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18th April, 2018

D-11-266152

Kim & Charmaine Burke
35 Earl Street
BEACON HILL NSW 2100

Dear Sir & Madam,

Re: Flood Report – Proposed Sub-division at 35 Earl Street, Beacon Hill

INTRODUCTION

I, Edward A. Bennett, practicing Civil, Structural, Geotechnical & Environmental Engineer hereby confirm that I inspected the above property for the purpose of providing a flood report for this property in respect to existing ground levels for ARI 1:100 rainfall events (1%AEP).

REPORT

The purpose for this flood report for No. 35 Earl Street, Beacon Hill, is to provide flood level for the new residential development. It is predicted that the flow path for the 1%AEP flood, will enter the property at Northern boundary.

We have relied upon the, Stormwater Pipes maps, from Northern Beaches Council's website refer **Appendix "A"**, the survey details and site plan provided by "Bee & Lethbridge", refer **Appendix "B"**, information from SIX Maps & near maps, and HEC-RAS 5.0.1, computations, refer **Appendix "D"** to determine a top water level in this location for the 1%AEP storm event .

Parameter used in determining Discharge and over land flows using HEC RAS:

The discharge through the pipe line was calculated using the rational method. The assumed catchment area (A) and the rainfall intensity (I) used for the calculation is shown in Fig 1 and Fig 2 resourced from SIX maps and BOM for this location.

$$Q = CIA/360 = 0.8 \times 268 \times 0.81 / 360 = 0.42 \text{ m}^3/\text{s}$$

Where, C= 0.8, I = 268 mm/hr & A = 0.81 ha

Assuming 50% blockage on stormwater main,

Total possible Discharge over land = 0.21 m³/s.



Fig 1: Assumed Catchment Area

Home	IFD Table	IFD Chart	Coefficients	ARI	Print IFD table	Help IFD table
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Intensity-Frequency-Duration Table

Location: 33.750S 151.250E Issued: 17/4/2018

Rainfall intensity in mm/h for various durations and Average Recurrence Interval

Average Recurrence Interval

Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	99.5	128	162	182	208	242	268
6Mins	93.2	120	152	171	196	228	252
10Mins	76.4	98.2	126	142	163	191	212
20Mins	55.7	72.1	93.7	107	123	145	162
30Mins	45.3	58.8	77.1	88.0	102	121	135
1Hr	30.9	40.2	53.3	61.0	71.1	84.4	94.7
2Hrs	20.6	26.8	35.6	40.8	47.5	56.5	63.3
3Hrs	16.2	21.0	27.8	31.8	37.1	44.0	49.3
6Hrs	10.7	13.9	18.2	20.8	24.1	28.6	31.9
12Hrs	7.01	9.10	11.9	13.6	15.8	18.7	20.9
24Hrs	4.54	5.91	7.81	8.95	10.4	12.4	13.9
48Hrs	2.84	3.72	4.99	5.76	6.76	8.09	9.12
72Hrs	2.10	2.76	3.73	4.32	5.08	6.10	6.88

(Raw data: 40.32, 9.12, 2.76, 85.38, 18.67, 6.1, skew=0.00, F2=4.3, F50=15.87)

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Copy Table

Fig 2: Rainfall Intensity

From HEC-RAS model in Appendix "D", the maximum flood water depth for the flow of 0.21 m³/s was found to be **160 mm**. (refer Appendix 'C' & 'D').

CONCLUSIONS:

The design for the new residential development will consider TWL for 1%AEP storm event being maximum flood water depth **160mm** according to our flood study. The overland flow required due to the lack of capacity of the existing pipe line throughout the site will follow the existing piped Council Easement as a trapezoidal shaped trench of min **160mm** deep.

It is our opinion that the property is not flood affected by this proposed development as new building platforms protected by the construction of the over flow channel over the length of the pipe easement from the street to the rear boundary.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'E.A. Bennett', is written over a light grey rectangular background.

E.A. Bennett M.I.E. Aust. Cp Eng. NPER 198230, Member AGS, BPB 0820

Fig 3: Map Stormwater

Appendix "B"

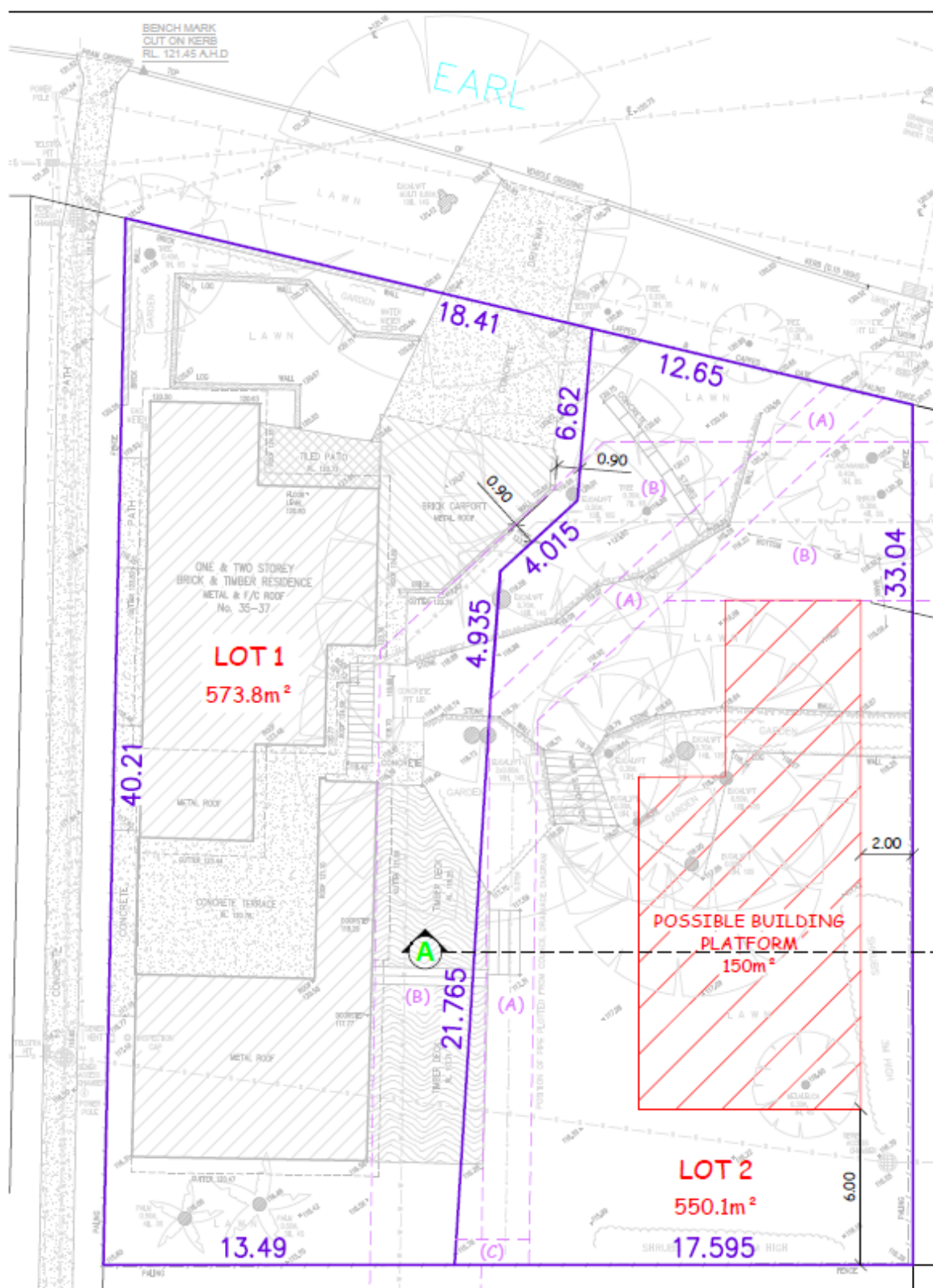


Fig: Site Plan
Appendix "C"

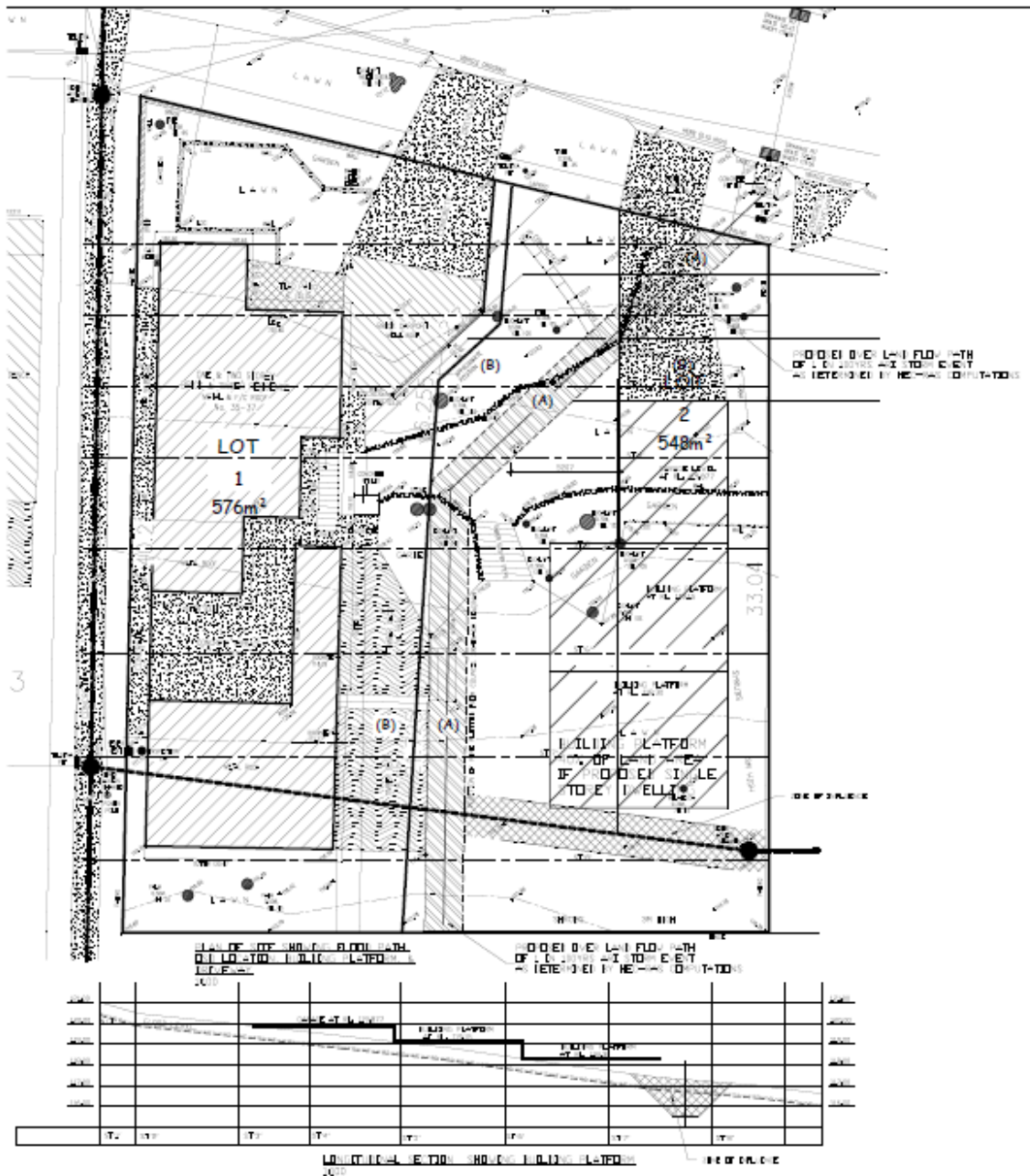


Fig. Flow path and Floor levels (Refer Drawing B-11-264297-3C for detail)

Appendix "D"

HEC-RAS 5.0.1:

HEC-RAS 5.0.1 was used to predict the flood levels for ARI 1:100 (1%AEP) rainfall events. Cross sections in the properties are interpolations of survey levels at certain intervals, starting at Station 0 (Downstream) near the southern end of the property to Station 35 (Chainage 35m) near the northern front of the property which is approx. 35m apart from Station 0. These survey level interpolations were used in the HEC-RAS model. The reach profile summaries are shown in the table below.

Fig: River Station “downstream”

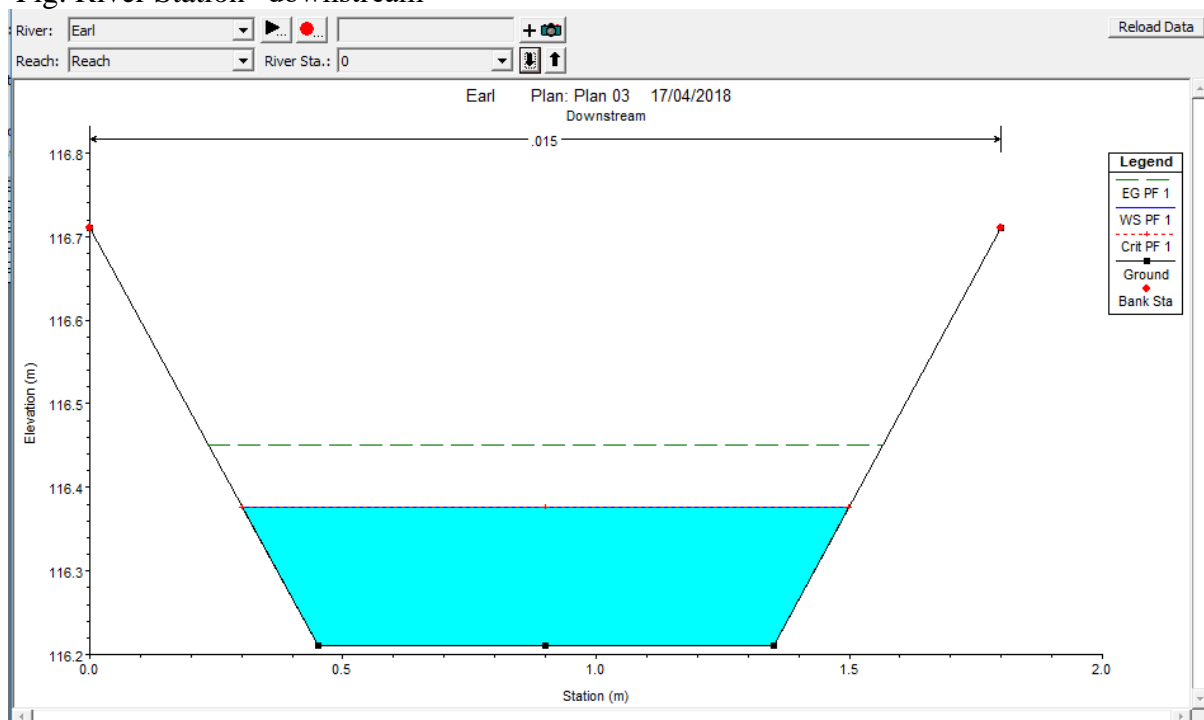


Fig: River Station “Chainage 5”

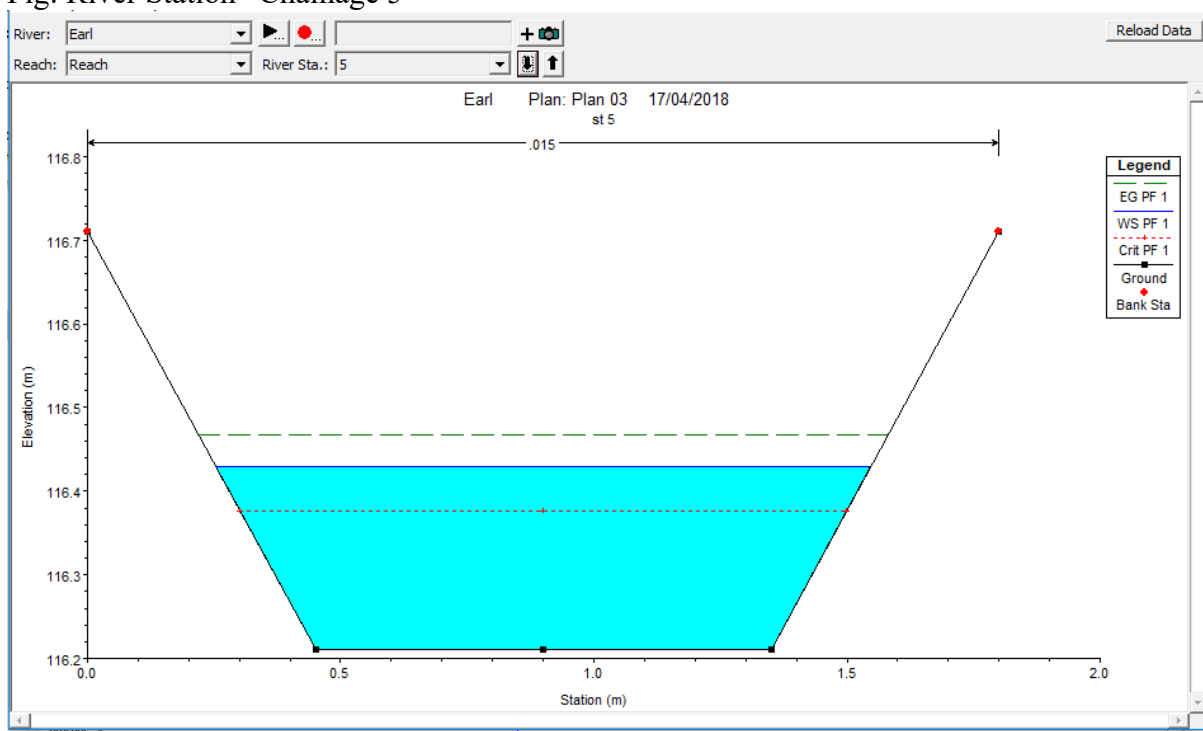


Fig: River Station “Chainage 10”

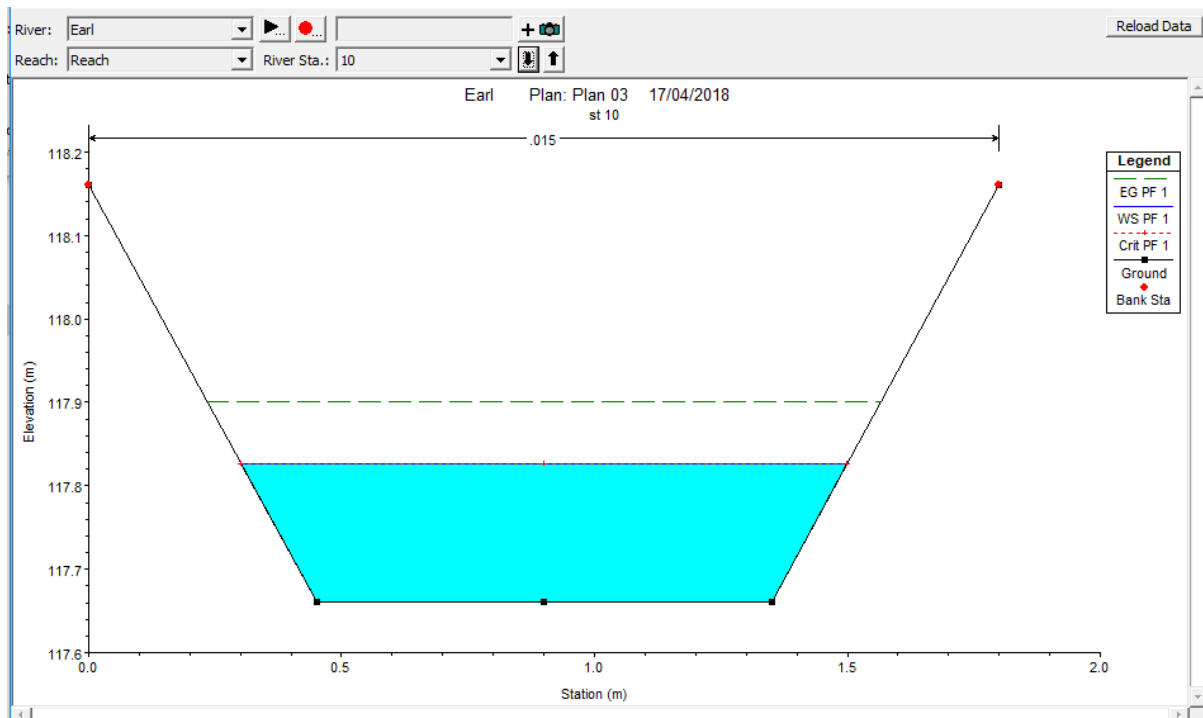


Fig: River Station “Chainage 15”

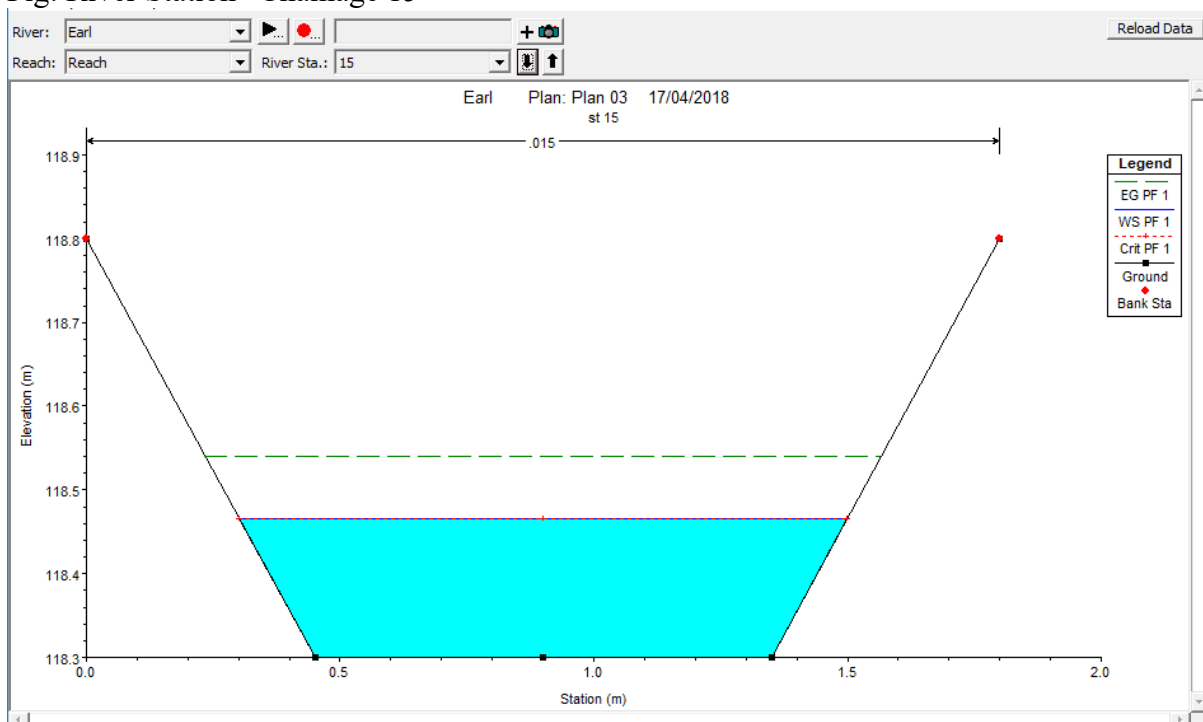


Fig: River Station “Chainage 20”

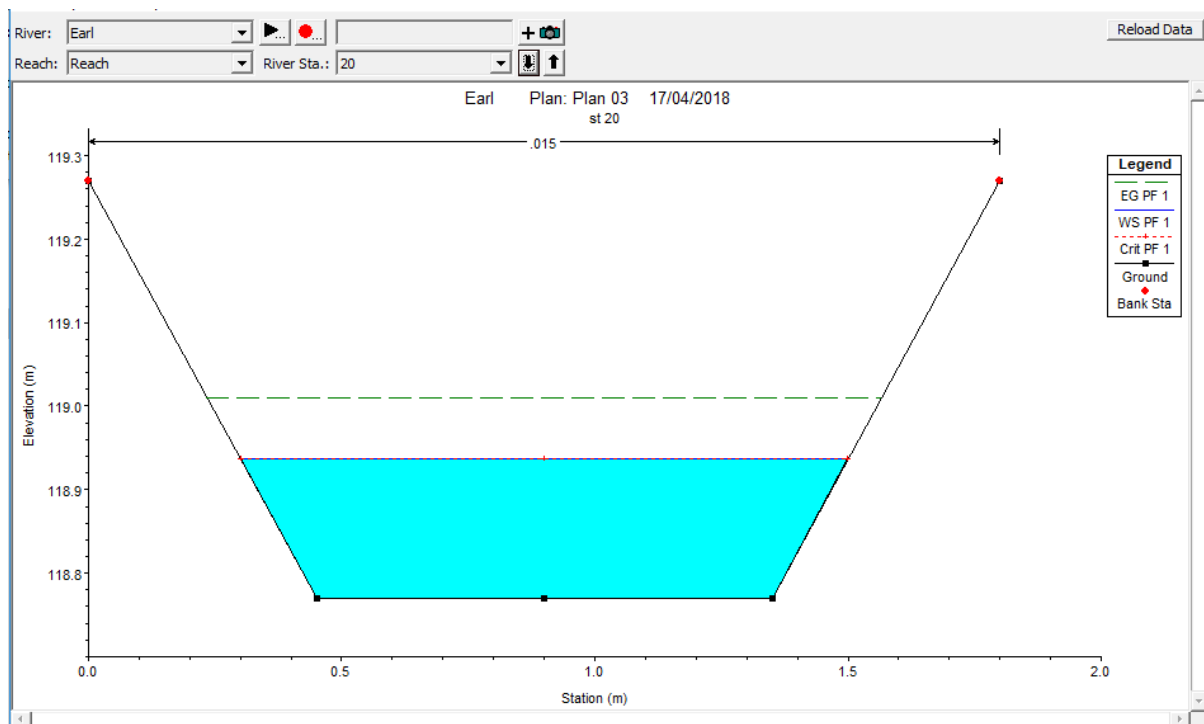


Fig: River Station “Chainage 25”

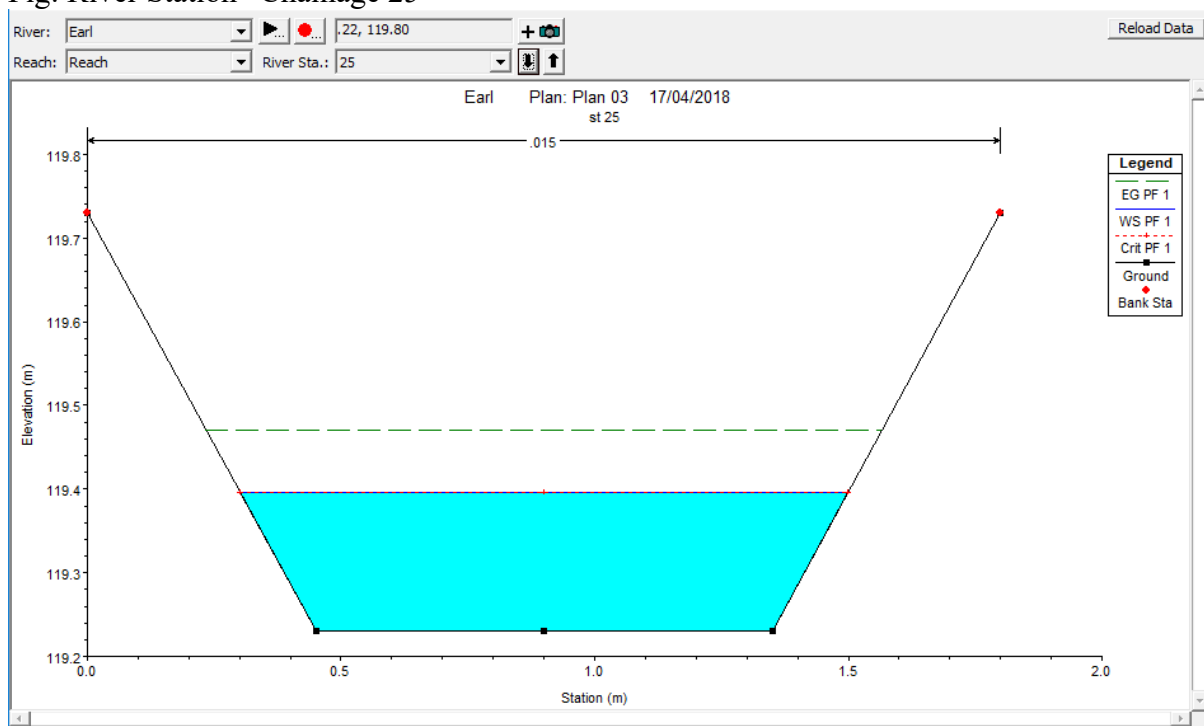


Fig: River Station “Chainage 30”

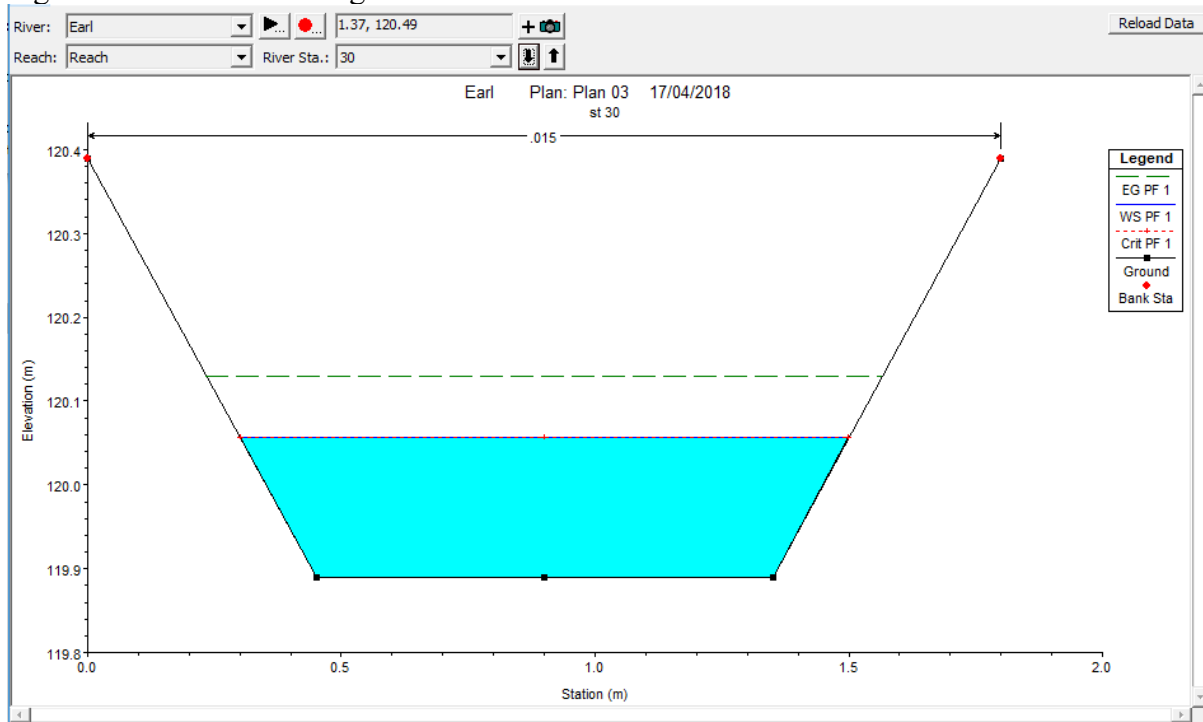


Fig: River Station “Chainage 35”

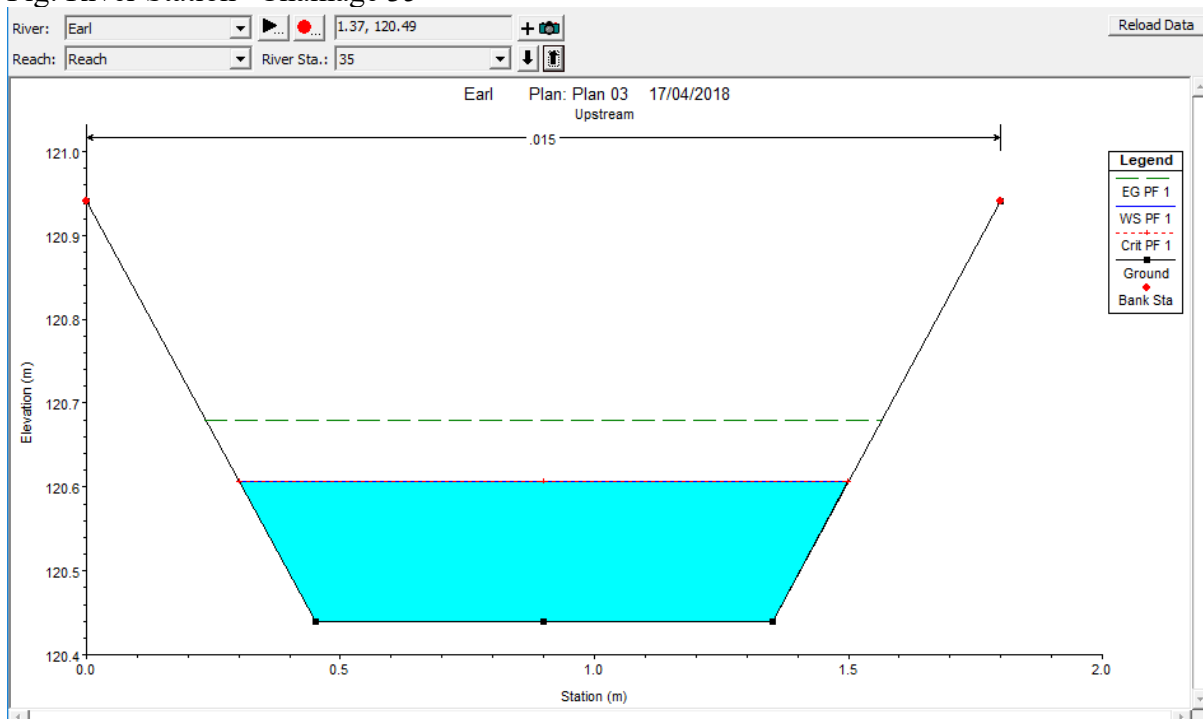


Table: Profile summary

HEC-RAS Plan: Plan 03 River: Earl Reach: Reach Profile: PF 1												
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach	35	PF 1	0.21	120.44	120.61	120.61	120.68	0.004948	1.20	0.17	1.20	1.01
Reach	30	PF 1	0.21	119.89	120.06	120.06	120.13	0.004954	1.20	0.17	1.20	1.01
Reach	25	PF 1	0.21	119.23	119.40	119.40	119.47	0.004954	1.20	0.17	1.20	1.01
Reach	20	PF 1	0.21	118.77	118.94	118.94	119.01	0.004948	1.20	0.17	1.20	1.01
Reach	15	PF 1	0.21	118.30	118.47	118.47	118.54	0.004963	1.20	0.17	1.20	1.01
Reach	10	PF 1	0.21	117.66	117.83	117.83	117.90	0.004954	1.20	0.17	1.20	1.01
Reach	5	PF 1	0.21	116.21	116.43	116.38	116.47	0.001944	0.87	0.24	1.29	0.65
Reach	0	PF 1	0.21	116.21	116.38	116.38	116.45	0.004963	1.20	0.17	1.20	1.01