Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Firth Buildings, 99 -101 Leeds Road, Dewsbury, WF12 7BU
t 01924 464342 f 01924 450662 e trevor.haigh@haighhuddleston.co.uk

FLOOD RISK ASSESSMENT

ON

Land at Cross Street, Monk Bretton, Barnsley,

South Yorkshire

FOR

Bellway Homes Ltd.

E14/6214/FRA001

April 2015

T. Haigh B.Sc., C.Eng., M.I.C.E.

Haigh Huddleston Associates is the trading name of Haigh Huddleston Associates Limited
Registered Office: Firth Buildings, 99-101 Leeds Road, Dewsbury, WF12 7BU
Registered in England Number 6458196

1.0 INTRODUCTION

1.1 This report is commissioned to investigate and report on the Flood Risk for this site in accordance National Planning Policy Framework – Technical Guidance and the proposals for drainage of this site when redeveloped as residential land. The report is based on information supplied by the client and from relevant authorities in both written and verbal format. Some of this information is in verbal form only. No liability can be accepted for information supplied by third parties which is subsequently found to be inaccurate or incorrect.

2.0 THE SITE

2.1 The proposed application site is shown on the location plan attached at Appendix A and comprises approximately 3.6ha of open arable land on the western side of Cross Street in Monk Bretton, Barnsley. The site currently comprises of principally agricultural land. There are a few isolated major trees on the site and also to the perimeter of the site.

2.2 The site lies around OS ref SE 36210 07860. Site levels vary from 117.30m AOD in the northwest corner down to 105m AOD in the south east corner of the site. The site has a significant falls from north to south and significant falls from west to east with site slopes around 1 in 40 to 1 in 50. Except for the south west corner where the ground slopes from north east to south west.

2.3 The site currently lies 1.5mile to the north-east of Barnsley town centre outside, approx. 3 mile east of the M1. The site is bounded by Cross Street to the east and the rear of development to Wordsworth street to the west. There is a football / cricket ground to the north and a cemetery to the south.

2.4 The nearest major watercourse is The River Dearne approx. 1200m to the south of the site that flows west to east. This is over 30m below site levels. .

2.5 There are foul and surface water systems that serve the residential developments to the north, south, east, and west of the site. Whilst there are adopted sewers close to the site, Yorkshire Water have stated that there is no capacity for additional surface water discharges into this system and that the current approved hierarchy of discharges to infiltration systems followed by discharges to watercourses should be utilised before any discharge to a public sewer could be considered.

3.0 PROPOSED DEVELOPMENT

3.1 It is proposed to develop the site for mixed residential development together with onsite open space and local facilities. A copy of the illustrative master plan is included at Appendix B. A mix of housing types and tenures is proposed. Approximately 96 dwellings are to be provided on the site together with public open spaces.

3.2 An area in the centre of the site is to be left as public open space but may be available for SUDs features.

4.0 IMPACT OF DEVELOPMENT

4.1 The site is currently a permeable open pasture land with little impermeable areas. The surface water run-off from the site is primarily to the south eastern boundary of the site. The development of the site will introduce new impermeable surfaces in the form of roofs, roads, drives and other hard paved areas. This will increase the run-off from the site significantly. In particular it would increase the speed of discharge of rainwater from the site if these are not attenuated.

4.2 The site itself even in its current condition could already generate significant flows from the site dependent on the rainfall patterns falling on the site. There is currently research being carried out to evaluate the risk of storm water run off from saturated agricultural sites. When these catchments have received significant rainfall over winter months they are not capable of absorbing any further rainfall and the water is discharged as an over land flow. In such instances the discharges from agricultural land can be close to the run off for a 100% impermeable area.

4.3 The topography of the area leaves the site almost on the brow of a hill so the land in most directions falls away from the site flows from the site. The cemetery area to the south would be most at risk if attenuation of the flows is not carried out. We have no details of any existing field or land drainage on or off the site. This could overload the land drainage system resulting in flooding in the downstream catchment if attenuation of flows is not implemented.

4.4 There are no reports of flooding of the site or in the immediate vicinity of the site. The E.A Risk of Flooding from rivers and the sea does not extend up to the site although there are areas adjacent to the River Dearne that are shown to flood for the 100 year and 1000year flood events. There are known flooding problems in the downstream catchment. It will therefore be necessary to attenuate these flows down to the current discharge rates or below. It will therefore be necessary to agree the methods and allowable discharges from the site and the method of attenuation of these flows if required.

4.5 The current hierarchy for discharges of rainfall from new development sites are primarily utilisation of infiltration methods, then connections to existing watercourses and then to public water sewer systems. The connections to watercourses should where ever possible maintain the existing watershed of the catchment and should not exceed current discharges rates.

4.6 A preliminary site investigation shows that the soils beneath the site are permeable and the use of infiltration systems would be feasible. Four season monitoring is now taking place but results to date suggest that this would be the case. Previous desktop studies and local knowledge of the area suggests that the site is underlain by a sands and gravels over a sandstone of the middle coal measures. The site investigation also indicates that the upper soil levels are also permeable. This would allow the use of infiltration systems. On site infiltration testing has been carried out that validates this appraisal.

4.7 Yorkshire water have stated that there is no capacity in the existing Surface water systems.

5.0 FLOOD RISK

5.1 The site is outside flood zones 2 and 3 as shown on the Environment Agency Websites. The development is classified as More Vulnerable in Table 2 of the Technical Guidance to the National Planning Policy Framework March 2012 and Table 3 of that document also states that the proposed residential development in this area is appropriate.

5.2 Due to the size of the development over 1Ha it will be necessary to prepare a site Specific Flood Risk Assessment for the site.

5.3 There are a number of potential flooding mechanisms that NPPF now requires are evaluated for each proposed development site. Each method of flooding requires an assessment to be made on its probability relative to the site development. The requirements of the document is;

i) No Flooding on the site for the 1 in 30 year storm;

ii) No flooding of properties for storms up to a 1% probability (a once in a 100 years storm).

iii)The risk assessment also includes for possible flooding both on site and off site, and the effects of the development on the downstream catchment or the flow regime of the watercourse.

iv) NPPF also requires that the effects of severe storms above the normal 1% probability are reviewed together with the effects of climatic change relating to the design life of the development.

5.4 It also requires that the effects of climate change are taken into account together with the impacts of extreme events and flood defence failures. Prior to this the Sequential Test outlined in NPPF, must also be applied to each development site.

5.5 Based on the published Environment Agency Flood Risk Maps the site does not fall within the 0.1% Flood Risk, nor does it fall within the 1% Flood Risk area. The site therefore falls within the low probability zone 1. The proposed residential development falls within the More Vulnerable Classification in Table 02 Technical Guidance to NPPF. The sequential test is therefore considered passed and development is considered appropriate in accordance with Table 3 Technical Guidance to NPPF.

5.6 NPPF requires that each flooding mechanism is addressed and levels of risk evaluated. We consider there are three main risks of flooding to the site the alternative mechanisms are not applicable to this site.

5.6.1 Inundation from floodwaters leaving watercourses or rivers entering the site. This can include the effects on culverted watercourses and where the risk of blockage can occur and from breach scenarios.

5.6.2 Rainwater falling on the site and not being able to leave the site at sufficient rate to prevent flooding on the site.

5.6.3 Overland flows from adjacent land sites or due to surcharging of sewerage systems or other watercourses.

5.6.4 The impact of the developed site on the existing drainage systems and off-site surface water systems must also be assessed as part of this flood risk assessment.

6.0 DISCUSSION OF FLOOD RISKS

6.1 Flood Risk from Watercourses, River & Tidal

6.1.1 The site does not to fall within the 1% probability Flood Risk from Rivers and Sea Maps as published by the Environment Agency nor does it fall within the 0.1% Flood Risk Area. The site is therefore considered not at risk from fluvial flooding. The site levels are significantly higher that adjacent primary watercourses.

6.1.2 The site does appear to have a small swath of possible flooding from surface water in the south east corner of the site. This appears to be due to the general topography of the area and can be catered for by the provision of flood routes through the sites. The catchment for this flow ids very limited and will be less so once the site is developed. The risk from this source can be managed very easily as stated above and is not considered to form a major risk to the site.

6.1.3 There are no recorded flood events on site or adjacent to the site but there are reported problems in the downstream catchment. The site is significantly above the bank levels to the watercourses to the south. It is not considered at risk from flooding from this source

6.1.4 The site falls outside all recorded flood zones from fluvial sources. The risk of flooding from river or tidal water is therefore considered acceptable for the type of development.

6.2 Risk of Flooding from overland flows from adjacent land.

6.2.1 The site lies on a slightly sloping site with existing residential development and infrastructure to the northern, eastern and western sides. To the south of the site the land is lower than the site; to the west and the north the ground levels are slightly higher than the site but any flows from the catchment will be primarily controlled by the existing drainage infrastructure within the developed sites. This would normally afford a minimum of a 1 in 30 year protection to the site. As the severity of the event increases there is a risk of storm water flows leaving the system due to surcharging of the systems. On all sides the flows would be channelled away from the site by the highways. Due to the limited size of the catchment the risk of flooding from this source is considered to be very low and acceptable for this development.

6.2.2 The site will be developed with an onsite drainage system that will ensure no flooding on the site for the 30 year storm and no flooding of buildings for the 1 in 100 year storm. In extreme storms above this criteria there is a slight risk of flood waters leaving the system and flowing overland through the development. It would be prudent to ensure there is an overland flood route through the site to cater for extreme storms. We would suggest that if external levels are designed so as to provide such a route, this will effectively reduce this risk to an acceptable level. The road pattern should follow the natural topography of the site so that flows are channelled naturally through the site utilising the open carriageways as much as possible and ensuring properties are not put at risk.

6.2.3 During the construction phase the risk of overland flows from the site can be increased when top soil is removed. A series of temporary bunds and detention areas with filtration systems will be required to prevent silts being carried off site to the watercourse. This can be carried out in phases and top soil strip should be minimised as much as possible.

6.3 Risk of Flooding from Rainwater Falling on Site

6.3.1 The risk of flooding from water falling on site and not being able to leave is considered to be low due to the topography and the geology of the of the site. The use of infiltration techniques will ensure no surcharging of systems downstream of the development.

6.3.2 The development of the site would increase the impermeable area of the site and hence surface water run off from its current status. This in itself will increase the flood risk to adjacent properties and those in the downstream catchment, if flows are not attenuated. The limitation on the current discharge, and the use of infiltration systems for the site, would reduce the off-site flood risk to an acceptable level.

6.3.3 Extreme rainfall events can be managed by the use of storm water attenuation systems that incorporate storage systems and infiltration systems. The design of these systems would be dependant on the agreed discharge for the site and the form of storage to be utilised. Suffice that the designed system can be detailed to cater for storm up to the 100 year return period with an allowance made for climatic change. This would currently suggest a 20 to 30% increase in flood water storage volume requirements.

6.3.4 The underlying ground is suitable for infiltration systems and the use of soakaways for domestic drainage would resolve any flood risk problems for developing the site. The highways may want a separate method of percolation basins which have not yet been designed or approved. The discharge from this system would be to the existing ground water regime. If the discharge is limited to this format it will be necessary to provide above or under ground storm water attenuation on site. The storage system for each soakaway should be designed to cater for a 100 year storm and additional storage to cater for climatic change could be catered for above ground in designated flood areas such as detention basins or shallow swales in public open spaces.

6.3.5 If on-site infiltration systems are utilised, and designed to cater for the 100 year event, then the change in flood risk to downstream properties would be negligible in relation to flood water flows in the downstream catchment.

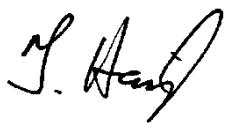
7.0 CONCLUSIONS

7.1 In our opinion the site is not at risk of flooding from river or tidal water up to a 1% return period nor is it at risk for storms in excess of the 0.1% risk level. The site is therefore not considered to be at risk of fluvial flooding from rivers or water courses.

7.2 The development of the site with the use of soakaways or other infiltration is feasible but there may be a need for infiltration basins for highway drainage systems. They should all be designed for the 100 year event and checked for the 30% increase due to climatic effects.

7.3 The risk of overland flows from adjacent land is considered to be low due to the extents of open land, the topography of the site and the geology of the site. It would be prudent to design a flood routing through the site to cater for extreme events. The risk of overland flows from the site to adjacent residential development will be significantly reduced by the development as all flows will be passed into the ground water regime rather than left on the surface.

7.4 If the measures outlined above are implemented we would consider that the requirements of NPPF can be satisfied and development of the site could proceed.



T.Haigh B.Sc., C.Eng., M.I.C.E.

APPENDIX A

LOCATION PLAN



Reproduced from OS Explorer map 1:25,000 scale by permission of Ordnance Survey® on behalf of The Controller of Her Majesty's Stationery Office. © Crown copyright. All rights reserved. Licence number 100049696.

	CLIENT	JOB TITLE	DRAWING TITLE
	BELLWAY HOMES YORKSHIRE	CROSS STREET, MONK BRETTON	SITE LOCATION PLAN

SCALE	SHEET
1:25,000	A4



Google earth

feet 2000
meters 800

APPENDIX B

PLANNING LAYOUT

MONK BRETTON

PLANNING LAYOUT LAYERS KEY:

- BRICK WALL
- BRICK WALL & FENCE
- CLOSE BOARDED TIMBER FENCE
- PROPERTY DIVISION
- POST & RAIL
- 10 — REAR GARDEN PLOT No.
- 10 — DRIVE PLOT No.
- GATE
- AFFORDABLE
- BCP — BIN COLLECTION POINT (BIN COLLECTION DAY ONLY)
- R — RENDERED UNITS (Refer to planning house type pack for extent or render)
- BLOCK PAVING
- INCIDENTAL PARKING SPACES
- INDICATIVE LANDSCAPING
- RETAINED TREE/VEGETATION
- REMOVED TREE/VEGETATION
- EASEMENT

SCHEDULE OF ACCOMODATION

Code	Name	Storeys	Accom	SQ FT	NUMBERS		
					Private	Afford.	TOTAL
Em	Embleton	1	2B/5P	656	0	1	**1**
A2	Affordable	2	3B/5P	714	0	13	**13**
B	Beswick	2	3B/5P	861	14	0	**14**
Sh	Shipley	2	3B/5P	883	6	0	**6**
Sa	Saltaire	2	3B/5P	883	2	0	**2**
A	Addingham	2	4B/7P	1087	18	0	**18**
IL	Ilkley	2	4B/7P	1216	18	0	**18**
Se	Settle	2	4B/7P	1400	11	0	**11**
H	Harrogate	2	4B/7P	1485	12	0	**12**
Grand Total					**81**	**14**	**95**

Path
BCP
Path (un)
Path
MONK BRETTON
Pheasant Inn (PH)
PCs
Cricket Ground
VINE CLOSE
DOVECOTE MEWS
Dovecote
CLUB STREET
Club
Vegetation cut back
Existing stone wall to be retained
Existing stone wall to be retained
Def
FW
World Bdy
FF
105.8m
105.2m
103.3m

Revision notes:	**Drawing Number:** 1505 01	**Project:** Monk Bretton	**Date:** April 2015	STEN Architecture Ltd Suite 10, Unit 3, Benton Office Park, Bennett Avenue, Horbury, Wakefield, WF4 5RA Telephone: 01924 669424	Web: www.sten-architecture.co.uk Twitter: @STEN_arch Facebook: stenarchitectureltd Linkedin: Sten Architecture
Rev: - / Date: - / Notes: -	**Client:** Bellway Homes	**Drawing Title:** Planning Layout	**Scale @ A1:** 1:500		
			Revision: -		

STEN ARCHITECTURE

APPENDIX C

FLOOD RISK MAPS

Environment Agency

Enter a postcode or place name: Other topics for this area...

Go | Risk of Flooding from Surface Water | View other Interactive Maps

Risk of Flooding from Surface Water

Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

The shading on the map shows the risk of flooding from surface water in this particular area.

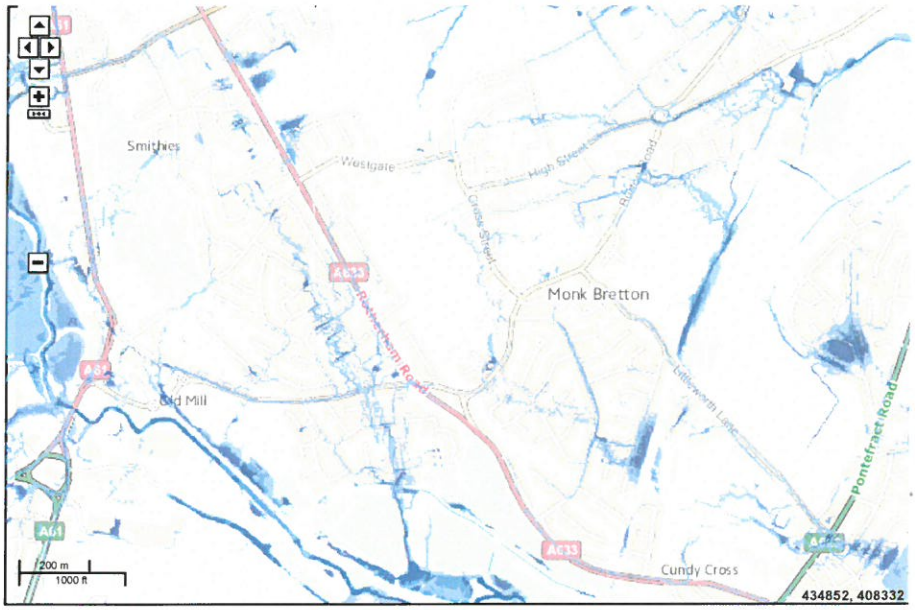
Click on the map for a more detailed explanation.

Map of X: 436,175; Y: 407,547 at scale 1:10,000

Map legend

- Risk of Flooding from Surface Water
- High
- Medium
- Low
- Very Low

Data search



Customers in Wales - From 1 April 2013 Natural Resources Wales (NRW) will take over the responsibilities of the Environment Agency in Wales.
© Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380.
Contains Royal Mail data © Royal Mail copyright and database right 2015.
This service is designed to inform members of the public, in line with our terms and conditions. For business or commercial use, please contact us.

creating a better place

Follow us: YouTube Twitter Flickr Facebook

Author: The Environment Agency | enquiries@environment-agency.gov.uk
Last updated: 24 April 2015

Privacy policy | Terms and conditions | Contact us | Cymraeg
© Environment Agency 2015

Enter a postcode or place name:

Go

Other topics for this area...

Risk of Flooding from Rivers and Sea

View other Interactive Maps

Risk of Flooding from Rivers and Sea

River flooding happens when a river cannot cope with the amount of water draining into it from the surrounding land. Sea flooding happens when there are high tides and stormy conditions.

The shading on the map shows the risk of flooding from rivers and the sea in this particular area.

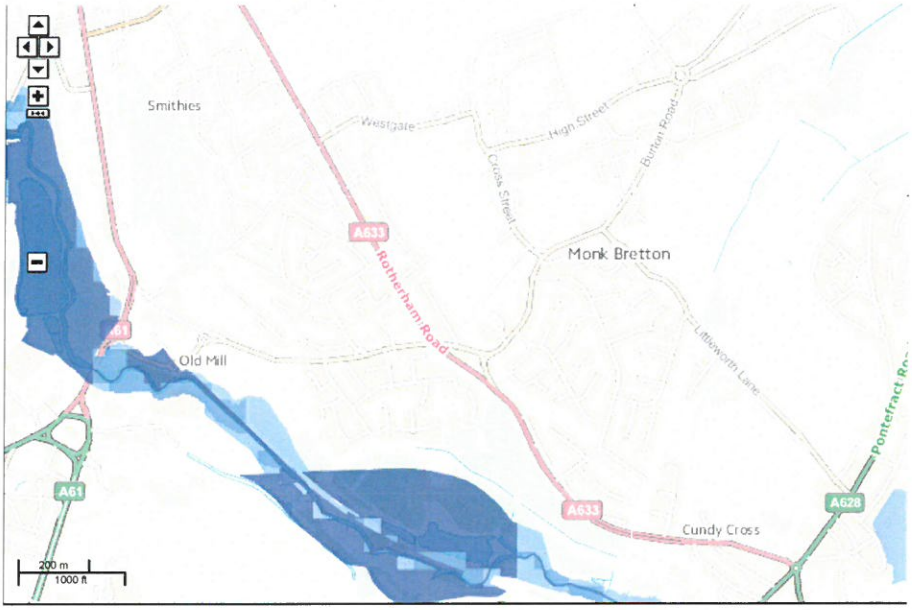
Click on the map for a more detailed explanation.

Map legend

- Risk of Flooding from Rivers and Sea
- High
- Medium
- Low
- Very Low

Map of X: 436,114; Y: 407,431 at scale 1:10,000

Data search



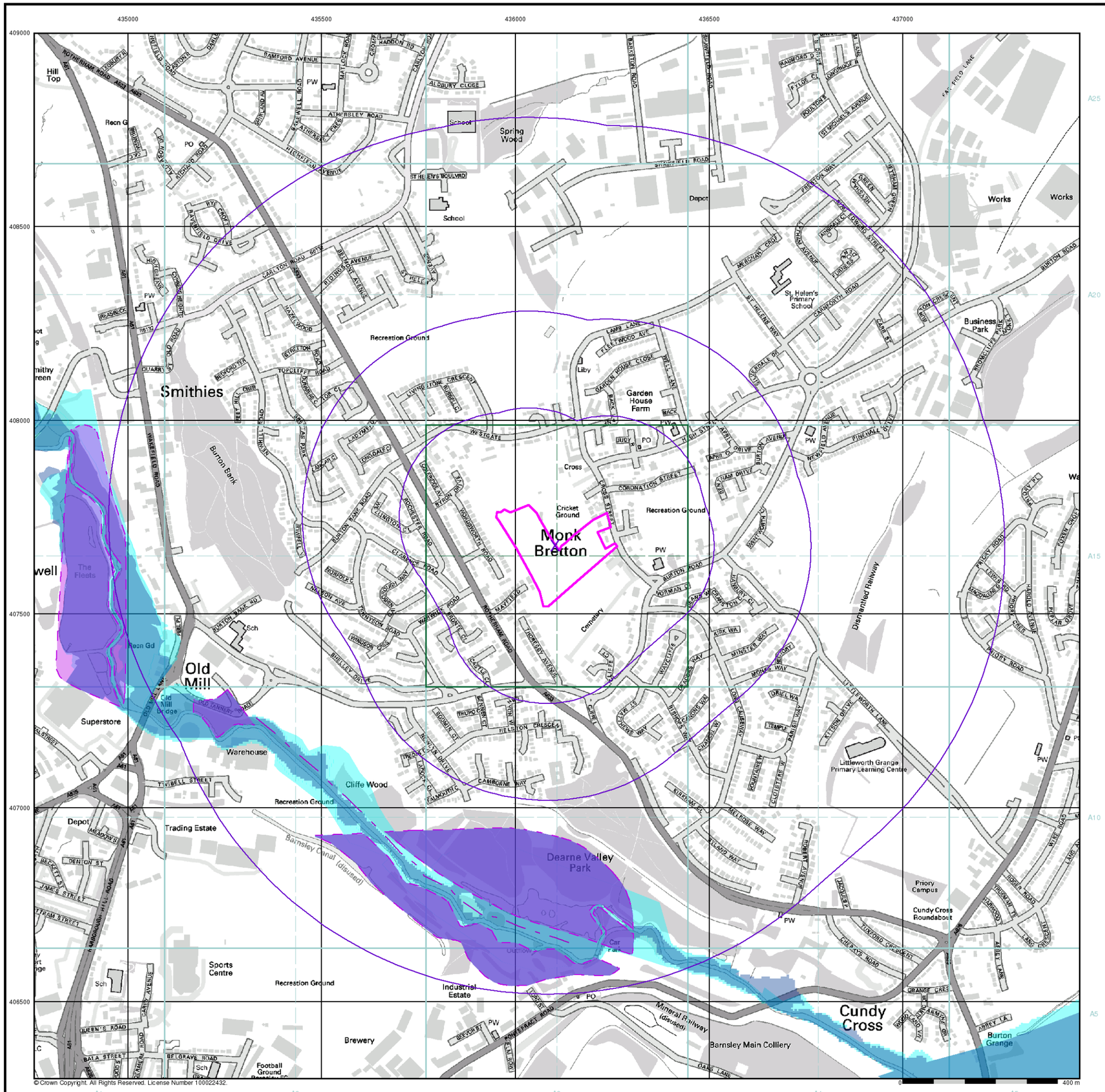
Customers in Wales - From 1 April 2013 Natural Resources Wales (NRW) will take over the responsibilities of the Environment Agency in Wales.
© Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380.
Contains Royal Mail data © Royal Mail copyright and database right 2015.
This service is designed to inform members of the public, in line with our **terms and conditions**. For business or commercial use, please **contact us**.

creating a better place

Follow us: YouTube Twitter Flickr Facebook

Author: The Environment Agency | enquiries@environment-agency.gov.uk
Last updated: 23 April 2015

Privacy policy | Terms and conditions | Contact us | Cymraeg
© Environment Agency 2015



© Crown Copyright. All Rights Reserved. License Number 100022432.

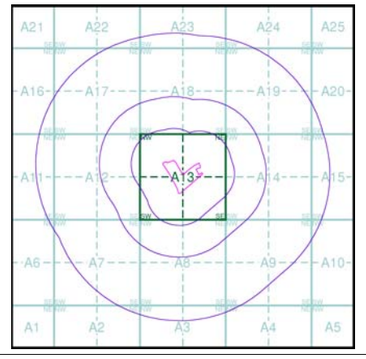
General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



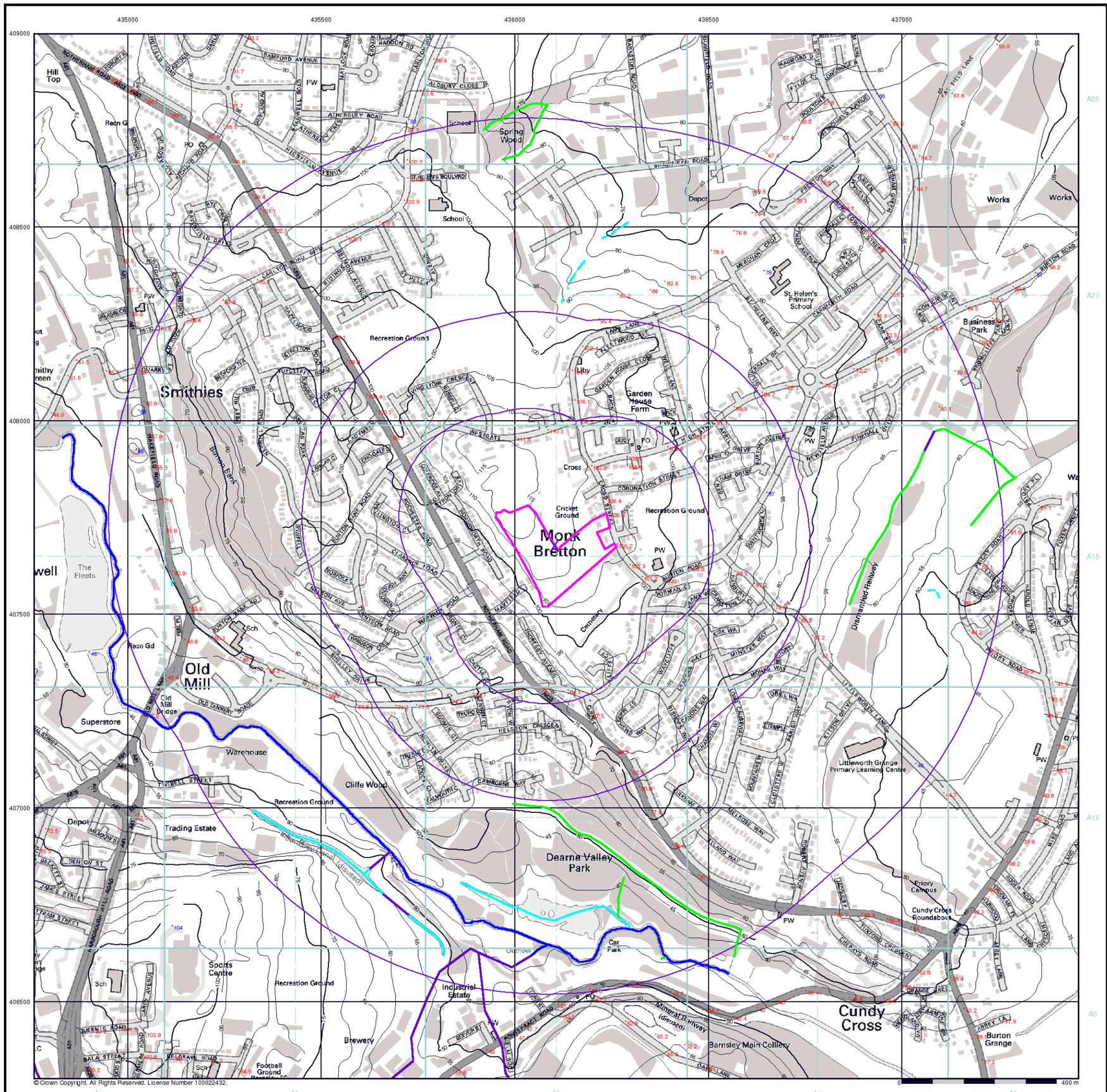
Order Details

Order Number:	59180607_1_1
Customer Ref:	1952
National Grid Reference:	436100, 407680
Slice:	A
Site Area (Ha):	3.58
Search Buffer (m):	1000

Site Details

Monk Bretton Working Mens Club, Cross Street, BARNSLEY, South Yorkshire, S71 2EP

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



© Crown Copyright. All Rights Reserved. License Number 100022432.

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID

EA Detailed River Network Data

- Primary River
- Secondary River
- Tertiary River
- Canal
- Canal Tunnel
- Undefined River
- Lake/Reservoir
- Offline Drainage Feature
- Extended Culvert (greater than 50m
- Underground River (inferred)
- Underground River (local knowledge
- Downstream of High Water Mark
- Downstream of Seaward Extension
- Not assigned River feature

Contours (height in metres)

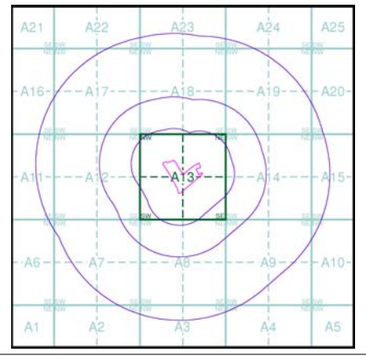
Standard Contour 105 100 95

Index Contour

167.3 Spot Height

45.8 Air Height

EA Detailed River Network Map - Slice A



Order Details

Order Number:	59180607_1_1
Customer Ref:	1952
National Grid Reference:	436100, 407680
Slice:	A
Site Area (Ha):	3.58
Search Buffer (m):	1000

Site Details

Monk Bretton Working Mens Club, Cross Street, BARNSLEY, South Yorkshire, S71 2EP

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

APPENDIX D

SITE FEATURES



NOTES

- GRASS & OVERGROWN AREAS
- BUILDING
- CROPPED AREA
- TARMAC HARDSTAND

APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

CLIENT

BELLWAY HOMES YORKSHIRE

JOB TITLE

CROSS STREET, MONK BRETTON

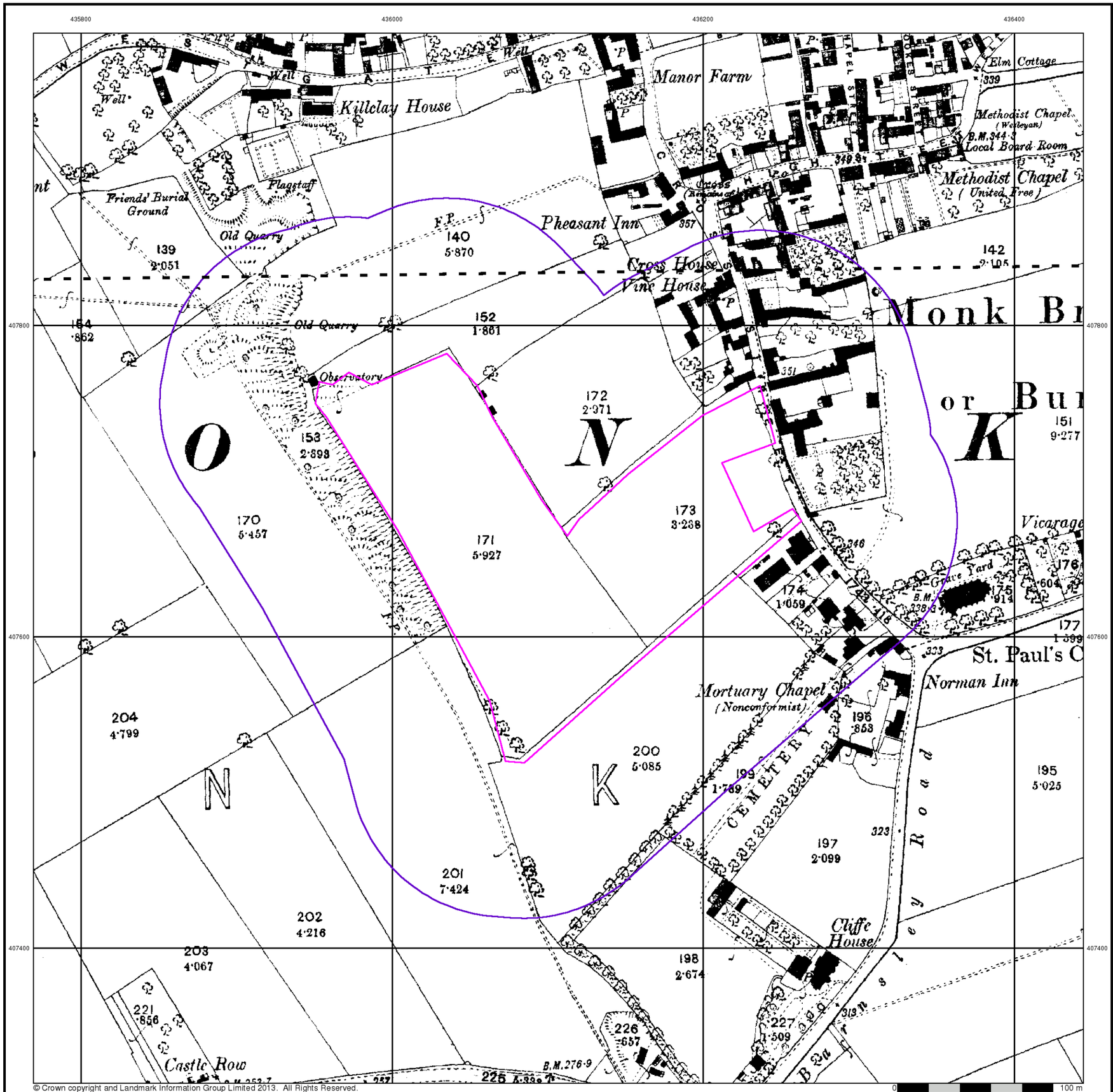
DRAWING TITLE

SITE FEATURES

SCALE	SHEET
1:1500	A3

APPENDIX E

HISTORIC PLAN



© Crown copyright and Landmark Information Group Limited 2013. All Rights Reserved.

Yorkshire

Published 1892

Source map scale - 1:2,500

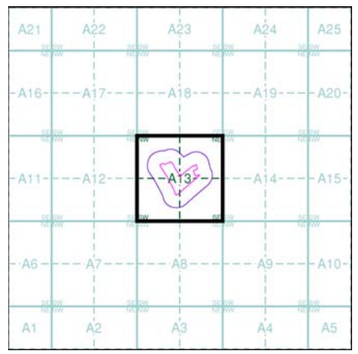
The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

274_04
1892
1:2,500

274_08
1892
1:2,500

Historical Map - Segment A13



Order Details

Order Number:	59180607_1_1
Customer Ref:	1952
National Grid Reference:	436100, 407680
Slice:	A
Site Area (Ha):	3.58
Search Buffer (m):	100

Site Details

Monk Bretton Working Mens Club, Cross Street, BARNSLEY, South Yorkshire, S71 2EP

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

APPENDIX F

GEOENVIRONMENTAL APPRAISAL EXTRACT

2 SITE DESCRIPTION

2.1 General

2.1.1 The site's location is shown on Drawing 1952/1 presented in Appendix B to this report. Site details are summarised in the Table below.

Detail	Remarks
Location	2 km north east of Barnsley town centre
NGR	SE 361 076
Approximate Area	3.6 ha (8.6 acres)
Known services	Twin 600mm diameter ductile iron water mains crossing the south eastern field, orientated approximately south to north.

2.2 Site Features

2.2.1 A Lithos Engineer completed a walkover survey of the site on the 14th August 2014.

2.2.2 A selection of site photographs is included on Drawing 1952/4.

2.2.3 The site comprises an 'L' shape area of arable land. At the time of walkover crops had been harvested leaving stubble across the site.

2.2.4 Salient features at the time of the walkover are presented on Drawing 1952/3 in Appendix B to this report, and summarised in the Table below.

Feature	Remarks
Current Access	Off Cross Street to the far south-east.
Topography	Gently sloping towards the centre of the site creating a gentle dome shape. Overall slight rise in level from east to west.
Approximate areas	24,500m^2 cropped land (western field). 10,000m^2 cropped land (south eastern field). 1,500m^2 existing residential and associated gardens (north-east).
Nature of boundaries	North – palisade fencing. South – low poorly maintained dry stone wall. East – concrete post and wire fencing adjacent to cricket ground. Various garden fencing adjacent to housing. West – small trees and poorly maintained hedgerow.
Surrounding land uses	North – Cricket field, and covered reservoir. Housing beyond. South – Housing. East – Thin open field, cemetery and housing beyond. West – Steep slope with housing beyond.

2.2.5 The site is divided in two by a low dry stone wall; a larger western field and a smaller south-eastern field.

2.2.6 The far north east of the site is occupied by an existing residential property, with associated gardens fronting Cross Street to the east.

2.2.7 Access to the site is via a low metal gate which opens onto Cross Street in the far south-east.

2.2.8 Along the south western boundary of the site land slopes steeply down approximately 12m to 15m with around a 1 in 3 slope. This slope is believed to be made up of competent rock.

2.2.9 Two water pipes run across the east of the site in a roughly north to south orientation. The pipes are suggested to be of cast iron construction. A manhole is understood to access these pipes approximately halfway along the sites south eastern boundary.

3 SITE HISTORY

3.1.1 Site centred extracts from Ordnance Survey (OS) maps dating back to 1854 have been examined. Some of these maps are presented in Appendix D to this report.

3.1.2 The sections below provide a summary of the salient points relating to the history of the site. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the site.

3.1.3 The site is shown as greenfield since the earliest edition 1854 plan, shown as fields divided up by hedgerows.

3.1.4 A sandstone quarry and 'old' (disused) quarry are shown 150m south and 20m north respectively. Both of these quarries are not marked on subsequent mapping.

3.1.5 Anecdotally it is suggested that some quarrying occurred along the northern half of the sites western boundary. It is also suggested that a local farmer disposed of slurry from a piggery into the adjacent northern quarry.

3.1.6 In 1894 cemeteries are shown 20m north and south.

3.1.7 In 1906 the cricket ground is shown immediately north west.

3.1.8 Development of housing within Monk Bretton and Barnsley occurs from 1932 to the present day.

4 ENVIRONMENTAL SETTING

4.1 General

4.1.1 Notes describing how the site's environmental setting has been assessed are included in Appendix A to this report. The responses received from Landmark and the Coal Authority are presented in Appendix E. These responses are summarised below, together with the findings of our own "desk study" investigation.

Issue	Data reviewed	Summary
Geology	1:50,000 BGS map (Sheet SE 30 NE) 1:10,000 BGS map (Sheet 87)	Drift – None anticipated. Solid – Oaks Rock Sandstone (Lower Coal Measures). Shallowest coal seam – Newhill Coal at about 20m depth. See further details in Section 4.3 below. Strata Dip – Gentle, to north east. Faults – None of significance to site.
Mining	Coal Authority BGS maps	The site is located within a Low Risk Area - within the defined coalfield, but no known defined risks have been recorded by the Coal Authority; there may still be unrecorded issues. Past and present workings – Workings in 13 seams from 70m to 540m bgl last worked in 1989. Opencast – None of significance to site. Mine entries – None recorded within 20m of site boundary. (Further details in Section 4.3 below)
Quarrying	Local Authority search Historical OS Plans	Small scale historical quarrying of sandstone within 50m of site boundary.
Radon	BRE Report BR211	Between 1% and 3% of homes above action level. No protective measures required.
Hydrogeology	Landmark Report	Source Protection Zone? None. Aquifer Undesignated (Drift); Secondary A (Solid). Groundwater abstractions? None within 500m of site boundary. Soil leaching potential - High. Pollution incidents? None of significance to site.
Hydrology	Landmark Report	Nearest watercourse – 500m south. Un named tertiary river. Pollution incidents? None of significance to site. Abstractions? None of significance to site. Discharge consents? 60m north. Yorkshire Water. Monk Bretton Reservoir. Trade discharges – Processed effluence.
Flood Risk	Environment Agency	The site is within a flood zone 1 where the risk of flooding is classified as low. The site area is greater than 1 hectare, therefore a Flood Risk Assessment, focused on the management of surface water run-off, will be required. Development that increases the amount of impermeable surfaces can result in an increase in surface water run-off, which in turn can result in increased flood risk both on site and elsewhere within the catchment.

11 GEOTECHNICAL TESTING

11.1 General

In-situ testing was undertaken to determine the suitability for use of soakaways for the drainage of surface water run-off at the site as summarised below.

11.2 Soakaway Tests

11.2.1 Five soakaway tests were carried out in accordance with BRE Digest BRE Digest 365[1] "Soakaway. The locations of the soakaways are shown on Drawing 1952/6 presented in Appendix B to this report.

11.2.2 General notes about soakaways, including their location, design, and Lithos's test methodology are presented in Appendix A.

11.2.3 Infiltration rates for each soakaway test have been calculated in accordance with BRE Digest 365. This design takes into account the time of emptying the soakaway pit between 25% and 75% of its effective depth. The effective depth is calculated from the starting water level to the soakaway pit base.

11.2.4 Where the water level did not fall to 25% effective depth, the data was interpolated in order to obtain a representative infiltration rate; this was the case for the second test within TP8 due to time constraints on site.

11.2.5 The calculated infiltration rates for each test are summarised in the Table below, and copies of these calculations are presented in Appendix I to this report.

Soakaway	Test	Stratum	Infiltration Rate (m/s)	Remarks
TP03	(Test 1)	Oaks Rock Sandstone	8.35E-05	25% full within 1 hour.
	(Test 2)		1.95E-04	25% full within 30 minutes.
TP06	(Test 1)	Granular residual soil	1.49E-04	
	(Test 2)		1.23E-04	
TP08	(Test 1)	Oaks Rock Sandstone	1.47E-05	25% full in just over 3 hours.
	(Test 2)		8.42E-6	Results extrapolated
TP12	(Test 1)	Oaks Rock Sandstone	1.20E-03	25% full within 10 minutes.
	(Test 2)		1.05E-03	
TP15	(Test 1)	Granular residual soil	3.09E-04	25% full within 30 minutes.
	(Test 2)		1.72E-04	

11.2.6 Drainage Engineers could use the infiltration rates reported above to determine the feasibility of soakaways as a solution for the discharge of surface water run-off.

11.2.7 However, CIRIA C697:2007[2] recommends that soakaways should not be constructed 'in ground where the water table reaches a level within 1m below the base of the soakaway at any time of the year'. Currently groundwater lies at >4.5m depth within the sandstone bedrock, however, levels may fluctuate seasonally, particularly at wetter times of the year.

11.2.8 Consequently groundwater levels will monitored within the monitoring wells installed across the site during the gas monitoring (see Section 10.1) with an additional 3 quarterly visits made to monitor groundwater only to provide data over a full 12 month period.

---

[1] *BRE Digest 365. Soakaway Design (1991).*

[2] *CIRIA C697. The SUDS Manual (2007).*