

Figure E.29 Peak levels at cross section CS31

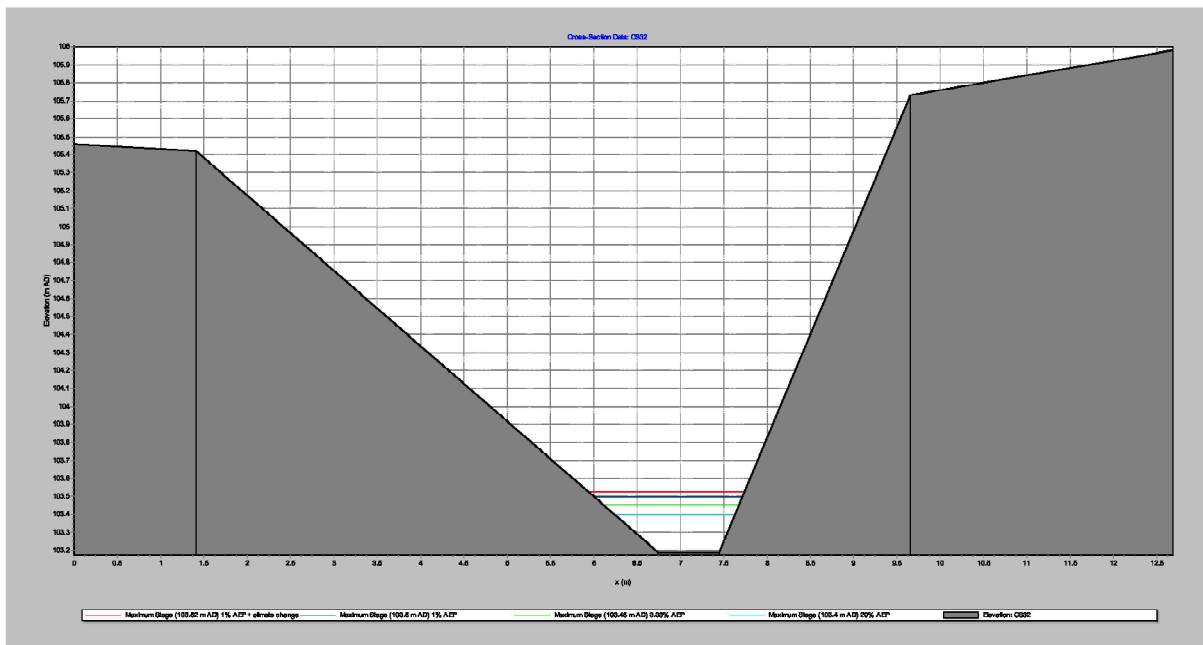


Figure E.30 Peak levels at cross section CS32

Land at Chipping Lane, Longridge  
Hydraulic Assessment

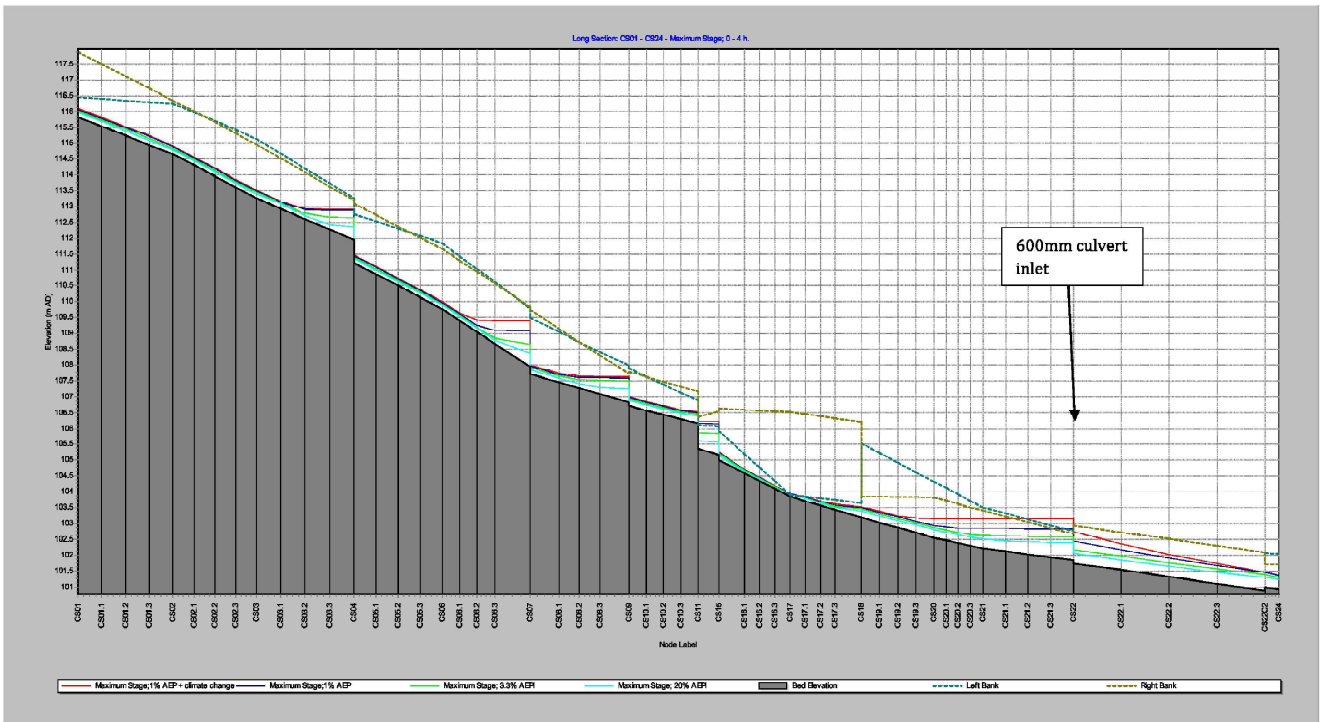


Figure E.15 Long section CS01 to CS24

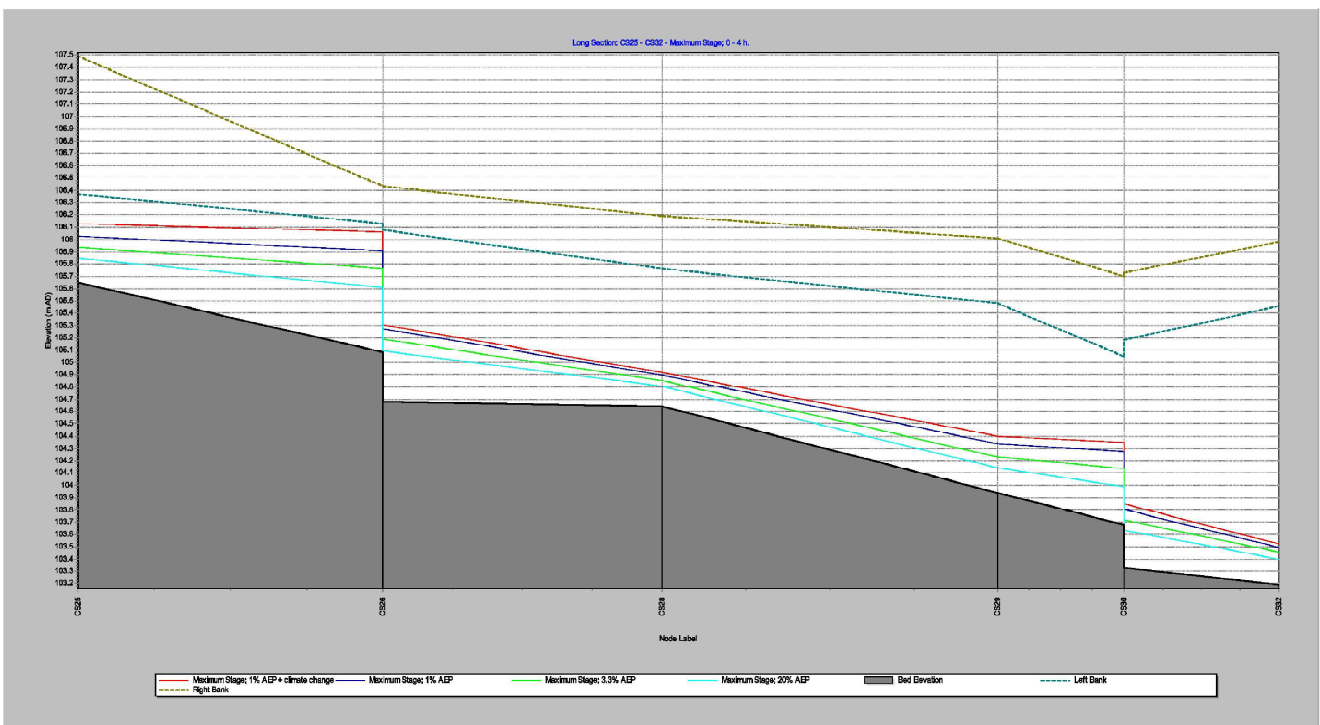


Figure E.15 Long section CS25 to CS32

Land at Chipping Lane, Longridge  
Hydraulic Assessment



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**APPENDIX F: ISIS OUTPUTS: PROPOSED SCENARIO SCHEMATIC,  
LONG-SECTION AND CROSS-SECTIONS**

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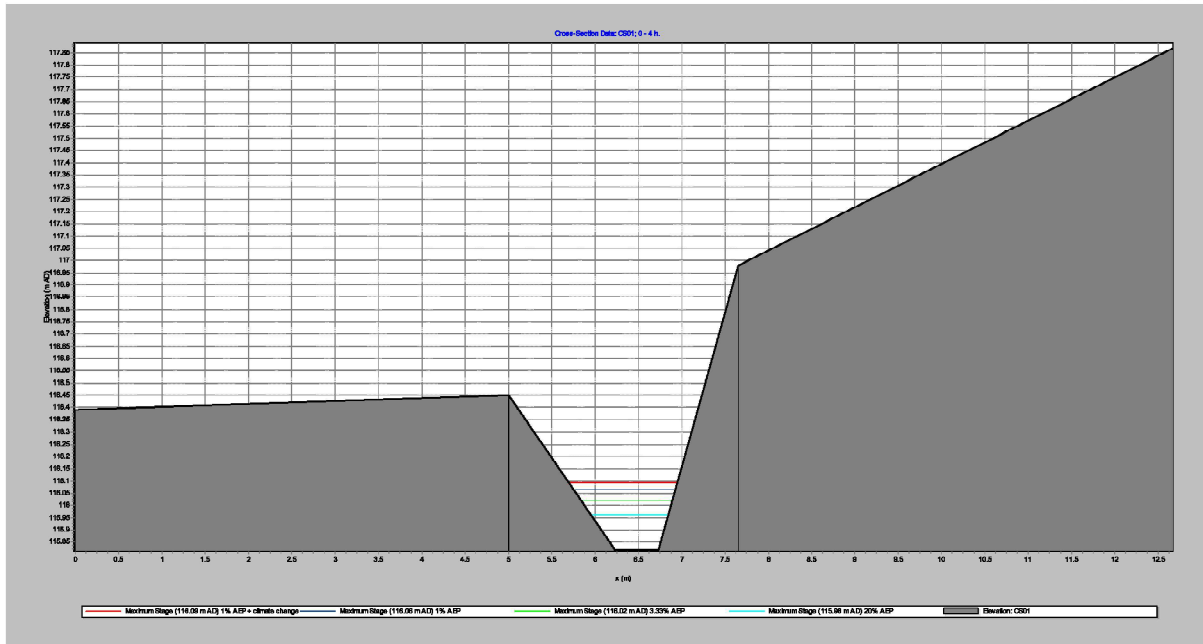


Figure F.1 Peak levels at cross section CS01

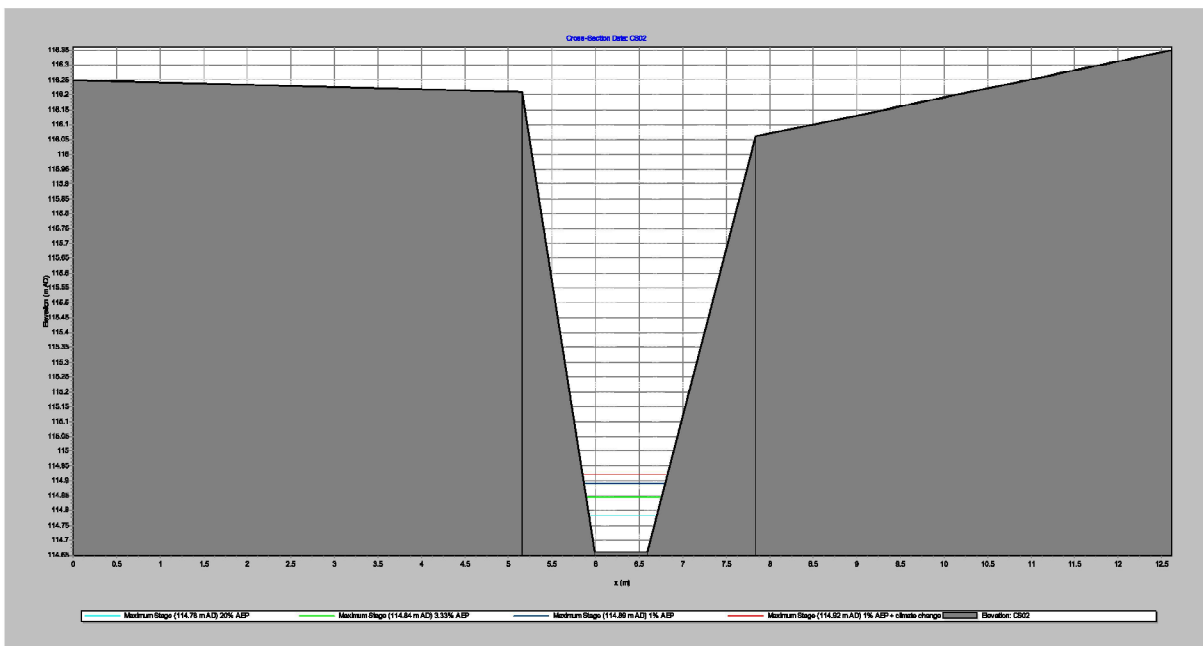


Figure F.2 Peak levels at cross section CS02

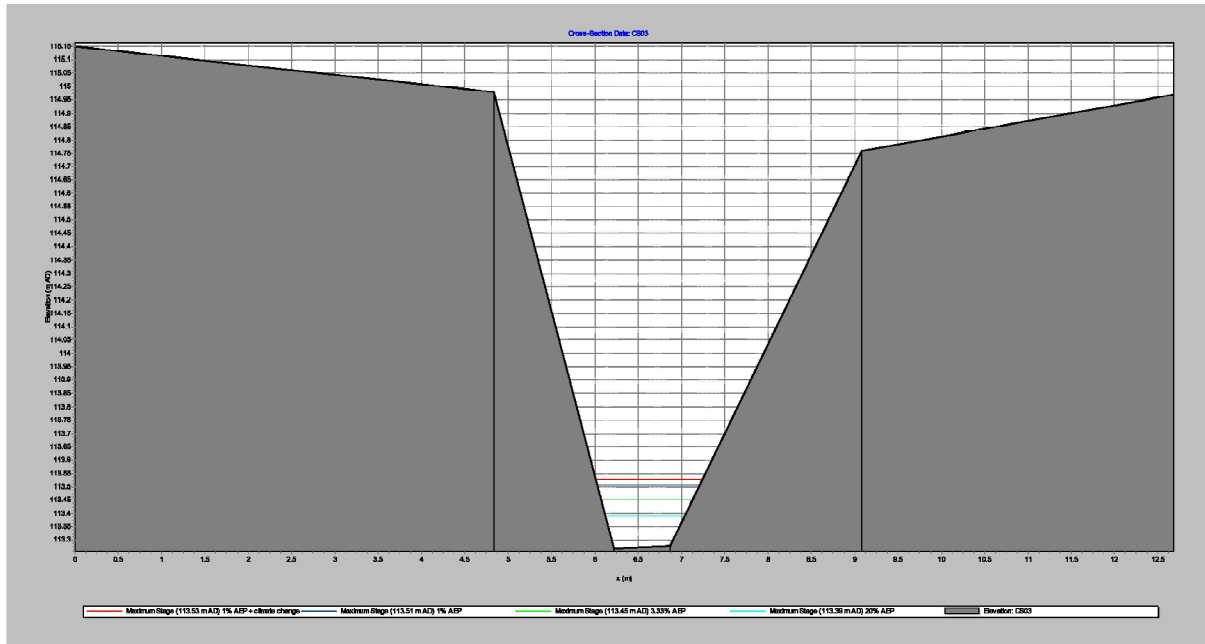


Figure F.3 Peak levels at cross section CS03

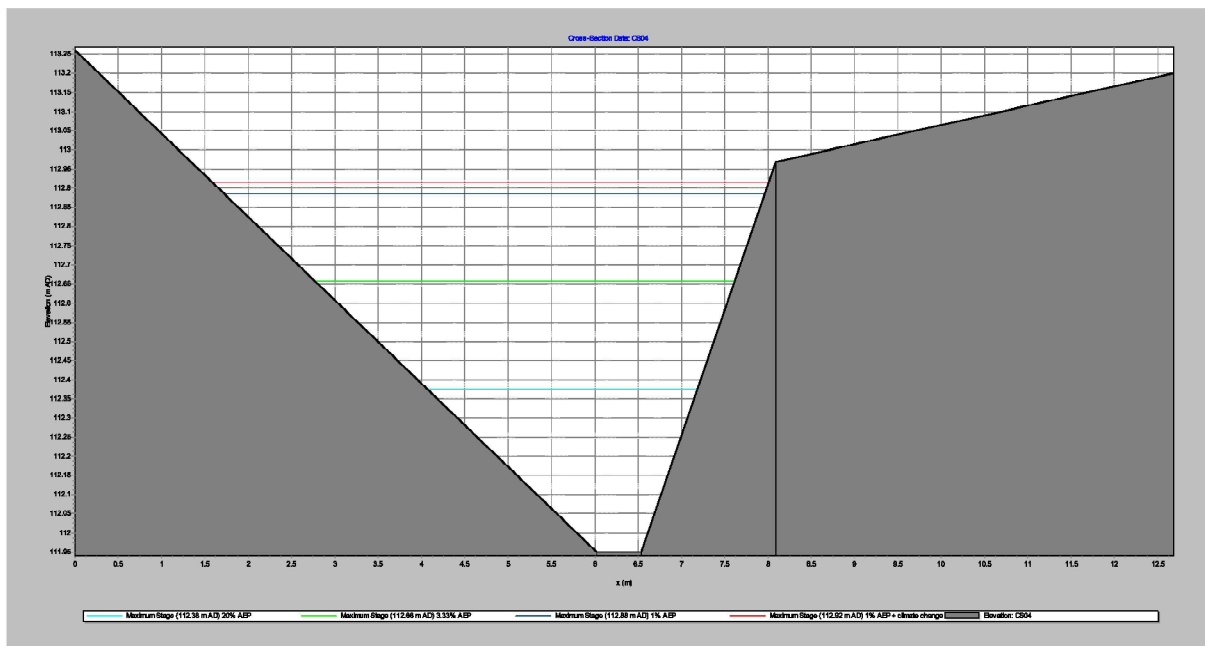


Figure F.4 Peak levels at cross section CS04



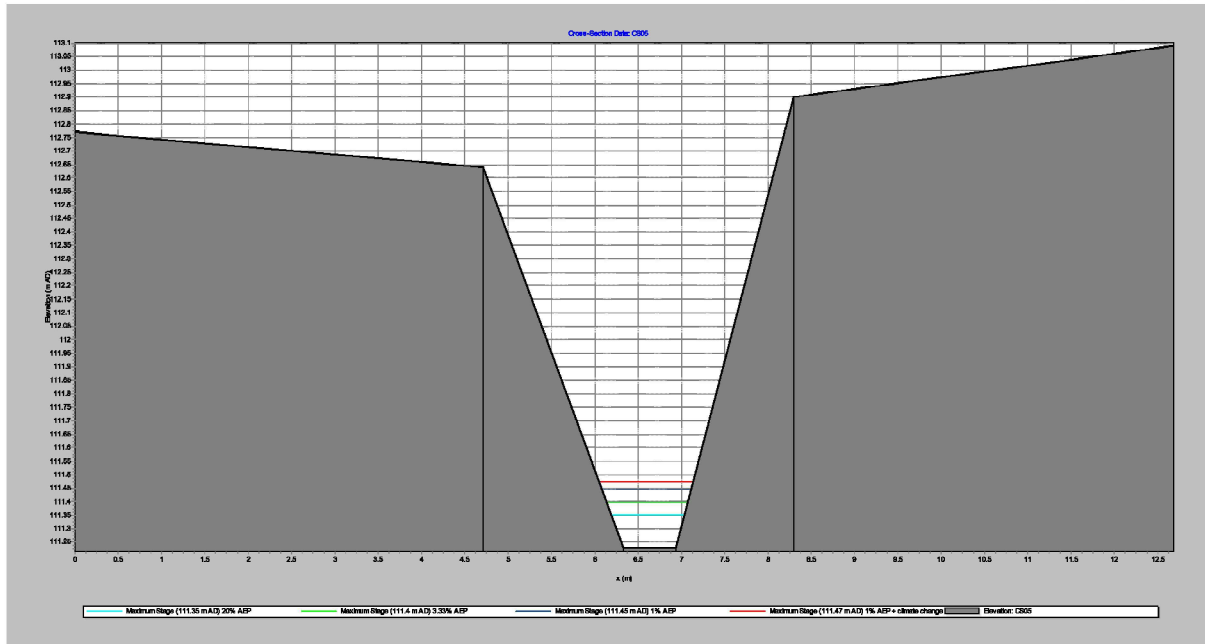


Figure F.5 Peak levels at cross section CS05

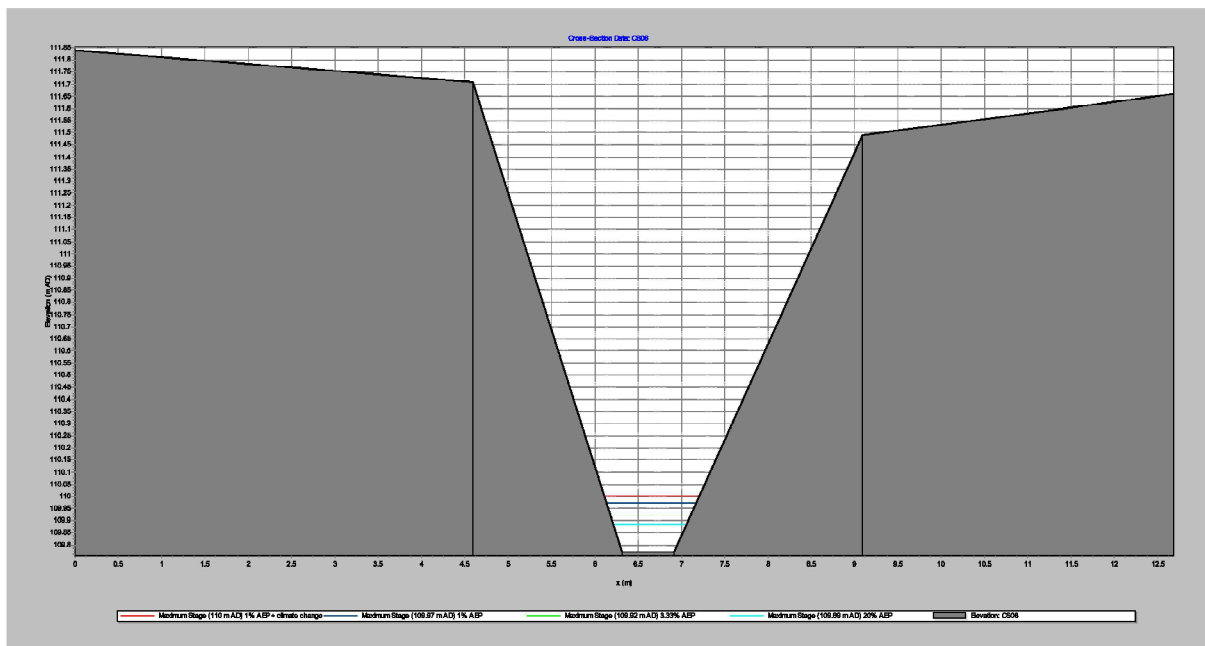


Figure F.6 Peak levels at cross section CS06

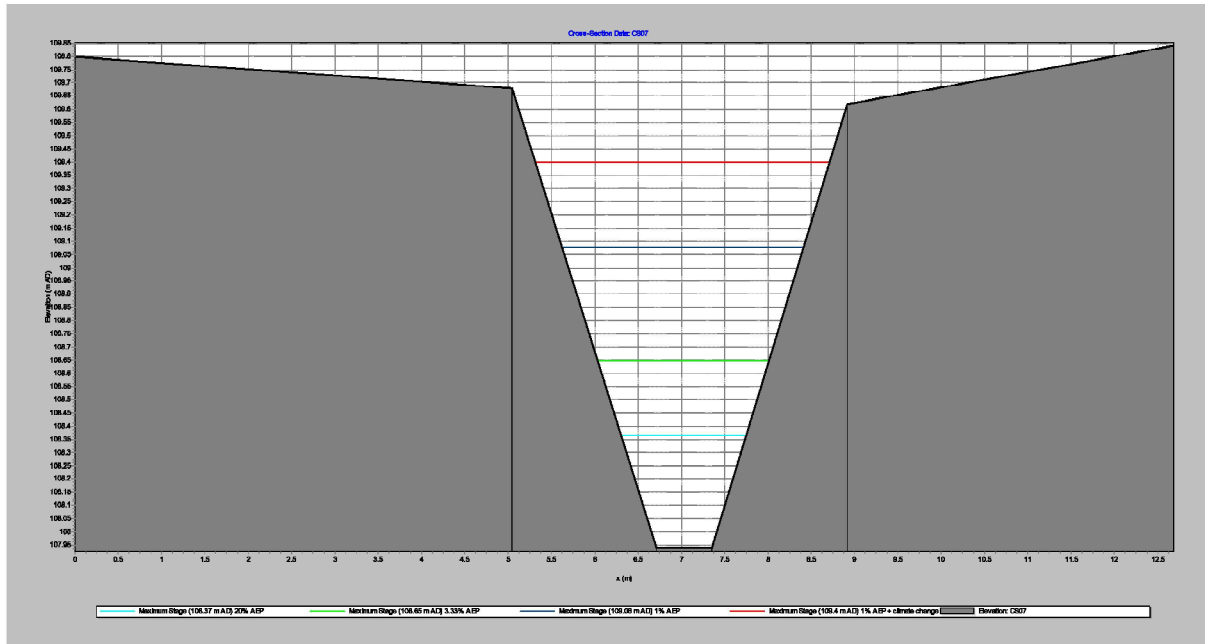


Figure F.7 Peak levels at cross section CS07

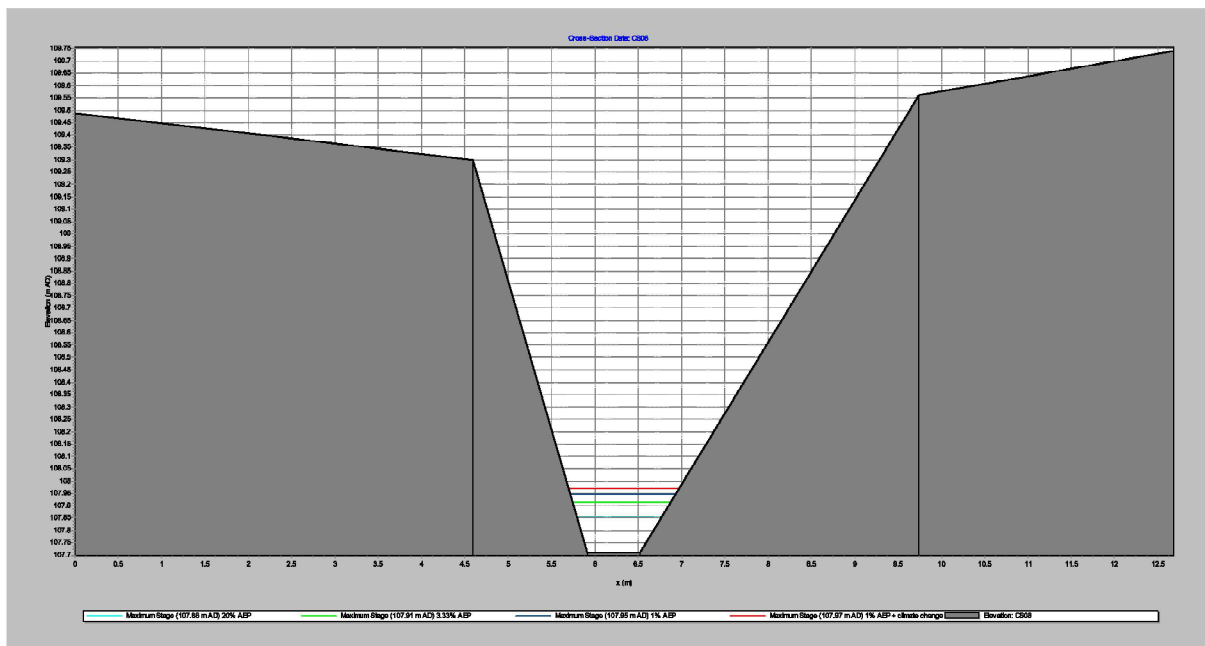


Figure F.8 Peak levels at cross section CS08

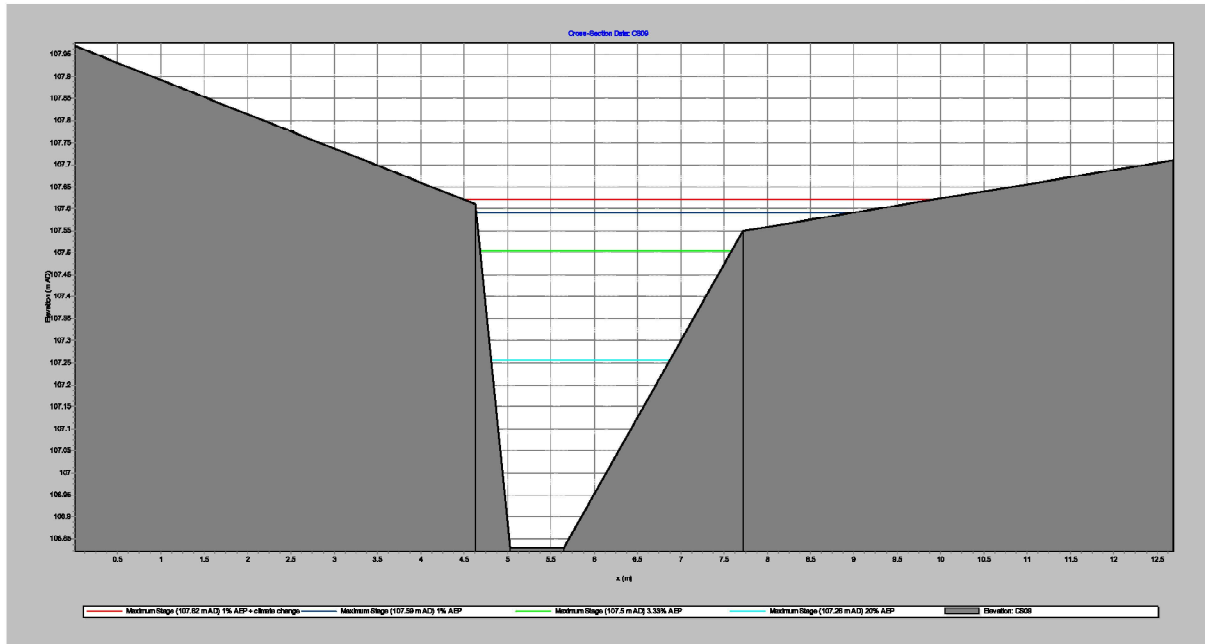


Figure F.9 Peak levels at cross section CS09

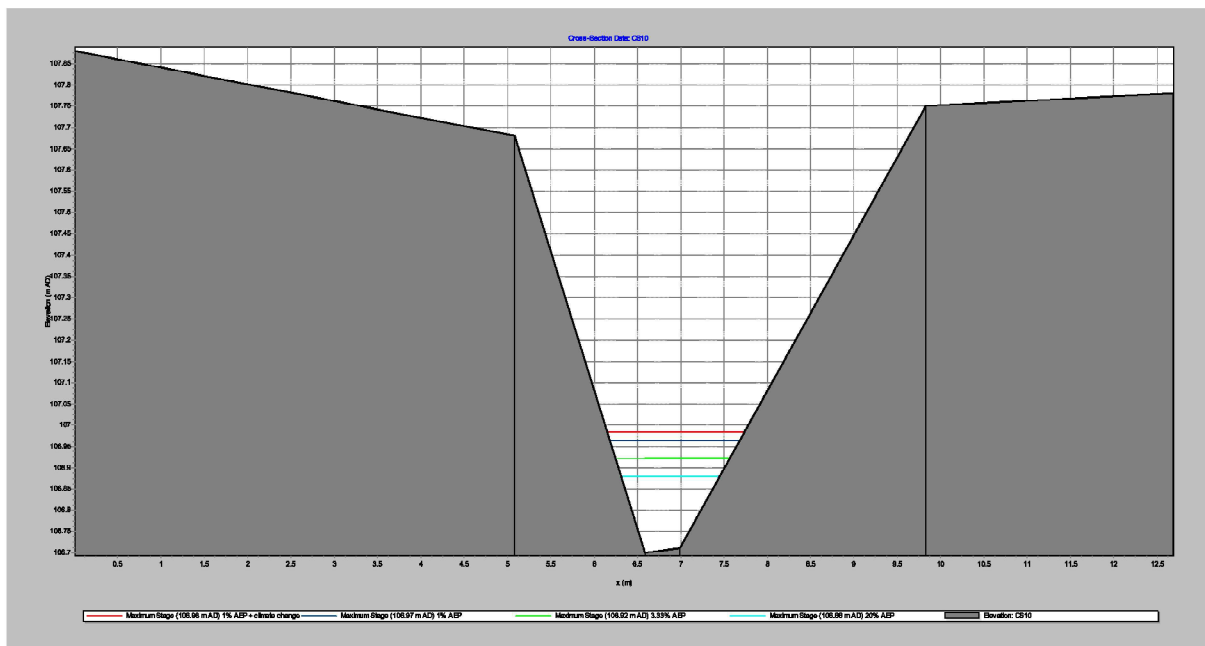


Figure F.10 Peak levels at cross section CS101

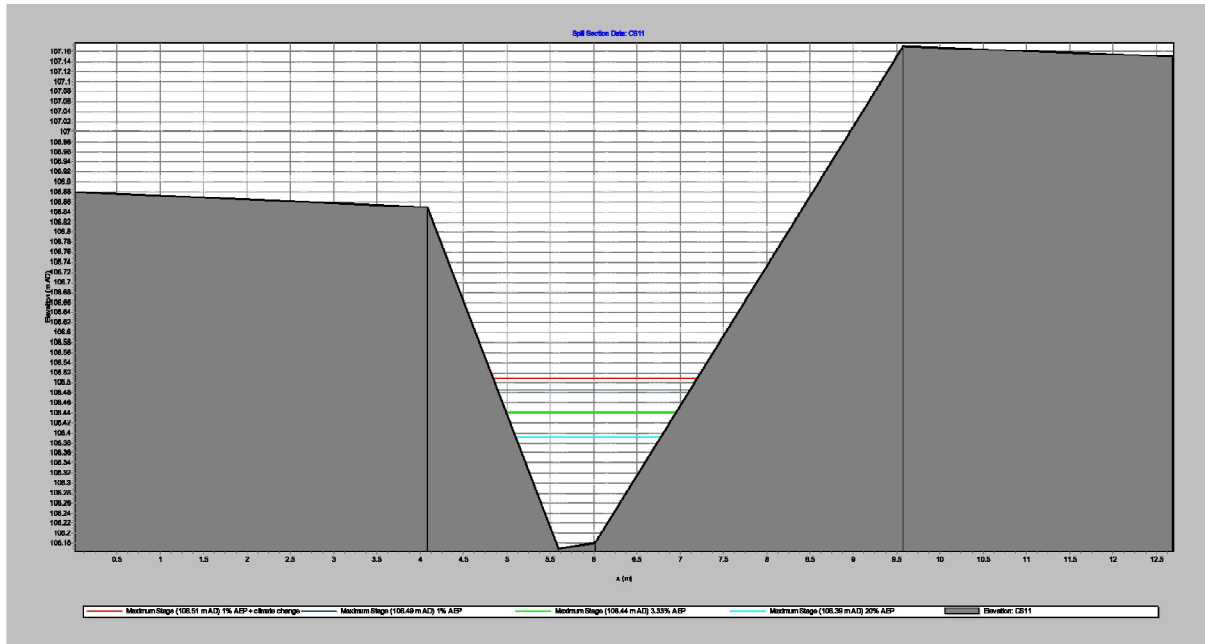


Figure F.11 Peak levels at cross section CS11

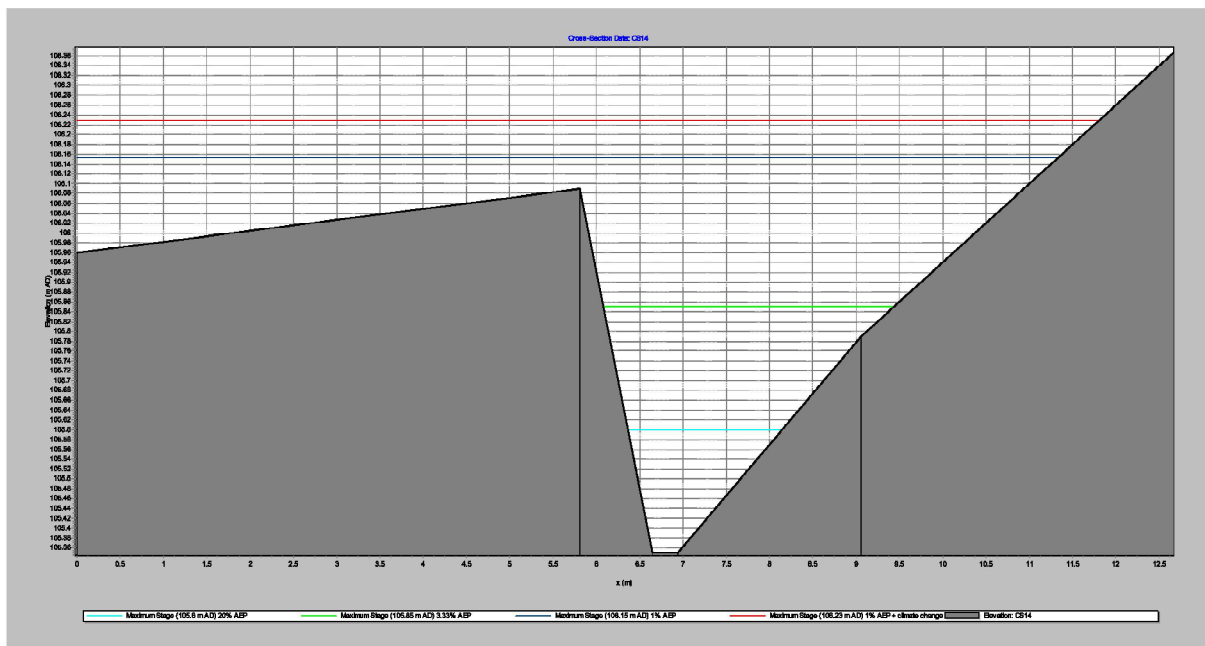


Figure F.12 Peak levels at cross section CS14

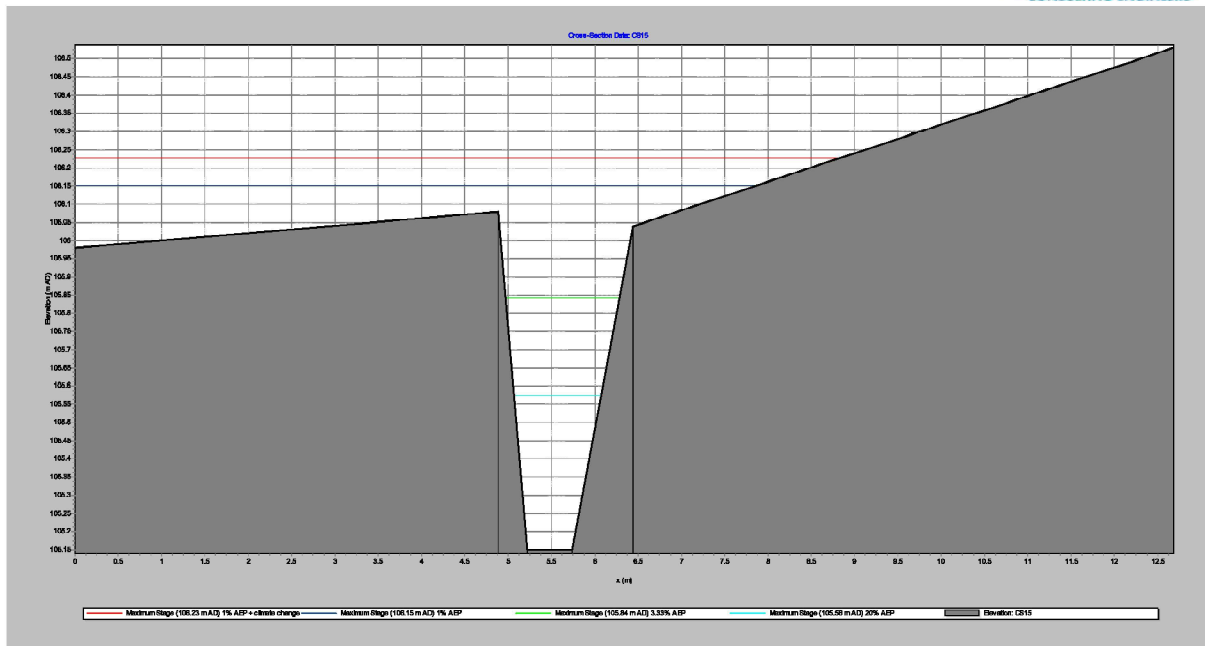


Figure F.13 Peak levels at cross section CS15

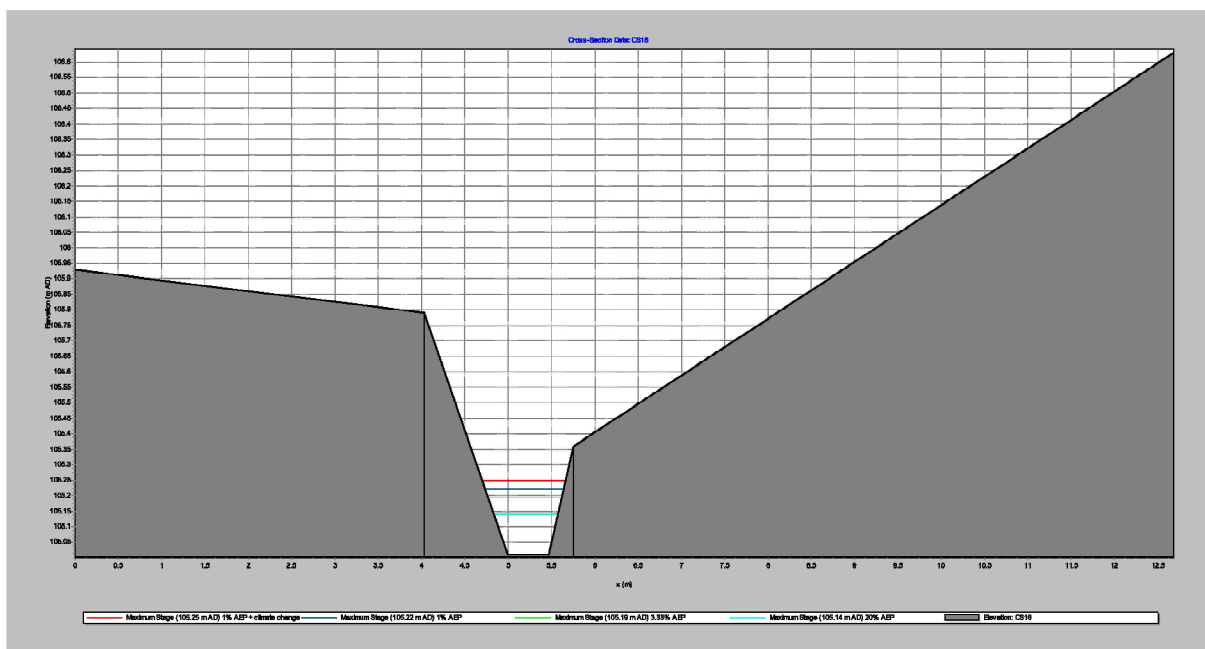


Figure F.14 Peak levels at cross section CS16

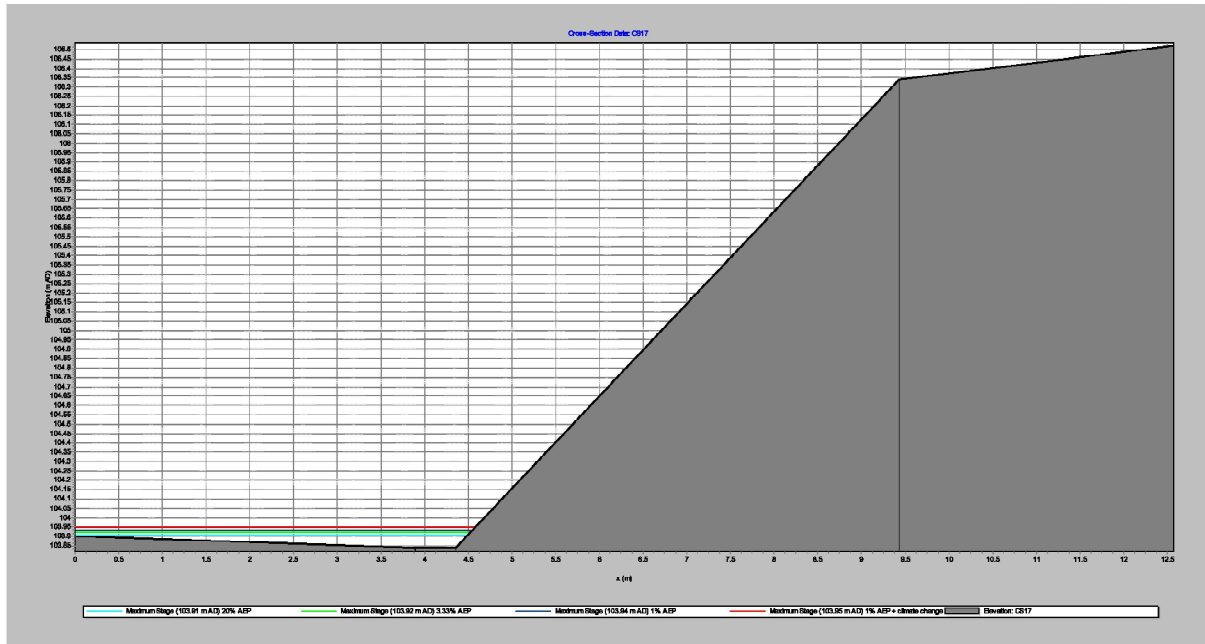


Figure F.15 Peak levels at cross section CS17

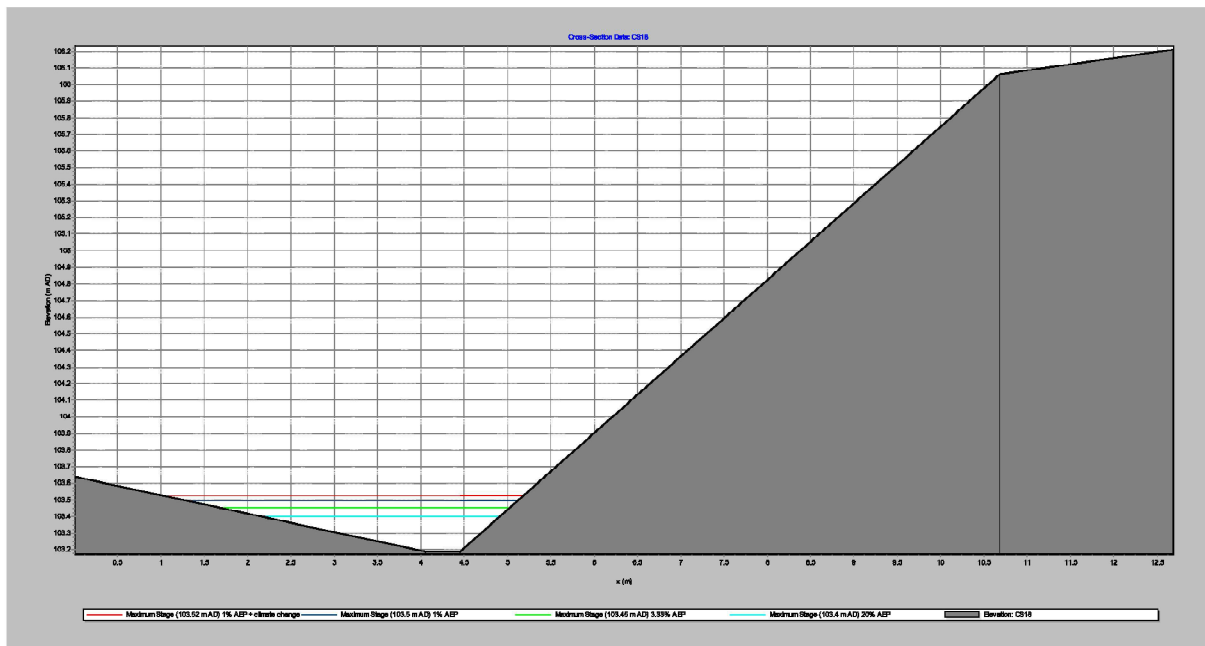


Figure F.16 Peak levels at cross section CS18

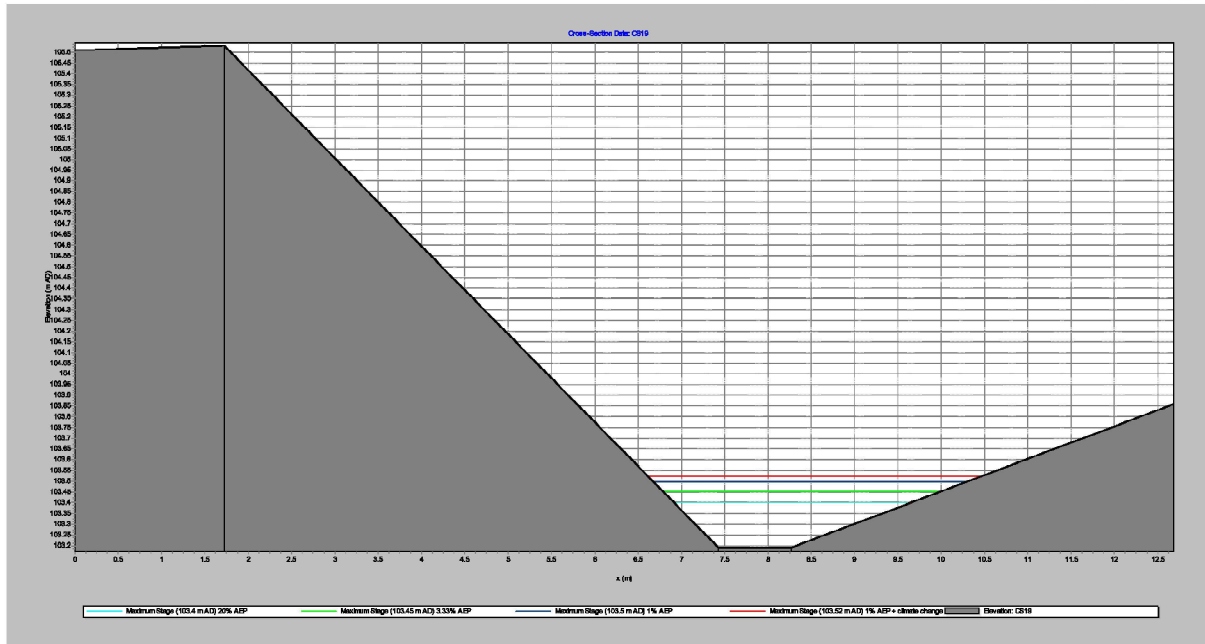


Figure F.17 Peak levels at cross section CS19

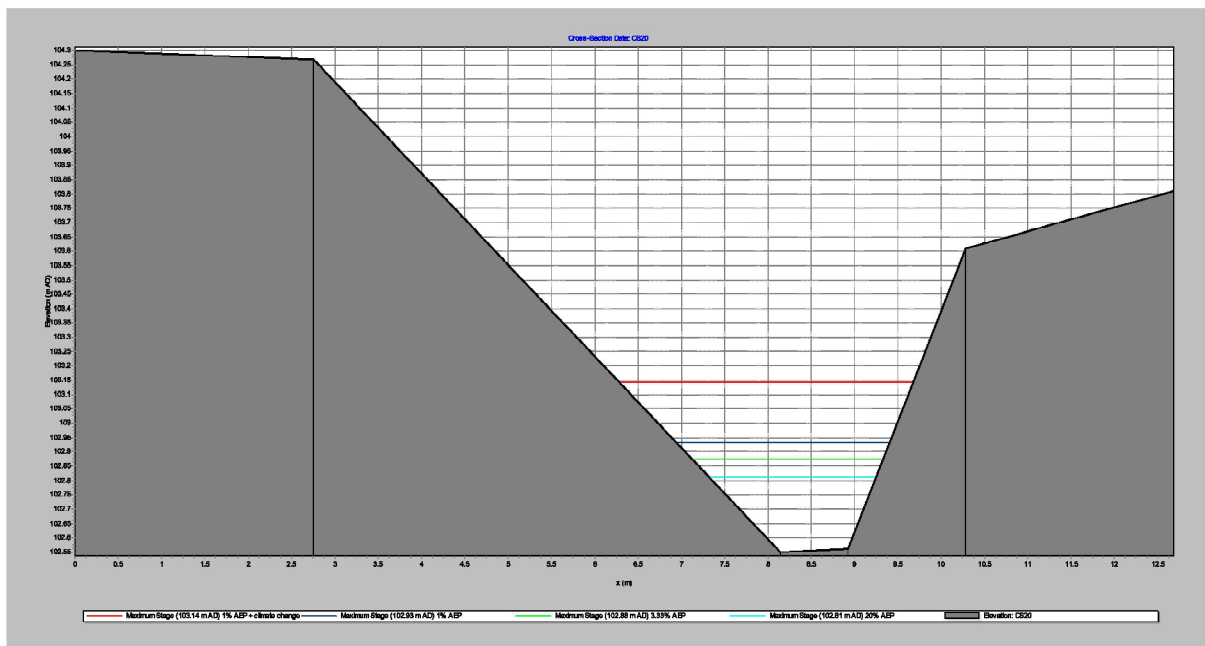


Figure F.18 Peak levels at cross section CS20

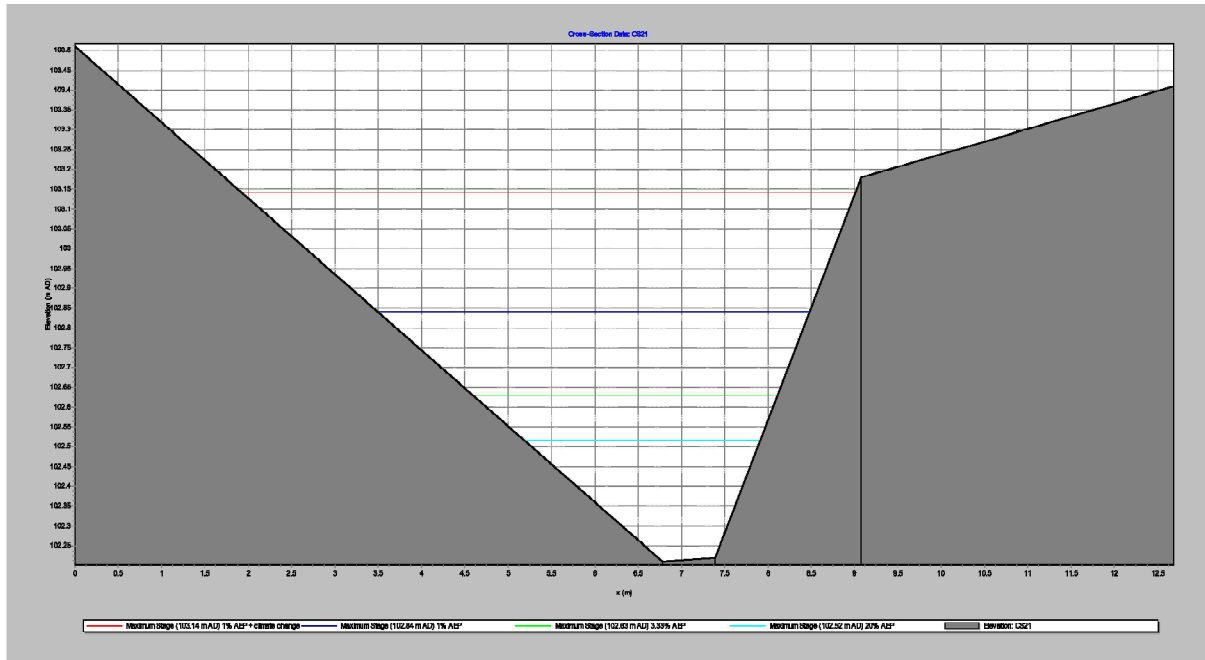


Figure F.19 Peak levels at cross section CS21

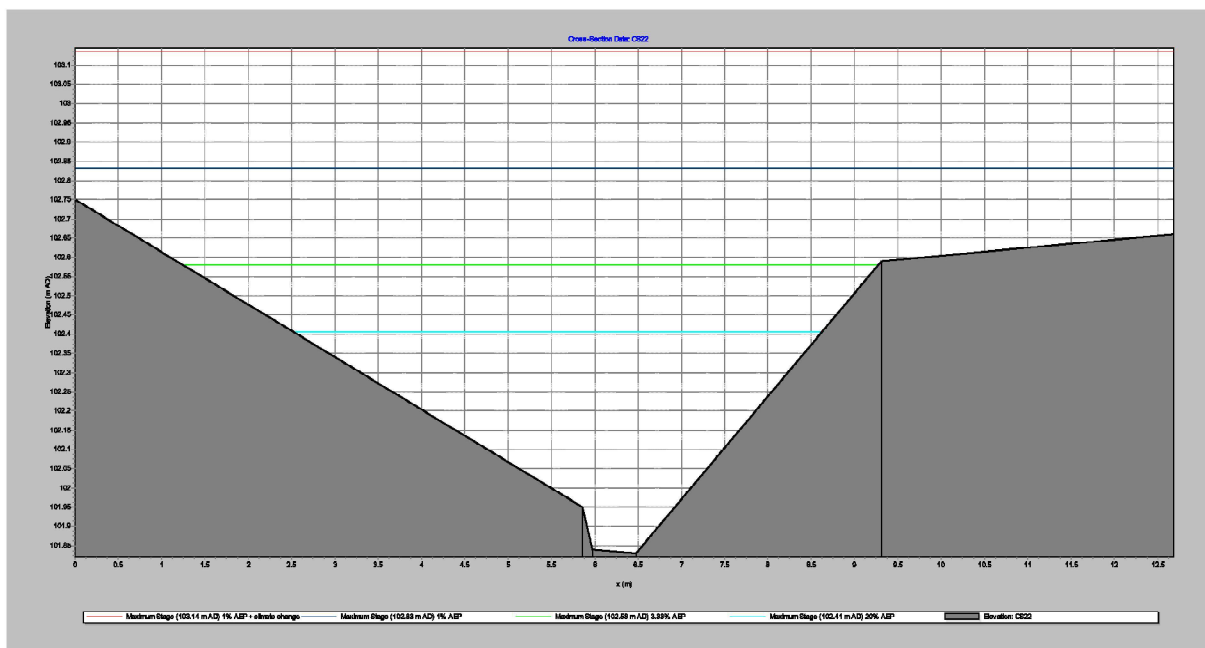


Figure F.20 Peak levels at cross section CS22



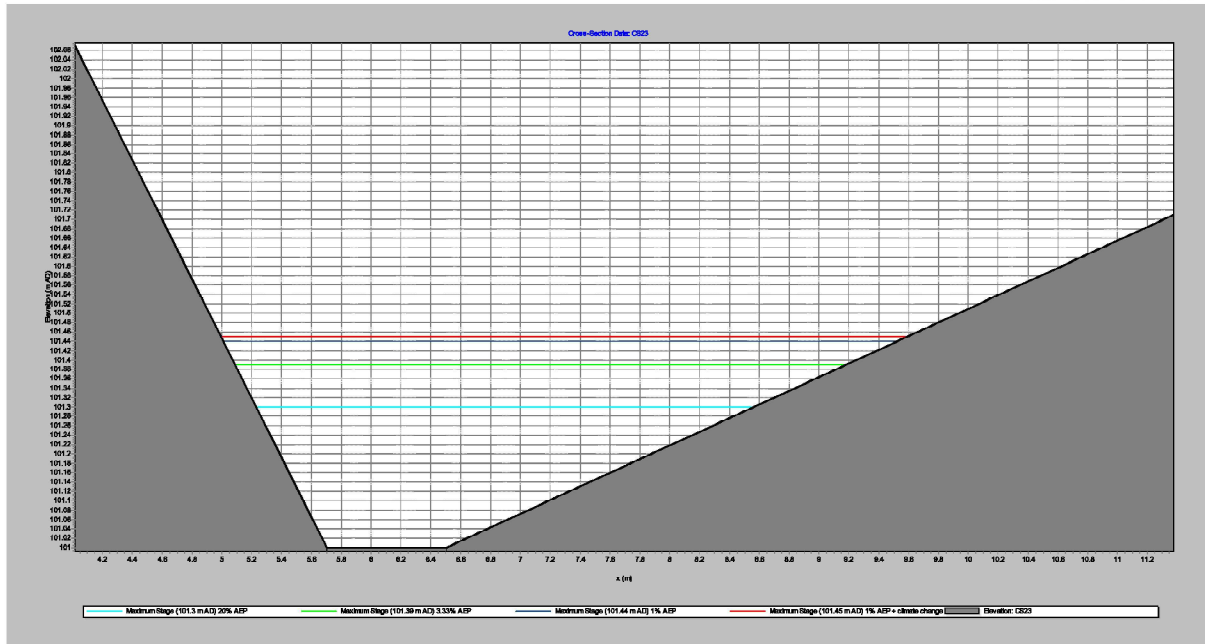


Figure F.21 Peak levels at cross section CS23

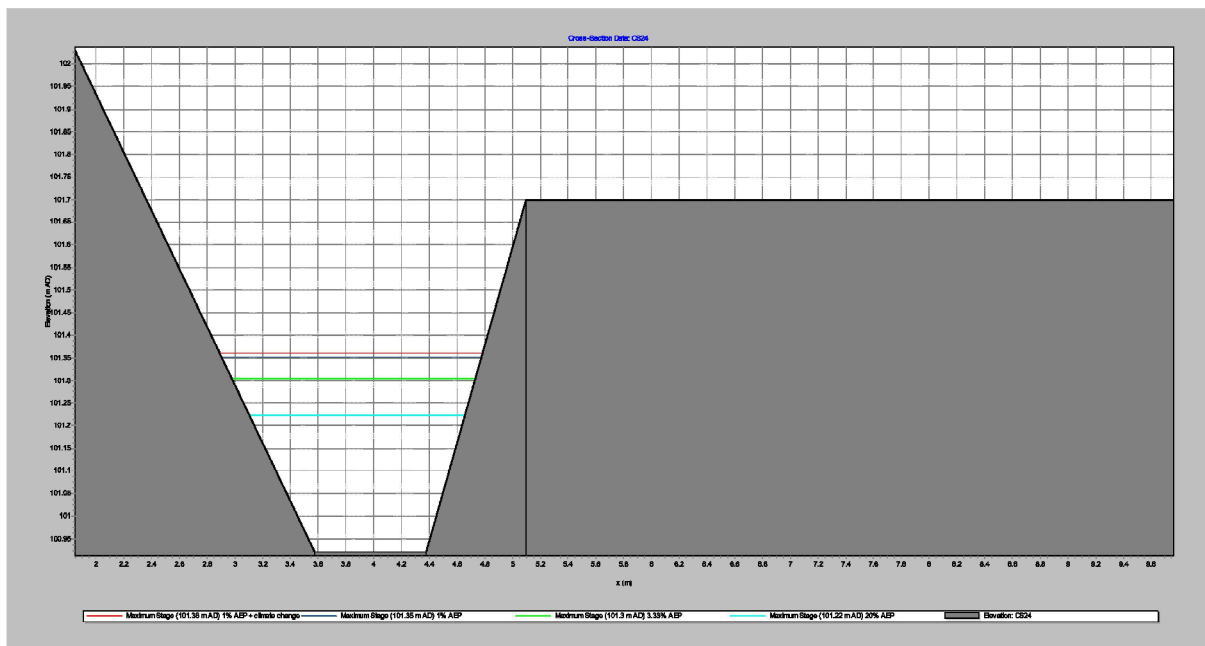


Figure F.22 Peak levels at cross section CS24

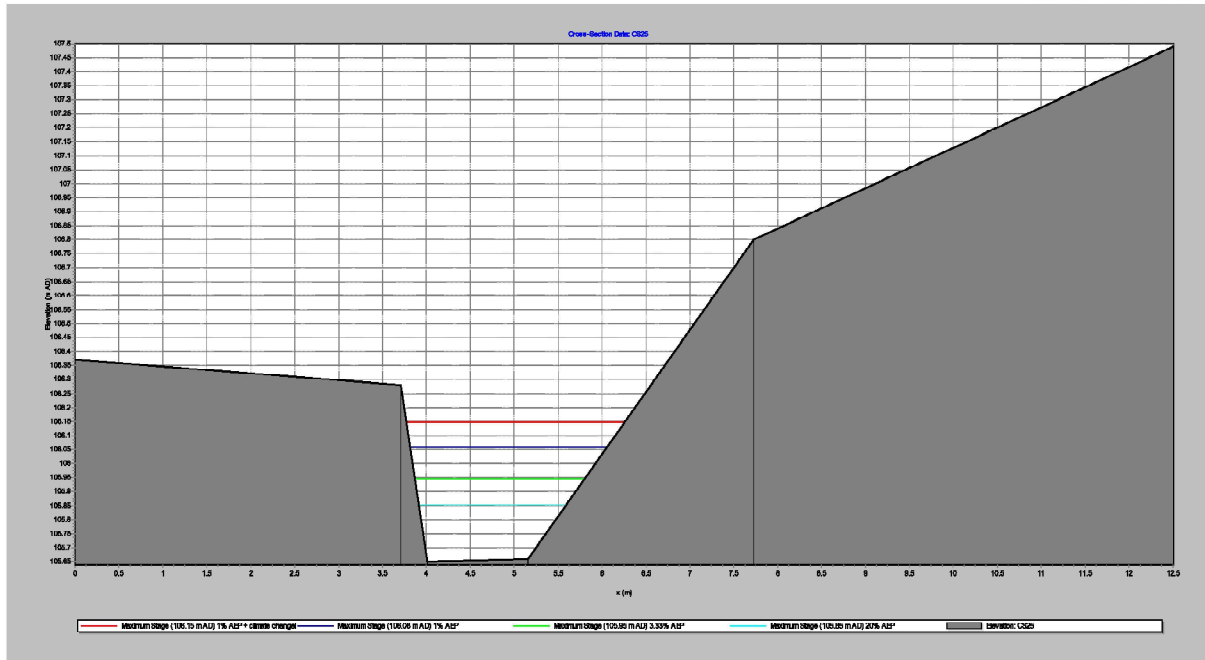


Figure F.23 Peak levels at cross section CS25

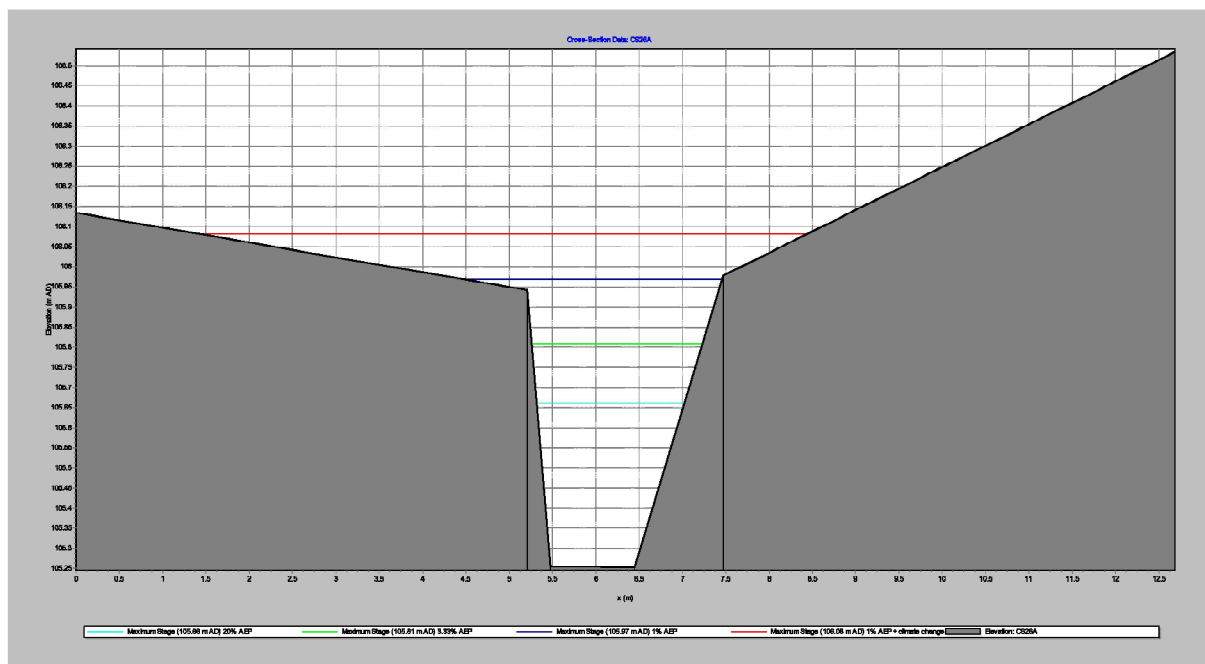


Figure F.24 Peak levels at cross section CS26

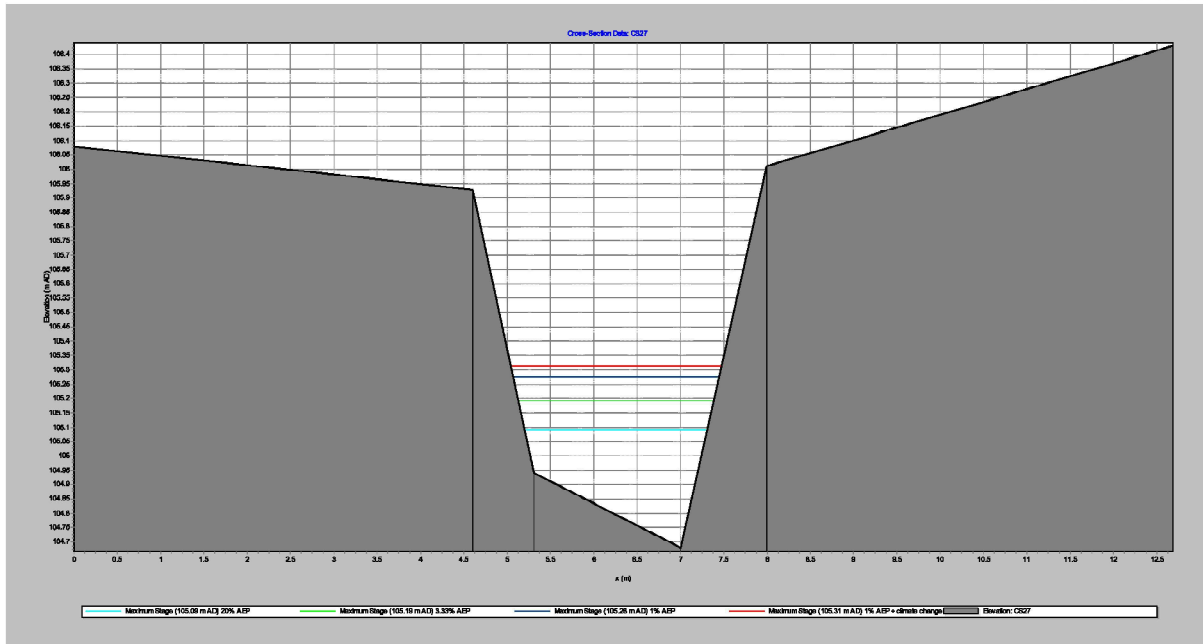


Figure F.25 Peak levels at cross section CS27

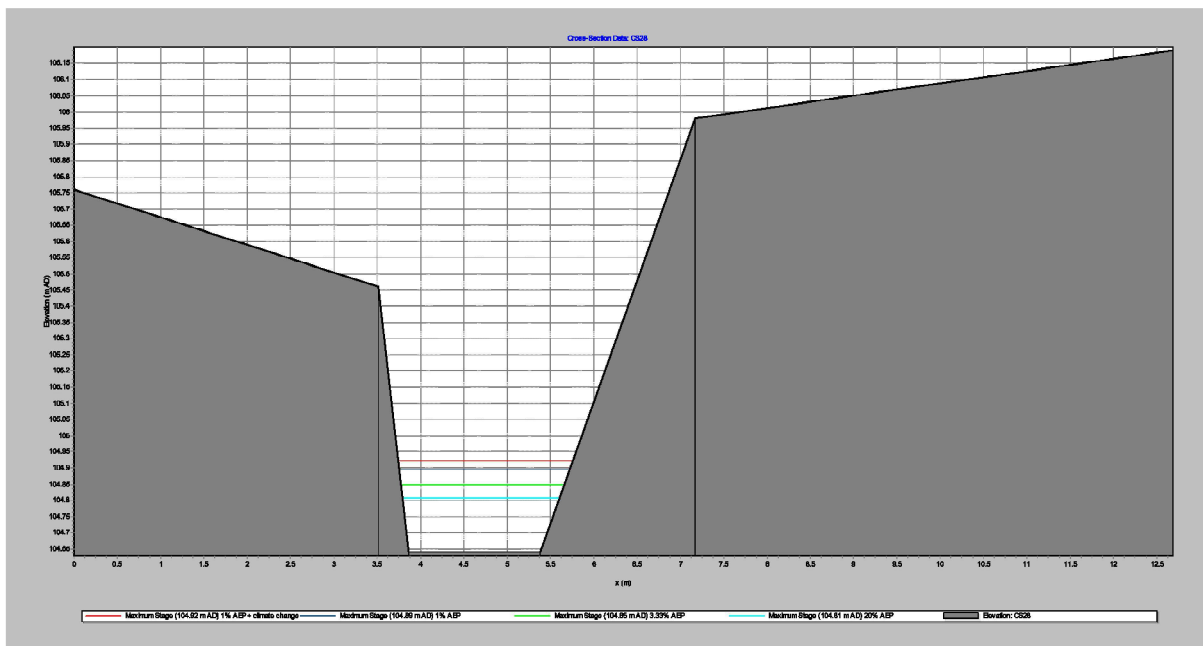


Figure F.26 Peak levels at cross section CS28

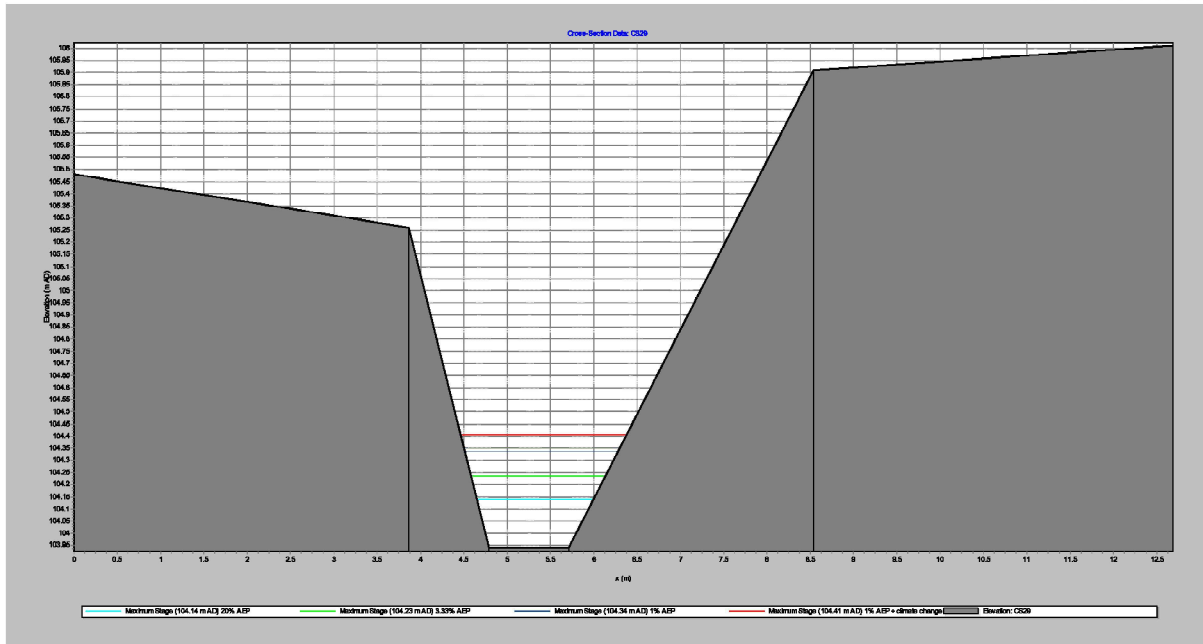


Figure F.27 Peak levels at cross section CS29

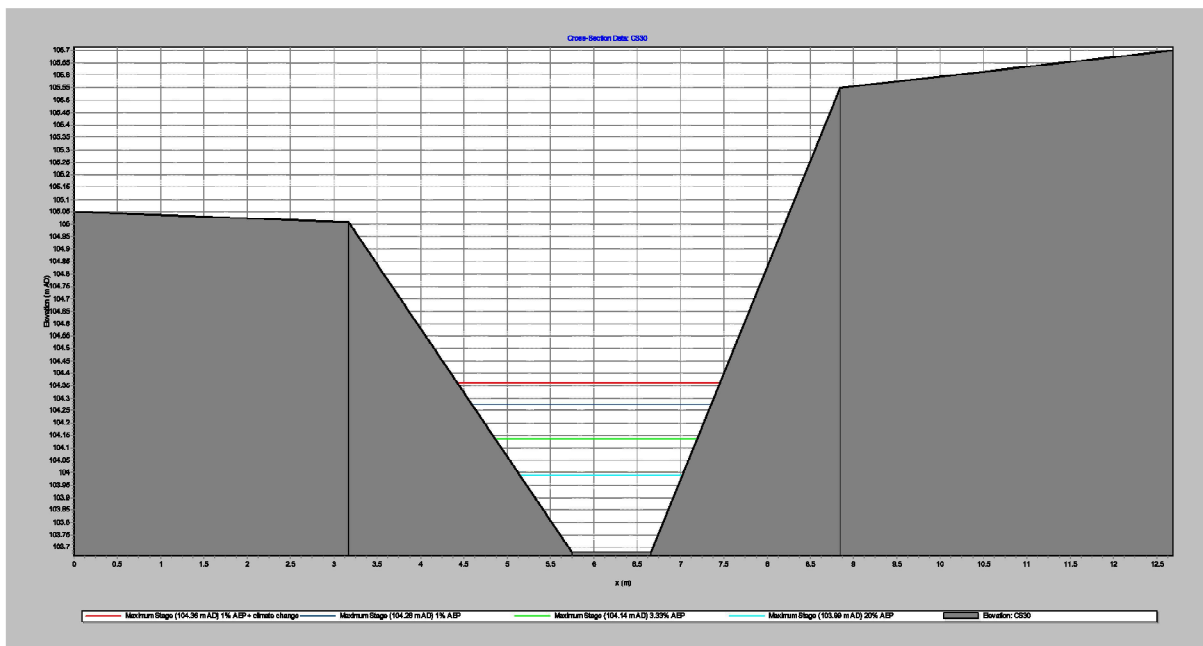


Figure F.28 Peak levels at cross section CS30

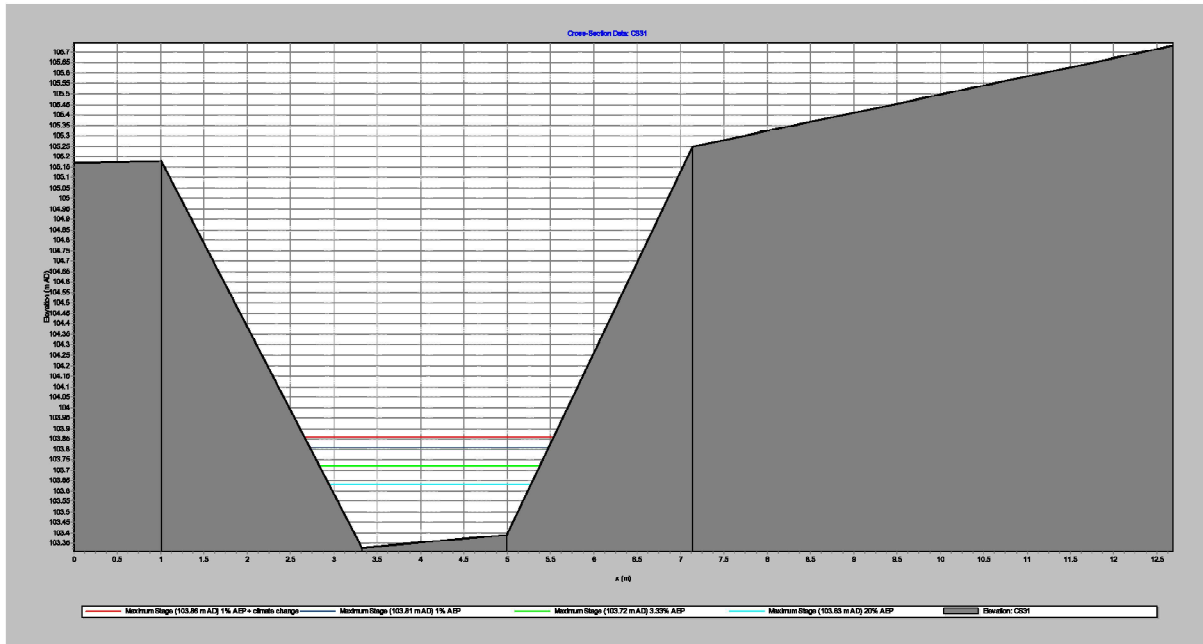


Figure F.29 Peak levels at cross section CS31

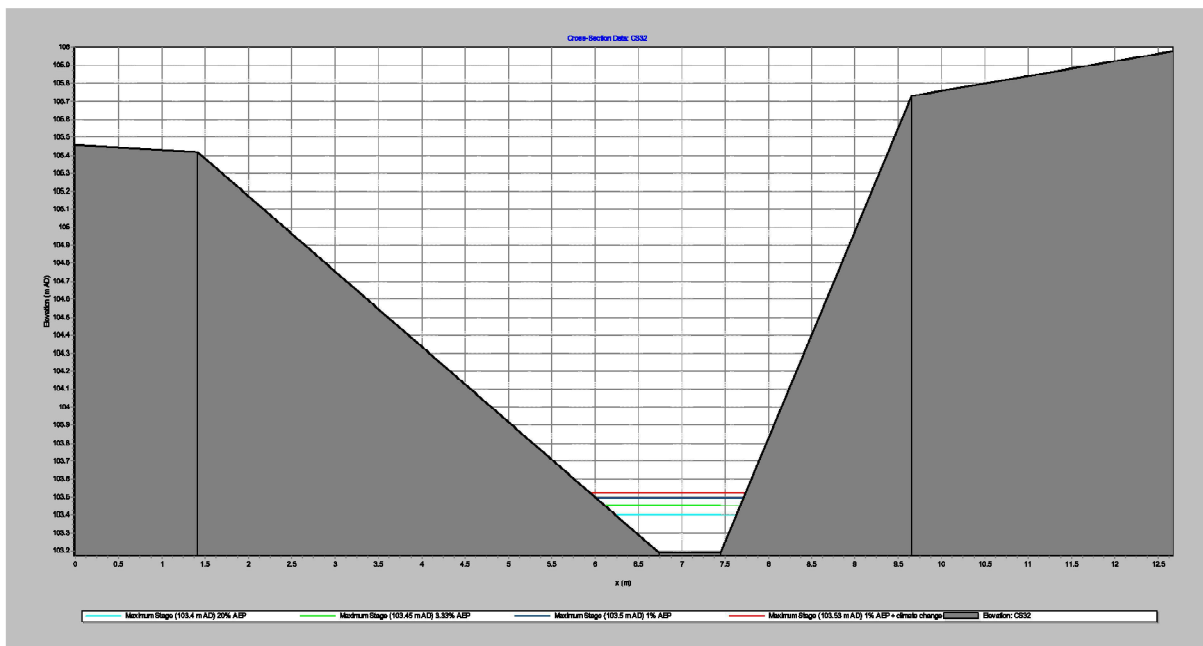


Figure F.30 Peak levels at cross section CS32

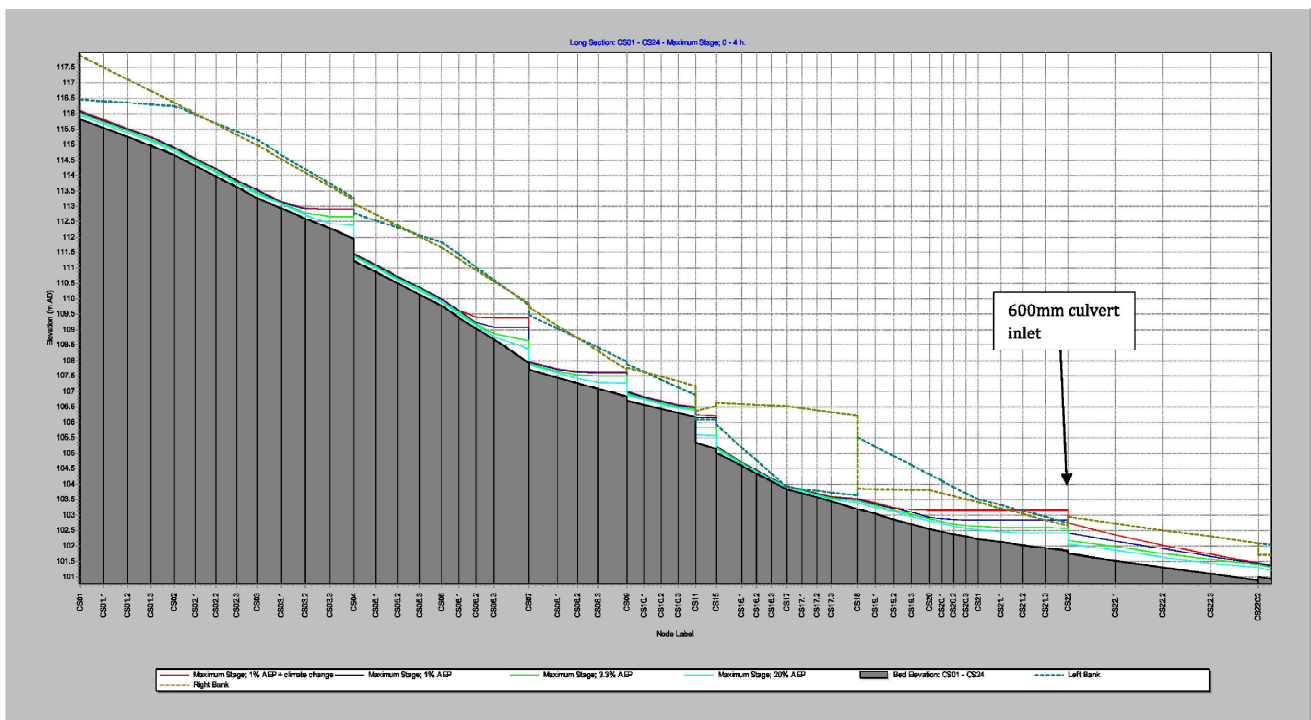


Figure F.31 Long section CS01 to CS24

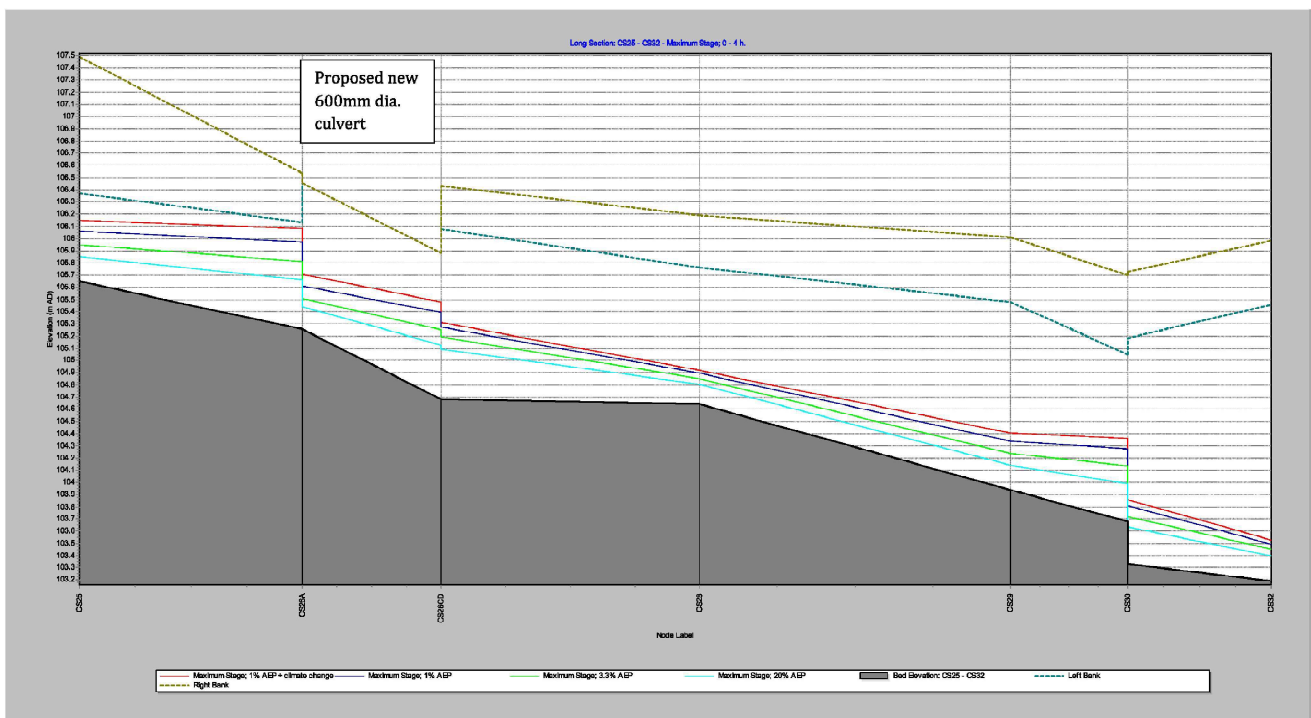


Figure F.32 Long section CS25 to CS32

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## **APPENDIX G: FLOOD MODELLER OUTPUTS: SENSITIVITY TESTING**

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Cross section	1% AEP level (mAOD)	Manning's roughness n+20% (mAOD)	Difference (m)	Manning's roughness n-20% (mAOD)	Difference (m)	1% AEP Flow + 20% level (mAOD)	Difference (m)
CS01	116.064	116.095	0.031	116.033	-0.031	116.095	0.031
CS02	114.892	114.920	0.028	114.858	-0.034	114.920	0.028
CS03	113.506	113.530	0.024	113.471	-0.035	113.528	0.022
CS04	112.883	112.884	0.001	112.883	0.000	112.917	0.034
CS05	111.444	111.478	0.034	111.421	-0.023	111.474	0.030
CS06	109.972	109.996	0.024	109.942	-0.030	110.001	0.029
CS07	109.077	109.080	0.003	109.069	-0.008	109.400	0.323
CS08	107.949	107.980	0.031	107.919	-0.030	107.973	0.024
CS09	107.590	107.591	0.001	107.589	-0.001	107.621	0.031
CS10	106.966	106.989	0.023	106.935	-0.031	106.985	0.019
CS11	106.487	106.487	0.000	106.485	-0.002	106.509	0.022
CS14	106.154	106.158	0.004	106.152	-0.002	106.229	0.075
CS15	106.152	106.155	0.003	106.150	-0.002	106.228	0.076
CS16	105.222	105.249	0.027	105.195	-0.027	105.249	0.027
CS17	103.936	103.947	0.011	103.925	-0.011	103.947	0.011
CS18	103.496	103.524	0.028	103.467	-0.029	103.523	0.027
CS19	103.496	103.524	0.028	103.467	-0.029	103.523	0.027
CS20	102.933	102.974	0.041	102.893	-0.040	103.143	0.210
CS21	102.837	102.877	0.040	102.833	-0.004	103.137	0.300
CS22	102.827	102.866	0.039	102.829	0.002	103.136	0.309
CS23	101.440	101.468	0.028	101.405	-0.035	101.450	0.010
CS24	101.352	101.389	0.037	101.304	-0.048	101.361	0.009
CS25	106.028	106.052	0.024	106.000	-0.028	106.125	0.097
CS26	105.911	105.911	0.000	105.911	0.000	106.059	0.148
CS27	105.274	105.288	0.014	105.267	-0.007	105.309	0.035
CS28	104.893	104.929	0.036	104.852	-0.041	104.917	0.024
CS29	104.336	104.358	0.022	104.312	-0.024	104.399	0.063
CS30	104.274	104.275	0.001	104.274	0.000	104.352	0.078
CS31	103.806	103.849	0.043	103.749	-0.057	103.851	0.045
CS32	103.496	103.524	0.028	103.467	-0.029	103.523	0.027
Maximum			0.043		-0.057		0.323
Mean			0.022		-0.021		0.073

*Table G.1 Sensitivity analysis on 1 in 100 year peak water level*

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## **APPENDIX H: NOTES OF LIMITATIONS**

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The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information.

This report was prepared by Betts Hydro Ltd for the sole and exclusive use of the titled client in response to particular instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

This document has been prepared for the titled project only and should any third party wish to use or rely upon the contents of the report, written approval from Betts Associates Ltd must be sought.

Betts Associates Ltd accepts no responsibility or liability for the consequences of this document being used for the purpose other than that for which it was commissioned and for this document to any other party other than the person by whom it was commissioned.

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# **Appendix C**

## **Site Investigation**

# soiltechnics

environmental and geotechnical consultants

Proposed residential development  
Land east of Chipping Lane  
Longridge, Preston

Ground Investigation Report  
(Phase 2)

Ivy Mill Business Centre, Crown Street, Failsworth, Manchester M35 9BG

**t:** 0161 9470270

**e:** [mail@soiltechnics.net](mailto:mail@soiltechnics.net)

**w:** [www.soiltechnics.net](http://www.soiltechnics.net)



**Proposed residential development  
Phase 2  
Land East of Chipping Lane  
Longridge  
Preston  
PR3 2NA**

**GROUND INVESTIGATION REPORT**

Soiltechnics Ltd. Ivy Mill Business Centre, Crown Street, Failsworth, Manchester, M35 9BG  
Tel: (0161) 9470270 E-mail: [mail@soiltechnics.net](mailto:mail@soiltechnics.net)

**Report originators**

Prepared  
by

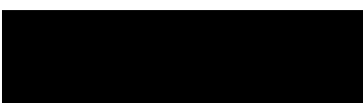


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Reviewed  
by



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Director, Soiltechnics Limited



## Aerial photograph of site



Approximate Phase 2 site boundaries edged in pink

## Report status and format

Report section	Principal coverage	Report status	
		Revision	Comments
1	Executive summary		
2	Introduction		
3	Desk study information and site observations		
4	Fieldwork		
5	Ground conditions encountered		
6	Laboratory testing		
7	Engineering assessment		
8	Chemical contamination		
9	Gaseous contamination		
10	Effects of ground conditions on building materials		
11	Landfill Issues		
12	Further investigations		
13	Remediation statement		
14	Drawings		

## List of drawings

Drawing	Principal coverage	Status	
		Revision	Comments
01	Site location plan		
02a	Plan showing existing site features and location and extent of development phases		
02b	Plan showing existing site features and location of exploratory points		
03	Plan showing site development proposals and location of exploratory points		
04	Plot summarising results of pocket penetrometer determinations		
05	Plot summarising results of hand held shear vane determinations		
06	Plot summarising results of Dynamic Cone Penetration (DCP) testing		

## List of appendices

<b>Appendix</b>	<b>Content</b>
A	Definitions of geotechnical terms used in this report
B	Definitions of geo-environmental terms used in this report
C	Trial pit records
D	Borehole records (driven tube sampler)
E	Infiltration test records
F	Copies of laboratory test result certificates – classification testing
G	Copies of laboratory test result certificates – concentrations of chemical contaminants
H	Analysis and summary of test data in relation to concentrations of chemical contaminants
I	Conceptual models for chemical contamination
J	Copies of Statutory Undertakers replies
K	Copy of correspondence received from the Local Authority Environmental Health Officer
L	Copy of Phase 1 Desk Study report undertaken by Curtins Consulting Ltd

# 1 Executive summary

## General

We recommend the following executive summary is not read in isolation to the main report which follows.

## Site description, history and development proposals

The site comprised three open grassed fields separated by mature hedgerows and sporadic trees, positioned on the north-western outskirts of Longridge, Preston. It is understood that the land is currently used by livestock for grazing. Localised ponding of surface water was evident across the site. Higgin Brook is also recorded adjacent to the north-western boundary. Historically the site has remained undeveloped farm land. We understand the scheme in its entirety will comprise the construction of up to 363 dwellings within what is termed Phases 1 and 2 (refer to Drawing 02a for details), with associated landscaping, gardens, hardstanding and access roads. This report refers to the Phase 2 area only in which 245 dwellings are proposed.

## Ground conditions encountered

Near surface soils generally comprised Topsoil (to depths of between 0.2m and 0.4m) overlaying cohesive Devensian Till deposits to beyond depths of investigation (>3.2m). Till comprised low to very high strength brown mottled grey and orange brown/grey, slightly silty to silty, slightly sandy, slightly gravelly clay in the initial 1m-1.5m below surface level. Below such depths deposits generally exhibit an increase in shear strength and trend towards a brown mottled grey, dark brown and reddish brown colour with varying amounts of silt, sand and gravel. Made Ground was also present in four locations and extended to depths between 1.2m and 2.0m. It is considered possible these soils are associated with some general infilling of depressions on the site and possibly historic ponds.

## Foundation solution

Traditional strip/trench fill type foundations considered suitable for the site, located at a minimum depth of 0.9m. Foundations will require deepening locally due to the presence of Made Ground, extending to depths of between 1.5m and 2.3m in such areas. CBR value of 2.17% considered representative of near surface soils. Buried concrete at the site would be classified as DS-1 AC-1s based on sulphate levels in Made Ground and Devensian Till. Infiltration testing indicates that the near surface Devensian Till deposits are impermeable. Severe instability in foundation/service trenches is unlikely. No groundwater recorded at the site. Refer to Section 7 for further details and recommendations on additional investigations.

## Chemical and gaseous contamination

We have not identified any significant chemical or gaseous contamination at the subject site, therefore, remediation is not considered necessary. We recommend that hardness values within surface waters of Higgin Brook are determined to enable a more detailed risk assessment to be completed in relation to water receptors. It is unlikely that protected water supply pipes will be required at the site.

## 2 Introduction

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2.1	Objectives
2.2	Client instructions and confidentiality
2.3	Site location and scheme proposals
2.4	Report format and investigation standards
2.5	Status of this report
2.6	Report distribution

---

### 2.1 Objectives

- 2.1.1 This report describes a ground investigation carried out for the Phase 2 area of a proposed residential development located on land east of Chipping Lane, Longridge, Preston PR3 2NA.
- 2.1.2 The objective of the ground investigation was to establish ground conditions at the site, sufficient to identify possible foundation solutions for the development and provide parameters necessary for the design and construction of foundations.
- 2.1.3 The investigation included an evaluation of potential chemical and gaseous contamination of the site leading to the production of a risk assessment in relation to contamination.
- 2.1.4 A Phase 1 Desk Study Assessment has been previously undertaken for the site by Curtins Consulting Ltd (ref EB1355/GL/3692 Revision A dated April 2014). A copy of their report is presented in Appendix L. We understand that we have the benefit of using such information and have provided a summary of the data in Section 3 of this report. This will also form a basis for our interpretative chemical and gaseous contamination assessments presented in Sections 8 and 9 respectively.
- 2.1.5 The investigation has also been produced to support a planning application for the site (ref 3/2014/0764) by satisfying National Planning Policies Framework sections 120 and 121.

### 2.2 Client instructions and confidentiality

- 2.2.1 The investigation was carried out in February 2016 and reported in April 2016 acting on instructions received from our client Barratt Homes (Manchester).
- 2.2.2 This report has been prepared for the sole benefit of our above named instructing client, but this report, and its contents, remains the property of Soiltechnics Limited until payment in full of our invoices in connection with production of this report.
- 2.2.3 Our original investigation proposals were outlined in our correspondence to Barratt Homes of 20<sup>th</sup> January 2016. The investigation generally followed our original investigation proposals. The investigation process was also determined to maintain as far as possible the original investigation budget costs.

## 2.3 Site location and scheme proposals

- 2.3.1 The National Grid reference for the site is 360447, 437970. A plan showing the location of the site is presented on Drawing 01, with the extent of the development phases presented on Drawing 02a.
- 2.3.2 We understand the scheme in its entirety will comprise the construction of up to 363 dwellings within what is termed Phases 1 and 2 (refer to Drawing 02a for details), with associated landscaping, gardens, hardstanding and access roads. This report refers to the Phase 2 area only in which 245 dwellings are proposed.
- 2.3.3 We have received layout drawings of the proposed scheme with the layout presented on Drawing 03.

## 2.4 Report format and investigation standards

- 2.4.1 Sections 2 to 6 of this report describe the factual aspects of the investigation with Section 7 presenting an engineering assessment of the investigatory data. Section 8 provides a risk assessment of chemical contamination based on readily available historic records, inspection of the soils and laboratory testing. Section 9 provides a similar risk assessment in relation to gaseous contamination with Section 10 providing a risk assessment relating to construction materials likely to be in contact with the ground. Section 11 discusses issues relating to classification of waste soils for disposal and reuse.
- 2.4.2 This investigation integrates both contamination and geotechnical aspects. The investigation was carried out generally, and where practical following the recommendations of BS EN 1997:2 2007 '*Eurocode 7 – Geotechnical Design – Part 2: Ground Investigation and Testing*'. The investigation process also followed the principles of BS10175: 2011 '*Investigation of potentially Contaminated Sites – Code of Practice*'. The following elements, defined in BS10175, have been completed and incorporated in this report.
- a) Phase I Preliminary investigation (desk study) – review of existing Phase 1 report undertaken by Curtins Consulting Ltd and site reconnaissance undertaken by Soiltechnics Ltd
  - b) Phase II Exploratory and main (intrusive) investigations
- 2.4.3 The extent and result of the preliminary investigation (desk study) undertaken by Curtins Consulting Ltd, in addition to site reconnaissance undertaken by Soiltechnics Ltd, is reported in Section 3. Fieldwork combined the exploratory investigation and main investigation stages into one phase with the extent of these works described in Sections 4 and 6 of this report. Any supplementary investigations deemed necessary are identified in Section 12. Section 13 provides information on any remedial strategy and specification if required.

## 2.5 Status of this report

2.5.1 This report is final based on our current instructions.

2.5.2 This investigation has been carried out and reported based on our understanding of best practice. Improved practices, technology, new information and changes in legislation may necessitate an alteration to the report in whole or part after publication. Hence, should the development commence after expiry of one year from the publication date of this report then we would recommend the report be referred back to Soiltechnics for reassessment. Equally, if the nature of the development changes, Soiltechnics should be advised and a reassessment carried out if considered appropriate.

## 2.6 Report distribution

2.6.1 This report has been prepared to assist in the design and planning process of the development and normally will require distribution to the following parties, although this list may not be exhaustive:

**Table summarising parties likely to require information contained in this report**

Party	Reason
Client	For information/reference and cost planning.
Developer/Contractor/project manager	To ensure procedures are implemented, programmed and costed.
Planning department	Potentially to discharge planning conditions.
Environment Agency	If ground controlled waters are affected and obtain approvals to any remediation strategies.
Independent inspectors such as NHBC/Building Control	To ensure procedures are implemented and compliance with building regulations.
Project design team	To progress the design.
Principal Designer (PD)	To advise in construction risk identification and management under the Construction (Design and Management) Regulations.

**Table 2.6**