


**379 Lang Lang-Poowong Road, Nyora**

**Stormwater Management Strategy**

Wallis Watson Nyora Pty Ltd

*October 2018*

DOCUMENT CONTROL DATA

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		<b>Synopsis</b>	<i>Stormwater discharge strategy for the proposed residential development on 379 Lang Lang-Poowong Road, Nyora</i>

**Reference:** 0900659

**Client:** Wallis Watson Nyora Pty Ltd

**Revision Table**

Rev	Description	Date	Authorised
A	Submission for Planning Approval	24/10/18	LM

**Distribution Table**

Date	Revision	Distribution
24/10/18	A	<i>Beveridge Williams – Internal, Council</i>

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## ***Glossary of terms***

Alphabetical list of terms and abbreviations used in report

AHD	Australian Height Datum A common national surface level datum approximately corresponding to mean sea level.
ARI	Average Recurrence Interval - <i>The average, or expected, value of the periods between exceedances of a given rainfall total accumulated over a given duration.</i>
Authorities	Organisations responsible for supply and management of sewer, water, gas, electricity and telecommunications, roads and transport
BPEMG	Best Practice Environmental Management Guidelines
BW	Beveridge Williams
MW	Melbourne Water
Client	Wallis Watson Nyora Pty Ltd
Council	South Gippsland Shire Council
IDM	Infrastructure Design Manual
Q <sub>5</sub>	Stormwater flow generated from 5 year ARI storm event.
Q <sub>100</sub>	Stormwater flow generated from 100 year ARI storm event.
Q <sub>gap</sub>	Flow difference between Q <sub>5</sub> and Q <sub>100</sub> storm event.
SEPP	State Environment Protection Policy
SWMS	Stormwater Management Strategy
WSUD	Water Sensitive Urban Design

# 1 INTRODUCTION

Beveridge Williams has been commissioned by Wallis Watson Nyora Pty Ltd (the Client) to prepare a Stormwater Management Strategy (SWMS) for a proposed residential development, located at 379 Lang Lang-Poowong Road, Nyora. Due to the nature of the local topography, however, a combined drainage strategy inclusive of the neighbouring lots of 30 Glovers Rod and 951 Yannathan Road is required to satisfy the Development Planning Overlay (DPO) – shown on planning scheme maps as DPO10. These three properties are referred to as “the site” within this document. The site area is approximately 103 ha and it is proposed to develop this land into a mixture of low and conventional density residential lots.

This SWMS report is intended to provide a conceptual drainage strategy for the development plan (APPENDIX A). The strategy aims to retain post development stormwater runoff to pre-development levels and to meet stormwater quality Best Practice Environmental Management Guidelines (BPEMG) to the satisfaction of Melbourne Water, South Gippsland Shire Council and other relevant authorities.

## 1.1 Site Overview

The site is currently vacant land and is bounded by Lang Lang-Poowong Road to the south, Glovers Road to the east and north and Yannathan Road to the west. The site is currently accessible from each road.

There is a large existing dam located on the north-western part of 379 Lang Lang-Poowong Road and there are existing watercourses and other dams also located on this property (Refer to Site Aerial Map in Figure 1 below).



Figure 1: Site Aerial Map (Source: Google Earth)



## 1.2 Site Context

The site lies within the South Gippsland Planning Scheme area. The site is generally separated into two zones, General Residential Zone (GRZ1) and Farming (FZ). The majority of 379 Lang Lang – Poowong Road is zoned General Residential Zone (GRZ1) and the remaining components of the site's properties are currently zoned Farming (FZ) (See Figure 2 below).

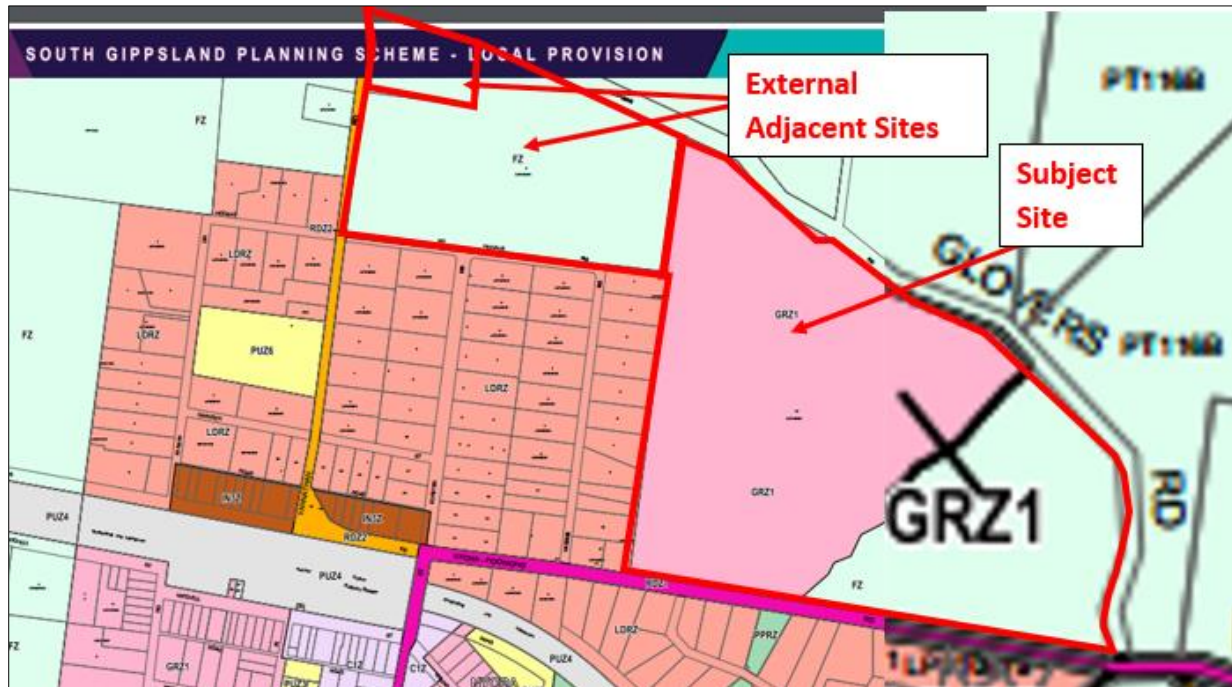


Figure 2: Zoning Map Plan (Source: South Gippsland Planning Schemes – Online)

Contextually, this SWMS is primarily focused on 379 Lang Lang – Poowong Road, however, this combined strategy has been developed for a holistic approach to the total development of the entire site.

It is recognised that at the time of this strategy's development, large portions of the site are zoned as FZ, and are, therefore, not available for development. The strategic deployment of assets within this document reflects the current situation and provides for the future development of the eastern and western portions of the subject site outlined above.

## 2 EXISTING CONDITIONS

### 2.1 Topography

Generally speaking, the site flows from south to north, from an approximate maximum elevation of 127m AHD to an approximate 104m AHD.

The site's northwestern lobe is transected by a low-lying ridge which directs a minor portion of runoff from 30 Grovers Road and the upstream external catchment towards 379 Lang Lang-Poowong Road, generally sloping in a southeasterly direction towards the existing waterway. A small knoll is centrally located within 379 Lang Lang-Poowong Road, locally interrupting the site's general slope from south to north. The existing waterway on 379 Lang Lang Poowong Road flows from south to north towards Grovers Road and ultimately deposits flows into farm dams further downstream.

A plan showing the site topography is shown in Figure 3 below.

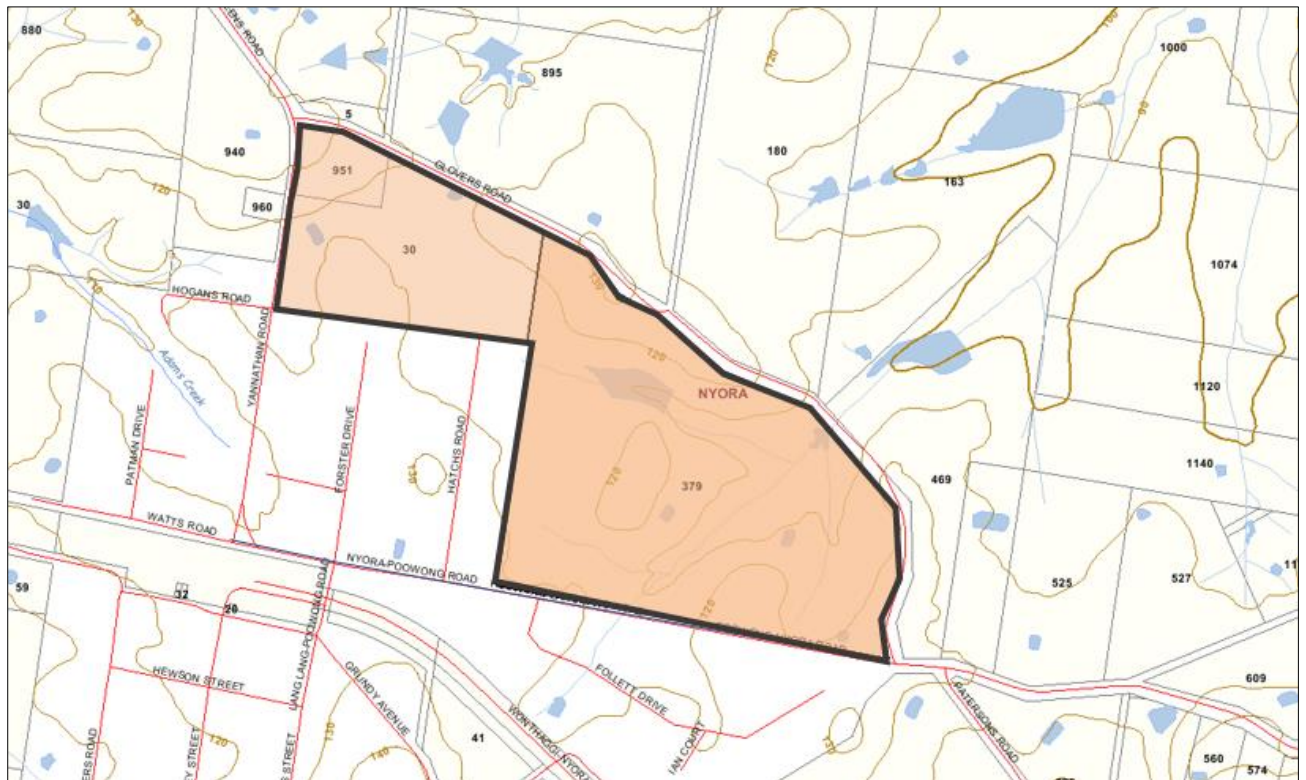


Figure 3: Site Topography Plan (Not to Scale) (Source: DEWLP-land.vic.gov.au)

## 2.2 Surface Water and Drainage

Overland flows from the high points on the south run north, towards the existing waterway and further northern direction. The north-west part of the site is primarily flat and flows towards both north and east as governed by the low-lying ridge (Refer to Figure 4 below).

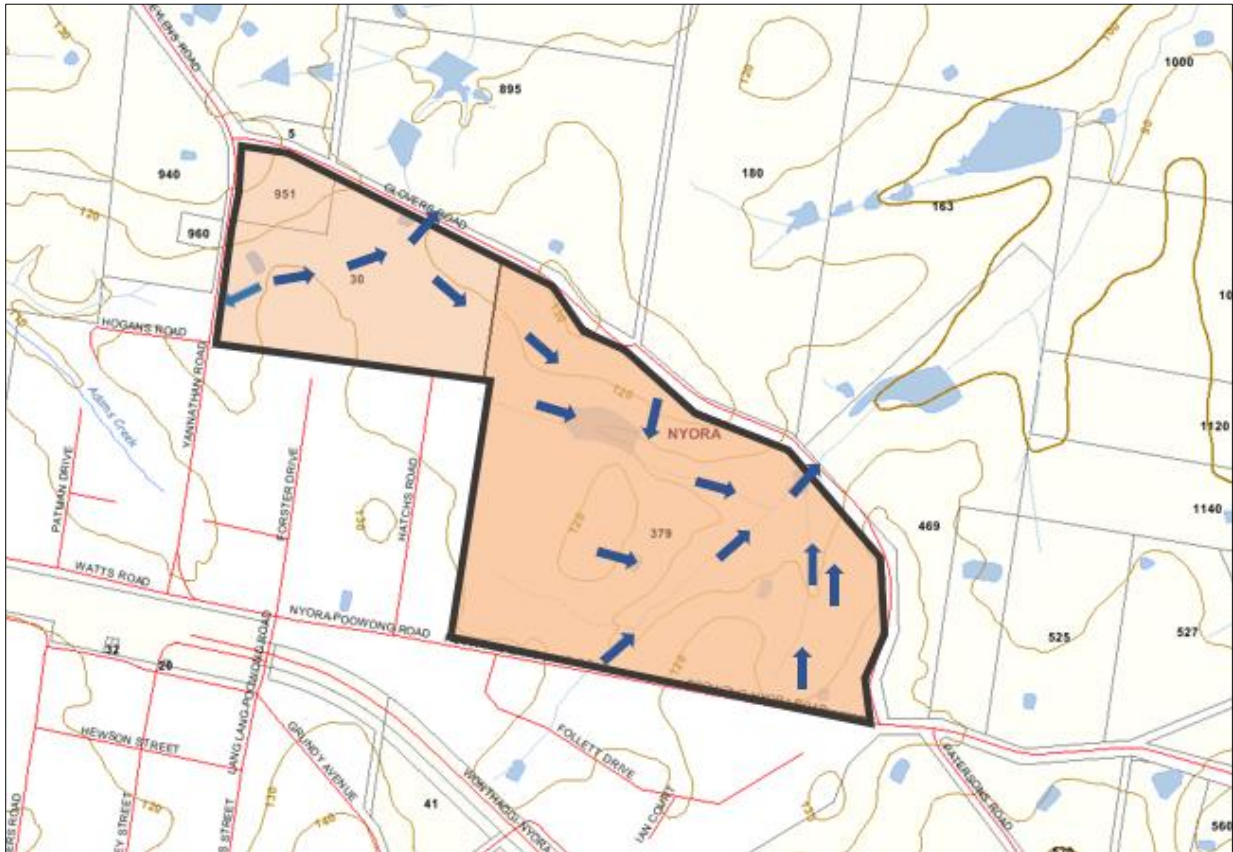


Figure 4: Site Analysis Plan (Not to Scale) (Source: DEWLP-land.vic.gov.au)





### **Stormwater Quantity Management**

For stormwater quantity management, it is proposed to provide four stormwater detention basins across the development of the overall site. The detention basins will serve to retard stormwater runoff for the 100-year ARI storm event on the development back to pre-development peak flows.

The basin locations are as follows:

- **Within 379 Lang Lang-Poowong Road:**

Three retarding basins

- **Within 30 Glovers Road:**

One retarding basin

### **Stormwater Quality Management**

The sedimentation basins, wetlands and bioretention basin will provide the required stormwater treatment to achieve the best practice standard. For stormwater quality management, it is proposed to provide two sedimentation basins, two wetlands and a bioretention basin within each of the stormwater detention basins on the subject site. In addition, a swale is also proposed from the southern to north eastern boundary which will provide the required stormwater treatment to achieve the best practice standard.

The location of the proposed basins/wetlands is as follows:

- **Within 379 Lang Lang-Poowong Road:**

- Two sedimentation basins
- Two wetlands
- One swale

- **Within 30 Glovers Road:**

- One bioretention basin

Details of both stormwater quantity and quality management are discussed in detail in Sections 4 & 5.

### **Legal Point of Discharge and Waterway**

The Legal Point of Discharge (LPD) for 379 Lang Lang Poowong Road will be to the waterway across Glovers Road on the external north east of the site. LPD for 30 Glovers Road and 951 Yannathan Road will be to the north of Glovers Road, however, as these properties are presently zone as FZ, this may be subject to change.

It is proposed to maintain the existing condition of the waterway on the subject site, with minor landscape modification surrounding the bank.

## 4 STORMWATER QUANTITY MANAGEMENT

It is part of Melbourne Water and Council requirements that the 1 in 100-year ARI post development peak flow be detained back to the pre-development levels. The following sections provide further details of the stormwater quantity management for the proposed development site.

### 4.1 Hydrology

The hydrological analysis of the 1 in 100-year ARI flows for the proposed development site was undertaken using the RORB runoff routing program model to determine the design flows of the pre-developed and developed scenarios. The following sub-sections provide details on the model calibration, catchment plans and the post-development flows results.

#### 4.1.1 Model Calibration/Validation

The pre-development and post development catchment plans were developed to include the entire catchment, as shown in Figure 6 and Figure 7, respectively (also in APPENDIX B). The post development catchment plan shows a series of sub-areas that indicate where stormwater discharge is channelled towards the existing dam to the east of the site.

The adopted RORB model parameters were based on calibration against the peak flows obtained using the Rational Method, whereby the  $k_c$  parameter for the pre-development scenario was determined by calibrating the RORB result to match the result obtained from the Rational Method. The  $k_c$  parameter for the post development scenario was determined by using a  $k_c$  to  $d_{av}$  ratio from the calibrated pre-development parameter. Details of these parameters are provided in Table 1.

**Table 1: RORB Input Parameters**

Parameter	Adopted Parameters for the Pre Development Scenario	Adopted Parameters for the Post Development Scenario
$k_c$	1.30	1.15
$d_{av}$	1.14 km	1.01 km
$m$	0.8	0.8
IL	10.00	10.00
$CRO_p$	0.6 (100yr)	0.6 (100yr)

Further, the RORB model sub-areas and fraction impervious used for the proposed detention basin are provided in Table 2 below.

**Table 2: RORB Sub-Catchment Areas and Fraction Impervious**

RORB Catchment Area (Overall sites – inclusive of 3 sites)	103 ha
RORB External Catchment Area to the south	93.2 ha
Fraction Impervious (Residential-Conventional Density)	0.6
Fraction Impervious (Residential-Low Density)	0.2
Fraction Impervious (Reserve)	0.1

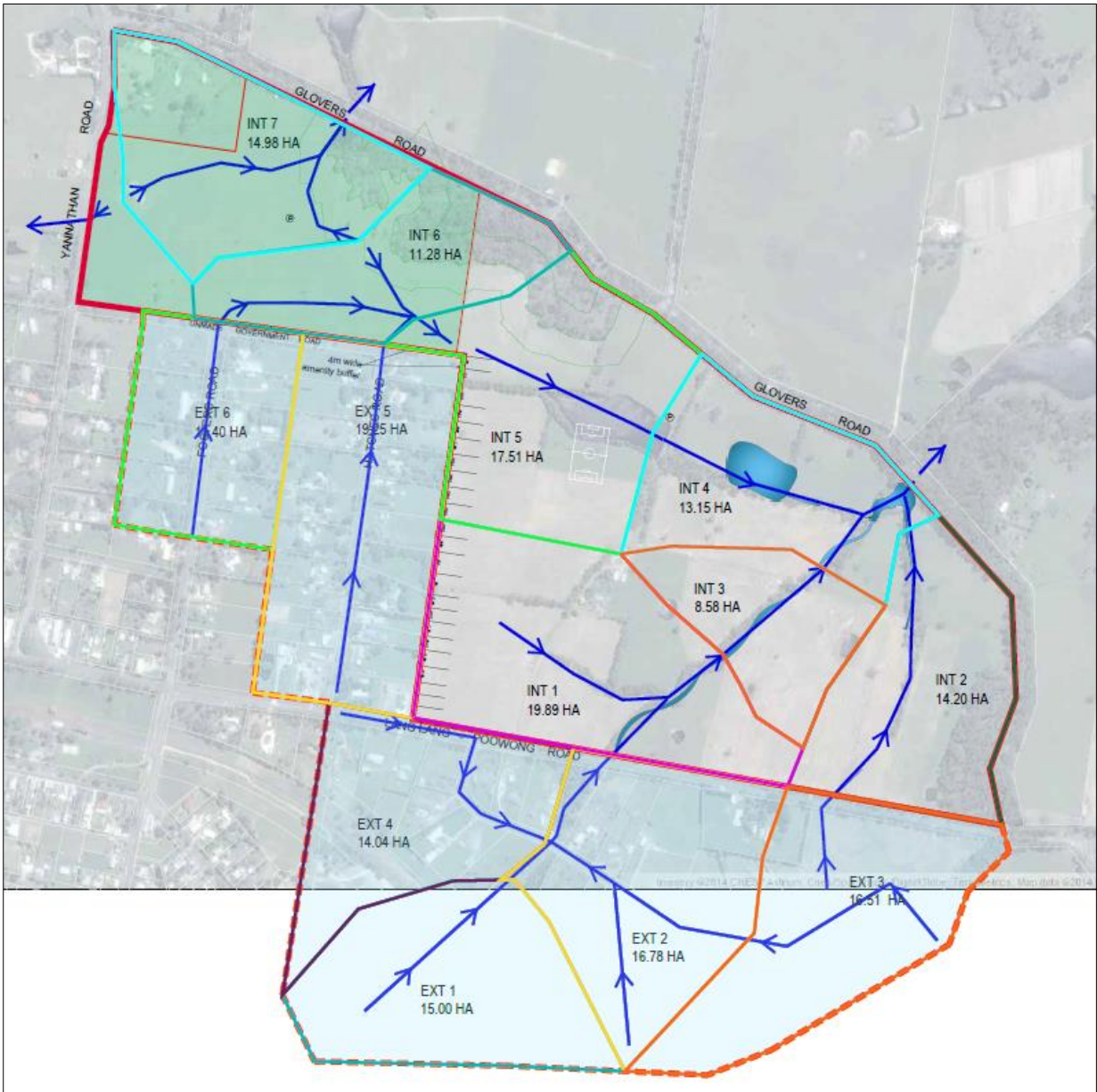


Figure 6: Pre-Development Catchment Plan





Figure 7: Post Development Catchment Plan

#### 4.2 100-year ARI Flood Results

The results of 1 in 100-year ARI peak pre-development and post development flows from the RORB modelling are shown in Table 3 below. Details of the RORB modelling results are shown in APPENDIX C.

Table 3: RORB Model Results for the 100-year ARI Post Development (Critical Durations in parentheses)

100 year ARI for SBRB		Storage Volume Required for Detention (m <sup>3</sup> )
Peak Pre-Development Flow (m <sup>3</sup> /s)	Peak Post Development Outflow (m <sup>3</sup> /s) (with Detention)	
8.17 (2hr)	8.01 (2hr)	25,200 m <sup>3</sup>

The above peak flows results indicate that the 1 in 100-year ARI post development peak flows can be detained to the pre-development level by providing a detention storage of 25,200 m<sup>3</sup>.

#### 4.3 Sub-surface Drainage

As previously mentioned, the LPDs for the site will be to the existing outfall/waterway(s) along the northern boundary based on the property from which flows are being disposed.

The subsurface drainage network for the development will convey all pipe flows to these locations, via the proposed water quality treatment facilities, which are the sedimentation basin, wetland, Bioretention basin and Swale. The pipe network will be adequately sized to convey the 1 in 5-year ARI flows throughout the proposed development's drainage network.

In addition, there is an external catchment (existing residential area lots fronting Lang Lang-Poowong Road) to the south of the site that will be directed to the proposed sub-surface drainage network.

#### 4.4 Overland Flow

Overland flows will be conveyed across the site to the nominated retarding basin assets for the specific portion of the catchment in which the flows originate. Due to the slope constraints, overland flows from lots on 951 Yannathan Road and on the western portion of 30 Glovers Road will be directed to the asset located on 30 Glovers Road (Refer to the Overland Flow Path Plan in Figure 9).

Retarding basin assets will have a controlled outlet whose design will be completed as part of the detailed design.

The internal roads for the development and the finished surface levels of the lots will be designed to ensure that the 1 in 100-year ARI overland flows through the site are within the safe hydraulic capacity of road floodway. A PC Convey assessment of the road reserve shows that the 100-year ARI gap flow can be contained within floodway safety criteria. A typical cross section is shown in Figure 8 and the calculation result is included in APPENDIX D.

The section location was chosen as it is the largest peak gap flow would be expected to provide the most conservative results (See Figure 9 for location of the assessment). The flood conveyance of the road reserves is within the flood safety criteria.

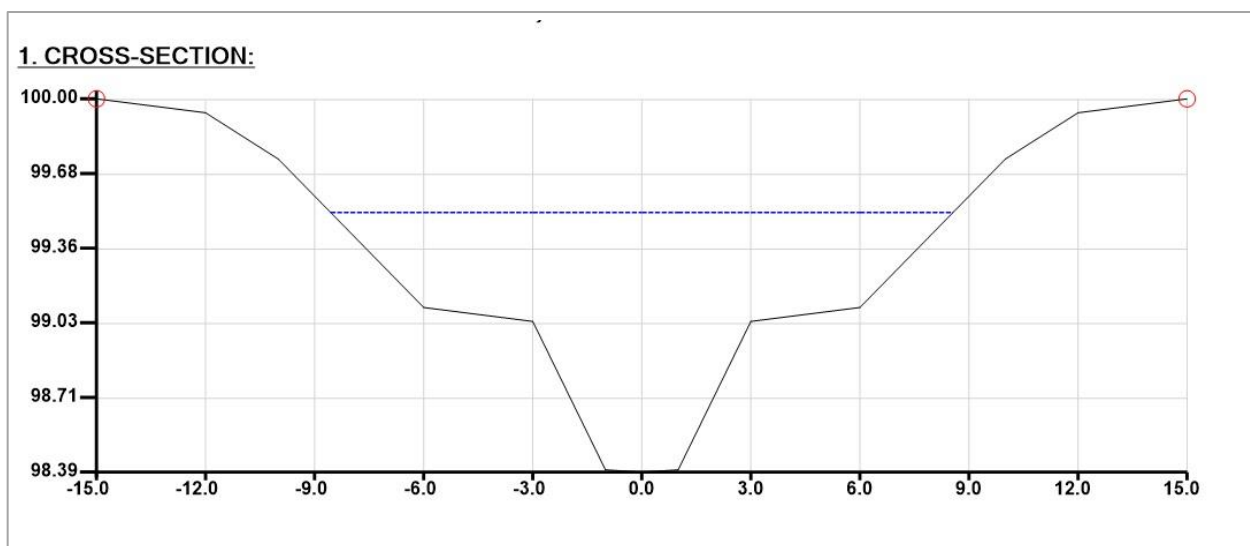


Figure 8: Typical Road Cross-Section showing the 100 year ARI Flood Level



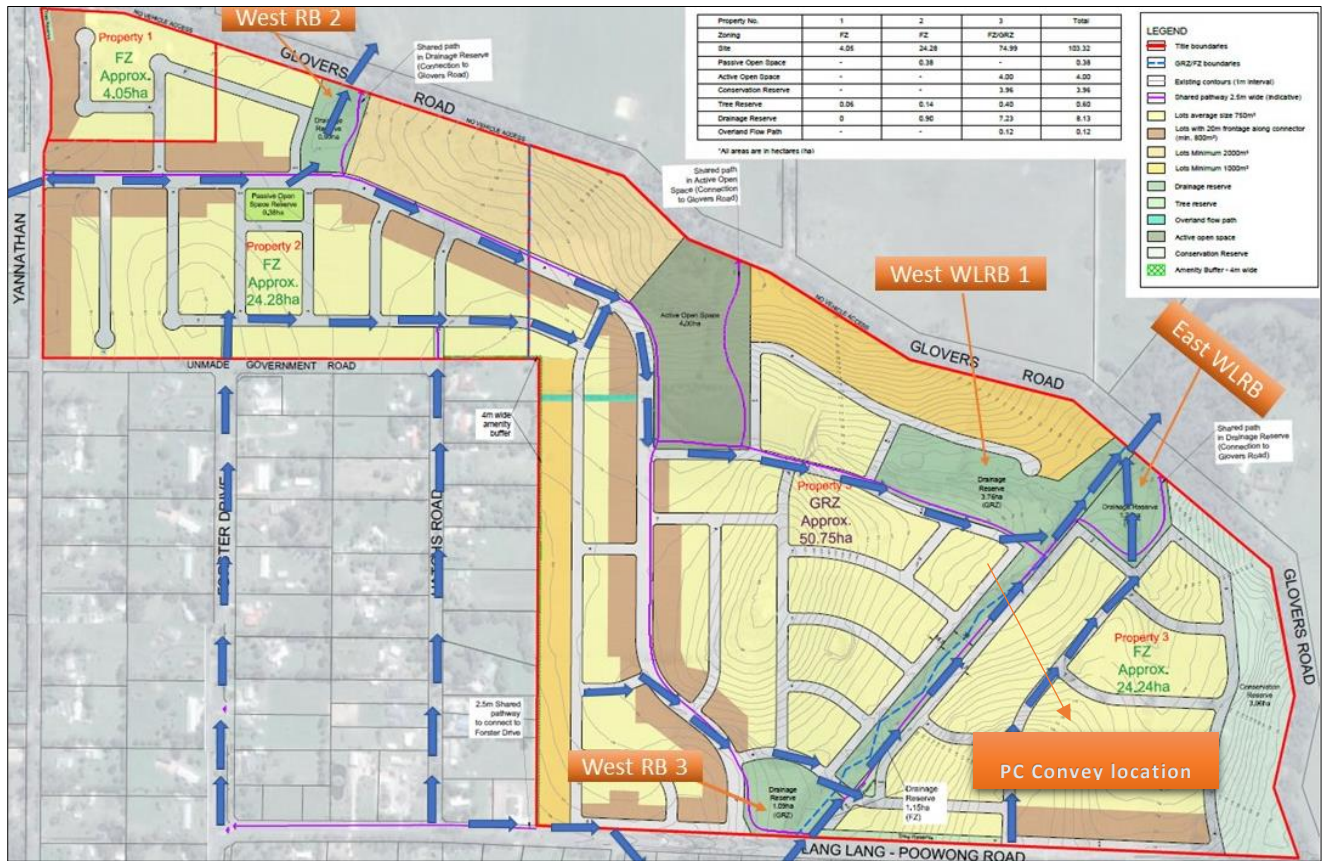


Figure 9: Indicative Overland Flow Path

#### 4.5 Sizing of the Detention Basin

Details of the proposed retarding basins are provided in Table 4 below and a plan of the indicative locations is provided in the previous Figure 9 (Also APPENDIX D).

The retarding basin assets will over-detain the 100-year ARI flow to allow the northern low density residential development runoff to be free draining. The total flow from the site is expected to be less than the pre-developed flow for design storms up to the 100-year ARI event.

Table 4: Details of Detention Basins

Retarding Basin	Outlet Controls for Detention Basin		Water Level at 100-year ARI	Storage
	Pipe Outlet	Crest Elevation/Width for Weir (100-year weir crest)		
West RB 2	3 x 600 mm dia pipe	1 m / 10 m	1.03 m	5,160 m <sup>3</sup>
West RB 3	525 mm dia pipe	1 m / 10 m	0.93 m	3,930 m <sup>3</sup>
West WLRB 1	4 x 600 mm dia pipe	1 m / 10 m	0.99 m	9,900 m <sup>3</sup>
East WLRB	600 mm dia pipe	1 m / 10 m	1.01 m	6,210 m <sup>3</sup>

## 5 STORMWATER QUALITY MANAGEMENT

Melbourne Water require all developments to provide a minimum best-practice water quality treatment via 'at source' methods. The current standards (BPEMG Targets) are 70/80/45/45 percent removal of Gross Pollutants/Total Suspended Solids/Total Phosphorous/Total Nitrogen (GP/TSS/TP/TN), respectively.

Stormwater quality modelling was conducted using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) for the proposed development site. The layout of the MUSIC Model is shown in Figure 10 and results of the MUSIC model are shown in Table 5. The proposed treatment for catchments contributing flows to 379 Lang Lang-Poowong Road will be two wetlands (each with a sedimentation basin). One of the wetlands (WLRB West) will be located adjacent to the current location of the existing dam while the other (WLRB East) will be located on the Eastern of the site.

The proposed treatment train for the catchments contributing flows to 30 Glovers Road, including the external catchments, will be a sedimentation and bioretention basin.

Stormwater quality treatment for the southern part of the site will be carried out via the proposed swale.

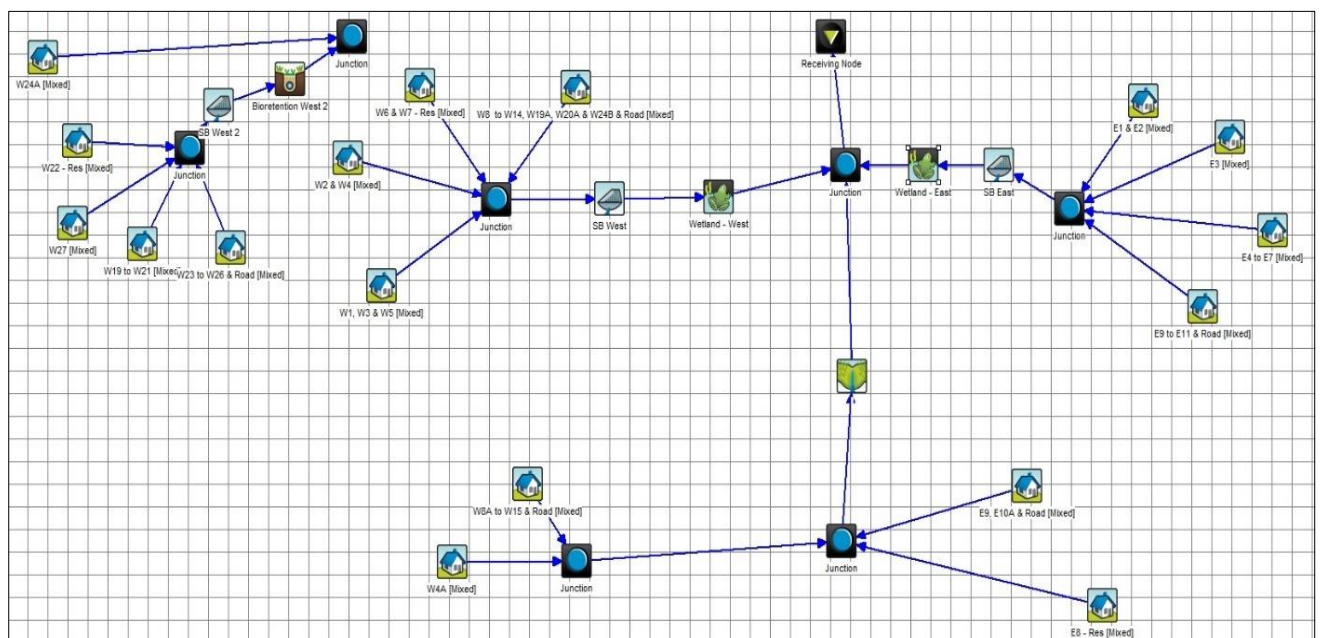


Figure 10: MUSIC Model Layout



**Table 5: MUSIC Model Results-Compared with BPEMG Target**

Parameter	% Removal at Receiving Outlet	BPEMG Target % Removal
Gross Pollutants (Kg/yr)	<b>100.0</b>	70
Total Suspended Solids (TSS) (Kg/yr)	<b>84.3</b>	80
Total Phosphorus (TP) (Kg/yr)	<b>68.4</b>	45
Total Nitrogen (TN) (Kg/yr)	<b>45.2</b>	45

As shown in Table 5, the proposed Bioretention Basin, sedimentation basins, wetlands and swales can meet the best practice BPEMG targets for the site.

Details of stormwater treatments assets are shown in Table 6 and Table 7.

**Table 6: Details of Sedimentation Basins and Wetlands**

Asset		Catchment Area	Surface Area	Permanent Pool Volume
<b>Sedimentation Basins</b>	SB West 2	25.54 ha	500 m <sup>2</sup>	N/A
	SB West	39.56 ha	800 m <sup>2</sup>	N/A
	SB East	19.32 ha	360 m <sup>2</sup>	N/A
<b>Wetlands</b>	WLRB 1	39.56 ha	8,000 m <sup>2</sup>	1,750 m <sup>3</sup>
	East WLRB	19.32 ha	3,500 m <sup>2</sup>	4,000 m <sup>3</sup>

**Table 7: Dimension Details of Swale**

Catchment Area	14.99 ha (proposed development)
Swale Top Width	8.0 m
Swale Bottom Width	2.0 m
Swale Length	430 m
Swale Depth	0.5 m
Swale Side Batter	1 in 6

The sedimentation basins are to be located in the base of the detention basins and the wetlands will be designed in accordance with Melbourne Water's Wetland Design Guidelines (as per the Wetland Design Manual). The design of the stormwater quality assets will be undertaken during the functional and detailed design phases of the project and submitted to Council and Melbourne Water at this time for comment and approval. The configuration of the outlet control structure will also be completed during the detailed design.

The concept design layout of the sedimentation basins and wetlands are shown in Figure 11. The concept design plans, including layout and cross sections of the stormwater treatment assets are included in APPENDIX D.



Figure 11: Concept Design Plan of the WSUD Assets (Not to Scale)

## 6 STAGING PLAN

As previously discussed, the majority of the site is currently zoned as FZ, precluding it from residential development at this time. Consequently, the preliminary development of the site is currently proposed to occur over 13 stages for the portion of 379 Lang Lang - Poowong Road zoned for residential development (GRZ1). The Indicative Subdivision and Staging Plan for these 13 stages is provided in APPENDIX E.

It is anticipated that the eastern component of 379 Lang Lang - Poowong Road will be rezoned for residential development in the future, and this region is therefore considered to be a long term residential area subject to this rezoning. Subsequent amendments to the zoning for the remainder of the site are anticipated, however, the staging of this potential development is not currently available.

### 6.1 Staging of Stormwater Management Assets for 379 Lang Lang – Poowong Road

The stormwater assets proposed in Sections 4 and 5 of this document have been conceptually designed in order to enable their construction in a staged manner complementing the development of the site.

To this end, West RB3, West WLRB 1 and the swale are proposed to be constructed to service Stages 1 through 13 of the staging plan, with East WLRB proposed to be constructed in line with the rezoning of the eastern component of 379 Lang Lang – Poowong Road. All remaining assets are to be constructed by the owners of the remaining two properties to service their portions of the site's development.

This approach will eliminate the need for interim assets.

## 7 CONCLUSION

This report has identified an overall drainage management strategy for the proposed development site located across the following properties:

- 379 Lang Lang-Poowong Road, Nyora;
- 30 Glovers Road, Nyora; and
- 951 Yannathan Road, Nyora.

The strategy provides methodologies for the management of stormwater on the site, which are as follows:

- Construction of drainage to meet the requirements of Melbourne Water and Council, including 1 in 100-year ARI capacity road reserves and underground drainage for the 1 in 5-year ARI storm event as needed.
- A stormwater detention volume of approximately 25,200 m<sup>3</sup> will be required to provide the appropriate detention for the proposed development. This volume will be contained within the proposed retarding basins located throughout the site, to cater for the designated sub-catchment areas.
- The stormwater quality treatment system required to meet BPEMG standards will consist of a swale, 2 wetlands and 3 sedimentation basins with a total combined area of 13,160 m<sup>2</sup>. One of the wetlands and sedimentation basins will be located within the western portion of 379 Lang Lang – Poowong Road (adjacent to the current location of the existing dam) and another wetland is to be located on the east of this lot to service the future residential development. The swale will bisect these two assets and will convey flows from the south of this lot to the north. In addition, a 3,500 m<sup>2</sup> bioretention basin will be located on 30 Glovers Road to provide treatment to the western catchment.
- Construction of WSUD assets and detention basins to meet the overall stormwater quality treatment and detention requirements.

The above strategy can be implemented and all Melbourne Water and Council's development requirements can be achieved, with no net effect on the downstream properties.

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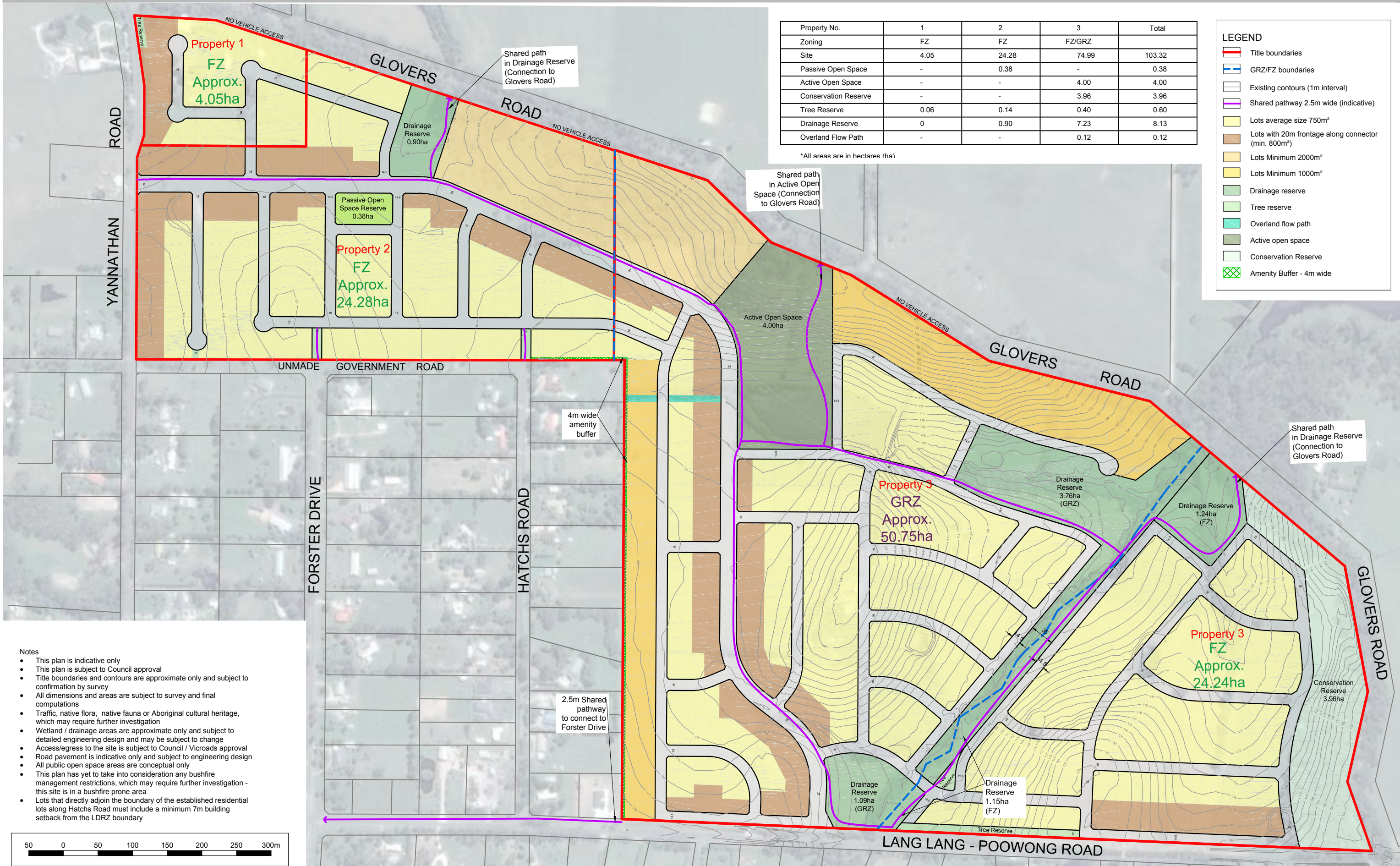
*Project Manager*



APPENDIX A.  
**Indicative Subdivision Plan**







Property No.	1	2	3	Total
Zoning	FZ	FZ	FZ/GRZ	
Site	4.05	24.28	74.99	103.32
Passive Open Space	-	0.38	-	0.38
Active Open Space	-	-	4.00	4.00
Conservation Reserve	-	-	3.96	3.96
Tree Reserve	0.06	0.14	0.40	0.60
Drainage Reserve	0	0.90	7.23	8.13
Overland Flow Path	-	-	0.12	0.12

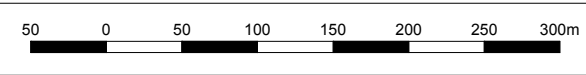
\*All areas are in hectares (ha)

**LEGEND**

- Title boundaries
- GRZ/FZ boundaries
- Existing contours (1m interval)
- Shared pathway 2.5m wide (indicative)
- Lots average size 750m<sup>2</sup>
- Lots with 20m frontage along connector (min. 800m<sup>2</sup>)
- Lots Minimum 2000m<sup>2</sup>
- Lots Minimum 1000m<sup>2</sup>
- Drainage reserve
- Tree reserve
- Overland flow path
- Active open space
- Conservation Reserve
- Amenity Buffer - 4m wide

**Notes**

- This plan is indicative only
- This plan is subject to Council approval
- Title boundaries and contours are approximate only and subject to confirmation by survey
- All dimensions and areas are subject to survey and final computations
- Traffic, native flora, native fauna or Aboriginal cultural heritage, which may require further investigation
- Wetland / drainage areas are approximate only and subject to detailed engineering design and may be subject to change
- Access/egress to the site is subject to Council / Vicroads approval
- Road pavement is indicative only and subject to engineering design
- All public open space areas are conceptual only
- This plan has yet to take into consideration any bushfire management restrictions, which may require further investigation - this site is in a bushfire prone area
- Lots that directly adjoin the boundary of the established residential lots along Hatchs Road must include a minimum 7m building setback from the LDRZ boundary



Indicative Development Plan  
Lang Lang -Poowong Road, Nyora

**DRAFT**

FOR DISCUSSION PURPOSES ONLY

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Version	Date	Description	Drafted	Approved	Version	Date	Description	Drafted	Approved
06	21.11.2014	Response to Council comments							
07	24.11.2014	Response to Council comments							
08		Plan amended	TG	DRAFT					
09	03.09.2018	Plan amended	TG/KT	DRAFT					

Date: 03.09.2018  
Version No: 09  
Job No: 0900659  
Scale (A1): 1:2500  
(A3): 1:5000





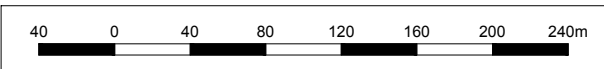
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- Lots Minimum 1000m<sup>2</sup>
- Drainage reserve
- Overland flow path
- Active open space
- Amenity Buffer - 4m wide

Site - Wallis Watson (GRZ + FZ)	74.99ha
Farming Zone (FZ)	24.24ha
* Lots Avg. 750m <sup>2</sup> Size	16.58ha
* Lots Min. 800m <sup>2</sup> Size	4.96ha
* Lots Min. 1000m <sup>2</sup> Size	7.62ha
* Lots Min. 2000m <sup>2</sup> Size	2.96ha
* Non-Arterial Roads	9.66ha
Drainage Reserve (GRZ only)	4.85ha
Active Open Space	4.00ha
Overland Flow Path	0.12ha
Net Developable Area (GRZ only)	41.79ha
Lot Yield (Lots Avg. 750m <sup>2</sup> Size)	215 lots 771m <sup>2</sup> average lot size
Lot Yield (Lots Min. 800m <sup>2</sup> Size)	58 lots 856m <sup>2</sup> average lot size
Lot Yield (Lots Min. 1000m <sup>2</sup> Size)	48 lots 1588m <sup>2</sup> average lot size
Lot Yield (Lots Min. 2000m <sup>2</sup> Size)	8 lots 3700m <sup>2</sup> average lot size
** Lot Yield (Overall)	329 lots @ 7.9 lots per ha 977m <sup>2</sup> average lot size
** Total Number of Lots	329

\* Indicates inclusion in NDA  
 \*\* Excludes FZ area

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  - Title boundaries and contours are approximate only and subject to confirmation by survey
  - All dimensions and areas are subject to survey and final computations
  - Traffic, native flora, native fauna or Aboriginal cultural heritage, which may require further investigation
  - Wetland / drainage areas are approximate only and subject to detailed engineering design and may be subject to change
  - Access/egress to the site is subject to Council / Vicroads approval
  - Road pavement is indicative only and subject to engineering design
  - All public open space areas are conceptual only
  - This plan has yet to take into consideration any bushfire management restrictions, which may require further investigation - this site is in a bushfire prone area
  - Lots that directly adjoin the boundary of the established residential lots along Hatches Road must include a minimum 7m building setback from the LDRZ boundary



Indicative Subdivision Plan (WW)  
 Lang Lang -Poowong Road, Nyora

**DRAFT**

**BW** Beveridge Williams  
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 Melbourne ph : 03 9524 8888  
 www.beveridgewilliams.com.au

Version	Date	Description	Drafted	Approved	Version	Date	Description	Drafted	Approved
01	03.09.2018	First Issue							

Date: 03.09.2018  
 Version No: 01  
 Job No: 0900659  
 Scale (A1):1:2000  
 (A3):1:4000

Wallis Watson Nyora Pty Ltd

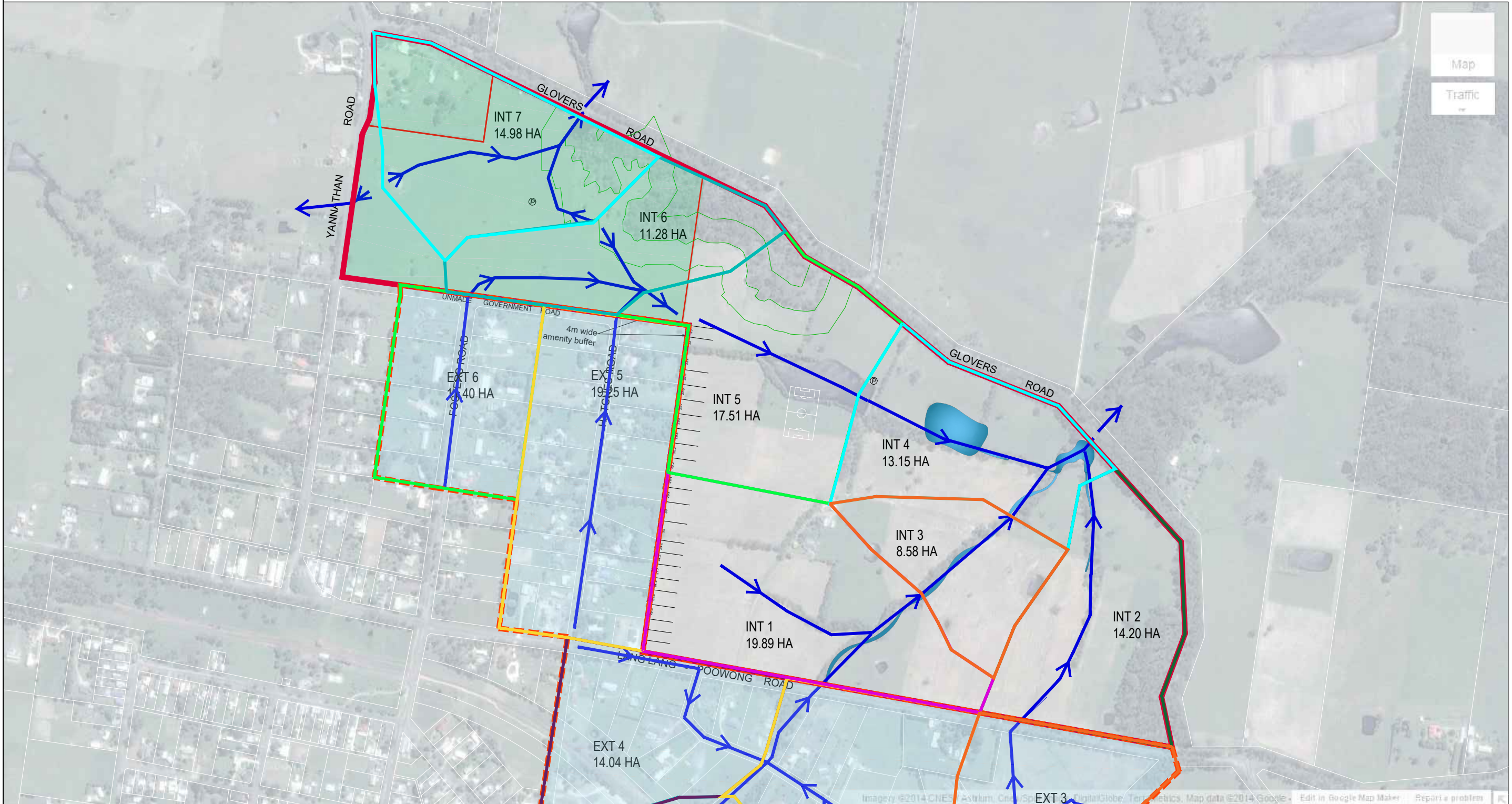
FOR DISCUSSION PURPOSES ONLY



APPENDIX B.  
**Pre and Post Development Plans**







Map  
Traffic

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PO	INITIAL ISSUE	DATE	DRN.	APP.	REV	DESCRIPTION	DATE	DRN.	APP.
		30.11.17	LN	LM					

PO	INITIAL ISSUE	DATE	DRN.	APP.	REV	DESCRIPTION	DATE	DRN.	APP.
		30.11.17	LN	LM					

PO	INITIAL ISSUE	DATE	DRN.	APP.	REV	DESCRIPTION	DATE	DRN.	APP.
		30.11.17	LN	LM					

PO	INITIAL ISSUE	DATE	DRN.	APP.	REV	DESCRIPTION	DATE	DRN.	APP.
		30.11.17	LN	LM					

Designed	L.NURHALIM
Date	30.11.17
Drawn	L.NURHALIM
Approved	L.MORRIS
Date	30.11.17
PS Number	PS



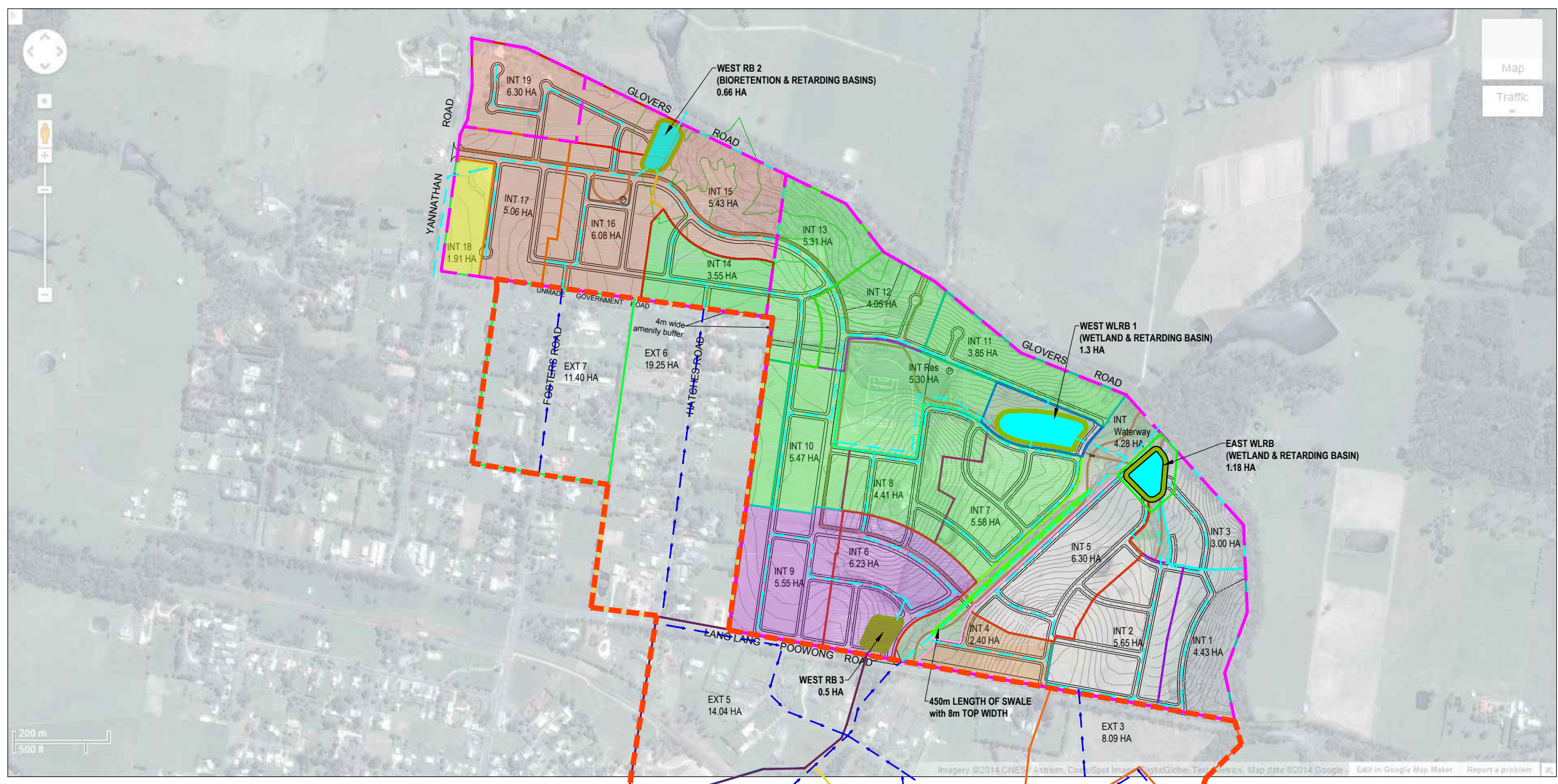
Project Details	379 LANG LANG-POOWONG ROAD, NYORA DEVELOPMENT PLAN OVERLAY-SCHEDULE 10 SOUTH GIPPSLAND SHIRE COUNCIL
Drawing Title	PRELIMINARY DRAINAGE STRATEGY PRE DEVELOPMENT CATCHMENT PLAN

Sheet 01 of 1	Scale NOT TO SCALE
Project Ref 0900659	Stage No 00
Drawing No 001	Rev P0

K:\Jobs Data\0900659 Nyora\_Wat\Drawings\SWMS\ORRB\Pre Dev Catchment Plan.dwg



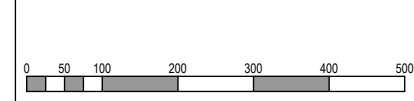
LEGEND - LAYOUT PLAN	
	CATCHMENT A (19.37HA)
	CATCHMENT B (2.40HA)
	CATCHMENT C (11.78HA)
	CATCHMENT D (37.51HA)
	CATCHMENT E (22.86HA)
	CATCHMENT F (1.91HA)
	PROPOSED OVERLAND FLOW (WITH DIRECTION)
	EXISTING OVERLAND FLOW (WITH DIRECTION)
	EXTERNAL CATCHMENT BOUNDARY
	TITLE BOUNDARY



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P1	UPDATED LEGEND AND CATCHMENTS	11.01.18	JG	AM	
P0	INITIAL ISSUE	30.11.17	LN	LM	
REV	DESCRIPTION	DATE	DRN.	APP.	REV

DESCRIPTION	DATE	DRN.	APP.



Designed	L.NURHALIM
Date	30.11.17
Drawn	L.NURHALIM
Approved	L.MORRIS
Date	30.11.17
PS Number	PS

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Project Details	379 NYORA-POOWONG ROAD, NYORA DEVELOPMENT PLAN OVERLAY-SCHEDULE 10 SOUTH GIPPSLAND SHIRE COUNCIL
Drawing Title	PRELIMINARY DRAINAGE STRATEGY

Sheet 01 of 1			
Scale 1:5000 @ A1			
Project Ref	Stage No	Drawing No	Rev
0900659	00	001	P1

K:\Jobs Data\0900659 Nyora\_Wat\Drawings\SWMS\ORRB\Post Dev Catchment Plan V2.dwg

APPENDIX C.  
**RORB Calculation Results**





RORBWin Batch Run Summary  
 \*\*\*\*\*

Program version 6.32 (last updated 3rd September 2017)  
 Copyright Monash University and Hydrology and Risk Consulting

Date run: 12 Sep 2018 16:47

Catchment file : K:\Jobs Data\0900659 Nyora\\_Wat\Models\RORB\Pre Dev\Pre Dev Catch.catg  
 Rainfall location: Nyora  
 Temporal pattern : ARR87 Volume 2 for zone 1 (filtered)  
 Spatial pattern : Uniform  
 Areal Red. Fact. : Based on ARR87 Bk II, Figs 1.6 and 1.7  
 Loss factors : Constant with ARI

Parameters: kc = 1.30 m = 0.80

Loss parameters Initial loss (mm) Runoff coeff.  
 10.00 0.60

Peak Description  
 01 Calculated hydrograph, Ext East  
 02 Calculated hydrograph, East Outlet  
 03 Calculated hydrograph, Ext West  
 04 Calculated hydrograph, West Outlet  
 05 Calculated hydrograph, Overall Outlet

Run	Dur	ARI	Rain(mm)	ARF	Peak0001	Peak0002	Peak0003	Peak0004	Peak0005
1	6m	100y	15.70	0.99	3.8178	0.9139	1.1005	0.3462	1.1870
2	10m	100y	20.54	0.99	5.4649	1.7334	1.4419	0.6694	2.2688
3	15m	100y	24.76	0.99	6.3039	2.5160	1.6259	0.9765	3.3025
4	20m	100y	27.93	0.99	6.5481	3.1271	1.5234	1.2072	4.1029
5	25m	100y	30.48	0.99	6.9450	3.6307	1.6203	1.4094	4.7859
6	30m	100y	32.59	0.99	6.3828	4.0397	1.4962	1.5505	5.3329
7	45m	100y	37.40	1.00	5.7723	4.9881	1.3164	1.8047	6.6142
8	1h	100y	40.91	1.00	6.6956	5.6730	1.5212	1.8827	7.3559
9	1.5h	100y	48.03	1.00	6.6078	6.1668	1.4372	1.8374	7.8228
10	2h	100y	53.63	1.00	7.0040	6.4364	1.6315	1.9308	8.1793
11	3h	100y	62.47	1.00	4.2230	6.1694	0.9192	1.7660	7.7808
12	4.5h	100y	72.67	1.00	4.7298	5.9757	0.9482	1.8819	7.6222
13	6h	100y	80.93	1.00	3.4018	6.3794	0.6915	1.7951	8.0154
14	9h	100y	94.26	1.00	3.2596	6.1117	0.6098	1.6993	7.6788
15	12h	100y	105.07	1.00	3.0603	5.5183	0.6054	1.4958	7.0141
16	18h	100y	122.81	1.00	1.9773	3.9981	0.3939	1.0478	5.0459
17	24h	100y	136.87	1.00	2.0585	4.7503	0.3980	1.2488	5.9991
18	30h	100y	148.48	1.00	1.5911	3.4229	0.3070	0.8488	4.2717
19	36h	100y	158.30	1.00	1.4470	3.5323	0.2765	0.8965	4.4288
20	48h	100y	174.00	1.00	1.7305	3.3967	0.3212	0.9627	4.3594
21	72h	100y	194.97	1.00	1.1520	2.2214	0.2226	0.5855	2.7405

Elapsed Run Time (hh:mm:ss) = 00:00:02



RORBWin Batch Run Summary  
 \*\*\*\*\*

Program version 6.32 (last updated 3rd September 2017)  
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Date run: 07 Sep 2018 10:34

Catchment file : K:\Jobs Data\0900659 Nyora\\_Wat\Models\RORB\Post Dev\Final\Post Dev Catch Opt 2.catg  
 Rainfall location: Nyora  
 Temporal pattern : AR&R87 Volume 2 for zone 1 (filtered)  
 Spatial pattern : Uniform  
 Areal Red. Fact. : Based on ARR87 Bk II, Figs 1.6 and 1.7  
 Loss factors : Constant with ARI

Parameters: kc = 1.15 m = 0.80

Loss parameters Initial loss (mm) Runoff coeff.  
 10.00 0.60

- Peak Description
- 01 Special storage : West RB 1 - Outflow
  - 02 Special storage : West RB 1 - Inflow
  - 03 Special storage : East RB - Outflow
  - 04 Special storage : East RB - Inflow
  - 05 Special storage : West RB 3 - Outflow
  - 06 Special storage : West RB 3 - Inflow
  - 07 Calculated hydrograph, Ext East
  - 08 Calculated hydrograph, East Outlet
  - 09 Special storage : West RB 2 - Outflow
  - 10 Special storage : West RB 2 - Inflow
  - 11 Calculated hydrograph, West Outlet 2
  - 12 Calculated hydrograph, West Outlet 1
  - 13 Calculated hydrograph, Outlet

Run	Dur	ARI	Rain(mm)	ARF	Peak0001	Peak0002	Peak0003	Peak0004	Peak0005	Peak0006	Peak0007	Peak0008	Peak0009	Peak0010	Peak0011	Peak0012	Peak0013
1	6m	100y	15.70	0.99	0.4247	4.7988	0.0847	4.1653	0.0746	2.4907	4.7776	1.3584	0.5530	4.9125	0.5530	0.1725	1.7269
2	10m	100y	20.54	0.99	0.8136	6.1486	0.1563	4.0347	0.1363	2.4816	6.4286	2.3823	0.9474	5.7310	0.9474	0.1775	3.1596
3	15m	100y	24.76	0.99	1.1590	6.7138	0.2295	4.4074	0.1486	2.6838	7.4666	3.3282	1.2878	6.3172	1.2878	0.1945	4.4564
4	20m	100y	27.93	0.99	1.4171	6.8539	0.2482	4.3345	0.1878	2.6742	7.5850	4.0690	1.4852	6.0898	1.4852	0.1838	5.4426
5	25m	100y	30.48	0.99	1.6097	7.1432	0.2713	4.1464	0.2174	2.5185	8.1241	4.5954	1.5616	5.9515	1.5616	0.1680	6.0617
6	30m	100y	32.59	0.99	1.7290	6.6301	0.3098	3.8936	0.2382	2.3736	7.4808	4.9822	1.6083	5.5347	1.6083	0.1574	6.4997
7	45m	100y	37.40	1.00	1.9629	5.9541	0.3815	3.4940	0.2808	2.1484	6.7342	5.6803	1.7011	5.1186	1.7011	0.1526	7.3886
8	1h	100y	40.91	1.00	2.0676	6.7150	0.4160	3.2380	0.2976	1.9515	7.8709	6.0125	1.8724	5.3401	1.8724	0.1382	7.8293
9	1.5h	100y	48.03	1.00	2.1144	6.6162	0.4563	3.2975	0.3182	1.9426	7.7015	5.9384	1.7090	5.0366	1.7090	0.1338	7.6522
10	2h	100y	53.63	1.00	2.1755	6.9557	0.4748	3.5593	0.3283	2.1569	8.3031	6.1775	1.8267	5.6154	1.8267	0.1458	8.0164
11	3h	100y	62.47	1.00	2.1208	4.4663	0.4948	2.3246	0.3344	1.4055	4.8546	5.8242	1.6309	3.5350	1.6309	0.0987	7.5105
12	4.5h	100y	72.67	1.00	2.1199	4.9075	0.4957	1.9041	0.3330	1.1530	5.5051	6.0983	1.7874	3.2763	1.7874	0.0820	7.8404
13	6h	100y	80.93	1.00	2.2033	3.6156	0.5012	1.3782	0.3428	0.8226	3.9401	5.9191	1.6169	2.2751	1.6169	0.0549	7.6191
14	9h	100y	94.26	1.00	2.2291	3.3822	0.6332	1.2024	0.3808	0.7227	3.8499	6.0021	1.5582	2.0878	1.5582	0.0508	7.6324
15	12h	100y	105.07	1.00	2.0430	3.1531	0.5165	1.2529	0.3419	0.7496	3.6306	5.5095	1.4674	2.0657	1.4674	0.0510	7.0561
16	18h	100y	122.81	1.00	1.5712	2.0298	0.4559	0.8280	0.2857	0.4959	2.3537	4.0763	0.9992	1.3498	0.9992	0.0336	5.1339
17	24h	100y	136.87	1.00	1.8250	2.1129	0.4993	0.8200	0.3250	0.4906	2.4707	4.8503	1.2112	1.3577	1.2112	0.0334	6.0919
18	30h	100y	148.48	1.00	1.2893	1.6406	0.4351	0.6245	0.2663	0.3748	1.9551	3.5134	0.8534	1.0551	0.8534	0.0261	4.3302
19	36h	100y	158.30	1.00	1.3814	1.4872	0.4320	0.5679	0.2703	0.3397	1.7518	3.6642	0.8417	0.9456	0.8417	0.0232	4.5465
20	48h	100y	174.00	1.00	1.4098	1.7856	0.4156	0.6394	0.2530	0.3827	2.0929	3.7573	0.9488	1.0987	0.9488	0.0266	4.6889
21	72h	100y	194.97	1.00	0.9589	1.1719	0.2657	0.4512	0.1597	0.2701	1.3884	2.3834	0.6628	0.7537	0.6628	0.0184	3.0060

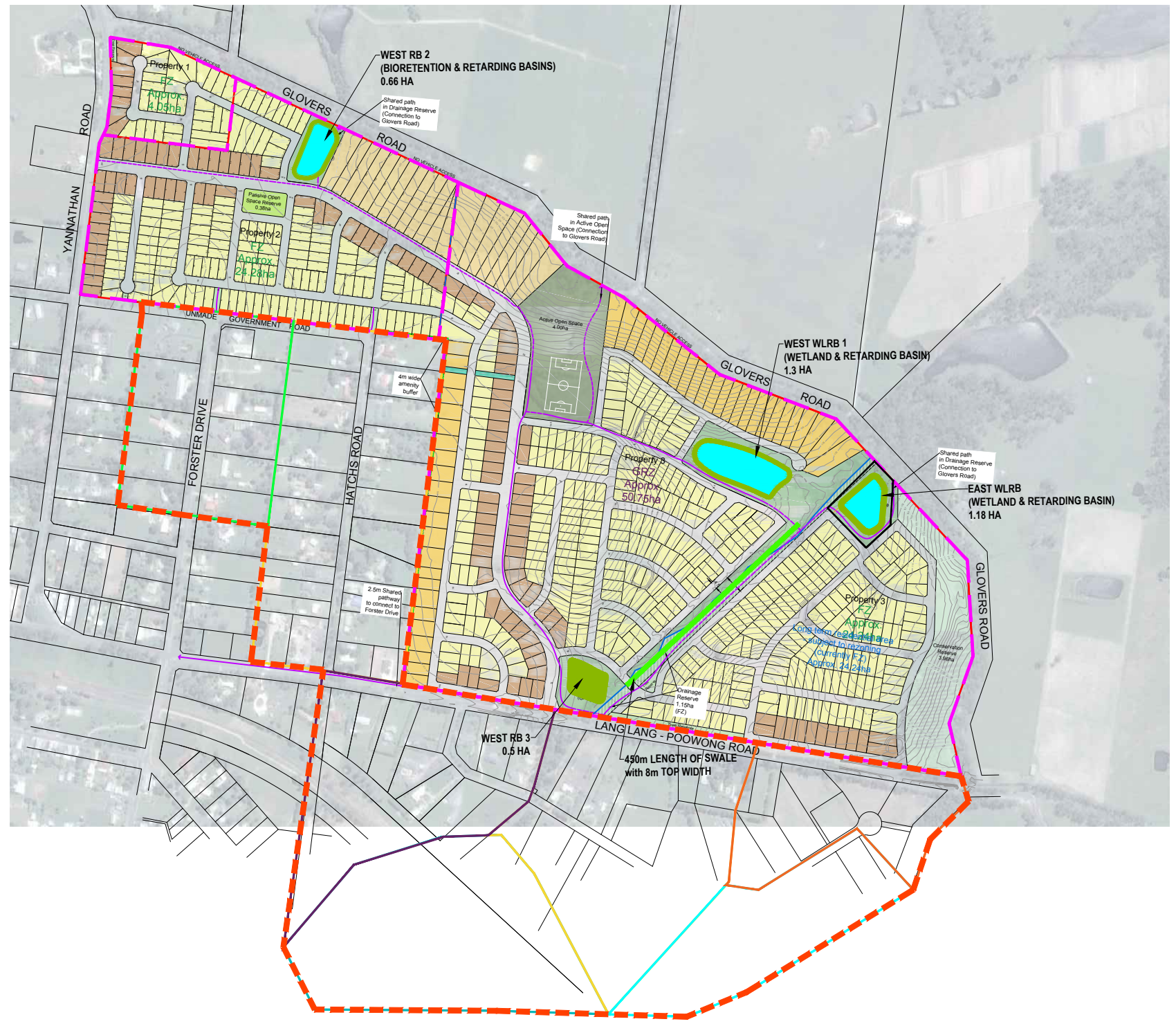
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APPENDIX D.  
**WSUD Assets and Detention Basin Concept Plan**



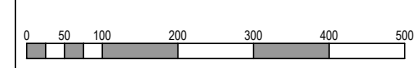
LEGEND - LAYOUT PLAN	
	CATCHMENT A (19.37HA)
	CATCHMENT B (2.40HA)
	CATCHMENT C (11.78HA)
	CATCHMENT D (37.51HA)
	CATCHMENT E (22.86HA)
	CATCHMENT F (1.91HA)
	PROPOSED OVERLAND FLOW (WITH DIRECTION)
	EXISTING OVERLAND FLOW (WITH DIRECTION)
	EXTERNAL CATCHMENT BOUNDARY
	TITLE BOUNDARY



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P1	UPDATED LEGEND AND CATCHMENTS	11.01.18	JG	AM					
P0	INITIAL ISSUE	30.11.17	LN	LM					



Designed  
Date  
Drawn  
Approved  
Date  
PS Number

L.NURHALIM  
30.11.17  
L.NURHALIM  
L.MORRIS  
30.11.17  
PS



Project Details  
379 NYORA-POOWONG ROAD, NYORA  
DEVELOPMENT PLAN OVERLAY-SCHEDULE 10  
SOUTH GIPPSLAND SHIRE COUNCIL

Drawing Title  
PRELIMINARY DRAINAGE STRATEGY

Sheet 01 of 1			
Scale 1:5000 @ A1			
Project Ref	Stage No	Drawing No	Rev
0900659	00	001	P1

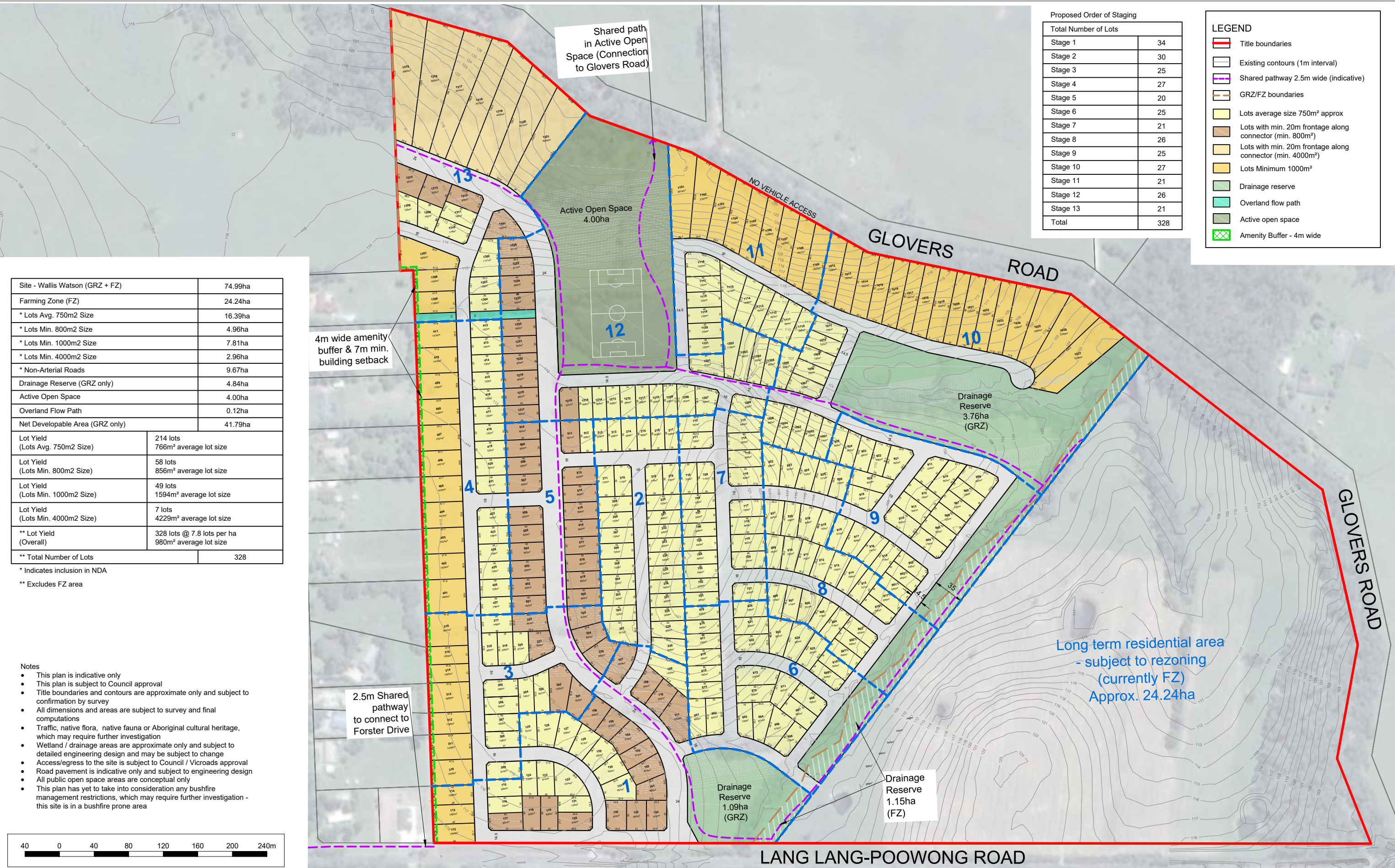
K:\Jobs Data\0900659 Nyora\_Wat\Drawings\SWMS\0900659-Preliminary Drainage.dwg



APPENDIX E.  
**Staging Plan for 379 Lang Lang – Poowong Road, Nyora**



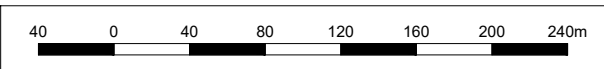




Site - Wallis Watson (GRZ + FZ)	74.99ha
Farming Zone (FZ)	24.24ha
* Lots Avg. 750m2 Size	16.39ha
* Lots Min. 800m2 Size	4.96ha
* Lots Min. 1000m2 Size	7.81ha
* Lots Min. 4000m2 Size	2.96ha
* Non-Arterial Roads	9.67ha
Drainage Reserve (GRZ only)	4.84ha
Active Open Space	4.00ha
Overland Flow Path	0.12ha
Net Developable Area (GRZ only)	41.79ha
Lot Yield (Lots Avg. 750m2 Size)	214 lots 766m <sup>2</sup> average lot size
Lot Yield (Lots Min. 800m2 Size)	58 lots 856m <sup>2</sup> average lot size
Lot Yield (Lots Min. 1000m2 Size)	49 lots 1594m <sup>2</sup> average lot size
Lot Yield (Lots Min. 4000m2 Size)	7 lots 4229m <sup>2</sup> average lot size
** Lot Yield (Overall)	328 lots @ 7.8 lots per ha 980m <sup>2</sup> average lot size
** Total Number of Lots	328

\* Indicates inclusion in NDA  
 \*\* Excludes FZ area

- Notes
- This plan is indicative only
  - This plan is subject to Council approval
  - Title boundaries and contours are approximate only and subject to confirmation by survey
  - All dimensions and areas are subject to survey and final computations
  - Traffic, native flora, native fauna or Aboriginal cultural heritage, which may require further investigation
  - Wetland / drainage areas are approximate only and subject to detailed engineering design and may be subject to change
  - Access/egress to the site is subject to Council / Vicroads approval
  - Road pavement is indicative only and subject to engineering design
  - All public open space areas are conceptual only
  - This plan has yet to take into consideration any bushfire management restrictions, which may require further investigation - this site is in a bushfire prone area



Proposed Order of Staging	
Total Number of Lots	
Stage 1	34
Stage 2	30
Stage 3	25
Stage 4	27
Stage 5	20
Stage 6	25
Stage 7	21
Stage 8	26
Stage 9	25
Stage 10	27
Stage 11	21
Stage 12	26
Stage 13	21
Total	328

LEGEND	
	Title boundaries
	Existing contours (1m interval)
	Shared pathway 2.5m wide (indicative)
	GRZ/FZ boundaries
	Lots average size 750m <sup>2</sup> approx
	Lots with min. 20m frontage along connector (min. 800m <sup>2</sup> )
	Lots with min. 20m frontage along connector (min. 4000m <sup>2</sup> )
	Lots Minimum 1000m <sup>2</sup>
	Drainage reserve
	Overland flow path
	Active open space
	Amenity Buffer - 4m wide

Indicative Subdivision and Staging Plan  
 Lang Lang-Poowong Road, Nyora  
 Wallis Watson Nyora Pty Ltd

**BW** Beveridge Williams  
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 Melbourne ph : 03 9524 8888  
 www.beveridgewilliams.com.au

Version	Date	Description	Drafted	Approved
01	03.09.2018	First Issue	TG/KT	DRAFT
02	21.09.2018	Plan amended	TG	
03	09.10.2018	Plan amended	TG	

Version	Date	Description	Drafted	Approved

Date: 09.10.2018  
 Version No: 03  
 Job No: 0900659  
 Scale (A1):1:2000  
 (A3):1:4000

