



PRIORS FARM
FLUVIAL MODEL REPORT

LIGHTWOOD STRATEGIC LTD

15 December 2025





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Contents

1 Introduction..... 1

2 Hydrological Assessment 6

3 Model Approach and Input Data 11

4 Sensitivity Testing..... 24

5 Fluvial Baseline Model Results 30

6 Scenario Modelling..... 37

7 Conclusions 44

Appendices

- Appendix A - Hydrological Report
- Appendix B - Model Log
- Appendix C - Topographical Survey



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1 Introduction

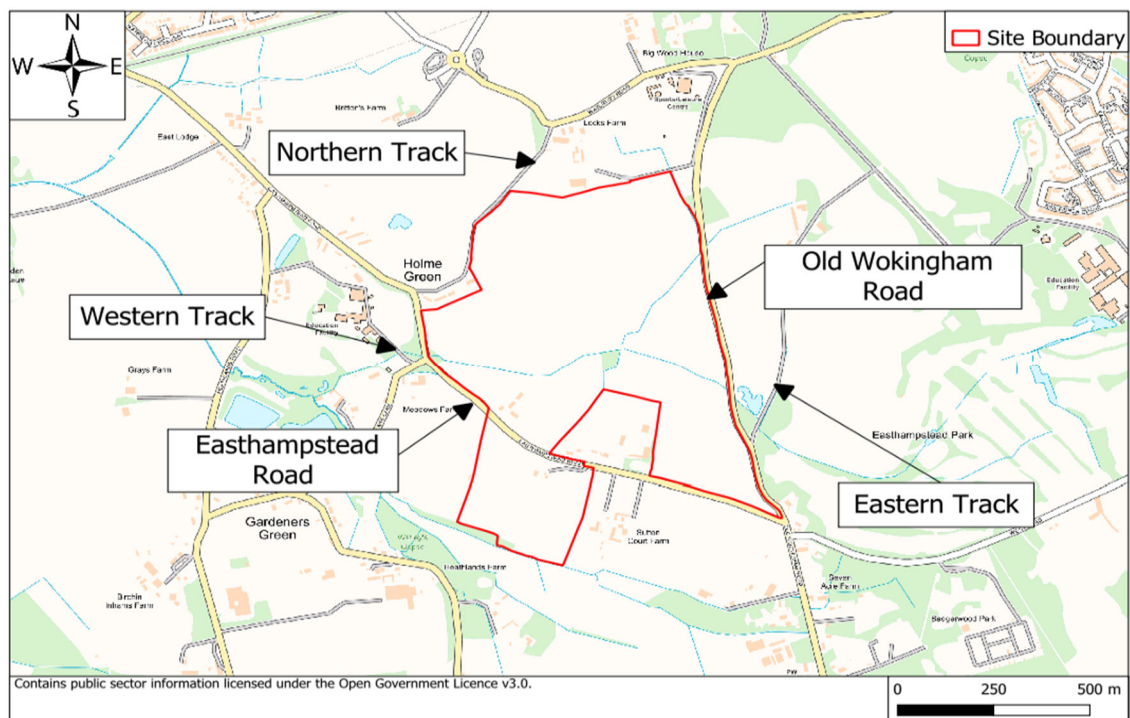
1.1 Background

1.1.1 This fluvial modelling report has been prepared by Abley Letchford, on behalf of Lightwood Strategic Ltd for Priors Farm, South Wokingham.

1.1.2 This report sets out the data and methods used to create a site-specific baseline model to represent the site-specific conditions. This report also sets out the baseline model results to define the fluvial flood extents.

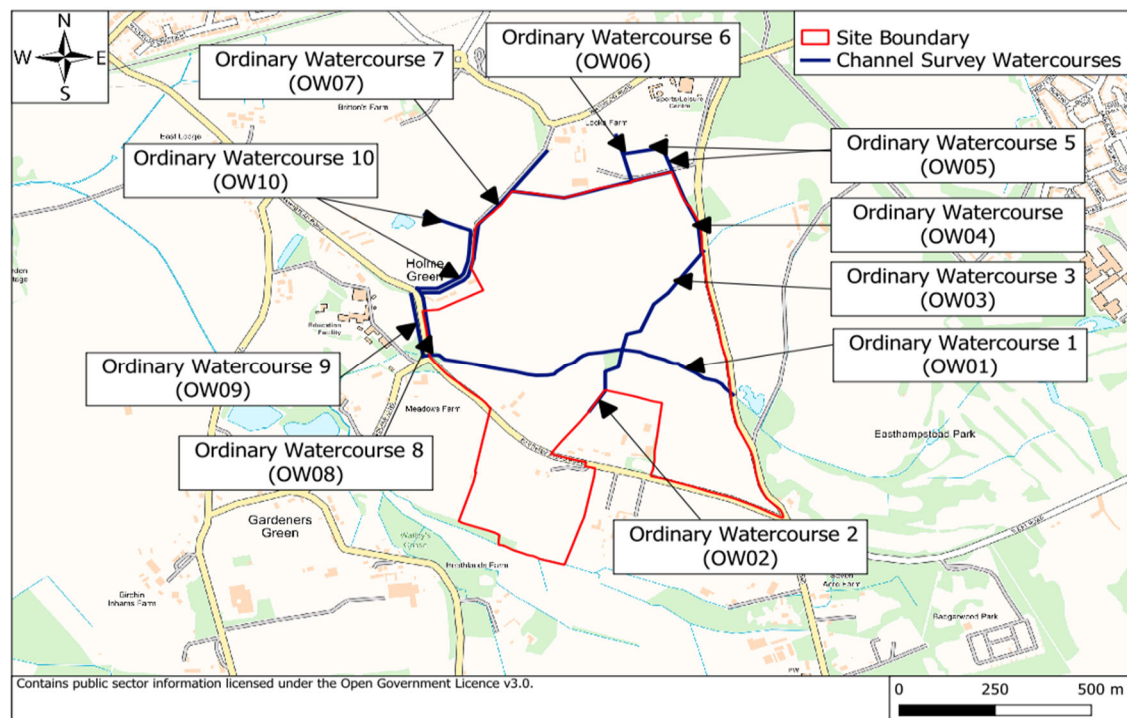
1.1.3 **Figure 1** shows the location of the site and catchment.

Figure 1: Site Location Plan



- 1.1.4 **Figure 2** shows the channel survey watercourses, labelled from Ordinary Watercourse 1 (OW01) through to Ordinary Watercourse 10 (OW10). There is survey data for Ordinary Watercourses 12 to 15 included in the channel survey provided by the surveyors. These watercourses have not been included within this study as they were located outside of the catchment boundary and did not influence the flood risk within the catchment as it flowed in a north westerly direction.

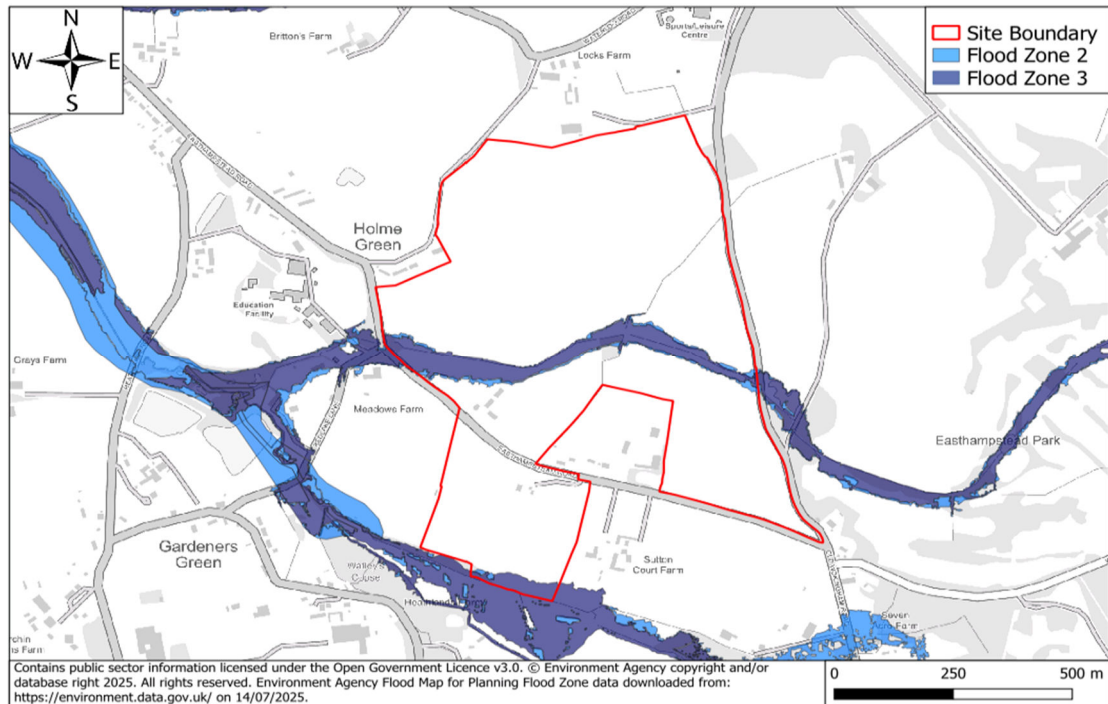
Figure 2: Channel Survey Watercourses



1.2 Environment Agency Flood Risk Mapping

1.2.1 **Figure 3** shows the Environment Agency (EA) Flood Map for Planning.

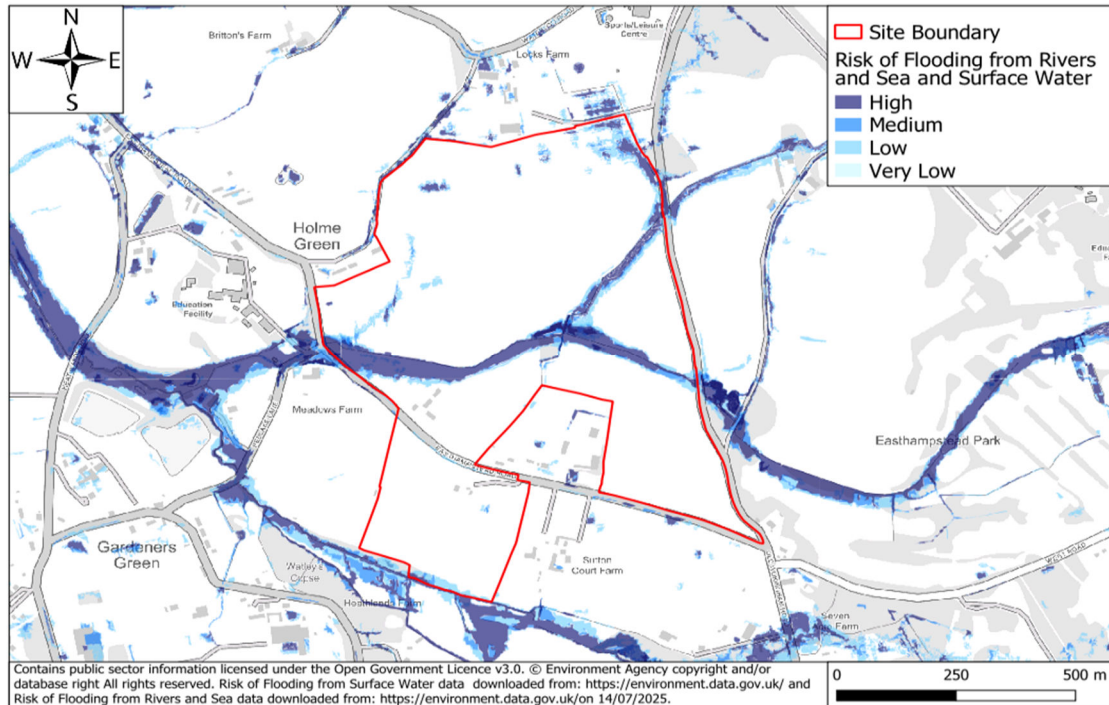
Figure 3: EA Flood Map for Planning



- 1.2.2 The EA Flood Map for Planning, as shown in **Figure 3**, shows that the majority of the site is located within Flood Zone 1 and therefore is at a very low risk of flooding from rivers and sea. The land immediately surrounding Ordinary Watercourse (OW01) is located within Flood Zones 2 and 3.
- 1.2.3 There is also an area in the south of the site, on the southern boundary that is located in Flood Zones 2 and 3. This is associated with the Emm Brook.
- 1.2.4 Both of these areas of potential risk of flooding from rivers and seas are aligned with the location of the existing watercourses through the site. Downstream of the site there are some unusual flood extent features that do not correlate to the information in the LiDAR data or site observations.
- 1.2.5 There are clear gaps in the Flood Zone 3 data to the east and west of Heathlands Road. The location of Flood Zone 2 flooding around Redlake Lane does not correspond with the location of Flood Zone 3 flooding in that area. It appears that Flood Zone 3 has been defined by strategic scale JFLOW modelling, whilst Flood Zone 2 may have been defined by a historic flood outline.
- 1.2.6 The topographical survey and observations from the site walkover identified a number of watercourses within the site which are not included in the Flood Zone mapping. This is due to them being Ordinary Watercourses as opposed to Main Rivers which is the primary focus of the EA flood zone mapping.
- 1.2.7 Based on site observations and data, the EA's flood zone mapping does not appear to be a true reflection of the site's conditions or representative of specific local structures and their impacts on flooding extents.

1.2.8 **Figure 4** shows the NaFRA Risk of Flooding from Surface Water and Rivers and Sea.

Figure 4: NaFRA Risk of Flooding from Surface Water and Rivers and Sea



1.2.9 The NaFRA study includes two datasets: Risk of Flooding from Rivers and Sea (RoFRS) and Risk of Flooding from Surface Water (RoFSW). In this area the RoFRS only covers OW01. RoFSW covers the remainder of the site including the smaller watercourses; as such it is not truly limited to surface water flooding. It is therefore most sensible to consider the two datasets together to get a full understanding of the risk of flooding from fluvial and surface water sources across the site, and thus inform the development strategy for the site.

1.2.10 **Figure 4** shows there are key areas of flooding from surface water and rivers and sea across the site.

1.2.11 Similarly to **Figure 3**, there is flooding shown along the extent of OW01 and along the immediate area of the watercourse. This flood extent is categorised as high flood risk for the majority of the watercourse extent with an area of lesser flood extent at the upstream and eastern site boundary where it is categorised as high in the channel and low surrounding the channel.

1.2.12 The surface water mapping indicates a surface water flow route that extends from the northeastern boundary to the centre of the site. Here there are areas of high, medium and low flood risk from surface water. This surface water flow route follows the channel and wider corridor of OW03. Central to the channel the flooding is categorised as high and the surrounding land of the channel, is categorised as low risk from surface water.

1.2.13 In the north-eastern corner of the site a surface water flow route is shown, both within the site and the land immediately to the north of the site. The EA surface water modelling is a strategic dataset therefore does not pick up the localised drainage features. Based on site observations and survey data, we would expect the surface water coming from the north of the site to be intercepted, conveyed and stored with the ditch system along the northern and then eastern boundaries of the site.



- 1.2.14 Another surface water flow route is shown within the west of the site. This area does not have an associated watercourse, channel or ditch. The flow route flows in a southerly direction into OW01. The catchment for this flow route is entirely within the site boundary.
- 1.2.15 There is an area of low and medium risk of surface water flooding along the site's southern parcel's southern boundary, associated with Emm Brook which flows to the south of the site.
- 1.2.16 There are a few isolated areas across the site which have a low risk of surface water flooding. These areas are associated with localised areas of low ground where surface water may pond.
- 1.2.17 The EA mapping, due to its national-scale strategic nature, does not necessarily consider any site-specific local information, land drainage or include local features, structures or additional watercourses. The mapping therefore provides a guide to vulnerable areas based on the topography of the area and not a detailed assessment of surface water flooding for a specific site. Abley Letchford's assessment will consider site specific features to more accurately define the baseline surface water flood extents across the site suitable to inform a site specific FRA.

1.3 Scope

- 1.3.1 The scope of works includes the following:
- Undertake a hydrological assessment to estimate the catchment to the site and generate fluvial hydrographs for the relevant return periods.
 - Build a new fluvial model with inflows for the catchment using the best available data to refine the baseline fluvial flood extents.
 - Run the model for the following return periods; 1 in 30, 1 in 100, 1 in 1,000 annual probability scenarios.
 - To assess the potential impact of climate change, the 1 in 100 annual probability scenario has been modelled with an uplift on flows using the most recent climate change allowances for the Loddon and Tributaries Management Catchment. For this site, this is a +14% climate uplift on peak flows.
 - The key aim of this modelling study is to better define the fluvial flood extents using site specific topographical data which considers the local features within the site and catchment in conjunction with local knowledge and site observations. The baseline model will then be used as a basis to test the impacts of the proposed development and interventions along the watercourses or in the floodplain area, which in turn will inform the development strategy.



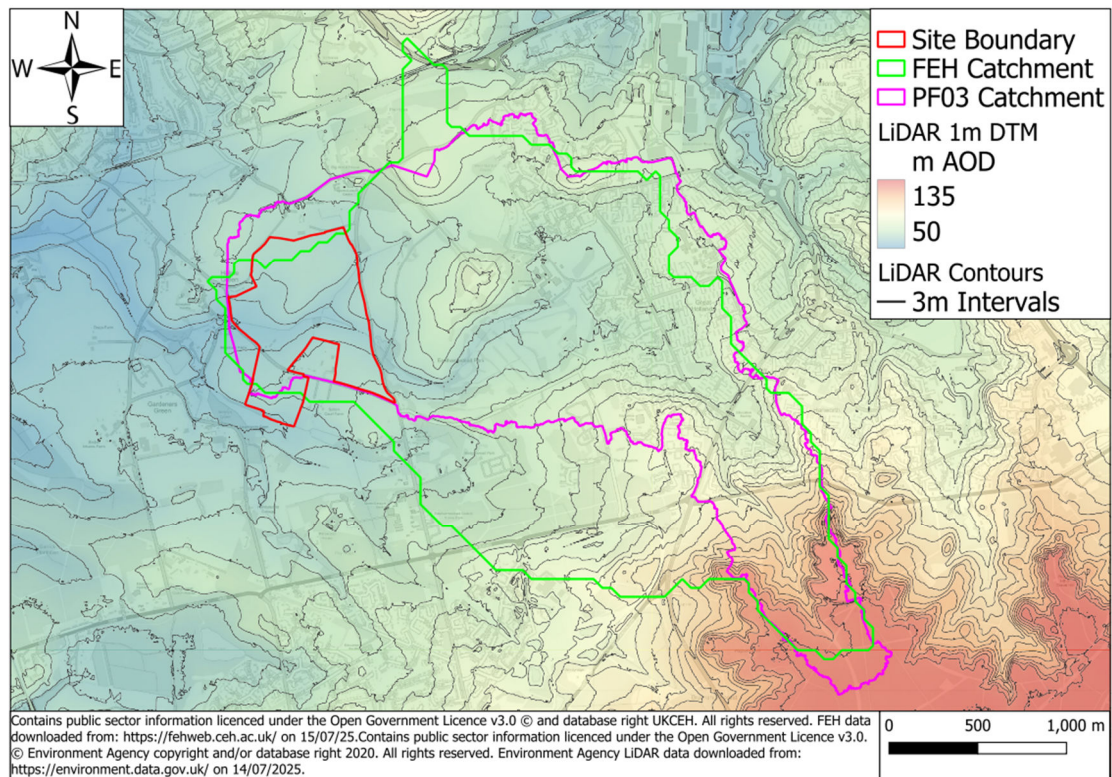
2 Hydrological Assessment

- 2.1.1 Full details for the hydrological assessment methodology and application can be found in the Abley Letchford Hydrological Assessment in **Appendix A**. A summary of the hydrological assessment is included within this chapter.
- 2.1.2 The hydrological study provides inflows for the Ordinary Watercourses. The catchment data was obtained from the Flood Estimation Handbook (FEH) webservice and updated where appropriate.
- 2.1.3 The study derived hydrographs for the following return periods; 1 in 30, 1 in 100 and 1 in 1,000 annual probability. To assess the impact of climate change, the 1 in 100 annual probability scenario was modelled with the applicable Climate Change Allowance which is 14%.
- 2.1.4 The hydrological analysis was completed using ReFH2 version 2.3. The Statistical Method was also completed. However, there were not enough years of similar data from the subject catchments therefore there was lower confidence in the calculated QMED value. The Statistical Method was therefore rejected. The Statistical Method was completed alongside the ReFH2 method as a comparison for the peak flow estimates.

2.2 Hydrological Inflow Boundaries

- 2.2.1 The catchment data was downloaded from the FEH Webservice.
- 2.2.2 The FEH catchment was adjusted using OS mapping, LiDAR data, EA indicative watershed dataset and site observations to derive the catchment draining through Priors Farm (PF03 catchment). The PF03 catchment deemed to be representative of the actual catchment through the area of interest. The FEH catchment area was 5.9km². The PF03 catchment has an area of 4.8km².
- 2.2.3 **Figure 5** shows the extent of the FEH catchment and PF03 catchment.

Figure 5: FEH Catchment and PF03 Catchment Extents



2.3 Catchment Descriptors

- 2.3.1 A review of the FEH Webservice catchment descriptors was carried out. A summary of key catchment descriptors and updates are summarised in **Table 1**. Red text in the table denotes catchment descriptors which have been updated from the FEH catchment descriptors. Further details of the checks and updates made to the catchment descriptors and are provided below in the table.



Table 1: Catchment Descriptors

Catchment Descriptor	FEH Catchment Descriptor	PF03 Catchment Descriptor
AREA	5.9km ²	4.8km ²
BFIHOST	0.445	0.445
BFIHOST19	0.468	0.468
DPLBAR	2.65	2.36
DPSBAR	23.80	23.80
FARL	1	1
FPEXT	0.12	0.12
LDP	5.7	5.7
PROPWET	0.29	0.29
SAAR	664	664
SPRHOST	37.68	37.68
URBEXT1990	0.097	0.180
URBEXT2000	0.114	0.180

2.4 Area

- 2.4.1 The FEH catchment area was adjusted for the PF03 catchment using OS mapping, LiDAR data and the EA watershed dataset. The FEH catchment area was 5.9km². The PF03 catchment area is 4.8km². The PF03 catchment area decreased from 5.9 km² to 4.8km², a decrease of 1.1 km². The difference in the catchment area between the FEH catchment and PF03 catchment is in the southern part of the FEH catchment. The FEH catchment appears to include an area which would drain to the Emm Brook catchment, to the south of the site, therefore it was excluded from the PF03 catchment.

2.5 BFIHOST and BFIHOST19

- 2.5.1 BFIHOST base flow index is a measure of catchment responsiveness based on the Hydrology of Soil Types (HOST) classification. It indicates the relationship between soil types and the runoff response. Permeable soils and geology tend to yield a higher baseflow.
- 2.5.2 BFIHOST19 is an updated method of classifying BFIHOST which improves on the classification of rarer soil types.
- 2.5.3 The BFIHOST values were reviewed using the Cranfield Soils online viewer. The FEH values were deemed to be reasonable and were accepted. The FEH BFIHOST value were accepted as the soil characteristics are deemed to be representative.



2.6 SPRHOST

- 2.6.1 SPRHOST is the standard percentage runoff associated with each HOST soil class.
- 2.6.2 The FEH SPRHOST values were reviewed using the Cranfield Soils online viewer. The FEH values were deemed to be reasonable and were accepted.

2.7 PROPWET

- 2.7.1 PROPWET is a measure of the proportion of the time that the catchment soils are defined as wet. Wetter regions have higher PROPWET values. Drier regions have lower PROPWET values. The PROPWET value for the FEH catchment is 0.29. The value is considered to be representative of the region that the PF03 catchment is in.

2.8 FARL

- 2.8.1 FARL is a measure of the degree of flood attenuation provided by reservoirs and lakes within a catchment. A value of 1 represents the absence of lakes or reservoirs within the catchment. There are no lakes or reservoirs within the FEH catchment or the PF03 catchment. The FARL value of 1 is therefore considered to be representative for the PF03 catchment.

2.9 URBEXT and URBEXT2000

- 2.9.1 URBEXT and URBEXT2000 is an index of the concentration of urban and suburban areas in 1990 and 2000 respectively expressed as a fraction.
- 2.9.2 OS mapping and aerial photography was reviewed for the PF03 catchment and the URBEXT2000 value adjusted to reflect the suburban areas within the PF03 catchment. The URBEXT2000 value was updated using the FEH Volume 5 Equation 6.2. The urban extents on the FEH Web Service were compared with OS urban extents. FEH does not pick up the urban areas of Jennett's Hill in the northern part of the catchment.
- 2.9.3 The URBEXT2000 value was adjusted from the FEH catchment URBEXT2000 to 0.18 in order to reflect the urbanisation of the PF03 catchment.

2.10 SAAR

- 2.10.1 SAAR is a measure of the average annual rainfall between 1961 and 1990 in millimetres. The FEH catchment is adjacent to the PF03 catchment therefore both catchments will have received similar average rainfall. The SAAR value for the FEH catchment appears reasonable therefore it has been accepted for use for the PF03 catchment.

2.11 DPSBAR

- 2.11.1 DPSBAR is an index for the overall catchment steepness. A value of greater than 300 represents mountainous regions. A value of less than 25 represents flatter regions. The DPSBAR value for the FEH catchment is 23.8. The FEH catchment and PF03 catchment are both relatively flat therefore the DPSBAR for the sites is considered representative.



2.12 ReFH2 Method

- 2.12.1 The ReFH2 method was used to derive hydrographs for the PF03 catchment. The ReFH2 method uses the FEH Webservice catchment descriptors to generate the design hydrographs for the return periods.

2.13 Storm Duration

- 2.13.1 The default ReFH2 rainfall parameters were applied. This approach is an industry standard approach. Rainfall parameters are not typically adjusted unless there is a specific reason to do so. These gave a storm duration of 7.5 hours and a timestep of 0.5 hours.
- 2.13.2 The ReFH2 Seasonal Correction Factor (SCF) of 0.69 was used. This was the ReFH2 default value. This approach is industry standard. Parameters are not typically adjusted unless there is a specific reason to do so.
- 2.13.3 The ReFH2 Areas Reduction Factor (ARF) of 0.97 was used. This was the ReFH2 default value. This approach is industry standard. Parameters are not typically adjusted unless there is a specific reason to do so.

2.14 Inflows

- 2.14.1 The total flow for the catchment was divided between the sub catchments based on their contributing area.

3 Model Approach and Input Data

3.1 Model Approach

3.1.1 A fluvial model with specific inflows was constructed using TUFLOW (2025.2.1-iSP-w64). This is the most up-to-date version of TUFLOW at the time of building and running the model.

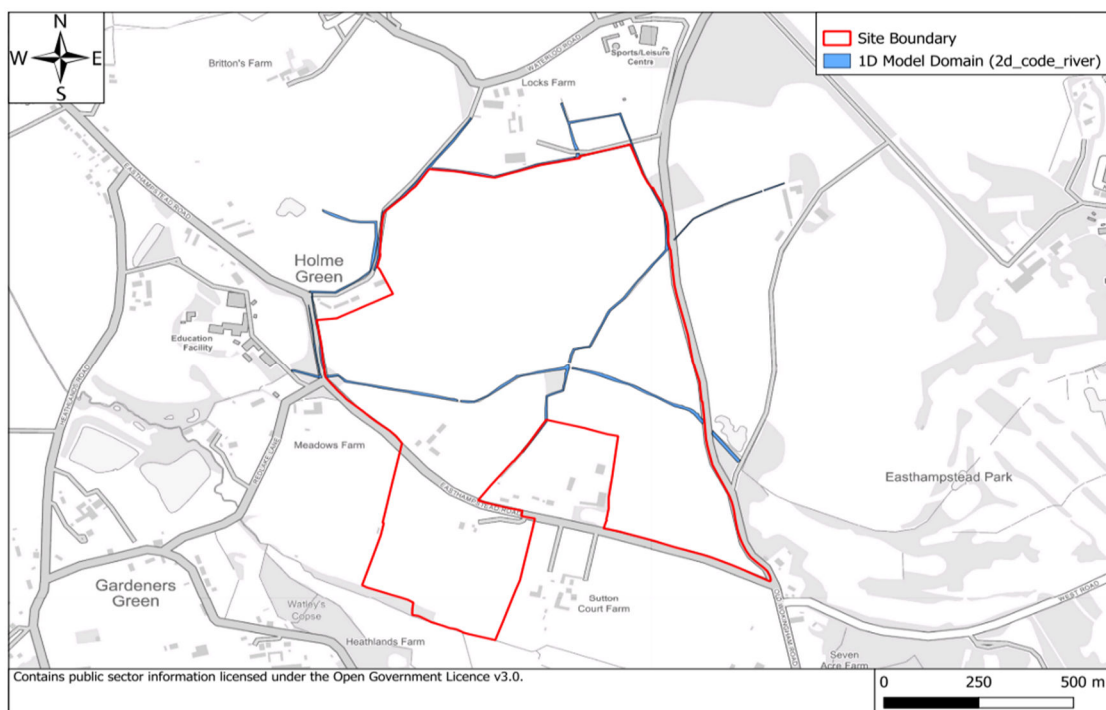
3.1.2 Single precision TUFLOW was used, as is recommended in the TUFLOW manual for fluvial models run using HPC GPU.

3.1.3 The model log is included in **Appendix B**.

3.2 Model Domains

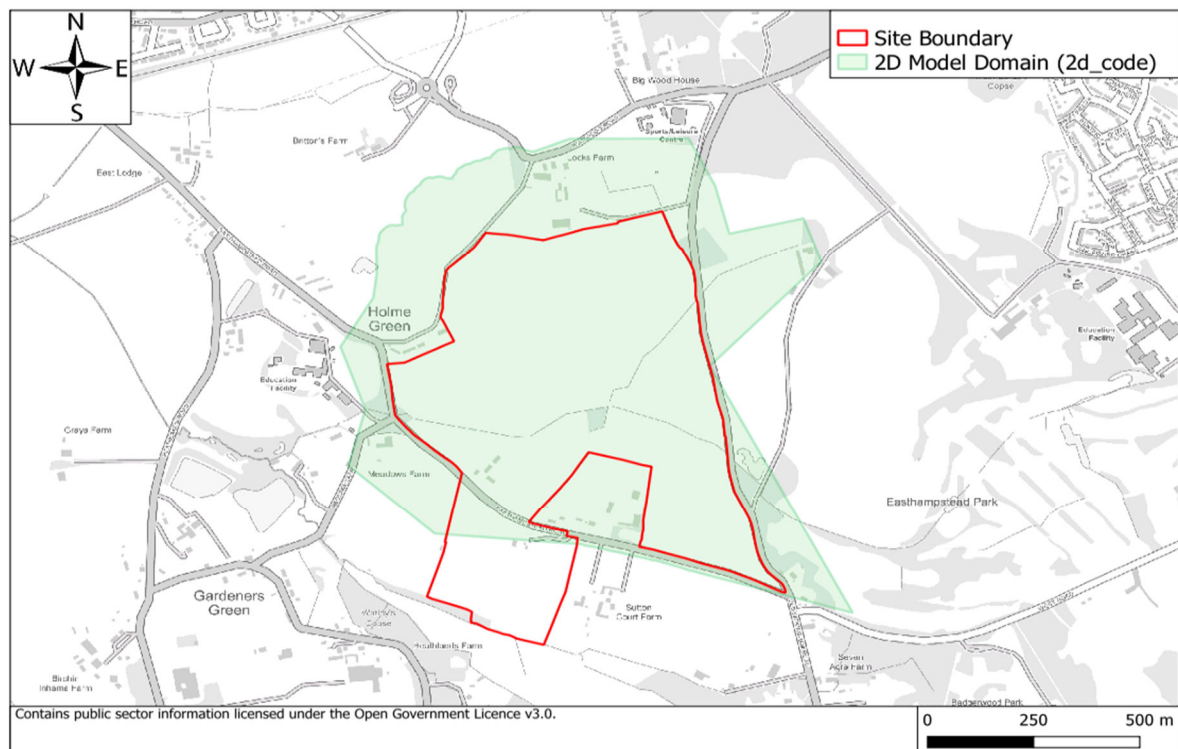
3.2.1 **Figure 6** shows the extent of the 1D model domain.

Figure 6: 1D Model Domain



3.2.2 **Figure 7** shows the 2D model extent.

Figure 7: 2D Model Extent



3.2.3 **Figure 7** shows the 2D model extent. There is one 2D model domain.

3.2.4 The 2D model area is 1.2km².

3.2.5 The model domain was set slightly larger than the catchment to ensure that there was no 'glass walling' of flow along the edges of the model.

3.3 Input Data

3.3.1 The latest available software and data has been used in the hydraulic model. The data is summarised below.

3.4 Hydraulic Software and Data

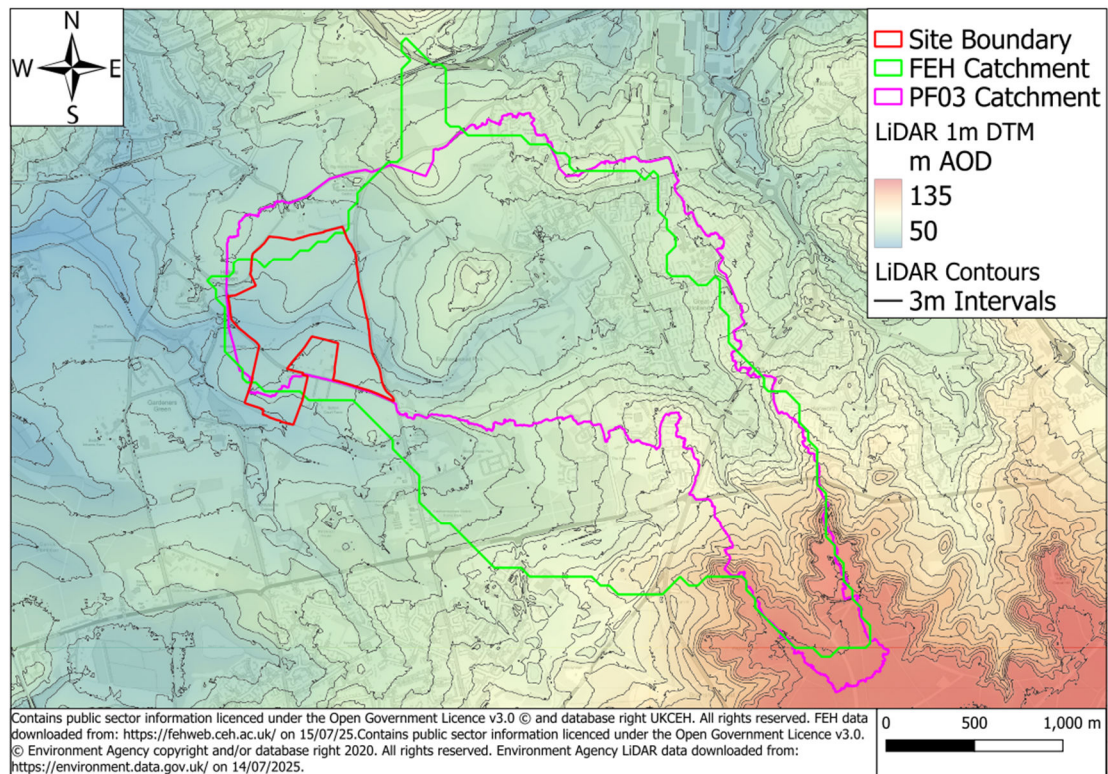
3.4.1 TUFLOW version 2025.2.1-iSP-w64 was used. This is the latest versions of the software at the time of building the model.

3.4.2 The hydrological inflows were updated using ReFH2 version 2.3. This is the latest version of the software.

3.5 LiDAR Data

- 3.5.1 1m DTM LiDAR flown in 2020 was used. This is the best available data at the finest available resolution. The LiDAR data was downloaded from the Defra open-source data service platform on 14th July 2025. **Figure 8** shows the extent of the LiDAR available for the site.

Figure 8: EA LiDAR Coverage

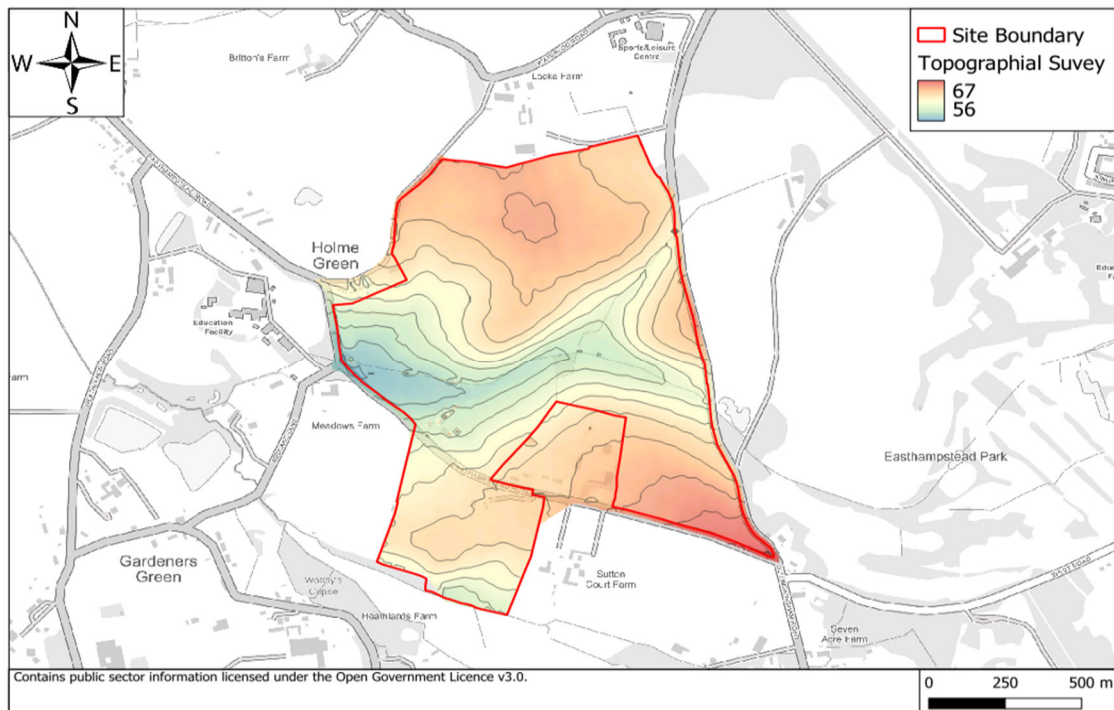


3.6 Ground Model Data

3.6.1 A topographical survey was carried out in June 2022 by Usk Land Survey. A copy of this survey is included in **Appendix C**.

3.6.2 **Figure 9** shows the extent of the topographical survey of the site.

Figure 9: Topographical Survey



3.6.3 The topographical survey has been used in preference to the LiDAR data where it is available as it is the best available data for the topography across the site.

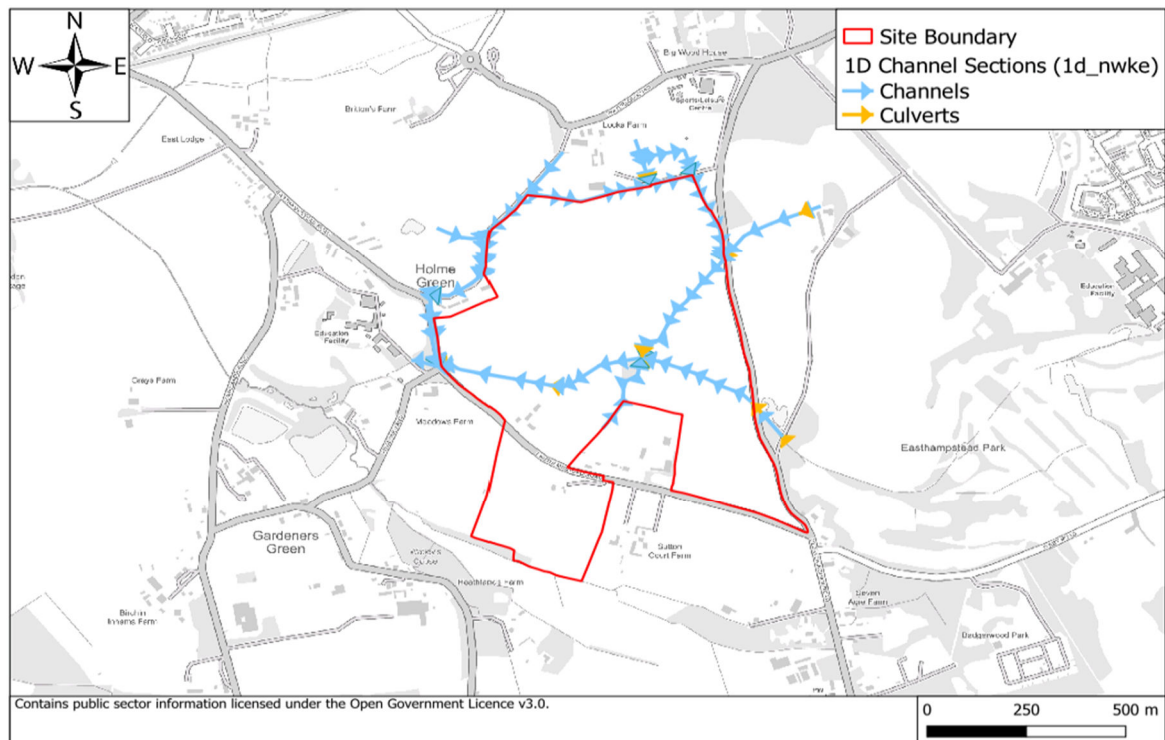
3.7 1D Network

3.7.1 ESTRY was used to define the 1D channel. There are 95 open channel sections and 8 culverts in the model, across the Ordinary Watercourses.

3.7.2 MK Surveys carried out a channel survey of the watercourses through the site in July 2025.

3.7.3 **Figure 10** shows the location of the 1D channel sections.

Figure 10: 1D Channel Section Location

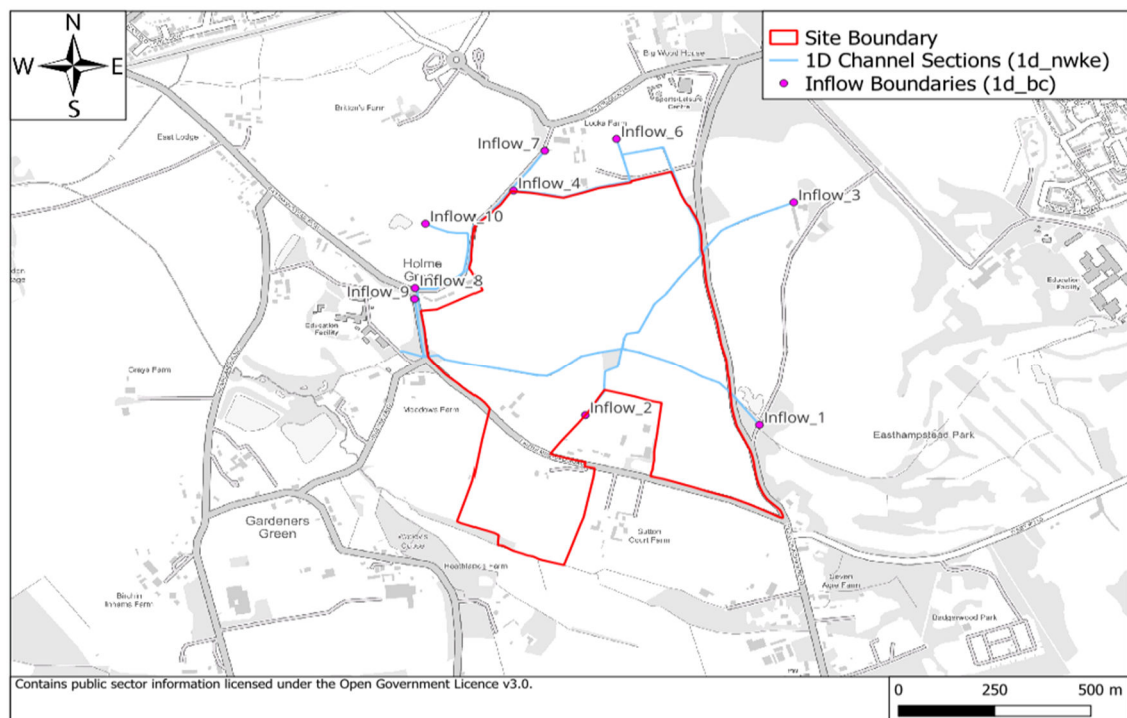


3.8 Inflow Boundaries

3.8.1 Inflows were included into the model using a 1d_bc boundary across the PF03 catchment.

3.8.2 **Figure 11** shows the location of the model inflows.

Figure 11: Model Inflows

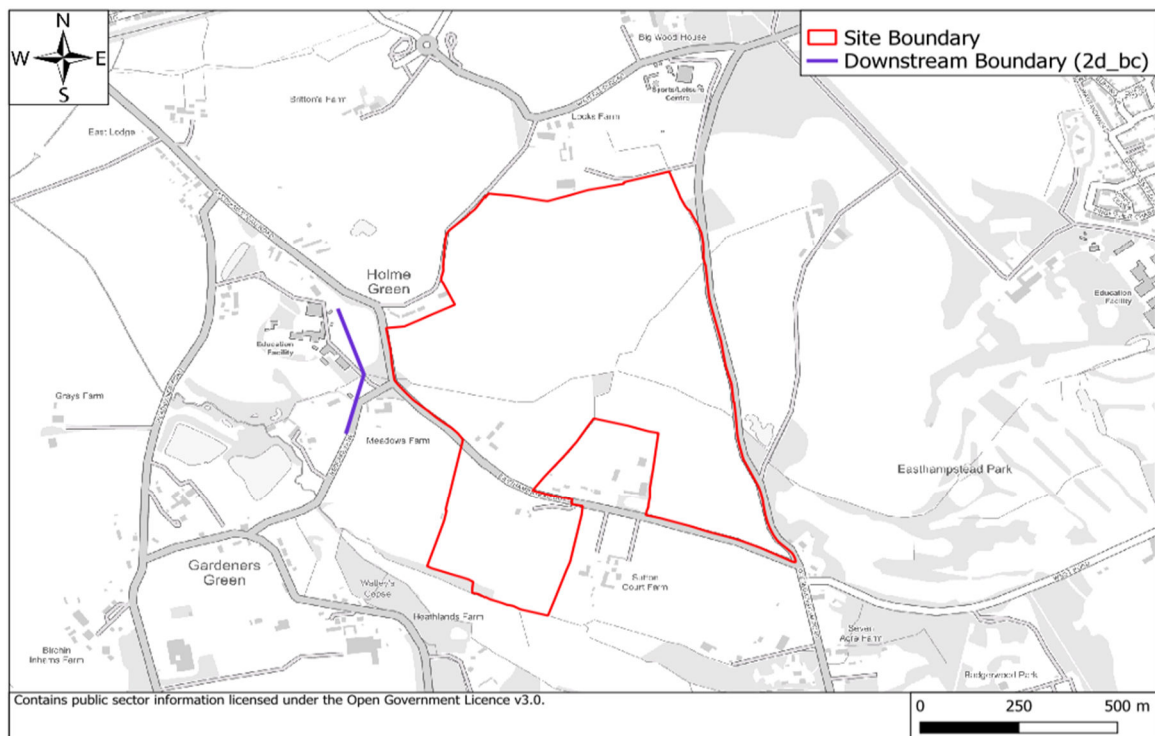




3.9 Downstream Boundary

- 3.9.1 A 2d_bc boundary was used to allow flow to exit the downstream boundary of the model domain and prevent any 'glass walling' along the boundary.
- 3.9.2 The best practice would be to use modelled data from the Emm Brook which is 350m downstream of the site. A model data request was submitted to the EA. The EA response confirmed that there is no modelled data of the Emm Brook in this area. The nearest downstream model is the River Loddon which was not suitable.
- 3.9.3 The next option would be to use recorded flood level data such as gauged data for OW01. However, this is also not available for this site due to the lack of gauges a suitable distance of the site.
- 3.9.4 Abley Letchford therefore used the slope of the downstream catchment to set the downstream boundary. LiDAR and site observations showed that the slope of the downstream part of the catchment is reasonably uniform, therefore this is a reasonable approach to take in the absence of downstream modelled or recorded flood level data.
- 3.9.5 The downstream boundary of the model has been set approximately 75m to the west of the site's western boundary. This downstream boundary is accepted to be sufficiently placed for this modelling study.
- 3.9.6 The downstream boundary's slope was calculated using the LiDAR ground elevations of the vertical and horizontal measurements of the downstream point of OW01. Sensitivity model runs were also carried out in which a $\pm 20\%$ increase and decrease of the downstream boundary slope was applied.
- 3.9.7 **Figure 12** shows the location of the downstream boundary within the model.

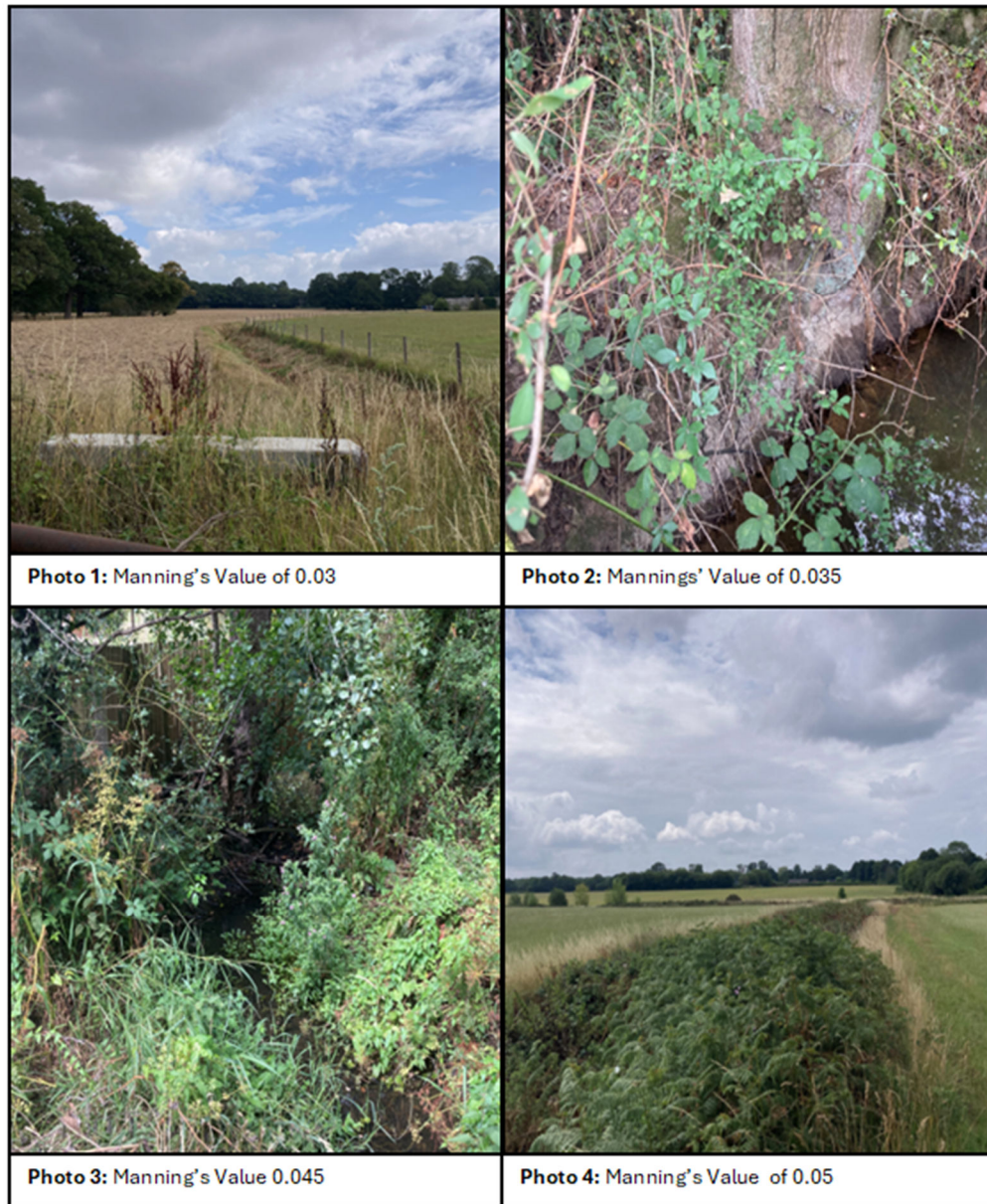
Figure 12: Downstream Boundary of the Model Domain



3.10 Roughness

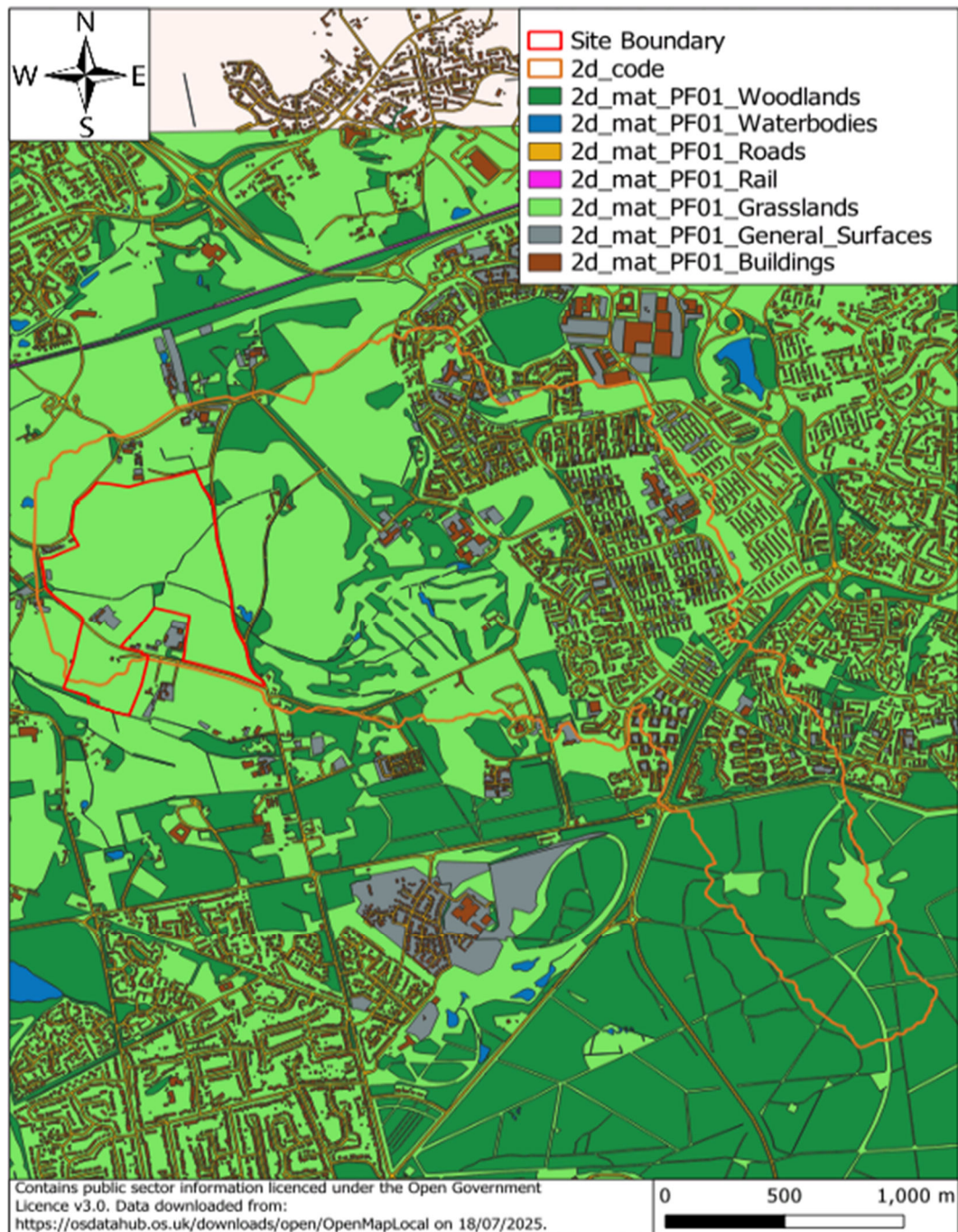
- 3.10.1 The hydraulic roughness can impact the conveyance of flood within the floodplain.
- 3.10.2 Mapping was downloaded from OS OpenMap to inform the land use types.
- 3.10.3 Manning's 'n' roughness values were assigned to the land use types within the model domain using Chow 's1959 industry standard guidance, satellite imagery of the site, photographs from a site walkover and professional judgement.
- 3.10.4 Photographs of the rationale for assigning the Manning's values in channel are shown in **Figure 13**.

Figure 13: Photographs and their Associated Manning's Values for In Channel Roughness



3.10.5 Roughness values were applied using 2d_mat vector files to define the location and the .tmf file to define the roughness.

Figure 14: Materials Layers





3.10.6 **Table 2** summarises the land use types, and roughness values selected for the 2D model domain.

Table 2: Summary of Manning's 'n' Roughness Values

ID	Description	Manning's 'n' Roughness Value
1	Grasslands	0.022
2	Roads and Pavements	0.022
3	Buildings	1
4	Waterbodies	0.03
5	Woodlands	0.10
6	General Surfaces	0.022
7	Rail	0.05

3.10.7 A high Manning's 'n' value of 1 was used to represent the building locations within the model and direct flow around the buildings.

3.11 1D/ 2D Domain Links

3.11.1 The 1D in-channel and 2D floodplain components of the model are connected along the tops of the banks using HX lines.

3.12 1D/ 2D Bank Level Representation

3.12.1 1D bank levels were defined using channel survey data. LiDAR data was used in areas where survey data was not available.

3.13 Model Layers

3.13.1 **Table 3** summarises the layers used within the model domain.



Table 3: 2D Model Layers

Layer	Purpose
1d_nwke_PF01	Defines the location of the 1D channel and structures.
1d_xs_PF01	Defines the 1D channel geometry.
1d_WLL_PF01	WLL interpolate the 1D water levels across the 1d domain.
1d_bc_PF01	Applies inflows to the model.
2d_code_PF01	Defines the 2D model extent.
2d_code_river_PF01	Defines the 1D model extent.
2d_bc_PF01	Defines the floodplain boundary.
2d_bc_hxi_PF01	Defines the link between the 1D and 2D model domains.
2d_zsh_PF01_P	Points defining levels along the zsh line which informs the bank levels.
2d_zsh_PF01_L	Line informing the bank location. The levels are taking from the zsh points layer.
2d_loc_PF01	Defines the model orientation.
2d_mat_PF01_Buildings	Defines the 2D roughness area for buildings.
2d_mat_PF01_General_Surfaces	Defines the 2D roughness area for the general surface (grass).
2d_mat_PF01_Woodlands	Defines the 2D roughness area for the natural environment (woodlands).
2d_mat_PF01_Grasslands	Defines the 2D roughness area for the natural environment (woodlands).
2d_mat_PF01_Roads	Defines the 2D roughness area for roads and paths.
2d_mat_PF01_Waterbodies	Defines the 2D roughness area for waterbodies.
2d_mat_PF01_Rail	Defines the 2D roughness area for rail networks.



3.14 Model Runs

3.14.1 The model was run for 12 hours with a fixed 1D timestep of 0.25 seconds and a fixed 2D timestep of 0.5 seconds.

3.14.2 The model was run for the following return periods:

- 1 in 30 annual probability;
- 1 in 100 annual probability;
- 1 in 1,000 annual probability; and
- 1 in 100 annual probability +14% climate change allowance.

3.14.3 The site is located within the Loddon and Tributaries Management Catchment. The relevant climate change allowance is the Central allowance (2080s) which is +14% for this management catchment.

4 Sensitivity Testing

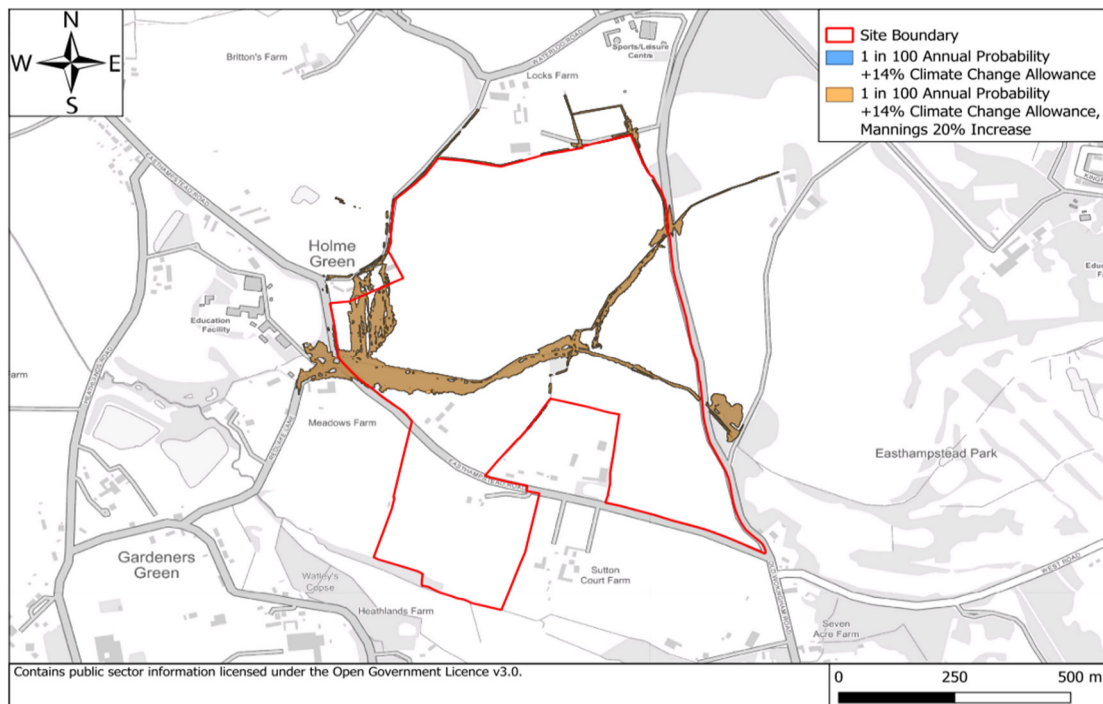
4.1.1 Sensitivity testing has been undertaken to assess the impact of uncertainty within the model and assumptions made.

4.2 Manning's 'n' Roughness

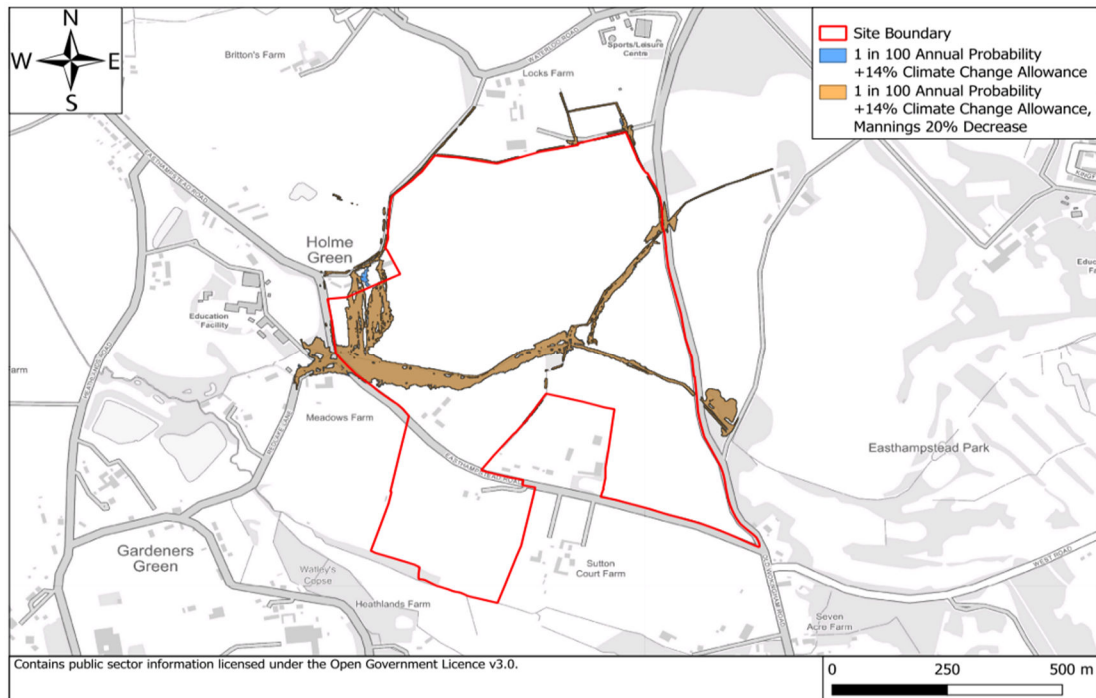
4.2.1 A 20% increase and decrease in the Manning's 'n' roughness estimations was modelled across the 2D model domain.

4.2.2 **Figure 15** and **Figure 16** shows the difference in the maximum flood extents for a $\pm 20\%$ increase and decrease in the Manning's 'n' roughness values.

**Figure 15: 1 in 100 Annual Probability +14% Climate Change Allowance Manning's
Roughness Sensitivity 20% Increase**



**Figure 16: 1 in 100 Annual Probability + 14% Climate Change Allowance Manning's
Roughness Sensitivity 20% Decrease**



- 4.2.3 **Figures 15 and 16** show a $\pm 20\%$ increase and decrease in the Manning's 'n' roughness values.
- 4.2.4 There is generally a slight increase in the modelled flood extents for a 20% increase in the Manning's roughness and a slight decrease in the modelled flood extents for a 20% decrease.
- 4.2.5 The area where the flood extent is more sensitive to the Manning's value selected is at the intersection between OW01, OW02 and OW03. This was noted on site as a localised flat area.
- 4.2.6 The model is therefore considered to be insensitive to this an increase and decrease in Manning's value and the assumptions made in assigning the Manning's roughness values are appropriate.

4.3 Culvert Blockage

- 4.3.1 A 20% culvert blockage and 50% culvert blockage was modelled to represent scenarios where the culverts within the model are partially blocked, due to vegetation or debris.
- 4.3.2 **Figure 17** and **Figure 18** shows the difference in the maximum flood extents for the blockage scenarios compared with the baseline 1 in 100 annual probability +14% climate change allowance scenario.

Figure 17: 1 in 100 Annual Probability +14% Climate Change Allowance and 20% Culvert Blockage

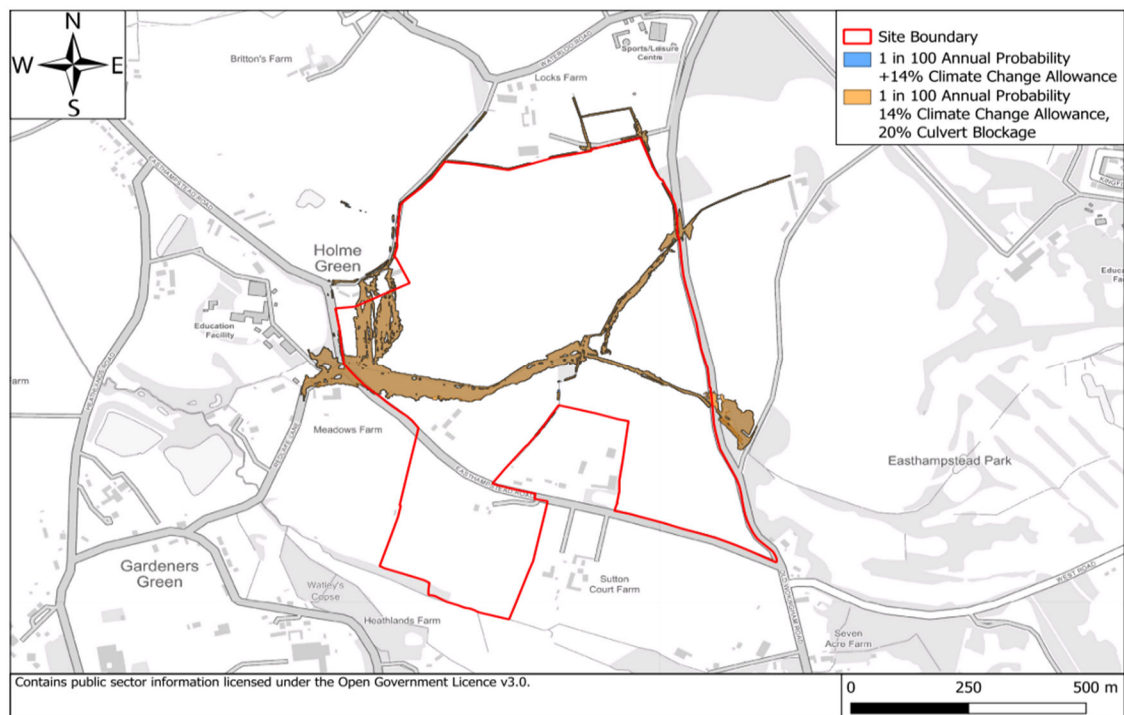
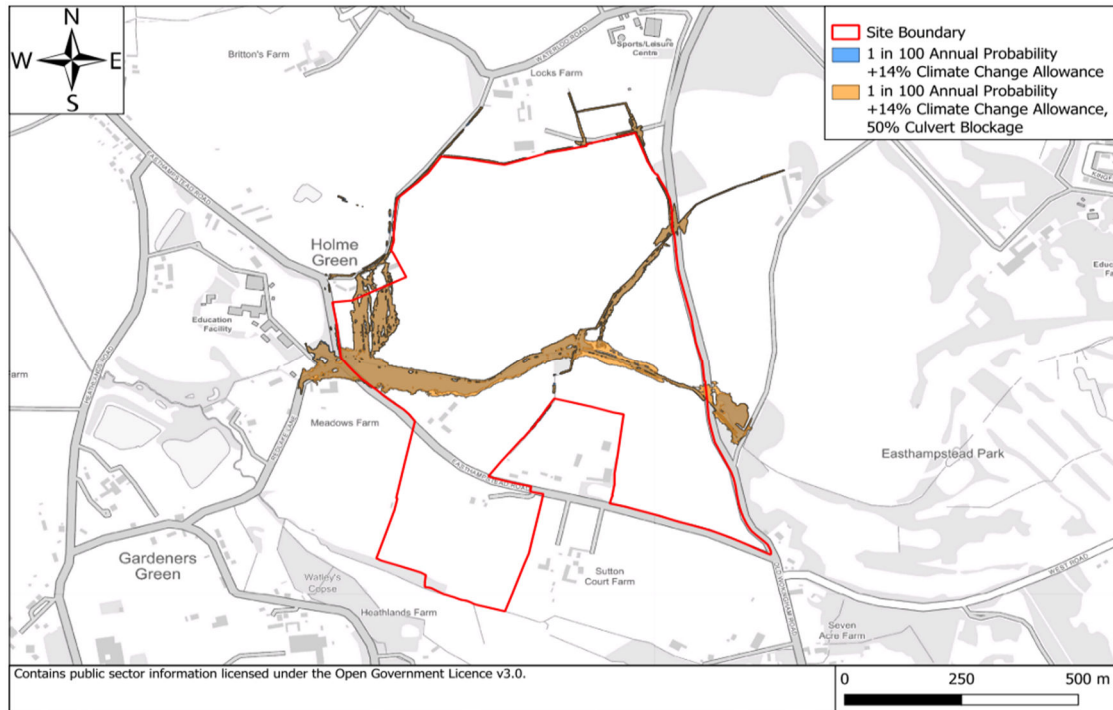


Figure 18: 1 in 100 Annual Probability +14% Climate Change Allowance and 50% Culvert Blockage



- 4.3.3 **Figures 17 and 18** show that the 20% and 50% culvert blockages slightly increase the extent of flooding immediately upstream of the culverts. Most notably at the Old Wokingham Road culvert on OW01 for the 20% and 50% blockage scenarios and at the structures of PF03_0013C and PF01_0544C, and at the confluence of OW02 and OW03 with OW01 for the 50% blockage scenario. As expected, the extent of flooding is greater with 50% culvert blockage compared to the 20% blockage.
- 4.3.4 The culvert blockages do not significantly impact the extent of flooding across the rest of the site and the overall modelled flood extent is not sensitive to culvert blockages.

4.4 Downstream Boundary

4.4.1 Figures 19 and 20 show a 20% increase and 20% decrease to the downstream boundary slope.

Figure 19: 1 in 100 Annual Probability +14% Climate Change Allowance and a Downstream Boundary 20% Increase

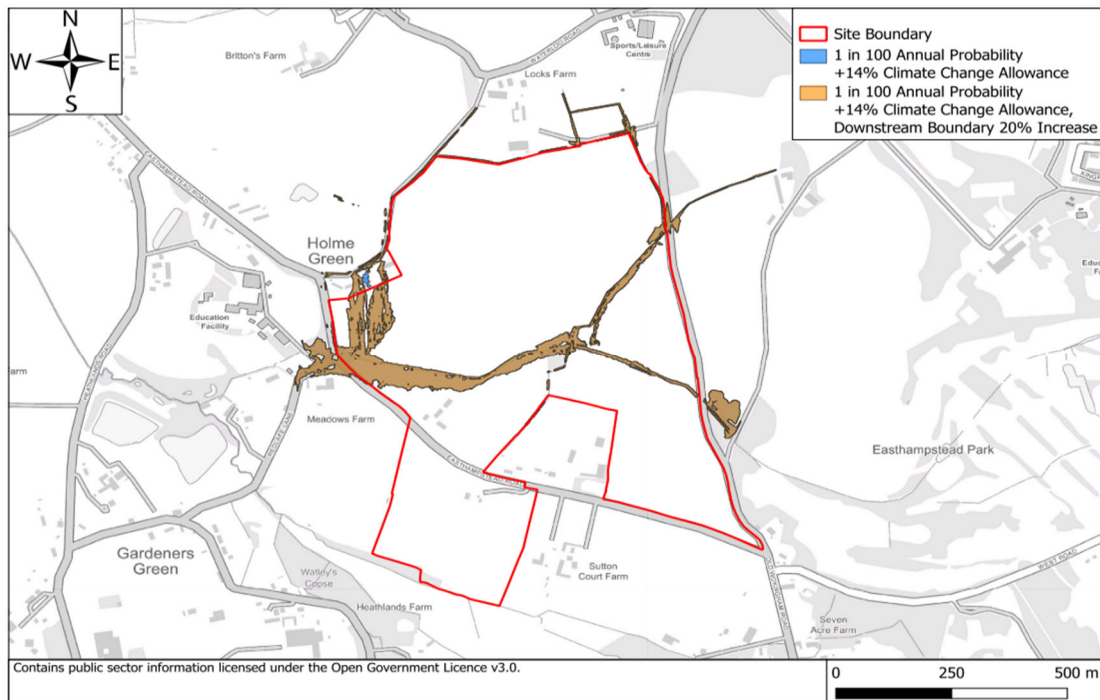
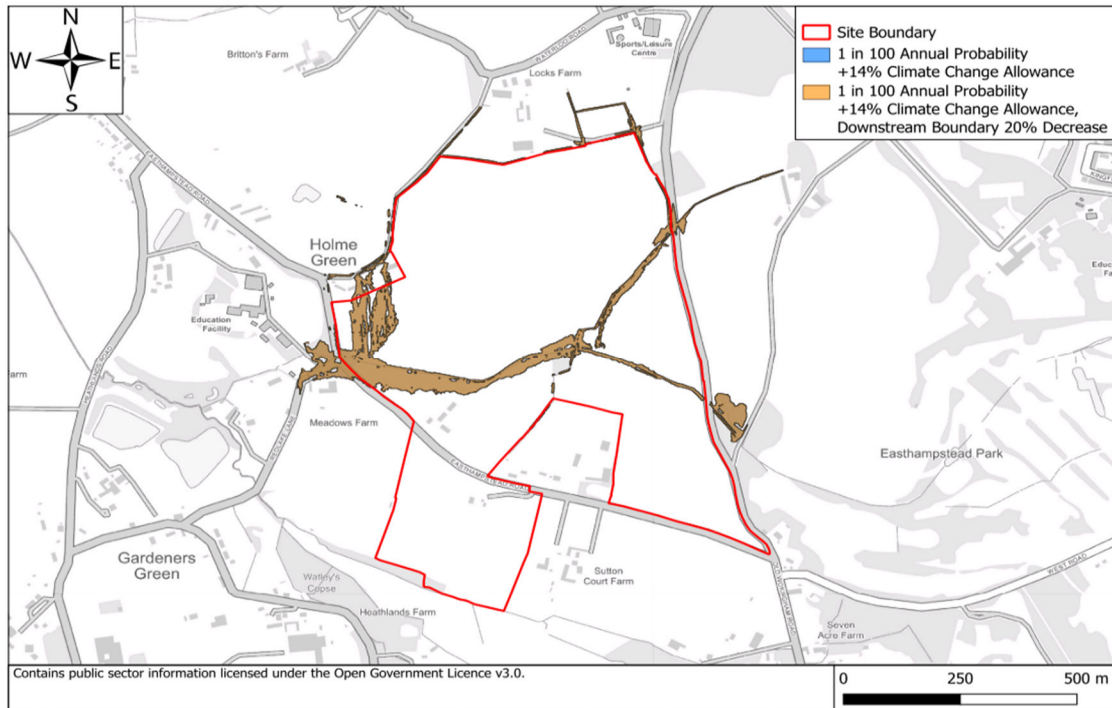


Figure 20: 1 in 100 Annual Probability +14% Climate Change Allowance and a Downstream Boundary 20% Decrease



- 4.4.2 As shown in **Figures 19** and **20**, the increase and decrease in the downstream boundary slope makes an insignificant impact on the modelled flood extents.
- 4.4.3 The model is therefore insensitive to the assumptions made for the downstream boundary slope.

5 Fluvial Baseline Model Results

5.1 Flood Extents

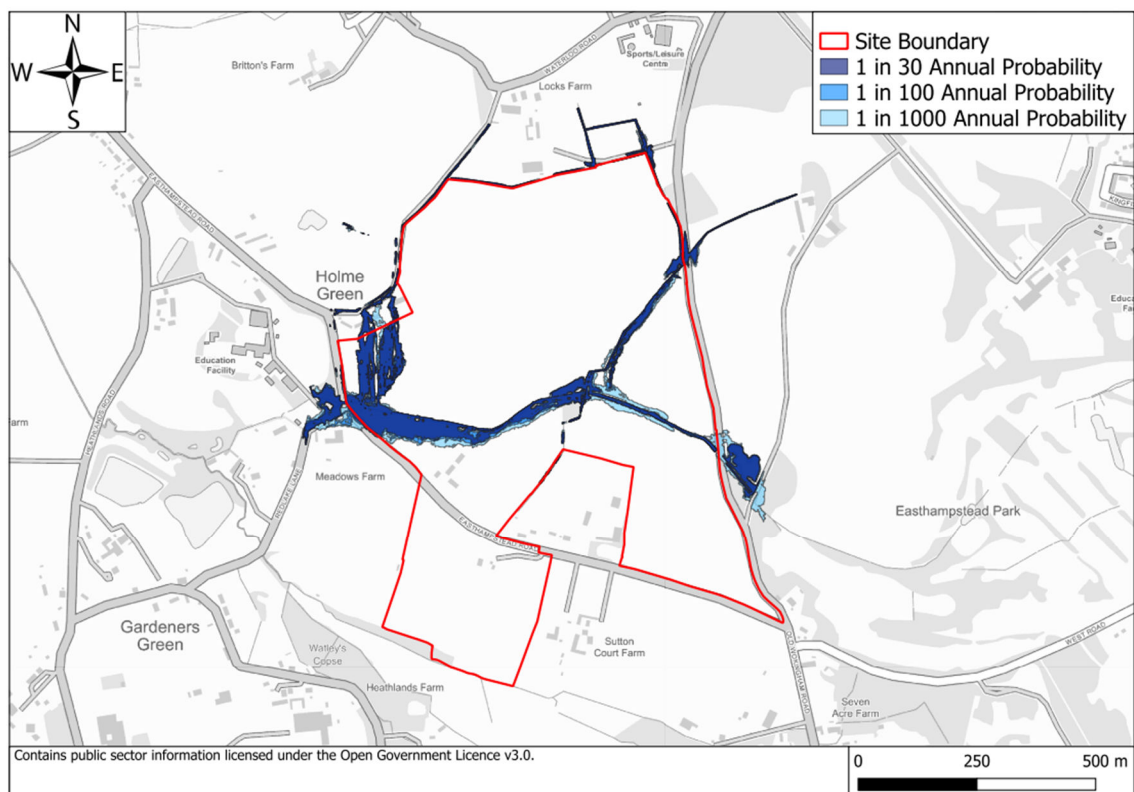
5.1.1 The model was run and the results were extracted for the following events:

- 1 in 30 annual probability;
- 1 in 100 annual probability;
- 1 in 1,000 annual probability; and
- 1 in 100 annual probability +14% climate change allowance.

5.2 Flood Extents

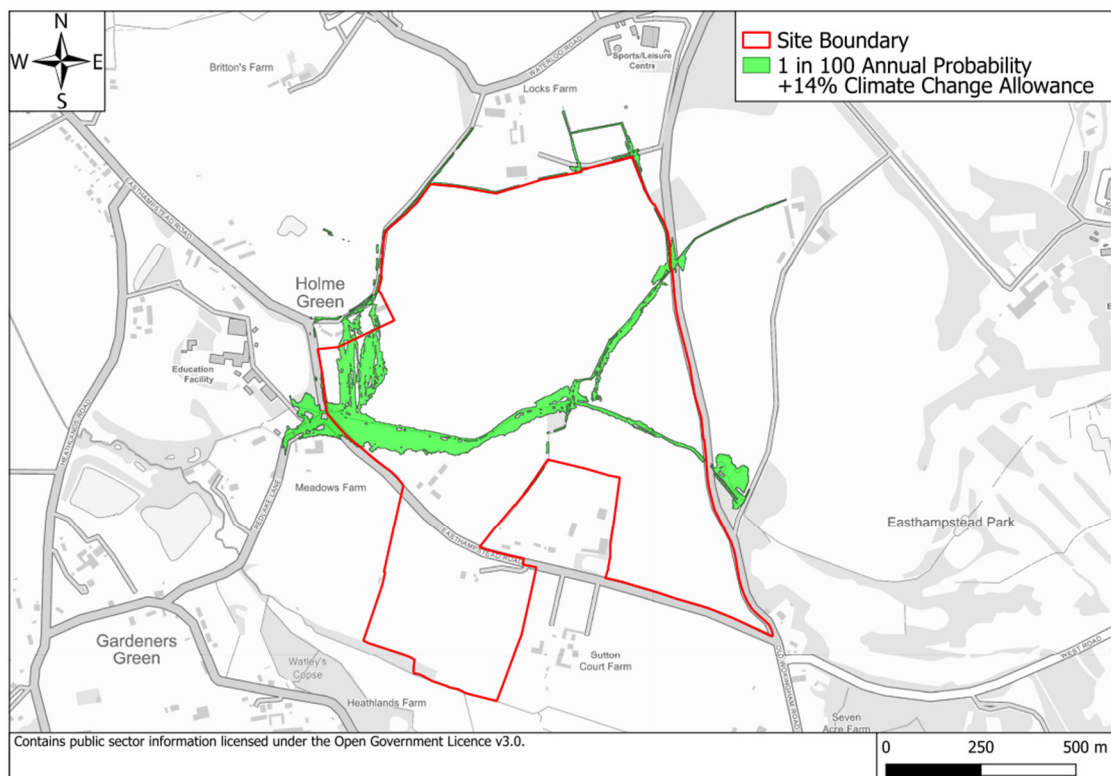
5.2.1 The maximum modelled flood extents for all modelled return periods are included in **Figure 21**. The climate change modelled flood extent is shown in **Figure 22**.

Figure 21: Abley Letchford Baseline Flood Extents



- 5.2.2 **Figure 21** shows the Abley Letchford 1 in 30 annual probability, 1 in 100 annual probability and 1 in 1,000 annual probability maximum flood extents. The flooding extent clearly follows the location of the watercourses and watercourse corridors. Most notably at OW01 flowing east to west through the centre of the site.
- 5.2.3 East of OW08, there is flooding that extends across the site to Holme Green. This appears in all return period scenarios. The flooding is coming from OW10. The ditch along northern track stops. The survey did not pick up a culvert in this location, nor was one visible during the site walkover. Flow from OW10, flows out of bank and along the northern track. The flow finds low points along the northern access track and then flows in a southerly direction, through the site to OW01. The depths of flooding are less than 0.02m.
- 5.2.4 In the northeastern area of the site, where there has been the inclusion of the OW04 and OW05 channels, there is water in channel which appears to stay in channel.
- 5.2.5 **Figure 22** shows the baseline flood extent for the 1 in 100 annual probability +40% climate change allowance scenario.

Figure 22: Abley Letchford Climate Change Flood Extents



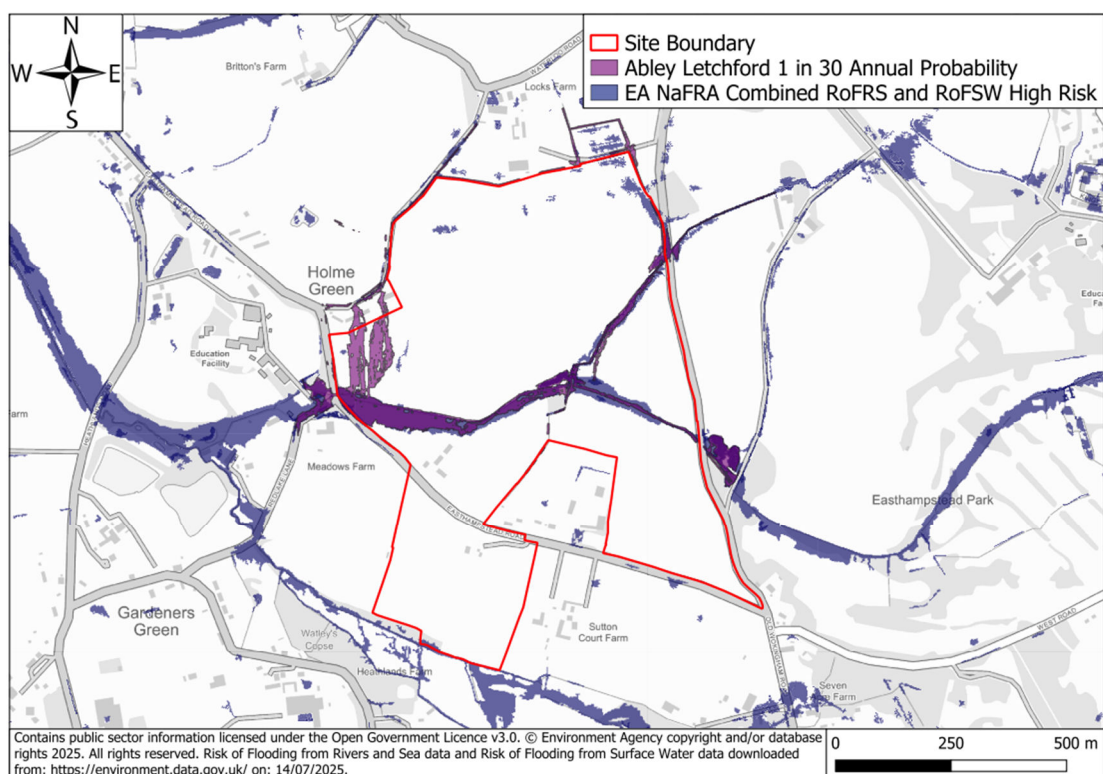
- 5.2.6 **Figure 22** shows the 1 in 100 annual probability +40% climate change allowance scenario. It shows a similar extent to the 1 in 1,000 annual probability from Abley Letchford's baseline results, as shown in **Figure 21**.
- 5.2.7 Flow largely remains in bank of these channels with some areas appearing to come out of bank at the downstream section of OW01. Similarly to the flood extent shown in **Figure 21**, downstream

of OW01 and at the intersection of OW01, OW02 and OW03, there is water that comes out of bank. Similarly, the overland flow route from OW10 is present in the western part of the site.

5.3 Comparison of EA and Abley Letchford Flooding Extents

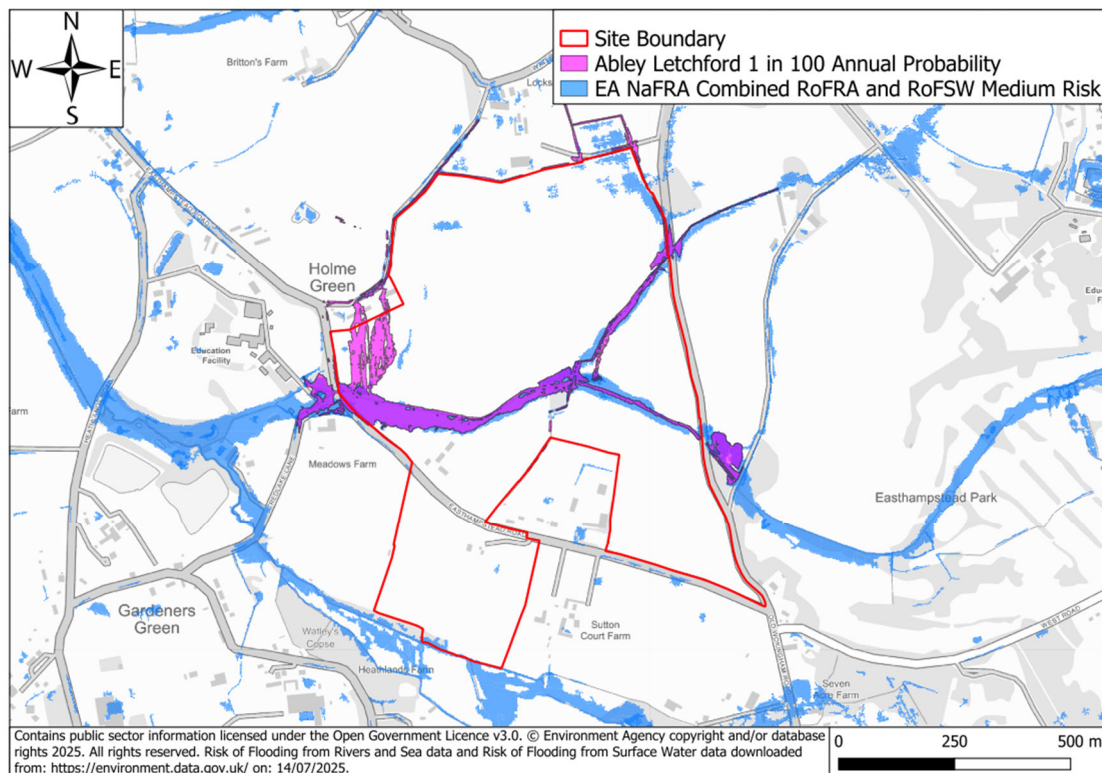
- 5.3.1 **Figures 23 – 25** show a comparison between the high, medium and low EA NaFRA surface water and rivers and sea flooding and Abley Letchford's, 1 in 30, 1 in 100 and 1 in 1,000 annual probability surface water extent.

Figure 23: Comparison of NaFRA 1 in 30 Annual Probability Flood Risk from Surface Water and Rivers and Sea and Abley Letchford 1 in 30 Annual Probability



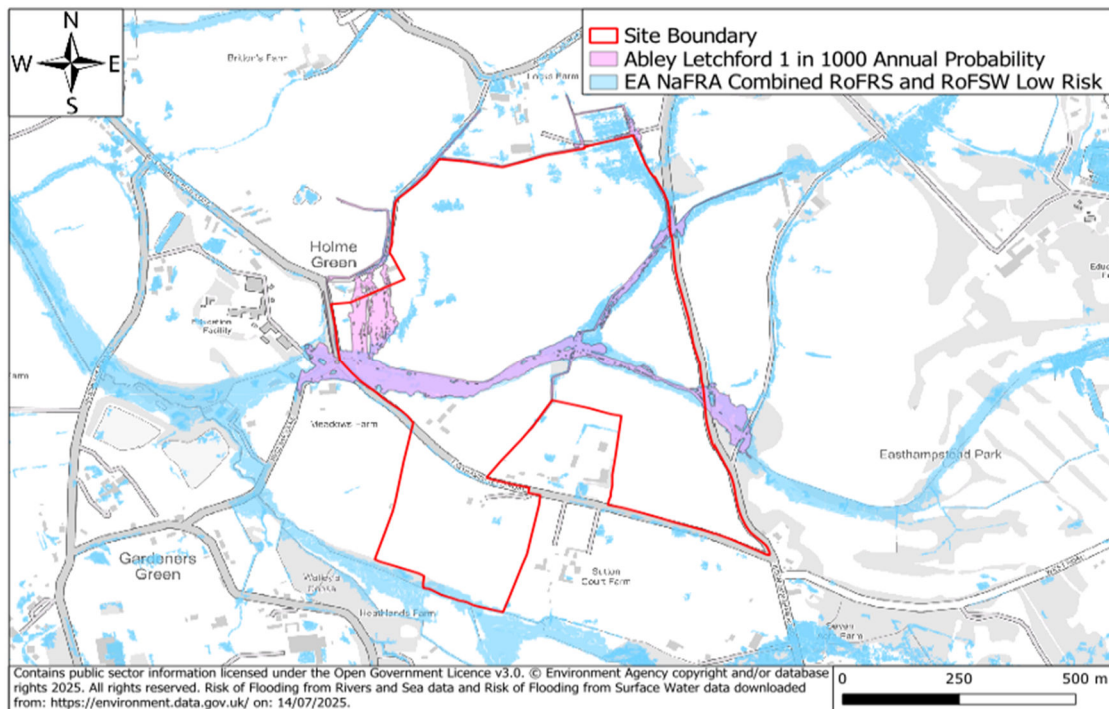
- 5.3.2 Abley Letchford's 1 in 30 annual probability model results in comparison to the EA NaFRA Surface Water and Rivers and Sea modelling are presented in **Figure 23**.
- 5.3.3 An area where there is more flooding in the Abley Letchford's results compared to the EA mapping is at the western boundary, east of OW08. This flooding appears to be a potential flow route across the site to Holme Green. It does not follow the location of any channel or ditch.
- 5.3.4 The flooding is less extensive in the northeastern corner of the site, the EA mapping shows there to be high, medium, low and very low flooding in this area. Abley Letchford's modelled results show no flooding in the centre of the OW04, OW05 and OW06 and less flooding to the south of OW04 and within the site boundary. This is most likely as the channels have been included in Abley Letchford's model which were not included within the strategic EA NaFRA modelling and thus water is being conveyed and stored within them, meaning the water has a place to go instead of ponding and flowing onto the site.

Figure 24: Comparison of NaFRA 1 in 100 Annual Probability Flood Risk from Surface Water and Rivers and Sea and Abley Letchford 1 in 100 Annual Probability



- 5.3.5 Abley Letchford's 1 in 100 annual probability model results in comparison to the EA Surface Water and Rivers and Sea modelling are presented in **Figure 24**.
- 5.3.6 Similarly to the 1 in 30 annual probability, the key areas where there is less extensive flooding include in the northeastern corner of the site, the EA mapping shows there to be high, medium, low and very low flooding in this area and significant flooding. In comparison Abley Letchford's results show minimal flooding in this area, instead minimal spotting and ponding, which is slightly more than in the 1 in 30 annual probability scenario. The inclusion of the channels means water can be captured, conveyed and stored within them. Additionally, upstream of OW01 there is less flooding in the Abley Letchford model results.
- 5.3.7 As in **Figure 23** and the 1 in 30 annual probability, there is flooding in the Abley Letchford model results in the west of the site which does not appear in the EA mapping. Here, the flooding extent is shown to be the consistent with the flooding as shown in the 1 in 30 annual probability scenario.

Figure 25: Comparison of NaFRA 1 in 1,000 Annual Probability Flood Risk from Surface Water and Rivers and Sea and Abley Letchford 1 in 1,000 Annual Probability



- 5.3.8 Abley Letchford's 1 in 1,000 annual probability model results in comparison to the EA Surface Water and Rivers and Sea modelling are presented in **Figure 25**.
- 5.3.9 Abley Letchford's baseline mapping has a slightly lesser extent than the EA NaFRA surface water and rivers and sea mapping. Along the extent of OW01, the flooding extent modelled by Abley Letchford is only marginally lesser than the EA mapping. Both results show water within channel, to the south of the channel and flooding occurring at the downstream boundary of the site.
- 5.3.10 Similarly, to **Figures 23** and **24**, **Figure 25** shows there to be flooding in the west of the site. Here there are flow routes that do not correlate to any channels or ditches.
- 5.3.11 In the northeastern corner of the site, the EA Flood extent has more flooding in the 1 in 1,000 annual probability scenario compared to Abley Letchford's modelled results. This difference is key in demonstrating how the inclusion of the channels impacts the flood risk of the site.
- 5.3.12 Overall, **Figures 23 – 25** all show that Abley Letchford's baseline flood mapping has a lesser extent than the EA NaFRA surface water and rivers and sea mapping apart from the area in the west of the site where there is a flooding extent that extends towards Holme Green.



5.4 Message Layers

- 5.4.1 No negative depth layers are present for all model runs. The model is therefore considered to be healthy and stable.
- 5.4.2 There were 19 warning messages. 12 of these are associated with 'ghost features'. 'Ghost features' are GIS features that have no associated geometries. These 'ghost features' do not impact the model and therefore Abley Letchford are satisfied for them to remain. 7 of the messages are associated with the crest/invert level of structures being below the bed level. Abley Letchford have reviewed these messages and the associated structures. Comparing the structure location to the survey information and site observations, this shows that the structures have been digitised accordingly and are representative of what is on site. Abley Letchford are therefore satisfied that those warning messages will not impact the model results.

5.5 TUFLOW Model Run Performance

- 5.5.1 The model is set up to run for the full range of events required. **Table 4** provides a summary of the 2D domain performance parameters.

Table 4: Model Run Parameters

Model Parameter	Value
Start time (hours)	0
End time (hours)	12
Model run time (hours)	1
Volume error	< 0%
Mass balance error	< ±0%

- 5.5.2 **Table 4** shows that the mass error for the 1 in 100 annual probability for the 2D domain. This is within the ±1% error. The model can therefore be considered to be stable and free of any major stability issues, according to TUFLOW guidance.
- 5.5.3 All of the modelled simulations were run for the full 12 hours. The model runs were run beyond the peak of the event. Therefore, the maximum flood extents from the model are representative of the peaks flood extents for each modelled scenario.



5.6 Limitations and Assumptions

5.6.1 Key limitations and assumptions of the study are listed below:

- The FEH catchment descriptors are representative of the catchment.
- The LiDAR data is representative of the elevations across the catchment (for this study a sense check was undertaken but not a detailed review).
- The topographical survey of the elevations across the site are representative (for this study a sense check was undertaken but not a detailed review).
- The materials data is representative of the roughness of the catchment (for this study a sense check was undertaken but not a detailed review).
- A grid cell size of 1m was used. The grid size provides a reasonable balance between the model resolution, and the model run time.

5.6.2 As with all hydraulic modelling, there remains some residual uncertainty within the model results. However, we have tried to mitigate this through the sensitivity testing.

6 Scenario Modelling

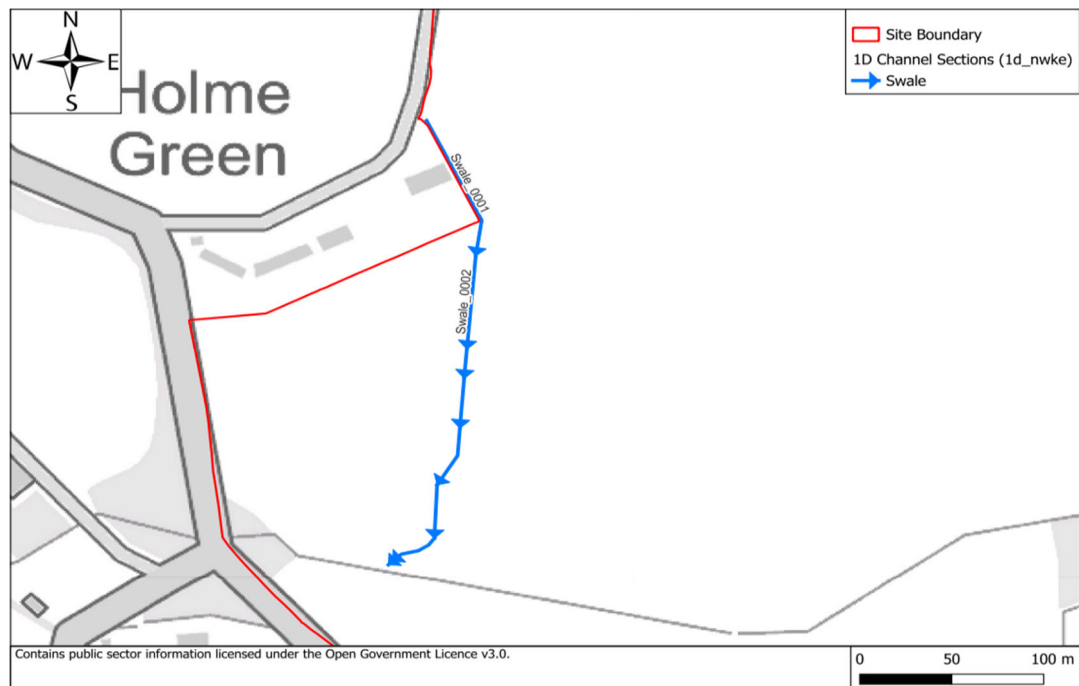
6.1.1 Abley Letchford has modelled the ‘with scheme’ scenario. This section sets out the updates made to the baseline model and the with scheme model results.

6.2 Holme Green Lane Swale

6.2.1 As shown in **Figure 2**, OW07 stops at the houses to the south of Holme Green Lane. The channel survey, nor the site walkover identified any culvert at the end of the watercourse. Flow within OW07 was spilling onto Holme Green Lane and through the houses at low points in the topography in a southerly direction towards OW01.

6.2.2 The swale conveys flows from OW07 along the green corridor within the masterplan into OW01. **Figure 26** shows the location of the swale.

Figure 26: Swale Location

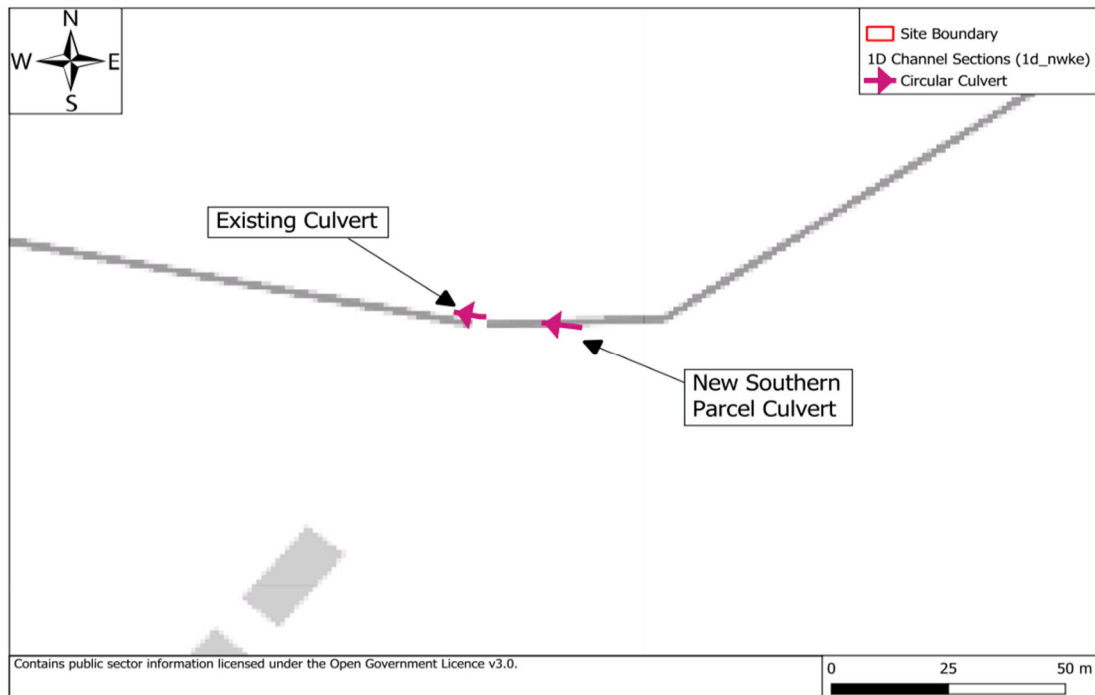


6.2.3 The swale is modelled as a 2m wide and 0.3m deep ‘V’ shaped channel between Swale 001 and Swale 003. The swale is 3m wide and 0.3m deep downstream of Swale 003. The bank levels were set using the topographical survey ground levels. The bed level has been set at 0.3m lower than the lowest bank.

6.3 Proposed Crossing of OW01

- 6.3.1 A 1,050mm diameter circular culvert was added to the model to represent the proposed road crossing to the development parcel to the south of OW01. The culvert location is shown in **Figure 27**.

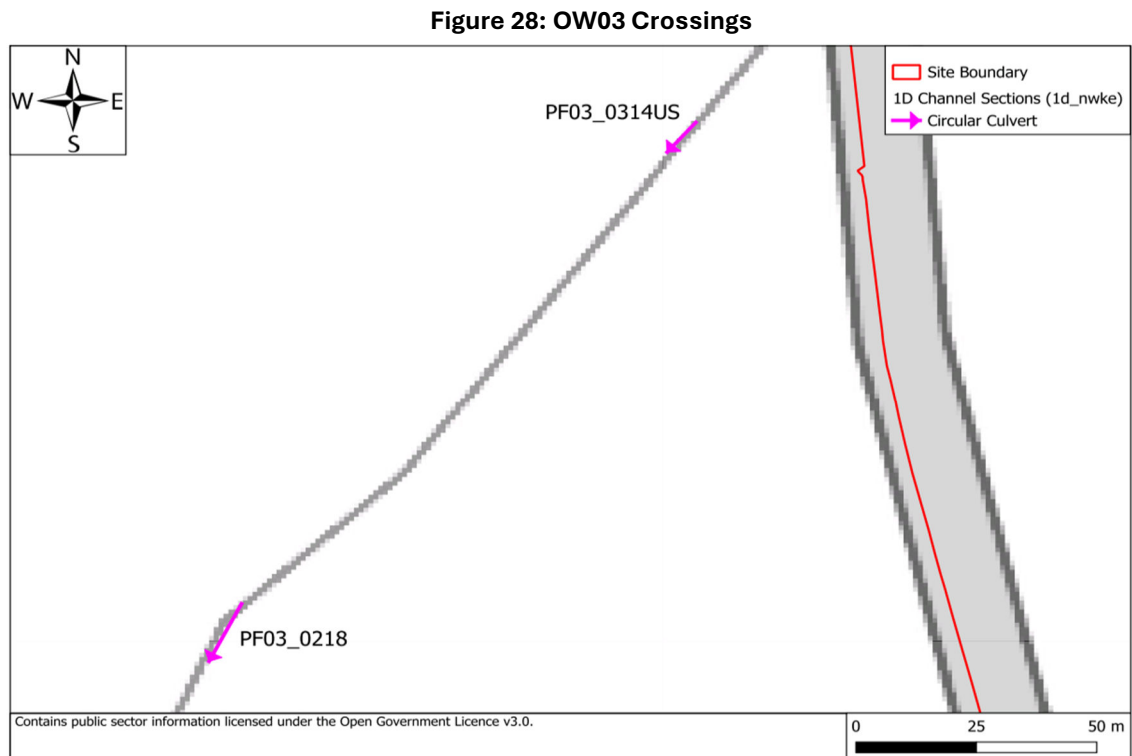
Figure 27: Proposed Crossing of OW01



- 6.3.2 The culvert diameter was set referencing the other culverts along OW01.
- 6.3.3 The upstream and downstream invert levels were set using the upstream and downstream cross section bed levels.

6.4 OW03 Crossings

6.4.1 Two crossings have been included in the model along OW03, as shown in **Figure 28**.



6.4.2 The invert levels were set using the upstream and downstream cross section bed levels. The culvert diameters were set using the available cross section areas.

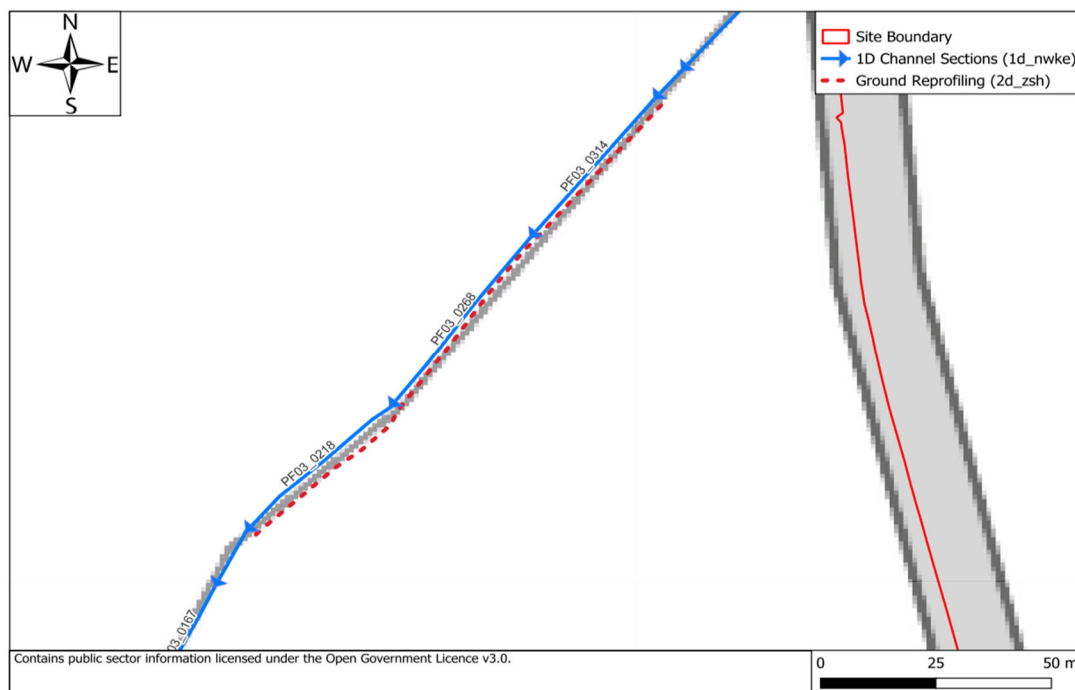
6.4.3 The circular culvert at PF03_0314US has a diameter of 675mm. The circular culvert at PF03_0218 has a diameter of 900mm.

6.5 Bank Reprofilng

6.5.1 The bank level of the channel of OW03 has been reprofiled along channel sections PR03_0314, PF03_0268 and PF03_0218 as flow was coming out of channel at a low point. A uniform level of 61.5m AOD was applied along the reach to prevent flow from coming out of the channel here.

6.5.2 Figure 29 shows the location of the proposed reprofiling.

Figure 29: Proposed Reprofilng Along OW03

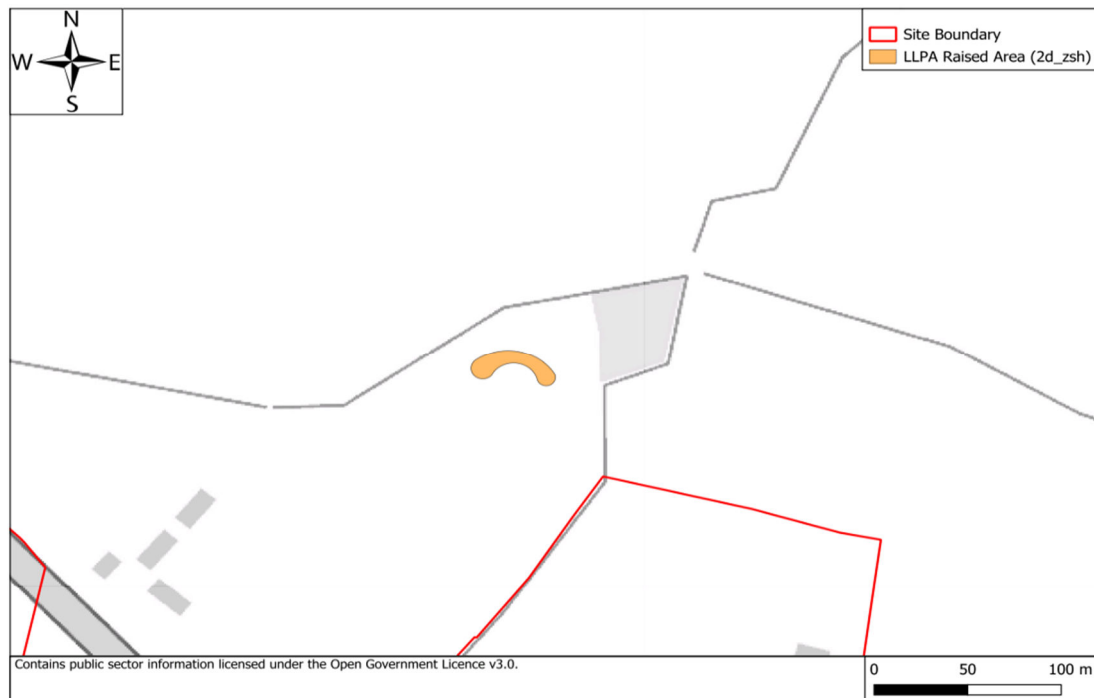


6.6 Local Landscaped Play Area Raised Area

6.6.1 The Local Landscaped Play Area (LLPA) was raised by 1m to ensure it was outside of the floodplain.

6.6.2 **Figure 30** shows the location of the LLPA.

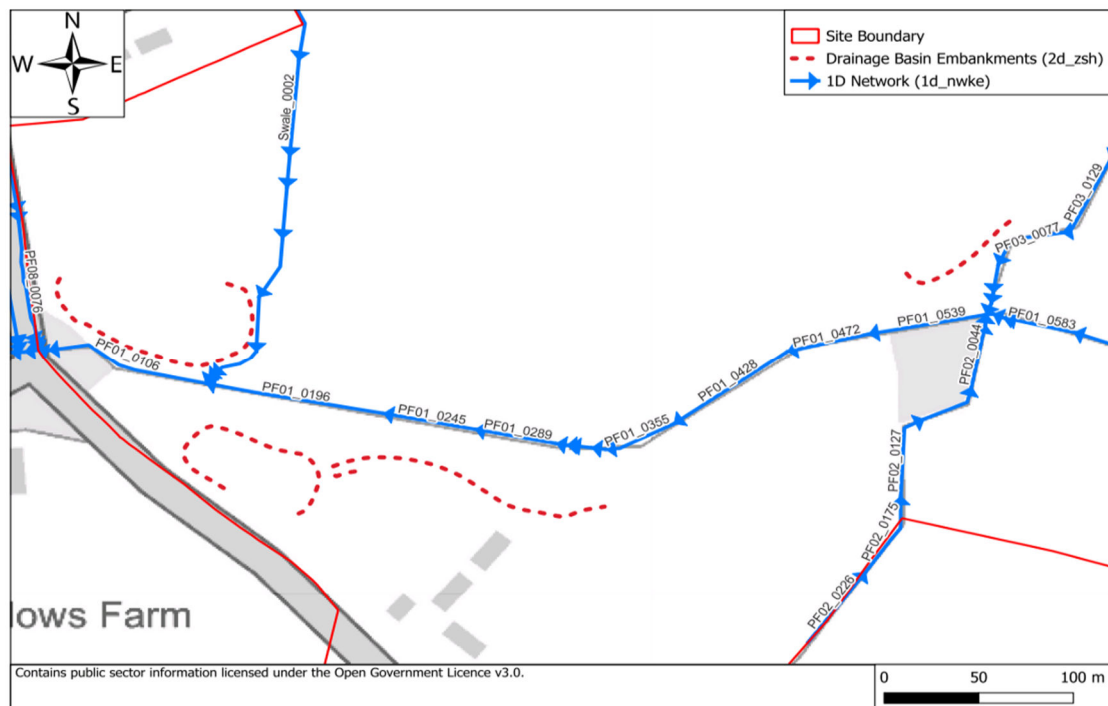
Figure 30: Local Landscaped Play Area Raised Area



6.7 Raised Bank Around Drainage Basins

6.7.1 0.5m high bunds were added around the drainage basins with the floodplain to prevent flooding from entering them. **Figure 31** shows the location of the drainage basin bunds.

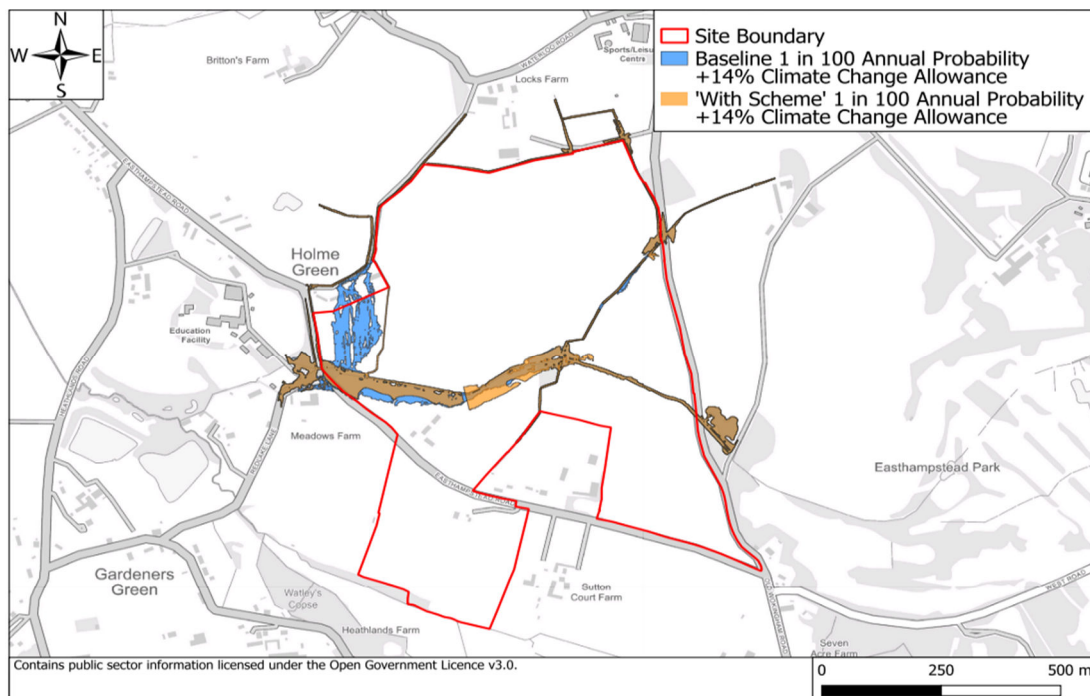
Figure 31: Drainage Basin Bund Location



6.8 Model Results

6.8.1 Figure 32 shows the 1 in 100 annual probability +14% climate change allowance modelled flood extent with all of the 'with scheme' elements included within it. The 1 in 100 annual probability +14% climate change allowance baseline flood extent has been included to show a comparison in the modelled flood outlines.

Figure 32: 'With Scheme' Flood Extent



- 6.8.2 The 'with scheme' flood extent shows less flooding in the western part of the site as the overland flow route from OW07 is managed within the swale.
- 6.8.3 There is an increase in flooding upstream of the southern development crossing as flow backs up behind the culvert and deck. There is a slight decrease in flooding downstream of the culvert due to the culvert holding back flow. There is also a slight increase in flooding upstream of the OW03 culverts.
- 6.8.4 The LLPA is not flooded within the 'with' scheme model. The LLPA raised area has an insignificant impact on the flood extents due to its small size and significant impact of the southern crossing culvert on the conveyance of flow in the localised area.
- 6.8.5 The drainage basin bunds are located outside of the modelled flood extents with the inclusion of the bunds. There is no significant impact on modelled flood extents, likely due to the inclusion of the southern crossing culvert.
- 6.8.6 There is no difference in the modelled flood extents upstream of the site.
- 6.8.7 There is significant betterment at Holme Green Lane and slight betterment in the downstream flood extent between Redlake Lane and Easthampstead Road.



7 Conclusions

- 7.1.1 This modelling report has been prepared by Abley Letchford, on behalf of the Lightwood Ltd to refine the surface water extents for Priors Farm, in South Wokingham.
- 7.1.2 A hydrological assessment was undertaken to provide hydrographs for the catchment. The FEH catchment descriptors were reviewed and refined using a desk-based assessment. ReFH2 software was used for the hydrological assessment.
- 7.1.3 The model was run for the following return periods: 1 in 30, 1 in 100, and 1 in 1,000 annual probability. The maximum flood levels and extents were extracted for all of the modelled return periods.
- 7.1.4 The site is located within the Loddon and Tributaries Management Catchment. The latest (July 2021) climate change allowance for the catchment is +14% for the Upper End uplift to flows and this is to be used to inform FRA studies. The maximum flood extents were extracted for all the modelled climate change scenario.
- 7.1.5 The model results show that the majority of the site is located outside of the surface water return periods of 1 in 30, 1 in 100 and 1 in 1,000. There are key areas where there are surface water flows, along the OW01 and OW03 and water comes out of channel in some sections of these watercourses. A particularly sensitive area is the intersection in the centre of the site.
- 7.1.6 Sensitivity testing was carried out to determine the impact of uncertainty and assumptions made within the modelling. Sensitivity tests were carried out for $\pm 20\%$ Manning's 'n' roughness values, 50% and 90% culvert blockages, 50% and 90% culvert blockage, a decrease in cut-off depth and a $\pm 20\%$ increase and decrease of the downstream boundary slope.
- 7.1.7 The assumptions made within the model are deemed to be reasonable and the model is generally not considered to be sensitive to any of the assumptions made. The culvert blockage sensitivity test showed that the culvert under Old Wokingham Road on OW01 was sensitive to being blocked in the 20% and 50% blockage scenarios. The low-lying area at the confluence of OW01, OW02 and OW03 was deemed to be more sensitive to some of the parameters tested. Therefore, it is recommended that space is left in the masterplan to reflect this. This particularly areas and the downstream and upstream areas are shown to be the most sensitive within all of the sensitivity runs.
- 7.1.8 The 'with scheme' scenario was modelled. The most notable differences were in the western part of the site where the swale conveys flow within the western part of the site, therefore the overland flow route is no longer present and the properties at Holme Green Lane are no longer shown to be affected by flooding. There is a notable increase in flooding upstream of the proposed crossing of OW01 but this is restricted to areas within the site. This is due to the diameter of the culvert restricting the conveyance of flow downstream. The 'with scheme' model does not increase flooding upstream of the site. Downstream of the site there is slight betterment between Redlake Lane and Easthampstead Road, likely due to the southern development parcel crossing holding back flow within the site.



Appendices



Appendix A - Hydrological Report



Priors Farm, South Wokingham SDL

Flood Estimation Report

Lightwood Strategic Ltd

26 November 2025





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Contents

1 Summary of Assessment 1

2 Method 2

3 Flood Estimates 7

4 Statistical Method 10

5 Revitalised Flood Hydrograph 2 (ReFH2) 13

6 Model Inflows 14

7 Discussion and Summary of Results 16

Appendices

- Appendix A – Pooling Groups
- Appendix B – WINFAP Summary
- Appendix C – ReFH2 Summary



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1 Summary of Assessment

1.1 Summary

- 1.1.1 This Flood Estimation Report has been prepared by Abley Letchford, on behalf of Lightwood Strategic Ltd to provide inflows to a hydraulic model at Priors Farm, South Wokingham in Berkshire using the latest data, software and methods proportionate to the scope of work.
- 1.1.2 The study is considered to be moderate based on the EA hydrology complexity guidance scope of work.
- 1.1.3 The western and central part of the catchment comprises of greenfield agricultural land. The eastern part of the catchment is primarily residential development. The southeastern part of the site is woodland.
- 1.1.4 The catchment is not influenced by reservoirs and is not pumped. The catchment also does not have extensive floodplain storage.
- 1.1.5 The catchment is not groundwater driven. The key mechanism of flooding is therefore flood flows exceeding the channel capacity.
- 1.1.6 The catchment is ungauged and therefore a limitation of the study is the lack of locally available information.
- 1.1.7 The final choice of method was ReFH2. The Statistical Method was also completed. However, there were not enough years of similar data from the subject catchments therefore there was lower confidence in the calculated QMED value. The Statistical Method was therefore rejected. The Statistical Method was completed alongside the ReFH2 method as a comparison for the peak flow estimates.

1.2 Flood Frequencies

- 1.2.1 The frequency of a flood event can be expressed in either annual exceedance probability (AEP) or as a return period. A return period is defined as the average time between years with a larger flood event. An AEP is defined as the probability of a certain size event occurring over a given period.
- 1.2.2 **Table 1** provides a conversion between return periods and AEP.

Table 1: Annual Exceedance Probability (AEP) and Related Return Period

Annual Exceedance Probability (%)	50	20	10	5	3.33	2	1.33	1	0.5	0.1
Annual Exceedance Probability	0.5	0.2	0.1	0.05	0.033	0.02	0.0133	0.01	0.005	0.001
Return Period (years)	2	5	10	20	30	50	75	100	200	1,000



2 Method

2.1 Requirement for Flood Estimates

Overview

- 2.1.1 This study provides inflows for use in a hydraulic model for the Ordinary Watercourses at Priors Farm, South Wokingham in Berkshire. The latest data, methodologies and software have been used, proportionate to the scope of works.
- 2.1.2 The study derives peak flow estimates at the downstream point of the catchment.
- 2.1.3 As part of the study, peak flow estimates will be calculated for the following return periods:
- 1 in 2
 - 1 in 5
 - 1 in 10
 - 1 in 20
 - 1 in 30
 - 1 in 50
 - 1 in 75
 - 1 in 100
 - 1 in 200
 - 1 in 1000
- 2.1.4 Climate change will be considered for the 1 in 100 annual probability scenarios. This will be discussed separately.

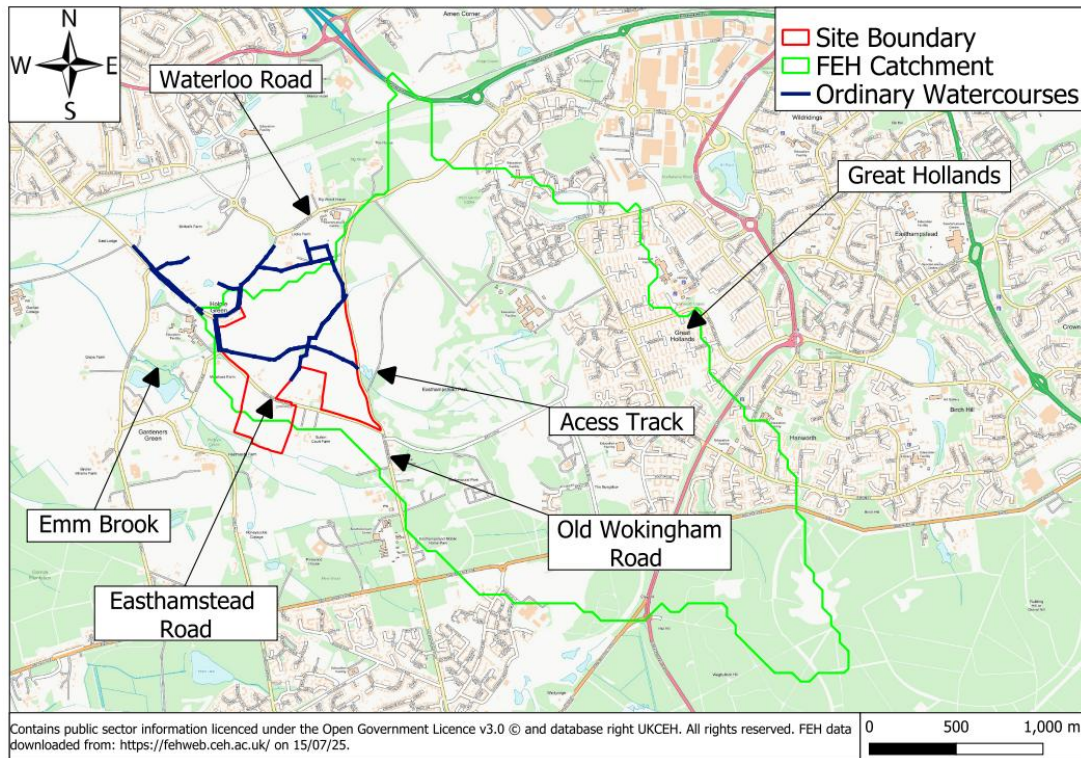
2.2 Project Scope

- 2.2.1 This study is considered to be moderate due to the scale of the application.
- 2.2.2 The inflows will be used in a hydraulic model of the Ordinary Watercourses and assist in determining the flood extents across the site.

2.3 Catchment

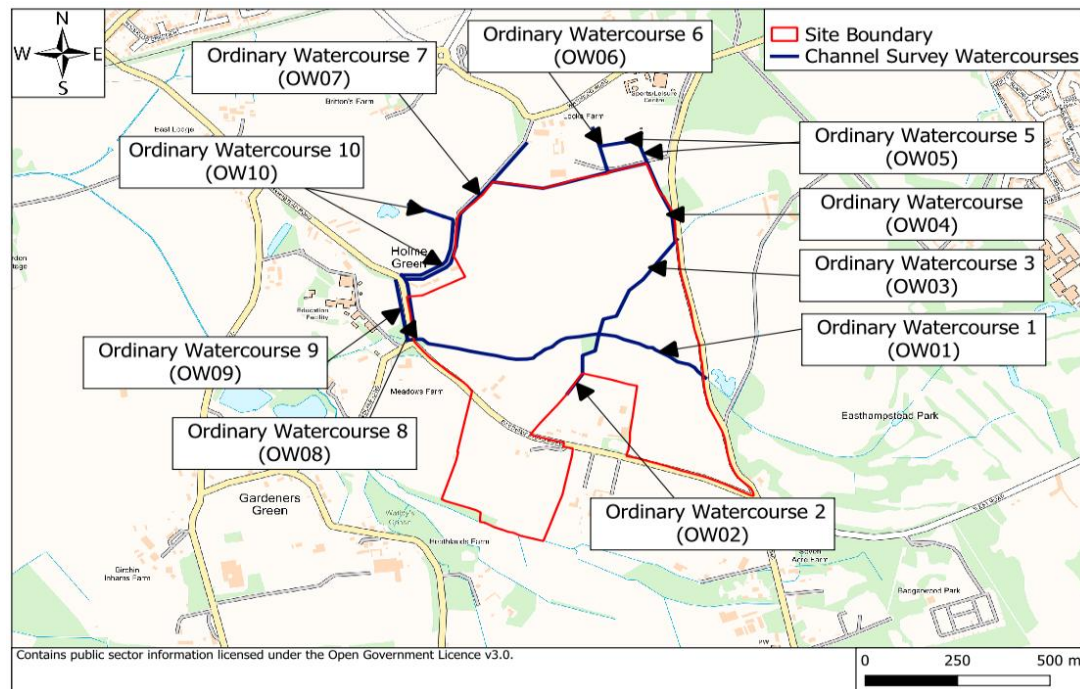
- 2.3.1 The catchment area was downloaded from the FEH Web Service as part of the catchment descriptors. The catchment area, watercourses and site location are shown in **Figure 1**.

Figure 1: Catchment Overview



- 2.3.2 The Ordinary Watercourses have been assigned numbers for the purpose of this study to identify them. The Ordinary Watercourse numbers are shown in **Figure 2**.

Figure 2: Ordinary Watercourse Numbers



- 2.3.3 **Figure 2** shows the channel survey watercourses, labelled from Ordinary Watercourse 1 (OW01) through to Ordinary Watercourse 10 (OW10). Ordinary Watercourse 1 (OW1) originates flows in a westerly direction across the central part of the site. OW02 flows in a northerly direction and joins OW1. OW3 flows in a southerly direction towards OW1. OW04 extends along the northern site boundary and feeds into OW3. OW5 flows in a southerly direction towards OW04. OW06 flows south and connects with OW5. OW7 flows in a southerly direction towards OW10. OW8 and OW09 both flow southerly from OW10. OW10 flows in a southerly direction towards OW09.
- 2.3.4 There is survey data for Ordinary Watercourses 11 to 15 included in the channel survey provided by the surveyors. These watercourses have not been included within this study as they were located outside of the catchment boundary and did not influence the flood risk within the catchment as flowed in a north westerly direction.
- 2.3.5 Ordinary watercourses flow in an easterly direction through Easthamstead Park, passing beneath the access track via a 300mm culvert, before continuing into the site. The flow then enters a 1m diameter culvert, which directs it beneath Easthamstead Road and ultimately discharges into the Emm Brook, located downstream to the south of the site.
- 2.3.6 The FEH catchment area is 5.9km².
- 2.3.7 The area of interest is at the downstream extent of the catchment, as shown in **Figure 1**.
- 2.3.8 The eastern part of the catchment is predominately the sub-urban area of Great Hollands. The western and central parts of the catchment is predominately rural agricultural fields. There is an area of woodland in the southeastern corner of the site.



2.4 Sources of Data

2.4.1 The latest (Version 13, August 2024) NFRA peak flow datasets were used. The dataset has been updated to include data until September 2023.

2.4.2 No changes were made to the peak flow datasets.

2.5 Gauging Stations (Flow and Level)

2.5.1 There are no available gauging stations within the catchment.

2.6 Other Data Sources

2.6.1 **Table 2** summarises other sources of data used within the study

Table 2: Summary of Other Sources of Data

Data	Relevance	Availability	Source	Details
Check flow gauging	Yes	No	N/A	NA
Historic flood data	Yes	Yes	DEFRA data portal – Recorded flood outlines	A sense check of the modelled outputs was carried out against the recorded outlines
Flow or river level data for events	Yes	No	NA	NA
Rainfall data for events	No	No	NA	NA
Potential evaporation data	No	No	NA	NA
Results from previous studies	Yes	No	NA	NA

2.7 Hydrological Understanding of the Catchment

Conceptual Model

2.7.1 The site location and catchment area are shown in **Figure 1**. The likely cause of flooding at the site is flood flows exceeding the channel capacity.

Unusual Catchment features

2.7.2 The catchment is not heavily urbanised.

2.7.3 There are no reservoirs within the catchment.



- 2.7.4 The catchment is not pumped.
- 2.7.5 The catchment is not considered to be highly permeable.
- 2.7.6 The catchment has not been previously mined.

2.8 Initial Choice of Approach

Is FEH Appropriate

- 2.8.1 FEH methods are considered to be appropriate.
- 2.8.2 The FEH Statistical Method and ReFH2 (version 2.3) methods will be carried out.
- 2.8.3 The hydrograph shapes will be derived using ReFH2.
- 2.8.4 A lumped catchment will be used for the peak flow estimates at the downstream point of the catchment. The catchment will be sub divided into sub catchments and the flows assigned based on their contributing catchment areas.

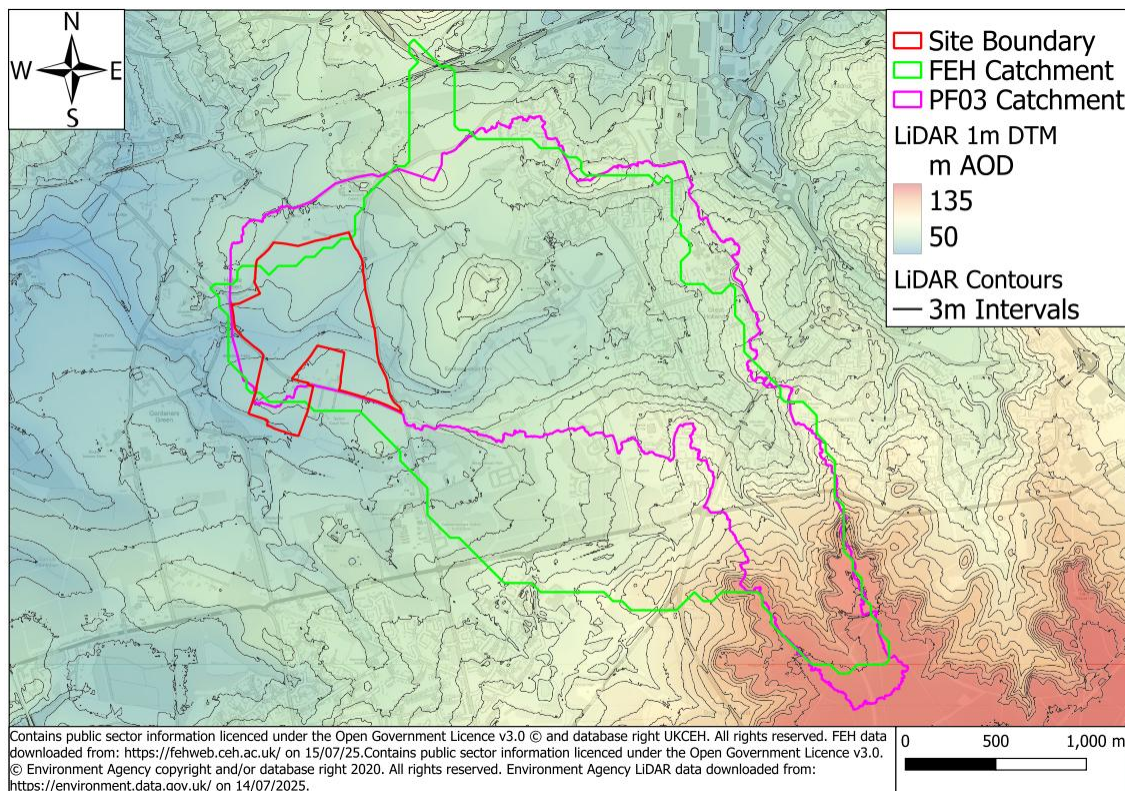
Software

- 2.8.5 The following software was used in this study.
 - FEH Web Service
 - WINFAP 5
 - ReFH2.3

3 Flood Estimates

3.1.1 **Figure 3** shows the located of the FEH catchment, adjusted catchment and site location.

Figure 3: Comparison of the FEH Catchment and Adjusted Catchment Areas



3.1.2 **Table 3** summarises the subject sites.

Table 3: Summary of the Subject Site

Site Code	Type of Estimate L – lumped catchment C – sub catchment	Watercourse	Site Name	Easting	Northing	FEH Area (km ²)	Revised Area (km ²)
PF03	C	Ordinary Watercourse	Priors Farm, South Wokingham SDL	482950	167100	5.9	4.8



3.2 Imported Catchment Descriptors

- 3.2.1 The catchment descriptors were extracted from the FEH Web Service.
- 3.2.2 The blue text in **Table 4** has been used to identify the catchment descriptors that have been updated from the FEH downloaded values.

Table 4: Summary of the Updated FEH Catchment Descriptors

Site Code	FARL	PROWET	BFIHOST	BFIHOST19	DLPBAR (km)	DPSBAR (m/km)	SAAR (mm)	URBEXT1990	URBXT2000	FPEXT
PF03	1	0.29	0.44	0.47	2.36	23.80	664	0.18	0.18	0.12

3.3 Checking Catchment Descriptors

Catchment Boundary

- 3.3.1 The FEH Online Service catchment boundary was checked using LiDAR data, EA watershed dataset, Ordnance Survey data, and google satellite imagery. A site walkover was also completed on 23rd July 2025 to observe the catchment characteristics.
- 3.3.2 The catchment boundary was adjusted to consider the slope of the catchment are the road drainage network.
- 3.3.3 The PF03 catchment area decreased from 5.9 km² to 4.8km², a decrease of 1.1 km². The difference in the catchment area between the FEH catchment and PF03 catchment is in the southern part of the FEH catchment. The FEH catchment appears to include an area which would drain to the Emm Brook catchment, to the south of the site therefore it was excluded from the PF03 catchment.

BFIHOST and SPRHOST

- 3.3.4 BFIHOST, BFIHOST19 and SPRHOST values for the catchment were checked using the Soil Survey for England and Wales soil type mapping/ Soilscales online viewer.
- 3.3.5 The percentage areas of each of the catchment in each of the soil class areas was compared. A summary is included in **Table 5**.



Table 5: Soil Type Review

ID	Soilscape Description	FEH Percentage	PF03 Percentage
1	Naturally wet very acid sandy and loamy soils	45%	26%
2	Slowly Permeable seasonally wet slightly acid but base-rich loamy and clayey soils	48%	64%
3	Loamy Soils	0.05%	0.02%
4	Freely draining slightly acid loamy soil	6%	8%

3.3.6 Soil ID 1 has a 19% decrease between FEH and PF03. Soil ID 2 has had a 16% increase between FEH and PF03. Whilst the percentages in each of these soil classes are different in the PF03 catchment, Soilscape lists both soil types as slowly permeable or naturally wet. A greater proportion of the FEH catchment was within soil ID 1 which was naturally wet which would likely cause greater runoff due to being less permeable. This in term greater flooding therefore is a conservative approach.

3.3.7 The FEH and F03 areas of soil ID 3 and 4 are approximately similar.

3.3.8 The FEH BFIHOST and SPRHOST values were accepted as the soil characteristics are deemed to be representative.

FARL

3.3.9 The FARL value was checked against OS mapping and the FEH Web Service information on reservoir and lake storage areas.

3.3.10 The FARL value for the catchment is 1. There are no notable lakes or reservoirs within the FEH catchment or the PF03 catchment therefore the FARL value of 1 is considered to be appropriate and the FEH FARL value was accepted.

URBEXT

3.3.11 The urban extents on the FEH Web Service were compared with OS urban extents. FEH does not pick up the urban areas of Jennett's Hill in the norther part of the catchment.

3.3.12 FEH Volume 5 Equation 6.2 was therefore used to calculate the URBEXT value. Equation 4.5 in 'URBEXT2000- a new catchment descriptor' was used to calculate the URBEXT2000 value.



4 Statistical Method

4.1.1 The purpose of carrying out the Statistical method is to estimate peak flows at the downstream node. The results of the Statistical method will be compared to the ReFH2 method peak flows.

4.1.2 **Table 6** provided a summary of the Statistical method

Table 6: Statistical Method

Site code	Method	Initial estimate of QMED (m³/s)	Data transfer						Final estimate of QMED (m³/s)
			NRFA numbers for donor sites used (see 3.3)	Distance between centroids d _{ij} (km)	Power term, a	Moderated QMED Adjustment factor (A/B) ^a	If more than one donor		
							Weight	Weighted average adjustment factor	
PF03	CD	1.1							1.1
Are the values of QMED consistent, for example at successive points along the watercourse and at confluences?						Single point flow estimate point considered. There are therefore no other points available for comparison.			
Which version of the urban adjustment was used for QMED, and why?						WINFAP 5			
Notes:									
Methods: AM – Annual maxima; POT – Peaks over threshold; DT – Data transfer; CD – Catchment descriptors alone.									
When QMED is estimated from POT data, it should also be adjusted for climatic variation. Details should be added.									
When QMED is estimated from catchment descriptors, the revised 2008 equation from Science Report SC050050 ^{Error! Bookmark not defined.} should be used. If the original FEH equation has been used, say so and give the reason why.									
The guidelines recommend great caution in urban adjustment of QMED on catchments that are also highly permeable (BFIHOST>0.8). The adjustment method used in WINFAP-FEH v3.0.003 is likely to overestimate adjustment factors for such catchments. In this case the only reliable flood estimates are likely to be derived from local flow data.									
The data transfer procedure is from Science Report SC050050. The QMED adjustment factor A/B for each donor site is given in Table 3.3. This is moderated using the power term, a, which is a function of the distance between the centroids of the subject catchment and the donor catchment. The final estimate of QMED is (A/B) ^a times the initial estimate from catchment descriptors.									
If more than one donor has been used, use multiple rows for the site and give the weights used in the averaging. Record the weighted average adjustment factor in the penultimate column.									



4.2 Search for Donor Sites for QMED

- 4.2.1 The PF03 catchment is ungauged.
- 4.2.2 A donor search completed in WINFAP5 to identify if there were any suitable donor catchments available.
- 4.2.3 WINFAP initially identified one potential donor station: 39029 – Tilling Bourne at Shalford. However, upon review, this station was found unsuitable due to its catchment characteristics. Specifically, the donor catchment has a FARL value of 0.88, whereas the subject site has a FARL value of 1.00. Therefore, leading to a differing hydrological response to rainfall.
- 4.2.4 The QMED value will therefore be calculated from the catchment descriptors.

4.3 Derivation of Pooling Groups

Descriptor

- 4.3.1 **Table 7** provided a summary of the derivation of the pooling groups.

Table 7: Summary of Pooling Group Adjustments

Name of group	Site code from whose descriptor s group was derived	Subject site treated as gauged?	Changes made to default pooling group, with reasons	Weighted average L-moments, L-CV, and L-skew, (before urban adjustment)
PF03	PF03	No	Stations Removed 49005 (Bolingey Stream @ Bolingey Cocks Bridge) Stations Added No additional stations added as greater than 500 years of data with 47005 removed.	L-CV: 0.296 L-SKEW: 0.258
Notes: Pooling groups were derived using the revised procedures from Science Report SC050050 (2008).				

4.4 Derivation of Flood Growth Curves at Subject Sites

- 4.4.1 **Table 8** summarises the Flood Growth Curve Parameters



Table 8: Summary of Growth Curve Parameters

Site code	Method (SS, P, ESS, J)	If P, ESS or J, name of pooling group (Error! Reference source not found.)	Distribution used and reason for choice	Note any urban adjustment or permeable adjustment	Parameters of distribution (location, scale, and shape) after adjustments	Growth factor for 100-year return period
PF03	P	PF03	Kappa 3 – Best Fit	NA	Location = 0.918 Scale = 0.357 Shape = -0.201	3.6

Notes:

Methods: SS – Single site; P – Pooled; ESS – Enhanced single site; J – Joint analysis

A pooling group (or ESS analysis) derived at one gauge can be applied to estimate growth curves at a number of ungauged sites. Each site may have a different urban adjustment, and therefore different growth curve parameters.

Urban adjustments to growth curves should use the version 3 option in WINFAP-FEH: Kjeldsen (2010). Growth curves were derived using the revised procedures from Science Report SC050050 (2008).

4.5 Flood Estimates from the Statistical Method

4.5.1 **Table 9** provides a summary of the final Statistical method flows.

Table 9: Summary of Statistical Method Peak Flows

Site code	Flood peak (m ³ /s) for the following return periods (in years)									
	2	5	10	20	30	50	75	100	200	1000
PF03	1.0	1.5	1.8	2.3	2.5	2.9	3.2	3.5	4.1	6.0



5 Revitalised Flood Hydrograph 2 (ReFH2)

5.1 Application of the ReFH2 Method

- 5.1.1 The purpose of carrying out the ReFH2 method is to estimate peak flows at the downstream node and hydrograph shape of the catchment. The results of the ReFH2 method will be compared to the Statistical method peak flows.

5.2 Catchment Sub-Divisions in the ReFH2 Model

- 5.2.1 The catchment was not further subdivided. The rural results were extracted where applicable and as indicated below.

5.3 Parameters for ReFH2 Model

- 5.3.1 **Table 10** provides a summary of ReFH2 method peak flows.

Table 10: Summary of ReFH2 Peak Flows

Site code	Method	T _p _{rural} (hours)	C _{max} (mm) Maximum storage capacity	PR _{imp}	BL (hours) Baseflow lag	BR Baseflow recharge
PF03	CD	4.76	388.71	0.70	41.77	1.94
OPT: Optimisation, BR: Baseflow recession fitting, CD: Catchment descriptors, DT: Data transfer						

5.4 Design Events for ReFH2 Method

- 5.4.1 **Table 11** provides a summary of the ReFH2 design event parameters.

Table 11: Summary of Design Parameters

Site code	Urban or rural	Season of design event	Storm duration (hours)	Storm area for ARF
PF03	Rural	Winter	7.50	0.97

5.5 Flood Estimates from the ReFH2 Method

- 5.5.1 **Table 12** provides a summary of the ReFH2 method peak flows.

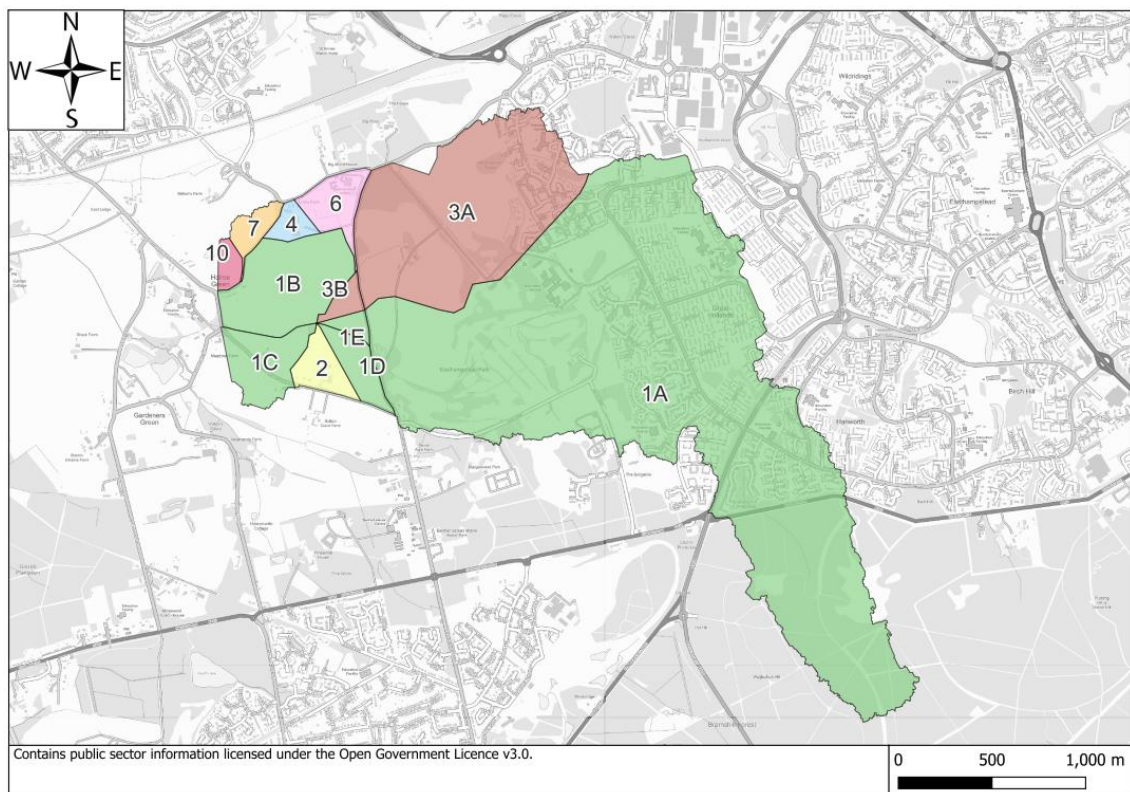
Table 12: Summary of ReFH2 Method Peak Flows

Site code	Flood peak (m ³ /s) for the following return periods (in years)									
	2	5	10	20	30	50	75	100	200	1000
PF03	1.0	1.4	1.7	2.0	2.2	2.5	2.7	2.9	3.5	5.0

6 Model Inflows

- 6.1.1 As discussed above, the peak flow estimates have been completed for the whole catchment. There are a number of smaller watercourses within the catchment as shown in **Figure 4**.

Figure 4: PF03 Sub Catchments





6.1.2 The total flow for the catchment has been divided between the sub catchments based on their contributing area. **Table 13** shows the sub catchments and their areas.

Table 13: PF02 Sub Catchment Contributing Area

Sub catchment ID	Area km ²	Percentage Area
1A	66.4	62.4
1B	5.7	4.2
1C	2.7	2.7
1D	1.4	1.1
1E	0.5	0.3
2	1.4	1.2
3A	16.9	13.9
3B	0.6	0.4
4	0.7	0.3
6	1.8	1.3
7	1.0	1.0
10	0.6	0.5



7 Discussion and Summary of Results

7.1 Comparison of Results from Different Methods

7.1.1 **Table 14** compares the peak flows from the methods carried out as part of this study with those from the FEH Statistical method for two key return periods.

Table 14: Ratio of Peak Flow to the FEH Statistical Method Peak Flow

Site code	Ratio of peak flow to FEH Statistical peak	
	Return period 2 years	Return period for 100 years
	ReFH2	ReFH2
PF03	1.1	1.1

7.2 Final Choice of Method

7.2.1 The ReFH2 method was selected for this study. The Statistical Method was rejected, as there was less confidence in the method due to an insufficient number of similar catchments. The Statistical Method was completed as a comparison.

7.3 Assumptions, Limitations and Uncertainty

Assumptions

7.3.1 The following assumptions were made in this study:

- The catchment descriptors are representative of the catchment
- The catchment areas are representative of the areas being drained
- The QMED values calculated are representative
- The pooling groups derived are representative of the subject catchment
- The ReFH2 hydrograph shapes are representative of the catchment response.

Limitations

7.3.2 A limitation of this study is that gauge data is not available.

Uncertainty

7.3.3 Uncertainty is not currently assessed within ReFH2, the final method selected.



Suitability for Future Studies

7.3.4 The peak flow estimates as part of this study are specific to the model extent. If future studies are located within the model extent, the results should be reviewed at a minimum. If future studies are located outside of the model boundary, an update to the hydrology may be required.

7.4 Checks

7.4.1 **Table 15** provides a summary of the checks carried out.

Table 15: Summary of Checks

Are the results consistent, for example at confluences?	NA – a single point estimate is being considered.
What do the results imply regarding the return periods of floods during the period of record?	NA – no gauge data of historic flood records available for comparison.
What is the 100-year growth factor? Is this realistic? (The guidance suggests a typical range of 2.1 to 4.0)	FEH Statistical: 3.6 ReFH2: 2.8
If 1000-year flows have been derived, what is the range of ratios for 1000-year flow over 100-year flow?	FEH Statistical: 1.7 ReFH2: 1.6
How do the results compare with those of other studies? Explain any differences and conclude which results should be preferred.	NA – no other studies available for the catchment.
Are the results compatible with the longer-term flood history?	Data from historic flood was not available at this site.
Describe any other checks on the results	NA

7.5 Final Results

7.5.1 The final accepted peak flows for this study are summarised in **Table 16**.

Table 16: Summary of the Final Accepted Peak Flows

Site code	Flood peak (m ³ /s) for the following return periods (in years)									
	2	5	10	20	30	50	75	100	200	1000
PF03	1.1	1.6	1.9	2.2	2.4	2.7	2.9	3.1	3.5	5.1



Appendices



Appendix A – Pooling Groups

Default Pooling Group						
Pooling Group ID	Pooling group stations	Years of AMAX data	Heterogeneity	Goodness of fit		
				GL	GEV	P3
PF03-Initial	27073 (Brompton Beck @ Snainton Ings)	43	Heterogeneous and a review of the pooling group is desirable.	0.10421	-0.4745	0.5308
	27051 (Crimple @ Burn Bridge)	51				
	26016 (Gypsy Race @ Kirby Grindalythe)	26				
	25019 (Leven @ Easby)	45				
	36010 (Bumpstead Brook @ Broad Green)	56				
	7009 (Mosset Burn @ Wardend Bridge)	25				
	26014 (Water Forlornes @ Driffield)	25				
	27010 (Hodge Beck @ Bransdale Weir)	41				
	49005 (Bolingey Stream @ Bolingey Cocks Bridge)	13				
	44008 (South Winterbourne @ Winterbourne Steepleton)	32				
	76011 (Coal Burn @ Coalburn)	46				
	7011 (Black Burn @ Pluscarden Abbey)	11				
	45816 (Haddeo @ Upton)	30				
	41020 (Bevern Stream @ Clappers Bridge)	54				
	39033 (Winterbourne Stream @ Bagnor)	61				
TOTAL		559				



Final Pooling Group							
Pooling Group ID	Pooling group stations	Years of AMAX data	Heterogeneity	Goodness of fit			
				GL	GEV	P3	Final chosen distribution
PF03-Final	27073 (Brompton Beck @ Snainton Ings)	43	Heterogeneous and a review of the pooling group is desirable.	0.7228	- 0.7207	0.2355	Kappa 3
	27051 (Crimple @ Burn Bridge)	51					
	26016 (Gypsy Race @ Kirby Grindalythe)	26					
	25019 (Leven @ Easby)	45					
	36010 (Bumpstead Brook @ Broad Green)	56					
	7009 (Mosset Burn @ Wardend Bridge)	25					
	26014 (Water Forlornes @ Driffield)	25					
	27010 (Hodge Beck @ Bransdale Weir)	41					
	44008 (South Winterbourne @ Winterbourne Steepleton)	11					
	76011 (Coal Burn @ Coalburn)	32					
	7011 (Black Burn @ Pluscarden Abbey)	61					
	45816 (Haddeo @ Upton)	54					
	41020 (Bevern Stream @ Clappers Bridge)	47					
	39033 (Winterbourne Stream @ Bagnor)	61					
TOTAL		546					



Appendix B – WINFAP Summary

UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Date of creation: 05-08-2025 11:11:30
Software: WINFAP Version: 5.2.9046 (25885)
Peak Flow dataset: Peak Flow Dataset 13.0.3
Supplementary data used: No

Site details

Site number: 1106553785
Site name: PF03
Site location: SU 82950 67100
Easting: 482950
Northing: 167100
Catchment area: 4.80 km²
SAAR: 664 mm
BFIHOST19: 0.468
FPEXT: 0.120
FARL: 1.000
URBEXT2000: 0.1780

Site data

At-site data

At-site data present: No

UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Analysis settings

Urbanisation settings

User defined: No
Urban area: 1.34 km²
PRimp: 70.00%
Impervious Factor: 0.300
UAF: 1.20673

Growth curve settings

Distance Measure Method: Small catchment
Pooling group URBEXT2000 Threshold: 0.030
Deurbanise Pooling Group L-moments: Yes

QMED settings

Use at-site data: No
Method: Donor Station(s)

Growth curve data and results

Pooling group AM data

Station	Distance	Years of data	QMED AM	L-CV Observed	L-CV Deurbanised	L-SKEW Observed	L-SKEW Deurbanised
27073 (Brompton Beck @ Snainton Ings)	0.473	43	0.812	0.212	0.213	0.033	0.032
27051 (Crimple @ Burn Bridge)	0.838	51	4.564	0.217	0.217	0.142	0.141
26016 (Gypsy Race @ Kirby Grindalythe)	1.017	26	0.100	0.318	0.318	0.253	0.253
25019 (Leven @ Easby)	1.109	45	5.090	0.341	0.342	0.373	0.372
36010 (Bumpstead Brook @ Broad Green)	1.426	56	7.855	0.348	0.350	0.107	0.106
7009 (Mosset Burn @ Wardend Bridge)	1.505	25	7.053	0.365	0.365	0.329	0.329
26014 (Water Forlomes @ Driffeld)	1.529	25	0.424	0.318	0.319	0.205	0.204
27010 (Hodge Beck @ Bransdale Weir)	1.568	41	9.420	0.224	0.224	0.293	0.293
44008 (South Winterbourne @ Winterbourne Steepleton)	1.658	32	0.572	0.405	0.406	0.254	0.254
76011 (Coal Burn @ Coalburn)	1.671	46	1.826	0.170	0.170	0.296	0.296
7011 (Black Burn @ Pluscarden Abbey)	1.698	11	4.298	0.495	0.495	0.581	0.580
45816 (Haddeo @ Upton)	1.742	30	3.352	0.288	0.289	0.408	0.407
41020 (Bevern Stream @ Clappers Bridge)	1.785	54	13.780	0.199	0.200	0.164	0.162
39033 (Winterbourne Stream @ Bagnor)	1.790	61	0.399	0.337	0.337	0.378	0.377
Total		546					

UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Pooling group suitability

Station	Suitability for QMED	Suitability for pooling	Years	Non-flood years	Percentage non-flood years	Mann Kendall (MK)	MK significance (%)	Discordancy	Comments
27073 (Brompton Beck @ Snainton Ings)	Yes	Yes	43	2	4.65	0.92	None	1.094	
27051 (Crimple @ Bum Bridge)	Yes	Yes	51	3	5.88	1.34	None	0.723	
26016 (Gypsy Race @ Kirby Grindalythe)	Yes	Yes	26	4	15.38			0.066	
25019 (Leven @ Easby)	Yes	Yes	45	3	6.67			0.182	
36010 (Bumpstead Brook @ Broad Green)	Yes	Yes	56	12	21.43	0.10	None	2.184	
7009 (Mosset Bum @ Wardend Bridge)	Yes	Yes	25	3	12.00			0.338	
26014 (Water Fortomes @ Driffeld)	Yes	Yes	25	3	12.00			0.692	
27010 (Hodge Beck @ Bransdale Weir)	Yes	Yes	41	1	2.44	-2.10	5	0.500	
44008 (South Winterbourne @ Winterbourne Steepleton)	Yes	Yes	32	9	28.12	1.17	None	1.239	
76011 (Coal Bum @ Coalburn)	Yes	Yes	46	0	0.00			1.332	
7011 (Black Bum @ Pluscarden Abbey)	Yes	Yes	11	1	9.09			2.112	
45816 (Haddeo @ Upton)	Yes	Yes	30	1	3.33	-0.45	None	0.918	
41020 (Bevern Stream @ Clappers Bridge)	Yes	Yes	54	3	5.56	1.19	None	1.012	
39033 (Winterbourne Stream @ Bagnor)	Yes	Yes	61	7	11.48	1.02	None	1.609	

Pooling group catchment descriptors

Station	Area	SAAR	FPEXT	FARL	URBEXT2000	BFIHOST19
27073 (Brompton Beck @ Snainton Ings)	8.060	721	0.237	1.000	0.008	0.811
27051 (Crimple @ Bum Bridge)	8.172	855	0.013	1.000	0.006	0.329
26016 (Gypsy Race @ Kirby Grindalythe)	15.850	757	0.030	1.000	0.000	0.927
25019 (Leven @ Easby)	15.088	830	0.019	1.000	0.004	0.495
36010 (Bumpstead Brook @ Broad Green)	27.547	588	0.045	0.999	0.007	0.367
7009 (Mosset Bum @ Wardend Bridge)	28.295	803	0.060	0.998	0.000	0.606
26014 (Water Fortomes @ Driffeld)	32.415	721	0.016	1.000	0.007	0.924
27010 (Hodge Beck @ Bransdale Weir)	18.820	987	0.009	1.000	0.001	0.303
44008 (South Winterbourne @ Winterbourne Steepleton)	20.183	1012	0.015	1.000	0.004	0.848
76011 (Coal Bum @ Coalburn)	1.630	1096	0.074	1.000	0.000	0.274
7011 (Black Bum @ Pluscarden Abbey)	36.375	808	0.041	0.980	0.001	0.663
45816 (Haddeo @ Upton)	6.808	1210	0.011	1.000	0.005	0.535
41020 (Bevern Stream @ Clappers Bridge)	35.480	886	0.076	0.993	0.013	0.362
39033 (Winterbourne Stream @ Bagnor)	45.312	717	0.033	1.000	0.001	0.812

Pooling Group Rejected Stations

Station	Distance	Years of data	QMED AM	L-CV Observed	L-CV Deurbanised	L-SKEW Observed	L-SKEW Deurbanised	Comments
49005 (Bolingey Stream @ Bolingey Cocks Bridge)	1.611	13	4.072	0.274	0.275	0.295	0.294	

UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Growth curve L-moments

Rural L-CV: 0.296 Urban L-CV: 0.267
Rural L-Skewness: 0.258 Urban L-Skewness: 0.290

Rural fitted parameters

Distribution	Location	Scale	Shape	H	Bound
GL	1.000	0.301	-0.258		-0.169
GEV	0.839	0.428	-0.132		-2.401
KAP3	0.918	0.357	-0.201	-0.400	-0.855

Goodness of fit

GL: 0.6633 *
GEV: -0.8007 *
P3: -2.6825
GP: -4.4114
KAP3: 0.1691 *

* Distribution gives an acceptable fit (absolute Z value < 1.645)

Heterogeneity

Standardised test value H2: 3.3503

The pooling group is heterogeneous and a review of the pooling group is desirable.

Standardised growth curves

Rural

Return period	GL	GEV	KAP3
2	1.000	1.000	1.000
5	1.502	1.549	1.522
10	1.890	1.961	1.923
20	2.328	2.396	2.363
25	2.482	2.542	2.516
30	2.615	2.665	2.645
50	3.018	3.024	3.032
75	3.375	3.325	3.366
100	3.651	3.548	3.620
200	4.404	4.120	4.294
500	5.626	4.960	5.340
1000	6.761	5.666	6.269

Urban

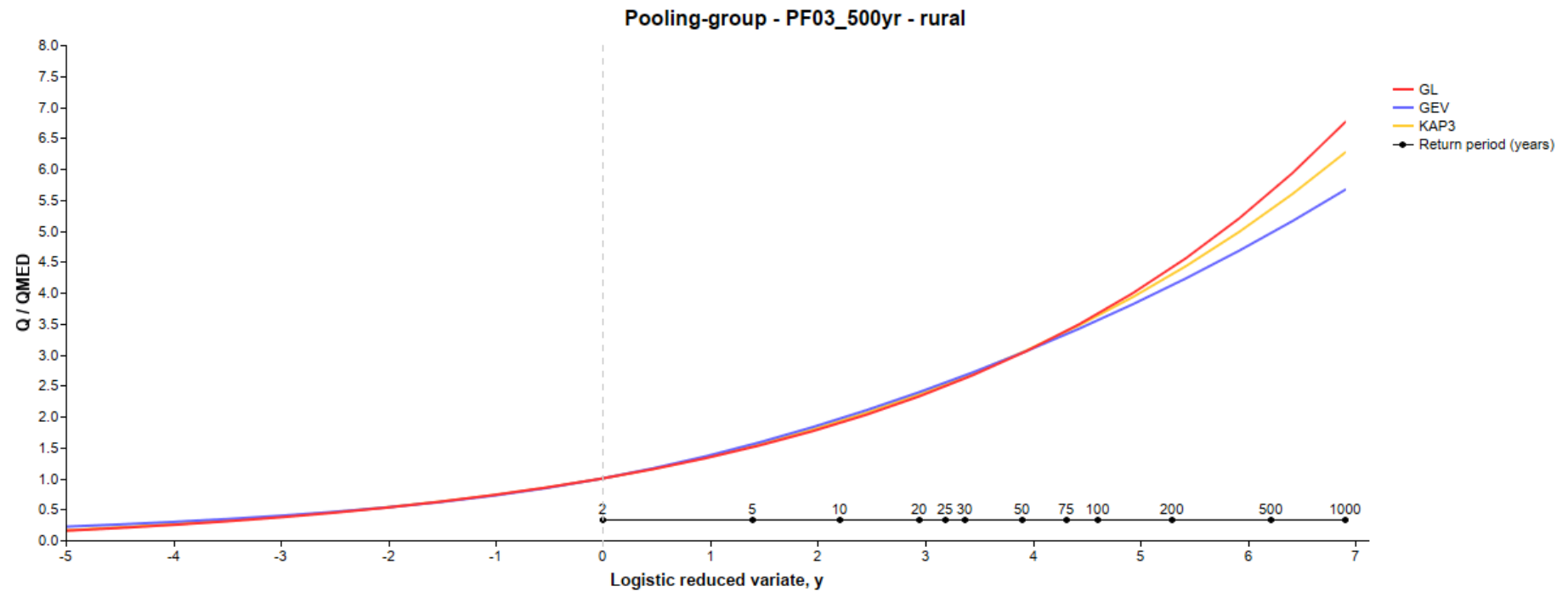
Return period	GL	GEV	KAP3
2	1.000	1.000	1.000
5	1.449	1.488	1.465
10	1.809	1.870	1.836
20	2.225	2.288	2.256
25	2.374	2.432	2.405
30	2.503	2.554	2.532
50	2.899	2.916	2.916
75	3.256	3.226	3.255
100	3.535	3.459	3.516
200	4.308	4.073	4.221
500	5.596	5.009	5.352
1000	6.824	5.826	6.388

Urban fitted parameters

Distribution	Location	Scale	Shape	H	Bound
GL	1.000	0.263	-0.290		0.093
GEV	0.862	0.364	-0.179		-1.170
KAP3	0.929	0.307	-0.241	-0.400	-0.348

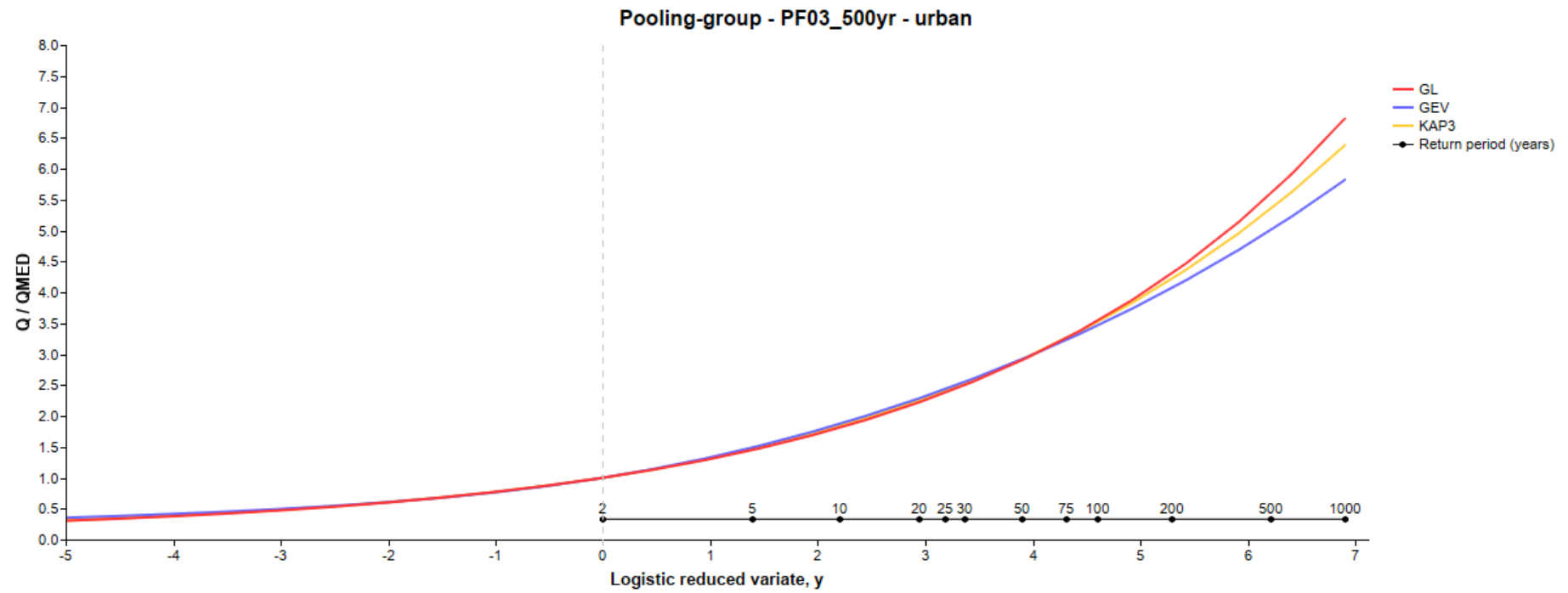
UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

QMED data and results

Donor selection criteria

Only sites suitable for QMED: Yes
 URBEXT2000: <0.030
 Donor adjusted FSE: 1.415
 No. of donors: 1

Donor stations

Station	Distance	Use QMED obs deurbanised	QMED obs	QMED deurbanised	QMED CDs urban	QMED CDs rural
39029 (Tilling Boume @ Shalford)	30.74	Yes	1.994	1.905	3.072	3.072

Donor suitability

Station	Suitability for QMED	Suitability for pooling	Years	Non-flood years	Percentage non-flood years	Mann Kendall (MKZ)	MKZ significance (%)	Comments
39029 (Tilling Boume @ Shalford)	Yes	No	55	0	0.00	-1.47	None	

Donor catchment descriptors

Station	Area	Centroid X	Centroid Y	SAAR	FPEXT	FARL	URBEXT2000	BFIHOST19
PF03 @ SU 82950 67100)	4.800	484957	166618	664	0.120	1.000	0.178	0.468
39029 (Tilling Boume @ Shalford)	58.775	508055	146327	810	0.029	0.879	0.022	0.744

Unused Donor stations

Station	Distance	URBEXT	Use QMED obs deurbanised	QMED obs	QMED deurbanised	QMED CDs urban	QMED CDs rural	Centroid X	Centroid Y	Area	SAAR	BFIHOST19	FARL	Years of data	QMED suitability	Pooling suitability
39036 (Law Brook @ Albury)	31.19	0.008	Yes	0.459	0.452	1.729	1.729	507365	144918	16.062	819	0.699	0.960	53	Yes	No
39027 (Pang @ Pangbourne)	32.91	0.012	Yes	2.140	2.081	6.817	6.817	453633	176722	175.683	694	0.782	0.996	55	Yes	No
42009 (Candover Stream @ Borough Bridge)	34.89	0.011	Yes	1.065	1.011	1.806	1.806	460964	141288	72.062	819	0.924	0.930	53	Yes	Yes
39025 (Enborne @ Brimpton)	36.70	0.020	Yes	16.700	16.271	18.310	18.310	448695	160991	142.010	789	0.563	0.978	56	Yes	Yes
42007 (Alre @ Drove Lane Alresford)	39.91	0.016	Yes	2.491	2.292	1.215	1.215	462212	133819	57.447	857	0.933	0.864	44	Yes	Yes
41022 (Lod @ Halfway Bridge)	40.24	0.009	Yes	16.600	16.453	12.981	12.981	491432	126899	52.438	857	0.428	0.951	53	Yes	Yes
41018 (Kird @ Tanyards)	40.60	0.004	Yes	19.903	19.826	18.502	18.502	498549	128364	67.358	820	0.342	0.961	32	Yes	No
41014 (Arun @ Pallingham)	40.96	0.029	Yes	80.282	78.218	76.769	76.769	507351	132316	382.690	805	0.343	0.958	49	Yes	No
39033 (Winterbourne Stream @ Bagnor)	41.08	0.001	Yes	0.399	0.398	2.053	2.053	445079	176491	45.312	717	0.812	1.000	61	Yes	Yes

QMED

Rural: 0.850 m³/s
 Urban: 1.026 m³/s

UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

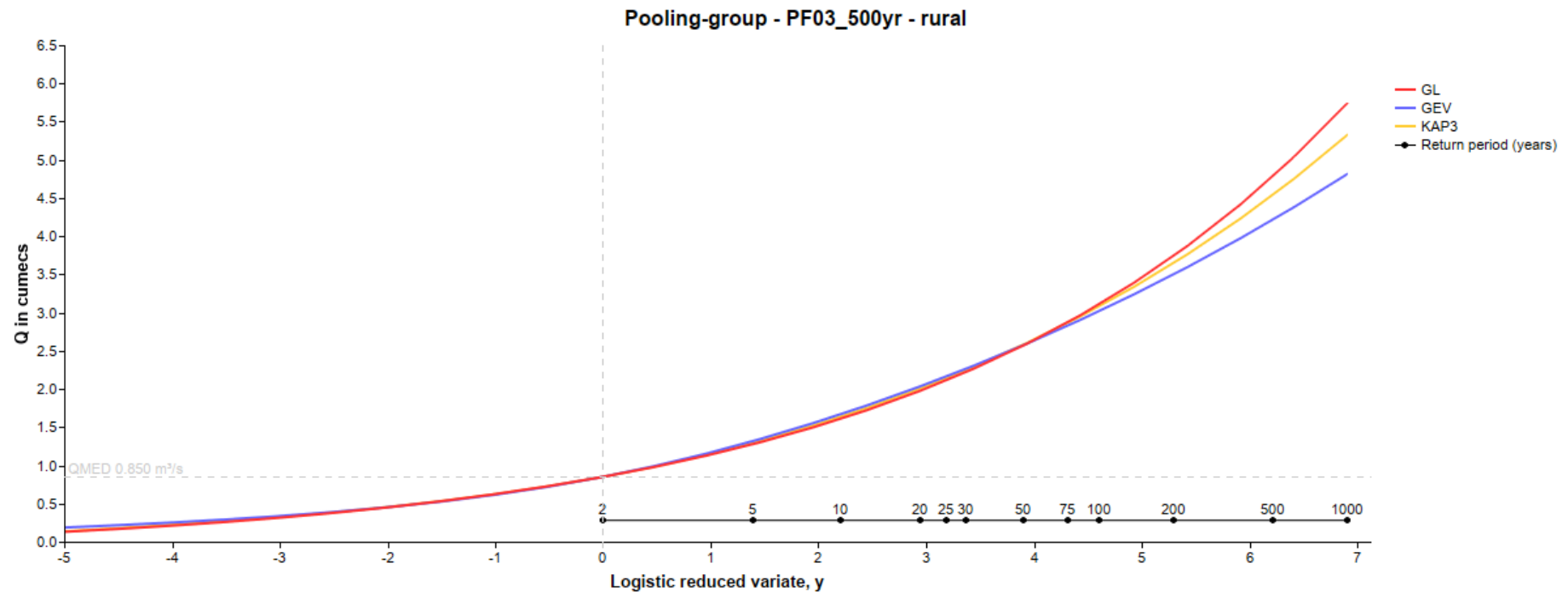
Flood Frequency Curve

Rural Flood Frequency Curve

Return period	GL (m³/s)	GEV (m³/s)	KAP3 (m³/s)
2	0.850	0.850	0.850
5	1.276	1.317	1.293
10	1.607	1.666	1.634
20	1.978	2.036	2.008
25	2.110	2.161	2.138
30	2.222	2.265	2.248
50	2.565	2.570	2.577
75	2.868	2.825	2.861
100	3.103	3.015	3.077
200	3.743	3.501	3.650
500	4.782	4.215	4.539
1000	5.746	4.816	5.328

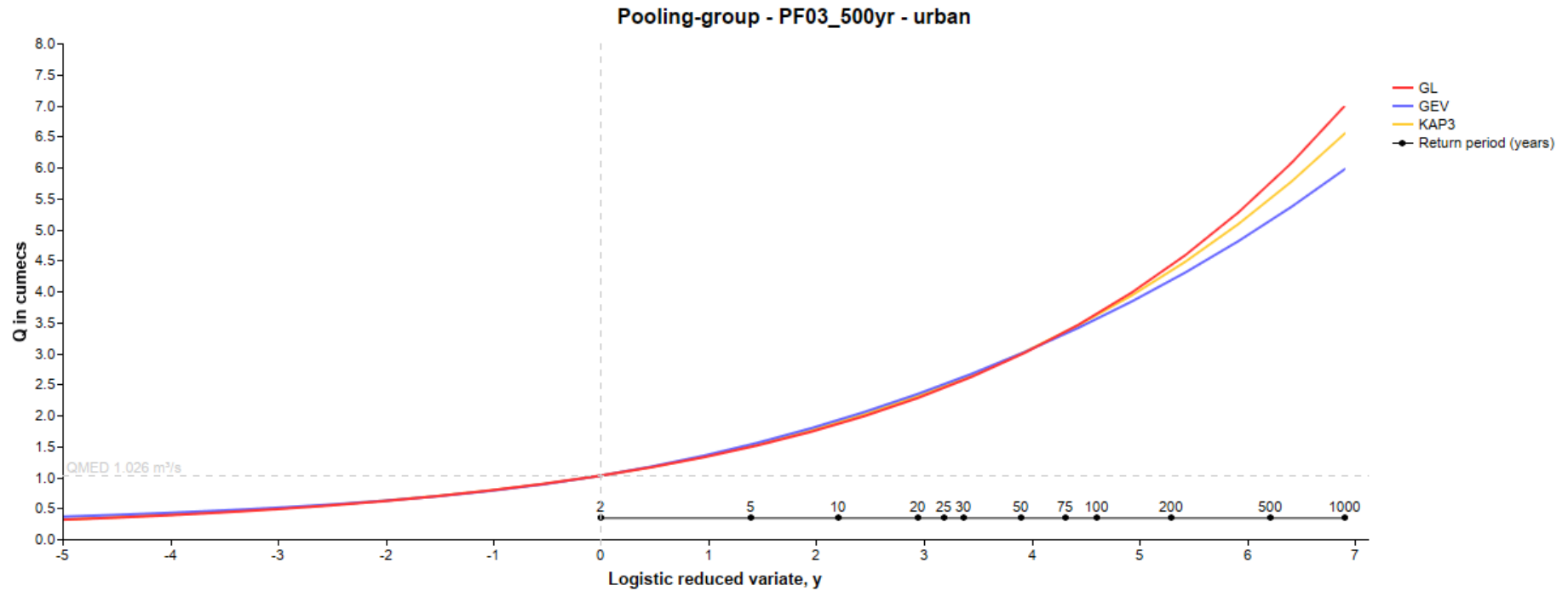
Urban Flood Frequency Curve

Return period	GL (m³/s)	GEV (m³/s)	KAP3 (m³/s)
2	1.026	1.026	1.026
5	1.486	1.526	1.502
10	1.855	1.918	1.883
20	2.281	2.347	2.314
25	2.435	2.495	2.466
30	2.567	2.619	2.597
50	2.973	2.990	2.991
75	3.339	3.308	3.338
100	3.625	3.548	3.605
200	4.418	4.177	4.329
500	5.739	5.137	5.489
1000	6.999	5.975	6.551



UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



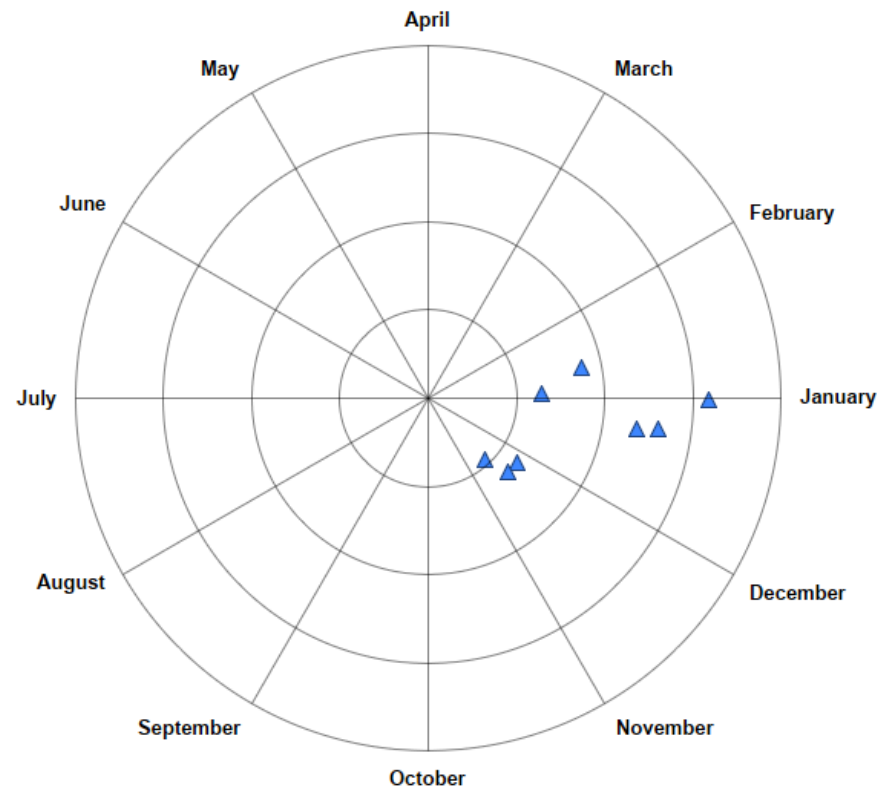
UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Appendix

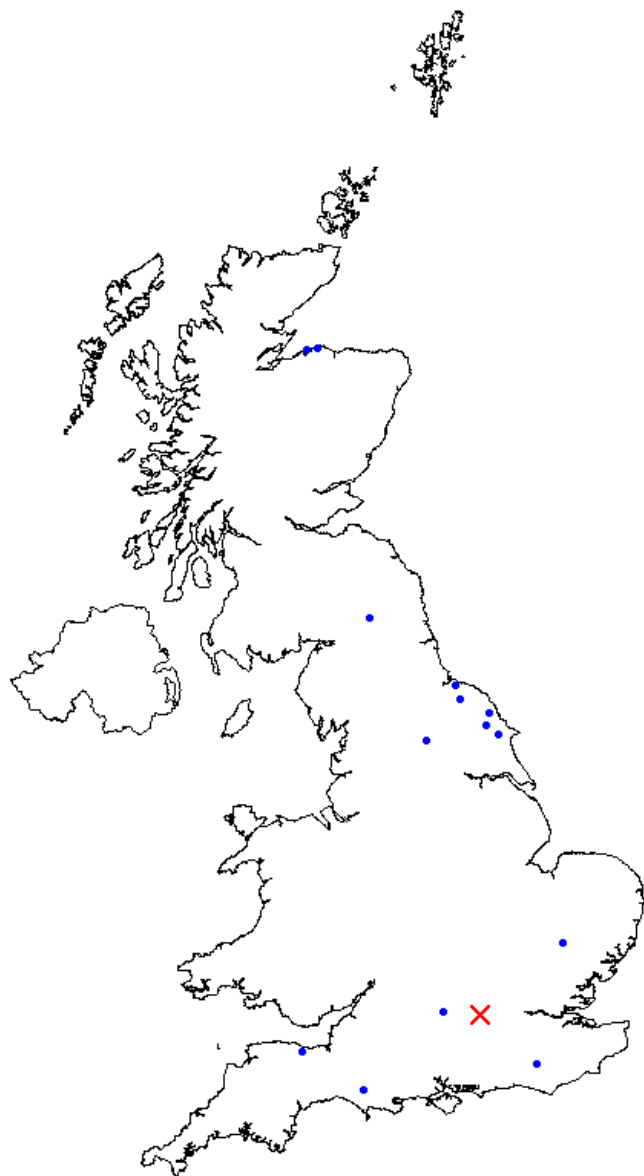
Station record parameters

Flood seasonality: PF03_500yr - rural



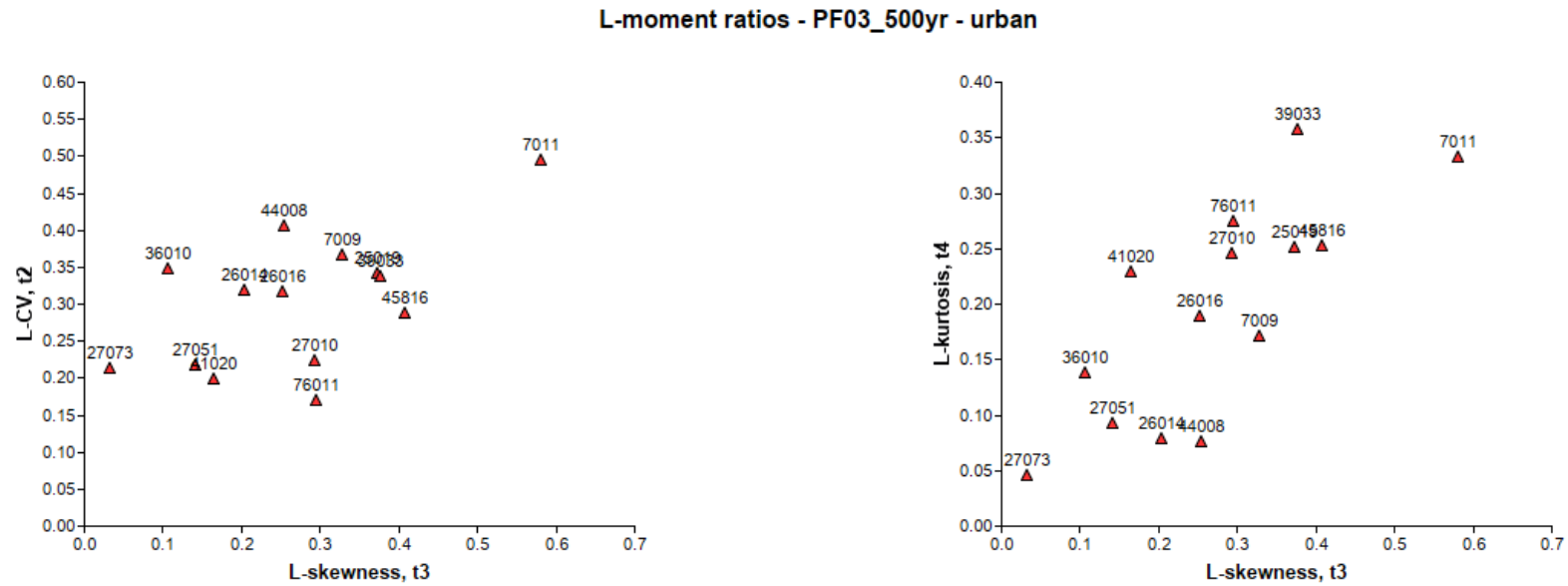
UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



UK Design Flood Estimation

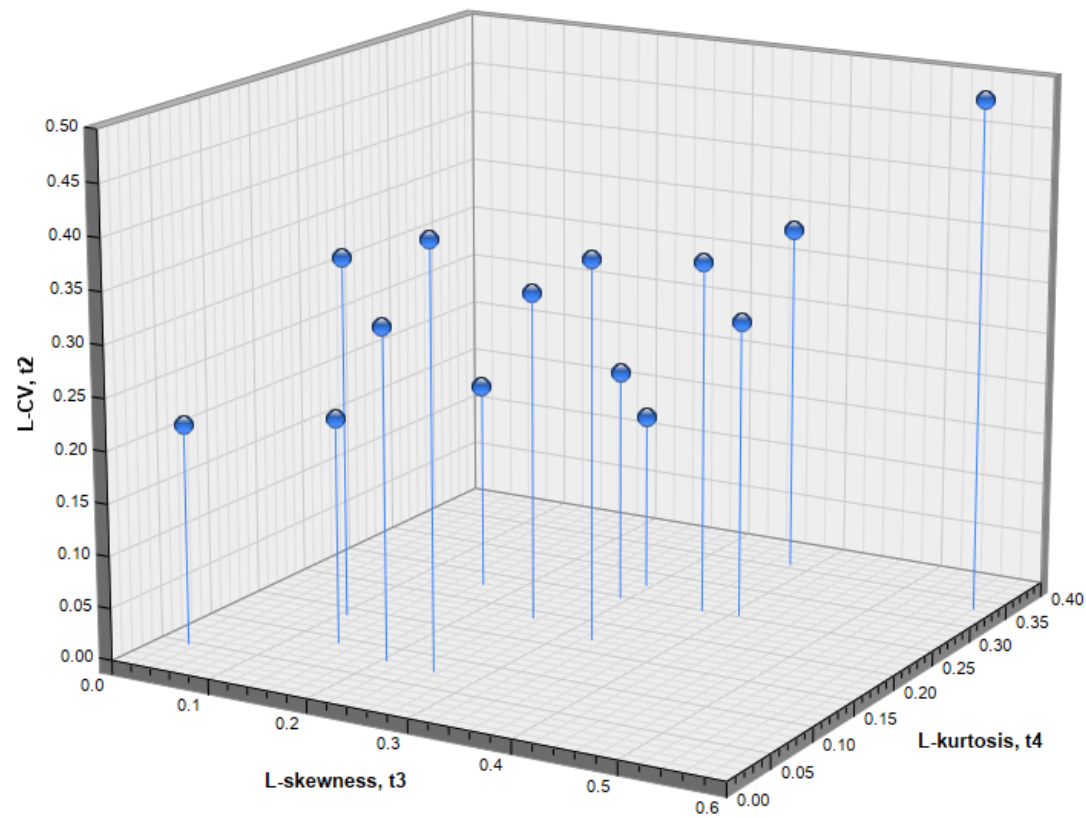
Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

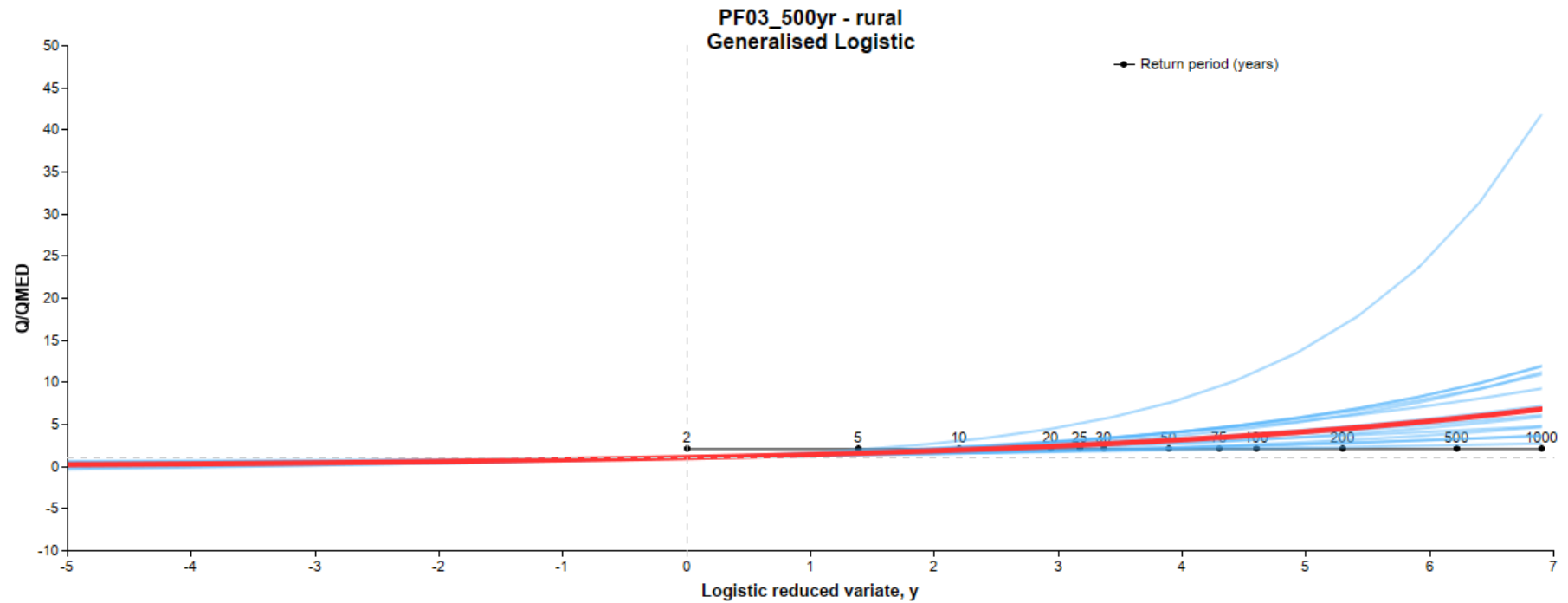
L-moment ratios - PF03_500yr - urban



UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

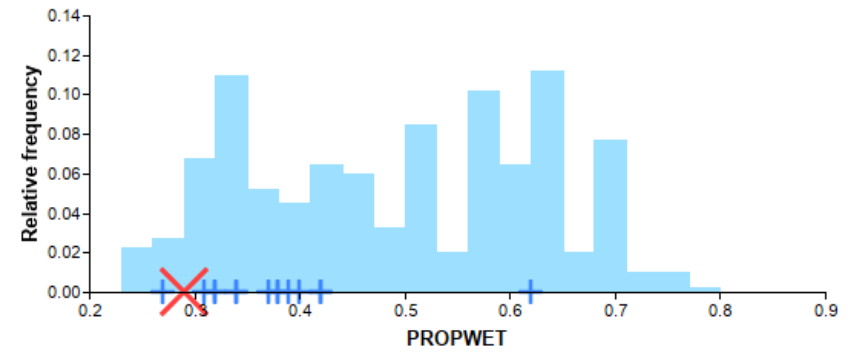
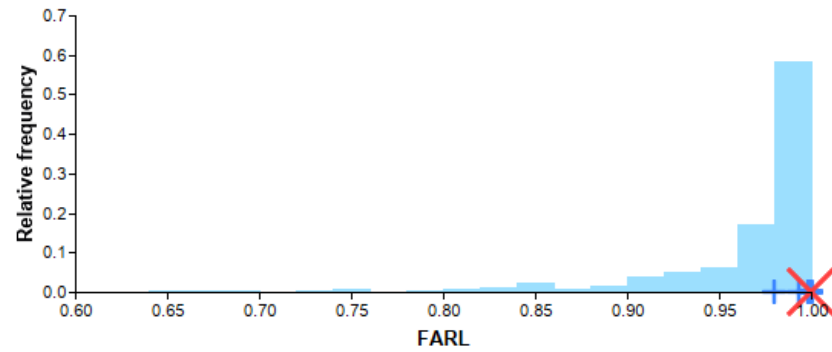
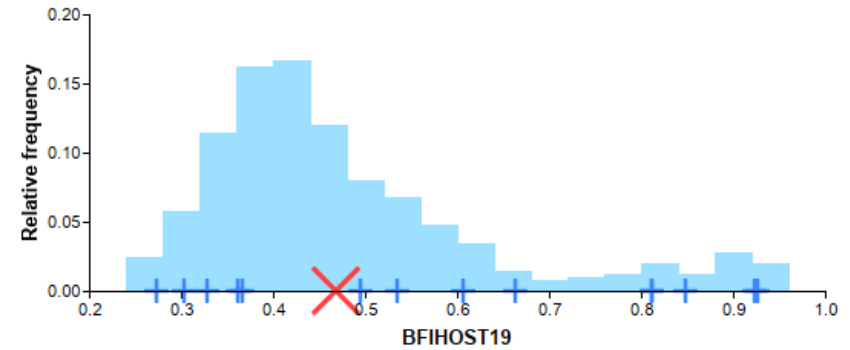
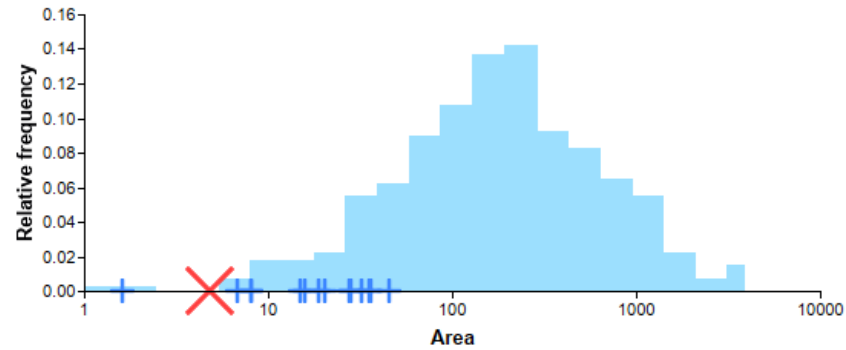
Pooling group growth curves



UK Design Flood Estimation

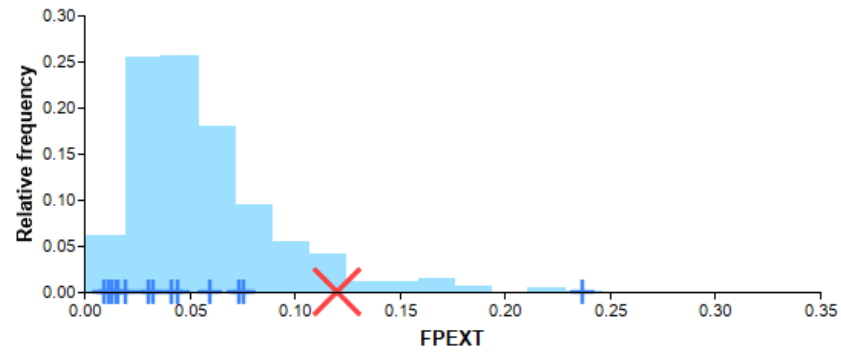
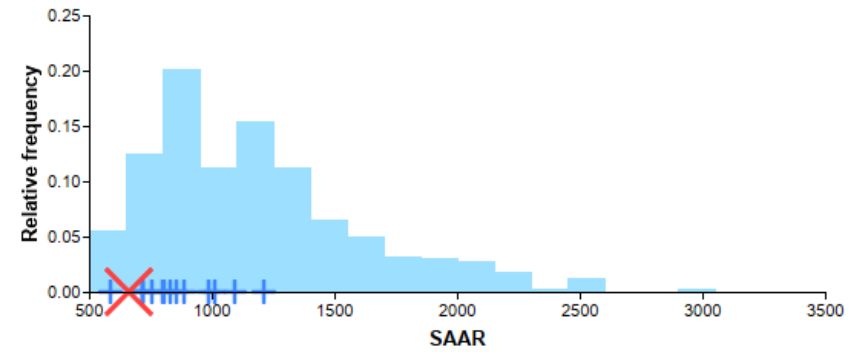
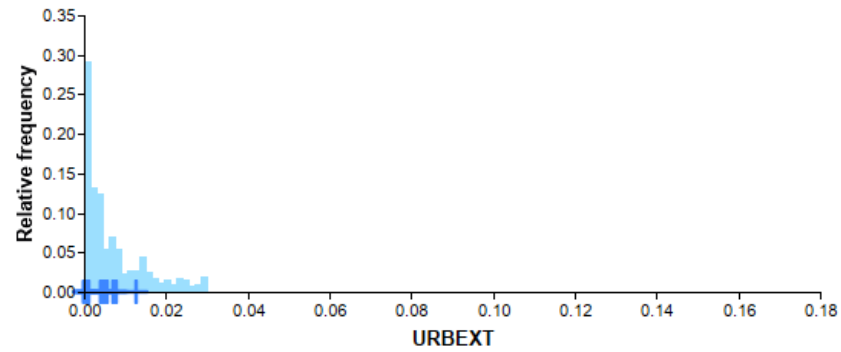
Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Catchment descriptors



UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method





Appendix C – ReFH2 Summary

UK Design Flood Estimation

Generated on 05 August 2025 12:43:49 by Hydro
Printed from the ReFH2 Flood Modelling software package, version 4.1.8879.22310

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details

Checksum: 282F-201E

Site name: PF03

Easting: 482950

Northing: 167100

Country: England, Wales or Northern Ireland

Catchment Area (km²): 4.8

Using plot scale calculations: No

Model: 2.3

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH22 (mm):	74.90	Total runoff (ML):	94.05
Total Rainfall (mm):	50.01	Total flow (ML):	239.99
Peak Rainfall (mm):	8.53	Peak flow (m ³ /s):	3.54

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH22)

Name	Value	User-defined?
Duration (hh:mm:ss)	07:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.69	No
ARF (Areal reduction factor)	0.97	No
Seasonality	Winter	No

Loss model parameters

Name	Value	User-defined?
Cini (mm)	107.29	No
Cmax (mm)	388.71	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	4.69	No
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m ³ /s)	0.14	No
BL (hr)	41.54	No
BR	1.94	No

Urbanisation parameters

Name	Value	User-defined?
Sewer capacity (m ³ /s)	0	No
Exporting drained area (km ²)	0	No
Urban area (km ²)	1.34	No
Effective URBEXT2000	0.18	n/a
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.748	0.000	0.245	0.000	0.120	0.120
00:30:00	1.093	0.000	0.367	0.003	0.119	0.122
01:00:00	1.593	0.000	0.540	0.014	0.117	0.132
01:30:00	2.315	0.000	0.795	0.037	0.116	0.153
02:00:00	3.350	0.000	1.173	0.077	0.116	0.192
02:30:00	4.815	0.000	1.733	0.142	0.116	0.258
03:00:00	6.827	0.000	2.551	0.244	0.117	0.362
03:30:00	8.533	0.000	3.344	0.402	0.120	0.522
04:00:00	6.827	0.000	2.800	0.631	0.126	0.757
04:30:00	4.815	0.000	2.041	0.933	0.135	1.068
05:00:00	3.350	0.000	1.452	1.284	0.149	1.434
05:30:00	2.315	0.000	1.019	1.661	0.169	1.830
06:00:00	1.593	0.000	0.709	2.040	0.194	2.234
06:30:00	1.093	0.000	0.490	2.398	0.225	2.623
07:00:00	0.748	0.000	0.337	2.711	0.261	2.973
07:30:00	0.000	0.000	0.000	2.950	0.303	3.253
08:00:00	0.000	0.000	0.000	3.096	0.349	3.444
08:30:00	0.000	0.000	0.000	3.142	0.397	3.539
09:00:00	0.000	0.000	0.000	3.094	0.447	3.541
09:30:00	0.000	0.000	0.000	2.972	0.496	3.468
10:00:00	0.000	0.000	0.000	2.800	0.544	3.344
10:30:00	0.000	0.000	0.000	2.599	0.588	3.187
11:00:00	0.000	0.000	0.000	2.384	0.629	3.013
11:30:00	0.000	0.000	0.000	2.167	0.667	2.833
12:00:00	0.000	0.000	0.000	1.955	0.700	2.655
12:30:00	0.000	0.000	0.000	1.751	0.729	2.480
13:00:00	0.000	0.000	0.000	1.561	0.754	2.315
13:30:00	0.000	0.000	0.000	1.388	0.776	2.164
14:00:00	0.000	0.000	0.000	1.230	0.795	2.025
14:30:00	0.000	0.000	0.000	1.086	0.811	1.897
15:00:00	0.000	0.000	0.000	0.953	0.824	1.776
15:30:00	0.000	0.000	0.000	0.828	0.835	1.663
16:00:00	0.000	0.000	0.000	0.714	0.844	1.557
16:30:00	0.000	0.000	0.000	0.611	0.850	1.461

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
17:00:00	0.000	0.000	0.000	0.520	0.855	1.376
17:30:00	0.000	0.000	0.000	0.440	0.858	1.298
18:00:00	0.000	0.000	0.000	0.366	0.859	1.225
18:30:00	0.000	0.000	0.000	0.299	0.858	1.157
19:00:00	0.000	0.000	0.000	0.237	0.856	1.093
19:30:00	0.000	0.000	0.000	0.181	0.852	1.032
20:00:00	0.000	0.000	0.000	0.131	0.846	0.977
20:30:00	0.000	0.000	0.000	0.089	0.839	0.929
21:00:00	0.000	0.000	0.000	0.058	0.832	0.889
21:30:00	0.000	0.000	0.000	0.036	0.823	0.858
22:00:00	0.000	0.000	0.000	0.021	0.814	0.835
22:30:00	0.000	0.000	0.000	0.011	0.805	0.816
23:00:00	0.000	0.000	0.000	0.005	0.795	0.800
23:30:00	0.000	0.000	0.000	0.002	0.786	0.788
24:00:00	0.000	0.000	0.000	0.000	0.776	0.777
24:30:00	0.000	0.000	0.000	0.000	0.767	0.767
25:00:00	0.000	0.000	0.000	0.000	0.758	0.758
25:30:00	0.000	0.000	0.000	0.000	0.749	0.749
26:00:00	0.000	0.000	0.000	0.000	0.740	0.740
26:30:00	0.000	0.000	0.000	0.000	0.731	0.731
27:00:00	0.000	0.000	0.000	0.000	0.722	0.722
27:30:00	0.000	0.000	0.000	0.000	0.714	0.714
28:00:00	0.000	0.000	0.000	0.000	0.705	0.705
28:30:00	0.000	0.000	0.000	0.000	0.697	0.697
29:00:00	0.000	0.000	0.000	0.000	0.688	0.688
29:30:00	0.000	0.000	0.000	0.000	0.680	0.680
30:00:00	0.000	0.000	0.000	0.000	0.672	0.672
30:30:00	0.000	0.000	0.000	0.000	0.664	0.664
31:00:00	0.000	0.000	0.000	0.000	0.656	0.656
31:30:00	0.000	0.000	0.000	0.000	0.648	0.648
32:00:00	0.000	0.000	0.000	0.000	0.640	0.640
32:30:00	0.000	0.000	0.000	0.000	0.633	0.633
33:00:00	0.000	0.000	0.000	0.000	0.625	0.625
33:30:00	0.000	0.000	0.000	0.000	0.618	0.618
34:00:00	0.000	0.000	0.000	0.000	0.610	0.610

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
34:30:00	0.000	0.000	0.000	0.000	0.603	0.603
35:00:00	0.000	0.000	0.000	0.000	0.596	0.596
35:30:00	0.000	0.000	0.000	0.000	0.589	0.589
36:00:00	0.000	0.000	0.000	0.000	0.582	0.582
36:30:00	0.000	0.000	0.000	0.000	0.575	0.575
37:00:00	0.000	0.000	0.000	0.000	0.568	0.568
37:30:00	0.000	0.000	0.000	0.000	0.561	0.561
38:00:00	0.000	0.000	0.000	0.000	0.554	0.554
38:30:00	0.000	0.000	0.000	0.000	0.548	0.548
39:00:00	0.000	0.000	0.000	0.000	0.541	0.541
39:30:00	0.000	0.000	0.000	0.000	0.535	0.535
40:00:00	0.000	0.000	0.000	0.000	0.528	0.528
40:30:00	0.000	0.000	0.000	0.000	0.522	0.522
41:00:00	0.000	0.000	0.000	0.000	0.516	0.516
41:30:00	0.000	0.000	0.000	0.000	0.510	0.510
42:00:00	0.000	0.000	0.000	0.000	0.503	0.503
42:30:00	0.000	0.000	0.000	0.000	0.497	0.497
43:00:00	0.000	0.000	0.000	0.000	0.491	0.491
43:30:00	0.000	0.000	0.000	0.000	0.486	0.486
44:00:00	0.000	0.000	0.000	0.000	0.480	0.480
44:30:00	0.000	0.000	0.000	0.000	0.474	0.474
45:00:00	0.000	0.000	0.000	0.000	0.468	0.468
45:30:00	0.000	0.000	0.000	0.000	0.463	0.463
46:00:00	0.000	0.000	0.000	0.000	0.457	0.457
46:30:00	0.000	0.000	0.000	0.000	0.452	0.452
47:00:00	0.000	0.000	0.000	0.000	0.446	0.446
47:30:00	0.000	0.000	0.000	0.000	0.441	0.441
48:00:00	0.000	0.000	0.000	0.000	0.436	0.436
48:30:00	0.000	0.000	0.000	0.000	0.431	0.431
49:00:00	0.000	0.000	0.000	0.000	0.425	0.425
49:30:00	0.000	0.000	0.000	0.000	0.420	0.420
50:00:00	0.000	0.000	0.000	0.000	0.415	0.415
50:30:00	0.000	0.000	0.000	0.000	0.410	0.410
51:00:00	0.000	0.000	0.000	0.000	0.405	0.405
51:30:00	0.000	0.000	0.000	0.000	0.401	0.401

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
52:00:00	0.000	0.000	0.000	0.000	0.396	0.396
52:30:00	0.000	0.000	0.000	0.000	0.391	0.391
53:00:00	0.000	0.000	0.000	0.000	0.386	0.386
53:30:00	0.000	0.000	0.000	0.000	0.382	0.382
54:00:00	0.000	0.000	0.000	0.000	0.377	0.377
54:30:00	0.000	0.000	0.000	0.000	0.373	0.373
55:00:00	0.000	0.000	0.000	0.000	0.368	0.368
55:30:00	0.000	0.000	0.000	0.000	0.364	0.364
56:00:00	0.000	0.000	0.000	0.000	0.359	0.359
56:30:00	0.000	0.000	0.000	0.000	0.355	0.355
57:00:00	0.000	0.000	0.000	0.000	0.351	0.351
57:30:00	0.000	0.000	0.000	0.000	0.347	0.347
58:00:00	0.000	0.000	0.000	0.000	0.343	0.343
58:30:00	0.000	0.000	0.000	0.000	0.338	0.338
59:00:00	0.000	0.000	0.000	0.000	0.334	0.334
59:30:00	0.000	0.000	0.000	0.000	0.330	0.330
60:00:00	0.000	0.000	0.000	0.000	0.326	0.326
60:30:00	0.000	0.000	0.000	0.000	0.323	0.323
61:00:00	0.000	0.000	0.000	0.000	0.319	0.319
61:30:00	0.000	0.000	0.000	0.000	0.315	0.315
62:00:00	0.000	0.000	0.000	0.000	0.311	0.311
62:30:00	0.000	0.000	0.000	0.000	0.307	0.307
63:00:00	0.000	0.000	0.000	0.000	0.304	0.304
63:30:00	0.000	0.000	0.000	0.000	0.300	0.300
64:00:00	0.000	0.000	0.000	0.000	0.296	0.296
64:30:00	0.000	0.000	0.000	0.000	0.293	0.293
65:00:00	0.000	0.000	0.000	0.000	0.289	0.289
65:30:00	0.000	0.000	0.000	0.000	0.286	0.286
66:00:00	0.000	0.000	0.000	0.000	0.283	0.283
66:30:00	0.000	0.000	0.000	0.000	0.279	0.279
67:00:00	0.000	0.000	0.000	0.000	0.276	0.276
67:30:00	0.000	0.000	0.000	0.000	0.273	0.273
68:00:00	0.000	0.000	0.000	0.000	0.269	0.269
68:30:00	0.000	0.000	0.000	0.000	0.266	0.266
69:00:00	0.000	0.000	0.000	0.000	0.263	0.263

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
69:30:00	0.000	0.000	0.000	0.000	0.260	0.260
70:00:00	0.000	0.000	0.000	0.000	0.257	0.257
70:30:00	0.000	0.000	0.000	0.000	0.254	0.254
71:00:00	0.000	0.000	0.000	0.000	0.250	0.250
71:30:00	0.000	0.000	0.000	0.000	0.247	0.247
72:00:00	0.000	0.000	0.000	0.000	0.245	0.245
72:30:00	0.000	0.000	0.000	0.000	0.242	0.242
73:00:00	0.000	0.000	0.000	0.000	0.239	0.239
73:30:00	0.000	0.000	0.000	0.000	0.236	0.236
74:00:00	0.000	0.000	0.000	0.000	0.233	0.233
74:30:00	0.000	0.000	0.000	0.000	0.230	0.230
75:00:00	0.000	0.000	0.000	0.000	0.228	0.228
75:30:00	0.000	0.000	0.000	0.000	0.225	0.225
76:00:00	0.000	0.000	0.000	0.000	0.222	0.222
76:30:00	0.000	0.000	0.000	0.000	0.219	0.219
77:00:00	0.000	0.000	0.000	0.000	0.217	0.217
77:30:00	0.000	0.000	0.000	0.000	0.214	0.214
78:00:00	0.000	0.000	0.000	0.000	0.212	0.212
78:30:00	0.000	0.000	0.000	0.000	0.209	0.209
79:00:00	0.000	0.000	0.000	0.000	0.207	0.207
79:30:00	0.000	0.000	0.000	0.000	0.204	0.204
80:00:00	0.000	0.000	0.000	0.000	0.202	0.202
80:30:00	0.000	0.000	0.000	0.000	0.199	0.199
81:00:00	0.000	0.000	0.000	0.000	0.197	0.197
81:30:00	0.000	0.000	0.000	0.000	0.195	0.195
82:00:00	0.000	0.000	0.000	0.000	0.192	0.192
82:30:00	0.000	0.000	0.000	0.000	0.190	0.190
83:00:00	0.000	0.000	0.000	0.000	0.188	0.188
83:30:00	0.000	0.000	0.000	0.000	0.185	0.185
84:00:00	0.000	0.000	0.000	0.000	0.183	0.183
84:30:00	0.000	0.000	0.000	0.000	0.181	0.181
85:00:00	0.000	0.000	0.000	0.000	0.179	0.179
85:30:00	0.000	0.000	0.000	0.000	0.177	0.177
86:00:00	0.000	0.000	0.000	0.000	0.175	0.175
86:30:00	0.000	0.000	0.000	0.000	0.172	0.172

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
87:00:00	0.000	0.000	0.000	0.000	0.170	0.170
87:30:00	0.000	0.000	0.000	0.000	0.168	0.168
88:00:00	0.000	0.000	0.000	0.000	0.166	0.166
88:30:00	0.000	0.000	0.000	0.000	0.164	0.164
89:00:00	0.000	0.000	0.000	0.000	0.162	0.162
89:30:00	0.000	0.000	0.000	0.000	0.160	0.160
90:00:00	0.000	0.000	0.000	0.000	0.159	0.159
90:30:00	0.000	0.000	0.000	0.000	0.157	0.157
91:00:00	0.000	0.000	0.000	0.000	0.155	0.155
91:30:00	0.000	0.000	0.000	0.000	0.153	0.153
92:00:00	0.000	0.000	0.000	0.000	0.151	0.151
92:30:00	0.000	0.000	0.000	0.000	0.149	0.149
93:00:00	0.000	0.000	0.000	0.000	0.148	0.148
93:30:00	0.000	0.000	0.000	0.000	0.146	0.146
94:00:00	0.000	0.000	0.000	0.000	0.144	0.144
94:30:00	0.000	0.000	0.000	0.000	0.142	0.142
95:00:00	0.000	0.000	0.000	0.000	0.141	0.141
95:30:00	0.000	0.000	0.000	0.000	0.139	0.139
96:00:00	0.000	0.000	0.000	0.000	0.137	0.137
96:30:00	0.000	0.000	0.000	0.000	0.136	0.136
97:00:00	0.000	0.000	0.000	0.000	0.134	0.134
97:30:00	0.000	0.000	0.000	0.000	0.132	0.132
98:00:00	0.000	0.000	0.000	0.000	0.131	0.131
98:30:00	0.000	0.000	0.000	0.000	0.129	0.129
99:00:00	0.000	0.000	0.000	0.000	0.128	0.128
99:30:00	0.000	0.000	0.000	0.000	0.126	0.126
100:00:00	0.000	0.000	0.000	0.000	0.125	0.125
100:30:00	0.000	0.000	0.000	0.000	0.123	0.123
101:00:00	0.000	0.000	0.000	0.000	0.122	0.122

Appendix

Catchment descriptors

Name	Value	User-defined value used?
Area (km ²)	4.8	No
ALTBAR	78	No
ASPBAR	295	No
ASPVAR	0.45	No
BFIHOST	0.45	No
BFIHOST19	0.47	No
DPLBAR (km)	2.36	No
DPSBAR (mkm ⁻¹)	23.8	No
FARL	1	No
LDP	5.7	No
PROPWET	0.29	No
RMED1H	12.5	No
RMED1D	32	No
RMED2D	41	No
SAAR (mm)	664	No
SAAR4170 (mm)	673	No
SPRHOST	37.68	No
URBEXT2000	0.18	No
URBEXT1990	0.18	No
URBCONC	0.86	No
URBLOC	1.27	No
DDF parameter C	-0.03	No
DDF parameter D1	0.26	No
DDF parameter D2	0.27	No
DDF parameter D3	0.32	No
DDF parameter E	0.3	No
DDF parameter F	2.72	No
DDF parameter C (1km grid value)	-0.03	No
DDF parameter D1 (1km grid value)	0.27	No
DDF parameter D2 (1km grid value)	0.29	No
DDF parameter D3 (1km grid value)	0.32	No
DDF parameter E (1km grid value)	0.3	No
DDF parameter F (1km grid value)	2.7	No



Appendix B - Model Log

A218 Priors Farm Direct Rainfall Model Log

Last updated: 20/09/2025

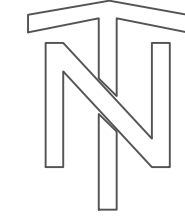
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Structures					
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Sensitivity					
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20/09/20225	PF01_2m_100yrCC40_Mannings-20PC_005	PF01_2m_100yrCC40_Mannings-20PC_005	PF01_2m_005	PF01_2m_005	Materials_-20PC
20/09/20225	PF01_2m_100yrCC40_50PC_Block_005	PF01_2m_100yrCC40_50PC_Block_005	PF01_2m_005	PF01_2m_005	Materials
20/09/20225	PF01_2m_100yrCC40_90PC_Block_005	PF01_2m_100yrCC40_90PC_Block_005	PF01_2m_005	PF01_2m_005	Materials
20/09/20225	PF01_2m_100yrCC40_5.5hr_Storm_Duration_005	PF01_2m_100yrCC40_5.5hr_Storm_Duration_005	PF01_2m_005	PF01_2m_005	Materials
20/09/20225	PF01_2m_100yrCC40_9.5hr_Storm_Duration_005	PF01_2m_100yrCC40_9.5hr_Storm_Duration_005	PF01_2m_005	PF01_2m_005	Materials
20/09/20225	PF01_2m_100yrCC40_DSB_+20PC_005	PF01_2m_100yrCC40_DSB_+20PC_005	PF01_2m_DSB_+20PC_005	PF01_2m_005	Materials
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Appendix C - Topographical Survey

Topographical Survey

Channel Survey



1. This drawing is copyright and its use or reproduction without the written permission of Usak Land Survey is prohibited
2. Due to unavoidable inaccuracies during the reproduction process of drawings, the drawings of Usak Land Survey are critical. Usak Land Survey should be requested to confirm dimensions based on survey information. Scales appearing at the base of this plan are not indicative of the actual dimensions.
3. This plan has been prepared in accordance with B.S. 1192, Part 1 in relation to scale and dimension. Tolerances permitted within the British Standard should be observed.
4. All dimensions and particulars should be checked on site. Any discrepancies and be reported to Usak Land Survey before any work commences.

[illegible]

STN	CO-ORDINATES	LEVEL	STN	CO-ORDINATES	LEVEL
NATIONAL GRID.			CONTROL USED: TYPE REFERENCE VALUE(M)		
ALL LEVELS RELATE TO ORDNANCE DATUM NEWLYN.					

 **Usk** Land Survey
No.40 ABERGAVENNY ROAD, USK, NP15 1SB
TEL: 01291 673491 MOB: 0787 2560386
EMAIL jonbarton@usksurveys.co.uk

Site Easthampstead Road
Wokingham
RG40 3BQ

Drawing No.	Revision
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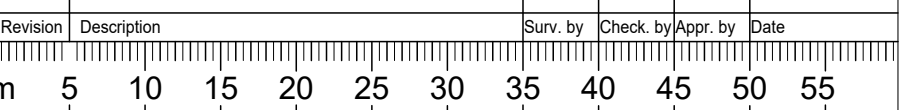
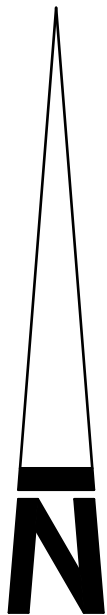
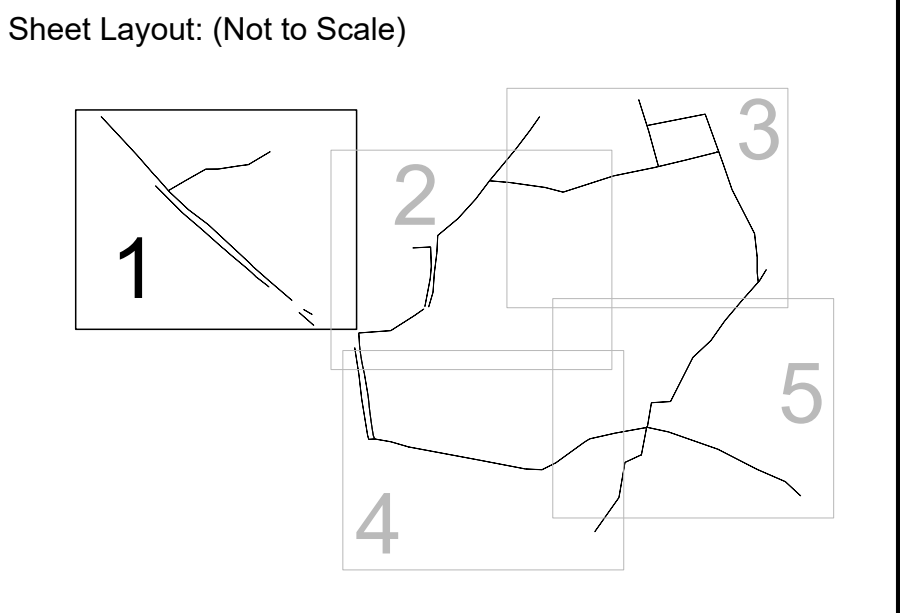
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CAD Filename: 1328.dwg Plot Scale: 1 = 1

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Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM. DERIVED FROM THE NATIONAL GRID NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Location Plan

Client:
Abley Letchford Partnership Ltd

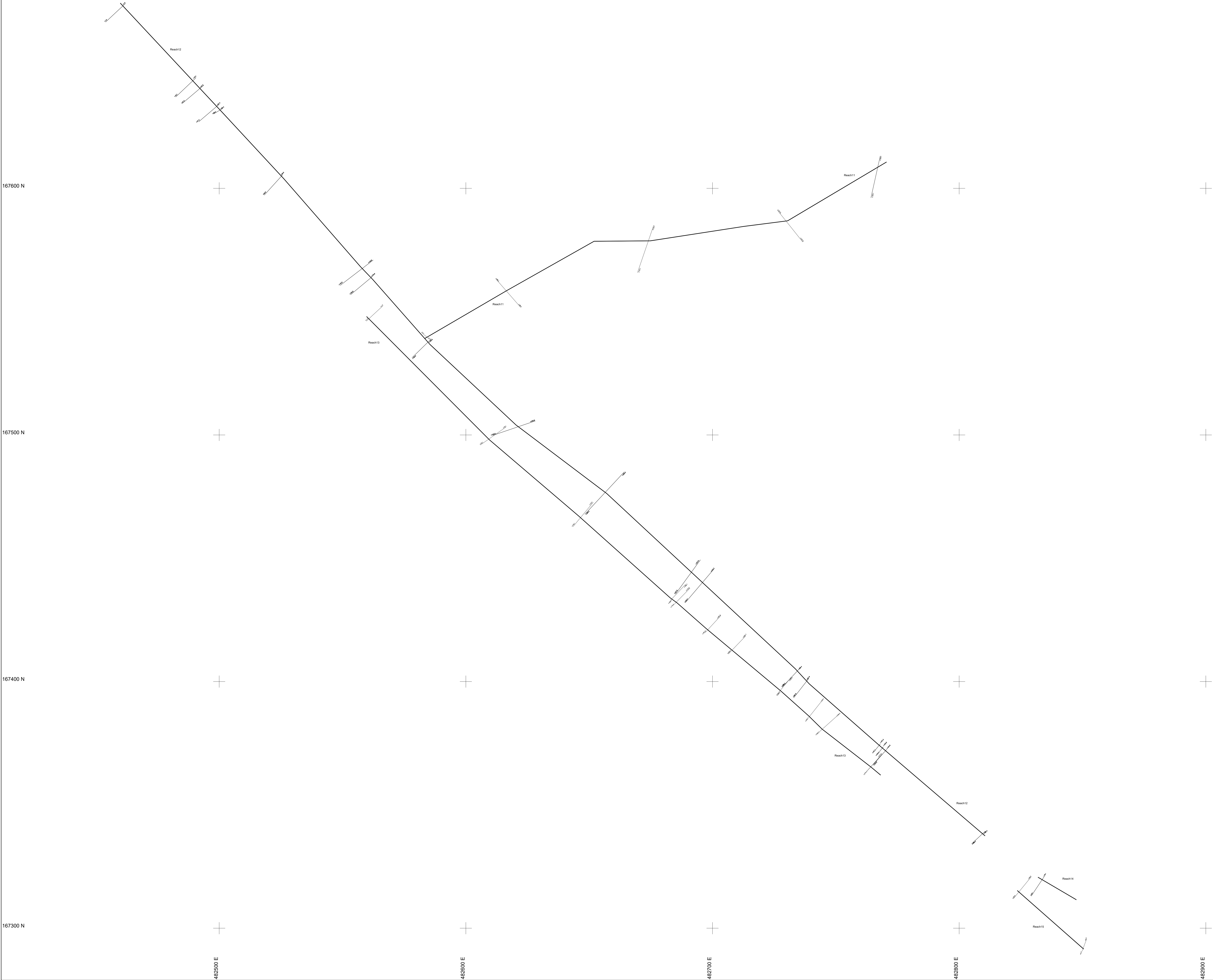
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South Wokingham
Berkshire**

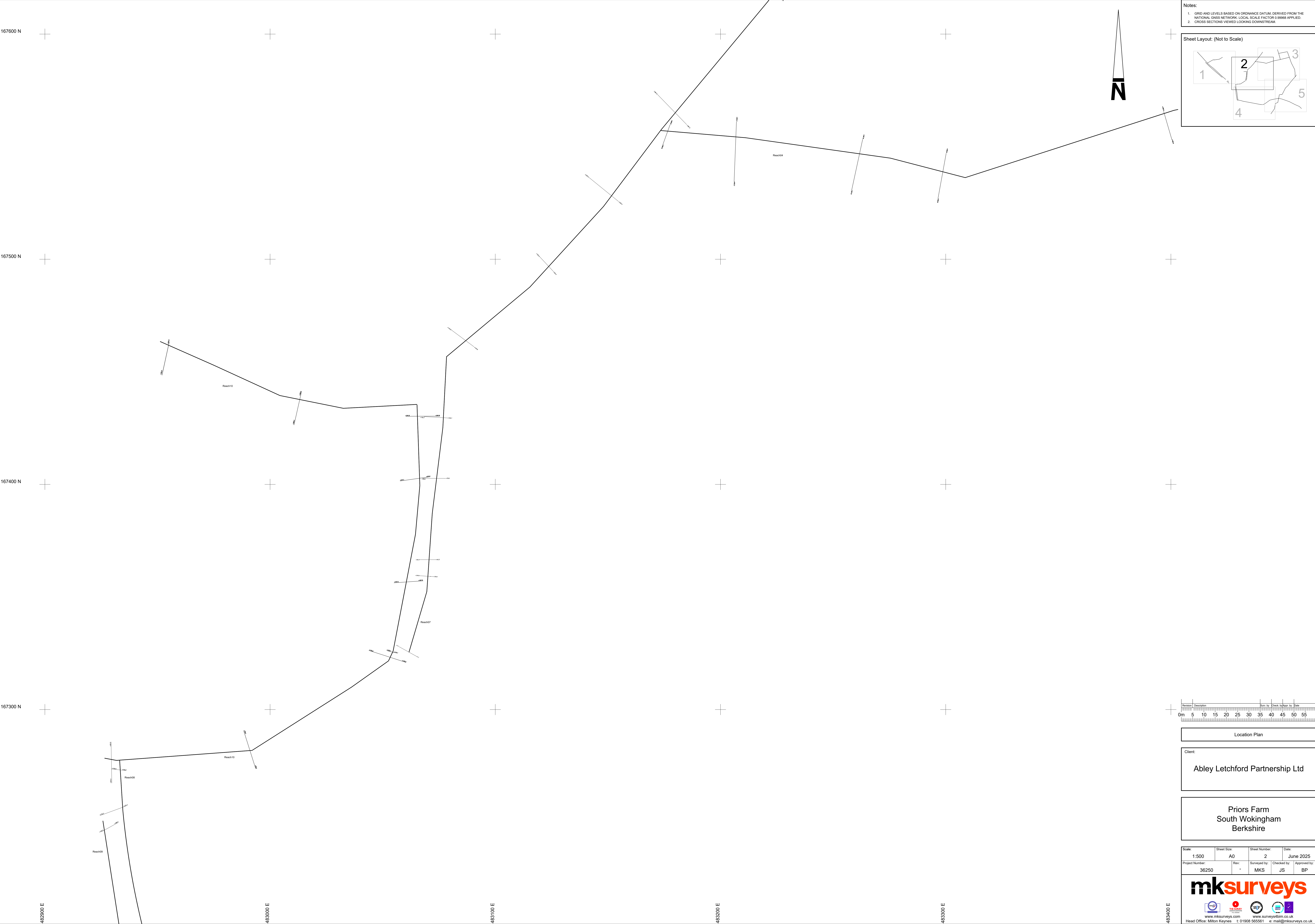
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Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS Approved by: BP

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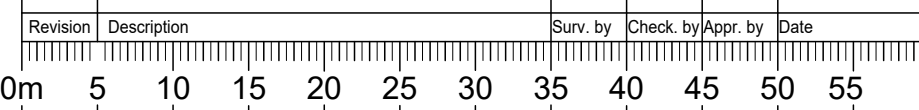
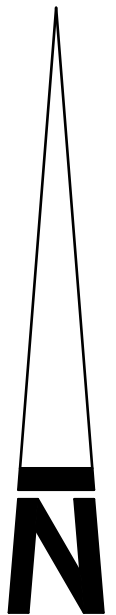
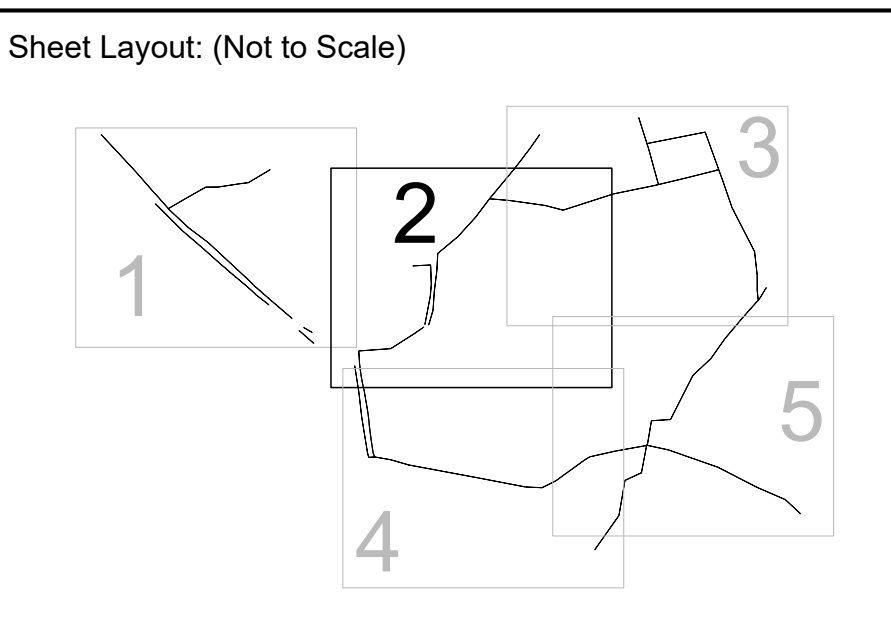
Head Office: Milton Keynes t: 01908 565561 e: mail@mk-surveys.co.uk





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Location Plan

Client:

Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

Scale:	Sheet Size:	Sheet Number:	Date:
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Project Number:	Rev:	Surveyed by:	Checked by:
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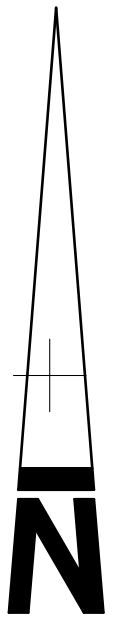
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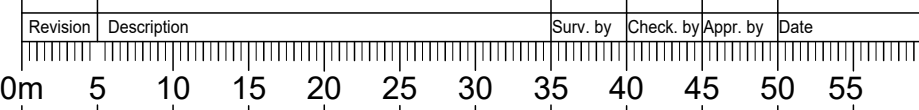
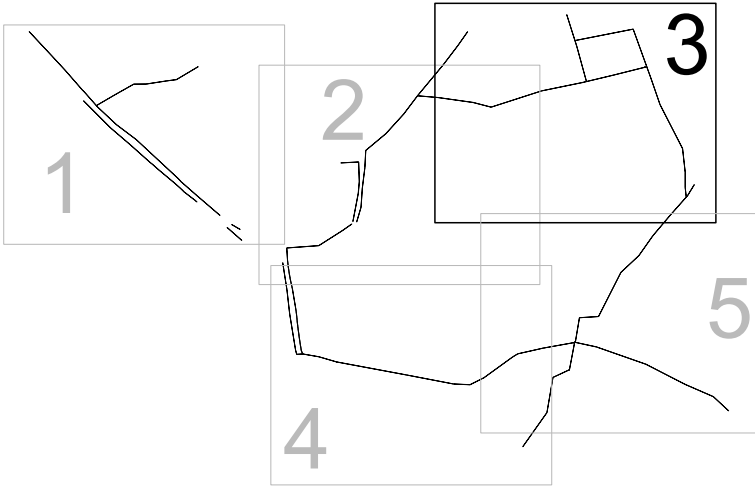
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Sheet Layout: (Not to Scale)



Location Plan

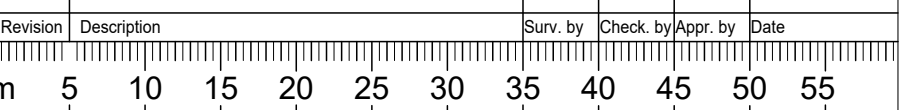
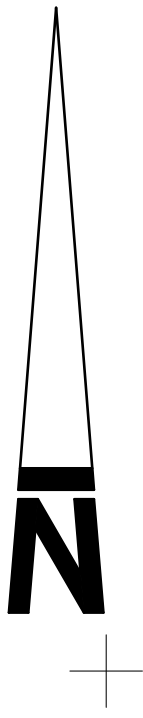
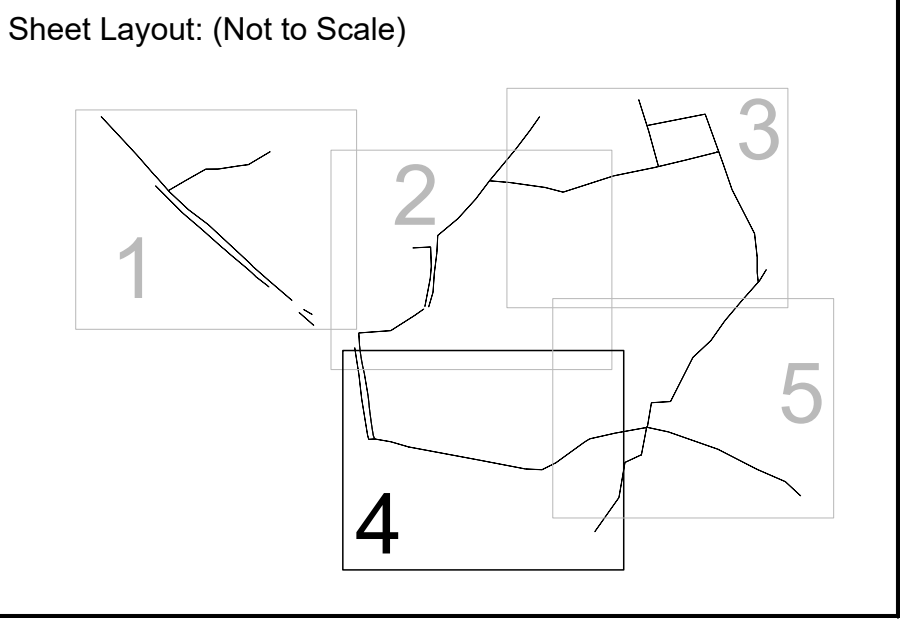
Client:

Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

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			BP

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2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Location Plan

Client:
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**Priors Farm
South Wokingham
Berkshire**

Scale: 1:500	Sheet Size: A0	Sheet Number: 4	Date: June 2025
Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS Approved by: BP

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167200 N

167100 N

167000 N

166900 N

483100 E

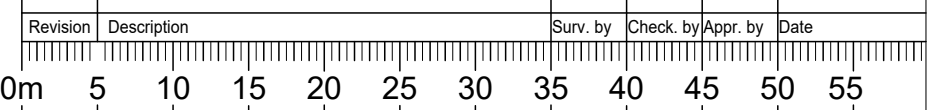
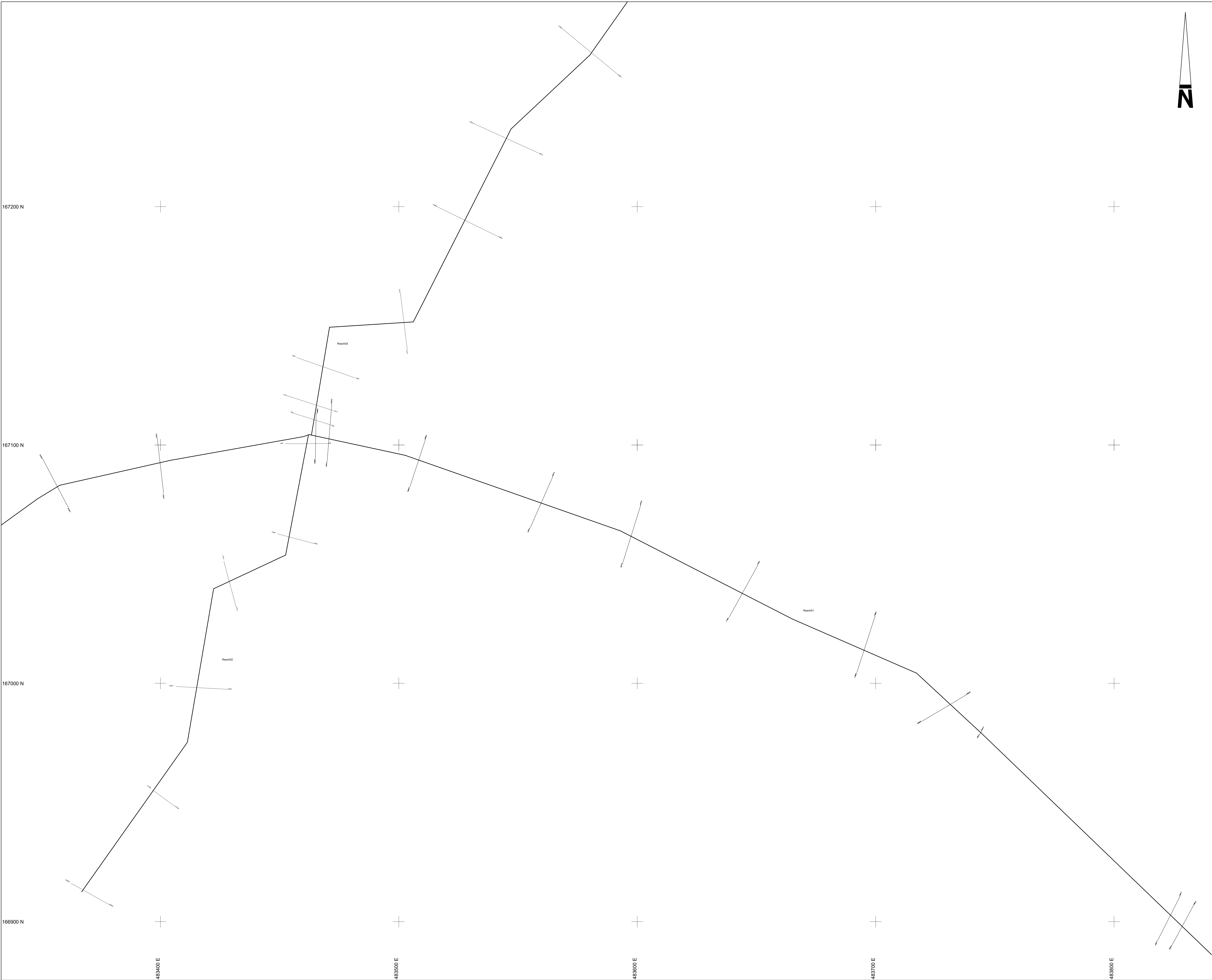
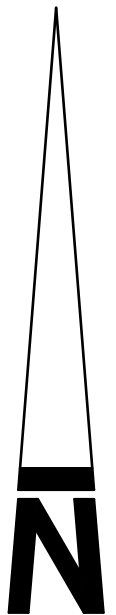
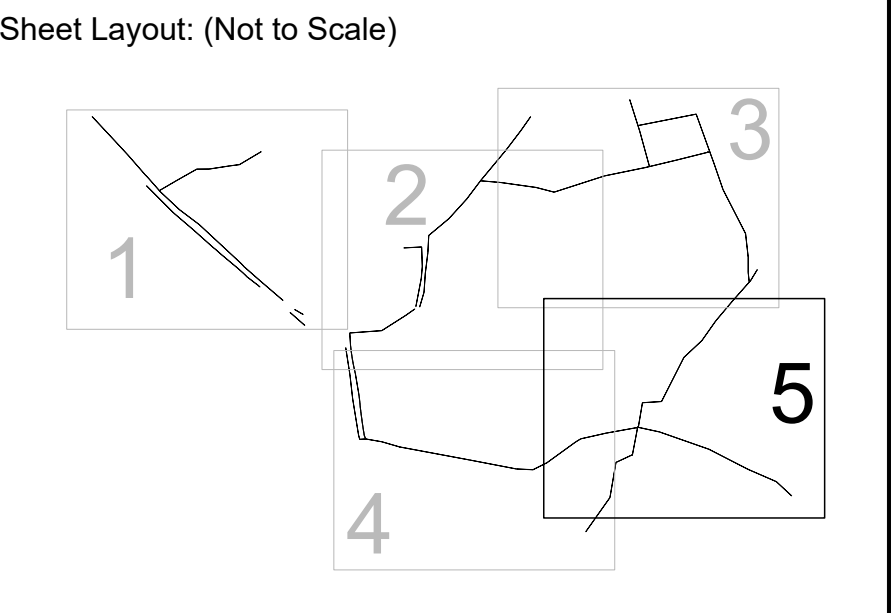
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483500 E

Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL GRID NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.
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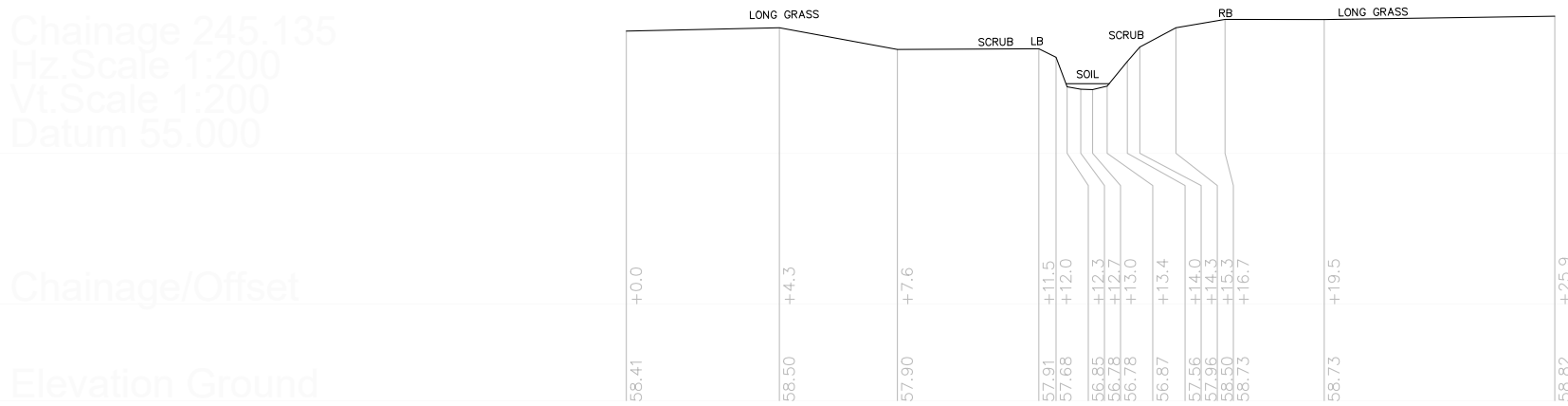
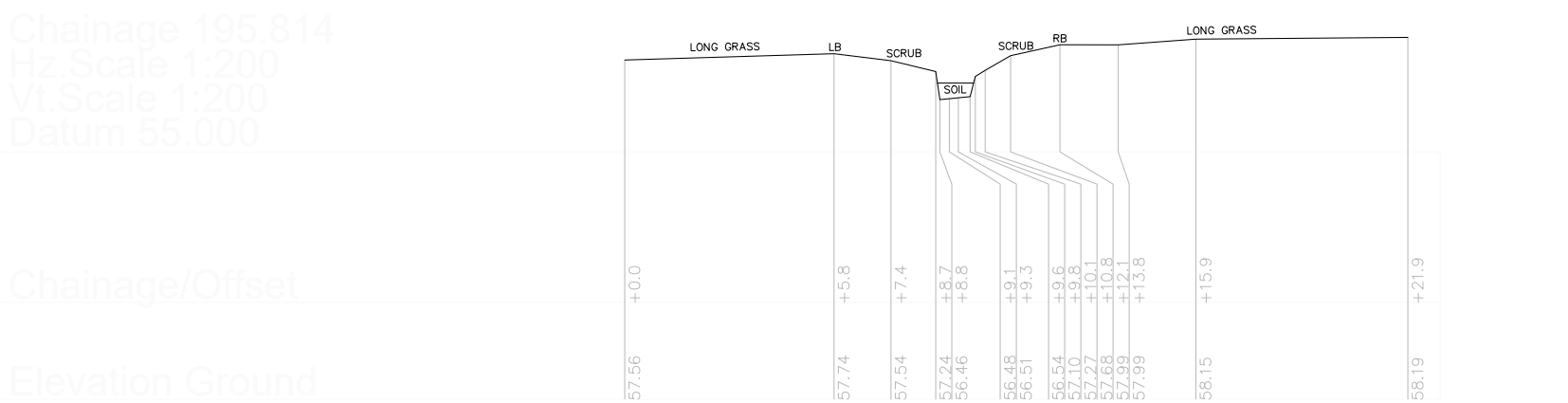
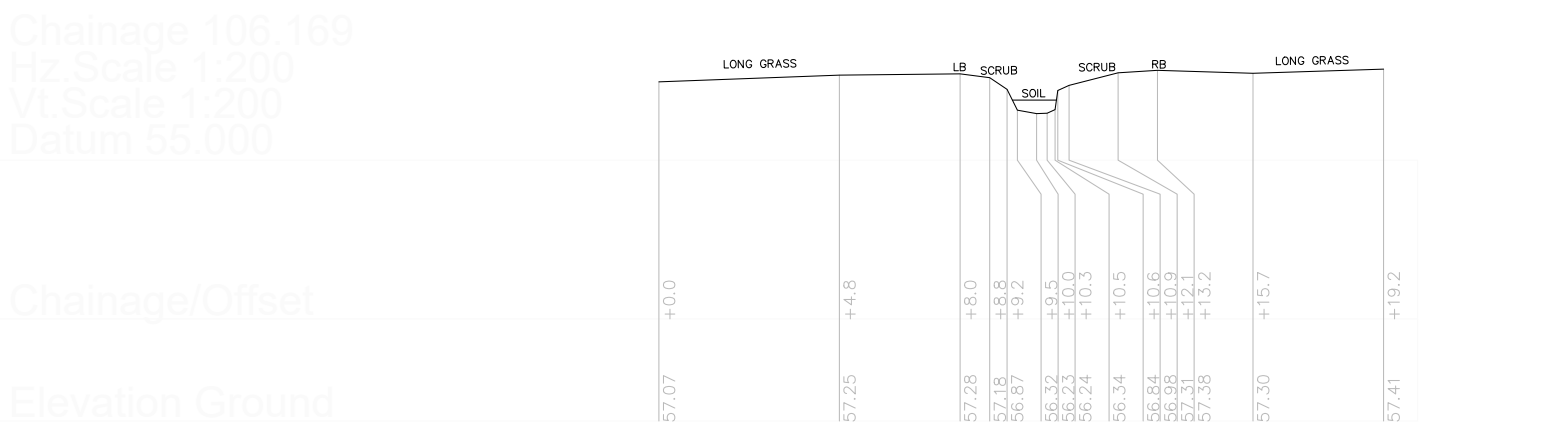
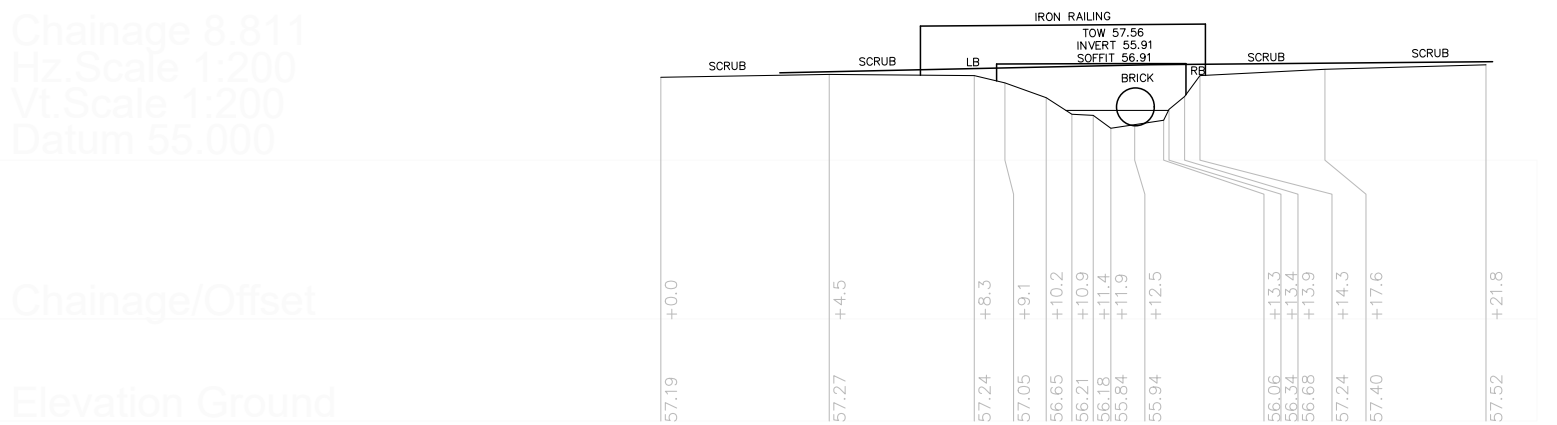
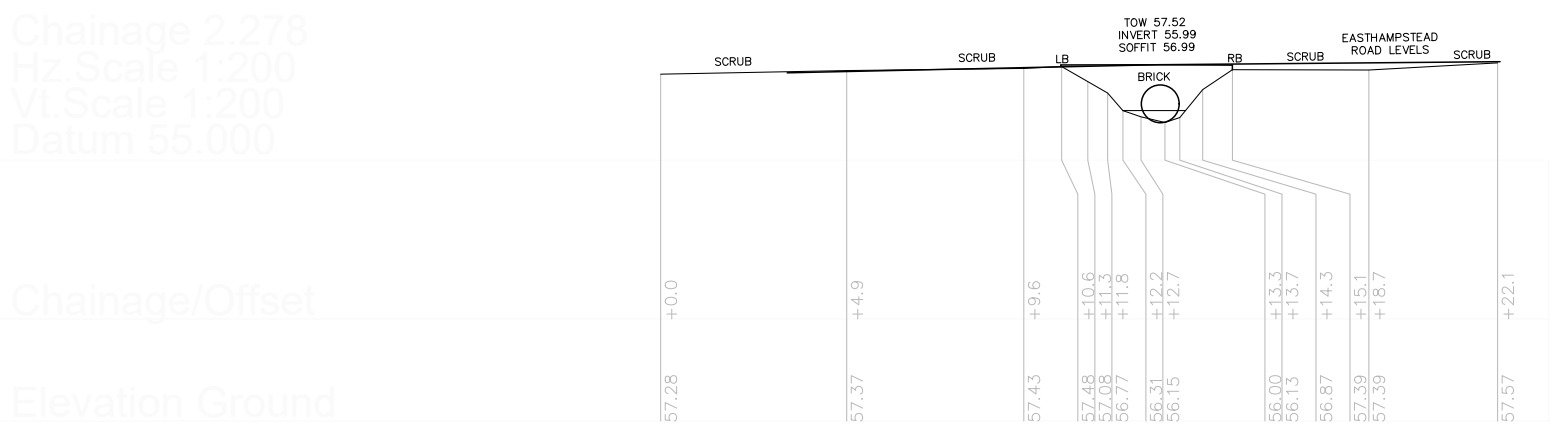
Location Plan

Client:
Abley Letchford Partnership Ltd

**Priors Farm
South Wokingham
Berkshire**

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Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS Approved by: BP

- Notes:
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 2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



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2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.

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Vx Scale 1:200
Datum 58.000

Chainage/Offset

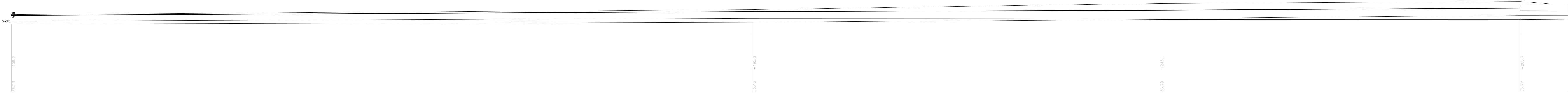
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Datum 58.000

Chainage/Offset

Elevation Ground



Chainage 294.5-472.1
Hx Scale 1:200
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Datum 58.000

Chainage/Offset

Elevation Ground



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Datum 58.000

Chainage/Offset

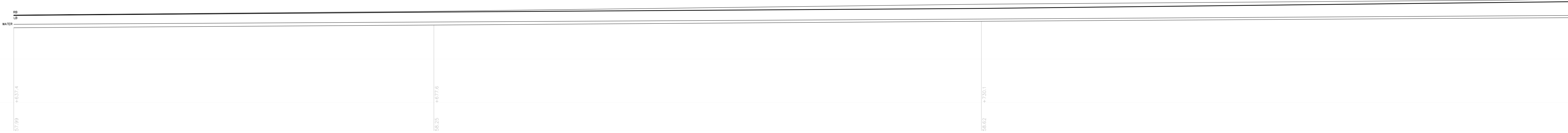
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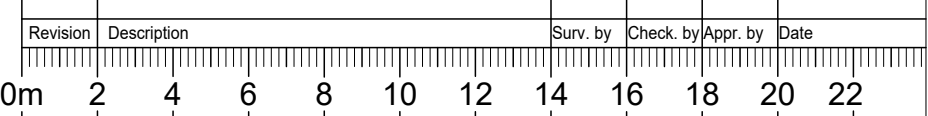
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Chainage/Offset

Elevation Ground



Long Section - Reach01

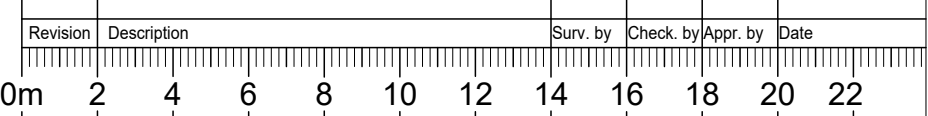
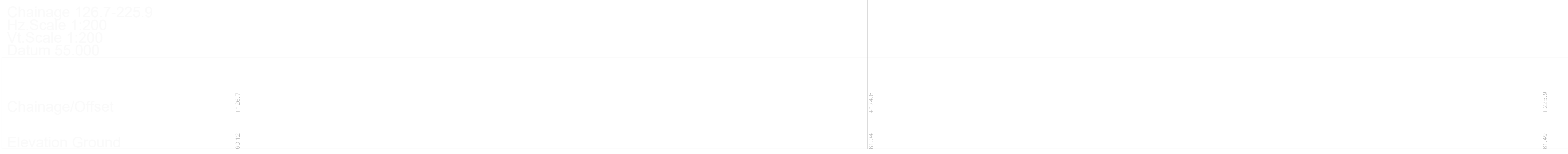
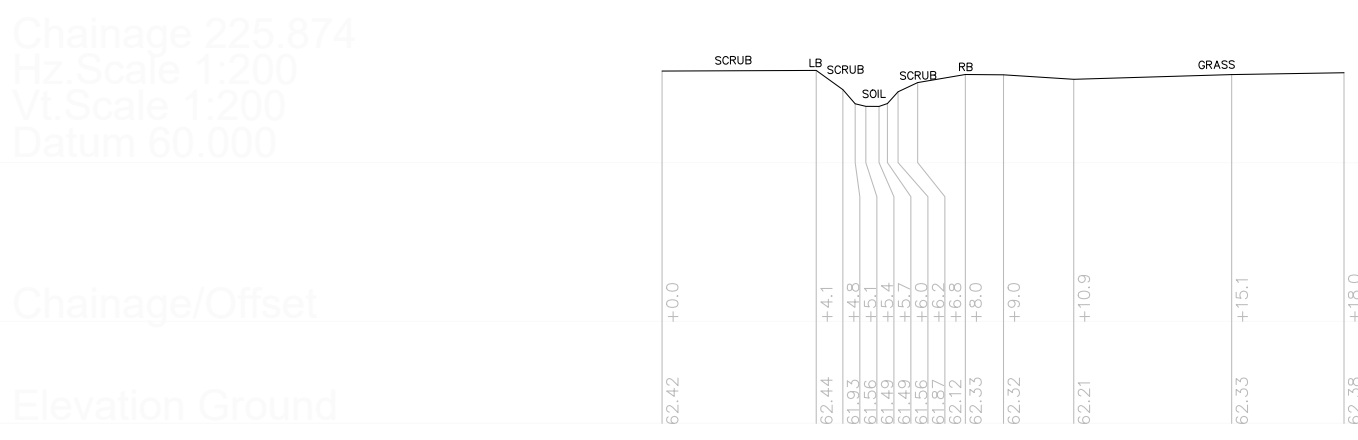
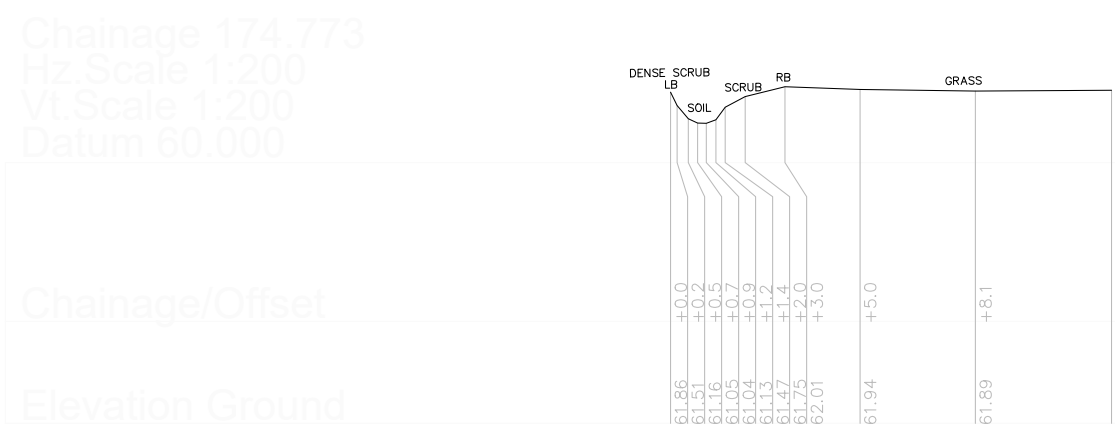
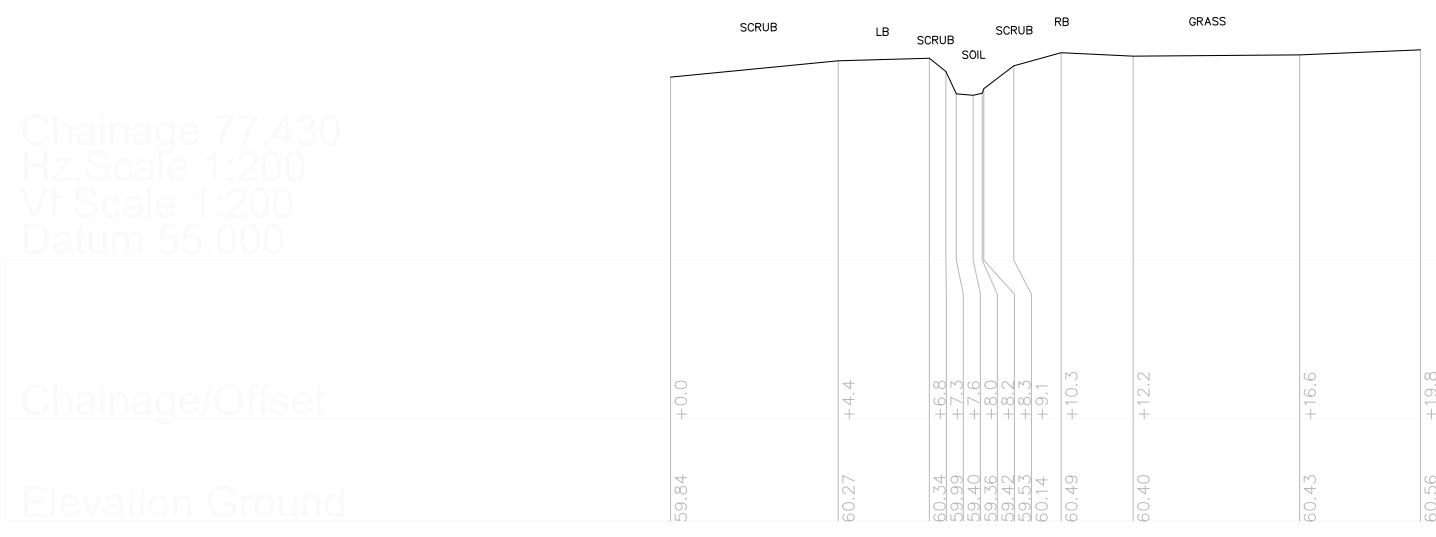
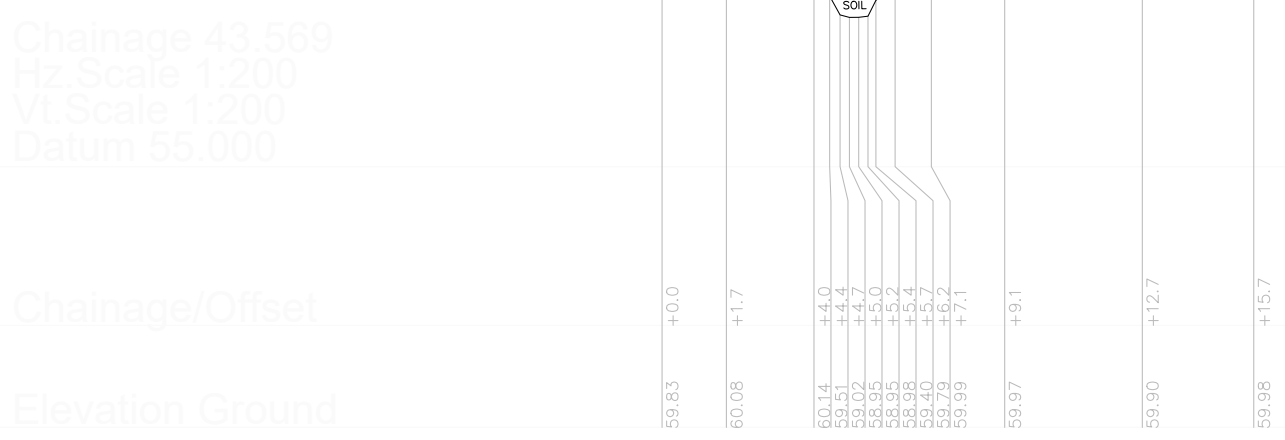
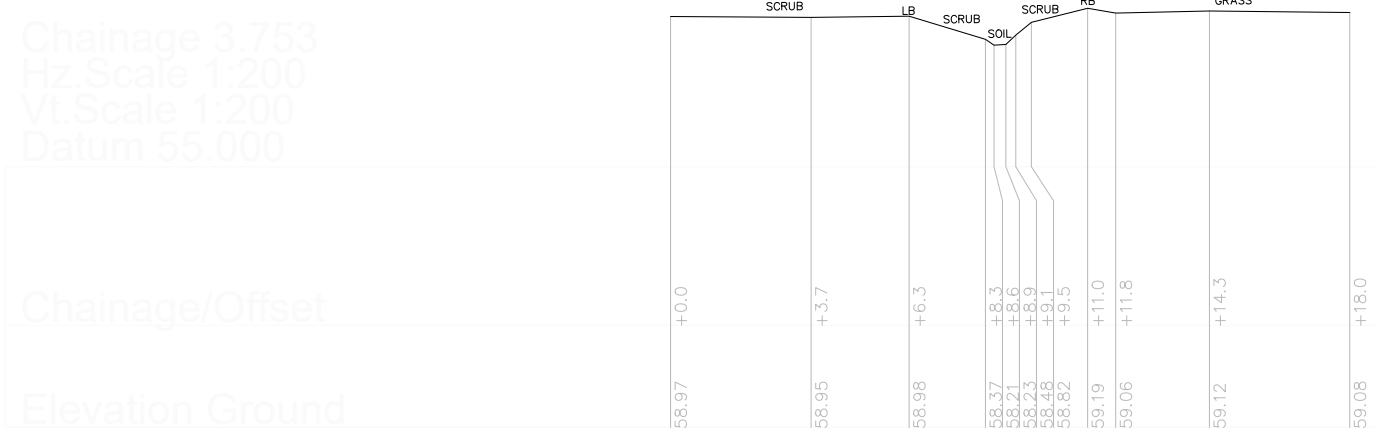
Client:

Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

Scale:	Sheet Size:	Sheet Number:	Date:
1:200	A0	7	June 2025
Project Number:	Rev:	Surveyed by:	Checked by:
36250	-	MKS	JS
			BP

Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM. DERIVED FROM THE NATIONAL GRID NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Cross Sections & Long Section - Reach02

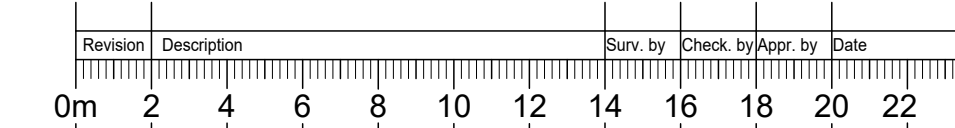
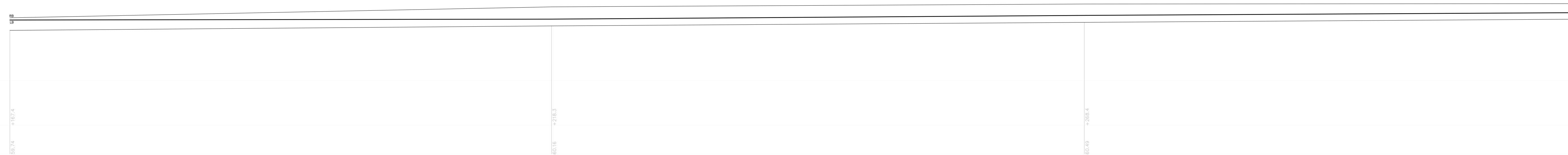
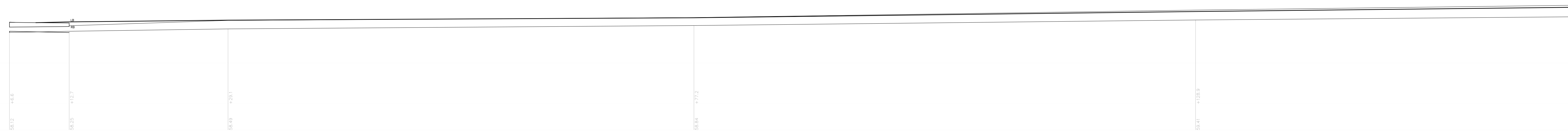
Client:

Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

Scale:	Sheet Size:	Sheet Number:	Date:
1:200	A0	8	June 2025
Project Number:	Rev:	Surveyed by:	Checked by:
36250	-	MKS	JS
			BP

1. GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL GNSS NETWORK. LOCAL SCALE FACTOR 0.99968 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



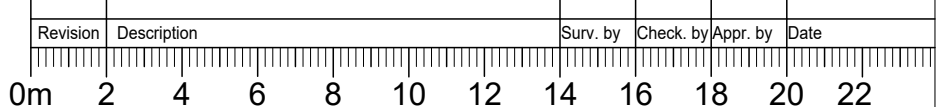
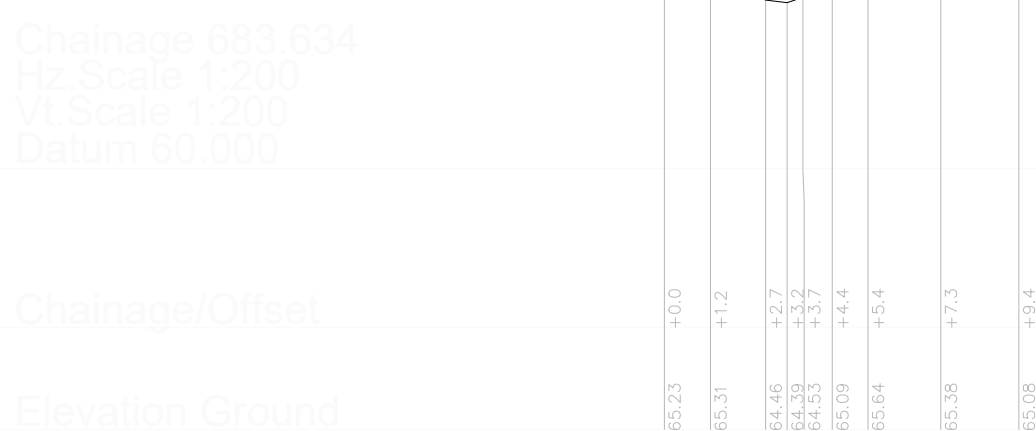
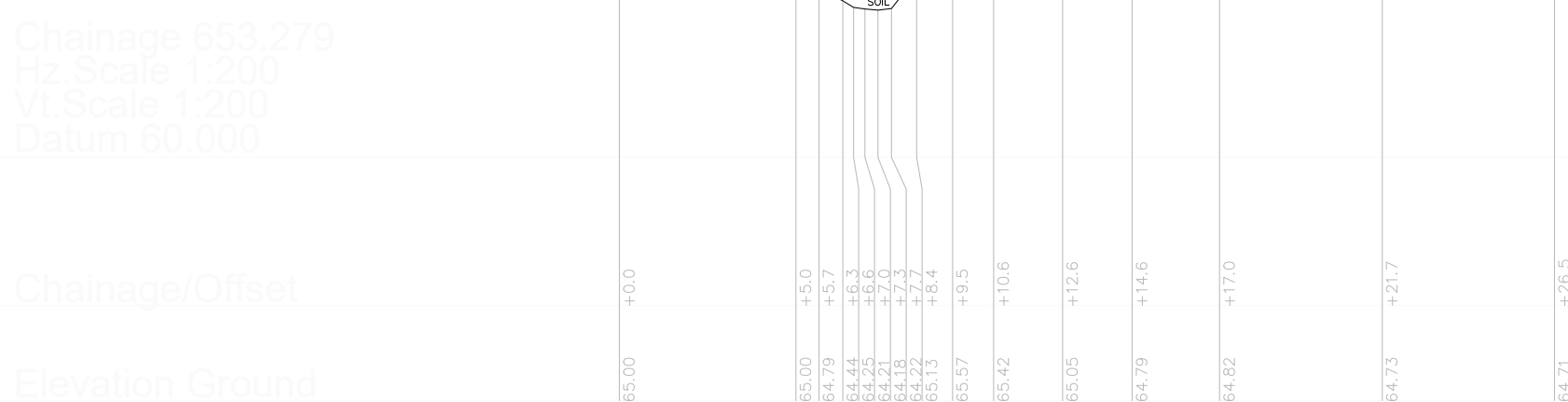
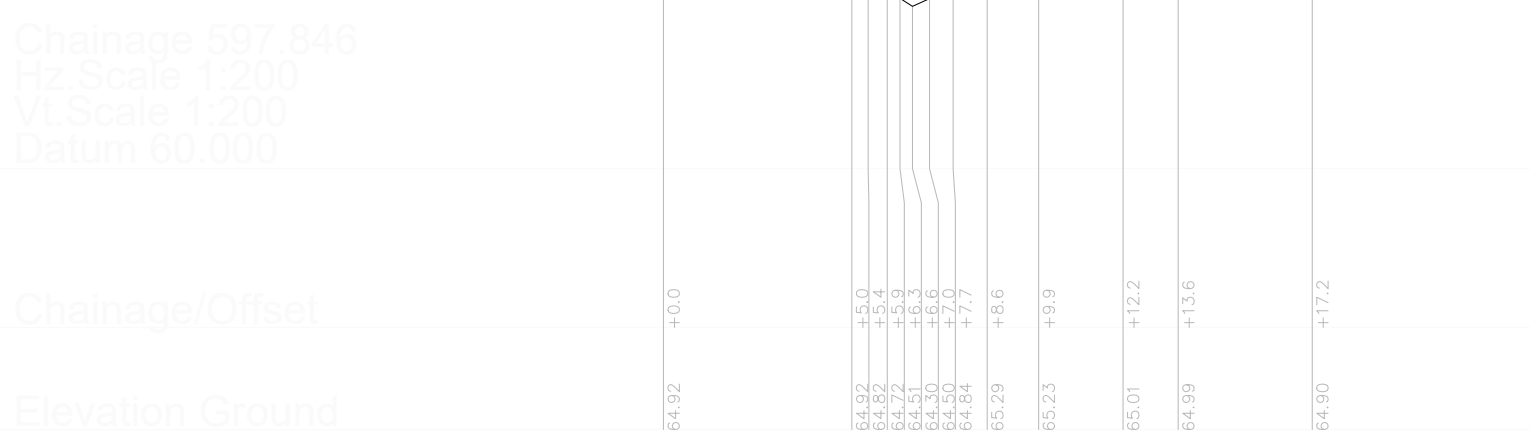
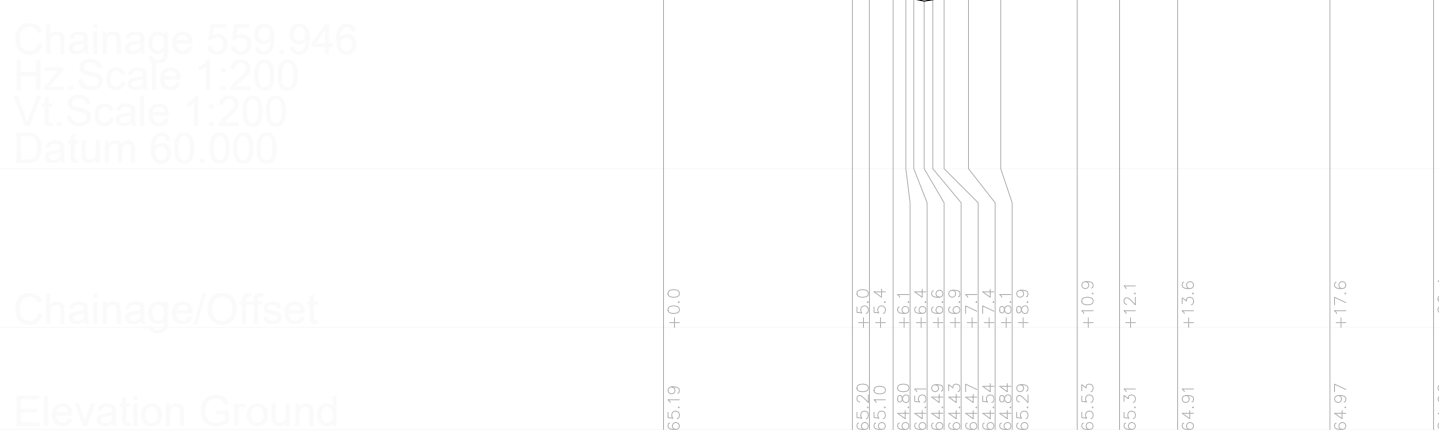
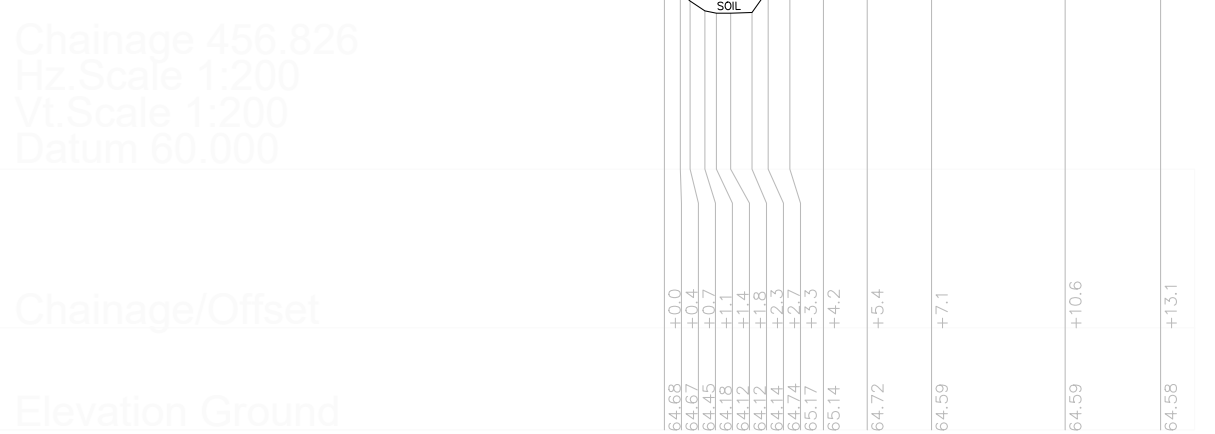
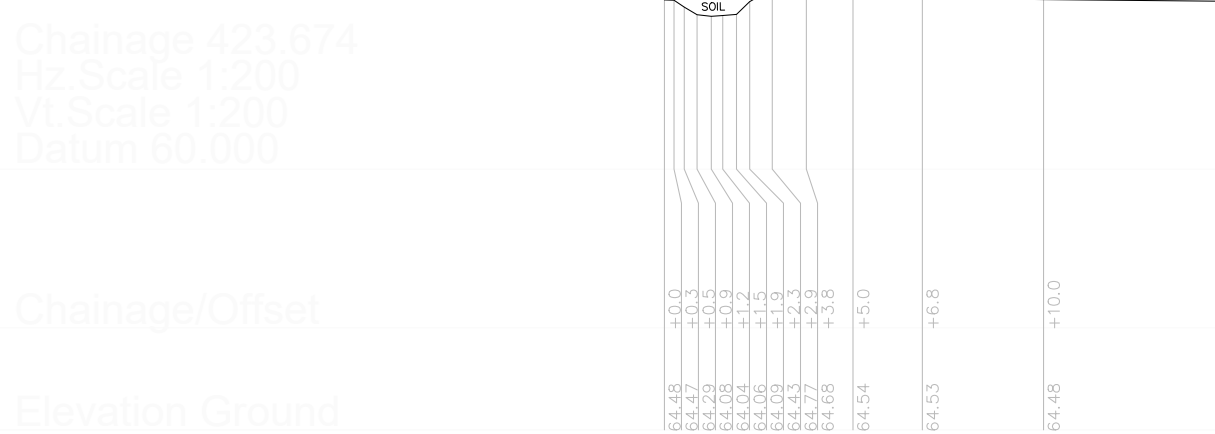
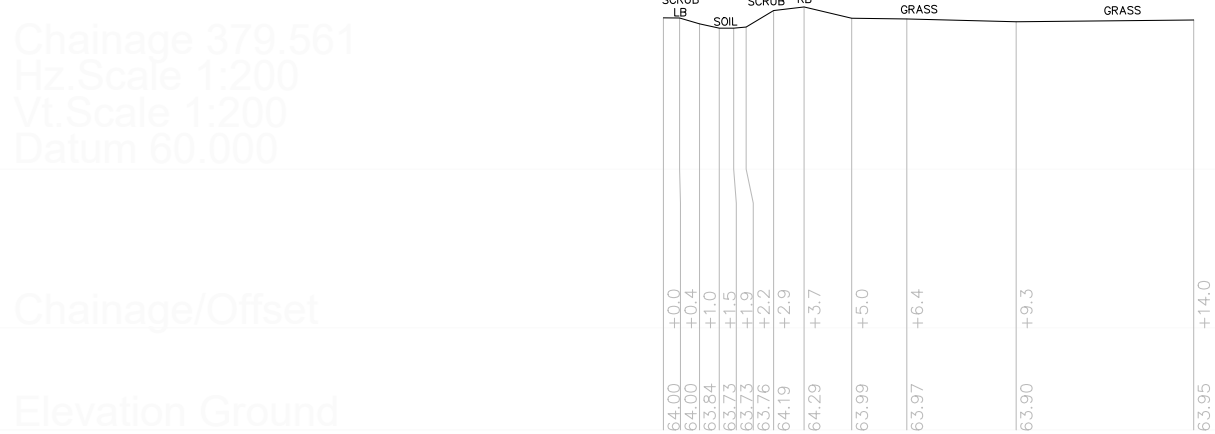
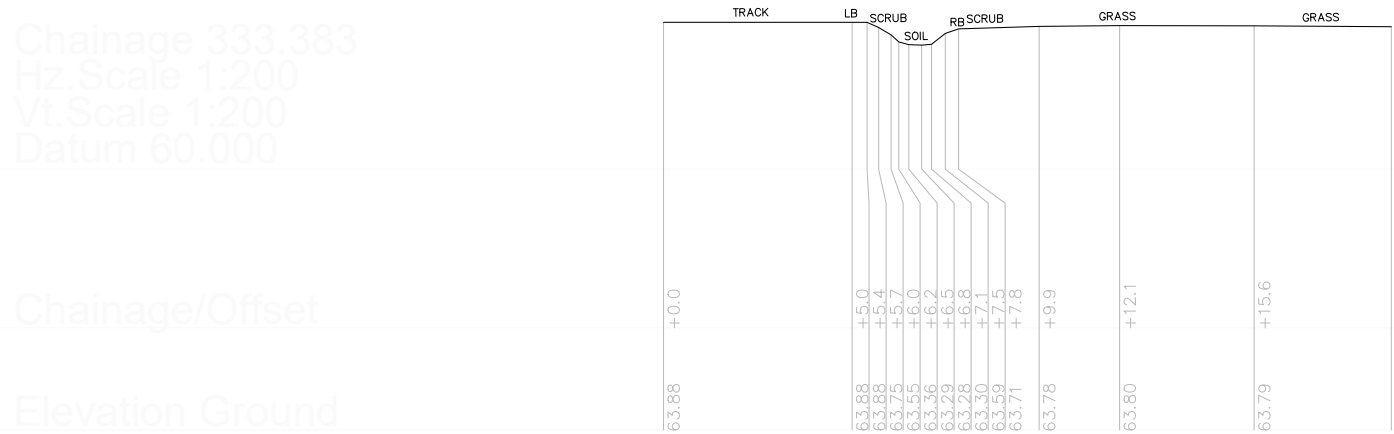
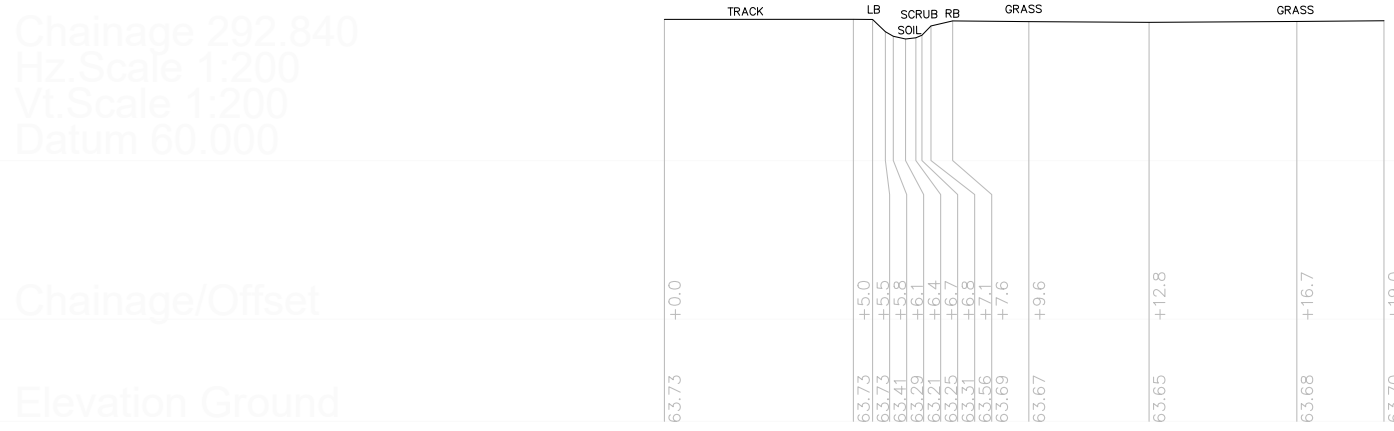
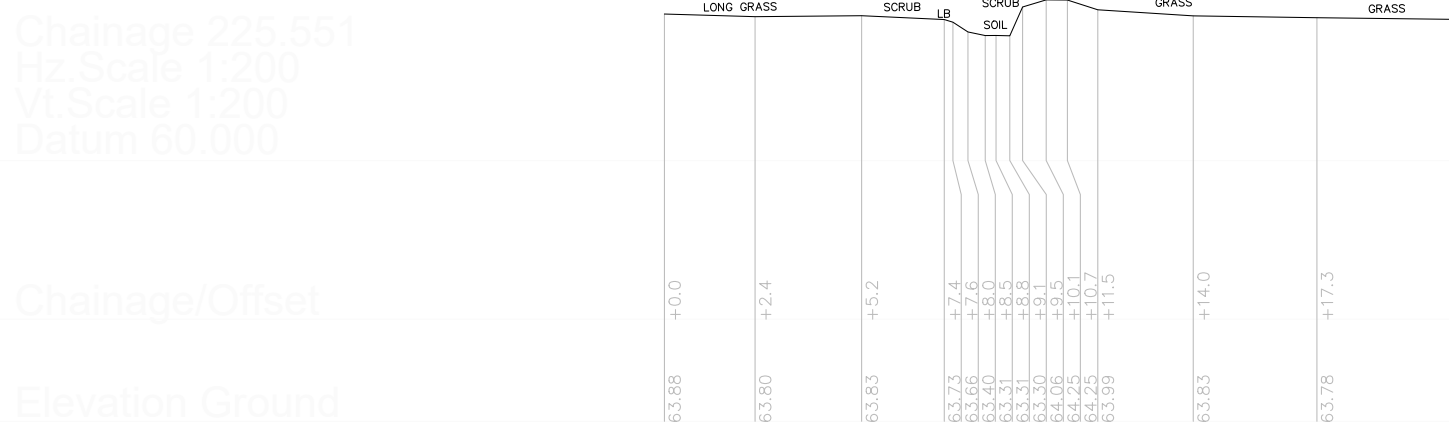
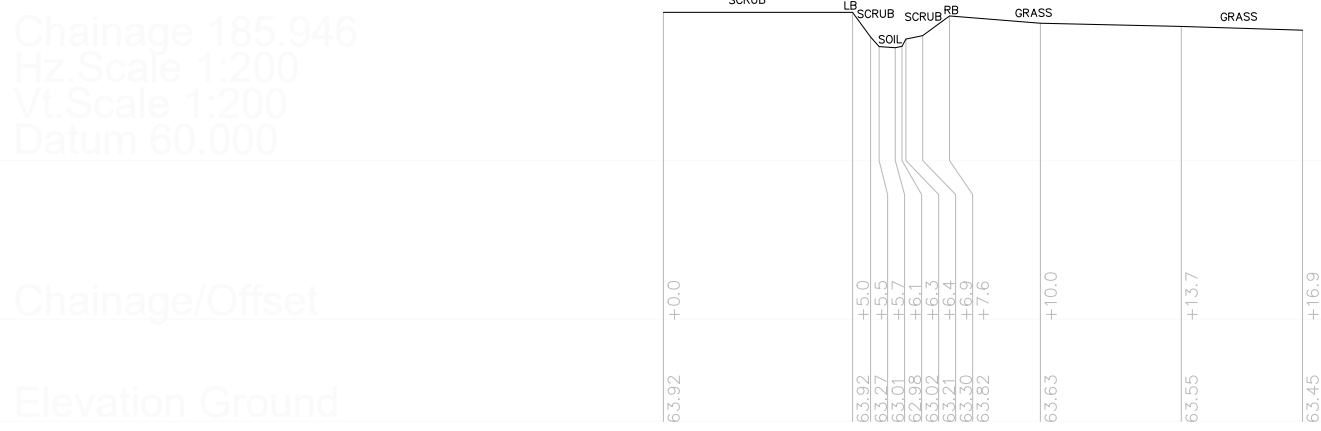
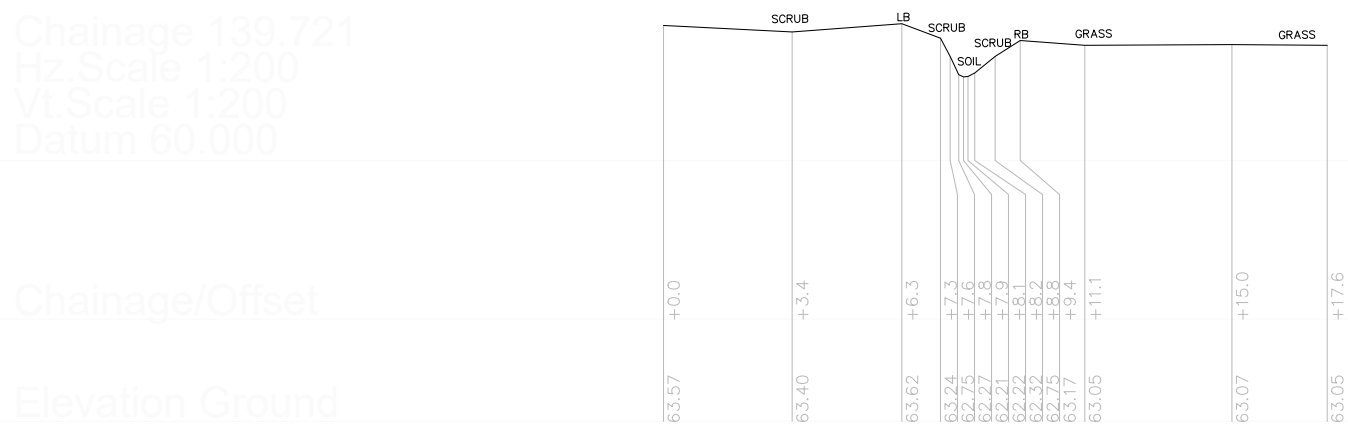
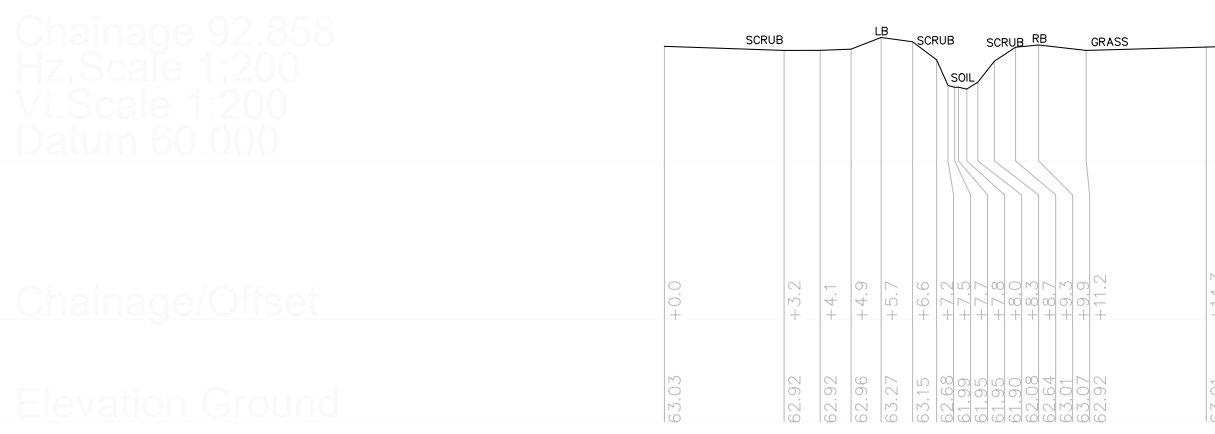
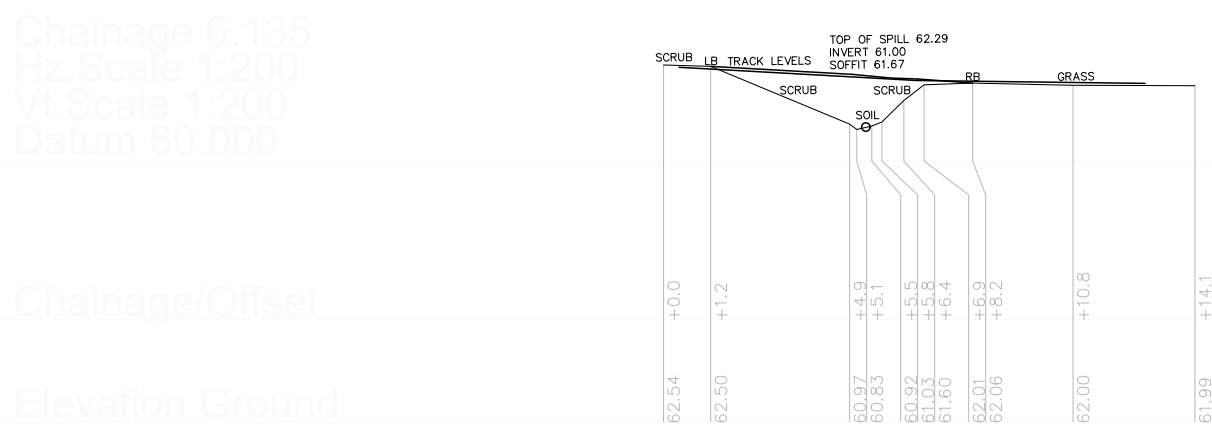
Client:

Priors Farm
South Wokingham
Berkshire

Scale: 1:200	Sheet Size: A0	Sheet Number: 10	Date: June 2025
Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS Approved by: BP

mk surveys

Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL OSNI NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Cross Sections - Reach04

Client:

Abley Letchford Partnership Ltd

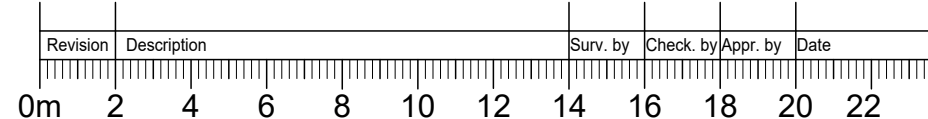
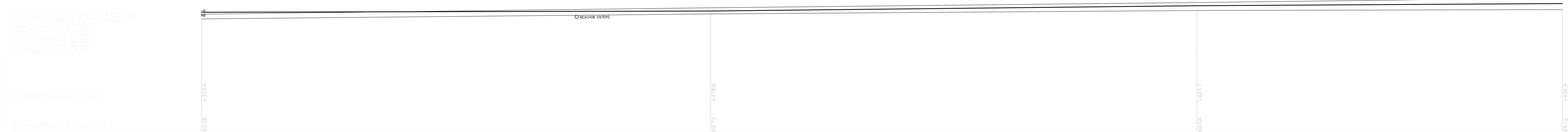
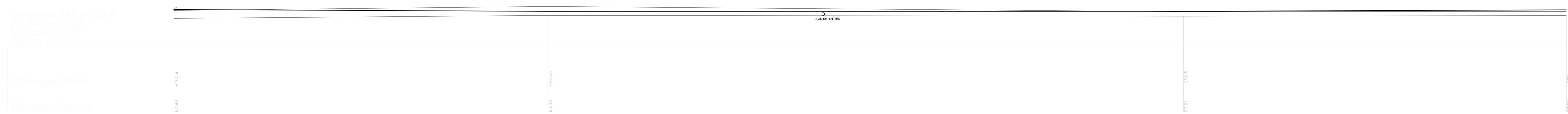
Priors Farm
South Wokingham
Berkshire

Scale: 1:200	Sheet Size: A0	Sheet Number: 11	Date: June 2025
Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS
		Approved by: BP	

mksurveys

www.mksurveys.com
www.surveys4bim.co.uk
Head Office: Milton Keynes T: 01908 565561 E: mail@mksurveys.co.uk

1. GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL GNSS NETWORK. LOCAL SCALE FACTOR 0.99968 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Long Section - Reach04

Client:

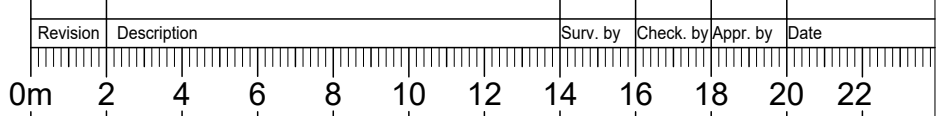
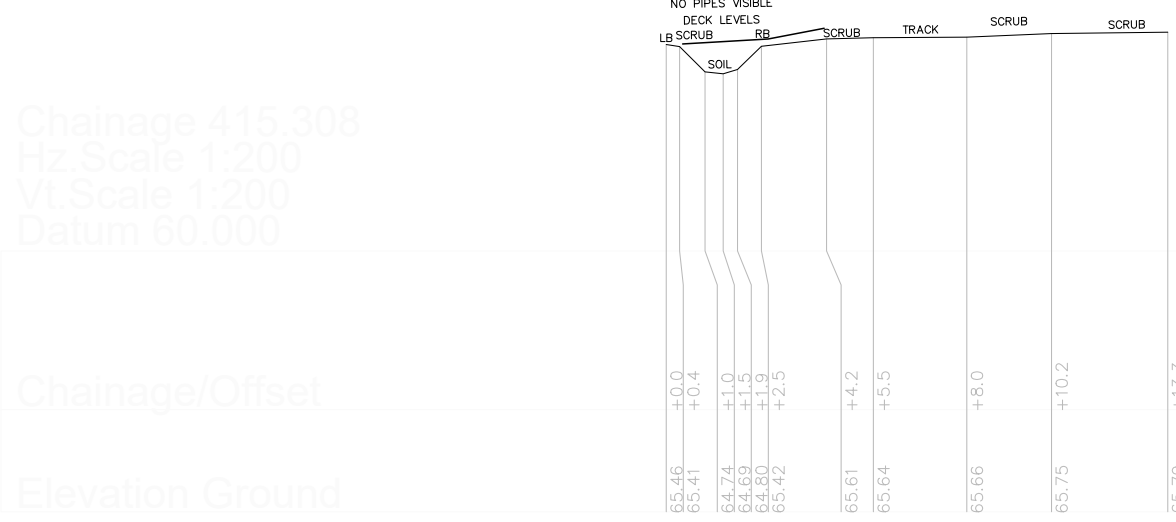
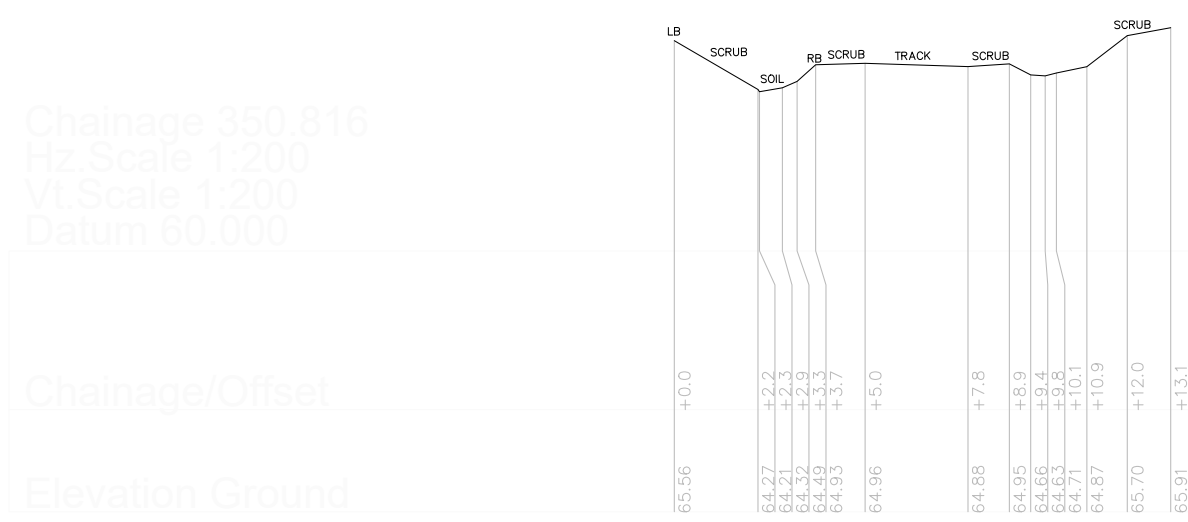
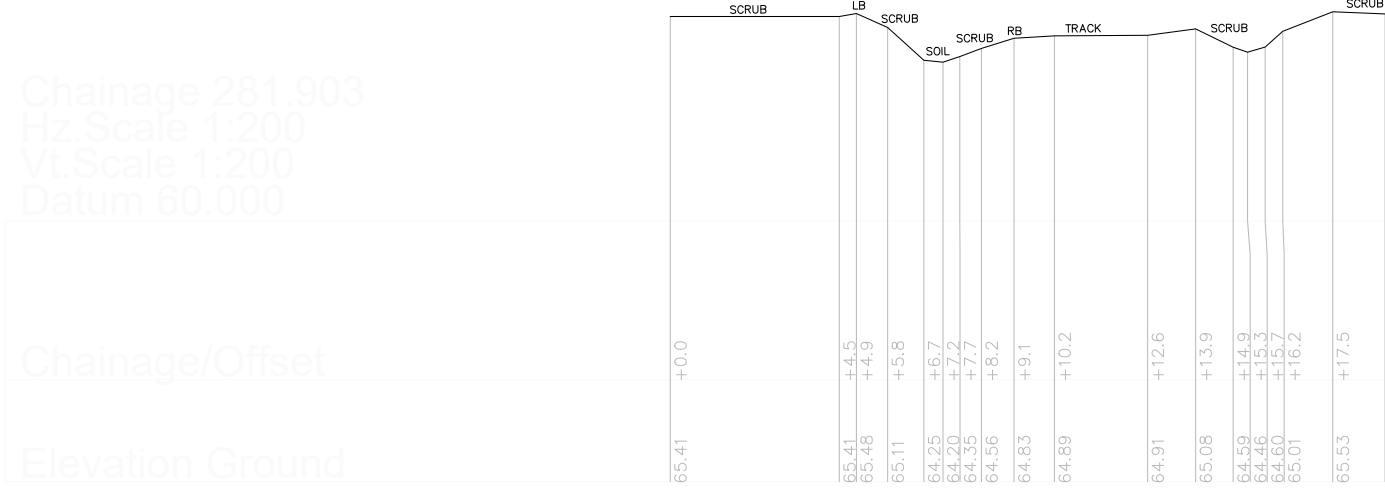
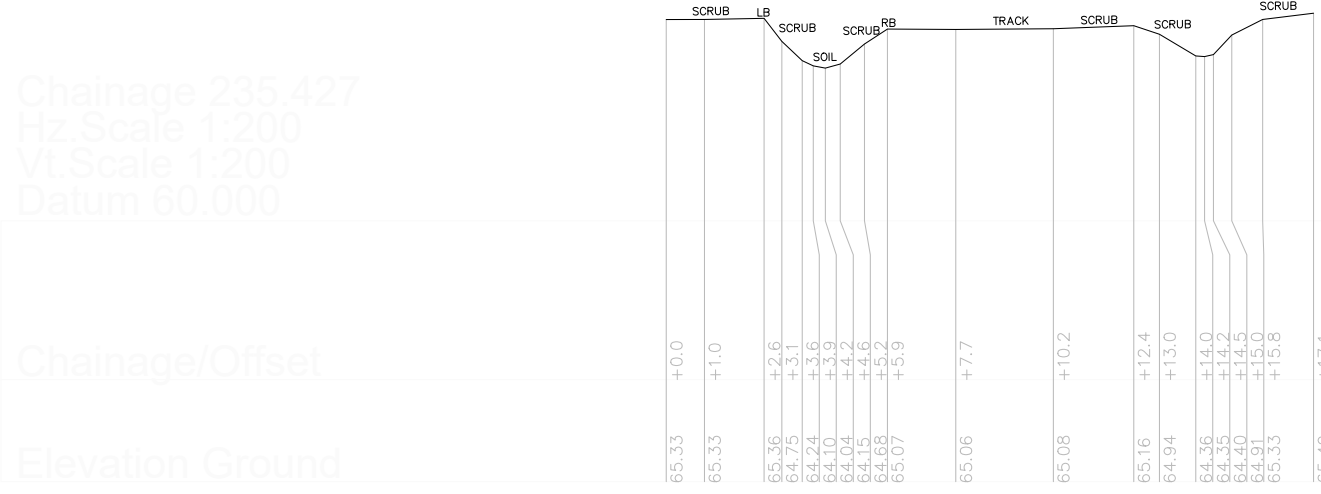
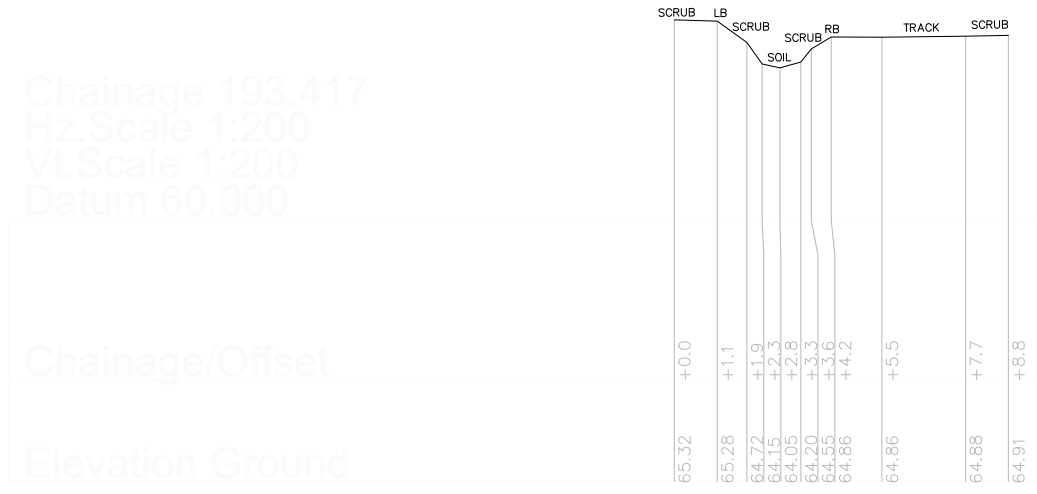
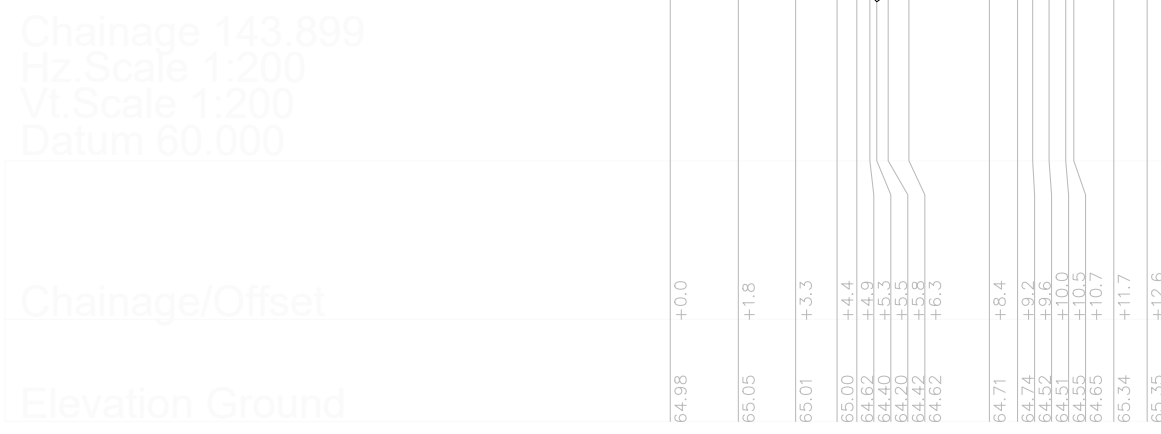
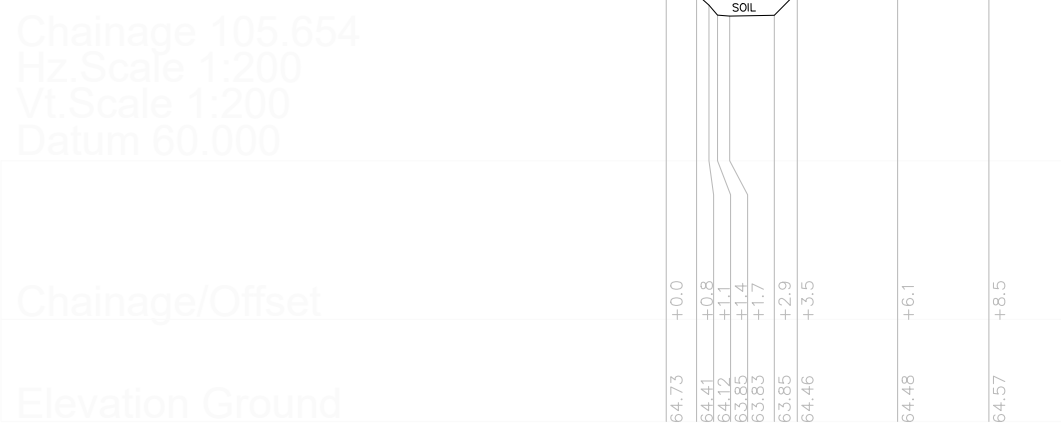
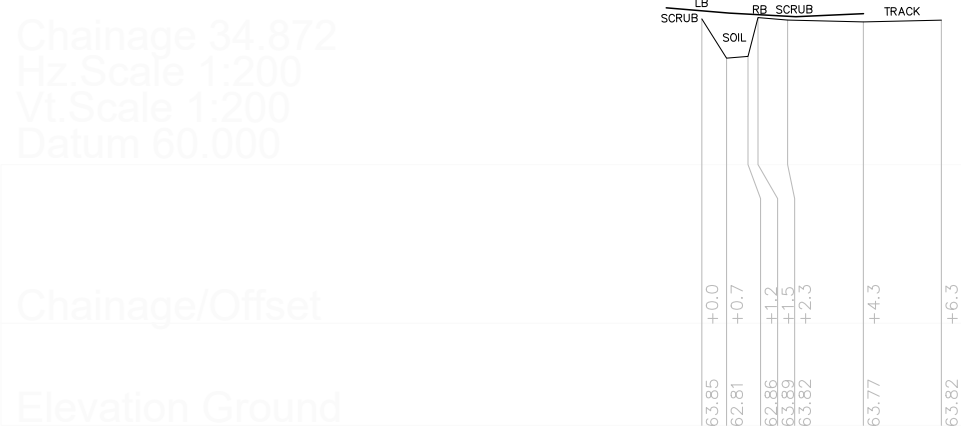
Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

Scale: 1:200	Sheet Size: A0	Sheet Number: 12	Date: June 2025
Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS Approved by: BP

mk surveys

Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL GRID NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Cross Sections - Reach07

Client:

Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

Scale: 1:200	Sheet Size: A0	Sheet Number: 15	Date: June 2025
Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS
		Approved by: BP	

Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM. DERIVED FROM THE NATIONAL GRID NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.

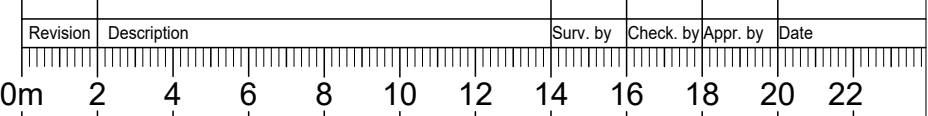
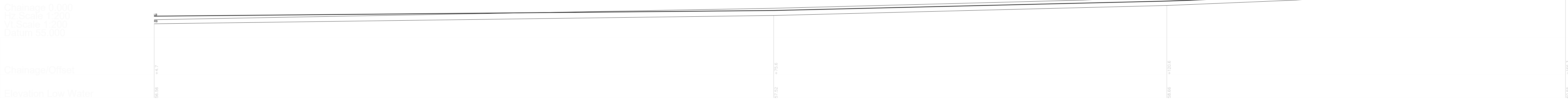
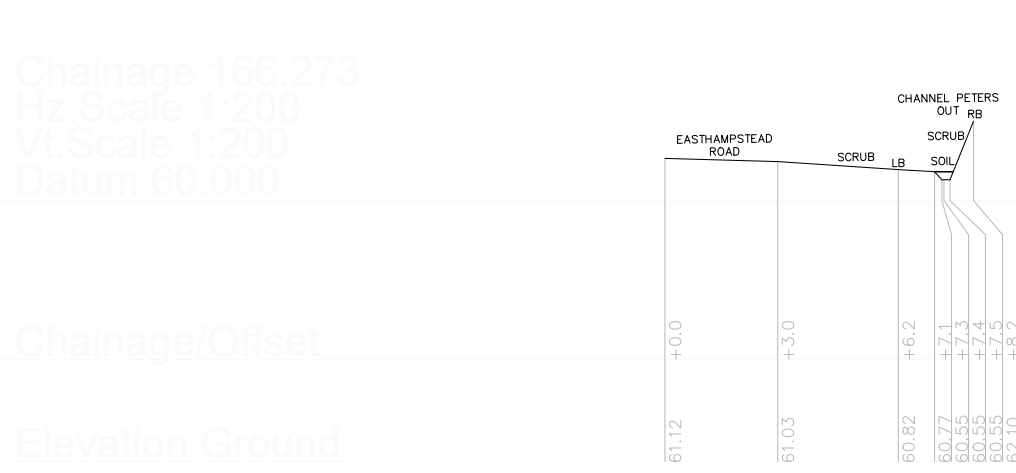
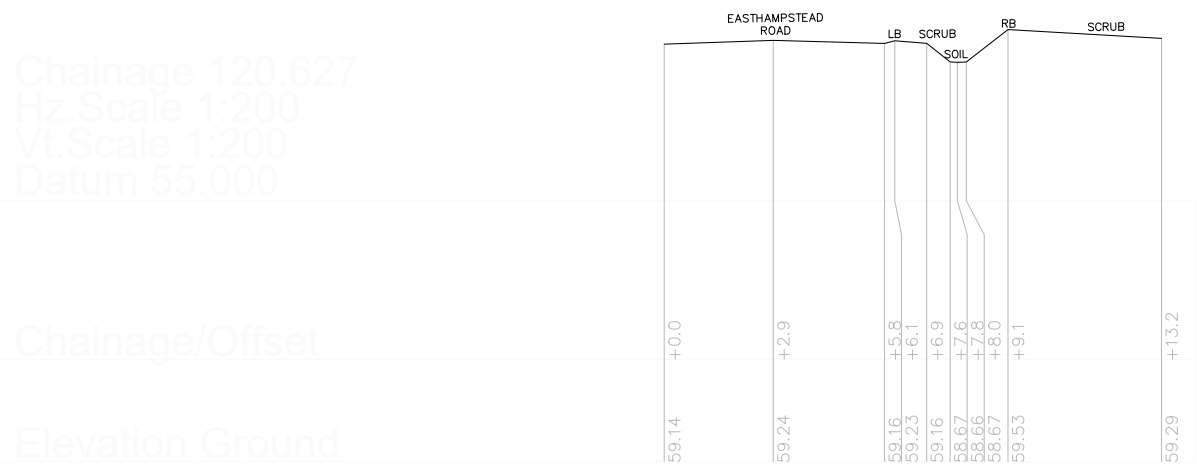
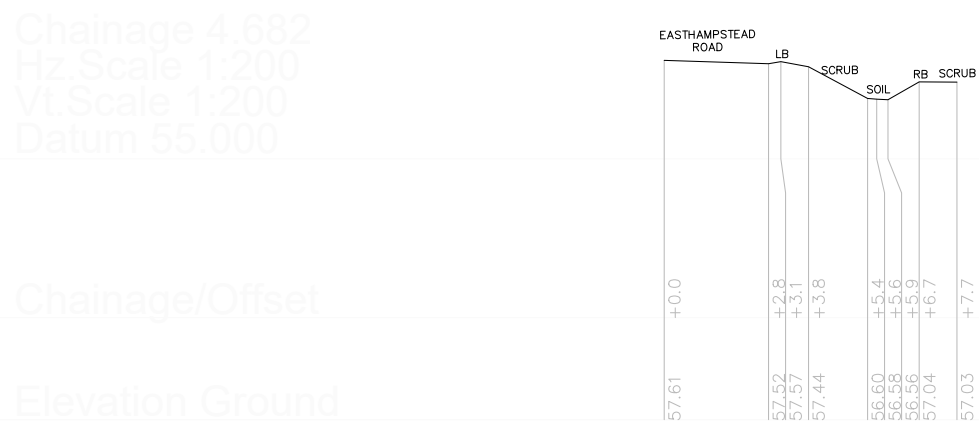
Chainage 1.1-143.8
Hx Scale 1:200
Vx Scale 1:200
Datum 60.000

Chainage/Offset

Elevation Ground



Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM. DERIVED FROM THE NATIONAL GNSS NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Cross Sections & Long Section - Reach09

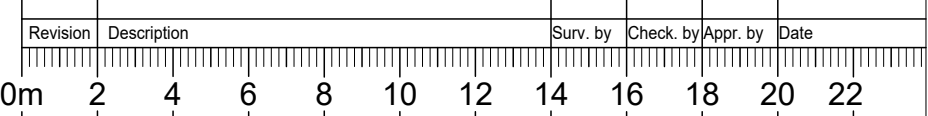
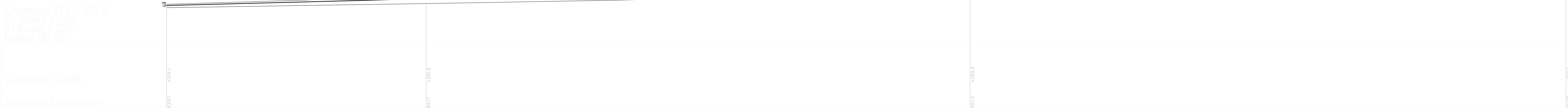
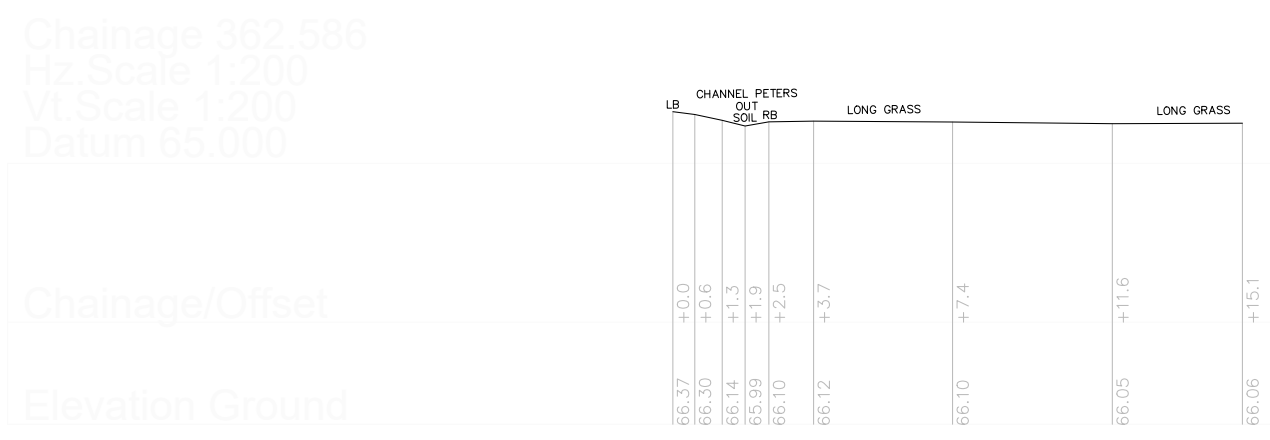
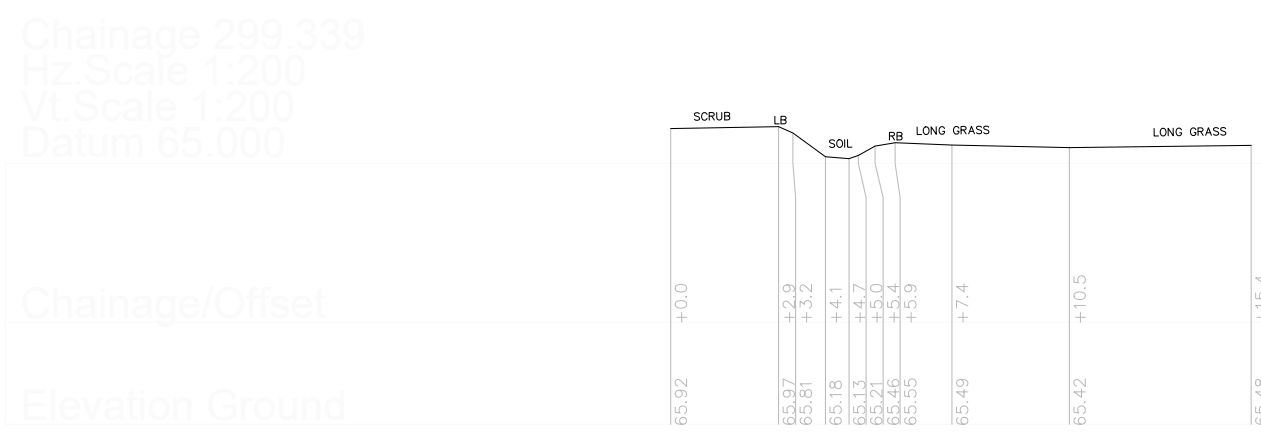
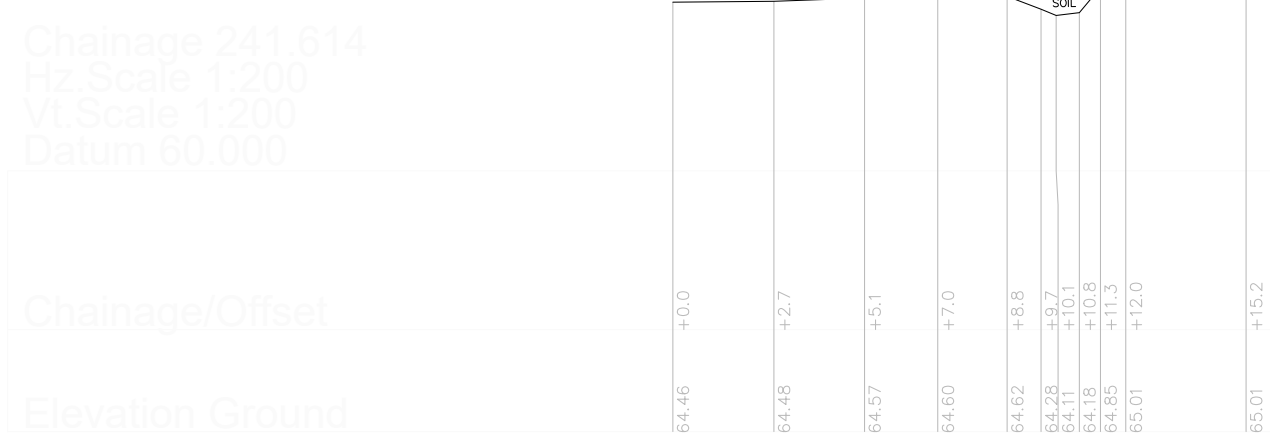
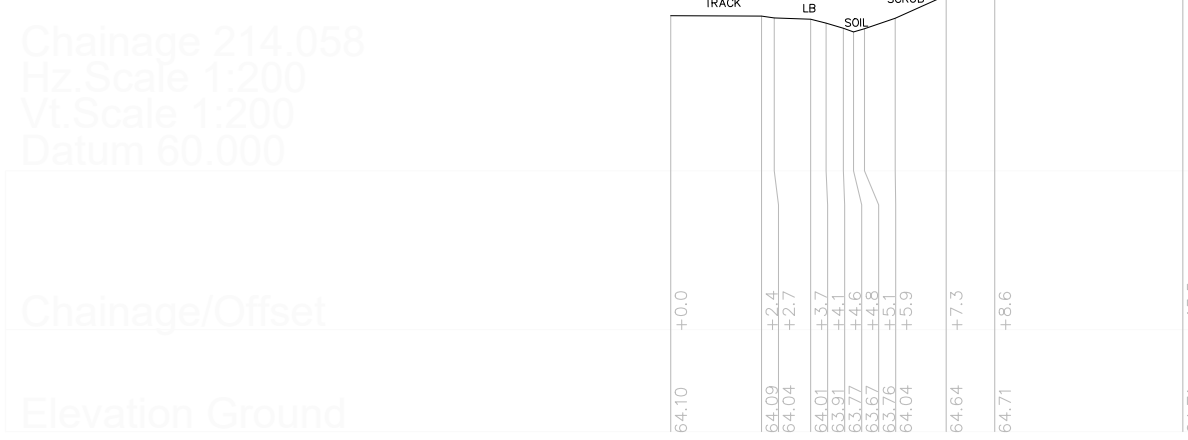
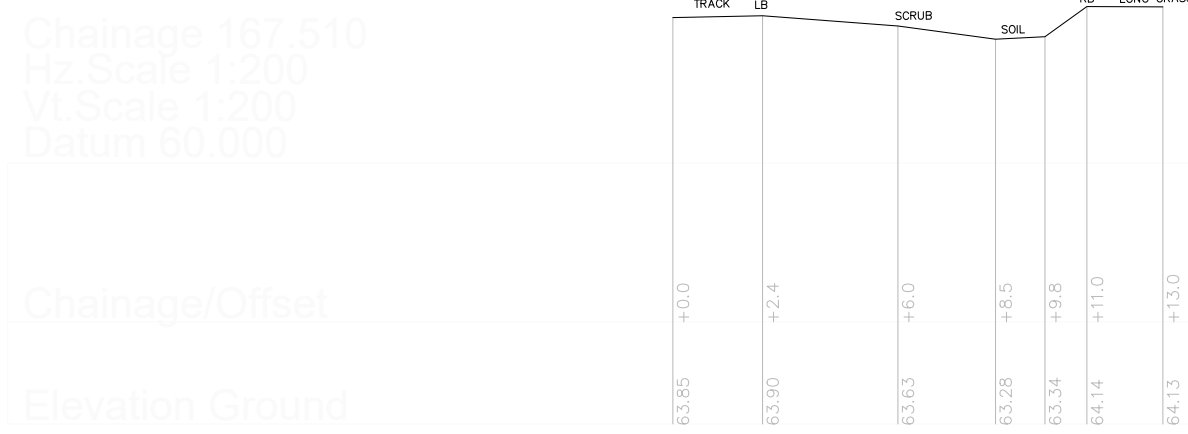
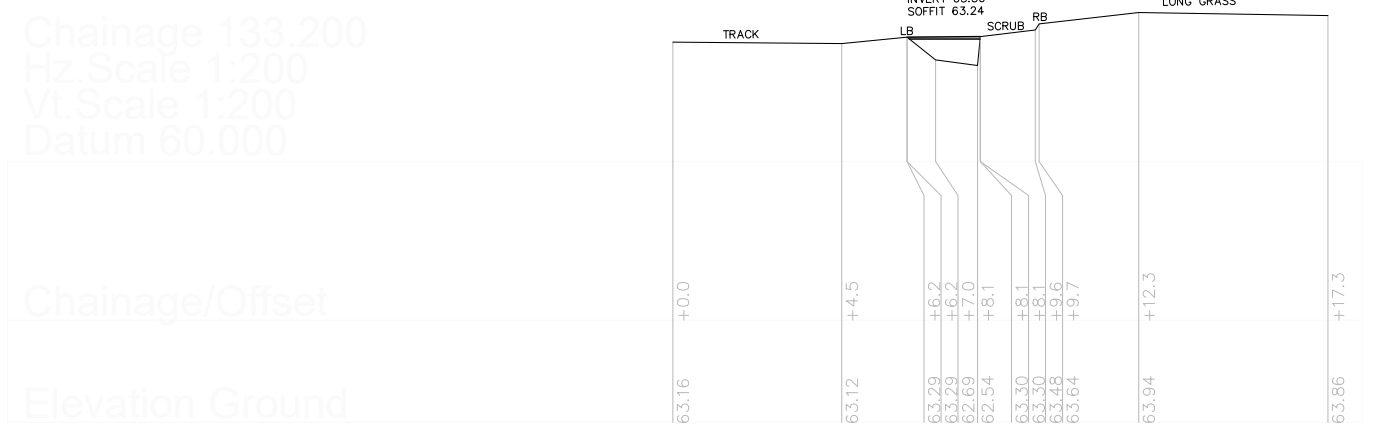
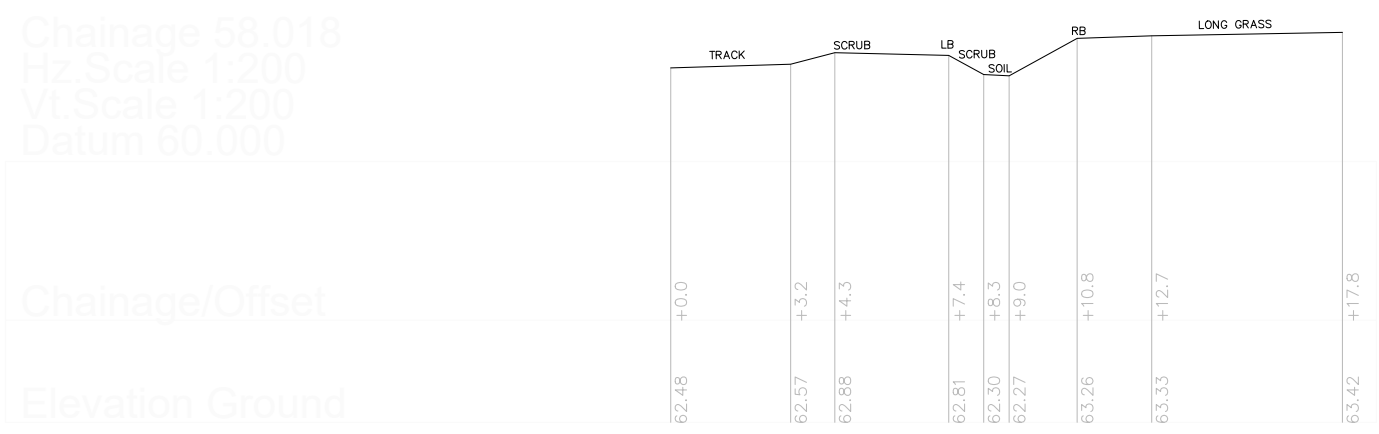
Client:

Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

Scale: 1:200	Sheet Size: A0	Sheet Number: 18	Date: June 2025
Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS
		Approved by: BP	

Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM. DERIVED FROM THE NATIONAL GRID NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



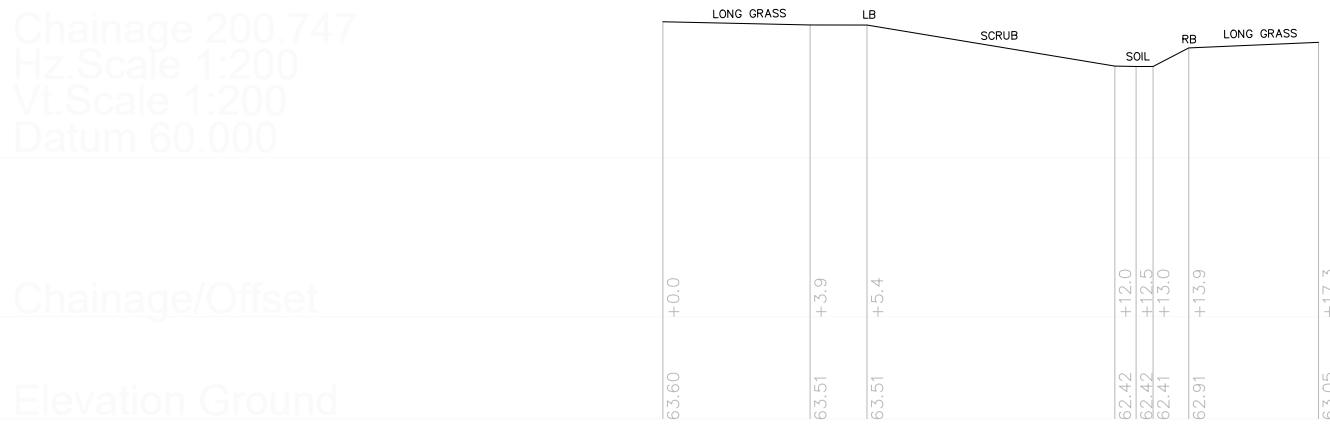
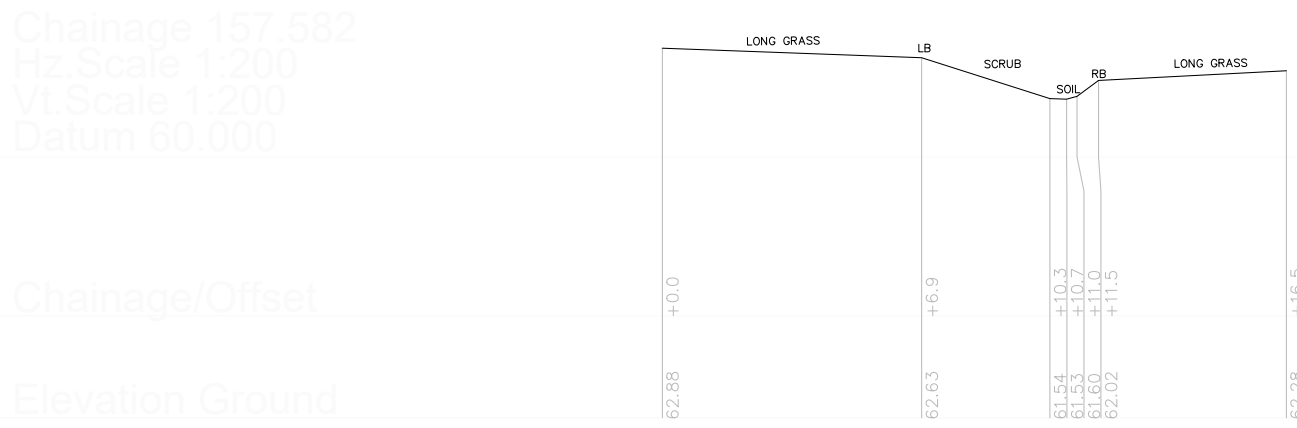
Cross Sections & Long Section - Reach10

Client:
Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

Scale: 1:200	Sheet Size: A0	Sheet Number: 19	Date: June 2025
Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS
		Approved by: BP	

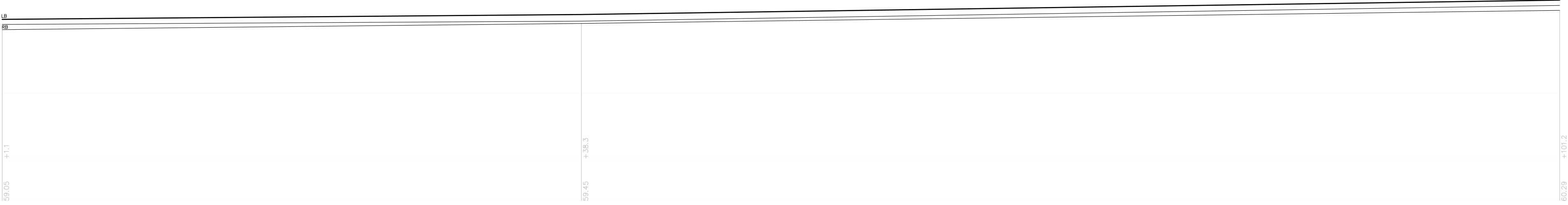
Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM. DERIVED FROM THE NATIONAL GRID NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Chainage 1.1-101.2
Hx Scale 1:200
Vt Scale 1:200
Datum 89.000

Chainage/Offset

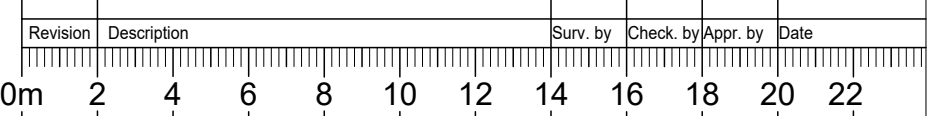
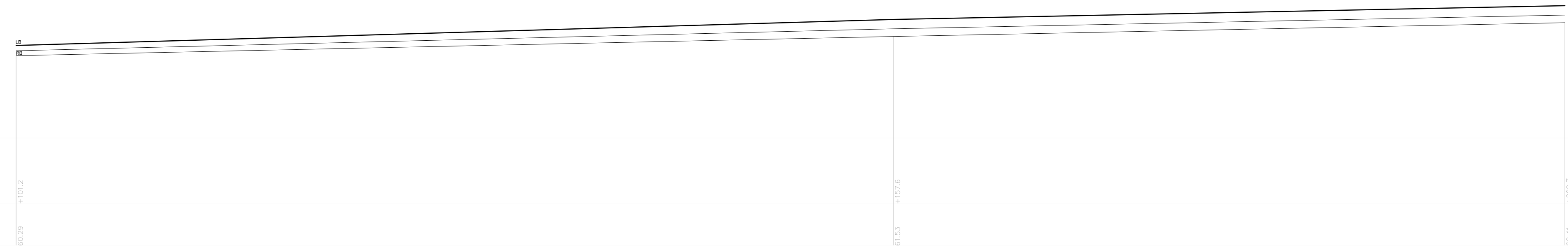
Elevation Low Water



Chainage 101.2-200.7
Hx Scale 1:200
Vt Scale 1:200
Datum 89.000

Chainage/Offset

Elevation Low Water



Cross Sections & Long Section - Reach11

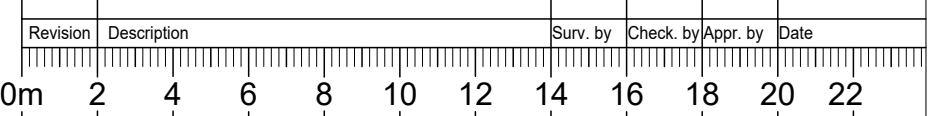
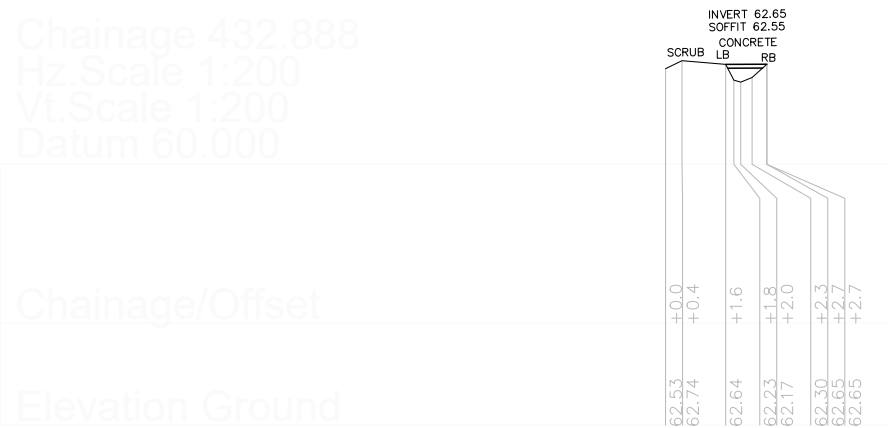
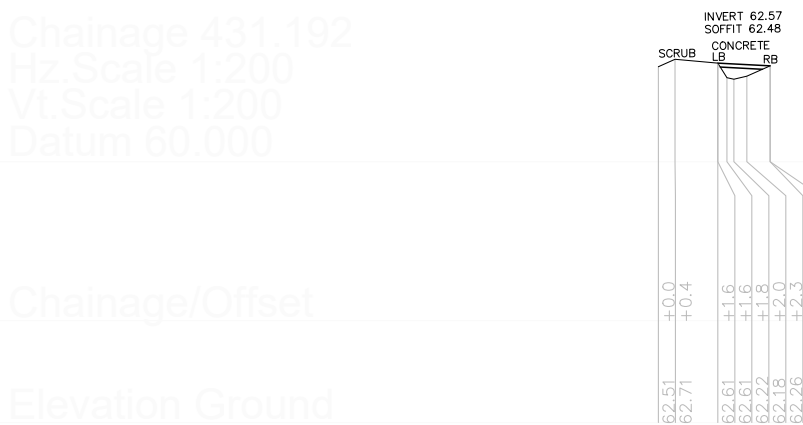
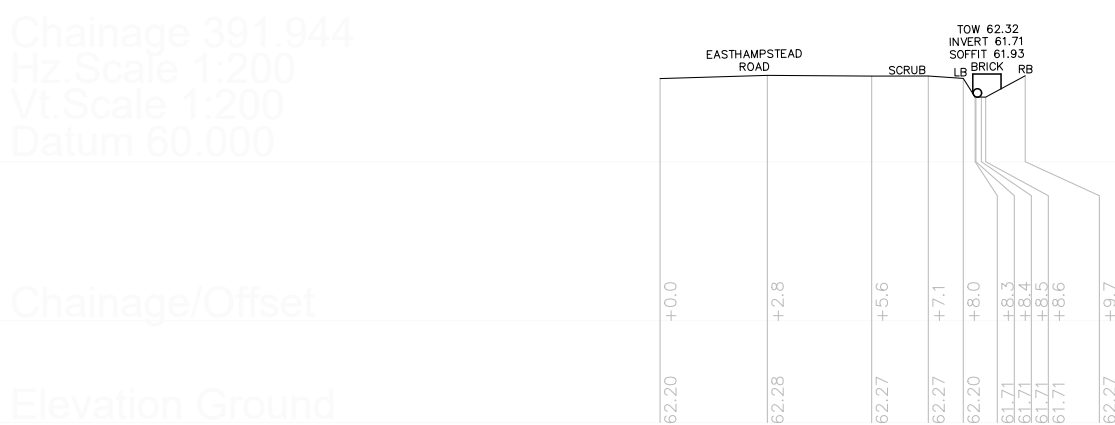
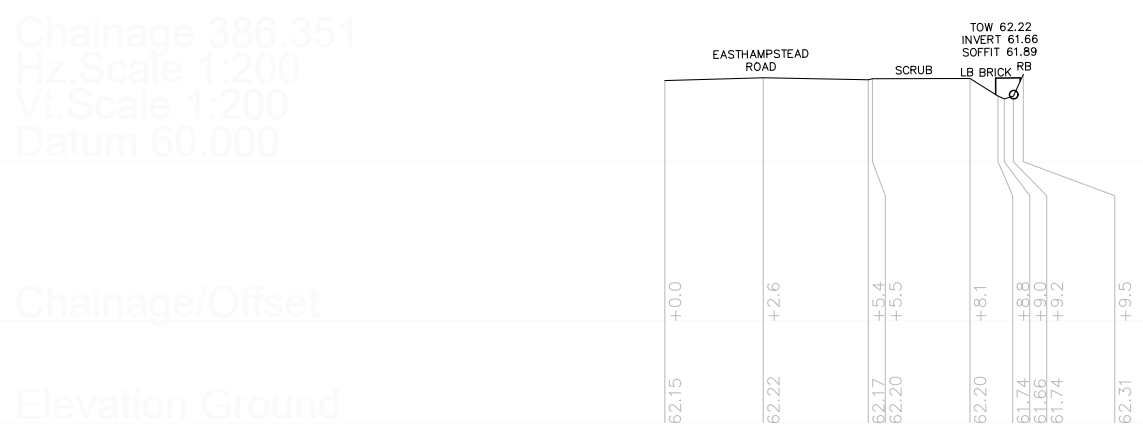
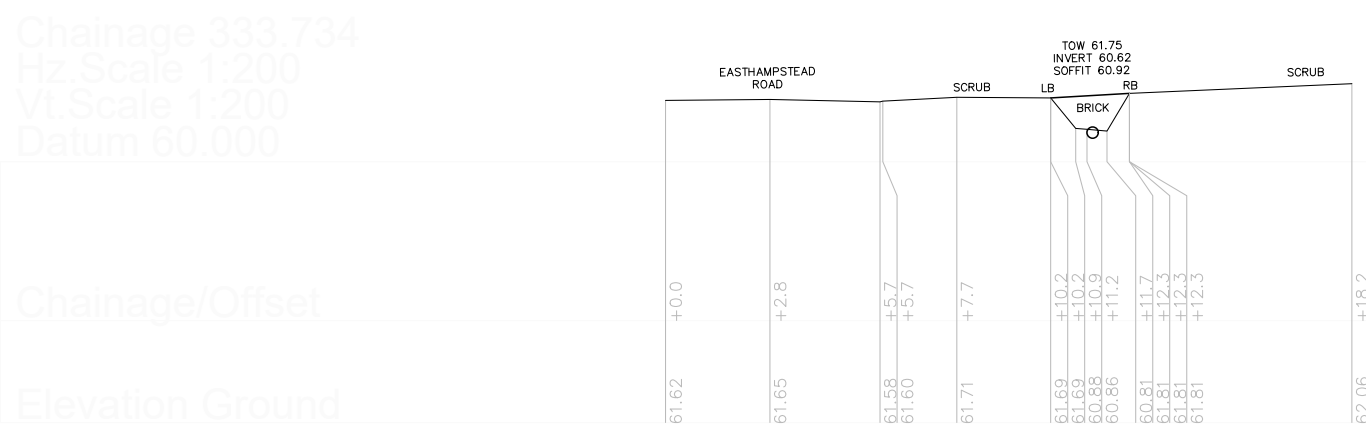
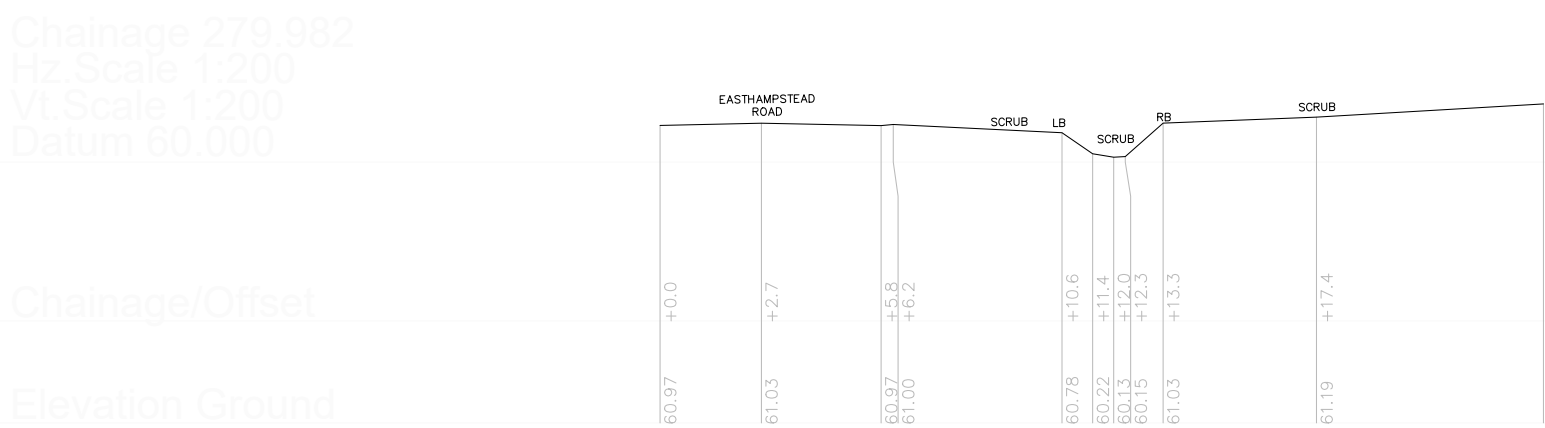
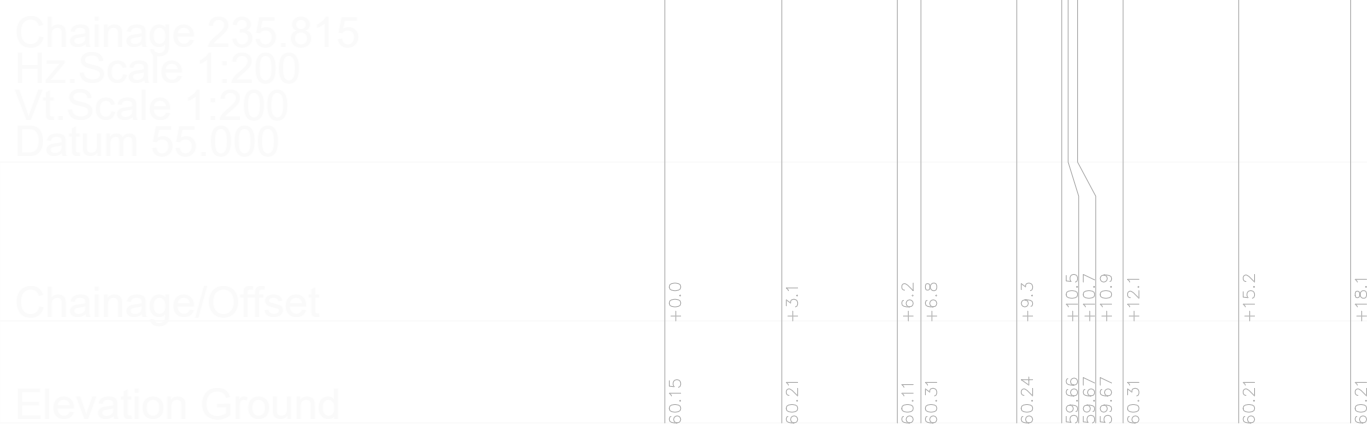
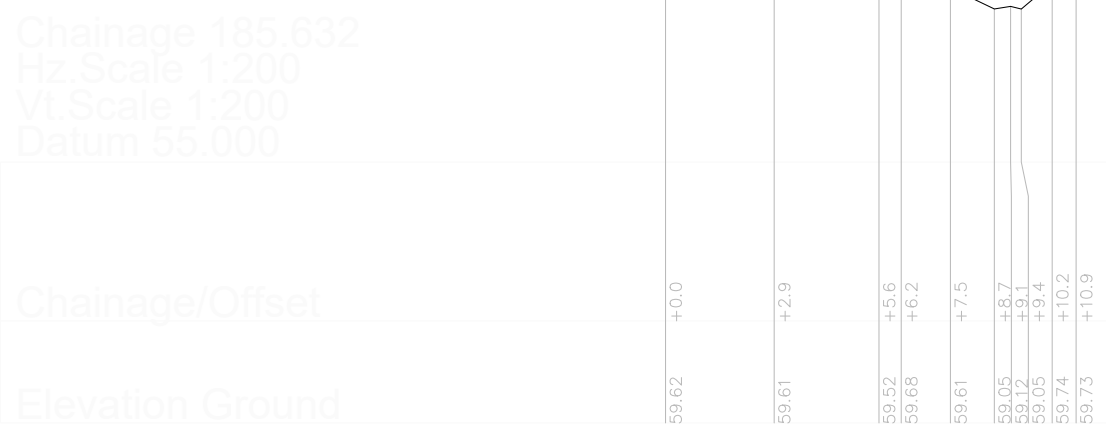
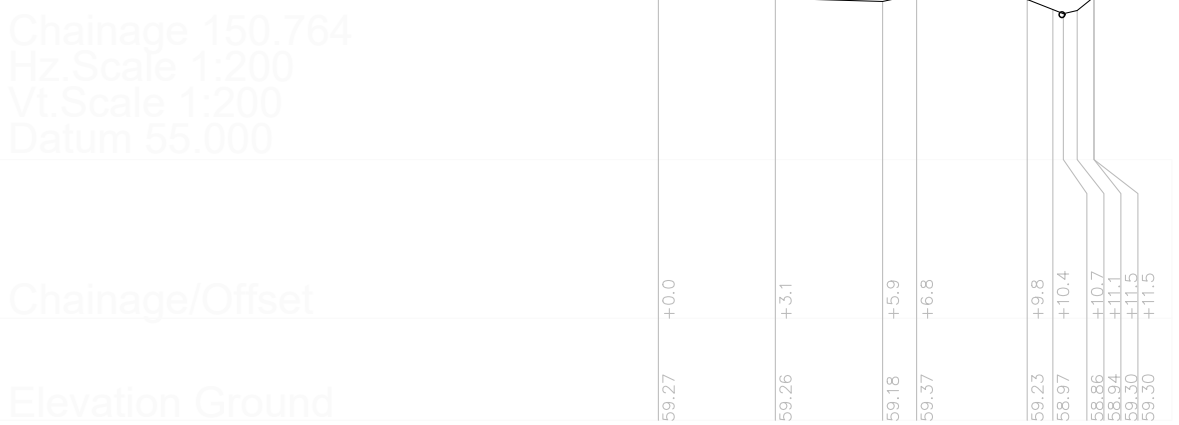
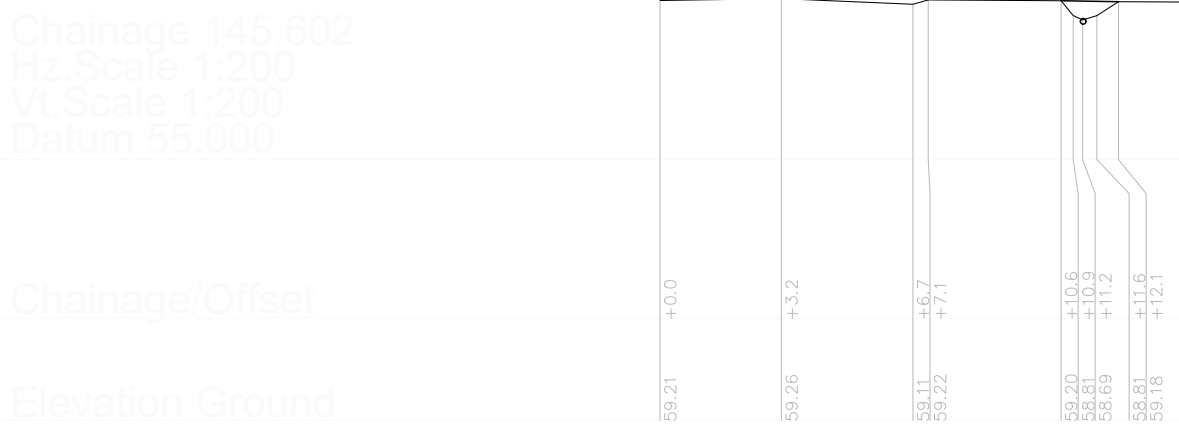
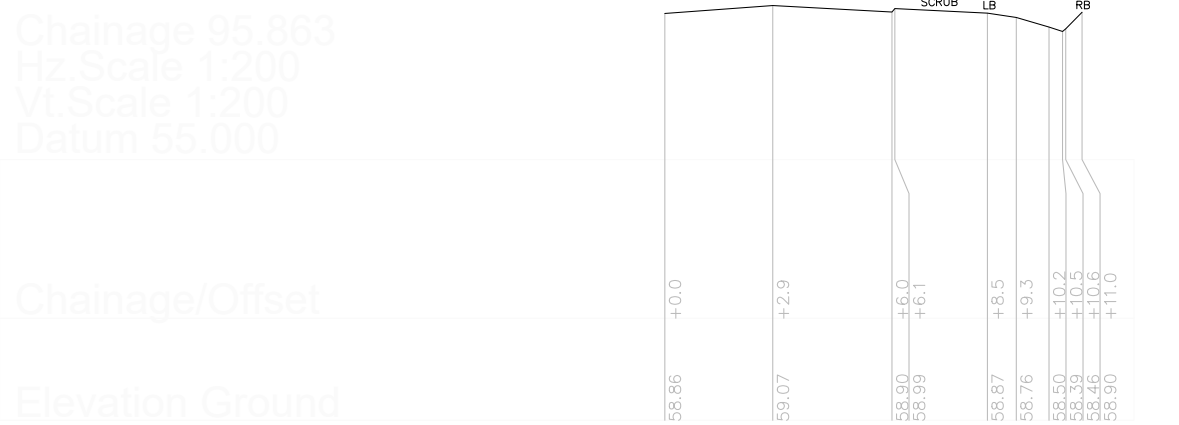
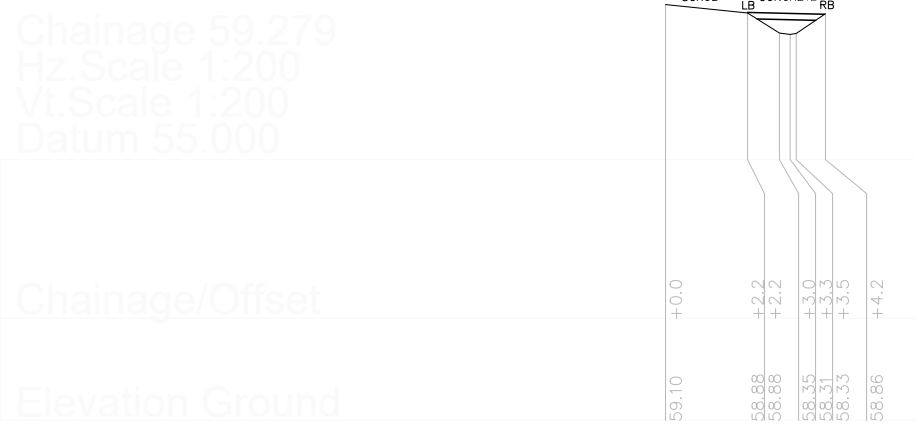
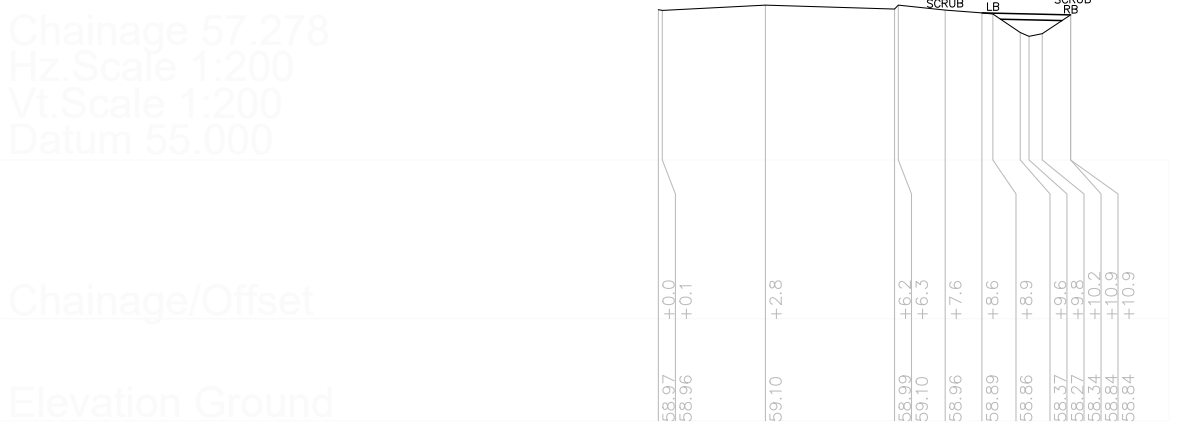
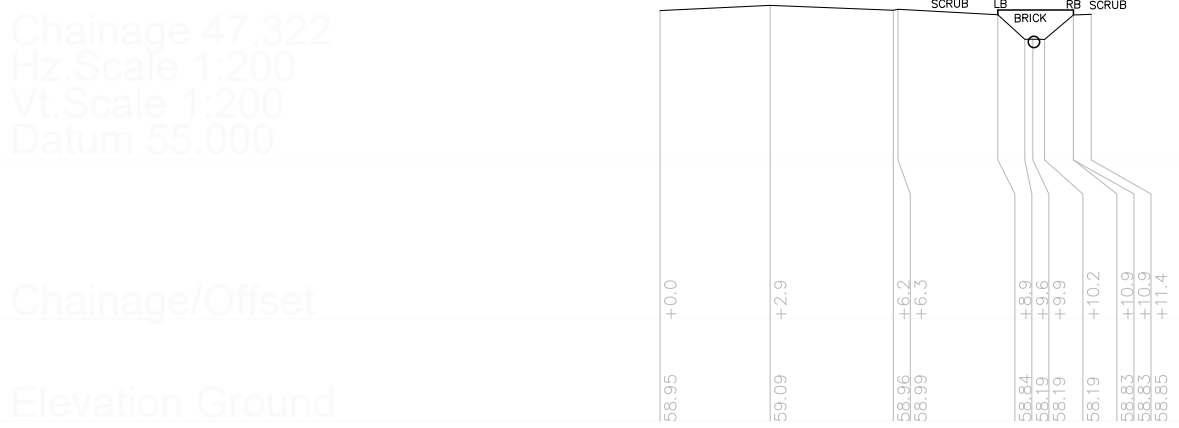
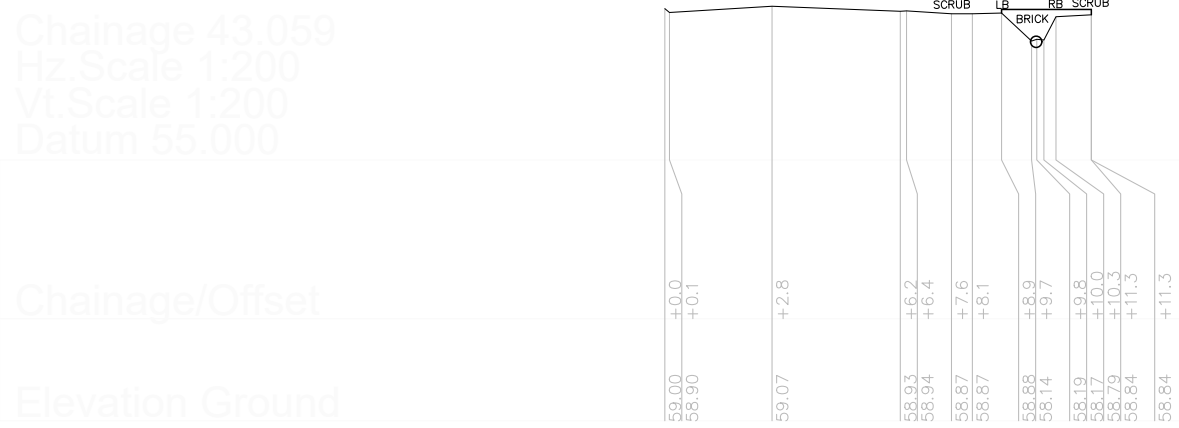
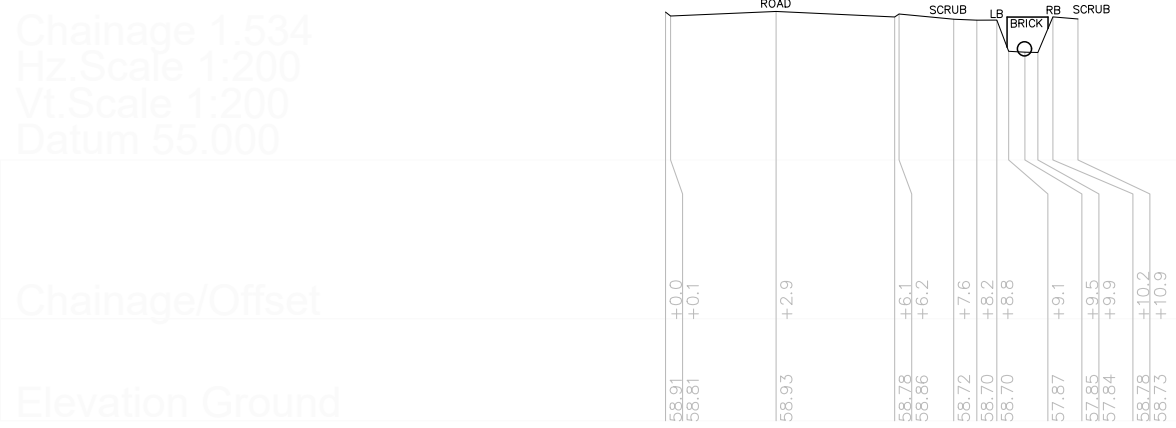
Client:

Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

Scale: 1:200	Sheet Size: A0	Sheet Number: 20	Date: June 2025
Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS
			Approved by: BP

Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM. DERIVED FROM THE NATIONAL GRID NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Cross Sections - Reach12

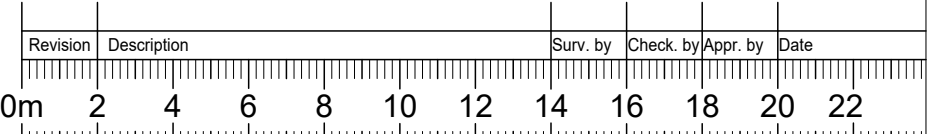
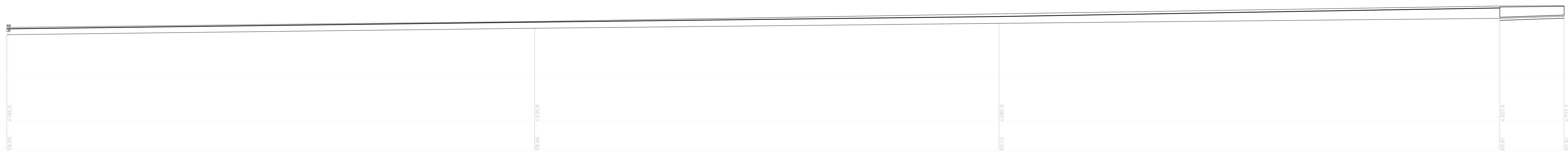
Client:

Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

Scale: 1:200	Sheet Size: A0	Sheet Number: 21	Date: June 2025
Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS
		Approved by: BP	

1. GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL GNSS NETWORK. LOCAL SCALE FACTOR 0.99968 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Scale: 1:200	Sheet Size: A0	Sheet Number: 22	Date: June 2025		
Project Number: 36250		Rev: -	Surveyed by: MKS	Checked by: JS	Approved by: BP

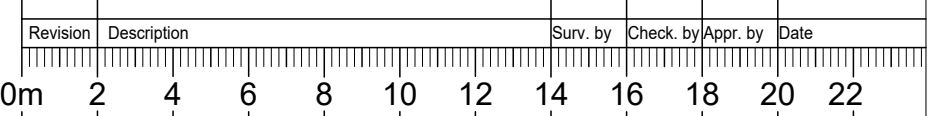
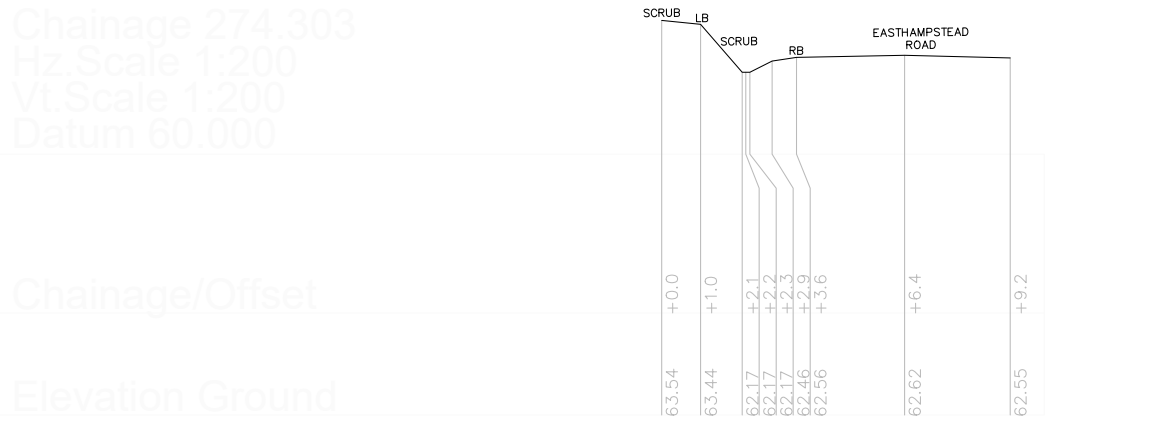
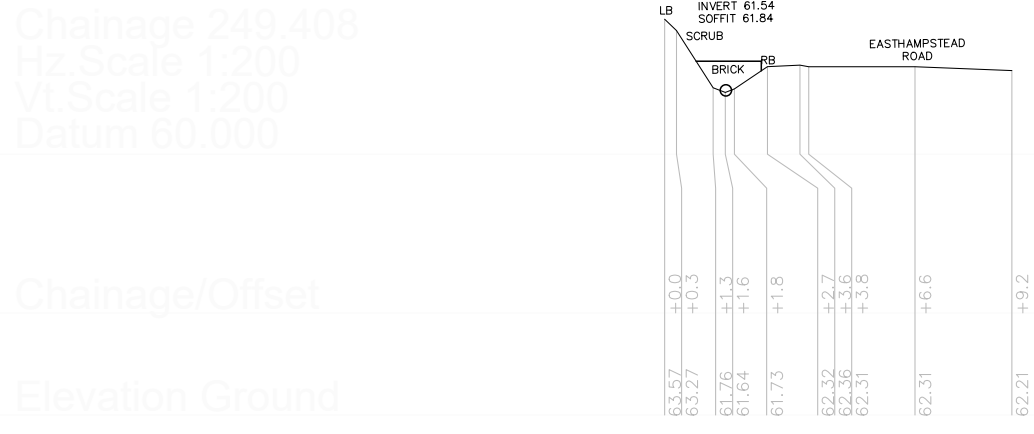
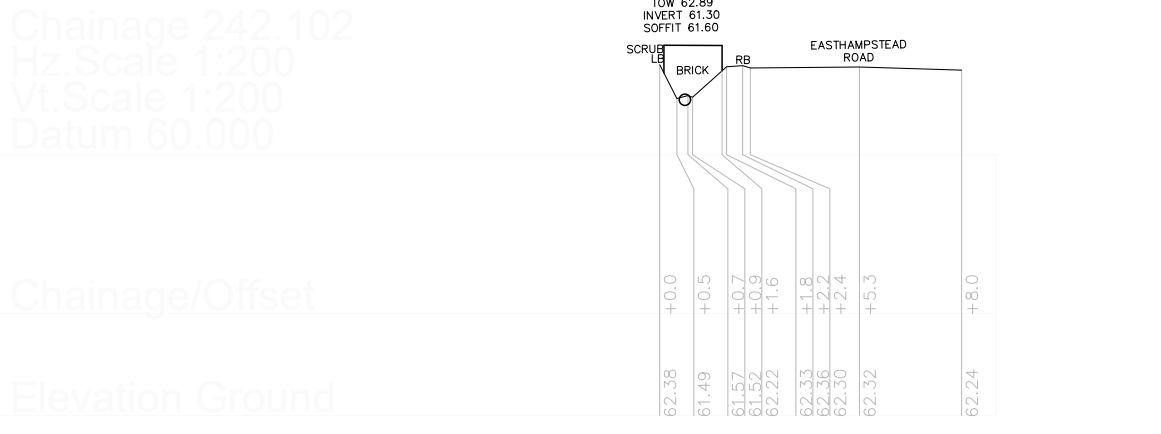
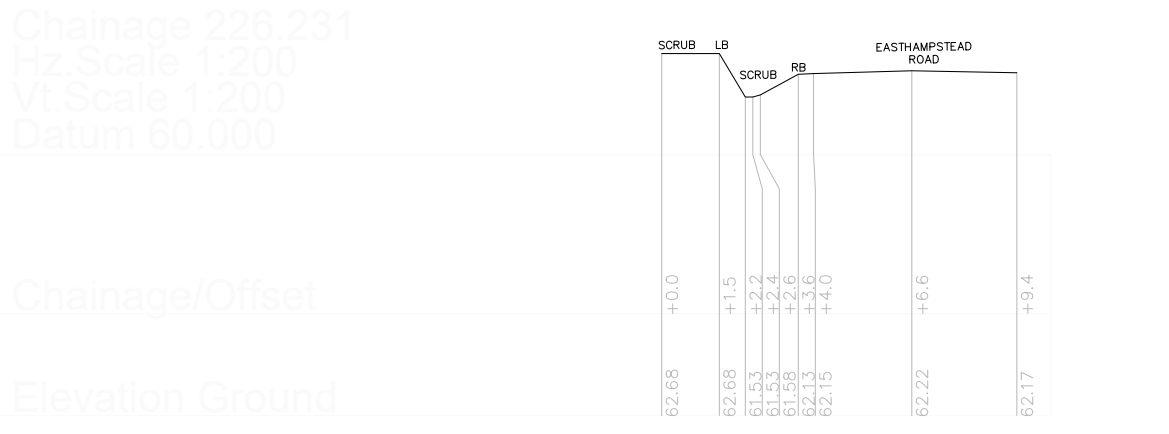
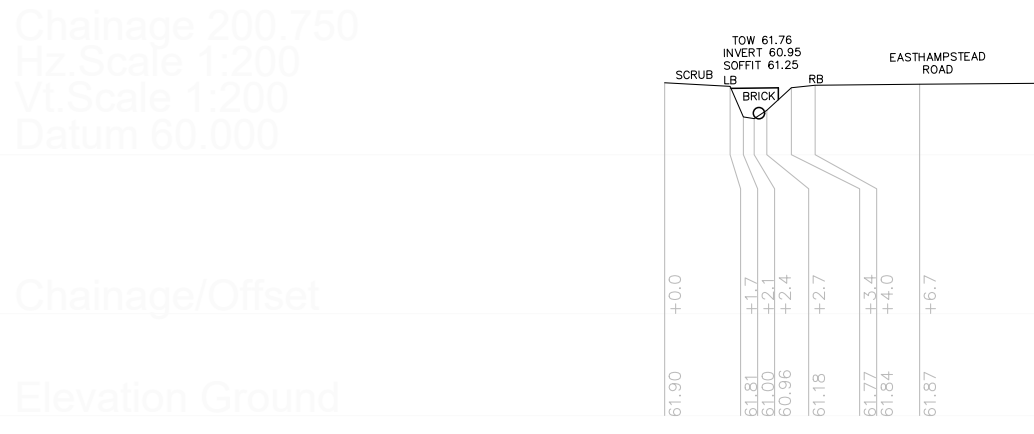
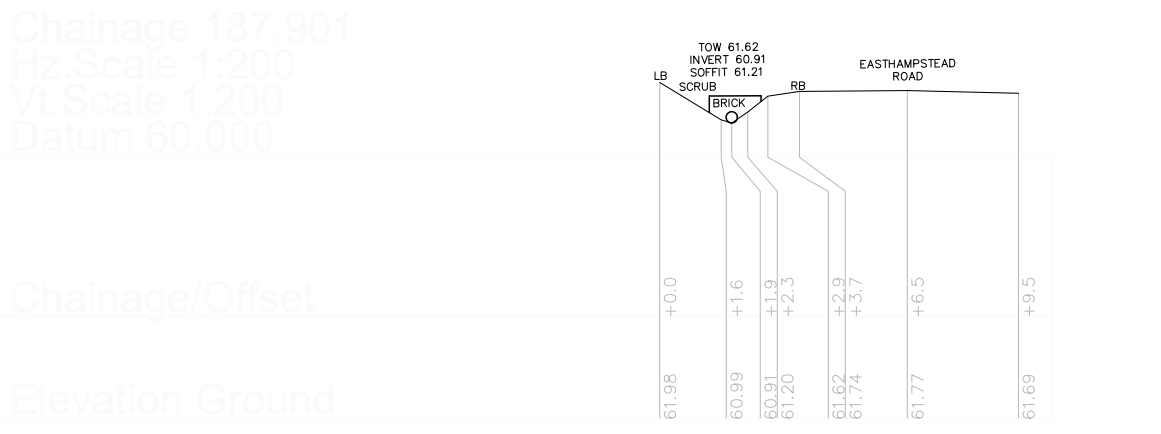
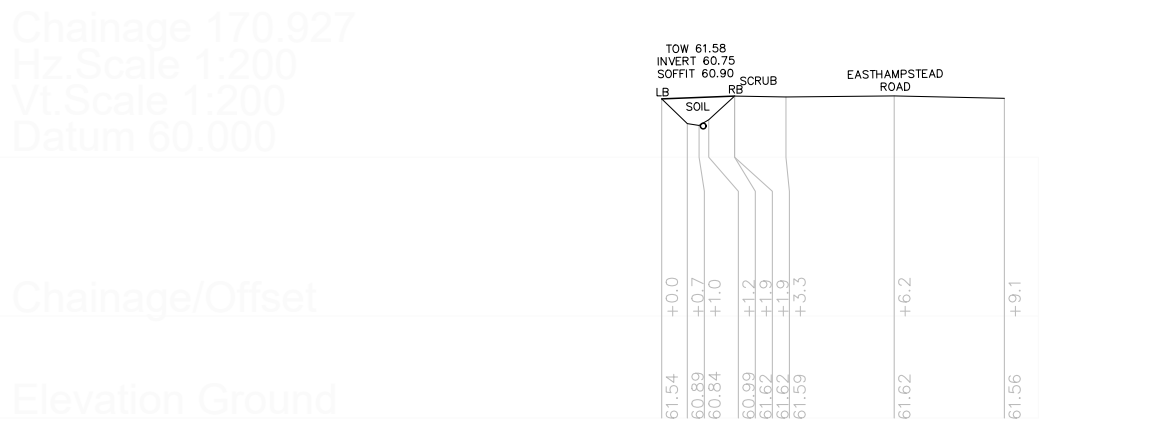
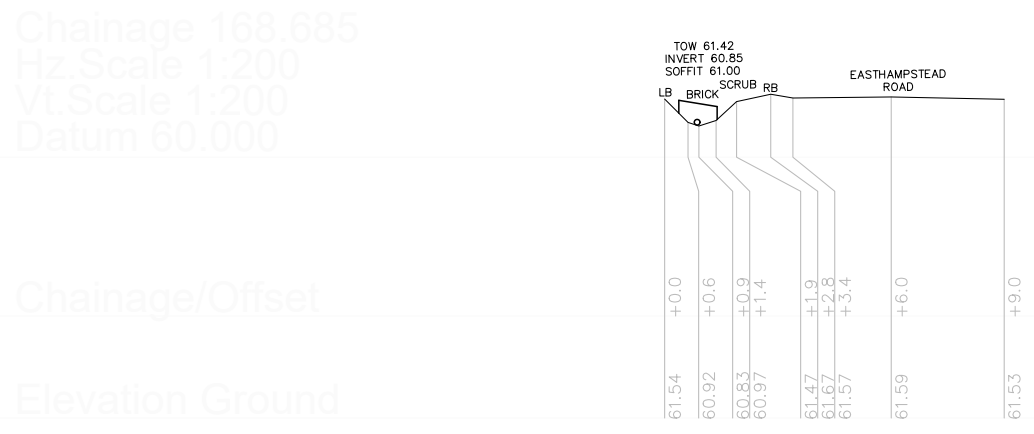
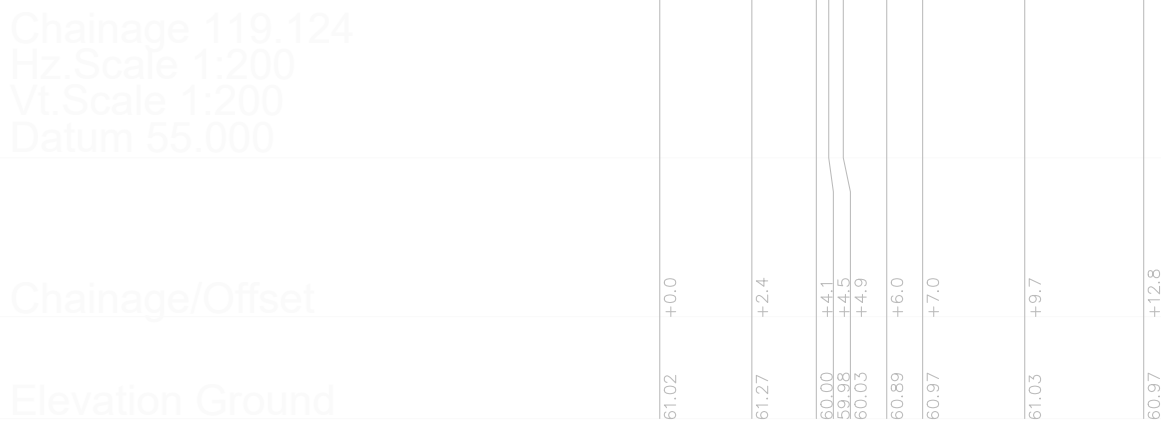
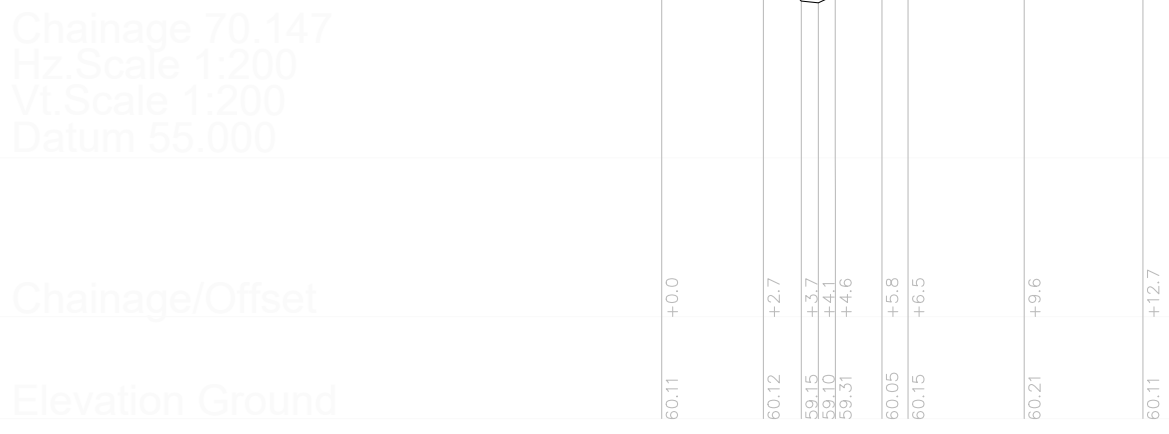
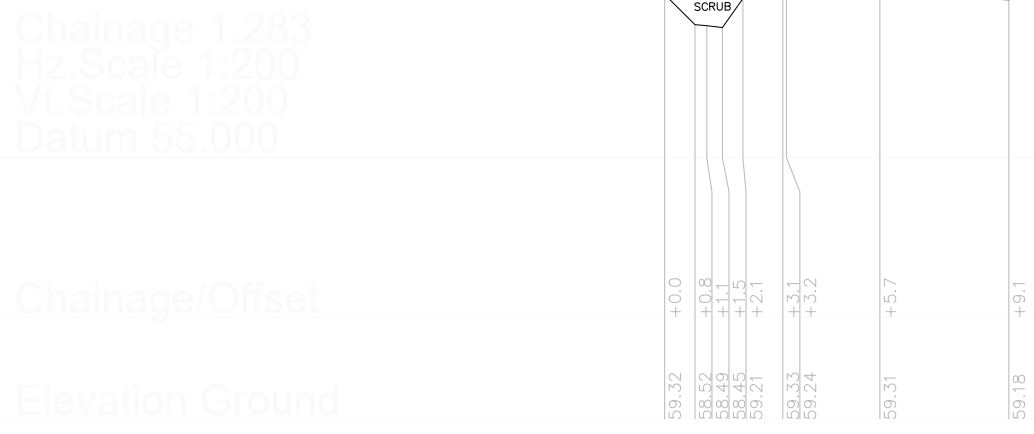
mk surveys

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- Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL GRID NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.

2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Cross Sections - Reach13

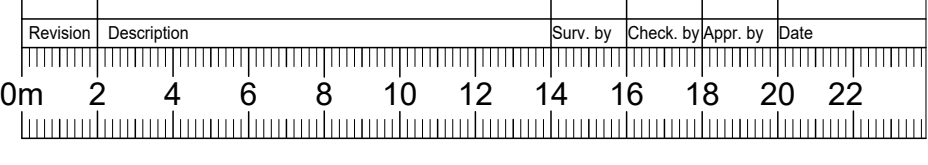
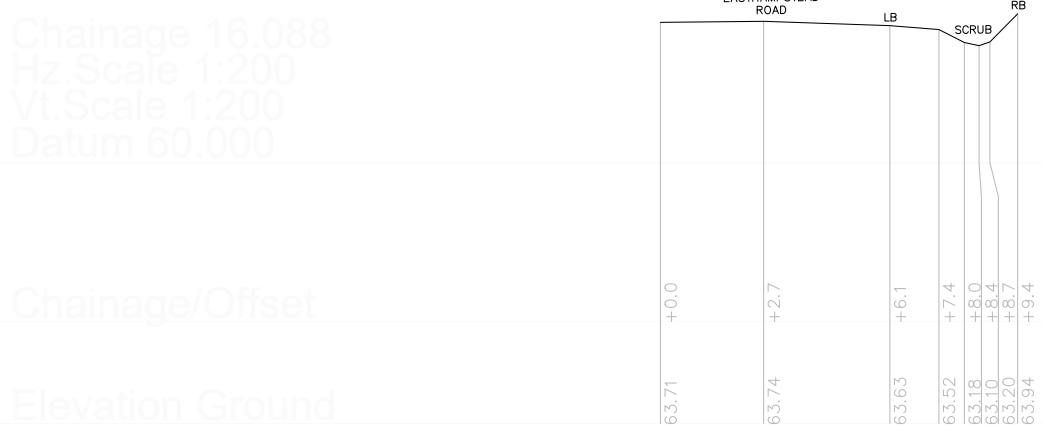
Client:

Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

Scale:	Sheet Size:	Sheet Number:	Date:
1:200	A0	23	June 2025
Project Number:	Rev:	Surveyed by:	Checked by:
36250	-	MKS	JS
			BP

Notes:
1. GRID AND LEVELS BASED ON ORDNANCE DATUM. DERIVED FROM THE NATIONAL GRID NETWORK. LOCAL SCALE FACTOR 0.99960 APPLIED.
2. CROSS SECTIONS VIEWED LOOKING DOWNSTREAM.



Cross Section - Reach14

Client:

Abley Letchford Partnership Ltd

Priors Farm
South Wokingham
Berkshire

Scale: 1:200	Sheet Size: A0	Sheet Number: 25	Date: June 2025
Project Number: 36250	Rev: -	Surveyed by: MKS	Checked by: JS
		Approved by: BP	

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