

2841

Wheelwright Centre, Dewsbury
Residential Development of existing educational building

DRAINAGE STRATEGY

DS(00)01

29th January 2020

Revision - B



Document Control

Revision	Date	Description	Approved
-	16/09/2019	Planning Stage Report	CM
A	16/12/2019	Amended following discussion with YW	CM
B	29/01/2020	Amended following VE and discussion with LLFA	CM

Preamble

- 1. Proposed Development**
- 2. Existing Surface Drainage Network**
- 3. Surface Water System**
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- Appendix B Proposed Site Layout**
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- Appendix D Sewer Records**
- Appendix E Proposed Drainage Layout**
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Preamble

Jameson Consulting Engineers have been appointed to prepare a Drainage Strategy on behalf of the MMR Property Group to support the planning application for re-development of the existing educational building at this site. The site has been developed over the last 100 years, around a central stone-built structure opened in 1893 as a Grammar School. Modern additions to the north, south and rear of the property has expanded the education centre and the drainage system has been developed accordingly to serve these extensions.

The site is located between Birkdale Road and Halifax Road (A638) behind an open green lawn at the front of the site. The site is accessed from Birkdale Road to the south, and ground levels rise to the north, following the topography of this area of Dewsbury. The green lawn area is not part of the development and does not lie within the clients' ownership.

The grid reference for the site is SE 23737 22536 at postcode WF13 4HG.

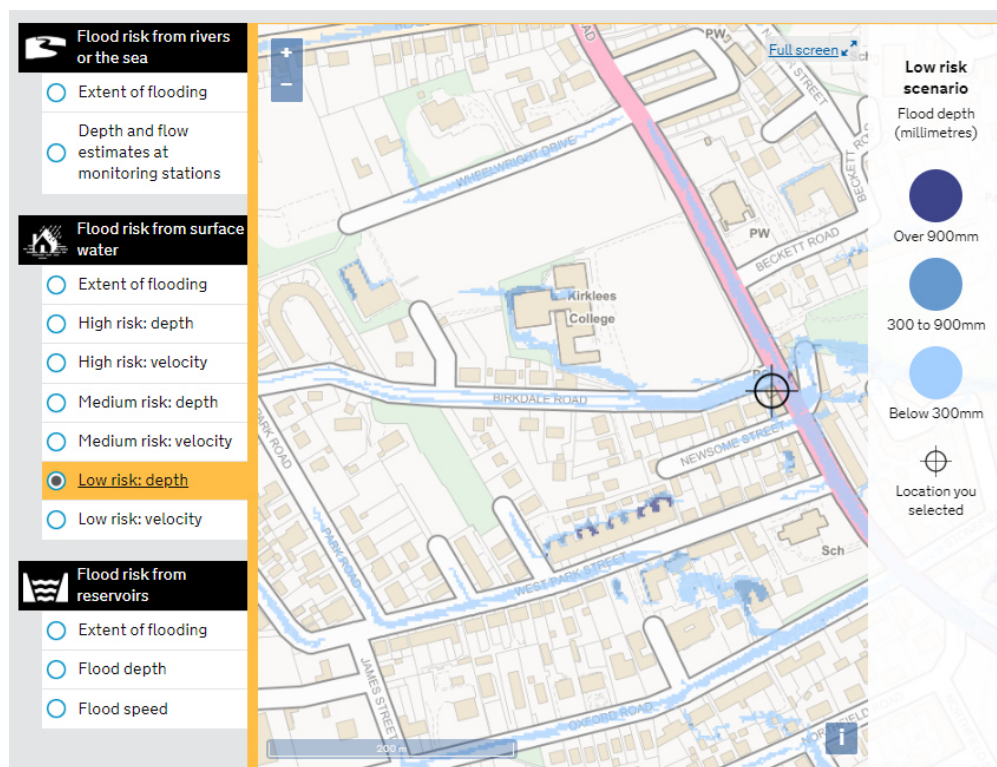
A flood risk assessment (FRA) has not been carried out as the site is located within Flood Zone 1, but the effects of surface water flooding are considered within this report.

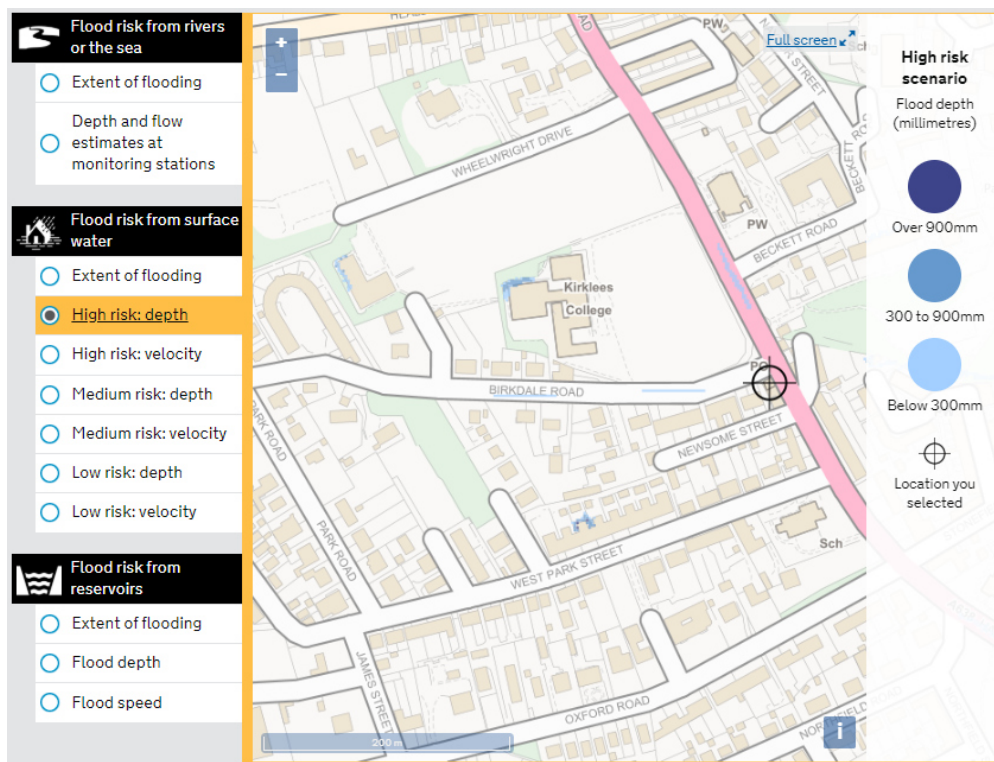
1. Proposed Development

- 1.1. The buildings on the site are to be converted from educational use to residential apartments. As part of the scheme the 2-storey flat roof building to the north of the site will be demolished to allow additional car parking spaces to be built to service the apartments. All other buildings remain for conversion.
- 1.2. The conversion from education to residential requires the installation and extension of the foul drain network.
- 1.3. The site falls from north to south from +96.2m at its highest point at the north of the site, to +89.9m at the southern entrance. The ground floors of the building are set above the ground levels in all areas, however several of the buildings have basement accommodation that are in part below external ground levels.
- 1.4. A Phase 2 site investigation should be carried to determine the local ground conditions and assess the suitability of an infiltration drainage design to any part of the external site spaces. It is however highly likely that the underlying ground is predominantly CLAY and therefore the soil sublayer is likely to be impermeable.
- 1.5. The Environment Agency's Flood Map for Planning indicates that the proposed development site lies within Flood Zone 1 (low risk).

2. Existing Surface Drainage Network

- 2.1. The existing drainage system is a separate foul and surface water network that connects to the sewers in Birkdale Road to the south of the site.
- 2.2. A CCTV survey has been carried out by Centara Ltd. and confirms the pipe sizes, inverts and condition of the drain network. A link can be provided to the full drainage survey report upon request.
- 2.3. The CCTV survey identifies several drains that are blocked with roots and debris, particularly at the outfall of the site.
- 2.4. The CCTV survey identifies that the surface water from the 2-storey flat roof building to the north of the site as connected to the foul water system. This drained area equates to 610 m² and is excluded from the surface water network capacity calculation.
- 2.5. In some locations, Manholes are blocked, and access has not been gained into chambers, however connectivity has been proved. As part of the proposed conversion works the drain system will be cleaned and access ensured to all chambers.
- 2.6. As the buildings extend to the west of the site, the building plateau cuts into the hillside and a cutting is formed behind the building. The local authority surface water flood map shows flood water collecting in this area in excess of 300mm deep and occurring at a high probability (>3.3%), i.e. a 1 in 30-year storm event.





- 2.7. The performance of the existing surface water system has been reviewed by analysis of the network under storm durations. The network performs satisfactorily up to a 1 in 20 year return period for all storm durations with no allowance for climate change (0% CC). Flooding within the network occurs at limited volumes (<3 m³) during a 1 in 30 year return period (0% CC).
- 2.8. As the return periods increase, the flood volumes increase in particular when allowances for climate change are added. The following table summarises the network performance, confirming that with an allowance of 40% CC, the network performs without flooding at a 1 in 4 year return period.

Return Period	Climate Change (%)	Flood Volume (m ³)	Discharge Volume (m ³)	Out Flow (l/s)
1 in 2	0	0	47	97.9
1 in 2	40	0	65	114.4
1 in 4	40	0.1	79	119.7
1 in 20	0	0.2	80	107.4
1 in 30	0	2.7	86	131.5
1 in 30	40	16.9	108	146.2
1 in 100	0	10.9	102	133.0
1 in 100	40	40.1	121	129.0

- 2.9. An existing area of hardstanding at the south of the site (lower driveway) drains directly to Birkdale Road and does not enter the private drain system. The LLFA have requested that as much of this area as possible is drained into the private system to benefit from the restricted

attenuated discharge. The levels fall steeply across the site at this point. The lowest level a drainage channel can be set, such that it still drains by gravity behind the flow control device is +90.1. If the channel were set closer to the gates and at a lower level it could not drain by gravity back behind the flow control. This approach adds 750 sq.m back into the network and increases the permissible 1 in 1 year flow, prior to the application of any development restriction.

- 2.10. Adjusting for the additional area added in 2.9 above, the existing flow from the site during a 1 in 1 year return period is 94.3 l/s.

3. Proposed Surface Water System

- 3.1. To mitigate the development's impact on the site itself and adjacent areas beyond the site boundary, additional drainage will be installed to accommodate run off from the new car park area to the north of the site (where the building will be demolished). This is the building that currently connects surface water to the foul drains, so the new car park area will add additional drained area to the surface water drainage system. Current guidance requires surface water disposal systems to be designed in accordance with requirement H3 of the Building Regulations 2000 with all possible options for disposal of surface water having been considered using the preferred hierarchy:
- Source control and extraction of water from the built design
 - Discharge through Infiltration
 - Discharge to Watercourse
 - Discharge to Public Sewer
- 3.2. Considering the above hierarchy, an infiltration drainage system has been discounted as the ground conditions consist of mainly clay and fine particle soils which are likely to be classed as impermeable for infiltration design purposes. It is also likely that surface water from the car park, discharged through the soil surface layers will end up collecting around the basement structure of the main building which needs to be avoided to protect the accommodation proposed at basement level.
- 3.3. There is no known watercourse within the site or accessible from the site and therefore drainage of surface water to the sewer via the drain network is the only viable option.
- 3.4. The green area to the east of the building is not in the clients' ownership and therefore surface water features offering attenuation cannot be considered in this area; accordingly, we have developed a design that uses underground attenuation tanks sited under the car parking areas.
- 3.5. Pre-planning advice has confirmed that the development of the site must ensure the reduction in surface water drainage flow off the site by 30%. In order to achieve this the surface water flow from the development will be restricted to 70% of the 1 in 1 year return period flow identified in 2.10 above. The maximum post development outflow from the site will therefore be 66 l/s.
- 3.6. The outflow from the surface water drainage network will be restricted by flow control devices, positioned prior to discharge of the surface network from the site. The FCD in our preliminary calculations are orifice plates positioned at new manholes S5 and S6 with a design flows as tabulated below.

MH	Orifice diameter (mm)
S5	120
S6	109

- 3.7. The outfall from the site will therefore be restricted to 66 l/s during all 1 in 30 year return period storm durations and adequate underground storage is provided within the network to retain the backflow without surface flooding.
- 3.8. The outfall from the site will be restricted to 66 l/s during all 1 in 100 year return period storm durations and adequate underground storage is provided within the network to retain the backflow without surface flooding.
- 3.9. Underground storage tanks have been provided in three locations where flooding develops in the attenuated system. The majority of existing surface water network is retained and where appropriate tanks are sited under car parks and road ways.
- 3.10. Silt trap protection has been provided at entry to the tanks, to allow for ease of silt removal from the system and access through manhole chambers is provided.
- 3.11. An allowance of 10% for climate change has been made for all return periods in the calculation of tank volumes and system design. This is in line with the central estimate for climate change for small sites to 2069 in Table 4 of Environment Agency "Adapting to climate change: Advice for flood and coastal erosion risk management authorities".
- 3.12. A Yorkshire Water (YW) surface sewer is present in Birkdale Road and a connection already exists serving the existing site. A copy of the YW records are included in Appendix D.
- 3.13. An S106 application with YW will be required to secure permission to re-use the existing drainage connection and to substantiate the rationale of this report or to conclude the findings of the LA.
- 3.14. Further to the discussion in 2.9, it should be noted that an area of 145 sq.m at the southern end of the site drains directly onto Birkdale Road through the gates of the site. This can not be re-directed back behind flow control devices as the ground levels do not permit a practical gravity connection. This has been agreed in principal with the LLFA in preliminary discussions.
- 3.15. The proposed drainage layout drawing is included at Appendix E with hydraulic design calculation included at Appendix G.

4. Foul Water System

- 4.1. A Yorkshire Water (YW) foul sewer is present in Birkdale Road and a connection exists that serves the existing site. A copy of the YW records are included in Appendix D.
- 4.2. The new foul network is separate from the surface water network and will be designed to suit the appliance discharge units (DU) from the apartments and communal facilities. At the preliminary stage each apartment is assessed as follows

Appliance	No.	DU
Basin	2	1.0
Shower (without plug)	2	1.2
Kitchen Sink	1	0.8
Dishwasher	1	0.8
Washing Machine	1	1.5
6l WC	2	4.0
Total		9.3

- 4.3. The development proposes 65 apartments, with a commercial allowance of 28 DU. The total number of DU is equal to 633 DU, accumulating in a final outflow of 17.6 l/s.
- 4.4. An S106 application with YW will be required to secure permission to re-use the existing drainage connection and to substantiate the rationale of this report or to conclude the findings of the LA.
- 4.5. The proposed drainage layout drawing is included at Appendix E with hydraulic design calculations included at Appendix F.

5. Design Strategy Summary

5.1. In order to manage the run off from the developed site, and accommodate future climate change, the design of the surface water drainage system includes the following: -

5.2. Attenuation

Attenuation is provided within the on-site surface water drainage system to ensure the on-site system does not flood during a 1 in 30 year event and no flooding or only controlled flooding at the surface within the site during a 1 in 100 year (+10% climate change) event.

5.3. Oil Separators

The new car park provides parking for 35 cars and is considered to pose a low to medium risk to surface water contamination. A petrol interceptor will therefore be installed to the new car park to treat the surface run-off from this area. All other areas remain as existing and are not treated through petrol interceptors.

5.4. Flood Exceedance

The residual risk of surface water flows affecting the building infrastructure have been mitigated by providing adequate storage for all storm events under the maximum return period of 1 in 100 years + 10% allowance for climate change.

5.5. Flood Flow Routes

The building floor levels are generally set above external ground levels, where existing basements are located the local ground levels fall away from the thresholds providing further protection. Flood flow routes are therefore likely to follow the road routes heading south onto Birkdale Road before entering the highway sewer network or continuing to flow to the south on the road network. However, the additional attenuation placed within the private drain network on the site is likely reduce these events to occurring above the 1 in 100 year return event, making flood events highly unlikely.

Flood flow routes in exceedance events have been reviewed against the topographical survey. Exceedance event flows would flow around the building footprint, across the car parks and out of the gates of the south site entrance onto Birkdale Road. The routes have been shown on drawing 2841 S(10)01 for clarity.

5.6. Design and Construction Standard

All on-site foul and surface water drainage has been designed in accordance with the current Building Regulation Standards. Construction should be in accordance with the building regulations standards, engineer specification and details and where appropriate to the standard set-out in Sewers for Adoption, 7th Edition.

6. Maintenance

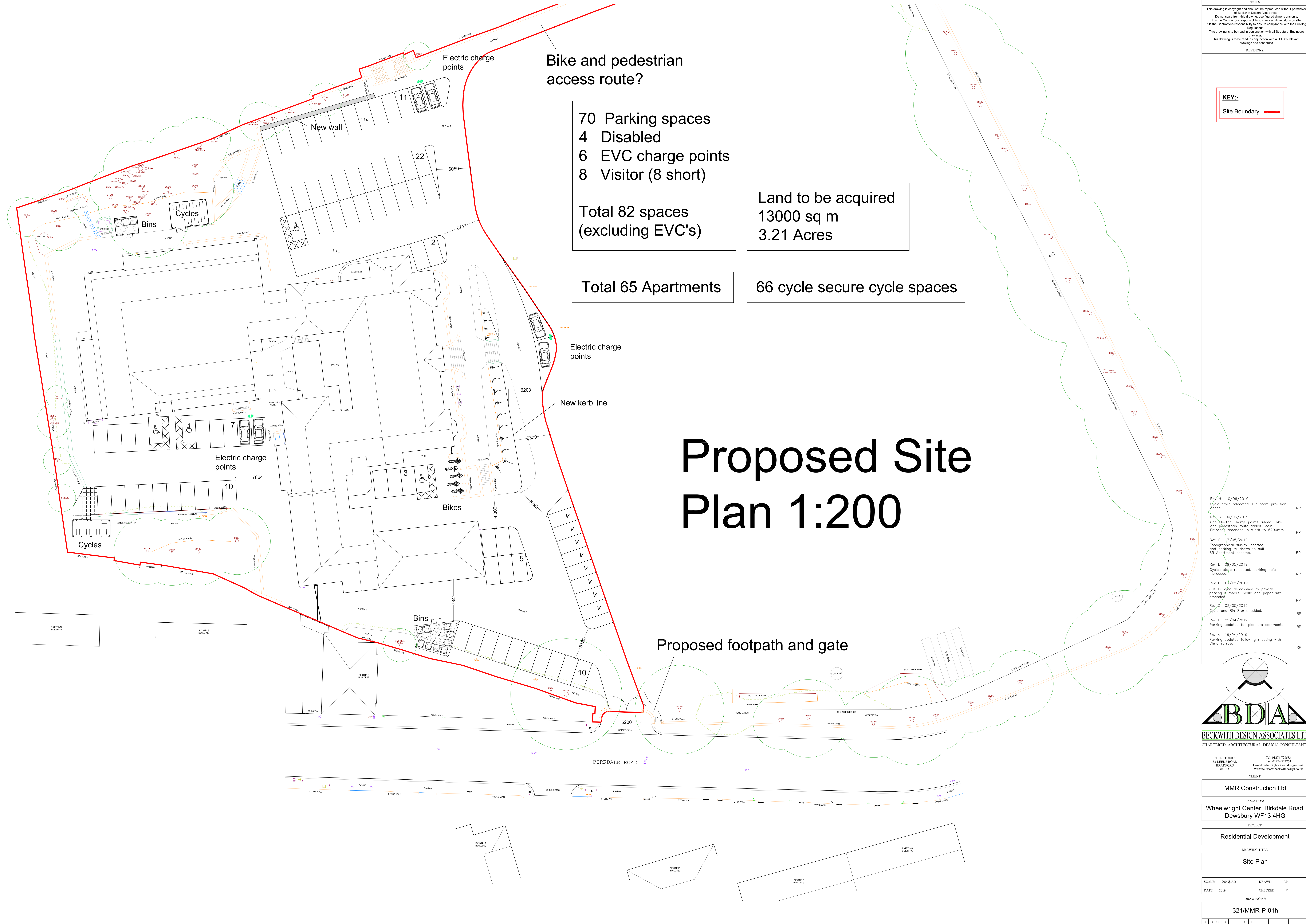
- 6.1. The drainage network needs to be maintained on a regular basis; as a minimum every 12 months the network needs to be checked by CCTV for serviceability and operational issues. Silt or grease deposits should be removed, and defects should be addressed immediately to ensure the efficacy of the system.
- 6.2. Repairs identified within the CCTV survey by Centara will be carried out under the contract to convert the building.
- 6.3. The surface water system contains flow control devices; these should be inspected on a 6 monthly basis to ensure it is free from blockage and fully operational.
- 6.4. The surface water system contains underground attenuation storage tanks; these should be inspected by CCTV for serviceability and operational issues on a yearly basis. If silt is building up within the tank, then jetting will be required to clean the tank structure.
- 6.5. After a significant storm event, the surface water system should be fully checked for debris, blockage and serviceability.
- 6.6. O&M Manuals are to be kept on site to ensure the management team have access to this information and are aware of the operation of the system.

7. Conclusion

- 7.1. The development is not considered to be at risk from fluvial or coastal flooding as it is sited in Flood Zone 1.
- 7.2. Surface water flooding has been addressed within this report such that surface water runoff from the development does not pose flood risk to the development itself or to its neighbours as appropriate design and management measures have and will be implemented.
- 7.3. The surface water runoff generated by the proposed development is managed in a manner which will ensure there is no risk of flooding or increased risk to surrounding sites, at present and considers allowances for future climate change (+10%) in accordance with the requirements of the NPPF.
- 7.4. The surface water network on the site has been assessed and the peak flow of surface water from the site has been reduced to 70% of its current flow.
- 7.5. The foul water network on the site has been assessed and the peak flow of foul water from the site can be adequately carried by the existing pipework with new drain runs as appropriate to serve the development.
- 7.6. The drainage system for the development therefore meets the requirements of the NPPF Chapter 10 and is a compliant planning application in this regard.

Appendix A Location Plan*Not used*

Appendix B Proposed Site Layout



Bike and pedestrian access route?

- 70 Parking spaces
- 4 Disabled
- 6 EVC charge points
- 8 Visitor (8 short)

Total 82 spaces (excluding EVC's)

Land to be acquired
13000 sq m
3.21 Acres

Total 65 Apartments

66 cycle secure cycle spaces

Proposed Site Plan 1:200

Proposed footpath and gate

NOTES:

This drawing is copyright and shall not be reproduced without permission of Beckwith Design Associates.

Do not scale from this drawing. Use figured dimensions only. It is the Contractor's responsibility to check all dimensions on site. It is the Contractor's responsibility to ensure compliance with the Building Regulations.

This drawing is to be read in conjunction with all Structural Engineers drawings.

This drawing is to be read in conjunction with all BDA's relevant drawings and schedules.

REVISIONS:

Rev	Date	Description	By
Rev. H	10/06/2019	Cycle store relocated. Bin store provision added.	RP
Rev. G	04/06/2019	6no Electric charge points added. Bike and pedestrian route added. Main Entrance amended in width to 5200mm.	RP
Rev. F	17/05/2019	Topographical survey inserted and parking re-drawn to suit 65 Apartment scheme.	RP
Rev. E	09/05/2019	Cycle store relocated, parking no's increased.	RP
Rev. D	07/05/2019	60s Building demolished to provide parking numbers. Scale and paper size amended.	RP
Rev. C	02/05/2019	Cycle and Bin Stores added.	RP
Rev. B	25/04/2019	Parking updated for planners comments.	RP
Rev. A	16/04/2019	Parking updated following meeting with Chris Yarrow.	RP

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CLIENT:

MMR Construction Ltd

LOCATION:
**Wheelwright Center, Birkdale Road,
Dewsbury WF13 4HG**

PROJECT:
Residential Development

DRAWING TITLE:
Site Plan

SCALE: 1:200 @ A0	DRAWN: RP
DATE: 2019	CHECKED: RP
DRAWING N°: 321/MMR-P-01h	
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z	

Appendix C EA Flood Map

Flood map for planning

Your reference
2841

Location (easting/northing)
423729/422579

Created
16 Sep 2019 9:02

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

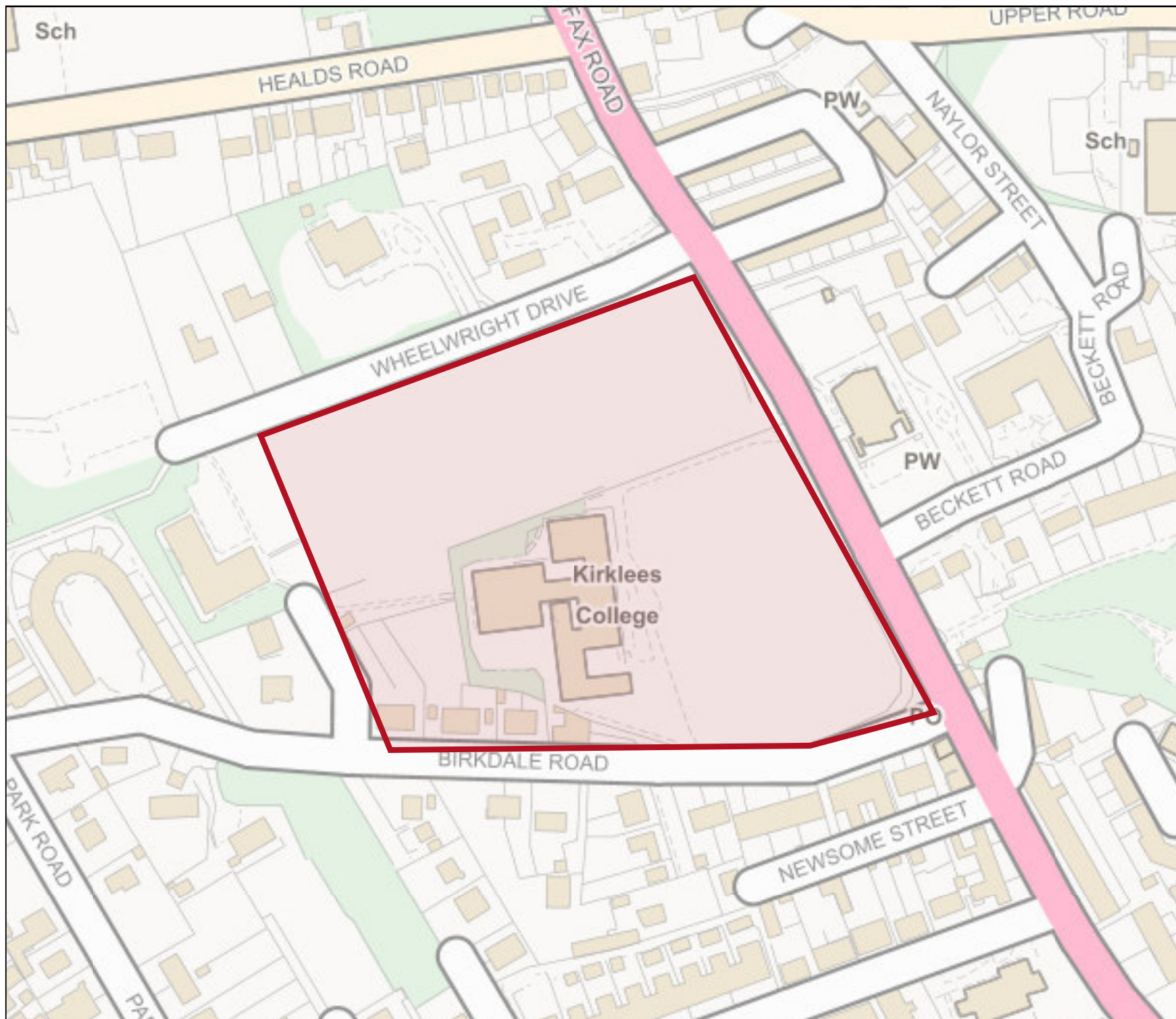
- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

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<https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>



Flood map for planning

Your reference
2841

Location (easting/northing)
423729/422579

Scale
1:2500

Created
16 Sep 2019 9:02

-  Selected area
-  Flood zone 3
-  Flood zone 3: areas benefitting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Flood storage area

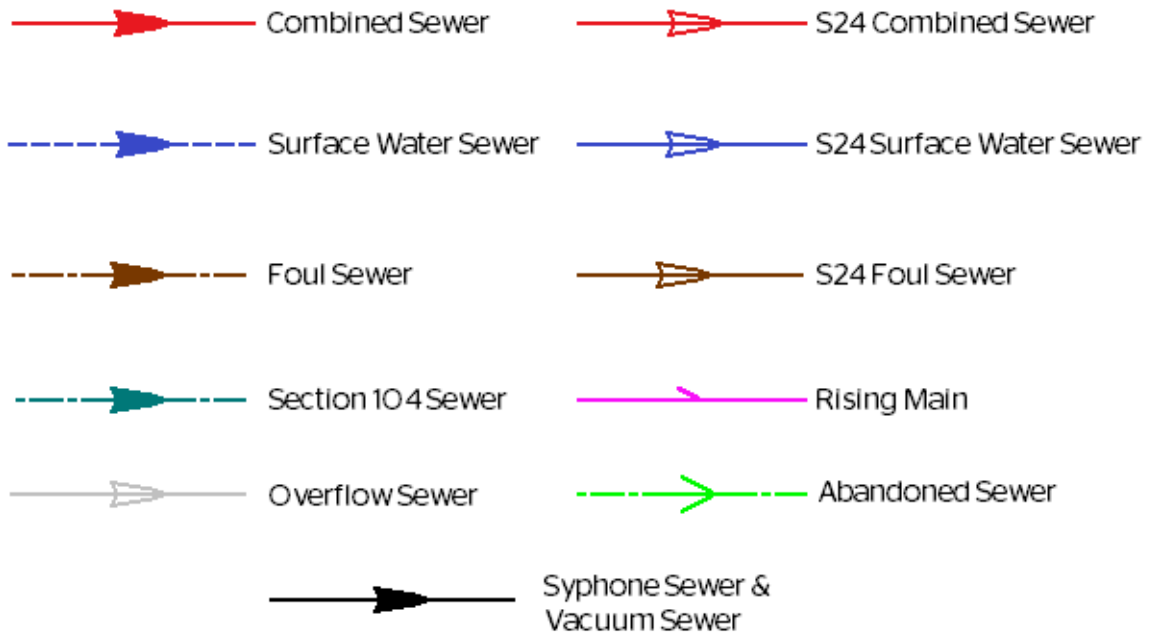
0 20 40 60m

Appendix D Sewer Maps

Property Identifier



Sewer Legend

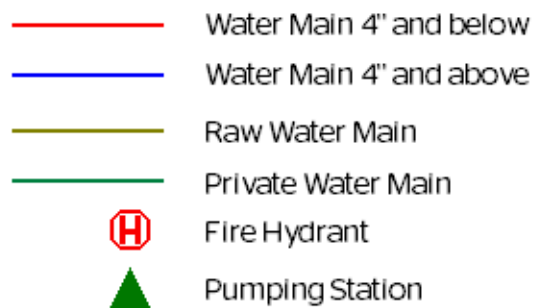


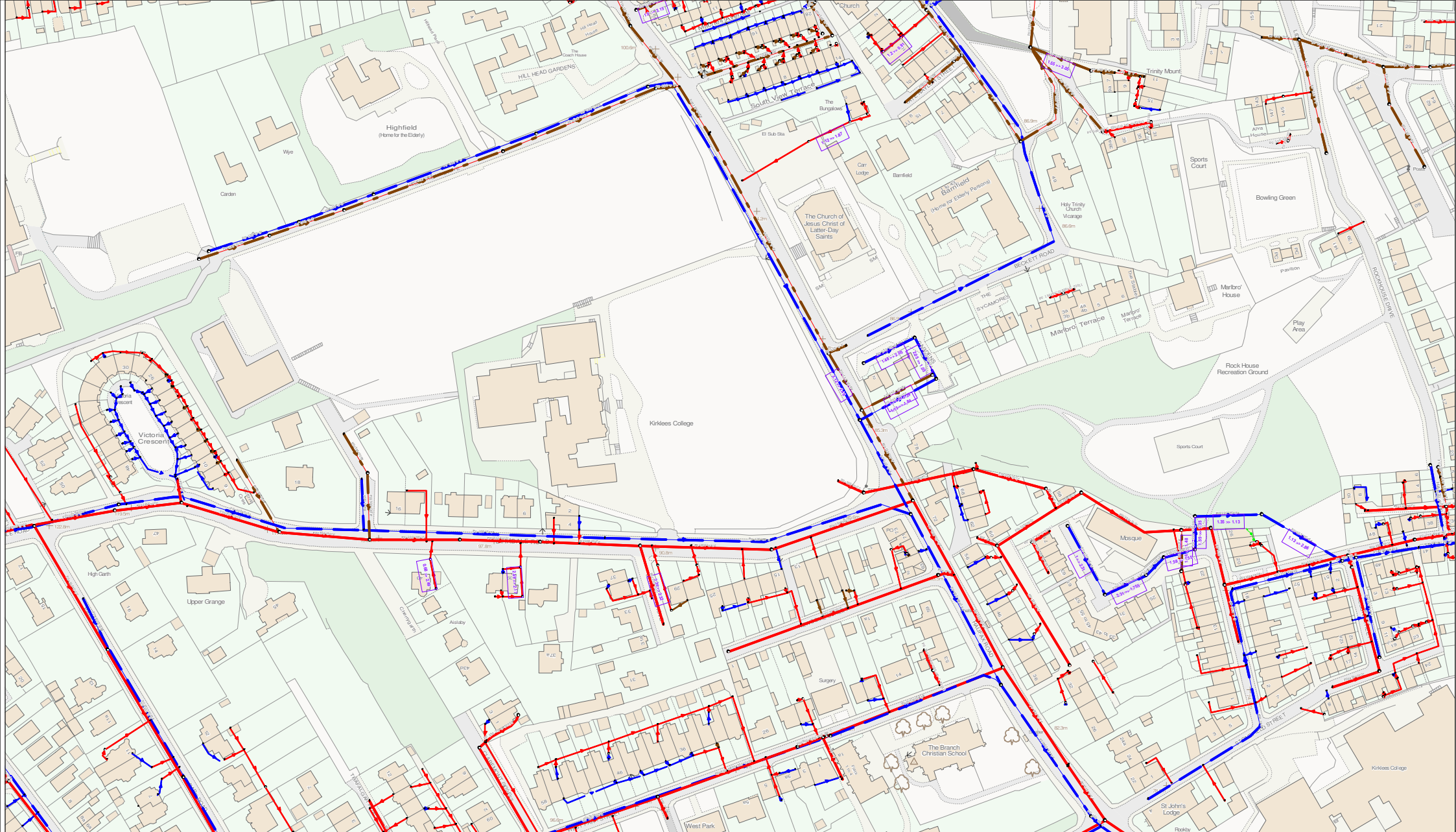
Pumping Station



Public Sewer Treatment Works

Water Legend

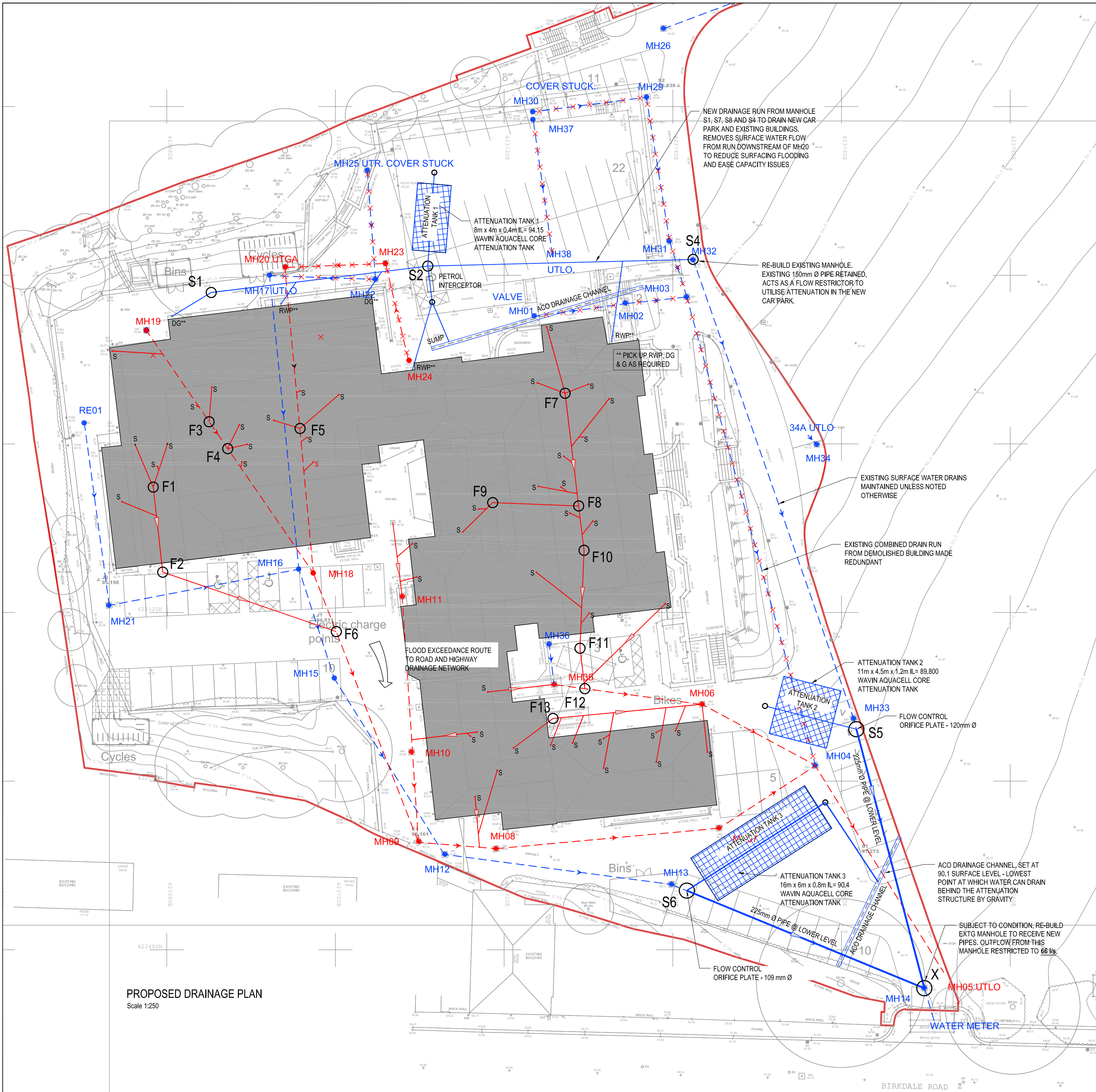




afemove A part of Yorkshire Water	423463 : 422335	Map Name : SE2322SW	Title	Partial Key	This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.
	 YorkshireWater	Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : Search Advisor L MULLOCK Contact Tel : 75 4506	Notes	Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS	
			(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	Date Req : 10/09/2019, 09:47:33 Date Gen : 10/09/2019, 09:47:39 Source : Sewer Network Enquiry	

Appendix E Proposed Drainage Layout

PLAN NAME: C:\JAMESON\CONSULTING\ENGINEERING\PROJECTS\2021\2841 JCE S (10) 01\2841 JCE S (10) 01.dwg | PLOTTED BY: CORIN MANNELL | PLOTTED DATE: 30 JANUARY 2022 14:07



PROPOSED DRAINAGE PLAN
Scale 1:250

CDM 2015 RISK NOTES

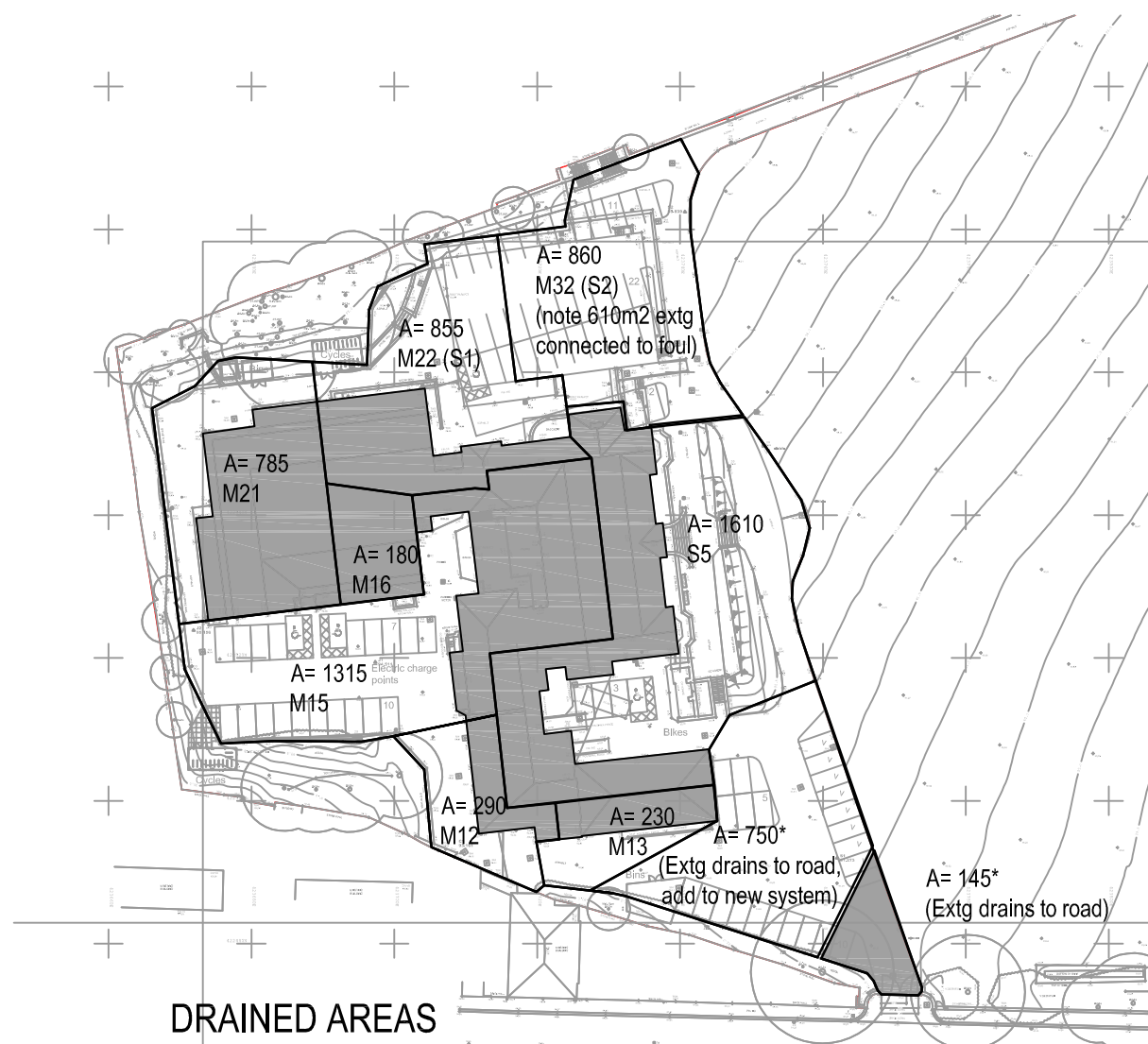
THE PROJECT HAS BEEN ASSESSED FOR SPECIFIC CONSTRUCTION RISK. THOSE RISKS THAT A COMPETENT CONTRACTOR SHOULD BE AWARE OF ARE NOT LISTED HERE. RISKS THAT ARE INHERENT IN THE DESIGN DECISIONS TAKEN THAT A CONTRACTOR NEEDS TO BE AWARE OF ARE HIGHLIGHTED BELOW AND REFERENCED IN LOCATION ON THE DRAWING PLANS BY THE NOTED SYMBOL.



① NONE

SITE & DRAWN MEASUREMENTS

- 1) DRAWN DIMENSIONS ARE BASED ON ARCHITECTS DRAWINGS OR INTERPOLATED FROM ELECTRONIC FILES. THE CONTRACTOR SHOULD TAKE SITE MEASUREMENTS AS REQUIRED TO ENSURE THE SET-OUT OF THE BUILDING IS CORRECT AND STRUCTURAL ITEMS ARE PLACED IN THE CORRECT POSITION, ARE THE CORRECT LENGTH AND PROPORTIONS.
- 2) IF IN DOUBT ASK.
- 3) SITE MEASUREMENTS ARE TO BE TAKEN BY THE CONTRACTOR PRIOR TO MATERIAL ORDER. ANY DISCREPANCIES ARE TO BE REPORTED TO THE DESIGNER FOR REVIEW.

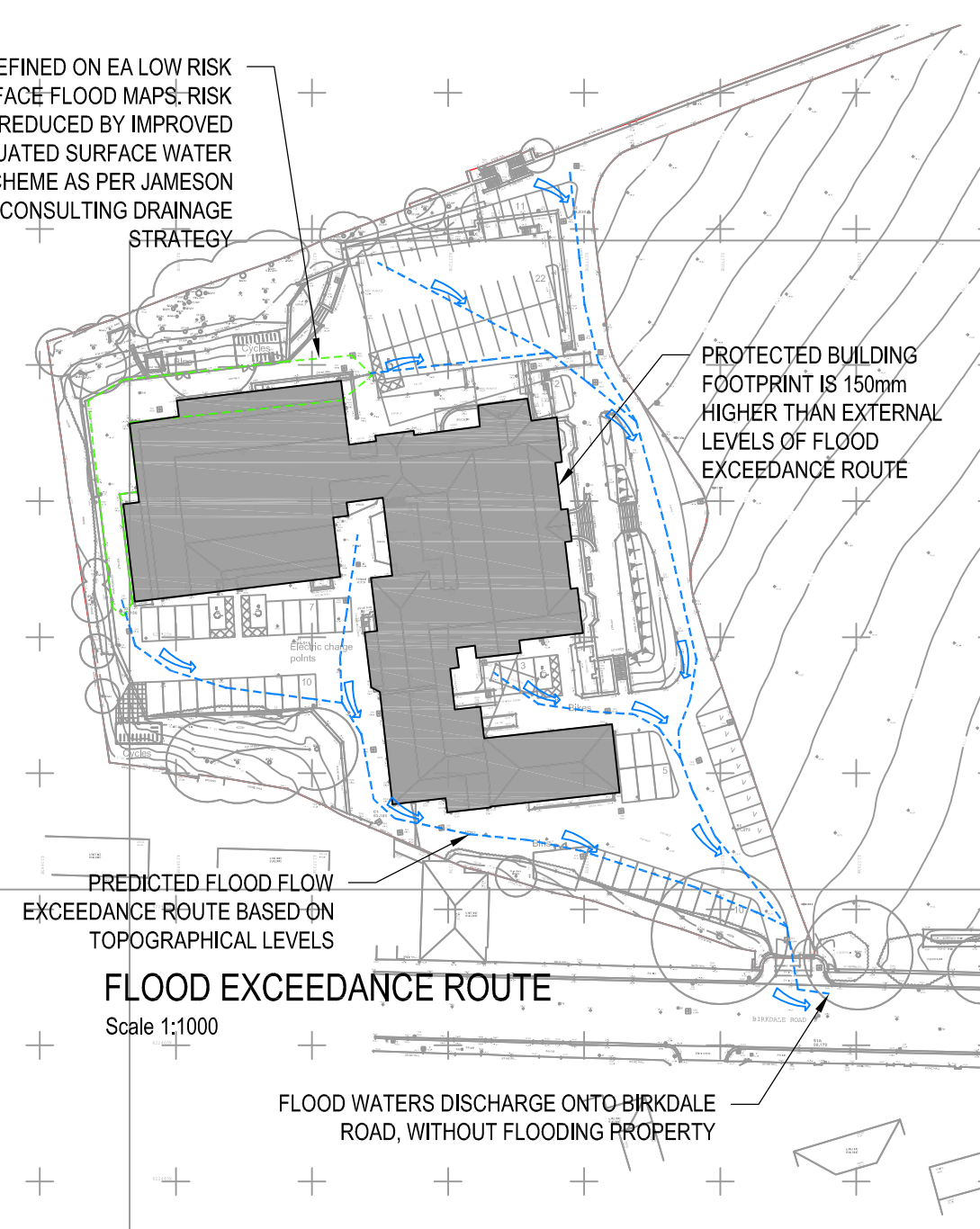


DRAINED AREAS

Scale 1:1000

Areas noted with * drain direct to the road in existing layout. New ACO channel added at lowest ground level position that can be drained back to the new system behind the flow control device. Area that drains to the road under the new scheme is reduced from 895 m2 to 145 m2.

AREA DEFINED ON EA LOW RISK SURFACE FLOOD MAPS. RISK REDUCED BY IMPROVED ATTENUATED SURFACE WATER SCHEME AS PER JAMESON CONSULTING DRAINAGE STRATEGY



FLOOD EXCEEDANCE ROUTE

Scale 1:1000

NOTES:
DO NOT SCALE FROM THIS DRAWING. UTILISE ONLY NUMBERED DIMENSIONS.
THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS, NOTIFY JAMESON CONSULTING LTD, IMMEDIATELY OF ANY DISCREPANCIES. UNLESS NOTED OTHERWISE.
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DRAWING STATUS

PLANNING

DRAINAGE KEY

FOUL

PROPOSED DRAIN + MANHOLE
INSPECTION CHAMBER
EXTG. DRAIN
EXTG. DRAIN ABANDONED
EXTG. SEWER
PROPOSED SEWER

SOIL & VENT PIPE (TO FREE AIR
UNLESS AAV NOTED)

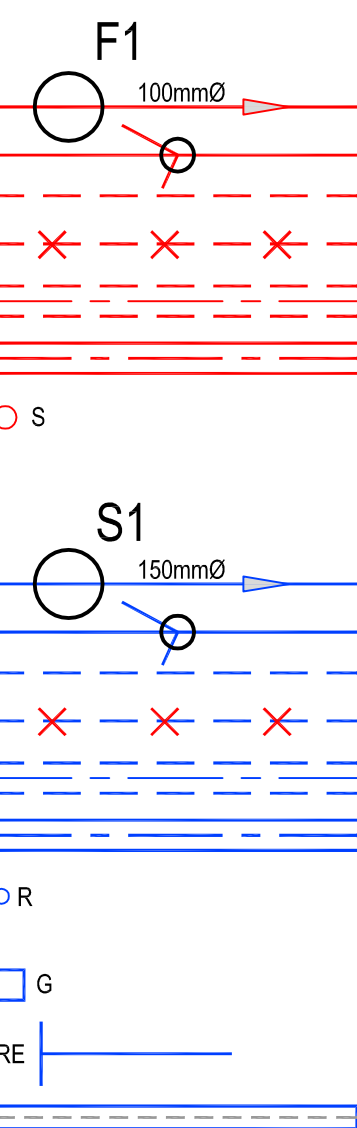
SURFACE

PROPOSED DRAIN + MANHOLE
INSPECTION CHAMBER
EXTG. DRAIN
EXTG. DRAIN ABANDONED
EXTG. SEWER
PROPOSED SEWER

RAIN WATER PIPE, RODABLE
ACCESS AT BASE UNO
GULLY POT TO DRAIN HARD
LANDSCAPING

RODDING EYE

SURFACE DRAINAGE CHANNEL



B	VALUE ENGINEERED SCHEME LLFA COMMENTS ADOPTED • INCREASE TO DRAINED AREA TO PICK UP LOWER DRIVE AREA. • INCREASED 1 IN 1 YR FLOW = 66 l/s • FLOOD EXCEEDANCE ROUTES SHOWN FOR CLARITY • ORIFICE PLATES IN LIEU OF HYDROBRAKE DRAINAGE STRATEGY AMENDED.	RL	CM	CM	29.01.20
A	YW DISCHARGE FLOW AGREED AT 58.4L/S DRAWING UPDATED ACCORDINGLY TO REFLECT 10% CLIMATE CHANGE	RL	CM	CM	16.12.19
REV	DESCRIPTION	BY	CHK	APP	DATE



Pure Offices, 4100 Park Approach, Thorpe Park, Leeds LS15 8GB
0113 8231 915 info@jamesonconsulting.co.uk

Client:

MMR CONSTRUCTION

Project:

WHEELWRIGHT CENTER
BIRKDALE ROAD
DEWSBURY, WF 13 4HG

Drawing Title:

PROPOSED DEVELOPMENT
PROPOSED SITE DRAINAGE PLAN

Scale	A1	Drawn	Date	Checked	Date	Approved	Date
1:250	RL	SEP 19	CM	SEP 19	CM	SEP 19	

Drawing No.
2841 JCE S (10) 01

Revision

B

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SHEET SIZE : A1 LANDSCAPE

Appendix F Foul Network Hydraulic Calculations



Drainage Design Report

Flow+

v6.0

Copyright © 1988-2019 Causeway Software Solutions Limited

Network

Filename

Username

Foul Network

C:\Jameson CE Ltd\Dropbox (Jameson Consulting)\2 Projects\2801 - 2900 JCE\2841 - Wheelwright Centre, Birkdale Road, Dewsbury\CALCULATIONS\2841 Foul Water Network Proposed.pfd

Chris Maxwell (chris@jamesonconsulting.co.uk)

Report produced on

18/09/2019 15:41:37

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Technical support web portal:

<http://support.causeway.com>

Flow+ v6.0 Design Report: Design Settings

C:\Jameson CE Ltd\Dropbox (Jameson Consulting)\2 Projects\2801 - Wheelwright Centre Project\2801 - Wheelwright Centre Project\JCEWATV\2801-1650-Landed

C:\Jameson CE Ltd\Dropbox (Jameson Consulting)\2 Projects\2801 - 2900 JCE\2841 Wheelwright Centre\Bridgwater@138832015b\Gawke\CV5\Aff\02\N6 52841150s\LWaired

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Link ID	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)	US Node ID	Dia (mm)	Width (mm)	Node Type	MH Type
2.000	13.136	21.0	100Circular		94.990	94.040	0.850	95.000	93.414	1.486M19		1200		Manhole	Adoptable
4.000	18.461	108.6	225Circular		93.800	91.630	1.945	93.400	91.460	1.715M11		1200		Manhole	Adoptable
4.001	10.628	48.3	225Circular		93.400	91.460	1.715	93.160	91.240	1.695M10		1200		Manhole	Adoptable
7.000	3.708	21.4	150Circular		92.820	91.330	1.340	92.600	91.157	1.293M35		1200		Manhole	Adoptable
5.005	15.270	24.4	150Circular		92.150	90.620	1.380	91.710	89.995	1.565M6		1200		Manhole	Adoptable
1.000	19.237	19.9	100Circular		95.510	94.210	1.200	95.000	93.244	1.656M20		1200		Manhole	Adoptable
1.002	7.479	34.5	150Circular		94.700	92.380	2.170	94.300	92.163	1.987M18		1200		Manhole	Adoptable
1.004	9.243	38.5	225Circular		93.160	91.240	1.695	92.800	91.000	1.575M9		1200		Manhole	Adoptable
1.005	26.522	34.9	225Circular		92.800	91.000	1.575	92.000	90.240	1.535M8		1200		Manhole	Adoptable
1.006	13.581	42.4	225Circular		92.000	90.240	1.535	91.710	89.920	1.565M7		1200		Manhole	Adoptable
1.007	35.161	115.3	225Circular		91.710	89.920	1.565	90.140	89.615	0.300M4		1200		Manhole	Adoptable
3.000	10.149	40.0	100Circular		95.000	93.700	1.200	95.200	93.446	1.654F1		1200		Manhole	Adoptable
3.001	21.758	17.0	150Circular		95.200	93.446	1.604	94.300	92.163	1.987F2		1200		Manhole	Adoptable
2.001	3.875	20.9	100Circular		95.000	93.414	1.486	95.000	93.229	1.673F3		1200		Manhole	Adoptable
2.002	17.889	21.1	100Circular		95.000	93.229	1.671	94.700	92.380	2.220F4		1200		Manhole	Adoptable
1.003	26.720	34.6	150Circular		94.300	92.163	1.987	93.160	91.390	1.620F6		1200		Manhole	Adoptable
1.001	17.200	19.9	100Circular		95.000	93.244	1.656	94.700	92.380	2.220F5		1200		Manhole	Adoptable
5.000	13.461	140.2	150Circular		92.500	91.400	0.950	92.500	91.304	1.046F7		1200		Manhole	Adoptable
5.001	5.296	147.1	150Circular		92.500	91.304	1.046	92.500	91.268	1.082F8		1200		Manhole	Adoptable
6.000	10.204	113.4	100Circular		92.500	91.400	1.000	92.500	91.310	1.090F9		1200		Manhole	Adoptable
5.002	11.624	149.0	150Circular		92.500	91.268	1.082	92.600	91.190	1.260F10		1200		Manhole	Adoptable
5.003	4.832	146.4	150Circular		92.600	91.190	1.280	92.600	91.157	1.293F11		1200		Manhole	Adoptable
5.004	14.019	26.1	150Circular		92.600	91.157	1.283	92.150	90.620	1.380F12		1200		Manhole	Adoptable
8.000	17.748	14.4	100Circular		93.200	91.900	1.200	92.150	90.670	1.380F13		1200		Manhole	Adoptable

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Appendix G Surface Network Hydraulic Calculations



Drainage Design Report

Flow+

v6.0

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Network

Filename

Username

Last analysed

Report produced on

Storm Network

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Chris Maxwell (chris@jamesonconsulting.co.uk)

29/01/2020 15:58:47

30/01/2020 13:24:58

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<http://support.causeway.com>

Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	England and Wales
M5-60 (mm)	20.000
Ratio-R	0.400
CV	0.750
Time of Entry (mins)	5.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	0.75
Connection Type	Level Soffits
Minimum Backdrop Height (m)	1.000
Preferred Cover Depth (m)	1.200
Enforce best practice design rules	x

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Site Makeup	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	
SAAR (mm)	
Soil Index	1
SPR	0.10
Region	1
Growth Factor 1 year	0.85
Growth Factor 30 years	1.95
Growth Factor 100 years	2.48
Betterment (%)	0
QBar	
Q 1 year (l/s)	
Q 30 year (l/s)	
Q 100 year (l/s)	

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Results for 1 year +10% Critical Storm Duration. Lowest mass balance: 99.92%															
Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	M17	1	93.756	0.000	0.0	0.0000	0.0000OK		2.000	M16	0.0	0.000	0.000	0.1473	
15 minute winter	M16	10	92.964	0.064	14.9	0.0307	0.0000OK		2.001	M15	14.7	1.047	0.176	0.1939	
15 minute winter	M21	10	94.296	0.056	12.3	0.1150	0.0000OK		3.000	M16	12.1	2.040	0.285	0.1361	
15 minute winter	M15	10	92.660	0.110	35.2	0.2307	0.0000OK		2.002	M12	34.8	1.924	0.434	0.4453	
15 minute winter	M12	10	92.070	0.100	39.3	0.0842	0.0000OK		2.003	M13	38.8	1.743	0.408	0.6056	
15 minute winter	M13	11	91.218	0.148	42.4	0.1076	0.0000OK		2.004	S6	42.5	1.780	0.508	0.0648	
30 minute winter	M14	26	89.097	0.097	28.3	0.1103	0.0000OK		1.004	X	28.3	1.882	0.303	0.0939	64.2
15 minute winter	S4	13	94.020	0.080	21.9	0.0227	0.0000OK		1.002	S5	21.5	2.264	0.546	0.5667	
30 minute winter	X	26	88.884	0.084	28.3	0.0000	0.0000OK								
30 minute winter	S5	26	90.147	0.347	35.8	13.1387	0.0000SURCHARGED		Orifice	M14	16.1				
30 minute winter	S6	26	90.595	0.295	42.4	18.8553	0.0000SURCHARGED		Orifice	M14	12.2				
15 minute winter	S1	10	94.302	0.102	13.3	0.2798	0.0000OK		1.000	S2	13.1	0.701	0.408	0.5137	
15 minute winter	S2	12	94.230	0.130	26.4	2.7233	0.0000OK		1.001	S4	21.9	1.209	0.593	0.5709	

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