Scunthorpe Sports Club

Proposed Residential Development
Land off Herriot Way
Scunthorpe
North Lincolnshire

Flood Risk Assessment
Prepared by EWE Associates Ltd
Final Report RevB October 2020

EWE Associates Ltd
7 Waveney Close
Burton Upon Stather
Scunthorpe
North Lincolnshire
DN15 9DT
t: 01724 721099
M: 07875 972270
e: lea.favill@eweassociates.com

CLIENT DETAILS

Scunthorpe Sports Club
19 Malvern Road
Scunthorpe
DN17 1EL

FAO Mr Andrew Dibden

CONTRACT

This report describes work commissioned by Scunthorpe Sports Club following written instruction on 28th February 2020. Scunthorpe Sports Club representative for the contract was Mr Jim Mumby of JEM Management Services. Lea Favill of EWE Associates Ltd carried out the work.

Date: 14th October 2020

Prepared by: …… …… Lea Favill
Director

REVISION HISTORY

Draft Report Rev0 issued 6th May 2020 - 1No copy issued to Mr Jim Mumby (JEM)
Final Report RevA issued 30th July 2020 - 1No copy issued to Mr Jim Mumby (JEM)
Final Report RevB issued 14th October 2020 - 1No copy issued to Mr Jim Mumby (JEM)

CONTENTS

APPENDIX E: - SEWER PLAN

LIST OF TABLES

1. INTRODUCTION

Terms of Reference

This report was commissioned by Scunthorpe Sports Club to support a planning application for the construction of a small residential development off Herriot Way in Scunthorpe. The site is located to the south of Herriot Way and to the west of Scotter Road. The centre of Scunthorpe is to the east of the site. The location of the site is shown on Table 2-1.

The development site lies within Zone 3 of the Environment Agency Flood Map (version 2.8.2), being the zone with risk of 1 in 200 year (1% Annual Exceedance Probability) or greater for tidal/coastal flooding. The development site is within an existing developed area and 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 in excess of 1 hectare until suitable consideration has been given to surface water runoff.

Approach to the Assessment

As there are three sources of flood risk – River Trent, Catchwater Drain and onsite surface water runoff – it is necessary to determine flood water levels at the site for the desired return periods emanating from these sources. Consideration has also been given to the site flooding from either overland flow or ponding of localised rainfall within the site.

The closest tidal watercourse is the River Trent which is 2km to the north west of the site. The River Trent is the responsibility of the Environment Agency. The area is defended by flood embankments, therefore overtopping and breach will require consideration.

The Catchwater Drain is 100m west of the proposed development site and is the responsibility of the Scunthorpe Internal Drainage Board. There are no modelled or historical flood levels available for the watercourse which could be used to estimate the 1 in 100 year flood level at the proposed development site.

The proposed development will reduce the overall paved and roofed area within the site. The site is currently a commercial site with extensive roofed and paved areas. The existing method of draining the site will be appraised. EWE Associates Ltd have undertaken a drainage feasibility study for the proposed development.

The storage volumes needed to attenuate surface water flow from the development to accommodate the required 1 in 100 year plus 30% 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, a senior river engineer during May 2020; during the visit a photograph survey of the site was undertaken. A spot

level survey of the site was provided by the client. The survey was related to ordnance survey datum.

The requirements for flood risk assessments are generally as set out in National Planning Policy Framework (NPPF). 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 development site lies partly within Zone 3 of the Environment Agency Flood Map (version 2.8.2), being the zone with risk of 1 in 200 year (0.5% AEP) or greater tidal/coastal flooding. The proposed development is residential, as such considered to be more vulnerable.

Table 1-1: 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	✓	×	×	×

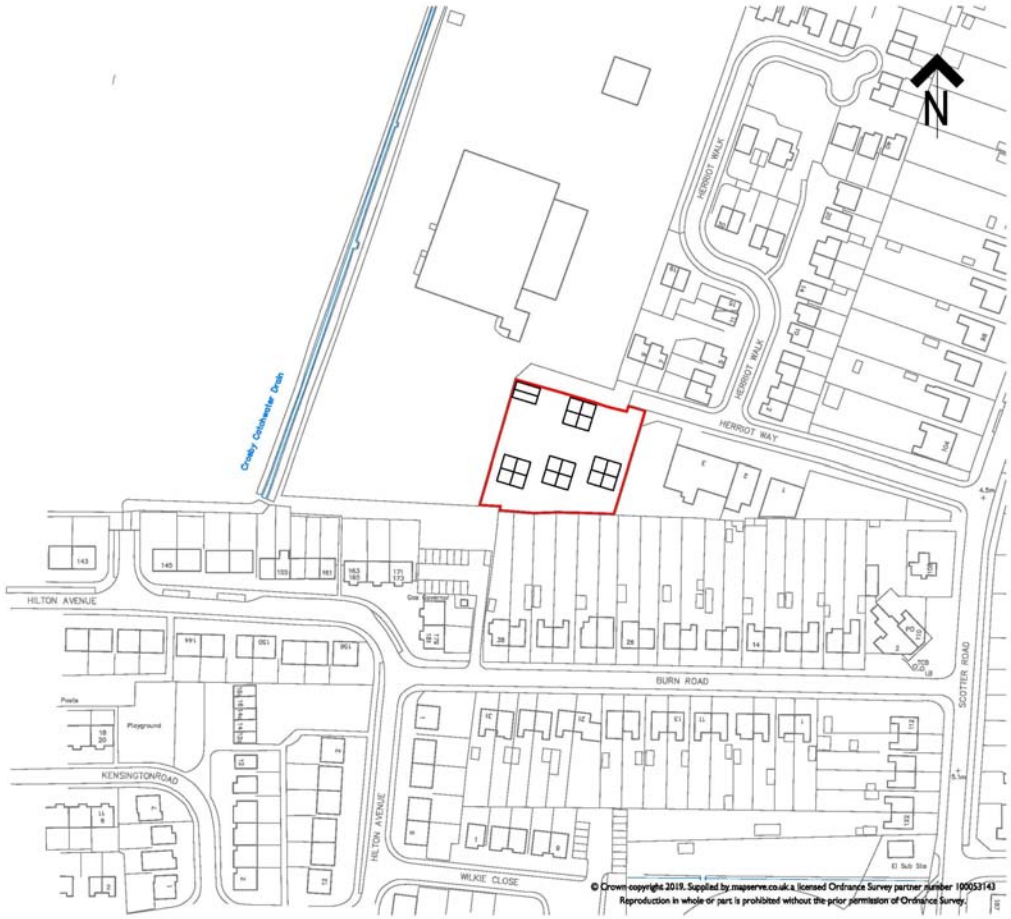
✓ Development is appropriate

× Development should not be permitted

2. DETAILS OF THE SITE

Site Location

Table 2-1: Location Plan



Site Details

Table 2-2: Site Details

Site Name	Land off Herriots Way Scunthorpe
Existing Land Use	Commercial
Proposed Development	Residential
Grid Reference	SE 87090 11455
County	North Lincolnshire
Local Planning Authority	North Lincolnshire Council
Internal Drainage Board	Not Applicable
Others	Not Applicable
Post Code	DN15 8XU

Site Description

The site is presently a commercial site. The site is located directly to the south of Herriot Way within the Skippingdale area of Scunthorpe. The main centre of Scunthorpe is located 3km east of the site. An aerial photograph of the existing site is provided below. The site has significant roofed and paved areas. During the day of the site inspection there was evidence of positive drainage within the site such as gullies to the paved areas.

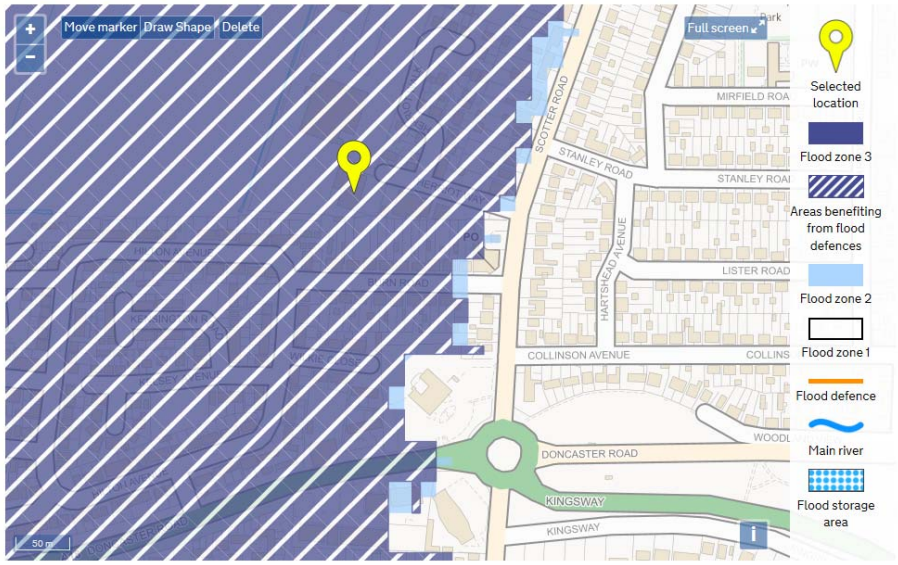
The site covers a total area of approximately 2155m². There is approximately 1595m² of roofed and paved areas as such the site is currently 75% impermeable. The land within the site boundary lies at a level of between 2.97mOD (south west corner) and 3.47mOD (south east corner). Herriot Way inline with the site entrance lies at a level of 3.5mOD. The building has a ground floor level of 3.23mOD. A plan of the area local to the site showing ground levels is provided at Appendix A.

The proposal involves the construction of 8 residential dwelling within the site boundary. The proposed layout plan of the development is provided at Appendix B of this report. It is considered that the proposed development will reduce the roofed and paved area to approximately 1110m² which will result in the site being approximately 52% impermeable following the development. As such there will be a reduction in impermeable area.

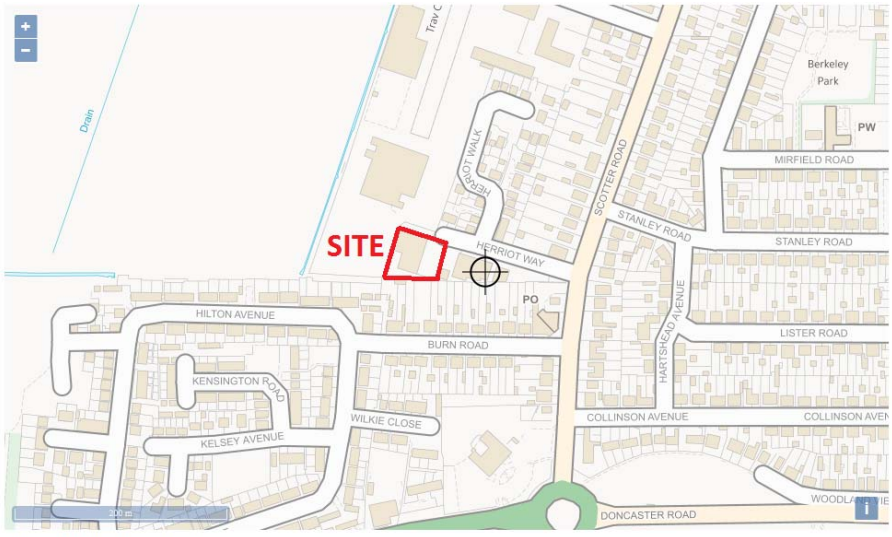
Site Photographs

3. INITIAL ASSESSMENT

Environment Agency Flood Map



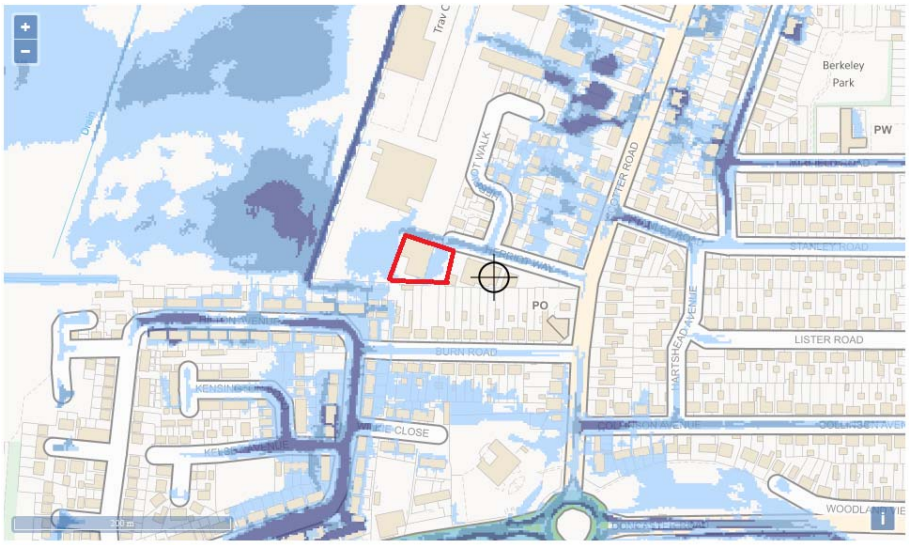
Environment Agency Reservoir Flood Map



Extent of flooding from reservoirs

Maximum extent of flooding Location you selected

Environment Agency Surface Water Flood Map



Extent of flooding from surface water

High Medium Low Very low Location you selected

Past Flooding History

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

Undertaking an internet-based search for flooding in the area provided no further information.

SFRA Flooding History

The SFRA contained no references to the site being flooded.

Environment Agency Flooding History

The Environment Agency provided no further information.

Environment Agency Reservoir Flood Risk

The Environment Agency reservoir risk map shows that the site and Scunthorpe are not located in an area which could be affected by a reservoir failure. As such, the probability of a flooding is extremely low.

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

Environment Agency Surface Water Flood Risk

The Environment Agency surface water flood risk map shows there is a single area of low risk flooding within the eastern part of the existing site where the lowest ground levels. Estimated flood depths during a 1 in 100 year event are likely to be less than 300mm.

Overland Flow & Ponding

There is no higher ground adjacent to the site which could promote overland flow of water across the site from the residential area. Consequently, no further consideration will be given to this mechanism.

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

Groundwater Flooding

Information on groundwater flooding is limited within the area. The SFRA makes no comment regards the potential for ground water flooding in the district. As such, risk from ground water flooding is low.

Sewer Flooding

Severn Trent Water is the statutory water undertaker and is responsible for the public sewer systems within the Scunthorpe area. There are existing surface water and foul sewers within the development site.

Anglian Water maintains a register of historical sewer flooding events (DG5 Register) within the area. There are no reported incidents close to the site. The SFRA provided no further information.

Possible Flooding Mechanisms

As there are three sources of flood risk – River Trent, Catchwater Drain and onsite runoff– it is necessary to determine flood water levels at the site for the desired return periods emanating from these source.

The first is from the River Trent which is the responsibility of the Environment Agency and is located approximately 2000m to the north west of the proposed development. The area is defended by flood embankments, therefore overtopping and breach will require consideration.

The second is from the Catchwater Drain which is the responsibility of the Scunthorpe Internal Drainage Board and is located directly to the west of the site. There are no flood embankments or flood walls, consequently overtopping of the natural drain bank top will only require consideration.

The proposed development will reduce the impermeable area and hence runoff from the site will also be reduced. However, consideration will need to be given to the existing drainage route and the drainage characteristics in order to evaluate the impact surface water runoff from the site will have on the site and elsewhere.

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.

River Trent

The River Trent is defended by flood embankments, which are approximately 2000m north west of the proposed development site. The Environment Agency were approached for flood level data at the development during April 2020. The Environment Agency commented that the site is unaffected by main rivers.

From previous flood risk assessments undertaken by EWE Associates Ltd in the area local to the Scunthorpe flood hazard maps have been provided. The following flood levels have been established from the mapping.

- River Trent 1 in 200 year overtopping results in a flood level of 0.38mOD to the north west of the site. The site does not flood during this event.
- River Trent 1 in 1,000 year overtopping results in a flood level of 0.42mOD to the north west of the site. The site does not flood during this event.
- River Trent 1 in 200 year plus climate change overtopping results in a flood level of 0.48mOD to the north west of the site. The site does not flood during this event.
- River Trent 1 in 200 year plus climate change breach results in a flood level of 0.48mOD to the north west of the site. The site does not flood during this event.

Catchwater Drain

The Catchwater Drain is located directly to the west of the site, being the responsibility of the Scunthorpe Internal Drainage Board who claims that there is no history of flooding since 1947 in the area and that the watercourse is unlikely to affect the site.

The Catchwater Drain in this area flows south towards the Gallagher Retail Park where the drain then flows west towards the orbital road. At this point the drain heads north towards the River Trent where it is pumped into the river by the Neap House Pumping Station. As such, even during high water levels within the River Trent the discharge from the Catchwater Drain will still be maintained. It is therefore considered that the local drains represent a low risk to the site.

Increase in Surface Water Runoff due to Development

Existing Drainage

The existing site is currently occupied by a commercial building and yard area with an existing combined roofed and paved area of 1595m². There is existing surface water and foul water drainage within and adjacent to the site. The sewers are the responsibility of Severn Trent Water. The sewer plan is provided at Appendix E of this report.

It is assumed that the existing development connects into the surface water sewer.

Proposed Impermeable Area

Following the development, the impermeable roofed and paved area will be reduced to 1110m² which is a reduction of more than 30%. The proposed impermeable area is illustrated on the plan provided at Appendix D of this report.

Current policy for brownfield sites is to recommend a 30% betterment on runoff from the site. As the reduced impermeable area has provide this betterment no attenuation is required for this development.

SUDs

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.

At this stage it is considered that the site is underlain by clay and silts which are unlikely to allow any infiltration at a reasonable rate.

The following SUDS techniques shown overleaf within Table 4-2. The precise combination of methods used will be dependent upon the site constraints identified at the final design stage

Table 4-2: SUDS Techniques and Suitability of Use

Method	Description	Potential for use at site
Filter drains	Drainage trench filled with gravel and provided with a pipe	Poor infiltration not suitable.
Swales	Shallow grass ditch	Maybe used to control overland flows
Permeable surfaces	Pavement surfaces that allow water to pass through into underlying storage in sub base e.g. permeable concrete block paving or porous asphalt.	Underdrained permeable paving recommended for private drive only.
Ponds and basins	Open areas that are used to store and treat rainwater. Ponds are permanent bodies of water and basins are generally dry and occasionally store water.	Not incorporated into design
Green roofs	Roof system that is vegetated with plants (note sedum plants rather than grass so no mowing is required)	Not incorporated into design
Infiltration devices	Methods that allow rainwater to soak into the ground, e.g. soakaways.	Poor infiltration not suitable.
Storage tanks	Underground tanks that temporarily store water in the drainage system.	Not incorporated into design
Rain Gardens & Filter strips adjacent to adoptable highway	Grassed area draining to stone filled trench with positive outfall into crate storage and borehole	Not incorporated into design

5. MITIGATION MEASURES

Raising Floor Levels/Land Raising

The River Trent defences are approximately 2000m north west of the site and are defended to the 1 in 200 year standard. Current Environment Agency overtopping and breach flood mapping shows that the site is not located within an area which is at risk of flooding.

It is also considered that the Catchwater Drain represent a low flood risk to the development and its occupants. However, if the pumping station was to fail at Neap House adjacent to the River Trent shallow low velocity flooding could be experienced within the catchment. However, it is likely that the majority of the flooding would be adjacent to the pumping station and not the development site.

The SFRA critical flood level for the area is estimated at 4.1mOD. However, the average ground level within the site is 3mOD and the site is relatively small. As such, raising ground floor levels to 4.1mOD is impractical.

Following discussions with the Environment Agency a minimum ground floor level of 3.5mOD plus a further 600mm of flood resilience measures is recommended therefore

Emergency Access & Egress

Dry access and egress can be provided during a 1 in 200 year flood event within the River Trent. During a 1 in 200 year plus climate change flood event and a breach of the defences it is considered that the site is located within an area which is low danger. It is therefore considered that the site will be safe and will also provide a safe refuge during a major flood event within the River Trent. It is considered that emergency services would be able to safely access the site during an extreme flood event.

Control of Runoff

The existing connection to the surface water drainage system should be utilised. There is no evidence of localised flooding due to incapacity. The size of the development is unlikely to have any significant impact on the localised drainage system.

Flood Resilience Measures

Consideration should be given to flood proofing the building to a level equivalent to the estimated breach level to reduce the residual damages if an extreme flood was to occur. Flood proofing is a technique by which buildings are designed to withstand the effects of flooding. There are two main categories of flood proofing, which are dry proofing and wet proofing.

Dry proofing methods are designed to keep water out of the building, and wet proofing methods are designed to improve the ability of the property to withstand the effects of flooding once the water has entered the building. Both would be required in this case, due to the possible failure of the dry proofing methods.

Where wet proofing is required it is important that a flood response plan should be prepared and practised regularly, so that any contents of the building can be moved to design flood level if required or are built to withstand immersion in water or are designed to be easily replaceable.

The differential pressures across load bearing walls and the flotation effect that will occur during flood events should be taken into account when considering dry proofing techniques. For most existing properties this means that dry flood proofing should only be considered if the expected flood depth is under 0.6m, which in this particular case is expected to be less than 0.6m in depth and as such dry proofing is likely to be successful. It is therefore considered that flooding in excess of 0.6m will cause some damage to the building; however, this is considered to be acceptable.

The following table summarises the recommendations for flood proofing measures which can be incorporated within the design of buildings[2]:

Feature	Considerations To Improve Flood Proofing
External Walls	Careful consideration of materials: use low permeability materials to limit water penetration if dry proofing required. Avoid using timber frame and cavity walls. Consider applying a water resistant coating. Provide fitting for flood boards or other temporary barriers across openings in the walls.
Internal Walls	Avoid use of gypsum plaster and plasterboards; use more flood resistant linings (e.g. hydraulic lime, ceramic tiles). Avoid use of stud partition walls.
Floors	Avoid use of chipboard floors. Use concrete floors with integrated and continuous damp proof membrane and damp proof course. Solid concrete floors are preferable; if a suspended floor is to be used, provide facility for drainage of sub-floor void. Use solid insulation materials.
Fitting, Fixtures and Services	If possible, locate all fittings, fixtures and services above design floor level. Avoid chipboard and MDF. Consider use of removable plastic fittings. Use solid doors treated with waterproof coatings. Avoid using double-glazed window units that may fill with flood water. Use solid wood staircases. Avoid fitted carpets. Locate electrical, gas and telephone equipment and systems above flood level. Fit anti-flooding devices to drainage systems.

[2] Development and Flood Risk Guidance for the Construction Industry, CIRIA C624, London 2004

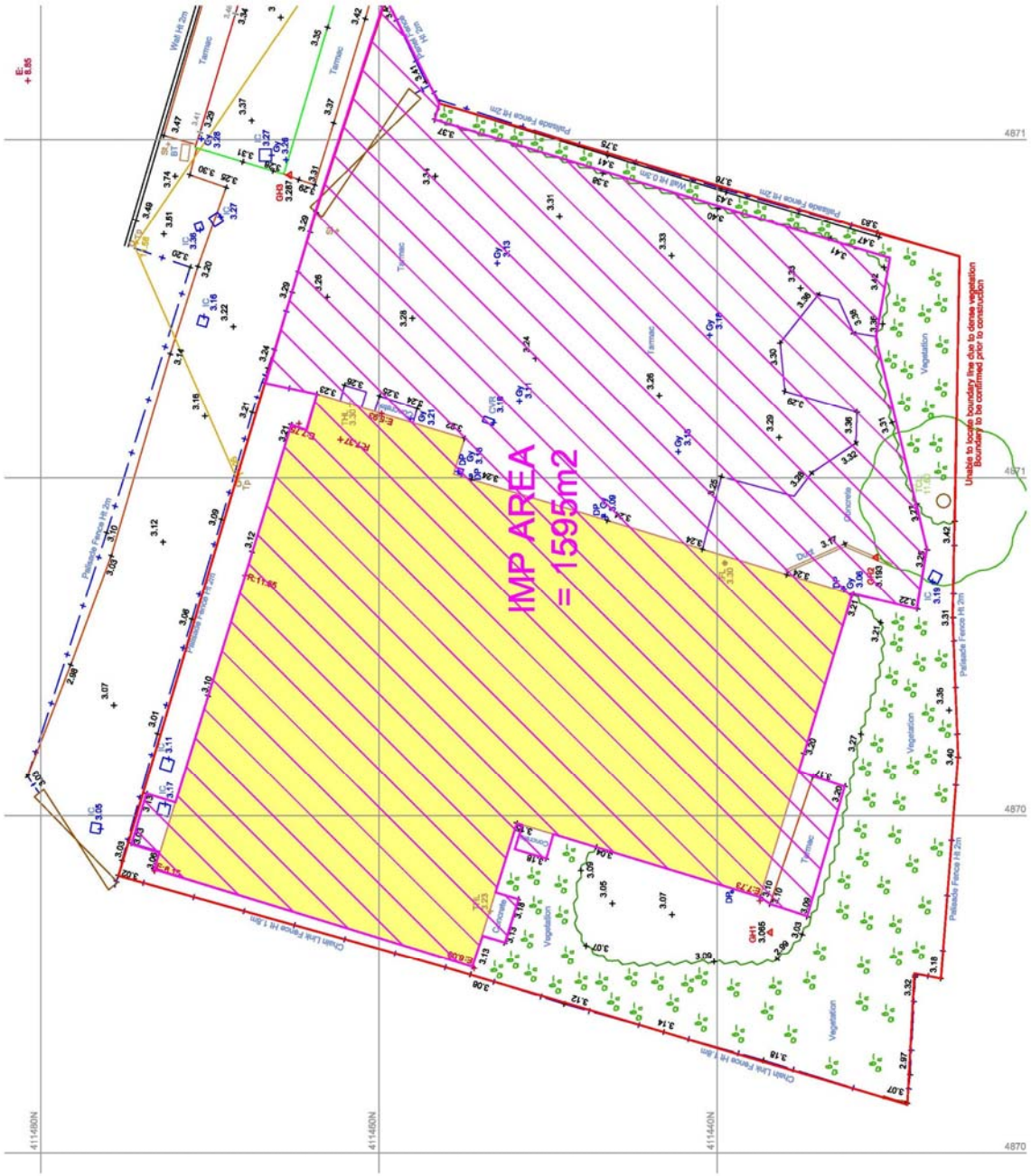
6. CONCLUSION

The SFRA critical flood level for the area is estimated at 4.1mOD. However, the average ground level within the site is 3mOD and the site is relatively small. As such, raising ground floor levels to 4.1mOD is impractical. Following discussions with the Environment Agency a minimum ground floor level of 3.5mOD plus a further 600mm of flood resilience measures is recommended. The proposed development significantly reduces the overall impermeable area and uses sustainable drainage systems where appropriate.

Appendix A: - Existing Site Levels

Appendix B: - Proposed Layout Plan

Appendix C: - Existing Impermeable Area Plan



Appendix D: - Proposed Impermeable Area Plan

Appendix E: - Sewer Plan

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
	F			
	F			
	F			
	F			
	F			
	F			
	F			
	F			
	F			
0300	F	-	0	0
0303	F	2.75	0.71	2.04
0306	F	3.01	0.84	2.17
0307	F	3.34	1.6	1.74
0308	F	3.15	0	3.15
0309	F	4.16	2.98	1.18
0310	F	-	0	0
0311	F	-	0	0
0402	F	-	0	0
0404	F	3.12	0.14	2.97
0501	F	-	0	0
1301	F	3.57	1.72	1.85
1302	F	3.27	0	3.27
1320	F	-	0	0
1400	F	4.07	1.3	2.77
1401	F	3.68	1	2.68
1402	F	3.38	0.91	2.47
1500	F	4.1	2.06	2.04
1501	F	4.1	1.55	2.55
2301	F	5.03	3.59	1.45
2302	F	4.49	3.47	1.03
2303	F	5.04	3.96	1.08
2305	F	5.15	2.92	2.23
2320	F	-	0	0
2402	F	4.07	3.7	0.37
2501	F	4.82	3.7	1.12
2502	F	4.71	0	4.71
3206	F	5.34	3.94	1.4
3207	F	5.39	4.03	1.36
3208	F	5.86	4.41	1.45
3301	F	5.73	4.6	1.13
3302	F	6.02	4.94	1.08
3401	F	-	0	0
3402	F	5.07	3.29	1.78
3405	F	4.67	3.11	1.56
3502	F	5.14	3.86	1.28
9303	F	2.89	1.12	1.77
0301	S	2.73	0.98	1.75
0302	S	2.88	0.95	1.93

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0401	S	2.75	0.85	1.9
0403	S	-	0.25	0
0405	S	3.16	1.15	2
0406	S	2.88	1.06	1.83
1303	S	3.71	2.38	1.33
1403	S	3.66	1.6	2.07
1405	S	3.13	1.36	1.77
1503	S	3.95	2.71	1.25
1504	S	4.1	2.58	1.52
1507	S	4.31	1.82	2.49
1508	S	4.1	1.77	2.33
1509	S	4	1.75	2.25
1510	S	4.02	1.71	2.32
1512	S	3.81	1.63	2.18
1513	S	3.35	1.51	1.84
1514	S	4.08	1.69	2.39
2304	S	5.24	3.28	1.96
2401	S	4.63	3.5	1.13
2403	S	4.63	3.53	1.1
2404	S	-	0	0
2503	S	4.77	3.58	1.19
3303	S	5.79	4.63	1.16
3304	S	6.03	5.01	1.02
3403	S	5.45	4.29	1.16
3404	S	5.12	4.08	1.04
3501	S	5.09	4.49	0.6
3503	S	5.07	3.79	1.28
9301	S	2.75	1.6	1.15
9302	S	2.84	1.78	1.06
9304	S	2.83	1.57	1.26

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Our Ref: 386664 - 1


Our Ref: 386664 - 1
0304
0305
S
S
2.86
2.99
0.92
0.92
1.94
2.07