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FLOOD RISK ASSESSMENT

ON

LAND AT
NORTH SIDE OF ABBEY ROAD
SHEPLEY
WEST YORKSHIRE
(PHASE 2)

FOR

YORKSHIRE COUNTRY PROPERTIES LTD.

E19/7465/FR01

OCTOBER 2020

M. Huddleston M.Eng.

Haigh Huddleston Associates is the trading name of Haigh Huddleston Associates Limited
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1.0 INTRODUCTION

1.1 This report is commissioned to investigate and report on the Flood Risk for this site in accordance Planning Practise Guidance- Flood Risk and Coastal Change April 2015 and the proposals for drainage of this site when redeveloped as residential land. The report is based on information supplied by the client and from relevant authorities in both written and verbal format. Some of this information is in verbal form only. No liability can be accepted for information supplied by third parties which is subsequently found to be inaccurate or incorrect.

2.0 THE SITE

2.1 The site is located to the east of Abbey Road North (A629), Shepley, and is situated around Ordnance Survey grid reference 419950, 410100. A site location plan is included in Appendix A.

2.2 The site is irregular in shape, with the western boundary formed by Abbey Road North, and the north eastern boundary formed by Knowle Road. The southern boundary is formed by adjacent fields (phase 1 planning application). The approximate site area is 1.9ha.

2.3 A dry stone wall crosses the site from south to north dividing the site into a western third and an eastern two-thirds. The watercourse follows the line of the stone wall and exits the site to the north beneath Knowle Road before being culverted beneath the railway embankment.

2.4 The western third of the site is overgrown with long grass and nettles. There is immature tree growth to the western edge and southern third of this field which is fenced off. In the central and eastern areas of the site are several small outbuildings and a concrete floor slab to a former building.

2.5 The eastern two thirds consist of better kept shorter cut grass. There is immature tree growth noted to the northern boundary and in the southern third of the field. A single greenhouse is located in the south east of the site.

2.6 The majority of the site boundary is formed by a 1m high dry stone wall. The central area of the southern boundary is formed by a post and wire fence.

2.7 The site slopes from south to north at a grade of approximately 1 in 9, from a high point of 183.75m AOD in the south eastern corner towards a low point of 168.80m AOD in the central northern area. The watercourse is approximately 600-800mm lower than the adjacent ground.

2.8 Overhead electricity lines start in the north west and head eastwards adjacent the northern boundary. A second set of overhead electricity lines start adjacent the western boundary and head southwards. It is assumed there are underground electricity cables in this area of the site.

2.9 A foul sewer enters the site from a property to the south and leaves the northern boundary adjacent the watercourse.

3.0 PROPOSED DEVELOPMENT AND CONSTRAINTS

3.1 The BGS Digital Geological Map of Great Britain at 1:50,000 scale has been consulted and we would report as follows:-

3.2 There are no areas of made ground or superficial strata overlying the site. A landfill site is recorded to the north of the proposed development, in addition a railway embankment is noted approximately 20m to the north, which we would presume to have been constructed using made ground.

3.3 The western third of the site is underlain by the Grenoside Sandstone formation, consisting of Sandstone. The eastern two-thirds of the site are underlain by the Pennine Lower Coal Measures Formation consisting of Mudstone, Siltstone and Sandstone. Recent boreholes undertaken on Phase 1 proved surface topsoil and clays underlain by sandstone to 15m and mudstone to 30m. Sandstone is normally considered as permeable strata due to the presence of cracks and joints, indicating that infiltration techniques may be suitable for this site. The use of soakaways was investigated during the site investigation for phase 1 and found negligible infiltration, and therefore these have been discounted for a possible surface water discharge solution. Please refer to the site investigation report for further details.

3.4 It is understood that the proposed development is for a series of detached, semi-detached and terraced houses, totalling 52 units, with associated car parking and access roads. A preliminary site layout is attached in the appendices.

3.5 A public combined sewer runs along Abbey Road to the west and The Knowle to the north of the site, this will likely have insufficient capacity to accept surface water from the site. Yorkshire water report that foul water should discharge to this public combined sewer at a point to the west of the site. There may be a need to provide a pumping station for foul water flows from the site to enable the full servicing of the site.

3.6 Yorkshire Water report that there is very limited capacity within the adjacent systems to service the site. Yorkshire Water have confirmed that if sustainable drainage is unsuitable for the site, then an outfall to a watercourse running through the central area of the site should

be considered as a potential outfall for the surface water drainage. At present the watercourse is open and runs within a very shallow channel prior being culverted below the The Knowle and the railway embankment to the north of the site.

3.7 This report is written assuming that infiltration methods are not suitable for this site as described above, and that the surface water from the site is channeled to the watercourse which currently runs centrally through the development. It is likely that a 2-stage surface water attenuation system will be utilized for this site with the discharge from phase 1 piped into the connected into the Phase 2 scheme and controlled prior to a final outfall to the watercourse.

3.8 Green field runoff rates undertaken using the HR Wallingford estimation tool indicate a Qbar of 12.5l/s for the Phase 2 area only and a 18.5l/s for the combined phase 1 and 2 areas. Note the prospective figures for the 1 in 100year events is 26.1l/s and 38.5l/s respectively. We would propose a restricted discharge rate of 15l/s for the combined phase 1 and 2 areas to the watercourse, this would need to be formally agreed with Kirklees MDC Land Drainage. This should be acceptable as its slightly below the 1 in 1year greenfield discharge rate for the entire site.

4.0 FLOOD RISK

4.1 On reviewing the Environment Agency websites flood risk maps, the site currently falls within flood zone 1: which is designated as low probability of flooding from sea or rivers less than 0.1% (ie 1 in 1000 year) probability of flooding.
The hierarchy of flood zones are described as:

Flood Zone 1: Low Probability. Land assessed as having a less than 1 in 1000 chance of river and sea flooding in any year (<0.1%).

Flood Zone 2: Medium Probability. Land assessed as having between a 1 in 100 and 1 in 1000 chance of river flooding (1% 0.1%) and between a 1 in 200 and 1 in 1000 chance of sea flooding (0.5% 0.1%) in any year.

Flood Zone 3: High Probability. Land assessed as having a 1 in 100 or greater chance of river flooding (>1%) and 1 in 200 or greater chance of sea flooding (>0.5%) in any year.

The site is therefore considered not to be at risk from fluvial flooding from rivers or sea for the 1 in 100 or 1 in 1000 year flood event. The proposed use of the site would be classified as More Vulnerable in Table 2: Flood Risk Vulnerability Classification in the Planning Practise Guidance- Flood Risk and Coastal Change April 2015. In accordance with that table the proposed development would be considered to be appropriate for the site.

4.2 The site does fall partially within an area subject to surface water flooding according to the EA maps.

4.2.1 High risk means that each year this area has a chance of flooding of greater than 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

4.2.2 Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

4.2.3 Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

4.2.4 Very low risk means that each year this area has a chance of flooding of less than 0.1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

4.2.5 The surface water flooding maps show some ingress into the site from the watercourse along the central corridor of the phase 2 site and at the northern boundary adjacent to the railway embankment and The Knowle. These indicate that the largest ingress will be from low risk events, however a small area liable to be flooded in high risk events is shown within the northern boundary of the site, this could potentially flood up to a depth of approximately

0.9m. If this depth is exceeded surface water would overflow onto Abbey Road North to the west. The risk is flooding to this area is likely due to reduced capacity of the culverted watercourse below the highway/railway embankment. At present it is proposed to elevate the plots adjacent to the Knowle by in excess of 2m above the current road levels.

4.2.6 There will be a slight risk of run off from the proposed new development to the south of the site however any flood routing will be carefully considered within the overall design. Floor levels adjacent the access road will need to be raised slightly to facilitate a flood route through the site. There will be a flood route accommodated along the access road adjacent to the watercourse through the site that would shed any run off from these sources onto the highway to the north of the site. The EA Flood Risk map for Planning for flooding from fluvial sources does not show flood waters encroaching onto the site.

4.2.7 The existing watercourse is consists of a very shallow depression and to effectively culvert the existing system the levels will need to be reduced to form a suitable route for the watercourse with sufficient capacity. The headwalls will need to be designed to avoid blockages and siltation ponds introduced to assist future maintenance.

4.3 The site does not appear to fall within an area subject to flooding from reservoirs according to the EA maps. We consider the risk of such a source of flooding would be low. The site does not fall within a flood warning zone.

4.4 Due to the size of the development being greater than 1Ha, it would be necessary to prepare a site Specific Flood Risk Assessment for the site.

4.5 There are a number of potential flooding mechanisms that the Planning Practise Guidance-Flood Risk and Coastal Change April 2015 now requires to be evaluated for each proposed development site. Each method of flooding requires an assessment to be made on its probability relative to the site development. The normal requirement of the document is for no flooding of properties for storms up to a 1% probability or a once in a 100 years storm. The risk assessment also includes for flooding both on site and off site, and the effects of the development on the downstream catchment or the flow regime of the watercourse. NPPG

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

4.6 It also requires that the effects of climate change are taken into account together with the impacts of extreme events and flood defence failures. Prior to this the Sequential Test, and where necessary, the exception test as outlined in Planning Practise Guidance- Flood Risk and Coastal Change April 2015, must also be applied to each development site. These aspects are not covered in this report but the proposed site being in Flood Zone 1, would mean these requirements are already met and do not apply.

4.7 The Planning Practise Guidance- Flood Risk and Coastal Change April 2015 requires that each flooding mechanism is addressed and levels of risk evaluated. We consider there are four main risks of flooding to the site. The alternative mechanisms are not applicable to this site.

- Inundation from floodwaters leaving watercourses or rivers entering the site. This can include the effects on culverted watercourses and where the risk of blockage can occur and from breach scenarios.
- Rainwater falling on the site and not being able to leave the site at sufficient rate to prevent flooding on the site.
- Overland flows from adjacent land sites due to surcharging of sewerage systems or other watercourses.
- The impact of the developed site on the existing drainage systems and off-site surface water systems must also be assessed as part of this flood risk assessment.

5.0 DISCUSSION OF FLOOD RISKS

5.1 Flood Risk from Watercourses, River & Tidal

5.1.1 The proposed development area does not fall within the 0.1% or the 1% probability Flood Risk Maps (Zone 2 and 3) as published by the Environment Agency. The site is therefore considered not to be at risk from fluvial flooding for the once in 100 year flood event. We therefore consider the risk of flooding of the site from River and Sea is acceptable for this type of development on this site.

5.2 **Risk of Flooding from overland flows from adjacent land.**

5.2.1 The site lies on an area of sloping land, with residential/commercial development on the North West side of Abbey Road North. There is a recent planning permission for residential development on elevated land to the south of the proposed site. There is also low density, sporadic residential properties to the east of the site. To the north there is an existing metaled lane with elevated railway embankment. These will tend to convey any low level overland flows away from the site. The residential areas to the south and to an extent the east both lie above the site, these will be served public drainage systems and as such the level of risk of flooding from surcharged sewers or drains is considered to be less than 3%. In extreme events any flood waters leaving this system would be channelled along the highways, or down the existing watercourse by the natural topography, through the site.

5.2.2 The surface water flood risk map indicates flood routes through the site along the line of the shallow existing watercourse and there is a risk of The Knowle to the north flooding to a potential depth of 1m above existing road levels. A flood route has been created through the central portion of the site. The proposed finished floor levels adjacent to the Knowle have also been substantially raised. Any overland flows are therefore not considered to be a flood risk to the site.

5.2.3 We would however, still recommend that an overland flood route is provided through the site to cater for extreme events, as is normal under the sewers for adoption criteria, and floor levels are to be based a minimum of 300mm above existing ground levels. The current layout includes for this as there is an area of public open space in the northern corner of the site, on the access road into the site where any flood water could gather before discharging into the existing watercourse as is the current situation.

5.3 **Risk of Flooding from Rainwater Falling on Site**

5.3.1 The risk of flooding from water falling on site and not being able to leave the site is relatively high. The impermeable area of the site will increase significantly due to the development and

thus would increase the run off from the site. This would increase the flood risk to downstream properties unless attenuation measures and restriction of flows took place.

5.3.2 The normal hierarchy for surface water discharge in accordance with current planning and SUDS policies is as follows:

1. The use of infiltration systems such as Soakaways.
2. Discharge to nearby rivers or watercourses with the use of attenuation.
3. Discharge to existing public sewer network with the use of attenuation.

5.3.3 There has not been a site investigation undertaken this site area however infiltration rates were limited on the previous phase and therefore for the purposes of this report the use of soakaways has been discounted.

5.3.4 If infiltration systems are considered unfeasible for the site, then storm water attenuation systems should be utilised to ensure the flows from the site to a suitable watercourse, or surface water sewer, are reduced to agricultural run-off rates or as otherwise agreed with the Land Drainage Authority.

5.3.5 There are no significant existing buildings or paved areas on site but the various agricultural run-off estimations show that the site would generate an agricultural run-off of between 12.5 and 26.1 lit/s for the various storms between the 1 in 1 year and the 1 in 100 year storm conditions for the phase 2 site in isolation. If the combined green-field discharge rates are considered for the entire site these are calculated as 18.5l/s and 38.5l/s for the 1 in 1year and 100year storms respectively.

5.3.6 For this site it is likely that a overall surface water strategy will be adopted and therefore we would recommend that a discharge of 15 lit/s/ha for the whole site (Phase 1 and 2) is used. This would limit the discharge rate to below the 1 in 1year greenfield runoff rate and should be satisfactory to the Kirklees Land Drainage Authority. Therefore, this has been utilised for the discharge of surface water from the site and allow the storage volumes for this scenario calculated. Negotiations would be required with the authorities and adjacent landowners to secure permission to discharge in perpetuity together with easements etc. for the construction

of a new off-site sewers and a headwall if so required. Any run off from the site post development would have to be limited to 15 lit/s which is the rate specified.

5.3.7 With attenuation of flows there would have to be a storm-water storage facility The use of above storage systems such as swales, detention basins or ponds, would provide the most sustainable urban drainage system and possibly the most economic but this would entails significant land up take due to the topography of the site and possibly large commuted sums for their adoption if an authority can be found that is prepared to adopt these. For the onsite sewerage system to be adopted there would still be a need for underground tanks to provide sufficient attenuation storage for the whole site so that sewers do not surcharge for the 1 in 30 year event. Based on this criteria, the estimated volumes of storage required are shown in the attached calculation sheets. For this run off the storage volumes require 336 cu.m for the 30 year storm and 697cu.m for the 100 year storm with 30% extra for climatic change allowance.

5.3.8 The use of below ground storage facilities on their own, may not provide a suitable level of treatment of the run off from the site, and biological systems, at source, may be needed to ensure contaminants are dealt with prior to discharge off site. The use of open swales and ponds would allow the use of reed beds and other organic systems to be employed, so should still be considered in the final designs if possible. Primary treatment for the roads would be the use of trapped gullies for all hard standings. The use of filter drains and permeable private drives adjacent to private drives would also provide a first stage treatment of run off from drives and allow a discharge into the top soils on site. Rain water butts may also be provided to enable some recycling of run off from the roofs and paved areas. The use of green roofs is not considered appropriate in this development due to the type of building construction.

5.3.9 The size of the storm water storage facilities would need to be determined accurately in the final detailed designs. These should be all in accordance with the current PPG. The volumes of storage can include flooding to roads and designated areas such as carpark areas or public open space for the 100 year storm with due allowance for climate change and urban creep, but must ensure that no buildings are flooded.

5.3.10 The estimated volumes of storage required for each of the storm profiles are based on not exceeding the allowable discharge rates for the whole site as agreed.

5.3.11 The proposed discharge point and discharge rates from the site needs to be formally agreed with Yorkshire Water, the Environment Agency and the Local Land Drainage Authority, prior to detailed design being undertaken.

5.4 **Impact on existing drainage systems.**

5.4.1 If the site is developed with attenuation systems and an agreed discharge rate reduced to agricultural rates of discharge, there should be no increase in the flood risk to properties off site or in the drainage networks downstream of the site. In real terms there would be slight reduction in flood risk to adjacent land due to the attenuation provided on site for the 1 in 100 year storms with the discharge rate cut to below the current estimated 1 in 1 year storm agricultural discharge rate.

5.4.2 The maintenance of the onsite storage tanks would be carried out by Yorkshire Water as part of the Section 104 Agreement and they would adopt the underground on site tanks. The maintenance of any, on or off site, above ground storage systems, will need to be resolved satisfactorily in perpetuity either with Yorkshire Water, a management company or Kirklees MDC. This may mean commuted sums being paid for such an agreement.

6.0 CONCLUSIONS

6.1 The area of the site to be developed currently falls within Flood Zone 1 as defined by the EA Flood maps. The area of the site to be developed is not at risk of flooding from river or tidal water up to a 1% return period. The flood risk is considered to be acceptable for residential development.

6.2 Soak-a-way testing has been carried out on the adjacent (phase 1) site. This has demonstrated that infiltration techniques for the site will be unviable. Note confirmation further testing is planned for the proposed Phase 2 investigation works. The use of attenuation systems to reduce the run-off from the site to agricultural, or agreed discharge rates, will be required to ensure there is no increase in flood risk to the downstream catchment. The use of underground attenuation systems may require the installation of both foul and surface water pumping systems unless negotiations with the Local Drainage Authority can source an alternative gravity outfall.

6.3 The risk of overland flows entering the site is considered to be low due to the topography of the area around the site, however there is the risk of the future developed site to the south generating overland flows and also a potential blockage to the watercourse. This risk can be further minimised by providing a flood water route through the site to ensure flood water flows are directed away from the existing and proposed housing. The floor levels of the proposed houses should be a minimum of 300mm above the adjacent road levels or existing ground level. In addition the floor levels along the northern boundary adjacent to the railway embankment have been raised 1.5m above existing ground levels to avoid the possibility of flooding.

6.4 The re-aligned watercourse through the site will need to be included within future management plans and resources to ensure that it is checked for any blockages in the future.

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APPENDIX A

LOCATION PLAN

Haigh Huddleston & Associates

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Firth Building
99-101 Leeds Road
Dewsbury
WF12 7BU

Client : Yorkshire Country Properties

Job Title: Abbey Road, Shepley (Phase 2)

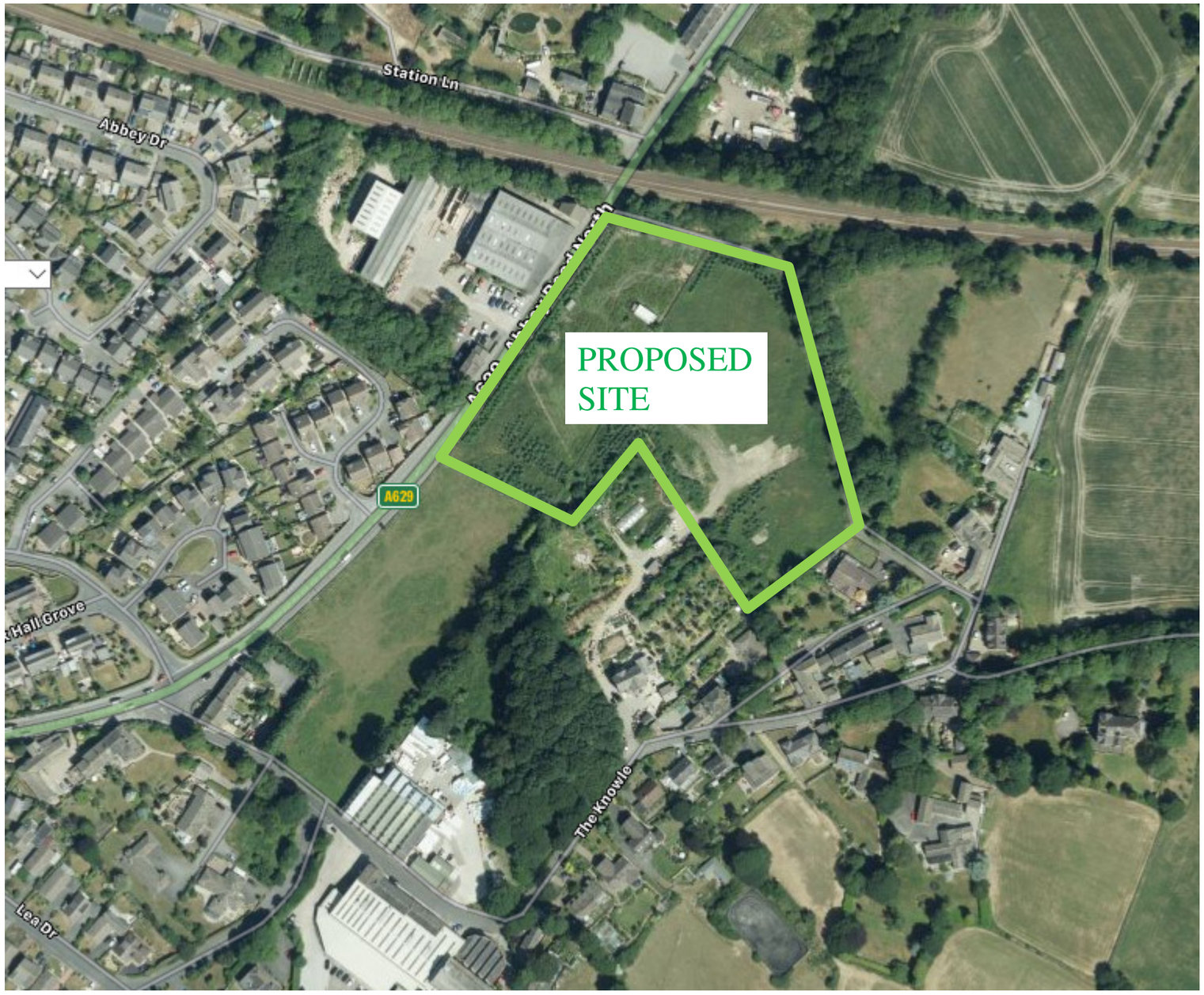
Job Number : E19/7465

LOCATION PLAN

OS Grid Reference : SE 199100
Easting : 419945
Northing : 410087

Topographical Survey carried out using GPS.

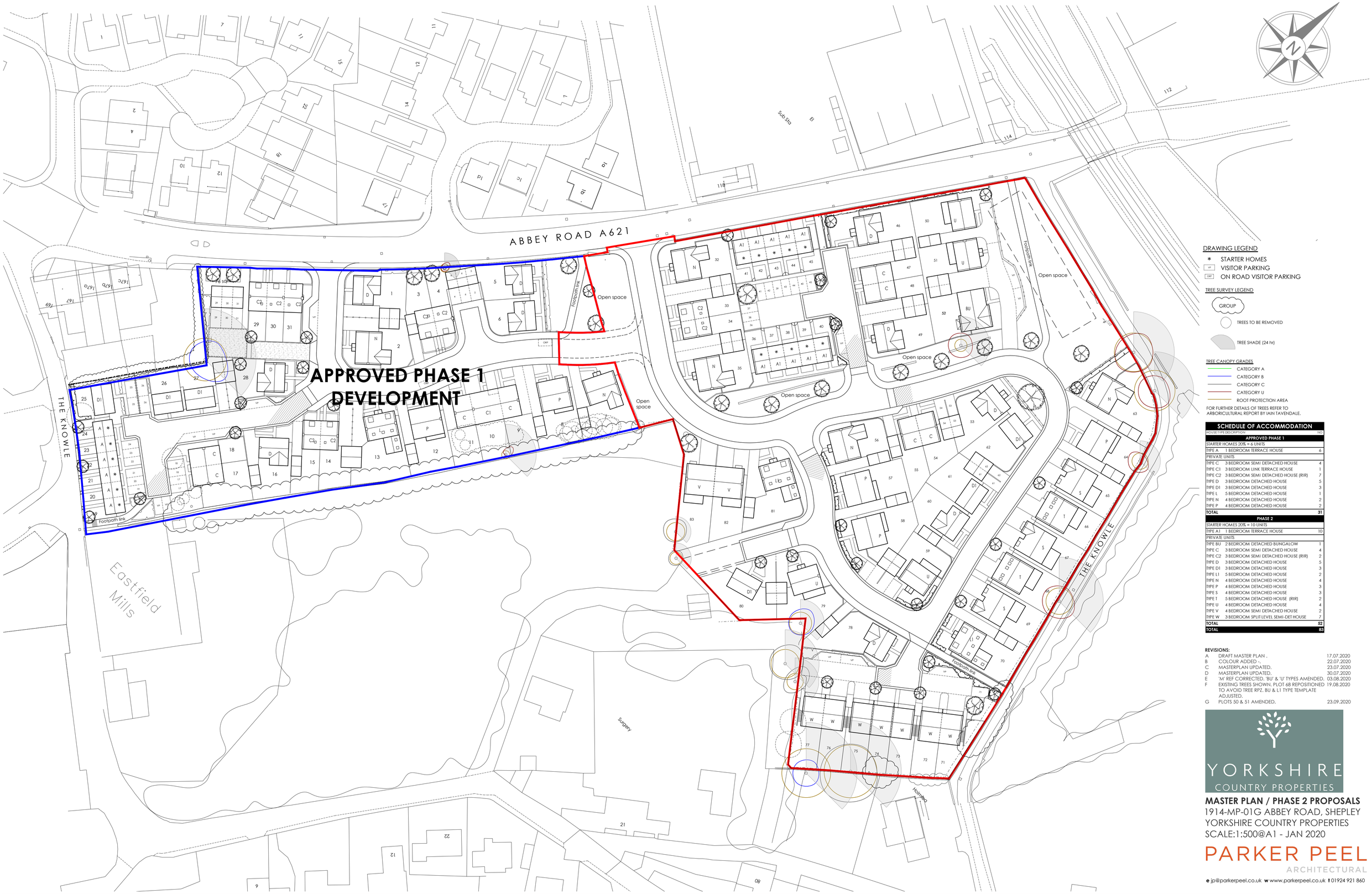
N



APPENDIX B

PROPOSED SITE PLAN

MASTER PLAN / PHASE 2 PROPOSALS - ABBEY ROAD, SHEPLEY



SCHEDULE OF ACCOMMODATION

HOUSE TYPE	DESCRIPTION	NO
APPROVED PHASE 1		
STARTER HOMES 20% = 6 UNITS		
TYPE A	1 BEDROOM TERRACE HOUSE	6
PRIVATE UNITS		
TYPE C	3 BEDROOM SEMI DETACHED HOUSE	4
TYPE C1	3 BEDROOM LINK TERRACE HOUSE	1
TYPE C2	3 BEDROOM SEMI DETACHED HOUSE (RIR)	7
TYPE D	3 BEDROOM DETACHED HOUSE	5
TYPE D1	3 BEDROOM DETACHED HOUSE	3
TYPE L	5 BEDROOM DETACHED HOUSE	1
TYPE N	4 BEDROOM DETACHED HOUSE	2
TYPE P	4 BEDROOM DETACHED HOUSE	2
TOTAL		**31**
PHASE 2		
STARTER HOMES 20% = 10 UNITS		
TYPE A1	1 BEDROOM TERRACE HOUSE	10
PRIVATE UNITS		
TYPE BU	2 BEDROOM DETACHED BUNGALOW	1
TYPE C	3 BEDROOM SEMI DETACHED HOUSE	4
TYPE C2	3 BEDROOM SEMI DETACHED HOUSE (RIR)	2
TYPE D	3 BEDROOM DETACHED HOUSE	5
TYPE D1	3 BEDROOM DETACHED HOUSE	3
TYPE L1	5 BEDROOM DETACHED HOUSE	2
TYPE N	4 BEDROOM DETACHED HOUSE	4
TYPE P	4 BEDROOM DETACHED HOUSE	3
TYPE S	4 BEDROOM DETACHED HOUSE	3
TYPE T	5 BEDROOM DETACHED HOUSE (RIR)	2
TYPE U	4 BEDROOM DETACHED HOUSE	4
TYPE V	4 BEDROOM SEMI DETACHED HOUSE	2
TYPE W	3 BEDROOM SPLIT LEVEL SEMI-DET HOUSE	7
TOTAL		**52**
TOTAL		**83**

REVISIONS:

A	DRAFT MASTER PLAN .	17.07.2020
B	COLOUR ADDED -.	22.07.2020
C	MASTERPLAN UPDATED.	23.07.2020
D	MASTERPLAN UPDATED.	30.07.2020
E	'M' REF CORRECTED. 'BU' & 'U' TYPES AMENDED.	03.08.2020
F	EXISTING TREES SHOWN. PLOT 68 REPOSITIONED TO AVOID TREE RP2. BU & L1 TYPE TEMPLATE ADJUSTED.	19.08.2020
G	PLOTS 50 & 51 AMENDED.	23.09.2020

YORKSHIRE COUNTRY PROPERTIES

MASTER PLAN / PHASE 2 PROPOSALS
1914-MP-01G ABBEY ROAD, SHEPLEY
YORKSHIRE COUNTRY PROPERTIES
SCALE:1:500@A1 - JAN 2020

PARKER PEEL ARCHITECTURAL
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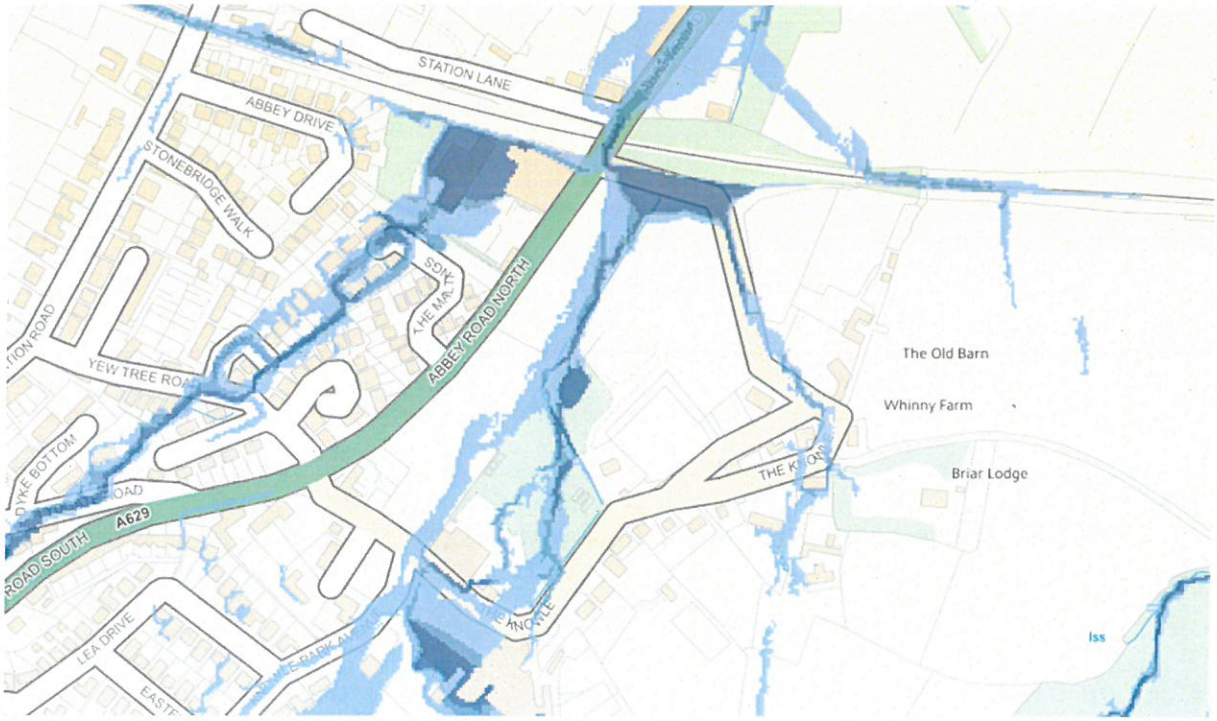
APPENDIX C

FLOOD RISK MAPS

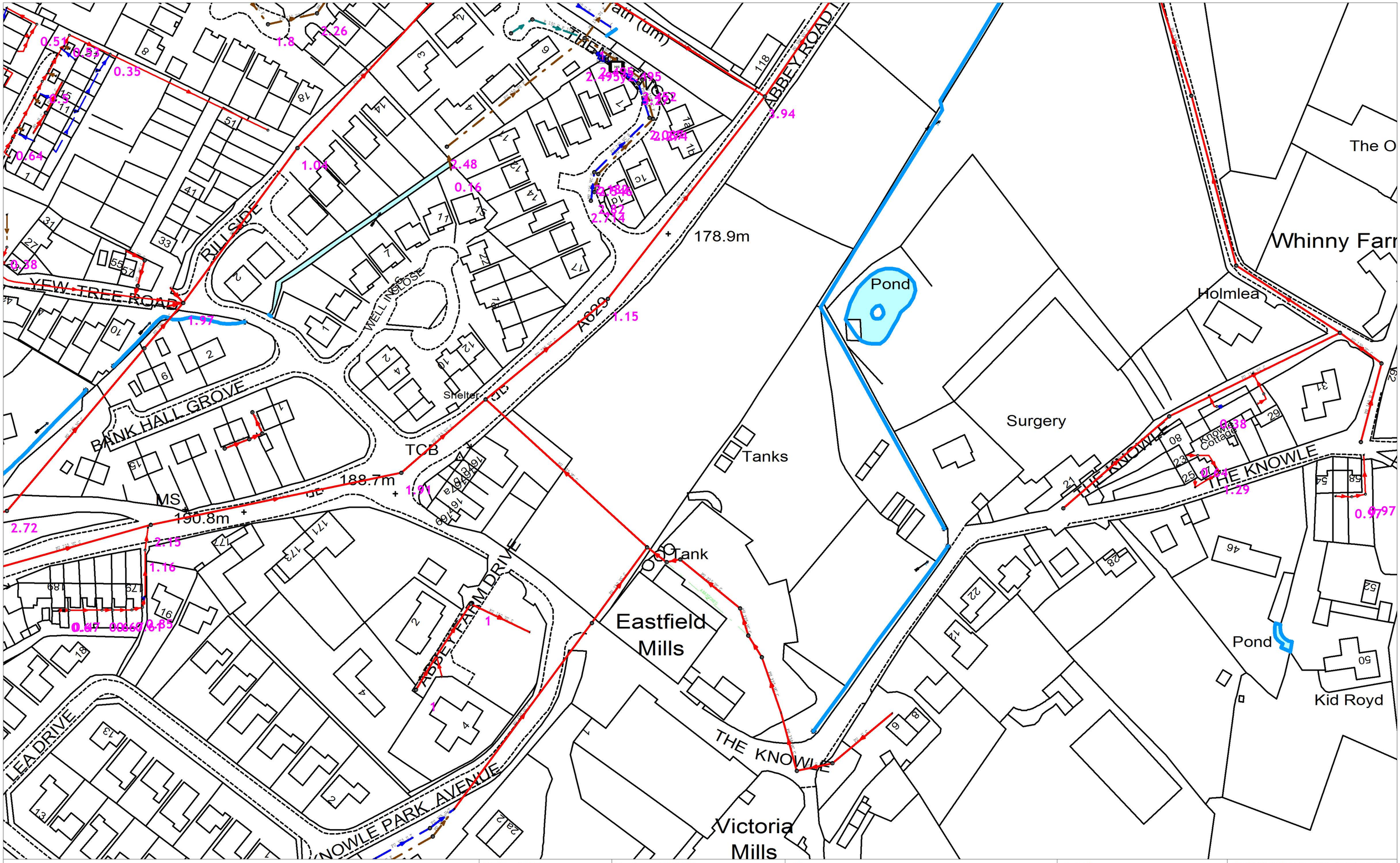
Flood maps from planning



Flood Risk From Surface Water

APPENDIX D

YORKSHIRE WATER RECORDS



419615 : 409849	Map Name : SE1909NE	Title	Partial Key Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
YorkshireWater	Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : YorMap Advisor C ROBERTS Contact Tel : 87 2582	Notes (Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2014. All rights reserved Ordnance Survey Licence number 100022432	This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.
			Date Req : 10/04/2019, 13:59:10 — Date Gen : 10/04/2019, 14:00:11
			Source : Sewer Network Enquiry

UPN: Undefined Originator: C ROBERTS, YorMap, 87 2582

APPENDIX E

GREENFIELD RUN-OFF

STORMWATER STORAGE CALCULATIONS

PRELIMINARY DRAINAGE FEASIBILITY PLAN

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Martin Huddleston
Site name:	Shepley (Phase 1 & 2)
Site location:	Abbey North Road

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be
the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.58683° N
Longitude:	1.70114° W
Reference:	3957797976
Date:	Oct 16 2020 16:28

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 2.8

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	916	916
Hydrological region:	3	3
Growth curve factor 1 year:	0.86	0.86
Growth curve factor 30 years:	1.75	1.75
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	18.52	18.52
1 in 1 year (l/s):	15.92	15.92
1 in 30 years (l/s):	32.4	32.4
1 in 100 year (l/s):	38.51	38.51
1 in 200 years (l/s):	43.88	43.88

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Martin Huddleston
Site name:	Shepley (Phase 2 only)
Site location:	Abbey North Road

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be
the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.58683° N
Longitude:	1.70114° W
Reference:	1916080243
Date:	Oct 16 2020 16:34

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1.9

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	916	916
Hydrological region:	3	3
Growth curve factor 1 year:	0.86	0.86
Growth curve factor 30 years:	1.75	1.75
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	12.56	12.56
1 in 1 year (l/s):	10.81	10.81
1 in 30 years (l/s):	21.99	21.99
1 in 100 year (l/s):	26.14	26.14
1 in 200 years (l/s):	29.78	29.78

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for PRELIM DESIGN 2.SWS

Pipe Sizes PRELIM DESIGN 2 Manhole Sizes PRELIM DESIGN 2

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.326	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	75	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for PRELIM DESIGN 2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	38.844	2.005	19.4	0.125	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	16.343	1.051	15.5	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	18.483	0.231	80.0	0.107	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	20.338	1.356	15.0	0.026	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	28.206	1.659	17.0	0.117	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	28.665	1.686	17.0	0.097	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	21.095	0.251	84.0	0.021	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	20.427	0.600	34.0	0.104	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	15.882	0.529	30.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	17.418	0.581	30.0	0.066	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	64.06	4.22	183.600	0.125	0.0	0.0	0.0	2.99	118.8	21.7
S1.001	63.62	4.30	181.595	0.133	0.0	0.0	0.0	3.34	132.6	22.9
S2.000	64.10	4.21	180.775	0.107	0.0	0.0	0.0	1.46	58.2	18.6
S1.002	63.08	4.40	180.544	0.266	0.0	0.0	0.0	3.40	135.0	45.4
S1.003	62.44	4.52	179.113	0.383	0.0	0.0	0.0	3.83	270.8	64.8
S1.004	61.80	4.65	177.454	0.480	0.0	0.0	0.0	3.83	270.8	80.3
S1.005	63.90	4.25	175.568	0.000	4.5	0.0	0.0	1.43	56.8	4.5
S1.006	63.22	4.37	175.242	0.104	4.5	0.0	0.0	2.70	191.1	22.3
S1.007	62.73	4.46	174.642	0.104	4.5	0.0	0.0	2.88	203.7	22.3
S1.008	62.21	4.56	174.113	0.170	4.5	0.0	0.0	2.88	203.7	33.1

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Network Design Table for PRELIM DESIGN 2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	14.194	0.946	15.0	0.051	4.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	15.963	0.872	18.3	0.052	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.009	13.210	0.777	17.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.010	11.718	0.781	15.0	0.027	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	33.134	0.221	149.9	0.124	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.011	19.152	1.277	15.0	0.019	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.012	36.794	2.453	15.0	0.144	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	43.874	1.994	22.0	0.165	4.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	39.200	2.613	15.0	0.093	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.002	14.416	0.961	15.0	0.071	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.003	10.085	0.206	49.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.000	11.372	0.038	300.1	0.000	4.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.013	4.730	0.075	63.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.014	13.030	0.250	52.1	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.015	5.214	0.060	86.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	64.89	4.07	175.425	0.051	0.0	0.0	0.0	3.40	135.0	9.0
S3.001	64.40	4.16	174.479	0.103	0.0	0.0	0.0	3.07	122.2	18.0
S1.009	61.92	4.62	173.532	0.273	4.5	0.0	0.0	3.83	270.9	50.3
S1.010	61.68	4.67	172.755	0.300	4.5	0.0	0.0	4.08	288.4	54.6
S4.000	62.91	4.43	172.194	0.124	0.0	0.0	0.0	1.28	90.6	21.1
S1.011	61.29	4.75	171.973	0.443	4.5	0.0	0.0	4.08	288.4	78.0
S1.012	60.55	4.90	170.696	0.587	4.5	0.0	0.0	4.08	288.4	100.8
S5.000	63.82	4.26	174.740	0.165	0.0	0.0	0.0	2.80	111.4	28.5
S5.001	62.79	4.45	172.746	0.258	0.0	0.0	0.0	3.40	135.0	43.9
S5.002	62.42	4.52	170.133	0.329	0.0	0.0	0.0	3.40	135.0	55.6
S5.003	62.04	4.60	169.097	0.329	0.0	0.0	0.0	2.25	159.2	55.6
S6.000	64.78	4.09	167.488	0.000	0.0	0.0	0.0	2.15	2436.7	0.0
S1.013	65.01	4.05	167.400	0.000	10.8	0.0	0.0	1.65	65.6	10.8
S1.014	64.57	4.12	167.100	0.000	10.8	0.0	0.0	2.82	448.7	10.8
S1.015	64.35	4.16	166.850	0.000	10.8	0.0	0.0	2.18	347.0	10.8

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Simulation Criteria for PRELIM DESIGN 2.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.326		

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Online Controls for PRELIM DESIGN 2.SWS

Hydro-Brake® Optimum Manhole: S6, DS/PN: S1.005, Volume (m³): 10.2

Unit Reference	MD-SHE-0091-4500-1600-4500
Design Head (m)	1.600
Design Flow (l/s)	4.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	91
Invert Level (m)	175.568
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	4.5
Flush-Flo™	0.399	4.1
Kick-Flo®	0.817	3.3
Mean Flow over Head Range	-	3.7

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 (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.9	1.200	3.9	3.000	6.0	7.000	9.0
0.200	3.8	1.400	4.2	3.500	6.5	7.500	9.3
0.300	4.1	1.600	4.5	4.000	6.9	8.000	9.6
0.400	4.1	1.800	4.7	4.500	7.3	8.500	9.9
0.500	4.1	2.000	5.0	5.000	7.7	9.000	10.1
0.600	4.0	2.200	5.2	5.500	8.0	9.500	10.4
0.800	3.4	2.400	5.4	6.000	8.4		
1.000	3.6	2.600	5.6	6.500	8.7		

Hydro-Brake® Optimum Manhole: S14, DS/PN: S1.013, Volume (m³): 24.3

Unit Reference	MD-SHE-0154-1500-2400-1500
Design Head (m)	2.400
Design Flow (l/s)	15.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	154
Invert Level (m)	167.400
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

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Hydro-Brake® Optimum Manhole: S14, DS/PN: S1.013, Volume (m³): 24.3

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.400	15.0
Flush-Flo™	0.673	14.6
Kick-Flo®	1.376	11.5
Mean Flow over Head Range	-	12.9

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 (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.5	1.200	13.2	3.000	16.7	7.000	25.0
0.200	11.7	1.400	11.6	3.500	17.9	7.500	25.9
0.300	13.1	1.600	12.4	4.000	19.1	8.000	26.7
0.400	13.9	1.800	13.1	4.500	20.2	8.500	27.5
0.500	14.4	2.000	13.7	5.000	21.3	9.000	28.2
0.600	14.6	2.200	14.4	5.500	22.3	9.500	29.0
0.800	14.5	2.400	15.0	6.000	23.2		
1.000	14.1	2.600	15.6	6.500	24.1		

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Storage Structures for PRELIM DESIGN 2.SWS

Tank or Pond Manhole: S6, DS/PN: S1.005

Invert Level (m) 175.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	175.0	1.500	175.0	1.501	0.0

Tank or Pond Manhole: S26, DS/PN: S6.000

Invert Level (m) 167.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	210.0	2.100	210.0	2.101	0.0

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Summary of Critical Results by Maximum Level (Rank 1) for PRELIM DESIGN 2.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.326
Return Period (years) 30 Cv (Summer) 0.750
Region England and Wales Cv (Winter) 0.840
M5-60 (mm) 19.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Sensitivity flows(s) (%) 0

PN	US/MH Name	Storm	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	+0%					183.693
S1.001	S2	15 Winter	+0%					181.689
S2.000	S18	15 Winter	+0%					180.909
S1.002	S3	15 Winter	+0%					180.684
S1.003	S4	15 Winter	+0%					179.265
S1.004	S5	15 Winter	+0%					177.629
S1.005	S6	240 Winter	+0%	+0%/15 Winter				176.466
S1.006	S7	15 Winter	+0%					175.338
S1.007	S8	15 Winter	+0%					174.737
S1.008	S9	15 Winter	+0%					174.233
S3.000	S19	15 Winter	+0%					175.481
S3.001	S20	15 Winter	+0%					174.564
S1.009	S10	15 Winter	+0%					173.667
S1.010	S11	15 Winter	+0%					172.897
S4.000	S21	15 Winter	+0%					172.341
S1.011	S12	15 Winter	+0%					172.139
S1.012	S13	15 Winter	+0%					170.887
S5.000	S22	15 Winter	+0%					174.853
S5.001	S23	15 Winter	+0%					172.879

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Summary of Critical Results by Maximum Level (Rank 1) for PRELIM DESIGN 2.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.132	0.000	0.36			40.4	OK	
S1.001	S2	-0.131	0.000	0.37			43.0	OK	
S2.000	S18	-0.091	0.000	0.66			34.6	OK	
S1.002	S3	-0.085	0.000	0.70			86.1	OK	
S1.003	S4	-0.148	0.000	0.51			124.0	OK	
S1.004	S5	-0.125	0.000	0.63			155.1	OK	
S1.005	S6	0.673	0.000	0.08			4.1	SURCHARGED	
S1.006	S7	-0.204	0.000	0.23			37.7	OK	
S1.007	S8	-0.205	0.000	0.22			37.7	OK	
S1.008	S9	-0.180	0.000	0.34			59.0	OK	
S3.000	S19	-0.169	0.000	0.14			16.5	OK	
S3.001	S20	-0.140	0.000	0.31			33.3	OK	
S1.009	S10	-0.165	0.000	0.42			92.3	OK	
S1.010	S11	-0.157	0.000	0.46			100.9	OK	
S4.000	S21	-0.153	0.000	0.48			39.9	OK	
S1.011	S12	-0.134	0.000	0.58			146.0	OK	
S1.012	S13	-0.109	0.000	0.72			191.1	OK	
S5.000	S22	-0.112	0.000	0.50			53.3	OK	
S5.001	S23	-0.092	0.000	0.65			83.4	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for PRELIM DESIGN 2.SWS

PN	US/MH Name	Storm	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S5.002	S24	15 Winter	+0%					170.299
S5.003	S25	15 Winter	+0%					169.325
S6.000	S26	180 Winter	+0%					168.465
S1.013	S14	180 Winter	+0%	+0%/15 Winter				168.466
S1.014	S15	480 Winter	+0%					167.165
S1.015	S16	480 Winter	+0%					166.938

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S5.002	S24	-0.058	0.000	0.90			106.2	OK	
S5.003	S25	-0.071	0.000	0.93			106.0	OK	
S6.000	S26	-0.223	0.000	0.01			17.6	OK	
S1.013	S14	0.841	0.000	0.38			14.6	SURCHARGED	
S1.014	S15	-0.385	0.000	0.05			14.6	OK	
S1.015	S16	-0.362	0.000	0.09			14.6	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for PRELIM DESIGN 2.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.326
Return Period (years) 100 Cv (Summer) 0.750
Region England and Wales Cv (Winter) 0.840
M5-60 (mm) 19.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Sensitivity flows(s) (%) 0, +30

PN	US/MH Name	Storm	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	+30%					183.726
S1.001	S2	15 Winter	+30%					181.723
S2.000	S18	15 Winter	+30%	+30%/15 Winter				181.386
S1.002	S3	15 Winter	+30%	+30%/15 Winter				181.123
S1.003	S4	15 Winter	+30%					179.320
S1.004	S5	15 Winter	+30%	+30%/15 Winter				177.761
S1.005	S6	360 Winter	+30%	+0%/15 Winter				177.209
S1.006	S7	15 Winter	+30%					175.367
S1.007	S8	15 Winter	+30%					174.765
S1.008	S9	15 Winter	+30%					174.273
S3.000	S19	15 Winter	+30%					175.499
S3.001	S20	15 Winter	+30%					174.594
S1.009	S10	15 Winter	+30%					173.717
S1.010	S11	15 Winter	+30%					172.952
S4.000	S21	15 Winter	+30%	+30%/15 Winter				172.639
S1.011	S12	15 Winter	+30%	+30%/15 Winter				172.523
S1.012	S13	15 Winter	+30%	+30%/15 Winter				171.511
S5.000	S22	15 Winter	+30%	+30%/15 Winter				175.053
S5.001	S23	15 Winter	+30%	+30%/15 Winter				173.837

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Summary of Critical Results by Maximum Level (Rank 1) for PRELIM DESIGN 2.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.099	0.000	0.60			68.1	OK	
S1.001	S2	-0.097	0.000	0.62			72.4	OK	
S2.000	S18	0.386	0.000	1.03			53.7	SURCHARGED	
S1.002	S3	0.354	0.000	1.12			136.4	SURCHARGED	
S1.003	S4	-0.093	0.000	0.79			194.4	OK	
S1.004	S5	0.007	0.000	1.00			243.7	SURCHARGED	
S1.005	S6	1.416	0.000	0.09			4.5	FLOOD RISK	
S1.006	S7	-0.175	0.000	0.36			60.7	OK	
S1.007	S8	-0.177	0.000	0.35			60.7	OK	
S1.008	S9	-0.140	0.000	0.56			96.7	OK	
S3.000	S19	-0.151	0.000	0.24			27.8	OK	
S3.001	S20	-0.110	0.000	0.52			56.1	OK	
S1.009	S10	-0.115	0.000	0.69			152.8	OK	
S1.010	S11	-0.103	0.000	0.76			167.2	OK	
S4.000	S21	0.145	0.000	0.77			64.3	SURCHARGED	
S1.011	S12	0.250	0.000	0.91			226.6	SURCHARGED	
S1.012	S13	0.515	0.000	1.09			291.3	SURCHARGED	
S5.000	S22	0.088	0.000	0.82			87.0	SURCHARGED	
S5.001	S23	0.866	0.000	0.98			125.6	SURCHARGED	

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Summary of Critical Results by Maximum Level (Rank 1) for PRELIM DESIGN 2.SWS

PN	US/MH Name	Storm	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S5.002	S24	15 Winter	+30%	+0%/15 Winter				171.316
S5.003	S25	15 Winter	+30%	+0%/15 Winter				169.578
S6.000	S26	360 Winter	+30%	+0%/120 Winter				169.554
S1.013	S14	360 Winter	+30%	+0%/15 Winter				169.564
S1.014	S15	600 Winter	+30%					167.165
S1.015	S16	720 Winter	+30%					166.938

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S5.002	S24	0.958	0.000	1.34			158.4	FLOOD RISK	
S5.003	S25	0.181	0.000	1.39			157.7	SURCHARGED	
S6.000	S26	0.866	0.000	0.01			13.2	SURCHARGED	
S1.013	S14	1.939	0.000	0.38			14.6	SURCHARGED	
S1.014	S15	-0.385	0.000	0.05			14.6	OK	
S1.015	S16	-0.362	0.000	0.09			14.6	OK	

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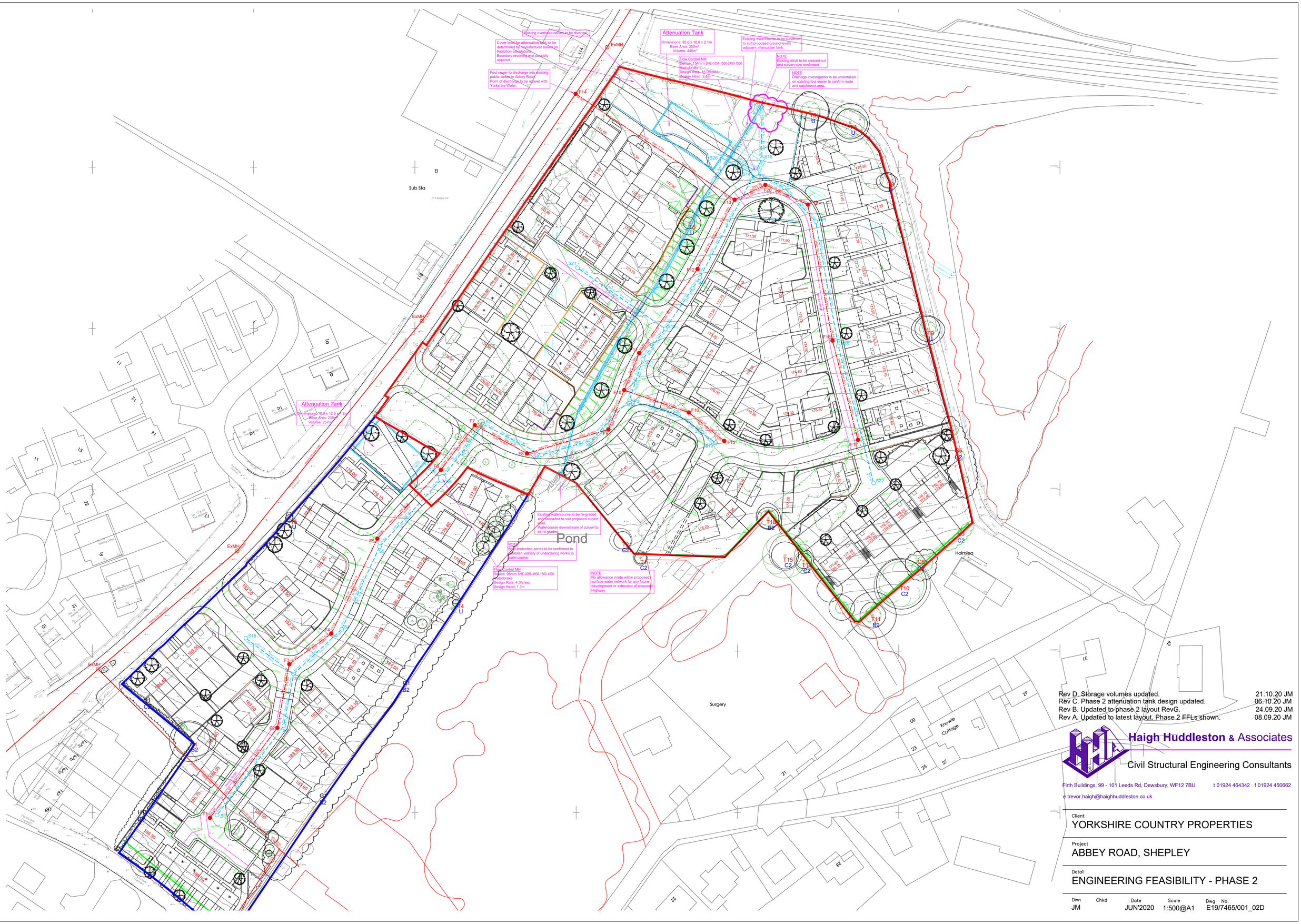

Rev D. Storage volumes updated.	21.10.20	JM
Rev C. Phase 2 attenuation tank design updated.	06.10.20	JM
Rev B. Updated to phase 2 layout RevG.	24.09.20	JM
Rev A. Updated to latest layout. Phase 2 FFLs shown.	08.09.20	JM

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Client
YORKSHIRE COUNTRY PROPERTIES

Project
ABBEY ROAD, SHEPLEY

Detail
ENGINEERING FEASIBILITY - PHASE 2

Dwn	Chkd	Date	Scale	Dwg No.
JM		JUN'2020	1:500@A1	E19/7465/001_02D