# Report

Vianello Holdings Pty. Ltd.

# Glenmore Park Precincts G & H

## Stormwater Management Strategy Report

May 2019

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# 1. GLOSSARY

| Term | Definition |
|---|---|
| **Airborne Laser Survey (ALS)** | Is a technique for obtaining a definition of the surface elevation (ground, buildings, power lines, trees, etc.) by pulsing a laser beam at the ground from an airborne vehicle (generally a plane) and measuring the time taken for the laser beam to return to a scanning device fixed to the plane. The time taken is a measure of the distance which, when ground truthed, is generally accurate to ± 150mm. |
| **Annual Exceedance Probability (AEP)** | Is the chance or probability of a natural hazard event (usually a rainfall or flooding event) occurring annually and is usually expressed as a percentage. |
| **Australian Rainfall and Runoff (AR&R)** | Refers to the current edition of Australian Rainfall and Runoff published by the Institution of Engineers, Australia. |
| **Dam Safety Committee (DSC)** | Is a NSW statutory body aligned with Department of Primary Industries. Its function is to ensure the safety of dams within NSW. |
| **Digital Terrain Model (DTM)** | Is a spatially referenced three-dimensional (3D) representation of the ground surface represented as discrete point elevations where each cell in the grid represents an elevation above an established datum. |
| **Exceedances per Year (EY)** | Is the number of times a year that statistically a storm flow will be exceeded. |
| **Floodplain Planning Level (FPL)** | The FPL is a height used to set floor levels for property development in flood prone areas. It is generally defined as the 1% AEP flood level plus 0.5m freeboard. |
| **Floodplain Development Manual (FDM) and Guidelines (April 2005)** | The FDM is a document issued by the Department of Environment Climate Change and Water (DECCW) that provides a strategic approach to floodplain management. The guidelines have been issued by the NSW Department of Planning (DoP) to clarify issues regarding the setting of FPL's.<br><br>This document is also the framework for the development of Floodplain Risk Management Studies and Plans. |
| **Floodplain Storage Areas** | Parts of a floodplain that are important for the temporary storage of floodwaters during the passage of a flood. Loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. |
| **Floodway** | Is the areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels. |
| **Hyetograph** | Is the distribution of rainfall over time. |
| **Hydrograph** | Is a graph that shows how the stormwater discharge changes with time at any particular location. |
| **Hydrology** | The term given to the study of the rainfall and runoff process as it relates to the derivation of hydrographs for given floods. |

| Term | Definition |
|---|---|
| **J. Wyndham Prince Pty Ltd (JWP)** | Consulting Civil Infrastructure Engineers and Project Managers undertaking these investigations. |
| **Peak Discharge** | Is the maximum stormwater runoff that occurs during a flood event. |
| **Probable Maximum Flood (PMF)** | Is the greatest depth of precipitation for a given duration meteorologically possible for a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends. |
| **Triangular Irregular Network (TIN)** | Is a technique used in the created DTM by developing a mass of interconnected triangles. For each triangle, the ground level is defined at each of the three vertices, thereby defining a plane surface over the area of the triangle. |
| **TUFLOW** | Is a computer program that provides two-dimensional (2D) and one dimensional (1D) solutions of the free surface flow equations to simulate flood and tidal wave propagation. It is specifically beneficial where the hydrodynamic behaviour, estuaries, rivers, floodplains and urban drainage environments have complex 2D flow patterns that would be awkward to represent using traditional 1D network models. |
| **XP-RAFTS** | Is a runoff routing model that uses the Laurenson non-linear runoff routing procedure to develop a sub catchment stormwater runoff hydrograph from either an actual event (recorded rainfall time series) or a design storm utilising Intensity-Frequency-Duration data together with dimensionless storm temporal patterns as well as standard AR&R 1987 data. |

# 2. EXECUTIVE SUMMARY

J Wyndham Prince (JWP) has been engaged by CCL Development on behalf of Vianello Holdings to prepare an amended Stormwater management Strategy report for Precinct G & H in order to address Penrith City Council's (PCC) Conditions of Consent for DA18/0427 (See Appendix D), primarily Condition 11 which states:

> *"Prior to the issue of a Construction Certificate, the Overarching Precinct G & H Stormwater Management Strategy Report prepared by J. Wyndham Prince dated December 2015 shall be amended and re-submitted to Council for approval".*

The primary objective of this report is to prepare an updated Stormwater Management Strategy to support both current Stages 4 and 6 application and future stages 7, 8 and 9 Development Applications (DA). The stormwater strategy developed builds upon the Precinct Wide Strategy previously approved by Penrith City Council (PCC) for the Precinct G & H (JWP, 2016).

This report presents a summary of the results of previous studies and nominates the specific locations and sizes of the water management elements required to meet the performance objectives specified in the Glenmore Park Stage 2 Release Area Development Control Plan (DCP) and PCC guidelines.

The investigation involved the following specific tasks:

- Prepare an *XP-RAFTS* hydrologic model for Precincts G and H under "existing" and "developed" conditions to reflect the latest development layout and sub-catchment boundaries.
- Determine the storage requirements to manage the 1 Exceedances per Year (EY) peak flows to pre-development levels.
- Undertake water quality modelling in *MUSIC* to confirm the size and location of devices required to achieve water quality targets.
- Prepare a Stormwater Management Strategy Report to support the development application for the development, detailing the investigations, findings, calculations and design details.

Plate 2.1 below illustrates the location of Precinct G & H with the Mulgoa stage 2 development precinct.

The updated strategy and the supporting modelling in this report has concluded the water management elements for the preferred management approach are:

- Maintain the constructed (stage 1-2) and future (stage 4 & 6) water quality and quantity basins with the environmental corridor.
- The existing Precinct E raingarden and detention basin located in Surveyors Creek corridor be amended to include an extended detention depth over the raingarden of 0.4 m and the outlet control and basin spillway level be increased by 40 mm in order to achieve the required flow management outcomes.

This strategy provides an alternative management option for the Precinct E Stormwater management device however, this strategy update provides the necessary support for the development of Precinct G & H and address PCC's condition of consent.

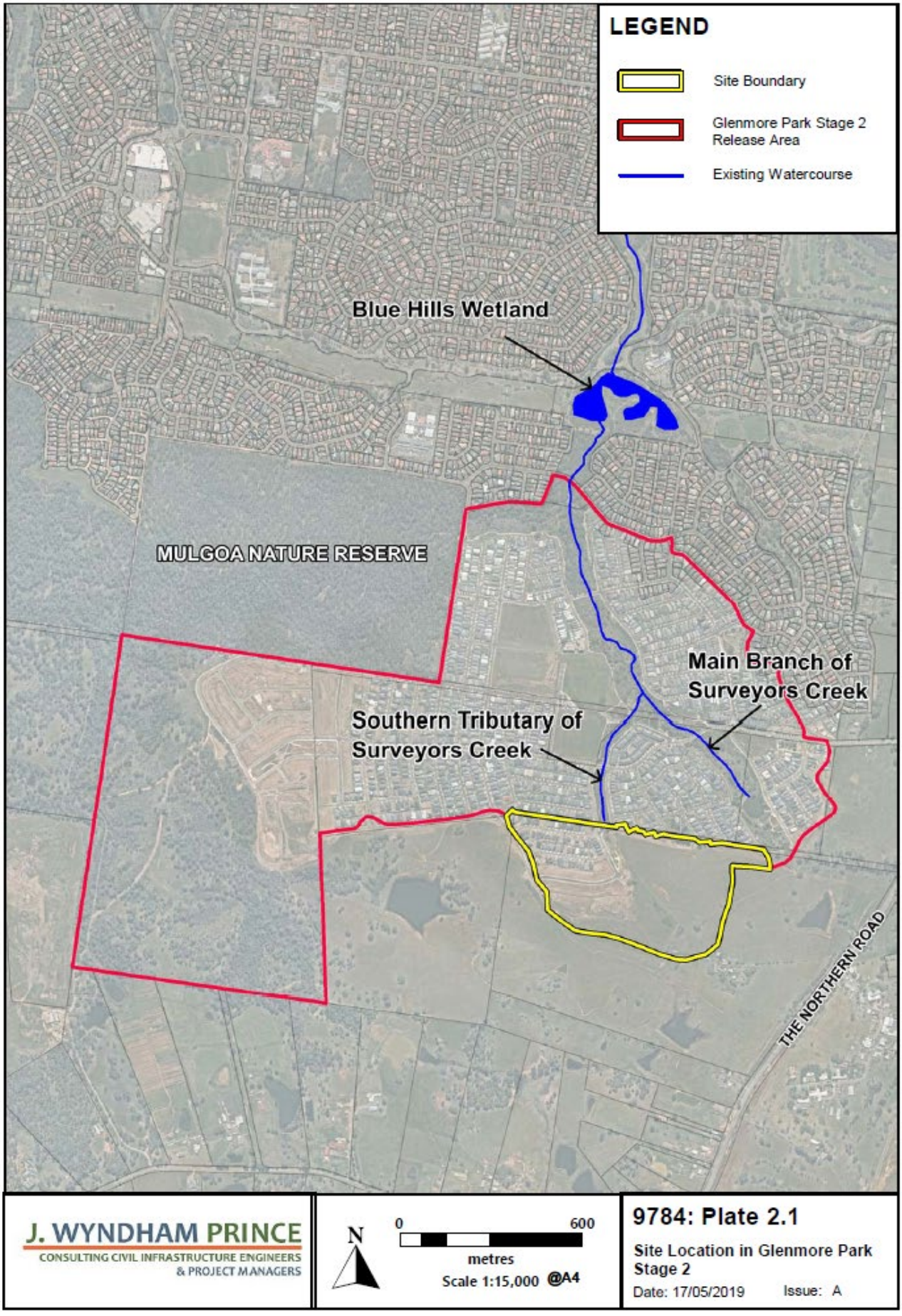


*Plate 2-1 – Site Locality*

# 3. EXISTING SITE CONDITIONS

The subject site is approximately 26 hectares in area and is located within the south-eastern portion of the Glenmore Park Stage 2 Release Area. The site is located in the upper portion of the catchment of the Southern Tributary of Surveyors Creek and borders the Bradley Ridge Precinct D & E development (to the north). A portion of the site, located to the east, drains towards the Main Branch of Surveyors Creek. Refer to Plate 3.1 below.

In order to achieve optimal stormwater management in this catchment, we have reassessed the existing conditions (pre-development) model completed as part of the Glenmore Park Stage 2 rezoning process to determine the appropriate targets for this assessment.

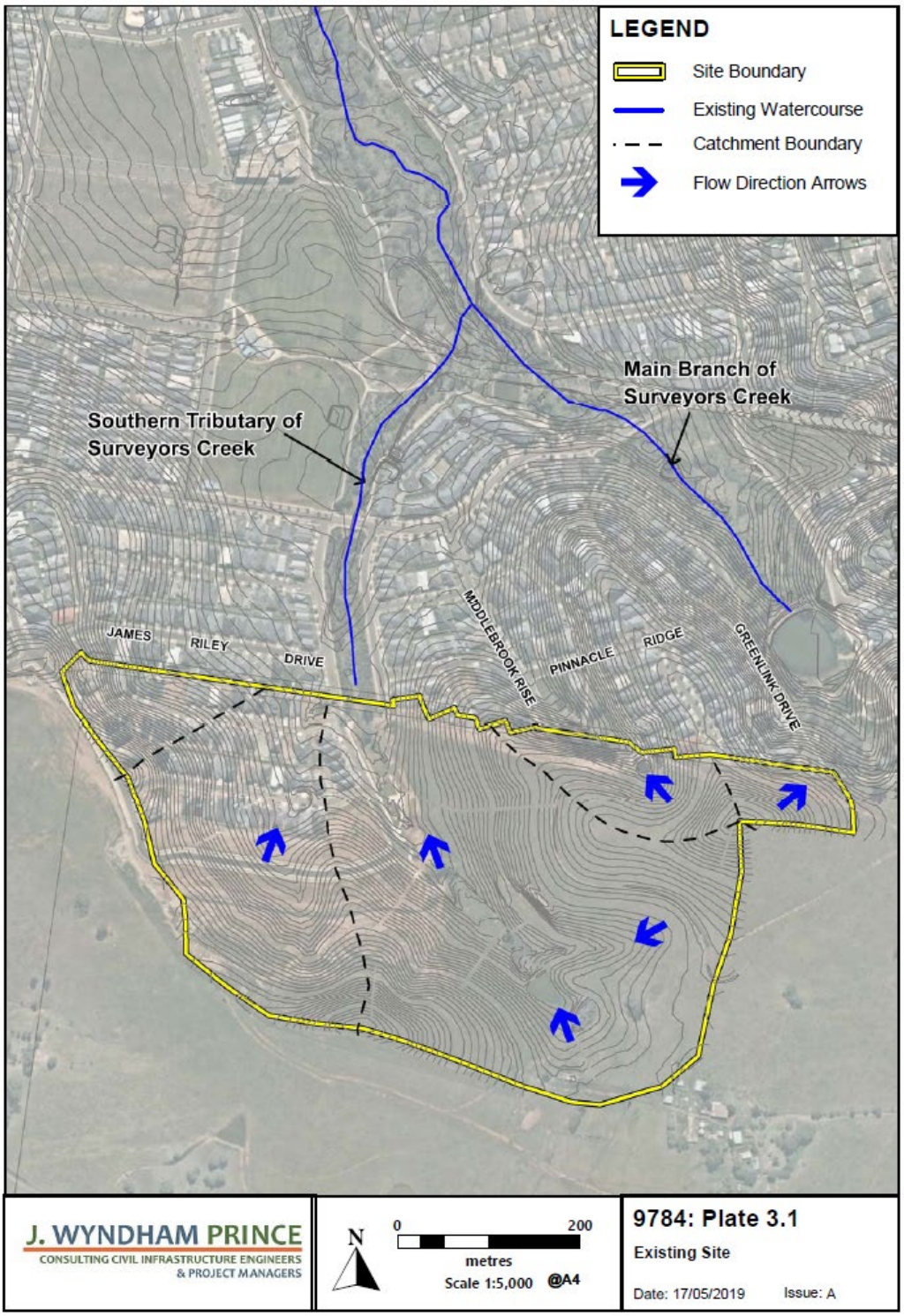


*Plate 3-1 – Existing Site Conditions*

# 4. PROPOSED DEVELOPMENT

The proposed Precincts G and H development includes approximately 380 residential lots and an environmental corridor which bisects the site. The development is separated into nine (9) stages (see Plate 4.1 for Stage boundaries). With Stages 1-3 already approved and under construction the delivery of an on-line detention basin and raingarden built in the environmental corridor will be achived. The development will also include 0.4 ha of open space for use by the incoming residents.

The environmental corridor is upstream of the Southern Tributary of Surveyors Creek and is proposed to convey flows up to the 1% Annual Exceedance Probability (AEP) event from the development.


*Plate 4-1 – Proposed development*

# 5. PREVIOUS REPORTS & STUDIES

## 5.1. Stormwater Management Strategy – Glenmore Park Stage 2 (JWP, 2005)

In 2005, J. Wyndham Prince completed the *"Glenmore Park Stage 2 Stormwater Management Strategy"* for the Glenmore Park Expansion Land Area Owners Group. This report presented the results of the investigations undertaken in developing a Stormwater Management Strategy that incorporated the principles of Water Sensitive Urban Design (WSUD) to integrate with and support the development planning process for the Glenmore Park Stage 2 Release Area.

The water quality strategy proposed in this investigation allowed for the provision of bio-retention systems, Enviropod pit inserts and rainwater tanks, which were modelled as a pond node due to the rainwater tank node not being included in earlier versions of the MUSIC water quality modelling software. The results of the modelling showed that the treatment train was adequate to achieve the applicable water quality targets at the time, with scope to be refined in subsequent investigations.

The stormwater management strategy proposed detention storage to restrict 1 Exceedances per Year (EY) post development peak flows to pre-development levels for local catchments within Glenmore Park Stage 2. This was consistent with the requirements of the Glenmore Park Stage 2 DCP. Detention incorporated within the existing Blue Hills Wetland provides adequate storage to restrict post development flows to pre-development levels for all storms up to and including the 1% Annual Exceedance Probability (AEP) event.

## 5.2. Glenmore Park Stage 2 – Stormwater Management Strategy Addendum Report – Revised Water Quality Modelling & Stream Erosion Index Assessment (JWP, 2010)

In 2010, J. Wyndham Prince completed the "Glenmore Park Stage 2 – Stormwater Management Strategy Addendum Report – Revised Water Quality Modelling & Stream Erosion Index Assessment" (Addendum Report) for the Landowners Group. This assessment revised the previous strategy for the Glenmore Park Stage 2 Release Area (JWP, 2005) to address updates to the development layout, PCC's design requirements and MUSIC modelling software.

Results of this investigation showed that the provision of rainwater tanks provided for each allotment and raingardens 0.55% of catchment within the development will ensure that the post development stormwater discharges will meet the DCP's water quality objectives for the Glenmore Park Stage 2. This assessment was undertaken in MUSIC version 3.01. The inclusion of rainwater tanks as an additional node in the new MUSIC model has allowed raingarden areas derived in the 2005 study to be reduced from 1% to 0.55% relative to the catchments they service.

## 5.3. Bradley Ridge Precincts D & E – Stormwater Management Strategy (JWP, 2010)

In 2010, J. Wyndham Prince completed the *"Bradley Ridge Precincts D & E – Stormwater Management Strategy"* for Norwest Land Pty Ltd.

As part of the stormwater management strategy, a combined bio-retention raingarden and detention basin system was proposed at the discharge location of both precincts to provide the required level of treatment of stormwater runoff from the site.

At the discharge location of Precinct E, the proposed bio-retention raingarden (as per Construction Certificate Information) adopted a filter area of 798 $m^2$ and an overall detention storage volume of 740 $m^3$. The sizing of the filter area was based on 0.55% of the catchment area draining to it (equating to approximately 14.5 ha), which is consistent with the findings of the *Addendum Report* (JWP, 2010). Refer Plate 5.1.

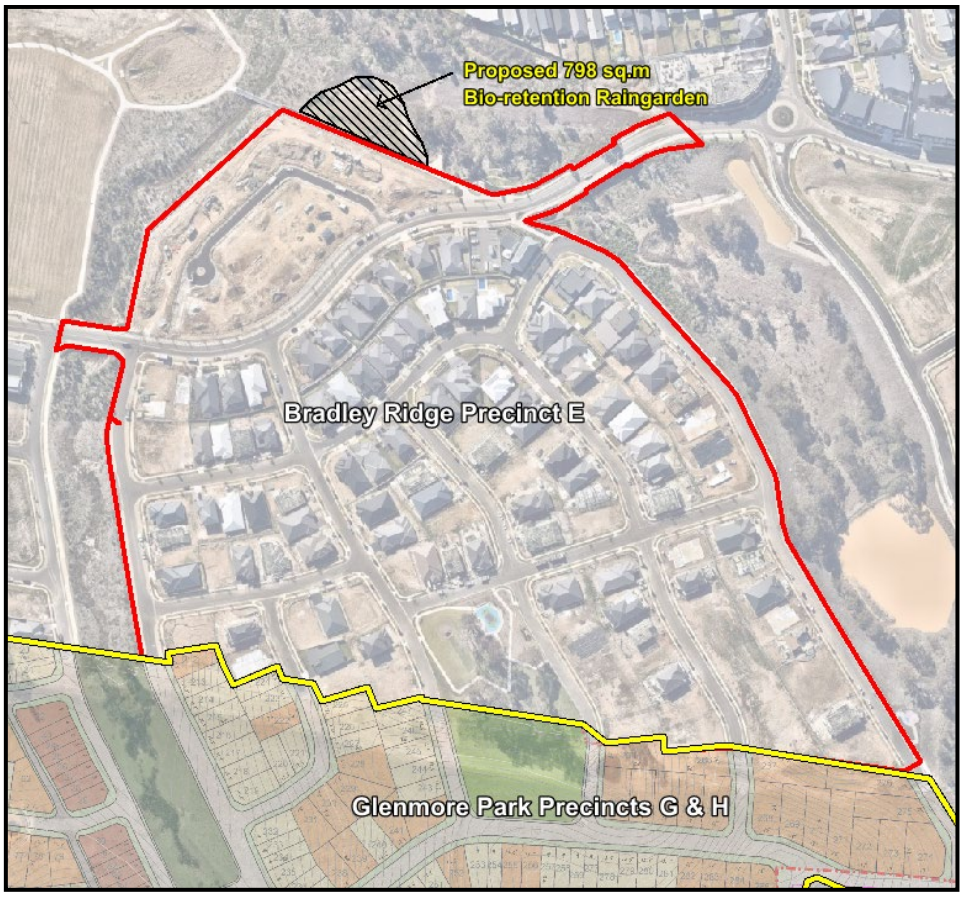


*Plate 5-1 – Bradley Ridge Precinct E Raingarden Location (JWP, 2015)*

Results of this investigation showed that the provision of rainwater tanks, Gross Pollutant Traps (GPTs) and bio-retention raingardens within the development will ensure that the post development stormwater discharges will meet the DCP's water quality objectives at the time. This assessment was undertaken in MUSIC version 3.01.

## 5.4. Glenmore Park Precincts G & H – Stormwater Management Strategy Report (JWP, 2015)

In 2015, J. Wyndham Prince completed the "Glenmore Park Precincts G & H – Stormwater Management Strategy report for Vianello Holdings Pty Ltd. The report was prepared to support the development of Stages 1 and 2 and future Development Applications.

The Stormwater Management Strategy comprised of a treatment train consisting of on lot treatment, street level treatment and subdivision / development treatment measures. The MUSIC version 6.1 was used to carry out the water quality assessment. The structural elements consisted of:

- Proprietary GPT units at each stormwater discharge point into the proposed bio-retention gardens.
- An on-line detention basin of approximately total volume of 1,220 $m^{3.}$
- A proposed bio-retention raingarden of total area 550 $m^2$ (as per Construction Certificate Information) located in Precinct G & H environmental corridor.
- A proposed bio-retention raingarden of total area 890 $m^2$ located in Precinct G & H corridor.
- A proposed extension of the Bradley Ridge Precinct E bio-retention raingarden of 140 $m^2$.
- A proposed extension to the Bradley Ridge Precinct E detention basin of 160 $m^3$.

Refer to Plate 5.2 for further detail of this strategy.

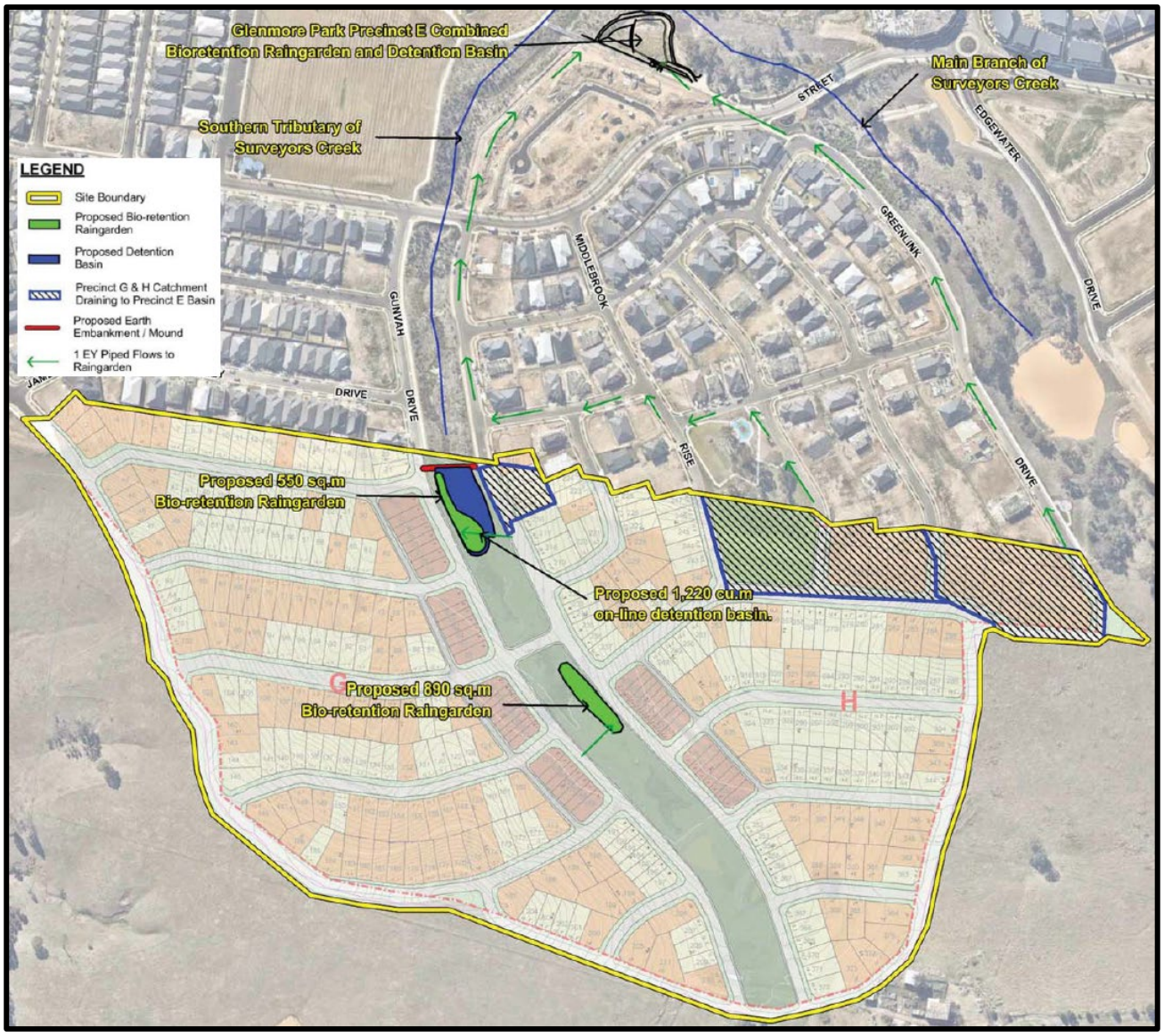


*Plate 5-2 – Glenmore Park Precincts G and H Stormwater Management Strategy (JWP, 2015)*

Furthermore, the peak discharge flow rate from the Precinct E site under "existing" conditions of 1.13 $m^3/s$ in the 1 EY event was adopted which was determined from Bradley Ridge Precinct D & H Stormwater management Strategy (JWP, 2010).

## 5.5. Glenmore Park Precincts G & H – Revised Detention Basin Design Stormwater Assessment (JWP, 2016)

In 2016, J. Wyndham Prince completed a stormwater assessment to support the Construction Certificate (CC) approval for Stages 1 and 2 development at Glenmore Park Precincts G & H. The primary objective of this report was to address a number of conditions provided in PCC's *"Notice of Determination"* (dated 31st August 2016).

The detention basin arrangement, which was presented in the original *"Glenmore Park Precincts G and H Stormwater Management Strategy"* (J. Wyndham Prince, 2015), that was approved as part of the original DA submission for the Stages 1 and 2 development (ref: DA15/1469), was amended to satisfy Council's conditions.

Results of the assessment indicated that a 1,070 $m^3$ of total detention was required to maintain post-development runoff from the site. In addition, the water quality treatment train was consistent with the original 2015 strategy and comprised of rainwater tanks, gross pollutant traps and two (2) bio-retention raingardens.

This strategy also maintained the treatment measures for the North Eastern portion of the site being treated as part of an amended Precinct E raingarden and basin located on the bank of the Surveyors Creek.

# 6. RELEVANT DEVELOPMENT GUIDELINES

## 6.1. Penrith City Council Development Control Plan (PCC, 2014)

The stormwater management strategy has been prepared to comply with *Penrith City Council's Development Control Plan* (DCP) (PCC, 2014). Part E of the DCP, which relates to the Glenmore Park Release Area, identifies the Water Management and Flood Management objectives and development controls as follows:

**Water Management**

- To ensure Mulgoa Creek and Surveyors Creek are able to function as healthy, natural riparian corridors.
- To maintain the stability and integrity of the finished creek profile.
- To ensure the quality of water leaving the urban areas does not adversely impact upon the health of Mulgoa Creek and Surveyors Creek.
- To reduce the volume of stormwater run-off from the site.
- To ensure stormwater runoff is adequately treated before it enters the riparian corridors.

**Flood Management**

- To manage the risk to life and property assets from flooding events.
- To allow the riparian corridor to function as a naturally occurring waterway.
- To manage most flood waters within the site.
- Stormwater detention is provided to reduce 1 year ARI post development flows to pre development levels.
- Stormwater events larger than the 1 year ARI will be managed within the existing Blue Hills Wetland.

## 6.2. Penrith City Council Glenmore Park Stage 2 (PCC, 2006)

The Glenmore Park Stage 2 DCP (Reference 2) identifies the Water Management and Flood Management objectives as follows:

- To ensure Mulgoa Creek and Surveyors Creek are able to function as healthy, natural riparian corridors.
- To maintain the stability and integrity of the finished creek profile.
- To ensure the quality of water leaving the urban areas does not adversely impact upon the health of Mulgoa Creek and Surveyors Creek.
- To reduce the volume of stormwater run-off from the site.
- To ensure stormwater runoff is adequately treated before it enters the riparian corridors.
- To manage the risk to life and property assets from flooding events.
- To allow the riparian corridor to function as a naturally occurring waterway.
- To manage most flood waters within the site.

This document nominates the mean pollutant load reductions as follows:

- Total Suspended Solids (TSS): 80%
- Total Phosphorous (TP): 45%
- Total Nitrogen (TN): 45%

## 6.3. Penrith City Council Water Sensitive Urban Design Policy (PCC, 2013)

*Penrith City Council's Water Sensitive Urban Design (WSUD) Policy* (PCC, 2013) identifies the following objectives for consideration with regard to stormwater management:

- Protect and enhance natural water systems such as creeks and rivers in the Penrith LGA.
- Treat urban stormwater to meet water quality objectives for reuse and/or discharge to receiving waters.
- Match the natural water runoff regime as closely as possible (where appropriate).
- Reduce potable water demand through water efficient fittings and appliances, rainwater harvesting and water reuse.
- Minimise wastewater generation and treatment of wastewater to a standard suitable for effluent reuse opportunities.
- Integrate stormwater management into the landscape so as to maximise the visual and recreational amenity of urban development.
- Provide objectives and controls for specific WSUD elements including water conservation, stormwater quality and waterway stability management.
- To safeguard the environment by improving the quality of stormwater run-off entering receiving waters.

This document nominates the mean pollutant load reductions as follows:

- Gross Pollutants: 90% for loads greater than 5mm
- Total Suspended Solids (TSS): 85%
- Total Phosphorous (TP): 60%
- Total Nitrogen (TN): 45%

This policy is supported by Penrith City Council's "WSUD Technical Guidelines" (PCC, 2015), which sets out the key parameters that are required to be used in sizing all Stormwater Treatment Measures in MUSIC.

# 7. PROPOSED STORMWATER MANAGEMENT STRATEGY

The Stormwater Management Strategy proposed for the Precinct G & H development has been prepared with consideration of the statutory requirements and guidelines listed in Section 6 of this report. The strategy focuses on mitigating the impacts of the development on the total water cycle and maximising the environmental, social and economic benefits that may be achieved through the use of technically viable and sustainable stormwater management practices.

The proposed strategy for the Precincts G and H site will consist of the following elements.

## 7.1. Water efficiency

### 7.1.1 On lot treatment

- Implementation of water efficient fittings and appliances in all dwellings (dual flush toilet, AAA shower heads, water efficient taps and plumbing).
- Minimisation of impervious areas through acceptable development controls.
- The provision of rainwater tanks on each allotment, along with the implementation of the above water efficient devices, will satisfy the requirements of BASIX. The connection of water tank to service internal uses will ensure any requirements are met and additional benefits are realised.


## 7.2. Water quality measures

### 7.2.1 Street level treatments

**Gross Pollutant Traps (GPTs)**

GPT devices are typically provided at the outlet of stormwater pipes just upstream of bio-retention raingardens. These systems operate as a primary treatment to remove litter, vegetative matter, free oils and grease and coarse sediments prior to discharge to downstream (Secondary and Tertiary) treatment devices. They can take the form of trash screens or litter control pits, pit filter inserts or wet sump gross pollutant traps.

Proprietary vortex style GPTs will be provided at each stormwater discharge point to the bio-retention raingardens within the Precinct G & H development.

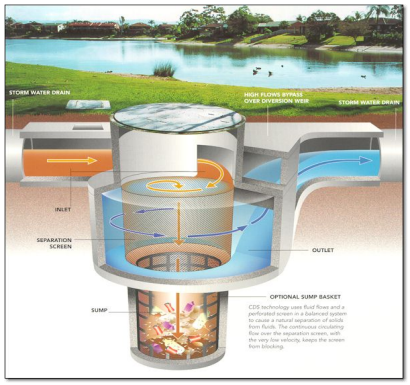


*Plate 7-1 – Vortex style GPT*

### Bio-retention systems (raingardens)

Two (2) bio-retention raingarden systems are proposed to treat stormwater runoff generated within the Precincts G and H development. These bio-retention systems will be located within the environmental corridor bisecting the site. In addition, an extension of the Precinct E raingarden is proposed to treat stormwater runoff which is generated by the portion of the site discharging into Precinct E.

The systems will be appropriately sized to achieve the nutrient reduction targets outlined in *Penrith City Council's WSUD Policy* (2013). The bio-retention systems will also attenuate first flush flows to reduce the risk of stream erosion within the downstream watercourse. The location of the bio-retention systems is shown on Figure 8.1. Refer to Section 8 for further discussion and detailed water quality assessment.

*Plate 7-2 – Typical bio-retention system after plant establishment*

## 7.3. Subdivision and Housing Construction Stage

Erosion and sediment control measures are to be implemented during the construction phase in accordance with the requirements of Penrith City Council and the guidelines set out by Landcom (the "Blue Book", 2004).

As the operation of "bio-retention" (raingarden) type water quality treatment systems are sensitive to the impact of sedimentation, construction phase controls should generally be maintained until the majority of site building works (approximately 80%) are complete. Alternatively, a very high level of at source control on individual allotments during the building and site landscaping works, which are regularly inspected by Council officers, would be required.

## 7.4. Long Term management

Regular maintenance of the stormwater quality treatment devices is required to control weeds, remove rubbish, and monitor plant establishment and health. Some sediment build-up may occur on the surface of the raingardens and within the swales and may require removal to maintain the high standard of stormwater treatment.

Proper management and maintenance of the water quality control systems will ensure long-term, functional stormwater treatment. It is strongly recommended that a site-specific Operation and Maintenance (O & M) Manual is prepared for the system. The O & M manual will provide information on the Best Management Practices (BMP's) for the long-term operation of the treatment devices. The manual will provide site-specific management procedures for:

- Maintenance of the GPT structures, including rubbish and sediment removal.
- Management of the raingarden, including plant monitoring, replanting guidelines, monitoring and replacement of the filtration media and general maintenance (i.e. weed control, sediment removal).

# 8. WATER QUALITY ANALYSIS

The stormwater quality analysis for this study was undertaken using the Model for Urban Stormwater Improvement Conceptualisation (*MUSIC*). This water quality modelling software was developed by the Cooperative Research Centre (CRC) for Catchment Hydrology which is based at Monash University and was first released in July 2002. Version 6.3 was adopted for this study.

The model provides a number of features relevant for the development:

- It is able to model the potential nutrient reduction benefits of gross pollutant traps, constructed wetlands, grass swales, bio-retention systems, sedimentation basins, infiltration systems, ponds and it incorporates mechanisms to model stormwater re-use as a treatment technique.
- It provides mechanisms to evaluate the attainment of water quality objectives.

The *MUSIC* modelling was undertaken to demonstrate that the stormwater management system proposed for the Precinct G & H development will deliver the required pollutant reduction targets specified in PCC's current guidelines. The pollutant reductions are shown in Table 8.1 and have been used throughout this assessment.

Penrith City Council has established default parameters for use in *MUSIC* models to represent the generation of various pollutants by different land uses. The parameters used in the MUSIC modelling are presented in the MUSC link report in Appendix C.

The Water Quality assessment and strategy is consistent with the approved Precinct G & H Stormwater Management Strategy and Precinct G & H Revised Detention Basin Design Stormwater Assessment. The parameters adopted in MUSIC model are also consistent with the parameters adopted in these studies.

| Pollutant | Target Reduction Required |
|---|---|
| Total Suspended Solids (TSS) | 85% |
| Total Phosphorous (TP) | 60% |
| Total Nitrogen (TN) | 45% |
| Gross Pollutants (GP) | 90% |

*Table 8-1 – Pollutant Removal Targets*

## 8.1. Catchments

A *MUSIC* model was established to represent the proposed development. One (1) model for a portion of Precinct G & H that drains in the adjacent Precinct E and a second model for the remainder of the Precinct G & H. The development has been split into sub catchments (see Plate 8.1).

Under 'Developed' condition, all urbanised catchments within the site adopted a percentage imperviousness of 65% which is consistent with previous stormwater management strategies, including the *Addendum Report* (JWP, 2010) and the Precinct G & H Stormwater Management Strategy (JWP, 2016). The catchments were split into roofs, roads, other impervious area and pervious areas, as appropriate to represent the post development catchment.

Sub catchments MU1-MU4 and MU7-MU9 drain into the two (2) bio-retention raingardens in the environmental corridor. Sub catchments MU5, MU6 and MU12 bypass any treatment devices and have been compensated for in bioretention basins 1 and 2. Sub catchment MU10 & 11 drain into the existing Bradley Ridge Precinct E development to be treated within the Precinct E bioretention raingarden within the Surveyor Creek corridor.

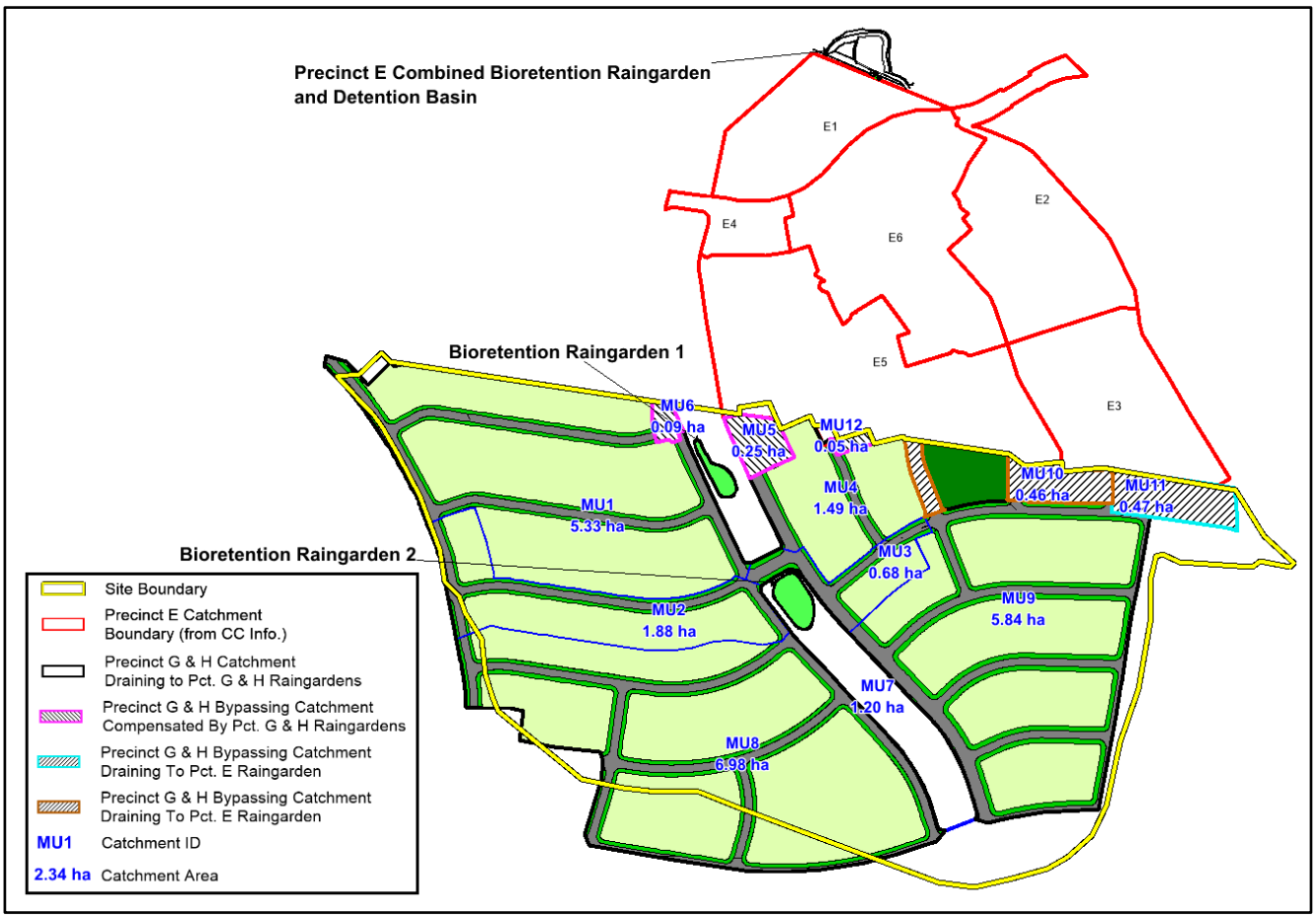


*Plate 8-1 – MUSIC developed catchments*

## 8.2. Modelling inputs and assumptions

The following assumptions and parameters have been adopted in the *MUSIC* model for the Precinct G & H development:

- The average roof area adopted for low and medium density lots are 250 $m^2$ and 150 $m^2$ respectively, based on the approximate average roof area within similar developments in Glenmore Park. It is assumed that 50% of the total roof area will be connected to the rainwater tanks.
- The average rainwater tank size adopted in the investigation was 3000 litres. It is assumed that the rainwater tanks will be topped up by the potable water supply once the level in the tank drops below 20%. Therefore, the volume available for stormwater top up was assumed to be 2400 litres.
- The average internal reuse amount adopted in the investigation was 0.1 kL per household per day, with outdoor reuse adopted to be 50 kL per household per year. This is consistent with PCC's *WSUD Technical Guidelines* (PCC, 2015).
- Local drainage throughout the development should be filtered by means of Gross Pollutant Traps prior to discharge into the downstream drainage systems, raingardens and the riparian corridors. It is assumed that trash and gross sediments will be effectively removed prior to entering the raingardens by the proposed GPT units.
- Bio-retention raingardens consist of a filtration bed with either gravel or sandy loam media and an extended detention zone of 300 mm – 500 mm deep, designed to detain and treat the first flush flows from the upstream catchment. The media beds of the raingardens are 500 mm deep. The location of the raingardens servicing the Precincts G & H development are shown on Figure 9.1.
- It is noted that the open space has been excluded from the assessment, as the land use in this area will not change as part of the proposed development.

The MUSIC model layout for the portion of Precinct G & H development draining into the environmental corridor is shown in Plate 8.2.

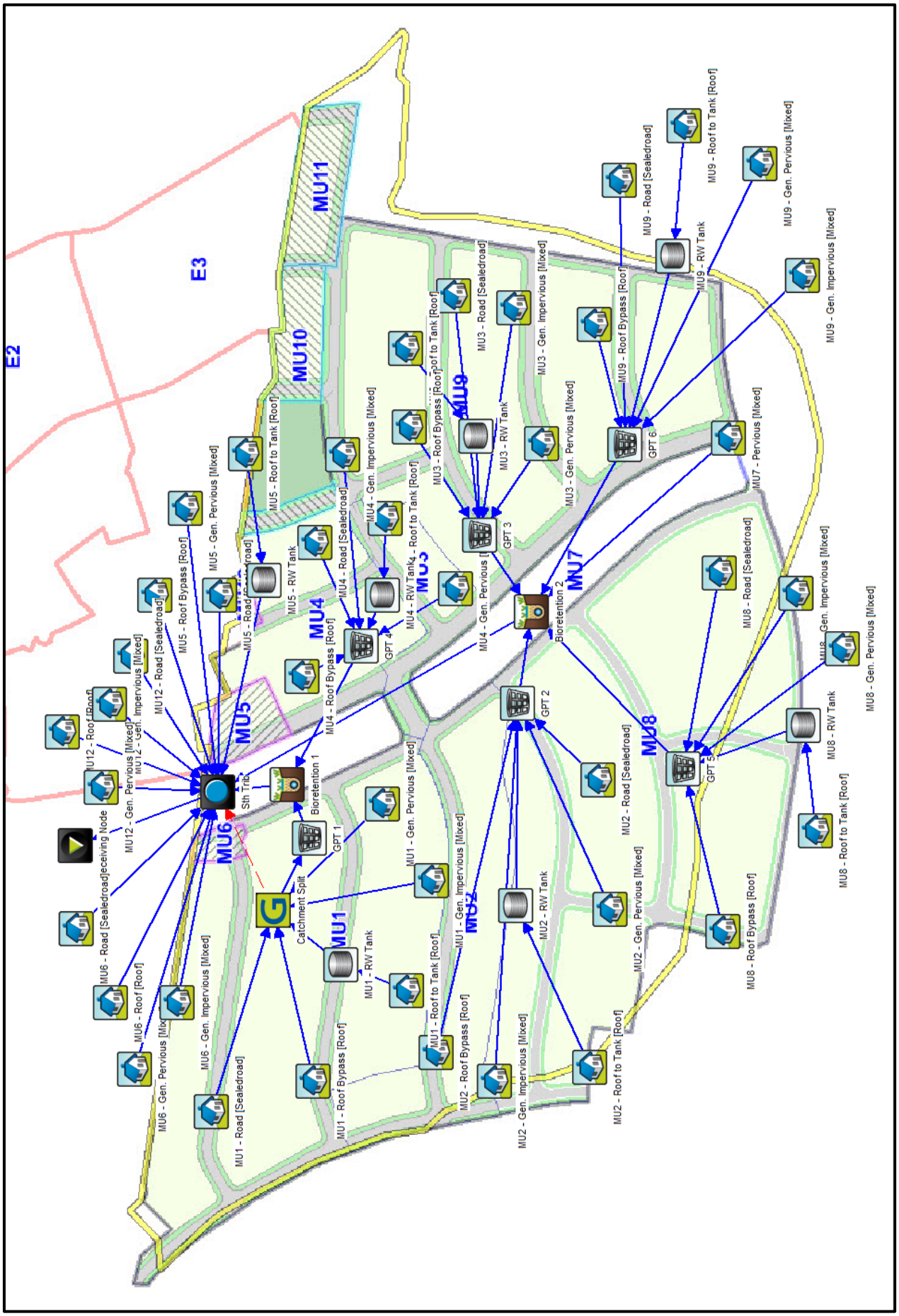


*Plate 8-2 – MUSIC model layout for catchments MU1-MU9*

### 8.2.1 Results of modelling

The performance of the proposed water quality management strategy and estimated annual pollutant load reductions for the Precinct G & H development, as determined through a stochastic MUSIC assessment, is summarised in Table 8.2.

The results demonstrate that the proposed strategy which includes Bio-retention raingarden 1 with the filter area of **550 m²** which has been approved and built as part of the Stages 1-3 together with a Bio-retention raingarden 2 with a filter area of **1350 m²** will achieve the reduction targets specified by Penrith City Council at the site discharge point for this portion of the catchment.

A copy of the MUSIC-Link report is included in Appendix C.

| Pollutant | Total Developed Source Loads | Minimum Reduction Required | Total Residual Load From Site | Total Reduction Achieved | Target Reduction Required | Total Reduction Achieved |
|---|---|---|---|---|---|---|
| | (kg/yr) | (kg/yr) | (kg/yr) | (kg/yr) | (%) | (%) |
| TSS | 12100 | 10285 | 1730 | 10370 | 85% | 86% |
| TP | 26.3 | 15.780 | 8.930 | 17.37 | 60% | 66% |
| TN | 213 | 95.85 | 93.8 | 119.2 | 45% | 56% |
| GP | 2440 | 2196.0 | 37.2 | 2402.8 | 90% | 98% |

*Table 8-2 – Estimate Mean Annual Pollutant Loads*

## 8.3. Remodelling of Precinct E Water Quality Device

As part of finalising this update strategy, PCC raised concerns with the proposed treatment approach for MU10 and MU11 (i.e. modification to Precinct E basin and bio retention raingarden) that was present and approved by PCC in the 2016 Strategy. At meeting the PCC staff on 27 March 2019, it was agreed that two (2) additional smaller devices within MU10 and MU11 (see Plate 8.1 for catchment locations) adjacent to the Precinct G & H boundary was not the preferred management outcome as it would increase the maintenance burden on PCC and would not provide a good urban outcome.

It was agreed with PCC officers that this strategy update would investigate an alternate management option within Precinct E for the treatment of catchment MU10 ad MU11. It was hoped that as part of the delivery of Precinct E, raingarden by others that some 'buffer' may be available for the treatment of the Precinct G & H catchments.

The MUSIC model completed for this portion of Precinct G & H uses the parameter consistent with the previous strategy with the model updated to include existing Bradley Ridge Precinct E catchments.

It is noted that the Stormwater Management Strategy for Precinct E was completed in 2010, and the raingarden was designed to meet Penrith City Council's (PCC) 2006 pollution target requirements.

Review of the existing Precinct E basin's WAE survey and aerial photos indicate that the Precinct E raingarden as constructed is approximately 815 m² in size. Therefore, this size has been adopted for Precinct E raingarden assessment.

The MUSIC model layout with the inclusion of MU10 and MU11 is shown in Plate 8.3.The performance of Precinct E raingarden without the addition of MU10 and MU11 is shown in Table 8.3.

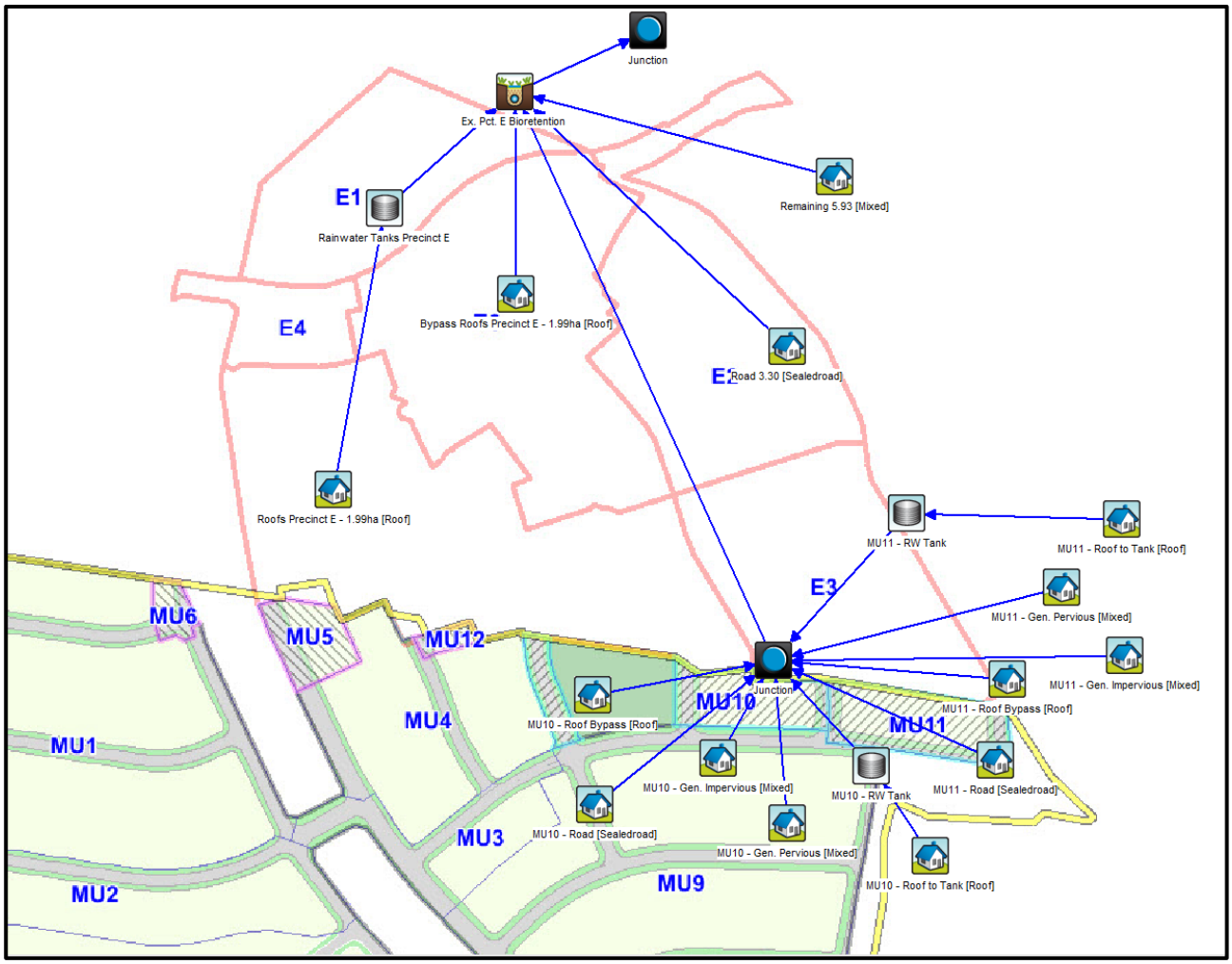


*Plate 8-3 – Precinct E, Precinct G & H Bypassing Catchments MU10 and MU11 MUSIC Model Layout*

| Pollutant | Total Developed Source Loads | Minimum Reduction Required | Total Residual Load From Site | Total Reduction Achieved | Current Target Reduction Required by PCC | Total Reduction Achieved |
|---|---|---|---|---|---|---|
| | (kg/yr) | (kg/yr) | (kg/yr) | (kg/yr) | (%) | (%) |
| TSS | 9290 | 7896.50 | 2100 | 7190 | 85% | 77.4% |
| TP | 18.2 | 10.92 | 7.08 | 11.12 | 60% | 61.1% |
| TN | 129 | 58.05 | 69.40 | 59.6 | 45% | 46.2% |
| GP | 1750 | 1575.0 | 92.5 | 1657.5 | 90% | 94.7% |

*Table 8-3 – Precinct E Raingarden performance in MUSIC Model (V6.3)*

It is important to note that while the performance of the existing Precinct E raingarden met PCC's 2006 target pollution requirements as part of its approval back in 2010, it does not achieve the current PCC requirements, particularly for total suspended solids (TSS) .

Therefore, unfortunately, there is no 'buffer' available in this raingarden that could be used to cater for Precinct G & H bypassing catchments MU10 and MU11. Amendment will, therefore, be required to this Precinct E device in order to achieve PCC desired outcome of a consolidated water quality treatment measure within Precinct E to treat this portion of Precinct G & H.

### 8.3.1 Modelling of Precinct E including Precinct G & H (MU10 & MU11)

Precinct G & H bypassing catchments MU10 and MU11 were then added to the unchanged Precinct E model. Performance of Precinct E raingarden with Precinct G & H bypassing catchments is shown in Table 8.4.

| Pollutant | Total Developed Source Loads | Minimum Reduction Required | Total Residual Load From Site | Total Reduction Achieved | Current Target Reduction Required by PCC | Total Reduction Achieved |
|---|---|---|---|---|---|---|
| | (kg/yr) | (kg/yr) | (kg/yr) | (kg/yr) | (%) | (%) |
| TSS | 9920 | 8432 | 2290 | 7630 | 85% | 76.9% |
| TP | 19.4 | 11.640 | 7.680 | 11.72 | 60% | 60.4% |
| TN | 137 | 61.65 | 75.5 | 61.5 | 45% | 44.9% |
| GP | 1850 | 1665.0 | 67.2 | 1782.8 | 90% | 96.4% |

*Table 8-4 – Precinct E raingarden performance with Precinct G & H bypassing catchments*

Given the poor performance of the Precinct E raingarden against the current water quality target, it is not the responsibility of Precinct G & H development to ensure existing infrastructure is upgraded to achieve new increased water quality targets.

Therefore, we have completed an assessment to determine the required reduction in load or kg/yr of pollutants that catchment MU10 and MU11 would need to achieve to ensure that PCC current water quality objectives are achieved.

Table 8.5 illustrates the pollutant removal requirements for MU10 and MU11 together with the residual loads from Precinct E device.

| Pollutant | Precinct E Developed Source Loads | Precinct E Actual Residual Load | Precinct G & H Site Developed Source Nodes | Precinct G & H permitted residual Loads | Total Target Residual Permitted |
|---|---|---|---|---|---|
| | (kg/yr) | (kg/yr) | (kg/yr) | (kg/yr) | (kg/yr) |
| TSS | 9290 | 2100.00 | 616 | 92.40 | 2192.40 |
| TP | 18.2 | 7.08 | 1.16 | 0.46 | 7.54 |
| TN | 129 | 69.40 | 7.88 | 4.33 | 73.73 |
| GP | 1750 | 92.50 | 78 | 7.80 | 100.30 |

*Table 8-5 – Total Target Residual Loads Limit for Precinct E and Precinct G & H*

In order to achieve the total target residual load outlined in Table 8.5, we have tested two (2) option for water quality treatment.

1. Increase the extended detention zone (EDZ) in the existing Precinct E raingarden from 300mm to 400mm.
2. Increase the footprint of the raingarden from 815m$^2$ to 880 m$^2$.

### 8.3.2 Option 1 – Increasing Extended Detention Depth (EDZ)

The current MUSIC model adopts an extended detention depth (EDZ) of 0.3 m for the raingarden which is in line with the Council's current requirements. Given that the Precinct E is located with a detention basin, the raingarden will be subject to depth of inundation of up to 1.2m during a regular 12 EY event,

This will result in the raingarden planting being inundated for approximately 2 hours during 12 EY events. The plant species used in the raingarden are designed to be inundated, and this minor increase in EDZ of 0.1 m which during the design event i.e 4 EY event would treat stormwater runoff for approximately 60 mins longer than the current situation. The results of the EDZ increase from the current 0.3m to 0.4m is provided in Table 8.6 below.

| Pollutant | Total PermittedTarget Residual Loads Limit | Total Residual Loads Achieved | Total Reduction Achieved |
|---|---|---|---|
| | (kg/yr) | (kg/yr) | (kg/yr) |
| TSS | 2192.40 | 2130 | 62.40 |
| TP | 7.54 | 7.31 | 0.23 |
| TN | 73.73 | 71.7 | 2.03 |
| GP | 100.30 | 67.2 | 33.10 |

*Table 8-6 – Total reduction achieved with Precinct E raingarden increase in EDZ*

The advantages of Option 1 are as follows:

1. Small isolated water quality devices which would be needed with catchment MU10 and MU11 within Precinct G & H are consolidated into a single device.
2. Council will ultimately be responsible for maintaining one (1) device instead of potentially three (3).
3. The EDZ extension would have minimal impact on the surrounding Surveyor Creek corridor and would result in the least amount of construction works within this recently completed device.
4. As the final media area is less in this option in comparison the option 2 this will result in a reduced cost of replacement of the media bed at the end of the raingardens expected life (15 + years) thus reducing the long maintenance burden of Council.
5. The hydraulic loading rate for this option increases to 40 $m^3/m^2/yr$ from hydraulic loading rate 36.5 $m^3/m^2/yr$ for the treatment of Precinct E alone.

   This loading rate is quite low in comparison to our recent work we have completed for Blacktown City Council which delivered raingardens that have hydraulic loading rates range from 50 $m^3/m^2/yr$ to 133 $m^3/m^2/yr$.

   Furthermore, Australian Runoff Quality (ARQ) indicates that the acceptable range of hydraulic loading for infiltration systems (including raingardens) is 5 ~ 1000 m/yr (See Plate 8.4 below).

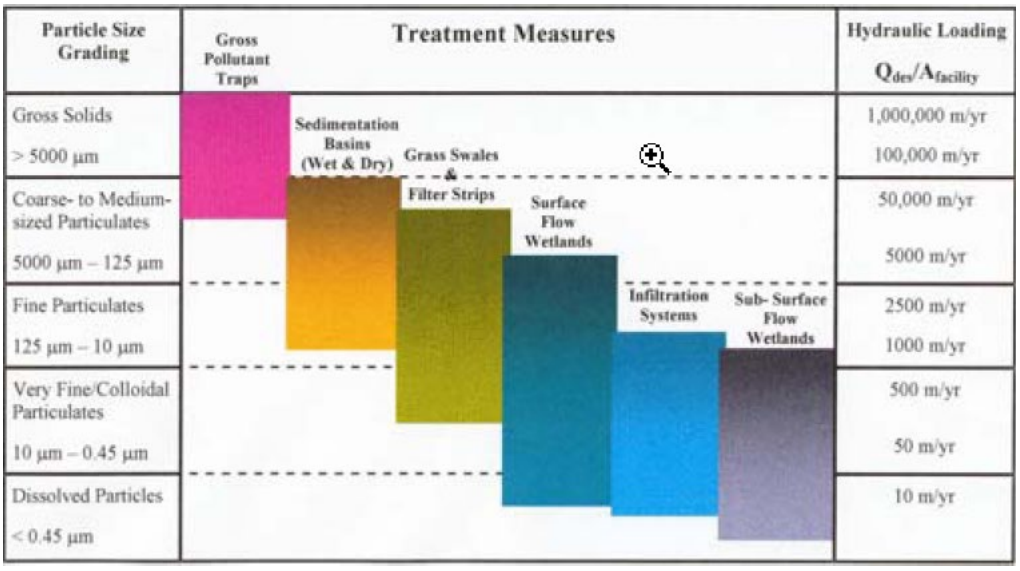


*Plate 8-4 – ARQ Acceptable Range of Hydraulic Loading Rate*

Therefore, there would be no impact on the long term performance of the raingarden, there will be no impact on plant health as the device is a basin and subject to frequent inundation, and this option is the less disruptive for the local area.

### 8.3.3 Option 2 – Increased Raingarden Media bed area

The existing Precinct E raingarden bed area is currently modelled at 815 $m^2$ if the bed area was increased to 880 $m^2$ the total reduction achieved is shown in Table 8.7.

| Pollutant | Total Target Residual Loads Limit | Total Residual Loads Achieved | Total Reduction Achieved |
|---|---|---|---|
| | (kg/yr) | (kg/yr) | (kg/yr) |
| TSS | 2192.40 | 2150 | 42.40 |
| TP | 7.54 | 7.42 | 0.12 |
| TN | 73.73 | 73.4 | 0.33 |
| GP | 100.30 | 67.2 | 33.10 |

*Table 8-7 – Total reduction achieved with Precinct E raingarden increase in size*

The disadvantages of Option 2 are as follows:

1. Considerable disruption will be necessary within the recently constructed device in order to increase the raingarden media bed area to 880 $m^2$.
2. Stitching both the existing and future raingarden together will come with some construction challenges.
3. A number of significant trees within the Surveyor creek corridor will possibly be impacted by the basin footprint extension.
4. Significant construction work will be necessary within an existing residential area, which may result in unhappy residents.

Given these considerable challenges for option 2 and the negligible impact that the increase in EDZ outlined in option 1 will have on the raingarden operations, we recommend that option 1 be the preferred management option for this portion of Precinct G & H.

Notwithstanding this recommendation, both options provide the required water quality treatment to support on going development of Precinct G & H and further details on the preferred option can be discussed with Council and presented in a future Development application for PCC consideration.

## 8.4. Stream Erosion Index

A Stream Erosion Index (SEI) assessment was prepared as part of the Glenmore Park Stage 2 revised Stormwater Management Strategy (see Section 5.2). As part of regional assessment, Glenmore Park Stage 2 Precinct G & H was considered untreated, and an appropriate SEI management delivered elsewhere in the catchment. Therefore, a separate SEI assessment is not required to support the updated Precinct G & H Strategy.

# 9. WATER QUANTITY MANAGEMENT

## 9.1. Detention Basins

In 2016, J. Wyndham Prince completed a stormwater assessment to support Construction Certificate (CC) approval for Stages 1 and 2 within the Precincts G & H. The detention basin proposed in the environmental corridor is now complete and provides peak storm flow attenuation up to the 1 EY event.

Additionally, the Bradley Ridge Precinct E detention basin is proposed to be extended as part of this strategy in order to manage flows up to the 1 EY event for the bypassing portion (Catchment MU10 and MU11 as detailed in Section 8.3) of Precinct G & H.

## 9.2. Hydrologic analysis

The hydrologic analysis for this study was undertaken using the rainfall – runoff flood routing model XP-RAFTS (Runoff and Flow Training Simulation with XP Graphical Interface) for pre and post development conditions. Modelling has built upon the approved Glenmore Park Precincts G & H – Revised Detention Basin Design Stormwater Assessment (JWP, 2016).

## 9.3. Sub-catchments (Pre and Post Development)

The sub-catchment breakup for the site was developed based on detailed survey information of the site in existing conditions and approved/future design information for both with the Precinct G & H and for Bradley Ridge Precinct E development. Catchment boundaries for the existing and developed areas contributing to the drainage system are shown in Figures 9.1 and 9.2, respectively in Appendix A.

The ‘existing’ case model was updated from the previous strategy (JWP 2016) to incorporate the Precinct E development. Precinct E basin is proposed to be augmented to cater for the additional catchment that Precinct G & H will now deliver to this device.

Under “Developed” Conditions, all urbanised catchments within the Precinct adopted a percentage imperviousness of 65%, which is consistent with previous stormwater management strategies, including the Addendum Report (JWP, 2010), for the Glenmore Park Stage 2 Release Area.

Refer to Appendix B for the XP-RAFTS model parameters adopted for the assessment.

## 9.4. Detention Management

The detention management for Precinct G & H site is consistent with the approved Glenmore Park Precincts G & H – revised Detention Basin Design Stormwater Assessment (JWP, 2016).The on-line detention basin in the environmental corridor will restrict flows for majority of Precinct G & H site and has been constructed as part of Stages 1 and 2 and does not require amendment as part of the strategy updated.

As discussed in section 8.3, a1.28 ha of developed catchment from Precinct G & H will be directed downstream into Precinct E. Consistent with the water quality approach, two (2) option for detention management have been assessed. These options align with the anticipated changes that will be required in order to support the required water quality outcomes.

- Option 1, which includes the additional 0.1m (EDZ) proposed in the raingarden, changes the available storage in the Precinct E detention basin. The discharge controls and spillway levels have also been amended to deliver the required flow management outcomes.
- The amended design results in an increase in the spillway level by 40 mm and provides an increase in the available basin storage by approximately 140 $m^3$. This combination of increased storage and outlet amendment delivered the required flows management targets original achieved for the Precinct E basin.
- Option 2 which considered the proposed 65 $m^2$ increase in the raingarden area. This amendment will result in a shift in the basin embankment; thus a change in the storage available to deliver the required flow management outcomes. In this option, the outlet arrangement remains unchanged from this which is currently constructed, and the basin storage increased to achieve the required flow targets. An additional 205 $m^3$ of storage is required to deliver the necessary flow management targets.

## 9.5. Results

Discharge estimates were derived for the existing and developed catchments for the 1 EY event. A range of storm durations from 10 minutes to 24 hours were analysed to determine the critical duration for each sub-catchment.

Please note that this assessment continues to use 1987 Australian Rainfall and Runoff (ARR) methodologies consistent with the approved 2016 strategy.

Peak discharges at key locations in the catchment were determined for the existing site and developed site both with and without detention provided below. Refer to Appendix B for further details.

### 9.5.1 Peak Flows Estimates

The peak flows for Precinct G & H basin, and Precinct E basin option 1 and option 2 are presented in Table 9.1 below.

| Node | Existing | | Developed (Without Detention Basin) | | Developed (With Detention Basin) | |
|---|---|---|---|---|---|---|
| | Flow ($m^3/s$) | Dur. (min) | Flow ($m^3/s$) | Dur. (min) | Flow ($m^3/s$) | Dur. (min) |
| Pct G&H | 1.38 | 120 | 3.13 | 90 | 1.36 | 120 |
| Pct E Basin (Option 1) | 0.72 | 120 | 1.92 | 25 | 0.72 | 120 |
| Pct E Basin (Option2) | 0.72 | 120 | 1.92 | 25 | 0.72 | 120 |
| Outlet | 2.16 | 120 | 5.04 | 90 | 2.08 | 120 |

*Table 9-1 – Summary of Peak Flows (1 EY EVENT)*

### 9.5.2 Precinct G & H Basin Performance

The existing Precinct G & H basin within the environmental corridor remains consistent with the approved Glenmore Park Precincts G & H Stormwater Management Strategy (JWP, 2016) and this basin does not require any changes as a result this strategy update.

Details of the performance of the Precinct E basin in both options detailed above are provided below in Table 9 -2 and 9-3.

| Node | Peak Inflow ($m^3/s$) | Peak Outflow ($m^3/s$) | Basin Volume Used ($m^3$) | Depth of Ponding (m) | TWL (m) AHD |
|---|---|---|---|---|---|
| Pct E Basin | 1.92 | 0.72 | 880 | 1.2 | 60.33 |

*Table 9-2 – Summary of Precinct E Basin Performance (Option 1) (1 EY Event)*

| Node | Peak Inflow ($m^3/s$) | Peak Outflow ($m^3/s$) | Basin Volume Used ($m^3$) | Depth of Ponding (m) | TWL (m) AHD |
|---|---|---|---|---|---|
| Pct E Basin | 1.92 | 0.72 | 945 | 1.2 | 60.26 |

*Table 9-3 – Summary of Precinct E Basin Performance (Option 2) (1 EY Event)*

# 10. SUMMARY AND CONCLUSION

This updated Stormwater Management Strategy for the Glenmore Park Precinct G & H development has been prepared to support the precinct as a whole and to address PCC condition of consent. The strategy has been prepared to conform with the statutory requirements and industry best practice for stormwater management in this catchment.

The Stormwater Management Strategy for Precinct G & H comprises a treatment train consisting of on lot treatment, street level treatment and subdivision / development treatment measures. The structural elements proposed the for the development consist of:

- Proprietary GPT units at each stormwater discharge point into the Precinct G & H bio-retention raingardens located in the environmental corridor.
- An on-line detention basin of a volume of 1,070 $m^3$ to treat the majority of Precinct G & H site which has been constructed as part of stage 1 and 2.
- Two (2) proposed approaches to extend Bradley Ridge Precinct E detention basin to treat bypassing catchments from Precinct G & H have been investigated:
  - Option 1 – Increasing the EDZ of the Precinct E raingarden by 0.1 m while extending the detention basin storage by approximately 140 $m^3$, increasing of basin spillway weir by approximately 40 mm and modifying the outlet configuration.
  - Option 2 – Increasing the Precinct E raingarden surface area by 65 $m^2$ while extending the detention basin storage by approximately 205 $m^3$. No change the current basin outlet configuration.

Both options deliver the required water quality and flow management outcomes consistent with PCC Stormwater management objectives.

The proposed updated Stormwater Management Strategy for the developed site provides a basis for the detailed design and development of the site to ensure that the environmental, urban amenity, engineering and economic objectives for stormwater management and site discharge are achieved.

The Stormwater Management Strategy proposed for the development site is functional; delivers the required technical performance; lessens environmental degradation and pressure on downstream ecosystems and infrastructure, and provides for a 'soft' sustainable solution for stormwater management within the Precinct.

Yours faithfully,

**J. WYNDHAM PRINCE**

[redacted]

**DAVID CROMPTON**
Manager – Stormwater & Environment

# 11. REFERENCES

J. Wyndham Prince Pty Ltd (2010). *Bradley Ridge Precincts D & E – Stormwater Management Strategy*

J. Wyndham Prince Pty Ltd (2005). *Stormwater Management Strategy, Glenmore Park Stage 2*.

J. Wyndham Prince Pty Ltd (2010). *Glenmore Park Stage 2 Stormwater Management Strategy, Addendum Report, Revised Water Quality Modelling Stream Erosion Index Assessment*.

J. Wyndham Prince Pty Ltd (2015). *Glenmore Park Precincts G & H - Stormwater Management Strategy Report*

J. Wyndham Prince Pty Ltd (2016). *Glenmore Park Precincts G & H – Revised Detention Basin Design Stormwater Assessment*

Penrith City Council (2013) *Water Sensitive Urban Design Policy*

Penrith City Council (2014) *Development Control Plan, Section E4 – Glenmore Park*

Penrith City Council (2015) *WSUD Technical Guidelines*

Penrith City Council (2006) *Glenmore Park Stage 2 – Penrith Development Control Plan 2006 Amendment*

# APPENDIX A
## FIGURES

Map-1

Precinct E Combined Bioretention Raingarden and Detention Basin

BRADLEY

JAMES

RILEY

DRIVE

DRIVE

GUNYAH

MIDDLEBROOK

STREET

EDGEWATER

GREENLINK

DRIVE

RISE

DRIVE

E1
1.5 ha

E4
0.48 ha

E6
3.04 ha

E2
2.34 ha

E5
3.8 ha

E3
2.06 ha

G1
1.5 ha

G2
6.81 ha

G3
1.62 ha

SC1
0.9 ha

H3
2.38 ha

H4
1.91 ha

H5
0.99 ha

SC2
0.54 ha

G4
1.44 ha

H2
3.89 ha

G5
1.57 ha

SC3
0.78 ha

H1
1.54 ha

N

0 144

metres

Scale 1:3,600

Projection: GDA 1994 MGA Zone 56

J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS & PROJECT MANAGERS

## LEGEND

- Site Boundary
- Precinct E Catchment Boundary (from CC Info.)
- Precinct G & H Existing Catchment Boundary
- E3 — Catchment ID
- 2.34 ha — Catchment Area
- Flow Direction

# Figure 9.1

## Glenmore Park Precincts G & H

**Existing Catchments**

Date: 14.05.2019 Issue: A

Precinct E Combined Bioretention Raingarden and Detention Basin

E1
1.50 ha

E2
2.34 ha

E3
2.06 ha

E4
0.48 ha

E5
3.80 ha

E6
3.04 ha

G1
5.33 ha

G2
8.86 ha

G3
0.09 ha

H1
6.37 ha

H3
1.49 ha

H4
0.86 ha

H5
0.47 ha

H6
0.05 ha

SC1
0.62 ha

SC2
1.20 ha

BRADLEY

JAMES

RILEY

DRIVE

DRIVE

GUNYAH

MIDDLEBROOK

STREET

GREENLINK

EDGEWATER

DRIVE

RISE

DRIVE

Map-1

N

0 144

metres

Scale 1:3,600

Projection: GDA 1994 MGA Zone 56

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CONSULTING CIVIL INFRASTRUCTURE ENGINEERS & PROJECT MANAGERS

## LEGEND

- Site Boundary
- Precinct E Catchment Boundary (from CC Info.)
- Precinct G & H Proposed Catchment Boundary
- Precinct G & H Bypassing Catchment
- E3 — Catchment ID
- 2.34 ha — Catchment Area
- Flow Direction

# Figure 9.2

**Glenmore Park Precincts G & H**

**Developed Catchments**

Date: 14.05.2019 Issue: A

# APPENDIX B
## XP-RAFTS MODEL PARAMETERS

# *XP-RAFTS* Parameters

## Intensity-Frequency-Duration (I.F.D.)

Design rainfall intensity-frequency-duration (I.F.D.) data for the site was adopted from the *Addendum Report* (JWP, 2010), which is consistent with the stormwater management strategies prepared for the Glenmore Park Stage 2 Precincts. The rainfall intensities adopted in the *XP-RAFTS* model are provided in Table B.1. The critical storm durations were determined using these values for each sub-catchment.

*Table B.1 – Adopted Rainfall Intensities*

| AEP | Duration (hours) | | |
|---|---|---|---|
| | 1 | 12 | 72 |
| 50% | 29.5 | 6.8 | 1.9 |
| 2% | 59.5 | 13.5 | 4.5 |

## PERN Values & Infiltration Losses

The PERN Manning's 'n' values and initial and continuing loss rate parameters adopted for the catchments in the *XP-RAFTS* modelling are listed in Table B.2 and Table B.3 respectively.

*Table B.2 – XP-RAFTS Pern Values*

| Catchment Condition | PERN |
|---|---|
| Pervious | 0.035 |
| Urban Pervious | 0.025 |
| Impervious | 0.015 |

*Table B.3 –Infiltration Losses*

| Catchment Condition | Loss |
|---|---|
| **Pervious Catchment** | |
| Initial Loss | 10.0 mm |
| Continuing Loss | 2.5 mm/hr |
| **Impervious Catchment** | |
| Initial Loss | 1.0 mm |
| Continuing Loss | 0.0 mm/hr |

Refer to Plates B.1 and B.2 for the *XP-RAFTS* model layouts for existing and developed conditions respectively.

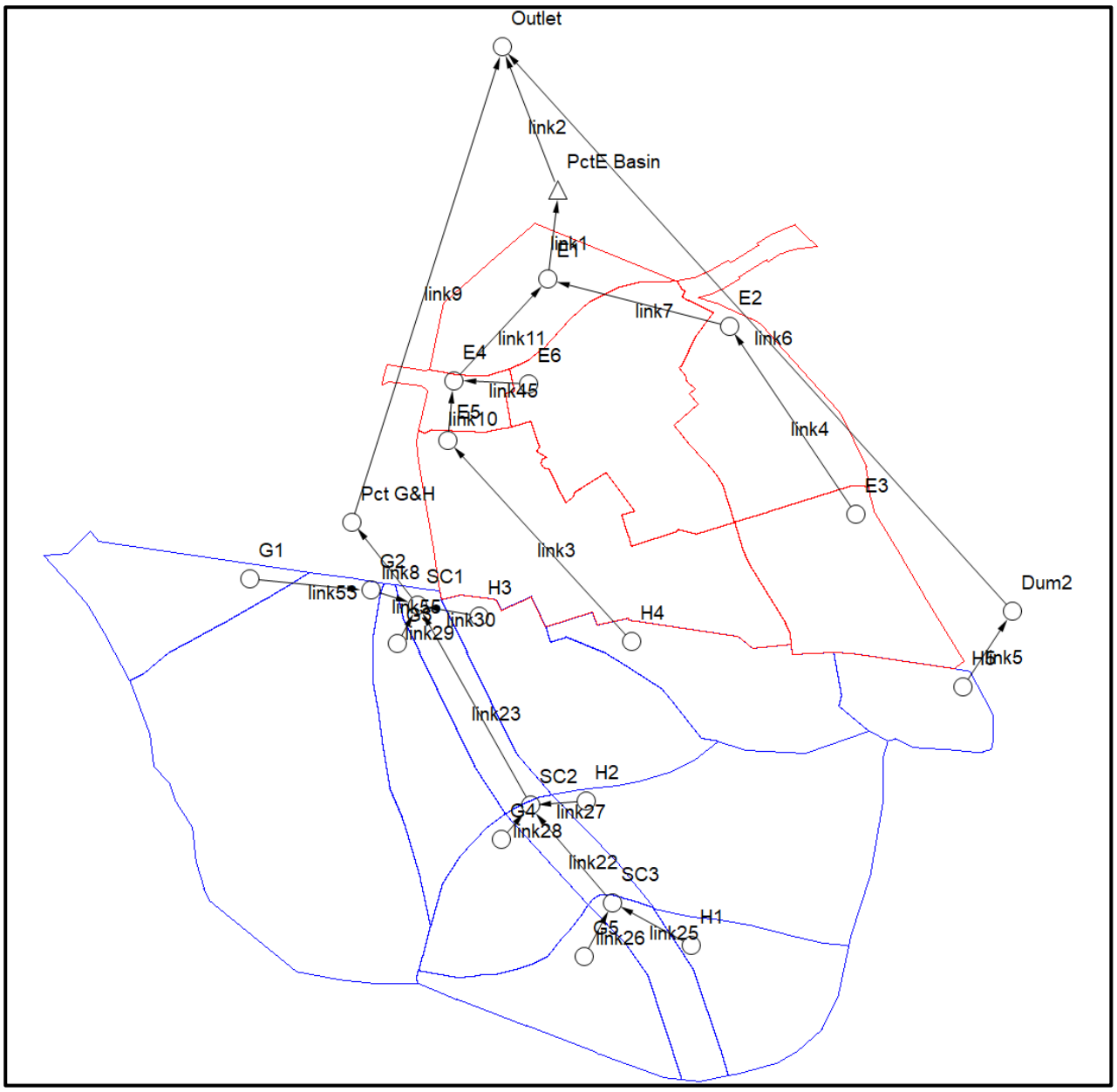


*Plate B.1 – Existing Conditions XP RAFTS Model*

(ref: 9784RA3_Exi.xp)

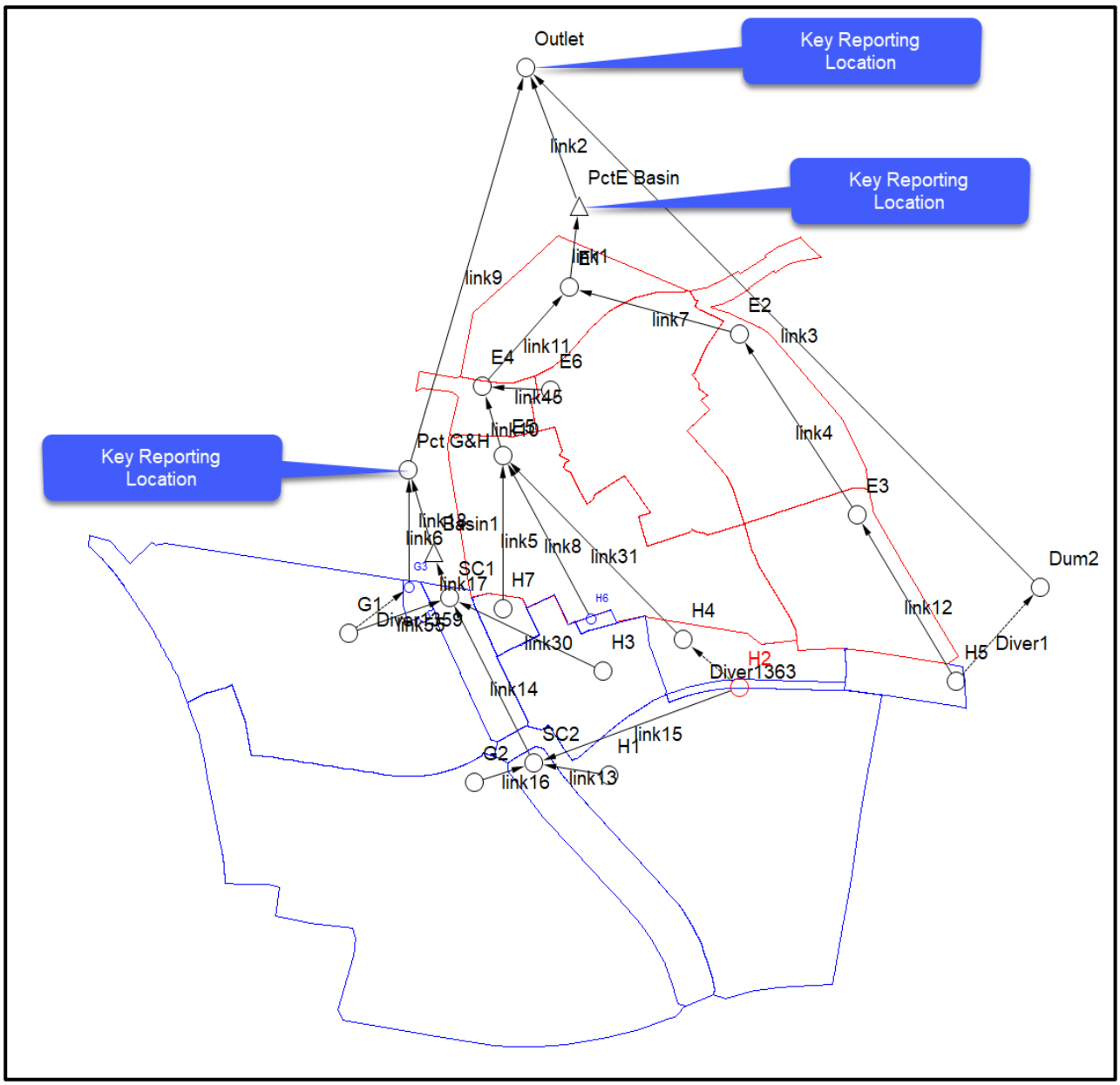


*Plate B.2 – Developed Conditions XP RAFTS Model*

(ref: 9784RA2_Dev_05.xp)

# APPENDIX C
## MUSIC-LINK REPORTS

PENRITH CITY COUNCIL

music@link

# MUSIC-*link* Report

| Project Details | | Company Details | |
|---|---|---|---|
| **Project:** | Highland Views Precinct G & H | **Company:** | J. Wyndham Prince |
| **Report Export Date:** | 17/05/2019 | **Contact:** | David Crompton |
| **Catchment Name:** | 9784_MU01_Pct G & H | **Address:** | [redacted] |
| **Catchment Area:** | 23.836ha | **Phone:** | [redacted] |
| **Impervious Area*:** | 76.35% | **Email:** | [redacted] |
| **Rainfall Station:** | 67113 PENRITH | | |
| **Modelling Time-step:** | 6 Minutes | | |
| **Modelling Period:** | 1/01/1999 - 31/12/2008 11:54:00 PM | | |
| **Mean Annual Rainfall:** | 691mm | | |
| **Evapotranspiration:** | 1158mm | | |
| **MUSIC Version:** | 6.3.0 | | |
| **MUSIC-link data Version:** | 6.30 | | |
| **Study Area:** | Penrith | | |
| **Scenario:** | Penrith Development | | |

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

## Treatment Train Effectiveness

| Node: Sth Trib | Reduction |
|---|---|
| **Flow** | 18% |
| **TSS** | 85.6% |
| **TP** | 66.2% |
| **TN** | 56% |
| **GP** | 98.5% |

## Treatment Nodes

| Node Type | Number |
|---|---|
| Bio Retention Node | 2 |
| Rain Water Tank Node | 7 |
| GPT Node | 6 |
| Generic Node | 1 |

## Source Nodes

| Node Type | Number |
|---|---|
| Urban Source Node | 43 |

## Comments

80% rainwater tank re-use is not required for residential development as per Penrith City Council WSUD Technical Guidelines

## Passing Parameters

| Node Type | Node Name | Parameter | Min | Max | Actual |
|---|---|---|---|---|---|
| Bio | Bioretention 1 | Hi-flow bypass rate (cum/sec) | None | 99 | 1.02 |
| Bio | Bioretention 1 | PET Scaling Factor | 2.1 | 2.1 | 2.1 |
| Bio | Bioretention 2 | Hi-flow bypass rate (cum/sec) | None | 99 | 2.23 |
| Bio | Bioretention 2 | PET Scaling Factor | 2.1 | 2.1 | 2.1 |
| GPT | GPT 1 | Hi-flow bypass rate (cum/sec) | None | 99 | 0.41 |
| GPT | GPT 2 | Hi-flow bypass rate (cum/sec) | None | 99 | 0.13 |
| GPT | GPT 3 | Hi-flow bypass rate (cum/sec) | None | 99 | 0.05 |
| GPT | GPT 4 | Hi-flow bypass rate (cum/sec) | None | 99 | 0.12 |
| GPT | GPT 5 | Hi-flow bypass rate (cum/sec) | None | 99 | 0.53 |
| GPT | GPT 6 | Hi-flow bypass rate (cum/sec) | None | 99 | 0.42 |
| Receiving | Receiving Node | % Load Reduction | None | None | 18 |
| Receiving | Receiving Node | GP % Load Reduction | 90 | None | 98.5 |
| Receiving | Receiving Node | TN % Load Reduction | 45 | None | 56 |
| Receiving | Receiving Node | TP % Load Reduction | 60 | None | 66.2 |
| Receiving | Receiving Node | TSS % Load Reduction | 85 | None | 85.6 |
| Urban | MU1 - Gen. Impervious | Area Impervious (ha) | None | None | 0.46 |
| Urban | MU1 - Gen. Impervious | Area Pervious (ha) | None | None | 0 |
| Urban | MU1 - Gen. Impervious | Total Area (ha) | None | None | 0.46 |
| Urban | MU1 - Gen. Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU1 - Gen. Pervious | Area Pervious (ha) | None | None | 1.87 |
| Urban | MU1 - Gen. Pervious | Total Area (ha) | None | None | 1.87 |
| Urban | MU1 - Road | Area Impervious (ha) | None | None | 0.66 |
| Urban | MU1 - Road | Area Pervious (ha) | None | None | 0 |
| Urban | MU1 - Road | Total Area (ha) | None | None | 0.66 |
| Urban | MU1 - Roof Bypass | Area Impervious (ha) | None | None | 1.18 |
| Urban | MU1 - Roof Bypass | Area Pervious (ha) | None | None | 0 |
| Urban | MU1 - Roof Bypass | Total Area (ha) | None | None | 1.18 |
| Urban | MU1 - Roof to Tank | Area Impervious (ha) | None | None | 1.18 |
| Urban | MU1 - Roof to Tank | Area Pervious (ha) | None | None | 0 |
| Urban | MU1 - Roof to Tank | Total Area (ha) | None | None | 1.18 |
| Urban | MU12 - Gen. Impervious | Area Impervious (ha) | None | None | 0.01 |
| Urban | MU12 - Gen. Impervious | Area Pervious (ha) | None | None | 0 |
| Urban | MU12 - Gen. Impervious | Total Area (ha) | None | None | 0.01 |
| Urban | MU12 - Gen. Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU12 - Gen. Pervious | Area Pervious (ha) | None | None | 0.02 |
| Urban | MU12 - Gen. Pervious | Total Area (ha) | None | None | 0.02 |
| Urban | MU12 - Road | Area Impervious (ha) | None | None | 0.01 |
| Urban | MU12 - Road | Area Pervious (ha) | None | None | 0 |
| Urban | MU12 - Road | Total Area (ha) | None | None | 0.01 |
| Urban | MU12 - Roof | Area Impervious (ha) | None | None | 0.01 |

Only certain parameters are reported when they pass validation

| Node Type | Node Name | Parameter | Min | Max | Actual |
|---|---|---|---|---|---|
| Urban | MU12 - Roof | Area Pervious (ha) | None | None | 0 |
| Urban | MU12 - Roof | Total Area (ha) | None | None | 0.01 |
| Urban | MU2 - Gen. Impervious | Area Impervious (ha) | None | None | 0.43 |
| Urban | MU2 - Gen. Impervious | Area Pervious (ha) | None | None | 0 |
| Urban | MU2 - Gen. Impervious | Total Area (ha) | None | None | 0.43 |
| Urban | MU2 - Gen. Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU2 - Gen. Pervious | Area Pervious (ha) | None | None | 0.66 |
| Urban | MU2 - Gen. Pervious | Total Area (ha) | None | None | 0.66 |
| Urban | MU2 - Road | Area Impervious (ha) | None | None | 0.34 |
| Urban | MU2 - Road | Area Pervious (ha) | None | None | 0 |
| Urban | MU2 - Road | Total Area (ha) | None | None | 0.34 |
| Urban | MU2 - Roof Bypass | Area Impervious (ha) | None | None | 0.23 |
| Urban | MU2 - Roof Bypass | Area Pervious (ha) | None | None | 0 |
| Urban | MU2 - Roof Bypass | Total Area (ha) | None | None | 0.23 |
| Urban | MU2 - Roof to Tank | Area Impervious (ha) | None | None | 0.23 |
| Urban | MU2 - Roof to Tank | Area Pervious (ha) | None | None | 0 |
| Urban | MU2 - Roof to Tank | Total Area (ha) | None | None | 0.23 |
| Urban | MU3 - Gen. Impervious | Area Impervious (ha) | None | None | 0.07 |
| Urban | MU3 - Gen. Impervious | Area Pervious (ha) | None | None | 0 |
| Urban | MU3 - Gen. Impervious | Total Area (ha) | None | None | 0.07 |
| Urban | MU3 - Gen. Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU3 - Gen. Pervious | Area Pervious (ha) | None | None | 0.24 |
| Urban | MU3 - Gen. Pervious | Total Area (ha) | None | None | 0.24 |
| Urban | MU3 - Road | Area Impervious (ha) | None | None | 0.24 |
| Urban | MU3 - Road | Area Pervious (ha) | None | None | 0 |
| Urban | MU3 - Road | Total Area (ha) | None | None | 0.24 |
| Urban | MU3 - Roof Bypass | Area Impervious (ha) | None | None | 0.06 |
| Urban | MU3 - Roof Bypass | Area Pervious (ha) | None | None | 0 |
| Urban | MU3 - Roof Bypass | Total Area (ha) | None | None | 0.06 |
| Urban | MU3 - Roof to Tank | Area Impervious (ha) | None | None | 0.06 |
| Urban | MU3 - Roof to Tank | Area Pervious (ha) | None | None | 0 |
| Urban | MU3 - Roof to Tank | Total Area (ha) | None | None | 0.06 |
| Urban | MU4 - Gen. Impervious | Area Impervious (ha) | None | None | 0.13 |
| Urban | MU4 - Gen. Impervious | Area Pervious (ha) | None | None | 0 |
| Urban | MU4 - Gen. Impervious | Total Area (ha) | None | None | 0.13 |
| Urban | MU4 - Gen. Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU4 - Gen. Pervious | Area Pervious (ha) | None | None | 0.52 |
| Urban | MU4 - Gen. Pervious | Total Area (ha) | None | None | 0.52 |
| Urban | MU4 - Road | Area Impervious (ha) | None | None | 0.17 |
| Urban | MU4 - Road | Area Pervious (ha) | None | None | 0 |

Only certain parameters are reported when they pass validation

| Node Type | Node Name | Parameter | Min | Max | Actual |
|---|---|---|---|---|---|
| Urban | MU4 - Road | Total Area (ha) | None | None | 0.17 |
| Urban | MU4 - Roof Bypass | Area Impervious (ha) | None | None | 0.34 |
| Urban | MU4 - Roof Bypass | Area Pervious (ha) | None | None | 0 |
| Urban | MU4 - Roof Bypass | Total Area (ha) | None | None | 0.34 |
| Urban | MU4 - Roof to Tank | Area Impervious (ha) | None | None | 0.34 |
| Urban | MU4 - Roof to Tank | Area Pervious (ha) | None | None | 0 |
| Urban | MU4 - Roof to Tank | Total Area (ha) | None | None | 0.34 |
| Urban | MU5 - Gen. Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU5 - Gen. Pervious | Area Pervious (ha) | None | None | 0.09 |
| Urban | MU5 - Gen. Pervious | Total Area (ha) | None | None | 0.09 |
| Urban | MU5 - Road | Area Impervious (ha) | None | None | 0.07 |
| Urban | MU5 - Road | Area Pervious (ha) | None | None | 0 |
| Urban | MU5 - Road | Total Area (ha) | None | None | 0.07 |
| Urban | MU5 - Roof Bypass | Area Impervious (ha) | None | None | 0.05 |
| Urban | MU5 - Roof Bypass | Area Pervious (ha) | None | None | 0 |
| Urban | MU5 - Roof Bypass | Total Area (ha) | None | None | 0.05 |
| Urban | MU5 - Roof to Tank | Area Impervious (ha) | None | None | 0.05 |
| Urban | MU5 - Roof to Tank | Area Pervious (ha) | None | None | 0 |
| Urban | MU5 - Roof to Tank | Total Area (ha) | None | None | 0.05 |
| Urban | MU6 - Gen. Impervious | Area Impervious (ha) | None | None | 0.01 |
| Urban | MU6 - Gen. Impervious | Area Pervious (ha) | None | None | 0 |
| Urban | MU6 - Gen. Impervious | Total Area (ha) | None | None | 0.01 |
| Urban | MU6 - Gen. Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU6 - Gen. Pervious | Area Pervious (ha) | None | None | 0.03 |
| Urban | MU6 - Gen. Pervious | Total Area (ha) | None | None | 0.03 |
| Urban | MU6 - Road | Area Impervious (ha) | None | None | 0.04 |
| Urban | MU6 - Road | Area Pervious (ha) | None | None | 0 |
| Urban | MU6 - Road | Total Area (ha) | None | None | 0.04 |
| Urban | MU6 - Roof | Area Impervious (ha) | None | None | 0.01 |
| Urban | MU6 - Roof | Area Pervious (ha) | None | None | 0 |
| Urban | MU6 - Roof | Total Area (ha) | None | None | 0.01 |
| Urban | MU7 - Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU7 - Pervious | Area Pervious (ha) | None | None | 1.196 |
| Urban | MU7 - Pervious | Total Area (ha) | None | None | 1.196 |
| Urban | MU8 - Gen. Impervious | Area Impervious (ha) | None | None | 0.58 |
| Urban | MU8 - Gen. Impervious | Area Pervious (ha) | None | None | 0 |
| Urban | MU8 - Gen. Impervious | Total Area (ha) | None | None | 0.58 |
| Urban | MU8 - Gen. Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU8 - Gen. Pervious | Area Pervious (ha) | None | None | 2.45 |
| Urban | MU8 - Gen. Pervious | Total Area (ha) | None | None | 2.45 |

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| Node Type | Node Name | Parameter | Min | Max | Actual |
|---|---|---|---|---|---|
| Urban | MU8 - Road | Area Impervious (ha) | None | None | 0.96 |
| Urban | MU8 - Road | Area Pervious (ha) | None | None | 0 |
| Urban | MU8 - Road | Total Area (ha) | None | None | 0.96 |
| Urban | MU8 - Roof Bypass | Area Impervious (ha) | None | None | 1.5 |
| Urban | MU8 - Roof Bypass | Area Pervious (ha) | None | None | 0 |
| Urban | MU8 - Roof Bypass | Total Area (ha) | None | None | 1.5 |
| Urban | MU8 - Roof to Tank | Area Impervious (ha) | None | None | 1.5 |
| Urban | MU8 - Roof to Tank | Area Pervious (ha) | None | None | 0 |
| Urban | MU8 - Roof to Tank | Total Area (ha) | None | None | 1.5 |
| Urban | MU9 - Gen. Impervious | Area Impervious (ha) | None | None | 0.27 |
| Urban | MU9 - Gen. Impervious | Area Pervious (ha) | None | None | 0 |
| Urban | MU9 - Gen. Impervious | Total Area (ha) | None | None | 0.27 |
| Urban | MU9 - Gen. Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU9 - Gen. Pervious | Area Pervious (ha) | None | None | 2.04 |
| Urban | MU9 - Gen. Pervious | Total Area (ha) | None | None | 2.04 |
| Urban | MU9 - Road | Area Impervious (ha) | None | None | 1.03 |
| Urban | MU9 - Road | Area Pervious (ha) | None | None | 0 |
| Urban | MU9 - Road | Total Area (ha) | None | None | 1.03 |
| Urban | MU9 - Roof Bypass | Area Impervious (ha) | None | None | 1.25 |
| Urban | MU9 - Roof Bypass | Area Pervious (ha) | None | None | 0 |
| Urban | MU9 - Roof Bypass | Total Area (ha) | None | None | 1.25 |
| Urban | MU9 - Roof to Tank | Area Impervious (ha) | None | None | 1.25 |
| Urban | MU9 - Roof to Tank | Area Pervious (ha) | None | None | 0 |
| Urban | MU9 - Roof to Tank | Total Area (ha) | None | None | 1.25 |

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**Failing Parameters**

| Node Type | Node Name | Parameter | Min | Max | Actual |
|---|---|---|---|---|---|
| Rain | MU1 - RW Tank | % Reuse Demand Met | 80 | None | 42.36 |
| Rain | MU2 - RW Tank | % Reuse Demand Met | 80 | None | 42.6644 |
| Rain | MU3 - RW Tank | % Reuse Demand Met | 80 | None | 41.5154 |
| Rain | MU4 - RW Tank | % Reuse Demand Met | 80 | None | 42.30 |
| Rain | MU5 - RW Tank | % Reuse Demand Met | 80 | None | 42.18 |
| Rain | MU8 - RW Tank | % Reuse Demand Met | 80 | None | 42.18 |
| Rain | MU9 - RW Tank | % Reuse Demand Met | 80 | None | 42.3823 |

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# MUSIC-*link* Report

| Project Details | | Company Details | |
|---|---|---|---|
| **Project:** | Highland Views Precinct G & H & PCT E | **Company:** | J. Wyndham Prince |
| **Report Export Date:** | 17/05/2019 | **Contact:** | David Crompton |
| **Catchment Name:** | 9784_MU01_Bypassing Catchments to Pct E | **Address:** | [redacted] |
| **Catchment Area:** | 0.94ha | **Phone:** | [redacted] |
| **Impervious Area*:** | 64.89% | **Email:** | [redacted] |
| **Rainfall Station:** | 67113 PENRITH | | |
| **Modelling Time-step:** | 6 Minutes | | |
| **Modelling Period:** | 1/01/1999 - 31/12/2008 11:54:00 PM | | |
| **Mean Annual Rainfall:** | 691mm | | |
| **Evapotranspiration:** | 1158mm | | |
| **MUSIC Version:** | 6.3.0 | | |
| **MUSIC-link data Version:** | 6.30 | | |
| **Study Area:** | Penrith | | |
| **Scenario:** | Penrith Development | | |

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

| Treatment Train Effectiveness | | Treatment Nodes | | Source Nodes | |
|---|---|---|---|---|---|
| **Node: Junction** | **Reduction** | **Node Type** | **Number** | **Node Type** | **Number** |
| **Flow** | 10.2% | Rain Water Tank Node | 3 | Urban Source Node | 14 |
| **TSS** | 1.9% | Bio Retention Node | 1 | | |
| **TP** | 5.1% | | | | |
| **TN** | 10.2% | | | | |
| **GP** | 22.8% | | | | |

## Comments

80% rainwater tank re-use is not required for residential development as per Penrith City Council WSUD Technical Guidelines

NOTE:

## Passing Parameters

| Node Type | Node Name | Parameter | Min | Max | Actual |
|---|---|---|---|---|---|
| Bio | Ex. Pct. E Bioretention | Hi-flow bypass rate (cum/sec) | None | 99 | 0.89 |
| Bio | Ex. Pct. E Bioretention | PET Scaling Factor | 2.1 | 2.1 | 2.1 |
| Urban | Bypass Roofs Precinct E - 1.99ha | Area Impervious (ha) | None | None | 1.99 |
| Urban | Bypass Roofs Precinct E - 1.99ha | Area Pervious (ha) | None | None | 0 |
| Urban | Bypass Roofs Precinct E - 1.99ha | Total Area (ha) | None | None | 1.99 |
| Urban | MU10 - Gen. Impervious | Area Impervious (ha) | None | None | 0.1 |
| Urban | MU10 - Gen. Impervious | Area Pervious (ha) | None | None | 0 |
| Urban | MU10 - Gen. Impervious | Total Area (ha) | None | None | 0.1 |
| Urban | MU10 - Gen. Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU10 - Gen. Pervious | Area Pervious (ha) | None | None | 0.16 |
| Urban | MU10 - Gen. Pervious | Total Area (ha) | None | None | 0.16 |
| Urban | MU10 - Road | Area Impervious (ha) | None | None | 0.1 |
| Urban | MU10 - Road | Area Pervious (ha) | None | None | 0 |
| Urban | MU10 - Road | Total Area (ha) | None | None | 0.1 |
| Urban | MU10 - Roof Bypass | Area Impervious (ha) | None | None | 0.05 |
| Urban | MU10 - Roof Bypass | Area Pervious (ha) | None | None | 0 |
| Urban | MU10 - Roof Bypass | Total Area (ha) | None | None | 0.05 |
| Urban | MU10 - Roof to Tank | Area Impervious (ha) | None | None | 0.05 |
| Urban | MU10 - Roof to Tank | Area Pervious (ha) | None | None | 0 |
| Urban | MU10 - Roof to Tank | Total Area (ha) | None | None | 0.05 |
| Urban | MU11 - Gen. Impervious | Area Impervious (ha) | None | None | 0.05 |
| Urban | MU11 - Gen. Impervious | Area Pervious (ha) | None | None | 0 |
| Urban | MU11 - Gen. Impervious | Total Area (ha) | None | None | 0.05 |
| Urban | MU11 - Gen. Pervious | Area Impervious (ha) | None | None | 0 |
| Urban | MU11 - Gen. Pervious | Area Pervious (ha) | None | None | 0.17 |
| Urban | MU11 - Gen. Pervious | Total Area (ha) | None | None | 0.17 |
| Urban | MU11 - Road | Area Impervious (ha) | None | None | 0.08 |
| Urban | MU11 - Road | Area Pervious (ha) | None | None | 0 |
| Urban | MU11 - Road | Total Area (ha) | None | None | 0.08 |
| Urban | MU11 - Roof Bypass | Area Impervious (ha) | None | None | 0.09 |
| Urban | MU11 - Roof Bypass | Area Pervious (ha) | None | None | 0 |
| Urban | MU11 - Roof Bypass | Total Area (ha) | None | None | 0.09 |
| Urban | MU11 - Roof to Tank | Area Impervious (ha) | None | None | 0.09 |
| Urban | MU11 - Roof to Tank | Area Pervious (ha) | None | None | 0 |
| Urban | MU11 - Roof to Tank | Total Area (ha) | None | None | 0.09 |
| Urban | Remaining 5.93 | Area Impervious (ha) | None | None | 2.368 |
| Urban | Remaining 5.93 | Area Pervious (ha) | None | None | 3.561 |
| Urban | Remaining 5.93 | Total Area (ha) | None | None | 5.93 |
| Urban | Road 3.30 | Area Impervious (ha) | None | None | 2.640 |
| Urban | Road 3.30 | Area Pervious (ha) | None | None | 0.659 |

Only certain parameters are reported when they pass validation

| Node Type | Node Name | Parameter | Min | Max | Actual |
|---|---|---|---|---|---|
| Urban | Road 3.30 | Total Area (ha) | None | None | 3.3 |
| Urban | Roofs Precinct E - 1.99ha | Area Impervious (ha) | None | None | 1.99 |
| Urban | Roofs Precinct E - 1.99ha | Area Pervious (ha) | None | None | 0 |
| Urban | Roofs Precinct E - 1.99ha | Total Area (ha) | None | None | 1.99 |

Only certain parameters are reported when they pass validation

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## Failing Parameters

| Node Type | Node Name | Parameter | Min | Max | Actual |
|---|---|---|---|---|---|
| Rain | MU10 - RW Tank | % Reuse Demand Met | 80 | None | 42.18 |
| Rain | MU11 - RW Tank | % Reuse Demand Met | 80 | None | 42.6452 |
| Rain | Rainwater Tanks Precinct E | % Reuse Demand Met | 80 | None | 19.98 |

Only certain parameters are reported when they pass validation

# APPENDIX D
## CONDITIONS OF CONSENT

PENRITH
CITY COUNCIL

# NOTICE OF DETERMINATION

## DESCRIPTION OF DEVELOPMENT

| | |
|---|---|
| Application number: | DA18/0427 |
| Description of development: | Torrens Title Subdivision x 45 Residential Lots, 5 Residue Lots & Public Roads & Site Remediation Works |
| Classification of development: | N/A |

## DETAILS OF THE LAND TO BE DEVELOPED

| | |
|---|---|
| Legal description: | Lot 239 DP 1224644 |
| Property address: | 100 Darug Avenue, GLENMORE PARK NSW 2745 |

## DETAILS OF THE APPLICANT

| | |
|---|---|
| Name & Address: | CCL Development<br>PO Box 4099<br>PENRITH PLAZA NSW 2750 |

## DECISION OF CONSENT AUTHORITY

In accordance with Section 4.18(1)(a) of the Environmental Planning and Assessment Act 1979, consent is granted subject to the conditions listed in Attachment 1.

Please note that this consent will lapse on the expiry date unless the development has commenced in that time.

| | |
|---|---|
| Date from which consent operates | 13 December 2018 |
| Date the consent expires | 13 December 2023 |
| Date of this decision | 23 November 2018 |

## POINT OF CONTACT

If you have any questions regarding this determination you should contact:

| | |
|---|---|
| Assessing Officer: | Lauren Van Etten |
| Contact telephone number: | [redacted] |

## NOTES

**Reasons**
The conditions in the attached schedule have been imposed in accordance with Section 4.17 of the Environmental Planning and Assessment Act 1979 (as amended).

**Conditions**
Your attention is drawn to the attached conditions of consent in Attachment 1.

**Certification and Advisory Notes**
You should also check if this type of development requires a Construction Certificate in addition to this development consent.

It is recommended that you read any Advisory Note enclosed with this Notice of Determination.

**Review of Determination**
The applicant may request Council to review its determination pursuant to Section 8.2 of the Environmental Planning and Assessment Act 1979 within six months of receiving this Notice of Determination.

These provisions do not apply to designated development, complying development or crown development pursuant to Section 8.2(2) of the Environmental Planning and Assessment Act 1979.

**Appeals in the Land and Environment Court**
The applicant can appeal against this decision in the Land and Environment Court within six months of receiving this Notice of Determination.

There is no right of appeal to a decision of the Independent Planning Commission or matters relating to a complying development certificate pursuant to Section 8.6(3) of the Environmental Planning and Assessment Act 1979.

**Designated Development**
If the application was for designated development and a written objection was made in respect to the application, the objector can appeal against this decision to the Land and Environment Court within 28 days after the date of this notice.

If the applicant appeals against this decision, the objector(s) will be given a notice of the appeal and the objector(s) can apply to the Land and Environment Court within 28 days after the date of this appeal notice to attend the appeal and make submissions at that appeal.

**Sydney Western City Planning Panel**
If the application was decided by the Sydney Western City Planning Panel, please refer to Section 2.16 of the Environmental Planning and Assessment Act 1979 (as amended) for any further regulations.

## OTHER APPROVALS

**APPROVAL BODIES**

| APPROVAL BODY NAME | DATE OF GENERAL TERMS OF APPROVAL | REF. NO. | NO. OF PAGES | RELEVANT LEGISLATION |
|---|---|---|---|---|
| Natural Resources Access Regulator | 2 October 2018 | IDAS1106746 | 3 | Water Management Act 2000 |
| NSW Rural Fire Service | 31 May 2018 | D18/5480 | 3 | Rural Fires Act 1997 |

The approval bodies listed above have provided General Terms of Approval for this development in accordance with the relevant legislation. A copy of these General Terms of Approval is provided with this development consent notice. Compliance with the relevant State Government departments' General Terms of Approval is required in conjunction with the following conditions listed in Attachment 1: Conditions of Consent issued by Penrith City Council.

## ATTACHMENT 1: CONDITIONS OF CONSENT

### General

1 The development must be implemented substantially in accordance with the following plans stamped approved by Council, the application form, and any supporting information received with the application, except as may be amended in red on the approved plans and by the following conditions.

| Drawing | Drawing Ref. | Revision | Prepared By | Dated |
|---|---|---|---|---|
| Subdivision Plan | - | F | Design & Planning | 01/08/18 |
| Landscape Plans | DA101- DA600 | 1 | Scott Carver | 27/07/18 |
| Engineering Plans Cover Sheet | 978410/DA01 | B | J. Wyndham Prince | - |
| Site Plan & Cut & Fill Plan | 978410/DA02 | B | J. Wyndham Prince | 31/07/2018 |
| Engineering Plan | 978410/DA03 | B | J. Wyndham Prince | 30/07/2018 |
| Site Sections | 978410/DA04 | B | J. Wyndham Prince | 30/07/2018 |
| Typical Sections | 978410/DA05 | B | J. Wyndham Prince | 30/07/2018 |
| Road Longitudinal Sections | 978410/DA06 | B | J. Wyndham Prince | 30/07/2018 |
| Road Longitudinal Sections | 978410/DA07 | B | J. Wyndham Prince | 30/07/2018 |
| Road Longitudinal Sections | 978410/DA08 | B | J. Wyndham Prince | 30/07/2018 |
| Basin Plan | 978410/DA09 | B | J. Wyndham Prince | 30/07/2018 |
| Basin Sections | 978410/DA10 | B | J. Wyndham Prince | 30/07/2018 |
| Soil & Water Management Plan | 978410/DA11 | B | J. Wyndham Prince | 31/07/2018 |

2 All relevant requirements of the Natural Resources Access Regulator and the Rural Fire Service's General Terms of Approval shall be satisfied **prior to the issue of a Construction Certificate and/or a Subdivision Certificate**, as relevant.

3 A **Construction Certificate** shall be obtained prior to the commencement of any engineering works.

4 The approved subdivision configuration should in no way be seen as pre-empting the separate consideration or approval of the future subdivision pattern for residue Lot 449. In this regard, a continuous perimeter road may still be required in accordance with the adopted Glenmore Park Stage 2 Precinct G Concept Plan should adjoining land not be available for development

5 The recommendations and necessary works outlined in the letter prepared by Geotechnique dated 24 November 2015 in regards to salinity management shall be implemented for the development.

6 **Prior to the issue of a Subdivision Certificate,** a matrix table shall be submitted to and endorsed by Penrith City Council detailing any infrastructure works, development contributions and/or land dedication required as a result of this development consent pursuant to the Glenmore Park Stage 2 Planning Agreement (No. 1), Second Council Planning Agreement and State Planning Agreement. All applicable infrastructure works, development contributions and/or land dedication shall be completed **prior to** (or concurrently with, in the case of land dedication) **the issue of a Subdivision Certificate or as detailed in the endorsed matrix table**.

7 Any proposed retaining walls shall be constructed of masonry or rock materials. This detail shall be reflected on the Construction Certificate plans.

8 Prior to the issue of a Construction Certificate, the Highland Views design guidelines are to be amended to detail steep lot controls and nominate affected lots. Details in this regard shall be approved by Council.

9 Dust suppression techniques are to be employed during works to reduce any potential nuisances to surrounding properties.

10 Mud and soil from vehicular movements to and from the site during works must not be deposited on the road.

11 **Prior to the issue of a Construction Certificate,** the Overarching Precinct G & H Stormwater Management Strategy Report prepared by J. Wyndham Prince dated December 2015 shall be amended and re-submitted to Council for approval. The amended report shall show the updated stormwater treatment strategy for Stage 4 in the precinct.

## Heritage/Archaeological relics

12 If any archaeological relics are uncovered during the course of the approved works, no further work shall be undertaken until further directed by Penrith City Council or the NSW Heritage Office.

The applicant is advised that depending on the possible significance of the relics, an archaeological assessment and an excavation permit under the Heritage Act 1977 may be required before any further work can be recommenced in that area of the site.

## Environmental Matters

13 Erosion and sediment control measures shall be installed **prior to the commencement of works on site** including approved clearing of site vegetation. The erosion and sediment control measures are to be maintained in accordance with the approved erosion and sediment control plan(s) for the development and the Department of Housing's “Managing Urban Stormwater: Soils and Construction” 2004.

14 No fill material shall be imported to the site until such time as a Validation Certificate (with a copy of any report forming the basis for the validation) for the fill material has been submitted to, considered and approved by Council.

The Validation Certificate shall:

- state the legal property description of the fill material source site,
- be prepared by an appropriately qualified person (as defined in Penrith Contaminated Land Development Control Plan) with consideration of all relevant guidelines (e.g. EPA, ANZECC, NH&MRC), standards, planning instruments and legislation,
- clearly indicate the legal property description of the fill material source site,
- provide details of the volume of fill material to be used in the filling operations,
- provide a classification of the fill material to be imported to the site in accordance with the Environment Protection Authority's "Environmental Guidelines: Assessment, Classification & Management of Non-Liquid Wastes" 1997, and
- (based on the fill classification) determine whether the fill material is suitable for its intended purpose and land use and whether the fill material will or will not pose an unacceptable risk to human health or the environment.

{Note: Penrith Development Control Plan 2014 defines an appropriately qualified person as "a person who, in the opinion of Council, has a demonstrated experience, or access to experience in hydrology, environmental chemistry, soil science, eco-toxicology, sampling and analytical procedures, risk evaluation and remediation technologies. In addition, the person will be required to have appropriate professional indemnity and public risk insurance."}.

If the Principal Certifying Authority or Penrith City Council is not satisfied that suitable fill materials have been used on the site, further site investigations or remediation works may be requested. In these circumstances the works shall be carried out prior to any further approved works.

15 Where a building is to take place on any land that is to be filled, such filling is to be compacted in accordance with AS 3798-1996. Certification is to be submitted to the Principal Certifying Authority by a Geotechnical Engineer verifying that the work has been undertaken prior to the commencement of the construction of any building.

If Penrith City Council is not the Principal Certifying Authority, a copy of the certification is to be submitted to Council for their reference.

16 All waste materials stored on-site during works are to be contained within a designated area such as a waste bay or bin to ensure that no waste materials are allowed to enter the stormwater system or neighbouring properties. The designated waste storage areas shall provide at least two waste bays / bins so as to allow for the separation of wastes, and are to be fully enclosed when the site is unattended.

17 All excavated material and other wastes generated as a result of the development are to be re-used, recycled or disposed of in accordance with the approved waste management plan.

Waste materials not specified in the approved waste management plan are to be disposed of at a lawful waste management facility. Where the disposal location or waste materials have not been identified in the waste management plan, details shall be provided to the Certifying Authority as part of the waste management documentation accompanying the Construction Certificate application.

All receipts and supporting documentation must be retained in order to verify lawful disposal of materials and are to be made available to Penrith City Council on request.

18 The operating noise level of plant and equipment shall not exceed 5dB(A) above the background noise level when measured at the boundaries of the premises. The provisions of the Protection of the Environment Operations Act 1997 apply to the development, in terms of regulating offensive noise.

19 Only clean and unpolluted water is to be discharged into Penrith City Council's stormwater drainage system. Liquid wastes suitable for discharge to the mains sewerare to be discharged in accordance with Sydney Water requirements.

If mains sewer is not available or if Sydney Water will not allow disposal to the sewer, then a licensed waste contractor is to remove the liquid waste from the premises to an appropriate waste facility.

The waste contractor and waste facility are to hold the relevant licences issued by the NSW Environment Protection Authority.

20 Should any "unexpected finds" occur during site excavation and earthworks, including, but not limited to, the identification/finding of contaminated soils, buried building materials, asbestos, odour and/or staining, works are to cease immediately and Council notified. Any such "unexpected finds" shall be addressed by an appropriately qualified environmental consultant.

All remediation works within the Penrith Local Government Area are considered to be Category 1 works under State Environmental Planning Policy No. 55 - Remediation of Land. Should any contamination be found during development works and should remediation be required, development consent is to be sought from Penrith City Council before the remediation works commence.

21 Site remediation works shall be carried out generally in accordance with the Remedial Action Plan, Highland Views, Stage 4, Mulgoa NSW (dated July 2018, ref J001046) as well as Penrith Development Control Plan, the ANZECC and NHMRC Guidelines (1992) and the applicable NSW Environment Protection Authority Guidelines.

On completion of the site remediation works, the following documentation is to be submitted for approval to the Principal Certifying Authority and Penrith City Council, if Council is not the Principal Certifying Authority:

- Written notification that the site remediation works have been completed is to be submitted **within 30 days of the said works having been completed**.
- A Validation Report, prepared by an appropriately qualified person as defined in Penrith Development Control Plan 2014, is to be submitted **before any engineering works can commence on the remediated site**. The report shall certify that the remediation works have been carried out in accordance with the approved Remedial Action Plan, relevant NSW Environment Protection Authority requirements and Penrith Development Control Plan 2014.

22 An appropriately qualified person/s (as defined in Penrith Development Control Plan 2014) shall:

a) Supervise the remediation works.

b) Supply Council with a copy of any relevant documentation for further testing carried out during the remediation works.

c) Address off site impacts and proposed management strategies where relevant.

d) (After completion of works) Certify by way of a Compliance Certificate or other written documentation that remediation works have been carried out in accordance with all conditions of this consent and that the site will not pose an unacceptable risk to human health or the environment (this information can be included in the Validation Report). A copy of the Compliance Certificate or other written documentation is to be submitted to the Principal Certifying Authority (PCA) and Penrith City Council if it is not the PCA.

The contact details of any appropriately qualified person/s engaged for the works shall be **provided with**

**the notice of commencement.**

23 Contaminated topsoil shall not be mixed with uncontaminated underlying natural soils.

24 **Prior to works commencing on site**, a Construction Noise Impact Assessment and Management Plan is to be prepared and submitted to Council for approval. This assessment is to consider (at minimum) the details of the construction program, construction methods, equipment and vehicles in association with the NSW Department of Environment and Change's "Interim Construction Noise Guideline" 2009.

The recommendations of the approved Management Plan are to be implemented and adhered to during the construction of the development.

## Utility Services

25 All services (water, sewer, electricity, telephone and gas), including the provision of service conduits and stub mains, are to be installed within the proposed public roads before final inspection of the engineering works.

**Prior to the issue of a Subdivision Certificate**, the following service authority clearances shall be obtained:

- a Section 73 Compliance Certificate under the Sydney Water Act 1994 shall be obtained from Sydney Water;
- a Notification of Arrangement Certificate from Endeavour Energy stating that satisfactory arrangements have been made for electricity supply to all proposed allotments in the subdivision, including any necessary easements; and
- a letter from an approved telecommunications service provider that satisfactory arrangements have been made for underground telephone services to all proposed allotments in the subdivision, including any necessary easements.

These clearances are to be submitted to the Principal Certifying Authority prior to the issue of a Subdivision Certificate.

26 **Prior to the issue of a Subdivision Certificate,** the Principal Certifying Authority shall be satisfied that telecommunications infrastructure may be installed to service the subdivision which complies with the following:

- The requirements of the Telecommunications Act 1997;
- For a fibre ready facility, the NBN Co's standard specifications current at the time of installation; and
- For a line that is to connect a lot to telecommunications infrastructure external to the premises, the line shall be located underground.

Unless otherwise stipulated by telecommunications legislation at the time of construction, the development must be provided with all necessary pits and pipes, and conduits to accommodate the future connection of optic fibre technology telecommunications.

**Prior to the issue of a Subdivision Certificate,** written certification from all relevant service providers that the telecommunications infrastructure is installed in accordance with the requirements above and the applicable legislation at the time of construction, must be submitted to the Principal Certifying Authority.

## Construction

27 Stamped plans, specifications, a copy of the development consent, the Construction Certificate and any other Certificates to be relied upon shall be available on site at all times during construction.

The following details are to be displayed in a maximum of 2 signs to be erected on the site:

- the name of the Principal Certifying Authority, their address and telephone number,
- the name of the person in charge of the work site and telephone number at which that person may be contacted during work hours,
- that unauthorised entry to the work site is prohibited,
- the designated waste storage area must be covered when the site is unattended, and
- all sediment and erosion control measures shall be fully maintained until completion of the construction phase.

Signage but no more than 2 signs stating the above details is to be erected:

- at the commencement of, and for the full length of the, construction works onsite, and
- in a prominent position on the work site and in a manner that can be easily read by pedestrian traffic.

All construction signage is to be removed when the Subdivision Certificate has been issued for the development.

28 Prior to the commencement of construction works:

(a) Toilet facilities at or in the vicinity of the work site shall be provided at the rate of one toilet for every 20 persons or part of 20 persons employed at the site.Each toilet provided must be:

- a standard flushing toilet connected to a public sewer, or
- if that is not practicable, an accredited sewage management facility approved by Council, or
- alternatively, any other sewage management facility approved by Council.

(b) All excavations and backfilling associated with the erection or demolition of a building must be executed safely and in accordance with the appropriate professional standards. All excavations associated with the erection or demolition of a building must be properly guarded and protected to prevent them from being dangerous to life or property.

(c) If an excavation associated with the erection or demolition of a building extends below the level of the base of the footings of a building on an adjoining allotment of land, the person causing the excavation to be made:

- must preserve and protect the building from damage, and
- if necessary, must underpin and support the building in an approved manner, and
- must, at least 7 days before excavating below the level of the base of the footings of a building on an adjoining allotment of land, give notice of intention to do so to the owner of the adjoining allotment of land and furnish particulars of the excavation to the owner of the building being erected or demolished.The owner of the adjoining allotment of land is not liable for any part of the cost of work carried out for the purposes of this condition, whether carried out on the allotment of land being excavated or on the adjoining allotment of land (includes a public road and any other public place).

(d) If the work involved in the erection or demolition of a building is likely to cause pedestrian or vehicular traffic in a public place to be obstructed or rendered inconvenient, or involves the enclosure of a public place, a hoarding or fence must be erected between the work site and the public place:

- if necessary, an awning is to be erected, sufficient to prevent any substance from, or in connection with, the work falling into the public place,
- the work site must be kept lit between sunset and sunrise if it is likely to be hazardous to persons in the public place, and
- any such hoarding, fence or awning is to be removed when the work has been completed.

29 Construction works or subdivision works that are carried out in accordance with an approved consent that involve the use of heavy vehicles, heavy machinery and other equipment likely to cause offence to adjoining properties shall be restricted to the following hours in accordance with the NSW Environment Protection Authority Noise Control Guidelines:

- Mondays to Fridays, 7am to 6pm
- Saturdays, 7am to 1pm if inaudible on neighbouring residential premises, otherwise 8am to 1pm
- No work is permitted on Sundays and Public Holidays.

Other construction works carried out inside a building/tenancy that do not involve the use of equipment that emits noise are not restricted to the construction hours stated above.

The provisions of the Protection of the Environment Operations Act 1997 in regulating offensive noise also apply to all construction works.

## Engineering

30 All roadworks, stormwater drainage works, associated civil works and dedications, required to effect the consented development shall be undertaken at no cost to Penrith City Council.

31 An Infrastructure Restoration Bond is to be lodged with Penrith City Council for development involving works around Penrith City Council's Public Infrastructure Assets. The bond is to be lodged with Penrith City Council prior to commencement of any works on site or prior to the issue of any Construction Certificate, whichever occurs first. The bond and applicable fees are in accordance with Council's adopted Fees and Charges.

An application form together with an information sheet and conditions are available on Council's website.

Contact Penrith City Council's City Works Department on (02) 4732 7777 or visit Penrith City Council's website for more information.

32 Prior to the issue of any Construction Certificate, a Section 138 Roads Act application, including payment of application and inspection fees, shall be lodged with and approved by Penrith City Council (being the Roads Authority for any works required in a public road). These works may include but are not limited to the following:

a) Vehicular crossings (including kerb reinstatement of redundant vehicular crossings)
b) Concrete footpaths and/or cycleways
c) Road opening for utilities and stormwater (including stormwater connection to Penrith City Council roads and other Penrith City Council owned drainage)
d) Road occupancy or road closures
e) The placement of hoardings, structures, containers, waster skips, signs, etc in the road reserve
f) Temporary construction access

All works shall be carried out in accordance with the Roads Act approval, the development consent, including the stamped approved plans, and Penrith City Council's specifications, guidelines and best engineering practice.

Contact Penrith City Council's City Works Department on (02) 4732 7777 or visit Penrith City Council's website for more information.

Note:

a) Where Penrith City Council is the Certifying Authority for the development, the Roads Act approval for the above works may be issued concurrently with the Construction Certificate.

b) All works associated with the Roads Act approval must be completed prior to the issue of any Occupation Certificate or Subdivision Certificate as applicable.

33 A Construction Certificate is to be approved by the Certifying Authority for the provision of engineering works (roads, drainage, earthworks and other subdivision works).

Prior to the issue of any Construction Certificate, the Certifying Authority shall ensure that the engineering plans are consistent with the stamped approved concept plans prepared by J. Wyndham Prince, Plan No.

978410/DA01 to 978410/DA11, revision B, dated 30/07/2018 and 31/07/2018, and that all subdivision works have been designed in accordance with the development consent, Penrith City Council's Design Guidelines for Engineering Works for Subdivisions and Developments, Engineering Construction Specification for Civil Works, Austroads Guidelines and best engineering practice.

The subdivision works may include but are not limited to the following:

- Public and private roads
- Stormwater management (quantity and quality)
- Interallotment drainage
- Private access driveways
- Sediment and erosion control measures
- Flood control measures
- Overland flow paths
- Traffic facilities
- Earthworks
- Bridges, culverts, retaining walls and other structures
- Landscaping and embellishment works

The Certifying Authority shall ensure that the engineering plans address the following requirements:

a) Provision of concrete turnaround facility for the basin access track to ensure Council's service vehicles can enter and exit the public road in a forward direction. The turnaround facility shall be designed to accommodate an 8.8m service vehicle.
b) Provision of temporary cul-de-sac heads at the ends of Road 104 and Road 105 for circulation of Council's waste collection vehicles. The turning heads shall be designed to accommodate Council's 12.5m heavy rigid vehicle with a minimum diameter of 20m and provision of guide posts around its perimeter.

The Construction Certificate must be supported by engineering plans, calculations, specifications and any certification relied upon.

Note:

a) Council's Development Engineering Department can provide this service. Contact Penrith City Council's Development Engineering Department on (02) 4732 7777 or visit Penrith City Council's website for more information.

34 Prior to the issue of any Construction Certificate, the Certifying Authority shall ensure that the proposed roads have been designed in accordance with Penrith City Council's Design Guidelines for Engineering Works for Subdivisions and Developments, Engineering Construction Specification for Civil Works and the following criteria:

| **Road No.** | **Road Reserve Width** | **Carriageway Width** | **Verge Width** | **Footpath / Cycleway Width** | **ESA** |
|---|---|---|---|---|---|
| Road 101A (Ch 330 - End) | 14.0m | 12.0m | 1.0m (both sides) | No footpath inside road boundary (both sides) | $5 \times 10^5$ |

| | | | | | |
|---|---|---|---|---|---|
| Road 104 (Ch 214 - Ch 402) | 12.8m | 8.0m | 1.0m (eastern side)<br><br>3.8m (western side) | No footpath inside road boundary (eastern side)<br><br>1.5m footpath (western side) | 5 x $10^4$ |
| Road 105 (Ch 47.4 - End) | 15.6m | 8.0m | 3.8m (both sides) | 1.5m footpath (both sides) | 5 x $10^4$ |
| Road 106 (Start - End) | 15.6m | 8.0m | 3.8m (both sides) | 1.5m footpath (both sides) | 5 x $10^4$ |

A copy of the pavement design prepared and certified by a suitably qualified geotechnical engineer must accompany the application for Construction Certificate.

35 A Stage 3 (detailed design) Road Safety Audit (RSA) shall be undertaken in accordance with Austroads Guide to Road Safety, Part 6: Road Safety Audit on the proposed roadworks by an accredited auditor who is independent of the design consultant. A copy of the RSA shall accompany the design plans submitted with the Construction Certificate or Roads Act application.

Prior to the issue of a Construction Certificate or Section 138 Roads Act approval, the Certifying Authority shall ensure that the recommendations of the RSA have been considered in the final design, through review of the Road Safety Audit Checklist, including Findings, Recommendations and Corrective Actions.

A copy of the Road Safety Audit shall be submitted to Penrith City Council by the applicant or Certifying Authority for information purposes.

36

The stormwater management system shall be provided generally in accordance with the Stormwater Compliance Letter prepared by J Wyndham Prince, reference 109784-10-Stage 4, dated 10 May 2018; the Highland Views updated MUSIC modeling dated 8 October 2018; and associated concept plan/s lodged for development approval, prepared by J. Wyndham Price, drawings 978410/DA01 to 978410/DA11, Revision B, dated 30 July and 31 July 2018 and **as amended in red**.

Engineering plans and supporting calculations for the stormwater management systems are to be prepared by a suitably qualified person and shall accompany the application for a Construction Certificate.

Where Council is not the certifying authority, an independent engineering consultant is to assess the final drainage plans and certify the stormwater quality requirements including MUSIC modelling meet the requirements of Council's WSUD Technical Guidelines.

**Prior to the issue of a Construction Certificate, the Certifying Authority shall ensure that the stormwater management system has been designed in accordance with Council's Stormwater Drainage for Building Developments and Water Sensitive Urban Design Policies.**

37 Prior to commencement of any works associated with the development, sediment and erosion control measures shall be installed in accordance with the approved Construction Certificate and to ensure compliance with the Protection of the Environment Operations Act 1997 and Managing Urban Stormwater series from the Office of Environment and Heritage.

The erosion and sediment control measures shall remain in place and be maintained until all disturbed areas have been rehabilitated and stabilised.

38 Work on the subdivision shall not commence until:

- a Construction Certificate (if required) has been issued,
- a Principal Certifying Authority has been appointed for the project, and
- any other matters prescribed in the development consent for the subdivision and the Environmental Planning and Assessment Act and Regulation have been complied with.

A Notice of Commencement of works is to be submitted to Penrith City Council five (5) days prior to commencement of engineering works or clearing associated with the subdivision.

39 Street lighting is to be provided for all new and existing streets within the proposed subdivision to Penrith City Council's standards.

40 All earthworks shall be undertaken in accordance with AS 3798 and Penrith City Council's Design Guidelines for Engineering Works for Subdivisions and Developments and Engineering Construction Specification for Civil Works.

The level of testing shall be determined by the Geotechnical Testing Authority/Superintendent in consultation with the Principal Certifying Authority.

41 Soil testing is to be carried out to enable each lot to be classified according to AS 2870 "Residential Slabs and Footings". The results shall be submitted to Penrith City Council prior to the issue of the Subdivision Certificate.

42 Upon completion of all works in the road reserve, all verge areas fronting and within the development are to be turfed. The turf shall extend from the back of kerb to the property boundary, with the exception of concrete footpaths, service lids or other infrastructure which is not to be turfed over. Turf laid up to concrete footpaths, service lids or other infrastructure shall finish flush with the edge.

43 Prior to the issue of a Subdivision Certificate, the Principal Certifying Authority shall ensure that all works associated with a Section 138 Roads Act approval or Section 68 Local Government Act approval have been inspected and signed off by Penrith City Council.

44 Prior to the issue of a Subdivision Certificate, the Principal Certifying Authority shall ensure that all subdivision works required by this consent have been satisfactorily completed or that suitable arrangements have been made with Penrith City Council for any outstanding works.

45 Prior to the issue of a Subdivision Certificate, the Principal Certifying Authority shall ensure that the:

a) Stormwater management systems (including on-site detention and water sensitive urban design)

- Have been satisfactorily completed in accordance with the approved Construction Certificate and the

requirements of this consent.

- Have met the design intent with regard to any construction variations to the approved design.
- Any remedial works required to been undertaken have been satisfactorily completed.

Details of the approved and constructed system/s shall be provided as part of the Works-As-Executed drawings.

46 The Subdivision Certificate 88b instrument shall include a restriction as to user and positive covenant relating to the:

a) Stormwater management systems (including on-site detention and water sensitive urban design)

The restriction as to user and positive covenant shall be in Penrith City Council's standard wording as detailed in Penrith City Council's Stormwater and Drainage for Building Developments policy.

47 Prior to the issue of a Subdivision Certificate, and installation of regulatory / advisory linemarking and signage, plans are to be lodged with Penrith City Council and approved by the Local Traffic Committee.

Note:

a) Contact Penrith City Council's Engineering Services Department on (02) 4732 7777 for further information on this process.

b) Allow eight (8) weeks for approval by the Local Traffic Committee.

c) Applicable fees are indicated in Council's adopted Fees and Charges.

48 Prior to the issue of a Subdivision Certificate, an application for proposed street names must be lodged with and approved by Penrith City Council and the signs erected on-site.

The proposed names must be in accordance with Penrith City Council's Street Naming Policy.

Note:

a) Contact Penrith City Council's Engineering Services Department on (02) 4732 7777 for advice regarding the application process and applicable fees.

b) Allow eight (8) weeks for notification, advertising and approval.

49 Prior to the issue of a Subdivision Certificate, a bond for the final layer of outstanding asphalt works (AC Bond) is to be lodged with Penrith City Council.

The final layer of asphalt on all roads shall not to be placed without the written consent of Penrith City Council (consent will generally be provided when 80% of the housing within the subdivision has been completed).

The value of the bond shall be determined in accordance with Penrith City Council's adopted Fees and Charges.

Note:

a) Contact Penrith City Council's Engineering Services Department on (02) 4732 7777 for further information relating to bond requirements.

50 Prior to the issue of a Subdivision Certificate, an Outstanding Works Bond for the construction, landscaping and implementation of Basin 2 is to be lodged with Penrith City Council.

The Outstanding Works bond will be refunded once the stormwater management system works have been completed to Penrith City Council's satisfaction and a separate Maintenance Bond has been lodged with Penrith City Council.

The value of the bonds shall be determined in accordance with Penrith City Council's adopted Fees and Charges

Note:

a) Contact Penrith City Council's Engineering Services Department on (02) 4732 7777 for further information relating to bond requirements.

51 Prior to the issue of a Subdivision Certificate, a Maintenance Bond is to be lodged with Penrith City Council for all subdivision works.

The value of the bond shall be determined in accordance with Penrith City Council's adopted Fees and Charges.

Note:

a) Contact Penrith City Council's Engineering Services Department on (02) 4732 7777 for further information relating to bond requirements.

52 Prior to the issue of a Subdivision Certificate, the following compliance documentation shall be submitted to the Principal Certifying Authority. A copy of the following documentation shall be provided to Penrith City Council where Penrith City Council is not the Principal Certifying Authority:

a) Works As Executed (WAE) drawings of all civil works. The WAE drawings shall be marked in red on copies of the stamped Construction Certificate drawings signed, certified and dated by a registered surveyor or the design engineer. The WAE drawings shall be prepared in accordance with Penrith City Council's Engineering Construction Specification for Civil Works.

b) The WAE drawings shall clearly indicate the 1% Annual Excedence Probability flood lines (local and mainstream flooding).

c) The WAE drawings shall be accompanied by plans indicating the depth of cut / fill for the entire development site. The survey information is required to show surface levels and site contours at 0.5m intervals. All levels ate to be shown to AHD.

d) CCTV footage in DVD format to Penrith City Council's requirements and a report in "SEWRAT" format for all drainage as identified as Council's future assets. Any damage that is identified is to be rectified in

consultation with Penrith City Council.

e) A copy of all documentation, reports and manuals required by Section 2.6 of Penrith City Council's WSUD Technical Guidelines for handover of stormwater management facilities to Penrith City Council.

f) Surveyor's Certificate certifying that all pipes and services are located wholly within the property or within appropriate easements and that no services encroach boundaries, private or public lands.

g) Documentation for all road pavement materials used demonstrating compliance with Penrith City Council's Engineering Construction Specification for Civil Works.

h) A Geotechnical Report certifying that all earthworks and road formation have been completed in accordance with AS 3798 and Penrith City Council's Design Guidelines and Construction specifications. The report shall include:

- Compaction reports for road pavement construction
- Compaction reports for bulk earthworks and lot regarding.
- Soil classification for all residential lots
- Statement of Compliance

i) Structural Engineer's construction certification of all structures

j) A slope junction plan for interallotment drainage lines indicating distances to boundaries and depths.

k) Soil testing for each lot to be classified according to AS 2870 "Residential Slabs and Footings".

53 Prior to handover of WSUD assets, Council requires all of the following conditions to be met:

- The WSUD assets / measures are constructed and operate in accordance with the approved design specifications / parameters and any other specific design agreements previously entered into with Council
- The performance of the WSUD measure(s) has been validated, which must include the provision of a Performance Validation Report supporting the performance of the WSUD measure
- Where applicable, the build up of sediment has resulted in no more than a 10% reduction of operational volume asset inspections for defects have been completed and, if any defects are found, rectified to the satisfaction of Council
- The WSUD infrastructure is to the satisfaction of Council, structurally and geotechnically sound (this will require the submission of documents demonstrating that such infrastructure has been certified by suitably qualified persons)
- Design drawings have been supplied in a format acceptable to Council
- Works-as-executed (WAE) drawings have been supplied for all infrastructure in a format and level of accuracy acceptable to Council
- Other relevant digital files have been provided (e.g. design drawings, surveys, bathymetry, models, etc)
- Landscape designs have been supplied, particularly those detailing the distribution of functional vegetation, i.e. vegetation that plays a role in water quality improvement (clearance certificates from the landscape architect will need to be supplied)
- The condition of the infrastructure associated with the land complies with the approved design specification
- Filter media infiltration rates are within 10% of the rates of the design parameters for the filtration system concerned
- Comprehensive operation and maintenance manuals (including indicative costs) have been provided. The plan should include details on the following:

i. Site description (area, imperviousness, land use, annual rainfall, topography, etc)

ii. Site access description

iii. Likely pollutant types, sources and estimated loads

iv. Locations, types and descriptions of measures proposed

v. Operation and maintenance responsibility

vi. Inspection methods (including inspection checklists)

vii. Maintenance methods (frequency, equipment and personnel requirements)

viii. Landscape and weed control requirements

ix. Operation and maintenance costs

x. Waste management and disposal options

xi. Reporting

54 The bio-retention basin is to be maintained by the proponent as a sediment basin until 80% of housing construction is completed and retained in the ownership of the proponent during this period. After 80% of housing has been constructed the sediment basin is to be decommissioned and the bio-retention basin completed. After completion of the bio-retention basin has occurred, the proponent is to maintain the bio-retention basin for a period of 3 years after which time handover is permitted (see separate conditions relating to handover).

55 **Prior to the issue of a Construction Certificate**, the following information is to be submitted to Council for review:

- A detailed operation and maintenance manual which includes estimated costing
- Detailed construction plans including all calculations, drawings and designs which are consistent with the design parameters used in the modelling and approved concept designs from the Development Application

56 Handover of assets to Council will not occur until Council is satisfied that they are constructed in with the approved plans, conditions of approval and all certification requirements have been complied with:

a) Vegetated systems (e.g. bioretention measure/s) are required to remain 'on maintenance' for a minimum period of three (3) years or as otherwise approved and a performance-based inspection has been undertaken with Council.
b) The on-maintenance period for all vegetated systems can be considered as on-maintenance once 80% of dwellings are substantially completed within the development sub-catchment associated with the relevant treatment measure.
c) Certification is required to be provided for the installation of the filter media to demonstrate that the media complies with the approved specifications. At a minimum compliance is required with the "Guidelines for Soil Filter Media in Bioretention Systems" (Facility for Advancing Water Biofiltration).
d)Photographs of the construction of the vegetated system are required as part of certification. A minimum of one labelled, date stamped photograph is required to be provided following each of the following construction phases:

i. Installation of the overflow pit and bulking out / trimming profiling

ii. Installation of under drainage

iii. Installation of cleanout points

iv. Installation of drainage layer

v. Installation of transition layer

vi. Installation of filtration media

vii. Laying of geofabric protection for build-out phase

viii. Laying of turf temporary protection layer

ix. Final planting

A licensed surveyor is required to undertake an 'as constructed' survey of the bioretention device elements. The survey data is to demonstrate that design grades and levels have been achieved to the required tolerances. A copy of the survey is required to be lodged as part of the certification.

57 Sight lines at road intersections are not to be compromised by crests in adjacent future subdivision stages and are to be in accordance with Austroads Guidelines and Australian Standards.

58 Future dwelling construction must ensure that driveways are not situated within 10m of intersections.

59 Prior to the issue of a Subdivision Certificate, an Outstanding Works Bond is to be lodged with Penrith City Council for the construction of a shared path on the southern side of Road 106 from approximately Ch 75 to Ch 190, in accordance with the Development Control Plan for Glenmore Park Stage 2. The bond shall be refunded when the rezoning proposal for Glenmore Park Stage 3 is approved and the amended shared path network for the subdivision finalized. If the rezoning proposal is not approved, the shared path shall be constructed in accordance with the current Development Control Plan for Glenmore Park Stage 2.

## Landscaping

60 All landscape works are to be constructed in accordance with the stamped approved plans and Sections C6 Landscape Design of Penrith Council's Development Control Plan 2014.

61 The approved landscaping for the site must be constructed by a suitably qualified and experienced landscape professional.

62 All plant material associated with the construction of approved landscaping is to be planted in accordance with the Tree Planting Specification prescribed in Penrith Development Control Plan 2014.

63 All landscape works are to meet industry best practice and the following relevant Australian Standards:

- AS 4419 Soils for Landscaping and Garden Use,
- AS 4454 Composts, Soil Conditioners and Mulches, and
- AS 4373 Pruning of Amenity Trees.

## Subdivision

64 **Prior to the issue of a Subdivision Certificate**, the original Linen Plan and six (6) copies shall be submitted. The Linen Plan must indicate that:

a) It is intended to dedicate all new roads to the public as road.

All required drainage easements, rights of way, restrictions and covenants are to be included on the linen plan.

All dedications of roads/drainage are to be undertaken at no cost to Penrith City Council.

The following information is to be shown on one (1) copy of the plan.

- The location of all buildings and/or other permanent improvements shall comply with any statutory boundary clearances or setbacks as defined by the Building Code of Australia and Council's resolutions.
- All existing services are wholly contained within the lot served and/or covered by an appropriate easement.

65 The linen plan of subdivision is to be supported by an 88B instrument creating the following:

a) Easements for support - the provision of an easement for support to cover any retaining walls or embankments that extend into the lots if the batters are steeper than 5:1.
b) Residue allotments restriction - no development or building shall be allowed or be permitted to remain on the named lot unless satisfactory arrangements have been made with Penrith City Council for services water, sewer, electricity and telephone, any outstanding contributions or consolidation with adjoining lots.
c) Easements for maintenance and repair 900mm wide benefitting lots with zero lot lines.
d) Restriction regarding future housing compliance with the Highland Views Design Guidelines.
e) Restriction regarding nomination of lots requiring stepped building designs as per the Highland Views Design Guidelines.
f) Restriction regarding single storey construction on Lots 442-451to provide a suitable transition at the rural interface.

66 **Prior to the issue of a Subdivision Certificate,** street trees are to be planted in accordance with the stamped approved plans.

67 A Surveyor's Certificate is to be lodged with the application for a Subdivision Certificate that certifies that all pipes and services are located wholly within the property or within appropriate easements and that no services encroach boundaries.

## Section 94

68 This condition is imposed in accordance with the ***Glenmore Park Stage 2 Voluntary Planning Agreement No. 2.*** Based on the current rates detailed in the accompanying schedule attached to this Notice, $796,725.00 is to be paid to Council **prior to a Subdivision Certificate being issued** for this development (the rates are subject to quarterly reviews). If not paid within the current quarterly period, this contribution will be reviewed at the time of payment in accordance with the VPA.

Council should be contacted prior to payment to ascertain the rate for the current quarterly period. The invoice accompanying this consent should accompany the contribution payment.

## Payment of Fees

69 All roadworks, dedications and drainage works are to be carried out at the applicant's cost.

70 Prior to the commencement of any works on site, all fees associated with Penrith City Council-owned land and infrastructure shall be paid to Council. These fees include Road Opening fees and Infrastructure Restoration fees.

## Certification

71 A Subdivision Certificate is to be obtained **prior to the release of the linen plan of subdivision**. The Subdivision Certificate will not be issued if any of the conditions in this consent are outstanding.

72 Prior to the commencement of any earthworks or construction works on site, the proponent is to:
(a) employ a Principal Certifying Authority to oversee that the said works carried out on the site are in accordance with the development consent and related Construction Certificate issued for the approved development, and with the relevant provisions of the Environmental Planning and Assessment Act and accompanying Regulation, and
(b) submit a Notice of Commencement to Penrith City Council.

The Principal Certifying Authority shall submit to Council an "Appointment of Principal Certifying Authority" in accordance with Section 81A of the Environmental Planning and Assessment Act 1979.

Information to accompany the Notice of Commencement
Five (5) days before any earthworks or construction/demolition works are to commence on site (including the clearing site vegetation), the proponent shall submit a "Notice of Commencement" to Council in accordance with Section 81A of the Environmental Planning and Assessment Act 1979.

## SIGNATURE

| | |
|---|---|
| Name: | Lauren Van Etten |
| Signature: | |

For the Development Services Manager