

4.1.9 Flooding



The impact pathway

BGI can reduce flood risk in different ways. Reducing flood risk is the primary objective of NFM schemes (EEA, 2017). One of the functions of SuDS is to manage rain as close as possible to where it falls, reducing the volume and flows of runoff entering the drainage system. Depending upon the design, conveyance and storage techniques, this can reduce the frequency and/or severity of flooding if the scale and size of the measures can accommodate larger rainfall events. This in turn leads to a number of benefits (e.g. reduced damage to property, avoided stress and anxiety), as Figure 4-12 shows.

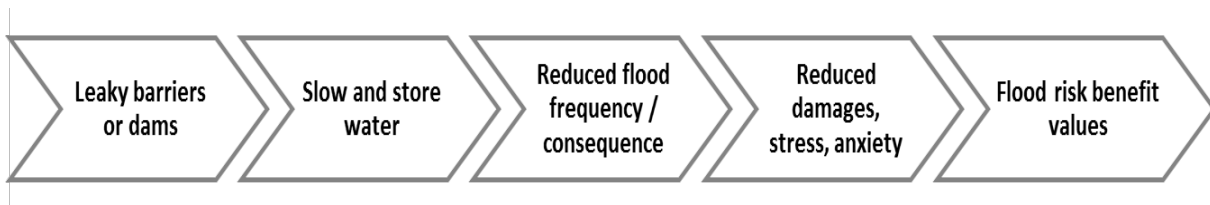


Figure 4-12 Impact pathway for flooding

Note that, whilst flooding is essentially a water quantity issue (see Section 4.1.14), it has its own category in the tool because of the importance of reducing flood risk in schemes involving BGI.

Benefits assessed in this category may be permissible for inclusion in GiA funding applications (see Box 3-2 below where BEST is being used to support a GiA application). Nevertheless, it is advisable to discuss and confirm this with the relevant stakeholders and funding bodies at the earliest opportunity.

Method of assessment

The assessment of benefits in this category will be made considerably easier by modelling the flood risk before and after (drainage interventions). Indeed, it is likely that an assessment based on modelling will have been undertaken where funding for flood risk reduction is being sought. Where no modelling is available, apply engineering judgement based on knowledge of previous flooding to estimate the potential degree of flood risk reduction in terms of the number/type of properties and other buildings, and the change in frequency of flooding.

The tool is designed to accommodate either of these using the following approaches.

- Use F1 if you have already completed a property damage assessment and calculated the present value (e.g. using the Multi-Coloured Manual).
- Use F2 if you are working with a water company and are considering willingness to pay approaches to assess the benefit.
- Use F3 if you have calculated the average annual damages for property and other areas but *have not* calculated the present value.
- Use F4 if you are using the government's FCRM (flood and coastal risk management) partnership funding calculator (PFC) to estimate the impacts.
- Use F5 to estimate wider impacts beyond property flooding (e.g. on travel disruption, intangible health effects).

In certain circumstances, it may be appropriate to combine these approaches. For example, estimating the benefits of flood protection up to a certain standard (e.g. 1 in 20) using the F1 method, and estimating further benefits from exceedance management (e.g. beyond 1 in 20 and up to 1 in 100) using F2 or F3. However, where this is the case, take care to consider the benefits to any individual property/building only once, so as to avoid double counting the benefits.

Quantifying benefits

Where there is a completed flood risk assessment for the scheme, no further quantification of the benefits should be necessary. Proceed straight to valuation. If, however, there is no such modelling or assessment work, provide an estimate of:

- The number of properties of different types at reduced risk;
- The change in risk (flood frequency);
- Any quantitative information relating to non-property impacts (see below); and
- The reduction in time lost by people through flooding (an estimate of the number of people and time).

Environment Agency (2017a) reviews the flood risk benefits from NFM schemes. It concludes that a useful metric for quantifying and comparing this benefit is m³ water stored, although it recognises that each m³ storage has a different impact depending on where it is placed within a catchment.

Even where a completed flood risk assessment exists, consider other potential impacts of flooding, e.g. non-residential properties. These are generally harder to estimate, such as loss of business, but can be significant, and may encompass the commercial and retail sectors, other private or public operations (e.g. schools), transport routes/networks and productive land (e.g. agricultural). To help capture such values, e.g. through disruption and time lost, F5 enables an estimate of time to be included.

Monetary values

Values to support assessment in this category need to be obtained from external sources such as the Multi-Coloured Handbook (FHRC, 2018) (for F1, F3 and F4) or the water company's WTP results (for F2). *Note that these values, even if assessed separately elsewhere, will need to be added to the tool to help provide a complete picture of the full range of benefits.*

It is important to note that approaches based on damage costs (F1, F3 and F4) relate predominantly to the physical costs of damage caused by flooding (e.g. to property). As such, they tend to be somewhat lower than those obtained using water company WTP surveys (F2), which encompass a wider range of values (e.g. distress) and motives (e.g. altruism – values of people not affected by flooding but concerned about its impacts on others). However, a further consideration is that water company WTP values have been obtained from a broad population base (all customers within that water company boundary). If this population is greater than that which is likely to benefit from the scheme, this may result in an overestimate of benefits.

The choice between using damage cost and WTP values will probably come down to data availability for the scheme, and the funding stakeholders' requirements. However, where different values are available, it is advisable to consider the impact on the result by applying more than one value (see Section 6 on Sensitivity Analysis). In addition, the risk of overestimation can be minimized by only applying the available values to those impacts (e.g. number of properties) that are likely to see a direct and tangible benefit.

Box 4-2: Using the MCM and Partnership Funding Calculator (F1, F3 or F4)

A common approach for valuing flood risk is that based on the UK's Multi-Coloured Manual (MCM) and Handbook (FHRC, 2018). This license-based software is often used for estimating damage to residential and non-residential property. It can also be used to value other impacts of flooding, including vehicle damage, infrastructure networks and recreation.

If using the MCM to help complete an assessment using F1 or F3, you need to ensure that any impacts assessed and included are not additionally assessed in other B£ST categories. At present, this risk mainly applies to recreation, although future versions of the MCM may also encompass tourism and health. This is shown in the table below.

Impact considered in MCM	Relevant B£ST category	Potential for overlap
Property damage	Flooding	High, but F1 and F3 designed to include outputs from MCM
Emergency cost	-	None. Can be included in F1 or F3
Infrastructure	-	None. Can be included in F1 or F3
Transport	-	High, but F5 designed to be used to include outputs from MCM
Agriculture	-	None. Can be included in F1 or F3
Land use	-	None. Can be included in F1 or F3
Effects on business	-	None. Can be included in F1 or F3
Environmental impacts	Biodiversity and ecology Water quality	Medium. Can occur where these have been explicitly valued using MCM or supporting guidance (Environment Agency, 2010)
Social impacts	Recreation	High, where chapter 8 of MCM has been used to value these

Flood risk benefits to households calculated in B£ST may support the second of the four outcome measures (OMs) described in Box 3-1 (OM2– households moved from one category of flood risk to a lower category). Biodiversity benefits may support OM4 (statutory environmental obligations fully met through FCERM). Other outputs of B£ST may be most relevant to OM1 (average benefit to cost ratio of schemes delivering OMs).

Where B£ST is used to support an application for grant-in-aid funding using F4, you should ensure that any benefits included in the application are directly associated with the flood risk reduction scheme. Benefits related to a change in the flood risk category of households can be automatically input into the PFC (OM2) and the monetary value of these benefits can be included within F4. Benefits derived from the scheme and assessed in the 'Biodiversity and ecology' category may contribute to OM4. Benefits derived from the scheme and assessed in all other categories may contribute to OM1, which includes avoided damage to infrastructure, utilities, public health, etc. However, the rules relating to the PFC may change or be clarified in future, and you should discuss this at the earliest opportunity with the Environment Agency.

Some estimates of the annual average damage costs to property from flooding based on changes in a range of return periods are shown in Table 4-7 (Environment Agency, 2017a). These are provided for illustration only, and it is recommended that the values from modelled assessments developed according to the requirements of funders are added to the tool.

Table 4-7 Illustrative annual values (£) for flood risk improvements (2016 prices)

Existing SOP	Standard or protection (SOP) after intervention											
	None	2 years	5 years	10 years	20 years	25 years	50 years	75 years	100 yrs	150 yrs	200 yrs	1000 yrs
None	0	0	1,947	3,410	4,112	4,219	4,645	4,802	4,883	4,906	4,922	4,962
2 years		0	1,947	3,410	4,112	4,219	4,645	4,802	4,883	4,906	4,922	4,962
5 years			0	1,463	2,165	2,272	2,698	2,855	2,936	2,959	2,975	3,015
10 years				0	702	809	1,235	1,392	1,473	1,496	1,512	1,552
20 years					0	107	533	690	771	754	810	810
25 years						0	426	583	664	687	703	743
50 years							0	157	238	261	277	317
75 years								0	81	104	120	160
100 years									0	23	39	79
150 years										0	16	56
200 years											0	40

This is consistent with government guidance (HM Treasury, 2018) which states that “generic national Weighted Annual Average Damage (WAAD) estimates are available for broader-scale, high-level scoping analysis. These are national average, per property, annual damage estimates and have been developed for residential properties across flood events with different probabilities and levels of flood warning service. The estimates for an average house in 2017 prices range from the following:

- a property with no flood protection and no flood warning service – £5,054 per property, per annum
- a property with existing protection against a “1 in 200 chance” (0.5% annual probability) and no flood warning service of more than 8 hours – £39 per property, per annum.”

The tool also includes some values related to non-property impacts for inclusion under F5. The evidence in this area is generally poor and the values are based on experience from specific events (e.g. the 2007 winter floods). Nevertheless, they provide an indication of the scale of impacts that could occur. Where no values are readily available for some of these other impacts that are nevertheless expected as a result of the scheme, they may be estimated using market values. For example, when expecting impacts on productive agricultural land, the value of these impacts can be estimated by multiplying the change in probability (e.g. number of additional ‘flood free days’ per year as a result of the scheme) by the value of the land. Value of land estimates can be obtained from the Government (<https://www.gov.uk/government/publications/land-value-estimates-for-policy-appraisal-2017>).

A further potential impact of flooding is on time, because of delays or disruption to transport. This will depend on several factors, including travel purpose (e.g. commuting), mode of transport and location. The approach to valuing travel time is currently being substantially updated by government (<https://www.gov.uk/government/publications/values-of-travel-time-savings-for-business-travellers>). In the meantime, the easiest way to account for this is to multiply the expected time gained (total hours) because of reduced flooding risk by the average hourly wage (£14.00) (Office for National Statistics, 2017).

The Multi-Coloured Handbook also includes a simple method for estimating the potential damage to vehicles as a result of flooding. This method “assumes that the total number of vehicles likely to be damaged during a flood occurring at any time of the day will equate to 28% of the total number of residential *and* commercial properties at risk (from a flood of any depth). Estimate the number of likely vehicles and multiply this by £3,100 (the value per vehicle, not the value of vehicles per household). This method does not require an assumption to be made on the presumed location of vehicles when a flood occurs”. Enter such values (including other flooding impacts if not included overall in an assessment (e.g. in F1) in the user-defined section.

The Handbook also provides a recommended value for the assessment of indirect damages for emergency services and other third-party costs, expressed as a proportion of the direct property damages. This is 5.6% (low) to 10.7% (high) and can be applied where property damages have been estimated.

Finally, the Handbook also considers the intangible health benefits of reducing flood risk. A figure of £285 per property per year is advised (2013 prices), which can also be applied and included under F5.

Avoiding double counting

Values obtained from either damage cost or WTP approaches relate specifically to the benefits of flood risk reduction, and the risk of double counting is therefore considered to be *minimal*. The exception to this where the Multi-Coloured Handbook has been used to value other impacts (e.g. recreation). Where this is the case, it is essential not to also value these categories using B£ST.

Confidence scores

The confidence score relating to the quantitative estimate will depend on the completed level of supporting assessments. For example, if a flood risk assessment models *the change* in risk, select a higher confidence score (75%-100%). Where the change in risk or quantities entered is largely based on judgement, apply a lower confidence score (typically 50% or less).

For monetary values, if the valuation uses a reputable damage cost approach (e.g. the Multi-Coloured Handbook) or a water company WTP survey, *and* the population impacted is likely to be similar to that in the original survey, then select a higher confidence score (75%-100%). If this is not the case, or if a significant proportion of the impacts is not related to properties, select a lower confidence score (50% or less).