

Ref: 6152/R1

**August 2018
Rev A – 14.12.18**

**Land South of Holt Road
Wrexham**

Flood Consequences Assessment



REPORT DETAILS

Site Name: Land South of Holt Road, Wrexham

Report Title: Flood Consequences Assessment

Report Number: 6152/R1

Revision	Date	Status
-	August 2018	For Planning Submission
A	December 2018	Minor Update

Client: Bloor Homes and Barratt Homes

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Greenhatch Group Ref. 24040_T Rev A

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Lees Roxburgh Drg. No. 6152/01-05A

1.0 **INTRODUCTION**

- 1.1 Lees Roxburgh have been instructed by Bloor Homes and Barratt Homes to carry out a Flood Consequences Assessment (FCA) for the proposed development of Land South of Holt Road, Wrexham.

It is proposed that the land will be developed for residential purposes.

This FCA has been prepared in support of an outline planning application for residential development of up to 600 No. dwellings with associated landscape works, public open space and on-site infrastructure, with all matters reserved except for access.

- 1.2 The site lies within an area designated on EA Flood mapping as Flood Risk Zone 1.

Within Wales, development is covered by Technical Advice Note 15: Development and Flood Risk (TAN15). The TAN15 development advice map for the area identifies that the site lies within Zone A being land deemed to be at the least risk if flooding.

- 1.3 This FCA has been prepared in accordance with TAN15 and addresses the following;

- The potential for the proposed development to be affected by flooding either from the development proposal or external sources.
- The potential for the proposed development to increase the flood risk elsewhere.
- That mitigation measures introduced to deal with any risks identified can be successfully managed.
- That the site can be developed and occupied safely.

The views and conclusion contained within this report are subject to the approval of the local planning authority.

- 1.4 This report has been prepared specifically for Bloor Homes and Barratt Homes for the sole purposes of the planning application and any reliance on its contents must be read in conjunction with the requirements of any subsequent planning conditions.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Location

- 2.1.1 The site is centred on National Grid references 336130, 351500 and is 28.52ha in total area (**Appendix 1**).
- 2.1.2 The site lies on the eastern outskirts of Wrexham, some 5km north east of the town centre.

2.2 Surrounding Land Use and Access

- 2.2.1 At its north west corner the site borders the recently improved A534 Holt Road/A5156 roundabout junction.

The A534 Holt Road, now a new dual carriageway, runs close to the northern boundary beyond a dedicated footpath/cycleway and an access road extension to Sandy Lane. There are field gate access points onto the site from the cul-de-sac end of Sandy Lane, adjacent to the roundabout junction.

- 2.2.2 To the north, beyond the A534 Holt Road, there is Wrexham Golf Course and then a large quarry area owned by Tarmac, with extensive agricultural land beyond Borrass and Borrass Head.

- 2.2.3 Immediately to the west of the site there is Tyn-twil Farm at the north west corner and the remainder of the boundary represents the easternmost extent of the Wrexham conurbation, with housing off St Mellion Crescent and Thornhurst Drive.

At the cul-de-sac end of Thornhurst Drive there is a gated entrance onto the site, but with a hedge behind currently preventing its use.

- 2.2.4 Just beyond the northern part of the eastern boundary the land falls away steeply to an access road into a Hanson Ready Mixed Concrete plant, located in what is an historic quarry area.

The remainder of the eastern boundary borders arable fields extending down to Sandy Lane, beyond which there is Clays Touring and Leisure Park and Clays Golf Course either side of Bryn Estyn Road.

- 2.2.5 To the south the site is bordered by Bryn Estyn Road, which extends past the St Mellion Crescent housing estate to become a narrow lane adjacent to the site. It continues past Bryn Estyn Court, an old school now converted into apartments, and is then gated across as it continues east and drops down to its junction with Sandy Lane.

There are field entry points into the site from Bryn Estyn Road.

- 2.2.6 Wrexham Rugby Club, a single residence, the Erilas Victorian Garden and the Erilas Centre are all located just to the south of Bryn Estyn Road, beyond which there is extensive agricultural land.

2.3 Site Description

- 2.3.1 The site is approximately rectangular in shape, but with an irregular perimeter particularly along its northern boundary where it is stepped back from the Sandy Lane access road. The southern boundary with Bryn Estyn Road also steps in around the Bryn Estyn Court apartments
- 2.3.2 The site comprises seven separate fields, with all but the smallest in the northwest corner set to maize crops at the time of the site inspection.
- 2.3.3 A drainage ditch enters the site from the direction of Tyn-twil Farm at the north west corner and runs along the southern edge of the smallest field in an easterly direction before coming to an abrupt end in a 3m deep hollow. At this point a wooded area field boundary within a slight valley joins from the south, with the possibility that there is an ephemeral pond located at the junction of field boundaries further to the south.
- 2.3.4 Close to the north east corner a drainage ditch commences within a small wooded valley and runs along the northern boundary for a short distance before leaving the site to enter 450mm culvert just beyond the site boundary.
- 2.3.5 External and internal field boundaries consist largely of hedges and trees, reinforced in places by post and wire fencing. There is a timber post and rail fence along the northern boundary where it approaches the A534 Holt Road and the Sandy Lane access road.
- 2.3.6 Four separate and interconnecting lines of overhead electricity cables cut across the site, intersecting with boundaries at seven locations around the site perimeter.

2.4 Topography

- 2.4.1 The site overall generally falls towards the north east boundary and the location where the drainage ditch leaves the site to enter culvert. However the site is undulating with hollows and areas of steep slopes, and with localised falls towards the south west and south east corners.
- 2.4.2 Reference should be made to the topographical survey (**Appendix 2**) but boundary levels can be summarised as follows;

- North west corner (adj. roundabout)... 73.5m AOD
- North east corner (adj. drainage ditch)... 60.0 m AOD
- South east corner (adj. Bryn Estyn Road)... 72.0m AOD
- South west corner (adj. Bryn Estyn Road)... 73.0m AOD
- Highest point (close to south west corner)... 78.6m AOD

2.5 **Existing Drainage**

- 2.5.1 Watercourse systems in the area are identified in **Appendix 1B**.
- 2.5.2 As previously noted one drainage ditch enters the site close to the north west corner and a second section leaves the site close to the north east corner. Subsequent to the site inspection a drainage investigation has been undertaken and has identified a 225mm diameter concrete culvert linking the two sections of ditch.
- 2.5.3 The drain leaving the site enters 450mm diameter culvert to appear in a 5.9m deep manhole within the dedicated footpath/cycleway adjacent to the A534 Holt Road, from where it outfalls in an easterly direction.
- 2.5.4 Manhole covers in Thornhurst Drive and Bryn Estyn Road to the west of the site reflect the presence of Welsh Water adopted sewers in the area. There is also a small foul water pumping station opposite Bryn Estyn Court that serves that property and the Erlas Cente complex. (**Appendix 3**)
- 2.5.5 There is a separate surface water system in Thornhurst Drive. Measured invert levels suggest a drain running towards the site, however the base of the manholes are all described as 'silted' on the topographical survey and no pipes are visible.

There are two possibilities: either what is observed is a heavily silted drainage system that is constructed to outfall beneath the western part of the site; or the manholes in Thornhurst Drive are actually road drainage soakaways, with percolation intended through the base. The system is not indicated on Welsh Water records.

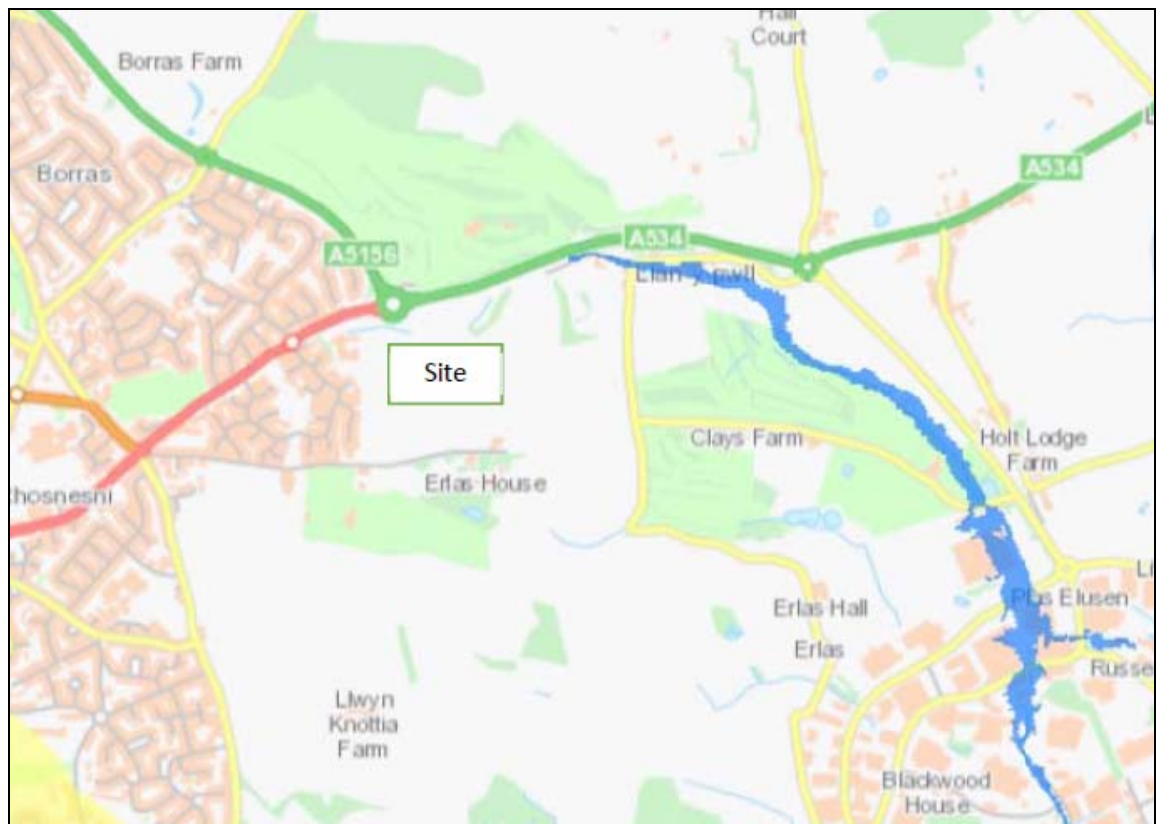
3.0 **FLOOD RISK**

3.1 **Flood Mapping**

3.1.1 **Natural Resources Wales Flood Risk**

- 3.1.1.1 Reference to the Flood Map (**Figure 1**) indicates that the overall site is located within an area of Zone A Flood Risk with a ribbon of Zone C Flood Risk associated with the continuation of the ditch/watercourse system in the north east corner.

Flood Risk Zone A comprises land assessed as having a 1 in 1000 or less annual probability of flooding (<0.1% in any year).



- Zone C1
- Zone C2
- Zone B
- Zone A

Figure 1: National Resources Wales Flood Risk Map

3.1.2 National Resources Wales Surface Water Flood Risk

- 3.1 Reference to the Surface Water Flood Risk Map (**Figure 2**) identifies sporadic areas of risk within the general area and locally within the site reflecting the topography.



- High Surface Water Flood Risk - Extent
- Medium Surface Water Flood Risk - Extent
- Low Surface Water Flood Risk - Extent

Figure 2: Natural Resources Wales Surface Water Flood Map

3.2 **TAN 15 Approach**

3.2.1 The Development Advice Maps determine the zoning based on flood mapping.

TAN 15 adopts a precautionary approach with the zoning categories defined in **Figure 3** below.

Description of Zone		Use within the precautionary framework
Considered to be at little or no risk of fluvial or tidal/coastal flooding.	A	Used to indicate that justification test is not applicable and no need to consider flood risk further.
Areas known to have been flooded in the past evidenced by sedimentary deposits.	B	Used as part of a precautionary approach to indicate where site levels should be checked against the extreme (0.1%) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider further flood risk.
Based on Environment Agency extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)	C	Used to indicate that flooding issues should be considered as an integral part of decision making by the application of the justification test including assessment of consequences.
Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.	C1	Used to indicate that development can take place subject to application of justification test, including acceptability of consequences.
Areas of the floodplain without significant flood defence infrastructure.	C2	Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered.

Figure 3: TAN15 Zoning

3.2.2 This site lies within Zone A and the Justification Test is not therefore applicable.

However, the risk of flooding from all sources including development drainage requires to be assessed.

3.3 **Sources of Flood Risk**

3.3.1 **River/Watercourse Systems and Local Water Bodies**

3.3.1.1 No surface water drainage systems have been identified within the main body of the area proposed for development with the only system identified being that within the northern area for which connectivity from west to north east has now been proven.

Otherwise the nearest recorded watercourse system is a minor system to the south east which runs away from the site and again does not present a source of risk to the development.

3.3.1.2 There are no water bodies in the area of the site.

3.3.2 **Existing Sewers and Drainage**

3.3.2.1 Copies of Welsh Water's public sewer records have been obtained and identify the presence of adopted drainage infrastructure in the area of the site. These records have been incorporated in **Appendix 3**.

3.3.2.2 Reference to the public sewer records indicates the following;

- Foul systems within the development to the west.
- Isolated foul systems to the south but with no connectivity to the main network identified.
- No surface water sewers in the area.

3.3.3 Land Drainage and Groundwater

3.3.3.1 The site area appeared well drained with no evidence of any ditch or watercourse features within the main body of the site and this is consistent with the presence of sandy soils identified on geological mapping.

3.3.3.2 No land drainage or groundwater issues are therefore anticipated which cannot readily be addressed within the normal design and construction process.

3.3.4 Comment

3.3.4.1 It is concluded that the risk associated with the following needs to be addressed by this FCA;

- Development drainage proposals.

4.0 SURFACE WATER RUNOFF

4.1 Requirements for Surface Water Drainage of the Site

- 4.1.1 TAN15 recommends that surface water generated by the development site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development.
- 4.1.2 Proposals should ensure that peak flow rates of surface water leaving the developed site are no greater than those prior to development, reducing surface water run off where possible.

4.2 Site Area

- 4.2.1 The site area comprises 28.52ha of which 15.55ha is proposed for the residential development.

4.3 Existing Site Run Off

- 4.3.1 The existing site is greenfield.
- 4.3.2 Existing greenfield run off rates have been calculated using HR Wallingford for the developable area (**Appendix 4**) and these are as follows;

- $Q_{bar...}$ 28.7 litres/sec
- $Q_{1...}$ 25.3 litres/sec
- $Q_{30...}$ 51.1 litres/sec
- $Q_{100...}$ 62.6 litres/sec

4.4 Surface Water Run Off from the Developed Site

- 4.4.1 The development plan is incorporated in **Appendix 6**.
- 4.4.2 Uncontrolled flows from the development will exceed greenfield run off rates. It is considered that if an offsite connection is proposed development run off rates limited to the greenfield run off rates identified in 4.3.2 would be appropriate.

4.5 Surface Water Outfall

- 4.5.1 At this stage the only ditch or watercourse systems which have been identified in the area to which positive surface water outfall connections could be made is the system which has now been proven as continuing west to north east within the northern area of the site.
- 4.5.2 The potential for infiltration based drainage therefore has been investigated.

4.6 Ground Infiltration Based Drainage

4.6.1 A Stage 1 Contamination Assessment (Desk Study) was undertaken by Smith Grant in November 2014 (ref. R2062-R01-v1 Final) and identified the site as being mainly underlain by well drained medium sandy soils.

4.6.2 A Phase 2 assessment (Trial Pit Investigation) in respect of infiltration capabilities has now been undertaken by Wardell Armstrong (ref. letter report 6th February 2018) and confirmed the site as being underlain by sand, occasionally gravelly, with clay horizons to the west (**Appendix 5**).

Wardell Armstrong have provided an initial assessment of the suitability of the use of soakaway drainage advising generally medium permeability with soil infiltration rates in the range 1×10^{-5} m/s to 1.21×10^{-4} m/s.

4.6.3 It is proposed to undertake further investigation with trial pits and infiltration testing in accordance with BRE365 in support of more detailed sitewide proposals at the appropriate stage.

4.7 Comment

4.7.1 Stage 1 assessment work has established ground conditions on the site as being substantially sandy and well drained and consistent with the hydrology of the area.

Site investigation work has confirmed the above and has demonstrated the infiltration capabilities of the underlying ground conditions.

4.7.2 For the purposes of this application infiltration basins have therefore been proposed as a primary means of providing a surface water drainage system to the development although limited connections to the watercourse system within the northern area of the site may be dictated by the topography. Further, the potential for infiltration at source will be the subject of more detailed investigation at a later stage.

5.0 FLOOD MITIGATION MEASURES

5.1 Development Drainage Proposals

5.1.1 A sitewide infiltration system is proposed to mimic the existing greenfield arrangements comprising a combination of;

- Piped systems outfalling to strategically located infiltration basins.
- Soakaways to houses and roads.
- Infiltration trenches to supplement, or as an alternative to, soakaways to houses

5.1.2 Further investigation work will be required at the appropriate time to establish infiltration rates on a sitewide basis for detailed design purposes.

More detailed design work will also be required to determine the extent to which infiltration at source can be safely introduced paying due regard to the topography.

5.1.3 The surface water drainage systems will be designed to Sewers for Adoption, Wrexham County Borough Council, SUDs Approval Body (SAB) and Building Regulations standards as appropriate.

Overall flows up to the 1 in 100 year event plus 30% allowance for climate change will be contained onsite.

The drainage strategy for the development is demonstrated in **Appendix 6** and incorporates 7 No. strategically located infiltration basins, the locations and extents of which are indicative at this stage and remain subject to further investigation and design development. In this regard it is noted that the extents of, and indeed the requirement for, basins will be mitigated by the introduction of infiltration at source.

5.2 Floor Levels

5.2.1 Floor levels will generally be set above external ground levels in accordance with good development practice.

5.3 Future Maintenance

5.3.1 Main pipe systems within the road network will be submitted for adoption by Welsh Water under the S104 agreement process with any sections serving adoptable highway only, including any draining to soakaway, to be incorporated in the S38 agreement with Wrexham County Borough Council. Timing may well be that this is achieved via the SAB process.

If not to be included in the S104 agreement, or covered by SAB arrangements, responsibility for the main infiltration basins will be placed with the management company for the development.

Private drainage, including infiltration facilities, will become the responsibility of the individual homeowners.

6.0 **CONCLUSIONS**

- 6.1 The proposal is for residential development.

Mapping confirms the site as being located in a Zone A area of flood risk. The Justification Test does not therefore apply.

- 6.2 At this stage the only ditch or watercourse systems which have been identified in the area to which a positive surface water outfall connection could be made is that to the north east. However the topography would significantly restrict the extent of the development area which could drain to this system.

The potential for infiltration based drainage has therefore been investigated.

- 6.3 Geo-environmental assessment work has identified the site as being generally underlain by gravelly sands with some clay horizons to the west for which favourable infiltration values have been established.

At this stage strategically located infiltration basins have been indicated, the extents of which will ultimately be mitigated by the provision, where appropriate, of soakaways and/or infiltration trenches within the main body of the development, all subject to more detailed investigation and assessment at the appropriate stage.

Overall the drainage system will be designed to contain flows onsite up to the 1 in 100 year event plus 30% allowance for climate change.

- 6.4 Main pipe systems within the road network will be submitted for adoption by Welsh Water under the S104 agreement process with any sections serving adoptable highway only incorporated in the S38 agreement with Wrexham County Borough Council. If not to be included in the S104 agreement responsibility for the main infiltration basins will be placed with the management company for the development.

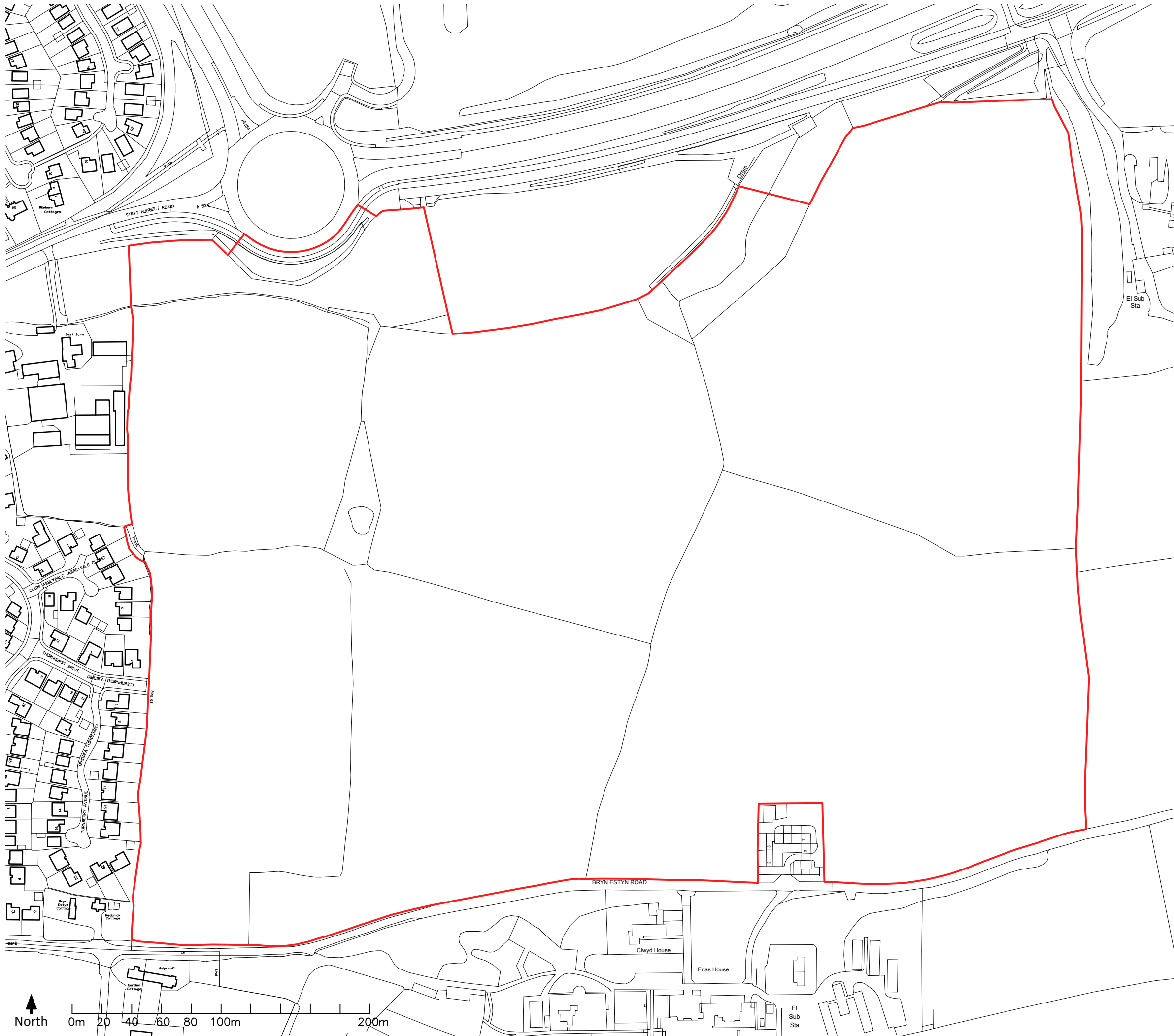
However timing may well be such that adoption and future maintenance of the drainage scheme is delivered via the SAB process.

Private drainage, including infiltration facilities, will become the responsibility of the individual homeowners.

- 6.5 It is therefore concluded that this FCA has demonstrated in accordance with TAN15 that the development can be delivered so as not to be at risk of flooding from external sources or from within the development, and so as not to increase flood risk to the surrounding area.

Appendix 1: Site Details

Appendix 1A: Location Plan



LANDSCAPE ARCHITECTURE
ENVIRONMENTAL PLANNING
MASTERPLANNING
URBAN DESIGN



Canada House, 3 Chepstow Street, Manchester M1 5FW
0161 228 7721 mail@randallthorp.co.uk www.randallthorp.co.uk

KEY:

 Site boundary



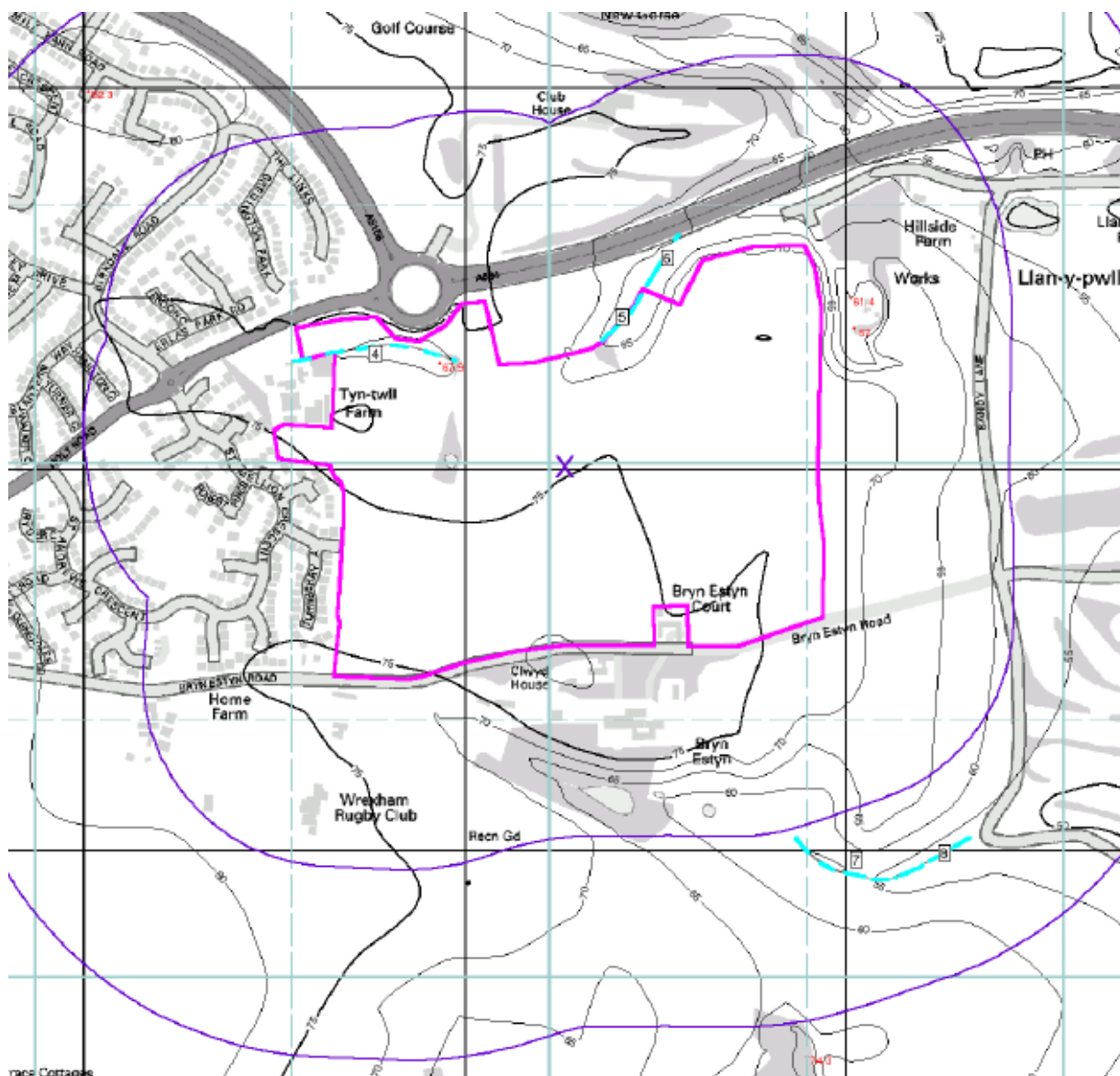
Land South of Holt Road Wrexham

Site Location Plan

Drwg No: 661B 03A
Drawn by: MP
Rev by: SB
QM Status: Checked
Scale: 1:2500 @ A3

Date: 09-11-17
Checker: JF
Rev checker: DL
Product Status:
Issue

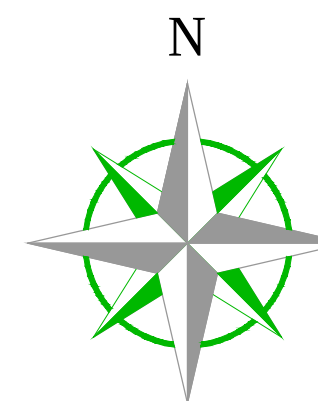
Appendix 1B: Watercourse Systems



LAND SOUTH OF HOLT ROAD, WREXHAM

Appendix 2: Topographical Survey

Greenhatch Group Ref. 24040_T Rev A



Station Information:

Station	Easting (m)	Northing (m)	Level (m)
W1	336006.661	351735.021	75.680
W2	335906.498	351772.661	75.879
W3	335924.179	351684.433	75.224
W4	335816.766	351702.980	75.034
W5	336071.246	351638.326	71.302
W6	336255.932	351538.175	74.154
W7	336240.459	351261.812	75.572
W7A	336362.009	351263.770	74.379
W7B	336433.354	351289.810	71.719
W8	336110.711	351266.100	79.040
W9	335995.717	351240.909	76.249
W10	335927.521	351218.250	72.357
W11	335883.266	351218.879	72.005
W12	335835.157	351295.578	77.533
W13	335871.727	351484.945	74.967

OS Note:
Some services may have been omitted due to parked vehicles.
The Ordnance Survey tile is to be used as a guide only.

OS Buildings Surveyed Buildings

This survey has been orientated to the Ordnance Survey (O.S.) National Grid (OSGB36) via Global Navigational Satellite Systems (GNSS) and the O.S. Active Network (OS Net). A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN02 & OSGM02 transformation models.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

[illegible]

Rev	Date	Description	Drawn	Q. Re
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greenhatch
group

- ❑ Topographical Surveys
- ❑ Site Engineering
- ❑ Utility / CCTV Surveys
- ❑ Measured Building Surveys
- ❑ 3D Laser Scanning
- ❑ Revit & BIM Models

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CLIENT	
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Bloor
Homes

PROJECT Holt Road,
Wrexham

TITLE

Topographical
Survey

SCALE A1@ 1: 1000	DATE 20.07.16
DRAWN WA	QUALITY REF G1523

Level datum	See note
Grid orientation	See note

Job number	24040	
Drawing No.	24040_T	Rev. 0

Comments
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

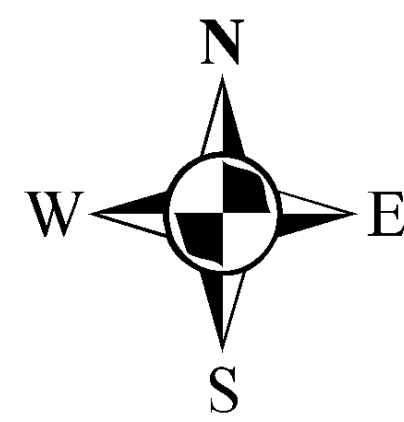
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Appendix 3: Welsh Water Public Sewer Records



Dŵr Cymru
Welsh Water

PPA0002425



LEGEND(Representative of most common features)

Waste network:	Foul chamber	Outfall
Surface water chamber	LH	Lamp hole
Combined chamber	Storm Overflow	
Combined sewer overflow	Rising main	
Special purpose chamber	Gravity sewer	
Treatment works	Private sewer	
Pumping station	Private sewer subject to Sect. 104 adaptation agreement	
Combined	Private Sewer Transfer	
Surface water	Lateral Drain	
Foul	Inspection Chamber	
Former S24 sewers (for indicative purposes only)		

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases, pipe material (other than Asbestos Cement or Pitch Fibre (PF)) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Our Cymru Cŵl gives this information as to the position of the underground apparatus for use of general guidance only on the basis of the best information available at the time of the survey. It is not intended to be used as a basis for any excavation or other works made to the property of the Company's apparatus and any work of locating the apparatus before carrying out any excavations must be carried out by the Company's staff. The Company's staff are not responsible for any damage to the apparatus. (Service pipes are not generally shown but their presence should be anticipated)

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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Map Ref: 334914,351535
Map scale: 1:1,250
Printed by: Gill
Printed on: 05.10.2017

Appendix 4: Existing Run Off Rates
HR Wallingford

Calculated by: Lees Roxburgh
Site name: Holt Road
Site location: Wrexham

Site coordinates

Latitude: 53.05702° N

Longitude: 2.9537° W

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Reference: 6413212

Date: 2018-07-31T15:23:53

Methodology

IH124

Site characteristics

Total site area (ha)	15.55
----------------------	-------

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	2
HOST class	---	---
SPR/SPRHOST	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm)	708	708
Hydrological region	9	9
Growth curve factor: 1 year	0.88	0.88
Growth curve factor: 30 year	1.78	1.78
Growth curve factor: 100 year	2.18	2.18

Notes:

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

Normally limiting discharge rates which are less than 2.0 l/s/ha are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	28.72	28.72
1 in 1 year (l/s)	25.27	25.27
1 in 30 years (l/s)	51.12	51.12
1 in 100 years (l/s)	62.61	62.61

Appendix 5: Infiltration Testing

Wardell Armstrong Letter 6th February 2018

Wardell Armstrong

Sir Henry Doulton House, Forge Lane, Etruria, Stoke-on-Trent, ST1 5BD, United Kingdom

Telephone: +44 (0)845 111 7777 Facsimile: +44 (0)845 111 8888 www.wardell-armstrong.com



your earth our world

Our ref: RP/MH/ST16134/0008

Date: 6 February 2018

Mr Scott Grady
Design & Technical Director
Bloor Homes North West
2 - 4 Whiteside Business Park
Station Road
Holmes Chapel
Cheshire
CW4 8AA

Dear Scott

Holt Road, Wrexham – Soakaway Testing

A soakaway ground investigation was undertaken between 15 and 18 January 2018, comprising 9 soakaway test pits. The locations of the trial pits are shown on the enclosed plan and the strata descriptions and results of the soakaway testing are shown on the enclosed report.

Wardell Armstrong was commissioned to undertake soakaway testing at the site south of Holt Road, Wrexham to aid in the design of the site drainage scheme. Locations for the tests were provided to us by Lees Roxburgh. Due to access restrictions caused by heavy rain a number of the positions had to be moved closer to field boundary's and tracks and 7 of the originally planned 16 tests could not be accessed at all. Tests SA03 – SA07 and SA10 – SA11 were not completed.

The soakaway tests were conducted by an engineer from Strata Renewables Ltd (SRL), a specialist ground investigation contractor. The test pits were all advanced to 2.00m below ground level (bgl). Tests could not be advanced further due to unstable ground conditions. The arisings were logged by the SRL engineer and descriptions of the material are provided on the test report. The encountered ground was mainly comprised of light brown occasionally gravelly sand with occasional clay horizons in the west, general agreement with previous investigations at the site. Perched groundwater was encountered above the clay horizons recorded in the west of the site.

Due to the granular nature of the soils the trial pits were not stable and had to be kept open by placing single sized clean stone within the pits. A slotted pipe was maintained within the stone to the base of the pit to enable the water level to be monitored. The pits were then filled with water to 1m bgl. Water levels were then recorded periodically until the water had drained. The tests were repeated a minimum of once more.

Soil infiltration rates have been calculated based on the recorded soakaway rates. These range between 1×10^{-5} and 1.21×10^{-4} m/sec indicating generally medium permeability. The full results can be found on the enclosed report.

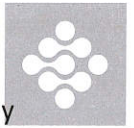


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ENERGY AND CLIMATE CHANGE
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MINING AND MINERAL PROCESSING
MINERAL ESTATES
WASTE RESOURCE MANAGEMENT



This investigation is intended to provide an initial assessment of the suitability of use of soakaway drainage at the site.

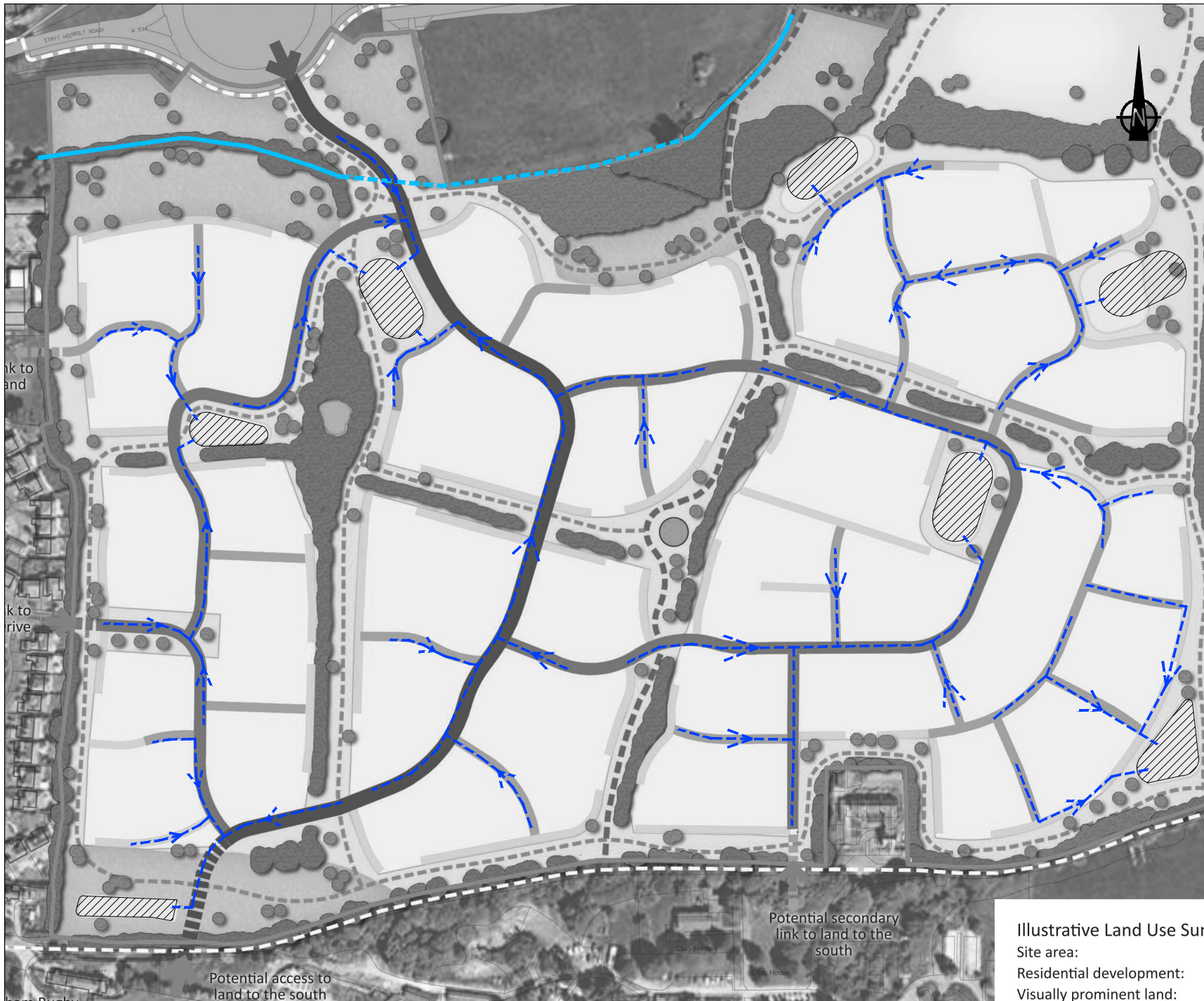
Yours sincerely
for Wardell Armstrong LLP

M HEYS
Senior Engineering Geologist
mheys@wardell-armstrong.com

Enc

Appendix 6: Surface Water Drainage Strategy

Lees Roxburgh Drg. No. 6152/01-05A



Notes

- Existing Watercourse
- Culverted Section
- Proposed Surface Water Network
- Indicative Attenuation Basins

Developable area = 15.55 Ha

GREENFIELD RUNOFF RATES

QBar ... 28.7 l/s
Q1 ... 25.3 l/s
Q30 ... 51.1 l/s
Q100 ... 62.6 l/s

ATTENUATION

Assumed to be provided in infiltration basins at this stage to contain flows up to the 1 in 100 year event + 30% allowance for climate change.

Requirement for and extent of basins will be mitigated by infiltration at source, all subject to detailed investigation.

SURFACE WATER OUTFALLS

Where levels might dictate connections to existing watercourse system to be limited to the equivalent greenfield run off rates

A	Base concept layout updated. Result of culvert investigation and surface water outfall note added.	RD	16.08.18
Rev	REVISION	By	Date

Bloor Homes North West
Barratt Homes

Land South of Holt Road
Wrexham

Surface Water Drainage Strategy

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Illustrative Land Use Summary
Site area:
Residential development:
Visually prominent land:

Job No. 6152	Drawing No. 01-05	Revision. A
Scale 1:2000@A3	Date August 2018	
Drawn By DM	Designed By JEL	Checked By JEL