FLOOD IMPACT ASSESMENT
No 84 KIORA RD, MIRANDA
DENTAL HOSPITAL

Prepared: April 26, 2011
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FLOOD AND DRAINAGE ASSESMENT – No 84 KIORA RD, MIRANDA.
PROPOSED DENTAL HOSPITAL

1. Introduction

At the request of Moran Corporation Pty Ltd, EWFW Pty Ltd has carried out a review of the stormwater drainage requirements and the flooding situation at No 84 Kiora Road for the proposed Dental Hospital as required by the Director General of the Department of Planning, NSW.

The finished floor level of the proposed basement carpark is to be approximately 5m below the road level in Urunga Lane at the back of the building. Access to the basement carpark will be from Urunga Lane.

The Director General has requested that a flood study be undertaken to determine the impact of any overland flow on the proposed development.

2. Background Information

The site comprising 476 square meters is at the corner of Kiora Road and Urunga Parade and enjoys rear lane access from Urunga Lane. The lane is 6.2m wide with narrow footpaths immediately adjacent to the rear wall of the adjoining buildings. The upstream catchment has an area of approximately 0.22 Ha and extends upstream to the intersection of Urunga Parade and Jackson Avenue. On the north side of Urunga Parade is Westfield's Miranda Fair Shopping Centre.

The catchment is serviced by an underground stormwater pipe system that starts at the corner of Kiora Road and Urunga Parade adjacent to the site. There is also a stormwater pit at the end of Urunga Lane that is piped through to the Railway corridor at Miranda Station.

The catchment is fully paved and extends from property boundary to property boundary on either side of Urunga Parade. The properties on either side of Urunga Parade fall away from the road therefore any stormwater falling within private the properties is generally diverted away from the street catchment. There are a number of downpipes connected to the street kerb and gutter but the flow contribution from these is limited to minor storm events only.

Generally the overland flow affecting the site is generated from rainfall falling on the road and footpath surfaces within Urunga Parade and traveling along the kerb and gutter past the site to the street gully pits. Any flooding affecting the site is a result of the stormwater runoff exceeding the capacity of the kerb and gutter in Urunga Parade and Urunga Lane.

Pipe information was obtained from Sutherland Council's GIS and verified on site by a visual inspection. Detailed survey of the site and Urunga Lane was provided by the client. The extent of the catchment is shown below in Plate 1.

Plate 1 – Aerial Photo showing extent of catchment draining to Urunga Lane in green with the site in red

3. Hydraulic Calculations

Investigation of flood behavior in a catchment requires a hydrological analysis to determine flood discharges and a hydraulic analysis to determine flood profiles (water levels), velocity, extent and depth of flooding. The hydrological analysis for the catchment area was carried out using the DRAINS program.

The DRAINS program was originally developed for urban stormwater drainage analysis. It uses the time-area method to generate flow hydrographs. In this method a rainfall hyetograph is combined with the time-area diagram in a similar manner to unit hydrograph calculations for each sub-catchment. The time base for the time-area diagram is specified by the user and is effectively the same as the time of concentration used in the Rational Method for the sub-catchment area.

Rainfall losses are modeled as initial losses for both impervious and pervious areas while continuing losses are calculated based on the Horton Infiltration Equation for pervious areas only. Losses include rainfall, which does not appear as runoff but is lost by infiltration into the soil and stored in puddles and trapped low spots throughout the catchment and are, therefore, not contributing to the flood waters. The hydrographs which show the quantity of runoff generated at certain time intervals throughout the storm event are then routed through the drainage system with pipe flows and overland flows determined by pit inlet capacities and pipe capacities using hydraulic grade line analysis.

Flood storage includes floodwaters that are temporarily stored during the storm and gradually released as the waters recede. These can be modeled in DRAINS as storage volumes at pits or as detention basins. Information input into the program include details of rainfall, initial and containing losses and general data for running the program, as well as catchment areas, pits, pipes, channels, storage and overland flow data. The catchment plan for the model and the calculation results are attached in the appendices.

The overland flow along Urunga Parade travels along the kerb and gutter until it splits at the intersection with Urunga Lane where 50% of the flow is diverted down Urunga Lane. We confirm that the design discharge along Urunga Lane for the **100 year ARI** storm is in the order of **0.04 cumecs** for existing site conditions and the design discharge for the **20 year ARI** storm is in the order of **0.03**

cumecs.

Using the detailed survey information we established a **HECRAS** model of Urunga Lane adjacent to the site. We modeled several scenarios using different downstream controls and found that the most appropriate control was normal depth conditions for sub critical flow. The overland flow level along the kerb and gutter in Urunga Lane was found to be **70mm** deep at the kerb and gutter.

4. Flooding Conclusion

The depth of overland flow in Urunga Lane is approximately 80mm below the top of kerb level in the laneway. At the proposed driveway to the basement carpark the depth of flow is 140mm below the driveway at the building entry and at the southern boundary of the site the depth of flow is 340mm below the driveway level at the building.

Normally it is desirable to have 300mm freeboard above the 100 year ARI flow level. In this instance given that the longitudinal grade in Urunga Lane is 4.5% the flow can quickly dissipate away from the site. We recommend that the driveway slab to the car lift be shaped to divert flow away form the site by creating an artificial crest in the driveway about 3m behind the kerb line. The critical point is on the northern side of the driveway where the freeboard is approximately 140mm. The crest should be around 160mm higher than the kerb in this location.

We further recommend that a sump pump be incorporated in the basement in the event that water ever does enter the building.

5. Site Stormwater Calculations

General Comments

- Re-development of property requires On Site Detention and Rainwater harvesting under Sutherland Council's LEP 2006 and Environment Specification – Stormwater Management 2009

- Stormwater calculations are based on the DRAINS (Version 2010.04 – March 2010) software package

Catchment Area

The site currently has a commercial building over part of the property with a fully sealed bitumen car park at the rear. It is considered that the site is totally impervious. The proposal is to demolish the existing building and construct a new building over the entire property with car parking in the basement below the building.

The site will be fully impervious with water being mainly caught by the roof and street awnings. Council requires that the stormwater discharge from the property to be limited to the pre-development discharge for all storm events up to and including the 1% AEP event (1 in 100). The maximum impervious area to be used to determine the PSD is to be limited to 75% of the total site area. Since the site is already fully impervious it was necessary to configure the DRAINS model so that the impervious and pervious areas were 75% and 25% of the total site, respectively, for the pre-development scenario.

The total site area including the awnings over hanging the street footpath is 578m^2.

The discharge for the site was calculated to be:-

Storm event (year ARI)	Pre-development Discharge (L/s)
2	16
5	21
10	24
20	28
50	31
100	34

Post Development Discharge

The proposed building has a flat roof, terraces on the 4th floor, awnings over hanging the footpath and a small amount of footpath fronting Urunga Parade. The catchment areas were divided as follows:-

Roof - 285m^2 Terrace 1 - 44m^2 Terrace 2 - 65m^2

Awning 1 - 52m^2 Awning 2 - 101m^2 Pathway - 25m^2

The full area for the site was considered 100% impervious and is to be connected to the existing stormwater pit located at the low side of the property in Kiora Road.

The flows calculated for the post-development scenario were generally 1L/s higher than the pre-development flows. The onsite detention volume was calculated as follows:-

Storm event (year ARI)	Pre-development Discharge (L/s)	Post-development Discharge (L/s)	Detention Volume Required (m^3)
2	16	17	0.80
5	21	22	0.93
10	24	25	1.40
20	28	29	1.80
50	31	32	2.10
100	34	35	2.50

Rainwater Harvesting

Council's DCP requires the provision of a Rainwater Tank to capture stormwater runoff for toilet flushing, laundry appliances, irrigation and car washing. The rainwater tank shall be assumed to be two-thirds full for the purposes of calculating peak flow and discharge. Where rainwater harvesting is included in the management of stormwater Council will allow one third of the rainwater tank volume to be offset from the OSD requirements.

For commercial developments where no Basix requirements are calculated Council requires the sizing of the rainwater tank to be carried out using a water balance model for the site. As a minimum requirement Council has stipulated that a dry period with no rainfall will not be less than 21 days.

The building is to be used as a Dental Hospital and the expected occupancy rate for the building will be around 225 people. Rainwater reuse will be limited to toilet flushing as there is very limited opportunity for landscaping and car washing. Based on standard practice each person on average is expected to use the toilet 3 to 4 times per day. Normally there would be a three 3 litre flushes and one 4.5 litre flush. On this basis the daily requirement for non-potable water is 3037 litres as shown below.

	One full flush 4.5 litre per day	Three half flushes 3.0 litre per day	**Total daily water requirement**
Daily water requirement per person	4.5	9.0	**13.5 L/person**

At 225 people x 13.5 L/day the daily = 3037 L/day
21 days of no rain as required by Council = 21 x 3037 = 63787 L (63.8 cu.m.)

In order to satisfy Council's requirements it will be necessary to provide a rainwater tank with a capacity of 63.8 m3, however, an offset of one third can be used against the OSD requirements. Therefore a credit of 21.2 m3 can be used against the OSD volume. As the OSD volume is relatively small at 2.5 m3 there will be no need to provide OSD for the site provided the rainwater is harvested

Water Quality

Council's DCP requires stormwater quality control on all developments to reduce the amount of suspended solids, total phosphorous and total nitrogen from leaving the developed site. In this instance the majority of the site is impervious with most of the water being reused in the rainwater tank. The only likely quality issue will be litter that may get washed into the stormwater system.

It is proposed to provide a trash screen on the outlet of the last pit prior to the connection to Council's system in the street.

6. Site Erosion and Sediment Control

Erosion and Sediment Control details have been prepared for the site and more particularly, for the excavation of the basement. Construction details have been included in drawing number 20190-SW-00 Issue A attached. It should be noted that these details are subject the construction methodology to be adopted by the selected contractor.

7. Certification

I hereby certify that the above concept design is in accordance with normal engineering practice and meets the requirements of the Building Code of Australia, the Environmental Planning and Assessment Regulation, and relevant Australian Standards. In particular the design is in accordance with the following:

- AS 3500.3 Stormwater Drainage;
- Sutherland Shire Council's Environmental Specification - Stormwater Management 2009;
- Sutherland Shire Council's Local Environmental Plan 2006 – Chapter 8 – Ecologically Sustainable Development***;***

I am an appropriately qualified and competent person in this area being listed in the National Professional Engineers Register (NPER) and as such can certify that the design and performance of the design systems comply with the above.

This certification shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.

Yours faithfully
EWFW PTY LIMITED

Edward P Lucas MIEAust, CPEng

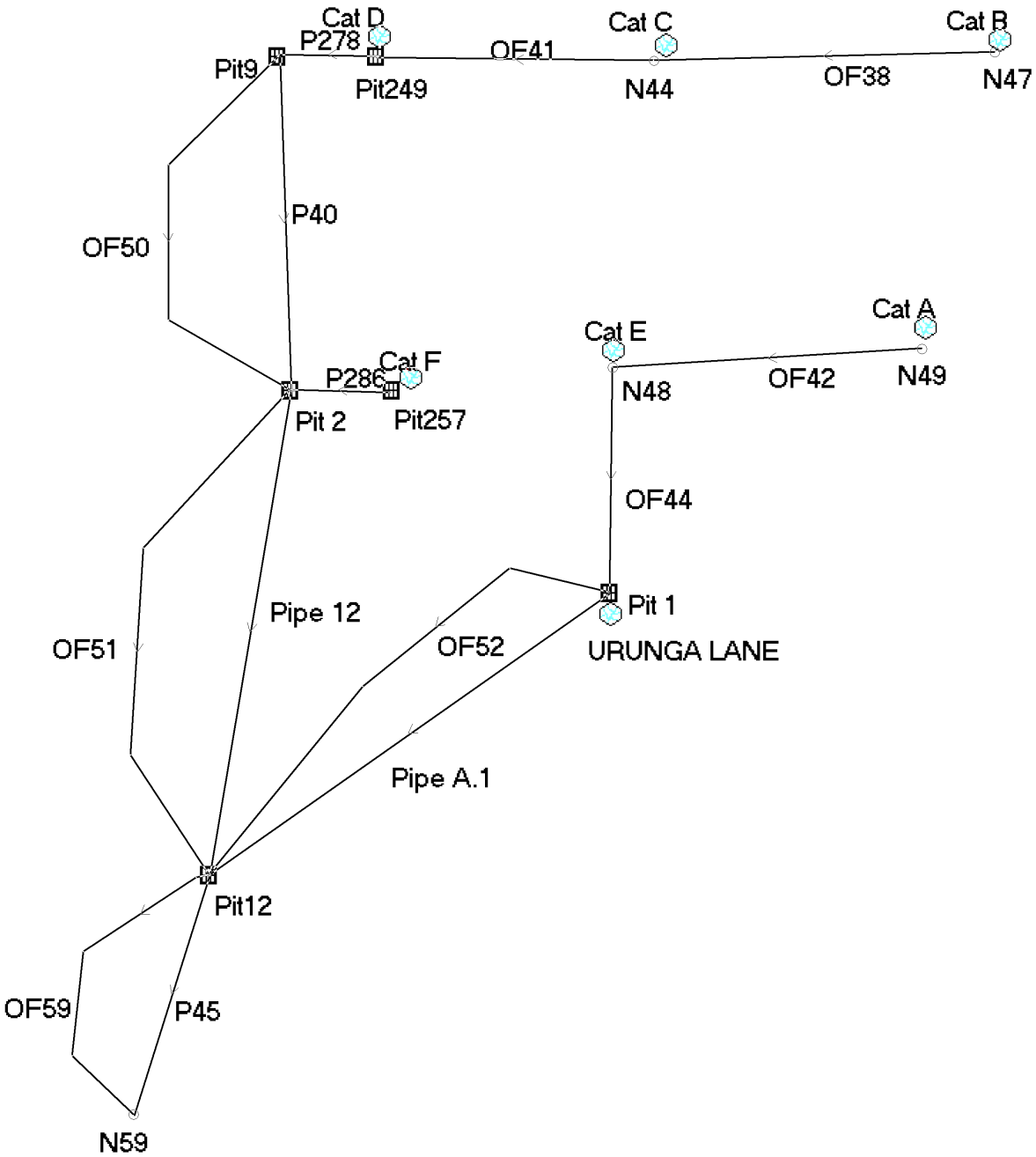
Enclosures Appendix 1 – DRAINS Catchment Plan (A3)
Appendix 2 – DRAINS model data and results for 100 year ARI
Appendix 3 – HECRAS Output Summary and sections
Appendix 4 – Extent Overland Flow in Urunga Lane Plan (A3)

Appendix 1 - DRAINS Catchment Plan (A3)

---------- DENOTES CATCHMENT BOUNDARY

CATCHMENT PLAN
84 KIORA ROAD, MIRANDA

Appendix 2 – DRAINS model data and results for 100 year ARI



FLOOD STUDY
84 KIORA ROAD, MIRANDA
100 YEAR ARI EVENT- DRAINS LAYOUT

DRAINS results for 100 year ARI Events

PIT / NODE DETAILS								
Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint	
Pit 1	36.27		0.028		1.73	0.024	Inlet Capacity	
Pit12	35.4		0.003		0.6	0.002	Inlet Capacity	
N59	35.08		0					
Pit249	36.5		0.03		0.7		None	
Pit9	36.42		0		0.68	0	None	
Pit 2	36.35		0		0.65	0	None	
Pit257	36.37		0.008		0.83		None	
B-CATCHMENT DETAILS								
Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)		Due to Storm
URUNGA LANE	0.005	0.005	0	2	6	0		AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
Cat C	0.035	0.035	0	3	6	0		AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
Cat B	0.035	0.035	0	3	6	0		AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
Cat E	0.042	0.042	0	3	6	0		AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
Cat A	0.035	0.035	0	3	6	0		AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
Cat D	0.017	0.017	0	3	6	0		AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
Cat F	0.022	0.022	0	3	6	0		AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
Outflow Volumes for Total Catchment (0.29 impervious + 0.00 pervious = 0.29 total ha)								
Storm	Total Rainfa cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)				
	95.81	92.89 (97.0%)	92.89 (97.0%)	0.00 (0.0%)				AR&R 100 year, 10 minutes storm, average 197 mm/h, Zone 1
	142.98	140.06 (98.0%)	140.06 (98.0%)	0.00 (0.0%)				AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
	176.54	173.62 (98.3%)	173.62 (98.3%)	0.00 (0.0%)				AR&R 100 year, 30 minutes storm, average 121 mm/h, Zone 1
	248.03	245.11 (98.8%)	245.11 (98.8%)	0.00 (0.0%)				AR&R 100 year, 1 hour storm, average 85 mm/h, Zone 1
	293.26	290.35 (99.0%)	290.35 (99.0%)	0.00 (0.0%)				AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
	332.65	329.75 (99.1%)	329.75 (99.1%)	0.00 (0.0%)				AR&R 100 year, 2 hours storm, average 57 mm/h, Zone 1
	512.98	510.00 (99.4%)	510.00 (99.4%)	0.00 (0.0%)				AR&R 100 year, 6 hours storm, average 29.3 mm/h, Zone 1
PIPE DETAILS								
Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)				Due to Storm
Pipe A.1	0.053	2.89	36.183	35.397				AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
P45	0.136	1.7	35.226	35.075				AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
P278	0.055	1.46	36.439	36.423				AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1

P40	0.055	1.11	36.372	36.352				AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
Pipe 12	0.071	3.79	36.184	35.397				AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
P286	0.021	0.51	36.353	36.352				AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
ERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF52	0.024	0.024	0	0.01	0	7.4	0.33	AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
OF59	0.002	0.002	0	0.002	0	7.4	0.09	AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
OF41	0.067	0.067	0	0.092	0.08	2.17	0.87	AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
OF38	0.035	0.035	0	0.075	0.06	1.63	0.77	AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
OF44	0.073	0.073	0	0.094	0.08	2.23	0.9	AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
OF42	0.035	0.035	0	0.075	0.06	1.63	0.76	AR&R 100 year, 20 minutes storm, average 147 mm/h, Zone 1
OF50	0	0	0	0	0	0	0	
OF51	0	0	0	0	0	0	0	
R 100 year, 20 minutes storm, average 147 mm/h, Zone								
Node	Inflow	Outflow	Storage Change	Difference				
	(cu.m)	(cu.m)	(cu.m)	%				
Pit 1	59.9	59.95	0	-0.1				
Pit12	125.41	125.75	0	-0.3				
N59	125.75	125.75	0	0				
N44	51.36	51.36	0	0				
N47	25.92	25.92	0	0				
N48	56.16	56.16	0	0				
N49	25.44	25.44	0	0				
Pit249	63.84	49.63	0	22.3				
Pit9	49.63	49.68	0	-0.1				
Pit 2	65.32	65.46	0	-0.2				
Pit257	16.32	15.65	0	4.1				

DRAINS results for 20 year ARI Events

PIT / NODE DETAILS				Version 8				
Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint	
Pit 1	36.27		0.028		1.73	0.022	Inlet Capacity	
Pit12	35.38		0.003		0.62	0.001	Inlet Capacity	
N59	35.07		0					
Pit249	36.5		0.03		0.7		None	
Pit9	36.42		0		0.68	0	None	
Pit 2	36.35		0		0.65	0	None	
Pit257	36.36		0.008		0.84		None	
SUB-CATCHMENT DETAILS								
Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)		Due to Storm
URUNGA LANE	0.005	0.005	0	2	6	0		AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
Cat C	0.035	0.035	0	3	6	0		AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
Cat B	0.035	0.035	0	3	6	0		AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
Cat E	0.042	0.042	0	3	6	0		AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
Cat A	0.035	0.035	0	3	6	0		AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
Cat D	0.017	0.017	0	3	6	0		AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
Cat F	0.022	0.022	0	3	6	0		AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
Outflow Volumes for Total Catchment (0.29 impervious + 0.00 pervious = 0.29 total ha)								
	Total Rainfa cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)				Storm
	73.92	71.00 (96.1%)	71.00 (96.1%)	0.00 (0.0%)				AR&R 20 year, 10 minutes storm, average 152 mm/h, Zone 1
	109.91	106.99 (97.3%)	106.99 (97.3%)	0.00 (0.0%)				AR&R 20 year, 20 minutes storm, average 113 mm/h, Zone 1
	135.69	132.77 (97.8%)	132.77 (97.8%)	0.00 (0.0%)				AR&R 20 year, 30 minutes storm, average 93 mm/h, Zone 1
	248.03	245.11 (98.8%)	245.11 (98.8%)	0.00 (0.0%)				AR&R 100 year, 1 hour storm, average 85 mm/h, Zone 1
	293.26	290.35 (99.0%)	290.35 (99.0%)	0.00 (0.0%)				AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
	332.65	329.75 (99.1%)	329.75 (99.1%)	0.00 (0.0%)				AR&R 100 year, 2 hours storm, average 57 mm/h, Zone 1
	512.98	510.00 (99.4%)	510.00 (99.4%)	0.00 (0.0%)				AR&R 100 year, 6 hours storm, average 29.3 mm/h, Zone 1
PIPE DETAILS								
Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)				Due to Storm
Pipe A.1	0.052	2.87	36.183	35.38				AR&R 100 year, 2 hours storm, average 57 mm/h, Zone 1
P45	0.128	1.68	35.218	35.067				AR&R 100 year, 2 hours storm, average 57 mm/h, Zone 1
P278	0.053	1.48	36.436	36.417				AR&R 100 year, 2 hours storm, average 57 mm/h, Zone 1

P40	0.053	1.12	36.367	36.345				AR&R 100 year, 2 hours storm, average 57 mm/h, Zone 1
Pipe 12	0.068	3.75	36.183	35.38				AR&R 100 year, 2 hours storm, average 57 mm/h, Zone 1
P286	0.021	0.54	36.345	36.345				AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
OVERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF52	0.022	0.022	0	0.01	0	7.4	0.3	AR&R 100 year, 2 hours storm, average 57 mm/h, Zone 1
OF59	0.001	0.001	0	0.001	0	7.4	0.12	AR&R 100 year, 2 hours storm, average 57 mm/h, Zone 1
OF41	0.065	0.065	0	0.09	0.08	2.13	0.87	AR&R 100 year, 2 hours storm, average 57 mm/h, Zone 1
OF38	0.035	0.035	0	0.075	0.06	1.63	0.77	AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
OF44	0.071	0.071	0	0.093	0.08	2.21	0.89	AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
OF42	0.035	0.035	0	0.075	0.06	1.63	0.76	AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone 1
OF50	0	0	0	0	0	0	0	
OF51	0	0	0	0	0	0	0	
for AR&R 100 year, 1.5 hours storm, average 67 mm/h, Zone								
Node	Inflow	Outflow	Storage Change	Difference				
	(cu.m)	(cu.m)	(cu.m)	%				
Pit 1	124.17	124.2	0	0				
Pit12	271.29	271.44	0	-0.1				
N59	271.45	271.45	0	0				
N44	106.46	106.46	0	0				
N47	53.73	53.73	0	0				
N48	116.42	116.42	0	0				
N49	52.73	52.73	0	0				
Pit249	132.33	113.93	0	13.9				
Pit9	113.93	113.93	0	0				
Pit 2	147.05	147.1	0	0				
Pit257	33.83	33.12	0	2.1				

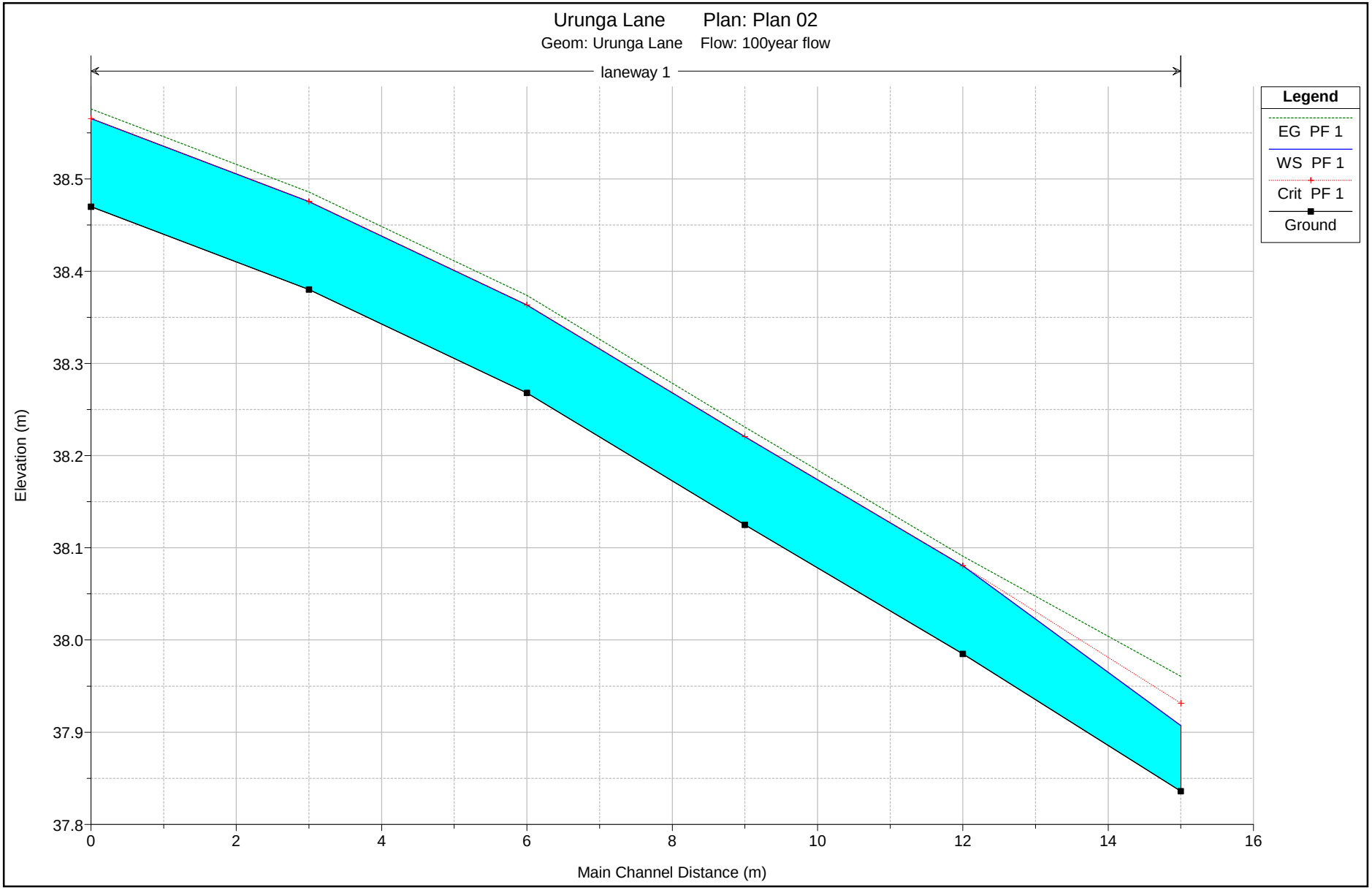
Appendix 3 – HECRAS Output Summary and sections

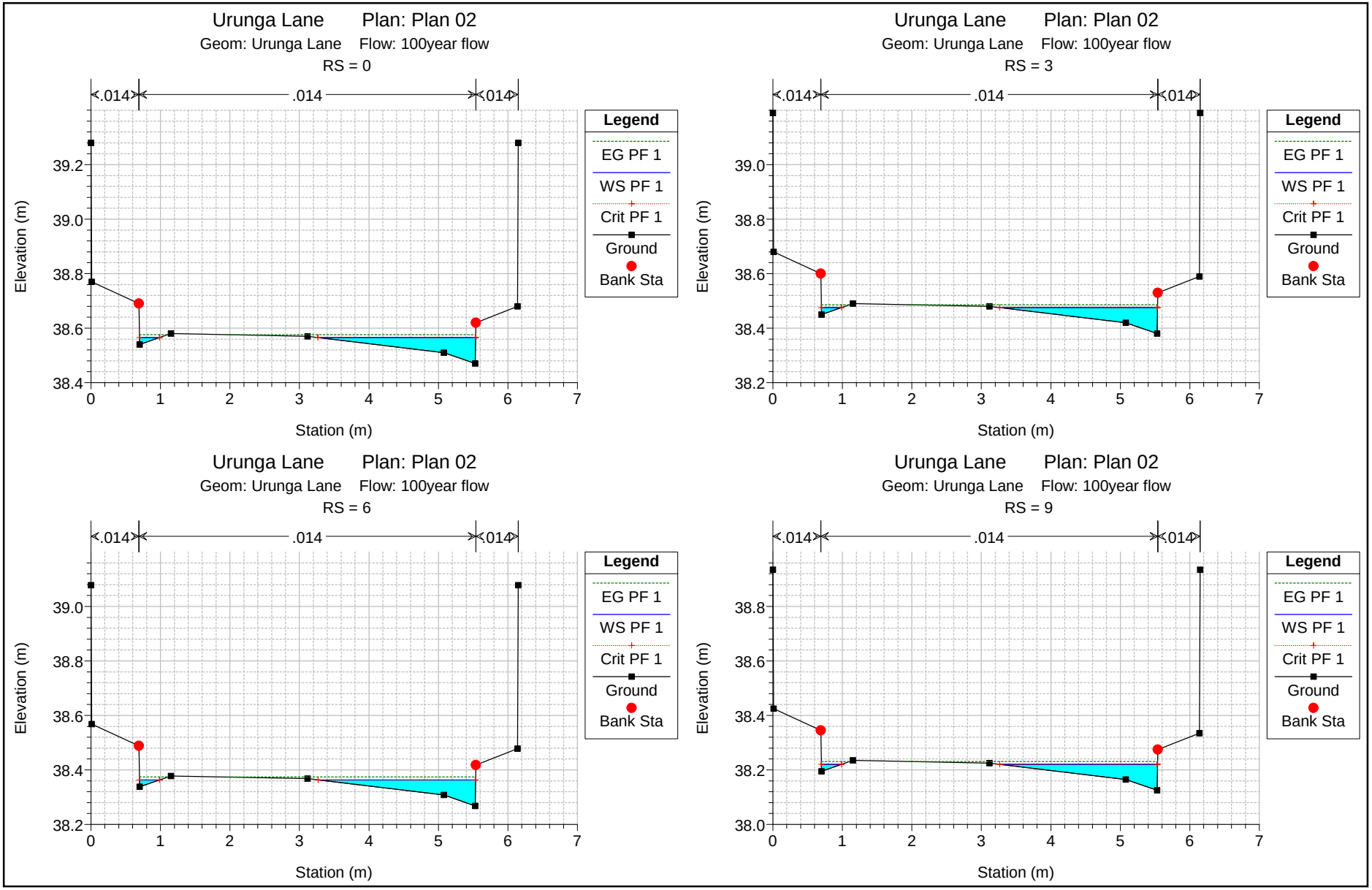
Overland Flow Calculations

Urunga Lane

For Proposed Development at 84 Kiora Road, Miranda

Cross Section	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl	Depth of Flow (m)
15	PF 1	0.04	37.84	37.91	37.93	37.96	0.028001	1.02	0.04	1.48	2.02	0.07
12	PF 1	0.04	37.99	38.08	38.08	38.09	0.003793	0.45	0.09	2.56	0.78	0.09
9	PF 1	0.04	38.13	38.22	38.22	38.23	0.003791	0.45	0.09	2.56	0.78	0.09
6	PF 1	0.04	38.27	38.36	38.36	38.37	0.003804	0.45	0.09	2.56	0.78	0.09
3	PF 1	0.04	38.38	38.48	38.48	38.49	0.003819	0.45	0.09	2.56	0.78	0.1
0	PF 1	0.04	38.47	38.57	38.57	38.58	0.003809	0.45	0.09	2.56	0.78	0.1

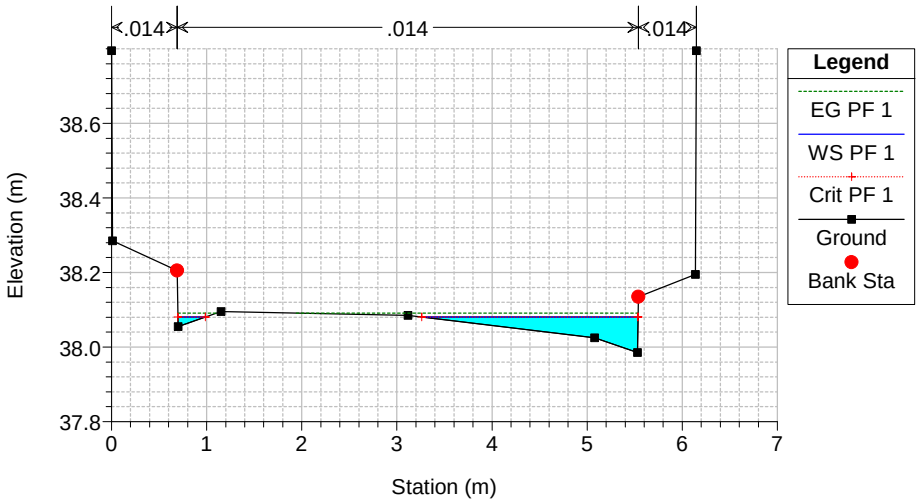

Urunga Lane Plan: Plan 02
Geom: Urunga Lane Flow: 100year flow
laneway 1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (m)
38.5
38.4
38.3
38.2
38.1
38.0
37.9
37.8
0
2
4
6
8
10
12
14
16
Main Channel Distance (m)


Urunga Lane Plan: Plan 02
Geom: Urunga Lane Flow: 100year flow
RS = 0
.014
.014
.014
Elevation (m)
Station (m)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Urunga Lane Plan: Plan 02
Geom: Urunga Lane Flow: 100year flow
RS = 3
.014
.014
.014
Elevation (m)
Station (m)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Urunga Lane Plan: Plan 02
Geom: Urunga Lane Flow: 100year flow
RS = 6
.014
.014
.014
Elevation (m)
Station (m)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Urunga Lane Plan: Plan 02
Geom: Urunga Lane Flow: 100year flow
RS = 9
.014
.014
.014
Elevation (m)
Station (m)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

Urunga Lane Plan: Plan 02

Geom: Urunga Lane Flow: 100year flow

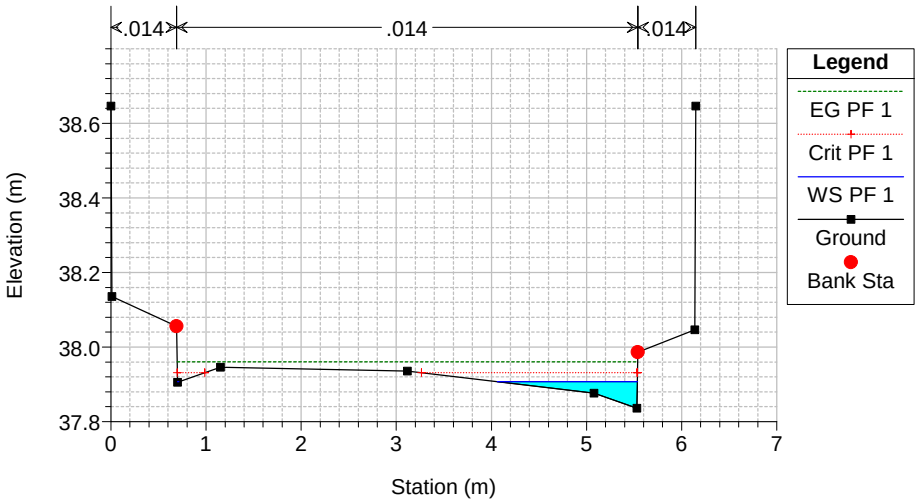
RS = 12



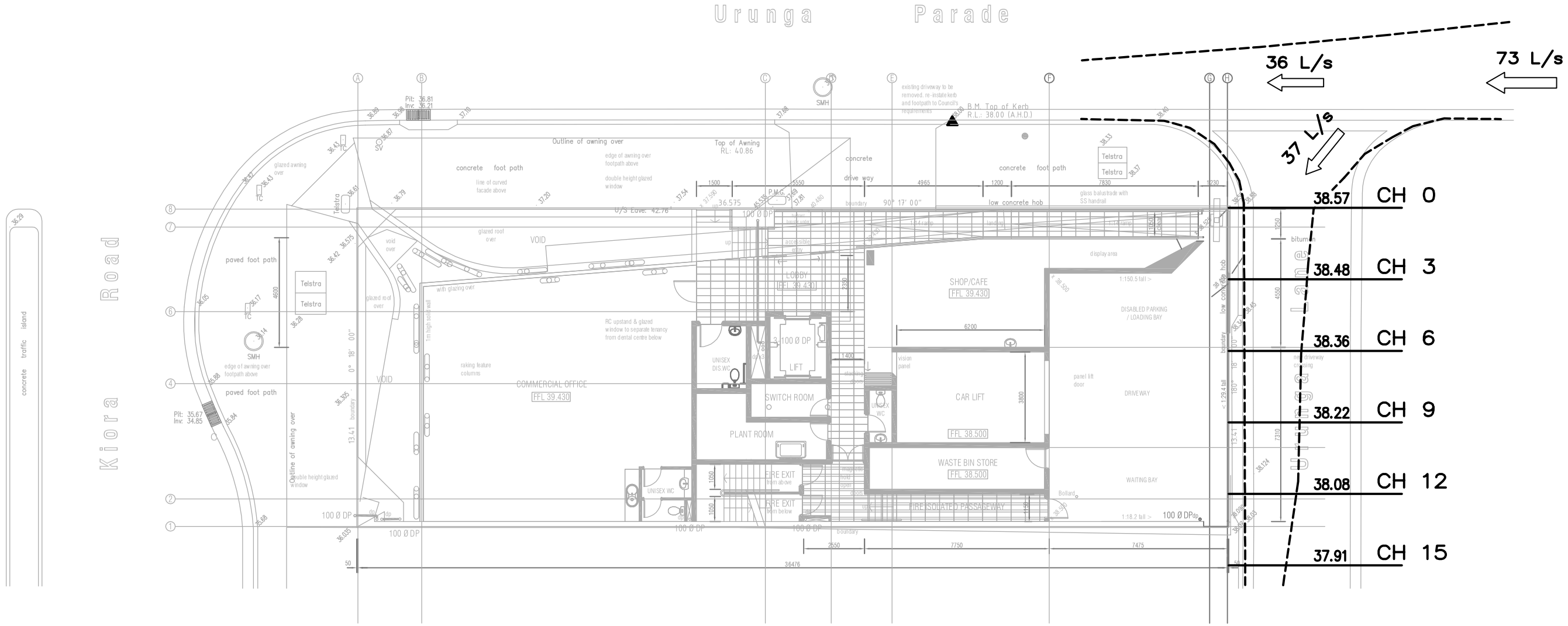
Urunga Lane Plan: Plan 02

Geom: Urunga Lane Flow: 100year flow

RS = 15



Appendix 4 – Extent Overland Flow in Norfolk Lane Plan (A3)



4 2 0 4 8 12 16 20

SCALE OF METRES

LEGEND

———	DENOTES HECRAS CROSS SECTION
CH 12	DENOTES CROSS SECTION CHAINAGE
38.48	DENOTES 100 YR ARI WATER LEVEL
- - - - - - - -	DENOTES APPROX EXTENT OF OVERLAND FLOW

N

100 YR OVERLAND FLOW PATH – URUNGA LANE
84 KIORA ROAD, MIRANDA

DATE 31 MARCH 2011

DRAWING NO. 3535–DA–01

Appendix 5 – Stormwater Concept Plans (A3)

NOTE:
RELOCATE AND MAINTAIN DIVERSION DRAINS AS REQUIRED TO SUIT EXTENT OF EXCAVATION LIMITS

CONSTRUCT DISH DRAIN ALONG BASE OF EXCAVATION TO DIVERT STORMWATER RUNOFF TO SEDIMENT POND

PROVIDE SEDIMENT TRAPS AROUND ALL STREET PITS TO DETAIL

CONSTRUCTION ZONE 10AM TO 3PM MON TO SAT

PROVIDE TYPE 'A' HORDING AROUND PERIMTER OF SITE

PROVIDE SEDIMENT TRAPS IN KERB AND GUTTER TO DETAIL

EXCAVATE 20 cu.m. POND MIN 1.2m DEEP TO ACT AS SEDIMENT DAM

PROPOSED EXCAVATION TO RL 27.65

CONNECT 225 Ø pvc SWP TO EXISTING DGGP TO COUNCIL REQUIREMENTS - IL 34.95

CONNECT PUMP LINE TO NEW STORMWATER LINE

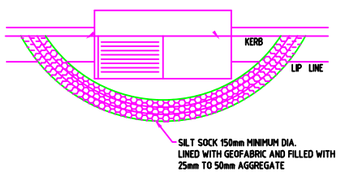
PROVIDE PUMP OUT SUMP AND DECANT TO STORMWATER SYSTEM WHEN SEDIMENTS HAVE SETTLED AND CLARITY OF WATER MEETS DISCHARGE QUALITY SPECIFICATIONS

CONSTRUCT 3.5m WIDE ACCESS ROAD AS EXCAVATION PROGRESS

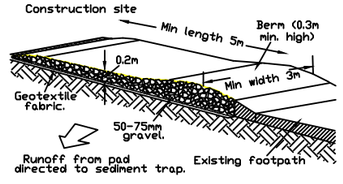
CONSTRUCT 10m LONG SHAKER RAMP TO DETAIL SHOWN

LEGEND:

- DENOTES EXISTING SURFACE LEVEL
- 21.0 DENOTES EXISTING CONTOUR LINE
- DENOTES SILT FENCE
- DENOTES DRAINAGE LINE PIPES TO BE ø 100 UPVC U.N.O. PIPES TO BE AT MIN. 1% GRADE U.N.O.
- DENOTES SITE BOUNDARY
- TREE GUARD 1.8m HIGH ATF FENCING



KERB INLET SEDIMENT TRAP



TEMPORARY CONSTRUCTION ACCESS TREATMENT

1 : 100 0 2 4 6 8 10 m

SITE PLAN

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B	DA SUBMISSION	26/04/11

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Drawing Title:
STORMWATER SERVICES
SITE SOIL EROSION & SEDIMENT CONTROL PLAN

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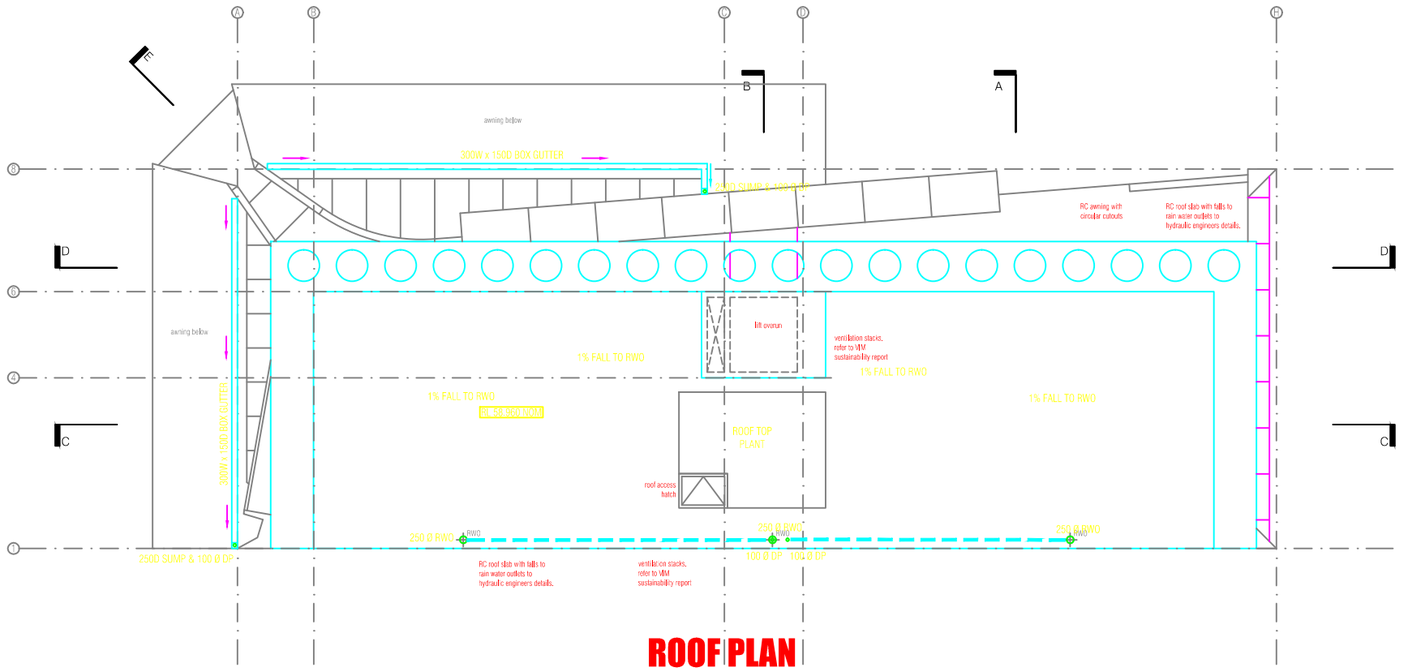
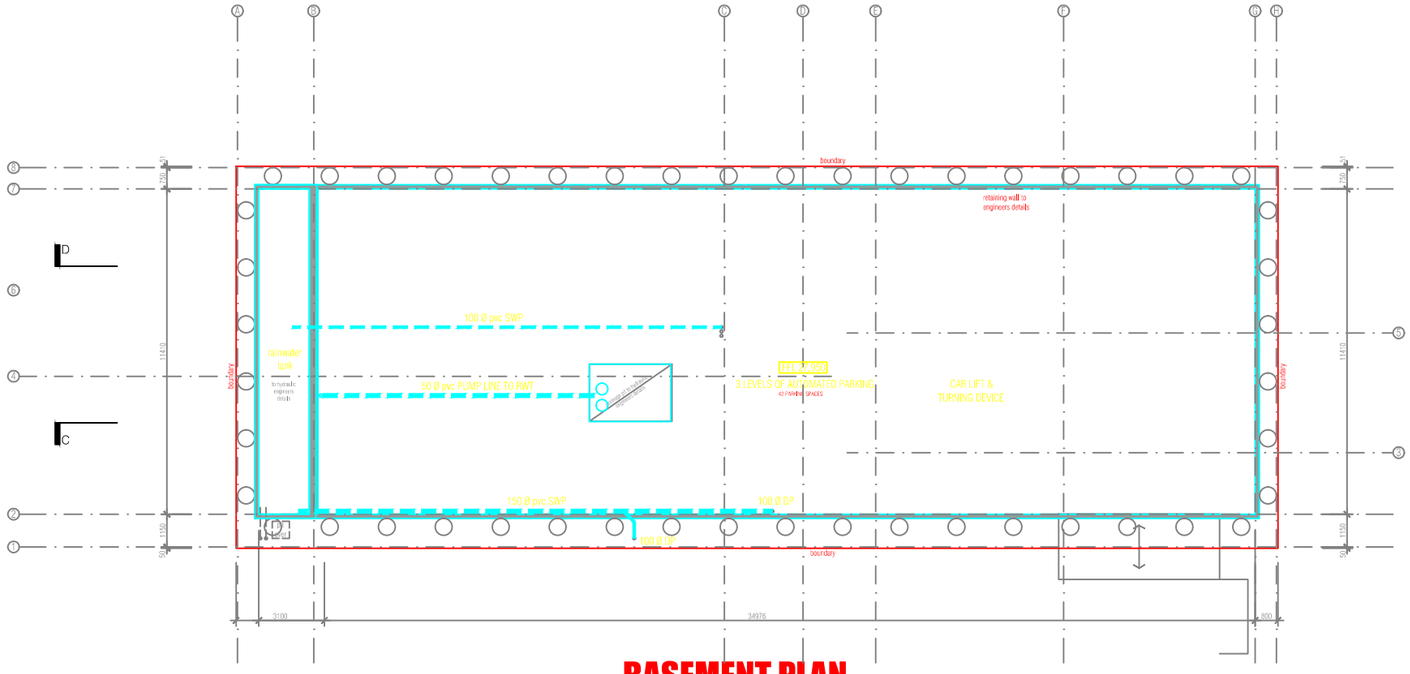


ROOF PLAN



BASEMENT PLAN

Issue	Amendment	Date
A	DA SUBMISSION	30/11/10
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Drawing Title:
STORMWATER SERVICES
ROOF PLAN
BASEMENT PLAN

Date:	Scale:	Drawn:
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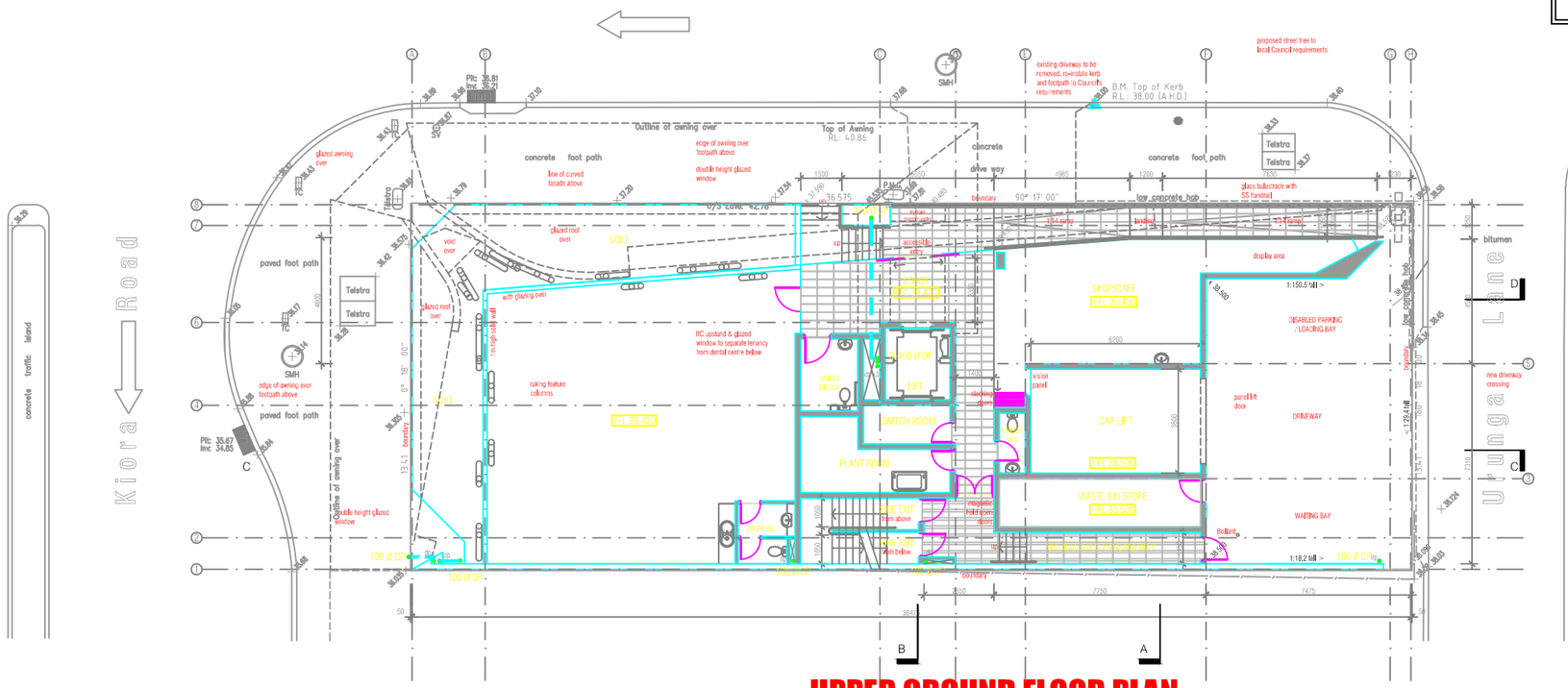
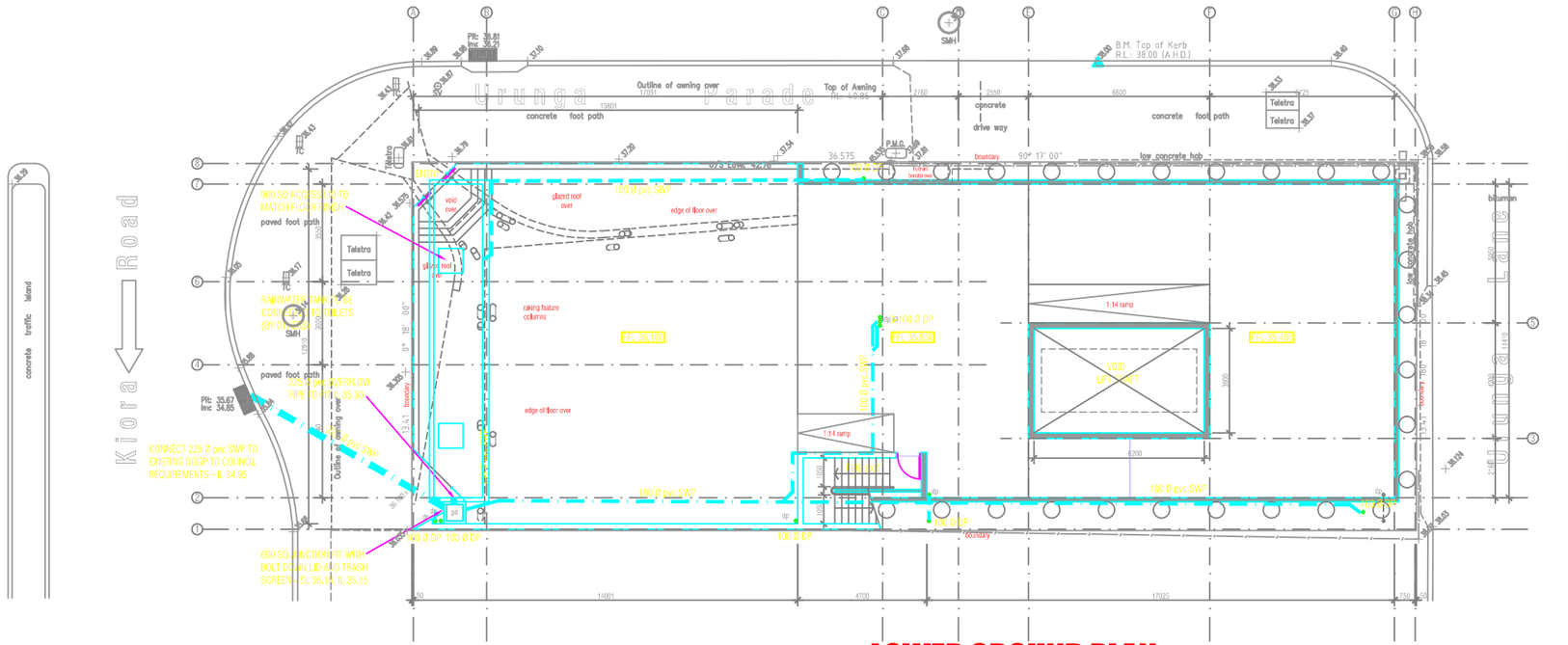


UPPER GROUND FLOOR PLAN



LOWER GROUND PLAN

Issue	Amendment	Date
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Drawing Title:
STORMWATER SERVICES
UPPER & LOWER GROUND PLANS

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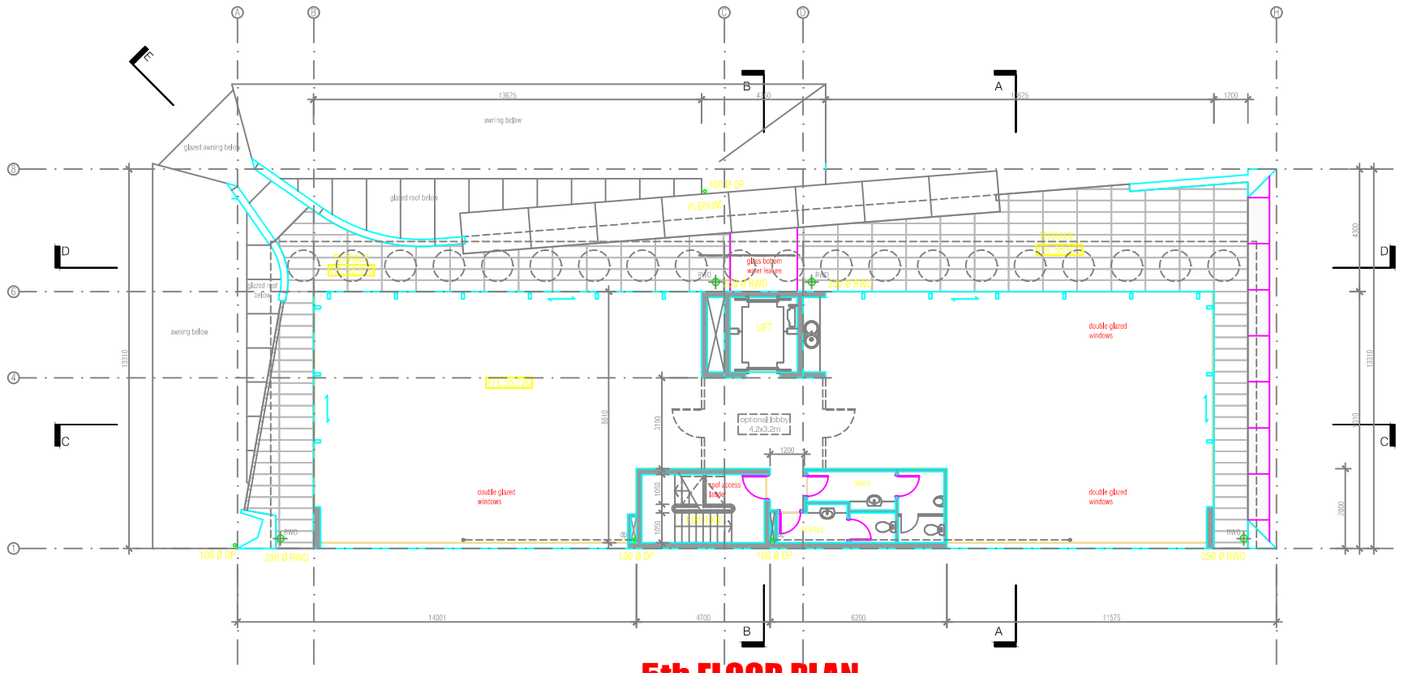
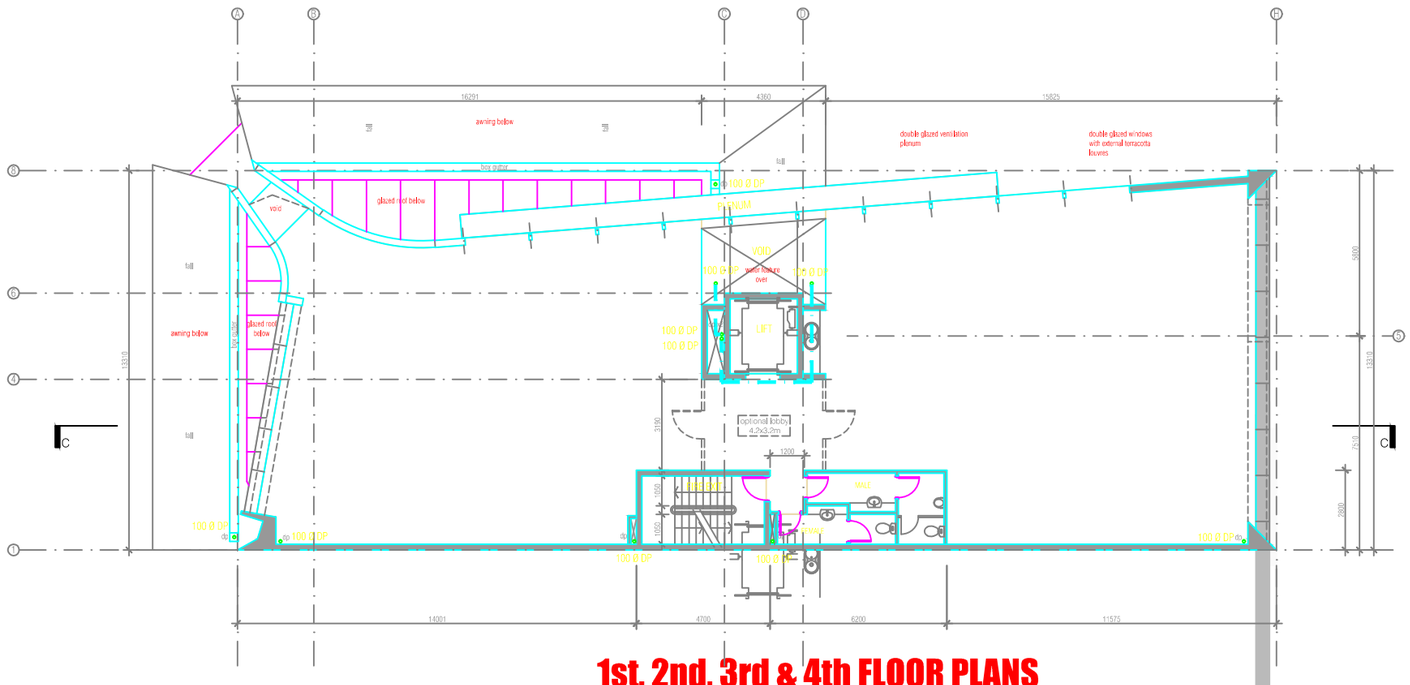


5th FLOOR PLAN



1st, 2nd, 3rd & 4th FLOOR PLANS

Issue	Amendment	Date
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Drawing Title:
STORMWATER SERVICES
LEVELS 1 TO 4
PLANS

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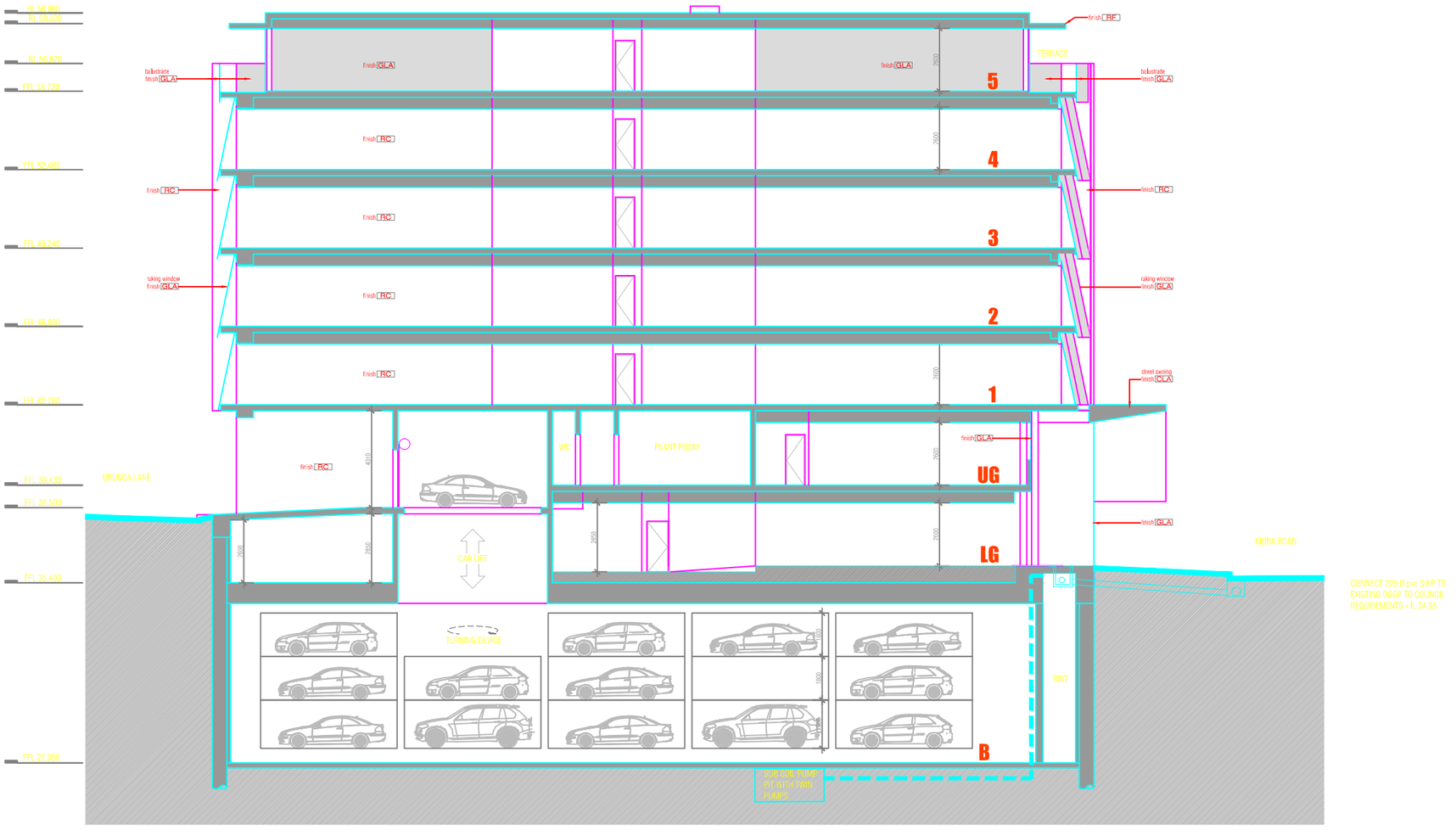

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