

1.0 EXISTING SITE SITUATION

- 1.1 The proposed development site is located on land at Waterpark Drive, Knowsley, Merseyside and is directly accessed off Waterpark Drive. The Ordnance Survey National Grid Reference (OS NGR) for the site is 342797 (Easting), 393079 (Northing) and the nearest postcode is L28 3QD.
- 1.2 The proposed development area is edged in red Figure 1 (below). A location plan is included Appendix A.



Figure 1: Aerial Photograph of site (proposed development area edged in red)

- 1.3 The River Alt enters the site from the south east west via a culvert and remains culverted until it outfalls downstream at OS NGR 341667 (Easting), 393945 (Northing).
- 1.4 The client wishes to reinstate part of the culverted River Alt as a natural channel. Correspondence with the Environment Agency has indicated that it would approve of the de-culverting of the watercourse.
- 1.5 To assess the impact of the de-culverting, Betts Hydro has obtained the Environment Agency's ISIS-TUFLOW model of the River Alt and has amended the model to represent the proposed open channel reach.

2.0 DEVELOPMENT PROPOSALS

- 2.1 The initial proposals are for a residential development and associated access roads within the red edge boundary indicated in Figure 1 (on Page 7). The proposed development plan is illustrated in Figure 2 and in Appendix B.

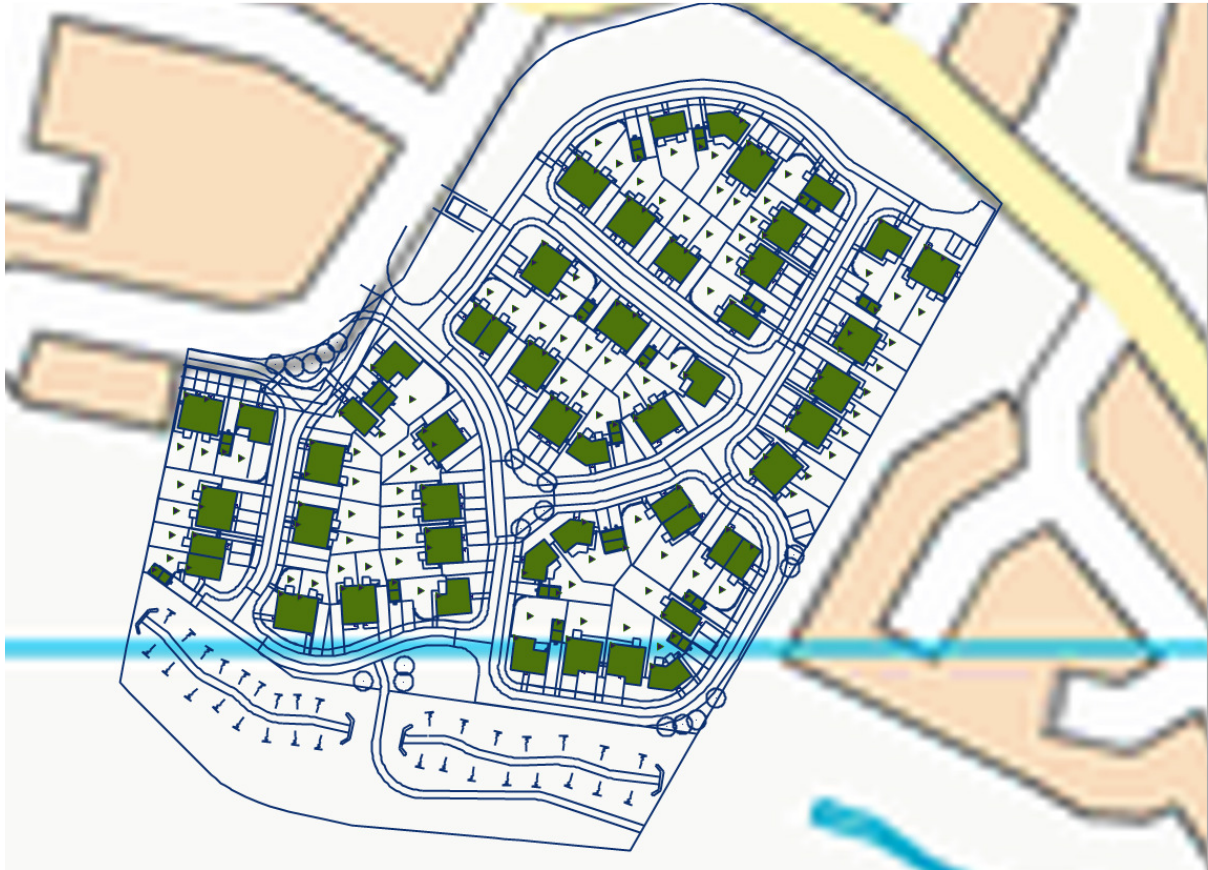


Figure 2: Development Proposals

- 2.2 The existing culvert running beneath the site is proposed to be opened and an open channel reinstated and a road crossing constructed. New culvert outlet and inlet structures will be required where the River Alt enters and leaves the site.

3.0 HYDRAULIC MODEL

Environment Agency Model

- 3.1 The Environment Agency model of the River Alt was completed in 2013. It is a 1D-2D dynamically linked ISIS-TuFLOW model which extends approximately 15.3km along the main watercourses draining through the study area and includes the designated Main River sections of the Upper Alt, Fazakerley Brook, Tue Brook and Deys Brook. A schematic of the Environment Agency model is shown in Appendix C.

Study Model

Existing Scenario

- 3.2 For the purpose of this study, a small reach of the River Alt was extracted from the model, extending from NGR 324926, 329929 (node label RALT07_1617) to 635m downstream of the existing culvert inlet (node label RALT07_0881l).
- 3.3 Flows up to the 0.1% Annual Exceedance Probability (AEP) or 1 in 1000 year return period remain within the river channel banks for the reach between NGR 343828, 391297 (node label RALT07_3589) and NGR 341663, 393960 (node label RALT07_0000n) and so the model was run in 1D ISIS only.

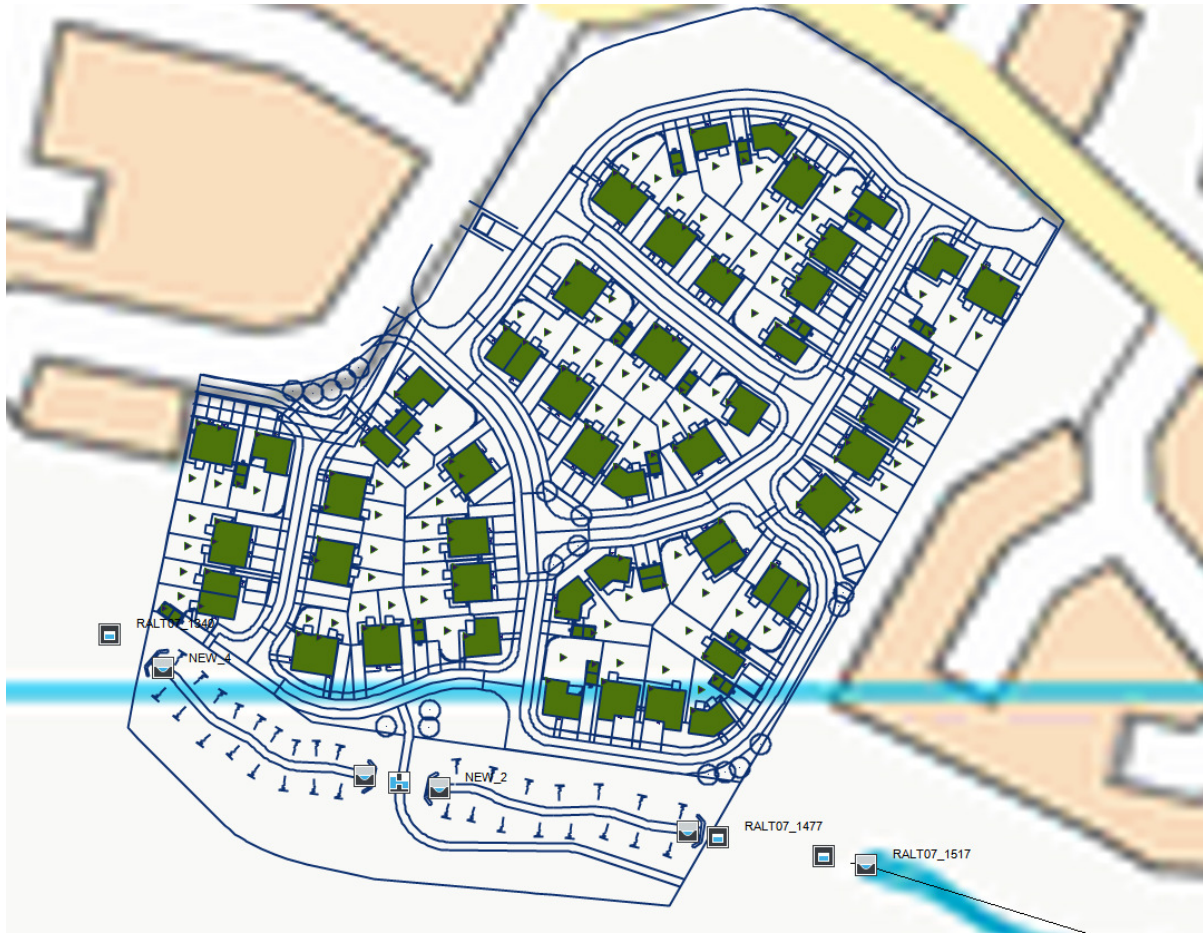


Figure 3: Study Model Schematic

- 3.4 The 1% AEP, 1% AEP plus climate change and the 0.1% AEP flows were extracted from the 1D results of the River Alt model at node label RALT07_1516l. The flow hydrographs are provided in Appendix D. Peak flows are shown in Table 1.

Annual Exceedance Probability	1%	1% plus climate change	0.1%
Flow (m ³ /s)	2.536	2.954	4.203

Table 1: Peak Flows

Proposed Scenario

- 3.5 The proposed scenario is the replace a reach of the culverted watercourse with an open channel within the site boundaries. A schematic of the proposed scenario model is shown in Figure 3.
- 3.6 For the proposed scenario, a new culvert outlet was added 40m downstream of the existing culvert entrance. This was then followed by 137m of trapezoidal open channel. The channel cross section is as shown in Figure 4. The proposed channel base width is 3.6m and depth 2.0m. The proposed side slopes are 2:1.

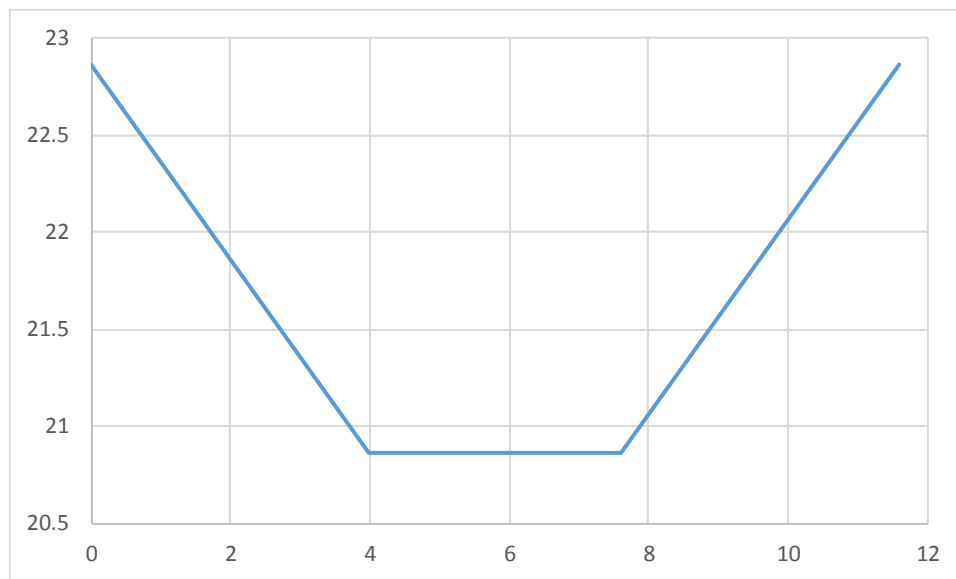


Figure 4: Proposed typical channel cross section

- 3.6 A proposed road cross is represented in the model by an orifice unit with dimensions 3.60m by 1.91m, matching the dimensions of the existing culvert.

4.0 RESULTS

Existing and Proposed Scenario

- 4.1 A comparison of existing and proposed peak water levels is shown in Appendix E. The results show that the proposed open channel has a nil effect on water levels downstream of the site.
- 4.2 The results also show that there is an increase in water level upstream of the site. The largest increase, however, in the 0.1% AEP event, still does not threaten to overtop the existing banks. The peak post development 0.1% AEP level (22.139mAOD) is 1.828m below the top of bank upstream of the existing culvert entrance. The effect of the proposed open channel lessens the further upstream and actually results in a lowering of water level at node label RALT07_1617, 101m upstream of the existing culvert entrance.

Sensitivity Testing

- 4.3 Sensitivity testing was carried out on the model parameters to determine the effects on the simulated flows and water levels due to controlled changes in accordance with best practice (refer to Appendix F for the full sensitivity analysis results).
- 4.4 The flow rates were increased by 20%, and Manning's n values (channel roughness) were increased by 20%, and the orifice unit weir and surcharge coefficients were altered by +/- 20%. These were all undertaken on the 1%AEP flow event.
- 4.5 The increase in Manning's roughness coefficient, n, resulted in a mean increase in level of 0.054m and a maximum increase of 0.068m, occurring at cross section RALT07_1617, approximately 100m upstream of the existing culvert inlet.
- 4.6 Increasing flow by 20% resulted in a mean increase in peak water level of 0.059m and a maximum of 0.069 occurring at cross section NEW_2, upstream of the proposed road bridge.
- 4.7 The effect of a reducing the orifice coefficients at the proposed road bridge by 20% resulted in a peak increase in 1%AEP level 0.04m at cross Section NEW_2, immediately upstream of the road bridge. The mean effect was an increase of 0.011m.
- 4.8 The effect of increasing the orifice coefficients at the proposed road bridge by 20% resulted in the peak 1%AEP reducing by a maximum of 0.025m with a mean change of - 0.006m.

5.0 CONCLUSIONS

- 5.1 The hydraulic assessment has indicated that the site remains entirely in fluvial Flood Zone 1.
- 5.2 The effect of reinstating a length of natural open channel and the addition of a proposed road bridge within the site does not have a detrimental effect of flood risk upstream or downstream of the site.
- 5.3 A thorough sensitivity analysis of key parameters has been undertaken and has shown that the model results are not significantly affected by changes in Manning's roughness, flow and orifice coefficients.

BIBLIOGRAPHY & REFERENCES

National Planning Policy Framework, CLG (2012).

Planning Practice Guidance, CLG (2014)

Web-based References

Bingmaps – <http://www.bing.com/Maps/>

British Geological Survey – <http://www.bgs.ac.uk/opengeoscience/home.html>

Chronology of British Hydrological Events – www.dundee.ac.uk/

CIRIA – <http://www.ciria.org/>

Cranfield University – <http://www.landis.org.uk/soilscapes/>

Environment Agency – www.environment-agency.gov.uk/

FloodProBE – <http://www.floodprobe.eu/>

Flood Forum – <http://www.floodforum.org.uk/>

Flood London – <http://www.floodlondon.com/>

Flood Resilience Group – <http://www.floodresiliencgroup.org/frg/>

Fylde Borough Council– <http://www.fylde.gov.uk/>

Google Maps – <http://maps.google.co.uk/>

Lancashire County Council- <http://www.lancashire.gov.uk/home/2010/classic/index.asp>

London Resilience – <http://www.londonprepared.gov.uk/>

Streetmap – <http://www.streetmap.co.uk/>

US Army Corps of Engineers – <http://www.hec.usace.army.mil/software/hecras/>

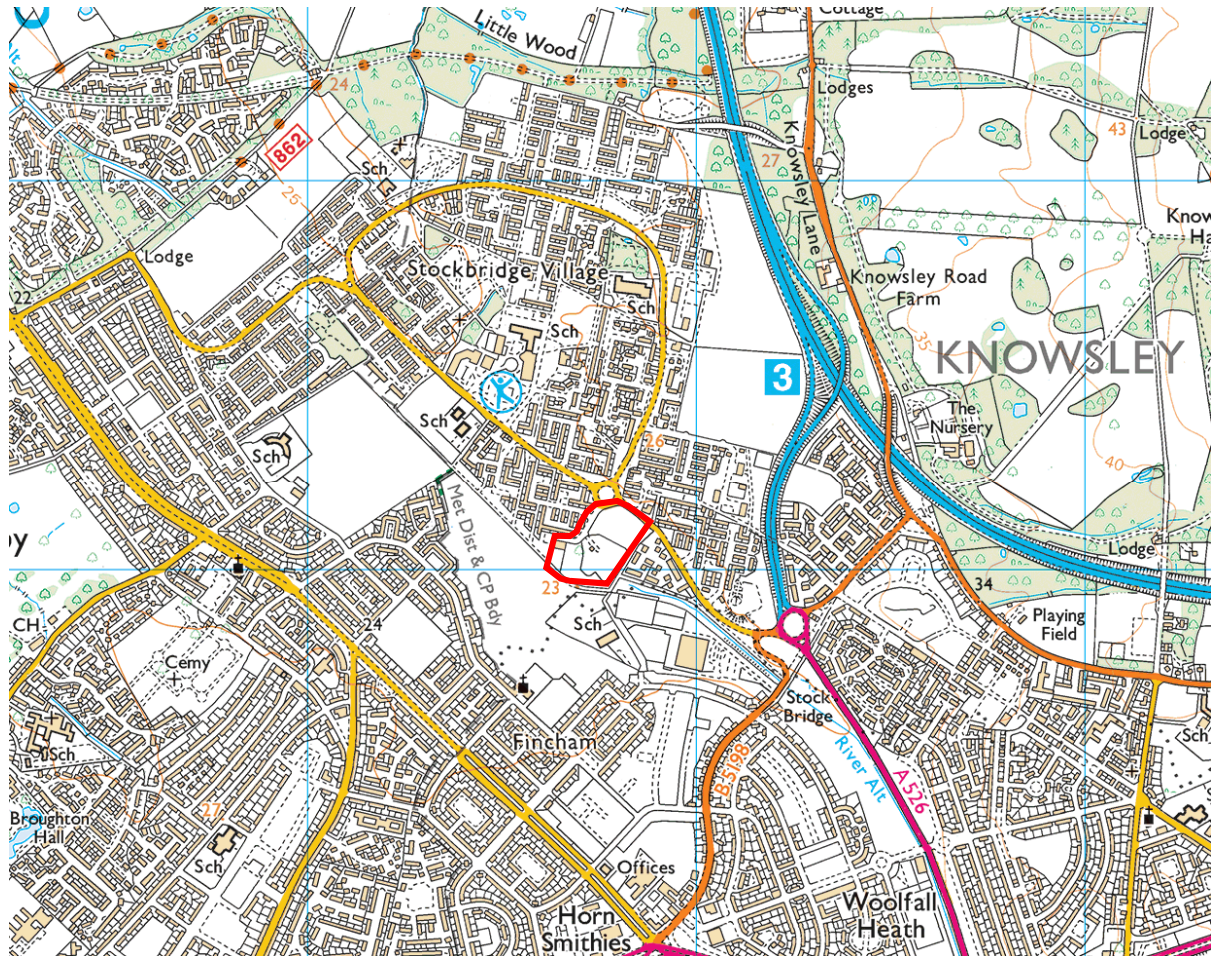
United Utilities - <http://www.unitedutilities.com/default.aspx>

Watertight International – <http://www.watertightinternational.com/>

APPENDIX A: LOCATION PLAN

This page has been left intentionally blank

This page has been left intentionally blank



OS X (Eastings)	342767
OS Y (Northings)	392938
Nearest Post Code	L28 3QD
Lat (WGS84)	N53:25:48 (53.430107)
Long (WGS84)	W2:51:46 (-2.862854)
Lat,Long	53.430107,-2.862854
Nat Grid	SJ427929 / SJ4276792938
mX	-318691
mY	7028614

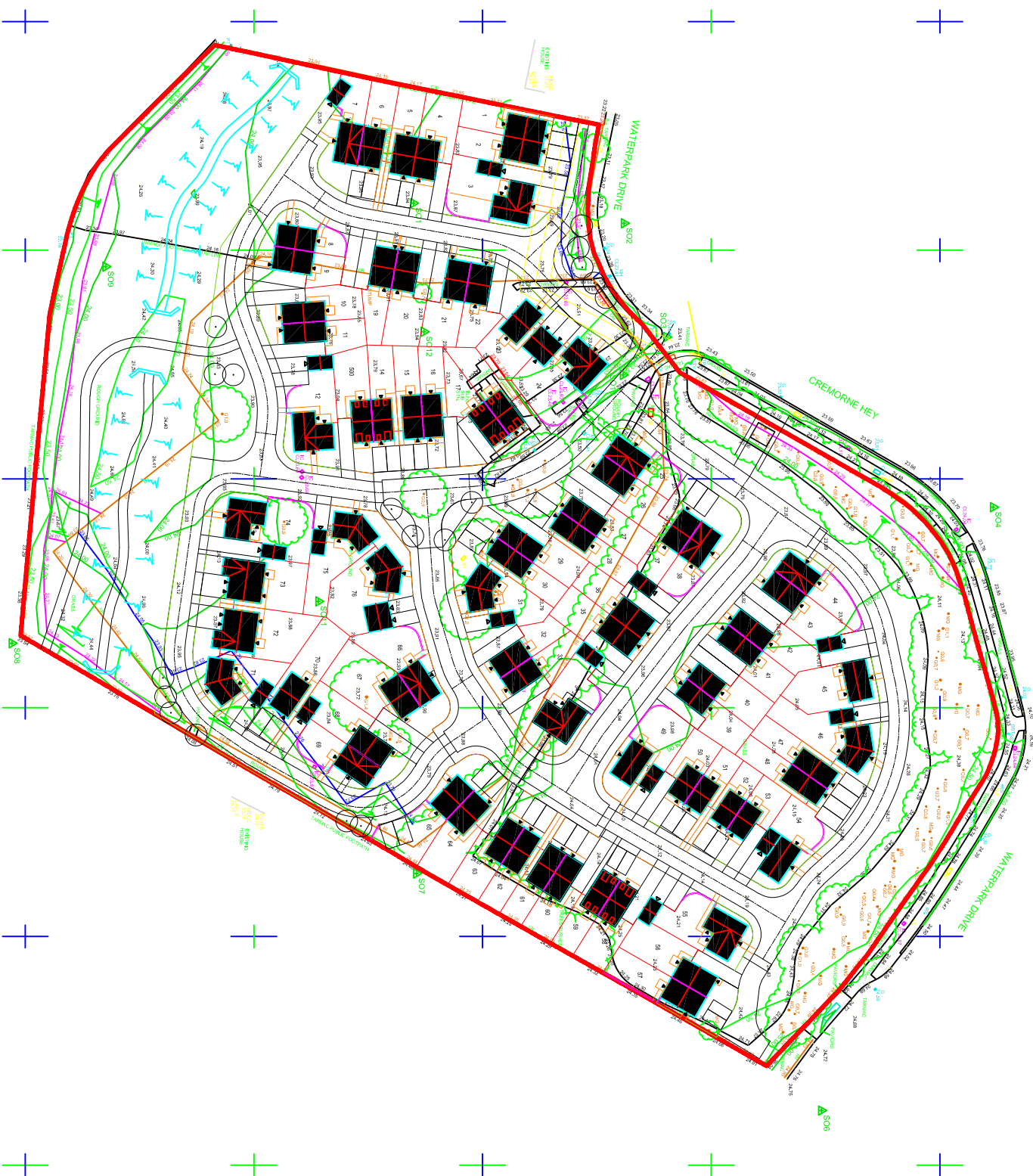
This page has been left intentionally blank

APPENDIX B: DEVELOPMENT PROPOSALS

This page has been left intentionally blank

This page has been left intentionally blank

This page has been left intentionally blank



APPENDIX C: ENVIRONMENT AGENCY MODEL SCHEMATIC

This page has been left intentionally blank

This page has been left intentionally blank

This page has been left intentionally blank