Bradbury PM ltd

Warwick Road
Batley Carr
Batley
Kirklees

Flood Risk Assessment

Prepared by EWE Associates Ltd
Draft Rev0 December 2016

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CLIENT DETAILS

Bradbury PM Ltd

Planning, Development and Project Management Consultants
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Dewsbury WF12 0JP

FAO Paul Bailey

CONTRACT

This report describes work commissioned by Bradbury PM Ltd following instruction on 28th November 2016. Bradbury PM Ltd representative for the contract was Mr Paul Bailey. Lea Favill of EWE Associates Ltd carried out the work.

Date: 20th December 2016

Prepared by: …… Lea Favill
Director

REVISION HISTORY

Draft Report Rev0 issued 20th December 2016
- 1No copy issued to Mr Paul Bailey (Bradbury PM Ltd)

EXECUTIVE SUMMARY

The proposed development site is currently a parcel of grass land to the east of Warwick Road and the west of Bradford Road and Batley Beck, within the centre of Batley near Dewsbury. The total site covers an area of approximately 0.815 hectares. The land within the site boundary lies at a level of between 50.38mOD adjacent to Bradford Road and 72.29mOD adjacent to Warwick Road. There is existing commercial development to the north and residential development to the south east and west of the proposed development site.

The proposal is to construct a residential development complete with access road and parking.

The risk of fluvial flooding from the Batley Beck is considered to be low. As such, it is considered that the site will not be inundated from this sources. However, it is recommended that the internal ground floor of any buildings proposed for construction within the site are elevated at least 150mm above the adjacent finished external ground level to mitigate against any localised flooding resulting from surface water runoff and overland flows.

As the development is residential, it is considered that dry access and egress from the development site will be essential during extreme flood events. It is considered that the proposed development is located outside of the 1 in 1,000 year extreme flood envelope for the Batley Beck and will be a safe area during flood events which is accessible to emergency services.

Consideration has been given to the hierarchy for surface water disposal which recommends the SUDs approach which includes infiltration as the first tier. Due to low infiltration rates and a steep sloping site it is considered impractical to use infiltration drainage.

However, other SUDs techniques can be used within the site and they have been considered. The second tier is to discharge to a watercourse. There are no watercourse adjacent to the site which are accessible. It is therefore assumed that the only option for discharging surface water from the site is the adjacent Yorkshire Water surface water sewer. Following the proposed development, the impermeable area will be increased to 2605m². It is considered that the site currently discharges runoff via a combination of infiltration, evaporation and overland flow to the sewer within Bradford Road.

Using software developed by Microdrainage the required attenuation has been calculated for the 1 in 100 year plus climate change (40%) event. The site will discharge into the surface water sewer to the east of the site at a peak discharge rate of 4.5l/s. The primary attenuation will be provided within a tank sewer and a single crate tank. The balancing pond will be used to accommodate the storage during 1 in 1 year, 30 year, 100 year and 100 year +CC storms (worst case scenario).

The proposal is to provide a hydro-brake to restrict flows from the site. The hydro-brake will reduce the runoff from the development site during higher return periods, hence, there will be a significant reduction in runoff and as such the development will provide significant betterment in terms of runoff being passed forward from the site into the receiving combined sewer.

It is concluded that there is a low risk of flooding from the fluvial sources at the site. The surface water runoff from the site will be reduced during extreme events by the introduction of attenuation restricting runoff from the site.

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1. INTRODUCTION

Terms of Reference

This report was commissioned by Bradbury PM Ltd to support a planning application for the construction of a residential development within an unused parcel of land located between Bradford Road and Warwick Road. The site can presently be accessed from the east off Bradford Road and from the west of Warwick Road. The location of the site is shown on Table 2-1.

The whole of the site lies within Zone 1 of the Environment Agency Flood Map (version 2.8.2), being the zone with risk of 1 in 1,000 year (0.1% AEP) or less for river flooding. The overall size of the development is less than 1 hectare.

It is usual for the Agency to raise an objection to development applications within the floodplain or Zone 2 or 3 of the flood map until the question of flood risk has been properly evaluated. The Agency will also object to developments where the total site area is more than 1 hectare until suitable consideration has been given to surface water runoff.

Approach to the Assessment

As there are two sources of flood risk initially identified – Batley Beck and surface water runoff – it is necessary to determine flood water levels at the site for the desired return periods emanating from the these sources. Consideration has also been given to the site flooding from either overland flow or ponding of localised rainfall within the site.

Kirklees District Council was included in the Calder Valley SFRA completed by JBA Consulting during November 2008. References have been taken from the assessment; however, there is very little site specific information within the report relevant to the area close to the site.

The Batley Beck is located to the east of the site. In line with the site the beck is open channel. However, the beck does pass beneath several bridges in line with the site. The beck is Main River, as such, the responsibility for flood defence and land drainage lies with the Environment Agency.

The Environment Agency has been approached for modelled flood data for the beck. The 1 in 100 year flood level in lien with the site has been estimated at 49.308mOD and the 1 in 200 year has been estimated at 49.356mOD. The lowest existing ground level within the site is 50.38mOD adjacent to Bradford Road. It is therefore considered that the site is at least 10m above the estimated flood level of the Batley Beck and therefore no further consideration has been given to the mechanism.

The proposed development will increase the paved and roofed area within the site. As such, the existing method of draining the site will be appraised. EWE Associates Ltd has undertaken a drainage feasibility study for the site and will provide indicative storage volumes estimated using Micro Drainage Software.

The storage volumes needed to attenuate surface water flow from the development to accommodate the required 1 in 100 year plus 40% climate change event, have therefore been calculated, using the proposed drainage strategy, as outlined above.

However, the volume balance requirements should be recalculated during the detailed design stage to reflect the actual development proposal, the extent of impermeable areas and runoff to be generated.

A walk over of the site was conducted by Mr Lea Favill, Principal Engineer during November 2016; during the visit a photograph survey of the site was undertaken. During the site visit an investigation into the existing drainage route from the site was also undertaken. A topographical survey of the development site was provided by the client's representative. The survey has been calibrated to OS GPS. The surveyed levels have been used within this report.

The requirements for flood risk assessments are generally as set out in National Planning Policy Guidance (PPG). The detail and complexity of the study required should be appropriate to the scale and potential impact of the development. For the purposes of this study, the following have been considered: -

- Available information on historical flooding in the area.
- Site level information.
- Details of structures, which may influence hydraulics of the watercourse and consideration of the effect of blockage of structures.
- Estimates of design levels, equivalent to a 200-year (coastal/tidal) and a 100-year (fluvial) return period flood event.
- Allowances for increased flows resulting from the effects of climate change.
- Allowances for sea level rise resulting from the effects of climate change.

Assess the existing runoff characteristics and the potential impact the proposed development will have on the runoff.

Further guidance is also provided in the CIRIA Research Project 624 "Development and Flood Risk: Guidance for the Construction Industry".

Application of Sequential & Exceptions Test

The whole of the site is located within Zone 1 of the Environment Agency Flood Map (version 2.8.2), being the zone with risk of 1 in 1,000 year (0.1% AEP) or less for river flooding. The proposed development is residential, as such, is more vulnerable.

Table 1: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	**Exception Test required**	✓
	Zone 3b	Exception Test required	✓	×	×	×

✓ Development is appropriate

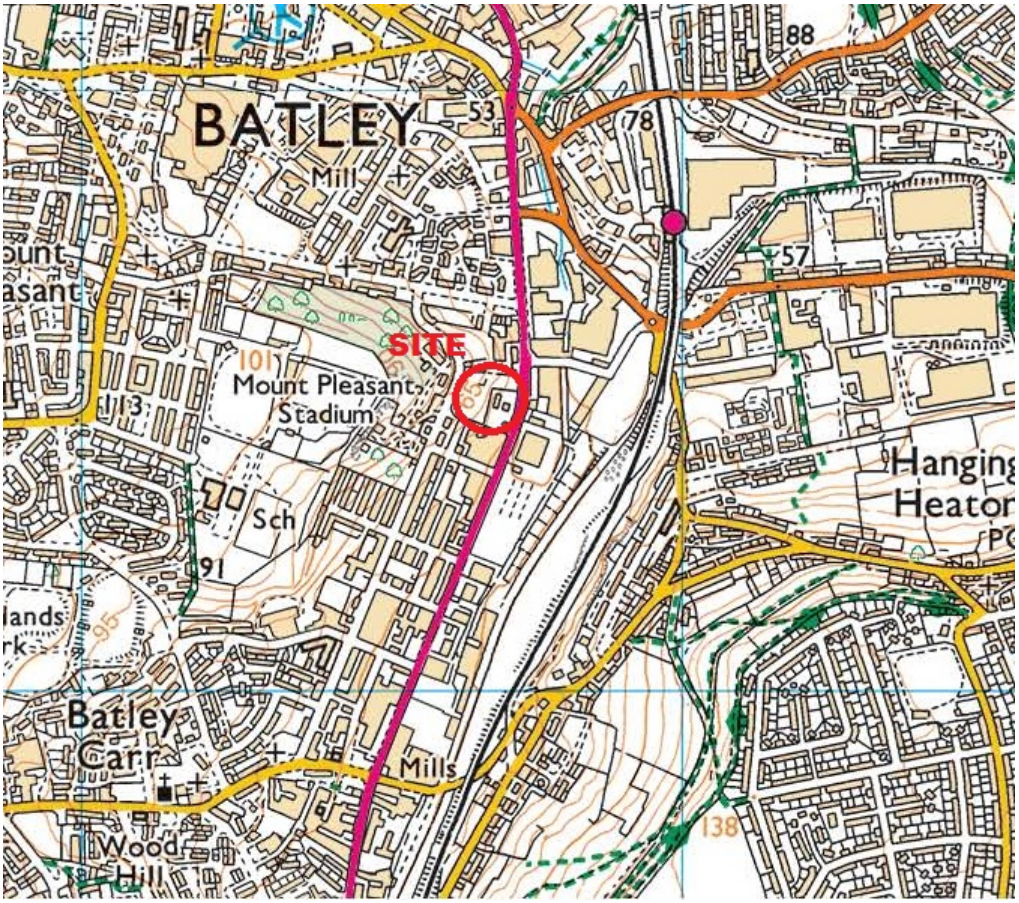
× Development should not be permitted

It is therefore considered that the sequential and exceptions tests are not required for the site.

2. DETAILS OF THE SITE

Site Location

Table 2-1: Location Plan



Ordnance Survey Licence no.: WL1005160

Site Details

Table 2-2: Site Details

Site Name	Warwick Road, Batley
Existing Land Use	Unused Grassland
Proposed Development	Residential
Grid Reference	SE 24671 23518
County	West Yorkshire
Local Planning Authority	Kirklees District Council
Internal Drainage Board	Not Applicable
Others	Not Applicable
Post Code	WF17 6HY

Site Description

The proposed development site is currently a parcel of grass land to the east of Warwick Road and the west of Bradford Road and Batley Beck, within the centre of Batley near Dewsbury. An aerial photograph of the existing site is provided below in **Error! Reference source not found.**.

The total site covers an area of approximately 0.815 hectares. The land within the site boundary lies at a level of between 50.38mOD adjacent to Bradford Road and 72.29mOD adjacent to Warwick Road. A plan of the site showing ground levels is provided at Appendix A.

There is existing commercial development to the north and residential development to the south east and west of the proposed development site.

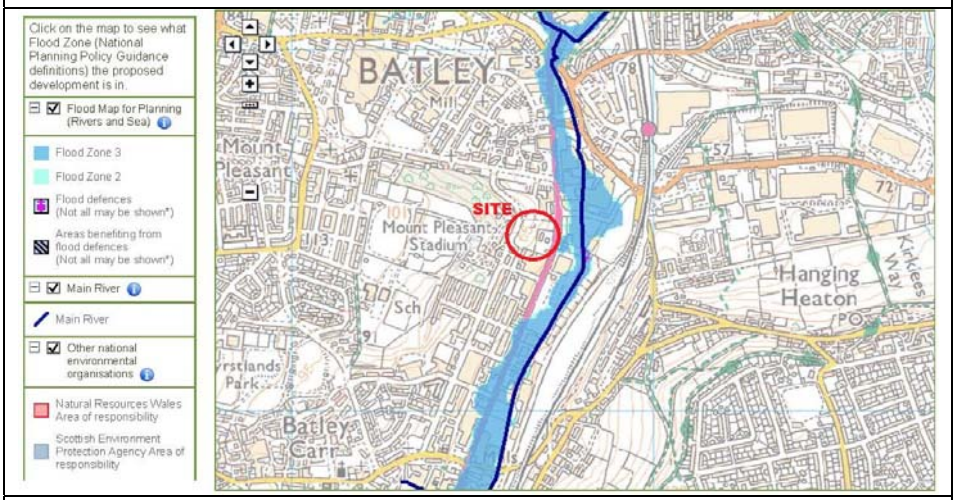
The proposal is to construct a residential development complete with access road and parking. Detailed layout plan for the development is provided at Appendix B of this report.

Site Photographs

3. INITIAL ASSESSMENT

Environment Agency Flood Zone Map

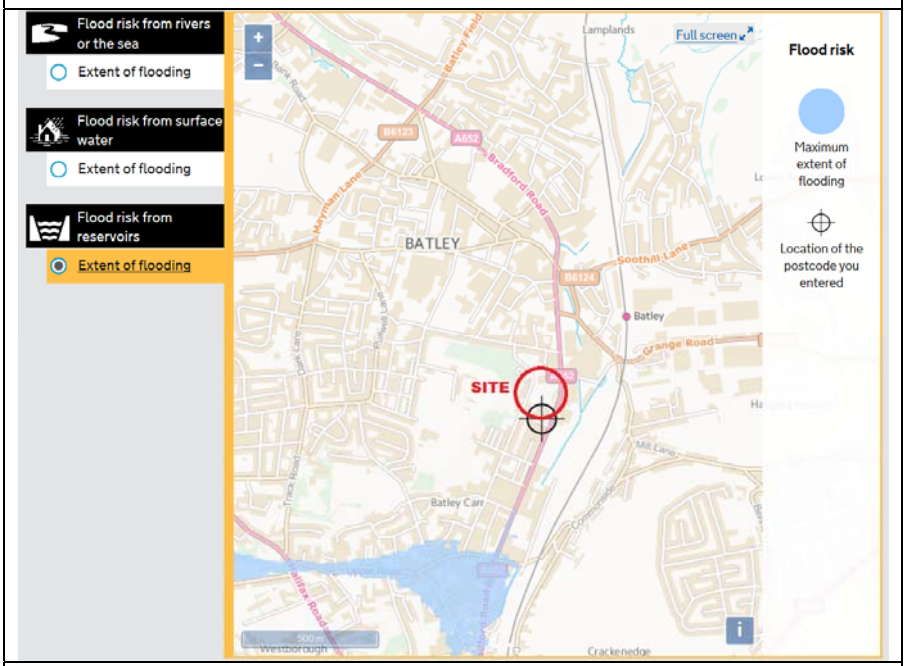
Figure 3-1: Environment Agency Flood Zones



Source: Environment Agency Website (www.environment-agency.gov.uk)

Environment Agency Reservoir Flood Risk

Figure 3-2: Environment Agency Flood Zones

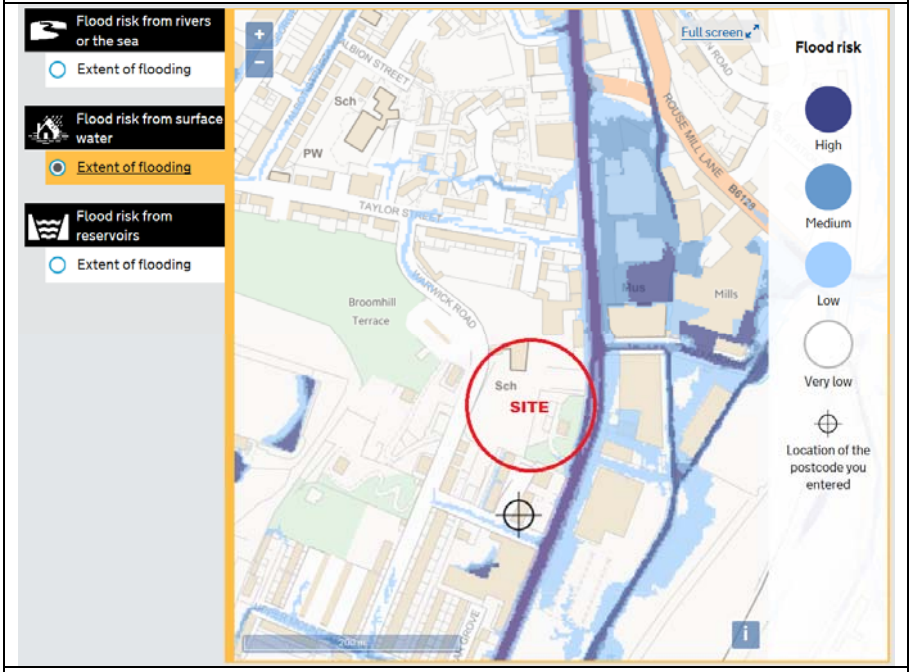


Source: Environment Agency Website (www.environment-agency.gov.uk)

Environment Agency Surface Water Flood Risk

The location of the proposed commercial building is within an area of very low and low risk according to the Environment Agency surface water flood risk map. As such, it is unlikely that the site will be flooded from surface water runoff.

Figure 3-3: Environment Agency Flood Zones



Source: Environment Agency Website (www.environment-agency.gov.uk)

Past Flooding History

A search on the British Hydrological Society Chronology of British Hydrological Events website[1] found no records of past flooding close to the site.

Undertaking an internet based search for flooding found no further reference to flooding close to the site.

SFRA Flooding History

The SFRA contained no references to the site being flooded.

Environment Agency Flooding History

The Environment Agency provided no historical references to the site being flooded.

[1] http://www.dundee.ac.uk/geography/cbhe/

Possible Flooding Mechanisms

As there is one remaining sources of flood risk which require detailed consideration – Onsite Runoff – it is necessary to determine flood water levels at the site for the desired return periods emanating from this source.

The proposed development will significantly increase the impermeable area and subsequently the runoff from the site will also be increased. An initial drainage strategy has been completed as part of this assessment based on available data.

The site slopes from west to east towards Bradford Road and the Batley Beck. Warwick Road is elevated above the site and it is therefore considered that excess runoff from the highway could flow through the site towards the Batley Beck. Therefore, this mechanism has been considered further.

There are no depressed areas within the site which could encourage ponding, therefore this flood mechanism has not been considered further.

Information on groundwater flooding is limited within the Kirklees District Council. The SFRA provided no further information. In addition, reference to the Groundwater Vulnerability Map and Source Protection Zones produced by the Environment Agency indicate that district is predominantly underlain by secondary B aquifer and are therefore unlikely to be source of significant flood risk.

Yorkshire Water is the statutory water undertaker and is responsible for the public sewer systems within Wakefield area. Yorkshire Water maintains a register of historical sewer flooding events (DG5 Register) within the area. There are no report incidents close to the site. The SFRA provided no further information.

4. FLOOD RISK ASSESSMENT

Requirements of the Environment Agency

The Environment Agency, as part of its development control procedures, generally require finished floor levels to be set above the 1% AEP plus climate change flood water level at the site. The development is residential in nature, as such it is considered that access and egress from the development site will be essential during times of extreme floods.

Existing Drainage

The site consists of a single grass field with an area of 0.815 hectares. There are no buildings, structures or paved areas within the site. It is therefore assumed, for the purpose of this assessment, that the site is 100% permeable. This area appears to drain towards Bradford Road and the Batley Beck to the east of the site.

Site investigation works have been undertaken within the site which show that the site is unsuitable for infiltration drainage. There is also a steep gradient from the west down to the east which would make the use of infiltration drainage impractical. It is therefore considered that infiltration drainage is not a practical therefore the proposed point of discharge is to the existing 225mm diameter surface water sewer which is located within the site which discharges into the larger 750mm diameter sewer located within Bradford Road.

The ICP SUDS Method has been used to calculate the Greenfield runoff from the site. The calculation sheet is provided at Appendix C of this report and the rates are tabulated below in Table 4-1.

Table 4-1: ICP SUDS flows from grass land area of 0.815ha

Return Period	Flow in litres per second (l/s)
Qbar	2.8
1 in 1 year	2.4
1 in 30 year	4.9
1 in 100 year	5.8

It is considered impractical to restrict to flows of less than 5 l/s. As such, for the purpose of this assessment the peak discharge rate from the whole site of **5 l/s** has been conservatively adopted during the 1 in 1 year event.

Proposed Drainage Strategy

It is proposed to ultimately discharge any surface water flows generated by the development of the site which cannot drain via infiltration to the local watercourse via a short section of 225mm diameter surface water sewer located within lower part of the site adjacent to Bradford Road.

The proposed impermeable area for the development site has been calculated to be approximately 0.2605 ha which is 32% of the total site area, with the remainder of the site proposed as gardens, landscaping and open space.

The drainage strategy utilises an appropriately sized hydro brake to restrict the flow rate to a maximum of 5l/s. As such, the flow will vary for each of the design storms shown above and it is expected that during the more extreme return periods there will be a considerable betterment as the hydro brake is likely to restrict flows to a lesser rate than estimated at present.

Based upon the assumption that the water authority will agree to the maximum discharge rates of 5l/s, a preliminary surface water network has been developed and attenuation has been sized using MicroDrainage software.

The model data for the proposed surface water drainage network has been obtained from the proposed development layout drawing and the drainage strategy drawing is provided at Appendix D of this report. A model has been developed to represent the main drainage runs within the proposed drainage network and contributing drainage areas within the development.

Overall, the hydraulic models include the following;

- 10 pipes to represent the proposed system
- 1 hydro-brake
- 1 tank sewer
- 1 outfall into the sewer with no surcharging

Impermeable area contributions have been based on those supplied on the proposed layout drawing, considered to be 100% impermeable, comprising of roofed and paved areas.

The models have been set up as a fixed runoff model assuming 100% runoff coefficient for roofed and paved areas. The rainfall characteristics for Batley have been utilised with a value for M5-60 given as 20mm (the depth of rain in a once in five years one hour duration event); and r given as 0.40 (the ratio of the M5-60 rainfall to the M5-2day rainfall). For durations over 60 minutes the FEH runoff data for Batley has been used.

Hydraulic Modelling Results

The proposed MicroDrainage models have been simulated with the 1 in 100 year plus climate change (40%) return period design storm events with durations of 15, 30, 60, 90, 180, 210, 240, 360, 600, 900 and 1440 minutes. At the request of the Environment Agency seven day 10080 minute duration was also undertaken. The durations were run in both Winter and Summer profiles. It was found that the Winter profile was critical.

The table overleaf shows a summary of the 1 in 100 year plus climate change model runs and the impact on the drainage system in terms of peak depth within the tank sewer and flow through the hydro-brake.

The 210 minute duration produced the largest flow through the hydro-brake (4.5 l/s) which is less than the restricted runoff rate (5l/s). The modelled result for the 210 minute Winter model run is provided at Appendix E. There was no flooding during any duration considered.

Return Period	Profile	Duration (min)	Peak water level in tank	Peak flow into sewer	Status
100 year+CC	Winter FSR	15min	64.502	3.4	Surcharge
100 year+CC	Winter FSR	30min	64.709	4.0	Flood risk
100 year+CC	Winter FEH	60min	64.782	4.2	Flood risk
100 year+CC	Winter FEH	90min	64.839	4.3	Flood risk
100 year+CC	Winter FEH	180min	64.911	4.4	Flood risk
100 year+CC	Winter FEH	210min	64.914	4.5	Flood risk
100 year+CC	Winter FEH	360min	64.910	4.4	Flood risk
100 year+CC	Winter FEH	600min	64.876	4.2	Flood risk
100 year+CC	Winter FEH	900min	64.798	4.1	Surcharge
100 year+CC	Winter FEH	1440min	64.737	3.8	Surcharge
100 year+CC	Winter FEH	10080min	64.651	1.8	OK

Sustainable Urban Drainage

The Environment Agency requires that adequate pollution control is incorporated into the proposed drainage system in order to prevent deterioration of the quality of the water environment. However, this is only applicable for surface water originating from access roads and communal parking areas, which needs to be passed through a petrol/oil interceptor or equivalent system prior to discharge into the existing surface water sewer or infiltration system. It is noted, however, that this will not apply to surface water originating from roof drainage.

To reduce the impact of surface water runoff from the development in accordance with the requirements of the Environment Agency and Local Authority, the employment of SUDS techniques to limit runoff volumes and rates from the site are recommended. SUDS techniques can also be used to provide an appropriate level of treatment to the runoff.

It is normal practice to ensure that the 1 in 30 year event is maintained within the drainage system and the 1 in 100 year is permitted to flood the surface as long as there is no flooding to buildings and the flood volume is contained within the site boundary in specific areas proposed for this purpose.

The following section will provide some possible SUDS techniques which could be employed on the site to balance flows in excess of the 1 in 30 year event. SUDS techniques will also provide treatment to the runoff to remove a proportion of the pollution and protect the quality of the downstream watercourses. Following guidance from CIRIA Report C522 the following levels of treatment will be provided:

- • Roofs – 1 level
- • Driveways – 1 level
- • Roads and communal parking areas – 2 levels.

The level of treatment indicates the number of SUDS techniques that will be used to treat pollution. For example, if two levels are required the runoff may enter a filter drain that leads to a basin or pond before outfall. It is recommended that source control techniques are used. In practice there will be little outflow from these techniques for a 1 in 2 year storm as most of the rainfall will be held within the system and will disperse via evapotranspiration. Further detail of the potential to use SUDS within this site is provided overleaf within Table 4-2. The precise combination of methods used will be dependent upon the site constraints identified at the final design stage.

The impermeable area within the site will be increased to approximately 0.2605 hectares following development. Consideration should be given to the SUDs techniques which are available for the development. As such, the following SUDS techniques shown overleaf in Table 4-2 have been considered for use at this site.

Table 4-2: SUDS Techniques

SUDs Group	Suitability for Proposed Development
Retention	✘
Wetland	✘
Infiltration	✘
Filtration	✘
Detention	✘
Open Channel	✘
Source Control	✓

Overland Flow

The Warwick Road is elevated above the western boundary of the site. The road is supported by highway drainage, however, if it capacity is exceeded then potentially excess flows could be directed through the site towards the Batley Beck. It is envisaged that any overland flows from Warwick Road would enter the site via the entrance off Warwick Road and follow the road network through the site. Some flow could enter via the road subbase adjacent to the western boundary of the site.

It is therefore recommended that an appropriately sized cut off drain is provided adjacent to Warwick Road to intercept any flows from the western boundary of the site. The drain should direct flows around the buildings within the proposed development.

5. MITIGATION MEASURES

Raising Floor Levels/Land Raising

The risk of fluvial flooding from the Batley Beck is considered to be low. As such, it is considered that the site will not be inundated from this sources. However, it is recommended that the internal ground floor of any buildings proposed for construction within the site are elevated at least 150mm above the adjacent finished external ground level to mitigate against any localised flooding resulting from surface water runoff and overland flows.

Emergency Access & Egress

As the development is residential, it is considered that dry access and egress from the development site will be essential during extreme flood events.

It is considered that the proposed development is located outside of the 1 in 1,000 year extreme flood envelope for the Batley Beck and will be a safe area during flood events which is accessible to emergency services.

Control of Runoff

Consideration has been given to the hierarchy for surface water disposal which recommends the SUDs approach which includes infiltration as the first tier. Due to low infiltration rates and a steep sloping site it is considered impractical to use infiltration drainage.

However, other SUDs techniques can be used within the site and they have been considered. The second tier is to discharge to a watercourse. There are no watercourse adjacent to the site which are accessible. It is therefore assumed that the only option for discharging surface water from the site is the adjacent Yorkshire Water surface water sewer. Following the proposed development, the impermeable area will be increased to 2605m². It is considered that the site currently discharges runoff via a combination of infiltration, evaporation and overland flow to the sewer within Bradford Road.

Using software developed by Microdrainage the required attenuation has been calculated for the 1 in 100 year plus climate change (40%) event. The site will discharge into the surface water sewer to the east of the site at a peak discharge rate of 4.5l/s. The primary attenuation will be provided within a tank sewer and a single crate tank.

The balancing pond will be used to accommodate the storage during 1 in 1 year, 30 year, 100 year and 100 year +CC storms (worst case scenario).

The proposal is to provide a hydro-brake to restrict flows from the site. The hydro-brake will reduce the runoff from the development site during higher return periods, hence, there will be a significant reduction in runoff and as such the development will provide significant betterment in terms of runoff being passed forward from the site into the receiving combined sewer.

It is recommended that during the detailed phase of the development the following items are considered.

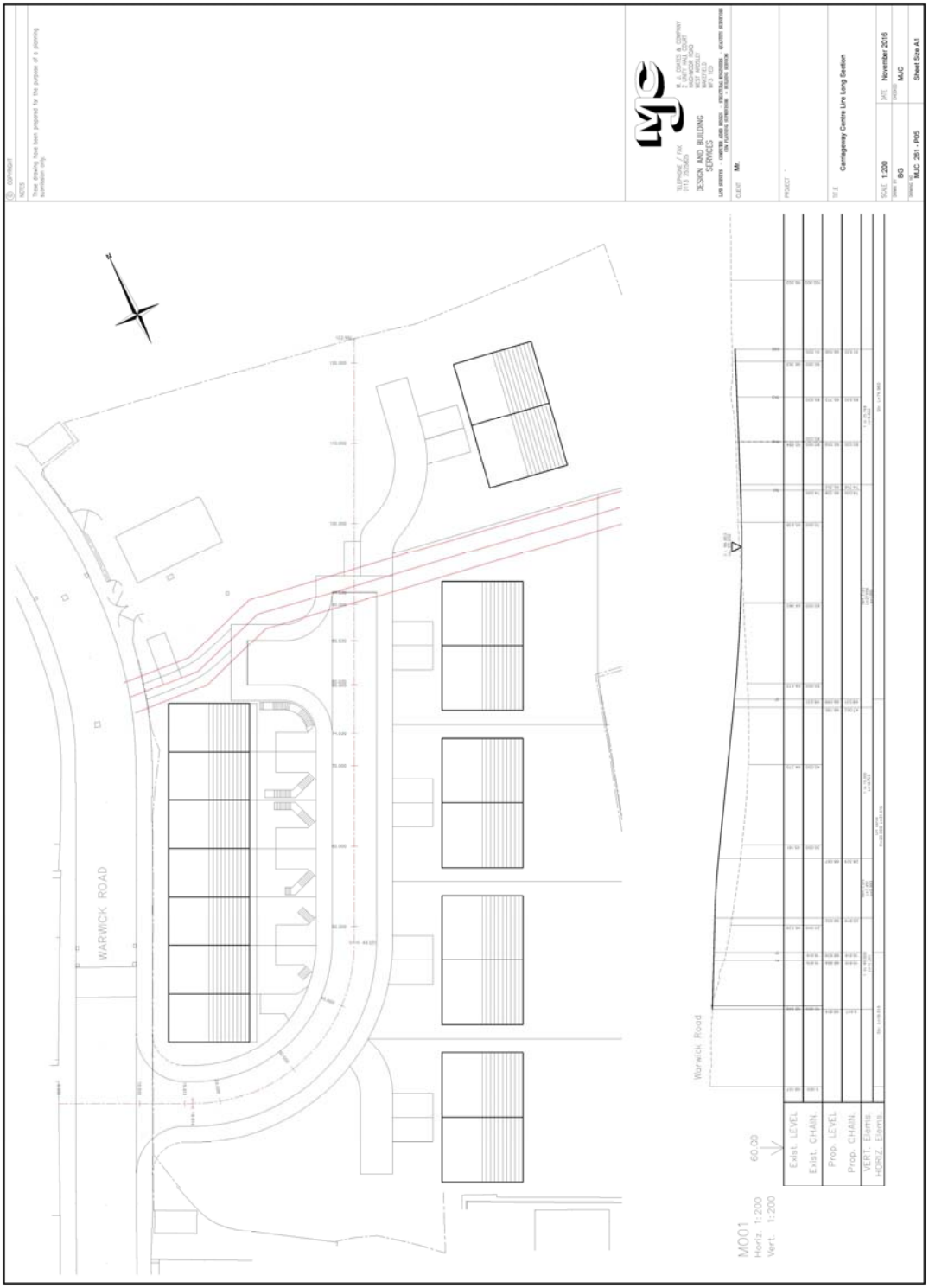
- The maintenance and adoption regimes for all elements of the development should be considered for the lifetime of the development.
- Consenting will be required from the Water Authority for any connections into the public sewer.

6. CONCLUSION

It is concluded that there is a low risk of flooding from the fluvial sources at the site. The surface water runoff from the site will be reduced during extreme events by the introduction of attenuation restricting runoff from the site.

Appendix A: - Levels

Appendix B: - Proposed Layout Plan



Appendix C: - ICPSUDS Runoff Calculation

EWE Associates Ltd		Page 1
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		
Date 21/12/2016 17:25 File	Designed By Lea Checked By	
Micro Drainage	Source Control W.12.4	

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.400
Area (ha)	0.815	Urban	0.000
SAAR (mm)	708	Region Number	Region 3

Results	**l/s**
QBAR Rural	2.8
QBAR Urban	2.8
Q1 year	2.4
Q1 year	2.4
Q30 years	4.9
Q100 years	5.8

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Appendix D: - Drainage Strategy Drawing

Appendix E: - WinDes Calculation Sheet

EWE Associates Ltd		Page 1
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		
Date 21/12/2016 17:07 File 100yr+CCWinter210...	Designed By Lea Checked By	
Micro Drainage	Network W.12.4	

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)
1.000	41.400	2.800	14.8	0.024	4.00	0.600	o	225
1.001	11.000	0.536	20.5	0.000	0.00	0.600	o	225
1.002	23.000	3.138	7.3	0.028	0.00	0.600	o	225
2.000	38.000	1.474	25.8	0.024	4.00	0.600	o	225
2.001	9.000	2.163	4.2	0.000	0.00	0.600	o	225
1.003	58.000	0.120	483.3	0.083	0.00	0.600	oo	900
3.000	73.000	0.983	74.3	0.073	4.00	0.600	oo	225
3.001	6.000	0.273	22.0	0.000	0.00	0.600	oo	225
4.000	17.000	0.070	242.9	0.029	4.00	0.600	oo	300
1.004	57.000	11.906	4.8	0.000	0.00	0.600	oo	150

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
1.000	1	72.000	70.500	1.275	69.200	67.700	1.275		1050
1.001	2	69.200	67.700	1.275	68.664	67.164	1.275		1050
1.002	3	68.664	67.164	1.275	66.740	64.026	2.489		1050
2.000	4	69.163	67.663	1.275	67.689	66.189	1.275		1050
2.001	5	67.689	66.189	1.275	66.740	64.026	2.489		1050
1.003	6	66.740	64.026	1.814	66.006	63.906	1.200		1800
3.000	7	66.662	65.162	1.275	65.679	64.179	1.275		1350
3.001	8	65.679	64.179	1.275	66.006	63.906	1.875		1350
4.000	9	64.986	63.976	0.710	66.006	63.906	1.800		1500
1.004	10	66.006	63.906	1.950	53.200	52.000	1.050	Hydro-Brake®	1800

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.004	SW11	53.200	52.000	52.000	0	0

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Online Controls for Storm

Hydro-Brake® Manhole: 10, DS/PN: 1.004, Volume (m³): 79.4

Design Head (m)	1.300	Diameter (mm)	86
Design Flow (l/s)	5.0	Invert Level (m)	63.906
Hydro-Brake® Type	Md5 SW Only		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	4.9	3.000	7.7	7.000	11.8
0.200	2.7	1.400	5.3	3.500	8.3	7.500	12.2
0.300	2.7	1.600	5.6	4.000	8.9	8.000	12.6
0.400	2.9	1.800	6.0	4.500	9.4	8.500	13.0
0.500	3.2	2.000	6.3	5.000	10.0	9.000	13.4
0.600	3.5	2.200	6.6	5.500	10.4	9.500	13.7
0.800	4.0	2.400	6.9	6.000	10.9		
1.000	4.5	2.600	7.2	6.500	11.3		

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Storage Structures for Storm

Tank or Pond Manhole: 6, DS/PN: 1.003

Invert Level (m) 64.026

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	49.0	1.400	0.0	2.800	0.0	4.200	0.0
0.200	49.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	49.0	1.800	0.0	3.200	0.0	4.600	0.0
0.600	49.0	2.000	0.0	3.400	0.0	4.800	0.0
0.800	49.0	2.200	0.0	3.600	0.0	5.000	0.0
1.000	49.0	2.400	0.0	3.800	0.0		
1.200	0.0	2.600	0.0	4.000	0.0		

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Summary of Results for 210 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm)	450.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	70.524	-0.201	0.000	0.02	0.0	3.1	OK
1.001	2	67.726	-0.199	0.000	0.03	0.0	3.1	OK
1.002	3	67.192	-0.197	0.000	0.04	0.0	6.8	OK
2.000	4	67.689	-0.199	0.000	0.03	0.0	3.1	OK
2.001	5	66.205	-0.209	0.000	0.02	0.0	3.1	OK
1.003	6	64.914	-0.012	0.000	0.01	0.0	10.8	OK
3.000	7	65.204	-0.183	0.000	0.08	0.0	9.5	OK
3.001	8	64.906	0.502	0.000	0.06	0.0	8.2	SURCHARGED
4.000	9	64.906	0.630	0.000	0.03	0.0	3.3	FLOOD RISK
1.004	10	64.906	0.850	0.000	0.03	0.0	4.5	SURCHARGED

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