NATIONAL 'CFRAM' PROGRAMME

Technical Methodology Note - Option Appraisal and the Multi-Criteria Analysis (MCA) Framework

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1.0	**PURPOSE**
	The purpose of this National 'CFRAM' Programme Technical Methodology Note is to set out certain requirements of the process for the development of flood risk management (FRM) options, including screening, and to set a common approach to the Multi-Criteria Analysis (MCA) for option appraisal. This complements, and should be read in conjunction with, the relevant sections of Generic [Stage I] Project Brief.
2.0	**SCOPE**
	This Note relates to: – Flood Risk Management Objectives (Section 8.4 and Appendix J of the Generic Project Brief), – Screening of Possible FRM Methods (Section 11.4 of the Generic Project Brief), – Appraisal of Potential Options (Sections 11.6 of the Generic Project Brief) – Selection of Preferred Options (Section 11.7 of the Generic Project Brief) This Note does not address or cover: – Methods for the evaluation of adaptability to climate change. – Methods for undertaking the Strategic Environmental Assessment (SEA), as the requirements for this are set out in the Project Brief. – The development of flood risk management options (Section 11.5 of the Generic Project Brief) from the methods that have been deemed potentially viable through the screening process. This is deemed to be a matter for the Consultants to determine in the manner they deem appropriate.

3.0	OVERVIEW OF SCREENING AND MCA OPTION APPRAISAL FRAMEWORK
3.1	***Framework Overview*** An objective of the CFRAM Projects is to: *"Identify viable structural and non-structural options and measures for the effective and sustainable management of flood risk in the Areas of Potential Significant Risk (APSRs)..."* (Section 1.2.1, Generic Project Brief), where *"The analysis, and method and option development and appraisal, to derive the set of actions and measures to be defined in the FRMP, as described herein, should form a robust and sound foundation for the future full development (after completion of this Project) of a measure to be taken to public exhibition or planning (as appropriate) and subsequent implementation."* (Section 11.1, Generic Project Brief) and *"The rejection of any method or option shall be robust and with clear and transparent reasoning"* (Section 11.1, Generic Project Brief) The screening and MCA option appraisal process is intended to provide an efficient, staged approach to achieving the above stated objective in the robust manner required, taking into account the wide range of potential benefits and impacts that flood risk management measures can have, and in coordination with the SEA/AA processes. The MCA appraisal outcomes will also inform the national prioritisation of preferred options and measures. There is hence a strong need for consistency across the CFRAM Programme to ensure that all potential works are considered on an equal basis.
3.2	***Robustness*** Appendix M of the Generic Project Brief sets out a non-exhaustive range of flood risk management (FRM) methods. The purpose of the screening and option appraisal process is to review all possible FRM methods, including those in Appendix M, and to identify the most appropriate suite of FRM options to be set out in the FRMP that the OPW, Local Authorities and other agencies can take forward to full scheme development, and then as appropriate to exhibition / planning and implementation. The processes should be sufficiently robust such that, not withstanding the need for project-level assessments (such as EIA), a full re-evaluation of methods and options for a given location or for the Study Area as a whole, in terms of option selection, is not required for the implementing agency to move forward with the measures and strategies set out in the FRMP.

3.3	***Application of Professional Judgement*** In the interests of efficiency, the screening process and option appraisal process is, as far as reasonably possible, to be automated, making use of measurable parameters. However, an automated system cannot always take account of specific or local issues or particular circumstances. It is therefore essential that the processes and all outcomes are subject to the application of professional review and judgement. With respect to all objectives, other than objective 2.A (Reduce Economic Damages), professional judgement needs to be applied within the requirements and guidance provided. Notwithstanding this, with a view to ensuring national consistency, the professional judgement should typically not change the calculated Local Weighting or scoring by more than 1 point, or by more than 2 points in exceptional circumstances. Any changes beyond this limit should be discussed and agreed with OPW (who will have a national overview of weighting and scoring). Wherever professional judgement forms the basis of an amendment to the Local Weighting or score, then the reasoning for this should be recorded and reported.
3.4	***Design Standards*** Section 11.2 of the Generic Project Brief defines the 1% Annual Exceedance Probability (AEP) event and the 0.5% AEP event as the preferred design standards against which measures should provide protection for fluvial and coastal flooding respectively. However, the Brief also defines that other design standards should be considered under certain circumstances. The screening and option appraisal processes need to keep this potential flexibility in mind. It is not however expected that extensive work will be done at screening stage to re-screen each measure for alternative design standards where a measure fails to meet the screening criteria at the preferred standard, nor that extensive work will be done at appraisal stage to determine the optimum design standard for an option. It is expected that: – Professional judgement be applied at screening to retain a measure that might fail at the preferred design standard, but that could be attractive and viable at other design standards – Professional judgement be applied at appraisal stage, and where it is considered that a scheme might be preferable and / or be more cost – beneficial at a higher or lower design standard then this should be noted in the Preliminary Options Report (and the FRMP if / as appropriate) – A measure be appraised at an alternative design standard if a potentially preferred (or the only potentially viable) option proves not to be viable at the preferred design standard, but, based on professional judgement and the risk information available, is likely to be viable at an alternative standard.

4.0	**FLOOD RISK MANAGEMENT OBJECTIVES**
4.1	Section 8.4 of the Generic Project Brief introduces the FRM objectives, with provisional objectives then set out in Appendix J, along with indicators that act as a means by which achievement or otherwise of the objectives can be measured or assessed. The objectives are defined under four categories: – Technical – Economic – Social – Environmental Note that the environmental category includes cultural heritage, which is assessed as part of the SEA process. The objectives have been developed to broaden the range of potential impacts of flooding and FRM measures that are taken into account in the development and selection of FRM options and strategies, and their subsequent prioritisation. All four categories are deemed important criteria in the selection of flood risk management measures for a given location. However, only the latter three (i.e., excluding the 'Technical' category) refer to benefits, and so it is only these that should be used to provide an indication of benefit relative to cost, and be used for the purposes of prioritisation (of programme investment to maximise benefit). The OPW have reviewed the provisional objectives, taking into account the lessons learned from the pilot studies and, in particular, public consultation on a draft set of objectives. The final set of objectives is set out in Appendix A.
5.0	**SCREEING PROCESS**
5.1	***Overview of the Screening Process*** The purpose of the screening process is to filter out FRM methods that are not going to provide applicable, acceptable or viable options or measures, either alone or in combination with other methods, for a given flood problem for a given location in the SSA under consideration. The screening process requires an indicative appraisal of all possible FRM methods for each of the various SSAs against each of the criteria set out in Section 11.4 of the Generic Brief. Considerations for each of the criteria are set out below. ***A) Applicability to Relevant Area*** Certain FRM methods would simply not be applicable to certain flood risk circumstances, and may be rejected on this basis. Examples might include: – Increasing conveyance or flow diversion in purely coastal flood situations – Rehabilitation of existing defences where no existing defences exist

Methods that may be applicable, even if unlikely to be viable or appropriate for other reasons, should not be rejected on the basis of applicability.

B) Social

In considering the social dimension during the screening process, outcomes of consultation processes previously undertaken (e.g., for start-up / SEA scoping and flood mapping) should be taken into account, along with the application of professional judgement and experience. Rejection of a method should only occur however where all variants of the measure would be unacceptable, for example, a permanent wall of 2m height may be unacceptable along the banks of a river through the middle of an urban area, but a permanent wall of 1.2m height topped with demountables to the 2m height may be acceptable.

C) Economic

While the screening process is an indicative appraisal, it should make use of available information. The economic risk assessment previously undertaken (as part of the Flood Risk Assessment) will provide an envelope of potential economic benefits. Professional experience, and some simple costing using unit costs, can be used to estimate the possible minimum* costs of a method. On this basis, an indicative benefit – cost ratio for a method, in isolation or potential combination with other methods, can be determined.

In assessing the potential benefits of a method, the standard of protection and the effectiveness of the method in reducing risk should be considered (i.e., it should not be assumed all of that the damages up to the 0.1% AEP event will be prevented, unless that is the standard being considered, and a percentage degree of reduction in risk (e.g. option take-up rate and effectiveness) should be applied for non-structural measures such as flood forecasting and warning).

* On the basis of a precautionary approach to avoid rejecting methods that may prove economically viable, supplementary items used in detailed costing (unmeasured items, optimism bias, archaeology, land purchase / compensation, etc,) may be excluded from the costing at this stage. On the same basis, the threshold for the indicative benefit – cost ratio for rejection of a method should not be set equal to unity, and a threshold of 0.5 should be applied.

D) Environmental

The environmental screening should make use of the SEA scoping and any other environmental assessment work available at the time.

Methods should not be rejected only on the basis that a method may have a detrimental impact on an environmentally or culturally valuable or protected site, as mitigation measures may be available. Screening should take into account the degree of detrimental impact on the site, the scope for mitigation and whether there are apparently viable and acceptable alternative approaches available.

	E) Cultural The approach taken to the cultural criteria of the screening should be similar to that undertaken for the environmental criteria, whereby a method should not be rejected only on the basis of a potentially minor negative impact. ***Consideration of Criteria in Combination*** The screening process may need to consider the criteria in combination as well as individually, e.g., for the example given under social criteria above, the permanent plus demountable option may be rejected if there would be a requirement for extensive demountables and the urban area in question is in a flashy catchment where there would not possibly be adequate warning time (based on recorded rather than predicted rainfall) to permit erection of the demountables without an intolerable level of false warnings. As with all rejections, the justification of rejection on the basis of 'in combination' reasons should be robust.
5.2	***Justification of Rejection of Methods at Screening*** In all cases where potential methods are rejected, justification should be provided which is robust, and with a clear and transparent reasoning. Such justification should be self-explanatory, but may vary in detail, with only brief text provided in some instances where the case for rejection is in itself self-evident (and would be so to the public and stakeholders) but with more detailed description required in other circumstances where the case for rejection is not so clear.
5.3	***Automation*** There is only limited scope for automation in the screening process, as much of the decision-making is indicative and will rely heavily on professional judgement and non-numeric factors. The exception to this may be the economic criteria where use may be made of the economic risk outcomes and unit costs. If an automated process is used, consideration should be given to the use of lookup tables for values or parameters that are used frequently (e.g., for multiple locations or multiple methods) to facilitate a single point amendment approach that, based on experience, can make significant savings in time as consultation and review processes lead to amendments in such values or parameters.
5.4	***Design Standards*** Given the potential for flexibility in the design standard, or standard or protection that may be adopted, methods or measures that might be effective and potentially viable at design standards other than those preferred, even if not so at the preferred standards, should not be rejected. This would apply in particular where: – A certain method is very likely to form (part of) a preferred option, but needs to be to a higher or lower standard due to factors such as health and safety requirements, available space for the method, social factors, etc. – There appears to be no viable methods that could achieve the preferred standard of protection

	– A method at a lower or higher standard of protection may become (part of) the preferred option overall, even if another option might (at this screening stage) appear to be more beneficial at the preferred standard.
5.5	***Requirements for Modelling*** The screening process is intended to be indicative and the OPW does not require that hydraulic modelling of all methods be undertaken at this stage. However, this may be appropriate in some instances to provide the required sound and robust justification for rejection, or indeed may be desirable, depending on the approach taken, to reduce the work required at the appraisal stage.
5.6	***Non-Structural FRM Methods*** Some non-structural FRM methods may be rejected during screening for various reasons. However, it should be noted that many non-structural methods are complimentary to structural methods in providing residual flood risk management, as well as providing stand-alone options in their own right, and some may represent the implementation of national policy (e.g., spatial planning, preparation of emergency response plans – See Section 6.6). As such, non-structural measures should not be rejected on the basis that other structural measures appear to be viable, but only on the basis that they are not applicable, appropriate or viable in the same manner as other methods. Land use management, natural flood management, green infrastructure, river restoration, etc. are terms used to cover (some of) a suite of measures that are intended to reduce flood risk by working with natural systems and, where possible, provide environmental benefits. While in small catchments they can effectively manage flood risk to a certain degree in their own right, in larger catchments than can work in a complimentary way with others measures to achieve flood risk management targets. At screening, such measures should not be rejected on the basis that other structural measures appear to be viable, but only on the basis that they are not applicable, appropriate or viable in the same manner as other methods.
6.0	**MCA OPTION APPRAISAL PROCESS**
6.1	**Overview of MCA Option Appraisal Process** The option appraisal process is set out in Section 11.6 of the Generic Project Brief, with reference made to Section 8.4 and Appendix J in relation to the FRM objectives that will form part of the appraisal process. Section 8 of the Generic Project Brief notes that both the Flood Risk Management Objectives set out in Appendix J, and the descriptions of the local weightings provided in Section 8.4, are subject to review and refinement. As stated in Section 1 herein, the purpose of this Technical Methodology Note is to clarify certain aspects of the option appraisal process, and to set a common approach to the Multi-Criteria Analysis (MCA) for option appraisal.

This section outlines the overall structure of the MCA framework, which forms the core of option appraisal, and provides a description of each component of the framework. The objectives are set out in Appendix A herein, with detailed guidance on the approach to be taken with respect to each objective then set out in Appendix B, including definition of global weightings and indicators, and guidance on assessing local weightings. Guidance on scoring the performance of different options under the MCA with respect to each objective is also set out in Appendix B.

Overall Framework

The appraisal of flood relief scheme options in the past has been primarily based on economic costs and benefits, with an EIA undertaken to minimise negative impacts on the environment and public consultation undertaken to ensure social acceptability. The National Flood Policy Review (OPW, 2004) set a broader range of objectives for flood risk management in Ireland, that was subsequently reinforced by the EU 'Floods' Directive [2006/60/EC].

The MCA framework has been developed to broaden the range of potential impacts that flooding and the implementation of FRM measures can have that are taken into account in the development and selection of FRM options and strategies, and their subsequent prioritisation. It is based on the numeric, but non-monetarised assessment of options against a range of objectives, whereby indicators are set for each objective. These indicators are then used to define scores for that objective on the basis of the degree to which the option being appraised goes beyond the Basic Requirement for that objective towards meeting the Aspirational Target. Weightings are applied globally (nationally) for each objective, with local weightings then applied to reflect the local importance of that objective in the context of the respective SSA, and these weightings are applied to the scores derived as above.

The sums of the scores, set against the total costs of their achievement, represent the preference for a given option (using all criteria) or the net benefits of an option (using only the economic, social and environmental criteria). These total scores can be used to inform the decision on the selection of (a) preferred option(s) for a given location and the prioritisation of potential schemes between locations.

Each component of the MCA Framework is explained in more detail below.

Objectives

The FRM objectives reflect what the overall flood risk management programme is seeking to achieve, expanding on the requirements of the National Flood Policy Review and the EU 'Floods' Directive.

At a local level, and for the purposes of the MCA, the objectives set out an aim that the each flood risk management option should be seeking to achieve, if possible. The degree to which an option achieves the objective is an indication of the 'success' of the option, and equally, the more an option achieves across all of the objectives, then the greater the preference that will be given to that option relative to others, taking account also of the cost of each of the options.

Indicators
The indicators are parameters, measurable and numeric where possible, by which the 'success' of an option in meeting a particular objective can be gauged.

Basic Requirements and Aspirational Targets
The objectives are termed as general aims for the management or reduction of flood risk, or for other benefits that can be accrued through the implementation of flood risk management measures.

To enable the assessment of the degree to which an option 'succeeds' in meeting the stated aims, a more defined aim needs to be set, along with a benchmark for neutral status (i.e., no impact).

The Basic Requirements and Aspirational Targets are set in terms of the defined indictor, i.e., make use of the same parameter setting target or threshold values for that parameter.

Aspirational Targets
The aim is defined as an Aspirational Target, whereby an option would be deemed as perfect with respect to the given objective if it were to meet the Aspirational Target. Typically this will represent complete removal of a risk, or the full achievement of another benefit, and it will be rare that any option will meet such Aspirational Targets for even one, let alone all, objectives.

The Aspirational Targets are therefore NOT requirements that must be met, and very effective options may still fail to meet the Aspirational Targets.

Basic Requirements
The Basic Requirement represents a neutral status or 'no change', whereby if an option has no impact on the matter the objective relates to, or meets what might be termed for some objectives as minimum requirements for acceptability, then that option will have met the Basic Requirement. If an option performs worse than the Basic Requirement, i.e., has a negative impact (a dis-benefit) or does not meet the minimum requirements for acceptability, it will score a negative-value score for that objective, but might still be considered further, depending on the degree of the dis-benefit or failure to meet the requirements.

The Basic Requirement is therefore NOT an absolute minimum requirement for acceptability, but a benchmark to define positive versus negative impacts or performance.

Scoring Against Objectives
An option may be scored against the objective by determining the degree to which it performs, measured using the defined indicator, in going beyond the Basic Requirement towards meeting the Aspirational Target (which are both expressed in the same terms as the indicator). The following generic rules should be applied in scoring, although specific guidance is given in Appendix B:

- An option that meets the Basic Requirement only should be given a score of zero.
- An option that meets the Aspirational Target should be given a score of five.
- An option that performs somewhere between the Basic Requirement and the Aspirational Target should be given a score proportional to the degree to which it achieves the objective beyond the Basic Requirement towards meeting the Aspirational Target.
- An option that performs better than the Aspirational Target (which for most objectives will not be possible) should still only be limited to a maximum score of five.
- An option that performs worse than the Basic Requirement, i.e., creates a dis-benefit or does perform to an acceptable standard, should be given a negative score down to –5 using, where possible, the same scoring mechanism as that used for scoring options that achieve between the Basic Requirement and the Aspirational Target.
- There are exceptions to the negative scoring where the performance or impact of the option becomes unacceptable, and the option should be rejected on the basis of its performance on the given objective alone. In such circumstances the option should be given a '-999' score and be rejected from further consideration. The thresholds for unacceptability of an option are defined where relevant in the detailed objective description sheets in Appendix B.

The resultant scores should only be considered as initial guidance for decision-making, and the arithmetic calculation of scores can sometimes give misleading results that do not take account of all relevant issues. The application of professional judgement in reviewing and confirming or amending all of the derived scores is essential.

Justification of the score assigned should be provided which is robust, and with a clear and transparent reasoning that should include quantitative evidence where reasonably possible. Such justification should be self-explanatory, but may vary in detail, with only brief text (potentially a standard comment) provided in instances where the basis for score is clear (and would be so to the public and stakeholders) but with more detailed description required in other circumstances where the basis for the score assigned is not so clear, such as where amendments have been made to numerically-derived scores or where the scoring has varied from the guidance for certain reasons.

Global Weightings

Global Weightings are assigned to each objective to give it more or less weight in the overall assessment of the suitability or value of the option. The Global Weightings are fixed nationally to ensure a consistent approach and basis for prioritisation, and are intended to represent the 'societal value' for the objective relative to the others, i.e., with those of most weight representing the most important objectives, and have been based on public consultation.

	Local Weightings The Local Weightings are assigned to each objective for each location under consideration (i.e., each SSA), and are intended to represent the local importance of that objective within the local context. They are very important within the framework as they provide scale to the process, whereby if the subject of a given objective is of much greater significance than another in the same location, and should have a greater influence on the choice of option, then this can be provided for through the Local Weightings. Similarly, the importance of an issue / objective in one location relative to another can also be provided for through the Local Weightings. Local Weightings for some objectives will be numerically determined according to the degree of risk (e.g., economic annual average damages, number of properties, etc.), but for some others will need to be set by professional judgement. In both instances however, the assignment should take into account local knowledge provided at the stakeholder and public consultation events (primarily for events during the mapping stage, but account may also need to be taken of significant issues raised during the optioneering stage PCDs). Guidance is provided on assigning Local Weightings in the detailed objective description sheets in Appendix B. Justification should be provided to the degree necessary to permit defence for the Local Weighting assigned in the face of public or stakeholder questioning. Such justification should be self-explanatory, but may vary in detail, with only brief text (potentially a standard comment) provided in instances where the basis for weighting is clear (and would be so to the public and stakeholders) but with more detailed description required in other circumstances where the basis for the weighting assigned is not so clear, and / or varies from the guidance provided or the numerical value derived.
6.2	***MCA Outcomes*** **Criteria Scores:** Once the MCA has been applied, each option will have a weighted score for each objective. For each option, the scores for each of the four criteria should be summed to provide the Criteria Scores. **MCA Benefit Score:** To derive the MCA Benefit Score, the scores for the economic, social and environmental Criteria Scores should be summed. This score represents the net benefits of the option. **Option Selection MCA Score:** To derive the Option Selection MCA Score, the scores for all four of the criteria should be summed. This score compliments the MCA Benefit Score with the Technical Criteria Score, and hence includes all of the aspects that should be taken into account in considering the preferred option for a given location.

	MCA Benefit – Cost Ratio (BCR): The MCA Benefit Score should then be divided by the cost of the option to provide a numerical, but non-monetarised, MCA Benefit - Cost Ratio that provides an indication of the overall benefits that can be delivered per Euro invested. The **Economic Benefit – Cost Ratio (BCR)** should also be calculated using the more traditional techniques (i.e., the FHRC Multi-Coloured Manual, rather than the option appraisal MCA set out herein). The above scores and ratio can be used to inform decisions on which option might be preferred for each SSA, as set out in Section 7 herein.
6.3	***Automation*** With the exception of most of the environmental objectives, there is significant scope for automation in the application of the MCA given the numeric nature of many of the indicators and function-based approach to scoring for many of the objectives. Where an automated process is used, serious consideration should be given to the use of lookup tables for values or parameters that are used frequently (e.g., for multiple locations or multiple methods) to facilitate a single point amendment approach that, based on experience, can make very significant savings in time in application of the MCA as consultation and review processes lead to amendments in such values or parameters.
6.4	***Application of Professional Judgement*** As noted in Section 3.1, an automated system can be prone to error and cannot take always account of specific or local issues. It is therefore essential, particularly for the option appraisal process, that the processes and all outcomes are subject to the application of professional review and judgement. The decisions on recommendations for preferred options is one to be made by the consultant, not by the MCA process.
6.5	***Design Standards*** As set out in Section 3.4, while the 1% AEP event and the 0.5% AEP event have been identified as the preferred design standards against which measures should provide protection for fluvial and coastal flooding respectively, other design standards should be considered under certain circumstances. In the event that professional judgement and / or consultation feedback indicates that alternative standards of protection might be preferred, then the appraisal should be undertaken for a sample alternative standard. It is not however expected that a full analysis be undertaken to optimise and define the alternative standard of protection for each option, but the appraisal should be undertaken on at least one alternative standard to demonstrate that alternative standards could provide (or

	indeed would not provide) greater benefit or return on investment, or provide benefits / viability in a manner that is more socially or environmentally acceptable, which in turn should inform the outline design of the option and be reported in the FRMP. The post-CFRAM full scheme development process can then undertake the more detailed analysis to identify the optimal standard of protection for the preferred option.
6.6	**Measures Required under National Policy** Certain non-structural flood risk management measures are required as matters of national policy. These would include: - Application of the Guidelines on the Planning System and Flood Risk Management (DoECLG & OPW, November 2009) - Preparation of emergency response plans for severe weather events, including flood events (A Framework for Major Emergency Management, DoECLG) As these measures are required to be applied regardless of other proposed measures, or of the outcomes of an appraisal under the MCA process, then they do not need to be subjected to an MCA appraisal, but may be assumed to be applicable and required for all AFAs and other SSAs. Standard texts can be prepared for the inclusion of these measures in the Preliminary Options Reports and the FRMPs.
7.0	**SELECTION OF PREFERRED OPTIONS AND PRIORITISATION**
7.1	***Option Selection*** The option selection process is set out in Section 11.7 of the Generic Brief. The following outcomes of the MCA process should be used to guide the decision-making process, subject to the application of professional judgement and consultation with the Steering and Progress Groups (and subsequently stakeholder and public consultation): – The Technical Criteria Score – The MCA Benefit Score – The Option Selection MCA Score – The MCA BCR – The Economic BCR Noting other considerations outlined below, greatest weight should be given in the option selection to the MCA BCR, which provides a measure of the overall benefits per euro investment. However, professional judgement must be applied at this stage, taking into account local consultation outcomes. The reasoning for the selection of a given option should be recorded and reported.

	All proposed measures (i.e., options selected as preferred options for a given AFA or SSA) should have a economic BCR in excess of unity, unless clear and robust justification can be given as to why an option that is not economically cost-beneficial is being proposed for implementation. The options should also be considered across all SSAs to check for spatial coherence, as set out in Section 11.7 of the Generic Project Brief. The options should also be considered across the SSAs with consideration of the potential impacts of future changes, such as climate change, as set out in Section 11.7 of the Generic Project Brief.
7.2	***Prioritisation*** The prioritisation of recommended options across all SSAs will be lead by the OPW as an inter-project, i.e., national, assessment taking account of projected multi-annual benefits. This will make use of the following MCA outcomes: – The MCA Benefit Score – The MCA BCR – The Economic BCR While the national prioritisation process will be lead by the OPW, the consultants should annotate the preferred options during the option selection process with any particular factors that they consider should be taken into account in the prioritisation process. Such factors might include special risks that have not been properly accounted for in the standardised MCA process.
8.0	**DEFINITIONS**
	No new definitions are established herein.
9.0	**REFERENCES AND RESOURCES**
	References – National CFRAM Programme – Stage I Tender Documents: Project Brief – 2149/RP/002/F, May 2010 – Report of the Flood Policy Review Group – OPW, 2009 – Directive on the assessment and management of flood risks (the EU 'Floods' Directive) – 2006/60/EC – Guidelines on the Planning System and Flood Risk Management (DoECLG & OPW, 2009) – A Framework for Major Emergency Management (DoECLG)

APPENDIX A TABLE OF FLOOD RISK MANAGEMENT OBJECTIVES

CRITERIA		OBJECTIVE		SUB-OBJECTIVE		GLOBAL WEIGHTING
1	Social	a	Minimise risk to human health and life	i)	Minimise risk to human health and life of residents	27
				ii)	Minimise risk to high vulnerability properties	17
		b	Minimise risk to community	i)	Minimise risk to social infrastructure and amenity	9
				ii)	Minimise risk to local employment	7
2	Economic	a	Minimise economic risk	i)	Minimise economic risk	24
		b	Minimise risk to transport infrastructure	i)	Minimise risk to transport infrastructure	10
		c	Minimise risk to utility infrastructure	i)	Minimise risk to utility infrastructure	14
		d	Minimise risk to agriculture	i)	Minimise risk to agriculture	12
3	Environmental	a	Support the objectives of the WFD	i)	Provide no impediment to the achievement of water body objectives and, if possible, contribute to the achievement of water body objectives.	16
		b	Support the objectives of the Habitats Directive	i)	Avoid detrimental effects to, and where possible enhance, Natura 2000 network, protected species and their key habitats, recognising relevant landscape features and stepping stones.	10
		c	Avoid damage to, and where possible enhance, the flora and fauna of the catchment	i)	Avoid damage to or loss of, and where possible enhance, nature conservation sites and protected species or other know species of conservation concern.	5

CRITERIA		OBJECTIVE		SUB-OBJECTIVE		GLOBAL WEIGHTING
3	Environmental (Continued)	d	Protect, and where possible enhance, fisheries resource within the catchment	i)	Maintain existing, and where possible create new, fisheries habitat including the maintenance or improvement of conditions that allow upstream migration for fish species.	13
		e	Protect, and where possible enhance, landscape character and visual amenity within the river corridor	i)	Protect, and where possible enhance, visual amenity, landscape protection zones and views into / from designated scenic areas within the river corridor.	8
		f	Avoid damage to or loss of features, institutions and collections of cultural heritage importance and their setting	i)	Avoid damage to or loss of features, institutions and collections of architectural value and their setting.	4
				ii)	Avoid damage to or loss of features, institutions and collections of archaeological value and their setting.	4
4	Technical	a	Ensure flood risk management options are operationally robust	i)	Ensure flood risk management options are operationally robust	20
		b	Minimise health and safety risks associated with the construction, operation and maintenance of flood risk management options	i)	Minimise health and safety risks associated with the construction, operation and maintenance of flood risk management options	20
		c	Ensure flood risk management options are adaptable to future flood risk, and the potential impacts of climate change	i)	Ensure flood risk management options are adaptable to future flood risk, and the potential impacts of climate change	20

APPENDIX B DETAILED DESCRIPTIONS OF INDIVIDUAL OBJECTIVES

OBJECTIVE 1.A (i)	
Objective	**Minimise risk to human health and life – Residents**
Indicator	Annual Average Number of residential properties at risk from flooding
Scoring	Based on calculated assessment, adjusted by professional judgement
Basic Requirement	Number of properties at risk is not increased
Aspirational Target	100% reduction in number of residential properties at risk
Global Weighting	27
Local Weighting	Based on calculated assessment, adjusted by professional judgement

Guidance on Assignment of Local Weightings

The local weightings should be calculated based on a score derived from the number of residential properties potentially affected by flooding, and the highest probability (lowest magnitude) of flood event that causes flooding of each property.

Receptor Scoring

All residential properties should be treated as equal for the purposes of the calculated score. To ensure that the local weighting on this category is appropriately scaled, each ground floor property should be afforded a score of 2, and each property above ground floor may be afforded a score of 1.

Probability Factoring

For each property, the score (2) is then factored by the probability of the highest probability (least severe) flood event that causes flooding of that property, where the factor applied is calculated as:

Factor = Probability of flooding (expressed as the AEP, e.g., 0.01 for 1%)

Total AFA Score (Local Weighting)

For the given AFA, the total AFA score is calculated as the sum of the factored scores for all of the residential properties at risk from flooding, subject to a maximum score of 5.

Other Factors

Known Areas of Highly Vulnerable People

The risk to life associated with the flooding of residential properties is related to the vulnerability of the people living in that property, with the elderly and very young particularly vulnerable.

The scoring should typically assume that a reasonable cross section of society exists in those that inhabit all of the properties at risk within an AFA. However, if it is known that an area is occupied by particularly vulnerable or resilient set of people then professional judgement should be applied to increase or decrease the score accordingly.

Rate of Onset
The risk to health and life is associated with the flooding of residential properties is related to the rate of onset of flooding and hence the time available to evacuate the vulnerable people. It is assumed that typically it will be evident that flooding may occur with a 1 to 2 hours available to then evacuate the vulnerable people before the depth / velocity of flood water creates difficulties for evacuation and / or a moderate risk to life. However, if the rate of onset is significantly greater or less than this, then professional judgement should be applied to decrease or increase the score accordingly.

Flood Depths and Velocities (Risk to Life)
The risk to life associated with the flooding of residential properties is related to the projected depths of flooding and the velocity of overland flood flow (i.e., the risk to life). It is assumed that typically a Low risk to life will exist for the community in general and residential areas within a community in particular. However, if the risk to life is greater than this, then professional judgement should be applied to increase or the score accordingly.

Existing Flood Warning Schemes
Where an existing flood warning scheme is in place, then the local weighting should be multiplied by a factor of 0.5, 0.7 and 0.9 for effective advance warning periods in excess of 6 hours, 4 hours and 2 hours respectively.

Final Local Weighting
Note that final local weighting taking into account the application of the factors for known areas of highly vulnerable people, the rate of onset, flood depths and velocities and the presence of existing flood warning schemes should still not exceed a maximum of 5.

The above provides guidance on the setting of local weightings for this objective. However, professional judgement should also be applied as per Section 3.3, and should take into account other factors that may influence the risk to life, such as the presence of basement properties.

Guidance on Option Scoring

Residual Risk Score
The residual risk score for a flood risk management option should be calculated in the same manner as the local weighting, but based on the flood hazard with the option applied.

In the case of measures providing flood defence, then the residual risk score can be calculated simply by adjusting the factor for probability to that of the standard of protection (following the simplistic assumption that once the standard of protection is exceeded for a given flood defence, then no defence is provided).

Option Scoring
Options are scored based on the degree of reduction in the risk to residential properties, calculated using the residual risk score as determined for the relevant option, and the final local weighting, and multiplied by a factor of 5.

The score for a given option should be calculated as:

Option Score = 5 X [(Local Weighting – Residual Risk Score) / Local Weighting]

The other factors detailed under the guidance on the assignment of Local Weighting should also be taken into account in assigning the score for a measure.

Standard of Protection Factor
A Standard of Protection Factor is not applicable to this objective, as it is implicit within the scoring process.

Non-Structural Option Risk Reduction
Flood warning does not reduce hazard, but generally can reduce risk. In the case of risk to people in residential properties, advance warning of an impending flood can be vital in providing sufficient time to evacuate the residents, and so flood forecasting and warning can significantly reduce the risk to life. The option score for non-structural warnings involving advance warning should therefore be 4, 2 and 1 for effective advance warning periods in excess of 6 hours, 4 hours and 2 hours respectively.

The above provides guidance on the setting of local weightings and scoring for this objective. However, professional judgement should also be applied as per Section 3.3.

OBJECTIVE 1.A (ii)	
Objective	**Minimise risk to human health and life – High vulnerability properties**
Indicator	Number and type of high vulnerability properties at risk from flooding
Scoring	Based on calculated assessment, adjusted by professional judgement
Basic Requirement	Number of high vulnerability properties at risk not increased
Aspirational Target	100% reduction in number of high vulnerability properties at risk
Global Weighting	17
Local Weighting	Based on calculated assessment, adjusted by professional judgement

Guidance on Assignment of Local Weightings

The local weightings should be calculated based on a score derived from the number and type of high vulnerability properties potentially affected by flooding, and the highest probability (lowest magnitude) of flood event that causes flooding of that property.

Property Scoring

Each type of high vulnerability property is assigned a score. The types of high vulnerability properties are categorised and scored as follows:

Property Type	Score
Hospitals	500 (IRR)
Nursing / Residential Homes	250
Prisons	250
Camping / Caravan / Halting Sites	100
Schools	50

Probability Factoring

For each property, the score is then factored by the probability of the highest probability (least severe) flood event that causes flooding of that property, where the factor applied is calculated as:

Factor = Probability of flooding (expressed as the AEP, e.g., 0.01 for 1%)

Other Factors

Rate of Onset of Flooding

The risk to life associated with the flooding of high vulnerability properties is related to the rate of onset of flooding and hence the time available to evacuate the vulnerable people. It is assumed that typically it will be evident that flooding may occur with a 1 to 2 hours available to then evacuate the vulnerable people before the depth / velocity of flood water creates difficulties for evacuation and / or a moderate risk to life. However, if the rate of onset is significantly greater or less than this, then professional judgement should be applied to decrease or increase the score accordingly.

Flood Depths and Velocities (Risk to Life)

The risk to life associated with the flooding of high vulnerability properties is related to the projected depths of flooding and the velocity of overland flood flow (i.e., the risk to life). It is assumed that typically a Low risk to life will exist for high vulnerability properties. However, if the risk to life is greater than this, then professional judgement should be applied to increase or the score accordingly.

Calculation of Other Factors

The rate of onset of flooding and the risk to life at the high vulnerability property can be determined from the outputs of the hydraulic modelling and flood mapping.

Total AFA Score (Local Weighting)

For the given AFA, the total AFA score is calculated as the sum of the factored scores for each property at risk from flooding, subject to a maximum score of 5.

Note that final local weighting taking into account the application of the factors for Rate of Onset of Flooding and Flood Depths and Velocities (Risk to Life) should still not exceed a maximum of 5.

The above provides guidance on the setting of local weightings for this objective. However, professional judgement should also be applied as per Section 3.3.

Guidance on Option Scoring

Residual Risk Score

The residual risk score for a flood risk management option should be calculated in the same manner as the local weighting, but based on the flood hazard with the option applied.

In the case of measures providing flood defence, then the residual risk score can be calculated simply by adjusting the factor for probability to that of the standard of protection (following the simplistic assumption that once the standard of protection is exceeded for a given flood defence, then no defence is provided).

Option Scoring
Options are scored based on the degree of reduction in the risk to high vulnerability properties, calculated using the residual risk score as determined for the relevant option, and the final local weighting, and multiplied by a factor of 5.

The score for a given option should be calculated as:

Option Score = 5 X [(Local Weighting – Residual Risk Score) / Local Weighting]

The other factors detailed under the guidance on the assignment of Local Weighting should also be taken into account in assigning the score for a measure.

Standard of Protection Factor
A Standard of Protection Factor is not applicable to this objective, as it is implicit within the scoring process.

Non-Structural Option Risk Reduction
Flood warning does not reduce hazard, but generally can reduce risk. In the case of high vulnerability properties, advance warning of an impending flood can be vital in providing sufficient time to evacuate the vulnerable people, and so flood forecasting and warning can significantly reduce the risk to life. The option score for non-structural warnings involving advance warning should therefore be 4, 2 and 1 for effective advance warning periods in excess of 6 hours, 4 hours and 2 hours respectively.

The above provides guidance on the setting of local weightings and scoring for this objective. However, professional judgement should also be applied as per Section 3.3.

OBJECTIVE 1.B (i)	
Objective	**Minimise risk to community – Social Infrastructure and Amenity**
Indicator	Number of social infrastructure assets at risk from flooding
Scoring	Based on calculated assessment, adjusted by professional judgement
Basic Requirement	Number of social infrastructure assets at risk not increased
Aspirational Target	100% reduction in number of social infrastructure assets at risk
Global Weighting	9
Local Weighting	Based on calculated assessment, adjusted by professional judgement

Guidance on Assignment of Local Weightings

The local weightings should be calculated based on a score derived from the number of social infrastructure and amenity assets potentially affected by flooding, and the highest probability (lowest magnitude) of flood event that causes flooding of each asset.

Receptor Scoring

All social infrastructure and amenity assets should be treated as equal for the purposes of the calculated score. To ensure that the local weighting on this category is appropriately scaled, each asset should be afforded a score of 25.

A weighing has not been applied to the scores, as all social infrastructure and amenity assets (where included) were designated during the PFRA vulnerability assessment as being of 'moderate' vulnerability, except for schools where a 'high' vulnerability classification was assigned due to elevated risk to human health and life arising from the concentration of children, which is provided for under Objective 1.A. (ii).

The relevant social infrastructure and amenity assets include:

- Schools and educational facilities
- Libraries
- Community centres
- Local and central government offices, including post offices
- Emergency services facilities (fire, Garda, civil defence, RNLI and coast guard stations)
- Health centres (other than hospitals and nursing homes)
- Churches and other religious centres

- Parks and public gardens, sports facilities, playgrounds
- Local cultural heritage sites or collections, sites of ecological interest or other sites of social amenity

Probability Factoring

For each asset, the score (25) is then factored by the probability of the highest probability (least severe) flood event that causes flooding of that asset, where the factor applied is calculated as:

Factor = Probability of flooding (expressed as the AEP, e.g., 0.01 for 1%)

Total AFA Score (Local Weighting)

For the given AFA, the total AFA score is calculated as the sum of the factored scores for all of the social infrastructure and amenity assets at risk from flooding, subject to a maximum score of 5.

Other Factors

Assets of Particular Social Value

A particular social infrastructure and amenity asset may be of exceptional local importance, i.e., where the loss of the asset (permanently or over a long period of time) would have a very severe detrimental impact on the functioning of the community as a whole and on the day-today lives of the people in the community (i.e., well beyond the normal expected impact that the loss of one of the listed social infrastructure assets might have. In such cases, professional judgement should be applied to increase the weighting accordingly.

Note that final local weighting taking into account the application of the factors for assets of particular social value should still not exceed a maximum of 5.

The above provides guidance on the setting of local weightings for this objective. However, professional judgement should also be applied as per Section 3.3.

Guidance on Option Scoring

Residual Risk Score

The residual risk score for a flood risk management option should be calculated in the same manner as the local weighting, but based on the flood hazard with the option applied.

In the case of measures providing flood defence, then the residual risk score can be calculated simply by adjusting the factor for probability to that of the standard of protection (following the simplistic assumption that once the standard of protection is exceeded for a given flood defence, then no defence is provided).

Option Scoring
Options are scored based on the degree of reduction in the risk to social infrastructure and amenity, calculated using the residual risk score as determined for the relevant option, and the final local weighting, and multiplied by a factor of 5.

The score for a given option should be calculated as:

Option Score = 5 X [(Local Weighting – Residual Risk Score) / Local Weighting]

The other factors detailed under the guidance on the assignment of Local Weighting should also be taken into account in assigning the score for a measure.

Standard of Protection Factor
A Standard of Protection Factor is not applicable to this objective, as it is implicit within the scoring process.

Non-Structural Option Risk Reduction
Flood warning does not reduce hazard, but generally can reduce risk. However, social infrastructure and amenity assets will still be damaged in the event of a flood regardless of the advance warning of the flooding (unless combined with individual protection measures), and so the negative impact (damage to the fabric and disruption to the service the asset provides) will still occur. While it is recognised that advance warning gives more time to prepare damage reduction measures, etc., it is considered that such mitigation measures should be part of a well-formed flood event emergency response plan, and so the advance warning will bring limited benefit. As such, a zero degree of reduction of risk to social infrastructure and amenity should be assumed in relation to non-structural options.

Enhancement or Creation of Social Amenity Sites
Where an option would enhance an existing social amenity site, or involve the creation of a new site, then professional judgement should be used to increase the score afforded that option under this Objective, taking account of the number and value of the sites involved.

The above provides guidance on the setting of local weightings and scoring for this objective. However, professional judgement should also be applied as per Section 3.3.

OBJECTIVE 1.B (ii)	
Objective	**Minimise risk to community - Local Employment**
Indicator	Number of non-residential (i.e., commercial) properties at risk from flooding
Scoring	Based on calculated assessment, adjusted by professional judgement
Basic Requirement	Number of non-residential properties at risk not increased
Aspirational Target	100% reduction in number of non-residential properties at risk
Global Weighting	7
Local Weighting	Based on calculated assessment, adjusted by professional judgement

Guidance on Assignment of Local Weightings

The local weightings should be calculated based on a score derived from the number of non-residential properties (taken as a place of employment) potentially affected by flooding, and the highest probability (lowest magnitude) of flood event that causes flooding of each property.

Receptor Scoring

All non-residential properties that are not derelict should be treated as equal for the purposes of the calculated score. To ensure that the local weighting on this category is appropriately scaled, each property should be afforded a score of 5.

A differential weighting has not been applied to the count, as reliable information would not be available as to the number of employees for any given property, nor of the indirect employment associated with that property / business

The relevant non-residential properties include:

- Offices
- Shops
- Services (Restaurants, Pubs, Hotels, etc.)
- Factories, Workshops and other Manufacturing Facilities
- Warehouses
- Health Centres (including hospitals and nursing homes)
- Other places of employment

Probability Factoring

For each property, the score (5) is then factored by the probability of the highest probability (least severe) flood event that causes flooding of that property, where the factor applied is calculated as:

Factor = Probability of flooding (expressed as the AEP, e.g., 0.01 for 1%)

Total AFA Score (Local Weighting)

For the given AFA, the total AFA score is calculated as the sum of the factored scores for all of the non-residential properties at risk from flooding, subject to a maximum score of 5.

Other Factors

Properties of Particular Importance for Local Employment

A particular non-residential property may be of exceptional local importance, i.e., where the property is the location for the employment of a particularly large number of people or a very high proportion of the people employed within the local area. Flooding of such a property (and the interruption to business and potential closure) would have a very severe detrimental impact on the community and could lead to a significant rise in local unemployment. In such cases, professional judgement should be applied to increase the weighting accordingly.

Local Employment Generated through Tourism

Local employment may be generated through local features and assets that are not based in particular buildings (and hence not included as non-residential properties). Such features may include local angling sites, tourist features or walks, sites of ecological value, heritage sites, etc. Flooding of such features and assets may negatively impact on local employment. In such cases, professional judgement should be applied to increase the weighting accordingly.

Note that final local weighting taking into account the application of the factors for properties of particular importance for local employment should still not exceed a maximum of 5.

The above provides guidance on the setting of local weightings for this objective. However, professional judgement should also be applied as per Section 3.3.

Guidance on Option Scoring

Residual Risk Score

The residual risk score for a flood risk management option should be calculated in the same manner as the local weighting, but based on the flood hazard with the option applied.

In the case of measures providing flood defence, then the residual risk score can be calculated simply by adjusting the factor for probability to that of the standard of protection (following the simplistic assumption that once the standard of protection is exceeded for a given flood defence, then no defence is provided).

Option Scoring
Options are scored based on the degree of reduction in the risk to local employment, calculated using the residual risk score as determined for the relevant option, and the final local weighting, and multiplied by a factor of 5.

The score for a given option should be calculated as:

Option Score = 5 X [(Local Weighting – Residual Risk Score) / Local Weighting]

The other factors detailed under the guidance on the assignment of Local Weighting should also be taken into account in assigning the score for a measure.

Standard of Protection Factor
A Standard of Protection Factor is not applicable to this objective, as it is implicit within the scoring process.

Non-Structural Option Risk Reduction
Flood warning does not reduce hazard, but generally can reduce risk. However, non-residential properties will still be damaged in the event of a flood regardless of the advance warning of the flooding (unless combined with individual property protection measures), and so the negative impact (damage to the fabric and disruption to the employment the property provides) will still occur. While it is recognised that advance warning gives more time to prepare damage reduction measures, etc., it is considered that such mitigation measures should be part of a well-formed flood event emergency response plan, and so the advance warning will bring limited benefit. As such, a zero degree of reduction of risk to local employment should be assumed in relation to non-structural options.

The above provides guidance on the setting of local weightings and scoring for this objective. However, professional judgement should also be applied as per Section 3.3.

OBJECTIVE 2.A	
Objective	**Reduce economic damages**
Indicator	Annual Average Damage (AAD) expressed in Euro / year, calculated in accordance with the economic risk assessment methods, but with no allowance for social / intangible benefits
Scoring	0.05 X percentage reduction in AAD
Basic Requirement	AAD is not increased
Aspirational Target	100% reduction in AAD
Global Weighting	24
Local Weighting	AAD for the SSA / €75,000

Guidance on Assignment of Local Weightings

The Local Weighting should be calculated as:

Local Weighting = AAD for the SSA / €75,000

Where:

The Local Weighting may not exceed the ceiling value of 5, and,

AAD is the Annual Average (economic) Damages, excluding any allowances for social and intangible benefits

'€75,000' is a factor that has been selected to set the Local Weighting equal to 5 in SSAs / AFAs where economic damages are among the highest typically encountered in Ireland, i.e., it has been set to ensure that there will not be a large number of locations where the ceiling value of 5 is exceeded. This factor has been selected based on trial application on a number of test cases to ensure that the factor meets the above criteria.

The above calculation process is automated, and in this instance the outcome should be used as calculated. Professional judgement does however need to be applied within the requirements and guidance provided in relation to the calculation of the Annual Average Damages.

Guidance on Scoring

Indicator Calculation

The indicator should be calculated on the basis of the economic damage analysis, to be undertaken in accordance with Appendix I of the Generic Project Brief and guided by the Technical Methodology Note on CBA, but with no allowance for social / intangible benefits as these are provided for under other objectives within the MCA.

Option Scoring
The score for a given option should be calculated as:

Score = 0.05 X Percentage Reduction in AAD

Standard of Protection Factor
A Standard of Protection Factor is not applicable to this objective, as it is implicit within the scoring process.

Non-Structural Option Risk Reduction
The following values should apply as the percentage reduction in AAD for non-structural options (i.e., those that do not reduce hazard, but can reduce risk):

Non-Structural Measure	**% Reduction in AAD**
Flood Forecasting and Warning: Warning Period > 12 hrs	10%
Flood Forecasting and Warning: Warning Period 6 - 12 hrs	6%
Flood Forecasting and Warning: Warning Period 2 - 6 hrs	4%
Flood Forecasting and Warning: Warning Period < 2 hrs	0%

OBJECTIVE 2.B	
Objective	**Minimise risk to transport infrastructure**
Indicator	Number and type of transport routes at risk from flooding
Scoring	Based on calculated assessment, adjusted by professional judgement
Basic Requirement	No increase in risk to transport infrastructure
Aspirational Target	Reduce risk to transport infrastructure to zero
Global Weighting	10
Local Weighting	Based on calculated assessment, adjusted by professional judgement

Guidance on Assignment of Local Weightings

The local weightings should be calculated based on a score derived from the number and type of transport routes potentially blocked by flooding, and the highest probability (lowest magnitude) of flood event that causes flooding of that route, taking account of the duration of flooding and the diversion time (in relation to road flooding).

Route and Airport Scoring

Each type of transport route and airport is assigned a score. The types of transport routes and airports are categorised and scored as follows:

Type	Road	Rail	Airports	Score
IRR			International	500
A	Motorway	Main line / DART / Luas		250
B	National Primary		Regional	150
C	National Secondary	Branch Line		75
D	Regional			25
E	Local Rural			10
F	Local Urban (Street)			See below

Local Urban Roads (Streets)

Within an AFA there may be multiple local roads (streets) at risk from flooding, and the flooding of these does not necessarily have a proportional cumulative effect in terms of impact on transport. As such, a maximum value of 25 should be applied with respect to the flooding of urban streets, with professional judgement applied in determining the score up to this maximum score.

Note that each road joining a junction should be treated as an individual road, and similarly train stations / rail junctions prone to flooding might reflect interruption to multiple routes.

Probability Factoring

For each route, the score is then factored by the probability of the highest probability (least severe) flood event that causes flooding of that route, where the factor applied is calculated as:

Factor = Probability of flooding (expressed as the AEP, e.g., 0.01 for 1% / 100-yr)

For example, a National Primary road at risk from flooding in events of probability of 0.02 and less, then the factored score would be = 150 X 0.02 = 3

Other Factors

Duration of Flooding

The damages associated with the flooding of transport routes are related to the duration of the flooding. It is assumed that substantive flooding of the route will last approximately 6 to 12 hours. However, if the duration of flooding, and hence disruption, is significantly greater or less than this, then professional judgement should be applied to increase or decrease the score accordingly, noting amended or compensatory behaviours when flooding is known but also the impact of long-term isolation of properties.

Diversion Time for Road Flooding

The damages associated with the flooding of roads are related to the length of diversion in terms of additional journey time. It is assumed that diversion would typically increase journey time by approximately 15 to 30 minutes. However, if the duration of flooding, and hence disruption, is significantly greater or less than this, then professional judgement should be applied to increase or decrease the score accordingly. In determining diversion time, advice should be sought on which routes are likely to remain open during a flood.

Calculation of Other Factors

Note that the factors for duration and diversion time do **NOT** need to be calculated based on distance, speed, etc., but may be estimated based on professional judgement taking into account local anecdotal information derived from local authority staff and public observations.

Total AFA Score (Local Weighting)

For the given AFA, the total AFA score is calculated as the sum of the factored scores for each transport route at risk from flooding, subject to a maximum score of 5.

For example, an AFA with a national secondary road and regional road at risk from flooding in events of probability of 0.01 and 0.05 respectively, and multiple urban streets at risk from flooding in events of probability from 0.1, then the factored score would be:

(National secondary road: 75 X 0.01 = 0.75) + (Regional road: = 25 X 0.05 = 1.25) + (Multiple urban streets) = 25 X 0.1 = 2.5 = Total AFA Score (i.e., Local Weighting) = 4.50

Note that final local weighting taking into account the application of the factors for duration and diversion time should still not exceed a maximum of 5.

The above provides guidance on the setting of local weightings for this objective. However, professional judgement should also be applied as per Section 3.3, taking account of other local factors.

Guidance on Option Scoring

Residual Risk Score

The residual risk score for a flood risk management option should be calculated in the same manner as the local weighting, but based on the flood hazard with the option applied.

In the case of measures providing flood defence, then the residual risk score can be calculated simply by adjusting the factor for probability to that of the standard of protection (following the simplistic assumption that once the standard of protection is exceeded for a given flood defence, then no defence is provided).

Option Scoring

Options are scored based on the degree of reduction in the risk to transport routes, calculated using the residual risk score as determined for the relevant option, and the final local weighting, and multiplied by a factor of 5.

The score for a given option should be calculated as:

Option Score = 5 X [(Local Weighting – Residual Risk Score) / Local Weighting]

The other factors detailed under the guidance on the assignment of Local Weighting should also be taken into account in assigning the score for a measure.

Standard of Protection Factor

A Standard of Protection Factor is not applicable to this objective, as it is implicit within the scoring process.

Non-Structural Option Risk Reduction

Flood warning does not reduce hazard, but generally can reduce risk. While transport routes will still be blocked in the event of a flood regardless of the advance warning of the flooding, and the negative impact (delay and disruption) could be slightly reduced if advance warning were available. As such, non-structural measures should afforded the percentage reduction in score as set out below:

Non-Structural Measure	% Reduction in Factored Score
Flood Forecasting and Warning: Warning Period > 12 hrs	10%
Flood Forecasting and Warning: Warning Period 6 - 12 hrs	6%
Flood Forecasting and Warning: Warning Period 2 - 6 hrs	4%
Flood Forecasting and Warning: Warning Period < 2 hrs	0%

Professional judgement should be applied to review and confirm scores as per Section 3.3.

OBJECTIVE 2.C	
Objective	**Minimise risk to utility infrastructure**
Indicator	Number and type of infrastructure assets at risk from flooding
Scoring	Based on calculated assessment, adjusted by professional judgement
Basic Requirement	No increase in risk to utility infrastructure
Aspirational Target	Reduce risk to utility infrastructure to zero
Global Weighting	14
Local Weighting	Based on calculated assessment, adjusted by professional judgement

Guidance on Assignment of Local Weightings

The local weightings should be calculated based on a score derived from the number and type of utility infrastructure receptors potentially affected by flooding, and the highest probability (lowest magnitude) of flood event that causes flooding of that receptor.

Receptor Scoring

Each type of utility receptor is assigned a score. The types of utility receptors are categorised and scored as follows:

Receptor Type	Score
Power Stations	500
HV Sub-Stations	250
Gas Assets – High Priority	100
Gas Assets – Medium Priority	25
Water Treatment Plants & Primary Pumping Facilities	250
Waste Water Treatment Plants & Primary Pumping Facilities	250
Core Telecommunication Exchanges	100
Non-Core Telecommunication Exchanges	25

Probability Factoring

For each receptor, the score is then factored by the probability of the highest probability (least severe) flood event that causes flooding of that receptor, where the factor applied is calculated as:

Factor = Probability of flooding (expressed as the AEP, e.g., 0.01 for 1%)

For example, a Water Treatment Plant at risk from flooding in events of probability of 0.02 and less, then the factored score would be:

Factored score = 250 X 0.02 = 5

Other Factors

Service Area / Population

The impact of flooding of a utility asset, and the associated damage and disruption of service, is related to the population and/or area it serves. It is assumed that an asset would be typical of its classification. However, if the population and/or area served is significantly greater or less than this, then professional judgement should be applied to increase or decrease the score accordingly.

Calculation of Other Factors

Note that the factors for service area / population do **NOT** need to be calculated based on the area or population served, but may be estimated based on professional judgement taking into account local anecdotal information derived from local authority staff and public observations. (Note: The OPW will seek industry standard data re typical service numbers).

Total AFA Score (Local Weighting)

For the given AFA, the total AFA score is calculated as the sum of the factored scores for each receptor at risk from flooding, subject to a maximum score of 5.

Note that final local weighting taking into account the application of the factors for service area / population should still not exceed a maximum of 5.

The above provides guidance on the setting of local weightings for this objective. However, professional judgement should also be applied as per Section 3.3.

Guidance on Option Scoring

Residual Risk Score

The residual risk score for a flood risk management option should be calculated in the same manner as the local weighting, but based on the flood hazard with the option applied.

In the case of measures providing flood defence, then the residual risk score can be calculated simply by adjusting the factor for probability to that of the standard of protection (following the simplistic assumption that once the standard of protection is exceeded for a given flood defence, then no defence is provided).

Option Scoring
Options are scored based on the degree of reduction in the risk to utility receptors, calculated using the residual risk score as determined for the relevant option, and the final local weighting, and multiplied by a factor of 5.

The score for a given option should be calculated as:

Option Score = 5 X [(Local Weighting – Residual Risk Score) / Local Weighting]

The other factors detailed under the guidance on the assignment of Local Weighting should also be taken into account in assigning the score for a measure.

Standard of Protection Factor
A Standard of Protection Factor is not applicable to this objective, as it is implicit within the scoring process.

Non-Structural Option Risk Reduction
Flood warning does not reduce hazard, but generally can reduce risk. While utility receptors could still be flooded in the event of a flood regardless of the advance warning of the flooding, and the negative impact (damage to the utility and disruption to the service the utility provides) could be slightly reduced if advance warning were available. As such, non-structural measures should afforded the percentage reduction in score as set out below:

Non-Structural Measure	**% Reduction in Factored Score**
Flood Forecasting and Warning: Warning Period > 12 hrs	10%
Flood Forecasting and Warning: Warning Period 6 - 12 hrs	6%
Flood Forecasting and Warning: Warning Period 2 - 6 hrs	4%
Flood Forecasting and Warning: Warning Period < 2 hrs	0%

The above provides guidance on the setting of local weightings and scoring for this objective. However, professional judgement should also be applied as per Section 3.3.

OBJECTIVE 2.D	
Objective	**Manage risk to agriculture**
Indicator	Agricultural production
Scoring	By professional judgement, taking account of local advice
Basic Requirement	No increase in the negative impact of flooding on agricultural production
Aspirational Target	Provide the potential for enhanced agricultural production
Global Weighting	12
Local Weighting	By professional judgement, taking account of local advice

Guidance on Assignment of Local Weightings

Setting of the Local Weighting is to be by professional judgement, taking account of the value and social importance of the agricultural industry in the area guided by advice from the steering and progress groups and via submissions from the public.

Guidance on Scoring

Option Scoring

Scoring is to be professional judgement, taking into account local advice.

Consideration in setting the scores for an option should include:

- An increase or decrease in the area of agricultural land subject to flooding
- The frequency and seasonality of flooding, and the seasonality of agricultural production and land use in the area
- The duration of flooding
- The source of floodwaters, noting that salt water flooding can cause significantly more damage to agricultural production than river flooding
- The overland flow velocity
- The existing and potential other agricultural uses of the land
- The potential for flood warning to mitigate the impacts of flooding on agriculture
- Factors that may not affect the area of land flooding but that could otherwise impact positively or negatively on agricultural production (e.g., risk to local dairy factory, long-term isolation of farms, etc.)
- The potential to enhanced agricultural production, such as through the reduction of the frequency or extent of flooding of agricultural land.

OBJECTIVE 3.A	
Objective	**Support the objectives of the WFD**
Sub-Objective	Provide no impediment to the achievement of water body objectives and, if possible, contribute to the achievement of water body objectives.
Scoring	Likelihood to impact on water body status elements: – Biology; – Physico-chemical; – Hydrology and morphology; – Priority substances and priority hazardous substances.
Basic Requirement	Provide no constraint to the achievement of water body objectives.
Aspirational Target	Contribute to the achievement of water body objectives.
Global Weighting	16
Local Weighting	5

Guidance on Assignment of Local Weightings

The Local Weighting to be applied for this objective is constant, and should always be set equal to 5 as WFD objectives must be achieved and are relevant to all waterbodies.

Guidance on Option Scoring

Scoring should be guided by professional judgement with reference to the scoring guidance below and the generic desciption of the likely impacts of measures on water body status.

The scoring of the options for this objective should take into account the duration and permanence of the likely impact(s) of the options on water body status elements, the sensitivity of the receiving water bodies, and the potential sources of pollution in the flood extent area.

Duration is defined in terms of:
- long term;
- medium term;
- short term.

Permanence is defined in terms of:
- permanent;
- recurring;
- intermittent.

Sensitive water bodies include:

- water bodies listed in the register of protected areas;
- high status water bodies.

Significant polluting sources include:

- plants licensed under Directives 96/61/EC and 91/271/EC;
- septic tanks greater than 500 PE;
- significant slurry storage facilities.
- establishments defined under Directive 2012/18/EU

Combining positive and negative scores

Most options will have the potential for both positive and negative impacts on water body status as, regardless of the nature of the options, they will all be designed to reduce flood risk which in turn will reduce pollution risk (by reducing the occurence of flood waters carrying pollutants from inundated areas back into the river – the significance of this positive impact varies depending on the potential sources of pollution within the inundated area and the sensitivity of the water body). Therefore, the overall score applied should be a combination of the best case positive score and the worst case negative score.

Example of combining scores

Option = hard defences and flow diversion

- +2 due to reduction of pollution risk to sensitive water bodies
- -2 due to construction stage impacts associated with walls
- -5 associated with diversion of flow into another river

In this case, the overall score should be '-3', combining the best case positive score and the worst case negative score.

Comparing options

When scoring multiple options for one AFA, it may happen that the options score the same even if they have varying degrees of impact. Professional judgement should be used to ensure that the scores reflect the varying degrees of impact between the options i.e. the scores should be manually adjusted to reflect the different degrees of impact associated with the different options.

Example of manual adjustment

Option 1 = flow diversion

- +2 due to reduction of pollution risk to sensitive water bodies
- -5 associated with diversion of flow into another river

Overall score = -3

Option 2 = flow diversion plus walls

- +2 due to reduction of pollution risk to sensitive water bodies
- -2 due to construction stage impacts to sensitive water bodies associated with walls
- -4 due to excavation and restoration of natural banks in sensitive water bodies
- -5 associated with diversion of flow into another river

Overall score = -3 (combining best case positive score and worst case negative score)

These options score the same even though Option 2 has more negative impacts associated with it. In this example, using professional judgement, Option 2 should be manually adjusted downwards by 1 point to reflect the comparitive difference in impacts between the options. If more than two options are being compared, and all differ in terms of the severity of their likely impacts on this objective, but all score the same using this methodology, the options should be manually adjusted upwards or downwards by a maximum of two points in either direction to reflect the comparitive difference in impacts between the options. Such adjustments will ensure that the overall MCA scores for the options reflect their differing degree of potential impact on this objective and will therefore ensure that this objective will have an influence in terms of the choice of a preferred option. In such cases a clear rationale should be recorded for the adjustment. It should be noted that such adjustments may have a significant impact on the overall MCA score of the preferred option (perhaps up to 10% of the overall MCA score).

Scoring Table

Score	Duration of impact	WB sensitivity	Examples
5	Permanent or long-term contribution to the achievement of wb objectives	All	Reinstatement of natural hydrological or morphological regime.
4	Medium-term or recurring contribution to the achievement of wb objectives	Sensitive	Reduced flooding in area with significant polluting sources in 1% AEP extent.
3		Non-sensitive	
2	Short-term or intermittent contribution to the achievement of wb objectives	Sensitive	Reduced flooding in area with no significant polluting sources in 1% AEP extent.
1		Non-sensitive	
0	No constraint to the achievement of wb objectives	All	No connectivity between measure and channel or flow.
-1	Short-term or intermittent impediment to the achievement of wb objectives	Non-sensitive	Construction phase impacts. In-stream or on-bank maintenance impacts. Overland floodways. Off-line storage. Rehabilitation of existing in-stream or on-bank defences.
-2		Sensitive	
-3	Medium-term or recurring impediment to the achievement of wb objectives	Non-sensitive	Excavation and restoration of banks. Flow diversion within the same river. One-off or very occasional dredging. Short culverts (e.g. under a road).
-4		Sensitive	
-5	Permanent or long-term impediment to the achievement of wb objectives	All	Channelisation / realignment that does not constitute a reinstatement of natural hydrological or morphological regimes. Regular dredging. Flow diversion to a different river (See futher guidance in tabvle below). Extensive culverting. Tidal barrage. On-line storage (dams and reservoirs). Improvement of channel conveyance. Permanent removal of natural banks.
-999	Unacceptable negative impact where feasible alternative exists		

The table below describes the likely impacts of flood risk management measures on the objectives of the WFD. It sets out a description of likely impacts that can be referred to when undertaking the scoring process to help ensure consistency between studies.

Category	Measure	Code	Likely Impacts (WFD)
NFM Protect	Land Use Management	LM	Effective land use management has the potential for positive impacts on water body status through the reduction of pollutants entering rivers and the restoration of natural hydrological and morphological regimes.
Protect	Maintenance Programme	MP	The maintenance of existing in-stream or on-bank flood defences has the potential for short-term and intermittent negative impacts on water status.
Protect	Upstream storage / Storage	S	On-line storage: creation of a dam and reservoir across the floodplain of a river, often with an outlet control structure such as an undershot culvert or sluices, to control outlet flow, and with an overflow weir and spillway. Positive impacts include reduced flooding and therefore reduced pollution. Negative impacts include permanent changes to hydrological and morphological regimes, barrier to migration. There is also the potential for eutrophication within the reservoir which can affect the channel downstream. Off-line storage: area of floodplain embanked to prevent or control flooding within the storage area or wash-land during minor events. Positive impacts include reduced flooding and therefore reduced pollution. Negative impacts include changes to hydrological (and to a lesser extent morphological) regimes.
Protect	Tidal Barrage	TB	Tidal barrages have the potential for significant negative impacts on migratory fish and other water dependent species and are a permanent change to hydrological and morphological regimes.
Protect	Improvement of Channel Conveyance	IC	Increased conveyance improves the efficiency of the channel, and thereby reduces the water levels for a given flow. This is often done by deepening or widening a channel, cutting berms to take more flow during flood events, realigning the bed profile (e.g. removing outcrops) or lining the channel with an artificial or soft (but low resistance) material (ranging from concrete or steel piles to low grass over geotextile). These measures all have the potential for negative effects to hydrological and morphological regimes (permanent or long term), physico-chemical conditions (short-term during construction), biology (arising from other impacts described).

Category	Measure	Code	Likely Impacts (WFD)
Protect	Hard Defences	D	Embankments are unlikely to have negative impacts upon water bodies except in areas where embankments extend right up to the channel bank in which case there
Protect	Culverting	C	Culverting represents a permanent morphological and hydrological impact. The extent of culverting is important is assessing the impact.
Protect	Diversion of Flow	DF	Flow diversion measures include realigning the entire river or creating by-pass channels. Realigning a river in a way that does not constitute a
Protect	Overland Floodways	OF	Overland floodways consitute a short-term and intermittent negative impact to the hydrological and morphological regime of the river and could also impact
Protect	Rehabilitation of Existing Defences	ED	Rehabilitation of existing in-stream and on-bank defences has the potential for short-term and occasional impacts of the physcio-chemical conditions of the river

	Existing Defences		defences has the potential for short-term and occasional impacts of the physcio-chemical conditions of the river associated with the works phase.

OBJECTIVE 3.B	
Objective	**Support the objectives of the Habitats and Birds Directives**
Sub-Objective	Avoid detrimental effects to, and where possible enhance, Natura 2000 network, protected species and their key habitats, recognising relevant landscape features and stepping stones
Scoring	Area of Natura 2000 site at risk of flooding and qualitative assessment of impact (flooding may have a positive, neutral or negative impact) Loss of, or significant changes to habitat of, riverine and wetland species associated with Natura 2000 sites.
Basic Requirement	No deterioration in the conservation status of designated sites as a result of flood risk management measures
Aspirational Target	Improvement in the conservation status of designated sites as a result of flood risk management measures
Global Weighting	10
Local Weighting	By professional judgement, taking account of local advice

Guidance on Assignment of Local Weightings

The local weighting may not exceed a ceiling value of 5. Professional judgement should be applied in assigning this weighing. After consultations with progress group, steering group and members of the stakeholder group, this weighting may change.

The presence of Annex IV (Habitats Directive) species of flora and fauna, and their key habitats, which are strictly protected wherever they occur, whether inside or outside the SAC/SPA, will have an impact on this score.

Guidance on Option Scoring

Scoring by professional judgement, based upon the following key datasets:

- Natura 2000 sites (SACs, SPAs)
- Ramsar Sites
- Annex IV (Habitats Directive) species of flora and fauna, and their key habitats

Note that the scoring allows a negative score of -5 to reflect the importance of avoiding environmental impacts. The positive scores reflect the opportunities for environmental enhancement. The network of sites must also be considered together with the impact upon the individual site.

Score	Description
+5	Potential to create new candidate SAC, SPA or Ramsar sites or enhance NHA sites to SAC, SPA or Ramsar status, which extend the existing network of international and European designations as a result of flood risk management measures.
+3	Improvement or enhancement of the condition or management of existing SAC, SPA or Ramsar sites and network as a result of flood risk management measures.
+1	Localised improvement or enhancement of the condition or management of existing SAC, SPA or Ramsar sites and network as a result of flood risk management measures.
0	No impact on existing SAC, SPA or Ramsar sites as a result of flood risk management measures.
-1	Any detrimental impact upon existing SAC or SPA site, including a delay in recovery of the site, but excluding impacts on the conservations objectives of the site, as a result of flood risk management measures, where suitable mitigation measures are technically feasible.
-3	Any detrimental impact upon existing SAC or SPA site, including a delay in recovery of the site, but excluding impacts on the conservations objectives of the site, as a result of flood risk management measures, where there are no suitable mitigation measures.
-5	Any detrimental impact upon conservation objectives of existing SAC, SPA or Ramsar site, including a delay in recovery of the site, as a result of flood risk management measures, where suitable mitigation measures are technically feasible.
-999	Any detrimental impact upon existing conservation objectives of SAC, SPA or Ramsar site, as a result of flood risk management measures, where there are no suitable mitigation measures.

OBJECTIVE 3.C	
Objective	**Avoid damage to, and where possible enhance, the flora and fauna of the catchment**
Sub-Objective	Avoid damage to, and where possible enhance, legally protected sites / habitats and other sites / habitats of national, regional and local nature conservation importance
Scoring	Area of national, regional or local conservation designations at risk of flooding and qualitative assessment of impact (flooding may have a positive, neutral or negative impact) Loss of, or significant changes to habitat of, riverine and wetland species associated with national, regional and local conservation designations.
Basic Requirement	No deterioration of in condition of existing sites due to the implementation of flood risk management option
Aspirational Target	Creation of new or improvement in condition of existing sites due to the implementation of flood risk management option
Global Weighting	5
Local Weighting	By professional judgement, taking account of local advice

Guidance on Assignment of Local Weightings

The local weighting may not exceed a ceiling value of 5. Professional judgement should be applied in assigning this weighing. After consultations with progress group, steering group and members of the stakeholder group, this weighting may change.

Guidance on Option Scoring

Scoring by professional judgement, based upon the following key datasets:

- Natural Heritage Areas (& proposed Natural Heritage Areas)
- Nature Reserves
- Wildfowl Sanctuary
- OSPAR
- National Parks

Note that the scoring allows a negative score of -5 to reflect the importance of avoiding environmental impacts. The positive scores reflect the opportunities for environmental enhancement. The network of sites must also be considered together with the impact upon the individual site.

Score	Description
+5	Potential to create new national, regional and local conservation sites as a result of flood risk management measures.
+3	Improvement or enhancement of the condition or management of existing national, regional and local sites as a result of flood risk management measures.
+1	Potential for localised improvement of flora/fauna
0	No impact on existing national, regional and local sites as a result of flood risk management measures.
-1	Potential localised loss of or disturbance to flora/fauna limited by the already modified nature of the channel/shoreline.
-3	Potential localised loss of or disturbance to flora/fauna
-5	Any detrimental impact upon the condition of existing national, regional or local sites as a result of flood risk management measures, where suitable mitigation measures are technically feasible.
-999	Any detrimental impact upon national, regional or local sites as a result of flood risk management measures, where there are no suitable mitigation measures.

OBJECTIVE 3.D	
Objective	Protect and where possible enhance fisheries resource within the catchment
Sub-Objective	Maintain existing and where possible create new fisheries habitat including the maintenance or improvement of conditions that allow upstream migration for fish species.
Scoring	• Area of suitable habitat supporting salmonid and other fish species • Number of upstream barriers
Basic Requirement	• No loss of integrity of fisheries habitat • Maintenance of upstream accessibility
Aspirational Target	• No loss of fisheries habitat • Improvement in habitat quality / quantity • Enhanced upstream accessibility
Global Weighting	13
Local Weighting	By professional judgement, taking account of local advice

Guidance on Assignment of Local Weightings

The local weighting may not exceed a ceiling value of 5. Professional judgement should be applied in assigning this weighing. After consultations with progress group, steering group and members of the stakeholder group, this weighting may change.

The following scoring system may be adopted.

5 = where there are designated waters (e.g. under EU Shellfish Waters Directive; EU Freshwater Fish Directive)

4 = waterbody supports substantial salmonid fisheries/shellfisheries and is of national value for fishing/angling

3 = waterbody supports substantial fisheries/shellfisheries and is of regional value for fishing/angling

2 = waterbody supports fisheries/shellfisheries and is of local value for fishing/angling

1 = fisheries could be present but unlikely given the modified nature of the channel/presence of barriers to movement; no known angling/fishing activities

0 = no fisheries or angling areas present

Guidance on Option Scoring

Scoring by professional judgement with reference to the scoring guidance below and the generic desciption of the likely impacts of measures.

It is noted that this objective only relates to inland fisheries and not marine fisheries. Shellfish waters in particular are included under the register of protected areas under the WFD and as such are included in Objective 4a.

The scoring of the options for this objective should take into account the duration and permanence of the likely impact(s) of the options on on fisheries and fisheries potential, the sensitivity of the receiving water bodies, and species e.g. salmonid sp. and designated salmonid waters.

Duration is defined in terms of:
- long term;
- medium term;
- short term.

Permanence is defined in terms of:
- permanent;
- recurring;
- intermittent.

Sensitive waters include:
- designated salmonid waters

Sensitive species include*:
- Atlantic Salmon
- Lamprey
- Shad
- Pollan
- Arctic Char
- Smelt

*Based on 2011 IFI National Programme: Habitats Directive and Red Data Book Fish species

Combining positive and negative scores

Instream and bank options have the greatest potential to impact negatively on fisheries, however some options may offer improvements and as such the overall score applied should be a combination of the positive and negative scores with reference to the worst case and best case scores.

Example of combining scores

Option = hard defences and flow diversion
- +2 due to reduction of pollution risk to sensitive water bodies and sensitive species
- -2 due to construction stage impacts associated with walls
- -5 associated with diversion of flow into another river

In this case, the overall score should be '-3', combining the best case positive score and the worst case negative score.

Comparing options

When scoring multiple options for one AFA, it may happen that the options score the same even if they have varying degrees of impact. Professional judgement should be used to ensure that the scores reflect the varying degrees of impact between the options i.e. the scores should be manually adjusted to reflect the different degrees of impact associated with the different options.

Example of manual adjustment

Option 1 = flow diversion

- +2 due to improved fisheries potential as a result of reduction of pollution risk to sensitive water bodies and species
- -5 associated with diversion of flow into another river

Overall score = - 3

Option 2 = flow diversion plus walls

- +2 due to improved fisheries potential as a result of reduction of pollution risk to sensitive water bodies and species
- -2 due to construction stage impacts to sensitive water bodies and species associated with walls
- -4 due to excavation and restoration of natural banks in sensitive water bodies
- -5 associated with diversion of flow into another river

Overall score = - 3 (combining best case positive score and worst case negative score)

These options score the same even though Option 2 has more negative impacts associated with it. In this example, using professional judgement, Option 2 should be manually adjusted downwards by 1 point to reflect the comparitive difference in impacts between the options. If more than two options are being compared, and all differ in terms of the severity of their likely impacts on this objective, but all score the same using this methodology, the options should be manually adjusted upwards or downwards by a maximum of two points in either direction to reflect the comparitive difference in impacts between the options. Such adjustments will ensure that the overall MCA scores for the options reflect their differing degree of potential impact on this objective and will therefore ensure that this objective will have an influence in terms of the choice of a preferred option. In such cases a clear rationale should be recorded for the adjustment. It should be noted that such adjustments may have a significant impact on the overall MCA score of the preferred option (perhaps up to 10% of the overall MCA score).

Scoring Table

Score	Duration of impact	Sensitivity	Examples
5	Creation of fisheries habitat or removal of barrier to upstream migration for wb where sensitive species are known to be present e.g. salmonids	Any wb	Reinstatement of natural hydrological or morphological regime.
4	Creation of fisheries habitat or removal of barrier to upstream migration for wb where other species are present e.g. coarse fish	Any wb	Reinstatement of natural hydrological or morphological regime.
3			
2	Creation of fisheries potential	Any wb	Land Use Management
1			
0	No change to fisheries potential of the wb	Any wb	Measures with no connection to channel, flow, bank side vegetation
-1	Short-term minor impacts to fisheries habitat	Non-sensitive wb	Construction phase impacts.
-2		Sensitive wb	
-3	Medium to long-term alternation of fisheries habitat	Non-sensitive wb	In-stream or on-bank maintenance impacts. Walls that require excavation and restoration of banks. Flow diversion within the same river. Rehabilitation of existing in-stream or on-bank defences. Dredging
-4		Sensitive wb	
-5	Permanent loss or removal of fisheries habitat and / or introduction of barriers to upstream migration.	Any wb	Channelisation/realignment. Regular dredging. Extensive culverting. Tidal barrage. On-line storage (dams). Improvement of channel conveyance. Walls that replace natural banks. Flow diversion to a different river.
-999	Unacceptable negative impact where feasible alternative exists		

The table below describes the likely impacts flood risk management measures fisheries. It can be referred to when undertaking the scoring process to help ensure consistency between studies.

Category	Measure	Code	Likely Impacts (Fisheries)
NFM Protect	Land Use Management	LM	Effective land use management has the potential for positive impacts on fisheries through the reduction of pollutants entering rivers and the restoration of natural hydrological and morphological regimes with the possibility of restoration and / or creation of fisheries potential.
Protect	Maintenance Programme	MP	The maintenance of existing flood defense measures is likely to result in some positive impacts to fisheries through removal of debris and other physical obstructions etc, particularly following flood events. There is however potential for negative impacts where management of vegetation leads to loss of habitat or disturbance to species. All in-stream works have potential to negatively impact directly on fish species and as such would have to be carried out with due care and attention. On-bank works also have potential for negative impacts, particularly with regard to release of sediment and other organic matter.
Protect	Upstream storage / Storage	S	On-line storage refers to creating a dam and reservoir across the floodplain of a river, often with an outlet control structure such as an undershot culvert or sluices, to control outlet flow, and with an overflow weir and spillway. Such a measure has the potential to negatively impact on fisheries through disturbance or loss of habitat and blockage to migratory routes. This will be particularly significant in sensitive waters and for sensitive species. Creation of eutrophic conditions in the reservoirs could also impact on fisheries down-stream. Off-line storage refers to an area of floodplain that is embanked to prevent or control flooding within the storage area or wash-land during minor events. This can produce positive effects including creation of new habitat. Negative impacts may occur where the storage interferes with the existing riparian zone.
Protect	Tidal Barrage	TB	Tidal barrages have the potential for significant negative impacts on migratory fish and other water dependent species and are a permanent change to hydrological and morphological regimes.
Protect	Improvement of Channel Conveyance	IC	Increased conveyance improves the efficiency of the channel, and thereby reduces the water levels for a given flow. This is often done by deepening or widening a channel, cutting berms to take more flow during flood events, realigning the bed profile (e.g. removing outcrops) or lining the channel with an artificial or soft (but low resistance) material (ranging from concrete or steel piles to low grass over geotextile). This measure includes primarily in-stream work elements and as such represents one of the measures with most negative possibility in terms of fisheries potential.

	Protect (cont'd)	Improvement of Channel Conveyance (cont'd)	IC (cont'd)	All aspects are likely to result in short-term construction related impacts however, some, over the medium to long term will have significant potential to cause loss of habitat, disturbance of species through changes to hydrological and morphological regimes (permanent or long term), physico-chemical conditions (short-term during construction) and biology . In the medium to long-term there may be the possibility for positive impacts where new habitat can be generated.
	Protect	Hard Defences	D	Flood walls have the potential for impacts for fisheries depending on the distance of the wall from the channel. Some walls will require excavation of the bank during the construction phase followed by bank restoration – with short-term effects associated with construction and medium-term associated with bank recovery. There would also potentially be long-term hydrological or morphological impacts. In some areas, walls may replace natural banks and this would represent a permanent impact on the hydrological and morphological regime of the channel and in turn on the habitats and species present.
	Protect	Culverting	C	Culverting represents a permanent morphological and hydrological impact with has the potential to permanent impact on fisheries habitat and species particularly with regard to upstream movement of fish species. The extent of culverting is important is assessing the impact.
	Protect	Diversion of Flow	DF	Realigning a river constitutes a permanent negative impact to the hydrological and morphological regime of a river which have potential for both short and medium term impacts to fisheries through loss of habitat and disturbance to species. Flow diversion via a bypass chanell from one point of a river to another point of the same river would have short-term and intermittent negative impacts to the hydrological and morphological regime of a river and consequently fish species during periods of overflow but this impact may have longer term consequences on fisheries habitat also. Flow diversion from one river to another is an interbasin transfer and can therefore affects the flow regime in both the contributing and receiving rivers and can also affect water quality in the receiving river. Such a measure should always be considered of maximum significance with respect to fisheries protection.
	Protect	Overland Floodways	OF	Overland floodways consitute a short-term and intermittent negative impact to the hydrological and morphological regime of the river and could also impact on the physico-chemical condition of the river as well as on the biology due to pollutants on the floodways being carried into the river during periods of operation.
	Protect	Rehabilitation of Existing Defences	ED	The rehabilitation of existing flood defense measures is likely to result in some negative impacts to fisheries where management of vegetation leads to loss of habitat or disturbance to species. All in-stream works have potential to negatively impact directly on fish species and as such would have to be carried out with due care and attention. On-bank works also have potential for negative impacts, particularly with regard to release of sediment and other organic matter. This measure has the potential for short-term and occasional impacts to the physcio-chemical conditions of the river associated with the works phase.

OBJECTIVE 3.E	
Objective	**Protect, and where possible enhance, landscape character and visual amenity within the zone of influence.**
Sub-Objective	Protect, and where possible enhance, visual amenity, landscape protection zones and views into/from designated scenic areas within the zone of influence.
Scoring	1. Length of waterway corridor qualifying as a landscape protection zone within urban areas 2. Change of quality in existing scenic areas and routes 3. Loss of public landscape amenities
Basic Requirement	1. No significant impact on landscape designation (protected site, scenic route/amenity, natural landscape form) within zone of visibility of measures 2. No significant change in the quality of existing landscape characteristics of the receiving environment
Aspirational Target	1. No change to the existing landscape form 2. Enhancement of existing landscape or landscape feature
Global Weighting	8
Local Weighting	By professional judgement, taking account of local advice

Guidance on Assignment of Local Weightings

The local weighting may not exceed a ceiling value of 5. Professional judgement should be applied in assigning this weighing. After consultations with progress group, steering group and members of the stakeholder group, and with the local community, this weighting may change.

Consideration may be given to the following items:

- Public use of landscape.
- Cultural associations, history and memories

The following scoring system may be adopted.

5 = landscape designated as a internationally/nationally important landscape and potentially affected
4 = landscape character type designated at a county level as highly sensitive and/or exceptional/high value and potentially affected
3 = landscape character type designated at a county level as moderate sensitivity and/or medium value; protected views present that could be affected
2 = landscape character type designated at a county level as low sensitivity and/or low value and potentially affected

1 = no specific landscape sensitivity/value, but landscape features/views are important at a local level and potentially affected
0 = no specific landscape designation, and no landscape value/sensitivity

Guidance on Option Scoring

Scoring should be guided by professional judgement with reference to the scoring guidance below and the generic description of the likely impacts of measures.

The scoring of the options for this objective should take into account the duration and permanence of the likely impact(s) of the options on landscape value and the sensitivity of the landscape to change.

Duration is defined in terms of; • Long term; • Medium term; • Short term.	**Permanence is defined in terms of;** • Permanent; • Recurrent; • Intermittent.
Range of Sensitivities include; • High (International/National); • Moderate (Regional/County/City; • Low (County/City/Local)	**Permanence is defined in terms of;** • Permanent; • Recurrent; • Intermittent.

Examples of Sensitive Landscapes include;

- World Heritage Sites (International);
- National Parks (International/National);
- Sensitive/Vulnerable Landscapes (National/Regional/County);
- High Amenity Landscapes/Areas (County);
- Scenic Views/Prospects and Routes (County/Local);
- Sensitive Riverscapes/Seascapes/Streetscapes/Local Amenity Walks (County/City/Local).

Combining Positive and Negative Scores
Constructing hard defences adjacent to watercourses has the potential to impact positively and negatively on landscape. A negative impact may arise from the construction of a visible man-made structure on the opposite bank of a river with a scenic walkway. A positive impact may arise from the removal of invasive species encroaching on the river bank.

+2 due to enhancement of local landscape feature (e.g. removal of invasive vegetative species)

-5 due to construction of hard defence where no defence existed prior

In the above example the overall score should be '-3', combining the best positive score with the worst negative score.

Comparing Options
When scoring multiple options for one AFA, it may happen that the options score the same even if they have varying degrees of impact. Professional judgement should be used to ensure that the scores reflect the varying degrees of impact between the options, i.e. the scores should be manually adjusted to reflect the different degrees of impact associated with the different options.

Example of manual adjustment
Option 1= flood storage

- +1 due to clearance of natural flood storage area
- -1 short term construction stage impacts
- -4 due to change in existing landscape form in the locality

Overall Score = -3 (highest positive added to highest negative)

Option 2 = river morphology changes

- -3 due to construction stage impacts in a riverscape recognised as being of high value in a County/City Development Plan

Overall Score = -3

The above options score the same even though Option 2 is more likely to be perceived to have the more significant negative impact arising from the inclusion of the riverscape in a County or City Development Plan. Option 2 should then be manually adjusted downwards by 1 point to reflect the comparative difference in impacts between the options. If more than two options are being compared, and all differ in terms of the severity of their likely impacts on this objective, but all score the same using this methodology, the options should be manually adjusted upwards or downwards by a maximum of 2 points in either direction to reflect the comparative difference between the options.

Scoring Table

Score	Duration of Impact	Sensitivity	Examples
5	Permanent significant enhancement of high sensitivity landscape character/feature in the zone of visibility of the selected measure	High	Reinstatement of natural river corridor morphology in a riverscape recognised as being of high value included in a County/City Development Plan
4	Permanent significant enhancement of moderate sensitivity landscape character/feature in the zone of visibility of the selected measure	Moderate	Clearance of significant extent of riparian vegetation/man-made obstractions in a river corridor of high landscape/amenity value included in a County/City Development Plan
3	Permanent localised enhancement of high value landscape/feature in the zone of visibility of the selected measure	High	Channel widening and deepening at specific location on a watercourse of high landscape value removing risk of flow restriction and visual impacts from blockages with detritus (vegetative/rubbish).
2	Permanent localised enhancement of moderate value landscape character/feature in the zone of visibility of the selected measure	Medium	Clearance of local area for use as temporary overland flow storage returning land-use to natural function.
1	Permanent localised enhancement of local sensitivity landscape character/feature in the zone of visibility of the selected measure	Low	Removal of artificial visible man-made flow restriction from local amenity view (screens from under bridge on local amenity walk).
0	No change to existing landscape character/feature in the zone of influence of the selected measure	-	No change to existing landscape character or features.
-1	Short term impact (construction) on local sensitivity landscape character/feature in the zone of visibility of the selected measure.	Low	Construction of extension to local flood embankment prior to establishment of vegetative mitigation (i.e. screening).
-2	Short term impact (construction) on moderate sensitivity landscape character/feature in the zone of visibility of the selected measure.	Low	Construction of significant flood storage area in large area of natural landscape prior to mitigation establishment
-3	Short term impact (construction) on high/moderate value landscape character/feature in the zone of visibility of the selected measure	Medium	Re-establishment of natural river corridor morphology in a riverscape recognised as being of high value in a County/City Development Plan
-4	Permanent impact on local/moderate value landscape character/feature in the zone of influence of the selected measure	Medium	Construction of permanent hard defences (flood walls) adjacent to a local amenity walkway in a historic garden/demesne
-5	Permanent impact on high value landscape character/feature in the zone of influence of the selected measure	High	Construction of tidal barrage in high amenity seascape which is the subject matter of a protected view/prospect
-999	Unacceptable negative impact where feasible options exist	High	Site specific.

OBJECTIVE 3.F.i	
Objective	**Avoid damage to or loss of features, institutions and collections of cultural heritage importance and their setting, and improve their protection from extreme floods.**
Sub-Objective	Avoid damage to or loss of features, institutions and collections of **architectural** value and their setting, and improve their protection from extreme floods where this is beneficial.
Scoring	a) The number of architectural features, institutions and collections subject to flooding. b) The impact of flood risk management measures on architectural features, institutions and collections.
Basic Requirement	a) No increase in risk to architectural features, institutions and collections at risk from flooding. b) No detrimental impacts from flood risk management measures on architectural features, institutions and collections.
Aspirational Target	a) Complete removal of all relevant architectural features, institutions and collections from the risk of harm by extreme floods. b) Enhanced protection and value of architectural features, institutions and collections importance arising from the implementation of the selected measures.
Global Weighting	4
Local Weighting	By professional judgement, taking account of local advice

Guidance on Assignment of Local Weightings

The local weighting may not exceed a ceiling value of 5. Professional judgement should be applied in assigning a value to this weighting but some guidance has been provided below. After consultations with progress group, steering group and members of the stakeholder group, this weighting may change.

Reference should be made to the PRFA Methodology for Classifying the Vulnerability of National Monuments from Flooding in the Republic of Ireland (OPW, 2011).

Score	Description
5	Internationally important feature(s) (i.e. Structures or sites of sufficient architectural heritage importance to be considered in an international context. These are exceptional structures that can be compared to and contrasted with the finest architectural heritage in other countries) present and potentially affected .
4	Nationally important feature(s) (e.g. Structures or sites that make a significant contribution to the architectural heritage of Ireland. These are structures and sites that are considered to be of great architectural heritage significance in an Irish context) present and potentially affected with a high to moderate vulnerability.
3	A number of sites/features listed on the Record of Protected Structures and/or Recorded by NIAH are present and potentially affected with a high to moderate vulnerability.
2	A number of sites/features listed on the Record of Protected Structures and/or Recorded by NIAH are present and potentially affected with a moderate to low vulnerability.
1	No architectural features are at risk from flooding but potential effects on the settings of designated architectural features.
0	No sites/features at risk.

Guidance on Option Scoring

FRM measures may have both positive and negative effects on features of cultural heritage, and these need to be taken into account when identifying and scoping potential effects. Scoring should be based on professional judgement guided by the criteria provided below.

Score	Description / ***Examples***		
5	No negative effects on architectural features and a number of architectural features (Internationally and Nationally important features) completely saved from what would otherwise have been inevitable loss from flooding.	Creation of elements which significantly enhance the setting of architectural features (Internationally and Nationally important features).	Creation of amenity value for a number of architectural features (Internationally and Nationally important features) which was previously not present.
4	Architectural features (Nationally important features, Record of Protected Structures and NIAH) partially saved from what would otherwise have been inevitable loss from flooding.	Creation of elements which enhance the setting of architectural features (Nationally important features, Record of Protected Structures and NIAH).	Creation of amenity value for a number of architectural features (Nationally important features, Record of Protected Structures and NIAH).which was previously not present.
3	Increase in the level of protection for a number of architectural features (Record of Protected Structures and NIAH) from extreme flooding, such that they are substantially less vulnerable to flood damage.	Removal of negative elements from the setting of architectural features (Record of Protected Structures and NIAH) so that the setting of the features is significantly enhanced.	Protection of the existing amenity for a number of architectural features (Record of Protected Structures and NIAH).
2	Increase in the level of protection for a number of architectural features (Record of Protected Structures and NIAH) from extreme flooding, such that they are significantly less vulnerable to flood damage.	Removal of negative elements from the setting of a number architectural features (Record of Protected Structures and NIAH) so that the setting of the architectural features is noticeably enhanced.	Partial protection of the existing amenity for a number architectural features (Record of Protected Structures and NIAH).
1	Increase in the level of protection for architectural features (Record of Protected Structures and NIAH) from extreme flooding, such that it is less vulnerable to flood damage.	Removal of negative elements from the setting of architectural features (Record of Protected Structures and NIAH) so that its setting is enhanced.	Protection of the existing amenity for architectural features (Record of Protected Structures and NIAH).
0	**No effects on architectural features**		

-1	No physical effects on architectural features (Record of Protected Structures and NIAH)	Changes to the setting of architectural features (Record of Protected Structures and NIAH) such that it is slightly changed.	Partial loss of access to architectural features (Record of Protected Structures and NIAH) which does not affect their existing amenity value.
-2	Multiple effects which score -1 individually and/or Physical effects on architectural features (Record of Protected Structures and NIAH) such that the structure is partially removed.	Changes to the setting of architectural features (Record of Protected Structures and NIAH) such that it is clearly modified.	Loss of access to architectural features (Record of Protected Structures and NIAH) such that its current amenity value is altered.
-3	Multiple effects which score -2 individually and/or Physical effects on architectural features (Record of Protected Structures and NIAH) such that the structure is completely removed.	Changes to the setting of architectural features (Record of Protected Structures and NIAH) such that it is completely altered.	Loss of access to architectural features (Record of Protected Structures and NIAH) such that its current amenity value is completely lost.
-4	Multiple effects which score -3 individually and/or Physical effect on architectural features (Nationally important features, Record of Protected Structures and NIAH) such that the structure is partially removed.	Changes to the setting of architectural features (Nationally important features, Record of Protected Structures and NIAH) such that it is clearly modified.	Loss of access to architectural features (Nationally important features, Record of Protected Structures and NIAH) such that its current amenity value altered.
-5	Physical effect on architectural features (Nationally important features, Record of Protected Structures and NIAH) such that the structure is completely removed.	Changes to the setting of architectural features (Nationally important features, Record of Protected Structures and NIAH) such that it is completely altered.	Loss of access to architectural features (Nationally important features, Record of Protected Structures and NIAH) such that its current amenity value is completely lost.
-999	Physical effects on architectural features (Internationally important) such that its Outstanding Universal Value (OUV) is altered.	Effects on the setting of an architectural features (Internationally important) such that its Outstanding Universal Value (OUV) is altered.	

OBJECTIVE 3.F.ii	
Objective	**Avoid damage to or loss of features, institutions and collections of cultural heritage importance and their setting, and improve their protection from extreme floods.**
Sub-Objective	Avoid damage to or loss of features, institutions and collections of **archaeological** value and their setting, and improve their protection from extreme floods where this is beneficial.
Scoring	a) The number of archaeological features, institutions and collections subject to flooding. b) The impact of flood risk management measures on archaeological features, institutions and collections.
Basic Requirement	a) No increase in risk to archaeological features, institutions and collections at risk from flooding. b) No detrimental impacts from flood risk management measures on archaeological features, institutions and collections.
Aspirational Target	a) Complete removal of all relevant archaeological features, institutions and collections from the risk of harm by extreme floods. b) Enhanced protection and value of archaeological features, institutions and collections arising from the implementation of the selected measures.
Global Weighting	4
Local Weighting	By professional judgement, taking account of local advice

Guidance on Assignment of Local Weightings

The local weighting may not exceed a ceiling value of 5. Professional judgement should be applied in assigning a value to this weighting but some guidance has been provided below. After consultations with progress group, steering group and members of the stakeholder group, this weighting may change.

Reference should be made to the PRFA Methodology for Classifying the Vulnerability of National Monuments from Flooding in the Republic of Ireland (OPW, 2011).

Score	Description
5	Internationally important archaeological feature(s) (i.e. World Heritage Site including those on the tentative list present and potentially affected.
4	Nationally important archaeological feature(s) (e.g. National Monument in State Care, sites on which Preservation Orders or Temporary Preservation Orders have been served) present and potentially affected.
3	A number of sites listed on the RMP/RPS present and potentially affected. (high to moderate vulnerability)
2	A number of sites listed on the RMP/RPS present and potentially affected. (moderate to low vulnerability)
1	Limited potential for effects on the settings of designated archaeological features due to proposed works.
0	No archaeological features at risk.

Guidance on Option Scoring

FRM measures may have both positive and negative effects on archaeological features, and these need to be taken into account when identifying and scoping potential effects. Scoring should be based on professional judgement guided by the criteria provided below

Score	Description / *Examples*		
5	No negative effects on archaeological features, and, A number of archaeological features (Recorded Monuments or National Monuments) completely saved from what would otherwise have been inevitable loss from flooding.	Creation of elements which significantly enhance the setting of archaeological features (Recorded Monuments or National Monuments).	Creation of amenity value for a number of archaeological features (Recorded Monuments or National Monuments) which was previously not present.
4	Archaeological features (Recorded Monuments or National Monuments) partially saved from what would otherwise have been inevitable loss from flooding.	Creation of elements which enhance the setting of an archaeological feature (Recorded Monuments or National Monuments).	Creation of amenity value for a number archaeological feature (Recorded Monuments or National Monuments) which was previously not present.
3	Increase in the level of protection for a number of archaeological features (Recorded Monuments) from extreme flooding, such that they are substantially less vulnerable to flood damage.	Removal of negative elements from the setting of archaeological features (Recorded Monuments) so that the setting of the features is significantly enhanced.	Protection of the existing amenity for a number of archaeological features (Recorded Monuments).
2	Increase in the level of protection for a number of archaeological features (Recorded Monuments) from extreme flooding, such that they are significantly less vulnerable to flood damage.	Removal of negative elements from the setting of a number archaeological features (Recorded Monuments) so that the setting of the archaeological features is noticeably enhanced.	Partial protection of the existing amenity for a number of archaeological features (Recorded Monuments).
1	Increase in the level of protection for archaeological features (Recorded Monuments) from extreme flooding, such that it is less vulnerable to flood damage.	Removal of negative elements from the setting of archaeological features (Recorded Monuments) so that it's setting is enhanced.	Protection of the existing amenity for archaeological features (Recorded Monuments).
0	**No effects on archaeological features**		

-1	No physical effects on archaeological features (Recorded Monuments or National Monuments)	Changes to the setting of archaeological features (Recorded Monument or National Monument) such that it is slightly changed.	Partial loss of access to archaeological features (Recorded Monuments or National Monuments) which does not affect their existing amenity value.
-2	Multiple effects which score -1 individually and/or Physical effects on archaeological features (Recorded Monuments) such that the monument is partially removed.	Changes to the setting of archaeological features (Recorded Monuments) such that it is clearly modified.	Loss of access to archaeological features (Recorded Monuments) such that its current amenity value is altered.
-3	Multiple effects which score -2 individually and/or Physical effects on archaeological features (Recorded Monuments) such that the monument is completely removed.	Changes to the setting of archaeological features (Recorded Monuments) such that it is completely altered.	Loss of access to archaeological features (Recorded Monuments) such that its current amenity value is completely lost.
-4	Multiple effects which score -3 individually and/or Physical effect on archaeological features (National Monuments) such that the monument is partially removed.	Changes to the setting of archaeological features (National Monuments) such that it is clearly modified.	Loss of access to archaeological features (National Monuments) such that its current amenity value altered.
-5	Physical effect on archaeological features (National Monuments) such that the monument is completely removed.	Changes to the setting of archaeological features (National Monuments) such that it is completely altered.	Loss of access to archaeological features (National Monuments) such that its current amenity value is completely lost.
-999	Physical effects on archaeological features (a World Heritage Site) such that its Outstanding Universal Value (OUV) is altered.	Effects on the setting of an archaeological feature (a World Heritage Site) such that its Outstanding Universal Value (OUV) is altered.	

OBJECTIVE 4.A.	
Objective	**Ensure flood risk management options are operationally robust**
Indicator	Level of operational risk of option - Degree of reliance on mechanical, electrical or electronic systems, or on human intervention, action or decision, for the option to operate or perform successfully
Scoring	By professional judgement, based on the guidance and criteria set out below
Basic Requirement	Moderate to high, but manageable, degree of operational risk, i.e., an option with a high degree of reliance on mechanical, electrical or electronic systems, or on human intervention, action or decision, but which, with the allocation of adequate resources, could be operated with an acceptable degree of risk of failure
Aspirational Target	No operational risk, i.e., no reliance on mechanical, electrical or electronic systems, or on human intervention, action or decision for the option to operate or perform successfully
Global Weighting	20
Local Weighting	Constant and equal to 5, i.e., no amendment to local weighting

Guidance on Assignment of Local Weightings

The Local Weighting to be applied for this objective is constant, and should always be set equal to 5, as it always a consideration in option design and selection.

Guidance on Scoring

Scoring is to be by professional judgement, based on the guidance and criteria set out below, taking into account the degree of reliance of the option on mechanical, electrical or electronic systems ('systems'), or on human intervention, action or decision ('intervention') to operate or perform successfully (i.e., to design). The scoring should also consider and be adjusted where necessary other relevant factors, such as:

- The risks / consequences of failure of the system or intervention (with a higher risk, and hence lower score, being given where failure would result in total or major failure and resultant flooding, as opposed to partial failure leading to only localised or minor flooding)
- Whether the interventions required are during times of flood (e.g., erection of demountables) or at other times (e.g., routine maintenance), where interventions required during a flood event would be deemed to represent a higher risk, and hence be assigned a lower score, due to potential travel or communications difficulties

- The frequency that interventions would be required, with a higher risk, and hence lower score, being assigned to measures that require frequent interventions
- Whether institutional changes will be required to effectively implement and operate a measure, with a higher risk, and hence lower score, if change is required
- Other locally context-specific issues that should give cause to deviate from the guidance below

Indicative Scoring for Objective

Description of operational risk for relevant score, with examples given in italics

Score	Description / ***Examples***
5	No operational risk, i.e., no reliance on systems or intervention, with limited monitoring / maintenance requirements *Fixed flood defence walls, Increased conveyance in self-cleansing rivers or diversion channels, Relocation*
4	Negligible operational risk, i.e., no reliance on systems or intervention, with more regular monitoring and intermittent, but potentially substantial, maintenance requirements *Fixed flood defence embankments, Uncontrolled storage, Increased conveyance measures (incl. diversion channels) where maintenance required*
3	Very low operational risk, i.e., there is a requirement for simple systems or interventions for the option to operate, with regular monitoring and maintenance required, but a very low likelihood of system / operation failure *Pumping systems, Tidal barriers, Storage with controlled inflow / outflow mechanisms, Simple flood forecasting and warning systems with long advance warning periods available (appx. 12 hours+)*
2	Low risk, i.e., there is a requirement for systems or interventions for the option to operate, with regular monitoring and maintenance required, and / or a low to moderate likelihood of system / operation failure *Complex flood forecasting and warning systems with long advance warning periods available, with a limited number of rapidly deployed in-situ flood defences (e.g., flood gates, tipping defences)*
1	Low / moderate risk, i.e., options that are fully reliant on systems or interventions for the option to operate, with regular monitoring and maintenance required, and a low to moderate likelihood of system / operation failure *Simple flood forecasting and warning systems with medium-range advance warning periods available (appx. 6 hours), with several rapidly deployed in-situ flood defences (e.g., flood gates, tipping defences)*

0	Moderate, but manageable, risk, i.e., options that are fully reliant on systems or interventions for the option to operate, with regular monitoring and maintenance required, and a moderate likelihood of system / operation failure *Complex flood forecasting and warning systems with medium-range advance warning periods available (appx. 6 hours), with several rapidly deployed in-situ flood defences (e.g., flood gates, tipping defences) or limited demountable defences that are stored on-site*
-1	Moderate / high risk, i.e., options that are fully reliant on systems or interventions for the option to operate, with regular monitoring and maintenance required, and a moderate to high likelihood of system / operation failure *Flood forecasting and warning system of long advance warning periods with substantial demountable defences requiring transport from off-site*
-3	High risk, i.e., options that are fully reliant on systems or interventions for the option to operate, with regular monitoring and maintenance required, and a high likelihood of system / operation failure *Flood forecasting and warning systems of medium-range advance warning periods with substantial demountable defences requiring transport from off-site*
-5	Foreseeable likelihood of failure that would render the measure ineffective *Flood forecasting and warning systems with short advance warning periods available (appx. 3 hours or less) and interventions or actions by the public required for damage to be avoided*
-999	Unacceptable risk, i.e., options that are fully reliant on systems or interventions for the option to operate that will be difficult to achieve, and for which failure of the system / intervention is likely and would have unacceptable consequences

Note: Where systems / interventions are required, it is assumed that redundancy and / or back-up systems will be included as part of the option design, e.g., manual overrides for automated systems, duplicate telemetry / communication systems, etc.

OBJECTIVE 4.B	
Objective	**Minimise health and safety risk in construction, maintenance and operation of the flood risk management option**
Indicator	Degree of health and safety risk during construction, maintenance and operation
Scoring	By professional judgement, taking into account the guidance and criteria set out below, with review of candidate preferred options by PSDP
Basic Requirement	Moderate to high, but acceptable and manageable, level of health and safety risk during construction, maintenance or operation
Aspirational Target	Negligible risk to health and safety during construction, maintenance or operation
Global Weighting	20
Local Weighting	Constant and equal to 5, i.e., no amendment to local weighting

Guidance on Assignment of Local Weightings

The Local Weighting to be applied for this objective is constant, and should always be set equal to 5, as it always a consideration in option design and selection.

Guidance on Scoring

Scoring is to be by professional judgement, taking into account the guidance and criteria set out below.

The indicative score under this objective should be set at five, and then have a point deducted for each specific risk (as defined under the Safety, Health and Welfare at work (Construction) Regulations) likely to be encountered in a) construction and then again in b) operation and maintenance.

As an example, a measure requiring deep excavation and working near water during construction, and then working near water during operation / maintenance, would have a score of 2 (5 – 2 (construction stage) – 1 (operation / maintenance stage) = 3).

Professional judgement needs then to be applied to take into account any locally or context-specific issues, e.g., specific hazards, or a potentially higher risk for construction in an urban environment.

The PSDP (or person assigned the duties of PSDP where a company is nominated as PSDP) should review the scoring afforded to the preferred option(s) and other options that would be realistically in contention to be adopted as a preferred option based on other objectives, to ensure that the scoring is appropriate and reasonable.

Note: It should be assumed in assigning scores that good construction health and safety practices will be implemented.

OBJECTIVE 4.C	
Objective	**Ensure flood risk can be managed effectively and sustainably into the future, and the potential impacts of climate change**
Indicator	Sustainability and adaptability of the flood risk management measure in the face of potential future changes, including the potential impacts of climate change
Scoring	By professional judgement, based on the guidance and criteria set out below
Basic Requirement	Option to provide for, or be adaptable to, the MRFS in terms of maintaining the standard of protection at acceptable cost
Aspirational Target	Option to provide for, or be adaptable to, the HEFS in terms of maintaining the standard of protection at negligible cost
Global Weighting	20
Local Weighting	Constant 5, i.e., no amendment to local weighting

Guidance on Assignment of Local Weightings

The Local Weighting to be applied for this objective is constant, and should always be set equal to 5, as it always a consideration in option design and selection.

It is recognised that the impacts of, and vulnerability to, potential future changes will vary significantly from community to community. However, this objective is used only for option selection, and is not used for prioritisation, and so the relative significance of the impacts and vulnerability to potential future change between communities is not relevant. As promoting adaptability is always important, the local weighting is to be kept constant.

Guidance on Scoring

Scoring is to be by professional judgement, taking into account the guidance and criteria set out below.

The scoring for a given measure should reflect the cost and the degree of difficulty and potential impacts (technically, socially, environmentally, legislatively, etc.) of potential future adaptations that would be necessary to maintain the Standard of Protection of the measure under the MRFS and/or HEFS, whereby the greater the cost, difficulty and impact, the lower the score.

This assignment of a score should take account should be taken of the robustness of the option in terms of the need for possible future interventions that may be through additional measures as well direct adaptation of the option under consideration. For example, an option may not be, nor need to, adaptable itself, but may nonetheless score highly if it is shown through a decision-tree analysis this it is very robust in terms of options for future interventions.

The guidance given below gives examples for certain scores. Other scores (between 5 and -5) should also be used, where appropriate, interpolating between the scores for which examples are given, where the costs and degree of difficulty and impact may be at the high or low relative to the examples given.

Score	Description / ***Examples***
5	Option is inherently adaptable at no / negligible cost, difficulty and impact and provides no impediment to future interventions to address new potential future risk areas (i.e., that are separate from the area benefitting from the option in question). This would include Non-Structural measures, and Structural measures designed using the assumptive approach to the HEFS and / or that would be able to maintain the standard of protection / risk reduction under the HEFS with no or negligible further cost or intervention
4	Option is readily adaptable at limited cost, difficulty and impact, and provides no impediment to future interventions to address new potential future risk areas, e.g.: • *Walls where the foundations and wall are built to permit an extension in height to maintain the required level of protection / risk reduction for the HEFS, which would be acceptable locally (e.g., typically less than 1.2-1.5m height in public areas after being raised)* • *Structural measures (e.g., walls) designed using the assumptive approach to the MRFS and / or that would be able to maintain the standard of protection / risk reduction under the MRFS with no or negligible further cost or intervention* • *Embankments, earth flow diversion channels or other such structures that could be readily topped-up / enhanced*
3	Option is adaptable at moderate cost, difficulty and impact, and provides no impediment to future interventions to address new potential future risk areas, e.g.: • *Walls where the foundations and wall are built to permit an extension in height to maintain the required standard of protection / risk reduction for :* o *the HEFS, which would be acceptable locally but where adaptation would have other negative implications / costs (e.g., more than 1.2-1.5m height in public areas after being raised, but with demountable defences necessary to provide protection above 1.2-1.5m)* o *the MRFS, which would be acceptable locally (e.g., typically less than 1.2-1.5m height in public areas after being raised)* • *Conveyance enhancement, major earth storage structures or similar measures where substantial earthworks would be required to enhance performance, but where adaptation would not require replacement of structural works*

Score	Description / ***Examples***
2	Option is adaptable at moderate to significant cost, difficulty and impact, and provides no impediment to future interventions to address new potential future risk areas, e.g.: • *Walls where the foundations and wall are built to permit an extension in height to maintain the required standard of protection / risk reduction for the MRFS, which would be acceptable locally but where adaptation would have other negative implications / costs (e.g., more than 1.2-1.5m height in public areas after being raised, but with demountable defences necessary to provide protection above 1.2-1.5m)*
1	Option is adaptable only at significant cost, difficulty and impact, and provides no impediment to future interventions to address new potential future risk areas, e.g.: • *Conveyance enhancement (including flow diversions), flow retention or similar measures where significant structural replacement works would be required* • *Protection measures which, once adapted, would exceed 1.2-1.5m in height in public areas with no scope for demountable barriers*
0	Option is not adaptable, but provides no impediment to future interventions to address new potential future risk areas. *Options that are not adaptable, although additional works (e.g., separate measures) may need to be undertaken to address potential future increases in risk to the area benefitting from the option in question, e.g.,:* • *Coastal / tidal defence walls that can not be raised (e.g., due to visual impact, and / or where demountables are not a viable option), but where a tidal barrage could be implemented as a separate future intervention* *Option does not hinder future interventions to address new potential future risk areas*
-1	Option is not adaptable, and will create a minor interference or impediment to with potential future measures *Options that will cause a minor impediment and some additional cost to future interventions that may be needed to address the MRFS or HEFS.*
-3	Option is not adaptable, and will create a moderate interference with or impediment to potential future measures *Options that will cause a moderate impediment and additional cost to future interventions that may be needed to address the MRFS or HEFS.*
-5	Option is not adaptable, and will create a major interference with or impediment to potential future measures *Options that will cause a major impediment and substantial additional cost to future interventions that may be needed to address the MRFS or HEFS.*
-999	Unacceptable interference with potential future measures