ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

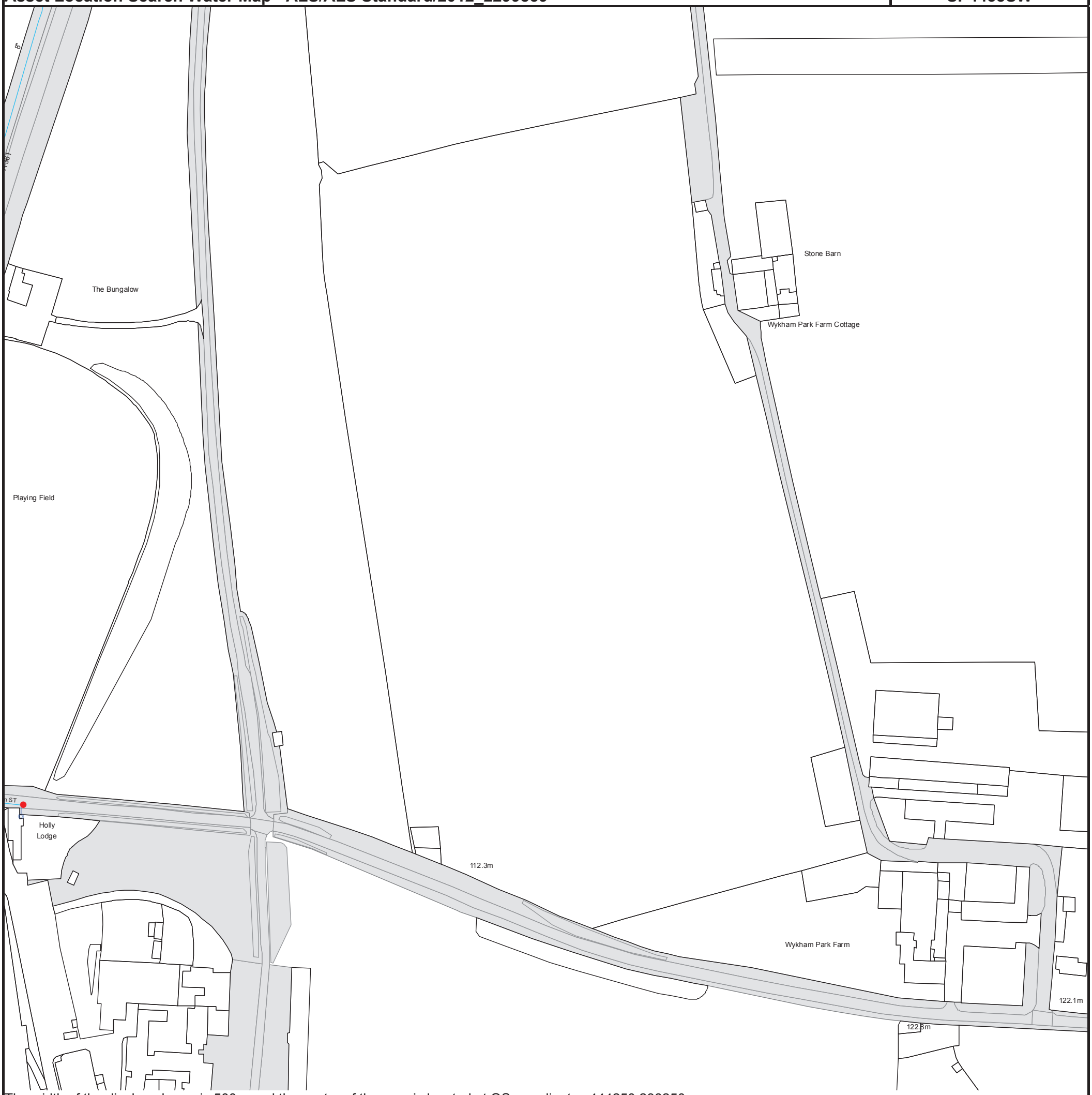
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0118 925 1504.

Asset Location Search Water Map - ALS/ALS Standard/2012_2299859

SP4438SW

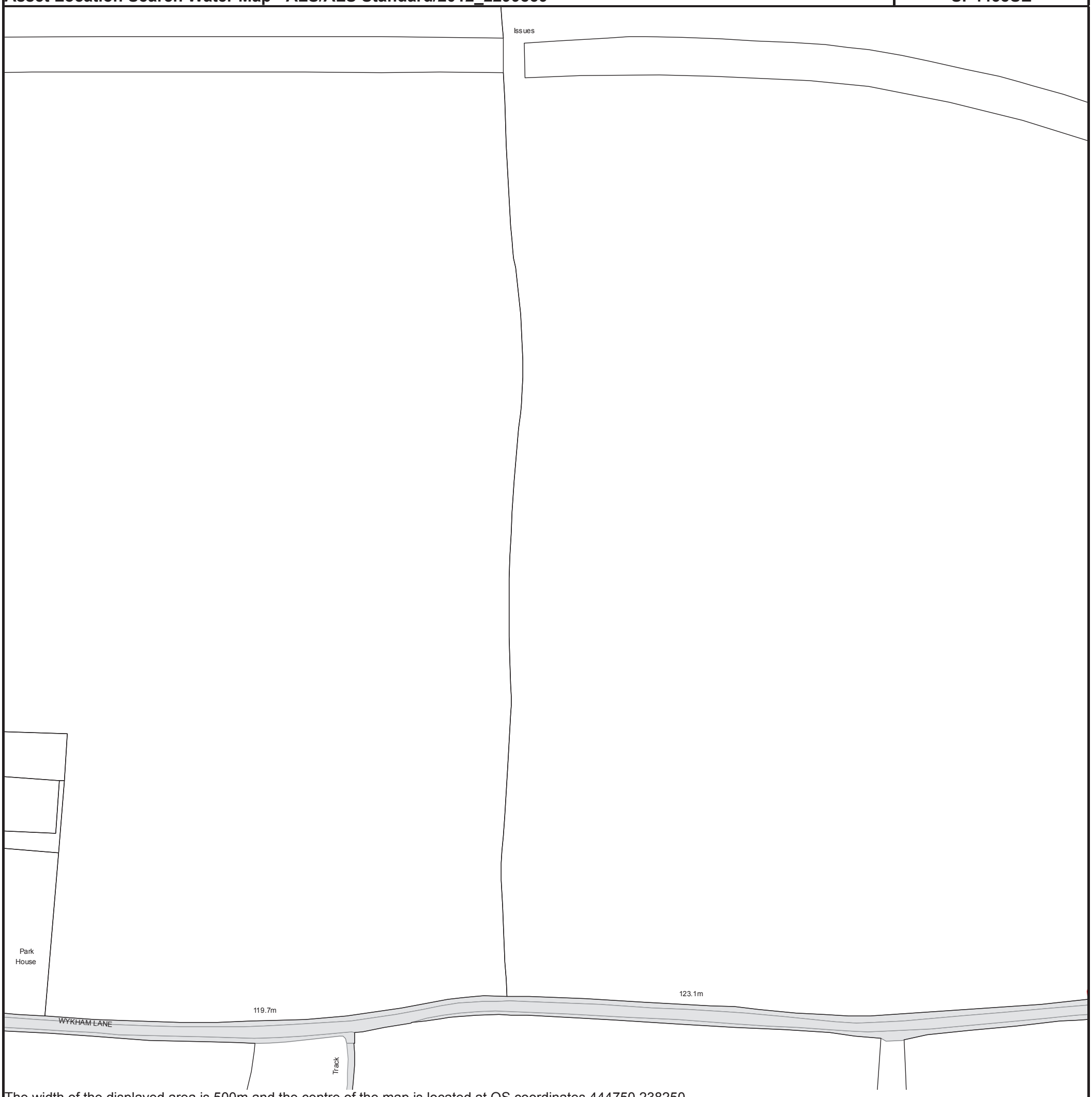


The width of the displayed area is 500m and the centre of the map is located at OS coordinates 444250,238250

Asset Location Search Water Map - ALS/ALS Standard/2012_2299859 | **SP4438NW**

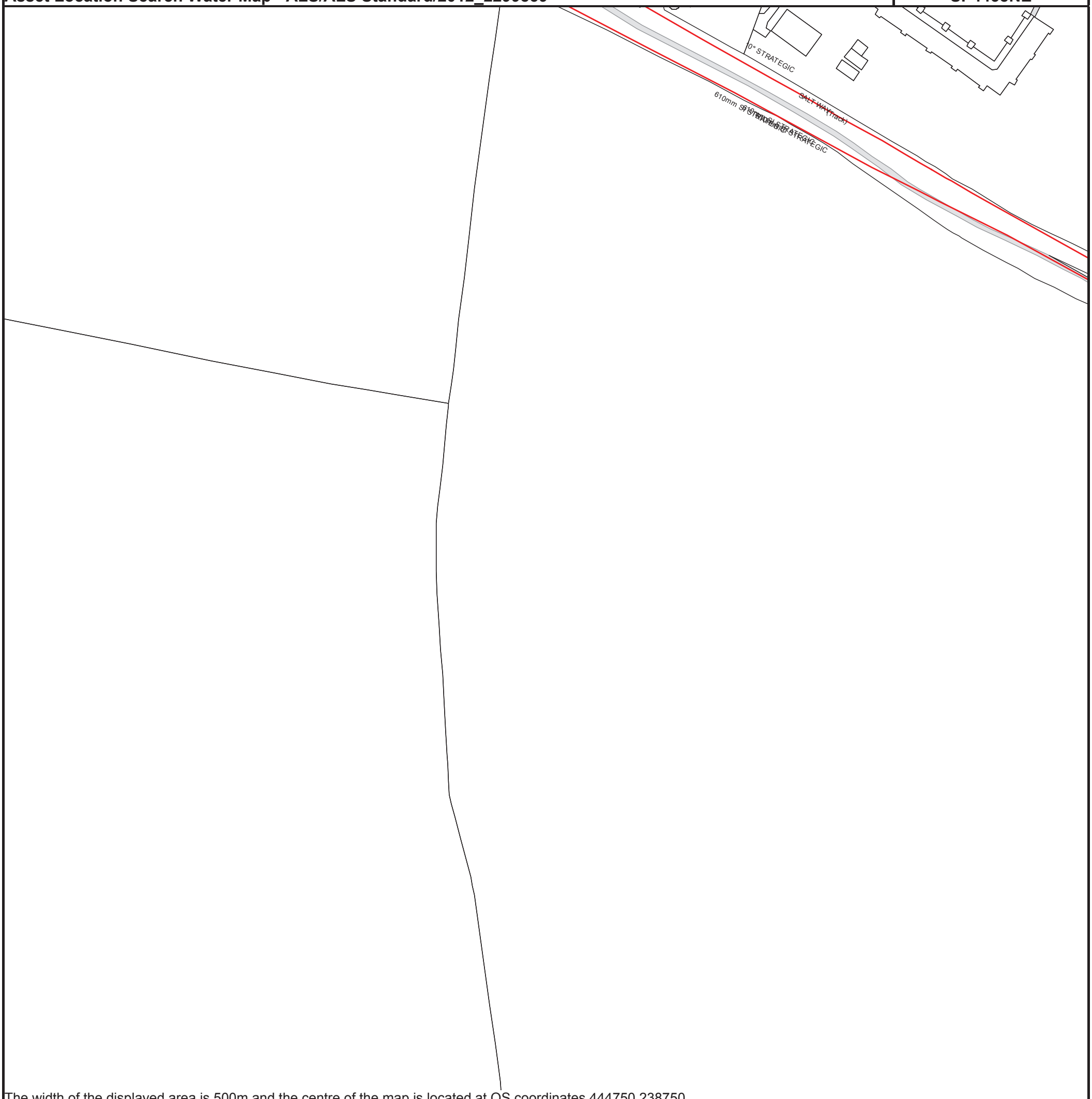
The width of the displayed area is 500m and the centre of the map is located at OS coordinates 444250,238750

Asset Location Search Water Map - ALS/ALS Standard/2012_2299859	SP4438SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 444750,238250

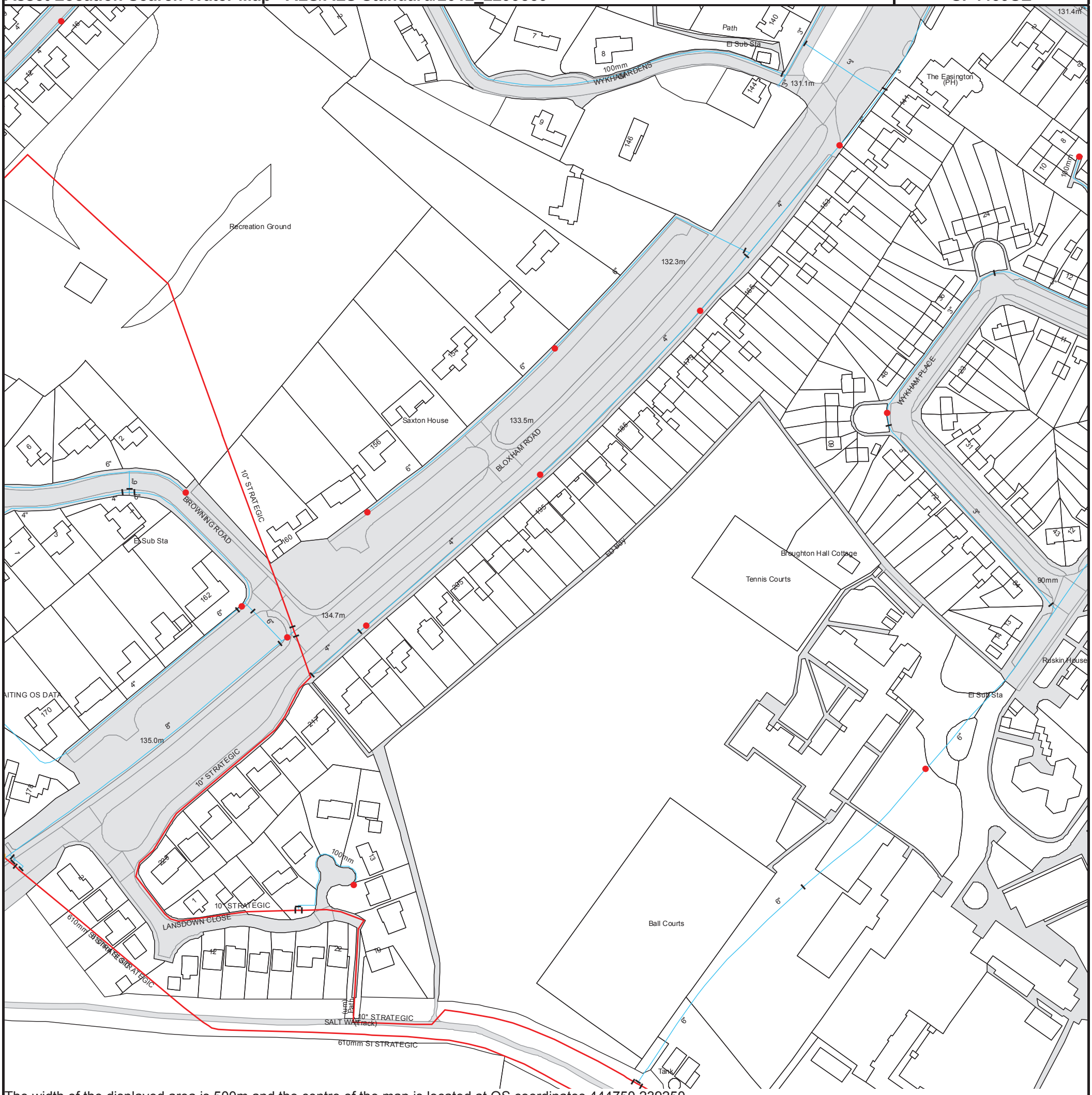
Asset Location Search Water Map - ALS/ALS Standard/2012_2299859 | **SP4438NE**



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 444750,238750

Asset Location Search Water Map - ALS/ALS Standard/2012_2299859

SP4439SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 444750,239250

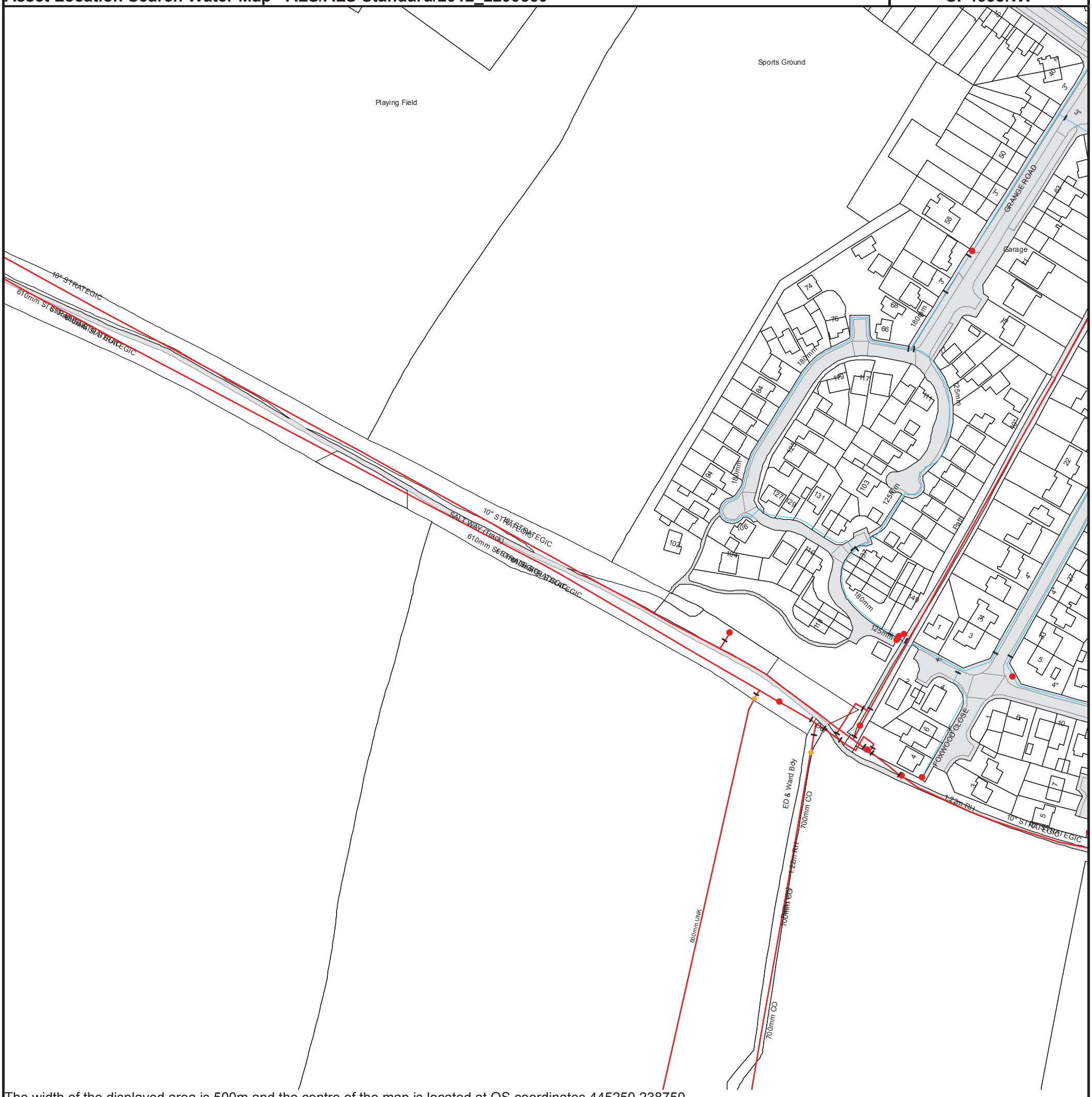
Asset Location Search Water Map - ALS/ALS Standard/2012_2299859

SP4538SW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 445250,238250

Asset Location Search Water Map - ALS/ALS Standard/2012_2299859

SP4538NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 445250,238750

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

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By Post – Cheque only, made payable to 'Thames Water Utilities Ltd' writing your Thames Water account number on the back. Please fill in the payment slip below and send it with your cheque to Thames Water Utilities Ltd., PO Box 223, Swindon SN38 2TW	**By BACS Payment** direct to our bank on account number 90478703, sort code 60-00-01 may be made. A remittance advice must be sent to Thames Water Utilities Ltd., PO Box 223, Swindon SN38 2TW. Or fax to 01793 424599 or email: cashoperations@thameswater.co.uk	**Telephone Banking** By calling your bank and quoting your invoice number and the Thames Water's bank account number 90478703 and sort code 60-00-01	**By Swift Transfer** You may make your payment via SWIFT by quoting **NWBKGB2L** together with our bank account number 90478703, sort code 60-00-01 and invoice number

Invoice

Emma Skelley

Wardell Armstrong LLP

Forge Lane
Stoke on Trent
ST1 5BD

Thames Water Utilities Ltd.
PO Box 223
Swindon
SN38 2TW

Customer Reference: N/A

Invoice No: ADS12333975
Our Ref: ALS/ALS Standard/2012_2299859

Customer Number: ADS110911
Purchase Order No: **ST11148**

Posting Date: 22-08-2012
Due Date: 05-09-2012

Search Address Supplied: 445267 238350, Wykham Park Farm, Wykham, Banbury, Oxfordshire, OX16 9ER

Description of Charges	Qty	Unit Price	VAT (20%)	Amount (Inc VAT)
Asset Location Search	1	£92.00	£18.40	£110.40

OUTSTANDING AMOUNT (Inc. VAT) £110.40

Please send any outstanding amount to Thames Water, PO Box 223, Swindon, SN38 2TW..

Your payment terms are within 14 days. Please see previous page for ways to pay.

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VAT Reg. No GB 537456915

Girobank Trans cash

Girobank plc Bootle Merseyside GIR 0AA

Payment slip

bank giro credit

138
208
70

Reference (customer account number): ADS110911 / ADS12333975

Credit account number: 257 1706

Amount due (40p fee payable at PO counter): £ 110.4

Cheque NOT acceptable at Post Office

By transfer from Alliance and Leicester Giro account number

Cashiers stamp and initials

Signature

Date

Wardell Armstrong LLP

Forge Lane
Stoke on Trent
ST1 5BD

NatWest
Collection Account
Thames Water
Utilities Ltd

57-17-06

Cash

Cheques

£

Items Fee

Please do not write or mark below this line and do not fold this counterfoil

Paragon 0530 01/2004

010010003339754 V7702571706 000110400 74 X

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Milford House
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Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

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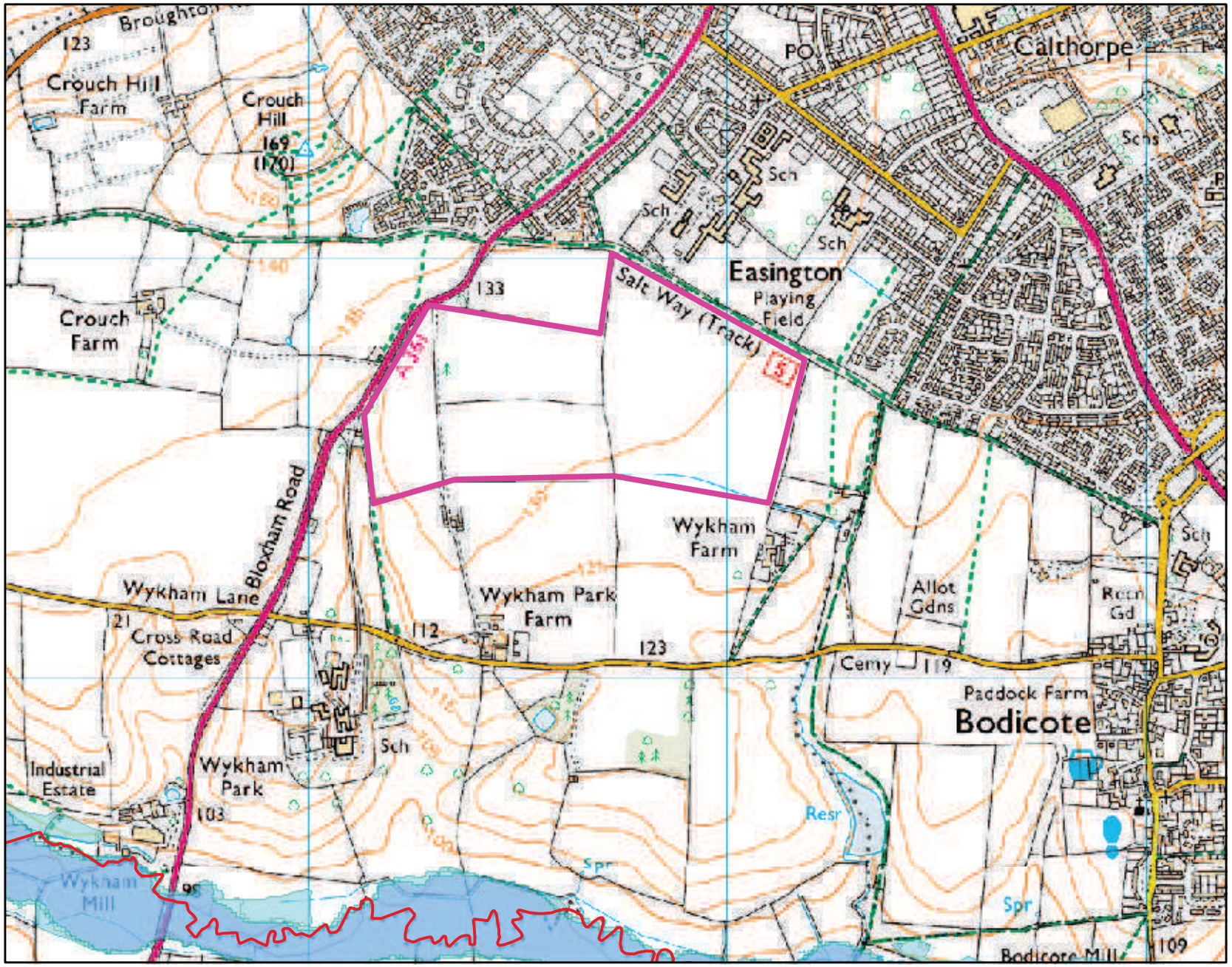
APPENDIX 2

Environment Agency Flood Map

Flood Map centred on Wykham Park Farm, Wykham ,Banbury
Created 20/09/2012 - REF: OX_0095_01



Environment Agency

Kilometres

0 0.15 0.3

N W E S

Legend

- Main River
- Flood defences
- Areas benefiting from flood defences
- Flooding from rivers or sea (FZ3)
- Extent of extreme flood (FZ2)
- Flood Map - flood storage areas

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

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

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APPENDIX 3

Environment Agency Correspondence

Skelley, Emma

From: Skelley, Emma
Sent: 21 August 2012 14:53
To: 'planning-wallingford@environment-agency.gov.uk'
Subject: FRA enquiry - Wykham, Banbury, Oxon [WM10671]
Attachments: Plan Base.pdf

Dear Sir/Madam

I'm currently preparing a Flood Risk Assessment and outline drainage strategy for a large site (circa 52ha) south of Banbury. We have been commissioned to prepare this report in readiness for promoting the site through the emerging Core Strategy.

The site address is below and I have attached a location plan for your reference.
Wykham Park Farm
Wykham
Banbury
Oxon
OX16 9ER
Grid ref: 445267, 238350

The outline proposals are for a mixed use development with circa 1000 residential units, a primary school, a local centre (circa 2.5ha) and employment land (circa 2ha).

The online flood map indicates that the site lies within Flood Zone 1. We would however, be grateful of your comments with regards to the scope for the FRA and outline drainage strategy. If you feel there are any site-specific issues that should be considered as part of the FRA we would be grateful if you could highlight these in your response. We would welcome any recommendations for surface water drainage. Should you have any queries please do not hesitate to contact me.

Kind regards,
Emma

Emma Skelley
Geologist
Wardell Armstrong LLP
Sir Henry Doulton House
Forge Lane
Etruria
Stoke on Trent
Staffordshire
ST1 5BD

Tel: 0845 111 7777
Fax: 0845 111 8888
www.wardell-armstrong.com

Skelley, Emma

From: planning-wallingford@environment-agency.gov.uk
Sent: 18 September 2012 15:46
To: Skelley, Emma
Subject: Environment Agency Response to: -
Attachments: PlanningProposal.rtf

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Wykham Park

The proposal has been reviewed and I enclose the Environment Agency's comments on:
Wykham Park Farm,
Wykham, Banbury, Oxon, OX16 9ER

LPA ref: -

Ms Emma Skelley
Wardell Armstrong Ltd
Sir Henry Doulton House Forge Lane
Stoke-on-Trent
Staffordshire
ST1 5BD

Our ref: WA/2012/112955/01-L01

Date: 18 September 2012

Dear Ms Skelley

MIXED USE DEVELOPMENT WITH CIRCA 1000 RESIDENTIAL UNITS, A PRIMARY SCHOOL, A LOCAL CENTRE (CIRCA 2.5HA) AND EMPLOYMENT LAND (CIRCA 2HA).
WYKHAM PARK FARM, WYKHAM, BANBURY, OXON, OX16 9ER

Thank you for consulting us on this pre-development enquiry. We received your e-mail, dated 21 August 2012 and we have the following comments.

The site is located within Flood Zone 1 and as such the primary flood risk associated with this development is that from surface water run-off. Development within this zone can generate significant volumes of water particularly where there is a proposed increase in the impermeable area. The requirement to assess the flood risks posed by the development includes an assessment of the run-off implications of development, appropriate to the nature and scale of that development.

In summary, we require a baseline drainage assessment to inform a more detailed drainage strategy/FRA. The drainage strategy should be developed alongside the development masterplan to ensure that adequate land is left for the drainage features and that the site layout considers their orientation.

These can be associated with SUDS features which will be required for the surface water drainage. This will also ensure that the surface water from this site does not increase the flood risk in the river system mentioned above.

There maybe limited infiltration across the site and therefore above ground sustainable drainage features could be more appropriate across the development. Discharge of surface water should be to existing watercourses across the site and should mimic the natural drainage patterns of the catchment. The natural drainage characteristics of the site can be used to shape the design of the surface water drainage and the masterplan for the site.

Cont/d..

Positive drainage of surface water across the development should be limited and we would expect that outfall to watercourses is provided through open channels or wetland features rather than piped systems. This opportunity should be discussed further to ensure that the future ecological and drainage reports do not contradict each other.

You will need to establish how the site currently responds under all rainfall events up to the 1 in 100 year event to determine the existing greenfield run-off rate. Catchment areas within the site should also be clearly defined with an associated greenfield run-off rate. This will then inform the drainage strategy with regards to a required surface water volume to be attenuated in order to design the indicative sustainable urban drainage system.

Existing overland flow routes should be established and it should be demonstrated how these routes will be maintained or managed in a sustainable way without increasing flood risk within the site and the surrounding area.

This also applies to overland flow routes within the development for any future proposed drainage strategy for any proposed informal drainage routes over the 1 in 30 year rainfall event up to the 1in 100 year event with a 30% allowance for climate change.

Residual flood risk, in the form of events greater than the design rainfall event, should also be considered to ensure that during extreme rainfall events the development is not at risk of flooding.

We would seek to ensure that the SUDS within the site are designed, located, constructed and managed in such a way as to positively contribute to the nature conservation value of the site.

<u>Any scheme should include the following features</u>

- Confirmation as to whether the individual SUDS are to be seasonally dry or have areas of permanent water. Wet and dry SUDS provide different habitat opportunities for invertebrates and macrophytes. Providing both wet and dry SUDS increases the habitat diversity available.
- The land around lakes and ponds, including SUDS basins can be valuable for wildlife if designed and managed appropriately. Therefore, a wide buffer zone should be established around each SUDS and the management of this zone provide maximum benefits for wildlife.
- Any planting within and around SUDS and ponds should be done with locally native species only. Non-native species can become invasive and result in the loss of habitat for native species and an increase in management costs due to control management being required. Using locally native species may increase the success rate of planting schemes as the species are able to cope with local conditions.
- A long term management plan of the open spaces (including the management of SUDS) should be included to ensure the features are managed for biodiversity in the long term.

SUDS and ponds can form part of a wider green & blue infrastructure strategy for the development, linking with other existing and proposed green infrastructure in the wider environment.

You should also look to use appropriate SUDS to ensure the water quality of local

watercourses is protected. This should be done by taking the requirements of the Water Framework Directive into account. The proposed development falls within waterbody Sor Brook (Broughton to Adderbury) GB106039037260, currently at Good Ecological Status. They must ensure that the proposed development doesn't cause deterioration in status of any WFD element. The site is also approximately 3 km upstream of a Thames Water drinking water abstraction. The applicant will need to ensure the development does not increase any water quality risk to it.

Yours sincerely

Mr Jack Moeran
Planning Liaison Officer

Direct dial 01491 828367
Direct e-mail planning-wallingford@environment-agency.gov.uk

End

Skelley, Emma

From: Skelley, Emma
Sent: 20 September 2012 12:31
To: 'planning-wallingford@environment-agency.gov.uk'
Subject: FAO Mr Jack Moeran - WA/2012/112955/01-L01 - Wykham Park Farm

Dear Mr Moeran

Thank you for your pre-planning response in relation to the above site. We will take your comments into consideration in the FRA and as part of the Masterplanning process.
With regards to surface water runoff, we would like to agree a discharge rate for the site with the Environment Agency to assist us with future calculations and preparation of the drainage strategy.

We have reviewed the Wallingford WRAP maps and followed the IH124 method and note that the soil is classified as being relatively permeable. The result of this is a QBAR value of approximately 0.15 litres/second/hectare and, therefore, in accordance with the EA/Defra document 'Preliminary Rainfall Runoff Management for Developments' (Rev E) we propose that surface water runoff rates from the development are restricted to 2 litres/second/hectare, and attenuated on site for events up to and including the 1 in 100 year event + climate change.

We would be grateful if you could confirm that our proposal to discharge surface water runoff from the development to existing watercourses, at a rate of 2 litres/second/hectare, is acceptable to the Environment Agency.

Your earliest response would be much appreciated so that we can prepare preliminary attenaution estimates to inform the Masterplan. If you have any queries please do not hesitate to call on 01782 276700.

Kind regards,

Emma Skelley

-----Original Message-----
From: planning-wallingford@environment-agency.gov.uk [mailto:planning-wallingford@environment-agency.gov.uk]
Sent: 18 September 2012 15:46
To: Skelley, Emma
Subject: Environment Agency Response to: -

The proposal has been reviewed and I enclose the Environment Agency's comments on:
Wykham Park Farm,
Wykham, Banbury, Oxon, OX16 9ER

LPA ref: -

Skelley, Emma

From: planning-wallingford@environment-agency.gov.uk
Sent: 30 October 2012 13:33
To: Skelley, Emma
Subject: Environment Agency Response to: -
Attachments: PlanningProposal.rtf

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Wykham Park, Pending

The proposal has been reviewed and I enclose the Environment Agency's comments on:
Wykham Park Farm,
Wykham, Banbury, Oxon, OX16 9ER

LPA ref: -

Ms Emma Skelley
Wardell Armstrong Ltd
Sir Henry Doulton House
Forge Lane
Stoke-on-Trent
Staffordshire
ST1 5BD

Our ref: WA/2012/112955/02-L01

Date: 30 October 2012

Dear Ms Skelley

MIXED USE DEVELOPMENT WITH CIRCA 1000 RESIDENTIAL UNITS, A PRIMARY SCHOOL, A LOCAL CENTRE (CIRCA 2.5HA) AND EMPLOYMENT LAND (CIRCA 2HA).
WYKHAM PARK FARM, WYKHAM, BANBURY, OXON, OX16 9ER

Thank you for consulting us on this matter. We received your email on the 20 September 2012 and we are now in a position to respond.

Having reviewed the details we note that there is a significant difference between the Qbar runoff rate, which is extremely low, and the 2l/s/ha as referenced in the Preliminary Rainfall Runoff document. It is possible that one of the design parameters is incorrect, as a quoted runoff rate of 0.15l/s/ha. If however this rate is correct then we would prefer that it is used to design the drainage features.

In order to provide a degree of betterment a runoff rate which is below any calculated rate could be used for design purposes.

Yours sincerely

Mr Jack Moeran
Planning Liaison Officer

Direct dial 01491 828367
Direct e-mail planning-wallingford@environment-agency.gov.uk

Please note that the view expressed in this letter by the Environment Agency is a response to a pre application enquiry only and does not represent our final view in relation to any future planning application made in relation to this site. We reserve the right to change our position in relation to any such application.

You should seek your own expert advice in relation to technical matters relevant to any planning application before submission

End

We may have to make this message and any reply to it public if asked to under the Freedom of Information Act, Data Protection Act or for litigation. Email messages and attachments sent to or from any Environment Agency address may also be accessed by someone other than the sender or recipient, for business purposes.

If we have sent you information and you wish to use it please read our terms and conditions which you can get by calling us on 08708 506 506. Find out more about the Environment Agency at www.environment-agency.gov.uk

Mr John Gibson - Associate Director
Wardell Armstrong Ltd
Sir Henry Doulton House Forge Lane
Stoke-on-Trent
Staffordshire
ST1 5BD

Our ref: WA/2013/114375/02-L01
Your ref:

Date: 09 May 2013

Dear Mr Gibson

1000 DWELLINGS TOGETHER WITH A LOCAL CENTRE INCLUDING RETAIL (A1), FINANCIAL SERVICES (A2), RESTAURANTS (A3-A5), UP TO A COMBINED TOTAL FLOORSPACE OF 1000M2, EMPLOYMENT SPACE (B1) UP TO A TOTAL FLOORSPACE OF 5000M2 WITH THE B1(A) OFFICE COMPONENT LIMITED TO A MAXIMUM OF 2,500M2, ASSOCIATED CAR PARKING, A COMMUNITY PRIMARY SCHOOL (INCLUDING SPACE FOR COMMUNITY USES (D1) AND ASSEMBLY AND LEISURE USES (D2)), GREEN INFRASTRUCTURE INCLUDING FORMAL AND INFORMAL OPEN SPACE, AMENITY SPACE, RETAINED HEDGEROWS, STRUCTURAL LANDSCAPING, SUPPORTING INFRASTRUCTURE (INCLUDING GAS, ELECTRICITY, SEWERAGE, WATER, TELECOMMUNICATIONS), SUSTAINABLE URBAN DRAINAGE SYSTEMS, NEW CONNECTION TO THE A361 BLOXHAM ROAD, PEDESTRIAN AND CYCLING CONNECTIONS TO THE SURROUNDING FOOTPATH AND CYCLE NETWORK AND ANY NECESSARY DEMOLITION AND GROUND REMODELLING. LAND INCLUDING OS7400, 5257, 4976, 2661, AND 5257 SOUTH OF SALT WAY ADJ TO BLOXHAM ROAD BANBURY

The Environment Agency has recently been consulted by the Local Authority regarding the above development proposal. Please find enclosed a copy of our comments for your information.
This response represents our advice as a statutory consultee on environmental issues associated with the proposed development. The reply should not be confused with the Council's decision notice, which will be issued by the Local Authority following determination of the application. Please contact the Local Authority if you wish to discuss the final decision to be made on this application.
If you have any queries about the Agency's response, please don't hesitate to contact me.

Cont/d..

Yours sincerely

Mr Jack Moeran
Planning Advisor

Direct dial 01491 828367
Direct fax
Direct e-mail planning-wallingford@environment-agency.gov.uk

End

Cherwell District Council
Planning & Development Services
Bodicote House White Post Road
Bodicote
Banbury
OX15 4AA

Our ref: WA/2013/114375/02-L01
Your ref: 13/00321/OUT

Date: 09 May 2013

Dear Ms Bailey,

1000 DWELLINGS TOGETHER WITH A LOCAL CENTRE INCLUDING RETAIL (A1), FINANCIAL SERVICES (A2), RESTAURANTS (A3-A5), UP TO A COMBINED TOTAL FLOORSPACE OF 1000M2, EMPLOYMENT SPACE (B1) UP TO A TOTAL FLOORSPACE OF 5000M2 WITH THE B1(A) OFFICE COMPONENT LIMITED TO A MAXIMUM OF 2,500M2, ASSOCIATED CAR PARKING, A COMMUNITY PRIMARY SCHOOL (INCLUDING SPACE FOR COMMUNITY USES (D1) AND ASSEMBLY AND LEISURE USES (D2)), GREEN INFRASTRUCTURE INCLUDING FORMAL AND INFORMAL OPEN SPACE, AMENITY SPACE, RETAINED HEDGEROWS, STRUCTURAL LANDSCAPING, SUPPORTING INFRASTRUCTURE (INCLUDING GAS, ELECTRICITY, SEWERAGE, WATER, TELECOMMUNICATIONS), SUSTAINABLE URBAN DRAINAGE SYSTEMS, NEW CONNECTION TO THE A361 BLOXHAM ROAD, PEDESTRIAN AND CYCLING CONNECTIONS TO THE SURROUNDING FOOTPATH AND CYCLE NETWORK AND ANY NECESSARY DEMOLITION AND GROUND REMODELLING. LAND INCLUDING OS7400, 5257, 4976, 2661, AND 5257 SOUTH OF SALT WAY ADJ TO BLOXHAM ROAD BANBURY

Further to my letter of objection to you dated 26 April 2013 we received an email from John Gibson on 03 May 2013. This provided further clarification to some of the surface water flood risk concerns we raised and we are now in a position to respond.

Environment Agency Position

We have no objection to the application as submitted, subject to the inclusion of a number of conditions, detailed under the headings below, to any subsequent planning permission granted.

Without the inclusion of these conditions we consider the development to pose an unacceptable risk to the Environment

Condition 1

No development shall take place until a surface water drainage scheme for the site, based on sustainable drainage principles and an assessment of the hydrological and hydro geological context of the development, has been submitted to and approved in writing by the local planning authority. The drainage strategy should demonstrate the surface water run-off generated up to and including the 1 in 100 year plus climate change critical storm will not exceed the run-off from the undeveloped site following the corresponding rainfall event. The scheme shall subsequently be implemented in

accordance with the approved details before the development is completed.

The scheme shall also include:

- Total runoff rate from all storm events up to and including the design event restricted to 60 litres/second.
- Details of the surface water drainage arrangements, outlining how any contamination risks will be mitigated

Reason

To prevent the increased risk of flooding, both on and off site.

Condition 2

If, during development, contamination not previously identified is found to be present at the site then no further development (unless otherwise agreed in writing with the local planning authority) shall be carried out until the developer has submitted a remediation strategy to the local planning authority detailing how this unsuspected contamination shall be dealt with and obtained written approval from the local planning authority. The remediation strategy shall be implemented as approved.

Reason

To ensure that any unexpected contamination encountered during the developments is suitable assessed and dealt with, such that it does not pose a unacceptable risk to ground or surface water.

Condition 3

No development approved by this permission shall be commenced until a scheme for the improvement j of the existing sewerage system has been submitted to and approved in writing by the local planning authority. The scheme shall be implemented as approved. No occupation of dwellings approved by this permission shall occur until the scheme for improvement j of the existing sewage system has been completed.

Reason

Ensuring that adequate sewerage infrastructure is provided in line with or prior to occupation will prevent future incidents and deterioration in the nearby watercourses.

Yours sincerely,

Mr Jack Moeran
Planning Advisor

Direct dial 01491 828367
Direct e-mail planning-wallingford@environment-agency.gov.uk

cc David Lock Associates Ltd.

End

APPENDIX 4

Thames Water Correspondence

Skelley, Emma

From: Geoff.Nokes@thameswater.co.uk
Sent: 20 September 2012 15:34
To: Skelley, Emma
Subject: Re: FW: Enquiry - Wykham Park Farm, Banbury, Oxon

Emma

We would most likely accept 5l/s into both of the proposed SW sewers as this is the realistic minimum attenuation rate. If it could be demonstrated that the existing is more then we would honour that discharge but for the surface water discharge the EA are the statutory consultee.

Regards
Geoff
Development Engineer - Waste
02035779228

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| From: |
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|"Skelley, Emma" <eskelley@wardell-armstrong.com>
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| To: |
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|<Geoff.Nokes@thameswater.co.uk>
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| Date: |
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|20/09/2012 14:47
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| Subject: |
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|FW: Enquiry - Wykham Park Farm, Banbury, Oxon
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Dear Geoff

Further to our recent correspondence (attached below) regarding the site at Wykham Park Farm, we will shortly be submitting an application for a formal impact study as you recommended. Although the impact study will ultimately provide information on suitable discharge locations, rates and necessary upgrading works for both foul and surface water flows, we are in the meantime preparing an outline drainage strategy (surface water) and would be grateful if you could provide your comments to the following question:

1. We are proposing to discharge the majority of surface water runoff to nearby watercourses due to the relatively impermeable nature of the ground. There are, however, two small areas of the site which are at lower elevations (up to 4 – 5m) than the proposed discharge location. These areas are a parcel of land in the south-eastern corner, and a parcel of land in the south-western corner of the site. We propose, therefore, that surface water from these two areas is discharged to two nearby public surface water sewers at the following locations:
   i. Sheet SP4538NW Manhole Ref 3603 or 4652;
   ii. Sheet SP4438NW Manhole Ref 1501 or Sheet SP4438SW Manhole ref 1403.

We would, of course, restrict surface water discharge rates into the public sewers to your requirements, and would be grateful if you could comment as to whether discharge to the public sewers would be acceptable in principle, and an indication of an acceptable discharge rate. We appreciate that the formal impact study will provide greater details and confirmation on discharge locations and rates, but if we could make an 'in principle' agreement with yourselves in the meantime it would be gratefully appreciated.

Kind regards,

Emma Skelley
Geologist
Wardell Armstrong LLP
Sir Henry Doulton House
Forge Lane
Etruria
Stoke on Trent
Staffordshire
ST1 5BD

Tel: 0845 111 7777
Fax: 0845 111 8888
www.wardell-armstrong.com

-----Original Message-----
From: Geoff.Nokes@thameswater.co.uk [mailto:Geoff.Nokes@thameswater.co.uk]
Sent: 04 September 2012 16:26
To: Skelley, Emma
Subject: RE: Enquiry - Wykham Park Farm, Banbury, Oxon

Emma

Go straight to Impact study and with the details provided should be enough

regards
Geoff

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  |"Skelley, Emma" <eskelley@wardell-armstrong.com
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  |<Geoff.Nokes@thameswater.co.uk
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  |RE: Enquiry - Wykham Park Farm, Banbury, Oxon |

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Geoff

Thank you for this information, I will pass this on to our Client and get back in touch should we wish to proceed with the study. Am I correct in assuming that the impact study could be carried out on the data I have already provided to you, since we do not have any more details should they be required for the study.

If you could confirm the above it would be gratefully appreciated.

As an alternative, I could attempt to submit a formal developer enquiry form to the Developer Services team for a charge. Could you give me your opinion on whether they are likely to process an application that doesn't have all the details they ask for eg anticipated flows. I have avoided submitting such an enquiry to date because I'm aware that I can't complete all of the details, but if you think there's a chance of it getting a response I might try.

Kind regards,

Emma Skelley
Geologist
Wardell Armstrong LLP
Sir Henry Doulton House
Forge Lane
Etruria
Stoke on Trent
Staffordshire
ST1 5BD

Tel: 0845 111 7777
Fax: 0845 111 8888
www.wardell-armstrong.com

(Embedded image moved to file: pic14615.gif) -----Original Message-----
From: Geoff.Nokes@thameswater.co.uk [mailto:Geoff.Nokes@thameswater.co.uk]
Sent: 04 September 2012 15:22
To: Skelley, Emma
Subject: Re: Enquiry - Wykham Park Farm, Banbury, Oxon

Emma

Unfortunately, we have a charge for giving this information, it will require an impact study as this would be a significant load on our small local Network, this requires a £400+vat cheque to obtain the scope and quote for the impact study, which is produced in about 2 weeks and an impact study of this kind could be £10k and need 12 weeks to complete.

Regards
Geoff
Development Engineer - Waste
02035779228

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| From: |
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  |"Skelley, Emma" <eskelley@wardell-armstrong.com
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| To: |

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  |<geoff.nokes@thameswater.co.uk
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  |04/09/2012
11:54 |

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| Subject: |
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  |Enquiry - Wykham Park Farm, Banbury,
Oxon |

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Dear Mr Nokes

Further to my recent telephone call with the Developer Services team, I have been asked to forward my original email enquiry to you. Please see below. Since sending the email on 21/08 I have received the asset plans for the site and I am therefore aware of the locations of the public sewers.

I look forward to receiving your response. Pease do not hesitate to call me to discuss further.

Kind regards,

Emma Skelley
Geologist
Wardell Armstrong LLP
Sir Henry Doulton House
Forge Lane
Etruria
Stoke on Trent
Staffordshire
ST1 5BD

Tel: 0845 111 7777
Fax: 0845 111 8888

www.wardell-armstrong.com

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From: Skelley, Emma
Sent: 21 August 2012 10:12
To: 'developer.services@thameswater.co.uk'
Subject: Pre-application Enquiry - Wykham Park Farm, Banbury, Oxon

Dear Sir/Madam

I am currently preparing a Flood Risk Assessment and outline drainage strategy for the following site (see attached plan):
Wykham Park Farm
Wykham
Banbury
Oxon
OX16 9ER
Grid Ref: 445267, 238350

The outline proposals are for a mixed use development with circa 1000 residential units, a primary school, a local centre (circa 2.5ha) and employment land (circa 2ha). The total site area is approximately 52ha.
I will shortly be requesting a copy of the public sewer records for the area, but I would be grateful if you could provide an indication of whether foul water flows could, in principle, be discharged to the public sewer network, or not. It is currently proposed that surface water will be managed using SUDS and discharged to watercourse. I would welcome your comments on the following:

- Are there any sewer easements affecting the site?
- Does the local public sewer network have sufficient capacity to accept foul water flows from a development of this scale without abnormal cost to the developer?
- Would Thames Water accept, in principle, a pumped discharge?
- Which manhole could foul water flows be discharged to?
- Would there be a restriction on discharge rate, and what would this be?
- If for whatever reason surface water cannot be discharged by any other means, would Thames Water accept discharge to public sewer?
    - If yes, would there be a restriction on the rate of discharge? At what MH location could surface water be discharged?

At this stage we are only gathering information on the site in readiness for promoting it through the emerging core strategy so I do not have any details other than what has been described above. I therefore, appreciate that you can only provide a response in principle to my questions above, and this will be sufficient for my purposes at this time. We would like to be fully aware of any potential development constraints, and significant abnormal costs as early as possible and hence your response to the above would be much appreciated. If you have any queries please do not hesitate to contact me on 01782 276700.

Kind regards,

Emma Skelley
Geologist
Wardell Armstrong LLP
Sir Henry Doulton House
Forge Lane
Etruria
Stoke on Trent

APPENDIX 5

Preliminary Surface Water Runoff, Attenuation Estimates and Pre and Post-Development Discharge Volume Calculation

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Gallagher Estates	Wykham Park Farm	WM10671	PAGE: 1 OF 1
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Estimation of Greenfield Runoff & Attenuation Calcs	(NAME AND SIGNATURE) E Skelley	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 05/09/2012	DATE:	DATE:

Following IH 124 method

SAAR	653	obtained from the Wallingford Procedure
SOIL	0.1	obtained from the Wallingford Procedure (SOIL = $0.1SOIL_1 + 0.3SOIL_2 + 0.37SOIL_3 + 0.47SOIL_4 + 0.53SOIL_5$)
Site Area	0.3	(square kilometers)

$QBAR_{RURAL} = 0.00108AREA^{0.89}.SAAR^{1.17}.SOIL^{2.17}$

$= 0.00108 \times 0.5^{0.89} \times 653^{1.17} \times 0.1^{2.17}$

$= \mathbf{0.0077}$ m^3/second

$= \mathbf{7.74}$ litres/second

ICP SUDS (to pro-rata IH124 method for sites less than 50 hectares)

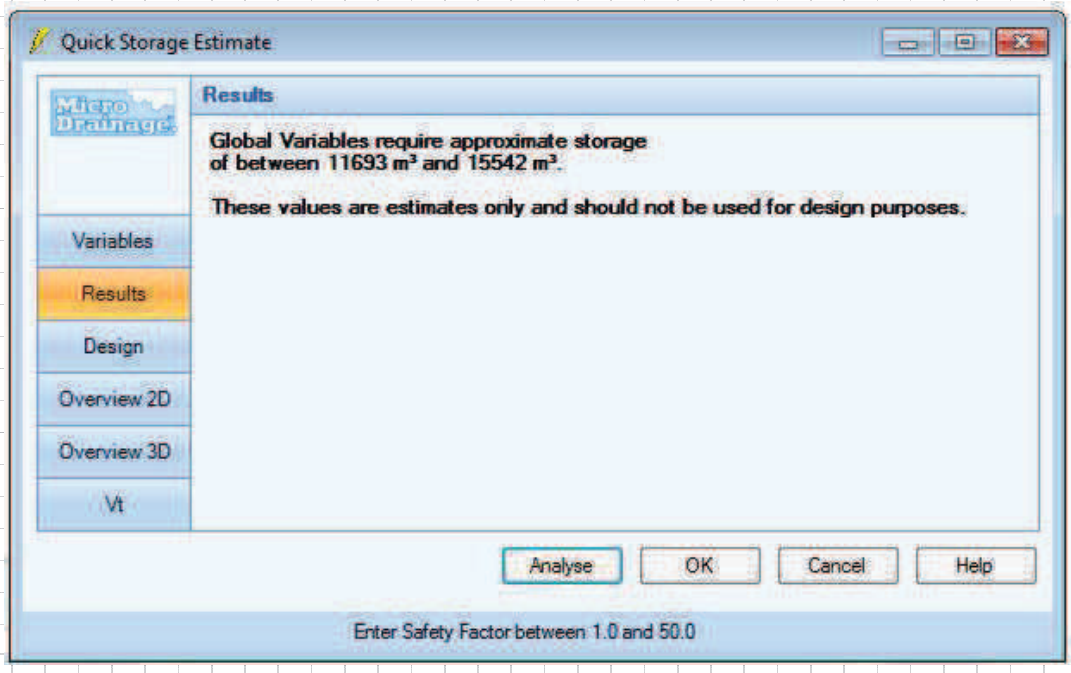
$= QBAR_{RURAL} / 0.5$ x Site area

$= 0.015 \times 0.3$

$= 0.00465$ m^3/second over site area

$= \mathbf{4.65}$ litres/second over site area

$= \mathbf{0.15}$ litres/second/hectare



Calculation Sheet

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
GALLAGHER ESTATES LTD	**WYKHAM PARK FARM**	**CA10769**	PAGE: 1 OF 1
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Rainfall Intensity: 100 Year - 6 Hour **1 IN 100** **DISCHARGE VOLUMES -** **RAINFALL INTENSITY**	(NAME AND SIGNATURE) L CHERA	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: MAY 2014	I	DATE:

Following the Wallingford Procedure

M5-60 =	19.7	mm	
Ratio r =	0.408		
Duration (D)=	360	minutes	
Z1 =	1.7		

M5-360 = M5-60 x Z1

= 33 mm

Return Period =	100		
Z2=	1.8		

M100 360 = M5-360 x Z2

= 32.7 x 1.82

= **59.5** **mm**

Rainfall intensity (mm/hr) = MT-D / D/60

= **59.5** / **6.00**

= **9.91** **mm/hr**

Including an allowance for climate change:

20% =	**11.90**	**mm/hr**
30% =	**12.89**	**mm/hr**

Calculation Sheet

REF: ST13628

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
GALLAGHER ESTATES LTD	**WYKHAM PARK FARM**	**CA10769**	PAGE: 2 OF 2
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Pre and Post Development Dischrge Volumes: 100 Year - 6 Hour **1 IN 100**	(NAME AND SIGNATURE) L CHERA	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE:	DATE:	DATE:

Pre-Development Dischrge Volumes

Pre-Development Impermeable Area = **0 m2**
Pre-Development Permeable Area = **524,600 m2**

Pre-Development Runoff Volume (100yr 6hr) = 0 m2 x 9.91 mm/hr x 6 hr = **0** m3

+ Greenfield Runoff Volume of = 2832.357 m2 (Refer to MicroDrainage Greenfield Volume Calculation)

Therefore 1 in 100 Year Pre-Development Runoff Volume = 2832 m3

Post-Development Dischrge Volumes

Post-Development Impermeable Area = **40800 m2** @ 20% Climate Change Allowance
Post-Development Impermeable Area = **259200 m2** @ 30% Climate Change Allowance

Post-Development Permeable Area = **224600 m2**

Post-Development Runoff Volume (100yr 6hr) = 32640 m2 x 11.90 mm/hr x 6 hr = **2330** m3
@ 20% Climate Change Allowance
+

Post-Development Runoff Volume (100yr 6hr) = 207360 m2 x 12.89 mm/hr x 6 hr = **16035** m3
@ 30% Climate Change Allowance

+ Greenfield Runoff Volume of = 0 m2

Therefore 1 in 100 Year Post-Development Runoff Volume = 18365 m3

Therefore, Additional Volume of Runoff Caused by the Developmen = 18365 - 2832

= **15533 m3**

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	19.700
Ratio R	0.408
Areal Reduction Factor	1.00
Area (ha)	52.460
SAAR (mm)	700
CWI	105.000
Urban	0.000
SPR	10.000

Results

Percentage Runoff (%)	8.82
Greenfield Runoff Volume (m^3)	2832.357

APPENDIX 6

Thames Water Sewer Impact Study (May 2013)

SEWER IMPACT STUDY

X4503 – 462

SMG 1190

PROPOSED CONNECTION AT WYKHAM PARK FARM, BANBURY

FOUL WATER SYSTEM

v1.0 May 2013

Prepared by: Girija Mulay
Reviewed by: Graham Moralee
Approved by: Tyrone Parkinson

Network & Process Modelling Group
Thames Water Utilities Ltd
Power House, Island Road
Reading, Berkshire
RG2 0RP

Asset Management

Contents

Appendices

1.0 Introduction

The following report was commissioned by Thames Water's Developer Services to investigate the capacity within the existing foul water system, and to ascertain the impact of a proposed new connection on the foul water network at Wykham Park Farm, Banbury, Oxfordshire.

The scope of the study is to undertake a preliminary desktop study based upon an updated verified hydraulic model.

The scope of the study includes:

- Carry out a flow survey.
- Undertake an updated verification exercise to confirm current flows and capacity in the foul sewer network downstream of the development site.
- Check the current performance of the network during a 1 in 20 year return period storm.
- Add development flows to the model and check the impact of additional flow to the network during a 1 in 20 year return period storm.
- Propose solutions to allow flows to be accepted into the existing network with 'no detriment' impact, if required.

2.0 Background

The proposed new development is on a Greenfield site and consists of 1,000 residential properties, a local centre and employment area covering a maximum of 6,000 m^2, and a primary school for 210 pupils. The development site is located in the Banbury catchment, to the south-west of the town centre, immediately to the south of Banbury Comprehensive School.

The foul flows from the development area have been calculated, using the latest Thames Water guidelines, as a pumped flow of 50.3 l/s.

A preferred connection manhole was not identified by the developer.

A plan showing the location of the development area is provided in Appendix A.

3.0 Existing Sewerage System and Treatment Works

The area is served by a separate foul and surface water sewer system.

Foul flows in this area gravitate in a north-easterly direction towards Cherwell Street SPS. Flows are lifted from here directly to Banbury Sewage Treatment Works (STW). Banbury STW also accepts flows from the north and the south of the catchment, from Grimsbury SPS and Adderbury SPS, respectively. Banbury STW is located approximately 3 km downstream of the development site.

The local foul sewer network drains in a north-easterly direction. Flows travel through pipe sizes ranging from 225 mm diameter to 1350 mm diameter towards Cherwell Street SPS.

The local foul water sewers are shown in the plan provided in Appendix B.

4.0 Thames Water Drainage Requirements

This study considers only the foul water sewer network.

The development should cause no detriment (e.g. additional or new flooding) to the existing system in a 1 in 20 year design rainfall event.

5.0 Sewer Impact Assessment

Assessment of the hydraulic loading of the foul water network was carried out by means of the existing foul water model of the Banbury catchment, which was last verified in 2006.

An updated flow survey was completed on the sewer network downstream of the development site. A model verification exercise was completed with the measured rainfall and flow data.

The proposed new development area and connection point details have been added to the hydraulic model, and the assessment completed to identify the impact of the proposed new development.

The analysis of the catchment indicates that the foul water sewer system is responsive to rainfall, with flooding being a risk in the catchment for extreme events.

The impact of the proposed foul water connection was assessed based on the design flows detailed in Section 2.0.

5.1 Foul Water Sewers

5.1.1 Assessment of Existing Catchment

The existing foul water model of the Banbury catchment was used to assess the capacity of the foul water sewer network in the study area.

The hydraulic model predicts that the foul sewers in the vicinity of the development site do not have available capacity in the existing scenario. However, further downstream, the existing sewer network is predicted to have spare capacity.

5.1.2 Assessment of Development Catchment

An analysis has been completed to assess the impact of connecting the flows from the development site into the public sewer.

Due to the location of the development site and the local topography, it will be necessary for the development site to be connected to the existing sewer network by a new sewage pumping station serving the development site.

Two connection manholes have been identified for the rising main discharge location; manholes SP45395501 and SP45402102. These manholes have been identified based on existing capacity issues in the sewer network. Both of these manholes are at least 1 km away from the development site, however, these have been assessed as the most suitable connection manholes with regard to the extent of network detriment caused.

An allowance of 50.3 l/s pumped inflow was used to represent the development, as described in detail in Section 2.

Table 1: Proposed Development Connections Details

Connection	Manhole	Diameter of Outgoing Sewer
Connection MH 1	SP45395501	300 mm
Connection MH 2	SP45402102	225 mm

An allowance of 50.3 l/s pumped inflow was used to represent the development, as described in detail in Section 2.

Model simulations have shown that connecting the foul flows from the development site into the existing network causes flooding and surcharge detriment. Network infrastructure improvements will therefore be required, to allow the development site to connect without causing detriment.

5.1.3 Foul System Improvement Works

The following options were considered, and discarded as not feasible.

Option	Reason for Discarding
Connect development site to the existing sewer network by gravity	Due to local topography, it would not be possible to connect the development site to the existing network using a gravity system.
Connect the rising main closer to the development site.	This would result in a significant amount of detriment in the existing sewer network, resulting in the need for extensive network infrastructure improvements.

Connection Manhole 1 – SP45395501

The hydraulic model predicts that the foul sewers immediately downstream of the connection manhole have insufficient capacity to accept the proposed development flows during the 1 in 20 year return period storm. The additional flows cause an increase in predicted flooding and surcharge levels in the downstream network.

An indicative option has been developed to prevent the detrimental impact on the existing foul sewer system. The option consists of the following network upgrades:

<u>Option – Pipe Upsizing – Basing View</u>

- Construct a new sewage pumping station serving the development site.
- Lay a rising main along an indicative route of Farmfield Road and Oxford Road, for an approximately length of 1 km.
- Upsizing from 300 mm diameter to 450 mm diameter between manholes SP45395501 and SP45398601, for a total length of 277m.

- Upsizing from 300 mm diameter to 1800 mm diameter between manholes SP45398601 and SP45399601, for a total length of 116 m.

Connection Manhole 2 – SP45402102

The hydraulic model predicts that the foul sewers immediately downstream of the connection manhole do not have available capacity to accept the proposed development flows during the 1 in 20 year return period storm. The additional flows cause an increase in predicted surcharge levels and flooding on a number of manholes in the downstream network.

An indicative option has been developed to prevent the detrimental impact on the existing foul sewer system. The option consists of the following network upgrades:

Option – On-line Storage and Flow Control – Basing View

- Construct a new sewage pumping station serving the development site.
- Lay a rising main along an indicative route of Bloxham Road and Springfield Avenue, for an approximately length of 1.7 km.
- Upsizing from 450 mm diameter to 1500 mm diameter between manholes SP45402202 and SP45402203, for a total length of 38m.
- Upsizing from 450 mm diameter to 525 mm diameter between manholes SP45408302 and SP45409313, for a total length of 9 m.
- Hydro-break flow control, with a limiting discharge of 60l/s at the downstream end of the on-line storage, within manhole SP45402203.

6.0 Risks and Issues

Current understanding of the hydrology of urban environments recognises that the effective pervious area (the pervious proportion of the catchment that produces surface runoff and generates flow in the sewer) is likely to exhibit a dynamic nature in relation to increasing volumes of rainfall, i.e. the more rainfall the greater the resulting effective pervious area is likely to be.

Whilst the hydrological models deployed attempt to simulate this dynamic behaviour, there is a risk that the model, when extrapolated to the 1 in 20 year standard, will not accurately predict the flows in the system. Therefore, any potential error is multiplied when the system is tested against a large design storm.

7.0 Conclusions

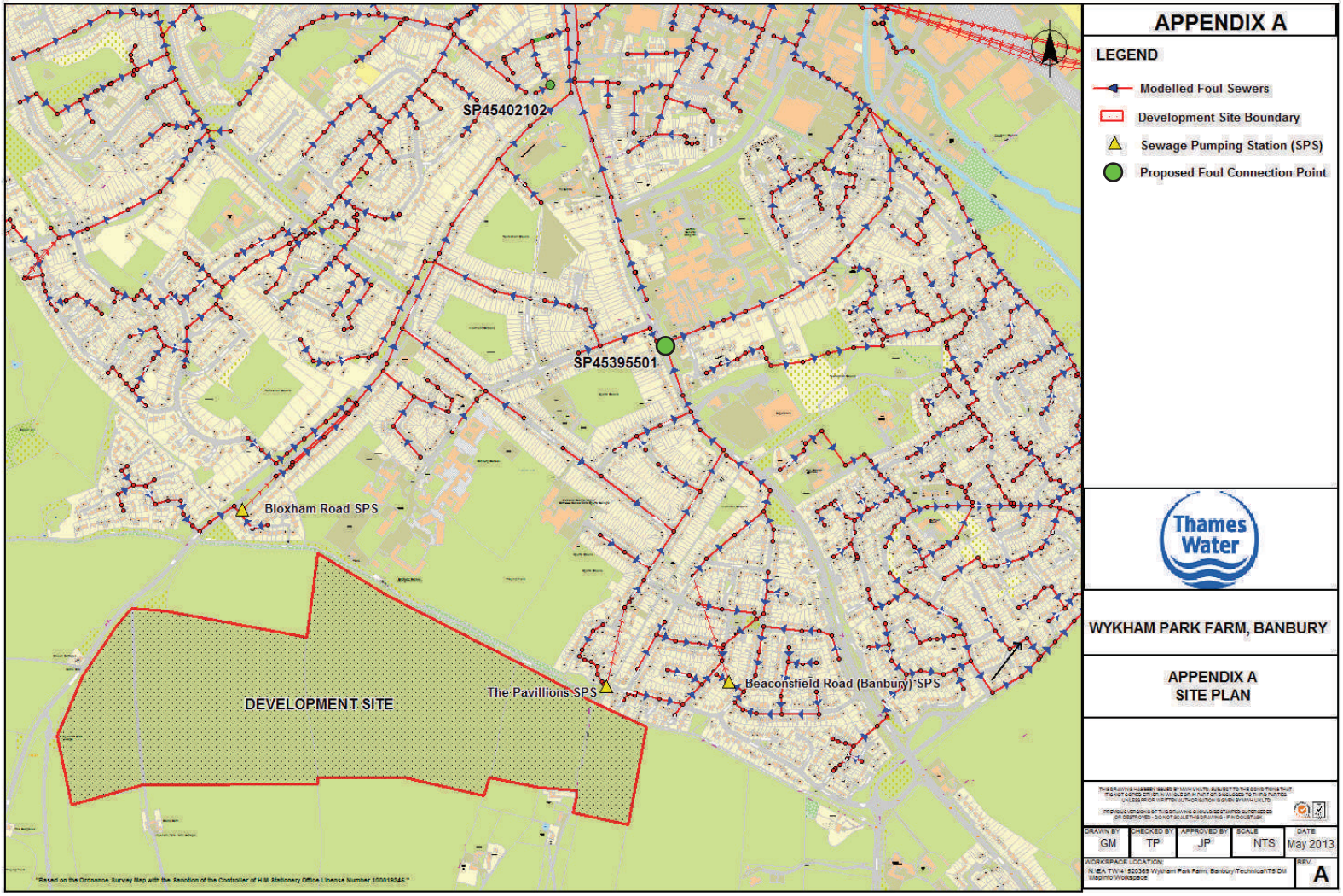
The desktop study has successfully investigated and identified the implications of the proposed new development on a Greenfield site at Wykham Park Farm, Banbury to the foul water network.

The hydraulic model predicts that the foul sewers immediately downstream of the connection manholes do not have available capacity in the existing network to accept the proposed development flows during the 1 in 20 year return period storm without causing detriment.

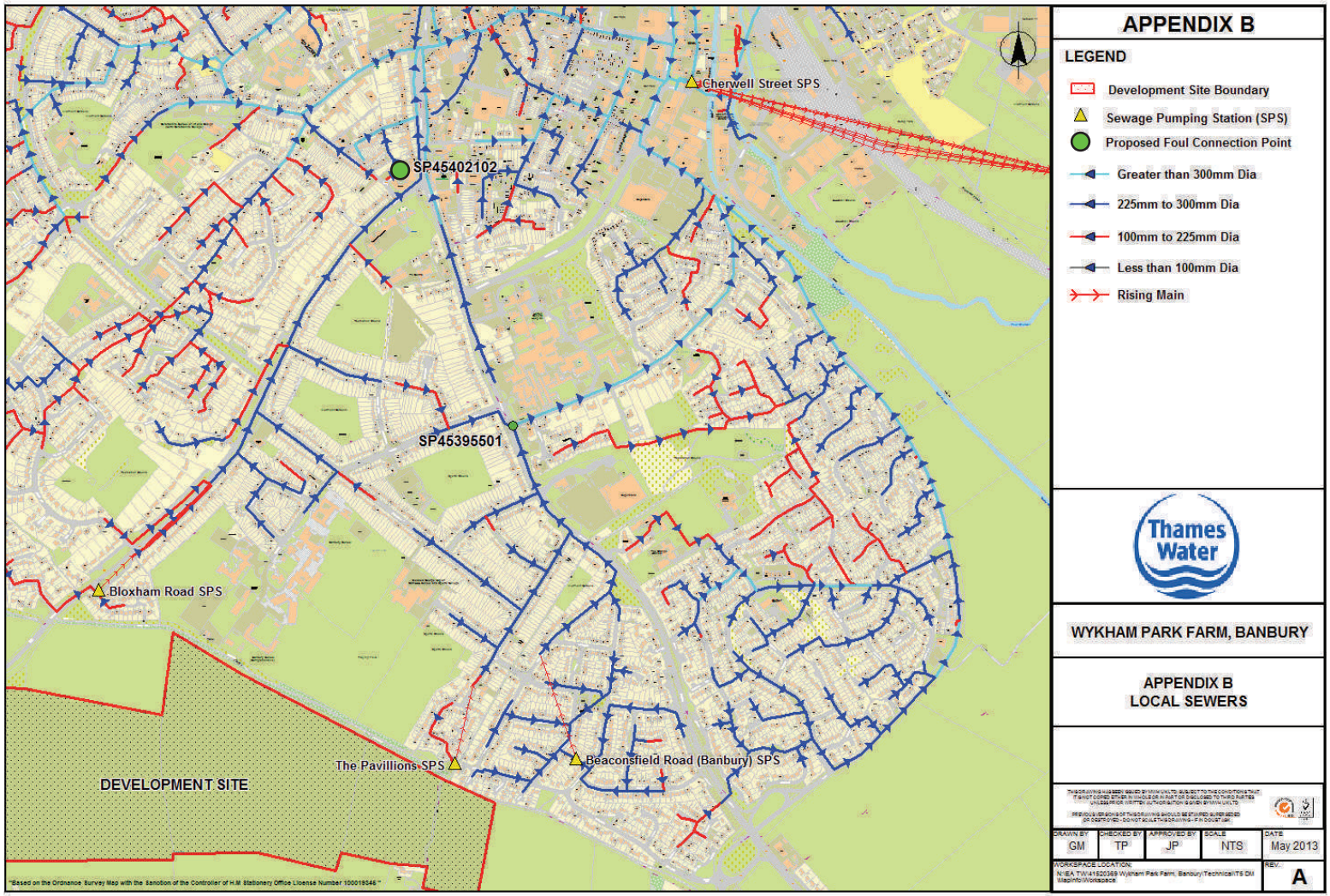
Improvements to the existing foul water system are required to enable the proposed connection to the sewer network, without causing any detriment to the level of service provided. The proposed options resolve the increase in surcharge and flooding and ensure a 'no detriment' impact on the sewer network.

The above are recommendations to Thames Water Utilities and may be altered or added to based on local operational knowledge of the system.

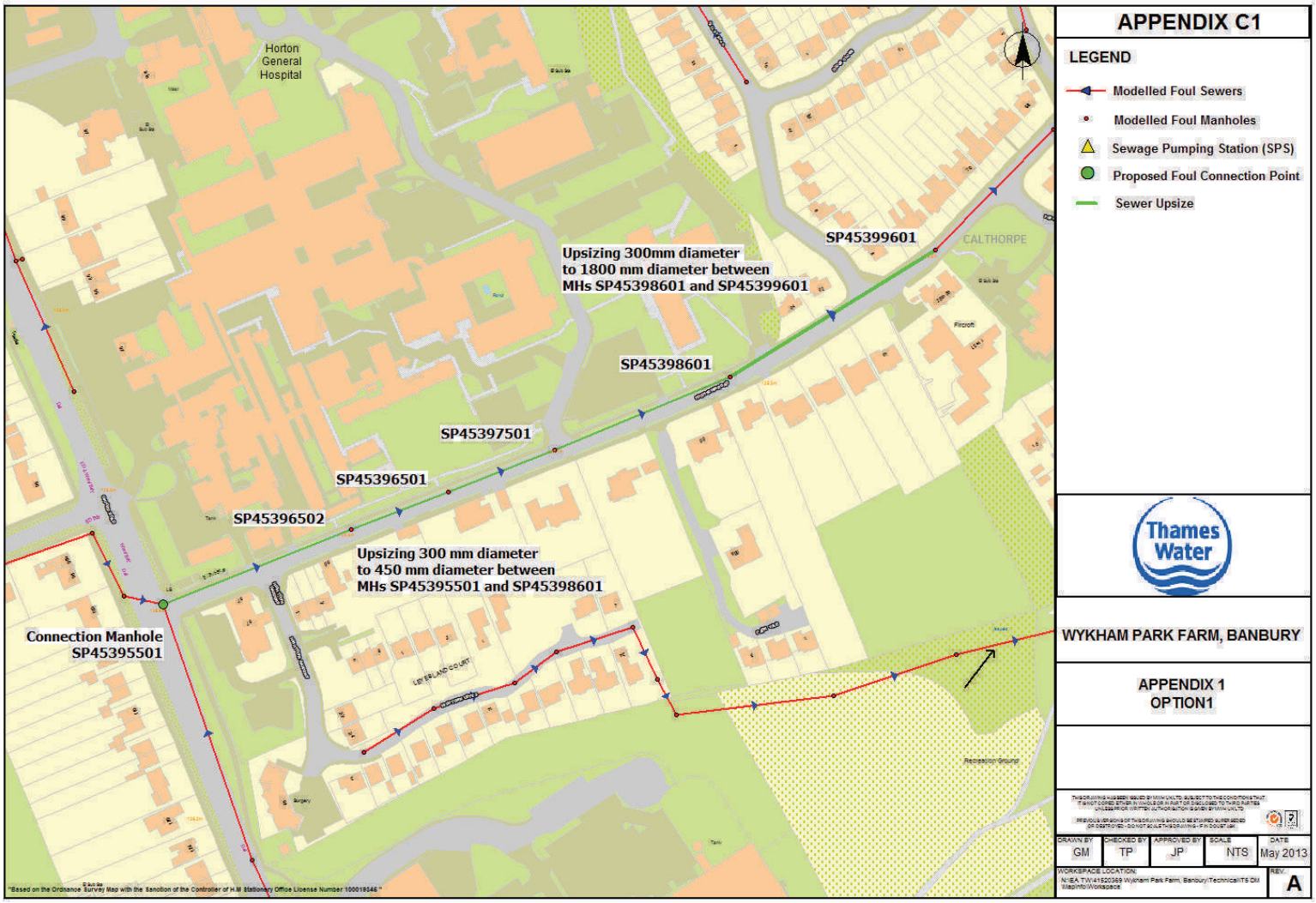
Appendix A – Site Plan



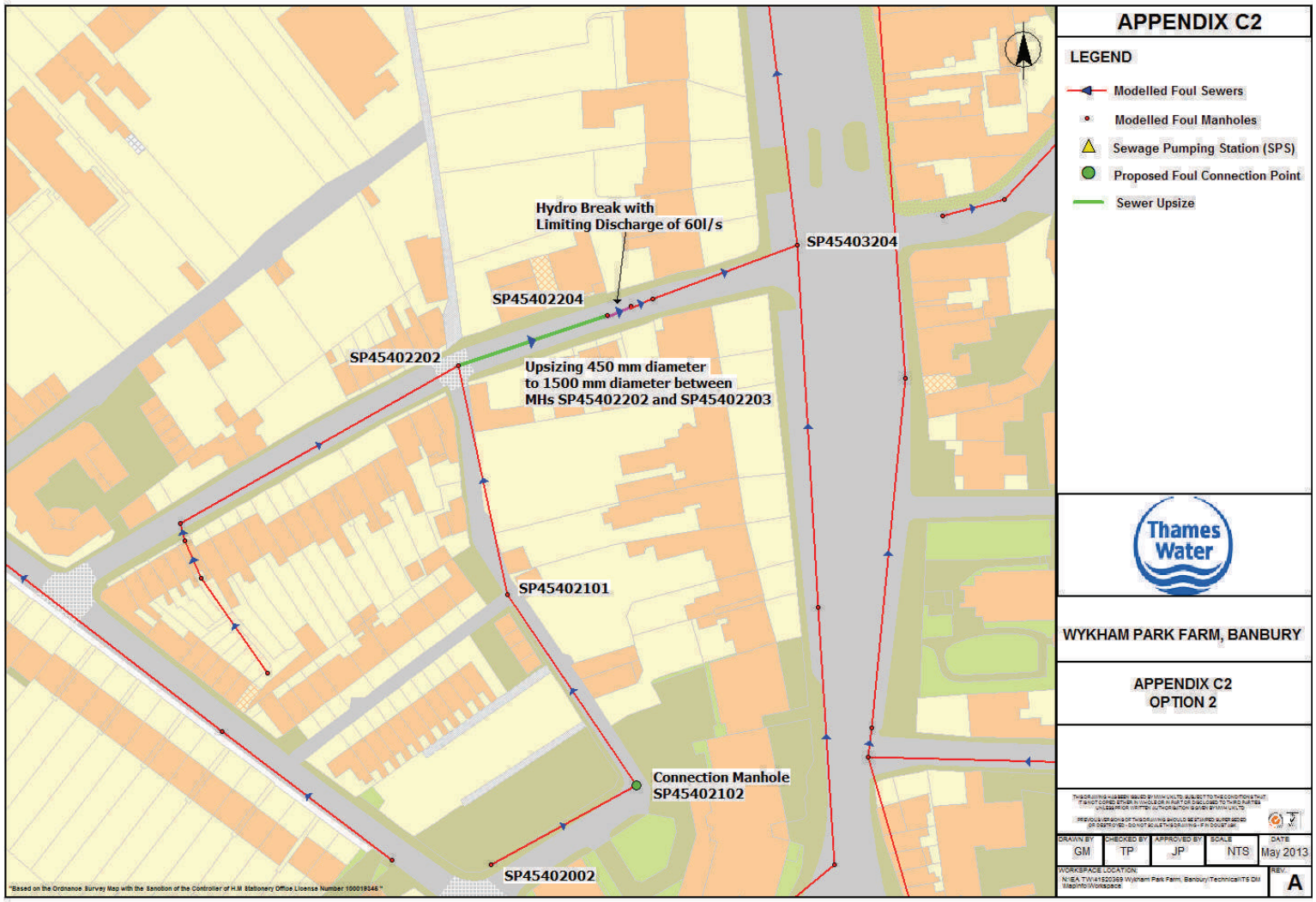
Appendix B – Plan showing Local Sewers



Appendix C1 – Connections and Improvements – Connection Manhole 1 – Option – Pipe Upsizing

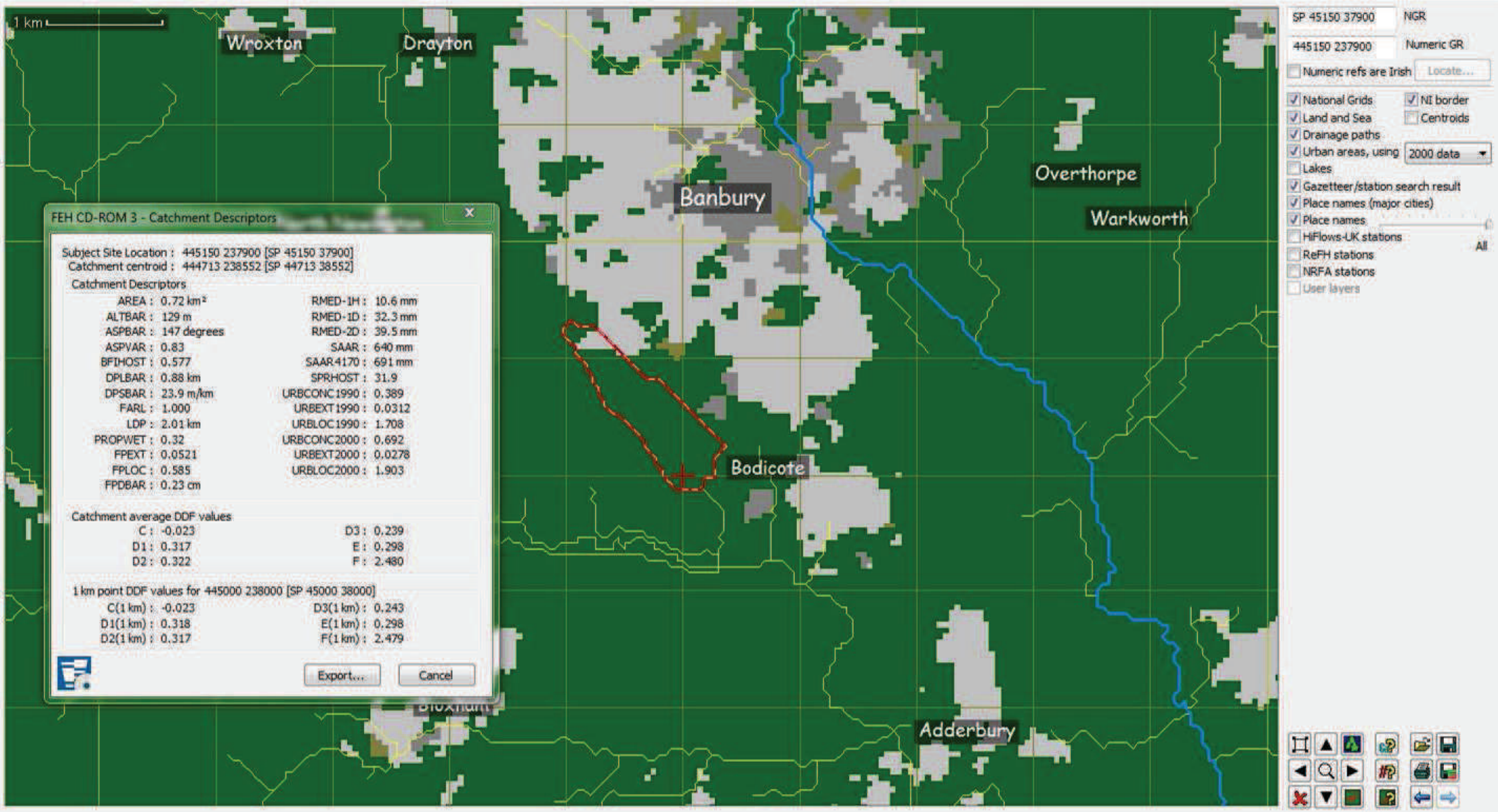


Appendix C2 – Connections and Improvements – Connection Manhole 2 – Option – On-line Storage



APPENDIX 7

Quantification of Flood Risk Posed by Ordinary Watercourse


1 km
Wroxton
Drayton
Banbury
Overthorpe
Warkworth
Bodicote
Adderbury
FEH CD-ROM 3 - Catchment Descriptors
Subject Site Location : 445150 237900 [SP 45150 37900]
Catchment centroid : 444713 238552 [SP 44713 38552]
Catchment Descriptors
AREA : 0.72 km²
ALTBAR : 129 m
ASPBAR : 147 degrees
ASPVAR : 0.83
BFIHOST : 0.577
DPLBAR : 0.88 km
DPSBAR : 23.9 m/km
FARL : 1.000
LDP : 2.01 km
PROPWET : 0.32
FPEXT : 0.0521
FPLOC : 0.585
FPDBAR : 0.23 cm
RMED-1H : 10.6 mm
RMED-1D : 32.3 mm
RMED-2D : 39.5 mm
SAAR : 640 mm
SAAR4170 : 691 mm
SPRHOST : 31.9
URBCONC1990 : 0.389
URBEXT1990 : 0.0312
URBLOC1990 : 1.708
URBCONC2000 : 0.692
URBEXT2000 : 0.0278
URBLOC2000 : 1.903
Catchment average DDF values
C : -0.023
D1 : 0.317
D2 : 0.322
D3 : 0.239
E : 0.298
F : 2.480
1 km point DDF values for 445000 238000 [SP 45000 38000]
C(1 km) : -0.023
D1(1 km) : 0.318
D2(1 km) : 0.317
D3(1 km) : 0.243
E(1 km) : 0.298
F(1 km) : 2.479
Export...
Cancel
SP 45150 37900
NGR
445150 237900
Numeric GR
Numeric refs are Irish
Locate...
National Grids
NI border
Land and Sea
Centroids
Drainage paths
Urban areas, using
2000 data
Lakes
Gazetteer/station search result
Place names (major cities)
Place names
HiFlows-UK stations
All
ReFH stations
NRFA stations
User layers

Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

User name	L Chera	**Catchment name**	FEH CD Catchment = 72 Hectar	**Date/time modelled**	02-Sep-2014 15:31
Company name	Wardell Armstrong	**Catchment easting**	445150	**Version**	1.4
Project name	Wykham Park Farm - Ordi	**Catchment northing**	237900		
		Catchment area	0.72		

Summary of model setup

Design rainfall parameters		Loss model parameters		Routing model parameters		Baseflow model parameters	
Return period (yr)	100	**C_{max} (mm)**	465	**T_p (hr)**	1.86	**BL (hr)**	31.9
Duration (hr)	6.25	**C_{ini} (mm)**	112	**U_p**	0.65	**BR**	1.37
Timestep (hr)	0.25	**α factor**	0.83	**U_k**	0.8	**BF_0 (m^3/s)**	0
Season	Winter						

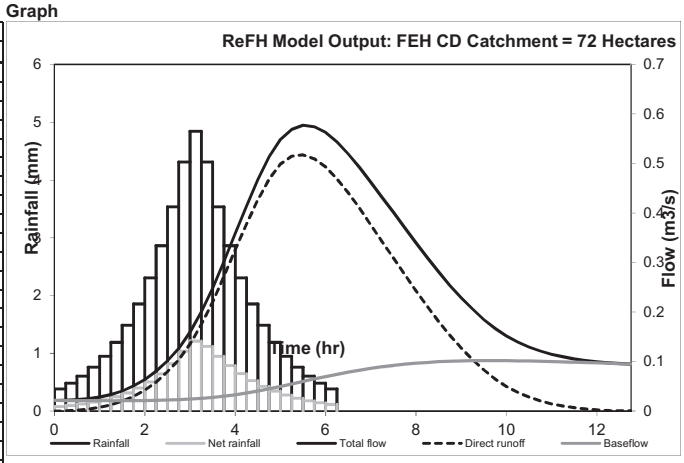
Summary of results

FEH DDF rainfall (mm)	69.3	**Peak rainfall (mm)**	4.8
Design rainfall (mm)	46.3	**Peak flow (m^3/s)**	0.6

Results

Series	Design Rainfall	Net rainfall	Direct runoff	Baseflow	Total flow
Unit	mm	mm	m^3/s	m^3/s	m^3/s
0.00	0.4	0.1	0.0	0.0	0.0
0.25	0.5	0.1	0.0	0.0	0.0
0.50	0.6	0.1	0.0	0.0	0.0
0.75	0.8	0.2	0.0	0.0	0.0
1.00	0.9	0.2	0.0	0.0	0.0
1.25	1.2	0.2	0.0	0.0	0.0
1.50	1.5	0.3	0.0	0.0	0.0
1.75	1.9	0.4	0.0	0.0	0.1
2.00	2.3	0.5	0.0	0.0	0.1
2.25	2.9	0.6	0.1	0.0	0.1
2.50	3.5	0.8	0.1	0.0	0.1
2.75	4.3	1.0	0.1	0.0	0.1
3.00	4.8	1.2	0.1	0.0	0.2
3.25	4.3	1.1	0.2	0.0	0.2
3.50	3.5	0.9	0.2	0.0	0.2
3.75	2.9	0.8	0.3	0.0	0.3
4.00	2.3	0.6	0.3	0.0	0.4
4.25	1.9	0.5	0.4	0.0	0.4
4.50	1.5	0.4	0.4	0.0	0.5
4.75	1.2	0.3	0.5	0.0	0.5
5.00	0.9	0.3	0.5	0.0	0.5
5.25	0.8	0.2	0.5	0.1	0.6
5.50	0.6	0.2	0.5	0.1	0.6
5.75	0.5	0.1	0.5	0.1	0.6
6.00	0.4	0.1	0.5	0.1	0.6
6.25	0.0	0.0	0.5	0.1	0.5
6.50	0.0	0.0	0.4	0.1	0.5
6.75	0.0	0.0	0.4	0.1	0.5
7.00	0.0	0.0	0.4	0.1	0.5
7.25	0.0	0.0	0.3	0.1	0.4
7.50	0.0	0.0	0.3	0.1	0.4
7.75	0.0	0.0	0.3	0.1	0.4
8.00	0.0	0.0	0.2	0.1	0.3
8.25	0.0	0.0	0.2	0.1	0.3
8.50	0.0	0.0	0.2	0.1	0.3
8.75	0.0	0.0	0.2	0.1	0.3
9.00	0.0	0.0	0.1	0.1	0.2
9.25	0.0	0.0	0.1	0.1	0.2
9.50	0.0	0.0	0.1	0.1	0.2
9.75	0.0	0.0	0.1	0.1	0.2
10.00	0.0	0.0	0.0	0.1	0.2
10.25	0.0	0.0	0.0	0.1	0.1
10.50	0.0	0.0	0.0	0.1	0.1
10.75	0.0	0.0	0.0	0.1	0.1
11.00	0.0	0.0	0.0	0.1	0.1
11.25	0.0	0.0	0.0	0.1	0.1
11.50	0.0	0.0	0.0	0.1	0.1
11.75	0.0	0.0	0.0	0.1	0.1
12.00	0.0	0.0	0.0	0.1	0.1
12.25	0.0	0.0	0.0	0.1	0.1
12.50	0.0	0.0	0.0	0.1	0.1
12.75	0.0	0.0	0.0	0.1	0.1
Total (mm)	**46.3**	**11.6**	**11.6**	**4.3**	**15.8**

Graph



Audit comments

Model run with ReFH dll version 1.4.0005

Catchment

Catchment descriptors imported from file
Catchment descriptor file = 'FEH CD Wykham Park Farm Catchment.csv'
Catchment decriptor file exported from CD ROM version 3
Catchment descriptor file exported on 02-Sep-2014 14:14
BFIHOST value of 0.577 used
PROPWET value of 0.32 used
SAAR value of 640 used
DPLBAR value of 0.88 used
DPSBAR value of 23.9 used
URBEXT value of 0.0312 used
C value of -0.023 used
D1 value of 0.3169 used
D2 value of 0.32163 used
D3 value of 0.23927 used
E value of 0.29815 used
F value of 2.48019 used

Rainfall

Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

Recommended season is Winter, as URBEXT < 0.125
ReFH design standard Seasonal Correction Factor of 0.68 applied
ReFH design standard Areal Reduction Factor of 0.98 applied

Loss Model

C_{Max} derived from catchment descriptors
ReFH design standard C_{ini} used
ReFH design standard α factor used

Routing Model

T_p derived from catchment descriptors
ReFH design standard used for U_p
ReFH design standard used for U_k

Baseflow Model

BL derived from catchment descriptors
BR derived from catchment descriptors
ReFH design standard BF_0 used

Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

User name	L Chera	**Catchment name**	72 Hectares	**Date/time modelled**	02-Sep-2014 15:40
Company name	Wardell Armstrong	**Catchment easting**	445150	**Version**	1.4
Project name	Wykham Park Farm	**Catchment northing**	237900		
		Catchment area	0.72		

Summary of model setup

Design rainfall parameters		Loss model parameters		Routing model parameters		Baseflow model parameters	
Return period (yr)	100	**C_{max} (mm)**	465	**T_p (hr)**	1.86	**BL (hr)**	31.9
Duration (hr)	6.25	**C_{ini} (mm)**	67	**U_p**	0.65	**BR**	1.37
Timestep (hr)	0.25	**α factor**	0.63	**U_k**	0.8	**BF_0 (m^3/s)**	0
Season	Summer						

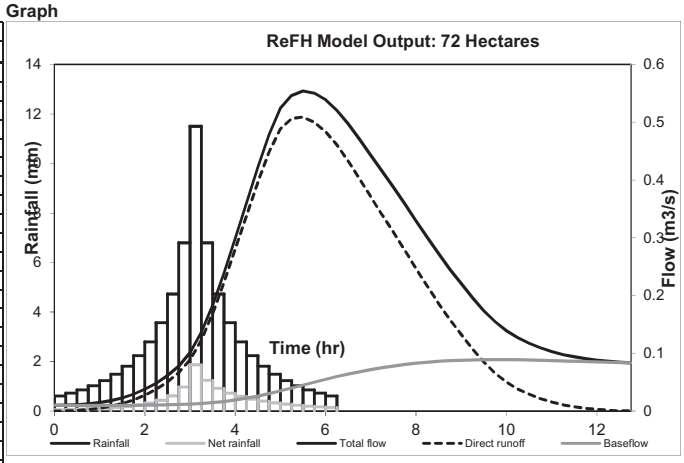
Summary of results

FEH DDF rainfall (mm)	69.3	**Peak rainfall (mm)**	11.5
Design rainfall (mm)	67.3	**Peak flow (m^3/s)**	0.6

Results

Series	Design Rainfall	Net rainfall	Direct runoff	Baseflow	Total flow
Unit	mm	mm	m^3/s	m^3/s	m^3/s
0.00	0.6	0.1	0.0	0.0	0.0
0.25	0.7	0.1	0.0	0.0	0.0
0.50	0.9	0.1	0.0	0.0	0.0
0.75	1.0	0.1	0.0	0.0	0.0
1.00	1.2	0.1	0.0	0.0	0.0
1.25	1.5	0.2	0.0	0.0	0.0
1.50	1.8	0.2	0.0	0.0	0.0
1.75	2.2	0.2	0.0	0.0	0.0
2.00	2.8	0.3	0.0	0.0	0.0
2.25	3.6	0.4	0.0	0.0	0.0
2.50	4.7	0.6	0.1	0.0	0.1
2.75	6.8	1.0	0.1	0.0	0.1
3.00	11.5	1.9	0.1	0.0	0.1
3.25	6.8	1.2	0.1	0.0	0.1
3.50	4.7	0.9	0.2	0.0	0.2
3.75	3.6	0.7	0.2	0.0	0.2
4.00	2.8	0.6	0.3	0.0	0.3
4.25	2.2	0.5	0.3	0.0	0.4
4.50	1.8	0.4	0.4	0.0	0.4
4.75	1.5	0.3	0.4	0.0	0.5
5.00	1.2	0.3	0.5	0.0	0.5
5.25	1.0	0.2	0.5	0.0	0.5
5.50	0.9	0.2	0.5	0.0	0.6
5.75	0.7	0.2	0.5	0.1	0.6
6.00	0.6	0.1	0.5	0.1	0.5
6.25	0.0	0.0	0.5	0.1	0.5
6.50	0.0	0.0	0.4	0.1	0.5
6.75	0.0	0.0	0.4	0.1	0.5
7.00	0.0	0.0	0.4	0.1	0.4
7.25	0.0	0.0	0.3	0.1	0.4
7.50	0.0	0.0	0.3	0.1	0.4
7.75	0.0	0.0	0.3	0.1	0.4
8.00	0.0	0.0	0.2	0.1	0.3
8.25	0.0	0.0	0.2	0.1	0.3
8.50	0.0	0.0	0.2	0.1	0.3
8.75	0.0	0.0	0.2	0.1	0.2
9.00	0.0	0.0	0.1	0.1	0.2
9.25	0.0	0.0	0.1	0.1	0.2
9.50	0.0	0.0	0.1	0.1	0.2
9.75	0.0	0.0	0.1	0.1	0.2
10.00	0.0	0.0	0.0	0.1	0.1
10.25	0.0	0.0	0.0	0.1	0.1
10.50	0.0	0.0	0.0	0.1	0.1
10.75	0.0	0.0	0.0	0.1	0.1
11.00	0.0	0.0	0.0	0.1	0.1
11.25	0.0	0.0	0.0	0.1	0.1
11.50	0.0	0.0	0.0	0.1	0.1
11.75	0.0	0.0	0.0	0.1	0.1
12.00	0.0	0.0	0.0	0.1	0.1
12.25	0.0	0.0	0.0	0.1	0.1
12.50	0.0	0.0	0.0	0.1	0.1
12.75	0.0	0.0	0.0	0.1	0.1
Total (mm)	**67.3**	**11.0**	**11.0**	**3.4**	**14.4**

Graph



Audit comments

Model run with ReFH dll version 1.4.0005

Catchment

Catchment descriptors imported from file
Catchment descriptor file = 'FEH CD Wykham Park Farm Catchment.csv'
Catchment decriptor file exported from CD ROM version 3
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BFIHOST value of 0.577 used
PROPWET value of 0.32 used
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DPLBAR value of 0.88 used
DPSBAR value of 23.9 used
URBEXT value of 0.0312 used
C value of -0.023 used
D1 value of 0.3169 used
D2 value of 0.32163 used
D3 value of 0.23927 used
E value of 0.29815 used
F value of 2.48019 used

Rainfall

Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

Recommended season is Winter, as URBEXT < 0.125
Recommended season overridden by the user
ReFH design standard Seasonal Correction Factor of 0.99 applied
ReFH design standard Areal Reduction Factor of 0.98 applied

Loss Model

C_{Max} derived from catchment descriptors
ReFH design standard C_{ini} used
ReFH design standard α factor used

Routing Model

T_p derived from catchment descriptors
ReFH design standard used for U_p
ReFH design standard used for U_k

Baseflow Model

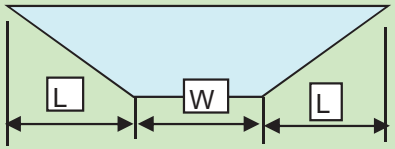
BL derived from catchment descriptors
BR derived from catchment descriptors
ReFH design standard BF_0 used

CA10769 - WYKHAM PARK FARM
FIELD DRAINAGE DITCH / ORDINARY WATERCOURSE CHANNEL CAPACITY CALCULATION

Channel Characteristics (Inputs - yellow)

Width L (m) ??
1

Height H (m) ??
1



Width W (m) ??
1

Mannings **n** Value 0.1

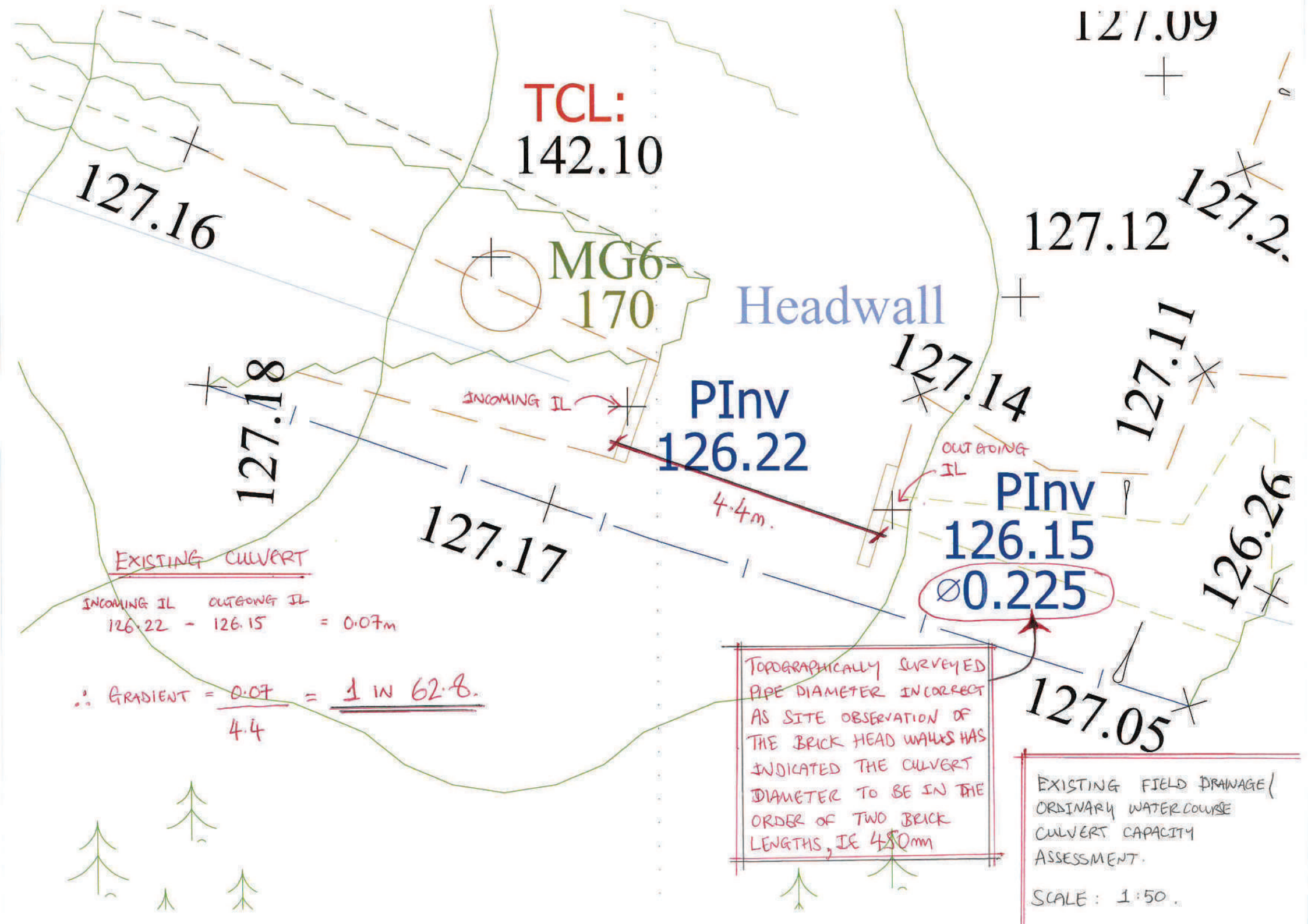
Gradient 1:?	**Velocity (m/s)**	**Q m3/s**
180	0.483470695	0.96694139
200	0.458660573	0.917321147
300	0.37449479	0.74898958
400	0.324322002	0.648644003
500	0.290082417	0.580164834
	#DIV/0!	#DIV/0!
	#DIV/0!	#DIV/0!

Area A (m2) = 2
Wetted Perimeter P (m) = 3.828427125
Hydraulic mean depth **m** = A/P 0.52240775

MANNINGS FORMULA : **v =1/n * m**2/3 * **i**1/2

where v = velocity (m/sec)
where i = channel gradient
where n = Mannings coeff

Chezy Equation : **Q = Av**


TCL:
142.10
127.16
MG6-
170
Headwall
127.18
127.17
INCOMING IL
PInv
126.22
4.4m.
127.14
127.12
127.11
OUTGOING
IL
PInv
126.15
Ø0.225
126.26
127.05
EXISTING CULVERT
INCOMING IL OUTGOING IL
126.22 - 126.15 = 0.07m
∴ GRADIENT = 0.07/4.4 = 1 IN 62.8.
TOPOGRAPHICALLY SURVEYED PIPE DIAMETER INCORRECT AS SITE OBSERVATION OF THE BRICK HEAD WALLS HAS INDICATED THE CULVERT DIAMETER TO BE IN THE ORDER OF TWO BRICK LENGTHS, IE 450mm
EXISTING FIELD DRAINAGE/ ORDINARY WATERCOURSE CULVERT CAPACITY ASSESSMENT.
SCALE : 1:50.

18 continued

ks = 0·600mm
S = 0·004 to 0·1
ie hydraulic gradient = 1 in 250 to 1 in 10

Water (or sewage) at 15° C full bore conditions.
velocities in m/s
discharges in m^3/s

REPRODUCED FROM HYDRAULICS RESEARCH WALLINGFORD TABLES FOR THE HYDRAULIC DESIGN OF PIPES AND SEWERS.

Gradient	Pipe diameters in mm: 350	375	400	450	500	525	600	675	700	750	800	825
0.00400 1/ 250	1.091	1.140	1.187	1.280	1.368	1.410	1.534	1.651	1.689	1.764	1.836	1.871
	0.105	0.126	0.149	0.203	0.269	0.305	0.434	0.591	0.650	0.779	0.923	1.000
0.00420 1/ 238	1.118	1.168	1.217	1.311	1.402	1.446	1.572	1.692	1.731	1.808	1.882	1.918
	0.108	0.129	0.153	0.209	0.275	0.313	0.444	0.606	0.666	0.799	0.946	1.025
0.00440 1/ 227	1.145	1.196	1.246	1.343	1.435	1.480	1.609	1.733	1.772	1.850	1.926	1.963
	0.110	0.132	0.157	0.214	0.282	0.320	0.455	0.620	0.682	0.817	0.968	1.050
0.00460 1/ 217	1.171	1.223	1.274	1.373	1.468	1.513	1.646	1.772	1.813	1.892	1.970	2.008
	0.113	0.135	0.160	0.218	0.288	0.328	0.465	0.634	0.698	0.836	0.990	1.073
0.00480 1/ 208	1.196	1.250	1.302	1.403	1.499	1.546	1.682	1.810	1.852	1.933	2.013	2.051
	0.115	0.138	0.164	0.223	0.294	0.335	0.475	0.648	0.713	0.854	1.012	1.097
0.00500 1/ 200	1.221	1.276	1.329	1.432	1.531	1.578	1.717	1.848	1.890	1.973	2.054	2.094
	0.117	0.141	0.167	0.228	0.301	0.342	0.485	0.661	0.727	0.872	1.033	1.119
0.00550 1/ 182	1.281	1.339	1.395	1.503	1.606	1.656	1.801	1.939	1.983	2.070	2.155	2.197
	0.123	0.148	0.175	0.239	0.315	0.359	0.509	0.694	0.763	0.915	1.083	1.174
0.00600 1/ 167	1.339	1.399	1.457	1.570	1.678	1.730	1.882	2.026	2.072	2.163	2.252	2.295
	0.129	0.155	0.183	0.250	0.330	0.375	0.532	0.725	0.797	0.956	1.132	1.227
0.00650 1/ 154	1.394	1.457	1.518	1.635	1.747	1.802	1.959	2.109	2.157	2.252	2.344	2.390
	0.134	0.161	0.191	0.260	0.343	0.390	0.554	0.755	0.830	0.995	1.178	1.277
0.00700 1/ 143	1.447	1.512	1.575	1.697	1.814	1.870	2.034	2.189	2.239	2.338	2.433	2.480
	0.139	0.167	0.198	0.270	0.356	0.405	0.575	0.783	0.862	1.033	1.223	1.326
0.00750 1/ 133	1.499	1.566	1.631	1.757	1.878	1.936	2.106	2.266	2.318	2.420	2.519	2.568
	0.144	0.173	0.205	0.279	0.369	0.419	0.595	0.811	0.892	1.069	1.266	1.373
0.00800 1/ 125	1.548	1.618	1.685	1.815	1.940	2.000	2.175	2.341	2.395	2.500	2.602	2.653
	0.149	0.179	0.212	0.289	0.381	0.433	0.615	0.838	0.922	1.105	1.308	1.418
0.00850 1/ 118	1.596	1.668	1.737	1.872	2.000	2.062	2.243	2.414	2.469	2.577	2.683	2.735
	0.154	0.184	0.218	0.298	0.393	0.446	0.634	0.864	0.950	1.139	1.349	1.462
0.00900 1/ 111	1.643	1.717	1.788	1.926	2.059	2.123	2.308	2.484	2.541	2.653	2.761	2.814
	0.158	0.190	0.225	0.306	0.404	0.459	0.653	0.889	0.978	1.172	1.388	1.504
0.00950 1/ 105	1.688	1.764	1.838	1.980	2.115	2.181	2.372	2.553	2.611	2.726	2.837	2.892
	0.162	0.195	0.231	0.315	0.415	0.472	0.671	0.913	1.005	1.204	1.426	1.546
0.01000 1/ 100	1.733	1.810	1.886	2.031	2.171	2.238	2.434	2.619	2.679	2.797	2.911	2.967
	0.167	0.200	0.237	0.323	0.426	0.485	0.688	0.937	1.031	1.236	1.463	1.586
0.01100 1/ 91	1.818	1.899	1.978	2.131	2.277	2.348	2.553	2.748	2.811	2.934	3.054	3.113
	0.175	0.210	0.249	0.339	0.447	0.508	0.722	0.983	1.082	1.296	1.535	1.664
0.01200 1/ 83	1.899	1.984	2.067	2.227	2.379	2.453	2.667	2.871	2.936	3.065	3.191	3.252
	0.183	0.219	0.260	0.354	0.467	0.531	0.754	1.027	1.130	1.354	1.604	1.738
0.01300 1/ 77	1.977	2.066	2.152	2.318	2.477	2.554	2.777	2.989	3.057	3.191	3.321	3.385
	0.190	0.228	0.270	0.369	0.486	0.553	0.785	1.069	1.176	1.410	1.670	1.810
0.01400 1/ 71	2.053	2.144	2.234	2.406	2.571	2.651	2.882	3.102	3.173	3.312	3.447	3.514
	0.197	0.237	0.281	0.383	0.505	0.574	0.815	1.110	1.221	1.463	1.733	1.878
0.01500 1/ 67	2.125	2.220	2.313	2.491	2.662	2.745	2.984	3.211	3.285	3.429	3.569	3.638
	0.204	0.245	0.291	0.396	0.523	0.594	0.844	1.149	1.264	1.515	1.794	1.945
0.01600 1/ 62	2.195	2.294	2.389	2.573	2.750	2.835	3.082	3.317	3.393	3.542	3.686	3.757
	0.211	0.253	0.300	0.409	0.540	0.614	0.871	1.187	1.306	1.565	1.853	2.009
0.01700 1/ 59	2.263	2.365	2.463	2.653	2.835	2.923	3.177	3.420	3.498	3.651	3.800	3.874
	0.218	0.261	0.310	0.422	0.557	0.633	0.898	1.224	1.346	1.613	1.910	2.071
0.01800 1/ 56	2.329	2.434	2.535	2.730	2.917	3.008	3.270	3.519	3.600	3.757	3.911	3.986
	0.224	0.269	0.319	0.434	0.573	0.651	0.925	1.259	1.385	1.660	1.966	2.131
0.01900 1/ 53	2.394	2.501	2.605	2.806	2.998	3.091	3.360	3.616	3.699	3.861	4.019	4.096
	0.230	0.276	0.327	0.446	0.589	0.669	0.950	1.294	1.423	1.706	2.020	2.190
Coefficient for part-full pipes:	200	200	200	250	250	250	300	350	350	400	400	450

ks = 0·600mm S < 0·1

DRAWINGS