John Newton and Partners
jnpgroup
Consulting Engineers

Title: **Flood Risk Assessment:**
Proposed Development
Hoyle Ing DyeWorks
Hoyle Ing
Linthwaite
Huddersfield
HD7 5QS

For: **James Dyson Directors' Pension Scheme**

Prepared by: **Chris Yates**

Date: **23rd March 2011**

Ref: **NG7621/HOY/FRA**

Amersham
Brighouse
Leamington Spa
Sheffield
Thames Gateway

Chkd: SE

REPORT ON ENVIRONMENTAL IMPACT ASSESSMENT (FLOODING) ON PROPOSED DEVELOPMENT OF HOYLE ING DYE WORKS, LINTHWAITE, HUDDERSFIELD

Appended documents:

- Appendix A Requirements of PPS25
- Appendix B Site Location Map
- Appendix C Photographs of Existing Site
- Appendix D Proposed Development Layout
- Appendix E Environment Agency Indicative Groundwater Map
- Appendix F Environment Agency Detailed FRA Map
- Appendix G Environment Agency Asset Location Map
- Appendix H Environment Agency Colne and Holme Flood Mapping Study, ISIS Hydraulic model Summery Sheets
- Appendix I Yorkshire Water Sewer Records

1. INTRODUCTION

1.1. Terms of Reference

1.1.1. JNPGroup was commissioned by Robert Halstead Charted Surveyor to undertake a Flood Risk Assessment (FRA) for the proposed redevelopment of Hoyle Ing Dye Works in Linthwaite, Huddersfield. The proposed site layout is shown in Appendix D.

1.1.2. The flood risk proposals are to be prepared in accordance with the Planning Policy Statement 25 (PPS25) Development and Flood Risk. See summary in Appendix A.

1.1.3. An assessment on the drainage proposals for the site will be conducted and reference to this will be included in this report.

1.2. Site Description

1.2.1. The total site to be considered in this report is split into two individual development sites by Manchester Road passing through.

1.2.2. To the south east of Manchester Road lies the greater part of the site covering an area of approximately 3300m^2.

1.2.3. This area is a combination of existing buildings which collectively make up the now inoperative Hoyle Ing Dye Works.

1.2.4. The south west boundary to this part of the site is formed by Hoyle Ing, an adopted road at a gradient of approximately 1 in 6 falling down towards Manchester Road.

1.2.5. The south east and north east boundaries are formed by properties and garden space.

1.2.6. The north west boundary is formed by Manchester Road.

1.2.7. To the north west of Manchester Road is the smaller area of the site which housed the water treatment and effluent plant for the Hoyle Ing Dye Works. The approximate size of this site is 700m^2.

1.2.8. The two sites are linked via a service tunnel which runs under Manchester Road.

1.2.9. The site extends to the north west down to the River Colne. This area of land drops from a level of approximately 127.00m at the rear of the water treatment and effluent plant, to a level of approximately 112.08m on the bank of the River Colne. Given that this drop is over an approximate distance of 10.0m the banking is very steep and unsuitable for development purposes.

1.2.10. The site co-ordinates are as follows:

OS X (Eastings)	409783
OS Y (Northings)	414549
Nearest Post Code	HD7 5QS
Lat (WGS84)	N53:37:39 (53.627383)
Long (WGS84)	W1:51:13 (-1.853550)
LR	SE097145
mX	-206336
mY	7065471

1.3. Proposed Development

1.3.1. *South east of Manchester Road*

1.3.1.1. The proposed development for the larger area of the site consists of converting an existing warehouse into 5 houses, a separate warehouse building to the north into a single residence and the rest of the site will have 6 new build town houses and 2 flats.

1.3.1.2. The residential development will comprise the following:-

- Impermeable areas such as roofs, roads and car parking areas.
- Permeable areas such as private gardens and soft landscaped areas.

1.3.1.3. Refer to Appendix D for overview of proposed development layout.

1.3.2. *North west of Manchester Road*

1.3.2.1. The proposals for this area of site are still being developed. It is likely that a small number of residential dwellings will be located on the site with their own parking facilities.

2. FLOOD RISK ASSESSMENT

2.1. Flood Risk from Watercourses

2.1.1. *General Observations*

2.1.1.1. To the north west of the site flows the River Colne. Beyond the River Colne, approximately 160m to the north west is the Huddersfield Narrow Canal.

2.1.1.2. The Environment Agency indicative flood outline map shows part of the existing site to be located in **Flood Zone 3.** This land is assessed as having an annual probability of 1% or greater for flooding from rivers. Refer to Appendix F for The Environment Agency's indicative flood map.

2.1.1.3. The banking which falls from the back edge of the water treatment and effluent plant, to the River Colne falls approximately 15m over a 10m distance

2.1.2. *Further Investigation*

2.1.2.1. *The Environment Agency*

2.1.2.1.1. The Environment Agency were contacted for flood modelling information along the River Colne.

2.1.2.1.2. The section which is most relevant to this site was at **chainage 12871**. This information can be found in appendix H

2.1.2.1.3. At Chainage 12871 the section is taken through part of the development site. It reveals that the water level for the 1% AEP is 112.660m AOD. For the more extreme event, the 0.1% AEP, the water level given is 114.121m AOD. The level for the lowest point on our client's site where development is likely to take place is 127.00m AOD. This is a difference of 12.897m between the worst anticipated flood water level and the site.

2.1.2.2. *The Strategic Flood Risk Assessment*

2.1.2.2.1. The Strategic Flood Risk Assessment[1] (SFRA) carried out for Kirklees Council in November 2008 does not indicate the area in which the site is located to be at any great risk from flooding. It generalises that flood risk increases along the River Colne downstream of its confluence with the River Holme, which is a significant distance downstream from our site.

2.2. Flood Risk from Groundwater

2.2.1. *General Observations*

2.2.1.1. The site is a brownfield site which has to our knowledge no historic problems with groundwater flooding.

2.2.1.2. The site is not located in a groundwater source protection zone.

2.2.1.3. The Environment Agency bedrock designation aquifer map shows the site and its surrounding area to be classified as a Secondary A aquifer

2.2.1.4. Refer to Appendix E for The Environment Agency's groundwater maps with descriptions.

2.2.2. *Further Investigation*

2.2.2.1. The Strategic Flood Risk Assessment[1] (SFRA) carried out for Kirklees Council in November 2008 does not indicate the area of Linthwaite to be at risk from groundwater flooding.

1.KIRKLEES COUNCIL
CALDER VALLEY
STRATEGIC FLOOD RISK ASSESSMENT
STAGE 1
NOVEMBER 2008
FINAL REPORT

2.3. Flood Risk from Public Sewers

2.3.1. *General Observations*

2.3.1.1. The topography of the site dictates that the southeast boundary will be the high point on the site. The adopted highway called Hoyle Ing runs from the high point of the site to the low point of Manchester Road.

2.3.1.2. Any water from a surcharged public sewer on Hoyle Ing will take the route down to Manchester Road and flow in a south westerly direction along Manchester Road.

2.3.1.3. Any proposed site entrances from Hoyle Ing will have to ensure that any run off from the existing highway will continue to take the current route down to Manchester Road.

2.3.2. *Further Investigation*

2.3.2.1. Public sewer maps were obtained from Yorkshire Water to establish the position and size of any public sewers on the site or in close proximity to the site.

2.3.2.2. A 225 diameter surface water sewer runs parallel to the rear of the south east boundary of the site, which in turn cuts across the development site. Any construction works in this location must adhere to current Yorkshire Water guidelines.

2.3.2.3. We do not foresee any physical flooding issues from public sewers. The natural fall of the land is away from our site and leads down Hoyle Ing.

2.3.2.4. Refer to Appendix I for Yorkshire Water sewer maps.

2.4. Site Walkover

2.4.1. *General Observations*

2.4.1.1. A site walkover was undertaken on the 17th January 2011 when the weather was good with sunny spells. There was evidence of recent rainfall as the ground was wet under foot. A tour of the inside of the buildings was conducted by the current site owner, followed by a walkover of the external areas around the building and also down to the River Colne.

2.4.1.2. Internally were down pipes from the north light roof structure which we were informed drained into the same system as the foul drains and the current owners paid a premium to Yorkshire Water for this privilege.

2.4.1.3. A bore hole is located on the site which was used for abstracting water for industrial processes on the site. This bore hole has been capped off but is in a position to be made operational if required.

2.5. Sequential and Exception Tests

2.5.1. In accordance with PPS 25 Table D.2 the development of Buildings used for dwelling houses is classed as "More Vulnerable".

2.5.2. The proposed development will take place in Flood Zone 1 (annual probability of <0.1% for flooding from rivers).

2.5.3. In accordance with PPS25 Table D.3, "More Vulnerable" development in Flood Zone 1 is classed as appropriate for the development and so sequential and exception tests are not required.

2.6. Flood Defence

2.6.1. Asset Location Data was included in the information pack obtained from The Environment Agency. This shows that there is a maintained open channel where the proposed site backs onto the River Colne. This asset would be privately maintained by the landowner and has an asset condition rating of 3 which is described as fair.

2.6.2. See Appendix G for The Environment Agency Asset Location Map

2.7. Flood Flow Path from River

2.7.1. If water levels were to rise along the River Colne, water would breech the river bank at Bargate Bridge, approximately 110metres upstream of the proposed site.

2.7.2. The Environment Agency Flood Map indicates that the flood waters would breach the right hand bank as you look up stream from Bargate Bridge and flood an area west of Bargate Road. This is indicated as Flood Zone 3 which has a 1% AEP.

2.7.3. For Flood Zone 2 which has a 0.1% AEP, the flood waters extend to flood an area between the River Colne and the Huddersfield Narrow Canal to the north. This flood area extends North up to Scarwood Bridge.

2.7.4. As the proposed site forms a boundary with the River Colne, flood water does encroach 2.04m up the banking towards the existing water effluent and treatment works.

2.7.5. See Appendix F for The Environment Agency Flood Map

2.8. Safe Means of Escape

2.8.1. All developable areas of the site are situated in Flood Zone 1 so a safe means of escape is available at all times.

2.8.2. Floor levels for the proposed development should be above 114.75m AOD. This gives a 600mm freeboard from the 0.1% AEP water level.

2.9. Floodplain Mitigation/Compensation

2.9.1. This is not applicable for this site, as no building will take place on floodplain areas.

3. RUN OFF ASSESSMENT

3.1. Existing Site Run-Off

3.1.1. The existing site is entirely made up of hardstanding surfaces, the majority of which are roofs. Due to the presence of north light roofs and roof pitches sloping to areas abutted by other buildings, part of the existing drainage solution is to have internal down pipes.

3.1.2. The internal down pipes discharge into the waste water system within the building and flow into the adopted combined sewer running alongside the bank of the River Colne. Special permission was agreed with Yorkshire Water for this arrangement.

3.1.3. The buildings along the perimeter of Manchester Road and Hoyle Ing discharge surface water directly on to the adjoining footways. The exception to this is an area to the rear of the site at the boundary with Hoyle Ing. This area was found to be positively drained into either the surface water sewer or the combined sewer, both adopted by Yorkshire Water in Hoyle Ing.

3.1.4. Further investigation by CCTV of this area is recommended to establish definite outfall points for the buildings in this vicinity.

3.2. Proposed Site Run-Off

3.2.1. *Discharge to Sustainable Urban Drainage System (SUDS)*

3.2.1.1. The proposed development will have less impermeable areas than the existing due to gardens being part of the proposed scheme.

3.2.1.2. In accordance with Environment Agency guidelines, the Building Regulations and Water Authorities advice, the preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration drainage system. Draining to SUDs, such as soakaways, storage tanks and permeable paving, reduces the impact of urbanisation on watercourse flows. This ensures the protection and enhancement of water quality and encourages recharge of groundwater in a manner which mimics nature.

3.2.1.3. There has been no site investigation and the use of SUDS has to be considered until proved otherwise. The following forms of sustainable drainage options have been evaluated to establish which solutions may be best suited to the site (See Table 2).

Table 2: Evaluation of sustainable drainage options

Component	Recommendation
Swales	Swales are used on site to convey and/or store runoff, as well as infiltrate water into the ground. The size of the proposed development means that swales would most likely be impractical for a drainage solution on this site.
Infiltration structures – basins, soakaways, etc.	Infiltration devices are used on site to store surface runoff and infiltrate water into the ground. The use of infiltration devices is dependent upon a suitably free draining sub-soil.
Wet ponds	The potential for a small pond would be unsuitable for a site of this size.
Pervious surfaces	The use of pervious surfaces would be a posible sustainable option to incorporate into the proposed development as it utilises hardstanding areas to manage runoff rates, volumes and water quality.
Green roofs	Green roofs are more suited to large buildings such as apartment block and offices due to the need for large relatively flat areas of roof space.

N.B It should be noted that PPG 3 (DETR 2000) calls for higher density housing developments, but also requires all developments to provide sufficient provision for open space and playing fields where such places are not already adequately provided for within easy access of new housing. Therefore, a balance needs to be found whereby appropriate SUDS solutions reflect the available space, in order for them to work effectively.

3.2.1.4. If SUD's are used on the scheme for surface water discharge, it is considered that any flooding issues downstream of the watercourse will not be affected negatively by the proposed development.

3.2.1.5. Analysis of a ground investigation study will assess whether or not there is a groundwater contamination risk. The site lies outside a Ground Water Source Protection Zone.

3.2.2. *Discharge to a Watercourse*

3.2.2.1. The River Colne runs to the north west of the site. It flows downstream in a north easterly direction towards the centre of Huddersfield.

3.2.2.2. The site owner would have rights to discharge into this watercourse as it borders the proposed site on the north west boundary.

3.2.2.3. Although the site abuts up to the River Colne, to construct a new outfall would prove difficult and expensive because of the steep banking between the River Colne and the developable area.

3.2.3. *Discharge to Public Sewers*

3.2.3.1. The option to discharge to local public sewers which currently exist along the highway known as Hoyle Ing has to be considered if soakaways are discounted.

3.2.3.2. Yorkshire Water Sewer records show that the nearest existing surface water drainage is located along the rear of the proposed site and this deviates down Hoyle Ing under Manchester Road and down to an outfall in the River Colne.

3.2.3.3. The manhole in the rear yard area is shown as a Yorkshire Water manhole on their records. During the site walkover this manhole was lifted and was found to have surface water drainage flowing through. It was difficult to determine if this sewer had a connection at some point along it's length from the adjacent building roof drainage on the development site. A CCTV survey would be necessary to confirm this either way.

4. PROPOSED DRAINAGE ASSESSMENT

4.1. Surface water drainage

4.1.1. Plot, highway and car parking surface water drainage is recommended to be taken to soakaway

4.1.2. If soakaways are not viable following a ground investigation report, surface water should be taken to the existing surface water sewer in Hoyle Ing. Although Yorkshire Water have said that the local sewers do not have capacity to accept water from any new development, if it can be proved by CCTV that part of the current complex positively drains to the adopted surface water sewer, then the proposed site would be entitled to the same rate of discharge to that from the existing use of the site. Discharges to the public sewer must also take into account a 30% reduction in existing discharge and climate change.

4.1.3. To limit the discharge rate from the development would require a flow restrictor and surface water storage on site.

4.1.4. If, after further investigation, no existing surface water runoff is shown to make its way to the adopted surface water sewer, then an outfall should be constructed into the neighbouring River Colne.

4.2. Foul water drainage

4.2.1. Foul water from the proposed development should be drained to the 300 diameter foul water sewer running along Manchester Road, as set out in Yorkshire Waters pre planning enquiry.

4.2.2. An alternative is to re-use the abandoned trade waste connection from the dye works which runs from the north west site to the sewer on the bank of the River Colne. This is assuming the connection and pipes have not been grouted up or grubbed out.

4.2.3. See Appendix I for Yorkshire Water Sewer Records.

5. CONCLUSIONS AND RECOMMENDATION

- Due to part of the subject site being in Flood Zone 3, the development of the site requires a Flood Risk Assessment which reviews all aspects of flood risk to the site and proposes a strategy for the discharge of surface water runoff in a manner which will not increase the risk of flooding either on or off site.

- The proposed development has been positioned within Flood Zone 1, therefore, a Sequential Test is not required.

- In accordance with PPS25 Table D.3 "More Vulnerable" development in Flood Zone 1 is classed as appropriate development.

- The preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration drainage system. SUDS, such as soakaways, storage tanks and permeable paving, can reduce the impact of urbanisation on watercourse flows. This ensures the protection and enhancement of water quality and encourages recharge of groundwater in a manner which mimics nature.

- To determine the feasibility of using infiltration techniques, a detailed site investigation should be carried out. This study involves preliminary investigations relating to contamination, subsoil ground conditions and soakage rates. The results of the investigation with respect to infiltration should be evaluated and the appropriate drainage method agreed.

- If soakaways are discounted as an option for the site a CCTV survey should be carried out to determine if any surface water from the site positively drains to any of the adopted sewers, either in Hoyle Ing or to the rear of the sites south east boundary.

- All infiltration devices will be designed in accordance with BRE 365 or CIRIA 156 and should provide adequate storage for the 1 in 30 year storm event. Additional on site storage should be provided for up to the 1 in 100 year event + 30% climate change allowance, with no risk of flooding to dwellings.

- If the site investigation shows soakaways / infiltration is not suitable, surface water should discharge to the watercourse which passes along the site boundary. This ideally would be via the Yorkshire Water sewer passing the site. A run off rate would have to be agreed with the Yorkshire Water and storage would be needed on site for additional volumes.

- Therefore, the proposed development has an acceptable flood risk within the terms and requirements of PPS 25.

- The comments stated above are based on information received from other consultees. The flood risk classification of this site has been based on the above observations, and the recommendations stated. This report is intended for the use of the developer of the site in support of their planning application for the site only.

Signed by: .....

Chris Yates

Signed by: .....

Stuart Evans
BEng CEng MICE MIStructE

FOR AND ON BEHALF OF JNP GROUP

Date: 23rd March 2011

APPENDIX A: Requirements of PPS25

Summary

1. The guidance states that:

2. The susceptibility of land to flooding is a material planning consideration;

3. The Environment Agency has the lead role in providing advice on flood issues, at a strategic level and in relation to planning applications;

4. Planning decisions should apply the precautionary principle to the issue of flood risk, using a risk-based search sequence to avoid inappropriate development on undeveloped and undefended flood plains etc;

5. Developers should fund flood defences and warning measures required because of the development;

6. Planning policies and decisions should recognise that the consideration of flood risk and its management needs to be applied on a whole-catchment basis and not only be restricted to flood plains.

7. With regard to PPS25, those proposing particular developments are responsible for;

8. Providing an assessment of whether any proposed development is likely to be affected by flooding and whether it will increase flood risk elsewhere and the measures proposed to deal with these effects and risks;

9. Satisfying the local planning authority that any flood risk to the development, or additional risk arising from the proposal will be successfully managed with the minimum environmental effect thus ensuring the safe development and secure future occupancy of the site.

10. After this has been addressed, it is then the local planning authority's responsibility (advised as necessary by the Environment Agency) to determine an application for planning permission after taking into account all material considerations, including the issue of flood risk and how it might be managed or mitigated. Local planning authorities are required to adopt a risk-based approach to proposals for development in flood risk areas. The assessment of risk should take into account:

    a. The area liable to flooding;
    b. The probability of it occurring, both now and over time;
    c. The extent and standard of existing flood defences and their effectiveness over time;
    d. The likely depth of flooding;
    e. The rates of flow likely to be involved; and
    f. The nature of the development proposed and the extent to which it is designed to deal with flood risk.

11. Local planning authorities in conjunction with the Environment Agency are responsible for determining that the threat of flooding should be managed. This is to ensure that the development is and remains safe throughout its lifetime (i.e. it has an ***appropriate*** degree of protection) and does not increase flood risk elsewhere.

12. Following flooding in December 2000 the Environment Agency provided indicative flood plain maps to all authorities and published them on the EA web site. In addition to these indicative maps (following a national programme adopted by the Agency in 1996), detail data and maps for priority areas at risk are available, to provide precise information for building developments.

13. The Government looks to local planning authorities under PPS25 to apply the risk-based approach to their decisions on development control through a sequential test. Under the test, sites are to be categorised under the following.

14. **Areas with little or no potential risk of flooding (annual probability less than 0.1% for rivers, tidal & coastal)** - These areas would have no constraints on development other than the need to ensure that the development does not increase run-off from the site to greater than that from the site in its undeveloped or presently developed state.

15. **Areas with low potential risk of flooding (annual probability between 1.0% - 0.1% for rivers and between 0.5% - 0.1% for tidal & coastal)** - These areas would be suitable for most developments including the current proposals for residential with nursery and surgery.

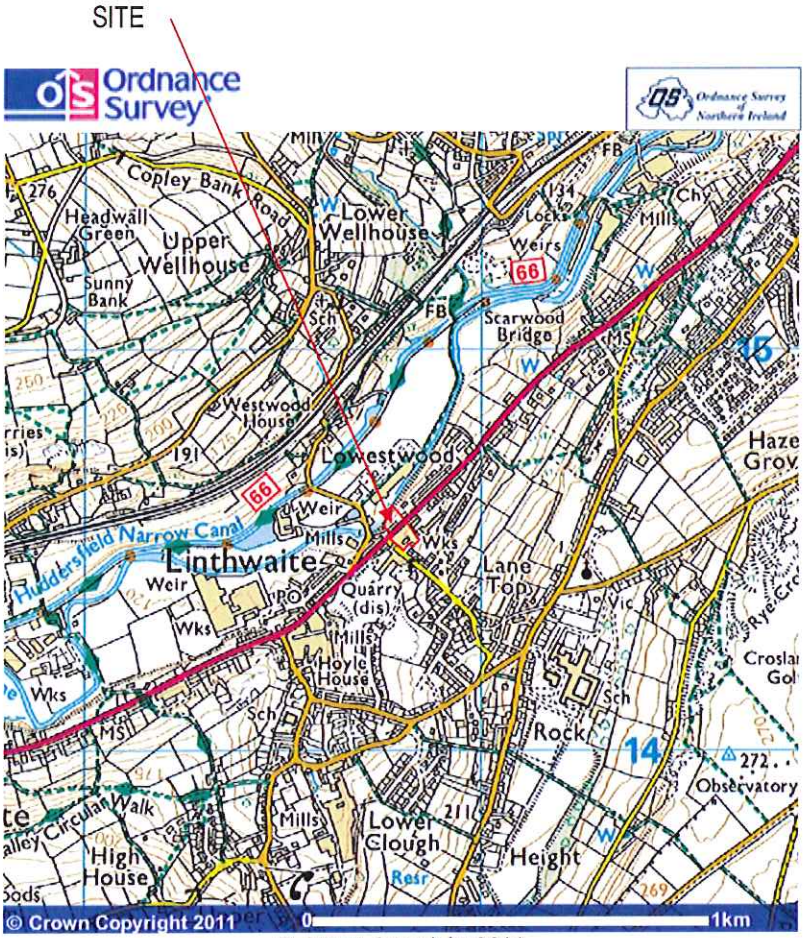
16. **Areas with high potential risk of flooding (annual probability greater than 1.0% for rivers and greater than 0.5% for tidal & coastal).** - These areas will generally be suitable for residential, commercial and industrial uses, provided there are adequate flood defences in place that ensure buildings are designed to resist flooding, there are suitable warning and evacuation procedures in place and the new development does not add to flood risk downstream.

17. **Areas at highest risk from flooding (including those areas behind defences that offer a standard of defence less than 1% for rivers and less than 0.5% for tidal & coastal or where there is a significant risk that failure could lead to rapid inundation by fast flowing water)** - These areas may be suitable for recreation, sport, amenity and conservation use.

APPENDIX B

SITE LOCATION MAP

APPENDIX B: Location Map



www.ordnancesurvey.co.uk/**getamap**

Image produced from Ordnance Survey's Get-a-map service.
Image reproduced with permission of Ordnance Survey and
Ordnance Survey of Northern Ireland.

Site boundary shown in red

APPENDIX C

PHOTOS OF EXISTING SITE

Photo 1 - View of Hoyle Ing Dye works on Manchester Road, looking north east

Photo 2 - View of Hoyle Ing Dye works on Manchester Road, looking south west

Photo – 3 View of Hoyle Ing (Adopted Road) with Dye works on the left

Photo – 4 View of site to the north west (Existing water treatment and effluent plant)

Photo 5 – The River Colne looking north. Proposed site above the banking to the right.

Photo 6 – The River Colne looking South from Bargate Bridge

Photo 7 – View of banking below the development site. Out fall from Yorkshire Water sewer can also be seen as a brick structure on the River bank.

Photo 8 – Rear yard area on the south east boundary of the site

APPENDIX D

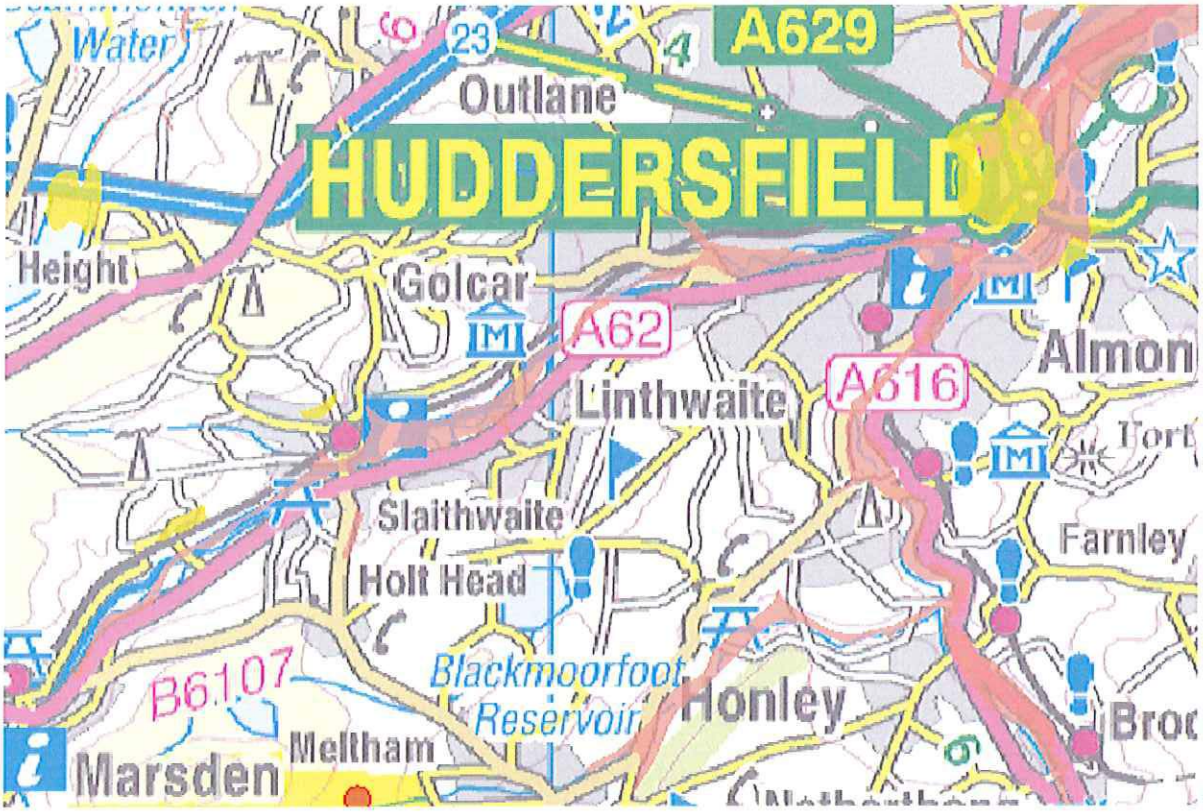
PROPOSED DEVELOPMENT LAYOUT

APPENDIX E

ENVIRONMENT AGENCY INDICATIVE GROUND WATER MAPS

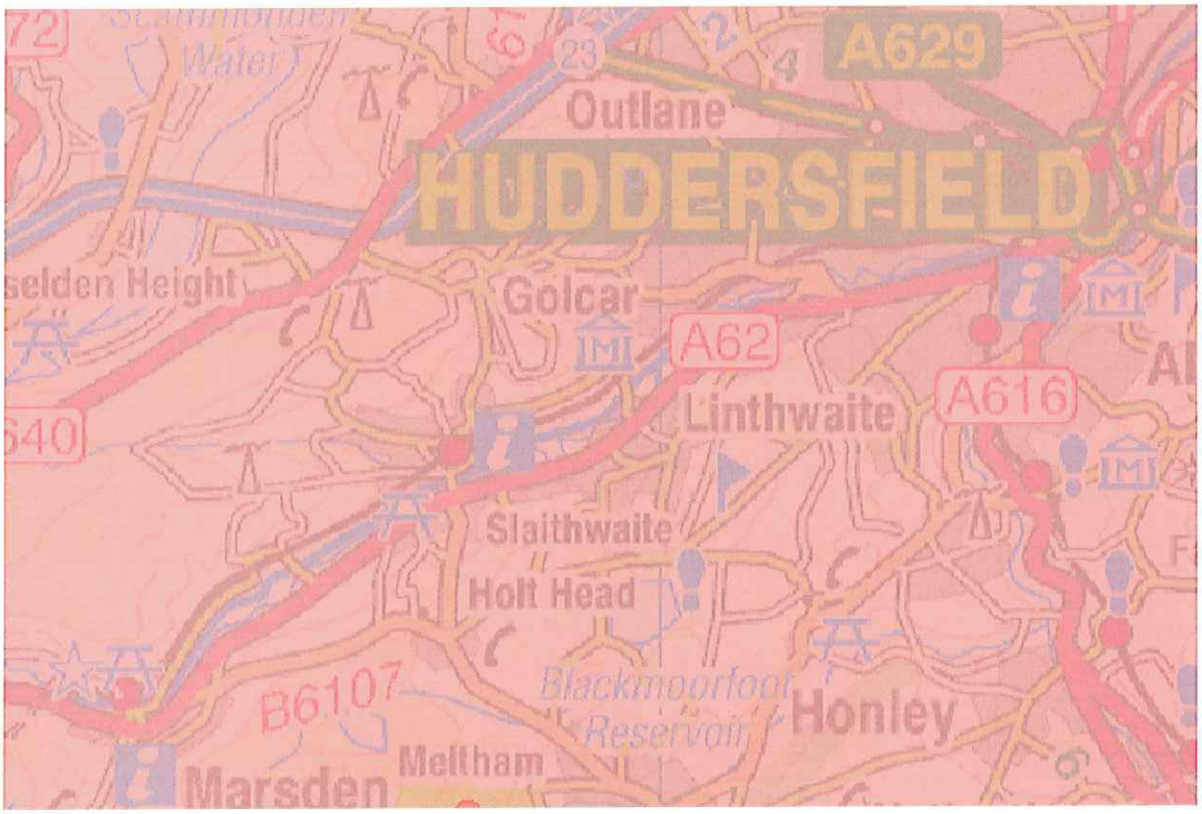
APPENDIX E: Environment Agency Indicative Groundwater map (Website)

Aquifer Maps - Superficial Deposits Designation



Secondary A - 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. These are generally aquifers formerly classified as minor aquifers

Aquifer Maps - Bedrock Designation

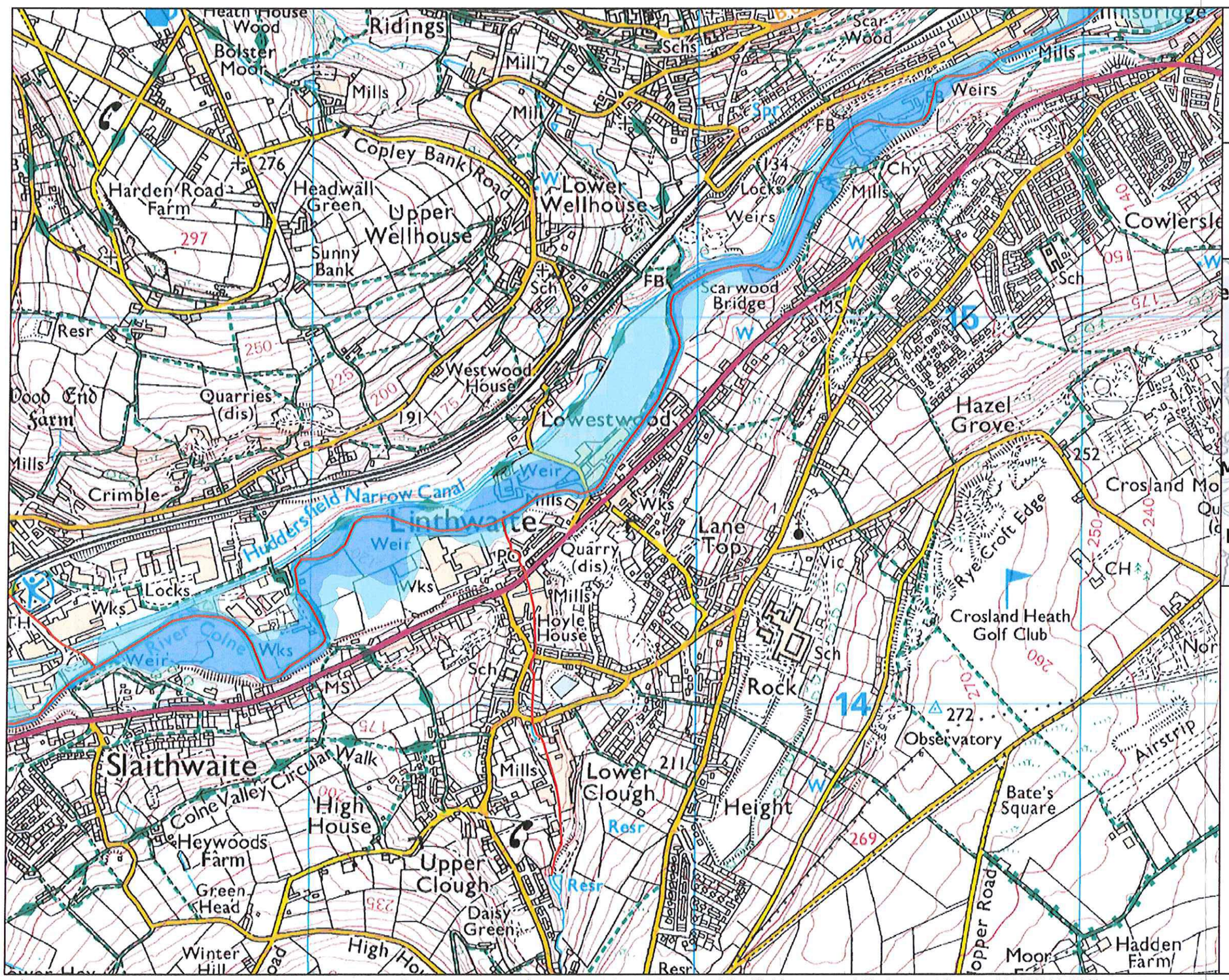


Secondary A - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

APPENDIX F

THE ENVIRONMENT AGENCY
DETAILED FRA MAP

Detailed FRA Map Centered on [Stoney Battery Road, Huddersfield] - Date Created 28/01/2011 [Ref: 16055]



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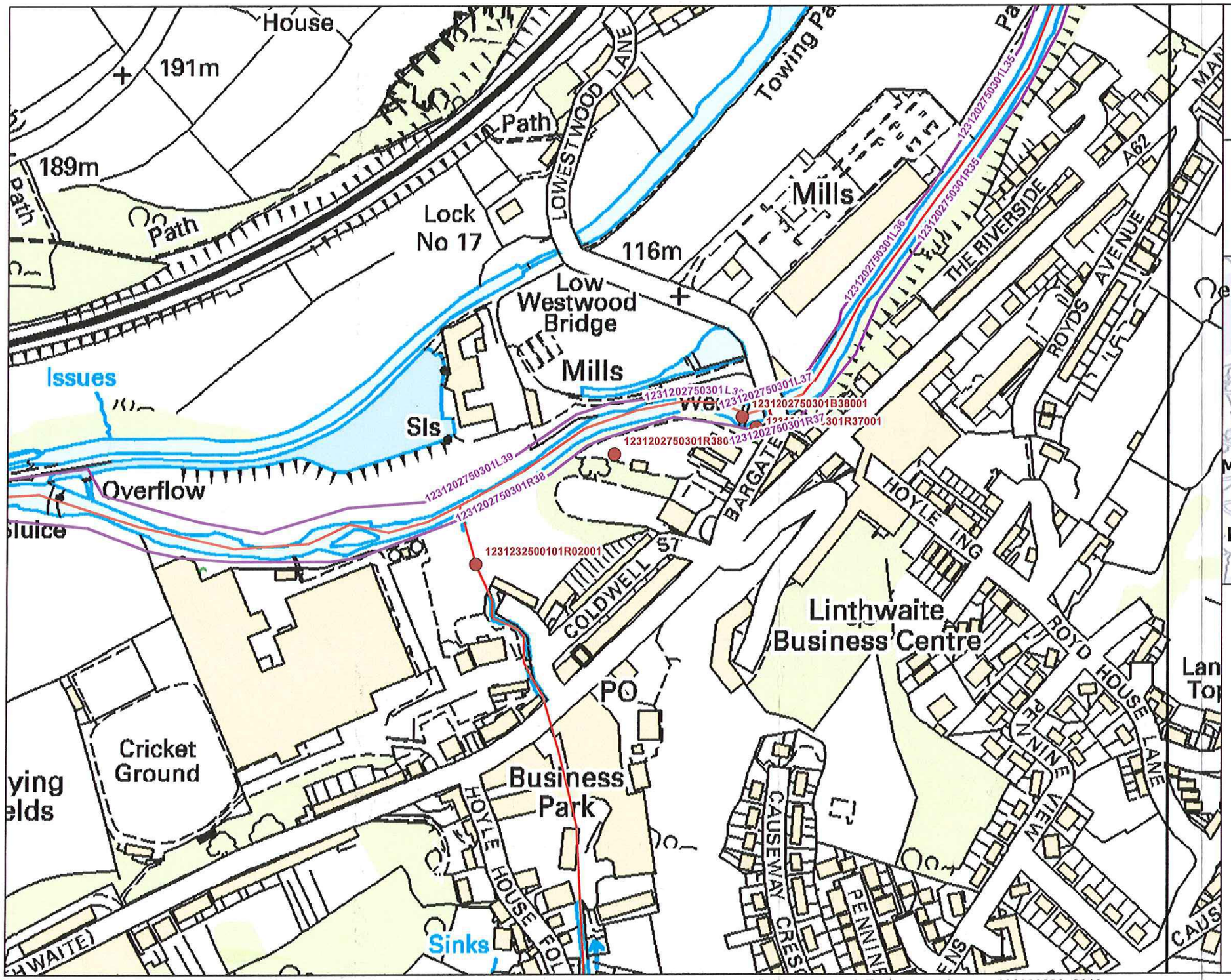
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

APPENDIX G

THE ENVIRONMENT AGENCY
ASSET LOCATION MAP

Asset Location Map Centered on Stoney Battery Road, Huddersfield - Date Created 04/02/2011 [Ref: 16055]



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LEGEND

- Structures
- Defences
- Main Rivers

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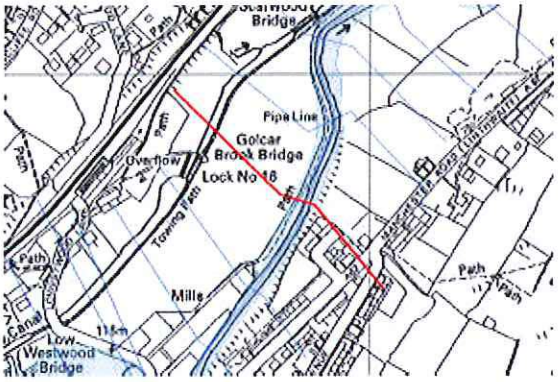
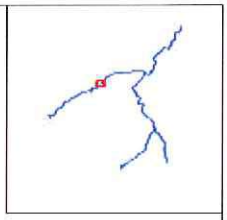
APPENDIX H

THE ENVIRONMENT AGENCY
COLNE AND HOLME FLOOD MAPPING STUDY
ISIS HYDRAULIC MODEL SUMMERY SHEETS

Location Plan



Cross Section References



River: COLNE

Reach: 03

Chainage: 12631

Section Type: SECTION

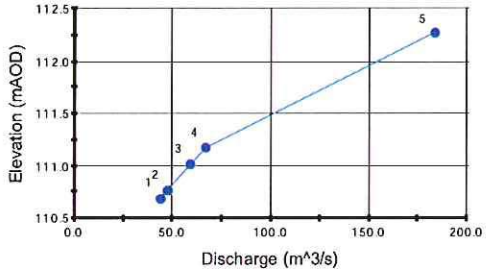
OS NGR: SE 09914 14826

Survey Dwg Ref: N/A

Photograph Ref: COLN03_12631.JPG

Next
Section d/s: 12511u
Section u/s: 12771

Rating Curve



Number represents model profile number

Summary of Results

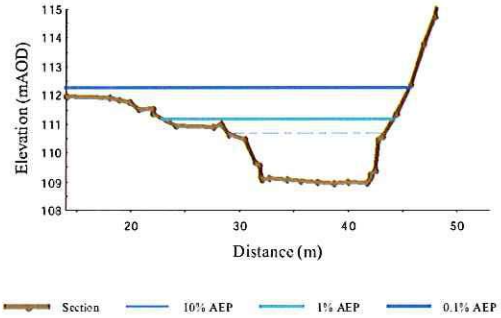
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	10.0	44.2	110.692	2.34
2	4.0	47.7	110.772	2.38
3	2.0	59.2	111.021	2.45
4	1.0	66.9	111.179	2.43
5	0.1	183.2	112.268	3.12

Level of Left Bank 111.767 mAOD

Level of Right Bank 116.658 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile

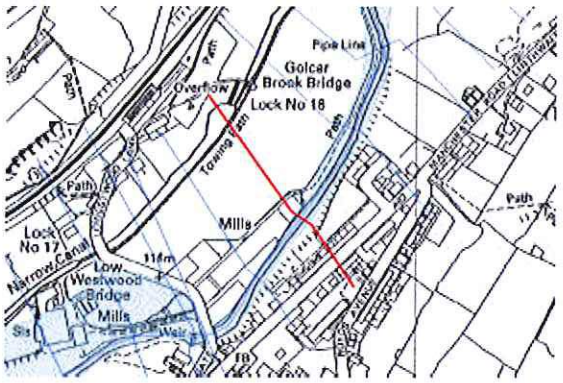


COLNE: 03: CROSS SECTION NUMBER 12631

Print Date: 29/03/2006

Environment Agency - North East Region
Colne and Holme Flood Mapping Study
ISIS Hydraulic Model Summary Sheet

Location Plan



Cross Section References

River: COLNE

Reach: 03

Chainage: 12771

Section Type: SECTION

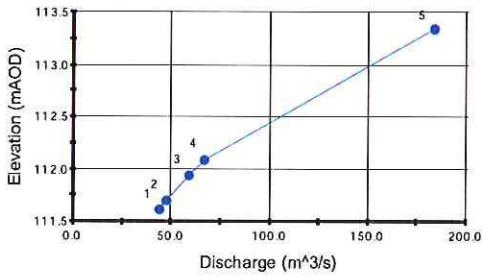
OS NGR: SE 09842 14707

Survey Dwg Ref: N/A

Photograph Ref: COLN03_12771.JPG

Next
Section d/s: 12631
Section u/s: 12871

Rating Curve



Number represents model profile number

Summary of Results

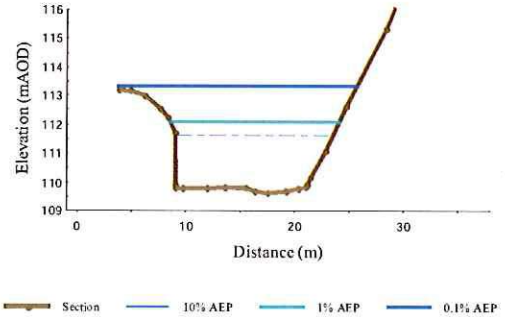
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	10.0	44.2	111.623	1.81
2	4.0	47.7	111.709	1.86
3	2.0	59.2	111.947	2.02
4	1.0	66.9	112.094	2.12
5	0.1	183.2	113.339	3.39

Level of Left Bank 113.178 mAOD

Level of Right Bank 119.899 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile

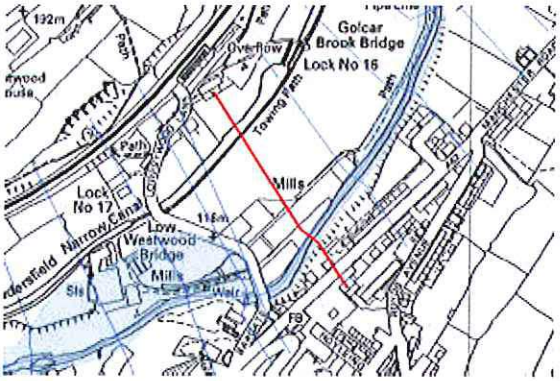


COLNE: 03: CROSS SECTION NUMBER 12771

Print Date: 29/03/2006

Environment Agency - North East Region
Colne and Holme Flood Mapping Study
ISIS Hydraulic Model Summary Sheet

Location Plan



Cross Section References

River: COLNE

Reach: 03

Chainage: 12871

Section Type: SECTION

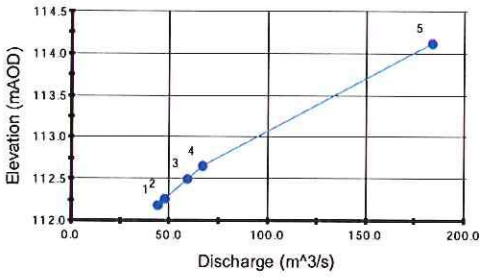
OS NGR: SE 09781 14628

Survey Dwg Ref: N/A

Photograph Ref: COLN03_12871.JPG

Next
Section d/s: 12771
Section u/s: 12981d

Rating Curve



Number represents model profile number

Summary of Results

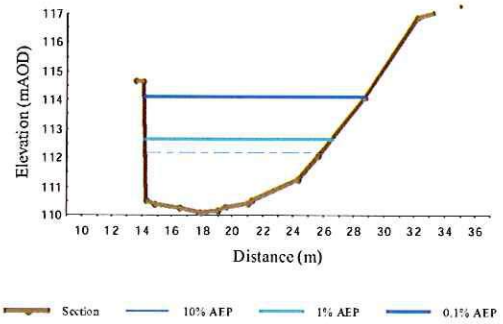
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	10.0	44.2	112.189	2.46
2	4.0	47.7	112.265	2.53
3	2.0	59.2	112.506	2.73
4	1.0	66.9	112.660	2.84
5	0.1	183.2	114.121	4.23

Level of Left Bank 114.655 mAOD

Level of Right Bank 116.864 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile

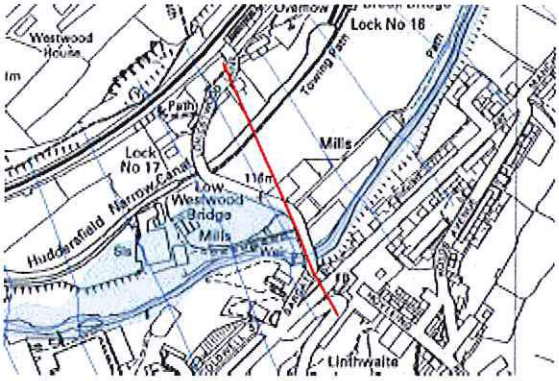


COLNE: 03: CROSS SECTION NUMBER 12871

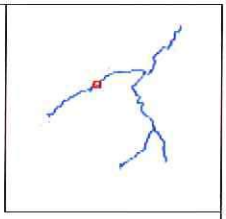
Print Date: 29/03/2006

Environment Agency - North East Region
Colne and Holme Flood Mapping Study
ISIS Hydraulic Model Summary Sheet

Location Plan



Cross Section References



River: COLNE

Reach: 03

Chainage: 12981

Section Type: BRIDGE, SECTION

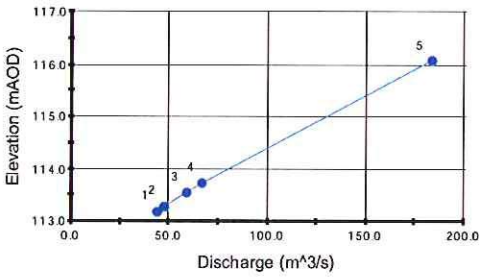
OS NGR: SE 09713 14548

Survey Dwg Ref: N/A

Photograph Ref: COLN03_12981.JPG

Next
Section d/s: 12981d
Section u/s: 13001d

Rating Curve



Number represents model profile number

Summary of Results

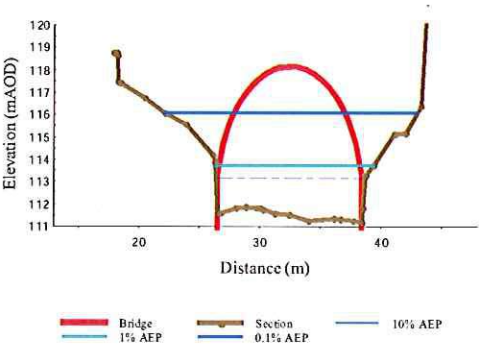
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	10.0	44.2	113.200	2.20
2	4.0	47.7	113.291	2.25
3	2.0	59.2	113.565	2.40
4	1.0	66.9	113.747	2.48
5	0.1	183.2	116.076	2.83

Level of Left Bank 118.755 mAOD

Level of Right Bank 120.923 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile

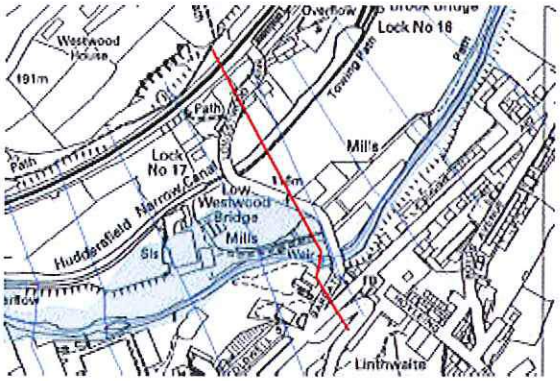


COLNE: 03: CROSS SECTION NUMBER 12981u

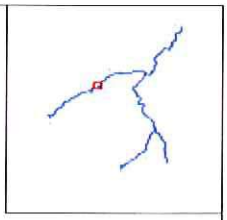
Print Date: 29/03/2006

Environment Agency - North East Region
Colne and Holme Flood Mapping Study
ISIS Hydraulic Model Summary Sheet

Location Plan



Cross Section References



River: COLNE

Reach: 03

Chainage: 13001

Section Type: SECTION, WEIR

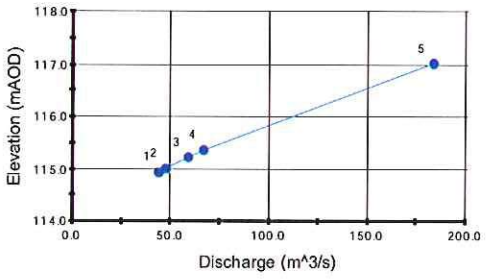
OS NGR: SE 09695 14545

Survey Dwg Ref: N/A

Photograph Ref: COLN03_13001.JPG

Next
Section d/s: 13001d
Section u/s: 13082

Rating Curve



Number represents model profile number

Summary of Results

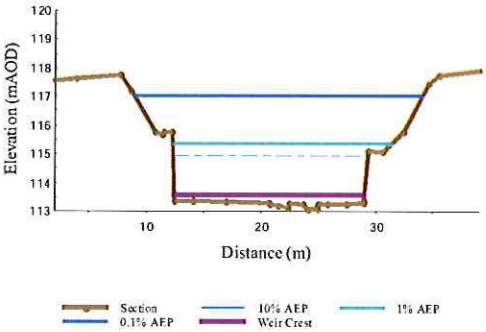
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	10.0	44.2	114.944	1.62
2	4.0	47.7	115.015	1.67
3	2.0	59.2	115.234	1.82
4	1.0	66.9	115.371	1.90
5	0.1	183.2	117.016	2.54

Level of Left Bank 117.746 mAOD

Level of Right Bank 117.435 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Weir Crest Profile
(Weir Type: Normal)

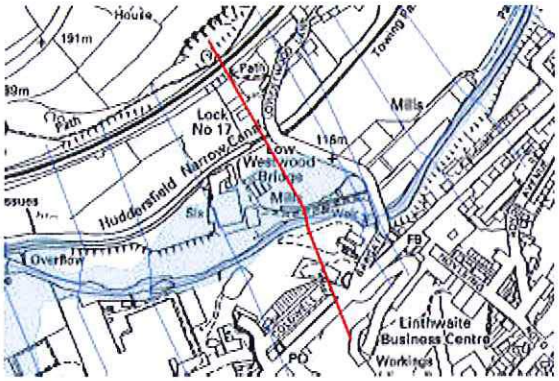


COLNE: 03: CROSS SECTION NUMBER 13001u

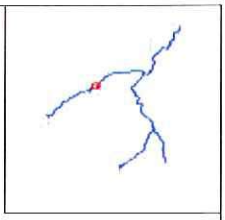
Print Date: 29/03/2006

Environment Agency - North East Region
Colne and Holme Flood Mapping Study
ISIS Hydraulic Model Summary Sheet

Location Plan



Cross Section References



River: COLNE

Reach: 03

Chainage: 13082

Section Type: SECTION

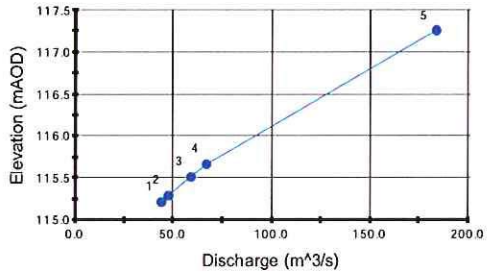
OS NGR: SE 09615 14545

Survey Dwg Ref: N/A

Photograph Ref: COLN03_13082.JPG

Next
Section d/s: 13001u
Section u/s: 13192d

Rating Curve



Number represents model profile number

Summary of Results

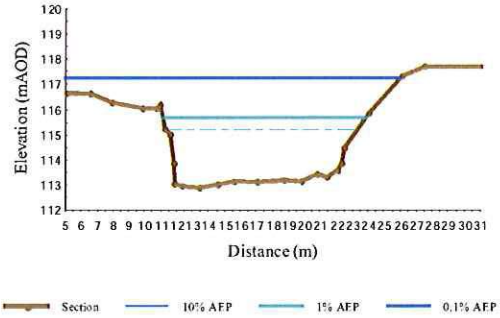
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	10.0	44.2	115.222	2.00
2	4.0	47.7	115.298	2.07
3	2.0	59.2	115.523	2.29
4	1.0	66.9	115.673	2.41
5	0.1	183.2	117.260	3.33

Level of Left Bank 116.188 mAOD

Level of Right Bank 117.344 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile

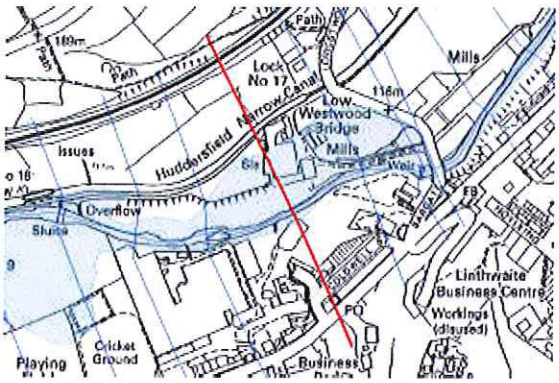


COLNE: 03: CROSS SECTION NUMBER 13082

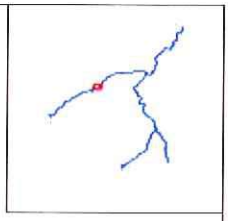
Print Date: 29/03/2006

Environment Agency - North East Region
Colne and Holme Flood Mapping Study
ISIS Hydraulic Model Summary Sheet

Location Plan



Cross Section References



River: COLNE

Reach: 03

Chainage: 13192

Section Type: SECTION

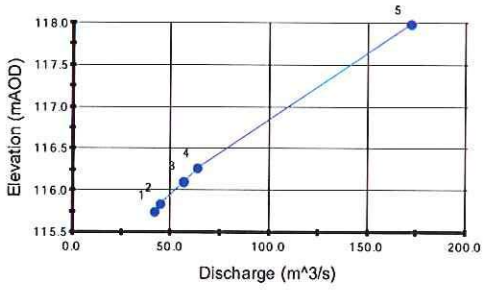
OS NGR: SE 09520 14492

Survey Dwg Ref: N/A

Photograph Ref: COLN03_13192.JPG

Next
Section d/s: 13192d
Section u/s: 13315

Rating Curve



Number represents model profile number

Summary of Results

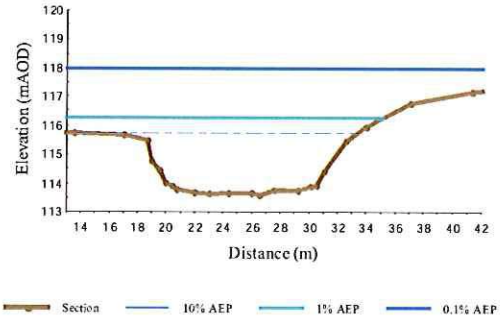
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	10.0	42.0	115.755	1.66
2	4.0	45.0	115.847	1.62
3	2.0	56.7	116.109	1.54
4	1.0	63.7	116.274	1.45
5	0.1	171.7	117.986	0.87

Level of Left Bank 115.497 mAOD

Level of Right Bank 116.772 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile

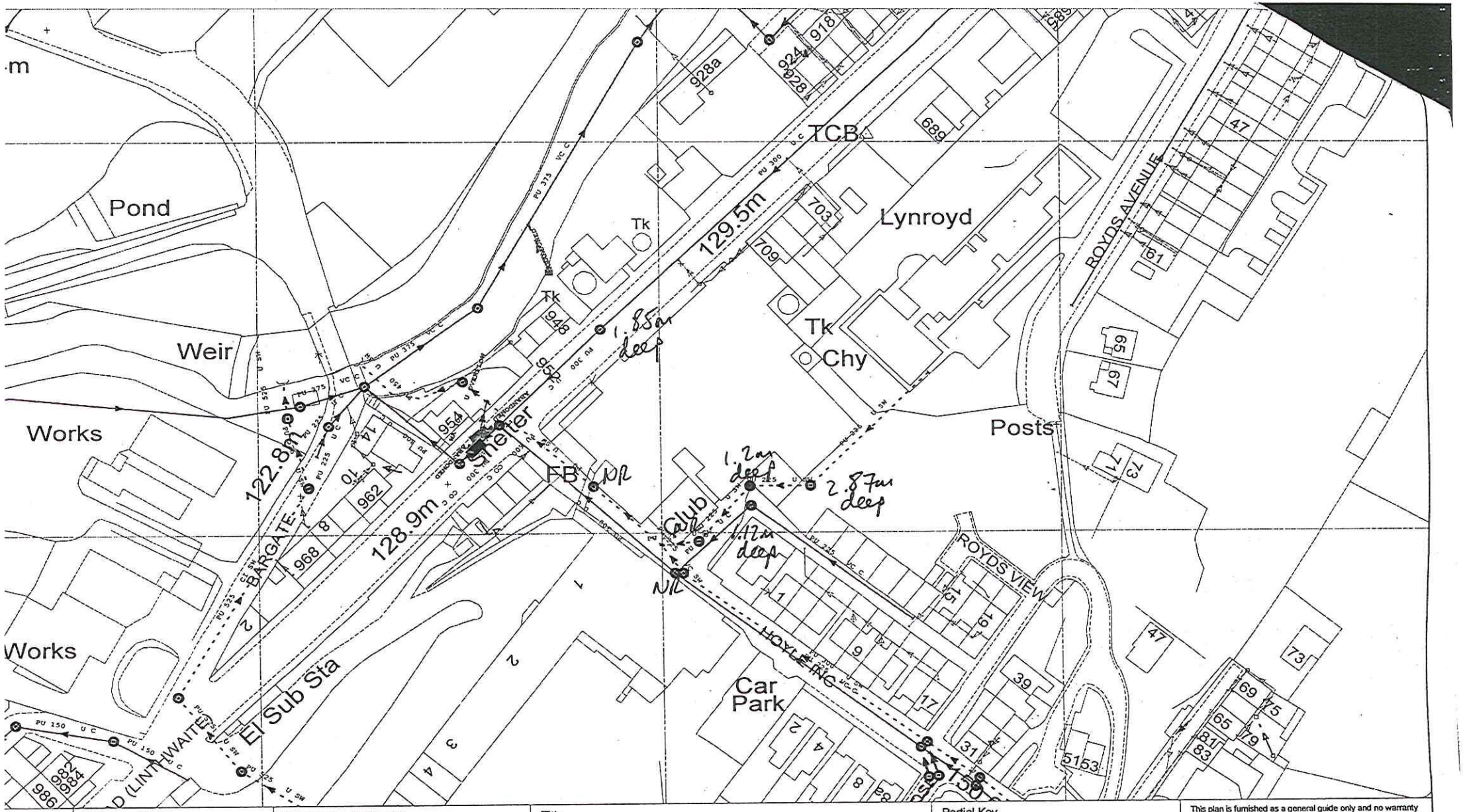


COLNE: 03: CROSS SECTION NUMBER 13192u

Print Date: 29/03/2006

APPENDIX I

YORKSHIRE WATER SEWER RECORDS



409637 : 414433	Map Name : SE0914SE	Title	Partial Key
Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : K KHAN Contact Tel :		Notes Nk - No recorded depth.	Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
YorkshireWater		(Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2004. All rights reserved Ordnance Survey Licence number 100019559	Date Req : 24/01/2011, 15:33:27 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 connection

Date Gen : 24/01/2011, 15:33:29

PN: Undefined Originator: K KHAN, New Development - Waste Water,