JORDAN SPRINGS RETIREMENT LIVING

RETIREMENT VILLAGE STORMWATER MANAGEMENT STRATEGY

Lend Lease Retirement Living

June 2018

SUSTAINABLE CERTIFICATION
ISO9001:2008
AS/NZS 4801:2001
ISO 14001:2004
Endorsed
Integrated Management System

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Jordan Springs Retirement Village – Stormwater Management Strategy

Issue	Amendment	Author	Reviewer	Approved
A	Issue for DA	CR	DC	DC
		14/06/2018	14/06/2018	14/06/2018
File Name:	110487 - 02 - Development Application Phase_264_JWP Documents\110487-02-Retirement Village.docx			

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1 INTRODUCTION

J. Wyndham Prince has been engaged by Lend Lease to undertake a "*Stormwater Management Strategy*" to support the Stage 2 Development Application (DA) for the proposed Jordan Springs Retirement Living (JSRL) development.

The JSRL development is located within the Western Precinct of Jordan Springs, near - Penrith, and is planned to be developed in two (2) Stages. Stage 1 – Residential Subdivision and Stage 2 – Retirement Village (Seniors Living). Both Stages 1 and 2 are subject to an overarching water quality strategy which was endorsed by Penrith City Council for all areas of Jordan Springs. This overarching strategy is entitled *"St Marys Project Western Precinct Plan – Water, Soils and Infrastructure Report"* (SKM, 2009) and was developed to set the framework for Water Management for the entire Jordan Springs Release Area.

The main purpose of this report is to review the proposed Retirement Village JSRL development layout and make comparisons on the footprint, assumptions and principles which were adopted in the overarching strategy.

As part of this assessment, it was recognised that the Retirement Village JSRL layout has an increased density from what was originally considered in the overarching strategy (SKM, 2009). A water quality assessment has therefore been undertaken in order to determine what additional water quality measures are required in order to deliver consistent pollutant management with the original intent.

Importantly, the water quality treatment measures which are identified in this report are proposed to be **in addition to** the regional wetlands which have already been constructed across the Jordan Springs Release Area. Together, these local and regional devices will ensure that water quality treatment is provided to the same level that was achieved in the overarching strategy (SKM, 2009).

Details of the Stormwater Management Strategy is provided in the following Sections 2 to 8.

2 THE SITE

The overall JSRL development is located within the Western Precinct of Jordan Springs, near Penrith, and is planned to be developed in two (2) stages (refer to Plate 2.1):

- **Stage 1** of the JRSL development (which is being submitted under a separate DA) consists of thirty one (31) residential lots together with local access roads and an entry road off Jordan Springs Boulevard. Stage 1 is generally bound by forested areas (owned by the National Parks) and is located directly alongside the Secret Garden Dam (Pond Ex1).

- **Stage 2** of the JRSL development (which is the subject of this report) consists of a community centre, fifty one (51) senior villas, two (2) apartment complexes, private road(s), carparking, basement carparking and landscaping / open space.

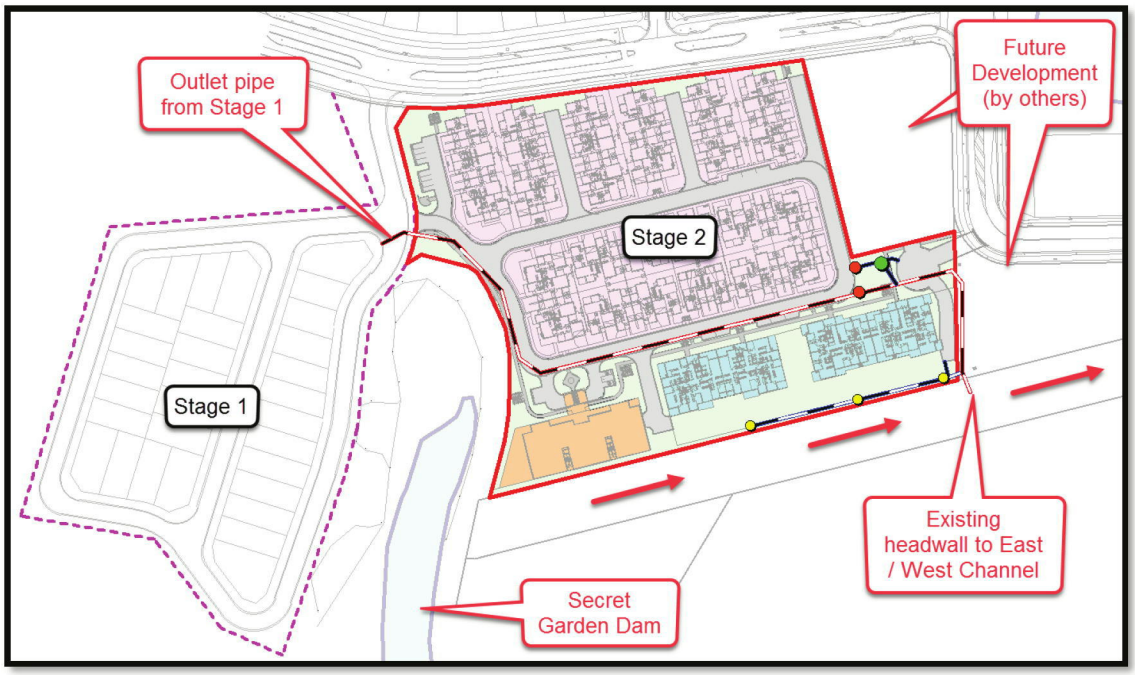

Plate 2.1 - JSRL Development (Stage 2)

In 2013 – 14, trunk stormwater infrastructure was constructed in the local area to facilitate for the future JRSL development areas. This trunk infrastructure included the construction of an East / West open channel which extends from the existing Secret Garden Dam (Pond Ex1), alongside the proposed Stage 2 area before ultimately draining to the East Lake (Pond A1).

Provision was made as part of this channel design to receive flows from the future Retirement Village JSRL development area, with a 1200mm dia outlet pipe stub and headwall being provided.

It is noted that Stage 1 will include an outlet pipe through Stage 2 for discharge to the East / West open channel. The outlet pipe has been proposed in order to avoid discharging into the Secret Garden Dam and potentially impacting water quality. The alignment of the outlet pipe will generally follow Stage 2 roadways, however will remain separate from the Stage 2 internal stormwater network. The two (2) pipe systems could potentially be connected at a point after the Stage 2 water quality measures and prior to discharge to the channel.

In addition to Stages 1 and 2 of the JSRL development, there are also two (2) other future developments in the vicinity of works. These are located just to the North – East and East of Stage 2 (being developed by others).

For the purposes of the design, allowance is made for the outlet pipe to cater for flows from both Stages 1 and 2 along with these additional future areas. These will be subject to separate DA submissions.

3 PREVIOUS STUDIES / REPORTS

3.1 St Marys Project Western Precinct Plan – Water, Soils and Infrastructure Report (SKM, 2009)

The overarching Stormwater Management Strategy for the Jordan Springs Release Area is entitled *"St Marys Project Western Precinct Plan – Water, Soils and Infrastructure Report"* (SKM, 2009).

This report was prepared by SKM (who are now known as Jacobs) to provide background information in describing existing and proposed conditions and also to provide Water, Soil and Infrastructure Management Strategies for the Western Precinct of the St Marys site. The study was a broad level investigation and identified the strategy for water cycle management, trunk drainage, groundwater, salinity and service infrastructure for the Western Precinct site.

The Strategy has been endorsed by Penrith City Council and consequently all DAs proposed within Jordan Springs are required to comply with this Strategy.

Water Quantity

The Strategy included a series of detention basins across the Precinct to manage flows for the 0.5 EY up to the 1% AEP event. Each basin was proposed to be constructed offline with a low flow bypass. The locations of these detention basins are shown on Plate 3.1 below.

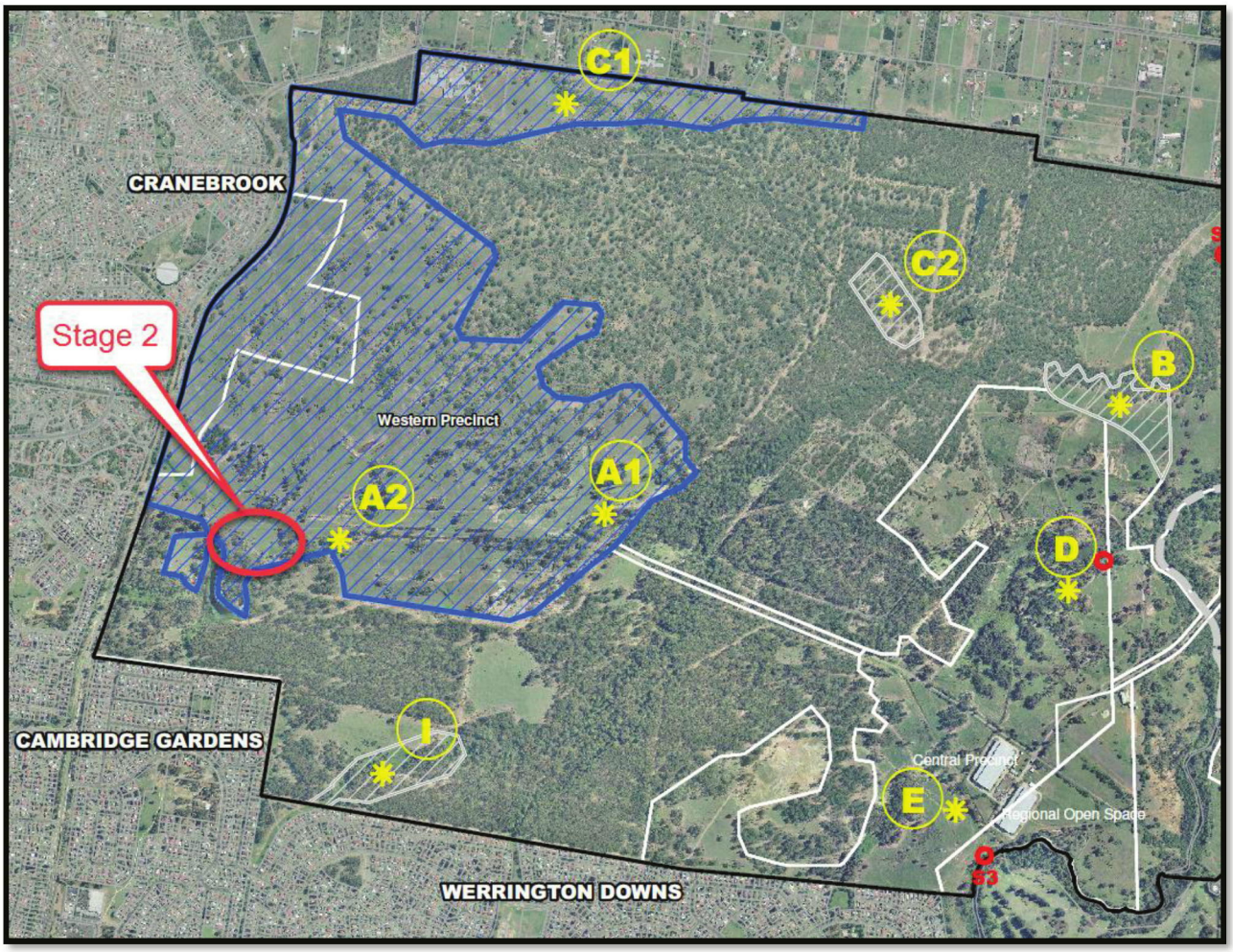

Plate 3.1 – Proposed Basin Locations Western and Central Precincts (Source: SKM, 2009)

Water Quality

The Strategy included a series of wetlands across the Precinct to provide water quality treatment. As part of the overarching Strategy (SKM, 2009), SKM undertook a water quality assessment in MUSIC (version 3.01) to determine the land take for each of these wetlands to ensure there is no net increase in annual pollutant loads into the receiving waterway.

The MUSIC modelling adopted a conservative approach for the Precinct Plan assessment. This approach excluded any additional WSUD controls and / or GPTs upon each individual DA with modelling solely focusing upon sizing of the wetlands.

Table B.3 of the Strategy (SKM, 2009) provided indicative sizes for each of the wetlands across the Western and Central Precinct. Most notably, the wetlands in the vicinity of the Stage 2 site included Pond A1 (sized at 1 Ha) and Pond A2 (sized at 1.8 Ha). The existing pond "EX1" which is directly located downstream from Stage 1 (and alongside Stage 2) was conservatively excluded from providing water quality treatment.

Plates 3.2 and 3.3 show the catchment plan and the MUSIC model layout as presented in the report (SKM, 2009). The Stage 2 JSRL development is located within sub-catchment 6,7,8,25.

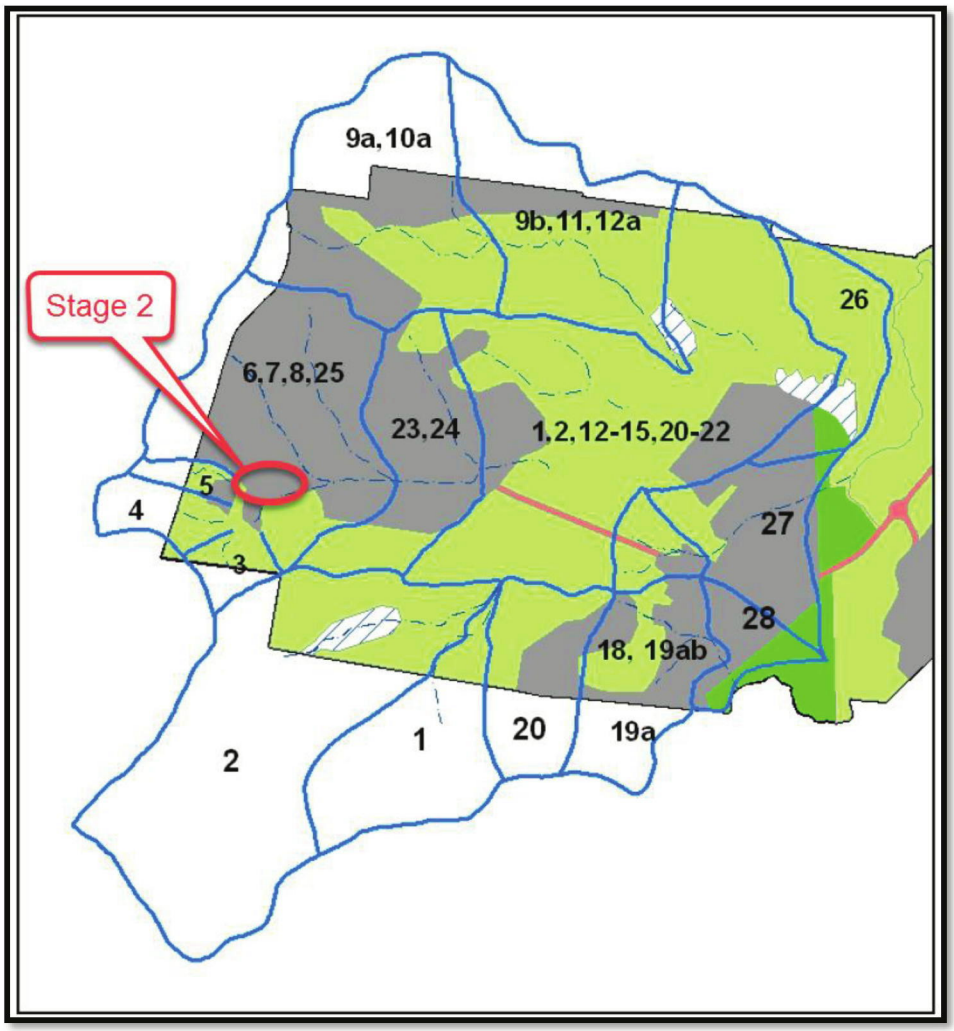

Plate 3.2 – MUSIC Model Sub-catchment Areas
(Source: SKM, 2009)

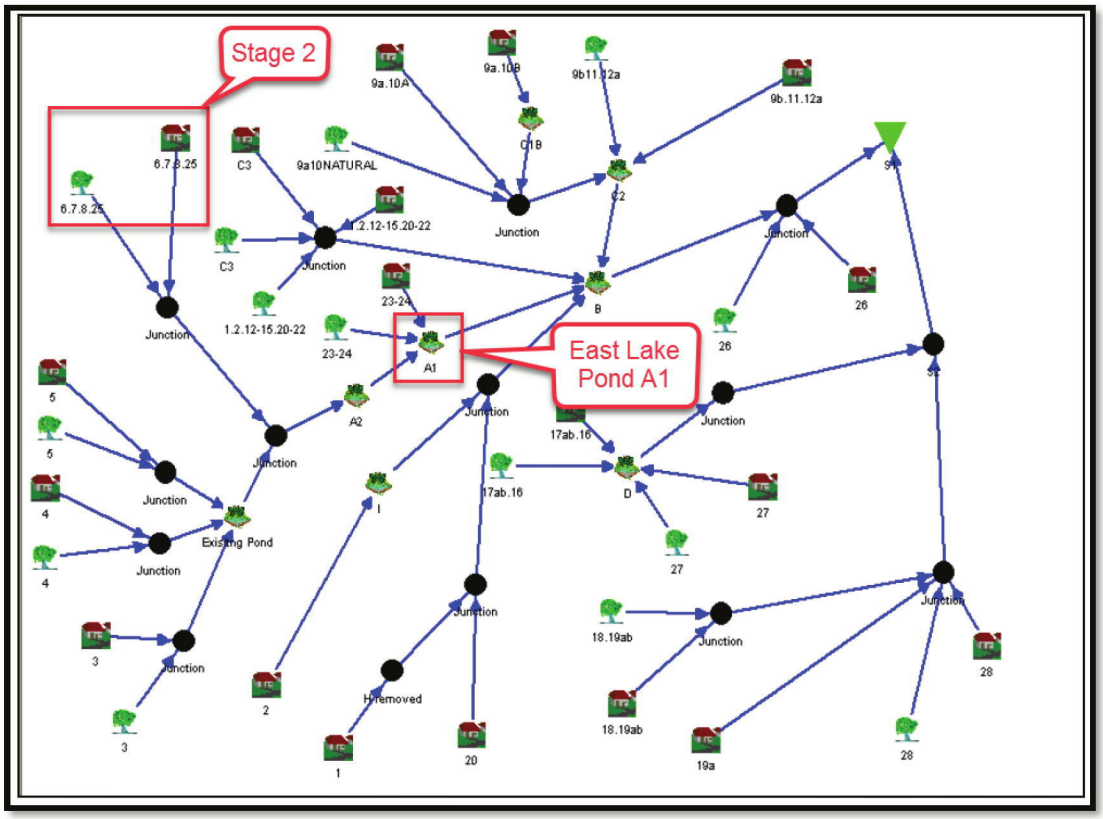

Plate 3.3 – Water Quality MUSIC Model Layout for Western and Central Catchment (Source: SKM, 2009)

A1.2 Jordan Springs Western Precinct Development – Upstream Extended East / West Open Channel Report (SKM, 2013)

Trunk stormwater infrastructure has already been constructed as part of the overall Jordan Springs Release Precinct. This infrastructure includes the downstream wetland (East Lake -Pond A1) which is approximately 2.9 Ha in size along with a formalised East / West open channel. Refer to Plate 3.4.

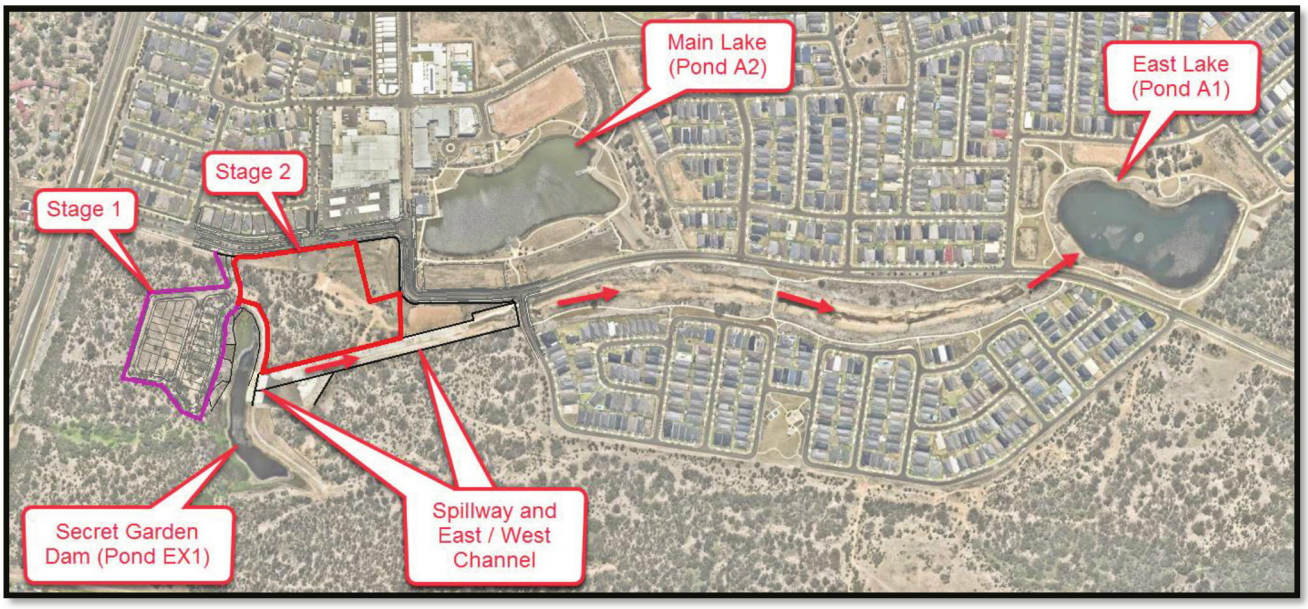

Plate 3.4 – Existing Trunk Infrastructure

The detailed design of the East / West open channel was prepared by SKM with modelling details provided within the *"Jordan Springs Western Precinct Development – Lend Lease – Upstream Extended East / West Open Channel Report"* (SKM, 2013).

A HEC-RAS assessment was undertaken to convey the 1% AEP event along the corridor without any flood impacts surrounding the future development areas. Results showed that the construction of the channel, together with filling and raising of surrounding development areas would prevent inundation of lots. It was noted that there some "slightly further" flooding in the regional park.

4 STAGE 2 ASSESSMENT

The proposed layout for Stage 2 of the JSRL development is shown on Plate 4.1 below and Figure 1.

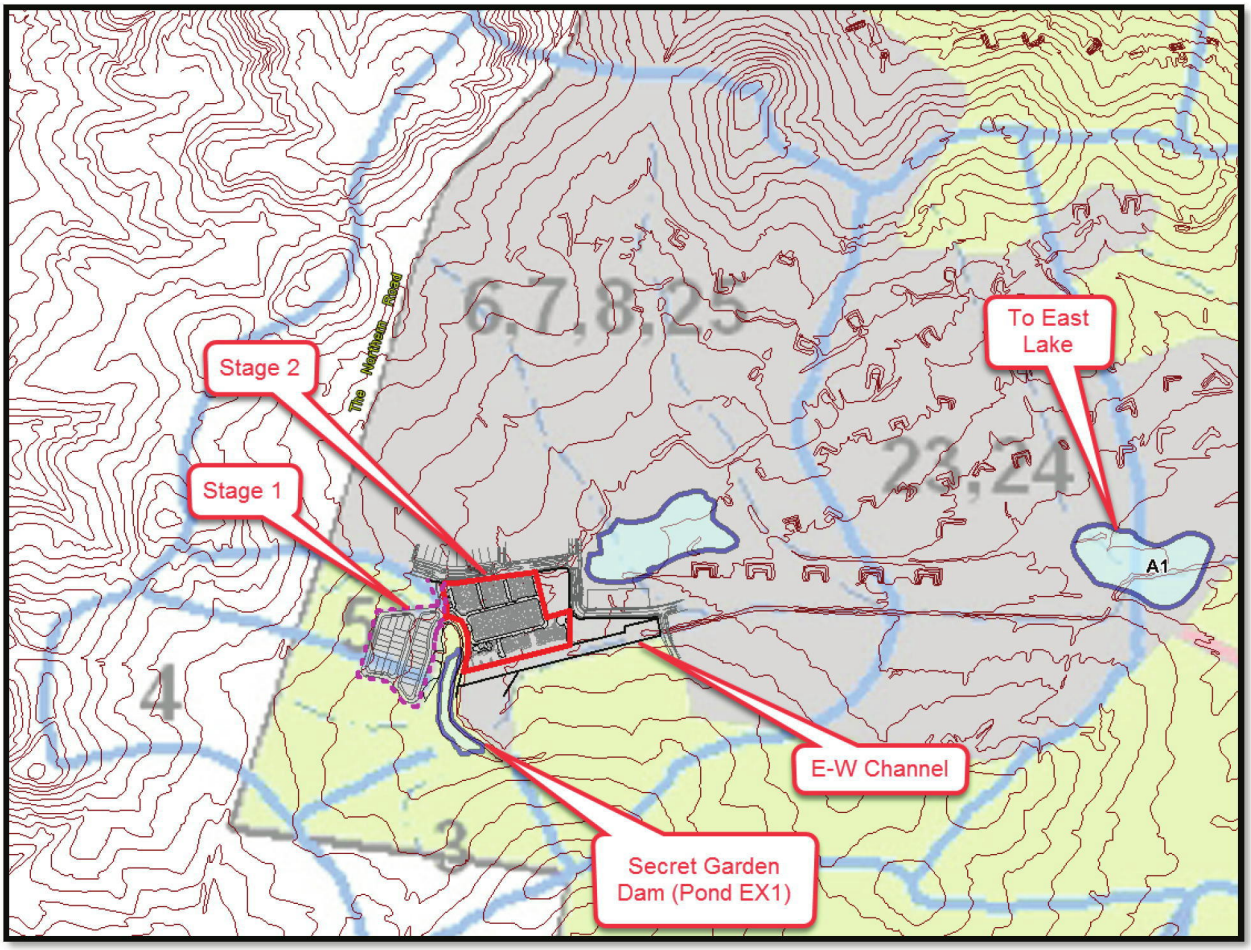

Plate 4.1 – Stage 2 Overlay with MUSIC Model Sub-Catchments

The underlying "grey" area shows the "developed" areas which were considered in the overarching strategy (SKM, 2009).

The comparison confirms that Stage 2 of the JRSL development was considered as "developed" by SKM when sizing the wetlands across the Precinct. Water quality treatment for Stage 2 has therefore been provided by the regional devices which have been constructed as part of the Jordan Springs Release on the basis of it being a residential subdivision.

Stage 2 of the JRSL development is located entirely within SKM's sub-catchments 6,7,8,25. The overarching strategy allowed for this area to drain into the East - West channel and then onto Pond A1 (i.e the East Lake).

As noted in Section 2 however, Stage 2 of the JSRL development includes a community centre, fifty-one (51) senior villas, two (2) apartment complexes, private road(s), carparking, basement carparking and landscaping / open space.

Importantly, it is recognised that the density associated with Stage 2 is higher than what was originally considered in the overarching strategy (which was at 70% impervious). A water quality (MUSIC) assessment has therefore been undertaken to determine the additional water quality devices which are required, to supplement / work in conjunction with the regional devices. The assessment has been made based on the **total pollutant loads** generated by JSRL Stage 2 with the objectives being consistent with the overarching report (SKM, 2009) which targeted *"the combined annual pollutant export from the developed site does not exceed the existing"*

Details of the Stormwater Management Strategy is discussed in Sections 5 and 6.

5 STORMWATER MANAGEMENT STRATEGY

A critical consideration for the Stormwater Management Strategy is the long term ecological sustainability of the JSRL development. To maintain stormwater quality at the required levels, a 'treatment train' approach is proposed where various types of pollutants are removed by a number of devices acting in series. The strategy focuses on mitigating the impacts of the development on the total water cycle and maximising the environment, social and economic benefits achievable by utilising responsible and sustainable stormwater management practices.

A range of Water Sensitive Urban Design (WSUD) measures are proposed to be adopted as part of the Stage 2 JSRL development to ensure that water quality treatment is delivered in accordance with the overarching strategy (SKM, 2009).

Importantly, these proposed Stage 2 devices will be provided **in addition** to the regional wetlands which have already been constructed across the broader Jordan Springs Release Area.

5.1 Water Sensitive Urban Design Measures

5.1.1 Cartridge Filter Systems

Cartridge filtration systems are underground pollution control devices that treat first flush flows. The unit consists of a vault containing a number of cartridges each loaded with media that targets specific pollutants. Each cartridge has a maximum treatable flowrate of approximately 0.7 - 1.6 litres per second. For an example of a typical cartridge filter system arrangement, refer to Plate 5.1.

Plate 5.1 - Typical Cartridges Filter System (During Construction)

5.1.2 Gross Pollutant Traps (GPTs)

GPT devices are typically provided at the outlet to stormwater pipes. These systems operate as a primary treatment to remove litter, vegetative matter, free oils, 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 and wet sump gross pollutant traps.

Manufacturers now also offer a new range of dry GPTs as possible end of line solutions to water quality management. Such proprietary devices offer the ability for gross pollutants to be captured in a cage at high level, which enables pollutants such as litter, leaves and debris to remain dry rather than being stored in a wet sump.

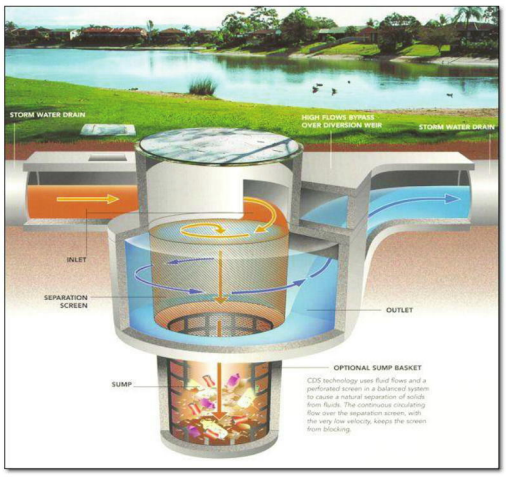

Plate 5.2 – Vortex Style GPT

Comment: A generic style GPT (which conservatively excludes treatment of TSS, TP and TN) has been proposed as part of the pipe system prior to connecting to the Storm Filter cartridges. By adopting a generic style node, this provides flexibility during in the future detailed design stage. Given the internal road network upon Stage 2 JSRL will remain under private ownership, there is also opportunity for Pit Filter Inserts to be adopted within internal pits (if desired) instead of an end of line GPT. See Section 5.1.3.

5.1.3 Pit Filter Inserts (Enviropod)

In theory, inlet pit filter inserts have several advantages over end of pipe GPT's, such as providing a dry, at source collection of litter, vegetative matter and sediment as well as allowing for staged construction works without having to provide additional / temporary GPT units. They also prevent premature clogging of end pipe GPT's during the construction / building phases.

In practice, feedback from various Councils have found that inlet pit filter inserts result in an unreasonable maintenance burden, particularly through access for cleaning and damage / vandalism. Pit inserts may be appropriate in low density residential areas where on street parking is unlikely or not permitted and where additional primary / secondary treatment measures are provided downstream in case of pit insert failure.

Inlet pit filter inserts (Enviropods) operate as a primary treatment to remove litter, vegetative matter, free oils, grease and coarse sediments prior to discharge to downstream (Secondary and Tertiary) treatment devices. Enviropods have several advantages over end of pipe GPT's such as providing a dry, at source collection of litter, vegetative matter and sediment as well as allowing for staged construction works without having to provide additional / temporary GPT's.

Enviropods will provide an at source mechanism for treatment of gross pollutants. Refer to Plate 5.2 below for an example of an Enviropod.

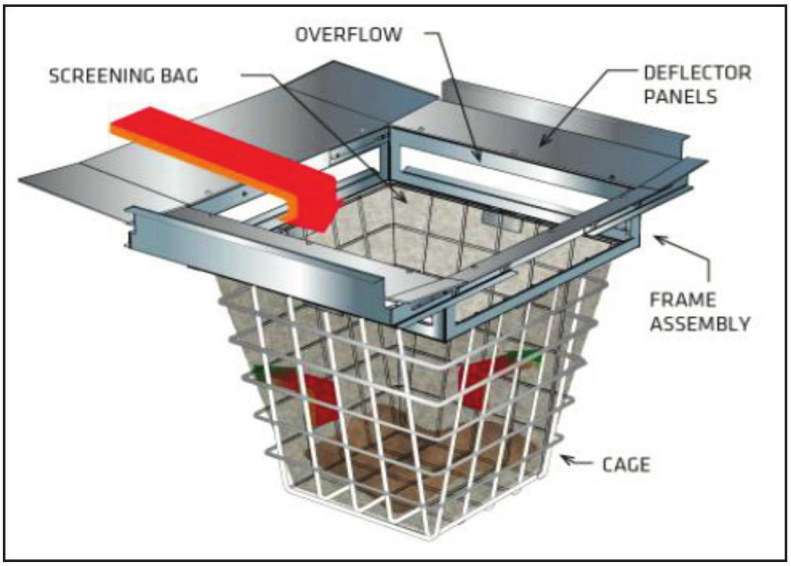

Plate 5.2 - Pit Filter Insert (Enviropod)

Comment: Enviropods are considered to be a viable option for Stage 2 of the JSRL development for those common areas which can be easily accessed given the site will remain under community title.

5.1.4 Rainwater Tanks

Rainwater tanks are sealed tanks designed to contain rainwater collected from roofs.

Rainwater tanks provide the following main functions:

- Allow the reuse of collected rainwater as a substitute for mains water supply, for use for toilet flushing, laundry, or garden watering.
- The water collected can be reused as a substitute for mains water supply either indoors (toilet flushing) or outdoors (garden watering). Rainwater tanks can be either above ground or underground. Above ground tanks can be placed on stands to prevent the need of installing a pump to distribute the water. Such systems are referred to as gravity systems. Pressure systems require a pump and can be either above or below ground tanks.

Tanks can be constructed of various materials such as ColorbondTM, galvanised iron, polymer or concrete.

Comment: Rainwater tanks are effective in removing suspended solids and a small amount of nutrient pollutants. They are also effective in reducing overall runoff volumes. The effectiveness of rainwater tanks is also increased when plumbed in for internal use.

6 WATER QUALITY ANALYSIS

A stormwater quality analysis for Stage 2 of the JSRL development has been 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 has been adopted for this study.

The model provides a number of features relevant for the Stage 2 JSRL development:

- It is able to model the potential nutrient reduction benefits of a variety of devices such as gross pollutant traps, pit inserts, rainwater tanks and stormwater cartridge systems and it incorporates mechanisms to model stormwater re-use as a treatment technique
- It provides mechanisms to evaluate the performance of water quality against Council standards, and in this instance against the overarching regional strategy (SKM, 2009).

6.1 Methodology

As discussed in Section 4, MUSIC modelling has been undertaken to determine what additional Stage 2 water quality devices are required, to supplement / work in conjunction with the regional devices (wetlands) in order to achieve the overall **total pollutant load** targets for Jordan Springs.

This need for modelling is associated with the increased density proposed across Stage 2 JSRL development (which was previously modelled by SKM as 70% impervious).

The following methodology has therefore been adopted:

- Create a single “Urban” node within MUSIC (based on SKM modelling parameters)
- Run MUSIC and determine the “Mean Annual Pollutant Loads” (kg / year) for Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN) thus to establish the target for JSRL.
- Create a MUSIC model representing the Stage 2 JSRL development, based on Council’s WSUD Design Policy (PCC, 2015) and Technical Guidelines (PCC, 2015)
- Run MUSIC and determine the “Mean Annual Pollutant Loads” (kg / year) for TSS, TP and TN based on the increased density yield.
- Determine the size and configuration of additional water quality target measures which are required to reduce the “Mean Annual Pollutant Loads” down to t what was achieved in the overarching Strategy (SKM, 2009).

Refer to Details in Section 6.2 to 6.4.

6.2 MUSIC Model Layout and Catchments

6.2.1 Stage 2 as per Overarching Strategy (SKM, 2009)

A MUSIC model representing Stage 2 of the JSRL development has been prepared to be consistent with the parameters adopted in the overarching strategy (SKM, 2009). This included the creation of a single “Urban” node encompassing the following:

- Catchment Area of 3.15 Ha
- 70% fraction impervious - as per Section A.2 of overarching report (SKM, 2009)
- Event mean concentrations – as per Table B.2 of overarching report (SKM, 2009).

Table 6.1 -Event Mean Concentrations
(Source: Table B.2 - SKM, 2009 Report)

Site conditions	TSS (mg/L) Storm Flow (Wet)	TSS (mg/L) Base Flow	TP (mg/L) Storm Flow (Wet)	TP (mg/L) Base Flow	TN (mg/L) Storm Flow (Wet)	TN (mg/L) Base Flow
Existing	50	7.9	0.075	0.075	1	0.75
Developed	110	12.6	0.2	0.1	1.5	1.0

6.2.2 *Stage 2 as per Council guidelines*

A MUSIC model has also been undertaken to represent Stage 2 based on Council's *WSUD Design Policy* (PCC, 2015) and Technical Guidelines (PCC, 2015).

In accordance with Council's *Water Sensitive Urban Design Technical Guidelines* (PCC, 2015), the landuse has been split into roof, road, urban pervious and urban impervious. A further split has also been provided to consider roof areas from the community centre and the apartment areas.

A catchment plan has been split into four (4) distinct sub-catchments across Stage 2. Refer to Plate 6.1 and Figure 1 for further details.

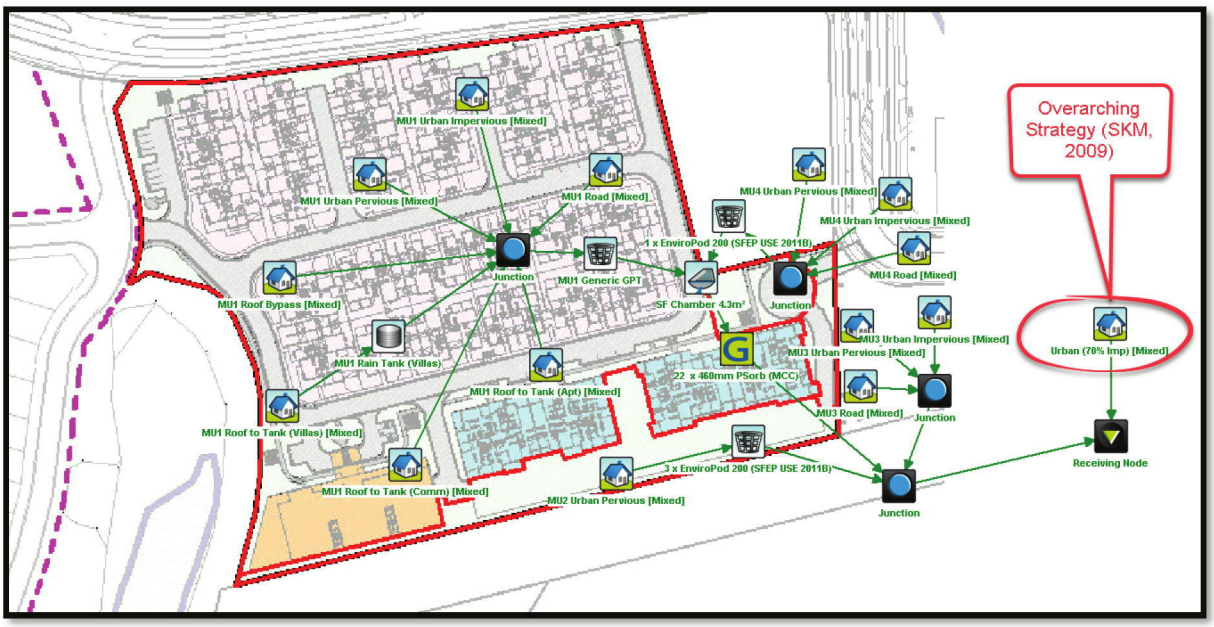

Plate 6.1 - MUSIC Catchments / Layout

6.2.3 *Modelling Inputs and Assumptions*

The *MUSIC* Modelling has adopted the following inputs and assumptions:

- All areas have been measured digitally and divided into lot, road, open space and roof areas. For a full breakdown of areas, refer to the summary table in Appendix A.
- The overall fraction impervious for the lots (i.e senior villas) was applied as medium density (i.e 85% impervious) in line with Council standards.

  The lot area was then split as followings:

  - Roof area (measured)
  - Urban Impervious (85% minus roof area)
  - Urban Pervious (remaining 15% of lot).
- Urban Impervious nodes then also include footpaths / impervious areas (measured digitally) whilst the Urban Pervious nodes include Open Space areas (measured digitally).
- The roof areas for the community centre and apartment were applied to the model. As a conservative approach, no rainwater tanks were considered on either landuse.
- 2.0 kL rainwater tanks on each Senior Living lot, 1.6 kL re-usable storage above top-up
- Rainwater tank re-use as stated has been assumed for each villa as follows:
  - Lots < 320m^2 - 0.08 kL/day internal use & 25 kL/year as PET- Rain
- A generic style GPT node has conservatively been adopted in MUSIC to provide flexibility in detailed design. The generic node has adopted no TSS, TP or TN removal. Such devices may include proprietary GPTs. Refer to Appendix A for parameters adopted.
- Enviropods (200 µm) have been placed within surface inlet pits at four (4) locations (three (3) in catchment MU2 and one (1) in catchment MU4). Each Enviropod node includes an assumed bypass of 20 l/s (per pit). It is assumed that surface water runoff around the property will drain to these pits for preliminary treatment.
- StormFilter Cartridge Systems consisting of 460 mm high StormFilter cartridge units have been adopted. The StormFilter chamber is provided such that the false floor of the chamber is at or above the 4EY (3-month ARI) tailwater within the drainage system immediately downstream. The device will consist of a 4.3 m^2 concrete chamber with twenty two (22) x 460 mm StormFilter Cartridges to cater for Stage 2. The StormFilters are placed into a single unit which will act as a secondary treatment device prior to discharging into the East – West open channel.

6.3 Pollutant Load Estimates

"Total annual pollutant load" estimates were derived from the results of the *MUSIC* model based on a stochastic assessment of Stage 2 JSRL and the proposed water quality treatment system.

A comparison of the "total annual pollutant load" estimates for TSS, TP, TN and Gross Pollutants between (a) the overarching model; and (b) the increased lot yield breakup is presented in Table 6.2.

Table 6.2 - Comparison of Mean Annual Pollutant Load Estimates (Stage 2 Only)

Pollutant	Total Pollutant Loads - Overarching Model	Total Pollutant Loads (Stage 2 JSRL)	
		No treatment	With treatment
	(kg/yr)	(kg/yr)	(kg/yr)
TSS	1990	1980	1190
TP	3.25	4.13	2.56
TN	22.7	32.3	22.6
GP	439	383	5.47

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The results indicate that the proposed treatment system (which includes on-lot rainwater tanks, gross pollutant traps, Enviropod pit inserts and StormFilter cartridges), will reduce the "total annual pollutant load" estimates exiting Stage 2 JSRL to be consistent with the results of the overarching report (SKM, 2009).

Table 6.3 below shows the overall MUSIC results for the Western and Central catchment form the overarching strategy (SKM, 2009). It is noted that the Stage 2 JSRL developed area is only a very small portion of the overall scheme.

Table 6.3 - MUSIC Results for Western and Central Catchment (Source: SKM, 2009)

	TSS (kg/year)	TP (kg/year)	TN (kg/year)
Existing	240,000	426	3,900
Developed, no controls	357,000 (+50%)	620 (+46%)	4,920 (+26%)
Developed, with controls	113,000 (-53%)	290 (-32%)	3,620 (-7%)

Note: The % values in brackets are the results compared to the existing case. The target reduction is -5% for the worst pollutant which provides a safety margin. The actual margin is in the range of approximately 5% for TN and up to 50% for TSS.

These proposed treatment measures across Stage 2 JSRL will therefore work in conjunction with the regional devices to achieve the overall objectives of ensuring that *"the combined annual pollutant export from the developed site does not exceed the existing" (SKM, 2009).*

7 WATER QUANTITY MANAGEMENT

7.1 Stormwater Detention

As discussed in Section 3.1, stormwater detention is provided across the Jordan Springs Release Area via a series of detention basins which manage the 0.5 EY event up to the 1% AEP event.

A review of the "*Figure A.2 RAFTS Model Schematic Layout – Proposed"* and "*Table A.3 Sub-catchment Parameters – Proposed*" indicates that Stage 2 of the JSRL development is located in sub-catchments 8 and 25. Refer to Plate 7.1 and Table 7.1 below.

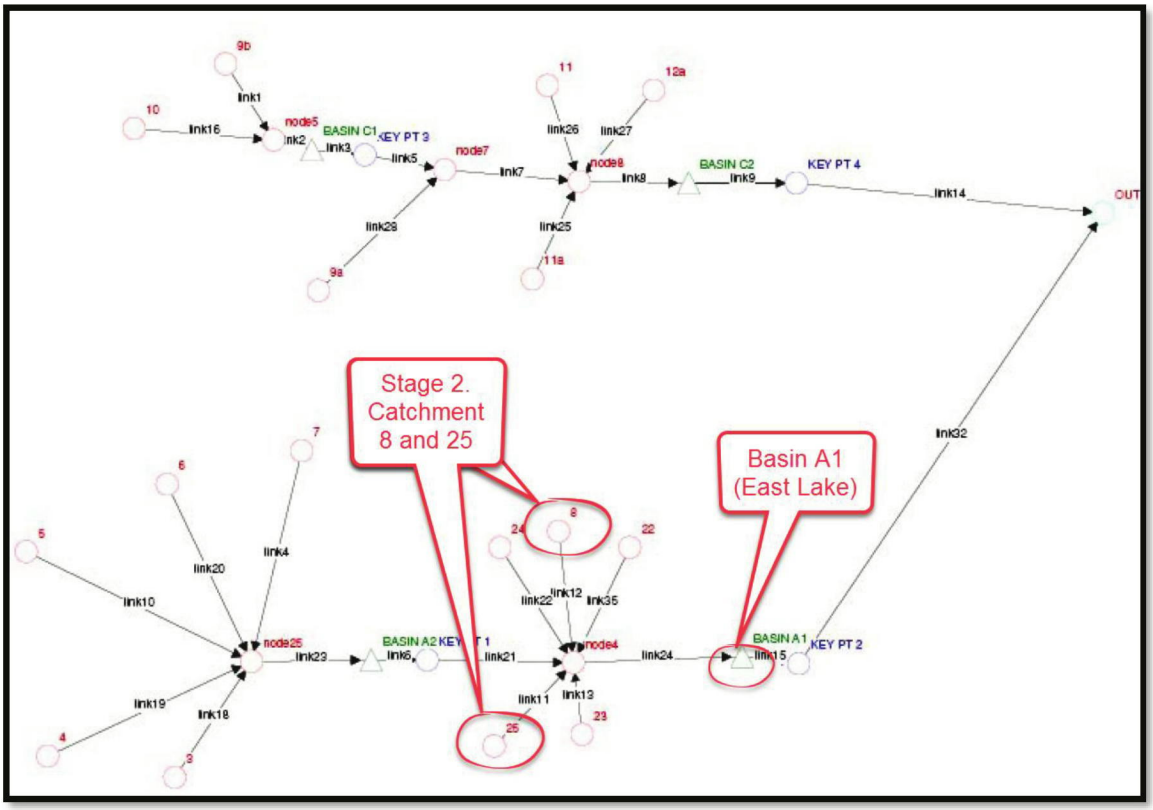


Plate 7.1 – RAFTS Catchments / Layout

Table 7.1 - Sub-catchment Parameters - Proposed
(Source: Table A.2 - SKM, 2009 Report)

Catchment	Area (ha)	% Impervious	Catchment	Area (ha)	% Impervious
3	13.6	46	24	56.4	70
4	21.3	65	22	15.8	73
5	8.7	66	9a	71.9	54
6	49.9	72	10	62.2	94
7	27.9	100	9b	33.5	96
8	51.9	100	11	33.7	3
25	9.95	92	11a	21	36
23	18.5	74	12a	21.6	8

Importantly, it is noted that proposed catchments 8 and 25 (which encompasses Stage 2 JSRL) were modelled at 100% and 92% fraction impervious in the overarching strategy. Both of these catchments have therefore been modelled at a higher fraction impervious than the current proposed density for Stage 2 JSRL.

Table 7.2 -Predicted Developed Peak Flows – 1% AEP Event
(Source: Table A.6 - SKM, 2009 Report)

Event	Peak flows (m^3/s)	
	Existing	Proposed
Key Point 1	25	15
Key Point 2	35	28
Key Point 3	21	21
Key Point 4	28	28

Table 7.3 -Predicted Developed Peak Flows – 0.5 EY Event
(Source: Table A.7 - SKM, 2009 Report)

Event	Peak flows (m^3/s)	
	Existing	Proposed
Key Point 1	10	4
Key Point 2	12	9
Key Point 3	8	6
Key Point 4	10	4

Key point 2 is located downstream of "Basin A1" (East Lake) with Tables 7.2 and 7.3 showing that pre - post flows across both the 0.5 EY and 1% AEP event are comfortably achieved.

On this basis, the regional "Basin A1" (East Lake) has been sized appropriately and no further detention is required as part of this current DA submission.

8 CONCLUSION

This Stormwater Management Strategy has been prepared to support the DA submission for Stage 2 of the JSRL development to Penrith City Council. The assessment has been prepared to determine the additional water quality measures which are required to ensure that the "total annual pollutant load" estimates exiting Stage 2 JSRL are consistent with the results of the overarching report (SKM, 2009) for Jordan Springs.

The Stormwater Management Strategy for Stage 2 of the JSRL development includes a "treatment train" of primary and secondary treatment measures, namely:

- Rainwater tank on each Senior Living lot (2kL)
- One (1) Gross Pollutant Trap
- Four (4) Pit Filter Inserts (Enviropods)
- Twenty two (22) 460 mm high StormFilter Cartridges with a 4.3 m^2 precast StormFilter chamber

Each of these treatment measures proposed across Stage 2 of the JSRL development will work in conjunction with the regional devices to achieve the overall objectives of ensuring that *"the combined annual pollutant export from the developed site does not exceed the existing" (SKM, 2009).*

With regards to water quantity management, a review of the overarching strategy (SKM, 2009) has indicated that the developed sub-catchments (which encompass the Stage 2 JSRL development area) has already considered a high fraction impervious (92% - 100%). On this basis, the regional "Basin A1" (East Lake) has been sized appropriately and no further detention is required as part of this current DA submission.

We trust that the information is suitable to support the DA submission for Stage 2 of the JSRL development. Should you require any further information, please do not hesitate to contact the undersigned on (02) 4720 3342.

Yours faithfully
J. WYNDHAM PRINCE

CHRIS RANDALL
Senior Water Resources Engineer

9 REFERENCES

Penrith City Council (2015). Water Sensitive Urban Design Policy.

Penrith City Council (2015). Water Sensitive Urban Design Technical Guidelines

Sinclair Knight Mertz (2009) *St Marys Project Western Precinct Plan – Water, Soils and Infrastructure Report*

Sinclair Knight Mertz (2013) *Jordan Springs Western Precinct – Upstream Extended East / West Open Channel Report*

APPENDIX A

Appendix A – MUSIC Parameters and Input

110487 - MUSIC MODELLING WORKSHEET
JORDAN SPRINGS RETIREMENT VILLAGE - STAGE 2

	Catchment Division								Node Inputs						
Catchment	Total Catchment Area (ha)	Impervious Areas (paths, driveways, etc) (ha)	Roofed (Community Centre) (ha)	Roofed (Apartment) (ha)	Lot Area	Roofed (Residential) (ha)	Road Area (ha)	Open Space (ha)	Road (ha)	Roof to Tank (Comm Centre)(ha)	Roof to Tank (Apartment) (ha)	Roof to Tank (Villas) (ha)	Roof Bypass (ha)	Urban Impervious	Urban Pervious
MU1	2.75	0.06	0.16	0.27	1.47	0.862	0.494	0.284	0.494	0.082	0.136	0.431	0.649	0.448	0.505
MU2	0.27	0.00	0.00	0.00	0.00	0.000	0.000	0.271	0.000	0.000	0.000	0.000	0.000	0.000	0.271
MU3	0.06	0.00	0.00	0.00	0.00	0.000	0.031	0.022	0.031	0.000	0.000	0.000	0.000	0.002	0.022
MU4	0.08	0.01	0.00	0.00	0.00	0.000	0.032	0.038	0.032	0.000	0.000	0.000	0.000	0.009	0.038
Total	3.15	0.07	0.16	0.27	1.47	0.86	0.56	0.62	0.56	0.08	0.14	0.43	0.65	0.46	0.84

MU3 bypasses water quality treatment.
MU4 bypasses GPT. MU2 treated by enviropods
Stage 1 also bypasses treatment via a single outlet pipe and a separate Stage 1 GPT

Check 3.15

Roof Area % of lots 58%

Flow to GPT/Raingarden

	Area (ha)	1yr Flow (m^3/s)	3mth Flow (m^3/s)
MU1	2.75	0.27	0.14
MU2	0.27	-	-

				RAINWATER TANK (villas)						
				Overflow Pipe Dia		High Flow By-pass	Daily Demand	PET - RAIN		Tank Surface Area
Catchment	Lots	Equivalent Pipe Area (m^2)	Equivalent Pipe radius (m)	Equivalent Pipe dia (mm)	Total Area of Roof to Tank (Ha)	1yr flow on roof (m^3/s)	Daily Demand (kL)	Annual Demand (kL/yr)	Total Tank Volume (m^3)	Tank Surface Area (m^2)
Residential	51	0.100	0.179	357	0.862	0.180	4.08	1275	81.6	63.75
Comm Centre	9	0.018	0.075	150	0.164	0.034	0.72	225	14.4	11.25
Apartment	14	0.027	0.094	187	0.272	0.057	1.12	350	22.4	17.50

PET - Rain for landscape area	25	kL/year/dwel
Assumed Daily Demand	80	L/day
Adopted Tank Size	2	kL
Assumed 80% is useable (w/o topups)	80	%
Useable tank	1.6	kL
Assumed Tank height	1.6	m
I5min/1yr	75	mm/hr

Input

DETENTION PARAMETERS FOR STORMFILTER SYSTEMS

Fill values in BLUE cells

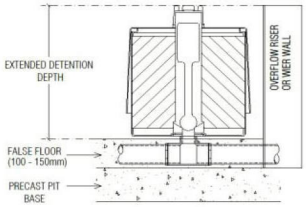
System Type (Detention or Precast)	Precast
Cartridge Height	460
Number of Cartridges	22
Cartridge Type	PSorb (MCC)

Detention Basin Properties For MUSIC

Inlet Properties	
Low Flow By-pass (cubic metres per sec)	0.000
High Flow By-pass (cubic metres per sec)	100.000
Storage Properties	
Surface Area (square metres)	4.3
Extended Detention Depth (metres)	0.54
Exfiltration Rate (mm/hr)	0.00
Evaporative Loss as % of PET	0.00
Outlet Properties	
Low Flow Pipe Diameter (mm)	81
Overflow Weir Width (metres)	2.0

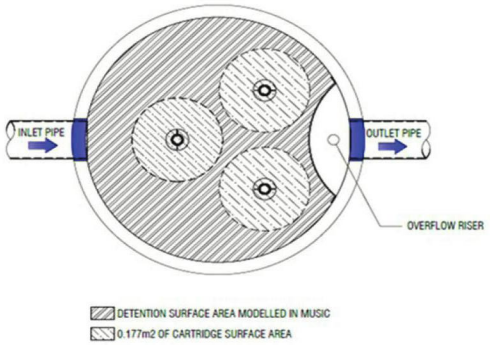
StormFilter Properties For MUSIC

Inlet Properties	
Low Flow By-pass (cubic metres per sec)	0.000
High Flow By-pass (cubic metres per sec)	0.01012

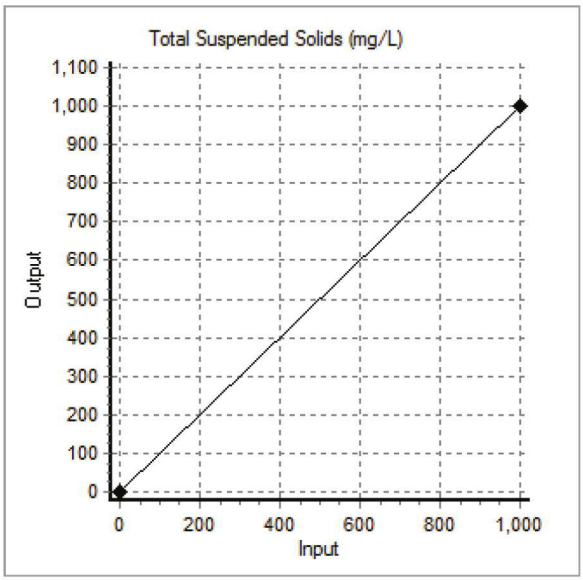


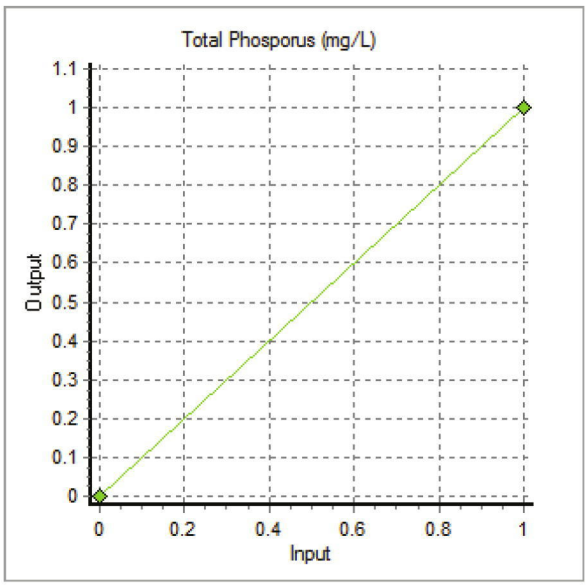
STORMFILTER CARTRIDGE DETAIL

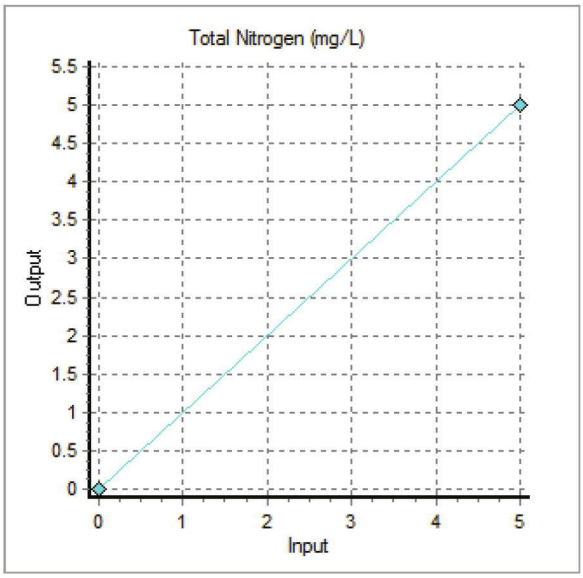
TYPICAL MANHOLE STORMFILTER

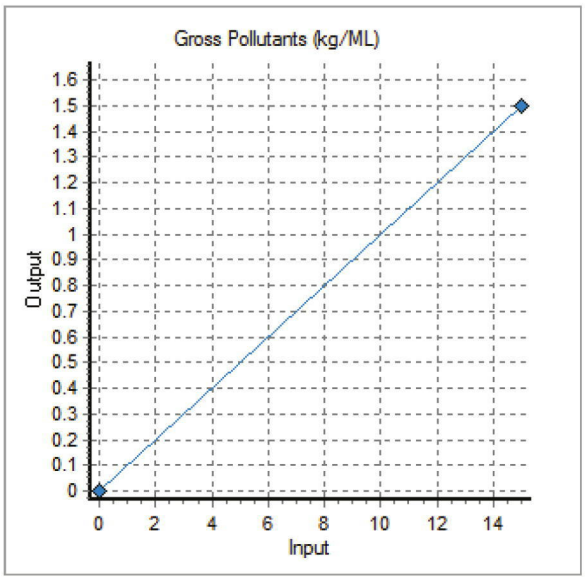


Gross Pollutant Parameters (adopted in MUSIC)









APPENDIX B

Appendix B – Figures

lendlease

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LEGEND

- Stage 2 Site Boundary
- Stage 1 Site Boundary
- Community Centre
- Villa Lots
- Apartments
- Road / Impervious Areas
- Open Space
- Stage 1 Outlet Pipe
- Stage 2 Outlet Pipe
- Proposed GPT
- Proposed Stormfilters with tank
- Proposed Enviropod Pit Inserts
- Flow direction
- East - West Channel

N
W E
S

Scale 1: 1,000 @ A3

25 0 25 m

110487-02 Figure 1

Jordan Springs Retirement Living - Retirement Village Stormwater Management

File Name: 110487-02 Figure 1
Date : 14/06/18 Issue : B

Jordan Springs Retirement Village – Stormwater Management Strategy

Issue	Amendment	Author	Reviewer	Approved
A	Issue for DA	CR	DC	DC
		14/06/2018	14/06/2018	14/06/2018
File Name:	110487 - 02 - Development Application Phase_264_JWP Documents\110487-02-Retirement Village.docx			

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