Our Ref: 26001 IFC and Compliance with OPW Conditions

1 July 2026

The Chief Executive Officer
Douglas Shire Council
PO Box 723
MOSSMAN QLD 4873

ATTENTION: NEIL BECK

Dear Neil,

2 ANDREWS STREET, NEWELL

OPW COMPLIANCE WITH CONDITIONS - L100 SP334253 - OP 2026_5948/1

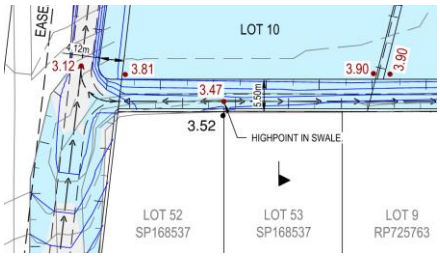
In accordance Condition 1 of OPW Approval OP2026/5948/1 we hereby attached amended **Issue For Construction (IFC)** plans with amendments made as required by the conditions.

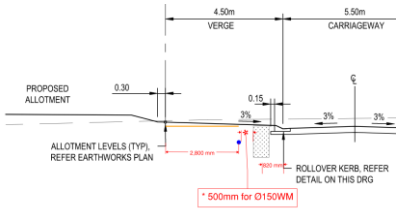
For ease of assessment, relevant responses associated with the proposed operational works are repeated below in the order in which they appeared in the Decision Notice.

Included with this response are the following documents:

- Amended Applin Consulting 26001 C001(1) to C019(2)
- Electrical plans (Not included. To be submitted by others)
- Landscape Plans

Assessment Manager Conditions & Advices		
Condition		**Response**
1	***General*** *Drawings must be submitted "For Construction" and must be certified as approved by a Registered Professional Engineer of Queensland (RPEQ).*	Complies. Revised plans revised to IFC Issue are attached.
2	***Earthworks*** *a. Prior to the prestart meeting, provide updated lot grading and lot levels to drain all lots to the rear perimeter drains.* *b. Prior to the prestart meeting, provide updated drawings with additional spot levels and design contours in the borrow area to demonstrate that the finished surface will not create ponding for Swale Drain 1.* *The additional information is required to include a longitudinal section along the drainage path from the proposed designed section of Swale Drain 1 to the north-south section of the swale approximately 550m to the west.* *Any drain invert reprofiling required to eliminate ponding is to be shown on the updated For Construction plans. The approved drainage works are to be constructed prior to works acceptance.*	Generally Complies a. Plans have been updated to drain to the rear. Refer 26001-C009(1) b. Plans have been updated to remove the existing humps along the invert to better drain the area. We note this area is extremely flat so some ponding may remain. c. As noted above, this area is extremely flat and has been poorly maintained which has resulted in siltation over the years and high points along the invert. Our plans show levelling out of these high points to better drain

	c. *The applicant is to ensure that any earthworks undertaken as part of this Operational Works approval maintains a free draining surface with no ponding of standing water resulting. Any amendments proposed to the existing finished surface profiles are to be identified and reported to Council prior to being undertaken on site. Amendments shall be recorded as constructed drawings to be submitted at the completion of the project and prior to Works Acceptance*	the area. Some minor ponding may remain until Council commits to regrade the whole drain to the creek outlet.
3	***Road*** a. *Construct the new roadworks generally in accordance with the Approved Plans by Applin Consulting and the FNQROC Development Manual requirements, prior to Works Acceptance*	Noted and will be complied with.
4	***Stormwater Drainage*** a. *Construct the stormwater culvert generally in accordance with Revision B of Applin Consulting Drawings 26001-C013 and requirements of the FNQROC Development Manual, prior to Works Acceptance.* b. *Prior to the prestart meeting, provide additional inlet capture calculations for the post development flow depth on Coulthard Close between Lematy Close and the new crossroad culvert. The calculations must confirm that the on-road flow depth and width are compliant with the FNQROC Development Manual and Queensland Urban Drainage manual (QUDM) criteria for the minor and major rainfall events.* c. *With reference to the Applin Consulting Drawing set, provide the following amendments or further clarification prior to the prestart meeting:* i. *Provide a longitudinal section for Drainage Swale 1 south from Chainage 416.29m to confirm the swale is free draining. Where identified as being required from the longitudinal section, the applicant is to undertake drain maintenance to achieve free draining conditions;* ii. *Confirm the flow rate and velocity in Drainage Swale 1 during the 20% AEP and 1% AEP rainfall events at the following key points:* a. *the rear of Lot 10;* b. *the southwest corner behind Lot 13;* c. *the rear of Lot 23; and* d. *downstream from the junction with Drainage Swale 2.* iii. *Provide a concrete invert in Drainage Swale 1 at the junction with Swale Drain 2 for a minimum distance of 10m upstream and downstream from the junction.*	a. Noted b. Additional calculations are attached with a plan showing catchments and road flow depths. Refer Stormwater Road Calculations appended to this letter. c. Complied with i. Details as requested have been added to plan 26001 C-16(2) ii. Refer Stormwater Drain Calculations appended to this letter. iii. A concrete base has been detailed on the revised plans as requested d. We assume DSC means drainage swale 02. We have lifted this level to RL 3.47m AHD which is only 50mm lower that the adjoining lot (L52 SP168537) to the east. See snip of amended plan below: 

	d. Prior to the prestart meeting, clarify the 1%AEP flow depth at Chainage 40m in Drainage Swale 1 or provide additional earthworks and drainage profile details to demonstrate how flows will be prevented from entering Drainage Swale 2 and impacting the hydraulic performance of this drain and culvert crossing.	
5	***Sewerage*** a. *Advice Note: Council's assessment of this Operational Works Application has not considered the on-site disposal requirements of Condition 6 ROL 2021_4160/1. Approval for civil works does not imply that Council accepts that the on-site sewerage requirement has been satisfied.* *It is recommended that the applicant undertake an On-Site Sewerage Assessment to ensure that there are no additional lot filling or grading requirements having regard to groundwater levels and the nominated flood levels.*	Noted
6	***Water Supply*** *a. The water reticulation layout is to be constructed generally in accordance with Applin Consulting Drawing 26001-C015 and the FNQROC Development Manual Guidelines, prior to Works Acceptance.* *b. Include on the water reticulation plan (Applin Consulting Drawing 26001-C013) the location of light pole footings and confirm the clearance between the footing and the water main. The revised drawing is to be endorsed by Council prior to commencement of water reticulation works.* *c. The minimum clearance between light pole footings and water mains are to be in accordance with WSA and verified and recorded by the consulting engineer during construction.* *The recorded clearances must be provided to Council prior to Works Acceptance.*	a. Noted and will be complied with. b. Light pole locations have been added to the plans. As per FNQROC and the Ergon standards, Ø150mm and smaller watermains passing light pole footings maintain 500mm clearance as shown below:  c. Noted and will be complied with.
7	***Erosion and Sediment Control*** *a. A copy of the Contractor's Erosion and Sediment Control (ESC) Plan is to be submitted to Council and endorsed by the Consulting Engineer, prior to commencement of any works.* *In particular, the ESC Plan must address the Institution of Engineers Australia Guidelines for Soil Erosion and Sediment Control and the Environment Protection (Water) Policy and Clauses CP1.05, CP1.13 and D5.10 of the FNQROC Development Manual, including requirements to the Douglas Shire Council.*	Noted and will be complied with. An ESC strategy has been included in the plans and this will form the basis for the contractor's ESC.

8	***Miscellaneous*** *a. The applicant is to provide a street lighting plan and show the locations of the streetlights on the relevant civil plans to confirm any conflicts between light pole locations and other services prior to the pre-start meeting.* *b. Prior to the pre-start meeting, the applicant must provide written evidence from Ergon and Telstra confirming arrangements have been made for the provision of services to this stage of the development* *c. Stormwater CCTV inspections are to be reviewed by the supervising engineer. The Engineering Report and Certification by an RPEQ must be provided to Council prior to Works Acceptance as required under FNQROC Development Manual CP1.25 Project Documentation*	a. Electrical plans are still being completed and will subject to a separate OPW lodgement. Light poles have been shown on the engineering and landscape plans based on preliminary electrical plans which we do not expect to change given the simple nature of this in fill development. b. This condition is normally applicable at Plan Sealing stage and written evidence will be available prior to plan sealing. c. Noted and will be complied with.

We trust that the attached provides sufficient supporting information to enable Council to allow a pre-start meeting to be arranged.

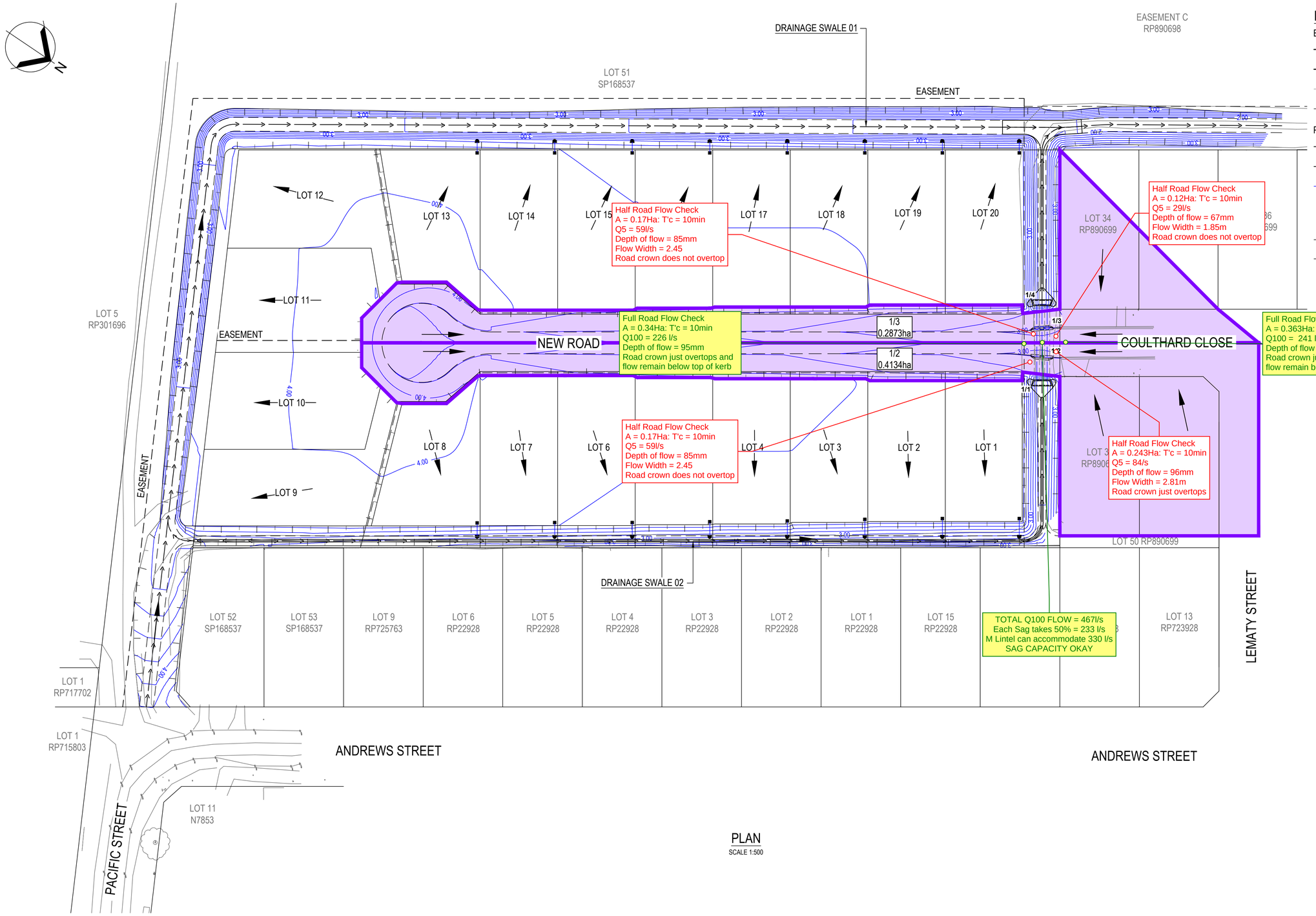
If you have any queries or require further information, please do not hesitate to contact this office.

Yours faithfully
APPLIN CONSULTING

GREG APPLIN
B Eng (Civil) RPEQ 06073

STORMWATER ROAD CALCULATIONS

DATE PLOTTED: 1 July 2026 9:39 AM



PLAN
SCALE 1:500

BEFORE YOU DIG
www.byda.com.au

REV	DESCRIPTION	DRN	APP	DATE
0	ISSUE FOR CONSTRUCTION	MT	GA	30.06.2026

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CERTIFICATION: G. APPLIN
RPEQ: 06073

APPLIN —— CONSULTING
M 0414 768 109 | E greg@applinconsulting.com.au

SCALES: 1:500 (0 5 10 15 20 25m)

CLIENT: FAR NORTH DEVELOPMENT GROUP P/L
NEWELL BEACH DEVELOPMENT

DESIGNED: M. TICKNER
DRAWN: M. TICKNER
CHECKED: G. APPLIN

PROJECT: LOT 51 COULTHARD CLOSE, NEWELL BEACH
DEVELOPMENT WORKS

TITLE: LOCAL DRAINAGE CATCHMENT PLAN

STATUS: FOR CONSTRUCTION
SCALE (AT FULL SIZE): REFER PLAN
SIZE: A1
DRAWING NUMBER: 26001-FIG001
REVISION: 0

CAD File: 26002-FIG001 [CATCHMENT].dwg

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Hydrology Calculations

Project No.	26001
Calc's By	GA
Checked By	GB

Location

Newell Beach

Half Road Flow flow from South

Catchment Details:

Catchment Number: **Half Road**

Catchment Area	=	A	=	0.170	ha
Length of Stream	=	L	=		km
Stream Slope	=	Se	=		%

Time of Concentration:

Friends Equation tc	=		5.5	min		min		min		min							
Overland sheet flow path Length	=		6.0	m		m		m		m							
Horton's Roughness Factor	=		0.035														
Surface Slope	=		3.00	%		%		%		%							
Additional Roadside Channel flow	=		4.4	min		min		min		min		min		min		min	
Channel Length	=		160	m		m		m		m		m		m		m	
Channel Slope	=		0.05	%		%		%		%		%		%		%	
Channel Vel. (assumed)	=		0.60	m/s		m/s		m/s		m/s		m/s		m/s		m/s	

Calculated Time of Concentration	=	tc	=	9.9	mins
Adopted Time of Concentration	=	tc	=	10.0	mins

Runoff Coefficient:

Fraction Impervious	=	f_i	=	0.7	Table 4.5.1 QUDM - Fraction Impervious (Urban Residential Low Density including roads)
1 hr rainfall Intensity for 10yr ARI	=	${}^{1}I_{10}$	=	84.5	
10 yr Discharge Coefficient	=	C_{10}	=	0.84	Table 4.5.3 QUDM

			63% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Coefficient of Runoff	=	C_y	=	0.67	0.71	0.80	0.84	0.88	0.97	1.00

Rainfall Intensity:

			63% (1yr)	39% (2yr)	18% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Intensity for Catchment tc (mm/hr)	=	${}^{t}I_y$	112.6	123.3	155.4	176.2	195.7	220.4	238.6

Runoff Calculation:

The Rational Method formula is: $Q_y = (C_y \,.\, {}^{t}I_y \,.\, A)/360$

				63.2% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Runoff Coefficient	=	C_y	=	0.67	0.71	0.80	0.84	0.88	0.97	1.00
Intesity for tc hours and y years	=	${}^{t}I_y$	=	112.60	123.28	155.43	176.17	195.65	220.42	238.58
Catchment Area	=	A	=	0.170 ha						

				63.2% (1yr)	**50% (2yr)**	**20% (5 yr)**	**10% (10 yr)**	**5% (20 yr)**	**2% (50 yr)**	**1% (100 yr)**
Calculated Peak Flow Rate	=	Qy	=	0.036 m^3/s	0.041 m^3/s	0.059 m^3/s	0.070 m^3/s	0.081 m^3/s	0.101 m^3/s	0.113 m^3/s

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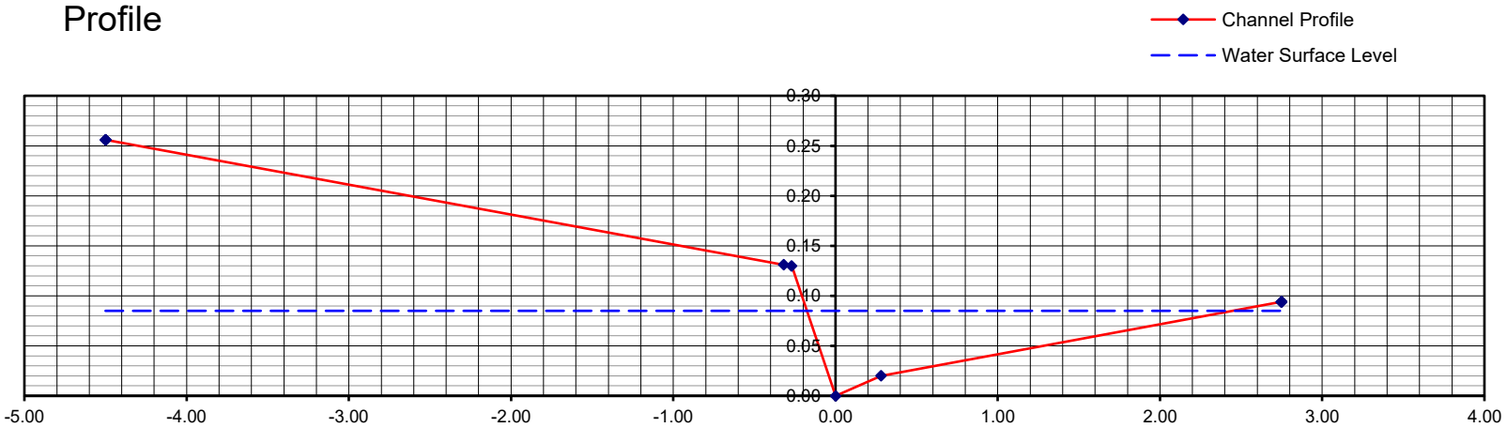
Channel Flow (Irregular shape)

Project No.	26001
Calc's By	GA
Checked By	GB

Location ROAD - 5.5m wide / 3% verge & roadway / 4.5m wide verge / 0.13m high kerb
Q5 (59l/s) flow check

Profile



Depth of flow (m)	0.085
Slope (%)	0.500
I.L.	0.000
A	0.099
P	2.667
R	0.037
WSE	0.085

SECTION	Width	Height	n	A	H_1	H_2	W	P	A/P	Q	$n^{1.5}xP$	$A^{1.66}/P^{0.66}$	$A^{1.66}/P^{0.66}/n$
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	4.180	0.125	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	0.050	0.001	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	0.270	0.130	0.013	0.008	0.000	0.085	0.177	0.196	0.038	0.005	0.000	0.001	0
Centre	0.000	0.000	0.013	0.000	0.085	0.065	0.000	0.020	0.000	0.000	0.000	0.000	0
	0.280	0.020	0.013	0.021	0.065	0.085	0.280	0.281	0.075	0.020	0.000	0.004	0
	2.470	0.074	0.015	0.071	0.000	0.065	2.170	2.171	0.032	0.034	0.004	0.007	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.099						**0.059**	0.005	0.012	1

Calculated Design Flows		
Q5	0.059	m^3/s
Q100	0.11	m^3/s
		m^3/s
		m^3/s

ADDITIONAL ROAD FLOW CHECKS		
Average flow velocity	0.593	m/s
Depth of flow	0.085	m
Flow width	2.447	
Depth*Velocity product	**0.050**	m^2/s

Comments

Crown does not overtop

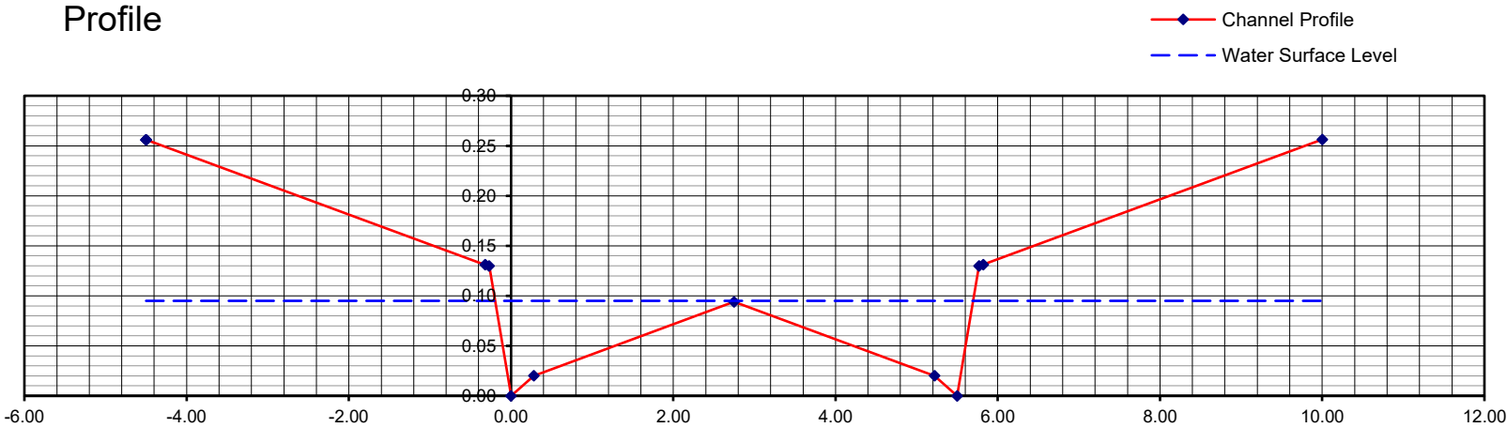
APPLIN —— CONSULTING

Channel Flow (Irregular shape)

Project No.	26001
Calc's By	GA
Checked By	GB

Location ROAD - 5.5m wide / 3% verge & roadway / 4.5m wide verge / 0.13m high kerb
Q100 (226l/s) South Check

Profile



Depth of flow (m)	0.095
Slope (%)	1.000
I.L.	0.000
A	0.254
P	5.962
R	0.043
WSE	0.095

SECTION	Width	Height	n	A	H_1	H_2	W	P	A/P	Q	$n^{1.5}xP$	$A^{1.66}/P^{0.66}$	$A^{1.66}/P^{0.66}/n$
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	4.180	0.125	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	0.050	0.001	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	0.270	0.130	0.013	0.009	0.000	0.095	0.197	0.219	0.043	0.009	0.000	0.001	0
Centre	0.000	0.000	0.013	0.000	0.095	0.075	0.000	0.020	0.000	0.000	0.000	0.000	0
	0.280	0.020	0.013	0.024	0.075	0.095	0.280	0.281	0.085	0.035	0.000	0.005	0
	2.470	0.074	0.015	0.094	0.001	0.075	2.470	2.471	0.038	0.071	0.005	0.011	1
	2.470	-0.074	0.015	0.094	0.075	0.001	2.470	2.471	0.038	0.071	0.005	0.011	1
	0.280	-0.020	0.013	0.024	0.095	0.075	0.280	0.281	0.085	0.035	0.000	0.005	0
	0.270	0.130	0.013	0.009	0.000	0.095	0.197	0.219	0.043	0.009	0.000	0.001	0
	0.050	0.001	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	4.180	0.125	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.254						**0.230**	0.011	0.033	2

Calculated Design Flows		
		m^3/s
Q100 total Flow	0.23	m^3/s
		m^3/s
		m^3/s

ADDITIONAL ROAD FLOW CHECKS		
Average flow velocity	0.904	m/s
Depth of flow	0.095	m
Depth*Velocity product	**0.086**	m^2/s

Comments

Q100 flows just overtop crown and remain below top of kerb

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Hydrology Calculations

Project No.	26001
Calc's By	GA
Checked By	GB

Location

Newell Beach

Half Road Flow flow from North West

Catchment Details:

Catchment Number:

Catchment Area	=	A	=	0.120	ha
Length of Stream	=	L	=		km
Stream Slope	=	Se	=		%

Time of Concentration:

Friends Equation tc	=		12.8	min		min		min		min							
Overland sheet flow path Length	=		40.0	m		m		m		m							
Horton's Roughness Factor	=		0.035														
Surface Slope	=		1.00	%		%		%		%							
Additional Roadside Channel flow	=		0.1	min		min		min		min		min		min		min	
Channel Length	=		5	m		m		m		m		m		m		m	
Channel Slope	=		0.50	%		%		%		%		%		%		%	
Channel Vel. (assumed)	=		0.60	m/s		m/s		m/s		m/s		m/s		m/s		m/s	

Calculated Time of Concentration	=	tc	=	12.9	mins
Adopted Time of Concentration	=	tc	=	10.0	mins

Runoff Coefficient:

Fraction Impervious	=	f_i	=	0.7	Table 4.5.1 QUDM - Fraction Impervious (Urban Residential Low Density including roads)
1 hr rainfall Intensity for 10yr ARI	=	${}^{1}I_{10}$	=	84.5	
10 yr Discharge Coefficient	=	C_{10}	=	0.84	Table 4.5.3 QUDM

			63% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Coefficient of Runoff	=	C_y	=	0.67	0.71	0.80	0.84	0.88	0.97	1.00

Rainfall Intensity:

			63% (1yr)	39% (2yr)	18% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Intensity for Catchment tc (mm/hr)	=	${}^{t}I_y$	112.6	123.3	155.4	176.2	195.7	220.4	238.6

Runoff Calculation:

The Rational Method formula is: $Q_y = (C_y \,.\, {}^{t}I_y \,.\, A)/360$

				63.2% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Runoff Coefficient	=	C_y	=	0.67	0.71	0.80	0.84	0.88	0.97	1.00
Intesity for tc hours and y years	=	${}^{t}I_y$	=	112.60	123.28	155.43	176.17	195.65	220.42	238.58
Catchment Area	=	A	=	0.120 ha						

				63.2% (1yr)	**50% (2yr)**	**20% (5 yr)**	**10% (10 yr)**	**5% (20 yr)**	**2% (50 yr)**	**1% (100 yr)**
Calculated Peak Flow Rate	=	Qy	=	0.025 m^3/s	0.029 m^3/s	0.041 m^3/s	0.049 m^3/s	0.057 m^3/s	0.071 m^3/s	0.080 m^3/s

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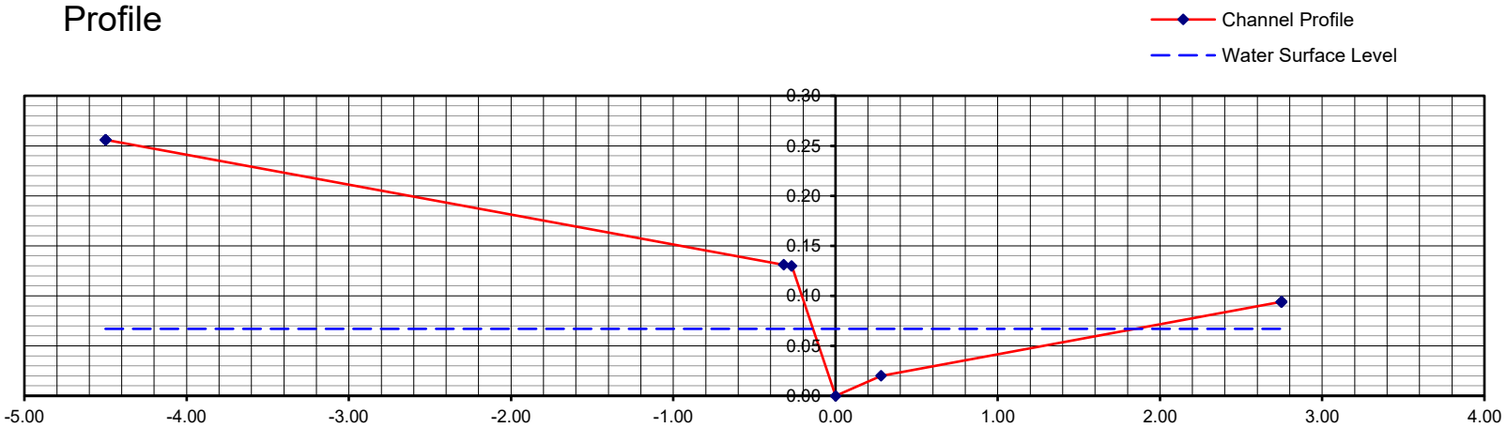
Channel Flow (Irregular shape)

Project No.	26001
Calc's By	GA
Checked By	GB

Location ROAD - 5.5m wide / 3% verge & roadway / 4.5m wide verge / 0.13m high kerb
Q5 (29l/s) flow check

Profile



Depth of flow (m)	0.067
Slope (%)	0.500
I.L.	0.000
A	0.057
P	2.025
R	0.028
WSE	0.067

SECTION	Width	Height	n	A	H_1	H_2	W	P	A/P	Q	$n^{1.5}xP$	$A^{1.66}/P^{0.66}$	$A^{1.66}/P^{0.66}/n$
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	4.180	0.125	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	0.050	0.001	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	0.270	0.130	0.013	0.005	0.000	0.067	0.139	0.154	0.030	0.002	0.000	0.000	0
Centre	0.000	0.000	0.013	0.000	0.067	0.047	0.000	0.020	0.000	0.000	0.000	0.000	0
	0.280	0.020	0.013	0.016	0.047	0.067	0.280	0.281	0.057	0.013	0.000	0.002	0
	2.470	0.074	0.015	0.037	0.000	0.047	1.569	1.569	0.023	0.014	0.003	0.003	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.057						**0.030**	0.004	0.006	0

Calculated Design Flows		
Q5	0.029	m^3/s
Q100	0.08	m^3/s
		m^3/s
		m^3/s

ADDITIONAL ROAD FLOW CHECKS		
Average flow velocity	0.514	m/s
Depth of flow	0.067	m
Flow width	1.847	
Depth*Velocity product	**0.034**	m^2/s

Comments

Crown does not overtop

APPLIN —— CONSULTING

Hydrology Calculations

Project No.	26001
Calc's By	GA
Checked By	GB

Location

Newell Beach

Half Road Flow flow from North West

Catchment Details:

Catchment Number:

Catchment Area	=	A	=	0.243	ha
Length of Stream	=	L	=		km
Stream Slope	=	Se	=		%

Time of Concentration:

Friends Equation tc	=		12.8	min		min		min		min							
Overland sheet flow path Length	=		40.0	m		m		m		m							
Horton's Roughness Factor	=		0.035														
Surface Slope	=		1.00	%		%		%		%							
Additional Roadside Channel flow	=		1.1	min		min		min		min		min		min		min	
Channel Length	=		40	m		m		m		m		m		m		m	
Channel Slope	=		0.50	%		%		%		%		%		%		%	
Channel Vel. (assumed)	=		0.60	m/s		m/s		m/s		m/s		m/s		m/s		m/s	

Calculated Time of Concentration	=	tc	=	13.9	mins
Adopted Time of Concentration	=	tc	=	10.0	mins

Runoff Coefficient:

Fraction Impervious	=	f_i	=	0.7	Table 4.5.1 QUDM - Fraction Impervious (Urban Residential Low Density including roads)
1 hr rainfall Intensity for 10yr ARI	=	${}^{1}I_{10}$	=	84.5	
10 yr Discharge Coefficient	=	C_{10}	=	0.84	Table 4.5.3 QUDM

			63% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Coefficient of Runoff	=	C_y	=	0.67	0.71	0.80	0.84	0.88	0.97	1.00

Rainfall Intensity:

			63% (1yr)	39% (2yr)	18% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Intensity for Catchment tc (mm/hr)	=	${}^{t}I_y$	112.6	123.3	155.4	176.2	195.7	220.4	238.6

Runoff Calculation:

The Rational Method formula is: $Q_y = (C_y \,.\, {}^{t}I_y \,.\, A)/360$

				63.2% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Runoff Coefficient	=	C_y	=	0.67	0.71	0.80	0.84	0.88	0.97	1.00
Intesity for tc hours and y years	=	${}^{t}I_y$	=	112.60	123.28	155.43	176.17	195.65	220.42	238.58
Catchment Area	=	A	=	0.243 ha						

				63.2% (1yr)	**50% (2yr)**	**20% (5 yr)**	**10% (10 yr)**	**5% (20 yr)**	**2% (50 yr)**	**1% (100 yr)**
Calculated Peak Flow Rate	=	Qy	=	0.051 m^3/s	0.059 m^3/s	0.084 m^3/s	0.100 m^3/s	0.116 m^3/s	0.144 m^3/s	0.161 m^3/s

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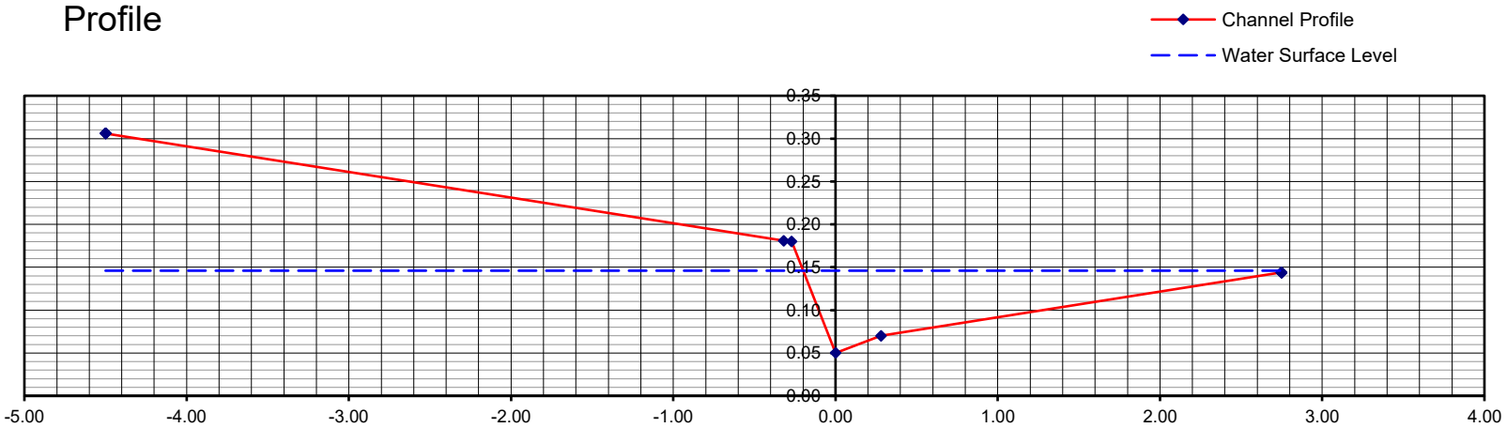
Channel Flow (Irregular shape)

Project No.	26001
Calc's By	GA
Checked By	GB

Location ROAD - 5.5m wide / 3% verge & roadway / 4.5m wide verge / 0.13m high kerb
Q5 (84l/s) flow check

Profile



Depth of flow (m)	0.096
Slope (%)	1.000
I.L.	0.050
A	0.130
P	2.993
R	0.043
WSE	0.146

SECTION	Width	Height	n	A	H_1	H_2	W	P	A/P	Q	$n^{1.5}xP$	$A^{1.66}/P^{0.66}$	$A^{1.66}/P^{0.66}/n$
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	4.180	0.125	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	0.050	0.001	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	0.270	0.130	0.013	0.010	0.000	0.096	0.199	0.221	0.043	0.009	0.000	0.001	0
Centre	0.000	0.000	0.013	0.000	0.096	0.076	0.000	0.020	0.000	0.000	0.000	0.000	0
	0.280	0.020	0.013	0.024	0.076	0.096	0.280	0.281	0.086	0.036	0.000	0.005	0
	2.470	0.074	0.015	0.096	0.002	0.076	2.470	2.471	0.039	0.074	0.005	0.011	1
				0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.130						**0.119**	0.005	0.017	1

Calculated Design Flows		
Q5	0.084	m^3/s
Q100	0.16	m^3/s
		m^3/s
		m^3/s

ADDITIONAL ROAD FLOW CHECKS		
Average flow velocity	0.915	m/s
Depth of flow	0.096	m
Flow width	2.813	
Depth*Velocity product	**0.088**	m^2/s

Comments

Crown just overtops
Otherside of road has capacity to accept
This is an existing situation

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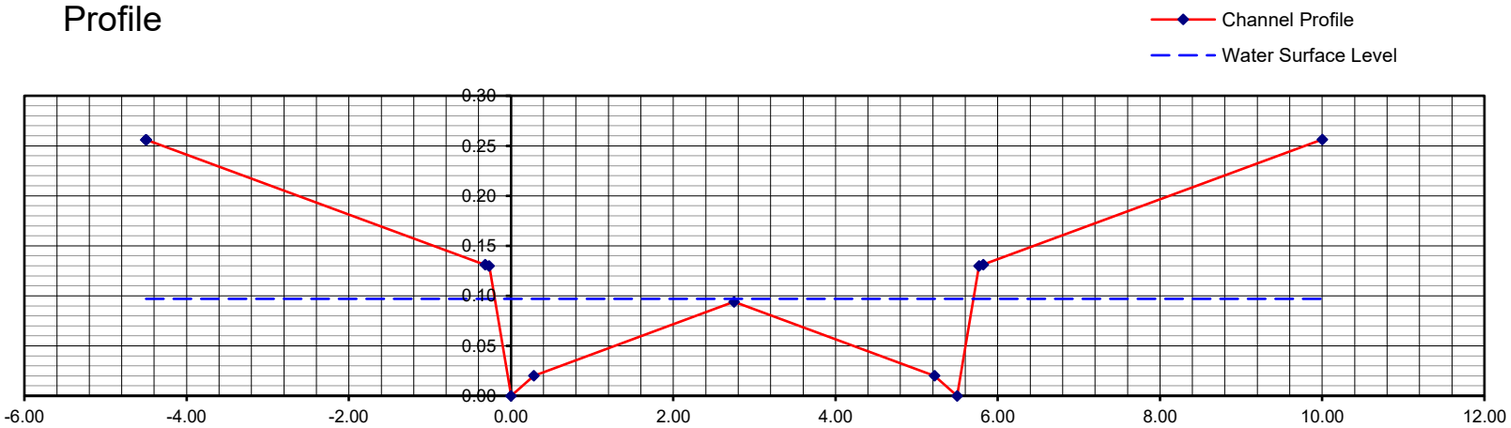
Channel Flow (Irregular shape)

Project No.	26001
Calc's By	GA
Checked By	GB

Location ROAD - 5.5m wide / 3% verge & roadway / 4.5m wide verge / 0.13m high kerb
Q100 (241l/s) North Check

Profile



Depth of flow (m)	0.097
Slope (%)	1.000
I.L.	0.000
A	0.266
P	5.971
R	0.045
WSE	0.097

SECTION	Width	Height	n	A	H_1	H_2	W	P	A/P	Q	$n^{1.5}xP$	$A^{1.66}/P^{0.66}$	$A^{1.66}/P^{0.66}/n$
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	4.180	0.125	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	0.050	0.001	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	0.270	0.130	0.013	0.010	0.000	0.097	0.201	0.224	0.044	0.009	0.000	0.001	0
Centre	0.000	0.000	0.013	0.000	0.097	0.077	0.000	0.020	0.000	0.000	0.000	0.000	0
	0.280	0.020	0.013	0.024	0.077	0.097	0.280	0.281	0.087	0.037	0.000	0.005	0
	2.470	0.074	0.015	0.099	0.003	0.077	2.470	2.471	0.040	0.077	0.005	0.012	1
	2.470	-0.074	0.015	0.099	0.077	0.003	2.470	2.471	0.040	0.077	0.005	0.012	1
	0.280	-0.020	0.013	0.024	0.097	0.077	0.280	0.281	0.087	0.037	0.000	0.005	0
	0.270	0.130	0.013	0.010	0.000	0.097	0.201	0.224	0.044	0.009	0.000	0.001	0
	0.050	0.001	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
	4.180	0.125	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
				0.266						**0.246**	0.011	0.035	2

Calculated Design Flows		
		m^3/s
Q100 total Flow	0.24	m^3/s
		m^3/s
		m^3/s

ADDITIONAL ROAD FLOW CHECKS		
Average flow velocity	0.926	m/s
Depth of flow	0.097	m
Depth*Velocity product	**0.090**	m^2/s

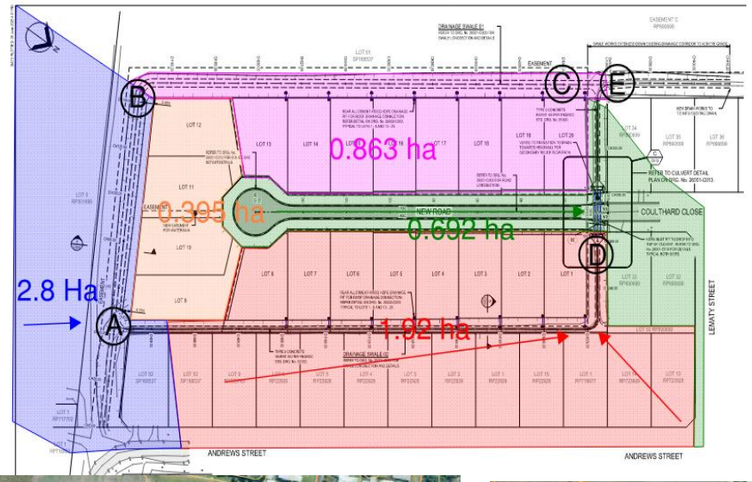
Comments

Q100 flows just overtop crown and remain below top of kerb

STORMWATER DRAIN CALCULATIONS

Existing Catchment Table

Catchment ID	Area (ha)	Impervious %
1	68.0	1.7%
2	475.5	0.7%
3	29.9	0.0%
4	29.2	0.8%
5	6.4	14.4%
6	0.2	29.1%
7	1.3	18.0%
8	0.6	22.8%
9	9.8	2.0%
10	2.8	1.9%
OUT	0.0	0.0%
Total	**623.7**	**1.0%**



CATCHMENT NAME	AREA	COLOURS
A	2.8	Blue
B	3.195	Blue + Orange
C	4.058	Blue + Orange + Pink
D	1.92	Red
E	6.67	Blue + Orange + Pink + Red + Green

APPLIN —— CONSULTING

Hydrology Calculations

Project No.	26001
Calc's By	GA
Checked By	GB

Location

Newell Beach - Point A

Catchment Details:

Catchment Number: **Blue**

Catchment Area	=	A	=	2.800	ha
Length of Stream	=	L	=		km
Stream Slope	=	Se	=		%

Time of Concentration:

Friends Equation tc	=		26.2	min		min		min		min							
Overland sheet flow path Length	=		230.0	m		m		m		m							
Horton's Roughness Factor	=		0.040														
Surface Slope	=		1.00	%		%		%		%							
Additional Roadside Channel flow	=			min		min		min		min		min		min		min	
Channel Length	=			m		m		m		m		m		m		m	
Channel Slope	=			%		%		%		%		%		%		%	
Channel Vel. (assumed)	=			m/s		m/s		m/s		m/s		m/s		m/s		m/s	

Calculated Time of Concentration	=	tc	=	26.2	mins
Adopted Time of Concentration	=	tc	=	26.0	mins

Runoff Coefficient:

Fraction Impervious	=	f_i	=	0.65	Table 4.5.1 QUDM - Fraction Impervious (Urban Residential Low Density exc roads)
1 hr rainfall Intensity for 10yr ARI	=	${}^{1}I_{10}$	=	84.5	
10 yr Discharge Coefficient	=	C_{10}	=	0.83	Table 4.5.3 QUDM

				63% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Coefficient of Runoff	=	C_y	=	0.66	0.71	0.79	0.83	0.87	0.95	1.00

Rainfall Intensity:

				63% (1yr)	39% (2yr)	18% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Intensity for Catchment tc (mm/hr)	=	${}^{t}I_y$		78.5	86.0	108.3	122.7	136.3	153.5	166.1

Runoff Calculation:

The Rational Method formula is: $Q_y = (C_y \,.\, {}^{t}I_y \,.\, A)/360$

				63.2% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Runoff Coefficient	=	C_y	=	0.66	0.71	0.79	0.83	0.87	0.95	1.00
Intesity for tc hours and y years	=	${}^{t}I_y$	=	78.54	85.96	108.31	122.74	136.30	153.49	166.08
Catchment Area	=	A	=	2.800 ha						

				63.2% (1yr)	**50% (2yr)**	**20% (5 yr)**	**10% (10 yr)**	**5% (20 yr)**	**2% (50 yr)**	**1% (100 yr)**
Calculated Peak Flow Rate	=	Qy	=	0.403 m^3/s	0.475 m^3/s	0.666 m^3/s	0.792 m^3/s	0.922 m^3/s	1.134 m^3/s	1.292 m^3/s

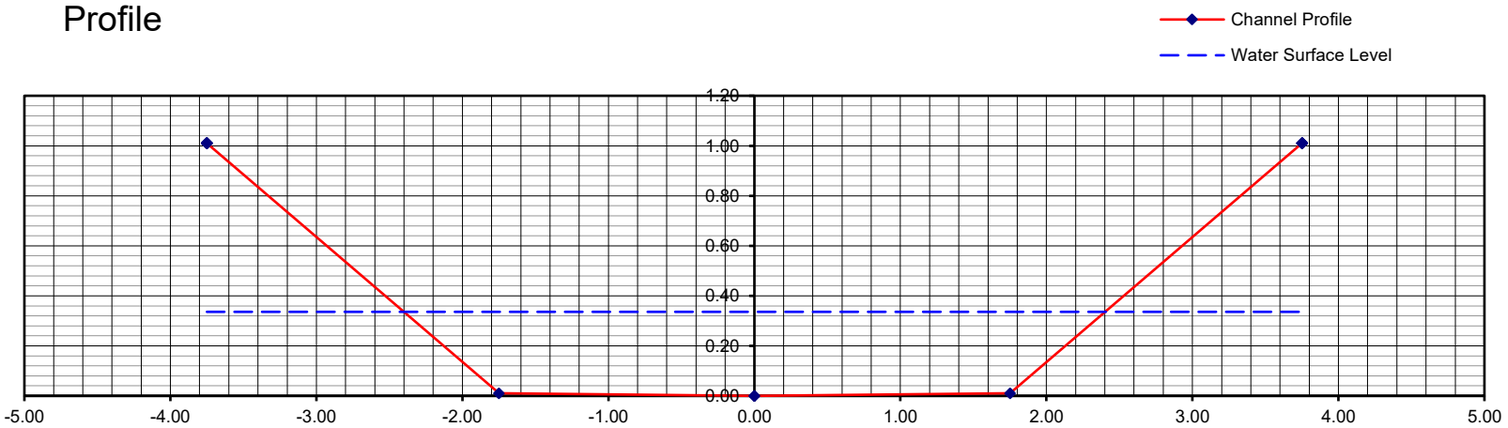
APPLIN ——— CONSULTING

Channel Flow (Irregular shape)

Project No.	26001
Calc's By	GA
Checked By	GA

Location Newell Beach Swale Drain 01 - Point A

Profile



Depth of flow (m)	0.336
Slope (%)	0.400
I.L.	0.000
A	1.371
P	5.284
R	0.259
WSE	0.336

SECTION	Width	Height	n	A	H_1	H_2	W	P	A/P	Q	$n^{1.5}xP$	$A^{1.66}/P^{0.66}$	$A^{1.66}/P^{0.66}/n$
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.326	0.000	0.326	0.000	0.000	0.000	0.000	0.000
	2.000	1.000	0.030	0.106	0.000	0.326	0.652	0.729	0.146	0.062	0.004	0.029	0.981
	1.750	0.010	0.030	0.579	0.326	0.336	1.750	1.750	0.331	0.584	0.009	0.277	9.239
Centre	0.000	0.000	0.030	0.000	0.336	0.336	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.030	0.000	0.336	0.336	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.750	0.010	0.030	0.579	0.326	0.336	1.750	1.750	0.331	0.584	0.009	0.277	9.239
	2.000	1.000	0.030	0.106	0.000	0.326	0.652	0.729	0.146	0.062	0.004	0.029	0.981
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				1.37						**1.293**	0.026	0.613	20.441

Calculated Design Flows		
Q20	0.666	m^3/s
Q100	1.292	m^3/s
		m^3/s
		m^3/s

Recommended Freeboard Calc's		
Calc'd channel velocity	0.94	m/s
Minimum	0.30	m
20% channel depth	0.07	m
$V^2/2g$	0.05	m

Comments

Q100 flow is 1292l/s
Swale flows 336mm deep in a Q100 event

APPLIN —— CONSULTING

Hydrology Calculations

Project No.	26001
Calc's By	GA
Checked By	GB

Location

Newell Beach - Point B

Catchment Details:

Catchment Number: **Blue/Orange**

Catchment Area	=	A	=	3.195	ha
Length of Stream	=	L	=		km
Stream Slope	=	Se	=		%

Time of Concentration:

Friends Equation tc	=			29.2	min		min		min		min						
Overland sheet flow path Length	=			320.0	m		m		m		m						
Horton's Roughness Factor	=			0.040													
Surface Slope	=			1.00	%		%		%		%						
Additional Roadside Channel flow	=			2.5	min		min		min		min		min		min		min
Channel Length	=			166	m		m		m		m		m		m		m
Channel Slope	=			0.50	%		%		%		%		%		%		%
Channel Vel. (assumed)	=			1.10	m/s		m/s		m/s		m/s		m/s		m/s		m/s

Calculated Time of Concentration	=	tc	=	31.7	mins
Adopted Time of Concentration	=	tc	=	30.0	mins

Runoff Coefficient:

Fraction Impervious	=	f_i	=	0.65	Table 4.5.1 QUDM - Fraction Impervious (Urban Residential Low Density including roads)
1 hr rainfall Intensity for 10yr ARI	=	${}^{1}I_{10}$	=	84.5	
10 yr Discharge Coefficient	=	C_{10}	=	0.83	Table 4.5.3 QUDM

				63% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Coefficient of Runoff	=	C_y	=	0.66	0.71	0.79	0.83	0.87	0.95	1.00

Rainfall Intensity:

				63% (1yr)	39% (2yr)	18% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Intensity for Catchment tc (mm/hr)	=	${}^{t}I_y$		73.9	80.9	102.0	115.6	128.4	144.5	156.4

Runoff Calculation:

The Rational Method formula is: $Q_y = (C_y \,.\, {}^{t}I_y \,.\, A)/360$

				63.2% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Runoff Coefficient	=	C_y	=	0.66	0.71	0.79	0.83	0.87	0.95	1.00
Intesity for tc hours and y years	=	${}^{t}I_y$	=	73.87	80.87	101.96	115.57	128.36	144.52	156.36
Catchment Area	=	A	=	3.195 ha						

				63.2% (1yr)	**50% (2yr)**	**20% (5 yr)**	**10% (10 yr)**	**5% (20 yr)**	**2% (50 yr)**	**1% (100 yr)**
Calculated Peak Flow Rate	=	Qy	=	0.433 m^3/s	0.510 m^3/s	0.715 m^3/s	0.851 m^3/s	0.991 m^3/s	1.219 m^3/s	1.388 m^3/s

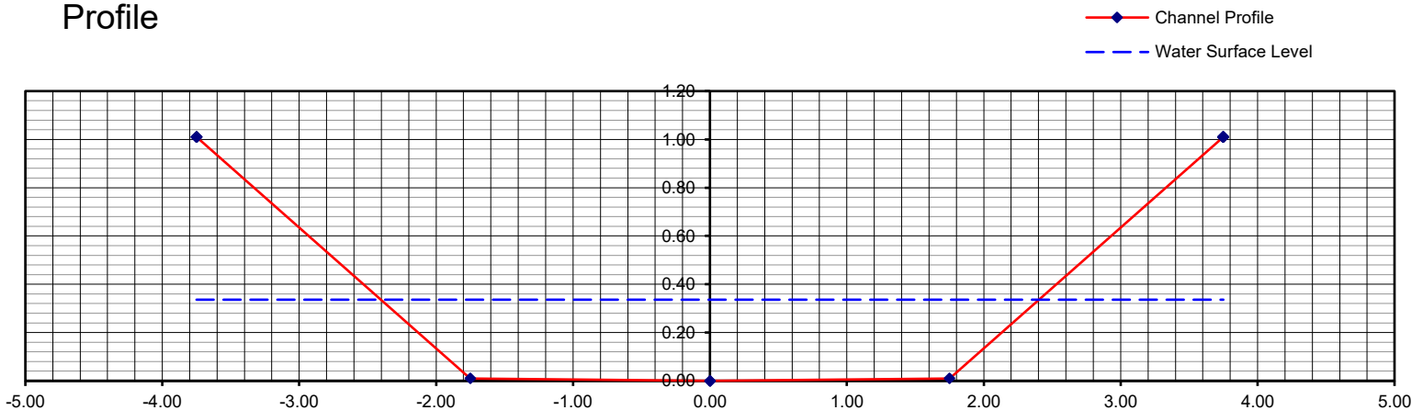
APPLIN ——— CONSULTING

Channel Flow (Irregular shape)

Project No.	26001
Calc's By	GA
Checked By	GA

Location Newell Beach Swale Drain 01 - Point B

Profile



Depth of flow (m)	0.350
Slope (%)	0.400
I.L.	0.000
A	1.439
P	5.361
R	0.268
WSE	0.350

SECTION	Width	Height	n	A	H_1	H_2	W	P	A/P	Q	$n^{1.5}xP$	$A^{1.66}/P^{0.66}$	$A^{1.66}/P^{0.66}/n$
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.340	0.000	0.340	0.000	0.000	0.000	0.000	0.000
	2.000	1.000	0.030	0.116	0.000	0.340	0.680	0.760	0.152	0.069	0.004	0.033	1.098
	1.750	0.010	0.030	0.604	0.340	0.350	1.750	1.750	0.345	0.626	0.009	0.297	9.900
Centre	0.000	0.000	0.030	0.000	0.350	0.350	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.030	0.000	0.350	0.350	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.750	0.010	0.030	0.604	0.340	0.350	1.750	1.750	0.345	0.626	0.009	0.297	9.900
	2.000	1.000	0.030	0.116	0.000	0.340	0.680	0.760	0.152	0.069	0.004	0.033	1.098
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				1.44						**1.391**	0.026	0.660	21.995

Calculated Design Flows		
Q100	1.388	m^3/s
Q20	0.72	m^3/s
		m^3/s
		m^3/s

Recommended Freeboard Calc's		
Calc'd channel velocity	0.97	m/s
Minimum	0.30	m
20% channel depth	0.07	m
$V^2/2g$	0.05	m

Comments

Q100 flow is 1388l/s
Swale flows 350mm deep in a Q100 event

Point B

APPLIN —— CONSULTING

Hydrology Calculations

Project No.	26001
Calc's By	GA
Checked By	GB

Location

Newell Beach - Point C

Catchment Details:

Catchment Number: **Blue/Orange/Pink**

Catchment Area	=	A	=	4.060	ha
Length of Stream	=	L	=		km
Stream Slope	=	Se	=		%

Time of Concentration:

Friends Equation tc	=			39.5	min		min		min		min						
Overland sheet flow path Length	=			520.0	m		m		m		m						
Horton's Roughness Factor	=			0.040													
Surface Slope	=			0.50	%		%		%		%						
Additional Roadside Channel flow	=				min		min		min		min		min		min		min
Channel Length	=				m		m		m		m		m		m		m
Channel Slope	=				%		%		%		%		%		%		%
Channel Vel. (assumed)	=				m/s		m/s		m/s		m/s		m/s		m/s		m/s

Calculated Time of Concentration	=	tc	=	39.5	mins
Adopted Time of Concentration	=	tc	=	35.0	mins

Runoff Coefficient:

Fraction Impervious	=	f_i	=	0.65	Table 4.5.1 QUDM - Fraction Impervious (Urban Residential Low Density including roads)
1 hr rainfall Intensity for 10yr ARI	=	${}^{1}I_{10}$	=	84.5	
10 yr Discharge Coefficient	=	C_{10}	=	0.83	Table 4.5.3 QUDM

				63% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Coefficient of Runoff	=	C_y	=	0.66	0.71	0.79	0.83	0.87	0.95	1.00

Rainfall Intensity:

				63% (1yr)	39% (2yr)	18% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Intensity for Catchment tc (mm/hr)	=	${}^{t}I_y$		69.0	75.6	95.4	108.1	120.1	135.2	146.3

Runoff Calculation:

The Rational Method formula is: $Q_y = (C_y \,.\, {}^{t}I_y \,.\, A)/360$

				63.2% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Runoff Coefficient	=	C_y	=	0.66	0.71	0.79	0.83	0.87	0.95	1.00
Intesity for tc hours and y years	=	${}^{t}I_y$	=	68.99	75.56	95.37	108.13	120.12	135.24	146.30
Catchment Area	=	A	=	4.060 ha						

				63.2% (1yr)	**50% (2yr)**	**20% (5 yr)**	**10% (10 yr)**	**5% (20 yr)**	**2% (50 yr)**	**1% (100 yr)**
Calculated Peak Flow Rate	=	Qy	=	0.513 m^3/s	0.605 m^3/s	0.850 m^3/s	1.012 m^3/s	1.179 m^3/s	1.449 m^3/s	1.650 m^3/s

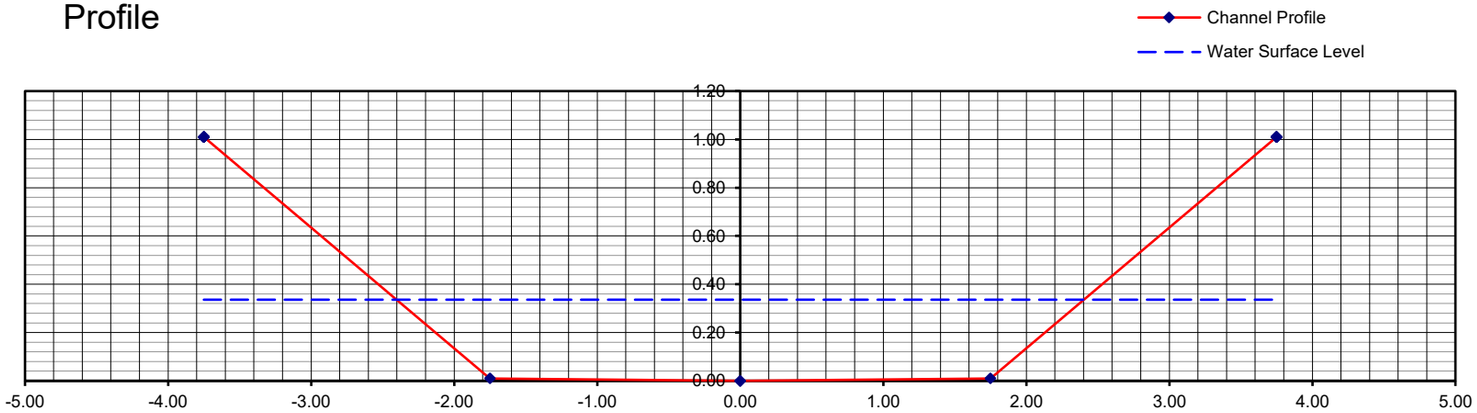
APPLIN ——— CONSULTING

Channel Flow (Irregular shape)

Project No.	26001
Calc's By	GA
Checked By	GA

Location Newell Beach Swale Drain 01 - Point C

Profile



Depth of flow (m)	0.385
Slope (%)	0.400
I.L.	0.000
A	1.611
P	5.552
R	0.290
WSE	0.385

SECTION	Width	Height	n	A	H_1	H_2	W	P	A/P	Q	$n^{1.5}xP$	$A^{1.66}/P^{0.66}$	$A^{1.66}/P^{0.66}/n$
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.375	0.000	0.375	0.000	0.000	0.000	0.000	0.000
	2.000	1.000	0.030	0.141	0.000	0.375	0.750	0.839	0.168	0.090	0.004	0.043	1.426
	1.750	0.010	0.030	0.665	0.375	0.385	1.750	1.750	0.380	0.735	0.009	0.349	11.629
Centre	0.000	0.000	0.030	0.000	0.385	0.385	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.030	0.000	0.385	0.385	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.750	0.010	0.030	0.665	0.375	0.385	1.750	1.750	0.380	0.735	0.009	0.349	11.629
	2.000	1.000	0.030	0.141	0.000	0.375	0.750	0.839	0.168	0.090	0.004	0.043	1.426
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				1.61						**1.651**	0.027	0.783	26.110

Calculated Design Flows		
Q100	1.65	m^3/s
Q20	0.85	m^3/s
		m^3/s
		m^3/s

Recommended Freeboard Calc's		
Calc'd channel velocity	1.02	m/s
Minimum	0.30	m
20% channel depth	0.08	m
$V^2/2g$	0.05	m

Comments

Q100 flow is 1,650l/s
Swale flows 385mm deep in a Q100 event

APPLIN —— CONSULTING

Hydrology Calculations

Project No.	26001
Calc's By	GA
Checked By	GB

Location

Newell Beach - Point D

Catchment Details:

Catchment Number: **Red**

Catchment Area	=	A	=	1.920	ha
Length of Stream	=	L	=		km
Stream Slope	=	Se	=		%

Time of Concentration:

Friends Equation tc	=		14.7	min		min		min		min					
Overland sheet flow path Length	=		40.0	m		m		m		m					
Horton's Roughness Factor	=		0.035												
Surface Slope	=		0.50	%		%		%		%					
Additional Roadside Channel flow	=		2.6	min		min		min		min		min		min	
Channel Length	=		220	m		m		m		m		m		m	
Channel Slope	=		0.50	%		%		%		%		%		%	
Channel Vel. (assumed)	=		1.40	m/s		m/s		m/s		m/s		m/s		m/s	

Calculated Time of Concentration	=	tc	=	17.3	mins
Adopted Time of Concentration	=	tc	=	17.0	mins

Runoff Coefficient:

Fraction Impervious	=	f_i	=	0.7	Table 4.5.1 QUDM - Fraction Impervious (Urban Residential Low Density including roads)
1 hr rainfall Intensity for 10yr ARI	=	${}^{1}I_{10}$	=	84.5	
10 yr Discharge Coefficient	=	C_{10}	=	0.84	Table 4.5.3 QUDM

			63% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Coefficient of Runoff	=	C_y	=	0.67	0.71	0.80	0.84	0.88	0.97	1.00

Rainfall Intensity:

			63% (1yr)	39% (2yr)	18% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Intensity for Catchment tc (mm/hr)	=	${}^{t}I_y$	93.1	101.9	128.3	145.4	161.5	181.9	196.9

Runoff Calculation:

The Rational Method formula is: $Q_y = (C_y \cdot {}^{t}I_y \cdot A)/360$

				63.2% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Runoff Coefficient	=	C_y	=	0.67	0.71	0.80	0.84	0.88	0.97	1.00
Intesity for tc hours and y years	=	${}^{t}I_y$	=	93.13	101.90	128.33	145.41	161.48	181.93	196.94
Catchment Area	=	A	=	1.920 ha						

				63.2% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Calculated Peak Flow Rate	=	Qy	=	0.333 m^3/s	0.386 m^3/s	0.548 m^3/s	0.651 m^3/s	0.758 m^3/s	0.941 m^3/s	1.050 m^3/s

Note

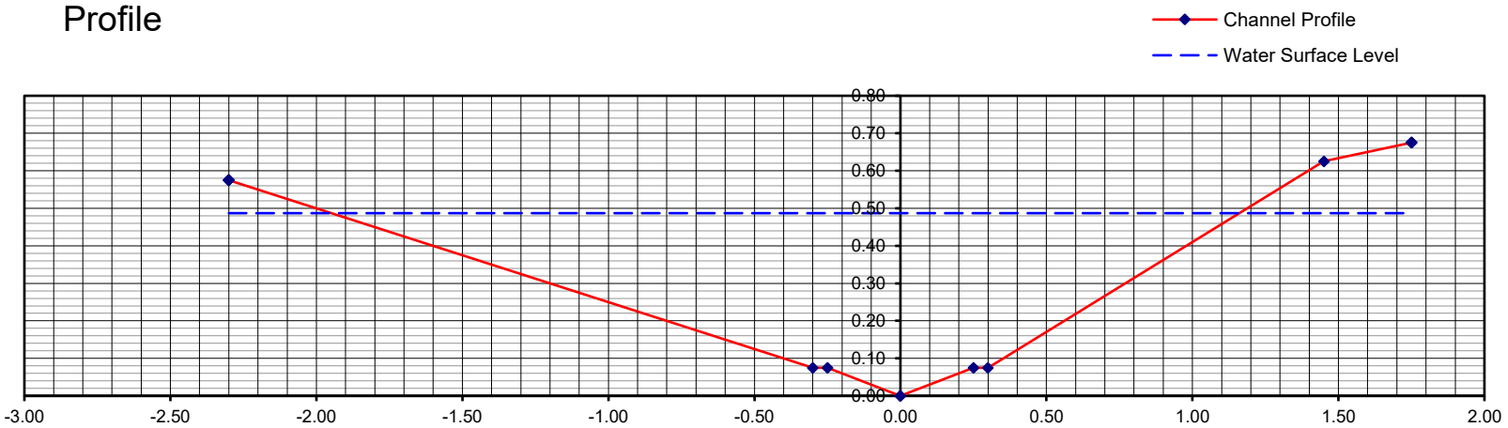
APPLIN ——— CONSULTING

Channel Flow (Irregular shape)

Project No.	26001
Calc's By	GA
Checked By	GA

Location Newell Beach Swale Drain 02 - Point D

Profile



Depth of flow (m)	0.487
Slope (%)	0.400
I.L.	0.000
A	0.783
P	4.100
R	0.191
WSE	0.487

SECTION	Width	Height	n	A	H_1	H_2	W	P	A/P	Q	$n^{1.5}xP$	$A^{1.66}/P^{0.66}$	$A^{1.66}/P^{0.66}/n$
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.412	0.000	0.412	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.412	0.000	0.412	0.000	0.000	0.000	0.000	0.000
	2.000	0.500	0.030	0.339	0.000	0.412	1.648	1.699	0.200	0.245	0.009	0.116	3.868
	0.050	0.000	0.013	0.021	0.412	0.412	0.050	0.050	0.412	0.055	0.000	0.011	0.877
	0.250	0.075	0.013	0.112	0.412	0.487	0.250	0.261	0.431	0.312	0.000	0.064	4.929
Centre	0.000	0.000	0.013	0.000	0.487	0.487	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.013	0.000	0.487	0.487	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.250	0.075	0.013	0.112	0.412	0.487	0.250	0.261	0.431	0.312	0.000	0.064	4.929
	0.050	0.000	0.013	0.021	0.412	0.412	0.050	0.050	0.412	0.055	0.000	0.011	0.877
	1.150	0.550	0.030	0.177	0.000	0.412	0.861	0.955	0.186	0.122	0.005	0.058	1.926
	0.300	0.050	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.78						**1.101**	0.015	0.325	17.407

Calculated Design Flows		
Q100	1.101	m^3/s
Q20	0.57	m^3/s
		m^3/s
		m^3/s

Recommended Freeboard Calc's		
Calc'd channel velocity	1.41	m/s
Minimum	0.30	m
20% channel depth	0.10	m
$V^2/2g$	0.10	m

Comments

Q100 flow is 1,101 l/s
Swale flows 487mm deep in a Q100 event
Drain is more than 1.2m deep - Freeboard is okay

APPLIN —— CONSULTING

Hydrology Calculations

Project No.	26001
Calc's By	GA
Checked By	GB

Location

Newell Beach - Point E

Catchment Details:

Catchment Number: **Blue/Orange/Pink/Red/Green**

Catchment Area	=	A	=	6.670	ha
Length of Stream	=	L	=		km
Stream Slope	=	Se	=		%

Time of Concentration:

Friends Equation tc	=		39.5	min		min		min		min					
Overland sheet flow path Length	=		520.0	m		m		m		m					
Horton's Roughness Factor	=		0.040												
Surface Slope	=		0.50	%		%		%		%					
Additional Roadside Channel flow	=			min		min		min		min		min		min	
Channel Length	=			m		m		m		m		m		m	
Channel Slope	=			%		%		%		%		%		%	
Channel Vel. (assumed)	=			m/s		m/s		m/s		m/s		m/s		m/s	

Calculated Time of Concentration	=	tc	=	39.5	mins
Adopted Time of Concentration	=	tc	=	8.0	mins

Runoff Coefficient:

Fraction Impervious	=	f_i	=	0.7	Table 4.5.1 QUDM - Fraction Impervious (Urban Residential Low Density including roads)
1 hr rainfall Intensity for 10yr ARI	=	${}^{1}I_{10}$	=	84.5	
10 yr Discharge Coefficient	=	C_{10}	=	0.83	Table 4.5.3 QUDM

			63% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Coefficient of Runoff	=	C_y	=	0.66	0.71	0.79	0.83	0.87	0.95	1.00

Rainfall Intensity:

			63% (1yr)	39% (2yr)	18% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Intensity for Catchment tc (mm/hr)	=	${}^{t}I_y$		121.1	132.6	167.3	189.7	210.6	237.2	256.6

Runoff Calculation:

The Rational Method formula is: $Q_y = (C_y \cdot {}^{t}I_y \cdot A)/360$

				63.2% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Runoff Coefficient	=	C_y	=	0.66	0.71	0.79	0.83	0.87	0.95	1.00
Intesity for tc hours and y years	=	${}^{t}I_y$	=	121.10	132.64	167.34	189.67	210.63	237.17	256.59
Catchment Area	=	A	=	6.670 ha						

				63.2% (1yr)	50% (2yr)	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)
Calculated Peak Flow Rate	=	Qy	=	1.481 m^3/s	1.745 m^3/s	2.449 m^3/s	2.917 m^3/s	3.395 m^3/s	4.175 m^3/s	4.754 m^3/s

Note

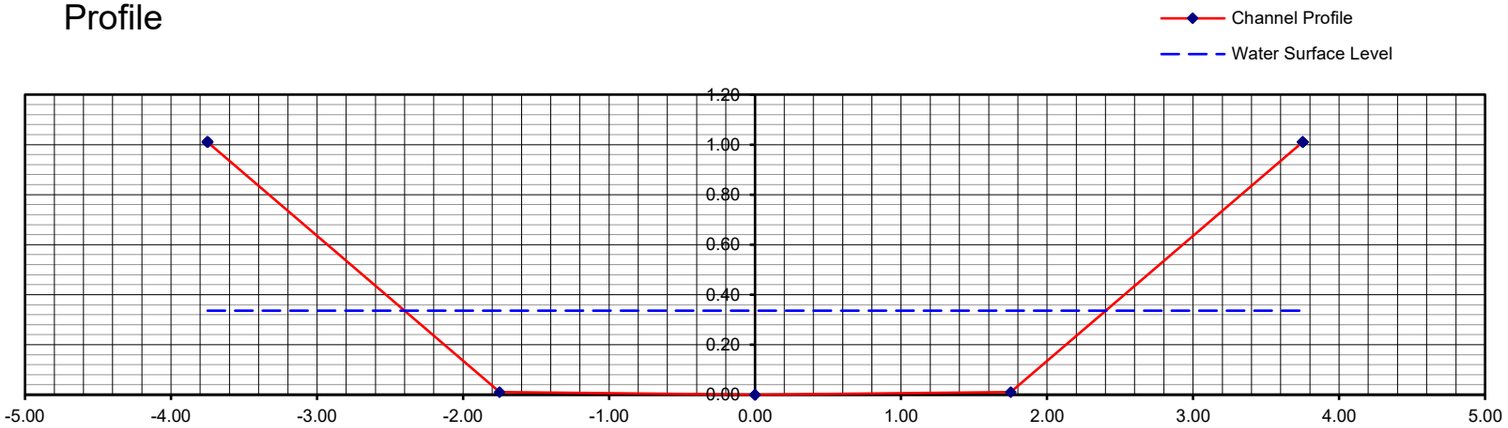
APPLIN ——— CONSULTING

Channel Flow (Irregular shape)

Project No.	26001
Calc's By	GA
Checked By	GA

Location Newell Beach Swale Drain 01 - Point E Downstream of site

Profile



Depth of flow (m)	0.506
Slope (%)	0.400
I.L.	0.000
A	2.246
P	6.214
R	0.361
WSE	0.506

SECTION	Width	Height	n	A	H_1	H_2	W	P	A/P	Q	$n^{1.5}xP$	$A^{1.66}/P^{0.66}$	$A^{1.66}/P^{0.66}/n$
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.496	0.000	0.496	0.000	0.000	0.000	0.000	0.000
	2.000	1.000	0.030	0.246	0.000	0.496	0.992	1.109	0.222	0.190	0.006	0.090	3.005
	1.750	0.010	0.030	0.877	0.496	0.506	1.750	1.750	0.501	1.166	0.009	0.553	18.435
Centre	0.000	0.000	0.030	0.000	0.506	0.506	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.030	0.000	0.506	0.506	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.750	0.010	0.030	0.877	0.496	0.506	1.750	1.750	0.501	1.166	0.009	0.553	18.435
	2.000	1.000	0.030	0.246	0.000	0.496	0.992	1.109	0.222	0.190	0.006	0.090	3.005
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				2.25						**2.712**	0.030	1.286	42.880

Calculated Design Flows		
Q100	2.711	m^3/s
Q20	1.41	m^3/s
		m^3/s
		m^3/s

Recommended Freeboard Calc's		
Calc'd channel velocity	1.21	m/s
Minimum	0.30	m
20% channel depth	0.10	m
$V^2/2g$	0.07	m

Comments

Q100 flow is 2,711l/s
Swale flows 506mm deep in a Q100 event
Depth of drain is 1.7m - Freeboard okay