STORMWATER MANAGEMENT REPORT

STAGE 6 GREENDALE
LOT 124 L37783

Document Name:	STAGE 6 GREENDALE_SWMP.docx
Revision:	1
Date:	24-11-21
Client:	Roberts Bros. Pty Ltd
Property Details:	LOT 124 on L37783, Mooloo Road, Pie Creek
Author:	Allister Haynes BE Civil (Hons) MIEAust CPEng RPEQ 13201

CONTENTS

SUMMARY

The key points of this investigation are as follows:

1. Provide a Stormwater Management Report to Gympie Council Requirements.
2. Identify internal and external catchment stormwater influence on proposed subdivision.
3. Stormwater flows into and through the site.

1.0 INTRODUCTION

This Stormwater Management Plan (SWMP) has been prepared for the new stage 6 subdivision project at Mooloo Road, Pie Creek.

This SWMP includes detail on the management of stormwater overland and piped flows. Appendix A includes Flood Study dated 22-2-2019.

2.0 SITE DESCRIPTION AND CRITCAL POINTS

The site is located at Mooloo Road (Lot 124 L37783) Pie Creek.

The existing area is grass and scattered regrowth trees. The surrounding area is half developed rural residential areas and rural/undeveloped land to the south and east.

The overall proposal is to construct 14 allotments and roads (roadworks and drainage) for stage 6 of the Greendale development.

As a result of these works stormwater management areas include:

- Main gully flow and culverts supported by flood report.
- Pit and Pipe system including swale.

Plans S4 and S5 enclosed show the stormwater catchments for the site.

All road flows are below the QUDM maximum of 200mm at the road centreline and other requirements.

Future owners of proposed Lot 136 and existing lot 51 SP311232 need to appropriately fence road reserve at culverts to allow water flows into the pipes without restriction. It is recommended that fences connect to proposed culvert headwall fences.

Owners of proposed Lots 136-137 and existing lot 51 SP311232 should not restrict flows in gullys or entry/exit of swale with solid fences. It is also critical for future owners after roads/operational works are completed (especially on lots below road level) to install driveways to Council standard drawing R-03 to ensure water is not allowed to enter their property.

3.0 STORMWATER FLOW ASSESSMENT

3.1 Existing Conditions

The site is generally rolling farmland with waterholes in the main gullys and upstream that have been modelled by flood consultants Hydrology & Water Management Consulting. As gullys are obvious Council have not in the past required an easement over main gully flow. There is a proposed Council stormwater easement over the pipe culvert and weir flow/access on proposed Lot 136. There is also an easement for swale in proposed lot 137.

3.2 Proposed Drainage System

The proposed works in this application cover the main culverts and pit and pipe/road flows.

In the initial Flood Study Lot 136 had a house pad extending into the existing gully, and a diversion of flow to avoid erosion of house site and enable a single bank of culverts. Recently it was considered better to extend the boundary of stage 6 into stage 7 of the same estate and allow a larger house site for lot 136 and leave gullys alone. Also the culvert size and configuration was altered to suit this change. Subsequent to the bulk earthworks application, the triple 2400 west culvert group was changed to two box culverts due to cost and time issues with pipes.

These changes were included in the flood report addendum of Appendix C attached.

The swale flows from road 5/Bottlebrush are designed for excess that the pipes will not cater for. It will also allow for full Q100 flow 100% pit blockage although that is considered unlikely.

3.3 Drainage Improvements/Non Worsening

Gympie Regional Council do not prefer the use of detention basins on subdivisions, so the main strategy was to use main culverts to restrict flow to original pre-development . Otherwise the strategy ensured road flows do not exceed QUDM flow requirements and future lots are safe from events up to Q100.

The main gullys will take the majority of external flows. The proposed lots adjacent to the gully have house pads created as part of development that are well above Q100 flows (generally one metre minimum).

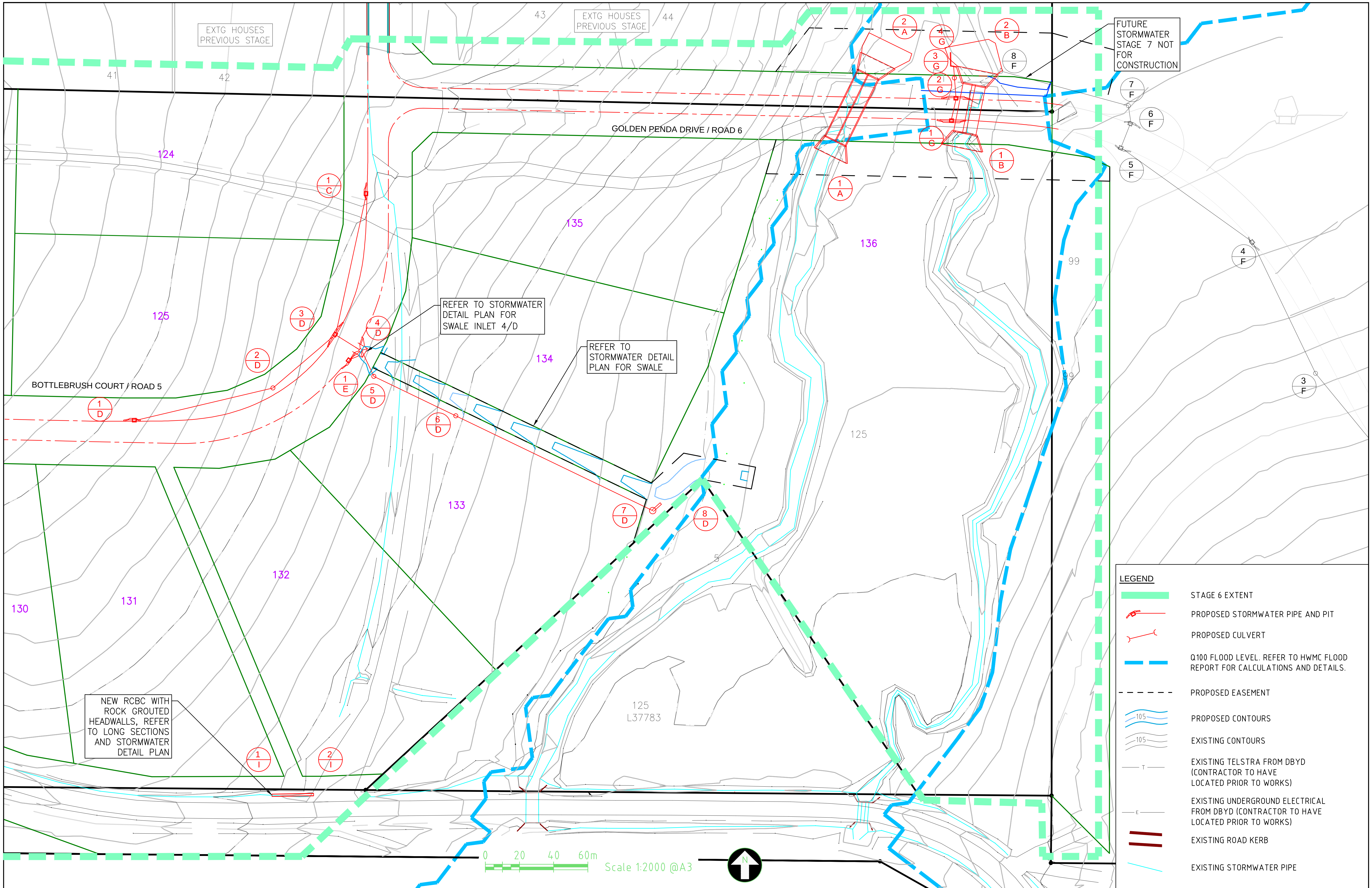
The overall strategy is to provide Q10 piped (minor) and Q100 (major) overland flows with culvert blockage to QUDM requirements. Road drainage is for Q5 event, and culvert on Mooloo Road Q2 as per GRC standard drawing R-15 based on traffic volume.

4.0 CONCLUSIONS

A stormwater management approach has been used to assess the site's stormwater requirements and water management needs. In summary:

- Subdivision main gullys will provide an overland flow path for this subdivision and surrounding area, as noted Council have not previously required an easement over main gully flow.
- Subdivision and gully catchments as per plans S4 and S5 in Appendix A.
- Stormwater culverts take minor flows to Q10, remaining Q100 event includes weir flow to QUDM requirements.
- Road flows and swale flows to QUDM limits and Q5 piped.

5.0 APPENDIX A – Plans S1-S18 including check calculations



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PSM/(**AHD**)RL	196359 82.237
SURVEYED	MURRAY & ASSOC
RPEQ NO.	13201
RPEQ NAME	ALLISTER HAYNES
CERTIFIED	

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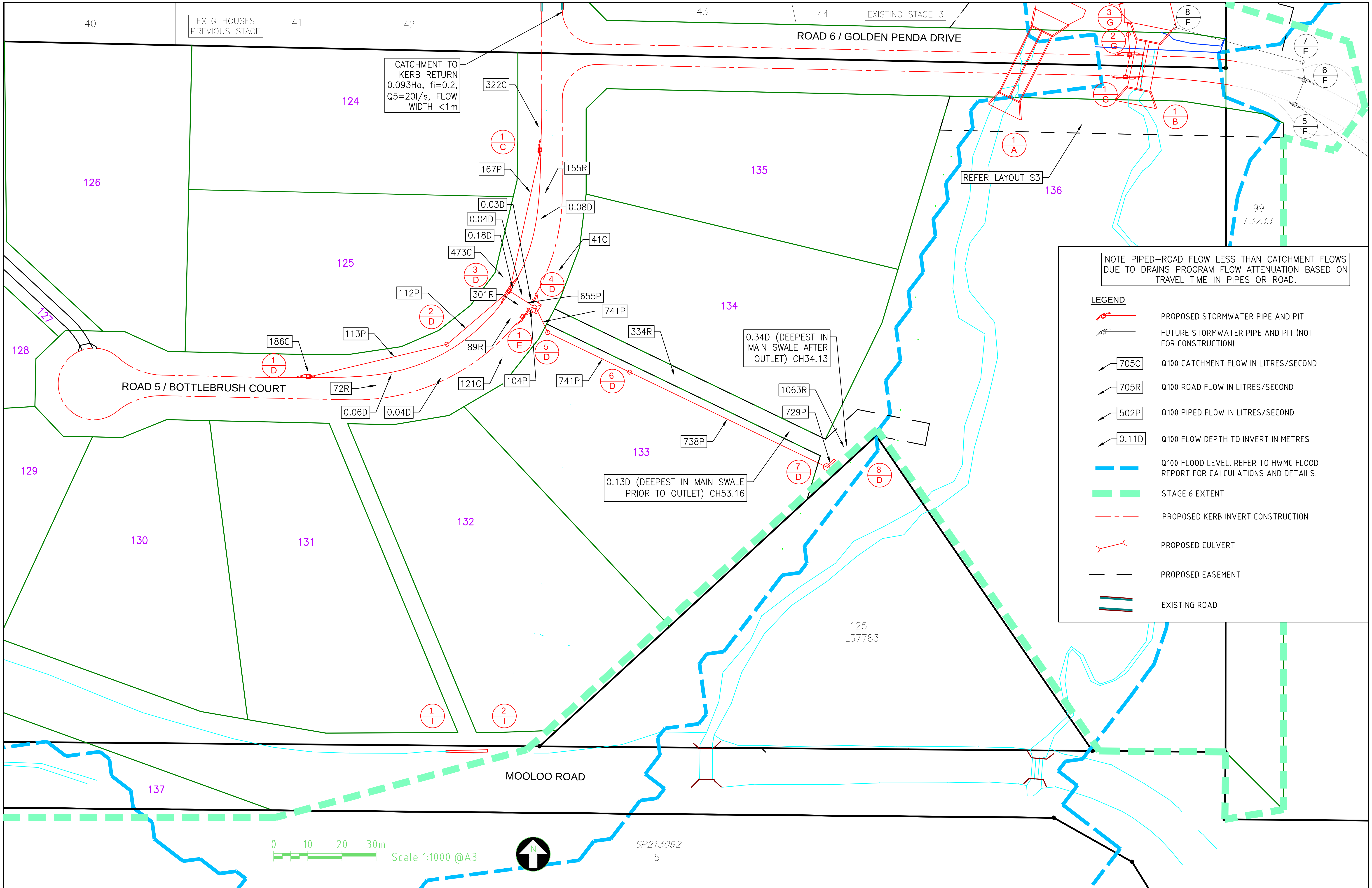
GREENDALE STAGE 6

LOT 124 L37783, 14 LOTS ROADWORKS AND DRAINAGE
WATERGUM DRIVE, PIE CREEK, FOR ROBERTS BROS. PTY LTD

STORMWATER LAYOUT PLAN 1

1803-GS6

Sheet No.	Revision No.
S1	A



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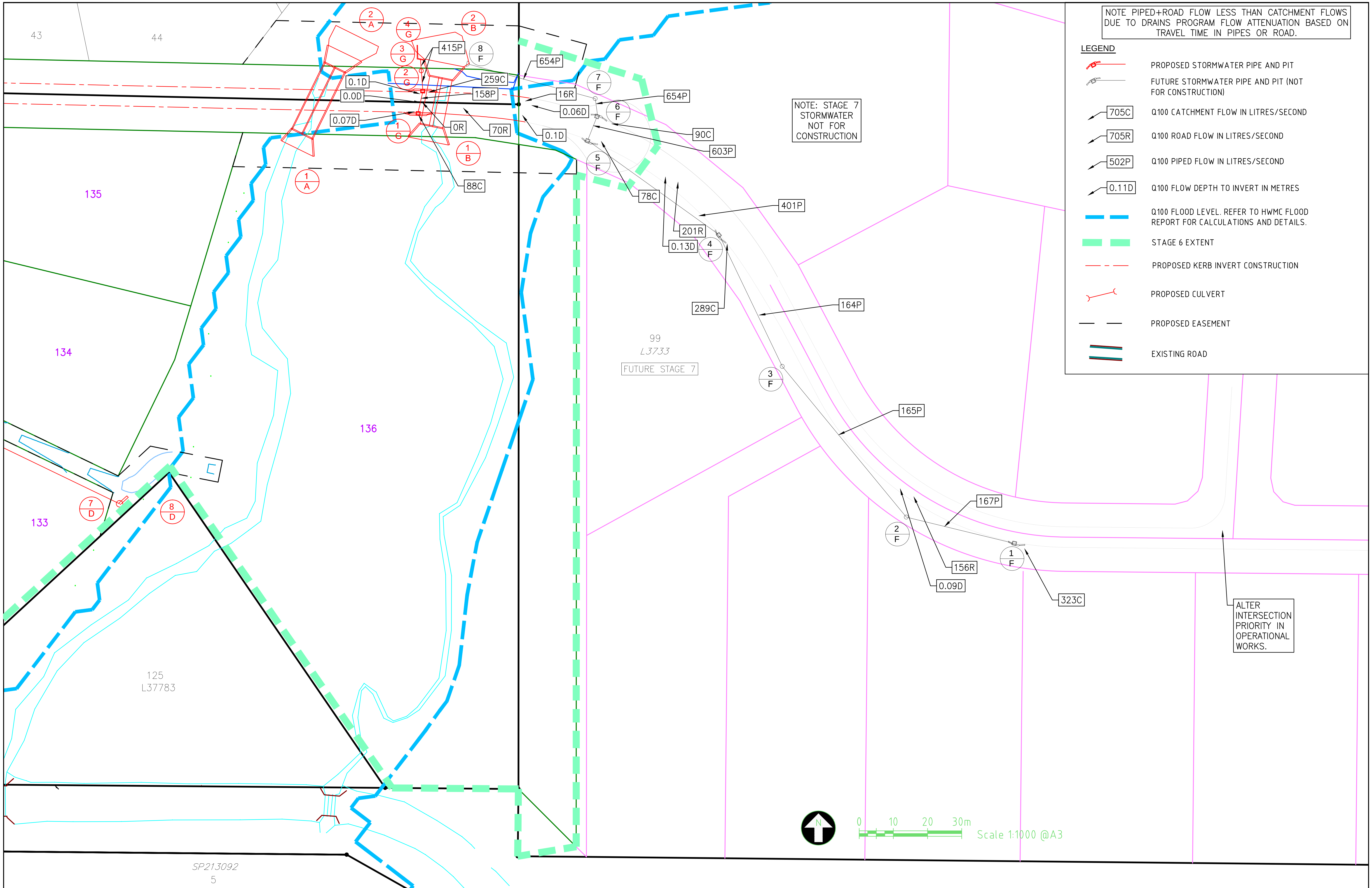
STORMWATER Q100 LAYOUT PLAN 1

1803-GS6

Sheet No. - Revision No.
S2 A



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STORMWATER Q100 LAYOUT PLAN 2

1803-GS6

Sheet No.	Revision No.
S3	A

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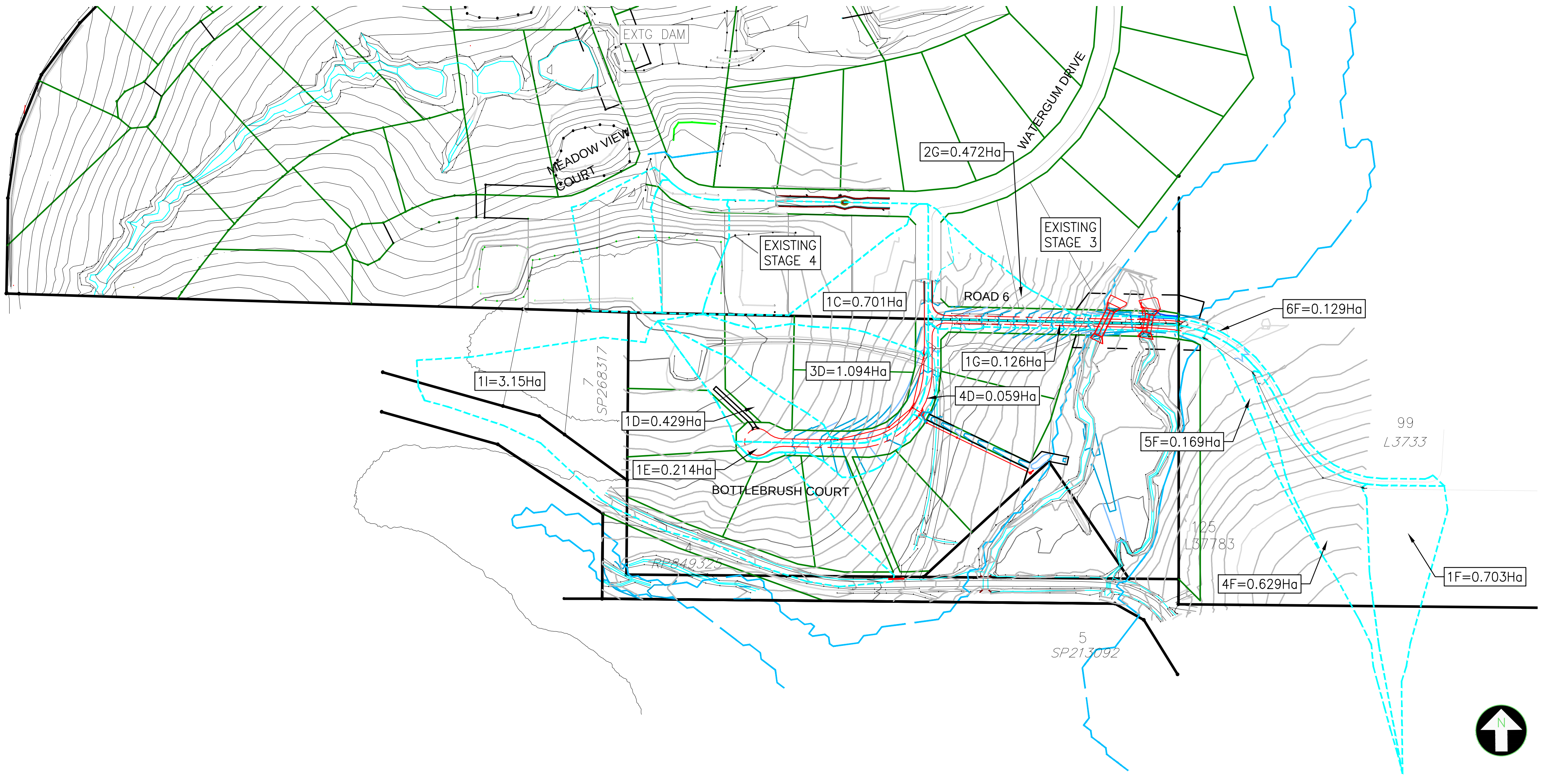
DATE: 14/10/2021



LEGEND

- STAGE 6 EXTENT
- PROPOSED ROAD CONSTRUCTION
- PROPOSED CULVERT
- PROPOSED STORMWATER PIT/PIPE
- PROPOSED EASEMENT
- EXISTING/PROPOSED CONTOURS
- EXISTING ROAD

A3

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GREENDALE STAGE 6

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STORMWATER CATCHMENT PLAN

1803-GS6

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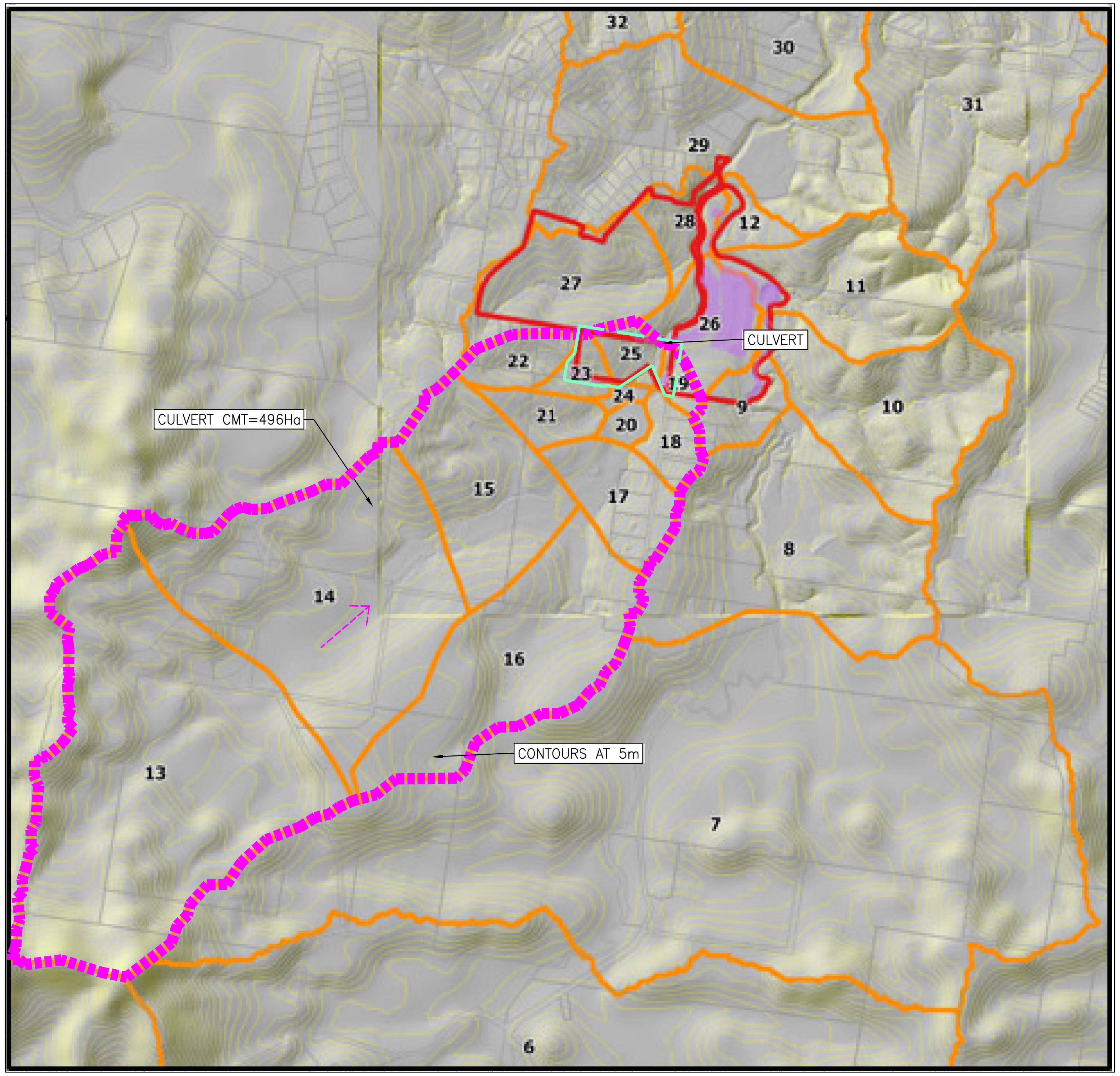
S4 A



CULVERT CATCHMENT
(BASE PLAN FROM HWMC IMAGE 4-1)

APPROXIMATE RATIONAL VERIFICATION OF Q100 FLOW AT PROPOSED CULVERT. FLOW IN FLOOD REPORT USED WNBM RAINFALL-RUNOFF MODEL AND SUB-CATCHMENTS 13-25 WITH ALLOWANCE FOR DETENTION AT RELEVANT POINTS.

fi=0.0 MAJORITY RURAL CATCHMENT) C10=0.59, C100=0.71
tc~2.5 HOURS (MAIN CHANNEL AVERAGE 1% OVER 2.62km =2.4hrs AT 0.3m/S STREAMFLOW TO QUDM)
Q100 RAINFALL INTENSITY 49mm/h, Q10 32.5mm/h
CATCHMENT AREA 496Ha

Q100=FCIA=1/360x0.71x49x496=47.9 CUMECS RATIONAL VS 47.9 CUMECS WNBM
Q10=FCIA=1/360x0.59x32.5x496=26.4 CUMECS RATIONAL VS 27.5 CUMECS WNBM

DETAILS AT CULVERT 1A-2A, 1B-2B:

Q100 FLOW=47.9 CUMECS

MAXIMUM WEIR VELOCITY OVER CULVERTS = 1.0m/s Q100

MAXIMUM WEIR VELOCITY DOWNSTREAM OF CULVERTS OVER EMBANKMENT= 2.4m/s Q100
MAXIMUM VELOCITY CULVERT OUTLET = 2.33 m/s (Q100)

CULVERT FLOW Q100=41.4 CUMECS

WEIR FLOW Q100=6.5 CUMECS
MAXIMUM Dv TRANSVERSE WEIR FLOW OVER ROAD CENTRELINE Q100 = 0.17 m^2/s, DEPTH = 0.2m MAXIMUM.
NOTE PEAK DEPTH AND VELOCITY DO NOT OCCUR AT THE SAME LOCATION.

CALCULATION OF PROPOSED CULVERT 1/I-2/I Q2 FLOW. TRAFFIC CATCHMENT OF MOOLOO ROAD ~70 LOTS SO AADT<2000 AND PIPE CAPACITY TO GRC STD DRG R-15.

fi=0.2 RURAL RESIDENTIAL CATCHMENT) C10=0.65, C2=0.55
tc=19 MINUTES
Q2 RAINFALL INTENSITY 83.9mm/h
CATCHMENT AREA 3.66Ha

Q2=FCIA=1/360x0.55x83.9x3.15=0.404 CUMECS RATIONAL

DETAILS AT CULVERT 1I-2I

MAXIMUM VELOCITY CULVERT OUTLET = 1.5 m/s

LEGEND

1B=0.127
CATCHMENT AND AREA IN Ha
STAGE 6 EXTENT

0 250 500 750m
Scale 1:25000 @A3

N

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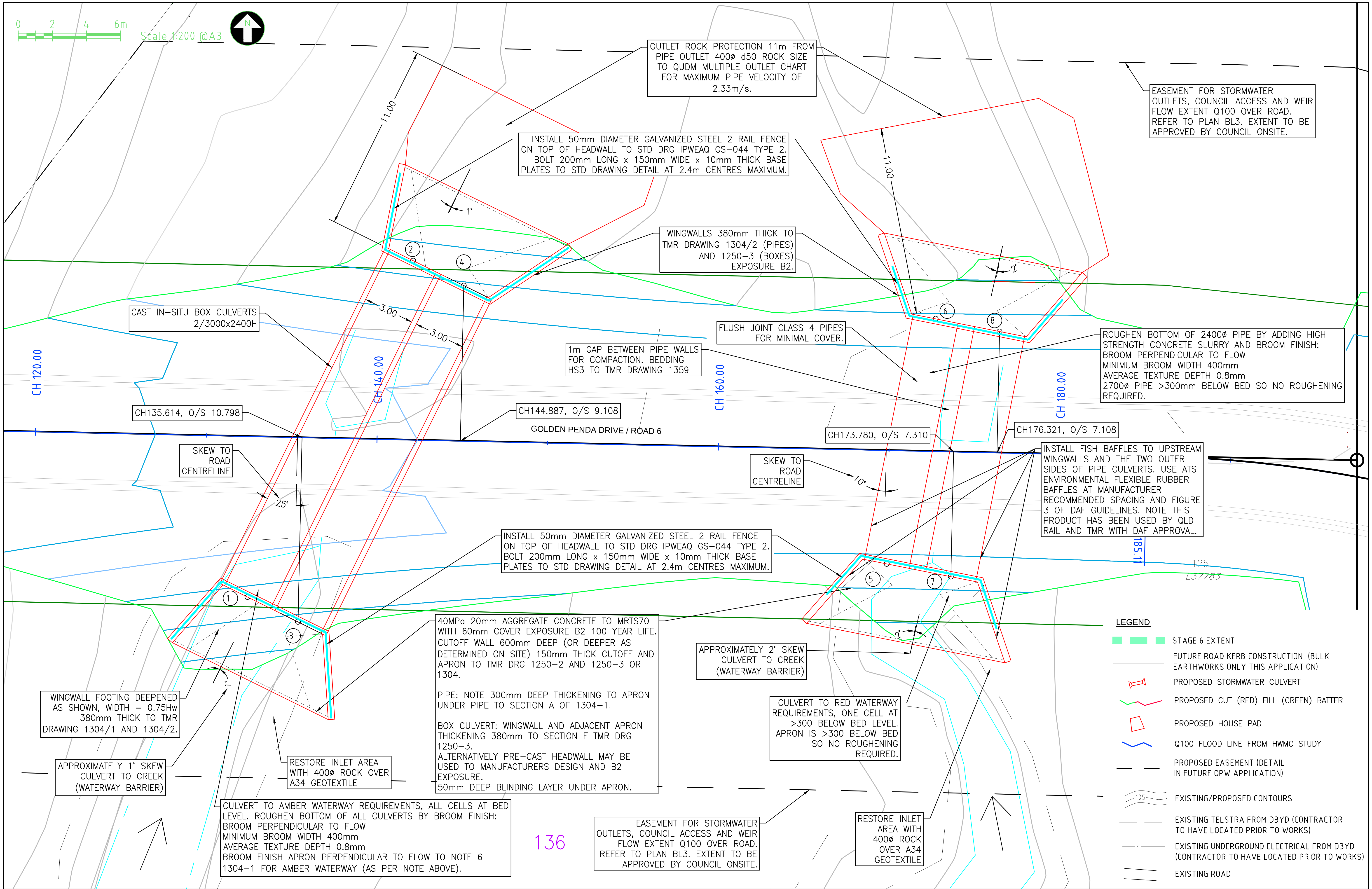
STORMWATER CMT PLAN CULVERT

1803-GS6
Sheet No. - Revision No.
S5 A



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STORMWATER CULVERT PLAN 1

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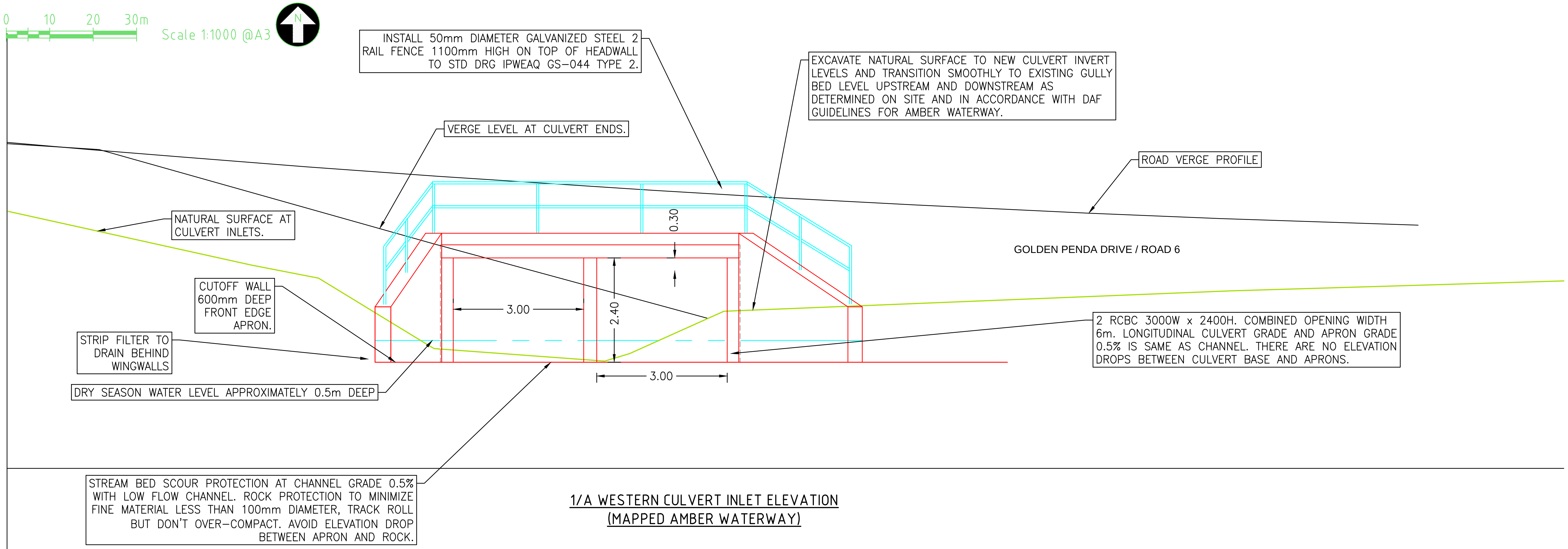
S6	A

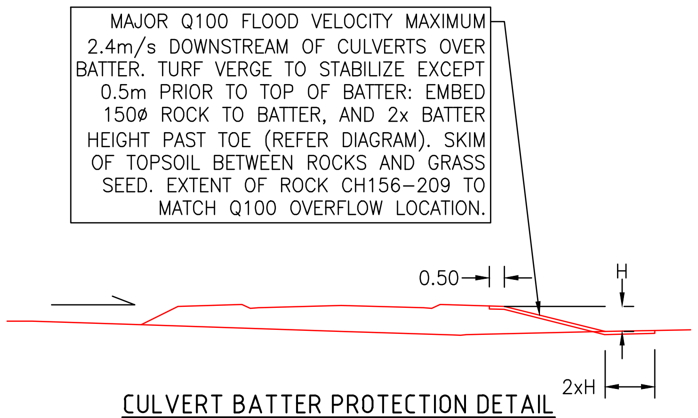


1/A WESTERN CULVERT INLET ELEVATION
(MAPPED AMBER WATERWAY)

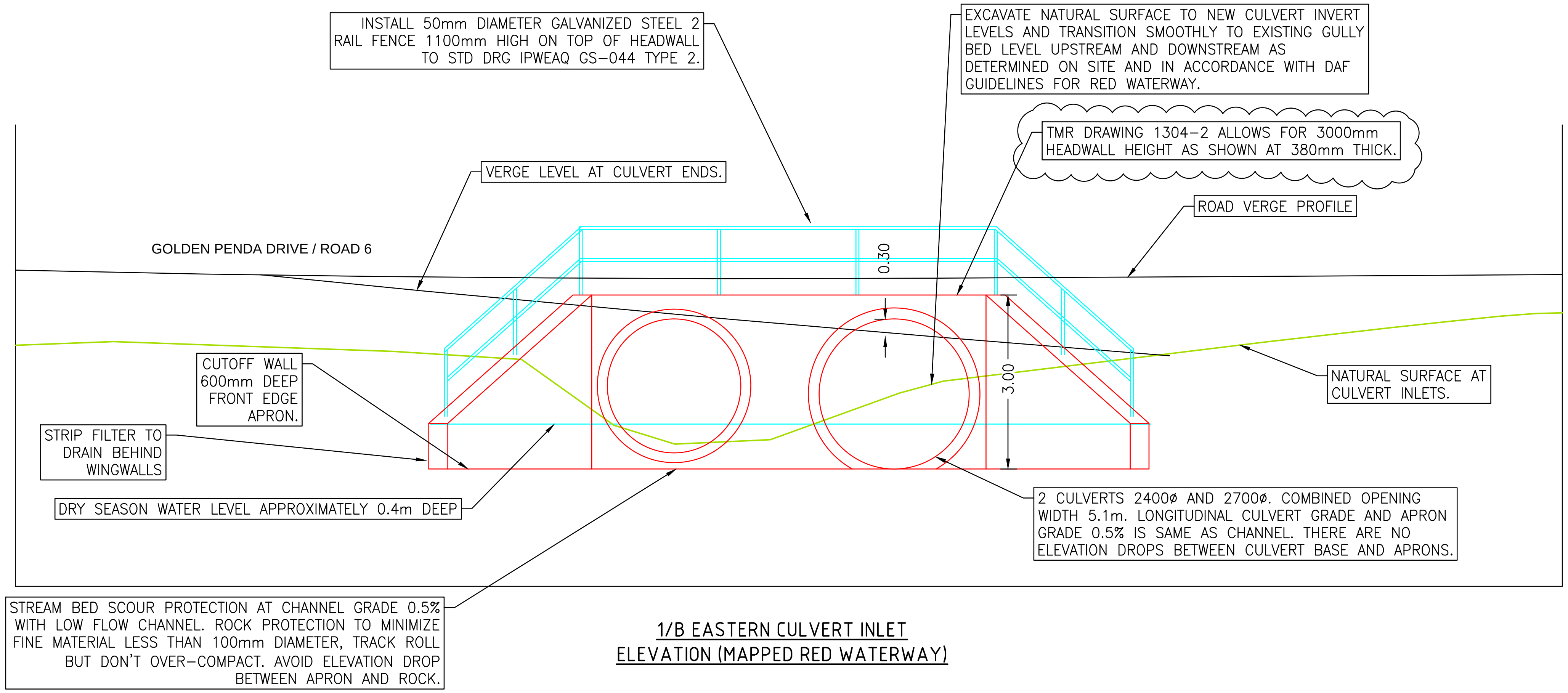
CULVERT NOTES

CONTRACTOR TO LIAISE WITH SUPERINTENDENT REGARDING CULVERT AND WINGWALL LOCATION AND HEIGHTS PRIOR TO ANY CHANGES.

CONTRACTOR TO ALLOW FOR CONSTRUCTION SIZE OF CULVERTS IN SETOUT AND CONFIRM WINGWALL LOCATION AND ANGLE AS REQUIRED PRIOR TO CONSTRUCTION.



CULVERT BATTER PROTECTION DETAIL



1/B EASTERN CULVERT INLET
ELEVATION (MAPPED RED WATERWAY)

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STORMWATER CULVERT PLAN 2

1803-GS6

Sheet No.	Revision No.
S7	A

SETOUT STORMWATER LINE A			
POINT NUMBER	EASTING AND NORTHING	LEVEL	COMMENTS
1	2848.737,4843.902	66.442	INVERT
2	2858.445,4863.599	66.332	INVERT
3	2851.697,4842.443	66.442	INVERT
4	2861.405,4862.141	66.332	INVERT

SETOUT STORMWATER LINE B			
POINT NUMBER	EASTING AND NORTHING	LEVEL	COMMENTS
5	2886.183,4845.838	66.313	INVERT 2400ø
6	2889.040,4860.197	66.240	INVERT 2400ø
7	2889.930,4845.093	66.033	INVERT 2700ø
8	2892.787,4859.451	65.960	INVERT 2700ø

A3

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GREENDALE STAGE 6

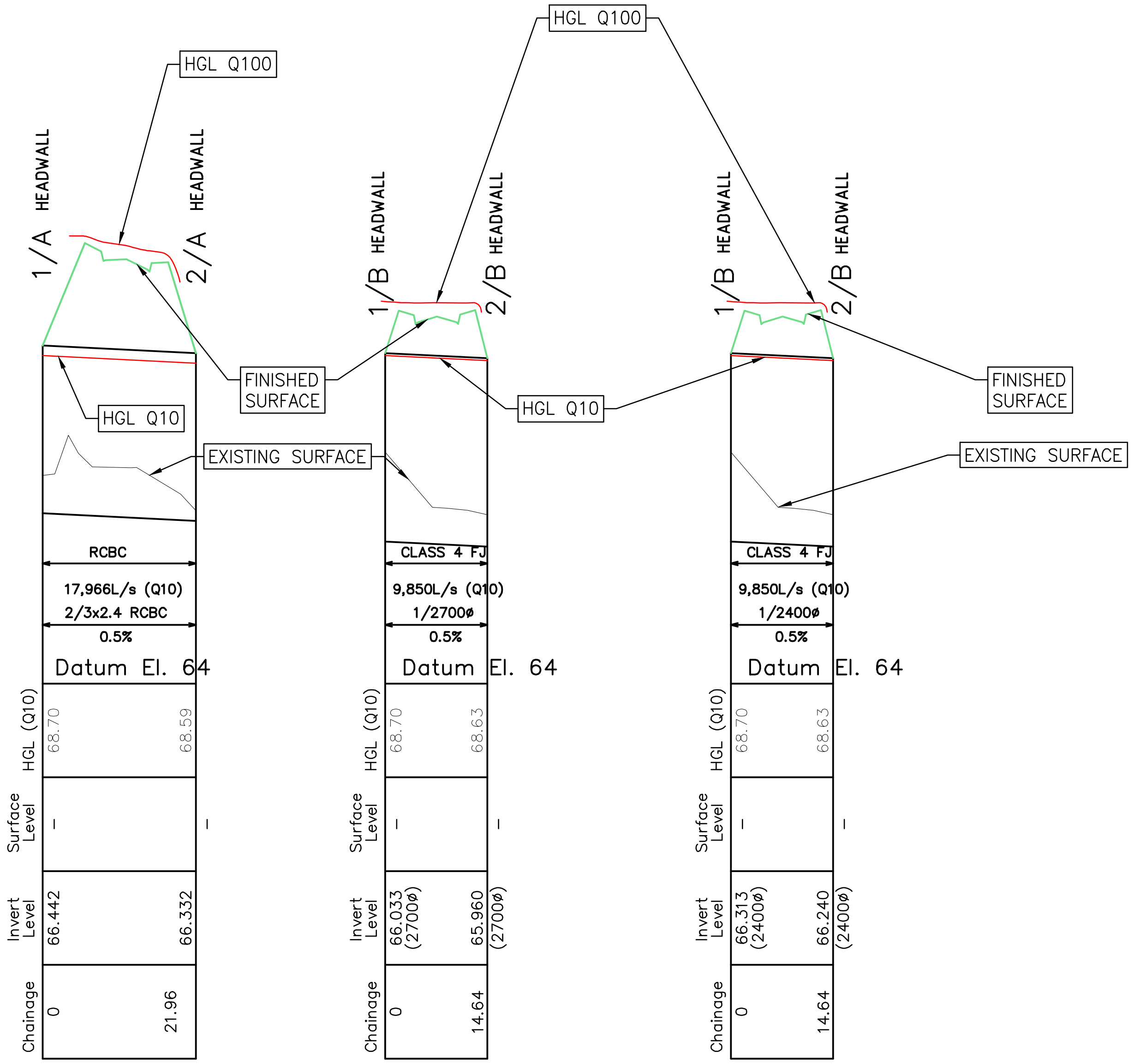
LOT 124 L37783, 14 LOTS BULK EARTHWORKS AND CULVERT
WATERGUM DRIVE, PIE CREEK, FOR ROBERTS BROS. PTY LTD

STORMWATER SETOUT

1803-GS6

Sheet No. - Revision No.

S8 A



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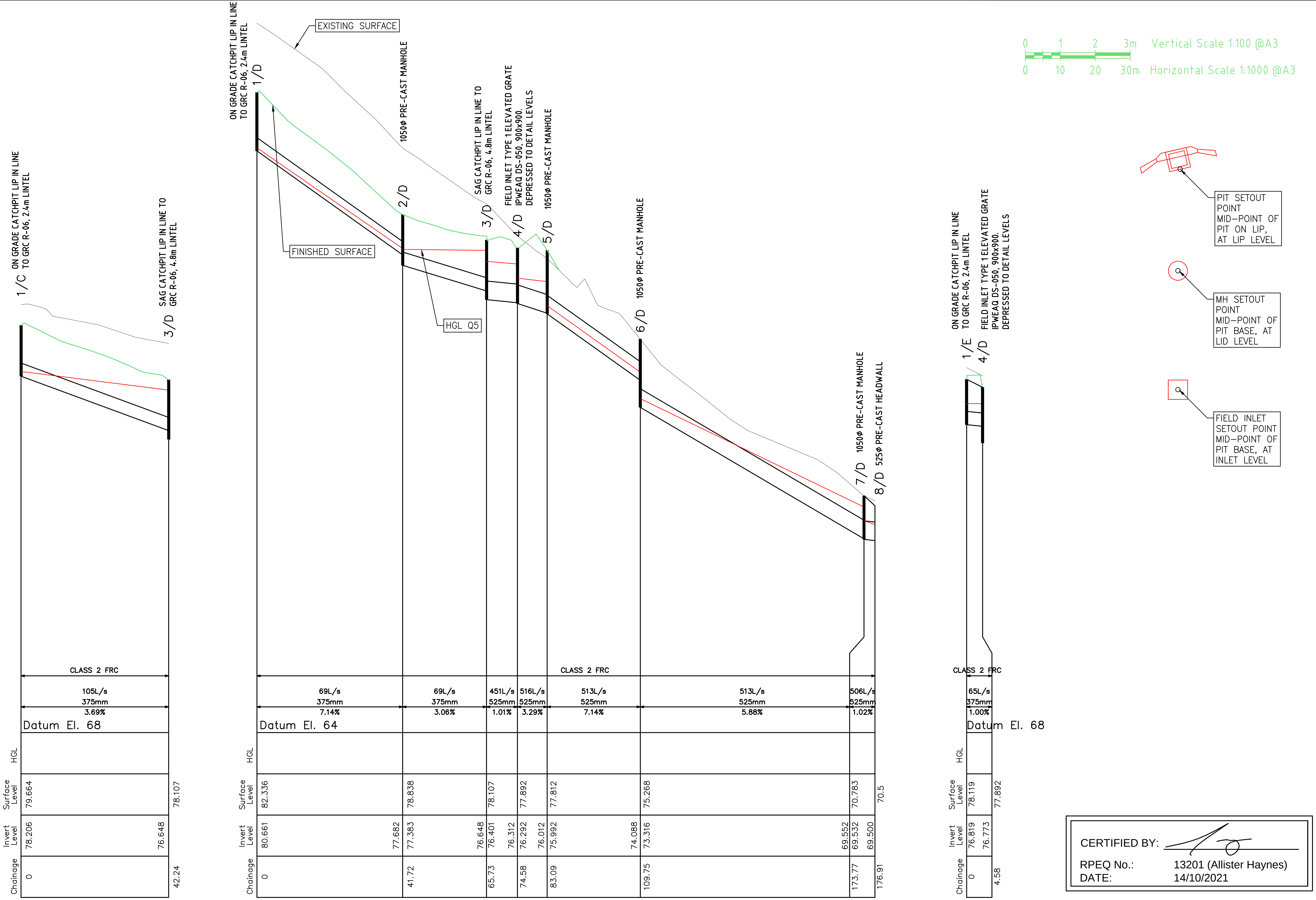
STORMWATER LONG SECTIONS 1

1803-GS6

Sheet No.	Revision No.
S9	A



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STORMWATER LONG SECTIONS 2

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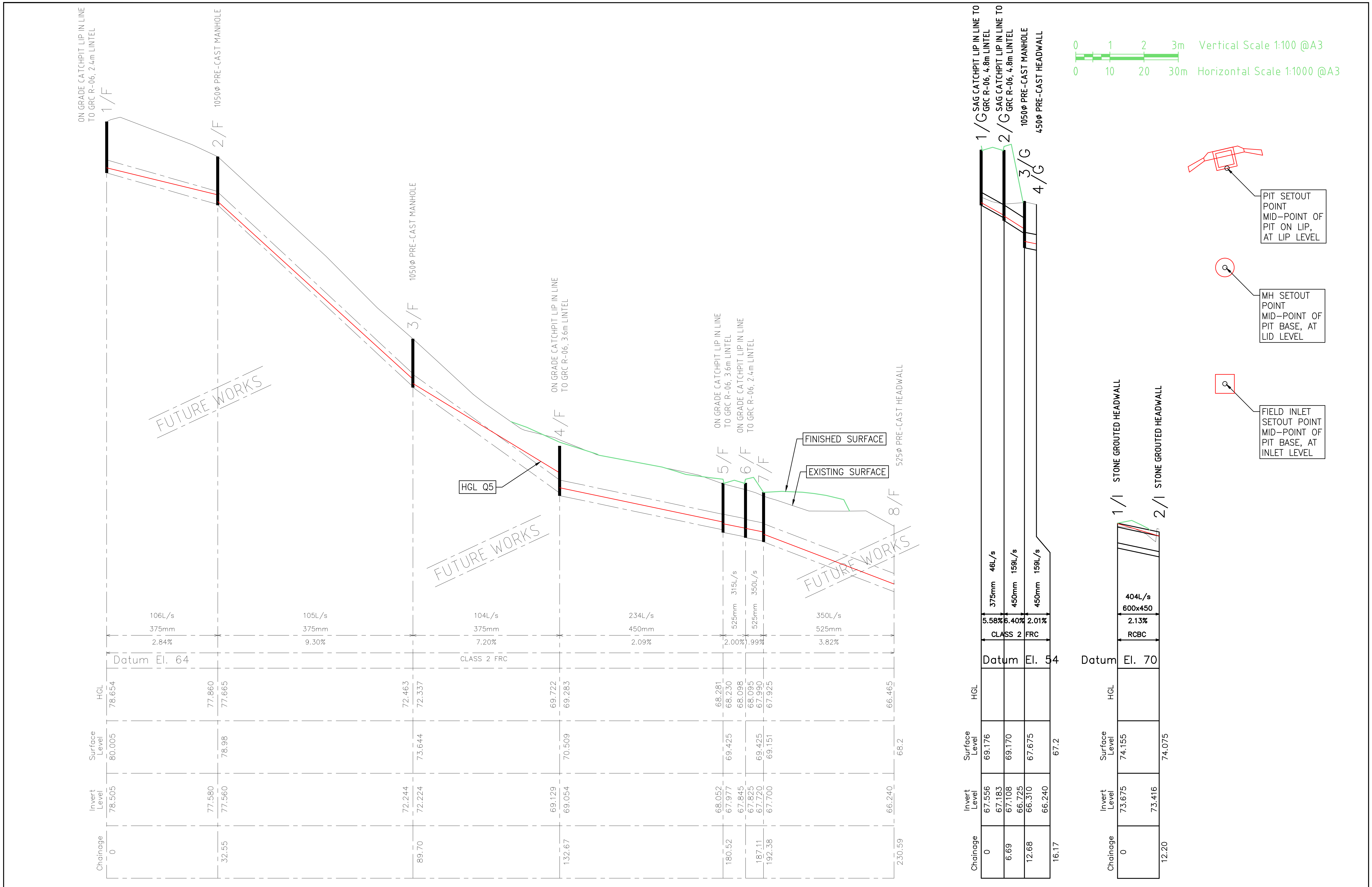
S10 A



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STORMWATER LONG SECTIONS 3

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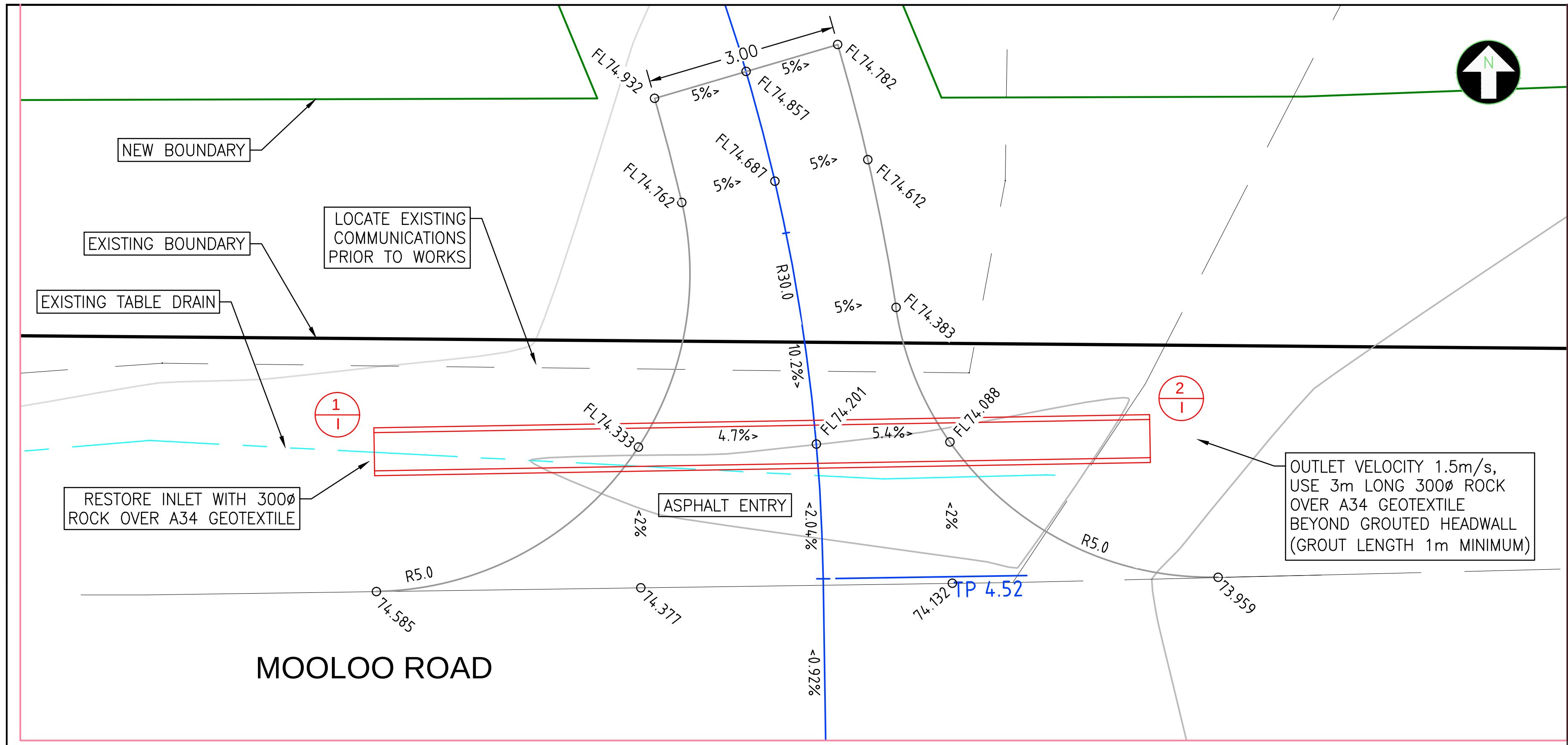
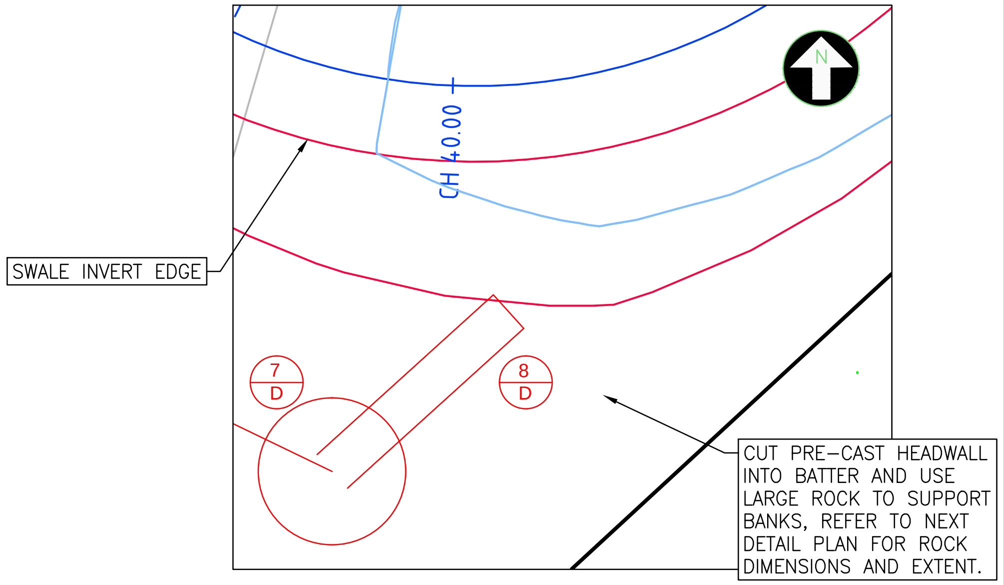


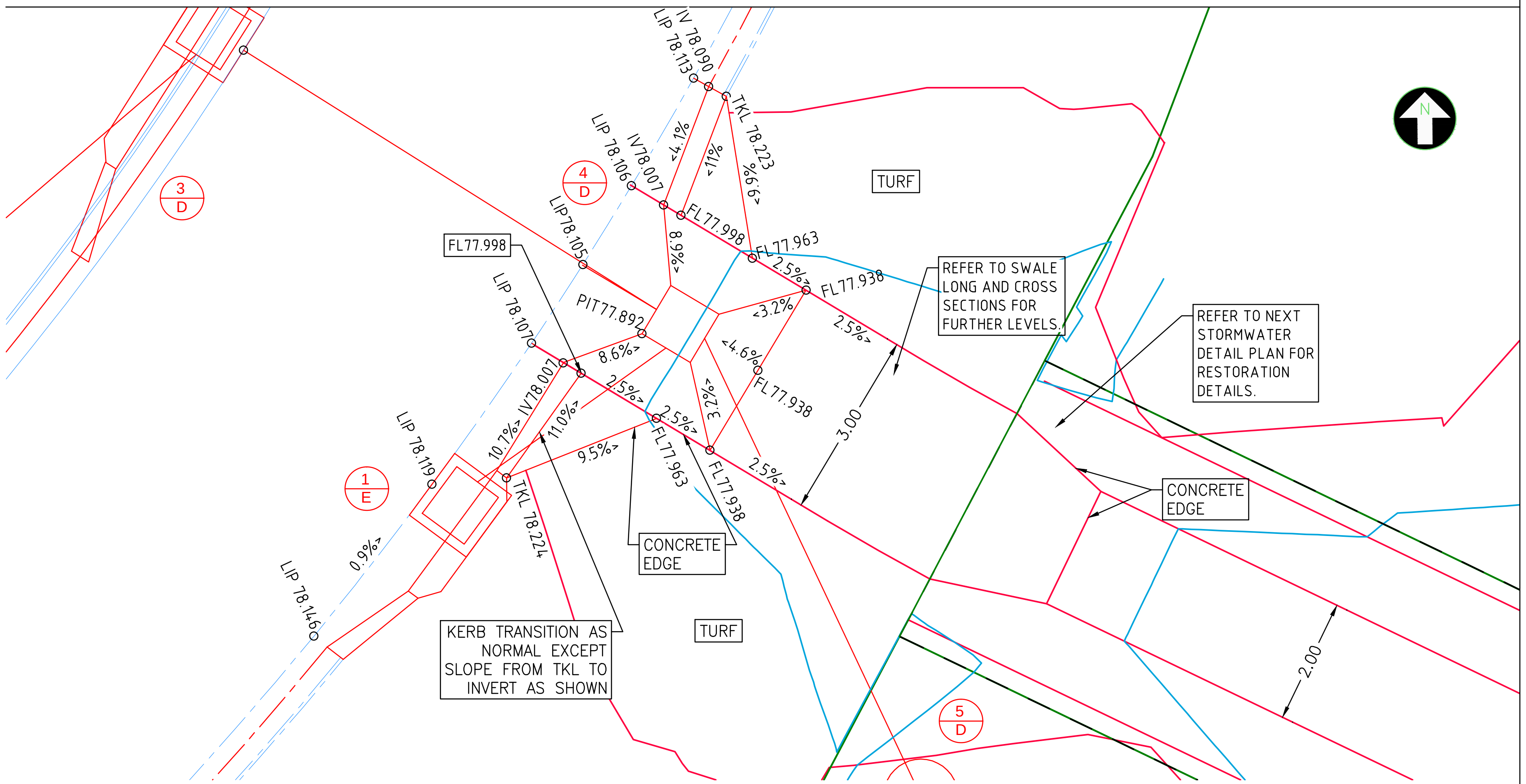
MOOLOO ROAD EMERGENCY ACCESS DETAIL

0 1 2 3m Horizontal Scale 1:100 @A3



0 1 2 3m Horizontal Scale 1:100 @A3

8/D OUTLET DETAIL



ROAD 5 PIT 5L AND Q100 OVERFLOW DETAIL

0 1 2 3m Horizontal Scale 1:100 @A3

A3			
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STORMWATER DETAILS 1

1803-GS6

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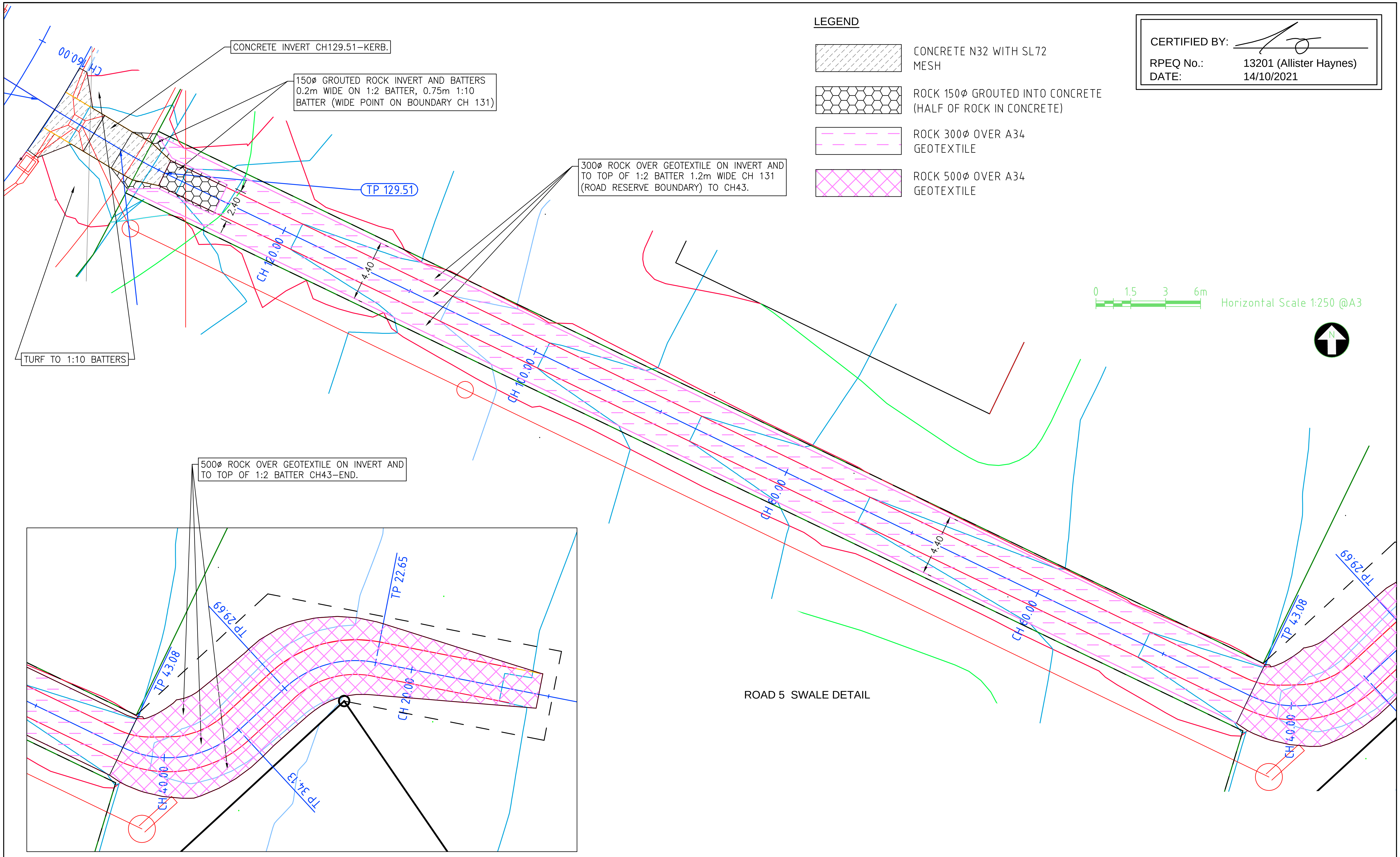
S12 A



ROAD 5 SWALE DETAIL

ROAD 5 SWALE AND OUTLET DETAIL

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STORMWATER DETAILS 2

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DATE: 14/10/2021

PIT & NODE DETAILS Version 3

Node	Area (ha)	Impervious %	Pervious %	Impervious C	Pervious C	Sum CA (ha)	Tc (min)	I (mm/h)	Arriving Flow (cu.m/s)	Inflow (cu.m/s)	Base Inflow (cu.m/s)
1/D	0.429	20	80	0.6175	0.6175	0.265	15	119	0.088	0.069	0
2/D	0.429					0.265	15.2	119	0.087	0.069	0
3/D	2.210*	20	80	0.6175	0.6175	1.365	15	119	0.453	0.453	0
4/D	2.497	60	40	0.78	0.78	1.566	15.4	118	0.513	0.513	0
5/D	2.483*					1.557	15.1	119	0.516	0.513	0
6/D	2.483*					1.557	15.1	119	0.514	0.511	0
7/D	2.483*					1.557	15.5	118	0.509	0.506	0
8/D	2.483*					1.557	15.5	118	0.508	0	0
1/C	0.701	20	80	0.6175	0.6175	0.433	13	126	0.152	0.105	0
1/E	0.214	40	60	0.684	0.684	0.146	6	161	0.065	0.065	0

* Partial Area

PIPE DETAILS

Node	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Dia (mm)	Rough (mm)	Nom Capacity (cu.m/s)	Under pressure	V (m/sec)	Headloss Coeff (Ku)	HGL (m)	Free-board	Overflow (cu.m/s)	Constraint
1/D	41.724	80.661	77.682	7.14	375	0.012	0.526	Yes	3.5	5.93	81.152	1.18	0.019	Inlet Capacity
2/D	24.005	77.383	76.648	3.06	375	0.012	0.344	No	2.4	0.3	77.573	1.27		None
3/D	8.849	76.401	76.312	1.01	525	0.012	0.486	No	2.5	0	76.812	1.3	0	None
4/D	8.511	76.292	76.012	3.29	525	0.012	0.88	No	2.4	0	76.785	1.11	0	None
5/D	26.658	75.992	74.088	7.14	525	0.012	1.296	Yes	5.5	0.66	76.69	1.12		None
6/D	64.02	73.316	69.552	5.88	525	0.012	1.176	Yes	5.1	3.48	74.767	0.5		None
7/D	3.147	69.532	69.5	1.02	525	0.012	0.489	No	2.5	0	70.019	0.76		None
8/D											69.961			
1/C	42.242	78.206	76.648	3.69	375	0.012	0.378	Yes	2.8	5.78	78.838	0.83	0.047	Inlet Capacity
1/E	4.58	76.819	76.773	1	375	0.012	0.197	Yes	1.5	4.73	77.238	0.88	0	None

Note: The pipe Nominal Capacity may be exceeded if the pipe is pressurised.
QUDM allows 6m/s, pipe grades over 7% make 5m/s hard to obtain and require additional manholes/structures

SUB-CATCHMENT DETAILS

Catchment	Imperv. (ha)	Pervious (ha)	Imperv. C	Pervious C	Sum CA (ha)	Tc (min)	I (mm/h)	Q (cu.m/s)
1D	0.086	0.343	0.62	0.62	0.265	15	119	0.088
3D	0.219	0.875	0.62	0.62	0.676	15	119	0.224
4D	0.035	0.024	0.78	0.78	0.046	6	161	0.021
1C	0.14	0.561	0.62	0.62	0.433	13	126	0.152
1E	0.086	0.128	0.68	0.68	0.146	6	161	0.065

LINK FLOWS

	Node	Item	Max.Flow (cu.m/s)	Max. Vel. (m/s)	Max U/S HGL (m)	Max D/S HGL (m)		Max Width (m)	Max DxV (sq.m/s)
Cmt Total	1/D	1D	0.088						
Pipe Flow		1D-2D	0.069	3.5	80.749	77.77			
Pit Bypass		OF1D-3D	0.019					1.04	0.04
Pipe Flow	2/D	2D-3D	0.069	2.4	77.497	76.812			
Cmt Total	1/C	1C	0.152						
Pipe Flow		1C-3D	0.105	2.8	78.344	76.812			
Pit Bypass		OF1C-3D	0.047					1.56	0.07
Cmt Total	3/D	3D	0.224						
Pipe Flow		3D-4D	0.453	2.5	76.812	76.785	Partial Area Effect		
Pit Bypass		OF3D-4D	0					0	0
Cmt Total	1/E	1E	0.065						
Pipe Flow		1E-4D	0.065	1.5	77.158	76.925			
Pit Bypass		OF1E-4D	0					0	0
Cmt Total	4/D	4D	0.021						
Pipe Flow		4D-5D	0.513	2.4	76.785	76.69			
Pit Bypass		OF4D-8D	0					0	0
Pipe Flow	5/D	5D-6D	0.513	5.5	76.225	74.767	Partial Area Effect		
Pipe Flow	6/D	6D-7D	0.511	5.1	73.562	70.019	Partial Area Effect		
Pipe Flow	7/D	7D-8D	0.506	2.5	70.019	69.961	Partial Area Effect		

Q5 EVENT, AND Q5 ROAD FLOWS

INSET OF SUBDIVISION EXTENT

A3	Rv	DATE	REVISIONS	APPR.
	A	14-10-21	FOR COUNCIL APPROVAL	ATH

PSM No	196359
(AHD) RL	82.237
SURVEYED	MURRAY & ASSOC

HAYNES CONSULTING ENGINEERS

HAYNES CONSULTING ENGINEERS
ABN 53 613 630 078
PO BOX 549 NOOSA HEADS QLD 4567
(0432) 784 150

GREENDALE STAGE 6
LOT 124 L37783, 14 LOTS ROADWORKS AND DRAINAGE
WATERGUM DRIVE, PIE CREEK, FOR ROBERTS BROS. PTY LTD
STORMWATER CALCULATIONS 1

1803-GS6
Sheet No. - Revision No.
S14 A

CERTIFIED BY:

RPEQ No.: 13201 (Allister Haynes)
DATE: 14/10/2021

PIT & NODE DETAILS — Version 3 / PIPE DETAILS

Node	Area (ha)	Impervious %	Pervious %	Impervious C	Pervious C	Sum CA (ha)	Tc (min)	I (mm/h)	Arriving Flow (cu.m/s)	Inflow (cu.m/s)	Base Inflow (cu.m/s)	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Dia (mm)	Rough (mm)	Nom Capacity (cu.m/s)	Under pressure	V (m/sec)	Headloss Coeff (Ku)	HGL (m)	Free-board	Overflow (cu.m/s)	Constraint
1/D	0.429	20	80	0.78	0.78	0.335	15	200	0.186	0.113	0	41.724	80.661	77.682	7.14	375	0.012	0.526	Yes	3.7	5.57	81.321	1.02	0.072	Inlet Capacity
2/D	0.429					0.335	15.2	198	0.184	0.112	0	24.005	77.383	76.648	3.06	375	0.012	0.344	No	2.7	0.3	77.631	1.21		None
3/D	2.210*	20	80	0.78	0.78	1.724	15	200	0.956	0.655	0	8.849	76.401	76.312	1.01	525	0.012	0.486	Yes	2.9	0	77.227	0.88	0.301	None
4/D	2.483*	60	40	0.936	0.936	1.941	15	199	1.075	0.741	0	8.511	76.292	76.012	3.29	525	0.012	0.88	Yes	3.3	0	77.066	0.83	0.334	None
5/D	2.483*					1.941	15.1	199	1.075	0.741	0	26.658	75.992	74.088	7.14	525	0.012	1.296	Yes	6	0.66	76.869	0.94		None
6/D	2.483*					1.941	15.1	199	1.072	0.738	0	64.02	73.316	69.552	5.88	525	0.012	1.176	Yes	5.7	2.42	75.171	0.1		None
7/D	2.483*					1.941	15.4	197	1.063	0.729	0	3.147	69.532	69.5	1.02	525	0.012	0.489	Yes	3.3	0	70.104	0.68		None
8/D	2.483*					1.941	15.4	197	1.062	0	0											70.012			
1/C	0.701	20	80	0.78	0.78	0.547	13	212	0.322	0.167	0	42.242	78.206	76.648	3.69	375	0.012	0.378	Yes	3.2	4.26	79.05	0.61	0.155	Inlet Capacity
1/E	0.214	40	60	0.756	0.756	0.162	6	269	0.121	0.104	0	4.58	76.819	76.773	1	375	0.012	0.197	Yes	1.3	5.81	77.445	0.67	0.017	Inlet Capacity

* Partial Area

Note: The pipe Nominal Capacity may be exceeded if the pipe is pressurised.
QUDM allows 6m/s, pipe grades over 7% make 5m/s hard to obtain and require additional manholes/structures

SUB-CATCHMENT DETAILS

Catchment	Imperv. (ha)	Pervious (ha)	Imperv. C	Pervious C	Sum CA (ha)	Tc (min)	I (mm/h)	Q (cu.m/s)
1D	0.086	0.343	0.78	0.78	0.335	15	200	0.186
3D	0.219	0.875	0.78	0.78	0.853	15	200	0.473
4D	0.035	0.024	0.94	0.94	0.055	6	269	0.041
1C	0.14	0.561	0.78	0.78	0.547	13	212	0.322
1E	0.086	0.128	0.76	0.76	0.162	6	269	0.121

HECRAS FLOWS:
CH145.33 INVERT 3/D=0.301cumecs
CH138.61 PAST PIT 4/D=0.334cumecs
CH89.4 PAST PIPE OUTLET 8/D=1.063cumecs

LINK FLOWS

	Node	Item	Max.Flow (cu.m/s)	Max. Vel. (m/s)	Max U/S HGL (m)	Max D/S HGL (m)		Max Width (m)	Max DxV (sq.m/s)	
Cmt Total	1/D	1D	0.186							
Pipe Flow		1D-2D	0.113	3.7	80.78	77.801				
Pit Bypass		OF1D-3D	0.072					1.87	0.09	
Pipe Flow	2/D	2D-3D	0.112	2.7	77.533	77.227				
Cmt Total	1/C	1C	0.322							
Pipe Flow		1C-3D	0.167	3.2	78.383	77.227				
Pit Bypass		OF1C-3D	0.155					2.54	0.14	
Cmt Total	3/D	3D	0.473							
Pipe Flow		3D-4D	0.655	2.9	77.227	77.066	Partial Area Effect			
Pit Bypass		OF3D-4D	0.301					17.32	0.03	FROM HECRAS CH141.86
Cmt Total	1/E	1E	0.121							
Pipe Flow		1E-4D	0.104	1.3	77.079	77.066				
Pit Bypass		OF1E-4D	0.017					1.29	0.04	
Cmt Total	4/D	4D	0.041							
Pipe Flow		4D-5D	0.741	3.3	77.066	76.869	Partial Area Effect			
Pit Bypass		OF4D-8D	0.334					4.23	0.09	FROM HECRAS CH133.33
Pipe Flow	5/D	5D-6D	0.741	6	76.278	75.171	Partial Area Effect			
Pipe Flow	6/D	6D-7D	0.738	5.7	73.618	70.104	Partial Area Effect			
Pipe Flow	7/D	7D-8D	0.729	3.3	70.104	70.012	Partial Area Effect			

Q100 EVENT, AND Q100 ROAD FLOWS

A3	A	14-10-21	FOR COUNCIL APPROVAL	ATH	
	Rv	DATE	REVISIONS	APPR.	

PSM No	196359
(AHD) RL	82.237
SURVEYED	MURRAY & ASSOC

HAYNES CONSULTING ENGINEERS

HAYNES CONSULTING ENGINEERS
ABN 53 613 630 078
PO BOX 549 NOOSA HEADS QLD 4567
(0432) 784 150

GREENDALE STAGE 6
LOT 124 L37783, 14 LOTS ROADWORKS AND DRAINAGE
WATERGUM DRIVE, PIE CREEK, FOR ROBERTS BROS. PTY LTD
STORMWATER CALCULATIONS 2

1803-GS6
Sheet No. - Revision No.
S15 A

CERTIFIED BY:

RPEQ No.: 13201 (Allister Haynes)
DATE: 14/10/2021

PIT & NODE DETAILS — Version 3

Node	Area (ha)	Impervious %	Pervious %	Impervious C	Pervious C	Sum CA (ha)	Tc (min)	I (mm/h)	Arriving Flow (cu.m/s)	Inflow (cu.m/s)	Base Inflow (cu.m/s)
1/G	0.126	60	40	0.78	0.78	0.098	6	161	0.044	0.046	0
2/G	0.691	20	80	0.6175	0.6175	0.447	13	126	0.157	0.159	0
3/G	0.691					0.447	13	127	0.157	0.159	0
4/G	0.691					0.447	13	127	0.157	0	0
1/F	0.703	20	80	0.6175	0.6175	0.434	13	126	0.152	0.106	0
2/F	0.703					0.434	13.2	126	0.152	0.105	0
3/F	0.703					0.434	13.4	125	0.151	0.104	0
4/F	1.332	20	80	0.6175	0.6175	0.823	13.5	125	0.285	0.234	0
5/F	1.501	20	80	0.6175	0.6175	0.927	13.8	123	0.318	0.315	0
6/F	1.63	60	40	0.78	0.78	1.027	13.8	124	0.353	0.35	0
7/F	1.619*					1.021	13.7	124	0.352	0.35	0
8/F	1.625*					1.024	13.9	123	0.351	0	0

PIPE DETAILS

Node	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Dia (mm)	Rough (mm)	Nom Capacity (cu.m/s)	Under pressure	V (m/sec)	Headloss Coeff (Ku)	HGL (m)	Free-board	Overflow (cu.m/s)	Constraint
1/G	6.69	67.556	67.183	5.58	375	0.012	0.465	No	2.9	5.93	67.91	1.27	0	None
2/G	5.987	67.108	66.725	6.4	450	0.012	0.809	No	3.9	0	67.243	1.93	0	None
3/G	3.491	66.31	66.24	2.01	450	0.012	0.453	No	2.5	0.2	66.562	1.11		None
4/G											66.428			
1/F	32.547	78.505	77.58	2.84	375	0.012	0.332	Yes	2.6	5.77	79.138	0.87	0.047	Inlet Capacity
2/F	57.152	77.56	72.244	9.3	375	0.012	0.6	No	4.1	0.66	77.86	1.12		None
3/F	42.97	72.224	69.129	7.2	375	0.012	0.528	No	3.7	0.3	72.463	1.18		None
4/F	47.852	69.054	68.052	2.09	450	0.012	0.463	Yes	2.8	2.08	69.722	0.79	0.051	Inlet Capacity
5/F	6.585	67.977	67.845	2	525	0.012	0.687	No	3	0	68.23	1.2	0.002	Inlet Capacity
6/F	5.275	67.825	67.72	1.99	525	0.012	0.684	No	3.1	0	68.095	1.33	0	None
7/F	38.213	67.7	66.24	3.82	525	0.012	0.948	No	3.9	0	67.925	1.23		None
8/F											66.465			

* Partial Area

Note: The pipe Nominal Capacity may be exceeded if the pipe is pressurised.

SUB-CATCHMENT DETAILS

Catchment	Imperv. (ha)	Pervious (ha)	Imperv. C	Pervious C	Sum CA (ha)	Tc (min)	I (mm/h)	Q (cu.m/s)
1G	0.076	0.05	0.78	0.78	0.098	6	161	0.044
2G	0.113	0.452	0.62	0.62	0.349	13	126	0.123
1F	0.141	0.562	0.62	0.62	0.434	13	126	0.152
4F	0.126	0.503	0.62	0.62	0.388	13	126	0.136
5F	0.034	0.135	0.62	0.62	0.104	13	126	0.037
6F	0.077	0.052	0.78	0.78	0.101	6	161	0.045

LINK FLOWS

	Node	Item	Max. Flow (cu.m/s)	Max. Vel. (m/s)	Max U/S HGL (m)	Max D/S HGL (m)		Max Width (m)	Max DxV (sq.m/s)
Cmt Total	1/G	1G	0.044						
Pipe Flow		1G-2G	0.046	2.9	67.632	67.259			
Pit Bypass		OF1G-2G	0					0	0
Cmt Total	2/G	2G	0.123						
Pipe Flow		2G-3G	0.159	3.9	67.243	66.86			
Pit Bypass		OF2G-4G	0					0	0
Pipe Flow	3/G	3G-4G	0.159	2.5	66.498	66.428			
Cmt Total	1/F	1F	0.152						
Pipe Flow		1F-2F	0.106	2.6	78.654	77.86			
Pit Bypass		OF1F-4F	0.047					1.62	0.07
Pipe Flow	2/F	2F-3F	0.105	4.1	77.665	72.463			
Pipe Flow	3/F	3F-4F	0.104	3.7	72.337	69.722			
Cmt Total	4/F	4F	0.136						
Pipe Flow		4F-5F	0.234	2.8	69.283	68.281			
Pit Bypass		OF4F-5F	0.051					2.35	0.05
Cmt Total	5/F	5F	0.037						
Pipe Flow		5F-6F	0.315	3	68.23	68.098			
Pit Bypass		OF5F-1G	0.002					0.61	0.01
Cmt Total	6/F	6F	0.045						
Pipe Flow		6F-7F	0.35	3.1	68.095	67.99			
Pit Bypass		OF6F-2G	0					0	0
Pipe Flow	7/F	7F-8F	0.35	3.9	67.925	66.465	Partial Area Effect		

Q5 EVENT, AND Q5 ROAD FLOWS LINES F AND G

A3	Rv	DATE	REVISIONS	APPR.
	A	14-10-21	FOR COUNCIL APPROVAL	ATH

PSM No	196359
(AHD) RL	82.237
SURVEYED	MURRAY & ASSOC

HAYNES CONSULTING ENGINEERS

HAYNES CONSULTING ENGINEERS
ABN 53 613 630 078
PO BOX 549 NOOSA HEADS QLD 4567
(0432) 784 150

GREENDALE STAGE 6
LOT 124 L37783, 14 LOTS ROADWORKS AND DRAINAGE
WATERGUM DRIVE, PIE CREEK, FOR ROBERTS BROS. PTY LTD
STORMWATER CALCULATIONS 3

1803-GS6
Sheet No. - Revision No.
S16 A

CERTIFIED BY:
RPEQ No.: 13201 (Allister Haynes)
DATE: 14/10/2021

PIT & NODE DETAILS — Version 3

Node	Area (ha)	Impervious %	Pervious %	Impervious C	Pervious C	Sum CA(ha)	Tc (min)	I (mm/h)	Arriving Flow (cu.m/s)	Inflow (cu.m/s)	Base Inflow (cu.m/s)
1/G	0.126	60	40	0.936	0.936	0.118	6	269	0.088	0.158	0
2/G	0.691	20	80	0.78	0.78	0.559	13	212	0.329	0.415	0
3/G	0.691					0.559	13	212	0.329	0.415	0
4/G	0.691					0.559	13	212	0.328	0	0
1/F	0.703	20	80	0.78	0.78	0.548	13	212	0.323	0.167	0
2/F	0.703					0.548	13.2	211	0.321	0.165	0
3/F	0.703					0.548	13.4	209	0.319	0.164	0
4/F	1.332	20	80	0.78	0.78	1.039	13.5	208	0.601	0.401	0
5/F	1.501	20	80	0.78	0.78	1.171	13.8	207	0.673	0.603	0
6/F	1.63	60	40	0.936	0.936	1.292	13.8	206	0.74	0.654	0
7/F	1.63					1.292	13.9	206	0.74	0.654	0
8/F	1.63					1.292	14	205	0.737	0	0

PIPE DETAILS

Node	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Dia (mm)	Rough (mm)	Nom Capacity (cu.m/s)	Under pressure	V (m/sec)	Headloss Coeff (Ku)	HGL (m)	Free-board	Overflow (cu.m/s)	Constraint
1/G	6.69	67.556	67.183	5.58	375	0.012	0.465	Yes	3.7	4.02	68.33	0.85	0	None
2/G	5.987	67.108	66.725	6.4	450	0.012	0.809	No	5	0	67.339	1.83	0	None
3/G	3.491	66.31	66.24	2.01	450	0.012	0.453	No	3.1	0.2	66.756	0.92		None
4/G											66.587			
1/F	32.547	78.505	77.58	2.84	375	0.012	0.332	Yes	2.9	4.26	79.351	0.66	0.156	Inlet Capacity
2/F	57.152	77.56	72.244	9.3	375	0.012	0.6	Yes	4.5	0.66	78.006	0.97		None
3/F	42.97	72.224	69.129	7.2	375	0.012	0.528	No	4.1	0.3	72.532	1.11		None
4/F	47.852	69.054	68.052	2.09	450	0.012	0.463	Yes	3.2	1.43	69.933	0.58	0.201	Inlet Capacity
5/F	6.585	67.977	67.845	2	525	0.012	0.687	No	3.4	0	68.368	1.06	0.07	Inlet Capacity
6/F	5.275	67.825	67.72	1.99	525	0.012	0.684	No	3.5	0	68.246	1.18	0.016	Inlet Capacity
7/F	38.213	67.7	66.24	3.82	525	0.012	0.948	No	4.6	0	68.022	1.13		None
8/F											66.562			

*Partial Area

Note: The pipe Nominal Capacity may be exceeded if the pipe is pressurised.

SUB-CATCHMENT DETAILS

Catchment	Imperv. (ha)	Pervious (ha)	Imperv. C	Pervious C	Sum CA(ha)	Tc (min)	I (mm/h)	Q (cu.m/s)
1G	0.076	0.05	0.94	0.94	0.118	6	269	0.088
2G	0.113	0.452	0.78	0.78	0.441	13	212	0.259
1F	0.141	0.562	0.78	0.78	0.548	13	212	0.323
4F	0.126	0.503	0.78	0.78	0.491	13	212	0.289
5F	0.034	0.135	0.78	0.78	0.132	13	212	0.078
6F	0.077	0.052	0.94	0.94	0.121	6	269	0.09

LINK FLOWS

	Node	Item	Max.Flow (cu.m/s)	Max. Vel. (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Max Width (m)	Max DxV (sq.m/s)
Cmt Total	1/G	1G	0.088					
Pipe Flow		1G-2G	0.158	3.7	67.71	67.339		
Pit Bypass		OF1G-2G	0				0	0
Cmt Total	2/G	2G	0.259					
Pipe Flow		2G-3G	0.415	5	67.339	66.956		
Pit Bypass		OF2G-4G	0				0	0
Pipe Flow	3/G	3G-4G	0.415	3.1	66.657	66.587		
Cmt Total	1/F	1F	0.323					
Pipe Flow		1F-2F	0.167	2.9	78.696	78.006		
Pit Bypass		OF1F-4F	0.156				2.67	0.13
Pipe Flow	2/F	2F-3F	0.165	4.5	77.697	72.532		
Pipe Flow	3/F	3F-4F	0.164	4.1	72.371	69.933		
Cmt Total	4/F	4F	0.289					
Pipe Flow		4F-5F	0.401	3.2	69.385	68.383		
Pit Bypass		OF4F-5F	0.201				3.26	0.12
Cmt Total	5/F	5F	0.078					
Pipe Flow		5F-6F	0.603	3.4	68.368	68.246		
Pit Bypass		OF5F-1G	0.07				2.89	0.06
Cmt Total	6/F	6F	0.09					
Pipe Flow		6F-7F	0.654	3.5	68.246	68.141		
Pit Bypass		OF6F-2G	0.016				1.57	0.03
Pipe Flow	7/F	7F-8F	0.654	4.6	68.022	66.562		

Q100 EVENT, AND Q100 ROAD FLOWS LINES F AND G

Rv	DATE	REVISIONS	APPR.
A	14-10-21	FOR COUNCIL APPROVAL ATH	

A3

PSM No 196359
(AHD) RL 82.237
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GREENDALE STAGE 6
LOT 124 L37783, 14 LOTS ROADWORKS AND DRAINAGE
WATERGUM DRIVE, PIE CREEK, FOR ROBERTS BROS. PTY LTD
STORMWATER CALCULATIONS 4

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	Blockage factor	wier coeff	weir length	Water ht				
Qg=BFx1.66L.h(3/2)	BF		L	h	^(3/2)	result	Calc is for 900x900 type 1 inlet	FOR STAGE 6 GREENDALE
	0.5	1.66	3.6	0.046	^(3/2)	0.0295		
	Length is weir access length, field inlet all sides, if kerb behind omit that side							
								PIT 4/D
	Blockage factor	constant	Area grate		Water ht			
Qg=BF.0.60Ag.(2gh)^(1/2)	BF		Ag	2g	h	^(1/2)	result	Calc is for 900x900 type 1 inlet	LESSER FLOW PER QUDM=0.030 AT 0.046 DEEP
	0.5	0.6	1.122	19.62	0.046	^(1/2)	0.319774	

Q5 OR Q100 EVENT, CHECK FIELD INLET 4/D 50% BLOCKAGE

Q100 EVENT-PIPED FLOW, SWALE AND ROAD WEIR FLOW AT LINE D

Plan: Plan 01 SWALE2 CL SWALE RS: 145.33 Profile: PF 1 — INVERT PIT 3A

E.G. Elev (m)	78.27	Element	Left OB	Channel	Right OB	dV
Vel Head (m)	0	Wt. n-Val.		0.013		
W.S. Elev (m)	78.27	Reach Len. (m)	3.37	3.37	3.37	
Crit W.S. (m)	78.14	Flow Area (m2)		2.74		
E.G. Slope (m/m)	0.000036	Area (m2)		2.74		
Q Total (m3/s)	0.3	Flow (m3/s)		0.3		
Top Width (m)	23.69	Top Width (m)		23.69		
Vel Total (m/s)	0.11	Avg. Vel. (m/s)		0.11		
Max Chl Dpth (m)	0.18	Hydr. Depth (m)		0.12		0.02

Plan: Plan 01 SWALE2 CL SWALE RS: 141.86 Profile: PF 1 — CENTRELINE ROAD

E.G. Elev (m)	78.26	Element	Left OB	Channel	Right OB	dV
Vel Head (m)	0.02	Wt. n-Val.		0.015		
W.S. Elev (m)	78.24	Reach Len. (m)	1.62	1.62	1.62	
Crit W.S. (m)	78.25	Flow Area (m2)		0.47		
E.G. Slope (m/m)	0.011185	Area (m2)		0.47		
Q Total (m3/s)	0.3	Flow (m3/s)		0.3		
Top Width (m)	17.32	Top Width (m)		17.32		
Vel Total (m/s)	0.64	Avg. Vel. (m/s)		0.64		
Max Chl Dpth (m)	0.04	Hydr. Depth (m)		0.03		0.03

Plan: Plan 01 SWALE2 CL SWALE RS: 138.61 Profile: PF 1 — LIP PRIOR PIT 4D

E.G. Elev (m)	78.18	Element	Left OB	Channel	Right OB	dV
Vel Head (m)	0.05	Wt. n-Val.		0.013		
W.S. Elev (m)	78.13	Reach Len. (m)	5.28	5.28	5.28	
Crit W.S. (m)	78.15	Flow Area (m2)		0.33		
E.G. Slope (m/m)	0.02121	Area (m2)		0.33		
Q Total (m3/s)	0.33	Flow (m3/s)		0.33		
Top Width (m)	12.45	Top Width (m)		12.45		
Vel Total (m/s)	1	Avg. Vel. (m/s)		1		
Max Chl Dpth (m)	0.03	Hydr. Depth (m)		0.03		0.03

Plan: Plan 01 SWALE2 CL SWALE RS: 133.33 Profile: PF 1 — TP

E.G. Elev (m)	78.07	Element	Left OB	Channel	Right OB	dV
Vel Head (m)	0.12	Wt. n-Val.		0.014		
W.S. Elev (m)	77.95	Reach Len. (m)	0.2	0.2	0.2	
Crit W.S. (m)	77.98	Flow Area (m2)		0.22		
E.G. Slope (m/m)	0.020825	Area (m2)		0.22		
Q Total (m3/s)	0.33	Flow (m3/s)		0.33		
Top Width (m)	4.23	Top Width (m)		4.23		
Vel Total (m/s)	1.51	Avg. Vel. (m/s)		1.51		
Max Chl Dpth (m)	0.06	Hydr. Depth (m)		0.05		0.09

Plan: Plan 01 SWALE2 CL SWALE RS: 129.51 Profile: PF 1 — TP

E.G. Elev (m)	77.8	Element	Left OB	Channel	Right OB	dV
Vel Head (m)	0.45	Wt. n-Val.		0.016		
W.S. Elev (m)	77.35	Reach Len. (m)	3.43	3.43	3.43	
Crit W.S. (m)	77.43	Flow Area (m2)		0.11		
E.G. Slope (m/m)	0.116523	Area (m2)		0.11		
Q Total (m3/s)	0.33	Flow (m3/s)		0.33		
Top Width (m)	2.21	Top Width (m)		2.21		
Vel Total (m/s)	2.98	Avg. Vel. (m/s)		2.98		
Max Chl Dpth (m)	0.05	Hydr. Depth (m)		0.05		0.15

Plan: Plan 01 SWALE2 CL SWALE RS: 98.46 Profile: PF 1 — GRADE CHANGE

E.G. Elev (m)	74.09	Element	Left OB	Channel	Right OB	dV
Vel Head (m)	0.07	Wt. n-Val.		0.06		
W.S. Elev (m)	74.01	Reach Len. (m)	8.46	8.46	8.46	
Crit W.S. (m)	74.02	Flow Area (m2)		0.28		
E.G. Slope (m/m)	0.102921	Area (m2)		0.28		
Q Total (m3/s)	0.33	Flow (m3/s)		0.33		
Top Width (m)	2.49	Top Width (m)		2.49		
Vel Total (m/s)	1.21	Avg. Vel. (m/s)		1.21		
Max Chl Dpth (m)	0.12	Hydr. Depth (m)		0.11		0.15

Plan: Plan 01 SWALE2 CL SWALE RS: 75.41 Profile: PF 1 — GRADE CHANGE

E.G. Elev (m)	72.26	Element	Left OB	Channel	Right OB	dV
Vel Head (m)	0.05	Wt. n-Val.		0.06		
W.S. Elev (m)	72.21	Reach Len. (m)	15.41	15.41	15.41	
Crit W.S. (m)	72.2	Flow Area (m2)		0.32		
E.G. Slope (m/m)	0.06242	Area (m2)		0.32		
Q Total (m3/s)	0.33	Flow (m3/s)		0.33		
Top Width (m)	2.57	Top Width (m)		2.57		
Vel Total (m/s)	1.03	Avg. Vel. (m/s)		1.03		
Max Chl Dpth (m)	0.14	Hydr. Depth (m)		0.13		0.14

Plan: Plan 01 SWALE2 CL SWALE RS: 53.6 Profile: PF 1 — GRADE CHANGE

E.G. Elev (m)	71.35	Element	Left OB	Channel	Right OB	dV
Vel Head (m)	0.06	Wt. n-Val.		0.06		
W.S. Elev (m)	71.29	Reach Len. (m)	10.52	10.52	10.52	
Crit W.S. (m)	71.29	Flow Area (m2)		0.31		
E.G. Slope (m/m)	0.074345	Area (m2)		0.31		
Q Total (m3/s)	0.33	Flow (m3/s)		0.33		
Top Width (m)	2.54	Top Width (m)		2.54		
Vel Total (m/s)	1.09	Avg. Vel. (m/s)		1.09		
Max Chl Dpth (m)	0.13	Hydr. Depth (m)		0.12		0.14

Plan: Plan 01 SWALE2 CL SWALE RS: 34.13 Profile: PF 1 — TP

E.G. Elev (m)	69.81	Element	Left OB	Channel	Right OB	dV
Vel Head (m)	0.05	Wt. n-Val.		0.06		
W.S. Elev (m)	69.76	Reach Len. (m)	4.44	4.44	4.44	
Crit W.S. (m)	69.66	Flow Area (m2)		1.1		
E.G. Slope (m/m)	0.019318	Area (m2)		1.1		
Q Total (m3/s)	1.06	Flow (m3/s)		1.06		
Top Width (m)	3.88	Top Width (m)		3.88		
Vel Total (m/s)	0.97	Avg. Vel. (m/s)		0.97		
Max Chl Dpth (m)	0.34	Hydr. Depth (m)		0.28		0.33

Plan: Plan 01 SWALE2 CL SWALE RS: 22.65 Profile: PF 1 — TP

E.G. Elev (m)	69.54	Element	Left OB	Channel	Right OB	dV
Vel Head (m)	0.08	Wt. n-Val.		0.06		
W.S. Elev (m)	69.47	Reach Len. (m)	7.65	7.65	7.65	
Crit W.S. (m)		Flow Area (m2)		0.86		
E.G. Slope (m/m)	0.039189	Area (m2)		0.86		
Q Total (m3/s)	1.06	Flow (m3/s)		1.06		
Top Width (m)	3.62	Top Width (m)		3.62		
Vel Total (m/s)	1.24	Avg. Vel. (m/s)		1.24		
Max Chl Dpth (m)	0.28	Hydr. Depth (m)		0.24		0.35

CERTIFIED BY:
RPEQ No.: 13201 (Allister Haynes)
DATE: 14/10/2021

A3	Rv	DATE	REVISIONS	APPR.
	A	14-10-21	FOR COUNCIL APPROVAL	ATH

PSM No	196359
(AHD) RL	82.237
SURVEYED	MURRAY & ASSOC

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GREENDALE STAGE 6
LOT 124 L37783, 14 LOTS ROADWORKS AND DRAINAGE
WATERGUM DRIVE, PIE CREEK, FOR ROBERTS BROS. PTY LTD
STORMWATER CALCULATIONS 5

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6.0 APPENDIX B – HWMC Flood Study dated 22-2-2019

Pie Creek Flood Assessment

Prepared By:

Hydrology and Water Management Consulting Pty Ltd

Prepared For:

Roberts Bros Pty Ltd

Reference: **J00296R1V1**
Date: **22 February 2019**

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Disclaimer

This report has been prepared for Roberts Bros Pty Ltd (The client). It is subject to the provisions of the agreement between Hydrology and Water Management Consulting Pty Ltd (HWMC) and the Client. Study results should not be used for purposes other than those for which they were prepared.

Report Status

Reference	Date	Status	Author
J00296R1V1	22/2/2019	FINAL	R Stewart RPEQ 13272
J00296D1V1	7/2/2019	DRAFT	R Stewart

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Appendix C	Box & Whisker Plots for Critical Duration Selection
Appendix D	Existing Case Flood Mapping
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Appendix G	Climate Change Mapping

Abbreviations

1D	One-Dimensional
2D	Two-Dimensional
AEP	Annual Exceedance Probability
ARI	Average Recurrence Interval
AHD	Australian Height Datum
ARR	Australian Rainfall and Runoff
BoM	Bureau of Meteorology
DEM	Digital Elevation Model
DTMR	Department of Transport and Main Roads (Queensland)
EY	Exceedances Per Year
GIS	Geographic Information Systems
HWMC	Hydrology and Water Management Consulting Pty Ltd
HCE	Haynes Consulting Engineers Pty Ltd
EA	Engineers Australia
FI	Fraction Impervious
IFD	Intensity Frequency Duration (rainfall intensity data)
RCP	Reinforced Concrete Pipe
RCBC	Reinforced Concrete Box Culvert
RFFE	Regional Flood Frequency Estimation
TIN	Triangular Irregular Network
QUDM	Queensland Urban Drainage Manual

1 INTRODUCTION

Hydrology and Water Management Consulting Pty Ltd (HWMC) has been commissioned by Roberts Bros Pty Ltd (the client) to undertake a Flood Assessment associated with a proposed residential subdivision in Pie Creek, located within the Gympie Regional Council Local Government Area.

There are currently 30 allotments on Lot 99 L3733 that have previously been approved for subdivision and the purpose of this report is to assist in confirming the proposed lot layout and bulk earthwork requirements. Council's has previously undertaken a flood study covering this area however it is regional in nature and therefore it has been necessary to undertake a refined study to determine flood levels across the site with a higher level of accuracy.

This project has been carried out in consultation with Haynes Consulting Engineers (HCE). Preliminary bulk earthworks details for the sub-division have been provided by HCE and these have been incorporated into the modelling. Details of the proposed access road crossing over Zacharia Creek have also been developed and assessed in the flood modelling.

2 EXISTING SITE CHARACTERISTICS

The site is situated in the locality of Pie Creek within the Gympie Regional Council Area. Pie Creek, a tributary of the Mary River, flows northwards along the eastern boundary of the site. Zacharia Creek flows through the site to the west of the proposed subdivision prior to discharging into Pie Creek.

The site is predominately clear of bushland except for scattered trees and vegetation along the creeks.

There are currently 30 approved allotments that are proposed on Lot 99 L3733 and this is the focus subdivision of this study. Lot 99 has a total area of approximately 28.2 hectares. The bulk earthworks that have been assessed in this investigation are also situated within the adjacent Lot 500 SP246422 and Lot 124 L37783. For the purpose of this report, these three lots will be referred to as 'the site'.

The location of the site along with aerial imagery is provided on Image 2-1.

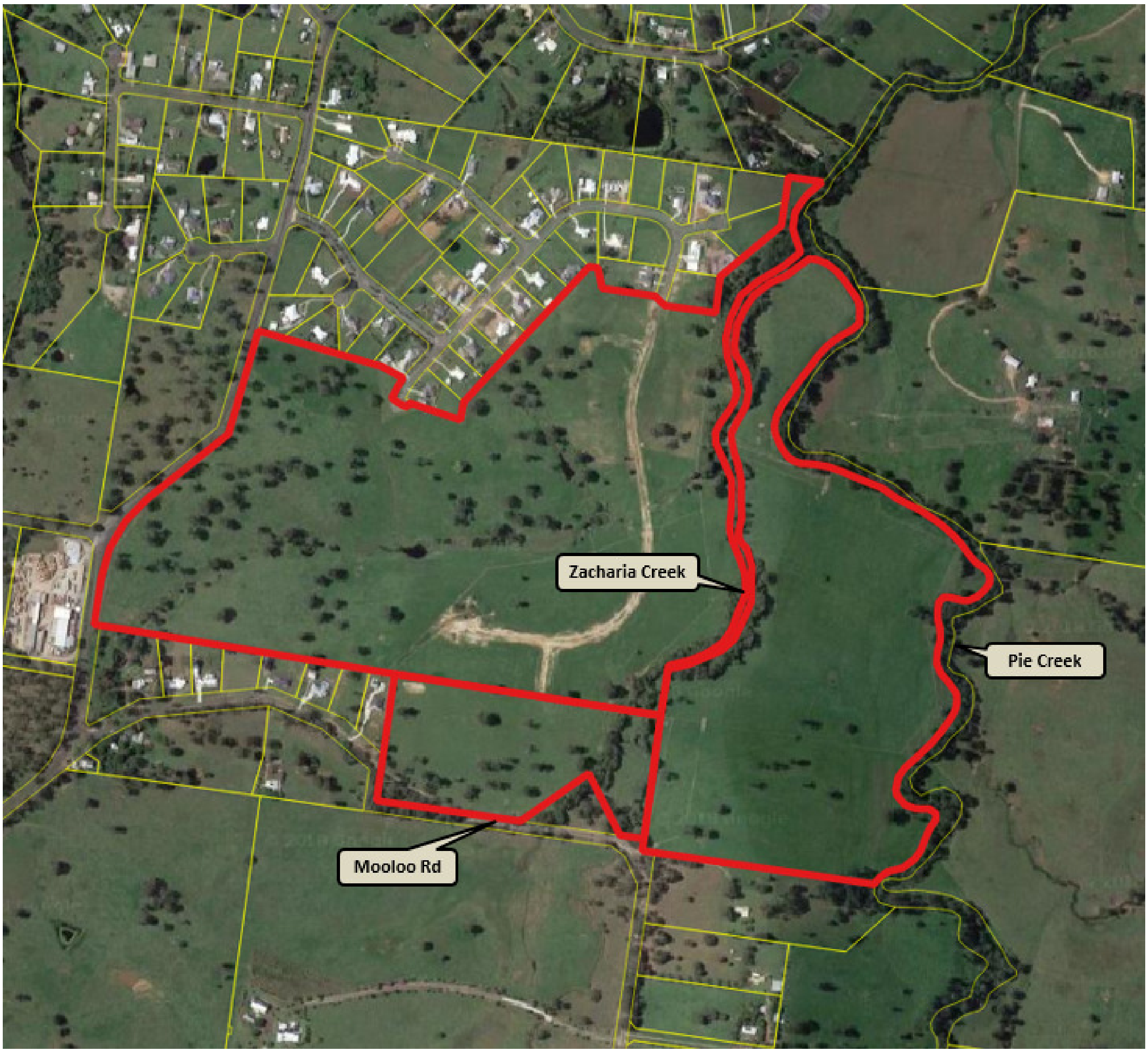


Image 2-1 – Site Location (Base Map from Google Imagery)

The topography of the site is shown thematically and with 1m contours on Image 2-2. Ground survey captured by Murray & Associates over a portion of the site has also been used in this investigation and is supplied in Appendix A for reference.

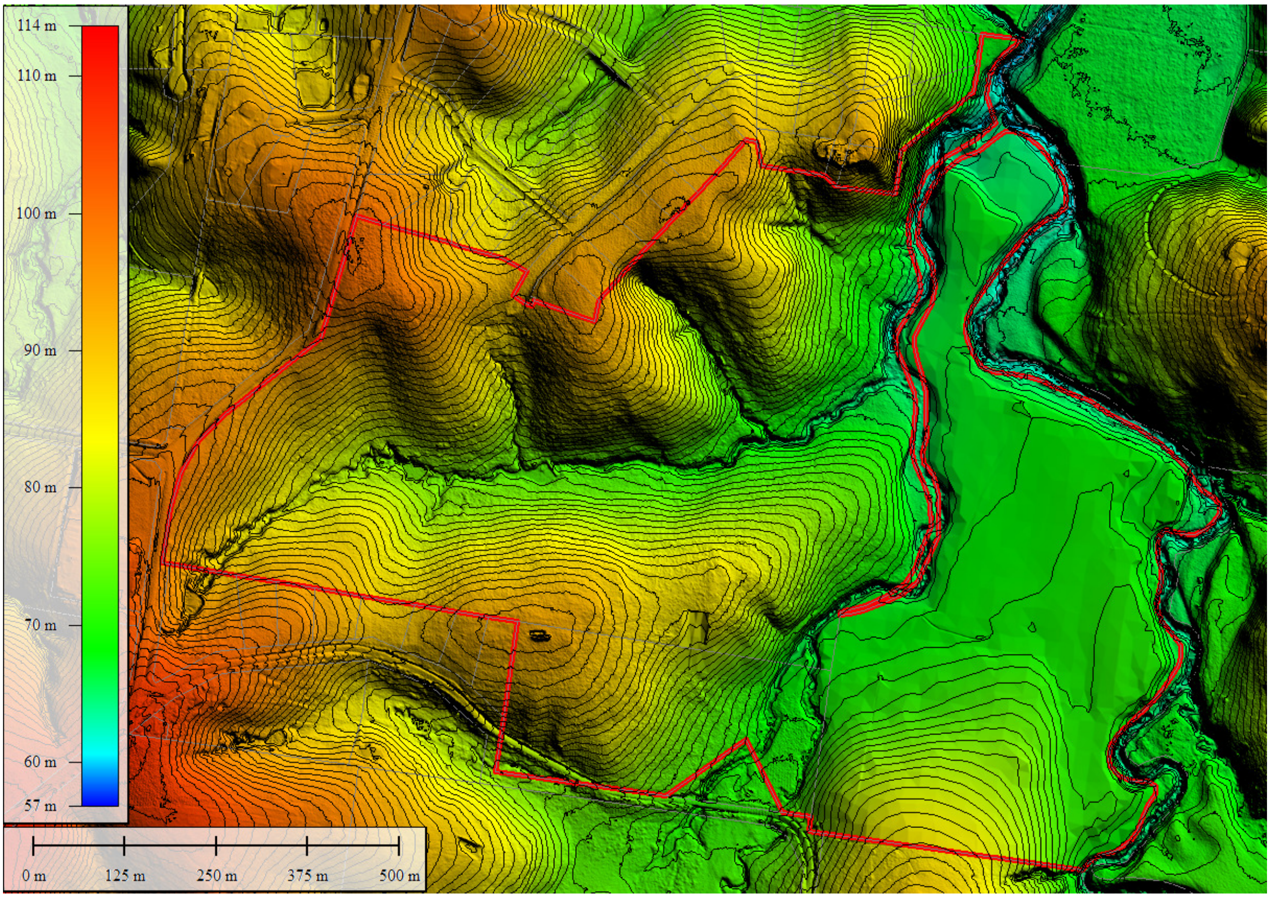


Image 2-2 – Topography of Site and Surrounds (1.0 m contour interval)

3 PROPOSED DEVELOPMENT

The proposed development is shown on the preliminary cut-fill layout plan by HCE which is included in Appendix B. An extract from this plan is provided on Image 3-1 for ease of reference.

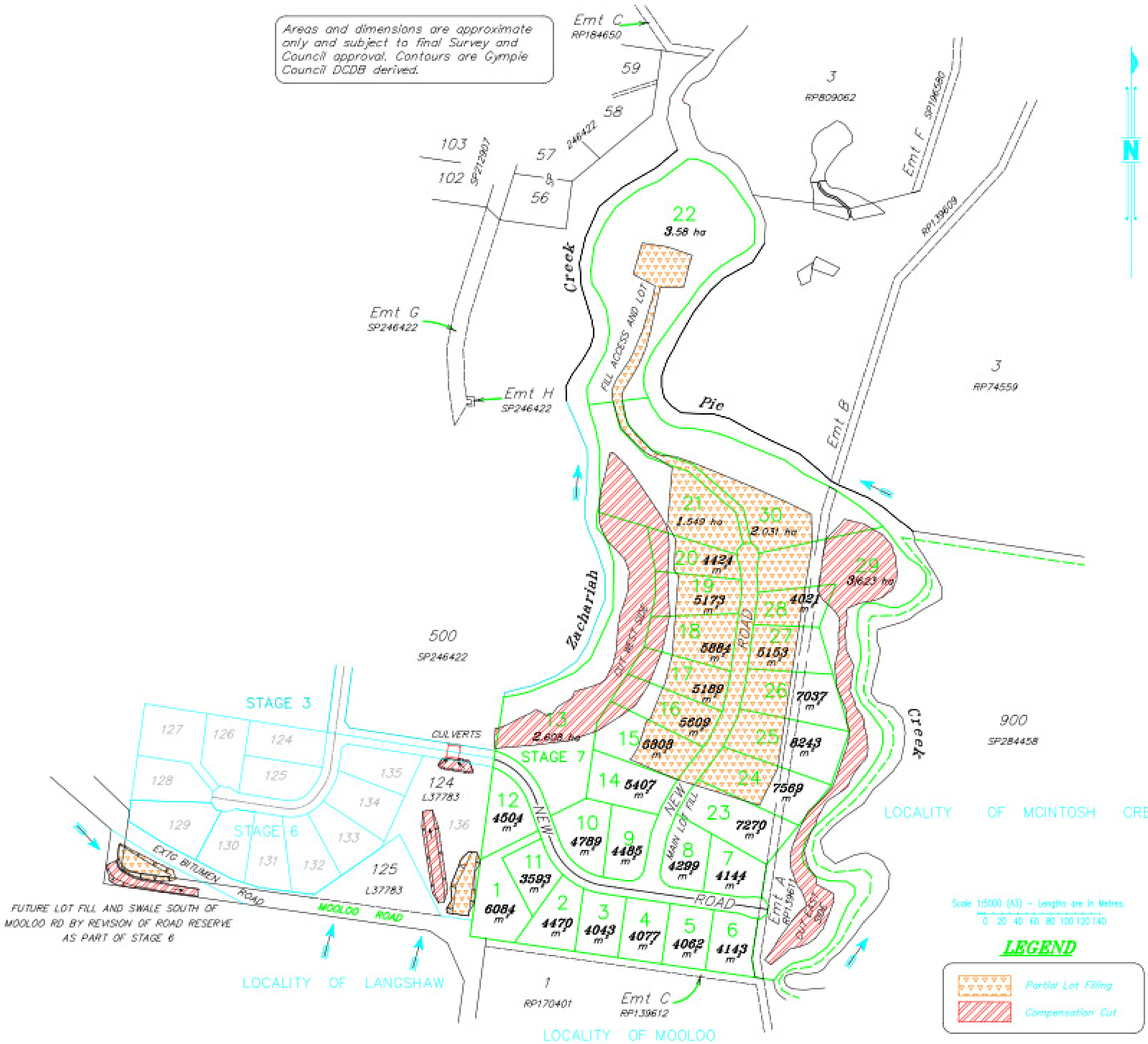


Image 3-1 – Extract from HCE Preliminary Cut-Fill Layout Plan

The bulk earthworks design includes cut and fill areas over Lot 99 L3733 to facilitate raising of the future allotments above the 1% AEP flood level with an appropriate level of freeboard. Filling for two potential future house sites on Lot 124 L37783 has also been included in the developed site model along with compensatory excavation for two drainage channels to mitigate offsite flood impacts.

A design for the access road and associated culvert configuration has also been iteratively developed in collaboration with HCE. The design has been developed to ensure flood immunity requirements are achieved without causing offsite flood impacts on external properties.

Further details of the proposed development are provided in Section 5.

4 EXISTING CASE MODELLING

Flood modelling has been carried out for the reginal creek systems effecting the site. This includes Zacharia Creek and Pie Creek along with their major tributaries.

Modelling has been undertaken using WBNM rainfall runoff hydrology modelling to generate flow hydrographs which are then input to a TUFLOW hydraulic model. Modelling has been carried out in accordance with the latest 2016 Australian Rainfall and Runoff Guidelines (ARR2016).

4.1 Hydrology

4.1.1 Model Setup

Hydrologic modelling of the catchment has been carried out using WBNM software developed jointly by the University of Wollongong, Rienco Consulting and Balance R & D. The 2017 version has been used for this investigation. The WBNM model has been run in conjunction with Storm Injector software that is developed by Catchment Simulation Solutions (v1.0.2.0). Storm Injector software facilitates modelling of the large number of ensemble rainfall temporal patterns that are required by ARR2016.

The WBNM Sub-catchments are shown on Image 4-1 and Sub-Catchment details are provided on Table 4-1.

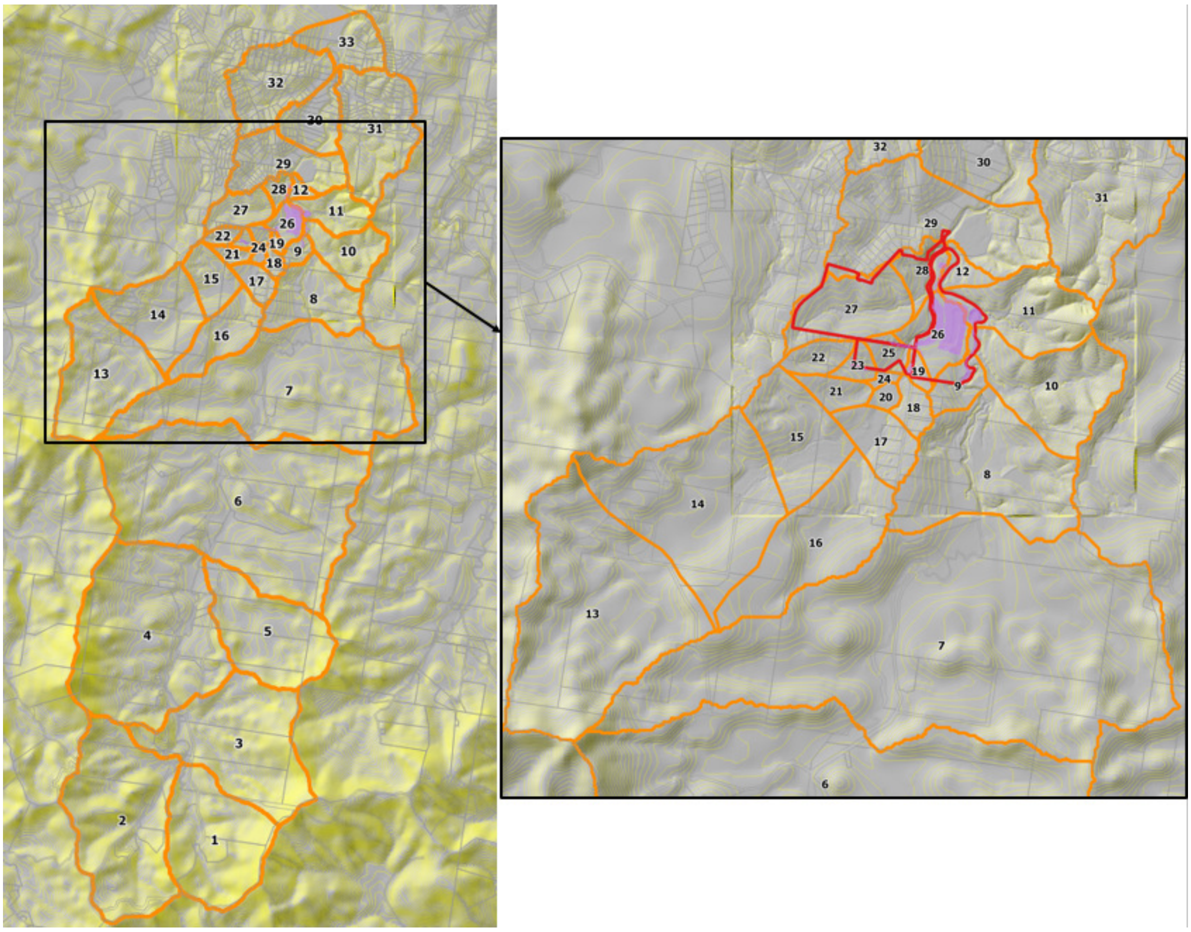


Image 4-1 – WBNM Sub-Catchment Plan

Table 4-1 WBNM Sub-Catchment Details

Sub-Catchment ID	Area (Ha)	Total Contributing Area (Ha)	Downstream Sub-Catchment ID
1	210.916	210.92	3
2	320.480	320.48	3
3	278.277	809.67	4
4	433.185	1242.86	6
5	188.499	188.50	6
6	633.768	2065.12	7
7	459.688	2524.81	8
8	99.545	2624.36	9
9	12.642	2637.00	10
10	61.830	2698.83	11
11	46.620	2745.45	12
12	7.741	2753.19	29
13	176.217	176.22	14
14	122.434	298.65	15
15	48.545	347.20	17
16	73.936	73.94	17
17	22.340	443.47	18
18	8.864	452.34	19
19	3.894	456.23	26
20	3.671	3.67	24
21	10.420	10.42	24
22	10.448	10.45	23
23	6.125	16.57	24
24	2.010	32.67	25
25	7.082	39.76	26
26	20.672	516.66	28
27	39.474	39.47	28
28	13.247	569.38	29
29	92.982	3415.55	30
30	62.417	3477.97	33
31	159.570	159.57	33
32	121.838	121.84	33
33	66.284	3825.66	-

The catchments upstream of the site are rural in nature and for the purpose of this investigation have been assigned a global fraction impervious value of 0.

A WBNM lag parameter of 1.6 has been applied to the modelling which is the default value recommended for use in the absence of calibration data.

Modelling has been carried out for the full range of standard design event storm durations ranging from 20 minutes up to 48 hours. For each duration, an ensemble of 10 different temporal patterns has been modelled and the adopted peak flow is taken as the value closest to the mean, with a bias to values above the mean (Storm Injector bias factor of 2).

Rainfall loss rates adopted for this investigation are based on values from the ARR data hub and are shown on Table 4-2 and 4-3.

Table 4-2 WBNM Rainfall Loss Rates

Pervious Area Initial Loss (mm)	Pervious Area Continuing Loss (mm/hr)	Impervious Area Initial Loss (mm)	Impervious Area Continuing Loss (mm/hr)
Varies (see table 5-3)	3.3	0	0

Table 4-3 WBNM Pervious Area Initial Loss (mm)

Duration	10% AEP	1% AEP
10 min	42.8	40.2
15 min	42.8	40.2
20 min	42.8	40.2
25 min	42.8	40.2
30 min	42.8	40.2
45 min	42.8	40.2
1 hour	42.8	40.2
1.50 hour	44.1	33.6
2 hours	40.9	32.3
3 hours	40.5	24.4
6 hours	30.8	13.3
12 hours	32.8	0
18 hours	34.5	0
24 hours	35.3	0
36 hours	40.4	8.6
48 hours	41.9	17.4

BoM's ARR2016 Rainfall IFD data has been used for this investigation. Design rainfall depths are shown on Table 4-4.

Table 4-4 Design Rainfall Depths (mm)

Duration	10% AEP	1% AEP
20 min	38.9	56.5
25 min	43.1	62.7
30 min	46.5	67.8
45 min	54.1	79.1
1 hour	59.5	87.4
1.5 hour	67.4	99.9
2 hour	73.6	110
3 hour	83.6	127
4.5 hour	96.1	148
6 hour	107	167
9 hour	126	202
12 hour	143	232
18 hour	172	286
24 hour	197	332
30 hour	218	372
36 hour	237	407
48 hour	267	465

4.1.2 Critical Duration Assessment

A critical duration assessment has been carried out key locations within the study area. The adopted critical duration events are shown in Table 4-5. The mean value temporal pattern from the ensembles of the critical duration events has then been selected to run through the TUFLOW Model.

Box and Whisker plots for the 1% AEP ensemble results associated with the key locations are provided in Appendix C. These plots also show the WBNM peak flows however it should be noted that these will differ slightly from the flows used in the TUFLOW model because of differences in stream routing between the two modelling systems.

Table 4-5 Critical Durations at Key Locations

Location	10% AEP	1% AEP
Model Outlet (WBNM ID 33)	6hr	6hr
Just downstream of Proposed Access Road Crossing (WBNM ID 26)	6hr	6hr
Minor Tributary of Zacharia Creek which flows to western culverts under Mooloo Rd (WBNM ID 24)	2hr	1.5hr

4.2 Hydraulics

4.2.1 Model Setup

Hydraulic modelling has been undertaken using TUFLOW HPC which is software developed by BMT WBM in Brisbane. TUFLOW is a computational engine that provides one-dimensional (1D) and two-dimensional (2D) solutions for the free-surface flow equations to simulate flood and tidal wave propagation.

TUFLOW HPC version 2018-03-AB-iSP-w64 has been used for this investigation.

The TUFLOW Model Layout is shown on Figure 5-1 and this includes thematic mapping of the model topography levels.

The TUFLOW model topography is based on a 5m grid. Model topography is largely based on Aerial LiDAR which has been provided by Gympie Council for using in this investigation. Ground survey of a portion of the site has also been incorporated into the model for improved representation of site ground levels. The ground survey has also been used to assess the accuracy of the LiDAR which was found to be a reasonable match with the ground survey (generally within approximately +/- 200mm).

A manning's 'n' hydraulic roughness value of 0.1 has been applied globally to the existing case modelling. This value is conservative for the rural nature of the floodplain and makes allowance for potential revegetation within the floodplain which may occur in the future

The two sets of culverts under Mooloo Road have been incorporated into the TUFLOW model based on survey detail by Murray & Associates. The western set of culverts are 2 / 1900 x 1600 RCBC with an US IL of 69.0 m AHD. The eastern set of culverts are 4 / 750mm RCP with an US IL of 70.1 m AHD. These culverts have been modelled using TUFLOW's 1D links (1d_nwk).

The TUFLOW Model has been run for the 10% and 1% AEP events based on the mean ensemble temporal pattern associated critical durations described in Section 4.1.2.

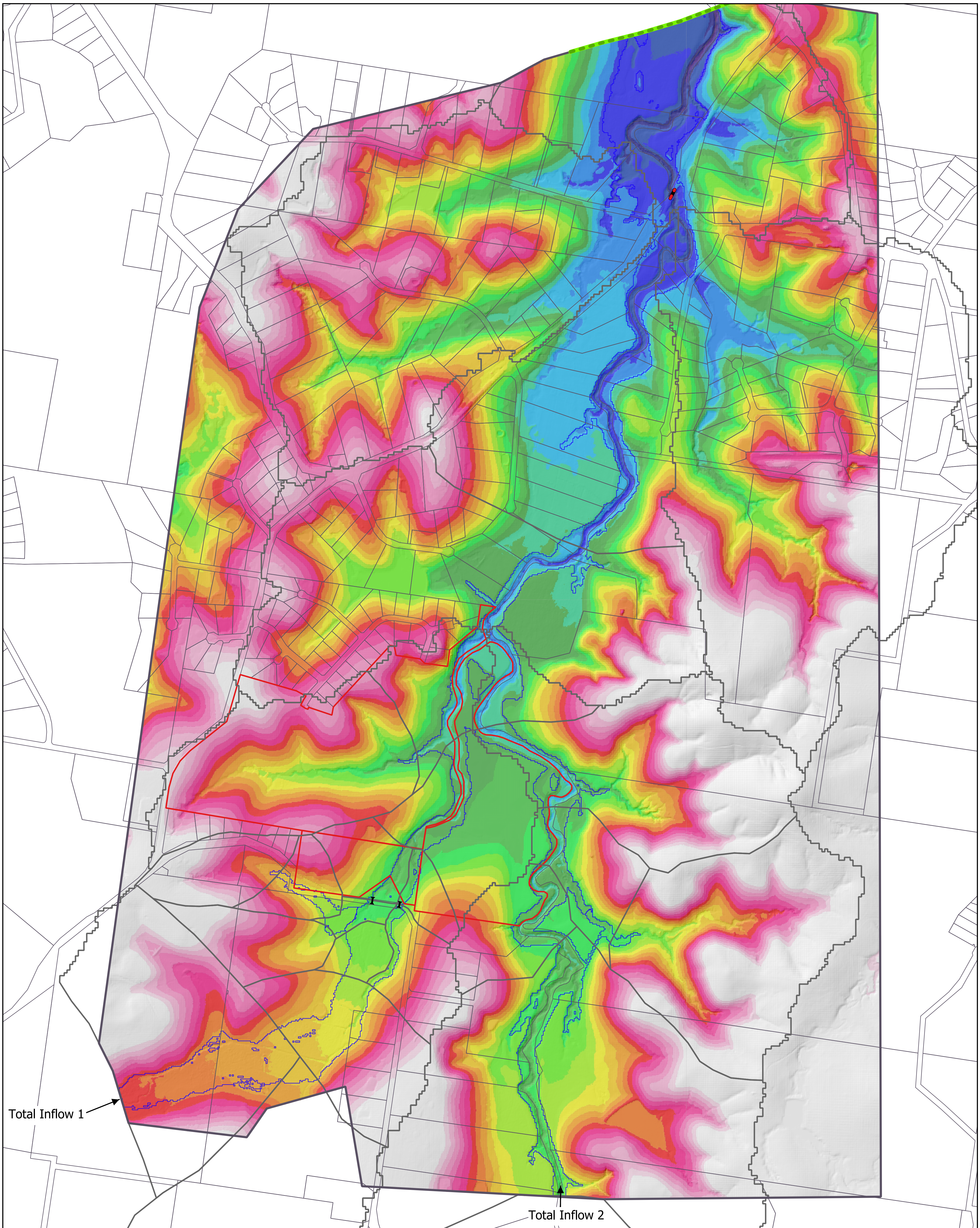
Catchment inflow boundary conditions of the TUFLOW model have been incorporated using TUFLOW's '2D_sa polygon' approach. This means, that for each WBNM sub-catchment, the inflow hydrograph is applied directly onto the 2D grid as follows:

- If all cells in the 2D_sa polygon are dry (typically at start of simulation), flow will be directed to the lowest 2D calculation point within the polygon.
- If one or more cells are wet within the polygon the total flow is distributed over all wet cells.

All sub-catchment inflows are local catchment hydrographs except for sub-catchments 7 and 14 which are total catchment hydrographs for the full contributing catchments.

A climate change sensitivity run has been modelled to understand the potential risks associated with climate change. The climate change scenario assumes a 20% increase in design rainfall intensity for the year 2100 which is based on the current recommendation of the QLD Government.

The downstream boundary condition is a normal depth rating curve which is calculated by TUFLOW based on a flood slope of 1%. The downstream boundary condition has been placed more than 2km downstream of the site to ensure that boundary condition effects do not influence results at the site.



Legend

- DCDB
- Site Boundary
- Model Extent (2d_code)
- 1D Culvert (1d_nwk)
- Downstream Boundary
- Bridge (2d_lfcsh)
- Local Catchment Inflow (2d_sa)
- 1% AEP Extent

Model Topography Level (m AHD)

<= 52	66 - 68	84 - 86
52 - 54	68 - 70	86 - 88
54 - 56	70 - 72	88 - 90
56 - 58	72 - 74	90 - 92
58 - 60	74 - 76	92 - 94
60 - 62	76 - 78	94 - 96
62 - 64	78 - 80	96 - 98
64 - 66	80 - 82	> 98
	82 - 84	

Hydrology & Water Management Consulting

125 0 125 250 m

HWMC Ref: J00296_Pie_Creek

Pie Creek Flooding

Figure 4-1

TUFLOW Model Layout

Client: Roberts Bros

4.2.2 Results

Peak flood depth mapping for the existing case modelling is provided in Appendix D. The flood maps for each AEP are based on the envelope of peak results for the various critical durations modelled.

Peak flows extracted from the TUFLOW model at key locations are provided below:

Table 4-6 Peak Flows at Key Locations

Location	10% AEP (m^3/s)	1% AEP (m^3/s)
Zacharia Creek at proposed crossing	27.5	47.9
Pie Creek midway through Site	71.1	172.2
Pie Creek downstream of Zacharia Confluence	87.5	218.1
Pie Creek at Model Outlet	96.8	238.8

4.2.3 Validation

Peak flows at the outlet of the TUFLOW model have been validated against the ARR2016 Regional Flood Frequency Estimation Model (RFFE). The TUFLOW peak flow at the model outlet for the 1% AEP event is 238.8 m^3/s. This is based on a critical duration of 6 hours and the mean temporal pattern from the ensemble of events. This compares very well to the RFFE value of 240.0 m^3/s. Details of the RFFE are provided in Appendix E.

5 PROPOSED CASE MODELLING

5.1 Proposed Case Model Updates

The proposed case model is equivalent to the base case model except for the design case updates described in this section.

The location of the proposed design elements incorporated into the TUFLOW model are shown on Image 5-1.

Image 5-1 – Proposed Case Model Updates

The proposed access road has been incorporated into the model based on a design tin provided by HCE on 25/1/2019. The design road crossing has a minimum crest level at the sag of 69.25 m AHD. The adopted road profile is shown on Image 5-2.

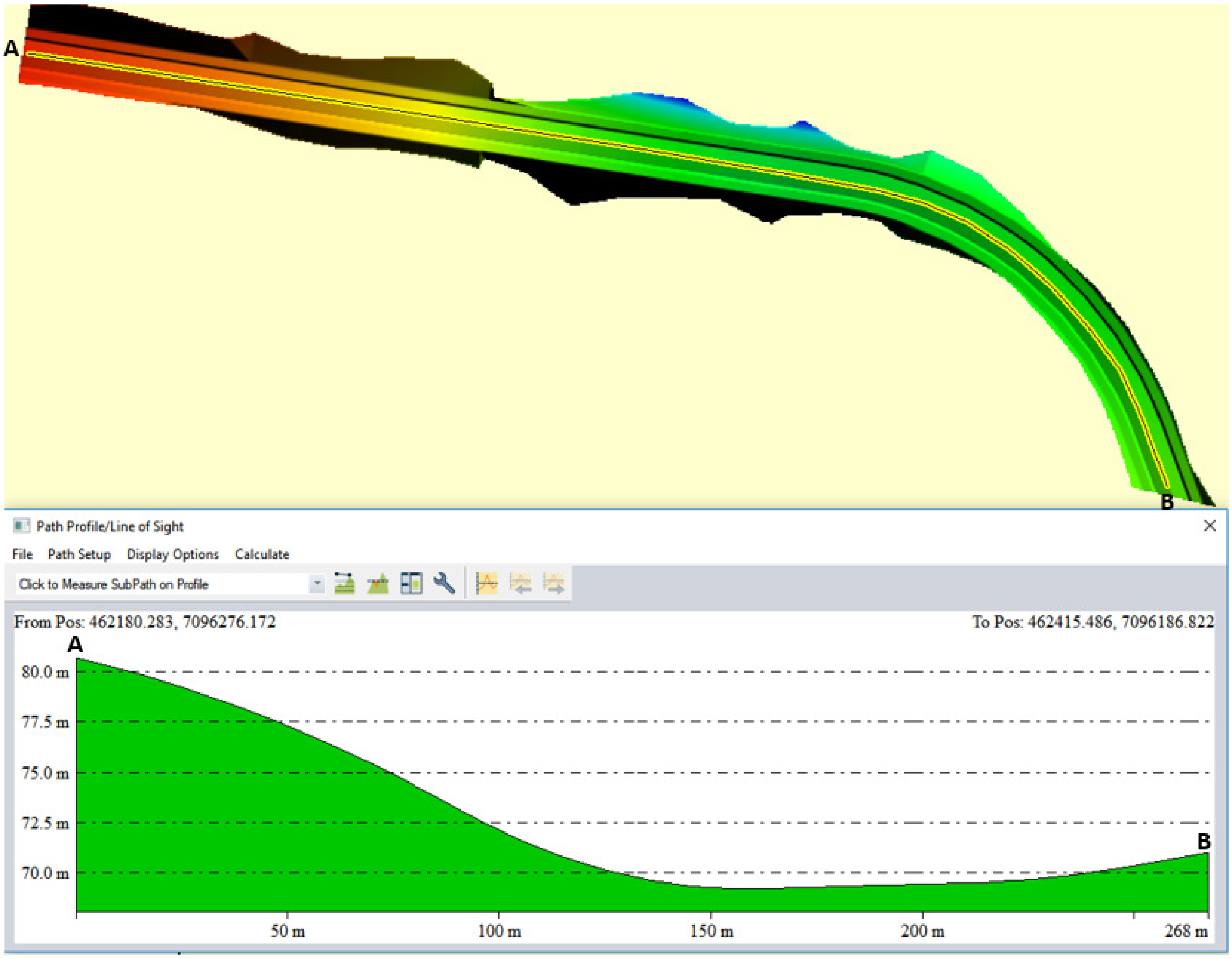


Image 5-2 – Access Road Crossing Longitudinal Profile

This road crossing has been modelled with a manning's 'n' of 0.03. The remainder of the development site has been left consistent with the existing case model ('n' of 0.1).

The proposed culverts at the access road crossing of Zacharia Creek have been modelled as:

- 4 / 2250 RCP with a length of 15m. USIL of 66.43 and DSIL of 66.35 m AHD.
- 1 / 2700 RCP with a length of 15m. USIL of 66.15 and DSIL of 66.15 m AHD.

The 2700 RCP has been given a reduced invert level to allow fish passage.

A design blockage factor of 20% has been applied.

Modelling assumes that the two branches of Zacharia Creek upstream of the proposed access road crossing will be joined by carrying out excavation immediately upstream of the road crossing for a distance of approximately 12m.

Design earthworks for the remainder of the development site have been incorporated using the design tin provided by HCE on 18/9/18. The exception to this is the cut and fill associated with the south-west lot filling situated south of Mooloo Rd. This has been incorporated based on the HCE design tin provided on 22/1/19.

Diversion channel 1 shown on Image 5-1 has been incorporated to mitigate upstream flood level impacts and to divert the eastern branch of Zacharia Creek around the adjacent fill pad. This channel has been modelled using TUFLOW z-point modifiers as follows:

- Channel top width of 10m
- Channel base width of 5m
- USIL of 70, DSIL of 68 m AHD.
- Length of approximately 90m

5.2 Model Results

5.2.1 Flood Mapping

Flood mapping for the proposed case modelling is provided in Appendix F. This includes peak flood depth mapping, peak flood level impact mapping and a plan showing peak flood levels for the 1% AEP across the site. In addition to this, peak flood level grids will be made available to HCE to assist bulk earthworks design to ensure final lot levels have an acceptable level of flood immunity.

The peak flood level impact maps show that flood level increases are generally contained within the development site boundary. There are some minor flood level increases shown on the rural land south of Mooloo Rd which occur as a result of the fill and associated drainage swale in this area. It is our view that these minor, localised flood level impacts are of no consequence because they:

- Are generally, less than 30mm
- Are caused by a re-distribution of flood waters across the site boundary as opposed to an increase in peak flow.
- Do not cause a meaningful increase to the area of flood inundation extent

The flood level increases shown over the land to the east of Pie Creek are understood to be contained on land owned by the Client and therefore are not of concern.

5.2.2 Road Crossing

The proposed road crossing has been designed to be flood free in the 10% AEP event and this has been achieved as shown on the flood maps in Appendix F.

The crossing also needs to comply with QUDM's requirements for overtopping during the major flood event (1% AEP). These requirements are set out in table 7.4.5 of QUDM which states that peak flow depths over the road are to be less than 200mm and have a depth-velocity product of less than $0.3m^2/s$. Modelling predicts that the peak depth over the road crest is less than 200mm and the depth-velocity product is less than 0.2m. Therefore, this road design complies with QUDM's requirements for transverse flow limits.

5.3 Climate Change Risk Assessment

A 1% AEP climate change scenario has been run based on a 20% increase in design rainfall for the year 2100. Peak flood depth mapping for this scenario is provided in Appendix G along with an impact map which shows the impact on peak flood levels compared to the current climate 1% AEP results. The mapping shows that climate change is expected to increase 1% AEP flood levels by amounts which vary over the site from approximately 100mm to 600mm.

Council's requirements for filling of lots is to achieve 300mm freeboard above the current climate 1% AEP peak flood level. If the development is to adopt this as the minimum lot level, then it is expected that these lots will be subject to potential 1% AEP inundation by up to 300mm under future climate conditions. Considering these results, it is recommended that a higher flood freeboard is incorporated into the earthworks design.

5.4 Emergency Planning

It is recommended that consideration be given to emergency planning aspects to manage the residual flood risks associated with flood events that are in excess of the design flood event (DFE). In particular, the northern most lot proposed near the confluence of Zacharia and Pie Creek has potential to become isolated during events in excess of the DFE. This risk may be managed by provision of a flood refuge area above the probable maximum flood level (not currently defined).

6 CONCLUSION

This Flood Assessment has involved detailed flood modelling of the regional creek systems impacting the proposed development site. Flood modelling has been carried out in accordance with latest industry guidelines and has demonstrated that the proposed lot layout is feasible in relation to flood immunity requirements and it is predicted to cause no offsite flood impacts of consequence.

Peak flood levels from this investigation will be provided to the project civil engineers to assist in setting final fill lot levels.

The expected increases to design flood levels associated with climate change have been modelled and it is recommended that allowance be made for these in setting final development fill levels. HWMC is unaware of any specific requirements by Gympie Council in relation to this issue.

It is recommended that consideration be given to emergency planning aspects to manage the residual flood risks associated with flood events that are in excess of the design flood event (DFE).

7 REFERENCES

1. BMT WBM, 2010, “TUFLOW User Manual”
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3. Department of Environment and Resource Management (2010) “Urban Stormwater Quality Planning Guidelines 2010”.
4. Engineers Australia, 1987, “Australian Rainfall and Runoff”
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8. Michael Boyd et al, 2012, “WBNM User Guide”
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12. W.J. Syme, 2001, “Modelling of Bends and Hydraulic Structures in a Two-Dimensional Scheme”
13. W.J. Syme, 2011, “Modelling Structures”, ASFPM SMS Workshop USA;

APPENDICES

Appendix A Survey

MURRAY & ASSOCIATES
SURVEYORS & TOWN PLANNERS
ACN 075 543 154

Murray Building,15-17 Currie St. Nambour Ph.(07)5441 2188 P.O. Box 246
Branch Offices at Maroochydore Caboolture Chinchilla Roma Gympie & Emerald

AV Air Valve	FH Fire Hydrant	T Tree	Telecommunications Line
BM Bench Mark	GRATE Stormwater Grate	TE Telstra Pit	Sewer Line
CP Control Point	GATE Gate	TPL Telstra Pillar	Water Line
ELP Elect. Light Pole	S Sign	WM Water Meter	Fenceline
EMH Electricity Manhole	GAS Gas Infrastructure	WV Water Valve	Electricity
PP Power Pole	SMH Sewer Manhole		Gas Line
EPL Electricity Pillar	SV Scower Valve		Edge of Bitumen
EPIT Electricity Pit	SWMH Stormwater Manhole		Tree line
			Underground Electricity
			Stormwater
			Overhead Powerline

REVISIONS

NO.	DESCRIPTION	DATE	INIT.

PROJECT

Contour & Detail Survey of
Part of Lot 900 on SP 284458,
Lot 3 on RP 74559 & Lot 3 on RP809062
Pie Creek
L.G.A. Gympie

CLIENT **Roberts Brothers**

Notes: Contour Interval is 0.5 metres. Underground services have been located from visible surface features only . A Dial Before You Dig search should be performed before the commencement of any excavation work. The property boundaries shown have not fully been investigated for the purposes of this survey. For an accurate determination of the boundaries, an Identification survey will be required.

Datum: via CORS AHD D

Drawn: CAC

F.W. CAC, KS

F.Bk -

Level Bk

Acc. Bk

Scale A1 1:2500

Date 11.04.18

File 61086

Job & Plan No. 61086 DTM 11.04.18

Licd. Surveyor Ian Smith

MURRAY & ASSOCIATES
SURVEYORS & TOWN PLANNERS
ACN 075 543 154

Murray Building,15-17 Currie St. Nambour Ph.(07)5441 2188 P.O. Box 246
Branch Offices at Maroochydore Caboolture Chinchilla Roma Gympie & Emerald

AV	Air Valve	FH	Fire Hydrant	T	Tree	T	Telecommunications Line
BM	Bench Mark	GRATE	Stormwater Grate	TE	Telstra Pit	S	Sewer Line
CP	Control Point	GATE	Gate	TPL	Telstra Pillar	W	Water Line
ELP	Elect. Light Pole	S	Sign	WM	Water Meter	//	Fenceline
EMH	Electricity Manhole	GAS	Gas Infrastructure	WV	Water Valve	E	Electricity
PP	Power Pole	SMH	Sewer Manhole			G	Gas Line
EPL	Electricity Pillar	SV	Scower Valve				Edge of Bitumen
EPIT	Electricity Pit	SWMH	Stormwater Manhole				Tree line
							Underground Electricity
							Stormwater
							Overhead Powerline

REVISIONS

NO.	DESCRIPTION	DATE	INIT.

PROJECT

Contour & Detail Survey of
Part of Lot 500 on SP 246422
& Lot 99 on L3733
Pie Creek
L.G.A. Gympie

CLIENT **Roberts Brothers**

Notes: Contour Interval is 0.5 metres. Underground services have been located from visible surface features only . A Dial Before You Dig search should be performed before the commencement of any excavation work. The property boundaries shown have not fully been investigated for the purposes of this survey. For an accurate determination of the boundaries, an Identification survey will be required.

Datum: AHD D via CORS

Drawn: CAC

F.W. CAC

F.Bk -

Level Bk

Acc. Bk

Scale A1 1:1000

Date 29.06.18

File 61086

Job & Plan No. 61086 DTM 29.06.18

Licd. Surveyor Ian Smith

Point	Easting	Northing	Elevation	Code
7	2917.057	4833.685	69.104	TBM/7
8	3006.063	4653.793	82.998	TBM/8
9	3122.741	4656.012	83.334	TBM/9
10	3303.472	4845.588	70.390	TBM/10
11	3275.867	5067.844	69.524	TBM/11
12	3029.319	5274.845	67.158	TBM/12
13	3022.525	5419.452	66.993	TBM/13
14	3009.207	5516.888	67.311	TBM/14

SHEET 1 OF 2

MURRAY & ASSOCIATES
SURVEYORS & TOWN PLANNERS
ACN 075 543 154
Murray Building,15-17 Currie St. Nambour Ph.(07)5441 2188 P.O. Box 246
Branch Offices at Maroochydore Caboolture Chinchilla Roma Gympie & Emerald

AV Air Valve
BM Bench Mark
CP Control Point
ELP Elect. Light Pole
EMH Electricity Manhole
PP Power Pole
EPL Electricity Pillar
EPIT Electricity Pit
FH Fire Hydrant
GRATE Stormwater Grate
GATE Gate
S Sign
GAS Gas Infrastructure
SMH Sewer Manhole
SV Scower Valve
SWMH Stormwater Manhole
T Tree
TE Telstra Pit
TPL Telstra Pillar
WM Water Meter
WV Water Valve
Telecommunications Line
Sewer Line
Water Line
Fenceline
Electricity
Gas Line
Edge of Bitumen
Tree line
Underground Electricity
Stormwater
Overhead Powerline

REVISIONS

NO.	DESCRIPTION	DATE	INIT.

PROJECT

Contour & Detail Survey of Lot 99 on L3733, Pie Creek, L.G.A. Gympie Shire Council

CLIENT **Roberts Brothers**

Notes: Contour Interval is 0.5 metres. Underground services have been located from visible surface features only . A Dial Before You Dig search should be performed before the commencement of any excavation work. The property boundaries shown have not fully been investigated for the purposes of this survey. For an accurate determination of the boundaries, an Identification survey will be required.

Datum: TBM 5 RL 82.123 AHD D via Greendale Stage 3

Drawn: CAC

F.W. -
F.Bk -
Level Bk
Acc. Bk
Scale A1 1:1000

Date 20.11.18
File 61995
Job & Plan No. 61995 DTM Sheet 1

Licd. Surveyor Ian Smith

Point	Easting	Northing	Elevation	Code
7	2917.057	4833.685	69.104	TBM/7
8	3006.063	4653.793	82.998	TBM/8
9	3122.741	4656.012	83.334	TBM/9
10	3303.472	4845.588	70.390	TBM/10
11	3275.867	5067.844	69.524	TBM/11
12	3029.319	5274.845	67.158	TBM/12
13	3022.525	5419.452	66.993	TBM/13
14	3009.207	5516.888	67.311	TBM/14

SHEET 2 OF 2

MURRAY & ASSOCIATES
SURVEYORS & TOWN PLANNERS
ACN 075 543 154
Murray Building,15-17 Currie St. Nambour Ph.(07)5441 2188 P.O. Box 246
Branch Offices at Maroochydore Caboolture Chinchilla Roma Gympie & Emerald

AV Air Valve
BM Bench Mark
CP Control Point
ELP Elect. Light Pole
EMH Electricity Manhole
PP Power Pole
EPL Electricity Pillar
EPIT Electricity Pit
FH Fire Hydrant
GRATE Stormwater Grate
GATE Gate
S Sign
GAS Gas Infrastructure
SMH Sewer Manhole
SV Scower Valve
SWMH Stormwater Manhole
T Tree
TE Telstra Pit
TPL Telstra Pillar
WM Water Meter
WV Water Valve
Telecommunications Line
Sewer Line
Water Line
Fenceline
Electricity
Gas Line
Edge of Bitumen
Tree line
Underground Electricity
Stormwater
Overhead Powerline

REVISIONS

NO.	DESCRIPTION	DATE	INIT.

PROJECT

Contour & Detail Survey of Lot 99 on L3733, Pie Creek, L.G.A. Gympie Shire Council

CLIENT **Roberts Brothers**

Notes: Contour Interval is 0.5 metres. Underground services have been located from visible surface features only . A Dial Before You Dig search should be performed before the commencement of any excavation work. The property boundaries shown have not fully been investigated for the purposes of this survey. For an accurate determination of the boundaries, an Identification survey will be required.

Datum: TBM 5 RL 82.123 AHD D via Greendale Stage 3

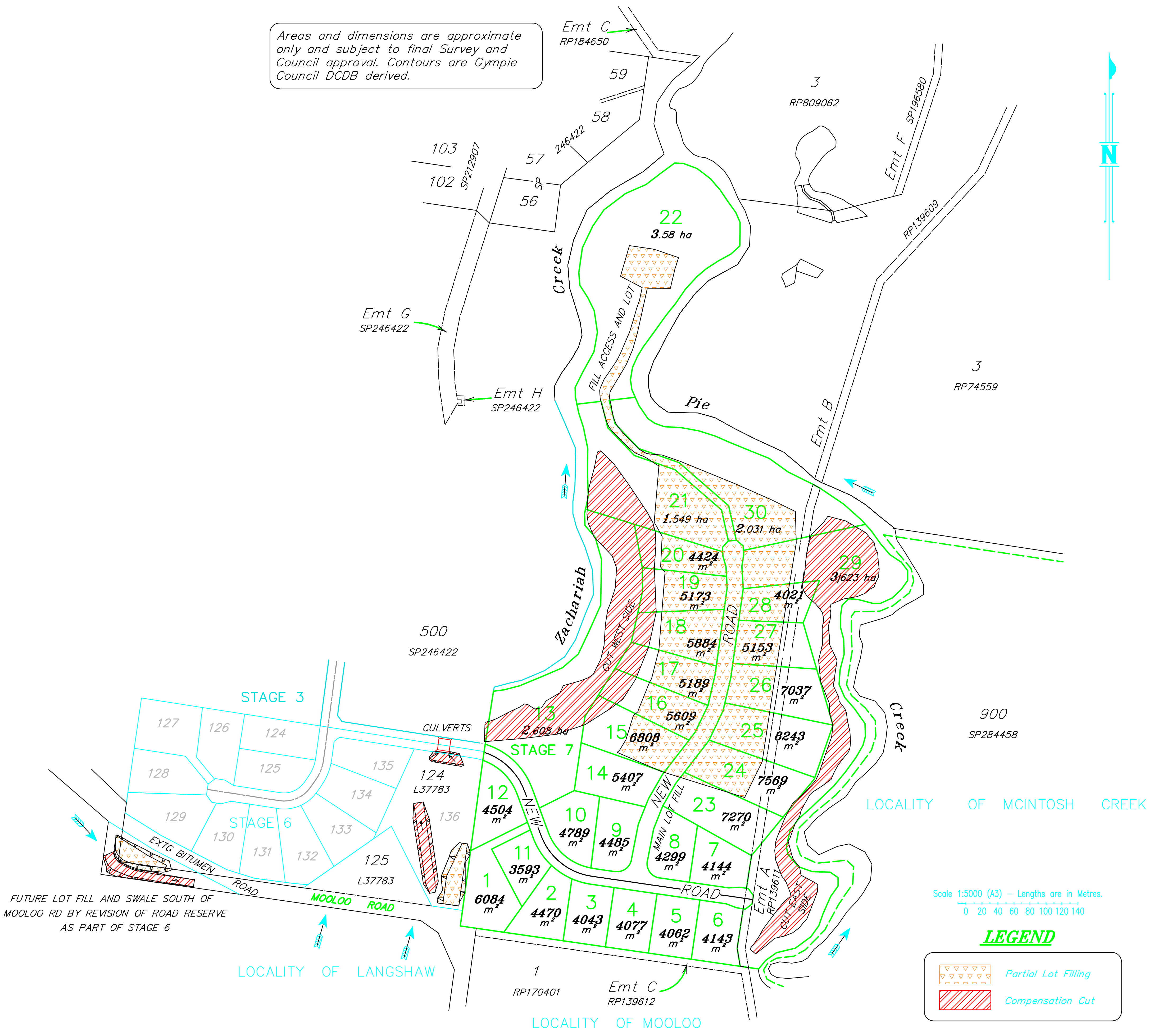
Drawn: CAC

F.W. -
F.Bk -
Level Bk
Acc. Bk
Scale A1 1:1000

Date 20.11.18
File 61995
Job & Plan No. 61995 DTM Sheet 2

Licd. Surveyor Ian Smith

Appendix B Cut-Fill Layout Plan


Areas and dimensions are approximate only and subject to final Survey and Council approval. Contours are Gympie Council DCDB derived.
Emt C
RP184650
59
58
57
56
246422
103
102
SP212907
3
RP809062
Emt F
SP196580
RP139609
22
3.58 ha
Creek
FILL ACCESS AND LOT
Emt G
SP246422
Emt H
SP246422
Pie
Emt B
3
RP74559
21
1.549 ha
30
2.031 ha
20
4424 m²
19
5173 m²
18
5884 m²
17
5189 m²
16
5609 m²
15
6808 m²
29
3.623 ha
28
4021 m²
27
5153 m²
26
7037 m²
25
8243 m²
24
7569 m²
23
7270 m²
Zachariah
CUT WEST SIDE
ROAD
500
SP246422
13
2.608 ha
STAGE 7
STAGE 3
CULVERTS
127
126
124
128
125
135
134
124
L37783
129
130
STAGE 6
131
132
133
125
L37783
136
14
5407 m²
12
4504 m²
NEW
10
4789 m²
9
4485 m²
NEW
MAIN LOT FILL
8
4299 m²
7
4144 m²
11
3593 m²
1
6084 m²
2
4470 m²
3
4043 m²
4
4077 m²
5
4062 m²
6
4143 m²
ROAD
Emt A
RP139612
CUT EAST SIDE
Creek
900
SP284458
LOCALITY OF MCINTOSH CREEK
EXTG BITUMEN
ROAD
MOOLOO ROAD
FUTURE LOT FILL AND SWALE SOUTH OF MOOLOO RD BY REVISION OF ROAD RESERVE AS PART OF STAGE 6
LOCALITY OF LANGSHAW
1
RP170401
Emt C
RP139612
LOCALITY OF MOOLOO
N
Scale 1:5000 (A3) – Lengths are in Metres.
0 20 40 60 80 100 120 140
LEGEND
Partial Lot Filling
Compensation Cut