

Flood Risk Assessment

Proposed Rabbit Ings Regeneration Scheme
near Royston, Barnsley

On behalf of the City of Wakefield Metropolitan
District Council and Yorkshire Forward

By WYG Engineering

File Ref:	A039273
Date:	September 2008

WYG ENGINEERING**DOCUMENT VERIFICATION**

Client: Carillion on behalf of the City of Wakefield Metropolitan District Council and Yorkshire Forward

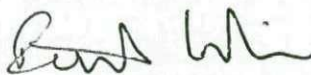
Project: Proposed Rabbit Ings Regeneration Scheme near Royston, Barnsley

Job Number: A039273

Document Title: Flood Risk Assessment

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Signed:



Date: 30 September 2008

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The conclusions reached are those which can reasonably be determined from the sources of information referred to in the report and from our knowledge of current professional practice and standards. Any limitations resulting from the data are identified where possible but both these and our conclusions may require amendment should additional information become available. The report is only intended for use in the stated context and should not be used otherwise.

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1 INTRODUCTION

This report has been prepared on behalf of the City of Wakefield Metropolitan District Council and Yorkshire Forward to accompany a planning application for the proposed regeneration of the Rabbit Ings Site, which lies 4.5 km north east of the centre of Barnsley in South Yorkshire. The report has been prepared in accordance with Planning Policy Statement 25 – Development and Flood Risk (PPS25) and follows the guidance in the Practice Guide Companion published by the Government's Department for Communities and Local Government.

1.1 Site Description

The site covers an area of approximately 65.9 ha, centred on grid reference 437 750 m E, 411 600 m N. A location plan, drawing A039273-001, is included in Appendix A.

The site is bordered by a railway line and Monckton Coke and Chemical Works to the West, a minor road to the east and agricultural land to the north and south.

An unnamed minor watercourse flows across the site from north to south and enters the Sandybridge Dyke at the south west corner of the site. The Sandybridge Dyke flows from east to west along the southern boundary of the site and forms the southern site boundary.

1.2 Data Collection

Data sources that have been used for this flood risk assessment are:

- Topographical survey (Derek Brook, dated 21-04-08)
- Environment Agency website and consultation.

1.3 Proposed Development

It is proposed to regenerate the Rabbit Ings site including re-grading and reclamation operations, to provide an open area for informal recreational space. The proposed works include landscaping and ecological enhancement works. Improved public access will be provided, notably on the former spoil tip part of the site. In addition, platforms for formal playing pitches together with changing facilities to the south west are proposed.

The Proposed Development Landscape Plan – A039273 L(90)0016, is included in Appendix C.

2 DATA

2.1 Topographical Survey

A topographical survey of the site is included in Appendix A. This survey shows that the site has considerable variation in levels across the site. The site is mainly a colliery spoil heap with a high point of 94 m AOD in the centre of the spoil heap and a low point of about 44 m AOD towards the south west corner of the site.

2.2 Environment Agency

2.2.1 Flood Risk

The Environment Agency's (EA) website flood risk map was consulted and the site is found to lie mainly in Flood Zone 1, Low Risk, probability of flooding less than 0.1% per annum. The EA flood risk map is shown on drawing A039273-002, included in Appendix B. A very small area of the site lies within Flood Zones 2 and 3. The zones in this area are broad brush as detailed modelling of the watercourses has not been undertaken.

2.2.2 Ground Water Protection

Reference to the Environment Agency (EA)'s website groundwater source protection map shows that there are no local sources of abstraction, nor any groundwater protection zones, in the vicinity of the site.

The EA groundwater source protection map is shown on drawing number A039273-003, included in Appendix B.

2.2.3 EA Correspondence

The EA has been consulted and copies of its responses are included in Appendix B. Discussions were also held with the EA by phone, regarding issues of flood plain compensation and modelling.

In summary, the significant information received comprises:-

1. Modelled flood levels are not available for the watercourses that cross or border the site. It will be acceptable to estimate the extent of the floodplain using the EA's website maps and the site survey.
2. The implementation of sustainable drainage systems (SUDS) should be carefully considered, and this approach is encouraged in Planning Policy Statement 25 (PPS 25 Development and Flood Risk). These techniques can be used to minimize pollution impacts and provide a method for attenuating run-off that could otherwise lead to flooding.
3. If the overall impermeable area of the proposed development is less than that of the existing development, no attenuation is required on site, providing that there is no change to the SW sewer diameters, outfalls and receiving system. This must be fully demonstrated.
4. Any new headwall details to a watercourse should be forwarded to the EA as these may require consent from under the Water Resources Act 1991 or the Land Drainage Act 1991, unless these are in the Internal Drainage Board (IDB) areas, where the Board will issue any appropriate consent. (Note, this site is believed to be outside the IDB's area).
5. Where the new run-off from the site is greater than previous, onsite attenuation will be required which must be provided up to the 1 in 100 year critical storm plus climate change allowance and controlled to the Greenfield run-off rate.
6. All drainage systems must be adopted or it must be demonstrated that their maintenance will be formally established in perpetuity with the development. This is particularly important with attenuation or filtration systems, which may not meet the criteria for adoption by a sewerage undertaker.

2.3 Existing drainage

Public sewer records for the area indicate existing 225mm diameter foul and combined sewers serving the residential area to the west of the site beyond the railway line. No public sewers are shown elsewhere in the vicinity of the site.

3 FLOOD RISK ASSESSMENT

3.1 Fluvial Flood Risk

As discussed above the Environment Agency's website flood risk map indicates that a small part of the site lies in Flood Risk Zones 2 or 3. In Flood Risk Zone 3 the chance of flooding from rivers is 1% per annum or greater.

As modelled levels are not available, the EA website map was compared with the topographical survey of the site and a conservative estimate of flood levels was made at 46.0 m AOD. When this level is plotted on the site plan, it can be seen that an area in the south west corner of the site falls below the estimated flood level. The proposed development includes sports pitches in this area, which would be liable to flood in the hundred year event. The approximate area liable to flood is shown on drawing A039273-005, included in Appendix C.

3.2 Tidal Flood Risk

The site is approximately 90 km from the coast and with ground levels at a minimum of 44 m AOD the risk of tidal flooding is negligible.

3.3 Overland Flow

The site comprises a colliery spoil heap, disused sports pitches and a former drift mine which are elevated above surrounding ground levels so overland flow does not appear to pose a significant risk.

3.4 Groundwater flooding

The site investigation report prepared by Scott Wilson in March 2004 shows varying levels of groundwater, some of which is perched. The highest groundwater found was 3 metres below ground level. No underground structures or basements are proposed so the risk of groundwater flooding is considered negligible.

3.5 Groundwater vulnerability

The Environment Agency's Groundwater Vulnerability Map Sheet 11 indicates that the site is underlain by a minor aquifer with soils of high leaching potential. Due to the contaminated nature of the site it is likely that infiltration drainage will not be permitted.

3.6 Sewer Flooding

Details of the existing site drainage are not currently available. The proposed development will, however, be drained by sewers designed in accordance with current best practice so the risk of flooding from sewers is considered to be low.

3.7 Artificial Sources

There is a small manmade surface water drainage lagoon at the south west corner of the site. This lagoon is at a low point on the site in an area where no development is proposed so it is considered to pose a low risk of flooding of the development.

3.8 Climate Change

In accordance with PPS25, the effects of future climate change should be considered. The effects of climate change are likely to increase flood levels in the watercourses. This will extend the area at risk of flooding from the watercourses. The effect of climate change will also be considered in the design of any necessary storage attenuation measures to restrict the discharge of surface water runoff from the site.

4 SITE DRAINAGE

4.1 Existing site drainage

A number of drains and ditches run across the site from north to south. The main drainage feature is a 600mm diameter culvert, 205 metres long, carrying the minor watercourse.

The site currently comprises 1.7 ha of concrete hardstanding, a small water body with an area of 0.12 ha, 40 ha of colliery spoil and open ground and 24.1 ha of vegetated area. The impermeability of the existing site has been calculated from these figures and the existing runoff coefficient is found to be 0.42.

4.2 Proposed new development drainage

In accordance with the recommendations in PPS25, the design of the new development should adopt measures to reduce the impact of surface water runoff through the use of sustainable drainage techniques.

It is normally recommended that permeability testing be undertaken in order to investigate whether infiltration is a potential means for disposal of surface water. As the site is contaminated in part, it is not considered to be possible to use infiltration drainage so permeability testing will not be required. Sustainable drainage under porous parking areas is proposed.

The redevelopment of the site includes the removal of the concrete hardstanding and the construction of a sports changing facility. This has the effect of reducing the runoff coefficient to 0.22.

4.2.1 New site drainage system

It is estimated that the proposed development will reduce the site runoff by 31% in the short term and 48% in the long term, so attenuation will not be required.

5 SEQUENTIAL TESTING

PPS25 recommends that a risk-based approach and sequential test be used in order to determine whether a site is suitable for the proposed development. The assessment of risk and sequential test are considered as follows:

The proposed development site is located partially within Flood Zone 3, therefore, in accordance with PPS25 that area of the site is only considered suitable for water-compatible development as listed in Table D2 of PPS25. Sports pitches are considered water compatible. Table D2 is included in Appendix D.

6 FLOOD RISK MANAGEMENT

It is proposed to lift the sports pitches that currently lie in the flood plain to a level of 46.8 m AOD. This will give a freeboard of 0.8m above the estimated flood level. Compensation for the loss of floodplain is provided alongside the Sandybridge Dike as shown on Drawing A039273-005 included in Appendix C.

Dry access to the site is readily available from the northwest and the east.

The redevelopment of the site will reduce the runoff from the site so no mitigation is required.

7 CONCLUSIONS

A small area of the site is at risk from fluvial flooding and in accordance with the requirements of the sequential test in PPS25: Development and Flood Risk, only water compatible development is proposed in that area.

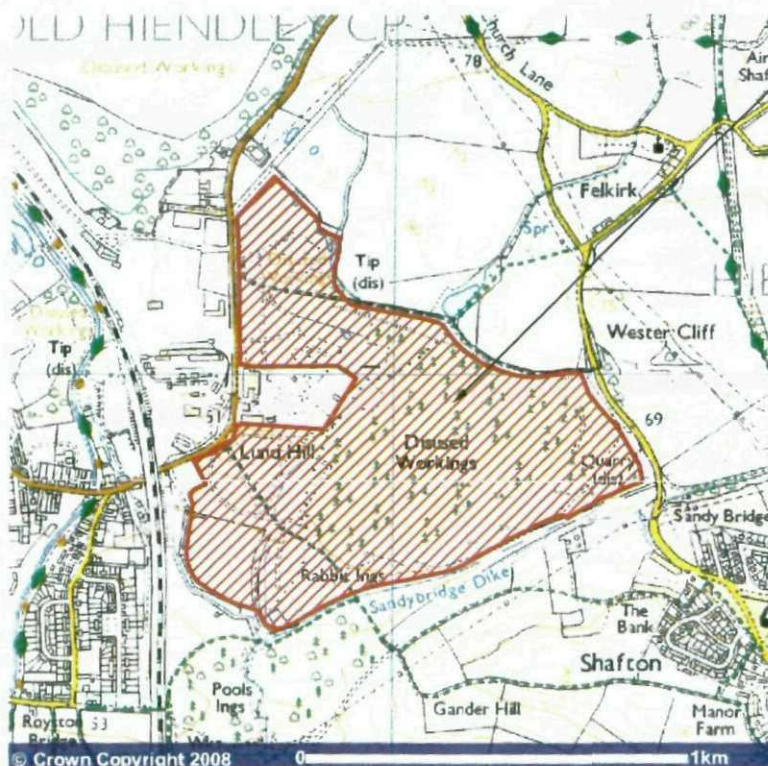
The redevelopment of the site reduces the impermeable area, thus decreasing the surface water runoff and benefitting the wider catchment.

This report concludes that flood risk on the site can be adequately mitigated and that there is a practical means of surface water management for the site.

Appendix A
Site Location Plan – A039273 - 001
Topographical Survey – A039273-302
Aerial photograph A944547- 004



APPROXIMATE
SITE LOCATION
POST CODE S72 9DP
GRID REF:
437750mE, 411600mN



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Consulting Engineers

Civil Electrical Environmental Health & Safety Highway Management Services Mechanical Rail Structural Town Planning Transportation

Client
YORKSHIRE FORWARD

Project
REGENERATION OF RABBIT INGS

Rev	Description	By	Chk	App	Date

Site location path
2/Engineers/Projects/000000 to 4099999 - A0192171 Rabbit Ings - Reports - Plans - Risk Assessment - Drawings

Drawing Title
SITE LOCATION PLAN

Scale at 44	Drawn By	Date	Checked By	Date	Approved By	Date
NTS	47	27.07.2009				

Project No.	Office	Type	Drawing No.	Revision
A039273	5101	C&S	FRA / 001	

APPROVAL ☐ INFORMATION ☒ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐



Rev	Description	By	Chk	App	Date

English Partnerships

Supported by

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Young
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Consulting Engineers

RABBIT INGS COLLIERY RECLAMATION

EXISTING SITE TOPOGRAPHICAL SURVEY

Project No.	Drawn By	Date	Checked By	Date	Approved By	Date
A039273	5101	CAS				
APPENDIX 1	INFORMATION	INDEX	CONTRACT	CONSTRUCTION		



NOTES :

1. DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS
2. ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE

REV	DESCRIPTION	BY	CHK	APP	DATE
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PROJECT: A039273
RABBIT INGS REGENERATION

DRAWING TITLE:
AERIAL VIEW

SCALE	A3	DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
	NTS	RT	10.10.08	RW	10.10.08		
PROJECT No.	A039273	OFFICE	51	TYPE	C&S	DRAWING No.	004
							REVISION

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SHEET SIZE: A3 LANDSCAPE

Appendix B

Correspondence from the Environment Agency

Environment Agency website flood risk map – A039273 - 002

Environment Agency website groundwater source protection map – A3039273 - 003



Bob Thompson
White Young Green
Newstead Court
Little Oak Drive
Sherwood Business Park
Annesley
Nottinghamshire
NG15 0DR

Our Ref : RFI/2008/3937

Your Ref :

Date : 31 March 2008

Dear Bob

RE: Rabbit Ings

Thank you for your enquiry which was received on 22 February 2008 and payment taken 12 March 2008.

Flood Risk Mapping & Data

The Flood Map

We provide the Flood Map (see enclosed extract).

What is the Flood Map?

The Flood Map is a new multi-layered map which provides information on flooding from rivers and the sea for England and Wales. The Flood Map also has information on flood defences and the areas benefiting from those flood defences.

The Flood Map consists of the following layers of information:

1. Flooding from rivers or sea without defences - the natural flood plain area that could be affected in the event of flooding from rivers and the sea - Flood Zone 3 on the enclosed map.
 - For flooding from rivers the map indicates the extent of a flood with a 1% (1 in 100) chance of happening each year
 - For flooding from the sea the map shows the extent of a flood with a 0.5% (1 in 200) chance of happening each year
2. Extent of extreme flood - the extent of a flood with a 0.1% (1 in 1000) chance of happening each year - Flood Zone 2 on the enclosed map.
3. Flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.



4. Areas benefiting from flood defences - areas that benefit from the flood defences shown, in the event of a river flood with a 1% (1 in 100) chance of happening each year, or a flood from the sea with a 0.5% (1 in 200) chance of happening each year. If the defences were not there, these areas would flood.

Flood History

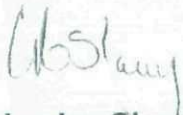
To the best of our knowledge there is no known flood history for this site. However, in close proximity to this location we do have some flood history available (see enclosed map).

Non Main River

The watercourse at this location is not designated as Main River. It is classed as an Ordinary Watercourse. The definition is "Every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows which does not form part of a main river. The Environment Agency does not have any more information available in regard to past flooding issues or current flood risk. For any information on any past flooding and for any record of the impact of local drainage on that watercourse we suggest you speak to your City Council Drainage Section and to Yorkshire Water.

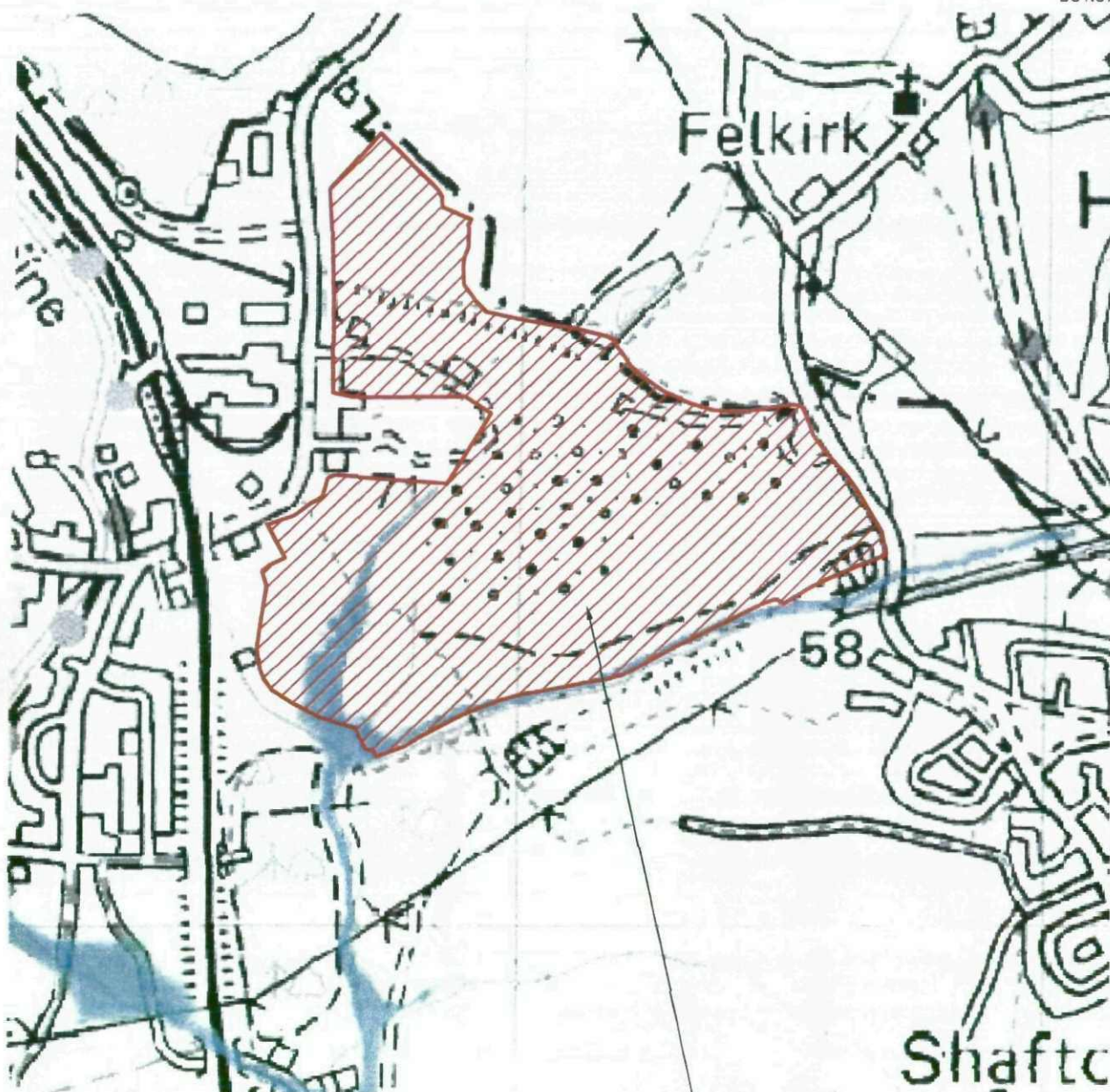
This information is provided subject to the enclosed notice which you should read.

Yours sincerely,



Lesley Staney
External Relations Officer

DO NOT SCALE



KEY FLOOD RISK ZONES

-  Flooding from rivers or sea without defences
-  Extent of extreme flood
-  Flood defences
-  Areas benefiting from flood defences

APPROXIMATE
SITE LOCATION
POST CODE S72 9DP
GRID REF:
437750mE, 411600mN

Rev	Description	By	Chk	App	Date
	Save location path				

Drawing Title:
ENVIRONMENT AGENCY
FLOOD RISK MAP

Scale at A4	Drawn By	Date	Checked By	Date	Approved By	Date
NTS	AT	27.05.2009	DP	27.05.2009		
Project No.	Office	Type	Drawing No.	Revision		
A039273	5101	C&S	FRA/002			
APPROVAL ☐	INFORMATION ☒	TENDER ☐	CONTRACT ☐	CONSTRUCTION ☐		

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Civil Electrical Environmental Health & Safety Highways Management Services Mechanical Rail Structural Town Planning Transportation

Client:
YORKSHIRE FORWARD

Project:
REGENERATION OF RABBITINGS



KEY
GROUNDWATER SOURCE
PROTECTION ZONES

- Inner zone
- Outer zone
- Total catchment
- Special interest

APPROXIMATE
SITE LOCATION
POST CODE S72 9DP
GRID REF:
437750mE, 411600mN

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Consulting Engineers

Civil Electrical Environmental Health & Safety Highways Management Services Insurance Risk Structural Town Planning Transportation

Client
YORKSHIRE FORWARD

Project
REGENERATION OF RABBIT INGS

Rev	Description	By	Chk	App	Date
	Saved location path				

Drawing Title
ENVIRONMENT AGENCY
GROUNDWATER PROTECTION ZONES

Scale	Drawn By	Date	Checked By	Date	Approved By	Date
NTS	RT	21/05/2009	DR	21/05/09		
Project No.	Office	Type	Drawing No.	Revision		
A039273	5101	C&S	FRA/003			
APPROVAL ☐	INFORMATION ☐	TENDER ☐	CONTRACT ☐	CONSTRUCTION ☐		

Appendix C
Site Runoff Calculations
Proposed Development Landscape Plan – A039273 L(90)0016
Compensation Floodplain A039273 - 005

Project Title **Rabbit Ings**

Work Section **Estimation of existing and future runoff**

The existing site is covered more than half by a heap of colliery spoil and the remainder of the site with the soft ground. There is a pond located at south west corner of the site.

The proposed Rabbits Ings Regeneration scheme includes the following:

A Large area to be developed as a countryside park;

A car park and sport pitches;

The proposed regeneration scheme shall improve the ground condition and reduce post development and long term runoff. The following calculation provides the comparison of the site hydraulic for pre and post development. The Rational Method is used in this comparative analysis

Apply Rational Method to establish the site runoff

$Q = CIA/360$ C- runoff coefficient, I - Rainfall intensity mm/hr, A catchment Area (ha)

Establishing runoff coefficient

Existing (pre development condition)

Description	A Area (ha)	C- Runoff coefficient	C*A
Open area (colliery spoil - assume heavy soil)	40.00	0.50	20.00
Concrete	1.69	1.00	1.69
Vegetated areas	24.09	0.25	6.02
Watercourse/Water body	0.12	1.00	0.12
Total	65.90		27.83

Existing effective runoff coefficient = $29.04 / 65.90 = 0.42$

Post development (short term)

Description	A Area (ha)	C- Runoff coefficient	C*A
Existing vegetation to be retained	14.23	0.25	3.56
Watercourse/Water body	0.12	1.00	0.12
Proposed car park & changing building	0.26	1.00	0.26
Proposed permeable paving	0.08	0.20	0.02
Proposed Multi Use Access Track (200 mm thick crush concrete)	2.12	0.30	0.64
Proposed woodland	11.60	0.30	3.48
Proposed grass verges	2.72	0.30	0.82
Proposed amenity grassland	4.80	0.30	1.44
Proposed species rich grassland	5.74	0.30	1.72
Proposed neutral grassland	21.17	0.30	6.35
Proposed wetland planting	1.17	0.30	0.35
Proposed sports pitches	1.89	0.20	0.38
Total	65.90		19.1

Post development short term effective runoff coefficient = $19.1 / 65.90 = 0.29$

White Young Green



Project No	A039273
Number of calculation sheets	4
Office	Nottingham
Division	C&S
Prepared by	RW
Date	28th Sep 2008

Project Title	Rabbit lngs
Work Section	Estimation of existing and future runoff

Post development (long term)

Description	A Area (ha)	C Runoff coefficient	C*A
Existing vegetation to be retained	14.23	0.25	3.56
Watercourse Water body	0.12	1.00	0.12
Proposed car park & changing building	0.26	1.00	0.26
Proposed permeable paving	0.08	0.20	0.02
Proposed Multi Use Access Track (200 mm thick crush concrete)	2.12	0.30	0.64
Proposed woodland	11.60	0.20	2.32
Proposed grass verges	2.72	0.20	0.54
Proposed amenity grassland	4.80	0.20	0.96
Proposed species rich grassland	5.74	0.20	1.15
Proposed neutral grassland	21.17	0.20	4.23
Proposed wetland planting	1.17	0.30	0.35
Proposed sports pitches	1.89	0.20	0.38
Total	65.90		14.52

Post development long term effective runoff coefficient = $14.52 / 65.90 = 0.22$

Estimate of critical storm duration

Longest drainage path length = 1600 m

Drop in elevation = 22 m

Slope = $22 / 1600 \times 100 = 1.4 \%$

Using the velocity for Upland Method of Estimating Time of concentration

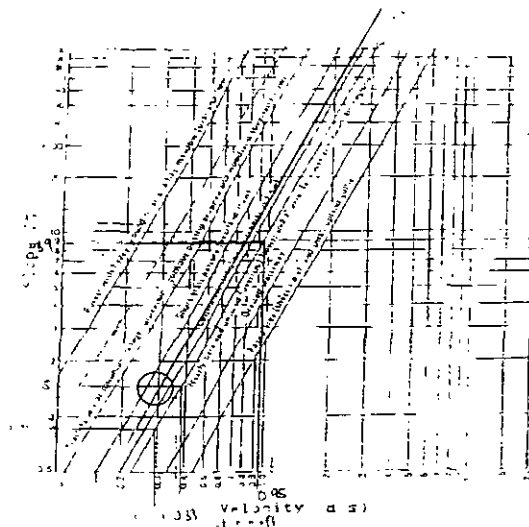
Velocity = 0.30 m/s

Time of flow = $1600 / 0.3 / 60 = 88.9$ min

Say time of entry $T_e = 3$ min

Critical storm duration = $88.9 + 3 = 91.9$ min

Nevertheless storm water runoff for 30, 60, 90, 120, 240, and 480 mins is established for broad study of the site hydrology



Estimate of Rainfall Intensity

From Figure 6.1 Rainfall depths of five year return period and 60 minutes duration ($M_{5,60}$ min)

$M_{5,60} = 20$

From Figure 6.2 Ratio of sixty minutes to two day rainfalls of five year return period (r)

$r = 0.35$

From Figure 6.3b relation between for different value of r (Z_1)

$Z_1 = 0.95$

$M_{5,54} = M_{5,60} \cdot Z_1 = 19.0$

From Table 6.2 Relationship between rainfall of return period T_r (M_{5, T_r}) and $M_{5, 60}$ England and Wales (Ratio Z_2)

$Z_2 = 0.64$

$M_{1,54} = M_{5,54} \cdot Z_2 = 12.2$ mm (for one year return period event)

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Project No	A039273
Number of calculation sheets	4
Office	Nottingham
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Prepared by	RW
Date	28th Sep 2008

Project Title	Rabbit Ings
Work Section	Estimation of existing and future runoff

Storm Duration (D) hrs	Z1	M5-D	Annual return period event			5 years return period event			30 years return period event			100 years return period event		
			Z2	M1-D = M5-D x Z2	Rainfall intensity mm/hr	Z2	M1-D = M5-D x Z2	Rainfall intensity mm/hr	Z2	M1-D = M5-D x Z2	Rainfall intensity mm/hr	Z2	M1-D = M5-D x Z2	Rainfall intensity mm/hr
0.25	0.539	10.78	0.612	6.6	26.38	1.03	11.11	44.43	1.577	17	68.02	1.923	20.73	82.93
0.5	0.786	15.71	0.623	9.79	19.57	1.03	16.18	32.37	1.617	25.4	50.8	1.996	31.36	62.71
1	1	20	0.64	12.8	12.8	1.03	20.6	20.6	1.637	32.73	32.73	2.03	40.6	40.6
2	1.239	24.77	0.659	16.3	8.164	1.03	25.52	12.76	1.627	40.31	20.15	2.011	49.82	24.91
4.00	1.416	28.32	0.673	19.1	4.767	1.03	29.17	7.292	1.613	45.89	11.42	1.983	56.17	14.04
10	1.893	37.87	0.696	26.3	2.635	1.022	38.7	3.87	1.565	59.25	5.925	1.907	72.21	7.221
24	2.263	45.26	0.711	32.2	1.34	1.02	46.16	1.923	1.525	69.03	2.876	1.848	83.63	3.485
48	2.825	56.51	0.73	41.3	0.86	1.02	57.64	1.201	1.476	83.39	1.737	1.766	99.78	2.079

Estimate and comparison of site runoff rate

Storm Duration (D) hrs	Annual return period event				5 years return period event				30 years return period event				100 years return period event			
	Rainfall intensity mm/hr	Existing runoff (l/s)	Post development short term runoff	Post development long term runoff	Rainfall intensity mm/hr	Existing runoff (l/s)	Post development short term runoff	Post development long term runoff	Rainfall intensity mm/hr	Existing runoff (l/s)	Post development short term runoff	Post development long term runoff	Rainfall intensity mm/hr	Existing runoff (l/s)	Post development short term runoff	Post development long term runoff
0.25	26.38	2040	1402	1064	44.4	3435	2361	1793	68.02	5259	3614	2744	82.93	6412	4408	3346
0.5	19.57	1513	1040	789.7	32.4	2502	1720	1306	50.8	3928	2699	2050	62.71	4848	3332	2530
1	12.8	989.6	680.1	516.4	20.6	1593	1095	831.1	32.73	2531	1739	1321	40.6	3139	2157	1638
2	8.164	631.2	433.8	329.4	12.8	986.4	677.9	514.7	20.15	1558	1071	813.2	24.91	1926	1323	1005
4.00	4.767	368.5	253.3	192.3	7.29	563.8	387.5	294.2	11.42	883.1	606.9	460.9	14.04	1086	746.1	566.6
10	2.635	203.7	140	106.3	3.87	299.2	205.6	156.2	5.925	458.1	314.8	239.1	7.221	558.3	383.7	291.4
24	1.34	103.6	71.19	54.06	1.92	148.7	102.2	77.6	2.876	222.4	152.8	116	3.485	269.4	185.2	140.6
48	0.86	66.48	45.69	34.69	1.2	92.83	63.8	48.45	1.737	134.3	92.3	70.09	2.079	160.7	110.4	83.87

Project No	A039273
Number of calculation sheets	4
Office	Nottingham
Division	C&S
Prepared by	RW
Date	28th Sep 2008

Project Title	Rabbit Ings
Work Section	Estimation of existing and future runoff

Estimate and comparison of site runoff volume

Storm Duration (D) hrs	Annual return period event			5 years return period event			30 years return period event			100 years return period event		
	Existing runoff volume (m³)	Post development short term runoff volume (m³)	Post development long term runoff volume (m³)	Existing runoff volume (m³)	Post development short term runoff volume (m³)	Post development long term runoff volume (m³)	Existing runoff volume (m³)	Post development short term runoff volume (m³)	Post development long term runoff volume (m³)	Existing runoff volume (m³)	Post development short term runoff volume (m³)	Post development long term runoff volume (m³)
0.25	1835.6	1261.5	958	3092	2124.6	1613	4732.7	3252.5	2469.8	5770.4	3965.6	3011.3
0.5	2723.7	1871.9	1421.4	4504	3095.5	2351	7069.7	4858.6	3689.4	8727.3	5997.7	4554.4
1	3562.6	2448.3	1859.1	5733	3940.3	2992	9110.5	6261.1	4754.4	11300	7765.8	5896.9
2	4544.5	3123.1	2371.6	7102	4880.7	3706	11219	7710.1	5854.7	13865	9528.7	7235.6
4.00	5306.9	3647.1	2769.4	8119	5579.4	4237	12717	8739.6	6636.4	15634	10744	8158.9
10	7332.5	5039.2	3826.5	10773	7403.3	5622	16491	11333	8605.8	20099	13813	10489
24	8950.1	6150.8	4670.7	12849	8830	6705	19213	13204	10027	23278	15997	12148
48	11487	7894.5	5994.7	16042	11024	8371	23209	15950	12112	27770	19085	14492

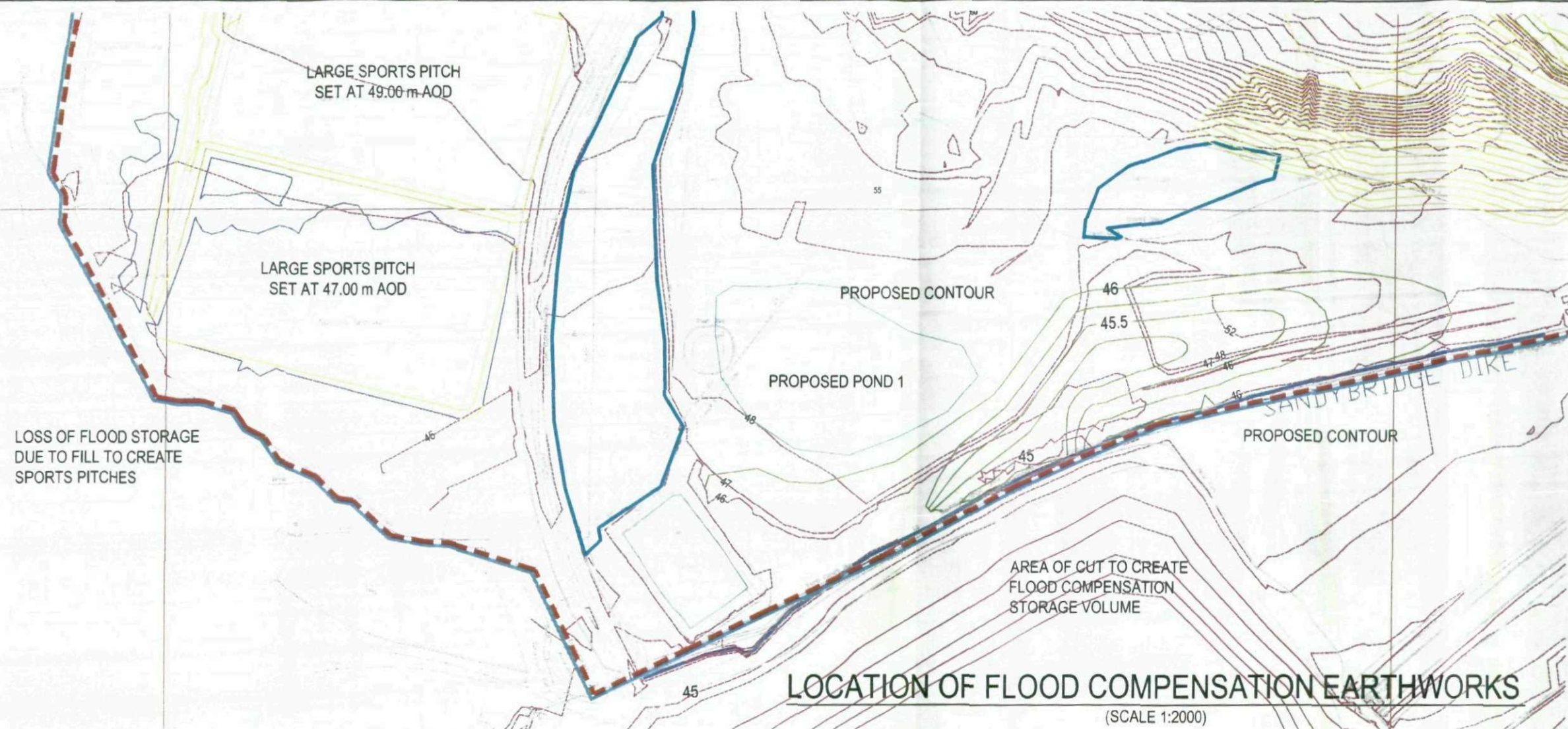
Summary

Total catchment area = 65.90 ha

It is estimated that the proposed development will reduce the site runoff rate and runoff volume by

31 % in the short term
and 48 % in the long term

[illegible][illegible][illegible][illegible]



NOTES:

1. DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS
2. ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE

LOSS OF FLOOD STORAGE VOLUME UP TO
46.00 m FLOOD LEVEL

CREATION OF COMPENSATION FLOOD STORAGE VOLUME
BELOW 46.00 m FLOOD LEVEL

CONTOUR SKETCH	LEVEL (m AOD)	AREA (m ²)	VOLUME (m ³)	CONTOUR SKETCH	LEVEL (m AOD)	AREA (m ²)	VOLUME (m ³)	DIFFERENCE (m ³)
	46.00	9684.32	1932.49		46.00	9826.09	1945.82	+ 13.33
	45.75	5703.57	1144.92		45.75	5740.46	1149.64	+ 4.72
	45.50	3455.79	592.76		45.50	3456.65	602.63	+ 9.87
	45.20	1286.30	168.63		45.25	1364.36	185.67	+ 17.04
	45.00	62.71	-		45.00	121.03	-	N / A
		TOTAL	3829.79			TOTAL	3829.79	+ 44.96

FOR APPROVAL

REV	DESCRIPTION	BY	CHK	APP	DATE
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Consulting

PROJECT: A039273
RABBIT INGS REGENERATION

DRAWING TITLE:
FLOOD VOLUME COMPENSATION LAYOUT

SCALE	A3	DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
1:2000	LA	15.04.08	DR	18.04.08	PB	18.04.08	
PROJECT No.	OFFICE	TYPE	DRAWING No.	REVISION			
A039273	51	C&S	FRA/005	-			

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SHEET SIZE : A3 LANDSCAPE

Appendix D

Tables D1 and D2 from PPS25

PPS 25 – Development and Flood Risk

Table D.1: Flood Zones

(Note: These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of flood defences)

Zone 1 Low Probability

Definition

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Appropriate uses

All uses of land are appropriate in this zone.

FRA requirements

For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA. This need only be brief unless the factors above or other local considerations require particular attention. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

Zone 2 Medium Probability

Definition

This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Appropriate uses

The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this zone.

Subject to the Sequential Test being applied, the highly vulnerable uses in Table D.2 are only appropriate in this zone if the Exception Test (see para. D.9.) is passed.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

Zone 3a High Probability

Definition

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Appropriate uses

The water-compatible and less vulnerable uses of land in Table D.2 are appropriate in this zone.

The highly vulnerable uses in Table D.2 should not be permitted in this zone.

The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test (see para. D.9) is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques;
- ii. relocate existing development to land in zones with a lower probability of flooding; and
- iii. create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b The Functional Floodplain

Definition

This zone comprises land where water has to flow or be stored in times of flood. SFRA should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).

Appropriate uses

Only the water-compatible uses and the essential infrastructure listed in Table D.2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows; and
- not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and
- ii. relocate existing development to land with a lower probability of flooding.

Table D.2: Flood Risk Vulnerability Classification

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.¹⁹
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste.²⁰ • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non-residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants. • Sewage treatment plants (if adequate pollution control measures are in place).

¹⁹ DETR Circular 04/00 para 18 *Planning controls for hazardous substances*
www.communities.gov.uk/index.asp?id=1144377

²⁰ See *Planning for Sustainable Waste Management Companion Guide to Planning Policy Statement 10* for definition
www.communities.gov.uk/index.asp?id=1500757

Table D.2: contd.

Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.
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Notes:

- 1) This classification is based partly on Defra/Environment Agency research on Flood Risks to People (FD2321/TR2)²¹ and also on the need of some uses to keep functioning during flooding.
- 2) Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.
- 3) The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

²¹ See website for further details. www.defra.gov.uk/science/Project_Data/DocumentLibrary/FD2320_3364_TRP.pdf