

FLOOD RISK ASSESSMENT ON HUDDERSFIELD ROAD MELTHAM



ON BEHALF OF HEYWOOD DEVELOPMENTS LTD

SEPTEMBER (INITIAL ISSUE)

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Flood Risk Assessment on Huddersfield Road, Meltham 1513/02r1					
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SEPTEMBER 2017

1.0 INTRODUCTION

- 1.1 Heywood Developments Ltd is proposing to develop a parcel of land located off Huddersfield Road, Meltham in Kirklees for residential dwellings. As part of the viability of the site and to supplement a planning application, it was decided that a Flood Risk Assessment Report should be undertaken.
- 1.2 It is within the general development strategy of the country for developments in areas where there is a risk of flooding to be assessed to avoid unnecessary increase in the requirement of flood defence. Under the National Planning Policy Framework (NPPF) and the accompanying Planning Practice Guidance (PPG), consultation is required with the Environment Agency, Land Drainage Authority and Water Authority and a Flood Risk Assessment Report should be prepared considering the development proposals and make recommendations for any flood mitigation measures.
- 1.3 ARP Associates have been appointed to carry out an assessment of the site, implement appropriate consultations and prepare a Flood Risk Assessment Report, in accordance with the NPPF, to satisfy the requirements of the Planning Authority.
- 1.4 The consultations and walkover survey have been carried out in September 2017.
- 1.5 The report has been initially prepared for the use and reliance of the Client only. The report shall not be relied upon or transferred to any other parties without the written agreement of ARP Associates. For the avoidance of any doubt, where ARP Associates enters into a letter of reliance for the benefit of a third party, that third party will be permitted to rely on the report. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party without ARP Associates consent.

2.0 SITE DESCRIPTION

General

- 2.1 The site is undeveloped greenfield land including a watercourse and public footpath in the centre of the site. The site is triangular in shape with a total area of approximately 1.37ha.

 The site is centred on Ordnance Survey Grid Reference SE 109 113.
- 2.2 A site location plan is presented in Appendix A.

Current Use

2.3 The site is presently a grassed field used for sheep grazing, and includes a public footpath running through the centre, adjacent to a watercourse.

Boundaries

2.4 The site is bounded by Huddersfield Road to the east and a disused railway to the west, which is now a public right of way called Meltham Greenway. The northern edge of the site tapers almost to a point, however, there is a short boundary along the property line for 245 Huddersfield Road. The southern boundary of the site is formed by the embankment down to an existing watercourse named Meltham Beck.

Topography and Vegetation

2.5 The site is generally covered in grass with an area of dense vegetation including semi-mature trees and large bushes in the centre of the site. This area includes an open watercourse with steep embankments, although as this flows further to the east of the site, the site levels drop so that the watercourse is at the same level as the surrounding area. Generally, the land falls to the east, although the southern portion falls to the south and southeast towards the watercourse. The high point of the site is in the western side at 148.42m A.O.D., with the low

point of 137.64m A.O.D. in the southeast corner. The site is at a higher level than Huddersfield Road in the northeast and lower than the adjacent Huddersfield Road in the southern portion of the site. There are trees located on the western and southern boundaries and through the centre of the site near the watercourse.

2.6 A topographical survey is presented in Appendix B.

<u>Drainage</u>

- 2.7 There are two watercourses in the vicinity of the site. One flows through the centre of the site towards the east and through a culvert under Huddersfield Road. There is also a watercourse along the southern edge of the site, also culverted under Huddersfield Road, which flows in an easterly direction.
- 2.8 The central watercourse is partially culverted and has an outfall from what appears to be a land drain discharging into it. It is not known if there is land drainage elsewhere upon the site.

3.0 ENVIRONMENT AGENCY CONSULTATION

- 3.1 A consultation was requested from the Environment Agency, however, at the time of writing the report, no response has not yet been received.
- 3.4 The Environment Agency Flood Map provided on their website, which shows areas of land that could flood from rivers or the sea and are shaded blue. These areas do not take into account defences as water can overtop or can fail in extreme conditions. The Zone classifications are:-
 - 3.4.1 Flood Zone 1 "Low Probability" is assessed as having a less than 1 in 1,000 annual probability of river or sea flooding in any year (less than 0.1%).
 - 3.4.2 Flood Zone 2 "Medium Probability" is assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding in any year (1% 0.1%) and between a 1 in 200 and 1 in 1,000 annual probability of flooding from the sea (0.5% 0.1%).
 - 3.4.3 Flood Zone 3 "High Probability" is assessed as having a 1 in 100 or greater annual probability of river flooding in any year (greater than 1%) and a 1 in 200 chance or greater annual probability of flooding from the sea (less than 0.5%).
- 3.5 The Environment Agency Flood Map shows the site to be located within Flood Zone 1 "low probability" with only a small portion in the southeastern corner located in Flood Zone 3 "High Probability".
- 3.6 The surface water flood map, shows areas where surface water only would be expected to flow or pond in England & Wales. All land in England and Wales will be within 'one' of a possible 'four' categories. The four categories shown on the map are:-

- 3.6.1 High This area has a chance of flooding greater than 1 in 30 in any given year (annual probability of flooding 3.3%).
- 3.6.2 Medium This area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%) in any given year.
- 3.6.3 Low This area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) in any given year.
- 3.6.4 Very low This area has a chance of flooding of less than 1 in 1000 (0.1%) in any given year.
- 3.7 The proposed development site is shown to have a very low risk of surface water flooding.
- 3.8 A copy of the flood map and surface water flood Map are presented in Appendix C.

4.0 WATER AUTHORITY CONSULTATION

- 4.1 A consultation was requested from Yorkshire Water, who are the Water Authority for this area and a copy of their response, reference R693347 dated 14th September 2017 is presented in Appendix D for reference purposes.
- 4.2 There are no existing public sewers recorded crossing the site.
- 4.3 Development of the site should take place with separate systems for foul and surface water drainage. Separate systems should extend to the points of discharge to be agreed.
- 4.4 Foul water domestic waste should discharge to the 350mm diameter public combined sewer recorded to the southwest of the site in Huddersfield Road. Foul water from kitchens and/or food preparation areas of any restaurants and/or canteens must pass through the fat and grease trap for adequate design before any discharge to the public sewer network.
- 4.5 In respect of surface water, reference is made to Requirement H3 of Building Regulations 2000 and Sustainable Drainage Systems. This establishes a hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration and watercourse in that priority order. Where appropriate, soakaways, swales and infiltration trenches (SuDS) may be adopted as part of the public sewer network.
- 4.6 The local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the Developer is advised to contact the Environment Agency/Local Land Drainage Authority/Internal Drainage Board, with a view to establishing a suitable watercourse for discharge.
- 4.7 It is understood that Meltham Dyke is located through the site which appears to be the obvious place for surface water disposal if SuDS are not viable.

5.0 LAND DRAINAGE AUTHORITY CONSULTATION

- A consultation was requested from Kirklees Council, who is the Land Drainage Authority for this area, and a copy of their response, dated 18th September 2017 is presented in E for reference purposes.
- 5.2 The Council confirmed that it is unlikely that soakaway will work based on British Geological Survey Data and the proximity to the watercourse. Therefore, it was confirmed that discharging to Meltham Dyke at greenfield rates using 5l/s/ha with an absolute minimum of 3l/s would be acceptable. It was confirmed that there is a watercourse crossing the central part of the site and along part of the boundary.
- 5.3 Although there are no sewers located in the highway, road gullies are present, therefore, it is considered likely that there is a separate carrier drain where these watercourses discharge to.
- 5.4 Kirklees Council advised it is likely that these systems will need surveying to assess their condition.
- 5.5 It was confirmed that connections using greenfield rates, based on an area that the slopes towards the watercourse only, will be granted, with the caveat that some repairs may be needed to facilitate volumes.
- 5.6 It was confirmed that it is Kirklees Council's policy is to open up the culverts not to enclose them further and that stand-off distances would need to be considered.
- 5.7 A map was included within the consultation showing the records that Kirklees Council hold.

 This demonstrates that there is a record of a culverted watercourse, on the western side of Huddersfield Road, extending from the north of the site.

6.0 MATERIAL CONSIDERATION IN RESPECT OF NPPF AND PPG

Flood Classification

6.1 Environment Agency flood mapping confirms that the site falls within Flood Zone 1, which is land assessed as having less than a 1 in 1000 (0.1%) annual probability of river flooding in any year. The very southeastern corner has a small section, which is shown to have a high risk of flooding (Flood Zone 3), however, development is to be restricted to Flood Zone 1 and, therefore, it is considered that the proposed development site, is situated wholly within a low risk of fluvial flooding area.

End Use

- 6.2 The development proposal is for the construction of residential dwellings on the site. A proposed access layout is presented in Appendix F.
- 6.3 When applying Table 2 of the PPG, the flood risk vulnerability classification shows that the proposed end use will fall into a "More Vulnerable" classification under the general classification "dwellings". With reference to NPPF, the citing of More Vulnerable development within Flood Zone 1 is deemed appropriate and assessment of other sites (the Sequential Test) is not deemed necessary.

Flood Sources

6.4 <u>Flooding from Rivers</u> - Meltham Dyke is classified as a main river and is located at the south of the site. As the site slopes significantly to the south towards the watercourse, it is considered that flooding of the site from this source is low risk. However, this will still need to be considered as part of any proposed development.

- 6.5 <u>Flooding from Local Watercourses</u> There is a watercourse located along the southern edge of the site and through the centre of the site. When considering the existing site topography, it can be seen that the watercourses have steep embankments and are at a much lower level than the adjacent land and the rest of the site. It is, therefore, apparent that the proposed development will not be at risk of flooding from this source. However, flooding from this source will still need to be considered.
- 6.6 <u>Flooding from the Sea</u> The site is not located near enough to the sea to cause a problem of flooding from this source.
- 6.7 <u>Flooding from Land</u> The Environment Agency Surface Water Flood Map shows a very low surface water risk across the proposed development site. There is a low risk in the southeast corner located adjacent to the watercourse, which is also the lowest point of the site. Land to the west and north is elevated from the main body of the site and the site itself slopes to the south and east to the low point where the watercourses are present. The railway embankment acts as a natural barrier to stop water from the west and north of the development. However, water can still flow into the site through the railway bridge at the public footpath. This could be dealt with by means of a drain along the western edge of the development. Whilst this will need to be considered during the detailed proposals, flooding from this source can be mitigated against and, therefore, be considered to be low risk.
- 6.8 <u>Flooding from Groundwater</u> Whilst there is no intrusive ground investigation, the Geological Survey of Great Britain provided on the British Geology Survey website shows the site to be located on Rosendale Formation mudstone and siltstone. The geology is likely to be impermeable, which is emphasised by the presence of the watercourse and will prevent issues of groundwater on the site. Therefore, flooding from this source is considered to be very low risk.

- 6.9 <u>Flooding from Sewer</u> There are no known existing public sewers on site. However, land drainage may be present and there is a foul water Treatment Plant associated with the adjacent residential dwelling to the north of the site. There will also be a new drainage system for the development. It is possible, therefore, that any blockage of the sewers will result in flooding from the lowest cover of manholes or gullies and this will need to be considered as part of any proposed development.
- 6.10 <u>Flooding from Reservoirs, Canals or Artificial Sources</u> The Environment Agency produce maps, which show the expected inundation area should a reservoir fail and release its capacity. It should be noted, however, that reservoir flooding is extremely unlikely to happen and there has been no loss of life in the UK from reservoir flooding since 1925.
- 6.11 The proposed development site is shown to be within the maximum extent of reservoir flooding. However, with reference to the likelihood of reservoir flooding, the risk from this source is deemed to be low. There are no other canals or artificial sources located within the vicinity of the site.

Climate Change

- 6.12 The NPPF and PPG have indicated that the Global sea level will continue to rise, depending on greenhouse gas emissions, and the sensitivity of the climate system and there will be an increase in rainfall across the country.
- 6.13 United Kingdom climate change guidance was revised in February 2016 for peak river flows and peak rainfall intensities. With regards to peak river flows, a regionalised approach has now been adopted to climate change impacts based upon the river basin district of the proposed development site, the flood risk vulnerability of the proposed development and the present day Flood Zone classification.

- 6.14 The proposed development site is situated within the River Humber river basin district, which based on an "upper end" climate change scenario, could see peak river flows increase by 50% by 2115. As the site is situated entirely within Flood Zone 1 an increase of 50% flows is deemed unlikely to affect the proposed development site.
- 6.15 In accordance with the revised climate change data, the published figures show that, for an expected life of greater than 50 years for any new development, the anticipated increase in rainfall could be around 40% and the drainage system should be designed in accordance with this. However, the Kirklees Council flood risk requirements for managing on/off-site flood risk from fluvial flooding is to assess the development using a 30% allowance for climate change for the 1 in 100 year event.
- 6.16 Due to the topography of the land and surrounding area, overland run-off from the adjoining land to the north and west could be an issue. However, the presence of the disused railway embankment means that water could only run-off to the site through and under the bridge. As part of the proposals, it would be recommended that a cut off drain is put in place to stop overland run-off from adjoining land and diverted around the development and into the watercourse. Therefore, any run-off from outside the site will be insignificant and on that basis, only rainfall falling within the site boundaries will need to be considered in respect of climate change.

Flood Mitigation

- 6.17 As the site falls within Flood Zone 1, flood mitigation measures are only required in the event of a catastrophic storm or blockage of the existing watercourse or proposed sewers. The following precautionary mitigation measures are, therefore, recommended:-
 - 6.17.1 The finished floor levels to the properties should be set to a minimum of 300mm above the adjacent bank level of any watercourse.
 - 6.17.2 The proposed dwellings will be designed without any basements and ground floor shall comprise solid concrete slabs or beam and block floors with screed construction.

- 6.17.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from upper level.
- 6.17.4 In the unlikely event of flooding of the site from a catastrophic storm, it would be appropriate to design external levels with falls to non-critical areas, such as landscaping, where the water can pond without causing flooding to the buildings.
- 6.17.5 It will be necessary to ensure that there is route for floodwater through the site to the watercourses crossing or adjacent to the site, without causing flooding of buildings. To achieve this, all external levels shall be a minimum of 150mm, or preferably 300mm, below the floor level and the proposed alignment across the site shall be designed to ensure that there is always a route for water through the site without causing ponding.

Sustainable Drainage

6.18 In order to comply with the requirements of NPPF, it will be necessary to consider aspects of Sustainable Drainage techniques for the new development. Whilst no intrusive investigation of the ground conditions have been carried out, a review of the Geological Survey Map of Great Britain shows the site to be underlain by Rosendale Formation consisting of mudstone and siltstone. This material is likely to be impermeable and, therefore, unsuitable for the disposal of surface water using infiltration techniques. It will be necessary to carry out appropriate infiltration tests in accordance with BRE Digest 365 'Soakaway Design' soakaway design prior to construction and the results presented in a report for the approval of the Planning Authority. However, for the purpose of this report, a positive system to watercourse will be required for surface water drainage.

Drainage

6.19 It is a requirement to ensure that surface water run-off from any proposed development has negligible consequence on downstream areas either in sewer capacity or discharge to watercourse.

Existing Surface Water Run-Off

- 6.20 The site is greenfield and, therefore, in accordance with current Guidelines and Regulations, indicative surface water calculations have been assessed using 5l/s/ha, in accordance with the Lead Local Flood Authority requirements. It is considered that an area of 0.50ha of the northern section of the site drains into the watercourse in the centre of the site, and an area of 0.69ha drains into the watercourse to the south of the site. Using 5l/s/ha, this equates to 2.5l/s and 3.5l/s respectively. As Kirklees Council specify an absolute minimum of 3l/s, an average value of these two figures is considered appropriate. The indicative catchment area plan is presented in Appendix G.
- 6.21 It is considered that Kirklees Council would be unlikely to approve culverting the watercourse in the centre of the site. This area is assessed to be 0.18ha in size and considered undevelopable.

Proposed Surface Water Drainage

6.22 Consideration of the proposed drainage should firstly be given to infiltration techniques (to ground). However, based on information available, the disposal of surface water using infiltration techniques may not be feasible. It will be necessary to carry out appropriate infiltration tests in accordance with BRE Digest 365 "Soakaway Design" prior to construction on site and the results presented in a report for the approval of the Planning Authority. However, for the purpose of this report a positive drainage system to watercourse will be required for surface water drainage.

- 6.23 The proposed development is likely to have a proposed impermeable area of approximately 0.60ha. Indicative calculations have been carried out using the WinDES Source Control Computer Program. The proposed surface water system should be designed to accommodate a 1 in 30 year storm event without flooding and the 1 in 100 year storm plus climate change event should be retained within the site in an area which will not affect the new buildings or third parties from flooding. Due to the high existing greenfield run-off rate and in line with the Lead Local Flood Authority recommendations, it is proposed to restrict surface water run-off to 3l/s in order not to increase the flood risk. However, this will need to be further agreed as part of the drainage strategy for the site.
- 6.24 Restricting the discharge rate to no greater than 3l/s, on-site storage of 198m³ will need to be provided for a 1 in 30 year storm. This can be achieved by several methods, including oversized pipes or underground tanks. One such option would be to provide 3m of 83m x 0.8m deep geo cellular underground attenuation or equivalent, to achieve the necessary volume. The drainage system will also need to accommodate the 1 in 100 year plus 30 year climate change event without causing flooding of property or third party. In the event that levels dictate that the 1 in 100 year plus climate change floodwater will flow off-site, an additional or larger storage facility will be required. Therefore, on-site storage would increase to 388m³. The surface water calculations are presented in Appendix H. However, detailed calculations and proposals will need to be prepared and submitted to the Planning Authority for approval prior to construction.

Watercourse Conditions

6.25 The discharge of surface water to watercourse will require the introduction of headwalls or works to the watercourse. This will need the consent of the Land Drainage Authority by submitting an Application for Consent to Work Within a Watercourse. There is also a requirement for a 9m strip to be provided from the top of the banking where no development can take place, and access arrangements will need to be agreed for future improvements or maintenance.

Foul Drainage

- 6.26 Foul water domestic waste shall discharge to the 350mm diameter public combined sewer recorded to the south of the site, located in Huddersfield Road.
- 6.27 Subject to detailed level design, if the site is not able to drain by gravity, an adoptable foul water pumping station may be required to facilitate connection to the public sewer network.

Emergency Egress During Times of Flood

- 6.28 It is a requirement under the PPG that occupants should be able to egress any building during times of flood, without being trapped by flood conditions.
- 6.29 As the site falls within Flood Zone 1, no special mitigation measures are required for emergency egress during times of flood.

7.0 COMMENTS

- 7.1 The site falls within Flood Zone 1 and the Sequential Test is satisfied. However, in order to accommodate the possibilities of flood from a catastrophic storm or blockage of the existing watercourses or proposed sewers, the following precautionary mitigation measures are recommended:-
 - 7.1.1 The finished floor levels to the properties should be set to a minimum of 300mm above the adjacent bank level of any watercourse.
 - 7.1.2 The proposed dwellings will be designed without any basements and ground floor shall comprise solid concrete slabs or beam and block floors with screed construction.
 - 7.1.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from upper level.
 - 7.1.4 In the unlikely event of flooding of the site from a catastrophic storm, it would be appropriate to design external levels with falls to non-critical areas, such as landscaping, where the water can pond without causing flooding to the buildings.
 - 7.1.5 It will be necessary to ensure that there is route for floodwater through the site to the watercourses crossing or adjacent to the site, without causing flooding of buildings. To achieve this, all external levels shall be a minimum of 150mm, or preferably 300mm, below the floor level and the proposed alignment across the site shall be designed to ensure that there is always a route for water through the site without causing ponding.
- 7.2 A 30% increase in rainfall shall be incorporated into any new positive drainage system to satisfy the requirements of climate change.
- 7.3 Sustainable Drainage Systems of infiltration techniques are considered to be unsuitable on this particular site and for the purpose of the report a positive drainage system will be

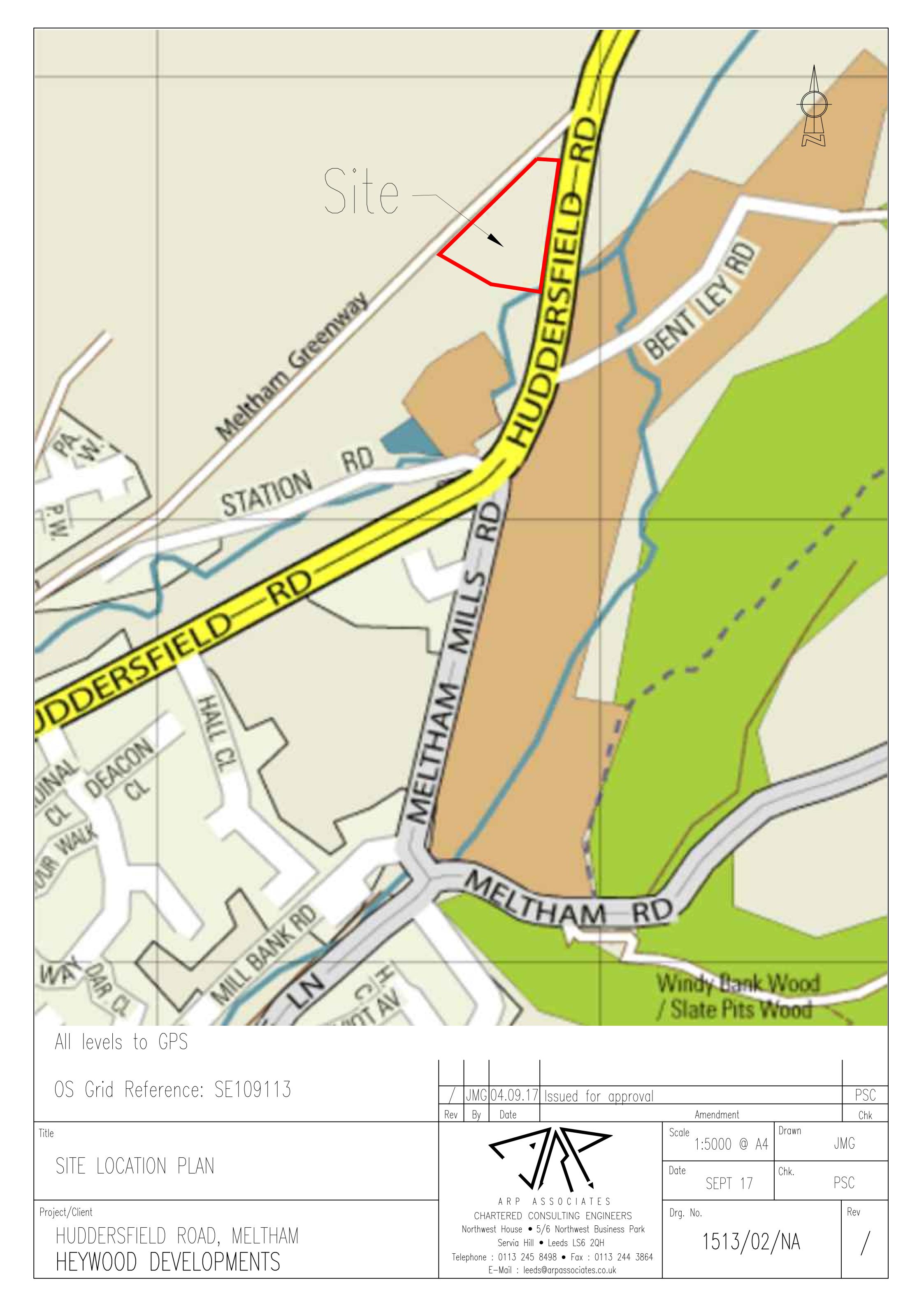
required. However, infiltration testing will need to be carried out in accordance with BRE Digest 365 "Soakaway Design" prior to construction on site and the results will be reported to the Planning Authority for approval.

- 7.4 Should infiltration techniques prove unsuccessful, the surface water drainage shall discharge to Meltham Dyke at the south of the site.
- 7.5 The proposed surface water drainage system shall be designed for an allowance for climate change and restricted to the agreed discharge rate with appropriate attenuation incorporated into the design. A design and calculations shall be submitted to the Planning Authority for approval prior to construction on site.
- 7.6 The discharge of surface water will require the consent of Kirklees Council as Lead Local Flooding Authority.
- 7.7 No properties or other restrictions shall be constructed within 9m of the watercourse banking and the development should comply with all land drainage By-Laws and the Land Drainage Act 1991.
- 7.8 The discharge of surface water to watercourse will require the introduction of headwalls or works to the watercourse. This will need the consent of the Land Drainage Authority by submitting an Application for Consent to Work Within a Watercourse. There is also a requirement for a 9m strip to be provided from the top of the banking where no development can take place, and access arrangements will need to be agreed for future improvements or maintenance.
- 7.9 Subject to detailed level design, if the site is not able to drain by gravity, an adoptable foul water pumping station may be required to facilitate connection to the public sewer network.
- 7.10 No special mitigation measures are required for emergency egress during times of flood.

7.11 Subject to compliance with the above, the proposed development can satisfy the requirements of the National Planning Policy Framework and the Planning Practice Guidance in relation to flood risk.

APPENDIX A

SITE LOCATION PLANS





TITLE NUMBER

WYK762518



WEST YORKSHIRE: KIRKLEES

ORDNANCE SURVEY MAP REFERENCE: SE1011SE SCALE 1:1250 Enlarged from 1/2500 Number GD 272728. ©CROWN COPYRIGHT. Produced by HMLR. Further reproduction in whole or in part is prohibited without the prior written perm HUDDERSFIELD ROAD Sinks Mill Meltham Dike

This title plan shows the general position of the boundaries: it does not show the exact line of the boundaries. Measurements scaled from this plan may not match measurements between the same points on the ground. For more information see Land Registry Public Guide 7 - Title Plans.

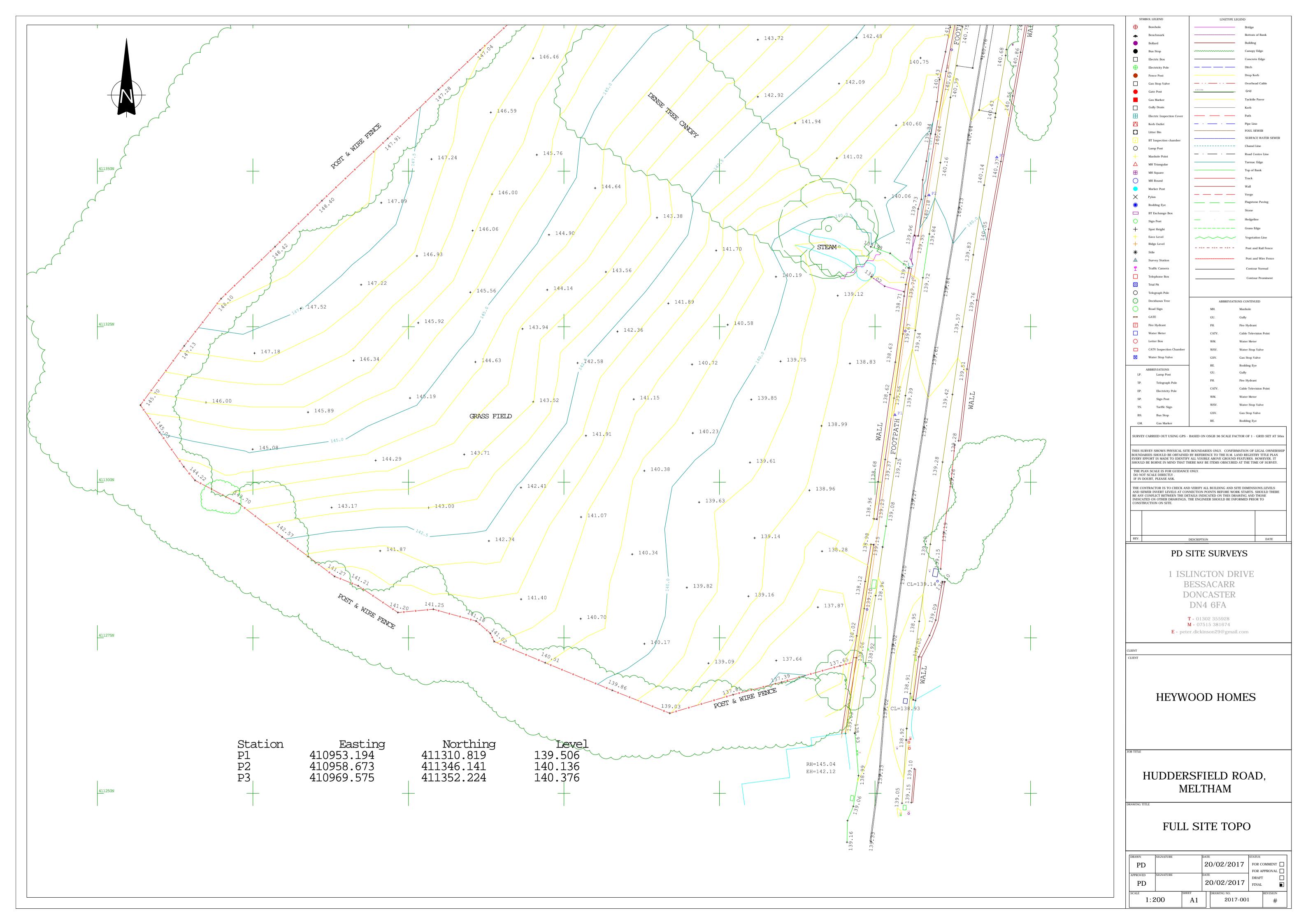
This official copy shows the state of the title plan on 20 April 2004 at 14:22:39. It may be subject to distortions in scale. Under s.67 of the Land Registration Act 2002, this copy is admissable in evidence to the same extent as the original. Issued on 20 April 2004.

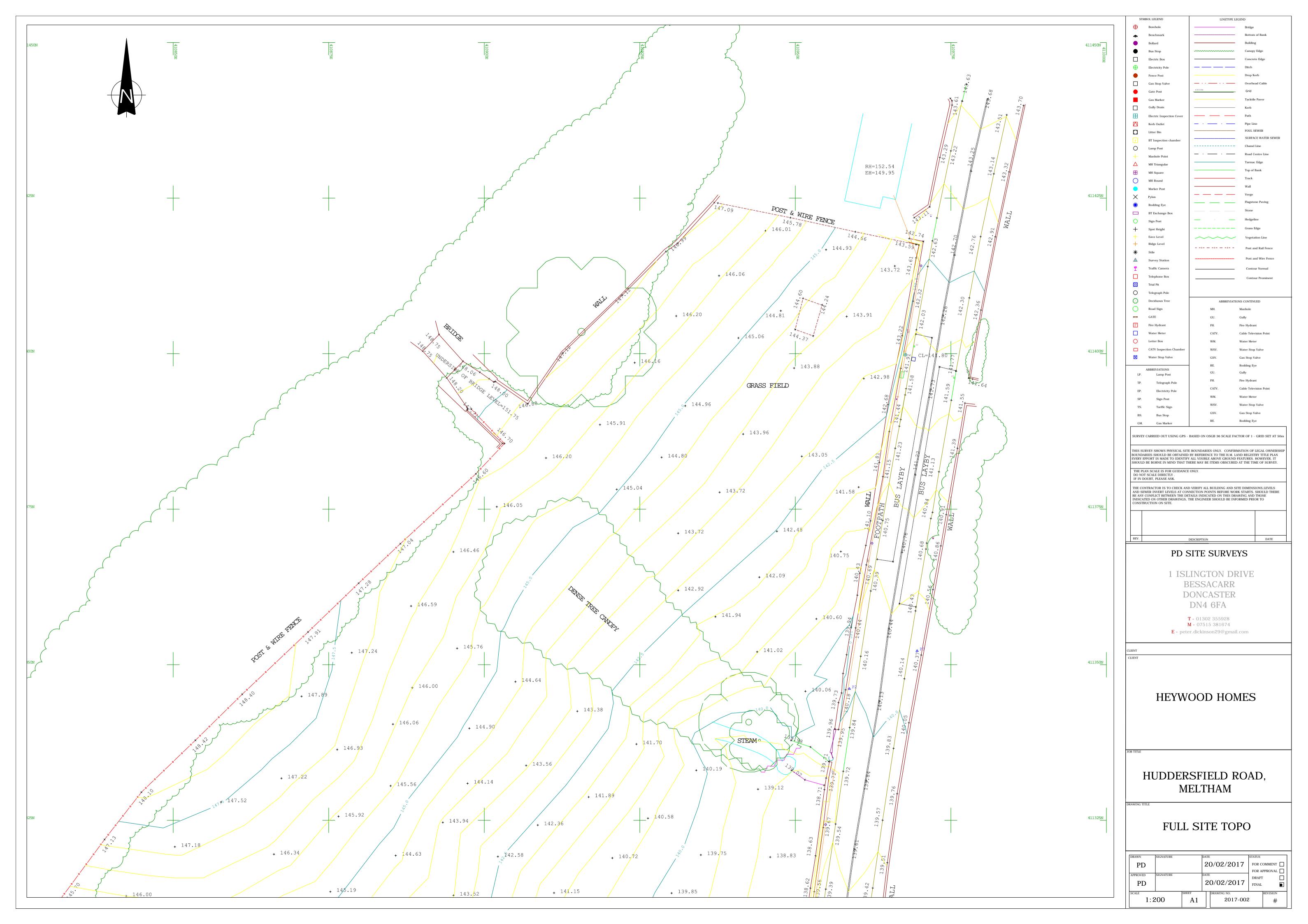
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APPENDIX B

TOPOGRAPHICAL SURVEY





APPENDIX C

ENVIRONMENT AGENCY CONSULTATION



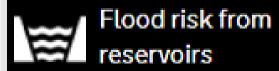
Flood risk from rivers or the sea

Extent of flooding

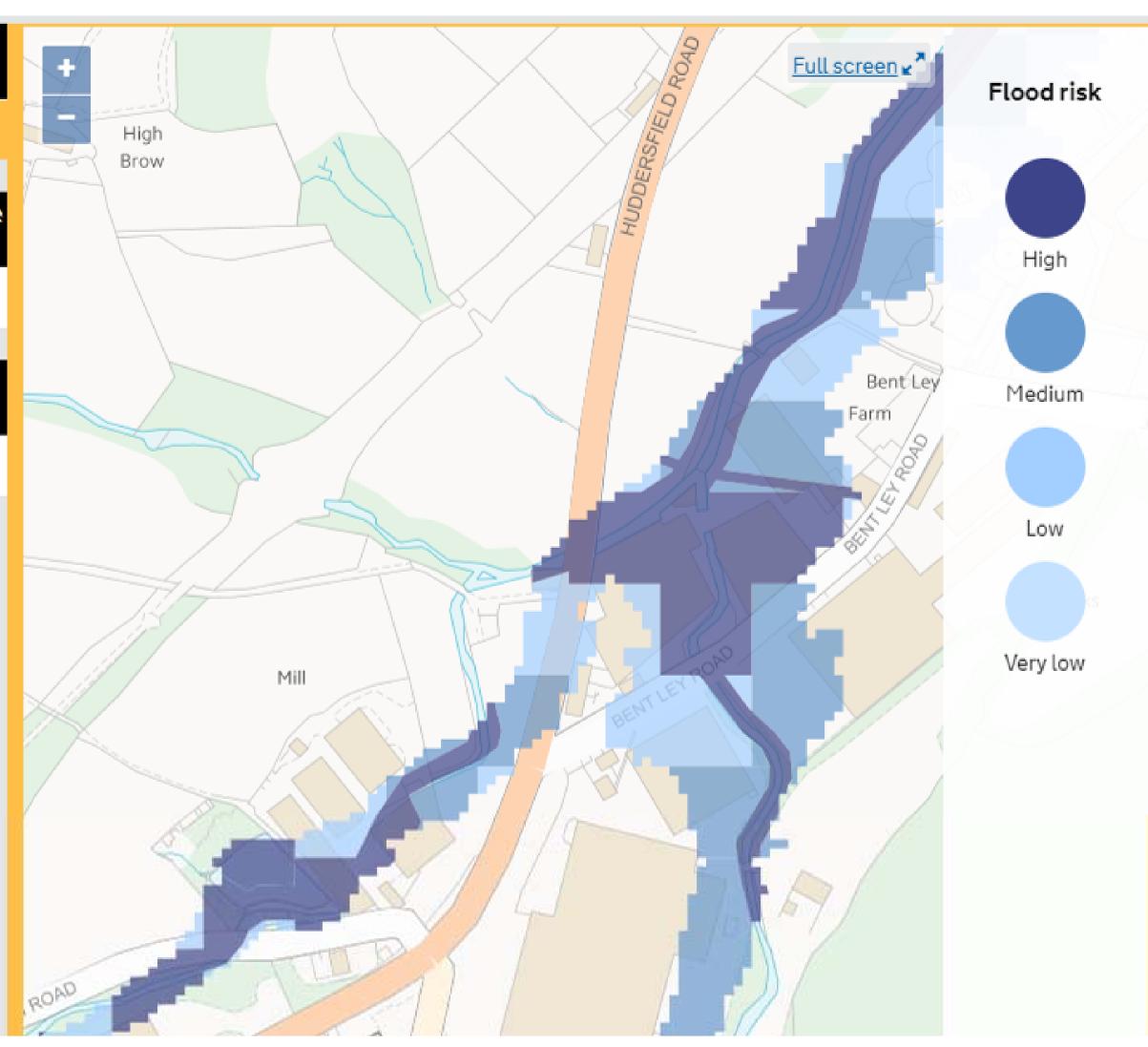


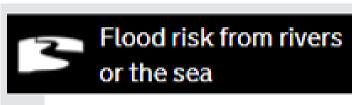
Flood risk from surface water

Extent of flooding



Extent of flooding



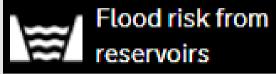


Extent of flooding

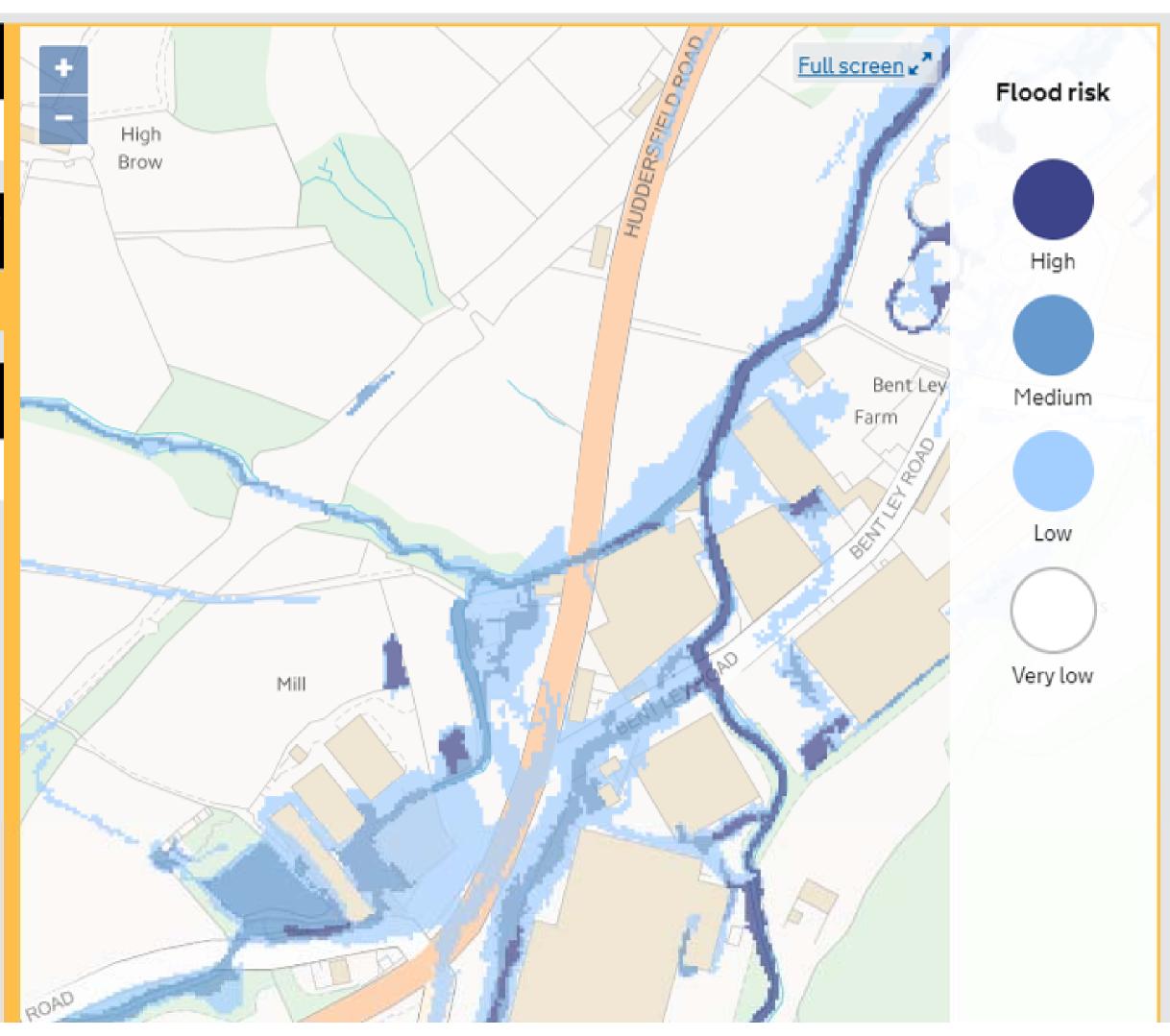


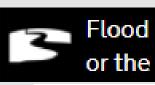
Flood risk from surface water

Extent of flooding



Extent of flooding





Flood risk from rivers or the sea

- Extent of flooding
- Depth and flow
 estimates at monitoring stations



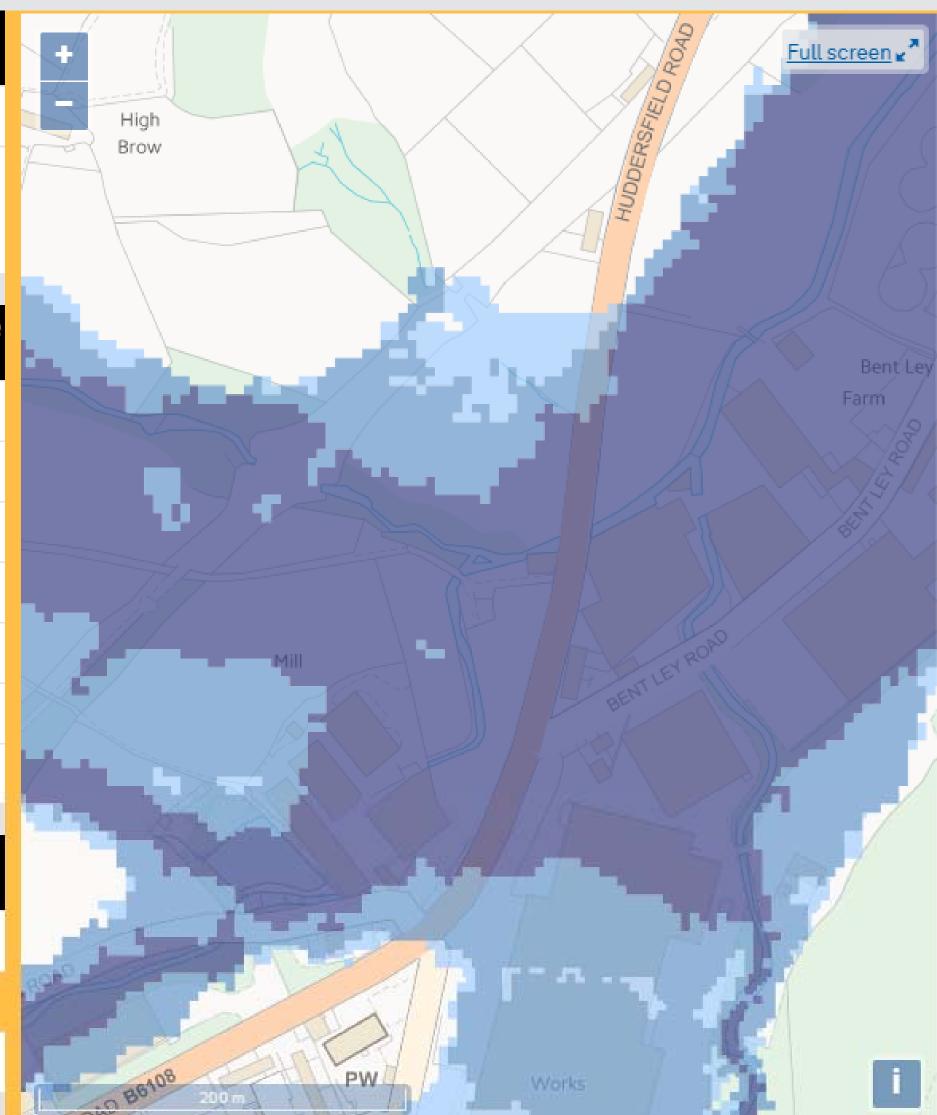
Flood risk from surface water

- Extent of flooding
- High risk: depth
- High risk: velocity
- Medium risk: depth
- Medium risk: velocity
- Low risk: depth
- O Low risk: velocity



Flood risk from reservoirs

- Extent of flooding
- Flood depth
- Flood speed



Flood depth (metres)



Over 2m



Between 0.3 and 2m



Below 0.3m

APPENDIX D

WATER AUTHORITY CONSULTATION



Mr P Carter Arp Associates Unit 5/6 Northwest Business Pk 1ST FLR Servia Hill Woodhouse Leeds LS6 2QH Yorkshire Water Services
Developer Services
Sewerage Technical Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482 Fax: (01274) 372 834

Your Ref:

Our Ref: T015250

Email: Technical.Sewerage@yorkshirewater.co.uk

For telephone enquiries ring: Chris Roberts on 0345 120 8482

14th September 2017

Dear Mr Carter,

Land off Huddersfield Road, Meltham, Kirklees - Pre-planning Enquiry on R693347 - RESIDENTIAL

Thank you for your recent enquiry. Our charge of £153.00 (plus VAT) will be added to your account with us, reference ARP013. You will receive an invoice for your account in due course.

Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records. The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months.

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul Water

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul water domestic waste should discharge to the 350 mm diameter public combined sewer recorded to the south west of the site in Huddersfield Road.

Foul water from kitchens and/or food preparation areas of any restaurants and/or canteens etc. must pass through a fat and grease trap of adequate design before any discharge to the public sewer network.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.







As the proposal site is currently undeveloped no surface water is known to have previously discharged to the public sewer network

As such, the local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority/Internal Drainage Board with a view to establishing a suitable watercourse for discharge.

It is understood that Meltham Dike is located through the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable).

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may obtain an application form from our website (www.yorkshirewater.com) or by telephoning 0345 120 84 82.

Surface water run-off from communal parking (greater than 800 sq metres or more than 50 car parking spaces) and hardstanding must pass through an oil, petrol and grit interceptor/separator of adequate design before any discharge to the public sewer network. Roof water should not pass through the traditional 'stage' or full retention type of interceptor/separator. It is good drainage practice for any interceptor/separator to be located upstream of any on-site balancing, storage or other means of flow attenuation that may be required.

Under the provisions of section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes fat, oil, nappies, bandages, syringes, medicines, sanitary towels and incontinence pants. Contravention of the provisions of section 111 is a criminal offence.

An off-site foul and surface water sewer may be required which may be provided by the developer and considered for adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the WRc publication "Sewers for Adoption - a design and construction guide for developers" 6th Edition as supplemented by Yorkshire Water's requirements, pursuant to an agreement under Section 104 of the Water Industry Act 1991. An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Developer Services Team (telephone 0345 120 84 82) for further information.

The public sewer network is for domestic sewage purposes. This generally means foul water for domestic purposes and, where a suitable surface water or combined sewer is available, surface water from the roofs of buildings together with surface water from paved areas of land appurtenant to those buildings. Land and highway drainage have no right of connection to the public sewer network. No land drainage to be connected/discharged to public sewer.







As a last resort, highway drainage may be accepted under certain circumstances. If it can be demonstrated, through satisfactory evidence, that SUDS are not a viable option, there are no watercourses or highway drains available and if capacity is available within the public sewer network, highway drainage discharges to the public sewer network may be permitted. In this event, the developer may be required to enter into a formal agreement with Yorkshire Water Services under Section 115 Water Industry Act 1991 to discharge non-domestic flows into the public sewer network.

The site is within an area that may be affected by river, coastal or estuarine flooding. We would advise you to contact the Environment Agency for details.

Yorkshire Water's Trade Effluent team must be consulted in respect of any proposed trade effluent discharge to the public sewer.

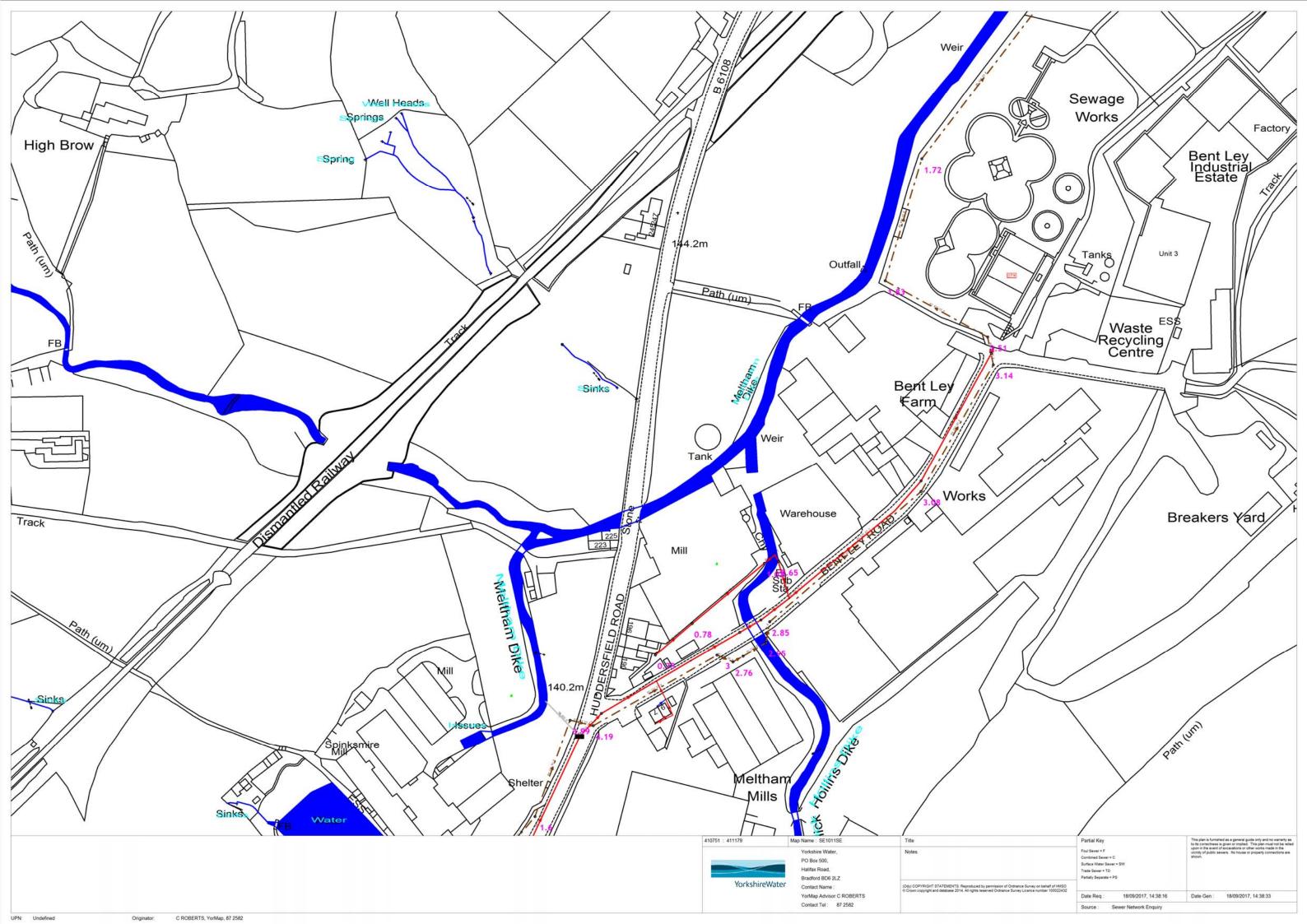
All the above comments are based upon the information and records available at the present time. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

Chris Roberts Sewerage Technician Developer Services







APPENDIX E

LAND DRAINAGE AUTHORITY CONSULTATION

Paul Carter

From: Paul Farndale < Paul.Farndale@kirklees.gov.uk>

Sent: Monday 18 September, 2017 9:56 am

To: Paul Carter

Subject: RE: 1513/02 - Land off Huddersfield Road, Meltham, Kirklees

Hello Paul,

Flood Zone 3 so a sequential test is a must.

I suspect if this is successful then an exceptions test is required. Given the position of the flood maps I suspect a reevaluation is necessary as it doesn't look right. This should be done in conjunction with a topographical survey. When the result are in as to where is likely to flood, if it has passed tests then a sequential approach is expected. Meltham Dike is enmained in this area, early dialogue is advised.

Ruling soakaway out on BGS data and proximity to a watercourse.

OK to discharge to Meltham Dike at greenfield rates using 5l/s/ha with 3l/s as an absolute minimum.

Our records show a highway drain crossing the site. We expect stand off distances as per sewer for adoption 6th edition in this respect. A bit of research on exact line is expected here. Diversions considered. There are additional road gullies with no highway carrier drain or public sewer show. Expect additional pipework from this location to also potentially cross the site.

Public sewers and CSO's appear to cross the southern tip of the site. Further stand offs required.

Please look at surface water flood mapping in that this may actually better represent the areas likely to be affect by river flooding.

Kind regards,

Paul Farndale
Principal Engineer
Flood Management & Drainage
Investment & Regeneration Service
Kirklees Council
01484 221000

From: Paul Carter [mailto:PaulCarter@arpassociates.co.uk]

Sent: 04 September 2017 17:37

To: Paul Farndale

Subject: 1513/02 - Land off Huddersfield Road, Meltham, Kirklees

Good Afternoon Paul

We have been instructed to prepare a drainage design to support a residential development (approximately 69 dwellings) at land off Huddersfield Road, Meltham, Kirklees. I have attached a site location plan for your reference. The site is currently a farmers field.

Paul Carter

From: Paul Farndale < Paul.Farndale@kirklees.gov.uk>

Sent: Monday 18 September, 2017 7:37 pm

To: Paul Carter

Subject: RE: 1513/02 - Land off Huddersfield Road, Meltham, Kirklees

Attachments: Meltham Dike.pdf

Hello Paul,

I think we've had this one in at planning or pre-planning where the access was over the central watercourse. Please see the map attached and give me a call as to where we are with proceedings. As you can see from the solid lines watercourses (of sorts) cross the central part of the site and along the frontage. Given there are no sewers in the road but road gullies are shown, either we have a separate carrier drain or they go into the system along the front of the site.

I suspect I have asked for these systems surveying to look at their condition and connections at greenfield (covering area that slope to it only) will be granted with the caveat that some repairs may be needed to facilitate volumes etc.

Might need a site visit this one once you know more. It is Kirklees policy to open up culverts not enclose them further. With this and stand off distances, needs a bit of thought.

Kind regards,

Paul Farndale
Principal Engineer
Flood Management & Drainage
Investment & Regeneration Service
Kirklees Council
01484 221000

From: Paul Carter [mailto:PaulCarter@arpassociates.co.uk]

Sent: 18 September 2017 17:25

To: Paul Farndale

Subject: RE: 1513/02 - Land off Huddersfield Road, Meltham, Kirklees

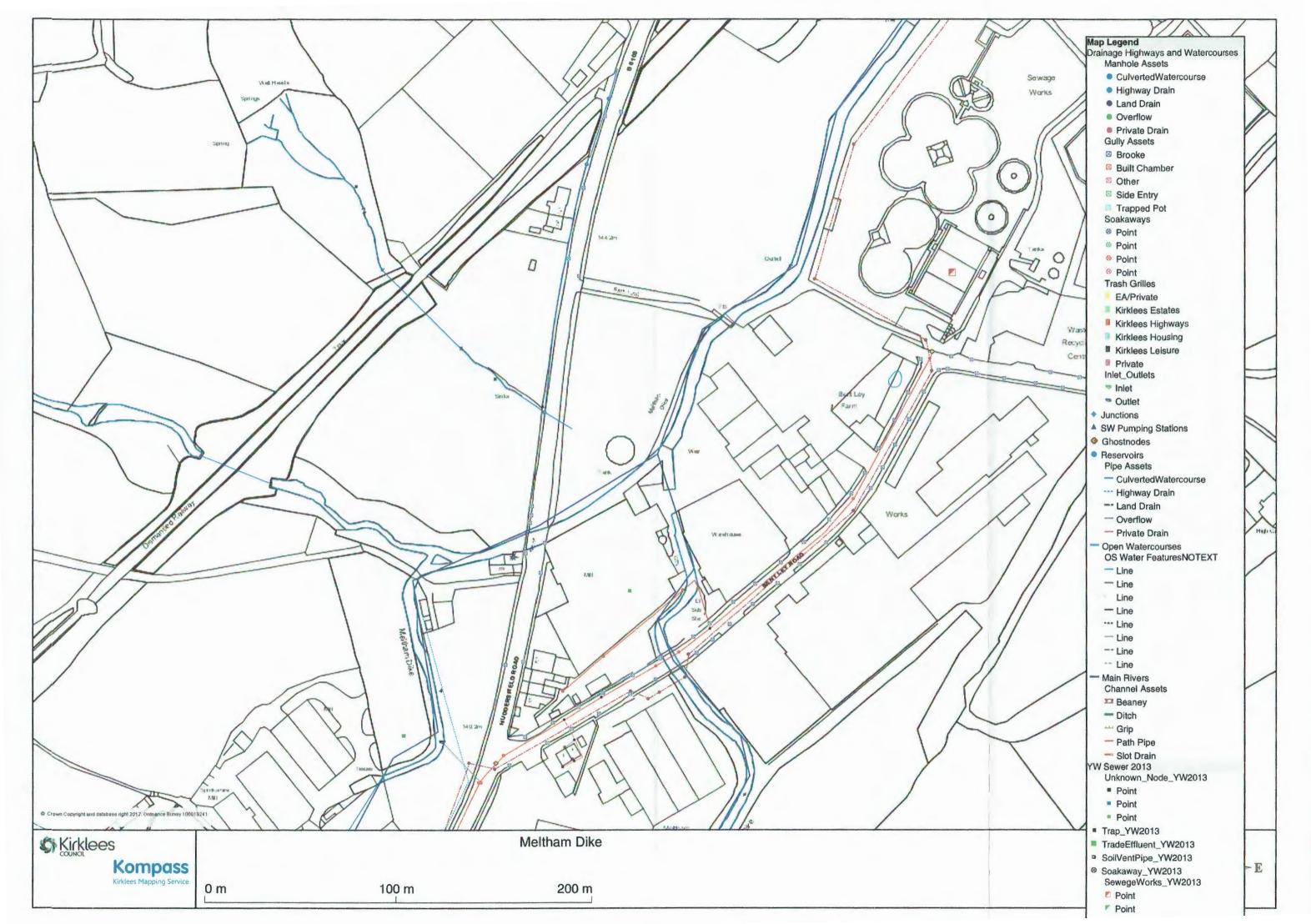
Good Afternoon Paul,

Thank you for your response below. I have attached an updated site location plan – please accept our apologies if the previous attachment was misleading. As referred to below, the watercourse is at the southern portion of the site. We note your approval to discharge to this watercourse, using 5l/s/ha with 3l/s as an absolute minimum.

Whilst we are awaiting a response from the environment agency, we note that it is only the very south eastern corner of the site which is in Flood Zone 3.

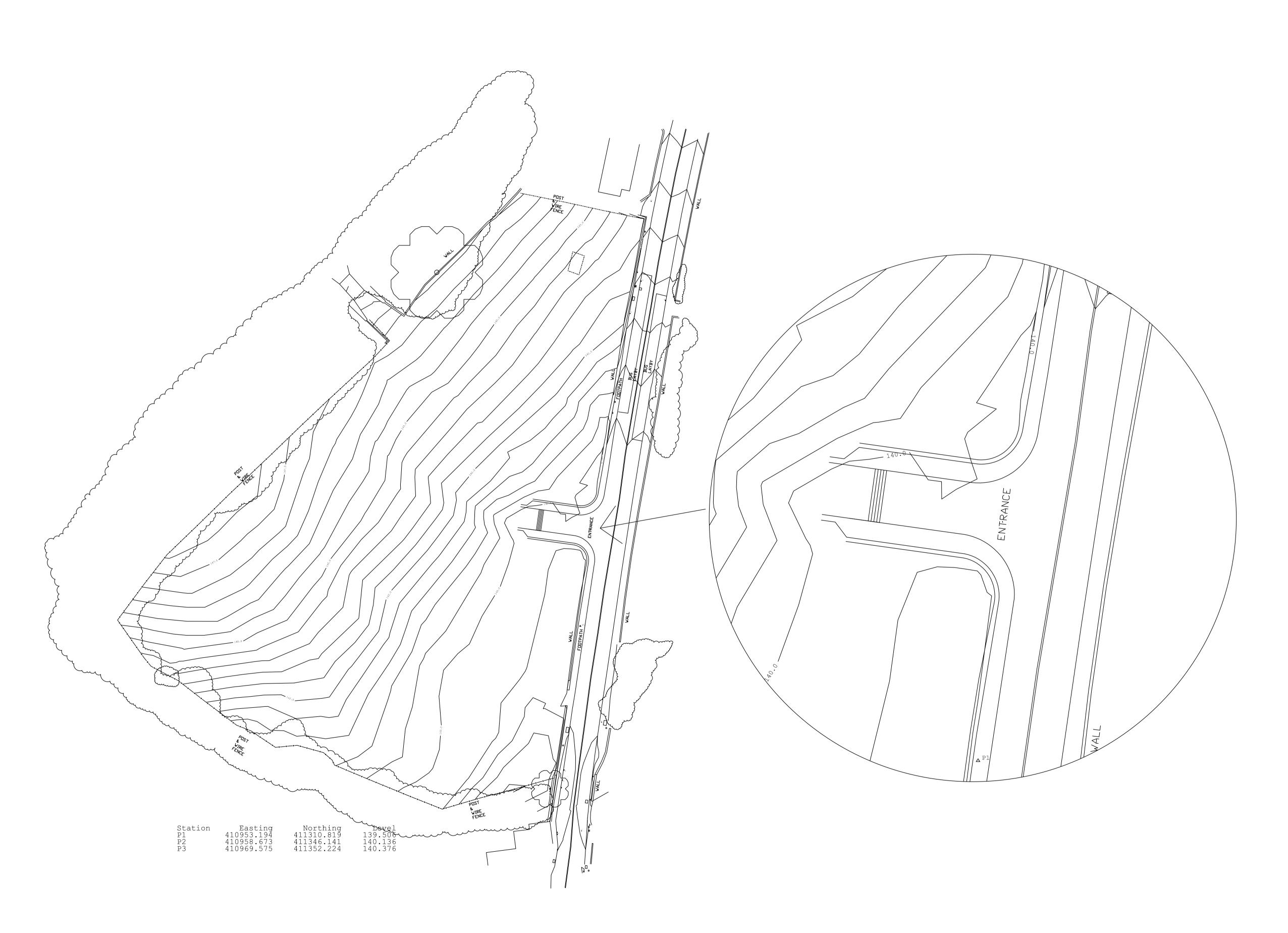
We trust that this is satisfactory, however, should you require any additional information at this time please do not hesitate to contact us.

Kind Regards



APPENDIX F

PROPOSED ACCESS LAYOUT



IF IN ANY DOUBT PLEASE ASK THE ARCHITECT FOR CLARIFICATION.

DO NOT SCALE FROM DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE

THE COPYRIGHT FOR THESE DRAWINGS REMAINS THE PROPERTY OF THE ARCHITECT, THEY MUST NOT BE REPRODUCED IN ANY WAY WITHOUT THE ARCHITECTS PRIOR WRITTEN CONSENT.



THE CHAPEL
MILLMOOR ROAD
MELTHAM
HUDDERSFIELD HD9 5JU
TELEPHONE (01484) 854848
FAX (01484) 854949

CLIENT

HEYWOOD HOMES LTD

PROJECT

RESIDENTIAL DEVELOPMENT OFF HUDDERSFIELD ROAD MELTHAM, HOLMFIRTH

DRAWING TITLE

SITE PLAN WITH NEW VEHICULAR ACCESS

Rev.	Notes		Date	Drawn
SCALE	1:500 & 1:200 @	03/17	ТМ	
PROJECT	No.	DRAWING	No.	Rev.
	1754	01		

APPENDIX G

INDICATIVE CATCHMENT AREA PLAN



APPENDIX H

INDICATIVE SURFACE WATER DRAINAGE CALCULATIONS

ARP Associates		Page 1
Northwest House	Huddersfield Rd, Meltham	
Servia Hill	Kirklees	٧
Leeds LS6 2QH		Micco
Date 21/09/2017 4:31pm	Designed by PSC	Desinado
File huddersfield rd meltham	Checked by WMW	Drainage
Elstree Computing Ltd	Source Control 2017.1.2	

Summary of Results for 30 year Return Period

Storm Event		Max Level (m)	Max Depth (m)	Max Control (1/s)	Max Volume (m³)	Status	
15	min	Summer	8.203	0.303	3.0	75.3	ОК
30	min	Summer	8.298	0.398	3.0	99.1	O K
60	min	Summer	8.398	0.498	3.0	123.9	O K
120	min	Summer	8.494	0.594	3.0	147.9	O K
180	min	Summer	8.541	0.641	3.0	159.5	O K
240	min	Summer	8.566	0.666	3.0	165.8	O K
360	min	Summer	8.587	0.687	3.0	171.0	O K
480	min	Summer	8.590	0.690	3.0	171.6	O K
600	min	Summer	8.586	0.686	3.0	170.7	O K
720	min	Summer	8.581	0.681	3.0	169.4	O K
960	min	Summer	8.566	0.666	3.0	165.7	O K
1440	min	Summer	8.529	0.629	3.0	156.6	O K
2160	min	Summer	8.468	0.568	3.0	141.4	O K
2880	min	Summer	8.397	0.497	3.0	123.7	O K
4320	min	Summer	8.266	0.366	3.0	91.2	O K
5760	min	Summer	8.170	0.270	3.0	67.1	O K
7200	min	Summer	8.101	0.201	3.0	50.1	O K
8640	min	Summer	8.056	0.156	2.9	38.8	O K
10080	min	Summer	8.026	0.126	2.8	31.4	O K
15	min	Winter	8.240	0.340	3.0	84.5	O K
30	min	Winter	8.348	0.448	3.0	111.5	O K

Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15	min	Summer	68.836	0.0	75.7	19
30	min	Summer	45.828	0.0	101.1	33
60	min	Summer	29.238	0.0	130.7	64
120	min	Summer	18.112	0.0	162.0	122
180	min	Summer	13.534	0.0	181.7	182
240	min	Summer	10.952	0.0	196.0	242
360	min	Summer	8.106	0.0	217.7	360
480	min	Summer	6.544	0.0	234.3	458
600	min	Summer	5.539	0.0	247.9	512
720	min	Summer	4.832	0.0	259.4	574
960	min	Summer	3.892	0.0	278.5	704
1440	min	Summer	2.866	0.0	307.2	982
2160	min	Summer	2.108	0.0	340.8	1404
2880	min	Summer	1.693	0.0	365.0	1812
4320	min	Summer	1.242	0.0	401.2	2548
5760	min	Summer	0.996	0.0	430.0	3232
7200	min	Summer	0.839	0.0	452.6	3896
8640	min	Summer	0.730	0.0	472.2	4584
10080	min	Summer	0.648	0.0	489.1	5248
15	min	Winter	68.836	0.0	84.9	18
30	min	Winter	45.828	0.0	113.3	33

ARP Associates		Page 2
Northwest House	Huddersfield Rd, Meltham	
Servia Hill	Kirklees	
Leeds LS6 2QH		Micco
Date 21/09/2017 4:31pm	Designed by PSC	Desipage
File huddersfield rd meltham	Checked by WMW	Drainage
Elstree Computing Ltd	Source Control 2017.1.2	

Summary of Results for 30 year Return Period

	Storm Event			Max Depth (m)	Max Control (1/s)	Max Volume (m³)	Status
60	min	Winter	8.462	0.562	3.0	139.7	O K
120	min	Winter	8.571	0.671	3.0	166.9	ОК
180	min	Winter	8.626	0.726	3.0	180.6	O K
240	min	Winter	8.657	0.757	3.0	188.3	O K
360	min	Winter	8.687	0.787	3.0	195.8	O K
480	min	Winter	8.695	0.795	3.0	197.9	O K
600	min	Winter	8.692	0.792	3.0	197.0	O K
720	min	Winter	8.682	0.782	3.0	194.5	O K
960	min	Winter	8.663	0.763	3.0	189.8	O K
1440	min	Winter	8.610	0.710	3.0	176.7	O K
2160	min	Winter	8.518	0.618	3.0	153.7	O K
2880	min	Winter	8.412	0.512	3.0	127.3	O K
4320	min	Winter	8.209	0.309	3.0	76.9	O K
5760	min	Winter	8.086	0.186	3.0	46.3	O K
7200	min	Winter	8.022	0.122	2.8	30.5	O K
8640	min	Winter	7.999	0.099	2.5	24.5	O K
10080	min	Winter	7.987	0.087	2.3	21.8	O K

Storm		Rain	${\tt Flooded}$	Discharge	Time-Peak	
	Even	t	(mm/hr)	Volume	Volume	(mins)
				(m³)	(m³)	
60		T-7	20 220	0 0	146.4	62
		Winter		0.0	146.4	
120	mın	Winter	18.112	0.0	181.5	120
180	min	Winter	13.534	0.0	203.5	178
240	min	Winter	10.952	0.0	219.6	236
360	min	Winter	8.106	0.0	243.8	350
480	min	Winter	6.544	0.0	262.4	460
600	min	Winter	5.539	0.0	277.6	566
720	min	Winter	4.832	0.0	290.6	652
960	min	Winter	3.892	0.0	311.9	744
1440	min	Winter	2.866	0.0	343.8	1054
2160	min	Winter	2.108	0.0	381.8	1516
2880	min	Winter	1.693	0.0	408.9	1964
4320	min	Winter	1.242	0.0	449.5	2640
5760	min	Winter	0.996	0.0	481.6	3288
7200	min	Winter	0.839	0.0	507.0	3888
8640	min	Winter	0.730	0.0	528.9	4488
10080	min	Winter	0.648	0.0	548.0	5152

ARP Associates		Page 3
Northwest House	Huddersfield Rd, Meltham	
Servia Hill	Kirklees	٧
Leeds LS6 2QH		Micco
Date 21/09/2017 4:31pm	Designed by PSC	Drainane
File huddersfield rd meltham	Checked by WMW	niailiade
Elstree Computing Ltd	Source Control 2017.1.2	

Rainfall Details

Return Period (years) 30 Cv (Summer) 0.750
Region England and Wales Cv (Winter) 0.840
M5-60 (mm) 19.000 Shortest Storm (mins) 15
Ratio R 0.350 Longest Storm (mins) 10080
Summer Storms Yes Climate Change % +0

Time Area Diagram

Total Area (ha) 0.600

 Time
 (mins)
 Area

 From:
 To:
 (ha)

 0
 4
 0.600

ARP Associates		Page 4
Northwest House	Huddersfield Rd, Meltham	
Servia Hill	Kirklees	
Leeds LS6 2QH		Micro
Date 21/09/2017 4:31pm	Designed by PSC	
File huddersfield rd meltham	Checked by WMW	Drainage
Elstree Computing Ltd	Source Control 2017.1.2	

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 7.900

Depth (m)	Area (m²)						
0.000	248.8	0.700	248.8	1.400	248.8	2.100	248.8
0.100	248.8	0.800	248.8	1.500	248.8	2.200	248.8
0.200	248.8	0.900	248.8	1.600	248.8	2.300	248.8
0.300	248.8	1.000	248.8	1.700	248.8	2.400	248.8
0.400	248.8	1.100	248.8	1.800	248.8	2.500	248.8
0.500	248.8	1.200	248.8	1.900	248.8		
0.600	248.8	1.300	248.8	2.000	248.8		

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0085-3000-0800-3000 Design Head (m) 0.800 Design Flow (1/s) Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes 85 Diameter (mm) Invert Level (m) 7.900 Minimum Outlet Pipe Diameter (mm) 100 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m) Flow	(1/s)
Design Point (Calculated)	0.800	3.0
Flush-Flo™	0.239	3.0
Kick-Flo®	0.517	2.5
Mean Flow over Head Range	-	2.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m) Flow	(1/s)	Depth (m) Flo	ow (1/s)	Depth (m) Flow	(1/s)	Depth (m)	Flow (1/s)
0.100	2.6	1.200	3.6	3.000	5.5	7.000	8.3
0.200	3.0	1.400	3.9	3.500	6.0	7.500	8.5
0.300	3.0	1.600	4.1	4.000	6.3	8.000	8.8
0.400	2.9	1.800	4.4	4.500	6.7	8.500	9.0
0.500	2.6	2.000	4.6	5.000	7.0	9.000	9.3
0.600	2.6	2.200	4.8	5.500	7.4	9.500	9.6
0.800	3.0	2.400	5.0	6.000	7.7		
1.000	3.3	2.600	5.2	6.500	8.0		

ARP Associates		Page 5
Northwest House	Huddersfield Rd, Meltham	
Servia Hill	Kirklees	
Leeds LS6 2QH		Micro
Date 21/09/2017 4:28pm	Designed by PSC	
File HUDDERSFIELD RD MELTHAM	Checked by WMW	Drainage
Elstree Computing Ltd	Source Control 2017.1.2	·

Summary of Results for 100 year Return Period (+30%)

Storm Event		Max Level (m)	Max Depth (m)	Max Control (1/s)	Max Volume (m³)	Status	
15	min	Summer	8.164	0.264	3.0	128.1	O K
30	min	Summer	8.253	0.353	3.0	171.1	O K
60	min	Summer	8.347	0.447	3.0	217.0	O K
120	min	Summer	8.444	0.544	3.0	263.7	O K
180	min	Summer	8.495	0.595	3.0	288.7	O K
240	min	Summer	8.526	0.626	3.0	303.8	O K
360	min	Summer	8.564	0.664	3.0	321.9	O K
480	min	Summer	8.584	0.684	3.0	331.8	O K
600	min	Summer	8.594	0.694	3.0	336.7	O K
720	min	Summer	8.598	0.698	3.0	338.3	O K
960	min	Summer	8.593	0.693	3.0	336.0	O K
1440	min	Summer	8.574	0.674	3.0	327.1	O K
2160	min	Summer	8.541	0.641	3.0	310.7	O K
2880	min	Summer	8.504	0.604	3.0	293.0	O K
4320	min	Summer	8.428	0.528	3.0	255.9	O K
5760	min	Summer	8.343	0.443	3.0	214.8	O K
7200	min	Summer	8.272	0.372	3.0	180.5	O K
8640	min	Summer	8.212	0.312	3.0	151.5	O K
10080	min	Summer	8.163	0.263	3.0	127.6	O K
15	min	Winter	8.196	0.296	3.0	143.7	O K
30	min	Winter	8.296	0.396	3.0	192.0	O K

Storm		Rain	${\tt Flooded}$	Discharge	Time-Peak	
	Even	t	(mm/hr)	Volume	Volume	(mins)
				(m³)	(m³)	
15	min	Summer	115.731	0.0	122.6	19
30	min	Summer	77.804	0.0	165.0	34
60	min	Summer	49.937	0.0	220.7	64
120	min	Summer	30.956	0.0	273.6	124
180	min	Summer	23.058	0.0	305.5	182
240	min	Summer	18.577	0.0	327.8	242
360	min	Summer	13.656	0.0	360.5	362
480	min	Summer	10.974	0.0	384.9	482
600	min	Summer	9.254	0.0	403.9	600
720	min	Summer	8.046	0.0	418.9	720
960	min	Summer	6.447	0.0	438.3	912
1440	min	Summer	4.709	0.0	431.8	1140
2160	min	Summer	3.432	0.0	552.7	1532
2880	min	Summer	2.739	0.0	587.4	1956
4320	min	Summer	1.989	0.0	637.5	2772
5760	min	Summer	1.583	0.0	682.5	3520
7200	min	Summer	1.325	0.0	713.9	4256
8640	min	Summer	1.147	0.0	740.9	5008
10080	min	Summer	1.015	0.0	763.6	5648
15	min	Winter	115.731	0.0	137.5	19
30	min	Winter	77.804	0.0	184.2	33

ARP Associates		Page 6
Northwest House	Huddersfield Rd, Meltham	
Servia Hill	Kirklees	٧
Leeds LS6 2QH		Micco
Date 21/09/2017 4:28pm	Designed by PSC	Desipago
File HUDDERSFIELD RD MELTHAM	Checked by WMW	Drainage
Elstree Computing Ltd	Source Control 2017.1.2	

Summary of Results for 100 year Return Period (+30%)

	Stor Even		Max Level (m)	Max Depth (m)	Max Control (1/s)	Max Volume (m³)	Status
60	min	Winter	8.403	0.503	3.0	243.9	ОК
120	min	Winter	8.512	0.612	3.0	296.7	ОК
180	min	Winter	8.571	0.671	3.0	325.2	O K
240	min	Winter	8.607	0.707	3.0	342.8	O K
360	min	Winter	8.651	0.751	3.0	364.4	O K
480	min	Winter	8.677	0.777	3.0	377.0	O K
600	min	Winter	8.692	0.792	3.0	384.0	O K
720	min	Winter	8.699	0.799	3.0	387.5	O K
960	min	Winter	8.700	0.800	3.0	387.8	O K
1440	min	Winter	8.674	0.774	3.0	375.3	O K
2160	min	Winter	8.631	0.731	3.0	354.4	O K
2880	min	Winter	8.579	0.679	3.0	329.6	O K
4320	min	Winter	8.469	0.569	3.0	276.1	O K
5760	min	Winter	8.338	0.438	3.0	212.3	O K
7200	min	Winter	8.231	0.331	3.0	160.6	O K
8640	min	Winter	8.149	0.249	3.0	120.6	O K
10080	min	Winter	8.088	0.188	3.0	91.4	O K

Storm		Rain	Flooded	Discharge	Time-Peak	
	Even	t	(mm/hr)	Volume	Volume	(mins)
				(m³)	(m³)	
60			40 007	0 0	0.47.0	60
		Winter		0.0	247.3	62
120	min	Winter	30.956	0.0	306.3	122
180	min	Winter	23.058	0.0	341.6	180
240	min	Winter	18.577	0.0	366.3	238
360	min	Winter	13.656	0.0	401.9	356
480	min	Winter	10.974	0.0	427.5	470
600	min	Winter	9.254	0.0	445.7	584
720	min	Winter	8.046	0.0	457.1	698
960	min	Winter	6.447	0.0	459.0	916
1440	min	Winter	4.709	0.0	441.0	1198
2160	min	Winter	3.432	0.0	618.9	1640
2880	min	Winter	2.739	0.0	657.6	2104
4320	min	Winter	1.989	0.0	712.0	3024
5760	min	Winter	1.583	0.0	764.6	3800
7200	min	Winter	1.325	0.0	799.8	4472
8640	min	Winter	1.147	0.0	830.1	5184
10080	min	Winter	1.015	0.0	856.0	5752

ARP Associates		Page 7
Northwest House	Huddersfield Rd, Meltham	
Servia Hill	Kirklees	٧
Leeds LS6 2QH		Micco
Date 21/09/2017 4:28pm	Designed by PSC	Drainage
File HUDDERSFIELD RD MELTHAM	Checked by WMW	niailiade
Elstree Computing Ltd	Source Control 2017.1.2	1

Rainfall Details

Return Period (years) 100 Cv (Summer) 0.750
Region England and Wales Cv (Winter) 0.840
M5-60 (mm) 19.000 Shortest Storm (mins) 15
Ratio R 0.350 Longest Storm (mins) 10080
Summer Storms Yes Climate Change % +30

Time Area Diagram

Total Area (ha) 0.600

 Time
 (mins)
 Area

 From:
 To:
 (ha)

 0
 4
 0.600

ARP Associates		Page 8
Northwest House	Huddersfield Rd, Meltham	
Servia Hill	Kirklees	الم
Leeds LS6 2QH		Micco
Date 21/09/2017 4:28pm	Designed by PSC	Desipago
File HUDDERSFIELD RD MELTHAM	Checked by WMW	Drainage
Elstree Computing Ltd	Source Control 2017.1.2	

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 7.900

Depth (m)	Area (m²)						
0.000	485.0	0.700	485.0	1.400	485.0	2.100	485.0
0.100	485.0	0.800	485.0	1.500	485.0	2.200	485.0
0.200	485.0	0.900	485.0	1.600	485.0	2.300	485.0
0.300	485.0	1.000	485.0	1.700	485.0	2.400	485.0
0.400	485.0	1.100	485.0	1.800	485.0	2.500	485.0
0.500	485.0	1.200	485.0	1.900	485.0		
0.600	485.0	1.300	485.0	2.000	485.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0085-3000-0800-3000 Design Head (m) 0.800 Design Flow (1/s) Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes 85 Diameter (mm) Invert Level (m) 7.900 Minimum Outlet Pipe Diameter (mm) 100 Suggested Manhole Diameter (mm) 1200

Control	Points	Head (m)	Flow (1/s)
Design Point	(Calculated)	0.800	3.0
	Flush-Flo™	0.239	3.0
	Kick-Flo®	0.517	2.5
Mean Flow ove	r Head Range	_	2.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m) Flow	(1/s)	Depth (m) Flo	ow (1/s)	Depth (m) Flow	(1/s)	Depth (m)	Flow (1/s)
0.100	2.6	1.200	3.6	3.000	5.5	7.000	8.3
0.200	3.0	1.400	3.9	3.500	6.0	7.500	8.5
0.300	3.0	1.600	4.1	4.000	6.3	8.000	8.8
0.400	2.9	1.800	4.4	4.500	6.7	8.500	9.0
0.500	2.6	2.000	4.6	5.000	7.0	9.000	9.3
0.600	2.6	2.200	4.8	5.500	7.4	9.500	9.6
0.800	3.0	2.400	5.0	6.000	7.7		
1.000	3.3	2.600	5.2	6.500	8.0		