FLOODING & DRAINAGE ASSESSMENT FOR A PROPOSED RESIDENTIAL DEVELOPMENT AT BAILDON MILLS, NORTHGATE, BAILDON

CONTENTS:

APPENDICES:

1.0 INTRODUCTION

1.01 Following instructions from KMRE Group Ltd during May 2016, CoDA Structures have undertaken an assessment of flooding and drainage issues in relation to a proposed development at Baildon Mills, Northgate, Baildon.

1.02 The site is currently occupied by a number of buildings.

1.03 It is proposed to convert the original mill buildings to residential dwellings and re-develop the garages in the northwest sector of the site with two cottages.

1.04 The local authority is Bradford Metropolitan District Council (BMDC).

2.0 POLICY CONSIDERATIONS AND OBJECTIVES

2.01 **National Planning Policy Framework:**

Section 10 of the National Planning Policy Framework (NPPF) published in March 2012 sets out Government policy on development and flood risk for England. It aims to ensure that flood risk is taken into account at all stages of the planning process, to avoid inappropriate developments in areas at risk of flooding, and to direct development away from areas of highest risk. Where new development is thought necessary in areas of flood risk, the NPPF aims to make it safe, without increasing flood risk elsewhere, and, where possible, reduce the overall flood risk.

The NPPF promotes a sequential risk-based approach to determine the suitability of land for development in flood risk areas. The broad aim of the NPPF is to reduce the number of people and properties within the natural and built environment at risk of flooding. To achieve this aim, planning authorities are required to ensure that flood risk is properly assessed during the initial planning stages of any development.

2.02 **Consideration and Objectives:**

This Flooding and Drainage Assessment Report will consider the following:-

- whether the proposed development is likely to be affected by flooding.
- whether the proposed development will increase flood risk to adjacent properties.

The report will also demonstrate that any existing flood risk or flood risk associated with the proposed development can satisfactorily managed. This will include:-

- whether the proposed development is likely to be affected by flooding and whether it will increase flood risk elsewhere.

- specifying the measures proposed to deal with the identified risks, including, where appropriate, proposals to reduce existing and/or future flood risk levels.

- satisfy the Local Authority that any flood risk to the development or additional risk arising from the proposal will be successfully managed so the site can be developed and occupied safely without risk to adjacent properties.

3.0 FLOODING ISSUES

3.01 The Site:

The site is located to the west of Northgate and lies approximately 5.5 miles to the north of Bradford City Centre. A site location plan (Fig. 1) is attached in Appendix A.

The Ordnance Survey co-ordinates for the centre of the site are 415410 mE, 439800 mN.

The site is approximately 0.66 hectares in area.

The general fall of the site is to the southeast. Site levels range from:-

Location	Level (mAOD)
North eastern boundary	159.48 – 164.42
North western boundary	164.42 – 167.28
Southern boundary	161.99 – 167.40
South eastern boundary	161.99 – 163.73
Western boundary	166.61 – 167.40

A site topographical survey (Fig 2) is attached in Appendix B. (Survey awaited)

A site aerial photograph is attached in Appendix C.

No watercourses are believed to run through the site or lie in the immediate vicinity of the site. However, there is a small mill pond in the north western sector of the site. It is understood there is an inlet and outlet to the pond but the exact locations are not known.

From the inspection of OS Maps and the Environmental Agency River Network Map there are watercourses in the surrounding area to the site as follows:-

- Unnamed watercourse approximately 120m to the north.
- Culverted watercourse approximately 120m to the north.
- Unnamed watercourse approximately 150m to the north.
- Unnamed watercourse approximately 250m to the south.

A small reservoir approximately 250m to the north of the site has recently been decommissioned.

There is a well approximately 50m to the east of the site.

There are groundwater issues approximately 230m and 400m south of the site.

The position of the former reservoir, well and groundwater issues are indicated on the Site Location Plan (Fig. 1) attached in Appendix A. The EA River Network Map attached in Appendix D.

3.02 **Flood Zone Classification:**

The site is located within Flood Zone 1 on the EA flood map. This zone comprises land assessed as having less than 1 in 1000 (<0.1%) annual probability of tidal or river flooding in any year.

A copy of the EA flood map is attached in Appendix E.

3.03 **Sources of Flood Risk:**

The following table shows a summary of the forms of flood and the potential issues in relation to the site that require further assessment.

Flood Source	Applicable	Comment
Fluvial	X	No watercourses on or in the immediate vicinity of the site.
Tidal	X	
Run Off	✓	Potential for run off from higher land to the north of the site.
Groundwater	X	Relatively high groundwater levels are unlikely in this location.
Sewers	✓	There is a public combined sewer in Providence Row adjacent the northern boundary of the site. There is a public combined sewer in Northgate adjacent the site.
Reservoirs, Ponds, Canals, etc.	✓	Mill pond on site.

3.04 **Flood Risk Assessment:**

The site is within Flood Zone 1. This zone comprises land assessed as having less than a 1 in 1000 (<0.1%) annual probability of tidal or river flooding in any one year.

From the inspection of OS maps, site levels and a site walkover the site may be at risk from potential overland flood waters from surface water runoff from adjacent higher land to the north of the site.

From inspection of the EA Website Risk of Flooding from Surface Water Maps, it would appear there is a very low risk (less than 1 in 1000 [0.1%]) of surface water flooding affecting the majority of the site. However, it would appear there is a low (between 1 in 1000 [0.1%] and 1:100 [1.0%]) to high risk (greater than 1 in 30 [3.3%] of surface water flooding affecting an area in the southern sector of the site. It is indicated that there is:-

- a low chance of below 300mm depth of flooding occurring in this area of the site and a low chance of either between 300 – 900mm depth of flooding or over 900mm depth of flooding occurring in very isolated small areas.

- a medium chance of below 300mm depth of flooding occurring in this area of the site and a medium chance of between 300 – 900mm depth of flooding occurring in very isolated small areas.

- a high chance of either below 300mm depth of flooding or between 300-900mm depth of flooding occurring in very isolated small areas.

However, it should be noted that surface water flooding can be difficult to predict and occurs when rainwater does not drain away through the 'normal' drainage systems or soaks into the ground but lies on or flows over the ground instead.

It should be noted the EA Website Risk of Flooding from Surface Water Map indicates there are overland flood routes along Northgate adjacent the site and The Grove to the south of the site.

The EA Website Risk of Flooding from Surface Water Maps are attached in Appendix F.

The effect of groundwater as a flood source is not believed to be an issue at this location.

Following the site walkover the site does not appear to be at risk from potential overland flood waters from potential overloading of the public combined sewers adjacent the site as any such flood waters are likely to run past the site along Providence Row to the northeast and Northgate to the south.

The mill pond on the site is a possible flood source if it over topped.

3.05 **Sequential Test:**

The Sequential Test should be applied at all stages of planning. Its aim is to steer new development to areas at the lowest probability of flooding.

Table 2 of the Technical Guidance to the NPPF (which categorises the flood risk vulnerability of land uses) indicates the proposed development is categorised as a 'less vulnerable' land use.

From the EA flood zone map site is identified as being Flood Zone 1.

Table 3 of the Technical Guidance to the NPPF indicates where the proposed land use is 'less vulnerable' development is appropriate in Flood Zone 1. Therefore the Sequential Test has been passed.

3.06 **Exception Test**

Table 3 of the Technical Guidance to the NPPF indicates where the proposed land use is 'less vulnerable' development is considered appropriate in Flood Zone 1 and the Exception Test is not required.

Notwithstanding the above the following sections of this report will demonstrate that the proposed development will be safe from flooding and will not increase flood risk elsewhere.

3.07 **Effect of Development on the Wider Catchment:**

The proposed development will result in no increase in impermeable area on the application area therefore surface water flows from the development will not be increased.

3.08 **Flood Risk Mitigation:**

The proposed development is in Flood Zone 1.

The finished floor levels of the new cottages on the site should be, if possible, set 0.30m above existing ground level.

The inlet and outlet pipes to the mill pond on the site should be located and camera surveyed with any defects repaired as necessary. The condition of the mill pond should be inspected regularly.

The existing overland flood routes on the site should be maintained.

4.0 DRAINAGE

4.01 **Public Sewers:**

A 225mm increasing to 300mm diameter combined sewer lies in Providence Row adjacent the site.

A 300mm diameter combined sewer lies in Northgate adjacent the site.

An extract from the public sewer record is attached in Appendix F.

4.02 **Existing Drainage:**

A survey of the existing drainage system has not yet been carried out.

4.03 **Geology:**

1:25,000 BGS Geological Sheets for Bradford indicate the following:-

- The site is underlain by Rough Rock of the Millstone Grit series.
- Glacial deposits of Till are likely to be present at the surface.
- No faults are present on the site but a fault lies approximately 100m to the northeast of the site.
- There are no recorded areas of made ground within 1000m of the site.

4.04 **Ground Conditions:**

A ground investigation has not been undertaken on the site. However, it is envisaged that clays overlying mudstones, sandstones or siltstone bedrock are likely to be encountered on the site.

4.05 **Foul Water:**

The existing drainage systems on the site will be re-used on the development. Where necessary additional foul water sewers will be provided on the development discharging to the public combined sewers adjacent the site utilising, subject to capacity, the existing connections.

The existing sewers on the site should be camera surveyed and any defects repaired as necessary.

4.06 **Environmental Setting:**

The site is underlain by a bedrock aquifer designated as a Secondary Aquifer – A which is strata which contains permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.

The superficial aquifer is designated as unproductive strata.

The overlying soils are classified as having a high leaching potential unless proved otherwise. However, low permeability drift deposits are likely to be present at the surface.

There are 3 no. water abstraction licenses held within 1000m of the site and details are

summarised as follows:-

- groundwater abstraction for industrial use 879m to the east
- groundwater abstraction for general use (2no.) 881m to the southeast

The site does not lie within a Source Protection Zone.

The use of infiltration drainage on the site has not been discussed with the EA Groundwater Protection Team. However, it is considered that, if ground conditions are suitable, the use of infiltration drainage on the development would be acceptable in principle. However, any scheme will need to include adequate treatment prior to infiltration and this should follow the guidance given in the CIRIA C753 The SUDS Manual.

4.07 **Surface Water Drainage:**

Geological maps indicate that the use of soakaways are unlikely to be feasible on the development as relatively impermeable clays are likely to underlie the site.

In addition, as the site is on the side of a relatively steep hillside, any surface water discharged to ground may migrate horizontally and breakout the hillside to the south potentially causing off site flooding issues. Therefore, even if ground conditions prove favourable, conventional soakaways are not considered to be an appropriate solution for the disposal of surface water on the development.

Therefore, it is proposed to maintain the existing drainage system on the site, particularly as all the existing mill buildings are being retained.

The existing sewers on the site should be camera surveyed and any defects repaired as necessary.

4.08 **Maintenance Requirements of Surface Water Drainage Systems**

a) Private Areas – Roofs and Hardstandings

Regular inspection and maintenance is required to ensure the effective long-term operation of below ground drainage systems. Initially, the maintenance will be the responsibility of the site owner. However, it will ultimately become the responsibility of a management company to which all the residents and tenants contribute through a levy stipulated in the deeds of each property.

Maintenance Schedule	Required Action	Recommended Frequency
Regular maintenance	Remove debris from any catchment surfaces (may cause risks to performance).	Monthly for first 3 months, then six monthly thereafter (and after large storm events).
	Visual inspection of manholes to ensure no obvious build-up of silt or other blockages. De-silt as required. Check to ensure there is no standing water in the manholes.	Monthly for first 3 months, then six monthly thereafter (and after large storm events).
	Remove sediment from inspection chambers, rainwater gullies, drainage channels and jet associated pipework.	Annually, or as required.
Ongoing monitoring	Inspect/check all rainwater gullies and drainage channels to ensure that they are in good condition and operating as designed.	Annually and after large storm events.
Remedial actions	Repair rainwater gullies and drainage channels. De-silt as required.	As required.

5.0 SUMMARY

The Site

The site is located to the west of Northgate and lies approximately 5.5 miles to the north of Bradford City Centre.
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From the inspection of OS Maps and the Environmental Agency River Network Map there are watercourses in the surrounding area to the site as follows:-
- Unnamed watercourse approximately 120m to the north.
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A small reservoir approximately 250m to the north of the site has recently been decommissioned.
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There are groundwater issues approximately 230m and 400m south of the site.

Flood Risk Assessment

The site is within Flood Zone 1. This zone comprises land assessed as having less than a 1 in 1000 (<0.1%) annual probability of tidal or river flooding in any one year.
From the inspection of OS maps, site levels and a site walkover the site may be at risk from potential overland flood waters from surface water runoff from adjacent higher land to the north of the site.
From inspection of the EA Website Risk of Flooding from Surface Water Maps, it would appear there is a very low risk (less than 1 in 1000 [0.1%]) of surface water flooding affecting the majority of the site. However, it would appear there is a low (between 1 in 1000 [0.1%] and 1:100 [1.0%]) to high risk (greater than 1 in 30 [3.3%] of surface water flooding affecting an area in the southern sector of the site. It is indicated that there is:-
- a low chance of below 300mm depth of flooding occurring in this area of the site and a low chance of either between 300 – 900mm depth of flooding or over 900mm depth of flooding occurring in very isolated small areas.
- a medium chance of below 300mm depth of flooding occurring in this area of the site and a medium chance of between 300 – 900mm depth of flooding occurring in very isolated small areas.
- a high chance of either below 300mm depth of flooding or between 300-900mm depth of flooding occurring in very isolated small areas.

However, it should be noted that surface water flooding can be difficult to predict and occurs when rainwater does not drain away through the 'normal' drainage systems or soaks into the ground but lies on or flows over the ground instead.
It should be noted the EA Website Risk of Flooding from Surface Water Map indicates there are overland flood routes along Northgate adjacent the site and The Grove to the south of the site.
The effect of groundwater as a flood source is not believed to be an issue at this location.
Following the site walkover the site does not appear to be at risk from potential overland flood waters from potential overloading of the public combined sewers adjacent the site as any such flood waters are likely to run past the site along Providence Row to the northeast and Northgate to the south.
The mill pond on the site is a possible flood source if it over topped.

Sequential Test

The Sequential Test should be applied at all stages of planning. Its aim is to steer new

	development to areas at the lowest probability of flooding. Table 2 of the Technical Guidance to the NPPF (which categorises the flood risk vulnerability of land uses) indicates the proposed development is categorised as a 'less vulnerable' land use. From the EA flood zone map site is identified as being Flood Zone 1. Table 3 of the Technical Guidance to the NPPF indicates where the proposed land use is 'less vulnerable' development is appropriate in Flood Zone 1. Therefore, the Sequential Test has been passed.
Exception Test	Table 3 of the Technical Guidance to the NPPF indicates where the proposed land use is 'less vulnerable' development is considered appropriate in Flood Zone 1 and the Exception Test is not required. Notwithstanding the above the following sections of this report will demonstrate that the proposed development will be safe from flooding and will not increase flood risk elsewhere
Flood Risk Mitigation	The proposed development is in Flood Zone 1. The finished floor levels of the new cottages on the site should be, if possible, set 0.30m above existing ground level. The inlet and outlet pipes to the mill pond on the site should be located and camera surveyed with any defects repaired as necessary. The condition of the mill pond should be inspected regularly. The existing overland flood routes on the site should be maintained.
Foul Drainage	The existing drainage systems on the site will be re-used on the development. Where necessary additional foul water sewers will be provided on the development discharging to the public combined sewers adjacent the site utilising, subject to capacity, the existing connections. The existing sewers on the site should be camera surveyed and any defects repaired as necessary.
Surface Water	Geological maps indicate that the use of soakaways are unlikely to be feasible on the development as relatively impermeable clays are likely to underlie the site. In addition, as the site is on the side of a relatively steep hillside, any surface water discharged to ground may migrate horizontally and breakout the hillside to the south potentially causing off site flooding issues. Therefore, even if ground conditions prove favourable, conventional soakaways are not considered to be an appropriate solution for the disposal of surface water on the development. Therefore, it is proposed to maintain the existing drainage system on the site, particularly as the existing mill buildings are being retained. The existing sewers on the site should be camera surveyed and any defects repaired as necessary.

5.0 CAVEATS

6.01 The comments given in this report and recommendations made are based on the information that could be obtained from reasonably accessible sources. Detailed discussions have not yet been held with statutory bodies and the local authority.

6.02 This report has been prepared for the sole use of KMRE Group Ltd and their development funders, unless agreed otherwise in writing by CoDA Structures.

Signed: .....

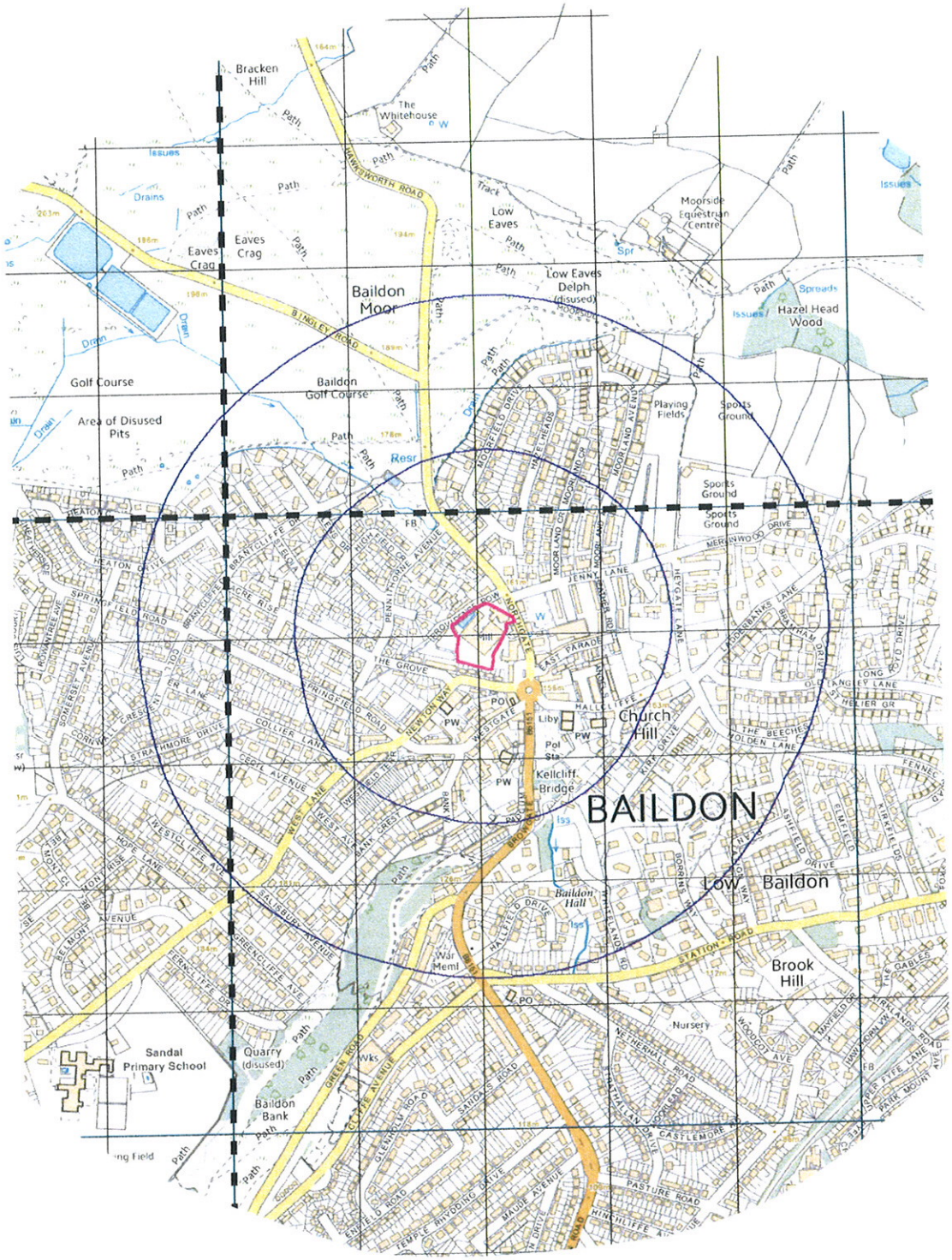
J Lawrence B Eng C Eng M I Struct E

APPENDIX A

SITE LOCATION PLAN - FIG. 1

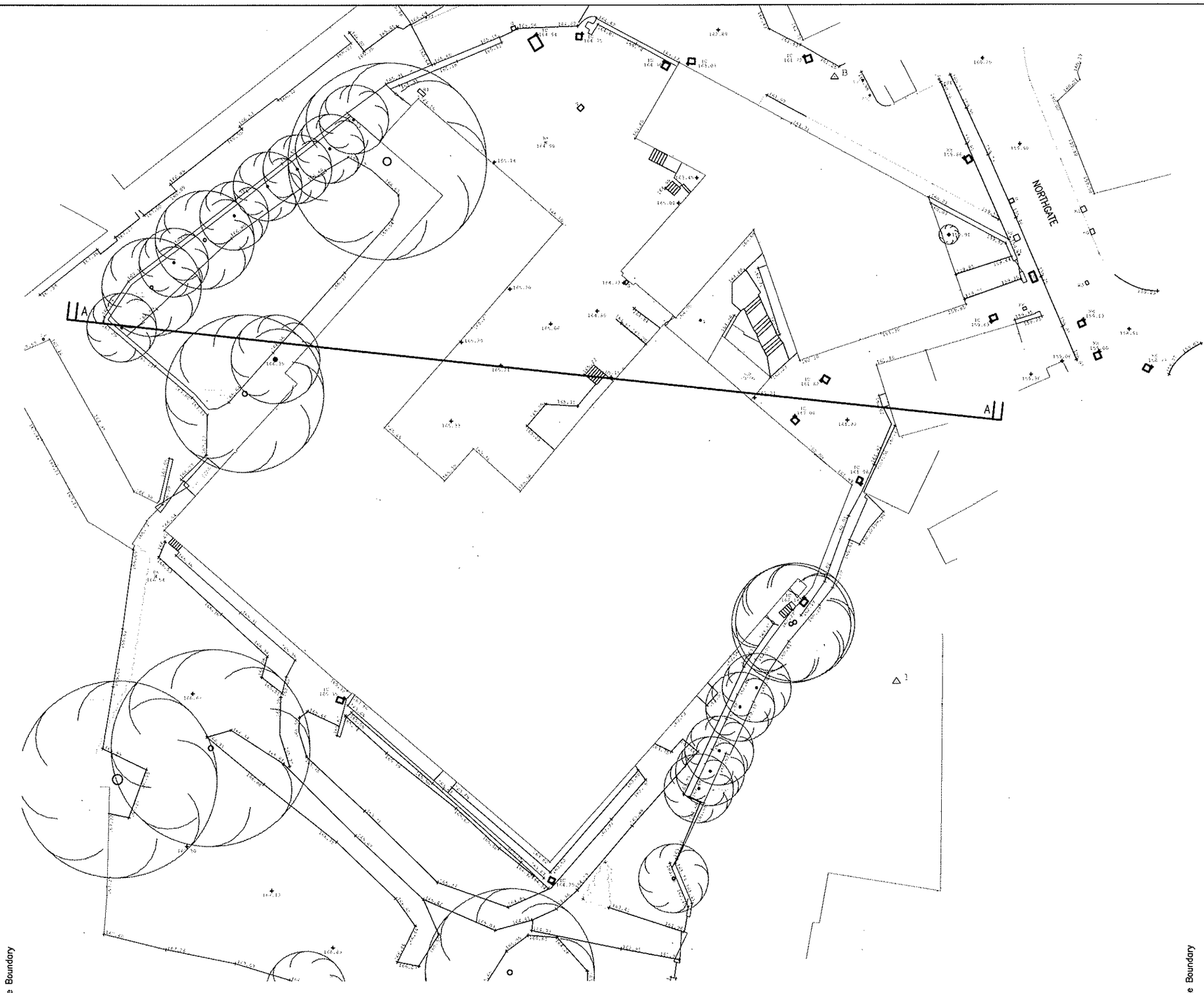
CoDa+— Structures
Consulting Civil & Structural Engineers
No 2 Harewood Yard
Harewood
Leeds LS17 9LF
Tel: 0113 288 6766
Fax: 0113 288 6765

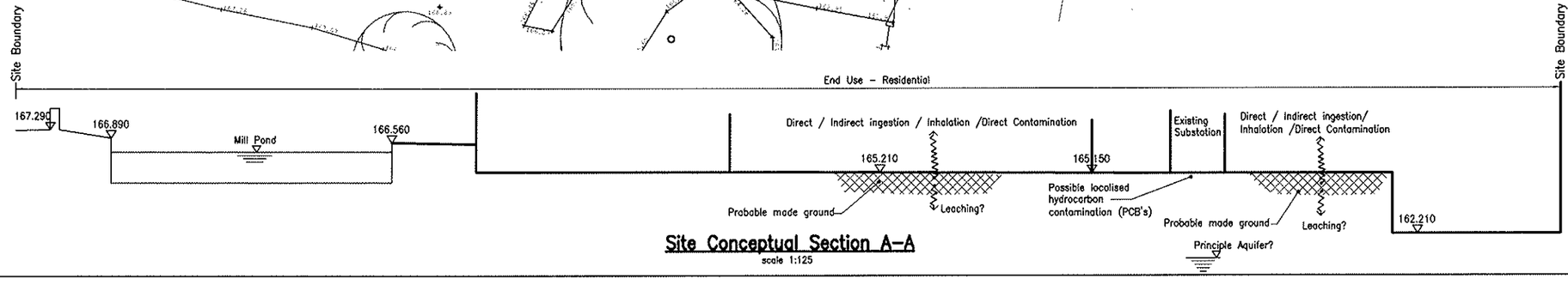
Project	Baildon Mills Northgate Baildon			
Title	Site Location Plan			
Drawn JL		Date 07.16	Drg. No. 7618/Fig1	Rev. -
Scale 1:10000		Checked JL		



APPENDIX B

SITE TOPOGRAPHICAL SURVEY - FIG. 2





Site Conceptual Section A–A
scale 1:125

Rev.	Content	Date

Client	KMRE Group		
Project	Baildon Mill, Baildon		
Title	Site Topographical Survey		
Drawn: RD	Date: 28.07.16	Drg. No.: 7618/Fig2	Rev.: –
Scale: 1:125:200 @A1	Checked: JL		

CoDa+– Structures
Consulting Civil & Structural Engineers
14 Springfield Court
Guiseley
Leeds LS20 8PD
Tel: 01943 872567
Fax: 01943 870824

APPENDIX C

SITE AERIAL PHOTOGRAPH

CoDa *Structures*
Consulting Civil & Structural Engineers
14 Springfield Court
Guiseley
Leeds LS20 8FD

BAILDON MILLS, NORTHGATE, BAILDON
SITE PHOTOGRAPHS

1. Site Aerial Photograph.

APPENDIX D

ENVIRONMENT AGENCY RIVER NETWORK MAP

Envirocheck®

General

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

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)

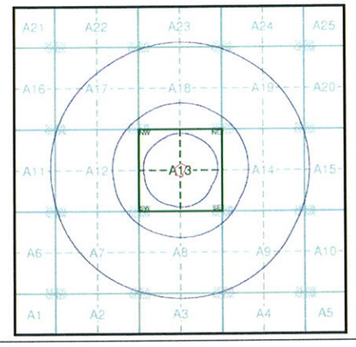
Standard Contour 105 100 95

Master Contour

Spot Height 167.3

- MLW Mean Low Water
- MHW Mean High Water

EA/NRW Detailed River Network Map - Slice A



Order Details

Order Number:	87953096_1_1
Customer Ref:	7618
National Grid Reference:	415410, 439800
Slice:	A
Site Area (Ha):	0.66
Search Buffer (m):	1000

Site Details

Baildon Mills, Northgate, Baildon, SHIPLEY, West Yorkshire, BD17 6JY

Landmark® Information Group

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

APPENDIX E

ENVIRONMENT AGENCY FLOOD MAP

Envirocheck®

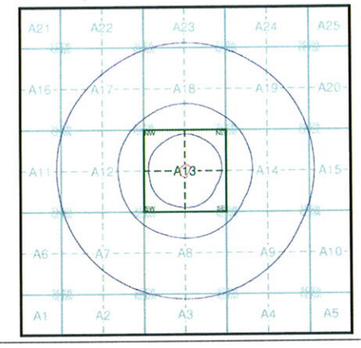
General

- Specified Site
- Specified Buffer(s)
- 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



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Site Details

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Fax: 0844 844 9951
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APPENDIX F

ENVIRONMENT AGENCY WEBSITE RISK OF FLOODING FROM SURFACE WATER 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.

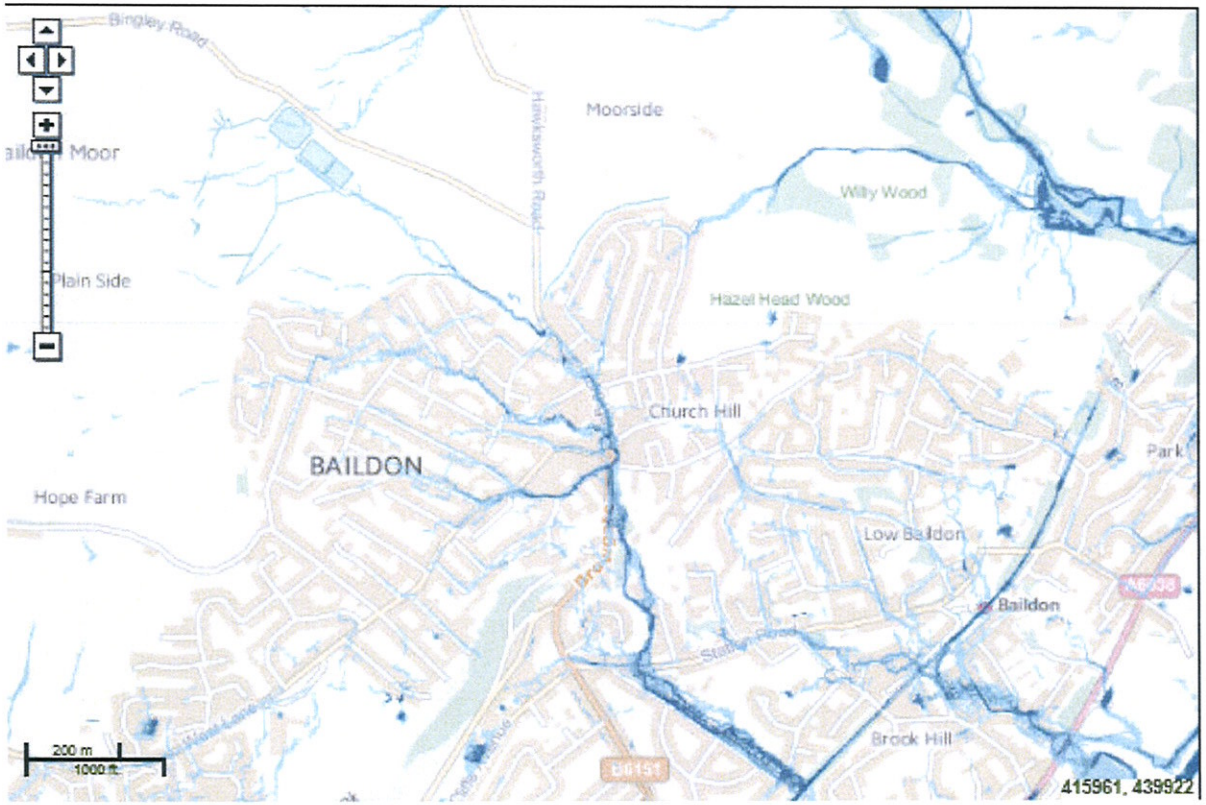
Click on the map for a more detailed explanation.

Map legend

- ☑ Risk of Flooding from Surface Water
  - High
  - Medium
  - Low
  - Very Low
- ☑ Other national environmental organisations
  - Natural Resources Wales Area of responsibility
  - Scottish Environment Protection Agency Area of responsibility

Map of BD17 6JY at scale 1:10,000

Data search



Surface Water Depth - Low Chance of Occurring

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 estimated water depth when there is a low chance of flooding.

Click in the legend to see estimated water depths for high and medium chances of flooding, and for estimated velocity (speed and direction of the water).

Map legend

- ☑ Surface Water Depth - Low Chance of Occurring
  - Over 900mm
  - 300-900mm
  - Below 300mm
- ☑ Other national environmental organisations
  - Natural Resources Wales Area of responsibility
  - Scottish Environment Protection Agency Area of responsibility

Chance of occurring

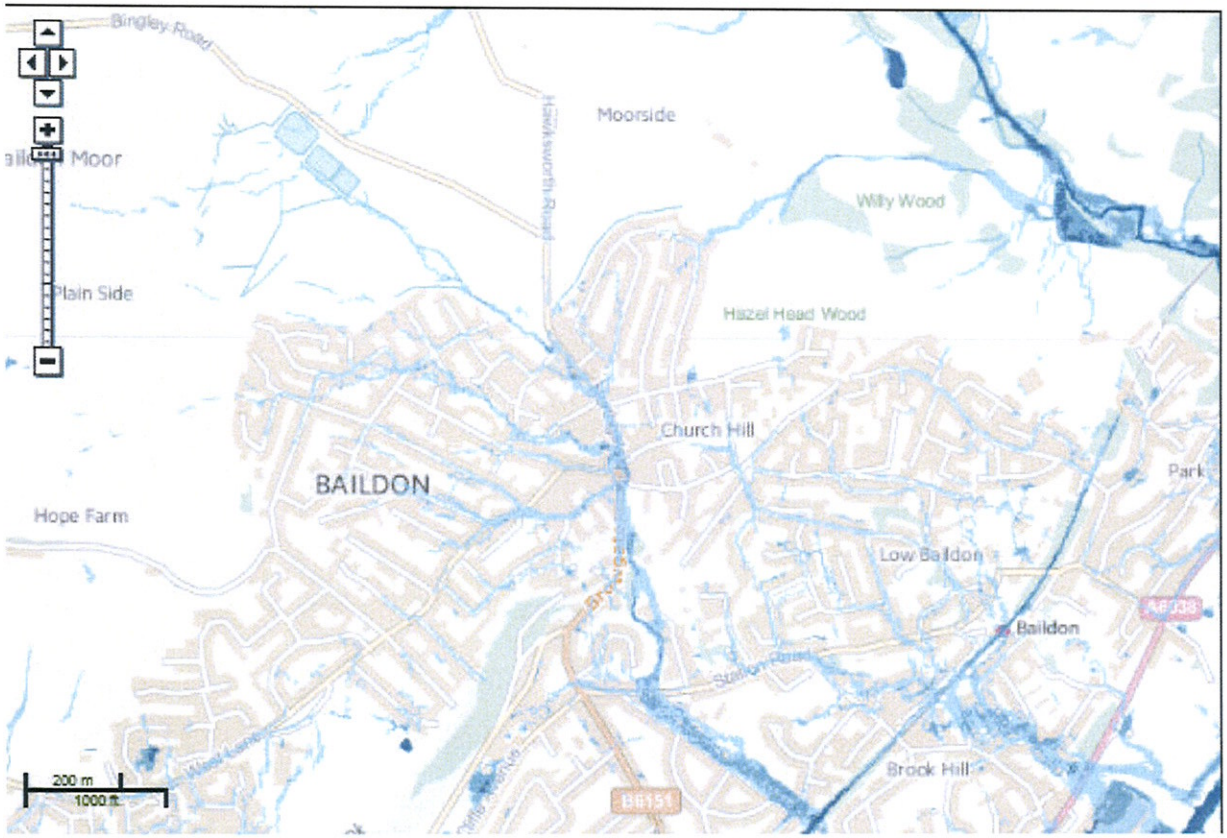
- ◉ Low
- ○ Medium
- ○ High

Other layers

Switch to layer:

- Surface water extent
- Surface water velocity

Map of X: 415,465; Y: 439,821 at scale 1:10,000 Data search



Surface Water Depth - Medium Chance of Occurring

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 estimated water depth when there is a medium chance of flooding.

Click in the legend to see estimated water depths for high and low chances of flooding, and for estimated velocity (speed and direction of the water).

Map of X: 415,465; Y: 439,821 at scale 1:10,000

Data search

Map legend

- [x] Surface Water Depth - Medium Chance of Occurring
  - Over 900mm
  - 300-900mm
  - Below 300mm
- [x] Other national environmental organisations
  - Natural Resources Wales Area of responsibility
  - Scottish Environment Protection Agency Area of responsibility

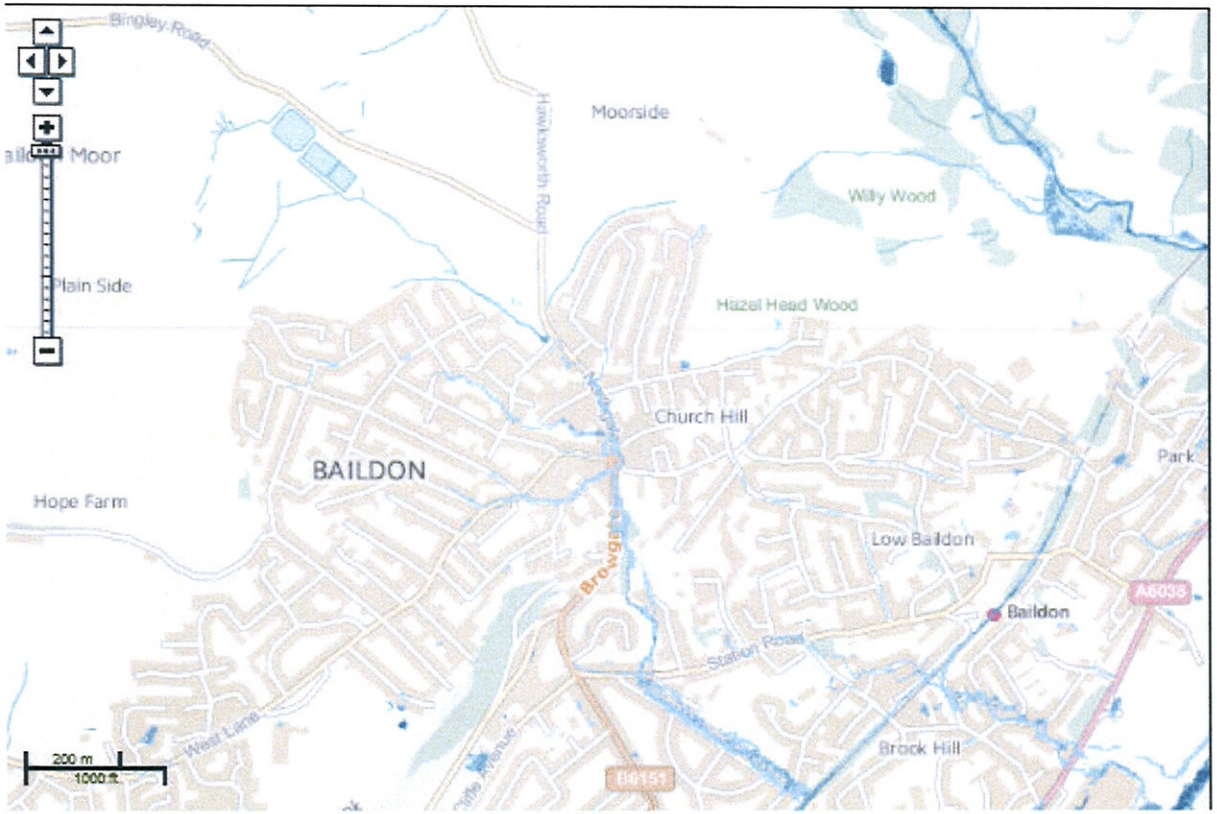
Chance of occurring

- ○ Low
- ◉ Medium
- ○ High

Other layers

Switch to layer:

- Surface water extent
- Surface water velocity



Surface Water Depth - High Chance of Occurring

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 estimated water depth when there is a high chance of flooding.

Click in the legend to see estimated water depths for medium and low chances of flooding, and for estimated velocity (speed and direction of the water).

Map legend

- [x] Surface Water Depth - High Chance of Occurring
  - Over 900mm
  - 300-900mm
  - Below 300mm
- [x] Other national environmental organisations
  - Natural Resources Wales Area of responsibility
  - Scottish Environment Protection Agency Area of responsibility

Chance of occurring

- ○ Low
- ○ Medium
- ◉ High

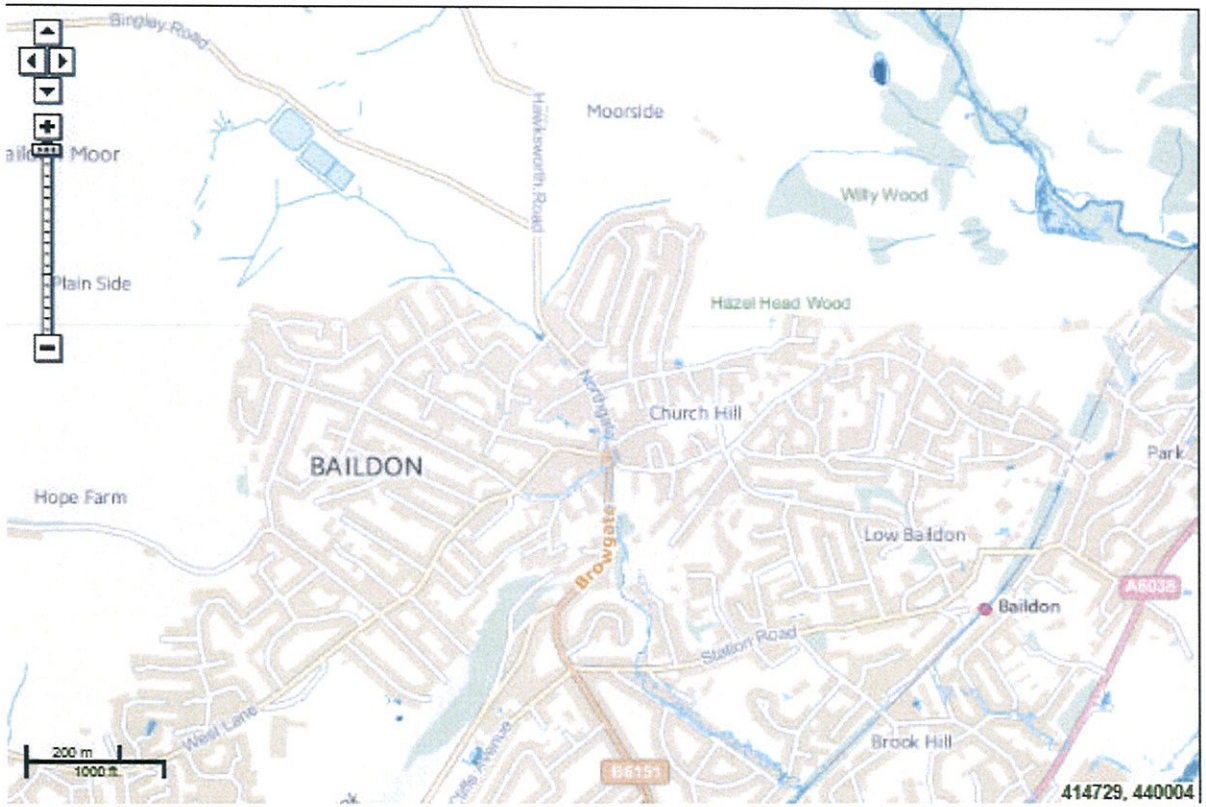
Other layers

Switch to layer:

- Surface water extent
- Surface water velocity

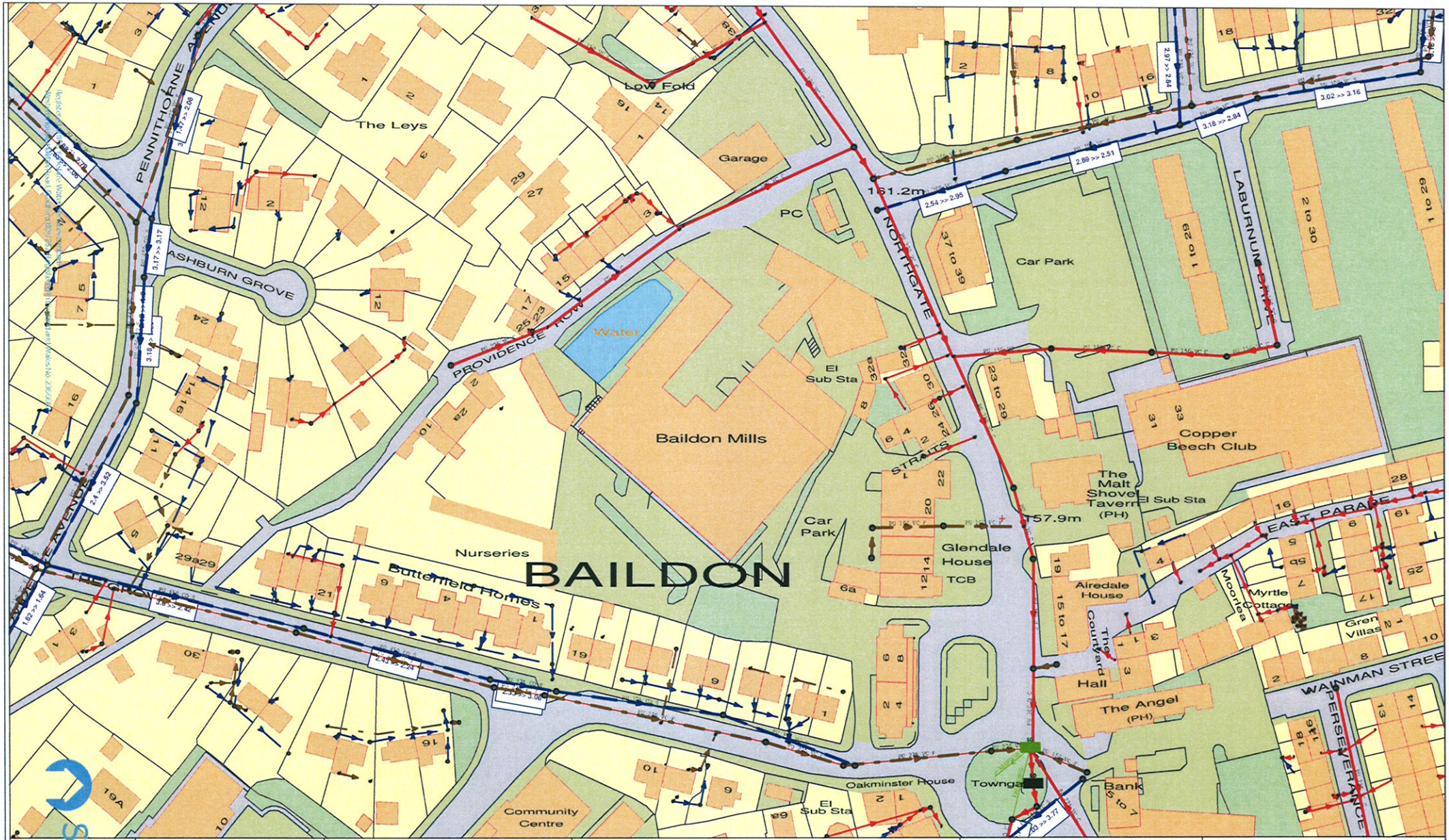
Map of X: 415,465; Y: 439,821 at scale 1:10,000

Data search



APPENDIX G

EXTRACT FROM THE PUBLIC SEWER RECORDS



SafeMove
A part of YorkshireWater

415192 : 439675	Map Name : SE1539NW	Title	Partial Key
YorkshireWater Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : jacklin Contact Tel :		Notes	Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
			Date Req : 31/05/2016, 09:05:22 Source : Sewer Network Enquiry

This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.

Date Gen : 31/05/2016, 09:05:23

UPN: Undefined Originator: jacklin, ,