim Guidelines for Development near Rail Corridors and Busy Roads.*

7. Ecologically Sustainable Development (ESD)

- The EA shall detail how the development will incorporate ESD principles in the design, construction and ongoing operation phases of the development.
- The EA should include a commitment to a likely minimum standard of ESD to be attained and provide detail of how those standards can be met.

8. Drainage, Stormwater Management and Flooding Potential

- The EA shall include a Stormwater/Drainage/Flood Study addressing drainage/groundwater/flooding issues associated with the development and the site, including consideration of any required infrastructure upgrades and stormwater/flooding management strategies/mitigation measures for development of the site and adjacent lands.
- The EA shall address the requirements for additional drainage infrastructure and the incorporation of Water Sensitive Urban Design measures.

9. Contributions

- The EA shall address the provision of public benefit, services and infrastructure having regard to Council's Section 94 Contribution Plan, and provide details of any Planning Agreement or other legally binding instrument proposed to facilitate

	this development. **10. Statement of Commitments** • The EA must include a draft Statement of Commitments detailing measures for environmental management, mitigation measures and monitoring for the project. **11. Consultation** • Undertake an appropriate and justified level of consultation in accordance with the Department's *Major Project Community Consultation Guidelines October 2007*.
Deemed refusal period	60 days

APPENDIX A

Relevant EPI's policies and Guidelines to be Addressed

- Objects of the EP&A Act 1979;
- NSW State Plan 2010;
- Draft Inner North Subregional Strategy;
- Metropolitan Transport Plan 2010, Integrating Land Use and Transport – A Planning Policy Package 2001 and Planning Guidelines for Walking and Cycling 2004 and Ryde City Council's Macquarie Park Traffic Study – Final Report;
- Ryde Planning Scheme Ordinance 1979, Ryde LEP 137 – Macquarie Park, Draft Ryde LEP 2010, relevant Development Control Plans, Ryde Bicycle Strategy and Master Plan 2007, Macquarie Park Pedestrian Movement Study 2009 and Macquarie Park Public Domain Technical Manual;
- SEPP 55 - Remediation of Land;
- SEPP 65 - Design Quality of Residential Flat Development and the Residential Flat Design Code (RFDC);
- SEPP (Infrastructure) 2007; and,
- Nature and extent of any non-compliance with relevant environmental planning instruments, plans and guidelines and justification for any non-compliance, including a consideration of the accessibility and traffic/transport principles detailed in the Ryde DCP 2006 and draft LEP 2009, including the "Ryde Bicycle Strategy and Master Plan 2007.

APPENDIX B

Plans and Documents to accompany the Application

General	The Environmental Assessment (EA) must include: 1. An executive summary; 2. A thorough site analysis including site plans, aerial photographs and a description of the existing and surrounding environment; 3. A thorough description of the proposed development; 4. An assessment of the key issues specified above and a table outlining how these key issues have been addressed; 5. An assessment of the potential impacts of the project and a draft Statement of Commitments, outlining environmental management, mitigation and monitoring measures to be implemented to minimise any potential impacts of the project; 6. The plans and documents outlined below; 7. A signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading; 8. A Quantity Surveyor's Certificate of Cost to verify the capital investment value of the project (in accordance with the definition contained in the Major Projects SEPP); and 9. A conclusion justifying the project, taking into consideration the environmental impacts of the proposal, the suitability of the site, and whether or not the project is in the public interest.
Plans and Documents	The following plans, architectural drawings, diagrams and relevant documentation shall be submitted; 1. **An existing site survey plan** drawn at an appropriate scale illustrating; • the location of the land, boundary measurements, area (sq.m) and north point; • the existing levels of the land in relation to buildings and roads; • location and height of existing structures on the site; and • location and height of adjacent buildings and private open space. • all levels to be to Australian Height Datum. 2. **A Site Analysis Plan** must be provided which identifies existing natural elements of the site (including all hazards and constraints), existing vegetation, footpath crossing levels and alignments, existing pedestrian and vehicular access points and other facilities, slope and topography, utility services, boundaries, orientation, view corridors and all structures on neighbouring properties where relevant to the application (including windows, driveways, private open space etc). Adjoining land uses and activities, sources of nuisances and heritage features of the surrounding locality and landscape shall also be shown. 3. **A locality/context plan** drawn at an appropriate scale should be submitted indicating: • significant local features such as parks, community facilities and open space and heritage items; • the location and uses of existing buildings, shopping and employment areas; • traffic and road patterns, pedestrian routes and public transport nodes. 4. **Architectural drawings** at an appropriate scale illustrating: • the location of any existing building envelopes or structures on the land in relation to the boundaries of the land and any development on adjoining land;

	• concept floor plans, sections and elevations of the proposed buildings; • elevation plans; • the height (AHD) of the proposed development in relation to the land; • the level of the lowest floor, the level of any unbuilt area and the level of the ground; and • any changes that will be made to the level of the land by excavation, filling or otherwise. 5. **Visual and View Analysis** - Visual aids such as a photomontage and digital perspectives must be used to demonstrate visual impacts of the proposed building envelopes in particular having regard to the siting, bulk and scale relationships from key areas. 6. **Aborist Report** which makes an assessment of the impact of the proposed development on all of the trees on site and tree protection measures during construction. 7. **Landscape Concept Plan** - illustrating treatment of open space areas on the site, screen planting along common boundaries and tree protection measures both on and off the site. *8.* **Acoustic Assessment** that identifies noise impacts and provides details of how these will be managed and ameliorated. 9. **Shadow diagrams** and **solar access schedule** showing solar access to the site and adjacent properties at summer solstice (Dec 21), winter solstice (June 21) and the equinox (March 21 and September 21) at 9.00 am, 12.00 midday and 3.00 pm. 10. **Stormwater / Drainage/ Flooding Assessment and Management Plan** - illustrating the concept for stormwater/drainage/flooding management. 11. **Groundwater Assessment** – identifying groundwater issues and potential degradation to the groundwater source that may be encountered during excavation. The assessment should identify contingency measures to manage any potential impacts. 12. **Preliminary Site Contamination Assessment** and documentation that demonstrates that the land can be made suitable for the intended purpose within the project delivery timeframe. 13. **Geotechnical Report** prepared by a recognised professional who assesses the risk of Geotechnical failure on the site and identifies design solutions and works to be carried out to ensure the stability of the land and structures and safety of persons.
Documents to be submitted	• 1 copy of the EA, plans and documentation for the **Test of Adequacy** (TOA); Once the EA has been determined adequate and all outstanding issues adequately addressed, 7 copies of the EA for exhibition; • 7 sets of architectural and landscape plans to scale, including one (1) set at A3 size (to scale); and 7 copies of the Environmental Assessment and plans on CD-ROM (PDF format), each file not exceeding 5Mb in size. **NOTE:** **All files must be titled and saved in such a way that it is clearly recognisable without the file being opened. If multiple PDF's make up one document/report each must be titled in sequential order.**

APPENDIX 3 - STORMWATER MANAGEMENT CONCEPT PLAN

WorleyParsons
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ISSUE	DATE	ISSUE DESCRIPTION
A	02-05-11	FINAL ISSUE

NORTH

ALLENGROVE CRESENT, NORTH RYDE
STORMWATER MANAGEMENT CONCEPT PLAN

APPENDIX 3

LOCATION: W:_INFRASTRUCTURE\PROJECTS\301015\02272 - ALLENGROVE CRES, NTH RYDE\10 DRAWINGS\SKETCHES\APPENDIX 3 - STORMWATER MANAGEMENT CONCEPT PLAN.DWG
USER NAME: James.hoang CTB FILE: __00-WP-Syd-std.ctb Plotter:\\ausydwppr101v\LT05YDRICOH3500RPCS
PLOT DATE & TIME: 4/5/2011 5:53:29 PM
SAVE DATE & TIME: 3/5/2011 5:29:14 PM