

# HANDBOOK FOR ECONOMIC APPRAISAL 2023

## FLOOD AND COASTAL EROSION RISK MANAGEMENT



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**Table 4.1** Categories of flood water

Category of Water	Description
<b>Major clean/grey</b> (IICRC Category 2)	Water contains significant contamination and can contain potentially unsafe levels of microorganisms or nutrients for microorganisms, as well as other organic or inorganic matter: commonly discharge from washing machines, dishwashers or toilet overflows (not including faeces).
<b>Minor black</b> (IICRC category 3)	Water is grossly contaminated: As 'Major clean/grey', but includes sewage backflow scenarios from an internal source where water may contain faeces, urine and other waste through toilet discharge system.
<b>Major flood/storm</b> (IICRC category 3)	Water is grossly contaminated: This is the most common category for a typical fluvial, surface water or coastal flood scenario. Water may contain: organic matter, pesticides, heavy metals or toxic organic substances.
<b>Major Flood including sewage</b> (IICRC category 3)	Water is grossly contaminated: As 'Major flood/storm', but with the inclusion of animal and human waste materials.
<b>Major Flood 'Contaminated'</b> (IICRC Special situations)	Water may contain regulated hazardous waste (as per Technical Guidance WM2, see: <a href="https://www.gov.uk/how-to-classify-different-types-of-waste">https://www.gov.uk/how-to-classify-different-types-of-waste</a> ), including (but not limited to): asbestos, heavy metals, pesticides, solvents, caustic chemicals etc.

Adapted from: Institute of Inspection, Cleaning and Restoration Certification (IICRC) (2006) S500: Standard and Reference Guide for Professional Water Damage Restoration. 3rd edn, IICRC: Washington DC.

**Table 4.2** The range of possible flood impacts on households (not exhaustive or necessarily mutually exclusive)

Direct Tangible Losses For Flooded Households	Intangible Losses On Flooded Households	Indirect Losses On Flooded Households	Indirect Losses For Non-Flooded Households
➤ Damage to building fabric	➤ Worry about future flooding	➤ Permanent evacuation from area	➤ Increased travel costs
➤ Damage to household inventory items	➤ Loss of memorabilia and irreplaceable items and pets	➤ Disruption to household due to flood damage	➤ Loss of income/earnings
➤ Clean-up costs	➤ Damage to physical and/or mental health, death or injury	➤ Temporary evacuation costs	➤ Loss of utility services
	➤ Loss of community	➤ Disruption due to flood warnings or alarms	➤ Loss of other services
	➤ Loss of confidence in authorities and services	➤ Loss of utility services	➤ Loss of leisure and recreational opportunities
		➤ Loss of income/earnings	➤ Increased cost of shopping and recreational opportunities
		➤ Loss of leisure and recreational opportunities	
		➤ Additional communication costs	
		➤ Loss of services	
		➤ Increased travel costs	
		➤ Increased cost of shopping and recreational opportunities	

**Tables 4.3** Social grade categorisation and weighted factor by occupation

Social Group	Description	Weighted Factor
AB	Upper middle and middle class: higher and intermediate managerial, administrative or professional	0.74
C1	Lower middle class: supervisory or clerical and junior managerial, administrative or professional	1.12
C2	Skilled working class: skilled manual workers	1.22
DE	Working class and those at the lowest level of subsistence: semi-skilled and unskilled manual workers. Unemployed and those with no other earnings (e.g. state pensioners)	1.64

**Table 4.4** Types of project appraisals (2023 values)

Overview, Initial and Full-Scale methods			
Scale of analysis	Overview	Initial	Full-Scale
Guidance	For rapid MDSF and similar desktop type appraisals: first approximations to identify areas where more detailed work is required	For more detailed appraisals where further assessment of household loss potential is warranted	For the detailed study of potential benefits using the most detailed of the standard data sets
Data requirements for the benefitting area	Number of properties at risk	Number, type and age of house at risk	Number, type, age and social class of houses and householders at risk
		Standard of protection (pre and post scheme for intangible values)	Standard of protection (pre and post scheme for intangible values)
			Government Weighting Factors for distributional impact analysis
Direct/tangible method of assessment	Annual average direct damages: sector average	Generalised standard residential depth/damage data for type and age of houses	Additional data for type, age and social grade of houses and householders
	Vehicle Damages: 42% of total properties damaged x £5,600 (2021 value)	Vehicle Damages: number of properties at risk above 0.39m x £6,944 (2022 value)	Vehicle Damages: number of vehicles at risk above 0.39m x £5,600 (2021 value)
Intangible method of assessment	Health: £279 per property per year for intangibles	Health: Defra's intangibles matrix	Health: Defra's intangibles matrix
Indirect method of assessment	Evacuation per household: temporary accommodation costs (£1,370) plus alternative accommodation costs (£3,921)	Evacuation per household: evacuation costs per property type and flood depth	Evacuation per household: survey on percentage of households evacuated and duration of evacuation. Evacuation costs per property type and flood depth
Vulnerability Analysis	Not required	Where feasible	Where feasible

**Table 4.5** Weighted Annual Average Damages (WAAD) (2023 values) assuming variable threshold Standards of Protection (SoP)

Existing SoP	No warning (£)	<8 hour warning (£)	>8 hour warning (£)
No protection	5,269	5,227	5,215
2 years	5,269	5,227	5,215
5 years	3,163	3,136	3,129
10 years	1,615	1,602	1,597
25 years	772	766	764
50 years	326	324	323
100 years	82	81	81
200 years	41	40	40



**Table 4.6** Estimate of the number of properties affected by different floods

Return Period	No. Of properties as % of 200 year No.
100	93
50	80
25	25
10	10
5	5

**Table 4.7** Intangible benefits associated with flood risk management improvements (2023 values)

			Standard of Protection After – AFP (RP in years)							
Standard of protection before – AFP (RP in years)			0.007	0.008	0.01	0.013	0.02	0.033	0.05	0.1
			-150	-125	-100	-75	-50	-30	-20	-10
	1	-1	£348	£343	£319	£244	£117	£40	£19	£8
	0.1	-10	£342	£336	£312	£236	£108	£34	£13	£0
	0.05	-20	£328	£322	£301	£225	£96	£21	£0	-
	0.033	-30	£308	£302	£279	£204	£75	£0	-	-
	0.02	-50	£231	£226	£202	£128	£0	-	-	-
	0.013	-75	£104	£99	£75	£0	-	-	-	-
	0.01	-100	£29	£24	£0	-	-	-	-	-
	0.008	-125	£6	£0	-	-	-	-	-	-

AFP = Annual Flood Probability

RP = Return Period

Annual Benefits = Damages (before) - Damages (after)

Source: Department for Environment, Food and Rural Affairs (Defra) (2004) Flood and Coastal Defence Project Appraisal Guidance. FCDPAG3 Revisions to Economic Appraisal on Reflecting Socio-economic Equity in Appraisal and Appraisal of Human Related Intangible Impacts of Flooding. Supplementary Note to Operating Authorities. July 2004. Defra: London.

**Table 4.8** The probability of evacuation and duration in relation to flood depth

Maximum depth in house (cm)	% who evacuated	Mean duration of evacuation in weeks
0	23	11
1-10	41	12
10-20	55	18
20-30	59	18
30-60	69	21
60-100	76	23
100+	87	33

**Table 4.9** Regional Residential House Prices (2023)

Region/Country	All residential	Detached	Semi detached	Terrace	Flat
England	£306,342	£481,808	£293,476	£250,990	£250,389
Scotland	£187,598	£338,051	£200,118	£159,369	£127,903
Wales	£216,132	£331,598	£209,566	£168,820	£135,457
Northern Ireland	£173,029	£265,704	£166,999	£120,552	£127,697
North East	£158,478	£274,032	£161,714	£128,171	£100,819
North West	£212,796	£371,243	£227,696	£164,421	£144,007
Yorkshire & Humberside	£206,592	£340,102	£207,109	£163,447	£134,167
West Midlands	£249,329	£416,008	£244,947	£197,608	£146,421
East Midlands	£246,949	£365,853	£228,082	£185,934	£133,664
East of England	£353,609	£549,474	£364,658	£297,209	£211,661
South West	£326,572	£521,200	£336,849	£274,487	£193,596
South East	£392,999	£699,874	£427,207	£332,516	£226,265
London	£533,816	£1,092,820	£693,136	£586,323	£441,474

Source: <https://landregistry.data.gov.uk/app/ukhpi/> (March 2022 - February 2023 average value)

# **5** ***Non-Residential properties***

## ***Tables and figures***

**Table 5.1:** Matching NRD (MCM) codes to the latest MCM code

**Table 5.2:** Indicative floor sizes for NRPs

**Table 5.3:** NRP Weighted Annual Average Damages (WAAD)

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**Table 5.1** Matching NRD (MCM) codes to the latest MCM code

NRD MCM code	Description	MCM Code	Property type
2	Retail	2	Retail
21	Shop/Store (Weighted mean)		
211	(High Street) Shop		
213	Superstore/Hypermarket		
214	Retail Warehouse		
215	Showroom		
216	Kiosk		
217	Outdoor market		
218	Indoor Market		
22	Vehicle Services (Weighted mean)		
221	Vehicle Repair Garage		
222	Petrol Filling Station		
223	Car Showroom		
224	Plant Hire		
23	Retail Services (Weighted mean)		
231	Hairdressing Salon		
232	Betting Shop		
233	Laundrette		
234	Pub/Social club/wine bar		
235	Restaurant		
236	Café/Food Court		
237	Post Office		
238	Garden Centre		
3	Offices	3	Offices
310	Offices (non specific)		
311	Computer Centres (Hi-Tech)		
320	Bank		
4	Distribution/logistics	4	Warehouses
410	Warehouse		
411	Electrical w/h		
412	Ambient goods w/h		
413	Frozen goods w/h		
420	Land Used for Storage		
430	Road Haulage		
5	Leisure and Sport	NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE	
51	Leisure (Weighted mean )	51	Leisure
511	Hotel		
512	Boarding House		

513	Caravan Mobile	Due to a change in Environment Agency guidance, readers should no longer apply the MCM damage value for caravan sites. Please see the following document for further information: <b>Environment Agency (2008) Economic evaluation of damages for Flood Risk Management projects, Environment Agency, Bristol</b>	
514	Caravan Static		
515	Self catering Unit	51	Leisure
516	Hostel (including prisons)		
517	Bingo hall		
518	Theatre/Cinema		
519	Beach Hut		
52	Sport (Weighted mean)	NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE	
521	Sports Grounds and Playing Fields	521	Playing Field
522	Golf Courses	521	Playing Field
523	Sports and Leisure centres	523	Sports Centre
524	Amusement Arcade/Park	523	Sports Centre
525	Football Ground and Stadia	525	Sports Stadium
526	Mooring/Wharf/Marina	526	Marina
527	Swimming Pool	523	Sports Centre
6	Public Buildings	6	Public Buildings
610	School/College/University/Nursery		
620	Surgery/Health Centre		
625	Residential Home		
630	Community Centres/Halls		
640	Library		
650	Fire/Ambulance station		
651	Police Station		
660	Hospital		
670	Museum		
680	Law court		
690	Church		
8	Industry	8	Industry
810	Workshop		
820	Factory/Works/Mill		
830	Extractive/heavy Industry		
840	Sewage treatment works		
850	Laboratory		
9	Miscellaneous	NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE	
910	Car Park	910	Car park
920	Public Convenience	NOT CURRENTLY AVAILABLE	
930	Cemetery/Crematorium	NOT CURRENTLY AVAILABLE	
940	Bus Station	NOT CURRENTLY AVAILABLE	
950	Dock Hereditament	526	Marina
960	Electricity Hereditament	960	Electricity sub-station

**Table 5.2** Indicative floor sizes for NRPs

New MCM Code	Property Type	Floor Area (m <sup>2</sup> )
2	Retail	340
3	Offices	360
4	Warehouses	3,270
5	Leisure and sports	NA
51	Leisure	1,020
52	Sports	NA
521	Playing Field	21,850
523	Sports Centre	5,400
526	Marina	1,860
525	Sports Stadium	25,600
6	Public Buildings	1,300
8	Industry	2,480
9	Miscellaneous	NA
910	Car park	3,500
910	MS Car park	2,700
960	Sub Station	48



**Table 5.3** NRP Weighted Annual Average Damages (WAAD) (2023 values)

Standard Of Protection								
MCM Code	Sector Type	None	5	10	25	50	100	200
2	Retail	86.69	42.84	31.22	16.05	7.16	1.79	0.89
3	Offices	84.90	39.06	29.46	14.74	6.48	1.63	0.81
4	Warehouses	97.37	51.33	37.15	18.84	8.53	2.13	1.07
5	Leisure and sport	NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE						
51	Leisure	196.48	67.64	53.85	24.45	10.49	2.62	1.31
52	Sport	NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE						
521	Playing Field	3.66	1.47	1.17	0.56	0.24	0.06	0.03
523	Sports Centre	45.20	19.56	14.97	7.28	3.18	0.80	0.40
526	Marina	16.34	7.49	5.49	2.79	1.23	0.30	0.16
525	Sports Stadium	11.45	5.58	4.11	2.10	0.93	0.23	0.12
6	Public Buildings	52.35	23.68	17.86	8.85	3.90	0.98	0.48
8	Industry	18.39	9.09	6.62	3.38	1.51	0.38	0.19
9	Miscellaneous	NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE						
910	Car park	5.64	2.52	1.87	0.94	0.41	0.10	0.05
960	SubStation	273.27	165.76	118.61	64.85	29.34	7.33	3.67
NRP sector average		90.37	47.28	34.64	18.29	8.32	2.18	1.09

**Table 5.4 Business floor space: rateable value per m2 of floor space (2023 values)**

Area	Main Category	Mean	Median	Upper quartile	Lower quartile
ENGLAND	Total	104.36	96.73	57.27	166.72
ENGLAND	Retail	190.91	140.00	87.82	227.81
ENGLAND	Offices	197.27	134.91	94.18	194.72
ENGLAND	Industrial	47.09	53.45	38.18	73.82
ENGLAND	Other	86.54	72.54	33.09	136.18
NORTH EAST	Total	71.27	66.18	39.45	114.54
NORTH EAST	Retail	162.91	98.00	61.09	165.45
NORTH EAST	Offices	108.18	89.09	63.64	126.00
NORTH EAST	Industrial	31.82	38.18	26.73	52.18
NORTH EAST	Other	54.73	43.27	19.09	90.36
NORTH WEST	Total	77.64	77.64	48.36	134.91
NORTH WEST	Retail	169.27	114.54	73.82	187.09
NORTH WEST	Offices	124.73	112.00	80.18	155.27
NORTH WEST	Industrial	38.18	44.54	31.82	59.82
NORTH WEST	Other	72.54	59.82	30.55	90.36
YORKSHIRE AND THE HUMBER	Total	71.3	76.4	45.8	131.1
YORKSHIRE AND THE HUMBER	Retail	162.91	115.82	75.09	187.09
YORKSHIRE AND THE HUMBER	Offices	124.73	104.36	76.36	146.36
YORKSHIRE AND THE HUMBER	Industrial	36.91	44.54	31.82	59.82
YORKSHIRE AND THE HUMBER	Other	70.00	66.18	29.27	119.63
EAST MIDLANDS	Total	62.4	66.2	43.3	105.6
EAST MIDLANDS	Retail	137.45	98.00	63.64	156.54
EAST MIDLANDS	Offices	89.09	87.82	68.73	114.54
EAST MIDLANDS	Industrial	40.73	44.54	33.09	57.27

EAST MIDLANDS	Other	67.45	64.91	28.00	113.27
WEST MIDLANDS	Total	73.8	76.4	48.4	124.7
WEST MIDLANDS	Retail	156.54	108.18	72.54	169.27
WEST MIDLANDS	Offices	129.82	110.73	82.73	150.18
WEST MIDLANDS	Industrial	42.00	48.36	35.64	62.36
WEST MIDLANDS	Other	78.91	73.82	36.91	115.82
EAST	Total	95.5	100.5	61.1	162.9
EAST	Retail	184.54	150.18	98.00	231.63
EAST	Offices	143.82	136.18	101.82	180.72
EAST	Industrial	53.45	59.82	42.00	81.45
EAST	Other	89.09	80.18	36.91	145.09
LONDON	Total	246.9	194.7	118.4	336.0
LONDON	Retail	299.09	220.18	148.91	353.81
LONDON	Offices	356.36	267.27	164.18	437.81
LONDON	Industrial	86.54	94.18	71.27	123.45
LONDON	Other	166.72	146.36	71.27	227.81
SOUTH EAST	Total	112.0	114.5	71.3	171.8
SOUTH EAST	Retail	198.54	156.54	106.91	234.18
SOUTH EAST	Offices	145.09	143.82	112.00	180.72
SOUTH EAST	Industrial	63.64	68.73	49.64	90.36
SOUTH EAST	Other	86.54	75.09	31.82	143.82
SOUTH WEST	Total	90.4	89.1	56.0	146.4
SOUTH WEST	Retail	175.63	140.00	92.91	213.82
SOUTH WEST	Offices	127.27	113.27	86.54	148.91
SOUTH WEST	Industrial	47.09	54.73	40.73	72.54
SOUTH WEST	Other	73.82	73.82	30.55	134.91

# 6 *Other flood losses:* Utility, schools, hospitals, transportation networks and emergency costs

## Tables and figures

**Introduction: Prioritisation of losses for inclusion in project appraisal**

**Infrastructure**

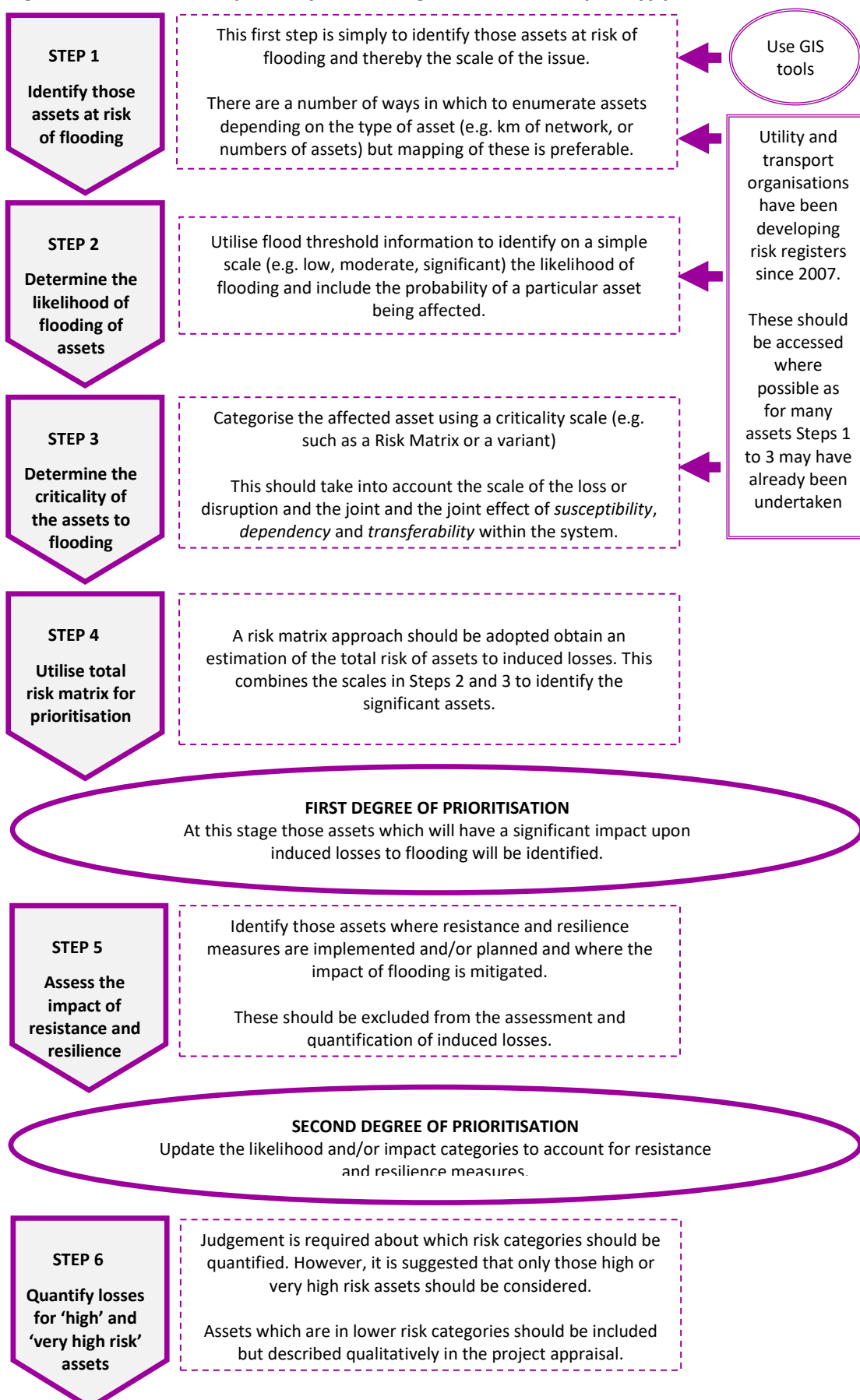
**Transport**

**Education and Health**

**Local Authority and Emergency Services**

## Introduction: Prioritisation of losses for inclusion in project appraisal

**Figure 6.1 Prioritisation process for selecting those assets to quantify potential losses**



**Table 6.1 Enumeration, descriptors and valuation measures to gauge the scale of the infrastructural risk**

Infrastructure type	Enumerator/ Descriptor	Valuation Measures
Roads	Length (in km) of motorways, A, B, minor within the floodplain; flood thresholds	User numbers (cars, HGV, LGV, PSV) Flood free alternatives
Railways	Length (in km) of intercity, regional, local, commuters tracks; flood thresholds	No. of passengers of different types (commuter, business, other), trains per day,
Electricity transmission	KV, lengths, thresholds of flooding of plinth	Supply catchment, population served
Electricity distribution	Size of substations; threshold of flooding	Supply catchment, population served
Gas pressure, pumping stations [1]	Type and number	Supply catchment, population served
Water treatment works	Type and number (pumping station, booster station etc); thresholds of flooding	Supply catchment, population served
Sewage treatment works	Type and number (biological filter, activated sludge, pumping station etc); thresholds of flooding	Drainage catchment, population served
Telecommunications [2]	Exchanges, cabinets, pillars, threshold of flooding	Population served
[1] Water distribution and supply mains, trunk sewers and gas lines can all but be ignored unless likelihood of fracture is high (e.g. on exposed river crossing or where it might be threatened by the ground around it becoming saturated so that it floats and threatened the pipe work joints).		
[2] Redundancy is now high with universal application of mobile telephony. Telecommunication losses and disruption can all but be ignored unless physical damage is likely with high probability within an exchange.		

**Table 6.2 Risk Matrix**

IMPACT**	<i>Significant</i>	Medium Risk	High Risk	Very High Risk
	<i>Moderate</i>	Low Risk	Medium Risk	High Risk
	<i>Low</i>	Negligible Risk	Low Risk	Medium Risk
		<i>Very Low</i>	<i>Low</i>	<i>Medium/High</i>
		LIKELIHOOD*		

\* These follow the Environment Agency's [Risk of Flooding from Rivers and Sea](#) likelihood bands.

\*\* The significant, moderate and low impact categories are defined for each receptor type.

**Table 6.3 Summary of impacts for utility and infrastructure assets assuming that there are no flood resilience measures or actions taken to increase redundancy**

Utility/ infrastructure	Susceptibility	Dependency	Redundancy/ Transferability	Scale 1 = few 2 = many 3 = very many	Total likely impact
<b>Electricity transmission and distribution</b>					
> 132 kV (fluvial)	Low	High	Low	3	Low
>132 kV (tidal) [1]	High	High	Low	3	High
<132 kV (fluvial)	Low	High	Low	2	Low
<132 kV (tidal)	High	High	Low	2	Medium
Grid (Super grid) substation	High	High	High	3	Medium [2]
Grid (Bulk Supply Point) substation	High	High	Medium	3	Medium [2]
Primary substation	High	High	Medium	2	Medium[2]
Distribution substation	High	High	Low	1	Medium/ Low [3]
<b>Gas transmission</b>					
Gas pressure stations	Medium	Medium	Low	1	Low
Gas pressure stations	Medium	Medium	Low	2	Medium
<b>Water and waste water treatment</b>					
Sewage treatment	Medium	High [4]	Low [5]	1	Medium
Sewage treatment	Medium	High [4]	Low	2	Medium
Water treatment	High	High	Medium [6]	1	Medium
Water treatment	High	High	Medium [6]	2	High
Water pump stations	High	High	Low	1 and 2	Medium
<b>Telecommunication systems</b>					
Connection points – cabinet	Low	Medium	High	2	Low
Telecoms connection points – pillars	Low	Medium	High	1	Low [7]
[1] Transmission lines across a coastal floodplain are likely to collapse during a severe tidal inundation. Also if a transmission line is within an area flooded for any considerable period of time, then maintenance of that structure will be difficult and the integrity of the asset threatened.					
[2] The absolute impact will depend upon the specific site plan and the location of equipment within it; in particular the positioning and height of the switching gear and transformers.					
[3] This is 'low' in the situations whereby the properties the substation is servicing are also flooded as the substation will be repaired before the houses. It is 'medium' in situations where the substation is servicing properties which remain dry (i.e. 'unflooded' properties).					
[4] Environmental damage through treatment bypass might be as important as physical damage.					
[5] A reminder that in this circumstance the redundancy remains low – unless measures have been taken as a consequence of the Pitt Review to increase the transferability of the service.					
[6] Depends upon locality.					
[7] Redundancy of landline facilities is extremely high with saturation coverage of mobile telephones.					

NB. This is Table 6.14 in the MCM 2013



## Infrastructure

**Table 6.4 Types of electricity substations (ENA, 2009)**

Substation type	Typical Voltage transformation levels	Approximate number in UK	Typical size	Typical numbers of customers supplied
Grid (Super grid)	400kV to 132kV	377	250m x 250m	200,000 to 500,000
Grid (Bulk Supply Point)	132kV to 33kV	1,000	75m x 75m	50,000 to 125,000
Primary	33kV to 11kV	4,800	25m x 25m	5,000 to 30,000
Distribution	11/kV to 400/230V	230,000	4m x 5m	1 to 500

**NB.** This is Table 6.6 in the MCM 2013

Energy Networks Association (ENA) (2009) 'Resilience to flooding of grid and primary substations', Engineering Technical Report (ETR 138), issue 1, Energy Networks Association, London.

**Table 6.5 Risk matrix for electricity substations**

IMPACT	Sig: Grid substations with serving a population of > 125 000	Medium Risk	High Risk	Very High Risk
	High: Primary substations those with > 10000 population supplied	Medium Risk	High Risk	High Risk
	Mod: Primary substations with 5,000 to 10,000 population supplied	Low Risk	Medium Risk	High Risk
	Low: Distribution substations with fewer than 500 people supplied.	Negligible Risk	Low Risk	Medium Risk
		Very Low	Low	Medium/High
		LIKELIHOOD		

NB. This is a revised version of Table 6.7 in the MCM 2013

**Figure 6.2 List of Approved Designated Services which are able to be considered to be added to the Protected Site List\***

- Gas reception terminals; storage installations including boosting and compression equipment; gas compressor stations and principal development and control sites for the control of gas supply systems and emergency procedures;
- Licensed electricity generators, and licensed network operators;
- Oil refineries and vital oil pumping stations;
- Sites with a continuous manufacturing process, not sustainable through standby generation, where regular shutdown for 3-hour periods is not possible and would cause significant financial damage;
- Major airports and associated control facilities;
- Significant railway operations;
- Ports and docks which have a national infrastructure significance;
- Essential water and sewerage installations;
- A major location for essential food manufacture, processing or storing;
- Hospitals as agreed with NHS Foundation Trusts, Primary Care Trusts, Acute Trusts, Local Health Boards (in Wales), Welsh NHS Trusts and NHS Health Scotland;
- Digital and telecommunication services where there is a national need for continued operation
- Emergency services of regional significance;
- Armed forces sites that provide civil protection support;
- Financial services where there is a national need for continued operation.

**Source: Department for Business, Energy and Industrial Strategy (2019; Table 1).**

Department for Business, Energy and Industrial Strategy (2019) Electricity Supply Emergency Code (ESEC), Revised November 2019,  
[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/845221/electricity-supply-emergency-code-nov-2019-rev.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/845221/electricity-supply-emergency-code-nov-2019-rev.pdf), accessed 12 April 2023.

\* PSL has replaced 'V' list customers.

**Table 6.6 Estimations of population served based on the perimeter fence length (after Energy Networks Association, 2018b)**

Sub station type	Average Perimeter Fence	Ratio customers to metres of perimeter
Grid (Super grid)	1000m	225:1
Grid (Bulk Supply Point)	300m	183:1
Primary	100m	150:1

**NB. This is Table 6.8 in the MCM 2013**

Energy Networks Association (ENA) (2018b) 'Resilience to flooding of grid and primary substations: Annex', Engineering Technical Report (ETR 138 Annex), Issue 1, 2018, Energy Networks Association (ENA): London.

**Table 6.7 Resilience levels for electricity substations\***

Flood type	Protection level			Allowance for climate change rises	Freeboard
	Grid Substation	Primary Substations <sup>†</sup> > 10,000 unrecoverable connections	Primary Substation <sup>†</sup> < 10,000 unrecoverable connections		
Fluvial	1:1000 Flood level	1:1000 Flood level	1:100 Flood level	Flood Depth x 20% or use of EA CC factored levels	300mm
Tidal	1:1000 Flood level	1:1000 Flood level	1:200 Flood level	105 mm or use of EA CC factored levels	300mm
Surface	1:1000 Flood level	1:1000 Flood level	1:100 Flood level	Flood Depth x20%	300mm

Source: UK Power Networks (2019, 10); ENA (2018a, 20).

\* Please note that critical infrastructure resilience is a priority area following recent floods and storms and the *National Flood Resilience Review* (HM Government, 2016) and so the resilience levels may be subject to change. Furthermore, some DNOs have issued guidance recommending additional safety factors are applied (e.g. Electricity North West, 2017). In particular, the updated ENA (2018a) suggests that Network Operators should ensure that they utilise the most recent guidance available. It is recommended that appraisers also check for updated information. The third round of Climate Change Adaptation Reporting accordance with the Climate Change Act 2008, provides the updated information on climate resilience for each supplier (Defra, 2022).

<sup>†</sup> ENA (2018a) suggests that network operators should focus on the resilience of service provision to sites supplying significant local communities (SLCs) (which are defined as those comprising at least 10,000 customers/connections) and to the level of the EA's Extreme Flood Outline (i.e. 1/1,000 flood risk). Therefore, those primary substations which are likely to serve a customer population of over 10,000 should have the same protection level (1:1000) as grid substations.

Department for Environment, Food and Rural Affairs (2022) Climate change adaptation reporting: third round reports, Reports from organisations invited to report under the third round of the climate change Adaptation Reporting Power, Latest update 24<sup>th</sup> March 2022, <https://www.gov.uk/government/collections/climate-change-adaptation-reporting-third-round-reports#energy-companies>, accessed 05 April 2023.

Electricity North West (2017) Substation Flood Protection, Electricity Policy Document 355, Issue 3, April 2017, <https://www.enwl.co.uk/globalassets/get-connected/cic/icpsidnos/g81-policy/policy-library-documents/substation/epd355---substation-flood-protection.pdf>, accessed 05 April 2023.

Energy Networks Association (ENA) (2018) 'Resilience to flooding of grid and primary substations', *Engineering Technical Report (ETR 138)*, Issue 3, June 2018, Energy Networks Association, London.

HM Government (2016) *National Flood Resilience Review*, September 2016, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/551137/national-flood-resilience-review.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/551137/national-flood-resilience-review.pdf), accessed 05 April 2023.

UK Power Networks (2019) Substation Flood Protection, Engineering Design Standard EDS, <https://g81.ukpowernetworks.co.uk/library/design-and-planning/substations-major/general/eds-07-0106-substation-flood-protection>, accessed 05 April 2023.

**Table 6.8 Potential intervention measures for electricity infrastructure with their advantages and disadvantages**

Intervention Measure		Advantages	Disadvantages
Permanent	EA intervention measure (wall or embankment)	Removes flood risk to design flood level	High cost solution and long 'solution' lead time
Permanent	Buildings and Critical assets protected 365 days per year	Access maintained and all apertures sealed with site not requiring to be manned during flood	Protection generally only effective to a height of 1 metre above ground level. Medium cost solution
Permanent	Barriers and gates at critical openings in perimeter	Access to critical part maintained	Site needs to be manned during flood incident. Medium cost solution
Permanent	Substation critical assets raised	Removes risk of flooding to new design threshold	High cost solution with long construction lead time
Permanent	Substation relocation outside floodplain	Wholly removes flood risk	Very high cost solution and disruptive to customers during construction
Demountable	Buildings and critical assets where supports are permanent and panels etc stored on site	Removes flood risk to design flood level	Medium to high cost solution and resource intensive during flooding with potential for operational failure.
Demountable	Site protection where supports are permanent and panels etc stored on site	Removes flood risk to design flood level	Medium to high cost solution and resource intensive during flooding with potential for operational failure.
Temporary	Site protection measures installed following flood warning	Low cost solution	High deployment and training costs for erection etc.

Source: Adapted from Energy Networks Association (2009)

NB. This is Table 6.10 in the MCM 2013

Energy Networks Association (ENA) (2009) 'Resilience to flooding of grid and primary substations', Engineering Technical Report (ETR 138), Issue 1, October 2009. Energy Networks Association, London.

**Figure 6.3 Indicative figures for average energy and gas consumption and willingness to pay to avoid a power outage**

**Average electricity consumption† – 2020 estimates**

Annual Energy Consumption per household (Ofgem, 2020)	Daily Energy Consumption per household
2,900 kWh	7.9 kWh

**Average gas consumption – 2020 estimates**

Annual Gas Consumption per household (Ofgem, 2020)	Daily Gas Consumption per household
12,000 kWh	33 kWh

**Willingness-to-pay\* to avoid disconnection of supply for electricity (2023 values)**

Willingness to pay to avoid disconnection – Domestic users (BERR, 2007)	Willingness to pay to avoid disconnection – Business users** (BERR, 2007)
£15.16 per kWh	£53.06 per kWh

The annual consumption per household figure is the medium Typical Domestic Consumption Value calculated by Ofgem (2020) – the higher or lower values might be used to provide a more conservative or maximum estimate. TDCVs are industry standard values and are those still recommended by the industry in April 2020. These figures are still those adopted as per the update of 1<sup>st</sup> May 2023. However, Ofgem report that they are undertaking their regular (but postponed due to Covid-19 impacts) update of these values which will be released in Spring 2023 so users are advised to check to see if there have been any updated consumption values (<https://www.ofgem.gov.uk/information-consumers/energy-advice-households/average-gas-and-electricity-use-explained>).

††TDCV Electricity Profile Class 1 has been used (i.e. those not on an Economy 7 tariff) the assumption being that households are not only reliant on electricity for power and this will provide a more conservative estimate. For a maximum estimate, TDCV Profile Class 2 can be used and accessed from Ofgem (2020).

\*These values have been generated in relation to electricity supply. However, this might also be used in the case of the disruption to a gas supply in the absence of other appropriate estimates.

\*\*This is an average value and there is likely to be significant variation amongst business owners depending upon the type of business and its dependency upon water.

Department of Business, Enterprise and Regulatory Reform (BERR) (2007) Electricity Priority Users Arrangements, Department for Business, Enterprise and Regulatory Reform, <https://webarchive.nationalarchives.gov.uk/ukgwa/20090609003228/http://www.berr.gov.uk/files/file40466.pdf>, accessed 05 April 2023.

Ofgem (2020) 'Typical Domestic Energy Consumption Values', <https://www.ofgem.gov.uk/information-consumers/energy-advice-households/average-gas-and-electricity-use-explained> revised Jan 2020, accessed 21 April 2023.



**Table 6.9 Risk matrix for sewage treatment works**

IMPACT	<i>Sig: &gt; 30,000 cumecs effluent dry weather flow</i>	Medium Risk	<b>High Risk</b>	<b>Very High Risk</b>
	<i>Mod: 5,000 to 30,000 cumecs effluent dry weather flow</i>	Low Risk	Medium Risk	<b>High Risk</b>
	<i>Low: &lt; 5,000 cumecs effluent dry weather flow</i>	Negligible Risk	Low Risk	Medium Risk
		<i>Very Low</i>	<i>Low</i>	<i>Medium/High</i>
LIKELIHOOD				

NB. This is Table 6.12 in the MCM 2013

**Table 6.10 Risk matrix for water supply**

IMPACT	<i>Sig: &gt; 20,000 population supplied or PSL customers</i>	Medium Risk	High Risk	Very High Risk
	<i>Mod: 5,000 to 20,000 population supplied</i>	Low Risk	Medium Risk	High Risk
	<i>Low: &lt; 5,000 population supplied</i>	Negligible Risk	Low Risk	Medium Risk
		Very Low	Low	Medium/High
LIKELIHOOD				

NB. This is Table 6.13 in the MCM 2013

## Transport

**Table 6.11 Total resource costs of travel as a function of speed (pence/km) (updated to 2022 prices)**

Total resource costs (pence per km)								
Speed (km/hr)	5	10	20	40	50	80	100	120
Car average p/km	323	163	86	48	41	27	25	22
LGV average p/km	378	196	104	59	50	38	36	33
OGV1 p/km	416	221	120	69	59	45	-	-
OGV2 p/km	531	288	162	98	85	68	-	-
PSV p/km	2391	1225	642	347	288	-	-	-

Data supplied by the Department for Transport (2012)

This is Table 6.15 in the MCM 2013

Department for Transport (2012) 'UNIT 3.5.6: Values of Time and Vehicle Operating Costs', Transport Analysis Guidance (TAG), October 2012, Department for Transport, London. This is now restructured into the following TAG guidance,

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1102785/tag-unit-a1.3-user-and-provider-impacts.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1102785/tag-unit-a1.3-user-and-provider-impacts.pdf), accessed 05 April 2023.

**Table 6.12 Indicative delay durations at different return periods**

Likelihood of flooding	Delay duration (Hours)
Up to and including the 5 year return period (0.2%)	6
Up to and including the 10 year return period (0.1%)	6
Up to and including the 25 year return period (0.04%)	12
Up to and including the 50 year return period (0.02%)	24
Up to and including the 100 year return period (0.01%)	48
Up to and including the 200 year return period (0.005%)	96

This is Table 6.17 in the MCM 2013

**Table 6.13 Speed-flow relations**

Road type	Free Flow speed (kph)	Free Flow limit (pcu/h/lane)	Limiting capacity (pcu/h/lane)	Speed at Limiting Capacity (kph)
	VC	QC	QM	VM
	Free flow speed	Speed falls linearly over this range		
Rural motorway	90	1800	2600	76
Rural dual carriageway	79	1600	2400	70
Rural all purpose road	70	400	1800	57
Rural all purpose road – poorly aligned	50		600	50
Urban motorway	80	1700	1400	66
<b>Urban dual carriageway</b>				
With limited access and 80 kph limit	65	1400	2200	56
65 kph speed limit	50	600	1100	30
<b>Urban single carriageway road</b>				
outer area	45	500	1000	25
intermediate area	35	350	600	25
central business area	25	250	500	15
<b>Suburban – major radial or outer ring roads</b>				
No major intersections	Speed limit		2000	47
< 1 major intersection per km			1700	27
1-2 major intersection per km			1200	20

Source: Department for Transport (1981)

Department for Transport has confirmed that these 1981 values are still applicable.

**NB. This is revised Table 6.16 in the MCM 2013**

Department for Transport (DfT) (1981) Traffic Appraisal Manual, Department for Transport, London

NB: This has been corrected for the 2019 MCH. A formatting error was present for the final three rows and additionally the limiting capacity of a 80 kph limited urban dual carriageway was corrected to read 2200pcu/h/lane.

**Table 6.14 Passenger numbers and statistics by Train Operating Company (Franchised companies only)**

Train Operating Company	Passenger Journeys per year 2018-2019 (millions)	Passenger Journeys per 24 hours 2018-2019 (averaged by dividing by 365)	Passenger kilometres 2018-2019 (millions)	Passenger train kilometres 2018-2019 (millions)	Route Kilometres operated 2018-2019
c2c	49.1	134,521	1237.8	7.3	125.5
Caledonian Sleeper	0.3	822	201.0	1.4	1470.9
Chiltern Railways	29.3	80,274	1652.4	12.2	354.1
CrossCountry	40.7	111,507	3715.8	32.7	2710.1
East Midlands Railway	26.7	73,151	2415.0	22.8	1549.8
Grand Central	1.5	4,110	418.4	2.5	762.8
Great Western Railway	100.1	274,247	6001.6	41.7	1997.2
Greater Anglia	84.9	232,603	3925.2	28.5	1591.6
Hull Trains	1.0	2,740	244.6	1.4	342.8
London North Eastern Railway	22.3	61,096	5807.3	23.4	1480.6
London Overground	188.1	515,342	1287.6	8.7	167.4
Merseyrail	42.1	115,342	666.9	6.4	120.7
Northern	101.3	277,534	2584.6	48.5	2800.3
ScotRail	97.8	267,945	2978.8	47.6	3120.5
South Western Railway	216.0	591,781	6039.6	39.0	997.8
Southeastern	183.2	501,918	4693.1	31.9	748.3
TfL Rail	51.3	140,548	642.8	3.8	59.5
Thameslink	341.5	935,616	9206.8	63.3	1287.5
TransPennine Express	29.2	80,000	2081.7	20.6	1039.6
Transport for Wales	34.1	93,425	1257.3	23.8	1784.8
Virgin Trains	39.5	108,219	7673.2	36.0	1310.0
West Midland Trains	78.7	215,616	2919.4	25.6	899.6

Source: Data downloaded from the ORR National Rail Trends Portal (2020)

NB: Train operating companies change as franchises generally operate over a fixed period.

The data provided here are the latest available in an entirely pre-COVID period. These data have not been updated to more recent figures due to the observable impacts of COVID-19 and local and national lockdowns on travel. ORR (2023) suggests that passenger rail usage continues to be affected and that passenger journeys are only 80% of those at pre-pandemic levels, but the differences vary considerably between areas. Until work and travel patterns stabilise we recommend using pre-pandemic figures. Furthermore, strike action across the networks in the last quarter of 2022/23 would impact on the figures provided. These data were collected for the 2018-2019 period and operators may have changed, it is suggested that users access the Rail Trends Portal at time of use and where necessary consider current and past operators of the route of interest.

\* These data have changed since the original version in the MCM as the ORR National Rail Trends Portal no longer provide data on 'timetabled train kms', but rather on 'passenger train kms.'

Office of Rail Regulation (ORR) (2023) 'The National Rail Trends (NRT) Portal', <http://dataportal.orr.gov.uk/>, accessed 21 April 2023.

**Table 6.15 Percentage delay/cancellation due to flooding (Posford Duvivier et al., 2002)**

Rail Service	Delay %	Cancellation %
Passenger service	40	60
Freight service	45	55

**NB.** This is Table 6.19 in the MCM 2013

**Table 6.16 Indicative compensation values for performance delays and cancelled services (data from Network Rail)**

Actual compensation values for each of the Train Operating Companies (TOCs) and Freight Operating Companies (FOCs), as agreed in the Track Access Agreements, are restricted information. Therefore, these indicative values are based on data of the actual delay costs and cancelled services between 2011 and 2013.

	Delay compensation value £s per minute per service *			Cancellation compensation value £s per service cancelled**		
	Low value (£)	Medium value (£)	High value (£)	Low value (£)	Medium value (£)	High value (£)
Passenger services	40	71	97	673	2034	2591
Freight services	-	18	-	-	1900	0

NB. This is Table 6.20 in the MCM 2013

\* Including a delay multiplier of 3

\*\* Including a cancellation multiplier of 3

These delay multipliers have been applied according to the Department for Transport (2009) which Burr (2008, 46) argues is “used by the rail industry to recognise that unexpected delays are more costly to passengers”.

Burr, T. (2008) *Reducing passenger rail delays by better management of incidents*, report by the comptroller and auditor general, HC 308, Session 2007-2008, 14 March 2008, National Audit Office, The Stationary Office, London, <http://www.nao.org.uk/wp-content/uploads/2008/03/0708308.pdf>, accessed 05 April 2023.

Department for Transport (2009) ‘Unit 3.5.7: The Reliability Sub-Objective’, *Transport Analysis Guidance (TAG)*, April 2009, Department for Transport, London. This is now restructured into the following TAG guidance [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1102785/tag-unit-a1.3-user-and-provider-impacts.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1102785/tag-unit-a1.3-user-and-provider-impacts.pdf), accessed 05 April 2023.



**Table 6.17 Values of Time - based on the willingness to pay of each type of passenger per hour (2023 values)**

	Value of time* (VoT) £ per hour		
	Business passenger	Commuter	Other passenger
Original values per hour	£49.34	£6.79	£5.98
Uplifted to account for an unexpected delay**	£148.01	£20.38	£17.93

NB. This is Table 6.21 in the MCM 2013

\*The resource cost estimate has been utilised in this instance as these values net of indirect taxation. Department for Transport (2012) have been updated utilising HM Treasury (2023) GDP Deflator (March 2023).

\*\* The values have been uplifted by applying the 'delay multiplier' factor of 3.0 (Department for Transport, 2009) which Burr (2008, 46) argues is "used by the rail industry to recognise that unexpected delays are more costly to passengers".

## References

Burr, T. (2008) Reducing passenger rail delays by better management of incidents, report by the comptroller and auditor general, HC 308, Session 2007-2008, 14 March 2008, National Audit Office, The Stationary Office, London, <http://www.nao.org.uk/wp-content/uploads/2008/03/0708308.pdf>, accessed 05 April 2023.

Department for Transport (2009) 'Unit 3.5.7: The Reliability Sub-Objective', Transport Analysis Guidance (TAG), April 2009, Department for Transport, London, This is now restructured into the following TAG guidance [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1102785/tag-unit-a1.3-user-and-provider-impacts.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1102785/tag-unit-a1.3-user-and-provider-impacts.pdf), accessed 05 April 2023.

Department for Transport (2012) 'UNIT 3.5.6: Values of Time and Vehicle Operating Costs', Transport Analysis Guidance (TAG), October 2012, Department for Transport, London. [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1102785/tag-unit-a1.3-user-and-provider-impacts.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1102785/tag-unit-a1.3-user-and-provider-impacts.pdf), accessed 05 April 2023.

HM Treasury (2023) 'Latest figures, GDP deflators at market prices, and money GDP', <https://www.gov.uk/government/statistics/gdp-deflators-at-market-prices-and-money-gdp-march-2023-quarterly-national-accounts>, accessed 05 April 2023.

**Table 6.18 Percentage breakdown of the journey purpose of rail travellers by Train Operating Company\* and grouped train operators in 2019\*\***

Train Company	Commute	Business	Leisure
c2c	67	6	27
Chiltern Railways	38	25	37
CrossCountry	15	28	57
East Midlands Railway	23	28	49
Gatwick Express	15	44	40
Great Northern	53	10	37
Great Western Railway	28	20	52
Greater Anglia	44	25	31
London North Eastern Railway	9	31	60
London Overground	61	3	37
Merseyrail	43	1	56
Northern	38	9	53
ScotRail	39	13	47
South Western Railway	53	15	32
Southeastern	48	21	31
Southern	52	9	39
TfL Rail	61	4	35
Thameslink	53	10	37
TransPennine Express	26	13	61
Transport for Wales	31	10	59
Virgin Trains	9	22	69
West Midland Trains	40	13	46
Grouped train operators	Commute	Business	Leisure
London and South East operators	50	13	37
Long distance operators	16	24	60
Regional operators	38	9	52

Source: Passenger Focus (2019a; 2019b)

**NB. This is Table 6.22 in the MCM 2013**

\* Please note that where operating franchise companies have changed between the surveys conducted, the data from the old and new operators have been merged to create this annual percentage. Weighted sample data have been utilised. Data on journey purpose is also available for some specific routes and can be accessed in the datasets presented in the links below.

\*\* These data have not been updated to more recent figures due to the continued change in travel patterns in comparison to pre-pandemic levels. Additionally, travel in 2022/23 has been impacted by strike action. Until work and travel patterns stabilise we recommend using pre-pandemic figures.

Transport Focus (2019a) 'National Passenger Survey data Spring 2019' <https://transportfocusdatahub.org.uk/> accessed 21 April 2023.

Transport Focus (2019b) 'National Passenger Survey data Autumn 2019' <https://transportfocusdatahub.org.uk/>, accessed 21 April 2023.

**Table 6.19 Percentage breakdown of the journey purpose of rail travellers by region (2010 data)**

Region	Commuting	Business	Leisure
Scotland	59	11	30
Wales	50	12	38
North East	40	21	39
North West	53	12	35
Yorkshire and Humberside	54	14	32
East Midlands	49	17	33
West Midlands	55	14	31
East of England	67	12	21
London	69	12	19
South East	63	13	24
South West	46	19	34
Great Britain	63	13	24

NB: the percentages do not equal 100 due to rounding

Source: Department of Transport (2010)

Department for Transport (2010) 'National Rail Travel Survey Overview Report, Updated December 2010  
Results from a survey of rail travel across Great Britain'

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/73094/national-rail-travel-survey-overview-report.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/73094/national-rail-travel-survey-overview-report.pdf) accessed 21 April 2023.

## Education and Health

**Table 6.20 Estimates of the value of a lost day's work – 2023 estimates**

Minimum estimate*	Average estimate
£69.33	£91.55

\*The minimum estimate is calculated using the £10.42 per hour National Living Wage (April 2023) for an adult and a 7.6 hour working day.

The average estimate is calculated using a median hourly wage for a full-time adult (excluding overtime) in April 2022 of £14.72 and a 7.6 hour working day (ONS, 2022).

The minimum estimate has been adjusted from gross pay values using HMRC (2023) to provide economic values net of Income Tax and National Insurance Contributions.

HMRC (2023) 'HMRC Tax Calculator', <https://www.gov.uk/estimate-income-tax>, accessed 05 April 2023.

Office for National Statistics (ONS) (2022) 'Annual Survey of Hours and Earnings, 2022 Provisional Results' ASHE: Table 6.6a 26 October 2022, <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/agegroupshetable6>, accessed 05 April 2023.

**Table 6.21 Average costs of hospital bed**

	Average bed cost in the NHS [1]	Average bed day cost for elective and non-elective admissions [2, 3] (surgery and general medicine)	Average bed day cost for critical care
Average cost of a bed per day	£346	£530	£983

[1] This value is for 2017/18 and includes only the cost of NHS beds and excludes contracted out services.

Source: NHS Improvement (2018) Reference costs 2017/18: highlights, analysis and introduction to the data, November 2017, London.

<https://webarchive.nationalarchives.gov.uk/ukgwa/20200501111106/https://improvement.nhs.uk/resources/reference-costs/>, accessed 05 April 2023.

[2] These values are for 2011-2012 and were provided directly from the Department of Health, however although older they might be more appropriate than the average (if it is known) of those types of treatment will be affected.

[3] The figures for critical care and general and surgery beds include the cost of treatment.

NB: These data provide the most updated values for average bed cost provided by the NHS reference cost data. The latest updated National Schedule of NHS Costs data (2021/22) and previous datasets did not provide values for average bed costs.

**Table 6.22 Indicative costs per patient transfer – 2012/2013 estimates**

Ambulance costs vary depending upon whether a journey is made as part of a contract or as a private journey, a cost per hour, the distance travelled and includes a minimum cost. Additionally, there are additional charges for long journeys (over 300 miles return) and on public holidays.

Appraisers will need to identify alternative sites for healthcare provision and the distance (in miles) to that location. It appears that this should also include the return journey as the ambulance will be required to return to its base. This distance should be multiplied by the costs per mile (which is approximately £0.30) to calculate the total mileage costs.

These can then be added to either of the fixed and time costs in the table below. There is a minimum charge for any ambulance transfer which might be used as a minimum indicative cost. However this would only be applicable for journeys which are undertaken in less than one hour.

Above this minimum, the costs rise according to the circumstances of the transfer, how long it takes and the day on which it occurs. Therefore a second higher indicative value is presented in the table below which is based on the following assumptions:

- Only NHS patients transferred
- The distance to the alternative supplier is less than 150 miles (and therefore does not incur the additional charge)
- That the transfer does not occur on Statutory Bank holidays
- That the transfer takes a total of 1.5 hours (including waiting time)

Cost type	Minimum value	Higher indicative value
Fixed costs and time costs	£140	£250
Mileage costs	Number of miles x 0.30 per mile	Number of miles x 0.30 per mile

Data provided by the London Ambulance Service NHS Trust (2012/2013 values)

## Local Authority and Emergency Services

**Table 6.23 Overall emergency costs as applicable to project appraisals (Summer 2007 Floods)**

Emergency costs applicable to project appraisals (based on Summer 2007 Floods - England)			
Cost item	Amount	Allowed* amount (%)	Allowed amount
<b>Total Bellwin and roads:</b>			
Bellwin	£30.20	42.5	£12.84
Roads infrastructure	£175.00	50	£87.50
<b>Environment Agency costs+:</b>			
Emergency repairs**	£14.80	50	£7.40
Emergency response	£2.20	100	£2.20
<b>TOTAL</b>	<b>£222.20</b>		<b>£109.94</b>
As % of economic property losses of £1,942m = 5.57%			

# 8 *Recreational gains and losses*

## *Tables and figures*

**Table 8.1:** Sources and methods of information on recreation users/beneficiaries

**Table 8.2:** Examples of visit numbers used for benefit assessment purposes

**Table 8.3:** £ gains and losses per adult visit with coastal protection scheme options at coastal sites

**Table 8.4:** £ value of losses and gains per visit for various changes at river sites



**Table 8.1** Sources and methods of information on recreation users/beneficiaries

Source/ method		Comments
1	Long period counts using people counters	Infra-red or other counters installed over a period (at least March to September). Counters are manually calibrated to relate passages to adult visits. Mainly applied in detailed studies: in conjunction with a CV survey – see MCM, Section 8.5.3 (Penning-Rowse et al., 2013).
2	Short period manual counts/surveys	Manual counts/surveys over a period of days normally including the August Bank holiday. At initial stage, this method might be combined with site visits and at detailed study stage, with the CV survey.
3	CV survey data	CV survey data on the frequency of visiting by local residents in conjunction with census data on the number of adult residents and staying visitors (in conjunction with managers' estimates of occupancy rates) can be used to generate visit number estimates. However, the tendency of survey respondents to overstate their visiting frequency has to be noted - see the Corton Case Study in the MCM, Section 8.7 (Penning-Rowse et al., 2013).
4	Old survey/count data for the project	Planning, tourism or recreation departments of local authorities or local colleges or schools may have undertaken surveys or counts at the project site in the past, which can be updated to indicate current levels of use.
5	Inferred estimate	The number of visits to a coastal or river site is inferred from counts of visits to a related site nearby such as: Car and coach parks multiplied by the average adult car or coach occupancy rate (Hengistbury Head), funfair, cafe, visitor centre, historic site or museum (Hurst Spit and Hurst Spit castle). This requires estimating the proportion of all visitors to the project site who also use the counted site and vice versa. At detailed level, this can be done in conjunction with the CV survey.
6	Visitor equations	A number of equations have been developed which predicts-distance-frequency functions so that from census data on the population in different zones a prediction can be made as to the number of visitors generated by the site.
7	Estimates from an informed persons or source	Written, telephone or personal contacts with: Car park attendants, park rangers/wardens, visitor centre staff, staff at associated visitor attractions, local authority tourism, sport and recreation or planning staff, regional or local offices of organisations such as the English Tourist Board, National Trust or English Heritage and their Welsh equivalents, the Environment Agency's recreation and fisheries staff, managers of general recreation or staying visitor facilities or tourism business organisations that may have information on bedspaces and occupancy rates - see the Corton Case Study in the MCM, Section 8.7 (Penning-Rowse et al., 2013); both commercial and club managers of specialist facilities (e.g. sailing, boating/sailboarding, fishing, birdwatching) and specialist organisations at national regional and local level for information on the availability of alternative sites e.g. for caravans or sailing.
8	Average number of visits to equivalent sites	This benefit transfer approach is only suitable for initial and strategic studies. The number of adult visits to the project site is estimated as being of the same order as the number of visits made to an equivalent site. However, there are few sites for which good data are available and little research to enable reliable identification of an equivalent site.

**Table 8.2** Examples of visit numbers used for benefit assessment purposes

Site*		Annual visit numbers	
Name	Characteristics	High estimate	Low estimate
<b>Undeveloped coastal sites</b>			
Hengistbury Head, Christchurch, Dorset	Natural headland, a SSSI, with nature, geology and archaeology sites	609,000	584,000
Hurst Spit, Hampshire	Undeveloped shingle spit with heritage site, Hurst Castle	107,000	880,000
<b>Developed coastal sites</b>			
St Mildred's Bay, Westgate, Kent	Small resort with promenade and sandy beach	212,000	-
Cliftonville, near Margate Kent	Small resort with clifftops and a mainly sandy beach	146,000	136,000
Corton, near Lowestoft, Suffolk	Small village resort with cliffs and partly sandy beach	97,000	75,000
<b>River sites</b>			
Local park	Park drawing visitors from 800m radius with no special attractions	30,000	60,000
'Honey pot' site, country park	Site drawing visitors from a 3 km radius	60,000	250,000
* At all these sites, both coastal and riverine, almost all the visits involved informal use of the site for activities such as sitting, sunbathing and picnicking, strolling, dog walking, and, at coasts, playing informal games, playing in the sand and swimming or paddling. Very few visits involved specialist uses such as angling or boating or sailboarding.			

**Table 8.3** £ gains and losses per adult visit with coastal protection scheme options at coastal sites

		£ per adult visit updated to 2023	
		Mean gain with options	Mean loss with 'Do nothing'
<b>Beach and promenade erosion</b>			
Yellow Manual Standard data: 4 sites	Nourished beach and promenade	3.83	9.22
Lee-on-Solent	(a) Shingle beach renourishment	2.20	4.75
	(b) Rock groynes with shingle beach renourishment	2.15	
Herne Bay Visitors Centre	(a) Reef or jetty with no boat facilities	6.46	8.87
	(b) Reef or jetty with boat facilities	3.35	
	(c) Higher seawall, and promenade, rock groynes	-4.14	
Cliftonville	(a) Concrete lower promenade	5.76	8.87
	(b) Rock lower promenade	3.40	
Corton	(a) Hold the line for a limited period. Short term protection to cliff, limited access to beach and along seawall	3.30	3.33
	(b) Hold the line for a longer period >50 years. Full access along renewed seawall and onto all the beach from village	14.78	
	(c) Managed retreat. Sea defences and seawall removed to leave a 'natural' seafront', direct access from village to beach	2.31	
St Mildred's Bay	Improved beach and promenade	3.61	13.29
Hastings	Beach improvement	0.00	9.40
<b>Breach Scenarios</b>			
Hengistbury Head	(a) 5 rock groynes full cliff protection	0.05	5.54
	(b) 3 rock groynes partial protection	-3.11	
	(c) Beach nourishment Annual disruption	-4.66	
Hurst Spit	Slightly enlarged shingle spit	0.86	8.35

NB. This is Table 8.7 in the MCM 2013

**Table 8.4** £ value of losses and gains per visit for various changes at river sites

Site	£ mean value of loss: updated to 2023	£ mean value of gain: updated to 2023
<b>River Misbourne: Low flows</b>		
Visitors	5.87	3.42
Residents	5.85	2.91
<b>River Wey: Low flows</b>		
Residents		3.33
<b>River Ravensbourne: Full River restoration</b>		
Visitors and residents		3.07
<b>River Skerne: River restoration</b>		
Residents		3.89

NB. This is Table 8.8 in the MCM 2013

# 9 *Appraisal of flood risk management for agriculture*

## *Figures and tables*

**Figure 9.1:** Flooding and drainage factors influencing agricultural productivity on floodplain

**Table 9.1:** Tolerance of flooding according to agricultural land use

**Table 9.2:** Drainage conditions for agriculture and water levels in fields and ditches

**Table 9.3:** Common farming performance field drainage conditions (England and Wales)

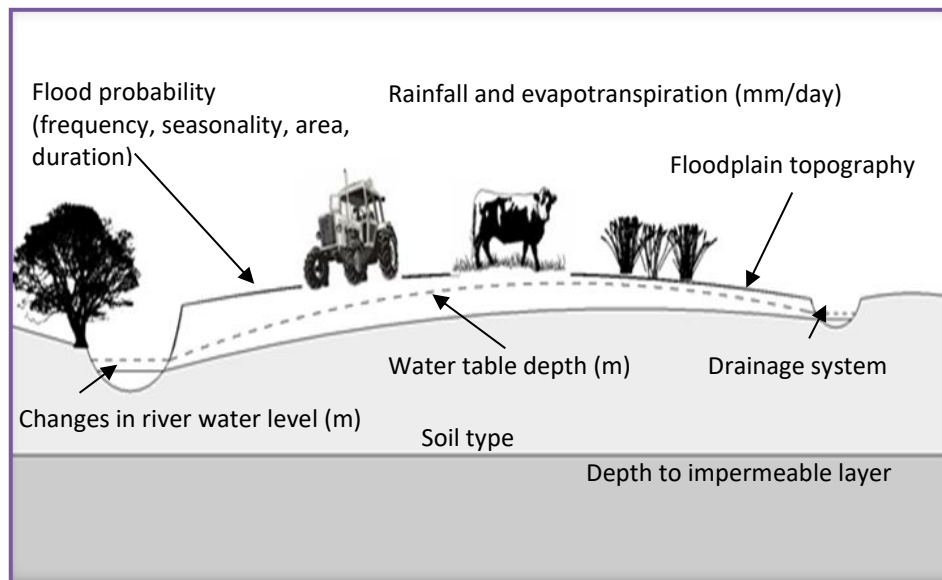
**Table 9.4:** The Impacts of flooding on farm land vary according to type of agricultural land use and

**Table 9.5:** Indicative Financial and Economic Gross Margins and Net Margins for Selected Crop and Livestock Enterprises and Systems

**Table 9.6:** Defra advise that different assumptions are made for alternative agricultural flood defence scenarios

**Table 9.7:** Estimated cost of a single annual flood and indicative average annual damage flood costs by land use and drainage condition, all England

**Figure 9.1** Flooding and drainage factors influencing agricultural productivity on floodplain



**Table 9.1** Tolerance of flooding according to agricultural land use

Agricultural land use Type	Common minimum acceptable flood frequency: annual probability	
	Whole Year	Summer April-October
Horticulture	5%	1%
Intensive arable including sugar beet and potatoes	10%	4%
Extensive arable: cereals, beans, oil seeds	10%	10%
Intensive grass: improved grass, usually dairying	50%	20%
Extensive grass, usually cattle and sheep	≥100%	33%

**Table 9.2** Drainage conditions for agriculture and water levels in fields and ditches

Agricultural drainage condition	Agricultural productivity class	Depth to water table from surface	Spring time freeboards in water-courses (natural drainage)	Spring time freeboards in water-course (field drains)
Good: 'rarely wet'	Normal, no impediment imposed by drainage	0.5 m or more	1 m sands,	1.2m clays to 1.6m sands (0.2m below pipe outfall)
			1.3 m peats	
			2.1 m clays	
Bad: 'occasionally wet'	Low, reduced yields, reduced field access and grazing season	0.3 m to 0.49 m	0.7 m sands	Temporarily submerged pipe outfalls
			1 m peats	
			1.9 m clays	
Very bad: 'commonly or permanently wet'	Very low, severe constraints on land use, much reduced yields, field access and grazing season: mainly wet grassland	Less than 0.3 m	0.4 m sands	Permanently submerged pipe outfalls
			0.6 m peats	
			1 m clays	



**Table 9.3** Common farming performance field drainage conditions (England and Wales)

£ 2019 Values	Field Drainage Conditions		
	Good	Bad	Very Bad
<b>Arable</b>			
Yield as % of 'good' category			
Winter wheat and barley	100	80	50
Spring wheat and barley	100	90	80
Oil seed rape	100	90	80
Potatoes, Peas, Sugar Beet	100	60	40*
Typical wheat financial gross margin £/ha	£800-£900	£380-£480	£200-£300
<b>Grassland</b>			
Typical nitrogen use on grass kgN/ha	150 - 200	50 – 75	0 - 25
Grass conservation	2 cut silage	1 cut silage or graze	1 cut hay or graze
Typical stocking rates; Live-stock units/ha	1.7 - 2.0	1.2 - 1.4	0.7 - 1.0
Typical livestock type	Dairy, intensive beef and sheep	Beef cows, 24 month beef, sheep	Fattening of 'store' cattle, and sheep
Typical financial gross margins £/ha (after forage costs)	£1770-£1,970 (dairy) £500-£900 (intensive beef/sheep)	£390-£590	£190-£390
Days reduction in grazing season compared to 'good' category	none	Spring: 14 to 21 Autumn: 14 to 21	Spring: 28 to 42 Autumn: 28 , no stock out in winter

**Notes:**

Livestock units: dairy cow, 1 Lu; beef cow, 0.8 Lu; 24 month beef, 0.7 Lu; sheep plus lamb, 0.14 Lu.

A grazing day is worth about £2.2/Lu in spring, £1.6 /Lu in autumn, and £0.40/Lu in winter in terms of savings in housing costs and feed conservation costs. \*not grown if persistently 'very bad'.

**Table 9.4** *The Impacts of flooding on farm land vary according to type of agricultural land use and the seasonality of the flood event*

	Spring	Summer	Autumn	Winter
	March – May	June- August	September – November	December – February
<b>Horticulture (soft fruits, salad crops)</b>	Complete loss of soft fruits and winter /spring salads	Complete loss of annual production, possible loss of perennial stock	Loss of late season harvest, possible loss of perennial stock: replanting/reseeding	Damage to standing crops, annuals /perennials
<b>Intensive Agriculture (including field vegetables &amp; roots)</b>	Delay in planting or loss of established crops	Likely complete loss of standing root crops eg potatoes/onions/carrots	Loss of unharvested autumn crops, notably potatoes. Delayed planting or loss of winter crops, substituted by spring sown crops	Possible loss of winter harvest crops (sprouts, and sugar beet). Yield loss on autumn sown crops
<b>Extensive arable (cereals and oil seeds)</b>	Loss or delay of spring sown cereals, yield loss on winter sown cereals, delayed spring treatments	Complete or partial loss of unharvested crops	Loss of unharvested autumn crops. Delayed planting or loss of winter crops, substituted by spring sown crops	Yield loss on autumn sown crops, reseeding with spring sown crops if severe damage
<b>Grassland: intensive (mainly dairy)</b>	Loss of grass yields, delayed stock turnout, delay fertiliser applications. Grass reseeding if long duration flooding	Loss of grass yields, partial or complete loss of hay/silage crop, loss of grazing, stock morbidity/mortality. Grass reseeding if long duration flooding	Loss of autumn grazing, stock relocation /housing. Possible reseeding if long duration.	Loss of winter 'accommodation' pasture.
<b>Extensive (mainly beef and sheep)</b>	Loss of grass yields, delayed stock turnout, delayed fertiliser applications.	Loss of grass yields, partial or complete loss of hay/silage crop, loss of grazing, stock morbidity/mortality.	Loss of autumn grazing, stock relocation /housing.	Limited impact on flood tolerant grass swards

NB. This is based on Table 9.4 in the MCM 2013

**Table 9.5** Indicative Financial and Economic Gross Margins and Net Margins for Selected Crop and Livestock Enterprises and Systems

	£ 2019 values		Winter wheat <sup>1</sup>	Extensive arable <sup>2</sup>	Intensive arable <sup>3</sup>	Dairy cows <sup>4</sup>	Beef & Sheep <sup>5</sup>
<b>Financial assessment</b>							
<i>a</i>	<i>Gross Output</i>	£/ha	1355	1301	2581	3512	1343
<i>b</i>	<i>Variable Costs</i>	£/ha	481	449	996	1453	580
<i>c</i>	<i>Gross Margin (a - b)</i>	£/ha	874	852	1584	2059	763
	<i>Fixed Costs</i> <sup>6</sup>						
<i>e</i>	<i>Semi-fixed Costs</i>	£/ha	251	245	371	533	276
<i>f</i>	<i>Total Fixed Costs</i>	£/ha	687	687	897	1403	747
<b>Net Margin</b>							
	<i>After semi fixed costs (c - e)</i>	£/ha	622	607	1214	1526	488
	<i>After full fixed costs (c - f)</i>	£/ha	187	166	687	656	17
<b>Economic Assessment</b>							
	Economic adjustment <sup>7</sup>		None	Minor subsidy removal	High value crops treated as wheat	Dairy area treated as wheat <sup>6</sup>	None
<i>g</i>	<i>Adjusted Gross Margin</i>	£/ha	874	852	874	874	763
	<i>Adjusted Net Margin</i>						
	<i>After semi fixed costs (g - e)</i>	£/ha	622	607	622	622	488
	<i>After full fixed costs (g - f)</i>	£/ha	187	166	187	187	17

**Notes:**

Some minor rounding errors

1 Assumes 9 t/ha

2 Assumes wheat 70%, oil seed rape, 20%, beans 10% by area.

3 Assumes wheat 66%, sugar beet 17%, potatoes and vegetables 17% y by area

4 Assumes dairy at 2 cows/ha stocking rate representing intensive grassland

5 Assumes beef suckler cows, beef fatstock and sheep in equal proportions by area, representative of extensive grassland

6 Land rent or land purchase costs are omitted from economic analysis

7 Dairy grassland area and high value crops are treated equivalent to a wheat crop

This is based on Table 9.9 in the MCM 2013, updated to 2019 prices (Defra, 2019)

2013 prices weighted by ratio of average of 2011-13 to average of 2017-2019 (2015=100)

Defra (2019) Agricultural Price Index. (published March 2019), <https://www.gov.uk/government/statistics/agricultural-price-indices>

Regional and local estimates vary according to circumstances and practices

Refer to Tables 9.8 and 9.9 in MCM 2013 (Penning-Rowsell *et al.*, 2013) for more detail.

**Table 9.6** Defra advise that different assumptions are made for alternative agricultural flood defence scenarios\*

	Scenario I	Scenario II	Scenario III
	Land lost to agriculture	Temporary, one-off loss of agricultural output	Permanent change in the value of agricultural output
All agricultural land use	Loss equivalent to market value of land less £600/ha to reflect 'single payment' subsidies where received (no adjustment on land for fruit and vegetables)		
<b>Crops:</b> Cereals; oilseeds; beans/peas. <b>Grassland:</b> Beef and sheep		Loss of Gross Margins per ha (adjusted for possible savings in costs), plus clean-up costs	Change in Net Margins associated with change in flood and land drainage conditions
<b>Other:</b> Dairy; sugar beet; potatoes; high value fruit/vegetables		As above, treated as though area occupied by wheat	As above, treated as though area occupied by wheat

\* Following Defra Guidance, 2008 (See also Tables 9.4 and 9.5 above)

**NB.** This is Table 9.16 in the MCM 2013

**Table 9.7** Estimated seasonally weighted cost of a single annual flood and indicative average annual damage flood costs by land use and drainage condition, all England and Wales monthly distribution of flooding (2019 prices)

	Drainage condition	Cost of a single annual flood £/ha	Indicative flood return period by land use, years	Average annual cost of flood damage according to indicative return period, £/ha
1. Extensive grass	Good	98	1	98
	Bad	79	0.75	105
	Very Bad	49	0.5	98
2. Intensive Grass	Good	177	3	59
	Bad	49	2	25
3. Grass/Cereal Rotation	Good	402	8	50
	Bad	311	5	62
4. All Cereal	Good	632	8	79
	Bad	451	5	90
5. Extensive Arable	Good	652	8	82
	Bad	480	5	96
6. Intensive Arable	Good	1154	10	115

**Notes:**

Some minor rounding errors

This is Table 9.20 in the MCM 2013