6 Introduction

To appraising the losses from utilities, schools, hospitals, transportation networks and emergency services: Prioritisation of losses for inclusion in project appraisal

TYPES OF LOSSES

In general losses to infrastructure can accrue in the following ways:

1. The physical susceptibility of a plant and/or its supporting networks. This relates directly to the physical damage potentially caused by flood waters and therefore on the performance of the asset. Henceforth, this will be referred to as the 'direct damages' component of losses.
2. The wider economic impact. This will include the disruption caused to locations both inside and outside of the flood risk zone.
3. Wider less tangible impacts. How these impacts affect those living both inside and outside of the flood risk zone.

Each of these losses may impact services and infrastructure to different degrees, the severity of which may depend upon:

- The **dependency** of properties/businesses/other infrastructure served by utility plants and networks;
- The ease and cost of **transferability** of production to sites not affected by flooding (e.g. the degree of redundancy in the system): if a service can easily be replaced by another service it is said to have high redundancy/transferability;
- The **duration** of any disruption.

(Penning-Rowsell *et al*., 2005 and Cabinet Office, 2010)

The effort and resources used in the assessment of any type of loss should be proportional to its impact and significance. Therefore, although it may be technically feasible to assess the potential of loss to many assets, it may not be effective or necessary to do so. Consequently, the initial step therefore, within any project appraisal is a prioritisation of the potential losses which should be included for quantification within an economic assessment.

PRIORITISATION OF LOSSES FOR INCLUSION IN PROJECT APPRAISAL

The prioritisation process is illustrated in Figure 6.1 (within the *Tables and Figures* for Chapter 6 on MCM-Online) and consists of five steps:

Step One: Identify those assets at risk of flooding

Step Two: Determine the likelihood of flooding of assets

Step Three: Determine the criticality of the assets to flooding

Step Four: Utilise a risk matrix for prioritisation

Step Five: Assess the impact of resistance and resilience

Through this filtering process, a shortlist of assets is prepared as candidates for detailed economic appraisal. This should be viewed in conjunction with the Appraisal Summary Tables (AST) within the Environment Agency FCERM guidance (2022a; 2022b).

Those assets that do not make the short-list should be merely enumerated and described (as illustrated in Table 6.1) to give qualitative weighting to the appraisal and provide details for any prospective Multi-Criteria Analysis.

THE TOTAL RISK MATRIX

One of the key elements of the prioritisation process is the use of a 'total risk' matrix. This provides a classification of the likelihood of damage or disruption and the scale of this impact. This process acts as a risk filter with generally only those assets considered to be at **High** or **Very High** risk being fully quantified within an appraisal: although there may be situations where it is appropriate to appraise other categories.

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.

Since flooding in 2007 there has been an increased focus on the securing of the continuity of service of utilities and communication networks during flooding. This has meant that many utility and transportation organisations have begun a process of assessing the susceptibility of their assets to flooding and have developed appropriate risk registers. These registers if accessible to appraisers will replace steps 1 to 3 in the prioritisation process and any filtering using the risk matrix.

LESSONS FROM PREVIOUS FLOODS: PERCENTAGE UPLIFTS FOR ASSESSING POTENTIAL LOSSES

A less resource intensive approach to assessing the potential losses due to the flooding of infrastructure which has been adopted by project appraisers has been to 'uplift' the potential direct

damages by a percentage factor. These percentage values have been calculated based upon the actual losses estimated from previous national-scale floods in 2000 and 2007 (Penning-Rowsell *et al*., 2002; Chatterton *et al*., 2010).

The appropriateness of use and transferability of the values to different flood situations will primarily depend on the context of the situation being examined. These values have been generated from some of the most severe flooding experienced in England and Wales in the last 50 years and therefore should not be considered typical of all flood situations. Therefore, these percentage values should ***not*** be used blindly as a 'fix' for assessing damages in these benefit categories. Where the likelihood of damages due to the disruption of services or damage to infrastructure is likely to be significant (based on assessment using the prioritisation process) a full appraisal is recommended.

SUMMARY OF THE RELATIVE IMPORTANCE OF UTILITY AND INFRASTRUCTURE LOSSES

A summary of the relative importance of all utility and infrastructure measures adopting the risk matrix approach (with the addition of scale) can be found in Table 6.3. This table provides a qualitative indicator of the proportionality of including the investigation of an infrastructure asset within an appraisal.

There may however be particular circumstances whereby an asset assumes greater significance; for instance when it is likely to be frequently flooded or whereby a disproportionate number of people may be impacted. Appraisers are therefore always recommended to undertake their own filtering approach and if in doubt speak to the infrastructure owners/providers to determine the criticality of assets.

Although not an exhaustive list we suggest a full monetary quantification of utility damages/losses is required (i.e. proportional) and will contribute significantly to the present value of benefits in the following situations. Where there is:

- Tidal inundation of electricity transmission lines greater than 132 kV unless flooding thresholds are less frequent than 1 in 75 years (1.3%);
- Tidal inundation of electricity transmission lines of less than 132 kV but only if flooding is more frequent than 1 in 25 years (4%);
- Flooding of sewage treatment works when the risk of flooding is more frequent than 1 in 75 years (1.3%) and the effluent dry weather flow is greater than 5,000 cumecs;
- Flooding of sewage treatment works when the risk of flooding is moderate (i.e. more frequent than 1 in 200 years; 0.5%) and the effluent dry weather flow is greater than 30,000 cumecs;
- Flooding of water treatment works when the risk of flooding is more frequent than 1 in 75 years (1.3%) and the population affected is greater than 5,000;
- Flooding of water treatment works when the risk of flooding is moderate (i.e. more frequent than 1 in 200 years; 0.5%) and where the dependent population is significantly large (i.e. >20,000);
- Flooding of electricity grid substations (including super grid and bulk supply point installations) when the risk of flooding is moderate (i.e. more frequent than 1 in 200 years; 0.5%) as these serve greater than 125,000 and up to 500,000 customers;

- Flooding of primary and grid substations where when the risk of flooding is more frequent than 1 in 75 years (1.3%); thereby serving a dependent population of greater than 5,000 people.

REFERENCES AND DATA SOURCES

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