HANDBOOK FOR ECONOMIC APPRAISAL 2024

FLOOD AND COASTAL EROSION RISK MANAGEMENT



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4 Residential Properties

Tables and figures

Table 4.1 Categories of flood water

Category of Water	Description
Major clean/grey (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).
Minor black (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.
Major flood/storm (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.
Major Flood including sewage (IICRC category 3)	Water is grossly contaminated: As 'Major flood/storm', but with the inclusion of animal and human waste materials.
Major Flood 'Contaminated' (IICRC Special situations)	Water may contain regulated hazardous waste (as per Technical Guidance WM2, see: https://www.gov.uk/how-to-classify-different-types-of-waste), 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 (2024 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 £6,832 (2023 ownership values)	Vehicle Damages: number of vehicles at risk above 0.39m x £5,600 (2021 value)
Intangible method of assessment	Health: £296 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 (£1,469) plus alternative accommodation costs (£4,202) (2024 value)	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) (2024 values) assuming variable threshold Standards of Protection (SoP)

Existing SoP	No warning (£)	<8 hour warning (£)	>8 hour warning (£)
No protection	5,647	5,602	5,590
2 years	5,647	5,602	5,590
5 years	3,390	3,361	3,354
10 years	1,731	1,716	1,712
25 years	828	821	819
50 years	349	347	346
100 years	88	87	87
200 years	44	43	43

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 (2024 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**	£369	£364	£339	£259	£124	£43	£20	£8
	0.1	**-10**	£363	£356	£331	£251	£115	£36	£13	£0
	0.05	**-20**	£348	£341	£319	£239	£101	£23	£0	-
	0.033	**-30**	£327	£320	£296	£216	£80	£0	-	-
	0.02	**-50**	£245	£240	£215	£136	£0	-	-	-
	0.013	**-75**	£111	£105	£80	£0	-	-	-	-
	0.01	**-100**	£31	£25	£0	-	-	-	-	-
	0.008	**-125**	£7	£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 (2024)

Region/Country	All residential	Detached	Semi detached	Terrace	Flat
England	£299,245	£459,879	£288,261	£246,557	£248,922
Scotland	£186,788	£329,472	£198,601	£157,347	£130,312
Wales	£212,533	£319,525	£207,333	£166,934	£138,162
Northern Ireland	£176,586	£272,395	£170,641	£122,105	£130,602
North East	£158,574	£267,142	£162,164	£129,223	£104,976
North West	£213,027	£361,795	£228,205	£165,053	£149,980
Yorkshire & Humberside	£205,688	£331,374	£206,736	£163,834	£137,413
West Midlands	£245,943	£400,281	£243,087	£196,051	£148,310
East Midlands	£242,828	£353,128	£225,792	£184,771	£137,122
East of England	£337,876	£515,587	£349,596	£285,527	£206,954
South West	£315,799	£493,605	£326,897	£266,243	£192,721
South East	£376,911	£657,104	£409,695	£320,510	£222,398
London	£516,571	£1,035,004	£669,765	£561,976	£430,271

Source: https://landregistry.data.gov.uk/app/ukhpi/ (March 2023 - February 2024 average values)

5 Non-Residential properties

Tables and figures

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: **Environment Agency (2008) Economic evaluation of damages for Flood Risk Management projects, Environment Agency, Bristol**	
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^2)
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) (2024 values)

		Standard Of Protection						
MCM Code	**Sector Type**	**None**	**5**	**10**	**25**	**50**	**100**	**200**
2	Retail	93.09	46.00	33.53	17.23	7.69	1.93	0.96
3	Offices	91.17	41.94	31.64	15.82	6.96	1.75	0.87
4	Warehouses	104.55	55.12	39.89	20.23	9.16	2.29	1.15
5	Leisure and sport	NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE						
51	Leisure	210.98	72.63	57.82	26.25	11.26	2.82	1.41
52	Sport	NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE						
521	Playing Field	3.93	1.58	1.26	0.60	0.26	0.07	0.03
523	Sports Centre	48.53	21.00	16.07	7.82	3.41	0.86	0.43
526	Marina	17.55	8.04	5.89	3.00	1.32	0.33	0.17
525	Sports Stadium	12.30	5.99	4.41	2.25	1.00	0.25	0.12
6	Public Buildings	56.21	25.43	19.18	9.51	4.19	1.05	0.52
8	Industry	19.74	9.76	7.11	3.63	1.62	0.41	0.20
9	Miscellaneous	NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE						
910	Car park	6.06	2.70	2.00	1.01	0.44	0.11	0.06
960	SubStation	293.44	178.00	127.37	69.64	31.50	7.87	3.94
NRP sector average		97.04	50.77	37.20	19.64	8.93	2.34	1.17

Table 5.4 Business floor space: rateable value per m² of floor space (most recent available data, 31st March 2023)

Area	Main Category	Rateable value per m² of floor space
ENGLAND	Total	88.00
ENGLAND	Retail	161.00
ENGLAND	Offices	181.00
ENGLAND	Industrial	41.00
ENGLAND	Other	91.00
NORTH EAST	Total	54.00
NORTH EAST	Retail	124.00
NORTH EAST	Offices	75.00
NORTH EAST	Industrial	28.00
NORTH EAST	Other	58.00
NORTH WEST	Total	59.00
NORTH WEST	Retail	126.00
NORTH WEST	Offices	94.00
NORTH WEST	Industrial	31.00
NORTH WEST	Other	71.00
YORKSHIRE AND THE HUMBER	Total	55.0
YORKSHIRE AND THE HUMBER	Retail	130.00
YORKSHIRE AND THE HUMBER	Offices	88.00
YORKSHIRE AND THE HUMBER	Industrial	31.00
YORKSHIRE AND THE HUMBER	Other	64.00
EAST MIDLANDS	Total	52.0
EAST MIDLANDS	Retail	122.00
EAST MIDLANDS	Offices	80.00
EAST MIDLANDS	Industrial	35.00
EAST MIDLANDS	Other	64.00
WEST MIDLANDS	Total	59.0
WEST MIDLANDS	Retail	128.00
WEST MIDLANDS	Offices	99.00
WEST MIDLANDS	Industrial	36.00
WEST MIDLANDS	Other	75.00
EAST	Total	76.0
EAST	Retail	145.00
EAST	Offices	120.00
EAST	Industrial	46.00
EAST	Other	85.00
LONDON	Total	257.0
LONDON	Retail	170.00
LONDON	Offices	359.00
LONDON	Industrial	83.00
LONDON	Other	212.00
SOUTH EAST	Total	96.0
SOUTH EAST	Retail	136.00

SOUTH EAST	Offices	133.00
SOUTH EAST	Industrial	57.00
SOUTH EAST	Other	88.00
SOUTH WEST	Total	70.0
SOUTH WEST	Retail	109.00
SOUTH WEST	Offices	100.00
SOUTH WEST	Industrial	41.00
SOUTH WEST	Other	73.00

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

Tables and figures

Introduction: Prioritisation of losses for inclusion in project appraisal

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

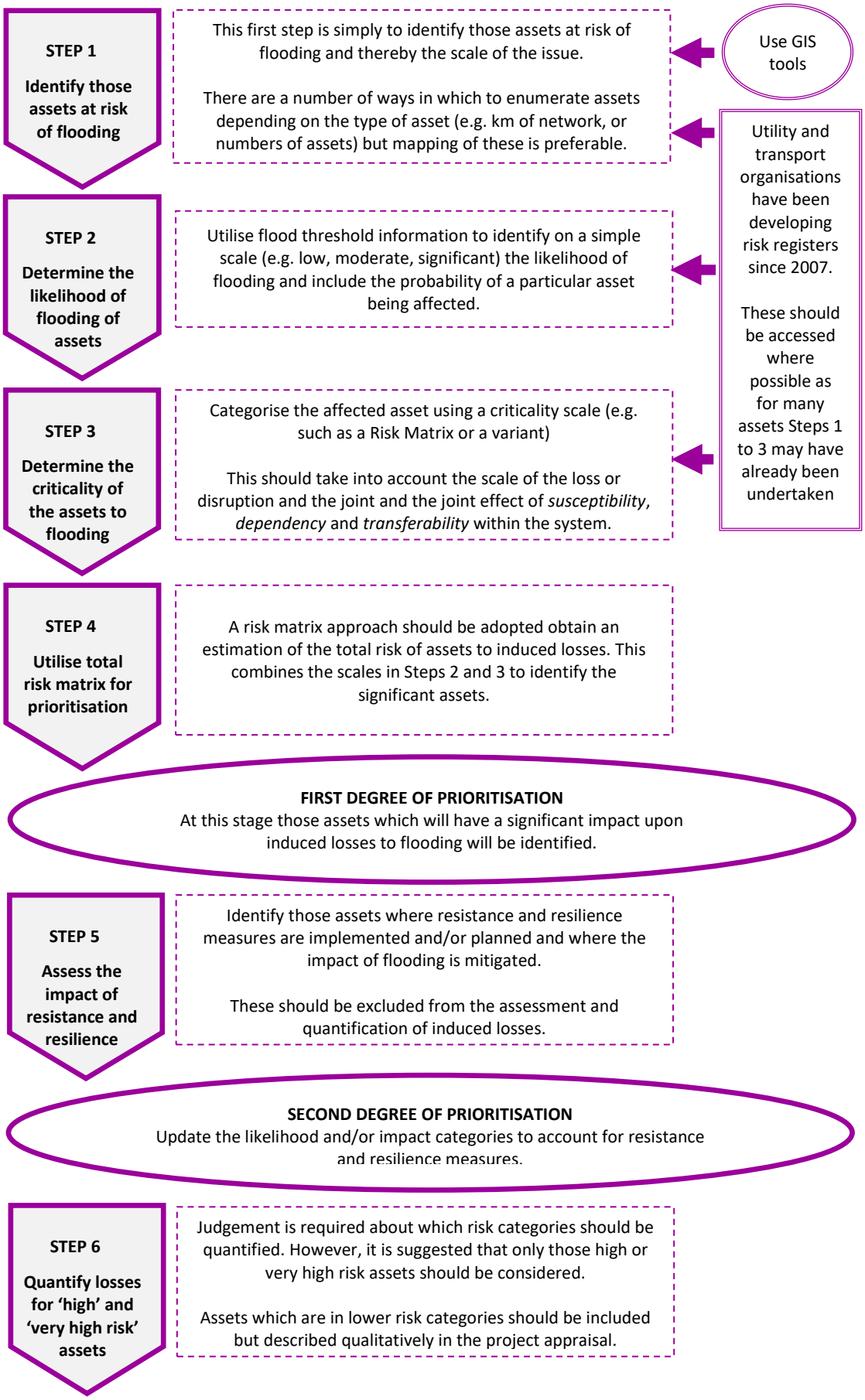

Table 6.1 Enumeration, descriptors and valuation measures to gauge the scale of the infrastructural risk

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**	*Significant*	Medium Risk	**High Risk**	**Very High Risk**
	Moderate	Low Risk	Medium Risk	**High Risk**
	Low	Negligible Risk	Low Risk	Medium Risk
		Very Low	*Low*	*Medium/High*
			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
Electricity transmission and distribution					
> 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]
Gas transmission					
Gas pressure stations	Medium	Medium	Low	1	Low
Gas pressure stations	Medium	Medium	Low	2	Medium
Water and waste water treatment					
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
Telecommunication systems					
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, accessed 08 April 2024.

* 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† > 10,000 unrecoverable connections	Primary Substation† < 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, 2023).

† 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 (2023) 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 9 August 2023, https://www.gov.uk/government/collections/climate-change-adaptation-reporting-third-round-reports#energy-companies, accessed 25 March 2024.

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 08 April 2024.

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, accessed 08 April 2024.

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 08 April 2024.

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 pant 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† – 2023 estimates

Annual Energy Consumption per household (Ofgem, 2023)	Daily Energy Consumption per household
2,700 kWh	7.4 kWh

Average gas consumption – 2023 estimates

Annual Gas Consumption per household (Ofgem, 2023)	Daily Gas Consumption per household
11,500 kWh	31.5 kWh

Willingness-to-pay* to avoid disconnection of supply for electricity (2024 values)

Willingness to pay to avoid disconnection – Domestic users (BERR, 2007)	Willingness to pay to avoid disconnection – Business users** (BERR, 2007)
£16.05 per kWh	£56.19 per kWh

The annual consumption per household figure is the medium Typical Domestic Consumption Value calculated by Ofgem (2023) – the higher or lower values might be used to provide a more conservative or maximum estimate and where more information is known about the type of property. TDCVs are industry standard values and are those recommended by the industry. The latest update was published on 23rd May 2023 and so the presented values are correct as of April 2024.
†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 11 April 2024.

Ofgem (2023) 'Typical Domestic Energy Consumption Values', https://www.ofgem.gov.uk/information-consumers/energy-advice-households/average-gas-and-electricity-use-explained revised 25th May 2024, accessed 11 April 2024.

Table 6.9 Risk matrix for sewage treatment works

IMPACT	*Sig: > 30,000 cumecs effluent dry weather flow*	Medium Risk	**High Risk**	**Very High Risk**
	Mod: 5,000 to 30,000 cumecs effluent dry weather flow	Low Risk	Medium Risk	**High Risk**
	Low: < 5,000 cumecs effluent dry weather flow	Negligible Risk	Low Risk	Medium Risk
		Very Low	*Low*	*Medium/High*
		LIKELIHOOD		

NB. This is Table 6.12 in the MCM 2013

Table 6.10 Risk matrix for water supply

IMPACT	*Sig: > 20,000 population supplied or PSL customers*	Medium Risk	**High Risk**	**Very High Risk**
	Mod: 5,000 to 20,000 population supplied	Low Risk	Medium Risk	**High Risk**
	Low: < 5,000 population supplied	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 2023 prices)

Total resource costs (pence per km)								
Speed (km/hr)	**5**	**10**	**20**	**40**	**50**	**80**	**100**	**120**
Car average p/km	342	173	91	51	43	29	26	23
LGV average p/km	401	208	111	62	53	40	38	35
OGV1 p/km	441	234	127	73	62	48	-	-
OGV2 p/km	563	306	172	104	90	72	-	-
PSV p/km	2533	1298	680	368	306	-	-	-

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, accessed 04 April 2024.

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
Urban dual carriageway				
With limited access and 80 kph limit	65	1400	2200	56
65 kph speed limit	50	600	1100	30
Urban single carriageway road				
outer area	45	500	1000	25
intermediate area	35	350	600	25
central business area	25	250	500	15
Suburban – major radial or outer ring roads				
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 an 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 2022-2023 (millions)	Passenger Journeys per 24 hours 2022-23 (averaged by dividing by 365)	Passenger kilometres 2022-2023 (millions)	Passenger train kilometres 2022-2023 (millions)	Route Kilometres operated 2022-2023
Avanti West Coast	26.6	72,837	5,095.9	23.8	1,310.0
c2c	33.8	92,534	774.5	5.9	125.5
Caledonian Sleeper	0.3	727	175.0	1.4	1,470.9
Chiltern Railways	19.3	52,977	1,051.3	9.1	349.2
CrossCountry	27.8	76,073	2,427.6	20.6	2,710.1
East Midlands Railway	25.5	69,992	2,197.4	22.7	1,490.3
Elizabeth line*	204.3	559,714	1,683.4	10.1	118.0
Govia Thameslink Railway	250.4	685,951	6,838.9	54.7	1,268.2
Grand Central	1.6	4,367	430.0	2.5	518.5
Great Western Railway	77.2	211,459	5,370.2	42.5	1,997.2
Greater Anglia	66.6	182,581	2,878.7	24.7	511.0
Heathrow Express	4.7	12,906	121.3	1.4	29.0
Hull Trains	1.1	3,151	261.0	1.5	344.4
London North Eastern Railway	23.4	64,202	5,586.1	22.0	1,514.5
London Overground	157.1	430,322	1,075.7	10.7	169.9
Lumo	1.1	3,140	537.4	2.0	629.6
Merseyrail	25.5	69,861	451.5	6.0	120.7
Northern Trains	81.4	222,912	2,473.3	44.4	3,158.0
ScotRail	63.7	174,482	2,051.7	38.8	3,120.5
South Western Railway	138.4	379,075	4,015.9	32.2	997.8
Southeastern	117.5	321,964	3,145.1	29.0	748.3
TfW Rail	23.2	63,447	977.3	21.5	1,826.6
TransPennine Express	19.2	52,720	1,402.1	12.0	1,312.3
West Midlands Trains	56.2	154,064	2,295.9	21.4	899.6

Source: Data downloaded from the ORR National Rail Trends Portal (2024)

NB: Train operating companies change as franchises generally operate over a fixed period. * These data have also changed since the MCM (2013) as the ORR National Rail Trends Portal no longer provide data on 'timetabled train kms', but rather on 'passenger train kms.'
*On 24 May 2022 the Elizabeth line opened to passengers. Also, on this date the service running under TfL Rail was rebranded as the Elizabeth line.

These data have been updated to the most recently available figures (2022/2023). It is recognised that rail journeys are still below pre-pandemic levels (ORR, 2024 suggests at 90% as for the same period in 2019, although vary regionally). However, data may now be more reflective of altered working and travel patterns. Strike action across the networks in the last quarter of 2022/23 have impacted the figures provided. These data were collected for the 2022/2023 period and operators may since have changed, it is suggested that users access the Rail Trends Portal at time of use.

Office of Rail Regulation (ORR) (2024) 'The National Rail Trends (NRT) Portal', http://dataportal.orr.gov.uk/, accessed 10 April 2024.

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 08 April 2024.

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, accessed 08 April 2024.

Table 6.17 Values of Time - based on the willingness to pay of each type of passenger per hour (2024 values)

	Value of time* (VoT) £ per hour		
	Business passenger	Commuter	Other passenger
Original values per hour	£52.31	£7.20	£6.34
Uplifted to account for an unexpected delay**	£156.94	£21.61	£19.01

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 (2024) GDP Deflator (March 2024).

** 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 04 April 2024.

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, accessed 04 April 2024.

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, accessed 04 April 2024.

HM Treasury (2024) '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-2024-quarterly-national-accounts, accessed 04 April 2024.

Table 6.18 ***Percentage breakdown of the journey purpose of rail travellers by Train Operating Company* and grouped train operators in 2024*****

Train Company	Commute	Business	Personal/Leisure
Avanti West Coast	33	13	53
c2c	45	6	49
Chiltern Railways	31	12	58
CrossCountry	31	11	58
East Midlands Railway	26	15	59
Elizabeth Line	39	8	53
Eurostar	15	20	65
Gatwick Express	23	8	69
Grand Central	32	13	55
Great Northern	19	13	68
Great Western Railway	30	10	60
Greater Anglia	31	12	56
Heathrow Express	29	16	54
Hull Trains	31	10	59
London North Eastern Railway	24	16	60
London Northwestern Railway	33	12	55
London Overground	38	10	52
Lumo	20	12	68
Merseyrail	24	7	68
Northern	28	7	64
ScotRail	35	6	59
South Western Railway	35	7	58
Southeastern	34	8	58
Southern	37	7	56
Thameslink	36	7	57
TransPennine Express	23	7	70
Transport for Wales	30	3	67
West Midlands Railway	32	9	58
Grouped train operators	**Commute**	**Business**	**Personal/Leisure**
Long distance operators	28	13	59
London and South East operators	34	9	57
Regional operators	30	6	63

Source: Passenger Focus (2024)

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 been updated to values provided by the Transport Focus *Rail User Survey* data. Surveys undertaken in the period March 2023 to Feb 2024 (inclusive) was utilised. Users can access the Transport Focus data for more specific information for the ToC or area of interest. Additionally, journeys in 2023/24 are likely to have been impacted by strike action.

Transport Focus (2024) 'National Passenger Survey data' https://transportfocusdatahub.org.uk/ accessed 10 April 2024.

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 accessed 10 April 2024.

Education and Health

Table 6.20 Estimates of the value of a lost day's work – 2024 estimates

Minimum estimate*	Average estimate
£76.14	£100.17

*The minimum estimate is calculated using the £11.44 per hour National Living Wage (April 2024) 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 2023 of £15.83 and a 7.6 hour working day (ONS, 2023).

The minimum estimate has been adjusted from gross pay values using HMRC (2024) to provide economic values net of Income Tax and National Insurance Contributions.

HMRC (2024) 'HMRC Tax Calculator', https://www.gov.uk/estimate-income-tax, accessed 08 April 2024.

Office for National Statistics (ONS) (2023) 'Annual Survey of Hours and Earnings, 2023 Provisional Results' ASHE: Table 6.6a, 01 November 2023, https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/agegroupashetable6, accessed 08 April 2024.

Table 6.21 Average cost(s) of a hospital bed

	Average bed cost in the NHS [1]	Average bed day cost for elective and admissions [2]]	Average bed day cost for non-elective admissions [2, 3]	Average bed day cost for critical care [2]
Average cost of a bed per day	£345	£2,349	£901	£1,881

These values have been presented by the Minister of State (Department of Health and Social Care) in a written response to a question raised in Parliament (Quince, 2023). They have been calculated using the 2020/21 NHS cost data.

[1] The standard bed costs the average cost of a bed day excluding any treatment costs.

[2] The figures for critical care and elective and non-elective beds include the cost of treatment.

[3] Patients who are admitted as non-elective admissions often spend longer in hospital (inc. recovery and waiting for discharge), so whilst the total costs for non-elective treatment is higher than elective treatment, the average day cost is reduced as it is spread over many more days.

NB: These data provide the most updated values for average bed cost provided by the NHS reference cost data. The latest updated publicly available National Schedule of NHS Costs data (2021/22) does not provide values for average bed costs. However, users are advised to check recent information to see if these have been updated https://www.england.nhs.uk/costing-in-the-nhs/national-cost-collection/

2020/2021 NHS National Cost Collection Data. https://www.england.nhs.uk/publication/2019-20-national-cost-collection-data-publication/ Accessed 12 April 2024.

Quince, W. (2023) Hospital Beds: Costs. Department of Health and Social Care written question – Question for Department of Health and Social Care UIN 165361, tabled on 14 March 2023 and answered on 30 March 2023. UK Parliament 2024 https://questions-statements.parliament.uk/written-questions/detail/2023-03-14/165361#. Accessed 12 April 2024.

Table 6.22 Indicative costs per patient transfer – 2012/13 estimates for mileage and 2021/2022 estimates for fixed and time costs.

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	£268	£390
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 in 2012/2013 values for the mileage costs. The Fixed costs and time costs have been updated using the 2021/22 NHS Reference costs (https://www.england.nhs.uk/costing-in-the-nhs/national-cost-collection/) based on the principles provided by the London Ambulance Service NHS Trust.

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**
Total Bellwin and roads:			
Bellwin	£30.20	42.5	£12.84
Roads infrastructure	£175.00	50	£87.50
Environment Agency costs+:			
Emergency repairs**	£14.80	50	£7.40
Emergency response	£2.20	100	£2.20
TOTAL	**£222.20**		**£109.94**
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

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-Rowsell 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-Rowsell 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-Rowsell 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**
Undeveloped coastal sites			
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
Developed coastal sites			
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
River sites			
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 2024	
		Mean gain with options	Mean loss with 'Do nothing'
Beach and promenade erosion			
Yellow Manual Standard data: 4 sites	Nourished beach and promenade	4.06	9.77
Lee-on-Solent	(a) Shingle beach renourishment	2.33	5.03
	(b) Rock groynes with shingle beach renourishment	2.28	
Herne Bay Visitors Centre	(a) Reef or jetty with no boat facilities	6.84	9.40
	(b) Reef or jetty with boat facilities	3.55	
	(c) Higher seawall, and promenade, rock groynes	-4.38	
Cliftonville	(a) Concrete lower promenade	6.10	9.40
	(b) Rock lower promenade	3.60	
Corton	(a) Hold the line for a limited period. Short term protection to cliff, limited access to beach and along seawall	3.50	3.52
	(b) Hold the line for a longer period >50 years. Full access along renewed seawall and onto all the beach from village	15.66	
	(c) Managed retreat. Sea defences and seawall removed to leave a 'natural' seafront', direct access from village to beach	2.45	
St Mildred's Bay	Improved beach and promenade	3.82	14.08
Hastings	Beach improvement	0.00	9.96
Breach Scenarios			
Hengistbury Head	(a) 5 rock groynes full cliff protection	0.05	5.87
	(b) 3 rock groynes partial protection	-3.29	
	(c) Beach nourishment Annual disruption	-4.94	
Hurst Spit	Slightly enlarged shingle spit	0.91	8.84

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
River Misbourne: Low flows		
Visitors	6.22	3.63
Residents	6.20	3.08
River Wey: Low flows		
Residents		3.52
River Ravensbourne: Full River restoration		
Visitors and residents		3.25
River Skerne: River restoration		
Residents		4.12

NB. This is Table 8.8 in the MCM 2013

9 Appraisal of flood risk management for agriculture

Tables and Figures

Figure 9.1 Flooding and drainage factors influencing agricultural productivity on floodplains in England and Wales

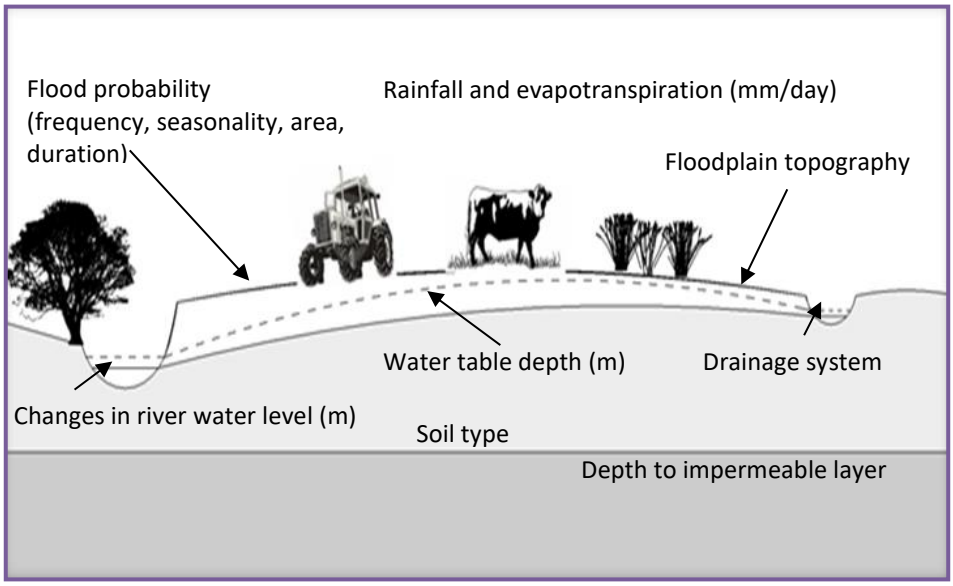

Table 9.1 General tolerance of flooding by agricultural land use in England and Wales

Agricultural land use Type	Common minimum acceptable flood frequency: annual probability	
	Whole Year	April-October
Horticulture and field scale vegetables	5%	1%
Intensive arable including sugar beet and potatoes	7%-10%	4%
Extensive arable: cereals, beans, oil seeds	10%-15%	7%-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 In England and Wales

Agricultural drainage condition	Agricultural productivity class	Depth to water table from surface	Springtime freeboard [1] in water-courses (natural drainage)	Springtime freeboard [1] in water-course (field drains)
Good: 'rarely wet'	Normal, no impediment imposed by drainage	0.5 m or more	1 m sands 1.3 m peats 2.1 m clays	1.2m clays to 1.6m sands (0.2m below pipe outfall)
Bad: 'occasionally wet'	Low, reduced yields, reduced field access and grazing season	0.3 m to 0.49 m	0.7 m sands 1 m peats 1.9 m clays	Temporarily submerged pipe outfalls
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 0.6 m peats 1 m clays	Permanently submerged pipe outfalls

Notes to table:
1. Freeboard refers to the mean difference between water level and adjacent field level

Table 9.3 Common farming performance and field drainage conditions in England and Wales

£ 2024 Values	Field Drainage Conditions		
	Good	**Bad**	**Very Bad**
Arable			
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[1]
Wheat financial gross margin [2] £/ha/year	£1,200-£1,500	£800-£1,000	£330-£430
Grassland			
Typical nitrogen use kg N/ha/year	150 - 200	50 – 75	0 - 25
Grass conservation	2 cut silage	1 cut silage or graze	1 cut hay or graze
Typical stocking rates [3]; Livestock units/ha/year	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
Financial gross margins[2] £/ha/year (after forage costs)	£2,200-£3,000 (dairy) £600-£950 (intensive beef/sheep)	£430-£630	£250-£430
Days reduction in grazing season compared to 'good' category[4]	none	Spring: 14 to 21 Autumn: 14 to 21	Spring: 28 to 42 Autumn: 28, no stock out in winter

Notes to table:
1. Not grown if persistently 'very bad'.
2. Gross Margins estimates based on Defra Farm Business Survey data 2018/19 to 2022/23, weighted by GDP deflators to 2024 prices, see Table 9.5
3. Livestock units (Lu): dairy cow, 1 Lu; beef cow, 0.8 Lu; 24-month beef, 0.7 Lu; sheep plus lambs, 0.14- 0.17 Lu.
4. A grazing day is worth about £3.2/Lu in spring/summer, £1.6/Lu in autumn, and £0.8/Lu in winter in terms of savings in housing costs and feed conservation costs.

Table 9.4 The Impacts of flooding on farmland by type of agricultural land use and the seasonality of flooding in England and Wales

	Spring	Summer	Autumn	Winter
	March – May	**June- August**	**September – November**	**December – February**
Horticulture (soft fruits, salad crops)	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
Intensive Agriculture (including field vegetables & roots)	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
Extensive arable (cereals and oil seeds)	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
Grassland: intensive (mainly dairy)	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.
Extensive (mainly beef and sheep)	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

Table 9.5 Estimated Financial and Economic Gross Margins and Net Margins (£/ha/year, 2024 prices) for wheat and selected farm types in England

	£ 2024 values		Winter Wheat[3]	Cereals (Extensive Arable)	General Cropping (Intensive Arable)	Dairy (Intensive Grass)	Lowland Grazing (Extensive Grass)
	Financial assessment [1,2]						
a	*Gross Output*	*£/ha/year*	1,954	1,452	1,908	4,793	988
b	*Variable Costs*	*£/ha/year*	627	590	825	2,509	515
c	*Gross Margin (a-b)*	*£/ha/year*	1,327	862	1,083	2,284	473
	Fixed Costs (including rent, excluding unpaid labour)						
d	*Semi-fixed Costs*	*£/ha/year*	306	250	334	599	205
e	*Total Fixed Costs*	*£/ha/year*	847	708	934	1704	588
	Financial Net Margin[4]						
f	*After semi fixed costs (c-d)*	*£/ha/year*	1,021	612	749	1,685	268
g	After full fixed costs (c-e)	*£/ha/year*	480	154	149	580	-115
	Adjustment to Financial Net Margin [5]						
h	Plus Farm rents	*£/ha/year*	127	106	154	250	84
i	Less unpaid family labour	*£/ha/year*	168	140	106	394	365
j	Subtotal (h-i)	*£/ha/year*	-42	-35	48	-144	-281
	Adjusted Financial Net Margin (excluding income subsidies)						
k	after semi fixed costs (f+j)	*£/ha/year*	979	577	797	1541	-13
l	After full fixed costs (g+j)	*£/ha/year*	438	119	197	436	-395
	Economic Assessment [6]						
	Adjustment for high value crops and dairy		None	None	High value crop area treated as wheat	Dairy area treated as wheat	None
	Gross Margin (c weighted by wheat area)	*£/ha/year*	1,327	862	1,132	1,156	473
	Net Margin						
	After semi fixed costs (k weighted by wheat area)	*£/ha/year*	979	577	833	780	-13
	After total fixed costs (l weighted by wheat area)	*£/ha/year*	438	119	245	271	-395
	Range high [7]	*£/ha/year*	657	179	368	407	-198
	Range low	*£/ha/year*	219	60	123	136	-593

Notes to table:

1. Estimated mean annual values in 2024 prices derived from Regional Farm Business Survey (FBS) mean annual values, for England (all farms by type) 2018/19 to 2022/23. weighted by GDP deflators (ONS, 2024)
2. Farm type classifications are based on the proportion of Total Output by value attributable to given enterprises, where more than 67% of total output by value is attributable to particular crop or livestock enterprises, namely Cereals (cereals and combinable crops such as field peas and beans, and oils seeds), General Cropping (arable crops including field scale vegetables), Dairy (milk production) and Grazing Livestock (beef and sheep).

3. Wheat: average yields 8.6 t/ha (2018/19 - 2022/23), average price 2024 (weighted) £217/t. The 10-year (2014/15-2023/24) GDP weighted price for wheat is £212/t in 2024 prices. Average total fixed costs (£/ha/year) for Winter Wheat are about 20% higher than the overall average for Cereals farms based on FBS crop production data.
4. Net margins here are the same as the Farm Business Income estimates derived by the Farm Business Survey and used in reporting Farm Incomes (Defra, 2024a). Net margins here show the financial returns generated by 'agricultural' activities, excluding income from subsidies and other sources, including land rents paid and paid wages and salaries but excluding charges for family labour. Basic Payment Scheme direct income subsidies averaged £117/ha/year in 2024 for eligible land. Agri-environment payments currently average about £40/ha/year on Lowland Grazing Livestock Farms.
5. For economic analysis, land purchase and/or rental costs are excluded, and unpaid familiar labour is included at equivalent cost. No deduction has been made here for National Insurance costs on labour, averaging about 10% of labour costs.
6 For economic analysis, the areas given to high value cropping and dairy production are treated as equivalent areas of a wheat crop. About 20% of cropping on General Cropping farms comprises high value root and field vegetable crops. About 80% of the area on Dairy farms directly supports milk production with the balance is for livestock rearing and fattening. These proportions can be treated as wheat equivalents. Detailed assessment of enterprise types and performance is recommended to allow for local variation.
7. The high to low range in estimated Net Margin is approximately +/-50% of the central estimate reflecting top and bottom quartile means and variations of between a 12% and 15% change in either Gross Output or Total Costs (£/ha/year).

Table 9.6 Defra guidance for the appraisal of alternative agricultural FCERM scenarios [1]

	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 (2008 prices) [2] to reflect 'single payment' subsidies where received (no adjustment on land for fruit and vegetables)		
Crops: Cereals; oilseeds; beans/ peas. **Grassland:** Beef and sheep		Loss of Gross Margins £/ha/year (adjusted for possible savings in costs), plus clean-up costs	Change in Net Margins £/ha/year associated with change in flood and land drainage conditions
Other: 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

Notes to table:
1. Following Defra (2008) Guidance (See also Tables 9.4 and 9.5 above)
2. £875/ha in 2024 prices

Table 9.7 Estimated economic cost of freshwater and saline flooding (£/ha in 2024 prices) for a single event of a given duration in weeks by land use and associated farm types in England

	Drainage condition	Freshwater flooding and duration [3]		Saline flooding and duration [2]	
Land Use Type [1, 2]		**1 to 2 weeks**	**2 to 4 weeks**	**1 to 2 weeks**	**2 to 4 weeks**
1. Extensive Grass. Lowland Grazing livestock	Good	75	272	361	883
	Bad	64	232	334	822
	Very Bad	39	162	99	229
2. Intensive Grass. Mainly Dairy	Good	114	406	438	1,091
	Bad	78	353	383	1,008
3. Grass/Cereal Rotation. Dairy/Cereal mixed	Good	355	824	687	1,380
	Bad	229	552	503	1,069
4. All Cereal	Good	596	1241	937	1,669
	Bad	379	751	623	1,130
5. Extensive Arable, crops harvested by combine harvester	Good	601	1265	937	1,652
	Bad	388	781	665	1,169
6. Intensive Arable with root crops (sugar beet and potatoes)	Good	930	1,573	1,233	2,568
7. Intensive Arable with specialist root crop and field scale vegetable production	Good	2,311	3,218	3,572	6,362

Notes to table:

1. Indicative associated Agricultural Land Classification Grade (ALC) by land use are as follows. Land use 1: ALC 4. Land use 2 and 3: ALC 3a and b. Land use 4 and 5: ALC 3a. Land use 6: ALC 2. Land use 7: ALC 1.
2. Average arable crop yields for land use and ALC associations are assumed relative to ALC 3, at + 15% for ALC 1, +10% for ALC 2 and -15% for ALC 4, but local conditions vary substantially and should be checked.
3. Assumes monthly distribution of flood probability for all England, with weighted monthly flood costs that vary according to land use and estimated monthly loss and damage to crops and livestock according to production cycles

Table 9.8 Estimated economic cost of flooding (£/ha in 2024 prices) in England for a single event of a given duration in weeks by Agricultural Land Classification (ALC) Grade and associated agricultural land use.

ALC grade [1]		Intensive Arable with root and vegetable crops	Intensive Arable with root crops (sugar beet and potatoes)	Extensive Arable: mainly cereals and oils seeds	Intensive Grass: mainly Dairy	Extensive Grass: mainly beef and sheep	Average Flood costs £/ha/event [2]
1	% of area	15	75	10			
	1 to 2 weeks	£2,310	£970	£665			£1,140
	2 to 4 weeks	£3,220	£1,635	£1,420			£1,750
2	% of area	5	60	35			
	1 to 2 weeks	£2,210	£930	£645			£895
	2 to 4 weeks	£3,080	1,570	£1,360			£1,595
3a	% of area		30	70			
	1 to 2 weeks		£860	£600			£680
	2 to 4 weeks		£1,450	£1,265			£1,320
3b	% of area			50	50		
	1 to 2 weeks			£570	£130		£350
	2 to 4 weeks			£1,190	£460		£825
4	% of area			20	40	40	
	1 to 2 weeks			£540	£115	£75	£180
	2 to 4 weeks			£1,120	£410	£270	£495
52	% of area					100	
	1 to 2 weeks					40	£40
	2 to 4 weeks					160	£160

Notes to table: (estimates are rounded)

1. Broad indicative associations of land use and farm type by ALC Grade for England are assumed that should be verified locally. Flood costs (£/ha) reflect difference in normal yields by ALC Grade relative to ALC Grade 3, namely: ALC Grade 1, 115%; Grade 2, 110%; Grade 3, 100%; Grade 4, 85%.
2. Monthly distributions of flood probability for all England are assumed, with weighted monthly flood costs that vary according to land use and crop, grassland and livestock production cycles.

Table 9.9 A simple example of the economic assessment of flood induced agricultural land use change

		Existing FCERM service	Future FCERM options	
			Option 1: Do Minimum	Option 2: Do Nothing
Flood return period (years) [1]		20	8	1
Land Use		General Cropping	Extensive Arable	Extensive Grass
Drainage condition		Good	Good	Bad
Net Margin [2]	£/ha/year	245	119	-395
Flood cost [3]	£/event	930	596	64
Annual flood cost [4]	£/ha/year	46	75	64
Net Margin less flood costs	£/ha/year	199	45	-459
Change in net benefits relative to Existing FCERM service [5, 6]	£/ha/year		-154	-658

Notes to table:

1. Based on Table 9.1
2. Based on economic Net Margins by land use in Table 9.5
3. Based on Table 9.7, single annual event, duration 1 to 2 weeks
4. A simple average cost for a single flood event is assumed for illustrative purposes rather than a complete estimate of Average Annual Damage (AAD) costs
5. Indicative changes in net annual economic benefits to agriculture at full implementation of FCERM scenario
6. Extensive Grassland Net Margin excludes potential annual agri-environment benefits that should be factored in.

Table 9.10 Weights applied to central estimates of the cost of a single flood occurring in a year (£/ha) to derive estimates of the seasonal cost of flooding on agricultural land in England and Wales

Flood season[1] and duration	Intensive and Extensive Arable		Intensive and Extensive Grass		Rough Grazing	
	Freshwater	Saline	Freshwater	Saline	Freshwater	Saline
1 to 2 weeks						
Winter	0.47	0.71	0.44	1.20	0.49	0.74
Spring	1.21	1.15	2.50	1.76	1.18	2.00
Summer	2.71	1.91	1.75	1.21	1.28	1.12
Autumn	1.38	1.19	1.07	1.37	0.42	0.80
2 to 4 weeks						
Winter	0.69	0.81	0.52	1.18	0.42	0.63
Spring	1.31	1.20	2.32	1.86	1.20	1.79
Summer	1.69	1.45	2.13	1.41	1.00	1.00
Autumn	1.21	1.12	0.80	1.29	0.42	0.63

Notes to table:

1. Winter: December to February inclusive. Spring: March to May. Summer: June to August. Autumn: September to November.