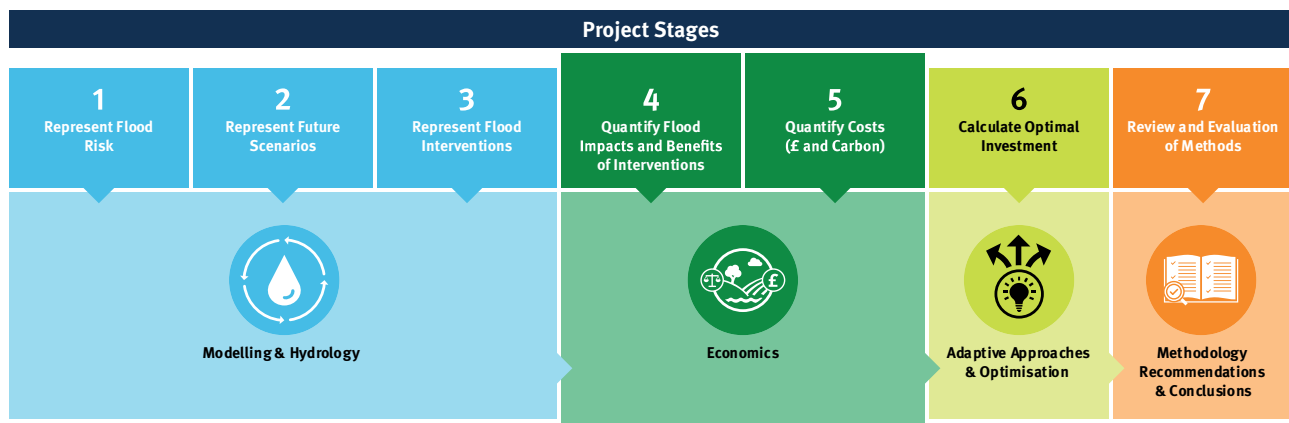


Flood Risk Investment Study

Economics Technical Report summary



Overview

The Oxford-Cambridge (OxCam) Arc Flood Risk Investment Study (FRIS) aimed to identify the optimum level of investment in, and timing of, flood protection measures across the OxCam Arc to achieve the highest economic return. The OxCam Arc covers a large part, but not all of, three major UK river catchments. The Thames, the Great Ouse and the Nene. This study only considers the impacts within the OxCam Arc boundaries (Figure 1)

The economic impacts of flooding and the benefits of flood risk interventions through damages avoided were calculated. This was compared against the capital and maintenance costs of the interventions. There is enormous uncertainty around future climate change and the location and level of housing and infrastructure development. As such a range of 29 future climate and growth scenarios were considered in this study.

A summary of the economic assessment approach is shown in Figure 2 and set out in this summary note. More details can be found in the full Economics Technical Report. This summary note is part of a series of summary notes which also includes a modelling & hydrology summary, an adaptive approaches & optimisation summary and an overarching project summary.



Figure 1: The OxCam Arc

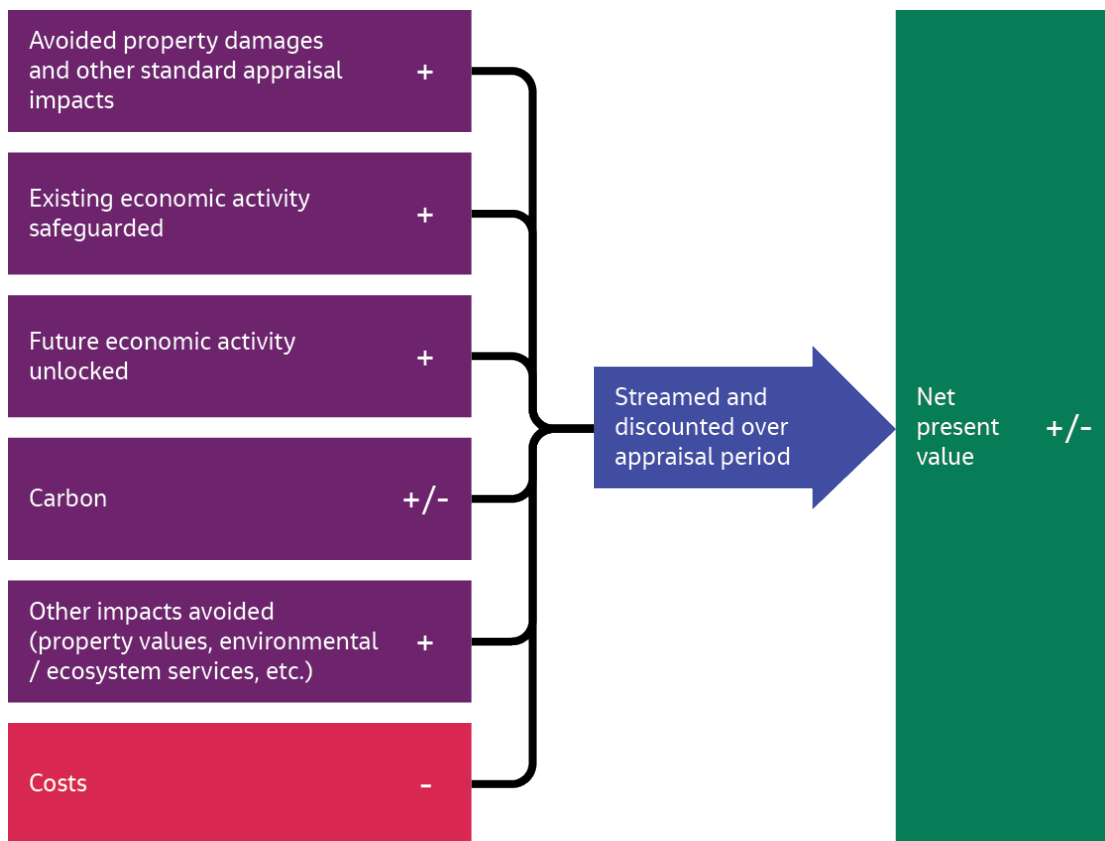


Figure 2: Appraisal impacts used to estimate the economic impacts of flooding. – sourced from *OxCam FRIS Economic Technical Report 2022*

Key assumptions

It is important to be aware of some key assumptions made in the economic assessment as follows:

- Net present value metrics are reported in 2020 prices and values unless otherwise stated
- Discounting is undertaken in line with the HM Treasury Green Book¹ principles (3.5% per annum for the majority of categories other than for life and health impacts at 1.5%)
- A consistent appraisal period for the investment pathways was set to allow for comparison. Specific flood interventions have an appropriate assumed lifespan. For new development related impacts a shorter lifespan is used to reflect best practice. This will ensure a level playing field for the different pathways
- All cost and benefit values are produced at factor (unit costs) or market prices. It is assumed that present day costs and impacts are applicable over the length of the study period (100 year).

¹[The Green Book: appraisal and evaluation in central government - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/publications/the-green-book)

Flood risk intervention cost profiling

Different approaches were needed to cost profile the flood risk interventions due to their varying nature and data availability.

The Environment Agency's internal long-term costing tool for flood and coastal risk management was used for linear defences, property flood resilience and natural flood management (NFM). This provides capital and maintenance costs (updated for inflation). Work undertaken for the Thames Valley Flood Scheme ²project was used to estimate costs for fluvial flood storage interventions.

Surface water flood risk reduction benefits have been calculated by assigning a cost saving to the assumed flood risk reduction volumes. Intervention costs, from the long-term costing tool, are based on an equivalent volume of storage meaning individual Sustainable Urban Drainage System intervention costs may not have been accounted for.

Sources of cost and carbon data

Data from the Environment Agency internal long-term costing tool was used to build the cost models. This provides indicative costs and guidance for a range of flood mitigation measures. Carbon emission data was obtained from the Environment Agency's internal Carbon Modelling Tool (CMT) version 7.3.

Construction Output Price Indices from the Office for National Statistics³ were used to index costs to 2020 where needed.

To account for the tendency for project appraisers to be overly optimistic an optimism bias adjustment was applied at 35%. This is within the recommended range for standard civil engineering projects.

² <https://www.gov.uk/government/publications/thames-valley-flood-scheme/thames-valley-flood-scheme>

³ <https://www.ons.gov.uk/businessindustryandtrade/constructionindustry/datasets/interimconstructionoutputpriceindices>

Impacts/benefits assessment

Standard appraisal impacts have been analysed along with benefits from avoided disruption to existing and future economic activity and carbon impacts including the carbon cost of flood recovery.

Standard appraisal impacts are assessed in accordance with:

- HM Treasury Green Book (HM Treasury, 2018).
- Flood and Coastal Erosion Risk Management: Appraisal Guidance (FCERM-AG) (Environment Agency, 2010).
- Multi Coloured Manual (MCM) (Penning-Rowsell, et al., Flood and Coastal Erosion Risk Management: A Manual for Economic Appraisal, 2013).
- Multi Coloured Handbook 2020 (MCH 2020) (Penning-Rowsell, et al., Flood and Coastal Erosion Risk Management: Handbook for Economic Appraisal, 2020)

Carbon accounting

Two approaches to carbon accounting were taken:

- estimating the quantity and the value of carbon emissions of different investments and flood interventions
- estimating carbon emissions associated with disruption, repair and replacement of flood damages and the potential carbon benefits of flood resilience/protection schemes based on damages and impacts avoided

Future development scenarios

Development scenarios created by the Infrastructure Transition Research Consortium (ITRC) at Newcastle University have been used. They provide a broadly representative range of future development scenarios, rather than explicitly representing local development plans. The high-level approach is as follows:

- Generation of high-level housing growth numbers (23,000, 30,000 and 43,000 homes per year).
- Feeding population growth estimates into the Urban Development Model (UDM, developed by ITRC at Newcastle) to predict the spatial pattern of housing development.
- Applying assumptions of spatial patterns of housing and non-residential development to translate housing density to simulated property point locations.

Results

The baseline damages assume that new interventions will not be introduced and that existing interventions will be maintained. Results are shown in Figure 3. As shown surface water flooding is the larger economic disruptor causing high transportation disruption and losses in terms of economic growth potential (GVA).

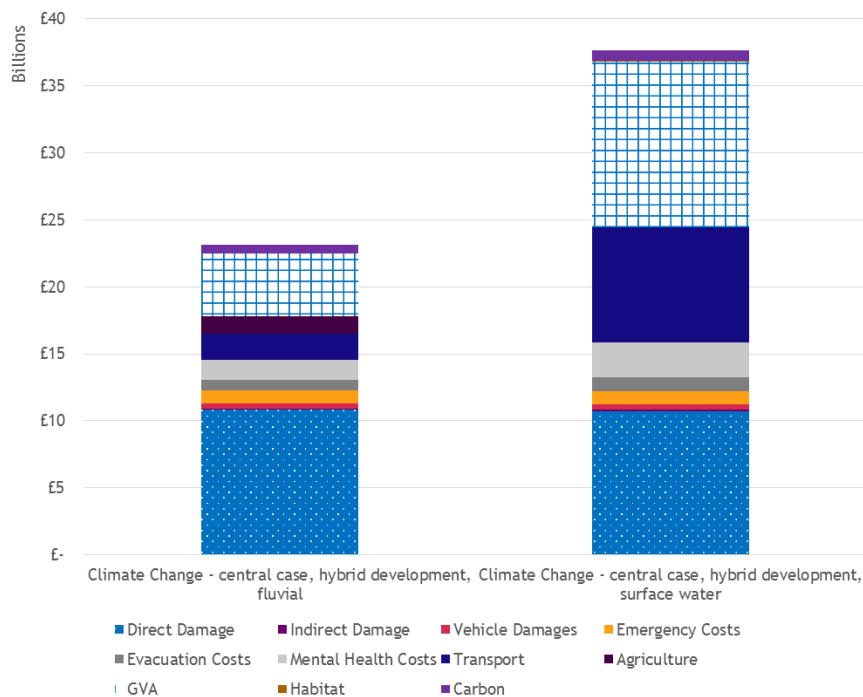


Figure 3: Total damages due to fluvial and surface water flooding by category (central climate change, hybrid development and no new interventions scenario) in absence of any interventions.

Fluvial baseline damages across the four climate change scenarios are shown in Figure 4. It shows that the higher the climate change scenario the higher baseline damages.

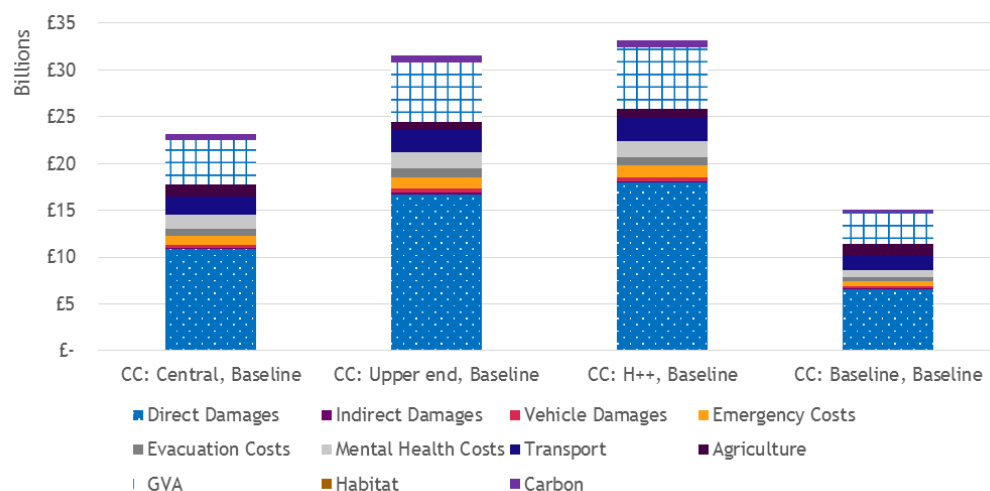


Figure 4: Total damages due to fluvial events by category without any new investments

Surface water baseline damages are consistent across all climate change scenarios and have an impact of between £35billion and £40billion of damages as shown in Figure 5.

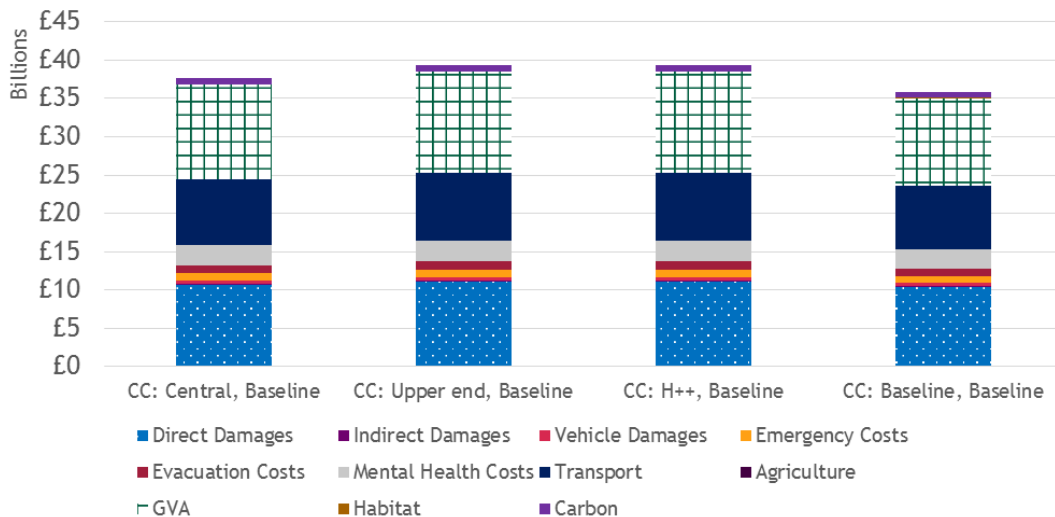


Figure 5: Total damages due to surface water events by category without any new investments

Limitations and lessons learnt

Notable analysis limitations included:

- Lack of data availability for utilities made modelling the impacts and avoided damages difficult and may have resulted in the benefit impacts being underrepresented.
- Insufficient data on property value impacts – general research on the impact on property values from flood events is inconclusive and could usefully be supplemented.
- Improved datasets could result in improved calculations – this would require an Environment Agency wide assessment on what data might be updated to better reflect overall economic impact calculations, including where data from other sectors (such as transport and WebTAG data⁴) might usefully be used to complement existing data sources.
- Data granularity is limited and data between sources is not always consistent - the National Receptor Dataset (NRD)⁵ forms a crucial part of the analysis undertaken when considering local economic impacts. Improved NRD consistency and an increase in granularity would provide more accurate estimates of economic impacts.

⁴ Transport Analysis Guidance (TAG). Department for Transport [\[https://www.gov.uk/government/publications/webtag-tag-overview\]](https://www.gov.uk/government/publications/webtag-tag-overview)

⁵ National Receptors Dataset (NRD) can be downloaded from the Defra Data Services Platform by registered users [\[https://environment.data.gov.uk/register\]](https://environment.data.gov.uk/register)

Lack of input of property floor levels could result in an exaggerated estimate of damages. For example, if the property floor level is above the surrounding land and flood level, that property would not incur the damages that our modelling expects. This is particularly important when considering new developments.

Key lessons learnt as part of the economic analysis undertaken:

- Economic benefits outside of the traditional benefits Multi-Coloured Manual (MCM)⁶ can be useful to support economic analysis - using a wider array of benefits provides greater granularity allowing for a better view of total benefits from interventions and also where those benefits might sit in relation to different benefit categories, providing decision makers with better information to make more informed choices.
- Complexity of analysis is supported by a database driven approach - increased economic parameters do make the analysis substantially more complicated. However, using a database driven approach has illustrated the viability of processing significant data to assess economic impacts over a wider range of schemes.

Conclusion

Adaptive approaches to flood protection are key to supporting climate resilience. The OxCam Flood Risk Investment Study highlights the true economic costs of flooding in the Arc, now and in the future, and the economic rewards of timely flood protection investment. The economic case for flood protection investment is compelling even before considering the more important social impacts of flooding to our communities and businesses who live in the Arc.

⁶ Flood and Coastal Erosion Risk Management Handbook and Data for Economic Appraisal 2022 [<https://www.mcm-online.co.uk/handbook/>]

Document Hierarchy

