Ardill Payne & PARTNERS

ENGINEERS PLANNERS SURVEYORS ENVIRONMENTAL PROJECT MANAGEMENT

STORMWATER MANAGEMENT STRATEGY REPORT

Submission to Byron Shire Council

PROPOSED REZONING FOR RESIDENTIAL DEVELOPMENT
53 McAuleys Road, Myocum

for:
McAuleys No1 Pty Ltd

September 2020

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Document Control Sheet

Filename:	10431-53 McAuleys Road Stormwater Management Strategy Report.docx				
Job No.:	10431				
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Client:	McAuleys No1 Pty Ltd				
File/Pathname	S:\01 Jobs\10400-10499\10431 53 McAuleys Road, Myocum\01 Administration\02 Reports\10431-53 McAuleys Road Stormwater Management Strategy Report.docx				
Revision No:	Date:	Checked By		Issued By	
		Name	Signed	Name	Signed
0	7.09.20	D. Roberts		P. Ghasemzadeh	
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1. Introduction

Ardill Payne and Partners (APP) has been commissioned to prepare a Stormwater Management Strategy for the proposed rezoning application of Lot 8 DP 589795, located at 53 McAuleys Lane, Myocum, NSW. The site is 35.02ha, is mapped as RU2 zone and is undergoing rezoning to residential land. The site zoning is shown in **Figure 1**.

This report proposes a strategy for the site major drainage and stormwater quality based on the proposed development master plan shown in Figure 3. The stormwater management strategy informs the requirements for compliance with Byron Shire Council's (BSC) Development Control Plan 2014 (DCP) – Chapter B3 and the BSC's Comprehensive Guidelines for Stormwater Management

Regarding stormwater quantity, according to DCP-Chapter B3 provision of onsite detention (OSD) for stormwater flow attenuation for RU2 land zone is not necessary. Regarding stormwater quality, according to the guideline stormwater treatment for development of a site larger than 2,500m^2 must meet the pollutants and retention criteria.

Based on the above notes the objectives of the site stormwater management strategy is to:

- provide adequate drainage with consideration of the site minor and major flow quantities
- improve post-development stormwater quality
- incorporate aesthetic integration of stormwater infrastructure into the built environment

The current report provides an assessment regarding the site stormwater condition, provides the requirements of the site main cross drainage and evaluates the stormwater treatment rates achieved by the proposed treatment train. A more detailed stormwater management plan will be prepared at the future DA stage.

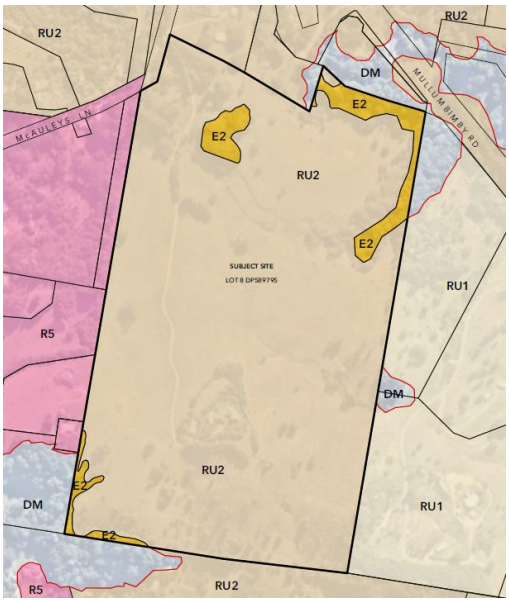


Figure 1: Subject Site Zoning

2. Site Condition

The proposed development at 53 McAuleys Lane, Myocum includes a residential subdivision for 41 lots with associated driveway and hardstand areas. The site locality is shown in **Figure 2**.

Figure 2: Site locality plan

The site is located on a hilly area with steep slopes toward all boundaries. A major mapped flow path is traversing the site in west-east direction draining the majority of the site from the eastern boundary. The site development plan, slopes and main flow paths are shown in **Figure 3**. As shown the proposed site internal roads cross the major flow path at two locations.

The site catchments and shown in **Figure 4**. The catchments main specifications are included in **Table 1**. More discussion regarding the site catchments is provided in **Section 3.2** of the report.

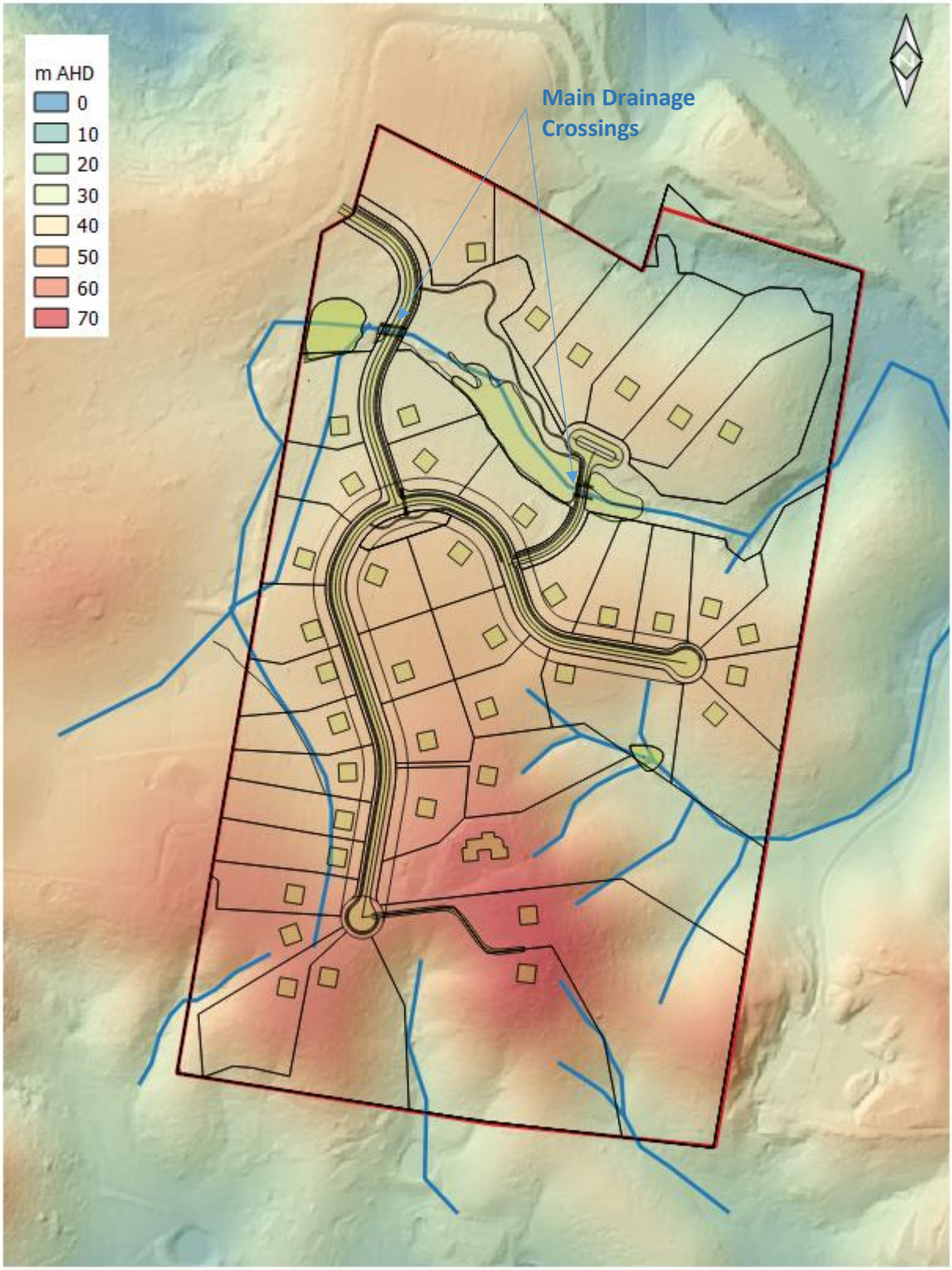


Figure 3: Site development plan, topography and flow paths

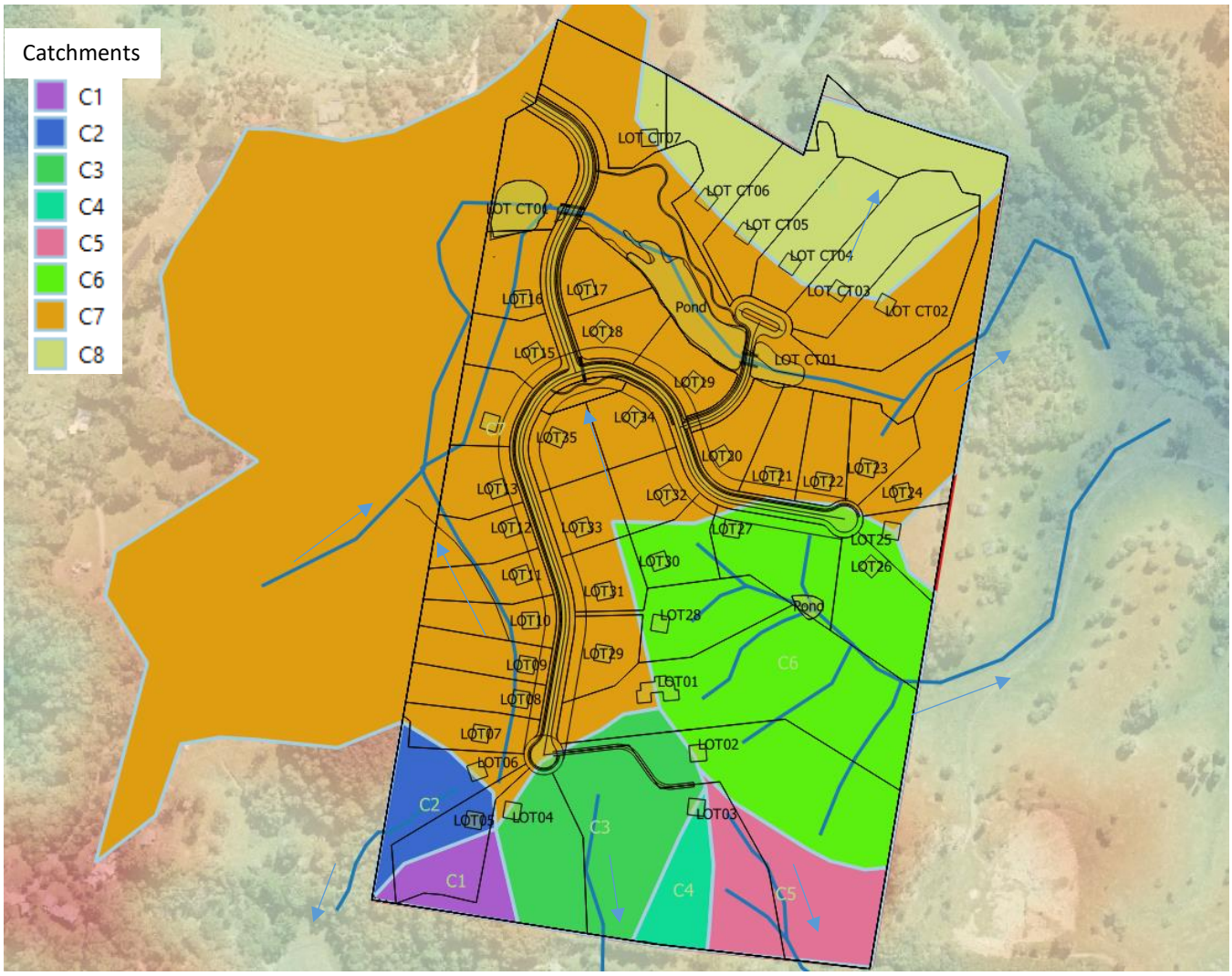


Figure 4: Site contributing catchments

Table 1: Catchments specifications

Name	Area	Slope (%)	Waterway Length (m)	Tc (min)
C1	0.64	20.00	80	3
C2	0.89	15.00	130	4
C3	2.68	10.00	220	7
C4	0.57	15.00	140	5
C5	1.73	22.00	180	5
C6	6.75	8.00	310	10
C7	33.09	4.00	1050	33
C8	3.69	16.00	180	5

Note: *Time of Concentration calculated from Bransby-Williams formula*

3. Proposed Stormwater Management

3.1. Considerations Regarding Development

The development will include 35 lots with Torrens title (lots 01 to 035) and 7 lots with community title (lots CT01 to CT07). Lot CT01 is a common lot located within the corridor of the site main flow path.

The development proposes subdividing this 30ha site onto large +2500m^2 lots (average lot area of 7140m^2). At this stage the development details on each lot is unknown. However, it is clear that the buildings and driveways footprint will cover only a small portion of each lot with other parts remaining undisturbed. As such the contributing areas for the design of the stormwater quality treatment measures have been defined as follows:

- 400m^2 roof area for each lot
- 200m^2 hardstand surfaces and driveway for each lot
- Site internal road

The above approach is in compliance with Section 3.3 of Music Modelling Guideline V3, 2018.

3.2. Considerations Regarding Catchments

In development of the site stormwater management strategy the notes below in regards to the proposed development in relation to the contributing stormwater catchments are considered.

- Catchment C1 covers parts of Lots 05 & 04 and flow to the site southern boundary. The catchment does not have a formed flow path and surface runoff travel the catchment as sheet flow. The catchment is very steep. No part of the development will be located in this catchment and the catchment remains untouched in post developed condition.

- Catchment C2 covers parts of Lots 05 & 06 and flow to the site south west corner. The catchment is very steep with a flow path located within the catchment. Runoff from the roofs of Lots 05 & 06 and a small portion of the future hardstand areas will discharge to this flow path. The effect of the development on the quantity of discharge from this catchment will be insignificant. There is an existing water pond at the site boundary along the catchment flow path which will be used for stormwater treatment.

- Catchment C3 is located mainly within Lots 3 & 4 and flow to the site southern boundary. The catchment is very steep with a flow path located within the catchment. Runoff from the shared driveway to Lots 2 and 3 will discharge to this flow path. There is 40m vegetation buffer is located between the driveway and the flow path ensuring the required treatment will be achieved. With consideration of the size of the catchment compare to the

development footprint the increase of the catchment flows due to the development will be insignificant.

- Catchment C4 is a small catchment located completely within Lot 3 and flow to the site southern boundary. The catchment is very steep with a small flow path located within the catchment. Roof runoff from Lot 03 can be discharged to this flow path. The development does not change the flow condition of this catchment.

- Catchment C5 is located within Lots 2 & 3. No part of the development should necessarily discharge to this catchment. As such the catchment flow condition will remain as per the pre-development condition.

- Catchment C6 is the second largest site catchment and discharges to the site eastern boundary. The catchment is not as steep as catchments 1 to 5 and includes a mapped flow path. Roof runoff from 6 lots and part of the site internal road discharge to the flow path located in this catchment. There is an existing pond in this catchment which can be used for stormwater treatment.

- Catchment C7 is the largest site catchment and discharges to the site eastern boundary. The catchment is relatively flat and includes a mapped flow path. Runoff from approximately 50% of the site and 70% of the development footprint flow to this flow path. The development runoff only enters the flow path after traversing long vegetation buffers providing a high level of quality treatment. The existing water ponds along the flow path will also be used for additional stormwater treatment. The ponds size and depth can be controlled by size and level of the culvert crossings located at the future site internal road.

3.3. Stormwater Management Strategy

APP has undertaken a detailed review of the SMP options for the subject site. The selection criteria utilised in the decision making process include:

- Site Constraints – Including landform and protected zones
- Proposed design layout – Aesthetics, development layouts, landscaping considerations
- Costs – Construction/implementation/maintenance
- Engineering– hydraulic/civil design requirements

The site stormwater management strategy will be as follows:

- The site is located at RU2 zone and discharges directly to a creek. As such no OSD needs to be provided at the site. However, the proposed large rainwater tanks proposed for each lot and the flow restrictions at the site internal road culvert crossings will effectively reduce the post development peak flows.

- Large 50kL plus rainwater tanks will be used on each lot for collection and reuse of roof water. The site does not have access to reticulated water and as such the collated roof water will be used in high rates on a daily basis. This ensures a high level of stormwater quality treatment and quantity mitigation.

- Where possible the generated flows at the site hardstand areas will be directed to the existing vegetation buffers and vegetated swales for quality treatment.

- The existing water ponding areas along the flow paths will be used for further stormwater quality treatment. Flow condition at the large water ponding area upstream of the site access road will be controlled by the size of the culverts proposed for cross drainage of the future road. Flows from approximately 70% of the development will discharge to this pond for further quality treatment.

4. Catchment Hydraulics

The DRAINS computer software was used to model the site catchments to determine the peak flows generated and assess the size of the cross drainage required. The main catchment characteristics for representation of the site existing and developed conditions are shown in **Table 2**. The catchments upstream of the subject crossings are shown in **Figure 5**.

Table 2: Catchments specifications

Name	Area	Slope (%)	Waterway Length (m)	Tc (min)
Crossing 1 Catch	21.77	3.0	650	22
Crossing 2 Catch	28.47	2.5	850	29
Crossing 3 Catch	1.98	7.0	150	6

Note: *Time of Concentration calculated from Bransby-Williams formula*

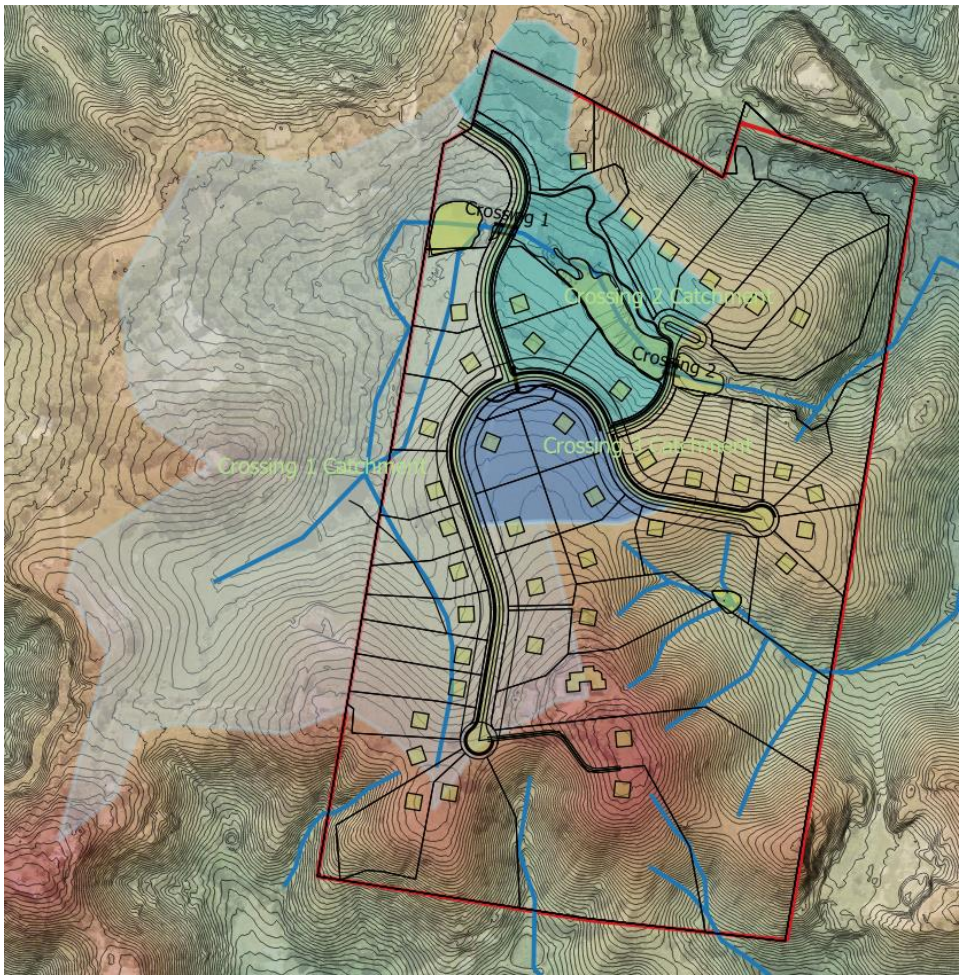


Figure 5: Catchments upstream of main drainage crossings

The design peak flows at the crossings are shown in **Table 3**. In calculating these numbers the storage volume within the existing ponds upstream of Crossings 1 and 2 is not considered and as such the numbers are conservative.

Table 3: Design peak flows at the site main culvert crossings

AEP (%)	Crossing 1 (m^3/s)	Crossing 2 (m^3/s)	Crossing 3 (m^3/s)
50	1.53	1.79	0.24
20	3.09	3.87	0.48
10	3.71	4.62	0.60
5	4.75	5.35	0.73
2	5.75	7.83	0.74
1	6.90	9.09	0.92

In accordance to NRLG Handbook of Drainage Design D5, 5% AEP design peak flows are used for the design of the culverts. The selected culvert sizes and flow condition are shown in **Table 4**.

Table 4: Main drainage crossings details and hydraulic calculation results

Cross Drainage	Event	Peak Inflow (m^3/s)	Culverts Specification	Culverts Invert Level (m AHD)	Max Upstream WL (m AHD)	Culverts Max Flow (m^3/s)	Road Surcharge (m^3/s)
Crossing 1	5% AEP	4.75	3 x 750mm RCP	35.3	36.78	3.64	0
Crossing 2		5.12*	3 x 750mm RCP	35.0	36.29	3.33	0
Crossing 3		0.73	1 x 525mm RCP	44.1	44.99	0.45	0
Crossing 1	1% AEP	6.9	3 x 750mm RCP	35.3	37.01	3.98	3.11
Crossing 2		9.32*	3 x 750mm RCP	35.0	36.73	4.00	3.46
Crossing 3		0.92	1 x 525mm RCP	44.1	45.05	0.47	0.32

Note: *Crossing 2 inflow is different from Table 3 because of flow reductions at Crossing 1*

Regarding **Table 4**:

- All calculations has been undertaken using DRAINS model.
- The site internal roads will have 20 year flood immunity.
- The 'Max Upstream WL' provides a preliminary measure for defining the future road levels and understanding the post development inundation extent upstream of the crossings.
- The selected culvert size at crossing 1 does not create an afflux outside of the site boundary.
- The post development peak flows for the 20 year event will be less than the predevelopment flows.

5. MUSIC Modelling

The load based pollutant reduction objectives of stormwater quality treatment are outlined in Design Specification D7 as follows:

- 80% reduction in total suspended solids (TSS)
- 60% reduction in total phosphorus (TP)
- 45% reduction in total nitrogen (TN)
- 90% reduction in litter / gross pollutants (GP)

The above objectives will be achieved by implementing stormwater quality improvement measures as part of the site stormwater management plan. To demonstrate sufficiency of the proposed treatment train, the site has been modelled using MUSIC computer software. MUSIC is widely accepted as the industry standard for stormwater quality modelling and is an accepted tool for assessment of onsite stormwater treatment effectiveness.

The full treatment train layout as modelled in MUSIC can be found in **Attachment 1**. The MUSIC model Source Node parameters were defined in accordance to the Water Sensitive Urban Design for South East QLD 2010 guideline.

The load based pollutant reduction figures were derived from the model for different arrangements and the solution providing the best management was selected.

The results of the MUSIC modelling are summarised in **Table 5**.

Table 5: Site Pollutant Reductions

Pollutant	Post Developed	Post Developed with Mitigation	% Reduction	Target %
Flow (ML/yr)	77.8	38.8	50.1	-
Total Suspended Solids (kg/yr)	17600	1440	91.8	80
Total Phosphorus (kg/yr)	32.9	6.43	80.4	60
Total Nitrogen (kg/yr)	174	69.5	60.2	45
Gross Pollutants (kg/yr)	1690	95.2	94.4	80

At this zoning stage the runoffs from the external catchment contributing to the inflows to the water ponds does not included in the model. The modelling results show that the stormwater quality treatment achieved by the proposed stormwater quality treatment train is much higher than the required pollutant reduction objectives.

6. Conclusion

The SMP developed by Ardill Payne & Partners demonstrates compliance with Council's requirements with respect to stormwater quantity and quality.

The site is located at RU2 rural residential zone and does not require stormwater water flow quantity mitigation. However, the hydraulic calculations provided in this report show that the peak flows will be reduced to less than the predevelopment values for 20 year design event due to the storage volume provided upstream of the site internal roads at the existing water ponding areas.

Stormwater quality is to be improved through a combination of 50kL plus rainwater re-use, grassed buffers and water ponds. MUSIC modelling indicates the proposed measures will provide adequate treatment of the stormwater run-off.

The stormwater concept presented in this report therefore complies with the requirements of Council's design guidelines named throughout the report.

7. Scope of Engagement

This report has been prepared by Ardill Payne & Partners (APP) at the request of McAuleys No1 Pty Ltd for the purpose of stormwater management for 53 McAuleys Road Subdivision and is not to be used for any other purpose or by any other person or corporation.

This report has been prepared from the information provided to us and from other information obtained as a result of enquiries made by us. APP accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this document for a purpose other than that described above.

APP declares that it does not have, nor expects to have, a beneficial interest in the subject project.

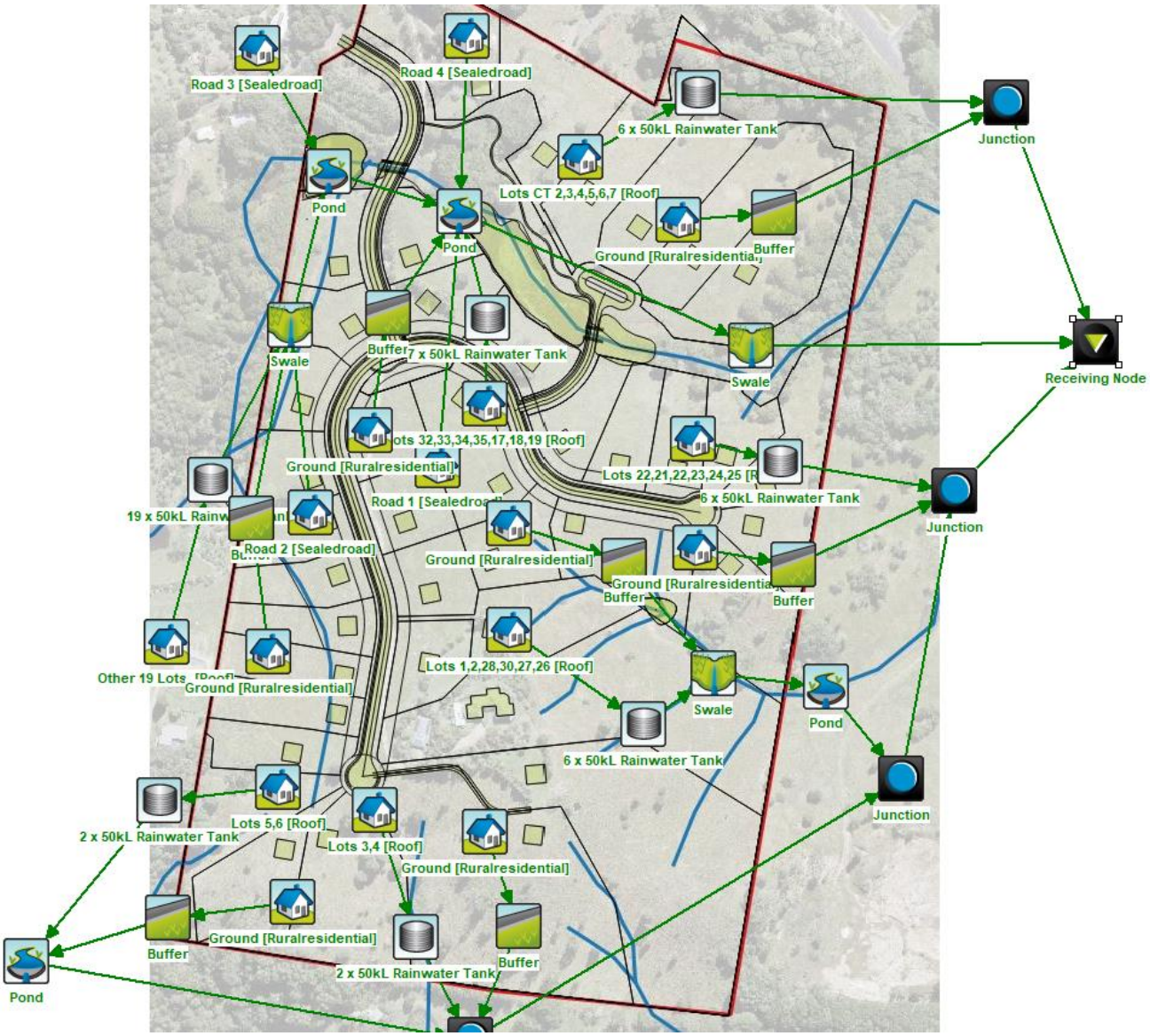
To avoid this advice being used inappropriately it is recommended that you consult with APP before conveying the information to another who may not fully understand the objectives of the report. This report is meant only for the subject site/project and should not be applied to any other.

8. Attachments

Attachment 1	MUSIC Modelling Results

ATTACHMENT 1

Attachment 1: MUSIC Modelling Results



	Sources	Residual Load	% Reduction
Flow (ML/yr)	77.8	38.8	50.1
Total Suspended Solids (kg/yr)	17600	1440	91.8
Total Phosphorus (kg/yr)	32.9	6.43	80.4
Total Nitrogen (kg/yr)	174	69.5	60.2
Gross Pollutants (kg/yr)	1690	95.2	94.4