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Our ref: AF1098-1-r0 Date: 13 August 2021
Your ref:

Power Developments Turnkey Housing
Att: Mr S. Bothma
Email: sbothma@poweergrp.co.za
Tel: 083 570 7950
Cc: Mr S. Levey
Mr N. Bezuidenhout
CC: Ms LM van Zyl (Cape EAPrac)

Dear Sirs

Proposed Village Ridge Development on Erven 21028 and 21029:- Floodline Determination

1. Introduction

We refer to our drawing AF1098-01-r0 of 11 August 2021 which indicates the 50 year and 100 year Recurrence Intervals (RI) floodlines for the proposed development of the Village Ridge precinct on erven 21028 and 21029, George.

The drawing presents key hydrological and hydraulic information used in the floodline determination analyses. This brief letter report provides background and supporting information.

2. The Site and River

Appendix A presents photographs of the site and the adjacent Camfersdrift River. The adjacent river is the Camfersdrift River.

The photographs show that the Ridge, where the development is proposed, is situated well above the River.

The photographs show a few key characteristics:

a. The catchment watershed, George Peak, is visible in Photograph 1. It is 5.5km from the site.

b. The proposed development is on a ridge (Photographs 1 to 3), whilst the river is in a fairly deep valley (photographs 4 to 6). This is confirmed by the contours shown on Drawing AF1098-1-r0. The river is some 8m to 13m below the ridge where the development is proposed.

c. The river is full of thick riverine vegetation which will keep river velocity's fairly slow (Photographs 5 and 6).

3. Hydrology and Hydraulic Analyses of Catchment and River

The key hydrology and river hydraulic information is listed on Drawing AF1098-01 and reproduced in Appendix B of this letter.

Two methods were used to estimate the peak flows, viz. the Soil Conservation Service (SCS) Method and the Rational Method. The results of the SCS method were used as:

a. They are slightly higher than the Rational Method and therefore more conservative (conservative: estimated flow rates which are less at risk of being exceeded by actual flow rates);

b. The SCS Method requires more exhaustive catchment and rainfall input data and is therefore known to produce more accurate estimates;

c. The SCS method allows for routing, which is the timing of peak flows from the various sub-catchments. This is undertaken using the HECHMS Hydrological Modelling System software (US Army, 2001).

4. Results of Analyses

The HECRAS River Analysis System (US Army, 2001) software was used to conduct backwater analyses to estimate the peak flood levels. The software uses river cross-sections, slopes and roughness to estimate velocities and peak water levels for estimated flood flow rates.

The results are tabulated in Appendix C. The Energy Grade Elevation is used for floodline determination. This is the elevation of the water surface and the flow energy of the water. As the flow velocity is low, the energy is also low to negligible.

The water surface profiles are presented in Appendix D. D1 shows the longitudinal long sections.

The River Station 70 to 10 cross-sections are shown in D2 to D8. The valley cross-section and the water levels are shown for the 100 year RI flow rates. The proposed development is on top of the right hand bank.

By inspecting D2, which is the most upstream River Station (RS) 70, the flow level is in the order of 212m amsl (above mean sea level), whereas the top of bank is in the order of 220m. Similarly, River Station RS10 is the most downstream cross-section. RS 10 has a water level of slightly above 208 m amsl, and a top of bank level of 216m amsl. It is evident that the estimated flood levels are in the order of 8m below the proposed development.

4. Conclusion

The proposed development is well above the 100 year RI floodlines and is in no danger of flooding.

Please contact ourselves for any further information.

Yours faithfully,

Alastair Fraser Pr. Eng

Appendix A. Photographs
Appendix B. Key Hydrological and Hydraulic Information
Appendix C. Results
Appendix D. Water Surface Profiles

Attached: Paper Size A2 drawing titled “AF1098-01-r0 Floodline Determination”.

References

CCT (2009). City of Cape Town. Floodplains and River Corridor Management Policy v2.1. Catchment, Stormwater and River Management Branch, Roads and Stormwater Department, City of Cape Town.
SANRAL (2007). Drainage Manual. Published by the South African National Roads Agency Limited; PO Box 415, Pretoria, 0001. www.nra.co.za: ISBN 1-86844-328-0.
US Army (2001). HEC-HMS Hydrlogical Modelling System. Users Manual v2.1. www.hec.usace.army.mil .
US Army (2016). HEC-RAS River Analysis System. Users Manual v5.0. www.hec.usace.army.mil .

MAPPING: 1: 50 000 topographical maps 3322 CD and 3422 AB; 1: 10 000 orthomaps 3322CD 19, 20, 24 and 25.

The Floodlines and Report have been prepared by Fraser Consulting Civil Engineering cc with all reasonable skill, care and diligence within the terms of SAACE Form of Agreement for Consulting Civil Engineering Services (2004) and taking account of the resources devoted to it by agreement with the Client. We disclaim any responsibility to the Client and Others in respect of any matters outside the scope of the above. The report/drawing is confidential to the Client and we accept no responsibility of whatsoever nature to the third parties to whom this report/drawing or any part thereof is made known. Any such party relies on the report/drawing at their own risk.

Appendix A. Photographs

A1. Site looking north-west, George Peak on the right of the photograph and is part of the watershed of the catchment.

A2. Site looking North-North-East (NNE), George peak visible towards the left, river valley is on right hand side of photograph.

A3. Site looking north-east, river valley evident in mid-ground

A4. Picture taken looking north from half-way down river valley. Pictures 6 to 9 follow in rotation rightwards

A5. Camfersdrift River looking upstream (NNE). Note deep banks

A6. Camferdrift River looking downstream. Note steep and deep banks.

Appendix B. Key Hydrological and Hydraulic Information

(Extract of information from Drawing AF1098-01-r0)

Notes for Floodline Drawing AF1098-01

1. TABLE OF RAINGAUGES IN AND CLOSE TO CATCHMENT AREA

Ref.	Name	Latitude	Longitude	MAP (mm)	Altitude (m amsl)	Years of Record	One Day Design Rainfalls (mm) for RI (years)					
		(deg) (min)	(deg) (min)				5y	10y	20y	50y	100y	200y
28775W	Witfontein	33 55	22 26	941	546	45	110	139	170	217	258	304
28338W	George	33 57	22 26	911	216	93	101	127	156	199	236	279
USE							104	135	163	208	247	290

Rainfall Information sourced from SANRAL (2009)

2. TABLE OF FLOOD ANALYSIS INFORMATION

Catchment Area	6.8 km^2
Land Usage	Brush/Scrub winter rainfall area, residential, commercial area and parks (eg. van Riebeek Gardens)
Soil Classifications	Hydrological Soil Classification: B/C (Moderate Stormwater Potential)
Time of Concentration	186 minutes (3 hours)
Flood Flow Estimates: (m^3/s)	

Method of Analyses	50 Year RI	100 Year RI
SCS	44 m3/s	57 m3/s
Rational	41 m3/s	48 m3/s
USE	44 m3/s	57 m3/s

3. TABLE OF MANNING'S n VALUES FOR THE RIVER AND FLOODPLAIN.

Position in Floodplain:	Left hand bank	Watercourse	Right hand bank
	0.175	0.175	0.175

4. Consideration from the City of Cape Town Floodplain and River Management Policy (2009):

   a. It is far more cost effective in the long term to develop in areas where the threat of flooding is infrequent and the severity of flooding is minimal as opposed to the retrospective implementation of flood mitigation works which would generally be very costly and sometimes prone to catastrophic failure when flood flows exceed the design flow of infrastructure.

   b. In determining catchment runoff the foreseeable ultimate development scenario for the catchment must be used.

   c. The flood levels must be based upon theoretical energy levels as opposed to water surface levels.

   d. Any structure built within the floodplain should be designed to withstand the forces and effects of flowing floodwaters, including scour of foundations, debris forces and buoyancy forces.

5. Note that the 100 year flood line is likely to be exceeded during the infinite course of time. We recommend that infrastructure close to the floodlines have raised floor levels to assist with the possibilities of climate change.

6. The position of the floodline on the ground should be based upon elevation data rather than the approximate position indicated on the drawing.

Appendix C. Results

C1. RESULTS OF 50 YEAR RI RAINFALLS

River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev*	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude #
	(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	Channel
70	44	210.2	211.68		211.69	0.006513	0.56	98.23	104.8	0.15
60	44	209.73	211.27		211.28	0.010365	0.62	76.67	78.98	0.19
50	44	209.25	210.63		210.66	0.01553	0.79	59.71	57.92	0.23
40	44	208.52	209.82		209.84	0.017201	0.77	63.02	71.55	0.24
30	44	207.76	209.12		209.14	0.011677	0.72	75.43	85.89	0.21
20	44	207.2	208.6		208.62	0.009316	0.65	77.77	78.88	0.18
10	44	206.49	208.08	207.48	208.1	0.012012	0.74	74.38	86.7	0.21

* The Energy Grade (EG) elevation determines the floodline

C2. RESULTS OF 100 YEAR RI RAINFALLS

River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev*	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude #
	(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	Channel
70	57	210.2	211.85		211.86	0.006368	0.6	116.54	106.57	0.16
60	57	209.73	211.45		211.47	0.010153	0.68	91.03	81.2	0.19
50	57	209.25	210.8		210.84	0.016039	0.88	69.99	59.72	0.24
40	57	208.52	209.98		210.01	0.017302	0.85	74.6	73.92	0.25
30	57	207.76	209.29		209.32	0.011257	0.77	90.4	87.99	0.21
20	57	207.2	208.78		208.8	0.009364	0.71	92.05	80.76	0.19
10	57	206.49	208.25	207.57	208.28	0.012009	0.81	91.31	106.48	0.21

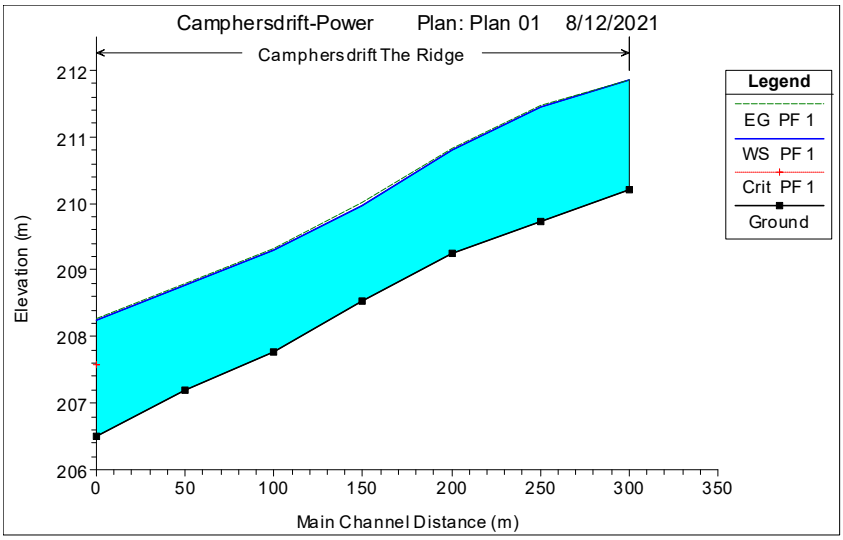
* The Energy Grade (EG) elevation determines the floodline

LEGEND:

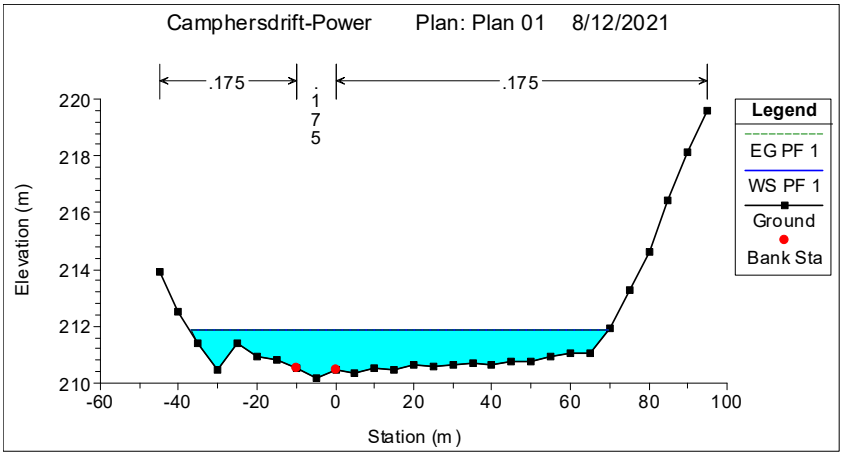
River Sta	Position where a cross-section is taken over the river and adjacent floodplains
Q Total	Flow rate in cubic metres per second
Min Ch. El.	Minimum channel elevation
W.S. Elev.	Ware Surface Elevation
Crit. W.S.	Critical Water Surface
E.G. Elevation	Energy Grade Elevation
E.G. Slope	Energy Grade Slope
Vel. Chnl	Maximum velocity in channel
Froude #	Froude number (determines if flow is downstream controlled (<1) or upstream controlled (>1)

Appendix D. Water Surface Profiles

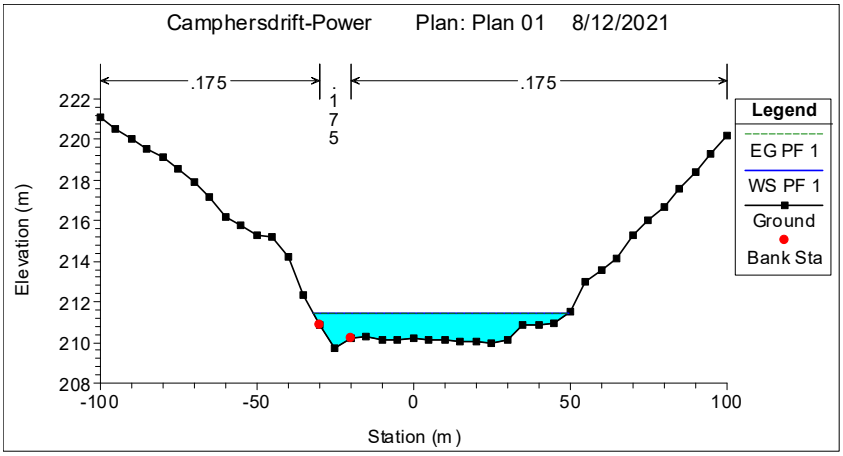
Notes.
1. All profiles are for the 100 year RI Rainfall / Floodline Events.
2. All Cross-sections (D2 to D8) are looking downstream (south).
3. The location of the proposed development is on top of the right hand bank (rhs of cross-section)
3. Location of River Stations (cross-sections) are shown on Drawing AF1098-01-r0.



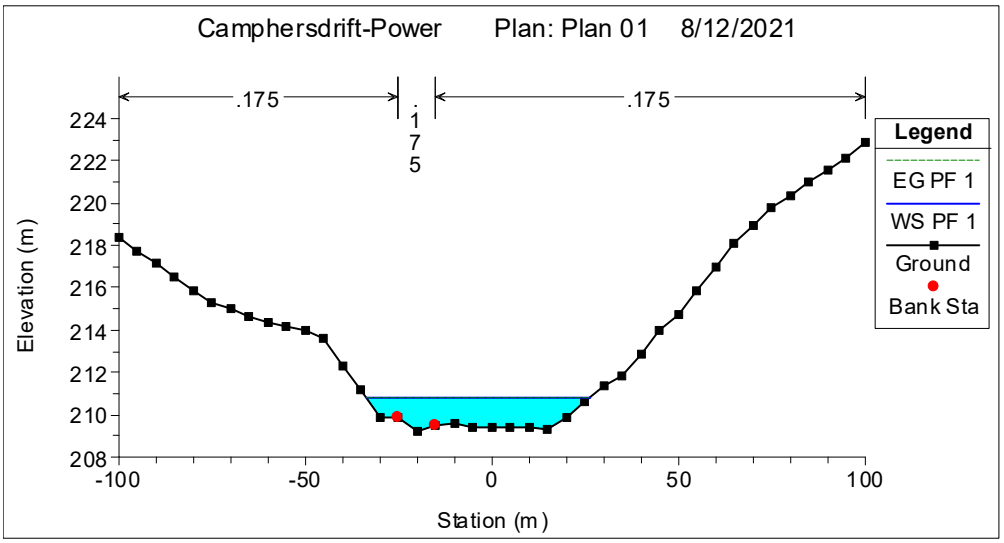
D1. Long-section profile indicating flow depths of less than 2m in depth.



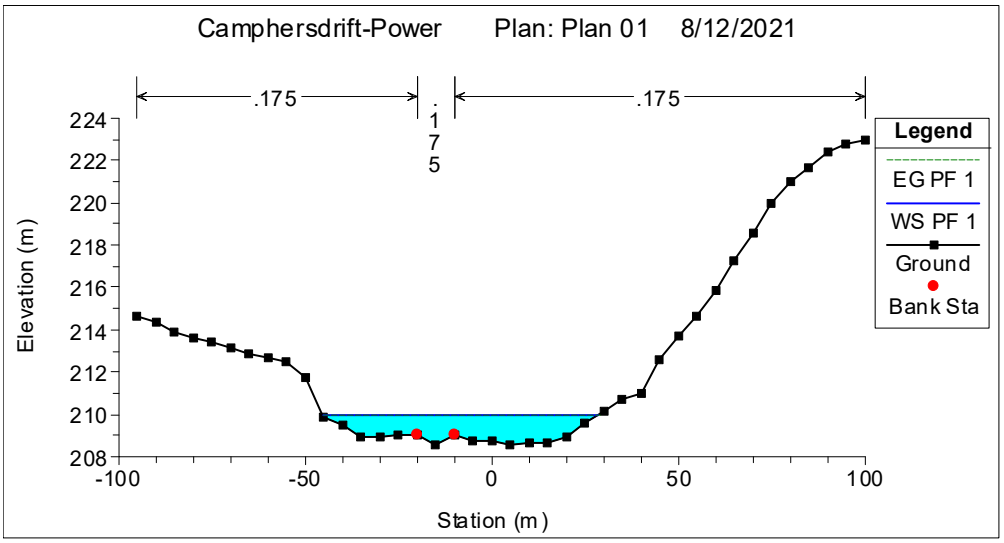
D2. River bed and water surface cross-sections at River Station (RS) 70 (most upstream)



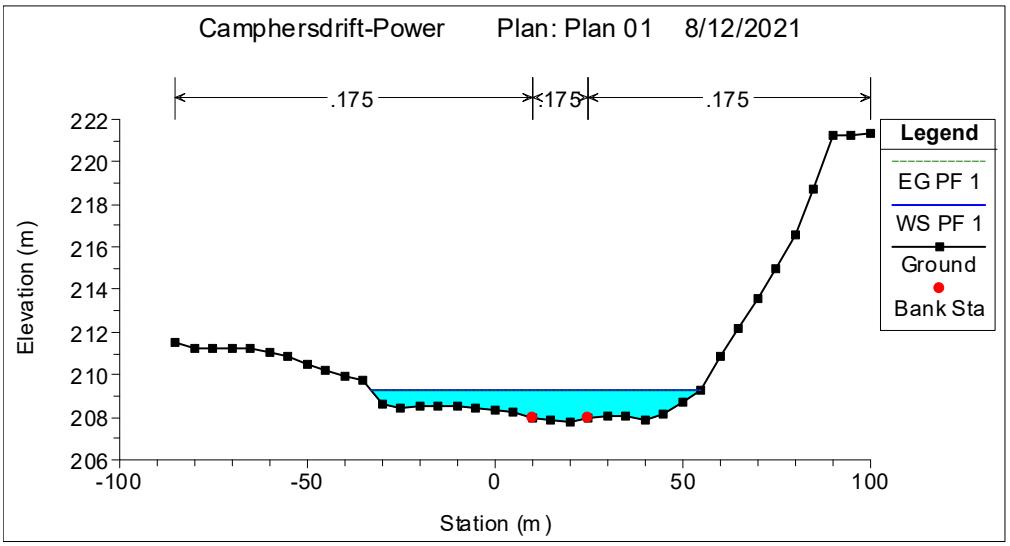
D3. River bed and water surface cross-sections at River Station (RS) 60



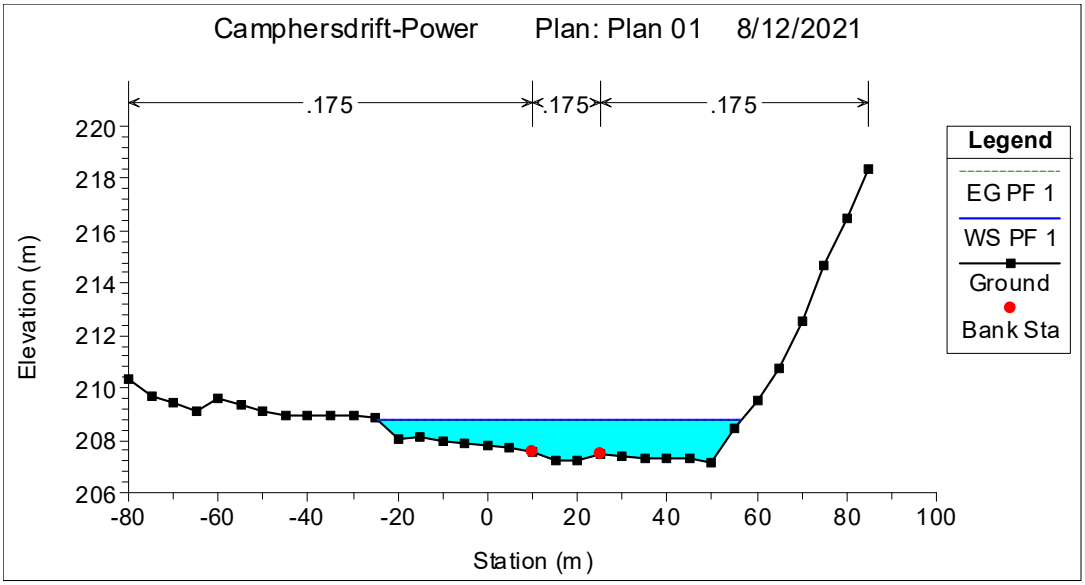
D4. River bed and water surface cross-sections at River Station (RS) 50



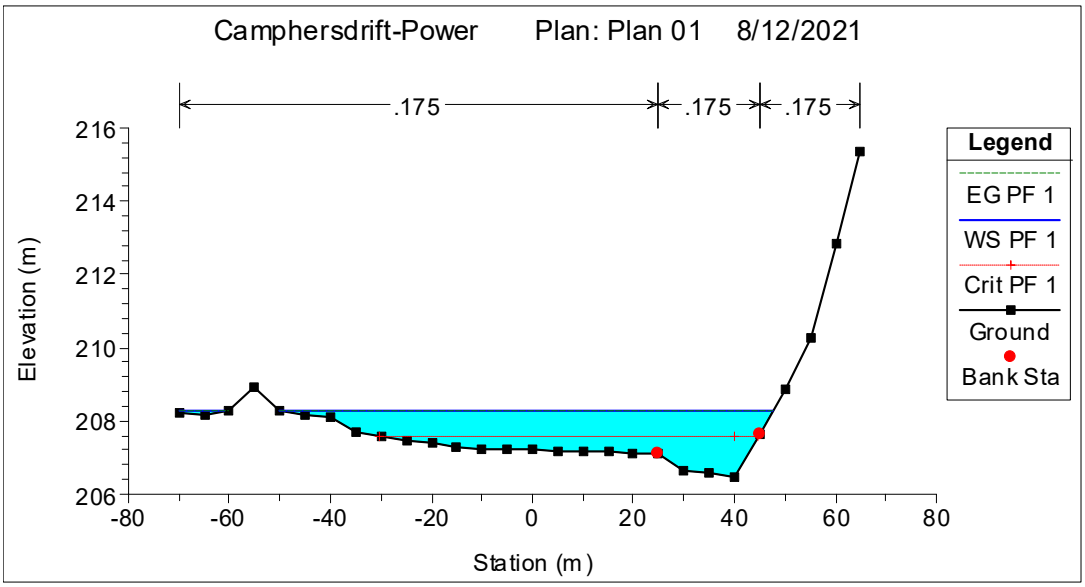
D5. River bed and water surface cross-sections at River Station (RS) 40



D6. River bed and water surface cross-sections at River Station (RS) 30



D7. River bed and water surface cross-sections at River Station (RS) 20



D8. River bed and water surface cross-sections at River Station (RS) 10 (most downstream). Note the berm at left hand bank (opposite proposed development) station -50m which was presumably built to control flooding.