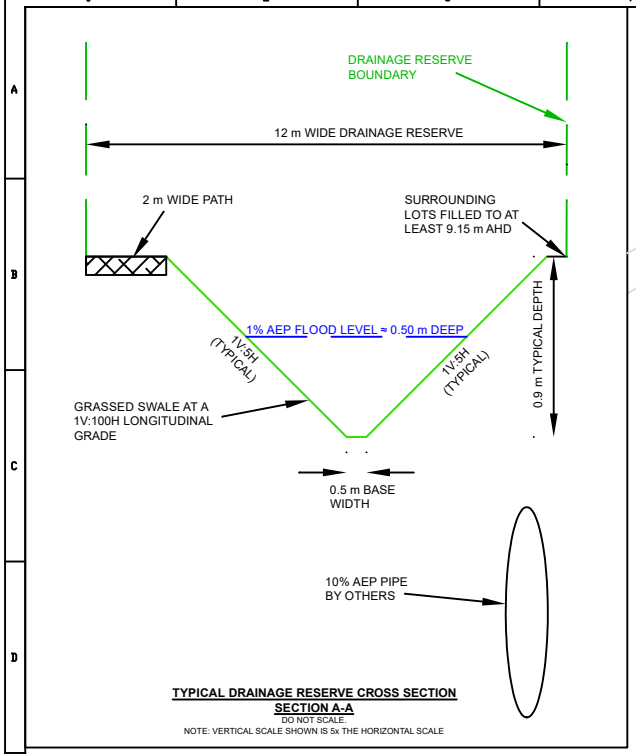

TYPICAL DRAINAGE RESERVE CROSS SECTION SECTION A-A

DO NOT SCALE.

NOTE: VERTICAL SCALE SHOWN IS 5x THE HORIZONTAL SCALE

NOTES:

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6. THE PROPOSALS SHOWN ARE IN GENERAL ACCORDANCE WITH THE REPORT "170 McDonalds Track, Lang Lang, Retarding Basin / Wetland Functional Design, 11/01/2018, Rev A, Stormy Water Solutions" WHICH DETAILED THE DESIGN OF THE WETLAND ADJACENT TO THE SUBJECT LAND.
7. THE FUTURE BYPASS ROAD PROPOSALS ARE AS PROVIDED BY SPEEDIE DEVELOPMENT CONSULTANTS AND ARE SUBJECT TO CHANGE.
8. THE SURVEY SHOWN ON THIS DRAWING IS FROM PRIOR TO THE ADJACENT THE RESIDENTIAL DEVELOPMENT. AS SUCH IT DOES NOT REPRESENT THE CURRENT CONDITIONS OF THE SUBJECT LAND OR THE ADJACENT DEVELOPMENT, INCLUDING THE FILL WHICH HAS BEEN PLACED ON THE SUBJECT LAND.

LEGEND:

- SUBJECT LAND
- DRAINAGE RESERVE PROPOSAL
- PROPOSED 10% AEP PIPES
- PROPOSED 1% AEP PIPES
- INDICATIVE 1% AEP GAP FLOW DIRECTIONS
- PROPOSED DRAINAGE RESERVE
- EXISTING CONSTRUCTED WETLAND
- PROPOSED DEVELOPMENT (SUBJECT TO CHANGE)
- EXISTING PARCELS
- 100 mm CONTOURS FROM PRIOR TO THE RESIDENTIAL DEVELOPMENT

THE FUTURE BYPASS ROAD IS TO DISCHARGE INTO THE EXISTING TABLE DRAIN ALONG THE SOUTH OF WESTERNPORT ROAD

WESTERNPORT ROAD

FUTURE LANG LANG TRUCK BYPASS

SUBJECT LAND

SUBJECT LAND

GENERAL EXPECTED LOCATION OF 10% AEP PIPES TO SERVICE THE SUBJECT LAND

SMALL SWALE OR PIPE ALONG THE EASTERN BOUNDARY OF THE EASTERN TRIANGLE TO ENSURE THAT THE EXTERNAL RESIDENTIAL CATCHMENTS ARE CONVEYED TO THE WETLAND

EXTENSIVE FILLING WILL BE REQUIRED TO ENSURE THAT THE ROAD OVERLAND FLOW PATHS SHOWN CAN FUNCTION

BAKER STREET

1% AEP PIPE TO ENABLE THE EASTERN TRIANGLE TO BE SERVICED IN THE EXISTING SEDIMENT BASIN

DRAINAGE RESERVE TO ALLOW 1% AEP GAP FLOWS TO BE CONVEYED SOUTH FROM THE ROAD TO THE WETLAND. SEE SECTION A-A

CLARKS ROAD

GROSS POLLUTANT TRAP (FOR LITTER) TO BE PLACED ON THE INLET INTO THE SEDIMENT BASIN

FUTURE LANG LANG TRUCK BYPASS

LINK ROAD

CLARKS ROAD

ALL LOTS TO BE FILLED TO AT LEAST 9.15 m AHD FRONTING THE WETLAND

1% AEP BOX CULVERTS (SIZED BY OTHERS) TO CONVEY THE GAP FLOWS UNDER THE EXISTING PATH

EXISTING CONSTRUCTED WETLAND / RETARDING BASIN WHICH WAS SIZED ASSUMING THE SUBJECT LAND DRAINED INTO IT

SUBJECT LAND 10% AEP PIPES TO DISCHARGE INTO THE EXISTING SEDIMENT BASIN

EXISTING PIPE FROM THE RESIDENTIAL DEVELOPMENT

N

SCALE : 0 25 50 100m

CONCEPT DESIGN SUBJECT TO CHANGE NOT FOR CONSTRUCTION

REVISION	DATE
V1 – INITIAL ISSUE	23/03/2023

DESIGNED	Michael Mag		
CHECKED	Valerie Mag		
AUTHORISED BY		PROJECTION	MGA94/Z55

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6 LINK ROAD, LANG LANG

STORM WATER MANAGEMENT STRATEGY
WESTERNPORT INDUSTRIAL ESTATE

SCALE:	AS SHOWN
SHEET	1 OF 1
DRAWING No.	2261/SWMS/1

Appendix B Hydrologic Modelling and Design

The RORB Runoff Routing Program – version 6.45, developed at Monash University by E. M. Laurenson and R. G. Mein, has been used to determine the design flows originating from the catchment. RORB is a general runoff and stream flow routing program used to calculate flood hydrographs from rainfall and other channel inputs. It subtracts losses from rainfall to produce rainfall excess and routes this through catchment storage to produce the hydrograph.

Generally, the models utilised are as per the 2018 Wetland Design Report, and have only been updated herein to reflect the current Subject Land Proposals. Hence, showing that the 2018 Wetland Design Report's findings are still valid.

B.1 Pre-development

B.1.1 Model Description

Pre-development conditions are taken as prior to the adjacent McDonalds Track residential development occurring.

Figure C.1 details the RORB model for the pre-development conditions model and Tables C.1 and C.2 detail the tabulation of the RORB model setup (i.e. catchment area, fraction impervious, reach lengths, etc). This catchment is based on existing site survey provided by the client and LiDAR information. The model setup only considers the developable area of the catchment and produces a representative hydrograph from the developable part of the catchment into Adams Creek, and towards Westernport Road.

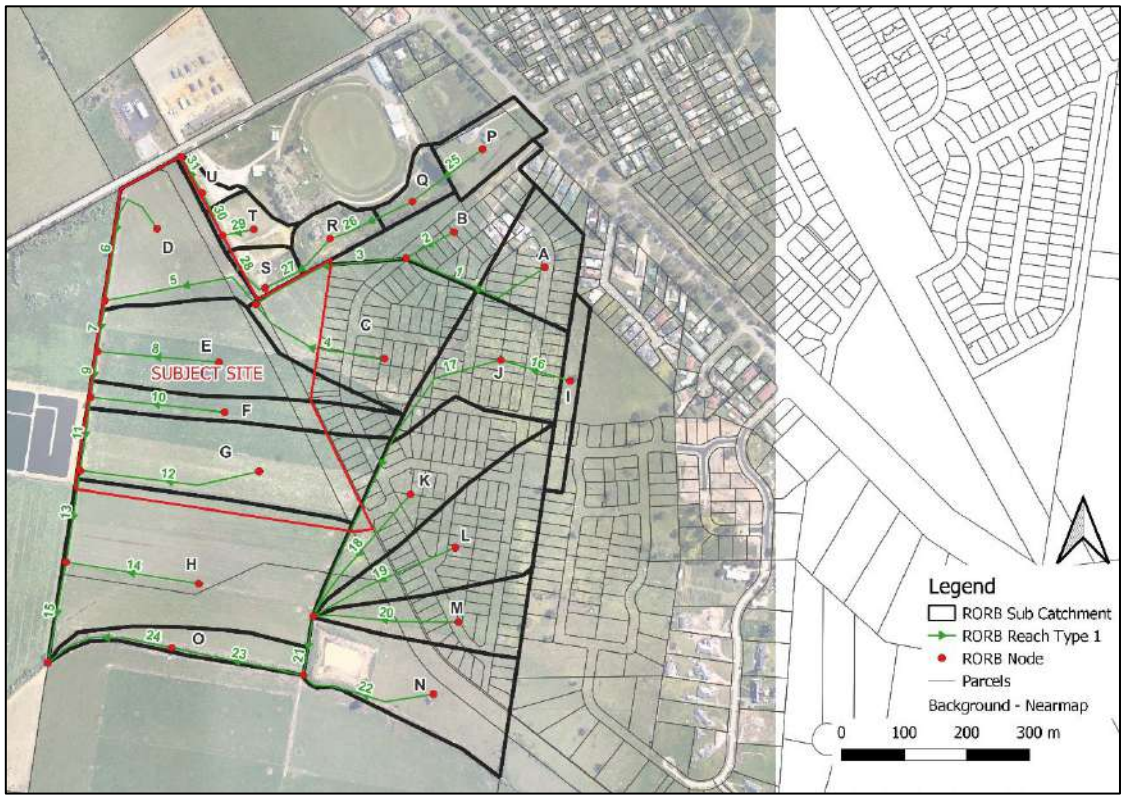


Figure B.1 Pre-development RORB model

Table B.1 RORB Sub-Catchment Details

Sub Area	Area (ha)	Area (km^2)	F_{imp}
A	2.2	0.022	0.05
B	2.8	0.028	0.05
C	5.5	0.055	0.00
D	3.6	0.036	0.00
E	4.6	0.046	0.00
F	2.1	0.021	0.00
G	5.8	0.058	0.00
H	9.3	0.093	0.00
I	0.9	0.009	0.65
J	3.5	0.035	0.00
K	3.9	0.039	0.00
L	4.3	0.043	0.00
M	2.4	0.024	0.00
N	4.5	0.045	0.00
O	1.5	0.015	0.00
P	1.4	0.014	0.10
Q	0.7	0.007	0.05
R	1.0	0.010	0.05
S	0.6	0.006	0.05
T	0.9	0.009	0.05
U	0.3	0.003	0.05
Total	**61.9**	**0.619**	**0.02**

Table B.2 RORB Reach Details

Reach	Reach Type	Length (km)	Slope (%)
1	1	0.250	
2	1	0.087	
3	1	0.257	
4	1	0.232	
5	1	0.265	
6	1	0.235	
7	1	0.082	
8	1	0.195	
9	1	0.074	
10	1	0.215	
11	1	0.119	
12	1	0.289	
13	1	0.148	
14	1	0.215	
15	1	0.164	
16	1	0.116	
17	1	0.538	
18	1	0.250	
19	1	0.252	
20	1	0.232	
21	1	0.095	
22	1	0.219	
23	1	0.215	
24	1	0.211	
25	1	0.140	
26	1	0.144	
27	1	0.133	
28	1	0.115	
29	1	0.051	
30	1	0.076	
31	1	0.067	

B.1.2 Model Parameters, Inputs and Validation

Identical parameters and inputs to the model developed as part of the 2018 Wetland Design Report have been adopted, including utilising the ARR 2019 datahub inputs for the location 38.273S, 145.564 E (accessed: 18/12/2017).

Table B.3 RORB pre-development parameters

k_c	d_{av} (km)	k_c/d_{av}	m	IL (mm)	Other Loss
1.08	0.73	1.47	0.8	15.0	$RoC_{1\%}$ = 0.6

It is assumed that the validation performed within the 2018 Wetland Design Report is applicable herein.

B.1.3 Model Results

The 1% AEP pre-development results are:

Flow towards Adams Creek (south) = 2.15 m^3/s (2-hour duration); and

Flow towards Westernport Road (north) = 0.25 m^3/s (1.5-hour duration).

B.2 Post-development Modelling

B.2.1 Model Description

A post-development model has been developed as per Figure B.2, Table B.4 and Table B.5.

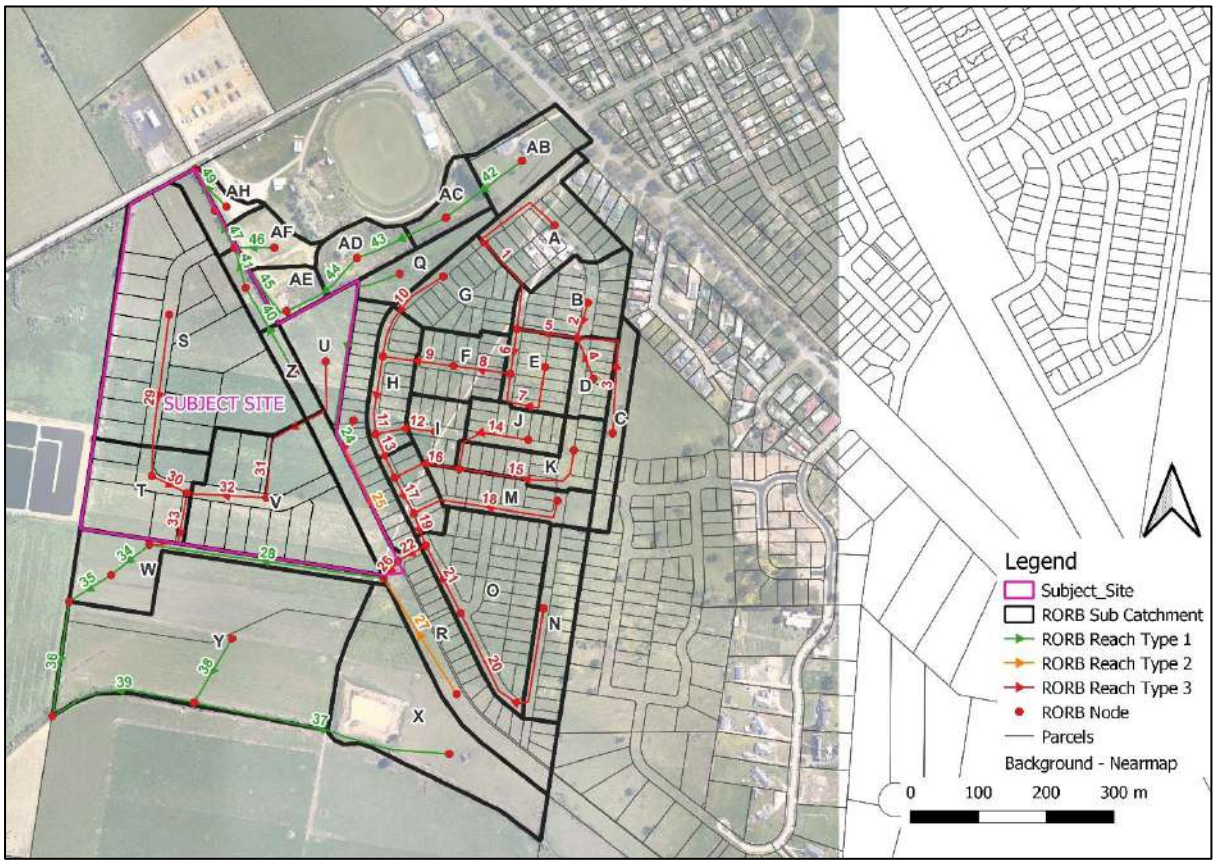


Figure B.2 Post-development RORB model

Table B.4 RORB Sub-Catchment Details

Sub Area	Area (ha)	Area (km^2)	F_{imp}
A	2.0	0.020	0.65
B	1.6	0.016	0.65
C	0.9	0.009	0.65
D	0.7	0.007	0.65
E	1.1	0.011	0.65
F	1.3	0.013	0.65
G	1.7	0.017	0.65
H	1.2	0.012	0.65
I	0.8	0.008	0.65
J	0.9	0.009	0.65
K	1.3	0.013	0.65
L	0.8	0.008	0.65
M	1.3	0.013	0.65
N	1.6	0.016	0.65
O	3.4	0.034	0.65
P	1.6	0.016	0.65
Q	0.9	0.009	0.05
R	3.5	0.035	0.65
S	7.4	0.074	0.90
T	2.2	0.022	0.90
U	1.2	0.012	0.90
V	4.1	0.041	0.90
W	1.8	0.018	0.10
X	4.4	0.044	0.00
Y	8.1	0.081	0.00
Z	0.4	0.004	0.60
AA	0.4	0.004	0.60
AB	1.4	0.014	0.10
AC	0.7	0.007	0.05
AD	1.0	0.010	0.05
AE	0.6	0.006	0.05
AF	0.8	0.008	0.05
AG	0.4	0.004	0.60
AH	0.3	0.003	0.05
Total	**61.9**	**0.619**	**0.51**

Table B.5 RORB Reach Details

Reach	Reach Type	Length (km)	Slope (%)
1	3	0.297	0.91%
2	3	0.054	1.66%
3	3	0.197	0.81%
4	3	0.064	0.94%
5	3	0.090	1.66%
6	3	0.067	0.33%
7	3	0.151	0.86%
8	3	0.085	0.35%
9	3	0.105	0.47%
10	3	0.153	0.39%
11	3	0.116	0.34%
12	3	0.089	0.68%
13	3	0.070	0.36%
14	3	0.139	0.86%
15	3	0.204	1.47%
16	3	0.101	0.40%
17	3	0.060	0.33%
18	3	0.239	0.75%
19	3	0.051	0.33%
20	3	0.317	0.47%
21	3	0.113	0.36%
22	3	0.047	0.33%
23	3	0.040	0.33%
24	1	0.308	
25	2	0.187	0.33%
26	3	0.033	0.33%
27	2	0.202	0.33%
28	1	0.350	
29	3	0.240	0.33%
30	3	0.058	0.34%
31	3	0.251	0.33%
32	3	0.117	0.33%
33	3	0.118	0.33%
34	1	0.072	
35	1	0.073	
36	1	0.171	
37	1	0.385	
38	1	0.110	
39	1	0.220	
40	1	0.146	
41	1	0.062	
42	1	0.140	
43	1	0.144	
44	1	0.133	
45	1	0.127	
46	1	0.059	
47	1	0.062	
48	1	0.067	
49	1	0.072	

B.2.2 Model Parameters, Inputs and Validation

The same model parameters and inputs as per Appendix B.1.2 have been adopted. The only change is to the K_c value (now 1.13) which has changed to retain the same K_c/d_{av} ratio between the two scenarios.

B.2.3 Retarding Basin Simulation

The retarding basin as per the 2018 Wetland Design Report has been simulated as per the relationship shown in Table B.6.

Table B.6 2018 Wetland Design Report retarding basin properties.

Stage (m AHD)	Storage (m^3)	Discharge (m^3/s)
6.50	0	0.000
6.80	3779	0.025
6.90	5144	0.026
7.00	6562	0.134
7.10	8031	0.326
7.20	9552	0.571
7.30	11122	0.856
7.40	12738	1.127
7.50	14377	2.867

B.2.4 Model Results

Table B.7 compares the post-development to the pre-development 1% AEP flow estimates.

Table B.7 post-development 1% AEP Flow Estimates

Scenario	Pre-development (Modelling Herein)	Post-Development (2018 Wetland Design Report)	Post-Development (Modelling Herein)
Total Wetland Inflow	N/A	5.15 m^3/s (20-minute)	4.85 m^3/s (20-minute)
Total Flow Towards Adams Creek	2.15 m^3/s (2-hour)	2.05 m^3/s (3-hour)	1.75 m^3/s (4.5-hour)
Total Flow towards Westernport Road	0.25 m^3/s (1.5-hour)	N/A	0.30 m^3/s (1.5-hour)

Note: All flow estimates are rounded to the nearest 0.05 m^3/s and are taken as the mean for the critical duration.

As can be seen:

- The modelling herein is generally consistent with the modelling undertaken as part of the 2018 Wetland Design Report;
- The post-development flow estimates towards Adams Creek are below the pre-development flow estimates;
- The post-development flow estimates towards Westernport Rd are increased by 0.05 m^3/s. Appendix C shows that this small increase has no detrimental downstream impact.

Appendix C Westernport Rd Table Drain Capacity

Speedie Development Consultants are proposing to send approximately 1.20 ha of the land which is to become the bypass road towards Westernport Rd. As per Appendix B, this increased the 1% AEP flow expected within the roadside drain from 0.25 m^3/s to 0.30 m^3/s.

Figure C.1 shows the existing form of this drain. From LiDAR information and Site Visit observations, the table drain is estimated as a trapezoid with 1V:3H batters, a 1V:400H longitudinal grade, 0.6 metres depth, a 0.5 metre base width and a Mannings n of 0.05.

Figure C.1 Existing Westernport Road Table Drain

Table C.1 shows that the increase in 1% AEP flow rate of 0.05 m^3/s only increases the expected flood depth in the table drain by 0.03 metres. With the increase, there is still in the order of 150 mm freeboard to Westernport Road.

Thus, it is deemed that there are no detrimental downstream impacts due to the Speedie Development Consultants proposal to send approximately 1.20 ha of bypass road towards Westernport Rd.

Table C.1 Westernport Road Table Drain Capacity Estimate

Capacity Estimate - Mannings		**Pre**	**Post**	
Longitudinal Slope =	s =	0.0025	0.0025	m/m
Mannings n	n =	0.05	0.05	
Base Width =	W =	0.50	0.50	m
Water Depth =	**D =**	**0.40**	**0.43**	**m**
Side Slopes =	SS = 1V: x H =	3.00	3.00	
Top Width =	TW = W + SS × 2 × D =	2.90	3.08	m
Area =	A = D × (SS × D + W) =	0.68	0.77	m^2
Wetted Perimeter =	WP = W + 2×((SS×D)^2 + D^2)$^{0.5}$ =	3.03	3.22	m
Hydraulic Radius =	R = A / WP =	0.22	0.24	m
Velocity =	**V = ($R^{2/3}$ × $s^{0.5}$) / n =**	**0.37**	**0.39**	**m/s**
Capacity =	**Q = A × V =**	**0.25**	**0.30**	**m^3/s**

Appendix D Hydraulic Capacity

Using the Rational Method methodology from the EDCM, the total design flow estimates from the Subject Land into the wetland have been estimated as per Table D.1. It is noted that the flow estimates in Table D.1 match well with the RORB modelling estimates generated from the modelling in Appendix B.

From Table D.1, the 1% AEP gap flow is estimated as 1.55 m^3/s.

Table D.1 Design Flow Estimates from the Subject Land into the Wetland

AEP	A (ha)	F_{imp}	$C_{10\%}$	C_{AEP}	$A_e = A \times C$ (ha)	$\sum A_e$ (ha)	Tc (min)	I (mm/hr)	Q (m^3/s)
10%	15.00	0.90	0.83	0.83	12.39	12.39	15.0	66.4	2.30
1%	15.00	0.90	0.83	0.99	14.87	14.87	20.0	93.3	3.85

Note: All flow estimates are rounded to the nearest 0.05 m^3/s. IFD location = 38.2625 S, 145.5625 E.

D.1 Road Gap Flow Capacities

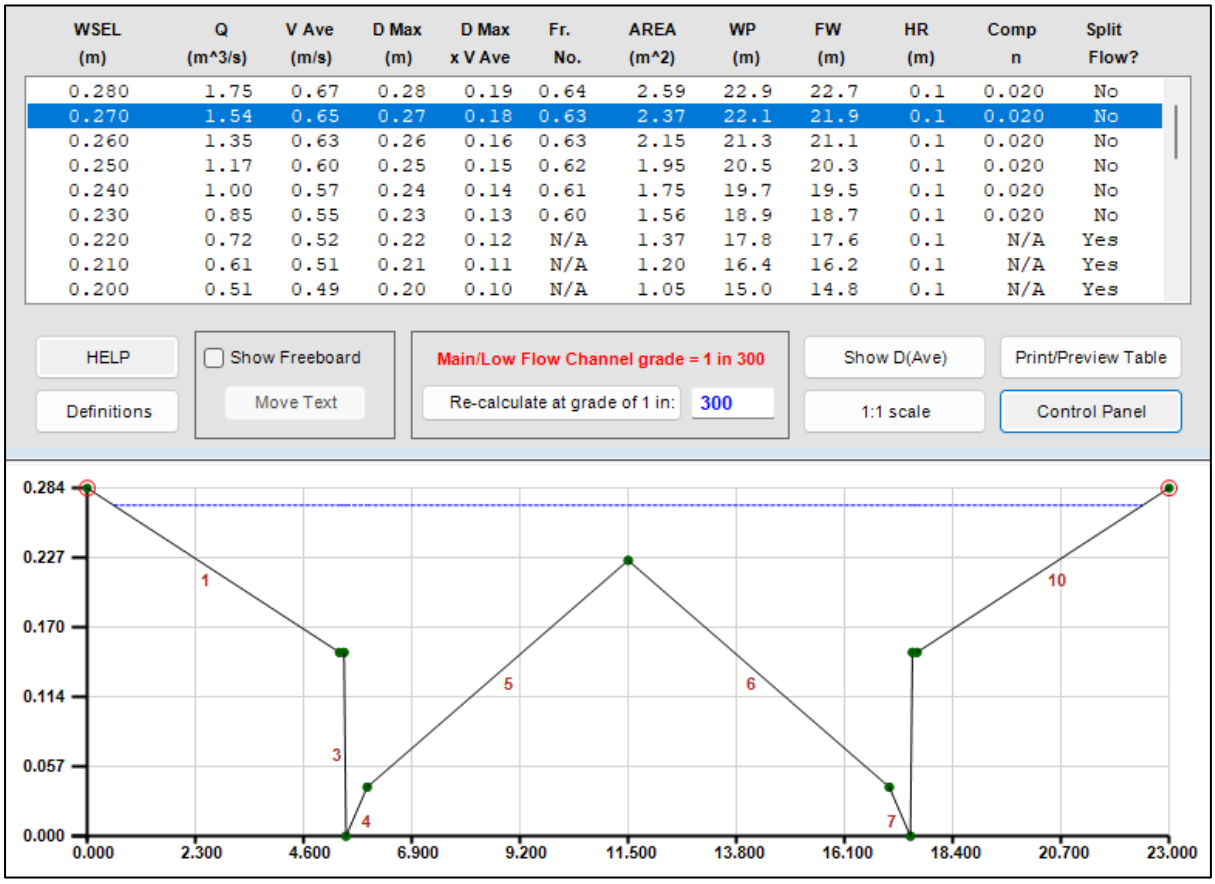
Within the Subject Land, a 23 metre wide road reserve at 1V:300H is expected to convey the 1% AEP gap flow estimate. The general road profile assumed herein is as per Table D.2, noting that this profile is subject to change through detailed design.

Table D.2 Typical 23 metre wide road profile assumed (dimensions in metres)

X	0.00	5.36	5.46	5.50	5.95	11.50	17.05	17.50	17.54	17.64	23.00
Y	0.284	0.150	0.150	0.000	0.040	0.225	0.040	0.000	0.150	0.150	0.284

Figure D.1 shows a output from the PcConvey software package showing that the road profile can suitably convey the 1.55 m^3/s 1% AEP gap flow estimate with:

- A maximum depth of 0.27 m (DELWP Flood Guidelines Safety Limits ≤ 0.50 m);
- A maximum velocity of 0.65 m/s (DELWP Flood Guidelines Safety Limits ≤ 2.00 m/s); and
- A maximum hazard of 0.18 m^2/s (DELWP Flood Guidelines Safety Limits ≤ 0.40 m^2/s).



WSEL (m)	Q (m^3/s)	V Ave (m/s)	D Max (m)	D Max x V Ave	Fr. No.	AREA (m^2)	WP (m)	FW (m)	HR (m)	Comp n	Split Flow?
0.280	1.75	0.67	0.28	0.19	0.64	2.59	22.9	22.7	0.1	0.020	No
0.270	1.54	0.65	0.27	0.18	0.63	2.37	22.1	21.9	0.1	0.020	No
0.260	1.35	0.63	0.26	0.16	0.63	2.15	21.3	21.1	0.1	0.020	No
0.250	1.17	0.60	0.25	0.15	0.62	1.95	20.5	20.3	0.1	0.020	No
0.240	1.00	0.57	0.24	0.14	0.61	1.75	19.7	19.5	0.1	0.020	No
0.230	0.85	0.55	0.23	0.13	0.60	1.56	18.9	18.7	0.1	0.020	No
0.220	0.72	0.52	0.22	0.12	N/A	1.37	17.8	17.6	0.1	N/A	Yes
0.210	0.61	0.51	0.21	0.11	N/A	1.20	16.4	16.2	0.1	N/A	Yes
0.200	0.51	0.49	0.20	0.10	N/A	1.05	15.0	14.8	0.1	N/A	Yes

Figure D.1 1% AEP Road Gap Flow Capacity

D.2 Drainage Reserve Capacity

The Speedie Development Layout nominates a 12 metre wide, 70 metre long drainage reserve to convey 1% AEP gap flows from the road system towards the wetland reserve.

At this stage, within the reserve there is assumed:

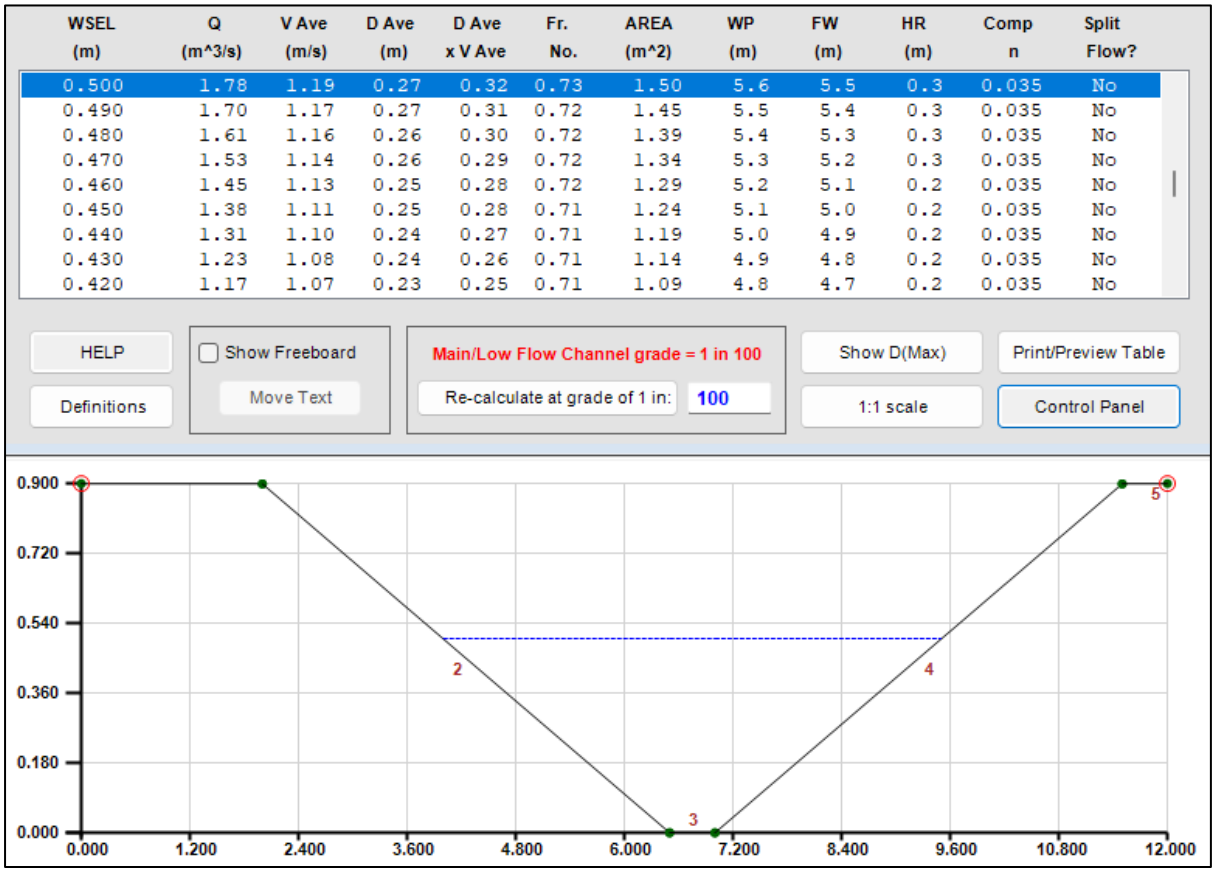
- A 2 metre wide path; and
- A grassed swale (0.5 m base, 1V:5H batters, 1V:100H longitudinal grade).

The typical section of this reserve is provided in Table D.3.

Table D.3 Typical drainage reserve road profile assumed (dimensions in metres)

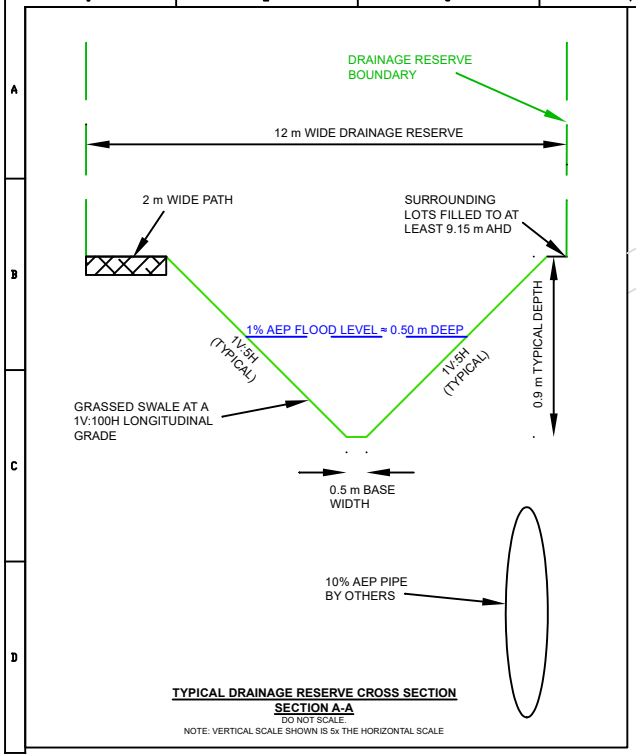
X	0.0	2.0	6.5	7.0	11.5	12.0
Y	0.90	0.90	0.00	0.00	0.90	0.90

Figure D.2 shows that this reserve proposal is able to convey the 1% AEP gap flow estimate with at least 300 mm freeboard to the surrounding lots.



WSEL (m)	Q (m^3/s)	V Ave (m/s)	D Ave (m)	D Ave x V Ave	Fr. No.	AREA (m^2)	WP (m)	FW (m)	HR (m)	Comp n	Split Flow?
0.500	1.78	1.19	0.27	0.32	0.73	1.50	5.6	5.5	0.3	0.035	No
0.490	1.70	1.17	0.27	0.31	0.72	1.45	5.5	5.4	0.3	0.035	No
0.480	1.61	1.16	0.26	0.30	0.72	1.39	5.4	5.3	0.3	0.035	No
0.470	1.53	1.14	0.26	0.29	0.72	1.34	5.3	5.2	0.3	0.035	No
0.460	1.45	1.13	0.25	0.28	0.72	1.29	5.2	5.1	0.2	0.035	No
0.450	1.38	1.11	0.25	0.28	0.71	1.24	5.1	5.0	0.2	0.035	No
0.440	1.31	1.10	0.24	0.27	0.71	1.19	5.0	4.9	0.2	0.035	No
0.430	1.23	1.08	0.24	0.26	0.71	1.14	4.9	4.8	0.2	0.035	No
0.420	1.17	1.07	0.23	0.25	0.71	1.09	4.8	4.7	0.2	0.035	No

Figure D.2 1% AEP Reserve Gap Flow Capacity



TYPICAL DRAINAGE RESERVE CROSS SECTION SECTION A-A

DO NOT SCALE.

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8. THE SURVEY SHOWN ON THIS DRAWING IS FROM PRIOR TO THE ADJACENT THE RESIDENTIAL DEVELOPMENT. AS SUCH IT DOES NOT REPRESENT THE CURRENT CONDITIONS OF THE SUBJECT LAND OR THE ADJACENT DEVELOPMENT, INCLUDING THE FILL WHICH HAS BEEN PLACED ON THE SUBJECT LAND.

LEGEND:

- SUBJECT LAND
- DRAINAGE RESERVE PROPOSAL
- PROPOSED 10% AEP PIPES
- PROPOSED 1% AEP PIPES
- INDICATIVE 1% AEP GAP FLOW DIRECTIONS
- PROPOSED DRAINAGE RESERVE
- EXISTING CONSTRUCTED WETLAND
- PROPOSED DEVELOPMENT (SUBJECT TO CHANGE)
- EXISTING PARCELS
- 100 mm CONTOURS FROM PRIOR TO THE RESIDENTIAL DEVELOPMENT

THE FUTURE BYPASS ROAD IS TO DISCHARGE INTO THE EXISTING TABLE DRAIN ALONG THE SOUTH OF WESTERNPORT ROAD

WESTERNPORT ROAD

FUTURE LANG LANG TRUCK BYPASS

SUBJECT LAND

SUBJECT LAND

GENERAL EXPECTED LOCATION OF 10% AEP PIPES TO SERVICE THE SUBJECT LAND

SMALL SWALE OR PIPE ALONG THE EASTERN BOUNDARY OF THE EASTERN TRIANGLE TO ENSURE THAT THE EXTERNAL RESIDENTIAL CATCHMENTS ARE CONVEYED TO THE WETLAND

EXTENSIVE FILLING WILL BE REQUIRED TO ENSURE THAT THE ROAD OVERLAND FLOW PATHS SHOWN CAN FUNCTION

BAKER STREET

1% AEP PIPE TO ENABLE THE EASTERN TRIANGLE TO BE SERVICED IN THE EXISTING SEDIMENT BASIN

DRAINAGE RESERVE TO ALLOW 1% AEP GAP FLOWS TO BE CONVEYED SOUTH FROM THE ROAD TO THE WETLAND. SEE SECTION A-A

CLARKS ROAD

GROSS POLLUTANT TRAP (FOR LITTER) TO BE PLACED ON THE INLET INTO THE SEDIMENT BASIN

FUTURE LANG LANG TRUCK BYPASS

LINK ROAD

CLARKS ROAD

ALL LOTS TO BE FILLED TO AT LEAST 9.15 m AHD FRONTING THE WETLAND

1% AEP BOX CULVERTS (SIZED BY OTHERS) TO CONVEY THE GAP FLOWS UNDER THE EXISTING PATH

EXISTING CONSTRUCTED WETLAND / RETARDING BASIN WHICH WAS SIZED ASSUMING THE SUBJECT LAND DRAINED INTO IT

SUBJECT LAND 10% AEP PIPES TO DISCHARGE INTO THE EXISTING SEDIMENT BASIN

EXISTING PIPE FROM THE RESIDENTIAL DEVELOPMENT

N

SCALE : 0 25 50 100m

CONCEPT DESIGN SUBJECT TO CHANGE NOT FOR CONSTRUCTION

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6 LINK ROAD, LANG LANG

STORM WATER MANAGEMENT STRATEGY
WESTERNPORT INDUSTRIAL ESTATE

SCALE:	AS SHOWN
SHEET	1 OF 1
DRAWING No.	2261/SWMS/1