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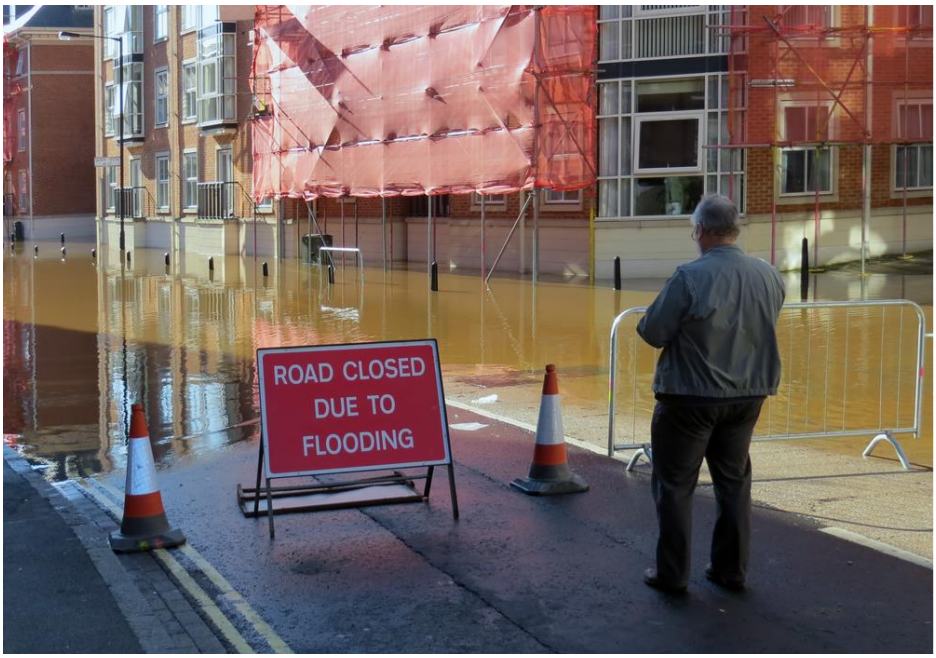
Enhancing Ex-Post Evaluation of Flood and Coastal Erosion Risk Management Strategies and Schemes



Phase 2 Case Study Report

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1. Introduction

This project on *Enhancing Ex-Post Evaluation of Flood and Coastal Erosion Risk Management Plans and Schemes* was commissioned to identify the extent of practice in ex-post evaluation and to explore how best to build on current practice.

The project was split into two phases:

Phase 1 – a review of the extent to which ex-post evaluation is undertaken, highlighting examples of good practice and barriers to ex-post evaluation, and consideration of how evaluation practice could be improved.

Phase 2 – dependent on the outcome of Phase 1 and will only proceed if there is a recommendation for new guidance to be provided by Defra and / or the Environment Agency.

As Phase 1 identified little or no experience of ex-post evaluation, preparation of guidance as a deliverable of Phase 2 was not appropriate. Before providing guidance the processes for undertaking ex-post evaluation would need to be in place. It was therefore agreed that Phase 2 should deliver:

> ***A pilot / case study approach of ex-post evaluation on a number of schemes / strategies in order to add most value in informing a decision on Defra / Environment Agency's long term plan for evaluation.***
>
> *Specifically this approach should be designed to provide insight into:*
>
> *1) Approaches to conduct ex-post evaluation*
>
> *2) Data requirements*
>
> *3) Data sources / gaps*
>
> *4) How information from an ex-post evaluation could be used*
>
> *With the aim of helping* ***directly to assess the feasibility and practicality of ex-post evaluation.***

This report covers the case studies and findings for Phase 2.

Scope of the Phase 2 research

The purpose of the Phase 2 work was to develop outline methods to be trialled through two case studies. These case studies were, of necessity, carried out on schemes where ex-post evaluation had not been planned for in advance. This approach enabled an outline assessment of data available through current processes and its suitability for ex-post evaluation. Due to the limited budget available for Phase 2 detailed analysis of data needs and availability was not possible, but as much detail as time and budget allowed were developed.

The focus of Phase 2 was at the scheme level. The reasons for this related to: the complexity and large scale nature of strategies which made them unsuitable for these exploratory case studies; and the difficulty of assessing benefits realisation due to the long time-frame over which strategies operated (e.g. 100 years). However, it should be noted that strategies should be considered for ex-post evaluation by Defra and the Risk Management Authorities (RMAs) as the iterative nature of strategies means that ex-post evaluation would be of benefit to them.

Good practice emphasises that ex-post evaluation should be built in from the start of any project and relevant data collected. The case studies were, therefore, limited by the availability of suitable data to enable ex-post evaluation of benefits. The case studies also relied on engagement with people previously involved in the schemes and, therefore, who may no longer be available to

contact and the collection of a hindsight view point, rather than monitoring to assess changes as time passed.

Phase 1 highlighted the need to embed a learning loop so that the findings of ex-post evaluation were used and systems improved. Phase 1 also emphasised the need to embed the need / validation for doing ex-post evaluation. This Phase 2 work will not address these issues but, as a by-product of these case studies, it should be possible to make suggestions to address these issues.

2. Research approach

The overall aim of the project was:

> ***To provide Defra with evidence to inform possible approaches to ex-post evaluation (EPE) of FCERM strategies and schemes.***

Objectives

Phase 2 objectives

The revised objectives for the Phase 2 work were:

1) To develop outline methods and approaches for undertaking ex-post evaluation
2) To explore the potential for 'light touch' approaches to ex-post evaluation(EPE)
3) To prepare a shortlist of four schemes suitable for case studies on ex-post evaluation
4) To take forward two of the shortlisted schemes as full case studies using the methods developed for ex-post evaluation
5) To investigate how existing data and approaches (quantitative and qualitative) could be used within ex-post evaluation and what new data or approaches might be needed going forward
6) To reflect on lessons arising from ex-post evaluation and consider how learning can be taken forward.

Research Methods

The case studies assessed two related but different objectives for ex-post evaluation:

- The extent to which benefit assessed in the appraisal are realised (framed as damages avoided)
- The extent of wider benefits (e.g. regeneration) which may or may not have been assessed in the appraisal.

Ex-post evaluation case study approach

The proposed method for the ex-post evaluation was based on guidance in the Magenta Book[1].

The case studies endeavoured to cover key elements of the Good Practice Principles (GPP) for ex-post evaluation developed in Phase 1. This was, however, limited by the case studies being undertaken retrospectively on schemes where ex-post evaluation had not been planned in from the start.

Good practice principles (GPP) for ex-post evaluation developed in Phase 1:

GPP1: Evaluation planned in from the outset
GPP2: Clear expression of the purpose of the ex-post evaluation
GPP3: Defined ex-post evaluation strategy / scheme objectives and outcomes
GPP4: Defined audience and needs from ex-post evaluation
GPP5: Identified evaluation questions and outcomes, checked against objectives and outcomes of the strategy / scheme (based on use of a logic model, which might mean

[1] HM Treasury (2011b) *The Magenta Book – Guidance for Evaluation*. The Magenta Book sets out principles and processes to improve the design and utilisation of evaluation across Government: https://www.gov.uk/government/publications/the-magenta-book

that ex-post evaluation could be undertaken in stages depending on when particular outcomes and impacts are anticipated / realised)

GPP6: Clearly chosen evaluation approach (e.g. quantitative, qualitative), confirmed data requirements and measurability including counterfactual and an approach to capturing unintended impacts

GPP7: Plan for resources and governance in place, including engagement with partners and / or stakeholders

GPP8: Monitoring of outputs, outcomes and impacts in place throughout the strategy / scheme

GPP9: Clear and robust evaluation and analysis of data

GPP10: Clarity on use and dissemination of findings

GPP11: Timeframe relevant to benefits realisation

Short list of schemes

Potential case studies were drawn from research undertaken in Phase 1 and proposals from the Steering Group. Strategies were excluded from the final list as the benefits were too long ranging with no immediate impact on local communities.

Schemes were shortlisted on the basis of covering a range of criteria:

- Structural and non-structural schemes
- Inland and coastal schemes
- Schemes that have flooded and not flooded since development
- A mixture of Environment Agency and non-Environment Agency schemes
- Availability of existing information
- Previous contacts from Phase 1
- Date of completion.

Two case studies were selected plus four back-up cases (in case information was lacking for the two selected or if it was decided to take forward two further case studies). The selected and back up case studies are listed in Appendix 1, along with the reasons for selection.

Case study research approach

The Project Appraisal Report (PAR) was used to obtain background information on the scheme, including: scheme appraisal objectives; baseline conditions prior to scheme implementation; the preferred option; and the preferred option objectives and the associated benefits expected. From this information, a retrospective logic model was produced, the purpose of which was to provide a framework for evaluating the benefits (outputs and impacts) of the scheme (the preferred option). A set of EPE objectives was prepared from the objectives for the preferred option. In addition three standard objectives were developed for use in all EPEs to cover unanticipated benefits and disbenefits and lessons learnt.

For each EPE case study, the actual benefits and disbenefits resulting from the scheme were investigated through desk research and stakeholder interviews. Desk research covered a review of available documents and internet searches for information relating to the scheme. Stakeholder interviews were held by phone with staff involved in the development, construction and implementation of the scheme as well as representatives from the local community.

The results from the desk research and stakeholder interviews were tabulated. A theory-based approach was then used to evaluate the outcomes and impacts of the scheme from technical, economic, social and environmental perspectives. Timescales for realising benefits were also assessed.

3. Summary of findings from the case study EPEs

Table 1 provides a brief summary of each of the schemes used in the case studies. More detailed background is presented in each of case study (Appendices 3 and 3). Sources of information obtained for the two case studies are listed in Table 2 and the results of the EPE for the two schemes are covered in Tables 3 and 4.

Table 1: Summary of background information on the two case studies

Scheme	Shaldon and Ringmore Tidal Defence Scheme	Upton upon Severn Flood Alleviation Scheme
Background summary	Shaldon and Ringmore are adjacent villages on the south side of the Teign Estuary in South Devon. The villages lie close to the mouth of the estuary and are at risk of flooding from extreme tidal events when high tide conditions combine with surges. Informal walls of inconsistent height and in some areas poor construction provided pre-scheme defences against tidal inundation. They included numerous low points along the frontage, particularly at beach access points. These defences provided protection from a tide with approximately a 1 in 17 (6%) chance of happening in any one year. The indicative standard of protection required for Shaldon and Ringmore, based on FCDPAG3 (Flood and Coastal Defence Project Appraisal Guidance – Economic Appraisal), was between 1 in 100 (1%) and 1 in 300 (0.33%).	Upton upon Severn is a historic market town situated on the River Severn in Worcestershire (16km downstream of Worcester and 10km upstream of Tewkesbury). Upton had a long history of flooding with 70 flood events occurring between 1970 and 2010 and was referred to as 'the most flooded town in Britain'. The areas at most risk of flooding were within the Waterfront and New Street areas. The two main roads serving the town were also at risk of flooding and in the 2007 floods the town became an island with the only access in and out of the town was by boat. A trial of temporary defences was carried out along the Waterfront from September 2006. The trial protected 26 properties from flooding to a level of a 1 in 75 year chance. The temporary defences were expensive to operate and labour intensive to deploy. Furthermore, during the major flood event of July 2007, the temporary defences were unable to be deployed in time due to severe traffic disruption which delayed the barriers from arriving on site. Therefore, the deployment of temporary defences was not considered sustainable in the long term.
Preferred option	To raise the existing defences and intervene in years 40 and 70 to respond to rising sea levels.	To build a flood bank, wall and flood gates at New Street and to build a flood wall with flood gates at the Waterfront.
Scheme start dates	January 2010	February 2011
Scheme completion dates	May 2011.	New Street: November 2011 Waterside: July 2012

Table 2: information sources for the two case studies

Data gathered	Shaldon and Ringmore Tidal Defence Scheme	Upton upon Severn Flood Alleviation Scheme
Documents obtained for the desk review	• PAR • Project Closure Report	• The PAR was the only document obtained.
Stakeholder interviews	• 6 stakeholder interviews held	• 9 stakeholder interviews held

Table 3: Shaldon and Ringmore Tidal Defence Scheme EPE

Summary of evaluation objectives	Shaldon & Ringmore Tidal Defence Scheme Impact evaluation
1) To determine whether the scheme was effective in managing flood risk to property and people in the villages of Shaldon and Ringmore?	The scheme has been shown to manage flood risk to people and property in Shaldon and Ringmore. However, it has yet to be tested to its design standard. It has reduced flood risk in line with the PAR [Ref 1] and therefore it can be assumed the optimum economic level. Due to the cost savings it may have delivered a higher cost : benefit ratio. Whilst the wall height is not the maximum that could be economically justified (1 in 1000 year 0.1% SoP), it is still economically viable and additionally was supported by the community and Planning Authority. Due to the level and quality of the community engagement from the outset of considering what to do about tidal flood risk in Shaldon and Ringmore the interaction with the community, FWD and operation of the floodgates has worked. Not installing a new local tide gauge has not affected this. The community engagement has also raised awareness, brought the issue out into the open and achieved a sense of wellbeing. The quality and level of engagement and the ethos behind the approach also delivered benefits to the stakeholders and authorities involved such as the Environment Agency. Notably the integrated team approach that contributed to reduced cost and construction time. <u>Timescale</u> Benefit realised on completion of scheme.
2) To determine how the tidal FAS has impacted on the local community?	Overall the impact has been positive. There are on going issues relating to surface water at Ringmore Brook that wasn't included in the tidal FAS although other surface water issues have improved, and some users of the estuary and foreshore tying boats to the gates.

Summary of evaluation objectives	Shaldon & Ringmore Tidal Defence Scheme Impact evaluation
	Again the level and quality of community engagement from the outset ensured that concerns, needs and expectations were considered. This has resulted in a scheme being delivered that reflects these aspects and incorporates the requirements. This has managed expectations, avoided conflict but also disappointment in the scheme or the scheme not working for the community to achieve the benefits it was designed to achieve. It has also had the economic benefit to the responsible agencies, of establishing community ownership of the scheme and their operation of the floodgates and maintenance of the street furniture. The community has been boosted by the scheme because its design was adapted to reflect their needs and respond to their concerns, such as surface water flooding, maintaining the link with the estuary and access to the foreshore. Therefore they have, generally, supported it and tidal flood risk is talked about and better understood. The lower level wall than the optimum design reflected the community needs for now and the design is sustainable in the short term (40 years) as the wall height can be increased to reflect climate change. <u>Timescale</u> Benefit realised on completion of scheme, but has grown and spread over the intervening four years.
3) To determine whether the scheme resulted in any environmental impacts, short term and on-going.	There were no adverse environmental impacts. In addition the niche habitats incorporated into the wall design has proved successful, further monitoring would be required to prove this statistically but the molluscs like them. Use of innovative techniques such as the flood glazing has ensured no impact on the Conservation Area and listed buildings. <u>Timescale</u> Benefit realised on completion of scheme for areas such as surface water flood risk. For niche habitats these were monitored and shown to have realised benefits after 18 months.
4) To determine whether the scheme had any impact on the landscape or visual amenity of the area, in terms of built and natural environment.	The use of a landscape architect linked with the level of community engagement has resulted in a scheme that fits the community, their expectations, needs and the visual integrity of the area. The selection of Option 2h rather than Option 1e (optimum cost: benefit score) responded to community needs, managed the visual impact and ensured planning approval. Community requests for enhancements were delivered via the scheme such as seats and planters. Due to their involvement with these aspects the community have taken ownership of these aspects. Innovative techniques such as flood glazing reduced the visual impact. <u>Timescale</u> Benefit realised on completion of scheme.

Summary of evaluation objectives	Shaldon & Ringmore Tidal Defence Scheme Impact evaluation
5) To determine the impact of the scheme on the commercial and recreational viability of the area including tourism, regeneration, local economy and the viability of Teignmouth port.	Listening to the community and designing their needs into the scheme, for example floodgates rather than a continuous wall, has maintained the link with the foreshore. Therefore the impact on recreation minimal and on tourism has been beneficial due to the FAS enhancing the area. There may have been economic benefit but this has not been quantifiable. However, the feel good factor created by the improved environment and look of the foreshore has supported independent investment such as improvements at the Clipper Café. <u>Timescale</u> Benefit realised over the intervening four years since the completion of scheme.
6) To determine whether the scheme was effective in maximising sustainability.	Maximising the use of existing structures and designing the FAS to allow the wall height to be raised at year 40 increased the scheme's sustainability. At year 70 the wall must be replaced to ensure the SoP meets the required standard. The community engagement and resultant trust and support for the FAS has meant that community flood wardens operate the eight floodgates. Without this the resource requirements for RMA to operate the gates would have made the FAS unsustainable. <u>Timescale</u> Benefit realised on completion of scheme with the agreement with the Parish Council. Have continued to be realised and should be further realised as year 40 when the wall height is increased.
7) To determine whether any unexpected benefits have arisen from the scheme (e.g. technical, economic, environmental, social, and psychological).	Unexpected benefits achieved are: • resolution of the surface water flooding issues, apart from Ringmore Brook that has been improved but not resolved • increased safety due to rationalisation of beach access points and continuous wall along the estuary edge • improved stakeholder relationships • ownership and operation of the scheme by the community • improved amenity (street furniture, renovation of ferry shelter) and enhance aesthetics contributing to the local economy through increased use of the area • looking at all flooding issues holistically secured additional resources (local levy) to try and resolve all the issues • no longer blighted as a defended flood plain which has boosted confidence in house buying and economic investment • sharing of learning and its influence on subsequent schemes such as Teignmouth.

Summary of evaluation objectives	Shaldon & Ringmore Tidal Defence Scheme Impact evaluation
	Timescale Benefit realised on completion of scheme for some aspects, such as enhanced aesthetics, and for others, such as reduced blight, over the intervening four years or has increased over time.
8) To determine whether any unexpected disbenefits have resulted from the scheme (e.g. technical, economic, environmental, social, and psychological).	Not finding a bit more money or including it in the tidal FAS to resolve the Ringmore Brook fluvial flooding issue, rather than just local levy to improve it. Expectation management is key. Members of the community who were not involved in the decisions about the scheme may never be in favour of it. This can lead to conflict, frustration and be detrimental should further investment to manage flood risk be needed again. Timescale Disbenefit realised on completion of scheme when first surface water flood happened and when gates were obstructed, on-going.
9) To determine the lessons arising from the ex-post evaluation.	Early, open, high quality community engagement linked with integrated team working is critical to success. This is success in design, construction and post-construction benefits delivery. Starting with everything on the table not just your task can bring additional benefits to you, your task and the concerns / needs of others. This could be funding, resolving other flood issues or ensuring the design meets all needs so will not be opposed. Timescale For most aspects the benefit was realised on completion of scheme. However, even when this was the case the value of the benefit and related benefits such as blight and its link to house purchasing has continued to be present if not increase.

Table 4: Upton upon Severn Flood Alleviation Scheme EPE

Summary of evaluation objectives	Upton upon Severn Flood Alleviation Scheme Impact evaluation
1) To determine whether the scheme was effective in managing flood risk in Upton upon Severn.	Technical • The scheme has been tested during flood events and in particular in February 2014 when flooding was 5.4m above its normal level and no properties were flooded. Therefore, the output of having the New Street and Waterfront schemes in place has resulted in the anticipated outcomes.

Summary of evaluation objectives	Upton upon Severn Flood Alleviation Scheme Impact evaluation
	• Although some people perceive that the scheme has increased the likelihood of flooding to properties outside of the area protected by the scheme, the modelling showed this not to be the case. • As there are no longer the issues with deploying the temporary barriers (including the potential for the barriers not to be erected in time), the risk of failing to protect properties and residents at risk has been reduced through construction of the scheme. <u>Economic</u> • Prior to the scheme deployment of temporary defences diverted operational resources (an estimate of the costs for temporary defences was taken into account in costing options in the PAR). Since the scheme has been in place incident management resources have continued to decrease with knowledge and experience of the way in which the scheme performs. <u>Timescale</u> • Benefits were realised on completion of the scheme. • Flood events have tested the scheme post completion. The ex-post evaluation has provided a means of reflecting on the operation of the scheme.
2) To determine whether the scheme was effective in maximising sustainability.	<u>Technical</u> • The continued deployment of temporary defences was not considered sustainable in the long term. • Use of clay from Upton Marina was a sustainable and beneficial use of a material that potentially would otherwise go for disposal. <u>Environmental</u> • Archaeological work proceeded sensitively enabling buried artefacts and information to be retrieved and providing ongoing educational and research opportunities. <u>Timescale</u> • Benefits were realised on completion of the scheme.
3) To determine whether the scheme minimised any environmental impacts.	<u>Environmental – visual impact</u> • A major concern with the scheme from local people was the visual impact of the scheme. This was taken into account in the design with inclusion of glass panels on top of the wall and use of reclaimed bricks. Overall the scheme is not considered to

Summary of evaluation objectives	Upton upon Severn Flood Alleviation Scheme Impact evaluation
	have an impact on the Conservation Area but instead is considered to fit with the local area. <u>Environmental – built</u> • The scheme included design features to minimise adverse environmental impacts, such as pedestrian access gates and footpaths. <u>Environmental – natural</u> • The impact on stag beetle habitat was mitigated by moving the dead tree and placing on the ground. Newly created stag beetle habitat also helped compensate for the loss of the standing dead tree. <u>Timescale</u> • Benefits were realised on completion of the scheme. • The ex-post evaluation has provided a means of reflecting on the visual and aesthetic impact of the scheme over time.
4) To determine whether the scheme enhanced the built and natural environment.	<u>Environmental – built</u> • A road was raised as part of the scheme, allowing ongoing vehicular access during floods. This would not have gone ahead without the scheme. Thus the scheme has resulted in ongoing benefits that would not have occurred otherwise. • Construction and raising of the pavement by the wall and resurfacing of the road has enhance the appearance of the area. • The river front has been upgraded and no longer looks 'tired'. <u>Environment – visual/amenity</u> • The new wall by the river includes more areas for planting flowers for Upton in Bloom and there are more lamp posts (12) with flower baskets. In addition trees were planted. These features are reported to have enhanced the appearance of the area. <u>Timescale</u> • Benefits were realised on completion of the scheme. • The ex-post evaluation has provided a means of reflecting on whether or not the scheme has enhanced the built and natural environment.
5) To determine the impact of the scheme on the commercial and recreational viability of the area	<u>Economic</u> • The scheme has resulted in an upturn in the local economy as evidenced by an increase in business revenue and fewer

Summary of evaluation objectives	Upton upon Severn Flood Alleviation Scheme Impact evaluation
including tourism, regeneration.	empty shops in the town. Furthermore there has been no need to cancel festivals and events, which again provide revenue. Timescale • Benefits were realised on completion of the scheme, although the economic gains have increased since.
6) To determine how the FAS has impacted on the local community.	Psychological • The presence of the scheme has resulted in many people feeling safer and no longer worrying about flooding. Timescale • Benefits were realised on completion of the scheme although feelings of well-being have developed since.
7) To determine whether any unexpected benefits have arisen from the scheme (e.g. technical, economic, environmental, social, and psychological).	Economic • Economic benefits have been accrued by businesses operating along the river. Social • A time capsule was buried by local school children to mark the construction of the defences. This would not have happened without the scheme. • Careful design resulted in the majority of people being in favour of the scheme compared to when the scheme was being proposed. • An unexpected effect and benefit of the bund was that it created an auditorium around the playing field. • The wall with the glass panels has provided a feature for sitting on or resting beer glasses. Timescale • Some of the benefits were realised on completion of the scheme (e.g. the time capsule). Other benefits have been realised since (e.g. use of the bund around the playing field as a sitting area to view sport).
8) To determine whether any unexpected disbenefits have resulted from the scheme (e.g. technical, economic, environmental, social, and psychological).	Environmental • Some limitation to access along the river frontage in the vicinity of the King's Head has been reported. Timescale • Disbenefits occurred on completion of the scheme.

Summary of evaluation objectives	Upton upon Severn Flood Alleviation Scheme Impact evaluation
9) To determine the lessons arising from the ex-post evaluation.	• The good working practices developed through early engagement with stakeholders and the local community resulted in a scheme going ahead that was accepted by all parties. It also enabled smooth running of the construction phase when issues arose and quick solutions were required (e.g. the need for a licence to exhume human remains). <u>Timescale</u> • For many aspects the benefits were realised on completion of the scheme. However, the consequential impact of these benefits has been realised with time. A few benefits, such as use of the bund around the playing field as a seating area and the social interaction with the use of the wall were unexpected and came to light post scheme completion.

4. Lessons from undertaking the case studies

The case studies are located in Appendices 2 and 3.

Various lessons were identified from carrying out the ex-post evaluation case studies and these are summarised in Table 5 along with recommendations for future ex-post evaluation practice.

Table 5: Lessons from undertaking the case studies with respect to Good Practice Principles

Good Practice Principles	Lessons from Shaldon & Ringmore	Lessons from Upton
GPP1: Evaluation planned in from the outset	Community engagement process evaluation was planned in and continuous for the appraisal stage and detailed design. After which it was a way of working rather than a separate process. The niche habitat evaluation was planned in at the detailed design stage, not from the outset, but as a research project rather than ex-post evaluation. Ex-post evaluation was undertaken retrospectively.	N/A – undertaken retrospectively
GPP2: Clear expression of the purpose of the ex-post evaluation	As this was a retrospective case study it was not covered in the PAR, however it was defined for the case study. However, due their pilot nature the purpose of the community engagement and niche habitat work was clear.	As this was a retrospective case study it was not covered in the PAR, however it was defined for the case study.
GPP3: Defined ex-post evaluation strategy / scheme objectives and outcomes	Objectives for the appraisal were defined in the PAR. Objectives for the preferred scheme were determined from section 2.7 of the PAR. Due to their pilot nature, objectives were defined for the community engagement and niche habitat work.	Objectives for the appraisal were defined in the PAR. Objectives for the preferred option were determined from section 2.7 of the PAR.
GPP4: Defined audience and needs from ex-post evaluation	Not defined for ex-post evaluation. It was defined for the community engagement and niche habitat work. The audience for the case study is Defra, the Environment Agency and other RMAs.	Not defined. The audience for the case study is Defra, the Environment Agency and other RMAs.
GPP5: Identified evaluation questions and outcomes, checked against objectives and outcomes of the strategy / scheme (based on use of a logic model, which might mean that	Evaluation questions were developed in relation to the evaluation objectives for the preferred option. A retrospective logic model was prepared based on the	Evaluation questions were developed in relation to the evaluation objectives for the preferred option. A retrospective logic model was prepared based on

Good Practice Principles	Lessons from Shaldon & Ringmore	Lessons from Upton
ex-post evaluation could be undertaken in stages depending on when particular outcomes and impacts are anticipated / realised)	information in the PAR. The outcome and impacts were taken from the benefits identified for the preferred option. Due to their pilot nature they were defined for the community engagement and niche habitat work.	the information in the PAR. The outcome and impacts were taken from the benefits identified for the preferred option.
GPP6: Clearly chosen evaluation approach (e.g. quantitative, qualitative), confirmed data requirements and measurability including counterfactual and an approach to capturing unintended impacts	This was in place for the niche habitats but as a research project rather than directly linked to the scheme. Case studies for the community engagement, innovative construction approaches (resin injection and flood windows) and for the quality of the scheme and approach have also been undertaken retrospectively but were not planned for. For the ex-post case study the evaluation approach (theoretical using theory of change and realist evaluation) was chosen on the basis of this being a retrospective evaluation.	The evaluation approach (theoretical using theory of change and realist evaluation) was chosen on the basis of this being a retrospective evaluation.
GPP7: Plan for resources and governance in place, including engagement with partners and / or stakeholders	Defined for the community engagement and niche habitats but there was no plan for resources for ex-post evaluation at the start of the scheme.	There was no plan for resources for ex-post evaluation at the start of the schemes.
GPP8: Monitoring of outputs, outcomes and impacts in place throughout the strategy / scheme	Due to the strong links with the community and their responsibility for operating the floodgates, there has been on-going monitoring and feedback from the Parish Council. This has not been for the evaluation of the scheme but for the on-going operation of it. However, it has provided some wider but not quantified feedback. With regard to the niche habitats, these were monitored for 18 months post-scheme completion and have shown a positive result. Longer term monitoring would be need for statistically viable data. Otherwise available documentation and interviews were used to identify the outputs / outcomes / impacts.	No monitoring or reporting of potential impacts arising from the scheme had been undertaken. These had to be identified from available documents and information available online.

Good Practice Principles	Lessons from Shaldon & Ringmore	Lessons from Upton
GPP9: Clear and robust evaluation and analysis of data	The evaluation and analysis of data was based on documents available and interviews held. It was not thorough or comprehensive as it was not possible to obtain all documents that might be relevant to the study. For the community engagement and niche habitats research this had been planned for.	The evaluation and analysis of data was based on documents available and interviews held. It was not thorough or comprehensive as it was not possible to obtain all documents that might be relevant to the study.
GPP10: Clarity on use and dissemination of findings	Project Closure Report has been completed. It is not clear how widely this will be shared beyond those with a responsibility to the scheme.	The ex-post evaluation case study is for use by Defra and the Environment Agency with wider dissemination at their discretion.
GPP11: Timeframe relevant to benefits realisation	Project Closure Report has been conducted later than anticipated but by being completed four years after the scheme was completed, it has been able to reflect on wider aspects such as the interaction with the community for the operation of the flood gates.	The ex-post evaluation case study was undertaken two and a half years after scheme completion. In this time most benefits appear to have been realised.

5. Conclusions and suggested improvements to current process

Lessons from carrying out the case has led to a series of recommendations for future ex-post evaluation with respect to the Good Practice Principles (Table 6) and developed in Phase 1 of this project.

Table 6: Suggested way forward for ex-post evaluation with respect to Good Practice Principles

Good Practice Principles	Suggested improvements to current process
GPP1: Evaluation planned in from the outset	The PAR needs to include the requirements for future ex-post evaluation. This could be done in an additional section or appendix to the PAR and needs to cover the recommendations for GPPs 2-11.
GPP2: Clear expression of the purpose of the ex-post evaluation	The purpose for ex-post evaluation needs to be defined in the PAR.
GPP3: Defined ex-post evaluation strategy / scheme objectives and outcomes	Objectives need to be defined for the preferred option within the PAR.
GPP4: Defined audience and needs from ex-post evaluation	This would need to be covered in the PAR and refined during he detailed design and construction phases.
GPP5: Identified evaluation questions and outcomes, checked against objectives and outcomes of the strategy / scheme (based on use of a logic model, which might mean that ex-post evaluation could be undertaken in stages depending on when particular outcomes and impacts are anticipated / realised)	Evaluation questions should be developed up-front at the PAR stage. Desired outcomes and impacts should also be identified at this stage through a logic model approach. It would be helpful for logic model to be developed as part of the PAR and refined during detail design, to provide the framework for future evaluation and also for reporting at the end of the project.
GPP6: Clearly chosen evaluation approach (e.g. quantitative, qualitative), confirmed data requirements and measurability including counterfactual and an approach to capturing unintended impacts	The evaluation approach taken in the case studies would be suitable for retrospective ex-post evaluations. However, it should be noted that this approach only provides a qualitative assessment. Integral to it are interviews with non-RMA stakeholders to gain wider perspectives on the benefits and disbenefits arising from schemes. The approach with modification to incorporate quantitative as well as qualitative assessments of benefits could be used for ex-post evaluation.
GPP7: Plan for resources and governance in place, including engagement with partners and / or stakeholders	Planning for resources would need to be built in.
GPP8: Monitoring of outputs, outcomes and impacts in place throughout the strategy / scheme	Planning for ex-post evaluation at the stage of the PAR will require monitoring needs to be identified. These would then be refined and tightened during the detailed design phase. Production of a project closure report (End Project Report or Post Project Review) is useful for helping to understand the impacts of the processes undertaken in delivering the scheme. This can then be used in the ex-post evaluation as a 'stepping-off' point for looking at the short and medium term impacts. To give a full perspective of the impacts it needs to honestly reflect

Good Practice Principles	Suggested improvements to current process
	multiple perspectives not just those of the responsible RMA.
GPP9: Clear and robust evaluation and analysis of data	Relevant documents for evaluation and analysis of data would include the project closure report plus any monitoring data and reports produced before and after scheme completion. These would need to be made available to reviewers undertaking the ex-post evaluation.
GPP10: Clarity on use and dissemination of findings	This needs to be planned for at the PAR stage but developed during detailed design and will evolve during the lifetime of the project up to the point of and with the findings of the evaluation. Clarity at the outset is required to ensure the objectives are robust and planned for.
GPP11: Timeframe relevant to benefits realisation	This will be specific to the benefit and objective being measured. As a guide between three to six years after completion. However, ex-post needs to also link into and incorporate feedback from existing on-going procedures such as post-event analysis, community engagement and maintenance inspections to get a full picture.

Appendix 1: Short list of case studies

Case studies	Priority	Scheme	Reason for selection and other comments / observations	Trade-offs
Selected case studies	1	Shaldon and Ringmore Tidal Defence Scheme (2011)	• An example of a coastal scheme that includes both structural and community elements, and which has been tested since completion. • Team members have considerable knowledge of the scheme and existing contacts. • A considerable amount of information is available on different aspects of the scheme. • In operation for four years.	None
	2	Upton-upon-Severn Flood Alleviation Scheme (2011 & 2012)	• Information appears to be readily available from the internet • Largely stood up to floods in 2014, although some flooding with homeowners rescued, so scheme has been tested. • PAR obtained.	Amount of readily available information traded for this being a second EA scheme.
Back-up case studies	3	Park Drain, Carlton (?)	• Scheme promoted by Drainage Board. • Little information readily available via the internet. • PAR obtained. • Suggested by SG.	Selected as a back-up as it is an IDB scheme, however little information readily available on the internet.
	4	Bristol Harbour (2011)	• Scheme promoted by Local Authority. • Replacement of tidal lock gates would provide an interesting case study. • Old lock gates used to make benches. • PAR obtained. • Suggested by SG.	Local Authority and tidal scheme with information available on the internet. Would make a good back-up case.
	5	Warden Hill Flood Relief Works, Cheltenham (2011?)	• Local Authority Scheme. • PAR obtained. • Suggested by SG.	Potential back-up if information not forthcoming on Park Drain.
	6	Seasalter to Graveney Sea Defences (2011?)	• PAR obtained. • Suggested by SG.	Potential back-up instead of Bristol Harbour, although this is another EA scheme.

Appendix 2: Shaldon and Ringmore Tidal Defence Scheme ex-post evaluation case study

Introduction

Background to the scheme

Shaldon and Ringmore are adjacent villages on the south side of the Teign Estuary in South Devon. The villages lie close to the mouth of the estuary and are at risk of flooding from extreme tidal events when high tide conditions combine with surges. They are picturesque Devon villages made up of cottages and Georgian houses fronting onto the beach and foreshore, with narrow lanes and alleyways behind. Their character is gained from their historic and present-day connections with the estuary.

Informal walls of inconsistent height and in some areas poor construction provided pre-scheme defences against tidal inundation. They included numerous low points along the frontage, particularly at beach access points. These defences provided protection from a tide with approximately a 1 in 17 (6%) chance of happening in any one year. The indicative standard of protection required for Shaldon and Ringmore, based on FCDPAG3 (Flood and Coastal Defence Project Appraisal Guidance – Economic Appraisal), was between 1 in 100 (1%) and 1 in 300 (0.33%).

There were 294 residential properties and 60 commercial properties at risk of flooding during the 1 in 100 (1%) annual chance event. This rises to 355 residential properties and 63 commercial properties at the then 1 in 300 (0.33%) annual chance event. More significant events would result in greater depths of flooding rather than a substantial increase in the number of properties flooded. This is due to the local topography.

Much of Shaldon lies in a 'basin' behind the existing defences with land and threshold levels as low as 1.5m AOD. The crest levels of the pre-scheme tidal defences were typically 3.2 to 3.4m AOD. For events exceeding the then 1 in 17 (6%) annual chance these defences would have started to over top, particularly at beach access points. At the 1 in 30 (3.33%) annual chance event more significant over topping would have occurred and the basin area would have started to fill. The 1 in 300 (0.33%) annual chance event (excluding wave action and future sea level rise) was predicted to be 3.86m AOD and would have resulted in flood depths of over 2.3m in the most vulnerable properties. The basin of Shaldon was expected to completely fill during a single high tide for a 1 in 50 (2%) annual chance event or higher.

Marine Parade Shaldon 1987 © Copyright Ben Brooksbank and licensed for reuse under this Creative Commons Licence.

Future sea level rise would have progressively reduced the standard of protection provided by the tidal defences. The effect of this would have been to increase the number of properties at risk. There were predicted to be 453 properties, 434 in Shaldon and 19 in Ringmore, at risk from a 1% event by 2107.

In addition to the tidal flooding, many recorded flood incidents were due to localised surface water ponding caused by a surface water drainage system that was prone to blockage and becoming tide locked. Had it not been for active community intervention, several historic tidal events would have flooded much larger areas of Shaldon and Ringmore than the events recorded on the FRIS database. Sand bagging of low points at slipway locations undoubtedly resulted in a significant reduction in the number and magnitude of recorded flood incidents.

Table 1: Flooding Incidents Recorded on the FRIS Database

Date	Description	Source
30 September 1960	5 properties affected	Fluvial
12 February 1972	8 properties flooded – Middle St, School Lane, Albion St, Ringmore Road and The Strand	Surface water runoff
21 January 1980	Property in School Lane plus a number of unknown properties	Fluvial
30 December 1981	No. 13 Albion St plus several other properties	Surface water runoff
03 January 1983	Number of properties unknown	Tidal
17 September 1992	Number of properties unknown	Surface water runoff
22 September 1992	Localised flooding	Tidal
28 February 1995	Number of properties unknown	Tidal
24 October 1999	Ringmore: Tide locking of minor watercourse; 6 cars flooded	Tidal
2 July 2000	2 properties flooded. Highway flooding – Ringmore Road, Laurel Lane, Coombe Road and Clifford Close	Tidal
27 October 2004	Number of properties unknown. Estimated to be a 1 in 17 (6%) event.	Tidal
24 June 2005	15 properties flooded.	Tide locked surface water

Scheme appraisal objectives

The overall scheme objective was to manage the risk to people and property from tidal flooding within the villages of Shaldon and Ringmore.

The Project Appraisal Report detailed the following objectives against the receptors: human beings, flora and fauna, landscape and visual amenity, cultural heritage, archaeology and material assets, traffic and transport, and use of natural resources[2].

Table 2: Technical, Economic and Environmental Objectives

Receptor	Project Objective
Human Beings	• Reduce the risk of tidal flooding to local homes and businesses within the areas of Shaldon and Ringmore at risk from tidal flooding • Develop a tidal flood risk management solution which is technically, economically and environmentally appropriate • Deliver a sustainable solution that meets the needs of the local community without compromising the ability of future generations to meet their own needs • Demonstrate best value for money • Optimise the standard of protection provided • Raise public awareness and appreciation of tidal flood risk • Minimise disturbance to the local community from construction works • Minimise construction, maintenance and public health and safety risks • Achieve good publicity and prevent adverse publicity

[2] Table 5, section 2.2.11 PAR version 6 July 2008

Receptor	Project Objective
Flora & Fauna	• No impact on protected or notable species, including migratory salmonids • Minimal encroachment onto foreshore • Prevent further spread of Japanese Knotweed (currently one small stand)
Landscape & Visual Amenity	• Minimise adverse impacts on sight lines and estuarine views • Promote the contribution made by the tidal flood defences to the character of the villages • Ensure sensitive design that is aesthetically pleasing and respects the historical setting of the village • To enhance the public open spaces • Provide appropriate mitigation for unavoidable losses
Cultural Heritage, Archaeology & Material Assets	• Protect designated features of heritage and archaeological interest, particularly listed structures and items noted on the Devon Historic Records • Minimise the impact on non-statutory cultural heritage assets • Develop a sensitive design that is aesthetically pleasing and respects the historical and cultural setting of the village
Traffic & Transport	• Minimise disruption to the local highway network and footpaths • Ensure no impact on the commercial or recreational viability Teignmouth port
Use of Natural Resources	• Support Environment Agency targets for sustainable use of natural resources • Be sustainable in operation and maintenance

Baseline

The 'Do Nothing' scenario[3] assumes the cessation of all maintenance activity within the study area immediately. This would have allowed the existing defences to fall into a state of disrepair and ultimately fail. The standard of protection would have been reduced from the pre-scheme 1 in 17 (6%) annual chance to less than the 1 in 5 (20%) annual chance in the event of breach or failure of the existing defences. The effects of climate change would exacerbate this further. The walls would deteriorate over time, leading to eventual collapse (the residual life is estimated to be 20-30 years), increasing both the frequency and severity of flooding.

Preferred option

The preferred option for the Shaldon and Ringmore Tidal Defence Scheme identified in the Project Appraisal was: Option 2h[4]: Raise the existing defences and intervene in years 40 and 70 to respond to rising sea levels.

This would reduce the annual chance of flooding initially to 1 in 300 (0.33%), from the pre-scheme 1 in 17 (6%) and protect 355 houses and 63 businesses in Shaldon and Ringmore. To cater for sea level rise the defences would then need to be raised in year 40 and, should a second intervention be justifiable nearer the time, replaced in year 70. The standard of protection (SoP) will steadily drop to 1 in 100 before the year 40 planned intervention.

The highest benefit cost ratio was provided by option 1e: raising existing defences to provide a 1 in 1000 (0.1%) standard of protection with no future intervention. However, assessments by and advice from the landscape architect, supported by public consultation and a letter from the Planning Authority, indicated that the maximum acceptable height of wall is 1.4m. This is equivalent to a 1 in 300 (0.33%) standard of protection at the time. Option 2h then became the preferred economic option that met environmental criteria.

[3] Section 2.3.6 PAR Version 6 July 2008
[4] Section 1.4 PAR Version 6 July 2008

Option 2h was the most environmentally acceptable because it:

i. used existing assets for as long as possible;

ii. built on existing assets minimising the impact on the foreshore;

iii. kept the height of the defences reasonably which was more acceptable to the Planning Authority and local residents, yet sea level rise will be accommodated in the life of the scheme;

iv. kept the mitigation measures required to a minimum, because the defences were not excessively high initially.

The components of Option 2h were:

i. 940m of existing wall raising and 470m of new build wall;

ii. strengthening of existing windows to ten properties on the defence line;

iii. eight (public) new telemetry linked flood gates and five sets of access steps;

iv. reinstatement of 40 gardens;

v. drainage works with new flapped surface water outfalls;

vi. intervention in year 40 to raise the defences to a 1 in 300 SoP, and if justifiable nearer the time, again in year 70 with a scheme rebuild to a 1 in 300 SoP.

Shaldon and Ringmore are two separate cells for low order events, but merge to become a single flood cell at higher return periods. With future sea level rise predictions, by the end of the appraisal period, Shaldon and Ringmore will become a single flood cell during a 1 in 3 (33%) annual chance event or higher. Therefore a scheme to protect both villages was promoted and the appraisal process confirmed that a combined Shaldon and Ringmore scheme was robust. It also confirmed that both the Shaldon and Ringmore flood cell works were economically viable in their own right with benefit cost ratios of 13.1 and 3.8 respectively.

The primary objective of this scheme was 'to manage the risk to people and property from tidal flooding within the villages of Shaldon and Ringmore'. In addition to this the preferred option objectives relating to economic, technical, environmental including political and social and other considerations have been derived from section 2.7 of the PAR 'Choice of preferred option' and are detailed below in Table 3.

Table 3: Preferred Option Objectives and relevant Evaluation Objective (Table 4 below)

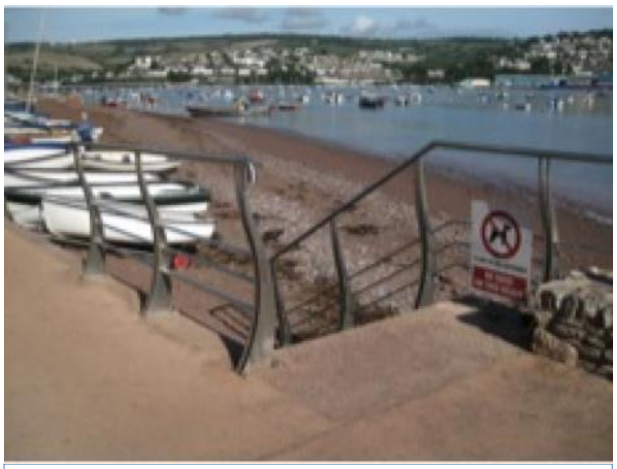
Primary Objective	Evaluation Objective
• Manage the risk to people and property from tidal flooding within the villages of Shaldon and Ringmore	1
Economic	
• Deliver an economically viable scheme that achieves the highest cost benefit ratio possible whilst not causing unacceptable environmental impact and that will secure planning approval and community acceptance.	1
Technical	
• Deliver a scheme that achieves the protection standard required using the existing foundations wherever possible.	1
• Deliver a scheme that does not worsen surface water flood risk.	1
Environmental	
• Deliver a scheme that does not excessively impact on sight lines and estuarine views, gains planning approval and community acceptance.	4
• Deliver a design that is sensitive and aesthetically pleasing and respects the historic and	4

Primary Objective	Evaluation Objective
cultural setting of the village.	
• Deliver a scheme that is not excessively high so typically equates to a level of protection of present day (2008) 1 in 300 year (0.3%).	1
• Encourage and support the community to maintain and update their Parish Flood Plan.	1
• Deliver a scheme that does not adversely affect the geomorphology of the estuary.	3
• Deliver a scheme that does not adversely impact on the foreshore.	3
• Deliver a scheme that creates vertical habitat opportunities to compensate for beach and foreshore loss.	3
• Deliver environmental improvements and community enhancements (from the community engagement work), some as enhanced mitigation: (Enhance the built and natural environment) ○ Provision of a viewing platform and seating area on the Embankment. ○ Improvements to the children's play area upstream of Shaldon Bridge, including landscaping works and replacement of play equipment. A more natural theme using timber, boulders and natural grassed areas was proposed; ○ Refurbishment of the ferryboat shelter, which is identified as an important feature of the village. The shelter is structurally sound but required a fresh coat of paint and cosmetic improvements; ○ The provision of bespoke, standalone planters, to add to the sparsely located, existing half barrel flower beds; ○ Provision of street furniture; including seating and picnic tables, around key community focal points to enhance that which already exists; ○ Installation of interpretation boards at various locations along the scheme. To include details of the flora and fauna to be seen in the area and the history of Shaldon and the estuary; ○ Attractive surface finishes to pedestrian areas.	2 / 3
• Maintain the link between the community and the estuary and access for pedestrians and boats by the provision of eight (public) floodgates.	2 / 5
Other	
• Maintain the flood warning provision (FWD) including installing a new local tide gauge.	1
• Sustainable construction.	6
• Ensure the scheme is delivered in such a way that allows for future management and construction requirements at year 40 and 70.	6
• Maintain the floodgates of the scheme to ensure good operational condition to minimise the risk of operational failure.	1
• Work with the Parish Council to develop the operational procedures and train personnel to have a dedicated and trained team of local residents able to respond rapidly to close the eight (public) floodgates.	1
• Reduce the risk to the public.	2
• Preserve the commercial and recreational viability of the port of Teignmouth.	5
• Maintain the operation of the Shaldon to Teignmouth ferry.	5

Scheme completion

Work started in January 2010, raising 940 metres of existing foreshore walls, constructing 470 metres of new foreshore wall, installing eight (public) floodgates and 25 flood windows and doors together with steps and ramps at specific locations. The work was of high quality fitting into the townscape by using local materials. The project employed a number of ground-breaking engineering techniques. Simple-looking walls in places conceal sheet piling that was installed with relatively quiet specialist equipment. Environmental enhancements were undertaken where opportunities allowed. A pumping station and outfall were included to resolve surface water issues.

Feature seat at the Embankment



Steps and railings Marine Parade

The scheme was completed in May 2011. It was the first example of 'Building Trust with Communities', the Environment Agency's approach to public engagement. Siting the contractor's main compound at Broadmeadow in Teignmouth across the river reduced construction traffic in the villages. The contractor's staff won praise from residents for their cheerful and considerate conduct. The flood defences were officially opened on Friday, 1 July 2011. The event marked the end of seven years work by the Environment Agency.

Purpose of ex-post evaluation

Ex-post evaluation as defined in Phase 1[5] assesses:

a) *The extent to which the benefits stated in the appraisal have been realised together with an account of why or why not*

b) *The extent to which any unanticipated benefits have occurred.*

The purpose of this ex-post evaluation of Shaldon and Ringmore Tidal FAS Case Study is to help inform possible approaches to ex-post evaluation of FCERM schemes. In particular, the Case Study will investigate how existing data and approaches (quantitative and qualitative) could be used within ex-post evaluation and what new data or approaches might be needed going forward.

[5] Collingwood Environmental Planning (2015) Enhancing Ex-Post Evaluation of Flood and Coastal Erosion Risk Management Strategies and Schemes. Report to Defra.

The Case Study considers the longer-term benefits (outcomes and impacts) arising from the scheme. It does not review project management processes that are evaluated as part of the Post Project Review and / or within a Post Project Appraisal.

Ex-post evaluation objectives and framework

Expected benefits arising from the scheme were identified in the PAR as part of the options appraisal[6]. These benefits along with the scheme objectives have been used to prepare ex-post evaluation objectives and an evaluation framework in the form of a retrospective[7] logic model.

Ex-post evaluation objectives

Ex-post evaluation objectives have been developed from the objectives of the FAS[8] along with a set of evaluation questions (Table 4). It should be noted that the ex-post evaluation will only consider those aspects of the scheme objectives that relate to the medium and long term outcomes and impacts of the scheme (and not aspects relevant to immediate post project evaluation).

Table 4: Shaldon and Ringmore Tidal FAS ex-post evaluation questions

Evaluation objective
1) To determine whether the scheme was effective in managing flood risk to property and people in the villages of Shaldon and Ringmore? a. Has flood risk been reduced to the optimum economic level? b. How has the interaction with the community, FWD, Parish Flood Plan, operation of the eight (public) floodgates and the new local tide gauge worked?
2) To determine how the tidal FAS has impacted on the local community? a. Has it met their needs now and for the future? b. Is it sustainable? c. How has public awareness of tidal flood risk changed? d. How has it affected safety?
3) To determine whether the scheme resulted in any environmental impacts, short term and on-going a. How has the scheme affect surface water flooding? b. Have the vertical habitat opportunities created been successful? c. Has the scheme had any impact on the Cultural Heritage, archaeology, Conservation Area and material assets?
4) To determine whether the scheme had any impact on the landscape or visual amenity of the area, in terms of built and natural environment. a. How has it enhanced public areas? b. How has it promoted the contribution made by the tidal FAS to the character of the village?
5) To determine the impact of the scheme on the commercial and recreational viability of the area including tourism, regeneration, local economy and the viability of Teignmouth port.
6) To determine whether the scheme was effective in maximising sustainability.
7) To determine whether any unexpected benefits have arisen from the scheme (e.g. technical, economic, environmental, social, and psychological).
8) To determine whether any unexpected disbenefits have resulted from the scheme (e.g. technical, economic, environmental, social, and psychological).
9) To determine the lessons arising from the ex-post evaluation.

[6] PAR section 2.7.26 and Table 15.
[7] A logic model would normally be developed at the start of a project.
[8] PAR para 2.2.11 and Table 5 on pages 13 and 14.

Retrospective logic model

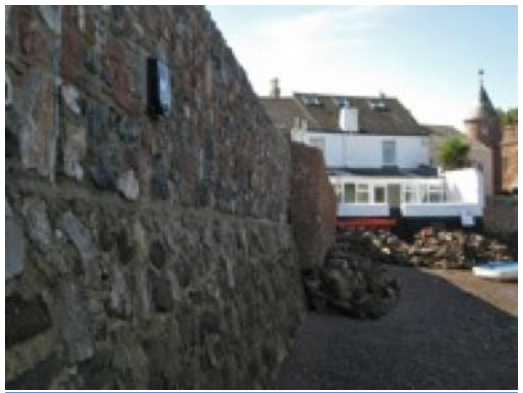
A retrospective logic model (Table 5) has been developed based on information contained within the Project Appraisal Report. The purpose of setting out the predicted benefits arising from the proposed scheme in a logic model is to provide a framework for evaluating the benefits (outcomes and impacts) of the scheme.

Table 5: Logic model for the preferred option for Shaldon and RIngmore Tidal FAS

Context	Inputs	Activities	Outputs	Outcomes	Impacts
The Issue addressed and the context in which it is located	What is invested	The tasks and works undertaken	What has been produced?	Short and medium term outcomes	Long-term and wider outcomes
Manage flood risk to property and people in the villages of Shaldon and Ringmore Understand how the tidal FAS has impacted on the local community Minimise adverse environmental impacts Minimise impact on the existing landscape and visual amenity of the area, in terms of built and natural environment. Minimise the impact of the scheme on the commercial and recreational viability of the area	Time and money £8,288K £50K from Teignbridge District Council from a developer contribution for the Shoreside development	Project Appraisal Detailed design and construction Extensive and thorough community and stakeholder engagement Environmental Impact Assessment Landscape design resulting in local stone cladding of walls, use of local materials Innovative works for reinforcing existing walls, resin injection into existing foundations, Niche habitat creation Siting of works compound	A tidal FAS including and resulting in: i. 940m of existing wall raising and 470m of new build wall; ii. strengthening of existing windows to ten properties on the defence line; iii. eight new telemetry linked flood gates and five sets of access steps; iv. reinstatement of 40 gardens; v. drainage works with new flapped surface water outfalls; vi. community flood wardens and ownership of the	<u>Technical</u> Immediate reduction in flood risk from 6% to 0.33% SoP to Shaldon & Ringmore Managed intervention will increase SoP in years 40 and 70 to cater for sea level rise impacts <u>Economic</u> Option 2h: Benefit £114,558k; Cost £12,474k; B/C Ratio: 9.2; Incr. B/C: 1.4 Substantial decrease in the residual risk of flooding to properties (more so than Option 1) <u>Health & Safety</u> All wall heights sufficient not to be a trip hazard <u>Environmental</u>	<u>Technical</u> Significant construction works during delivery period and future construction periods in years 40 and 70 <u>Economic</u> Considerable initial capital outlay and future capital outlay <u>Environmental</u> Raised walls result in loss of sight lines and estuarine views

Context	Inputs	Activities	Outputs	Outcomes	Impacts
Maximise sustainability		over the river in Teignmouth Rationalising of existing openings to form a functional FAS structure yet maintaining access and functionality for community use Use of locally sourced materials. Consideration of all sources of flood risk not just tidal. Designed to allow height increase at year 40 to manage risk from climate change	flood risk including the closure of the eight (public) gates during times of flood risk and the maintenance and use of the visual enhancements such as planters and seating. vii. niche habitats within the wall structure. viii. reduced surface water flood risk.	Visual enhancement of the foreshore area	

Gate 4 Riverside



New wall on top of old, Embankment

Ex-post evaluation approach

The approach to this ex-post evaluation Case Study involves:

- Formulation of evaluation questions – based on scheme objectives and information in the PAR (see Table 4 above)
- Identification of benefits – from the PAR
- Investigation of benefits – involving desk based review of documents and data and stakeholder interviews
- Analysis and synthesis of data – including impact evaluation

Identification of benefits and disbenefits

The predicted benefits and disbenefits (negative impacts) arising from the scheme for ex-post evaluation have been identified from the PAR and are included in the outcomes and impacts columns of the Logic Model (Table 5). The PAR also identified a range of issues, for example through the environmental assessment that would need to be addressed by the scheme.

The actual benefits and disbenefits resulting from the scheme were investigated through desk research and stakeholder interviews.

Desk review

The desk review covered two aspects:

a) Review of available documents relating to the scheme for information on benefits

- PAR
- Project Closure Report

b) Internet search for information

This involved searching for information on the Shaldon and Ringmore Tidal FAS using key words and phrases:

- Shaldon and Ringmore Tidal Defence Scheme
- Flooding in Shaldon

Stakeholder interviews

Stakeholder interviews were used in combination with the information gathered through the desk research.

Stakeholder identification

The Flood and Coastal Risk Manager for the area and the Project Manager for the scheme (as identified in the PAR) were contacted for information and contact details of other relevant stakeholders.

Emails requesting interviews were sent to nine further contacts that included: Environment Agency staff involved in different aspects of the scheme, estate agents and Shaldon Parish Council. Subsequently seven interviews were conducted.

Stakeholder interview approach

A semi-structured approach was taken with interviews, which were undertaken by phone or Skype. Following an introduction to the purpose the case study and ex-post evaluation, interviewees were asked about the benefits of the scheme from their perspective and involvement in the project. A set of standard prompts (Appendix 4) were used to guide and prompt discussions as appropriate.

Findings from the investigation and evaluation of benefits

Findings from the desk review and stakeholder interviews in response to the evaluation questions have been summarised in Table 6.

Gate 10 at the bottom of Horse Lane by the ferryboat shelter, Marine Parade

Flood glazing at Ringmore Towers © TFS Defence Doors http://www.defencedoors.com/news.htm

Table 6: Benefits and disbenefits / issues identified through the desk research and stakeholder interviews

Evaluation objectives	Findings	Impact evaluation
10) To determine whether the scheme was effective in managing flood risk to property and people in the villages of Shaldon and Ringmore? • Has flood risk been reduced to the optimum economic level? • How has the interaction with the community, FWD, Parish Flood Plan, operation of the eight (public) floodgates and the new local tide gauge worked?	<u>Economic</u> • Actual final cost was £7371K, this was £1158K less than the original FSoD approved cost (£8529K) [Ref 2]. <u>Technical</u> • Scheme has been installed as per the design and has been tested by floods and proved successful, but not tested to its design limit. [Interviewee S&R 1, 2 & 6]. • 2014 a wave dominated event and it held up to that pretty well, it has been tested. Caused some steps to be undermined and they have now been removed (at the seaward end of the scheme) [Interviewee S&R 2]. • The community have successfully operated the gates and therefore ensured the FAS has been functional and the level of protection has been in place during times of flood risk [Interviewee S&R 2 & 6]. • The PCR notes some issues with gate telemetry and this has been rectified and the learning to involve Hydrometry and Telemetry staff more during design and construction. This has been done, to the benefit of the Teignmouth FAS [Interviewee S&R 1]. • The new local tide gauge was not installed as part of the scheme, nor as part of the Teignmouth scheme on the opposite bank. However, the required telemetry appears to be working with the gates being closed by the community flood wardens prior to any potential flood. The community have been happy with the gate closure warnings received so this has not been needed [Interviewee S&R 6) • FWD has continued to be provided (now an opt out scheme) [Interviewee S&R 6]. <u>Social</u> • Community support for and ownership of the tidal FAS and greater understanding of the risk [Interviewee S&R 1, 2 and 6] • Awareness of and conversations about the flood risk are now more open and out there [Interviewee S&R 4]. • Positive feedback initially after completion and up to a year after completion [Interviewee S&R 1].	The scheme has been shown to manage flood risk to people and property in Shaldon and Ringmore. However, it has yet to be tested to its design standard. It has reduced flood risk in line with the PAR [Ref 1] and therefore it can be assumed the optimum economic level. Due to the cost savings it may have delivered a higher cost : benefit ratio. Whilst the wall height is not the maximum that could be economically justified (1 in 1000 year 0.1% SoP), it is still economically viable and additionally was supported by the community and Planning Authority. Due to the level and quality of the community engagement from the outset of considering what to do about tidal flood risk in Shaldon and Ringmore the interaction with the community, FWD and operation of the floodgates has worked. Not installing a new local tide gauge has not affected this. The community engagement has also raised awareness, brought the issue out into the open and achieved a sense of wellbeing.

Evaluation objectives	Findings	Impact evaluation
	• Owners with flood windows and doors have a duty to shut them. They have a landowners pack that is kept with the deeds of the property so should be passed on to help reduce the risk of non-closure [Interviewee S&R 2]. • Better protection gives the community a sense of wellbeing [Interviewee S&R 6]. • Managed to get a wall built to a sensible height and taking a sensible approach to be able to add to the height in the future [S&R 7]. • There is an increased understanding of the risk and that it is from the tide [Interviewee S&R 6]. • The dedication of the Flood Wardens has been exemplary, to the extent that the co-ordinator who has only recently stepped down (but who was involved from the original community engagement during the PAR stage) has been put forward for a Queen's Award by the Environment Agency [S&R 6]. • A fully integrated team working on the scheme during design and construction delivered multiple benefits including: o whole team buy-in to solutions was obtained with early value engineering reducing both cost and the construction programme. o ensuring all design requirements were seamlessly incorporated into the finished works o focussing on value engineering opportunity and to achieve rapid turnaround of design modifications where the historic infrastructure resulted in some interesting unforeseen challenges – such as sections of original wall built directly on sand with next to no foundation o supplier focussed value engineering [Ref 2].	The quality and level of engagement and the ethos behind the approach also delivered benefits to the stakeholders and authorities involved such as the Environment Agency. Notably the integrated team approach that contributed to reduced cost and construction time. <u>Timescale</u> Benefit realised on completion of scheme.
11) To determine how the tidal FAS has impacted on the local community? • Has it met their needs now and for the future? • Is it sustainable? • How has public	<u>Economic</u> • Enhanced the local area, especially the quay where the Clipper Café is now more up market [Interviewee S&R 1]. • Improvements at the quay area have contributed to the greasy spoon café being upgraded to a popular posh café, definitely an economic improvement [Interviewee S&R 2]. • The beach huts development and quay area improvements would have happened anyway [Interviewee S&R 4].	Overall the impact has been positive. There are on going issues relating to surface water at Ringmore Brook that wasn't included in the tidal FAS although other surface water issues have improved, and some users of the estuary and foreshore tying boats to the gates.

Evaluation objectives	Findings	Impact evaluation
awareness of tidal flood risk changed? • How has it affected safety?	Technical • By selecting Option 2h to raise the SoP now and at year 40 and 70, this has resulted in the required SoP currently and a wall height that is acceptable to the community and planning authority [Ref 1, Source A & B]. • Flood risk has reduced making it safer [Interviewee S&R 1]. • Improved safety [S&R 2]. • Surface water pumping station and outfall at Horse Lane that has been transferred to Teignbridge District Council was also delivered above the PAR requirements [Ref 2]. • Taught them (Environment Agency) that they had to deal with surface water and sewage flood risk equally with the tidal risk [S&R 7]. Environmental • Significant input from the community and the use of landscape architects from the outset ensured that the design was acceptable to the community and reflected the local character [Interviewee S&R 3]. • All visible walls were stone clad with locally sourced stone and it has been recognised that the FAS has enhanced the area in keeping with the local surroundings. It blends in and has matured although some stonework still looks too clean [Interviewee S&R 1]. • The design of the wall upstream of the bridge means that a wall now protects a drop down to the foreshore. Before there was just an embankment [Interviewee S&R 2]. Social • Amenity access during flood events can also be catered for with local arrangements [Interviewee S&R 6]. • Heightened community awareness and response due to the flood wardens and community responsibility to operate the eight (public) floodgates during floods [Interviewee S&R 1]. • During times of flood risk the closing of the gates now creates a continuous barrier between the community and the risk. Before it had been an ad hoc barrier. Access is now improved, formalised, clear with good provision with handrails, steps and ramps [Interviewee S&R 1]. • Community support for and ownership of the tidal FAS and greater understanding of the risk [Interviewee S&R 6].	Again the level and quality of community engagement from the outset ensured that concerns, needs and expectations were considered. This has resulted in a scheme being delivered that reflects these aspects and incorporates the requirements. This has managed expectations, avoided conflict but also disappointment in the scheme or the scheme not working for the community to achieve the benefits it was designed to achieve. It has also had the economic benefit to the responsible agencies, of establishing community ownership of the scheme and their operation of the floodgates and maintenance of the street furniture. The community has been boosted by the scheme because its design was adapted to reflect their needs and respond to their concerns, such as surface water flooding, maintaining the link with the estuary and access to the foreshore. Therefore they have, generally, supported it and tidal flood risk is talked about and better understood. The lower level wall than the

Evaluation objectives	Findings	Impact evaluation

	• It is a comfort having the gate shut but the water barely comes to the bottom of the gates [S&R 7].
	• Viewing and access points have been enhanced and the level of use has improved [Interviewee S&R 2].
	• Significant and early engagement with the community to obtain their support delivered benefits including:
	  ○ strong relationships carried into the design using a liaison group
	  ○ ownership and acceptance of the scheme proposals and planning application
	  ○ support and flexibility during construction – reducing compensation
	  ○ ownership and operation of the final scheme [Ref 2].
	<u>Psychological</u>
	• In terms of people visiting and house hunting in Shaldon, the FAS and related flood risk is more openly talked about and does not put people off as it is being managed acceptably [Interviewee S&R 4].
	• Community extremely please with the scheme [Interviewee S&R 2].
	• FAS gave a psychological boost to the community that is lasting and has increase ambience [Interviewee S&R 2].
	• Due to the high level of early community engagement (Building Trust with Communities) we ended up doing things to a higher standard because by engaging with the people we had given them the platform for them to ask for more [Interviewee S&R 2]
		optimum design reflected the community needs for now and the design is sustainable in the short term (40 years) as the wall height can be increased to reflect climate change.
		<u>Timescale</u>
		Benefit realised on completion of scheme, but has grown and spread over the intervening four years.

12) To determine whether the scheme resulted in any environmental impacts, short term and on-going • How has the scheme affect surface water flooding?	<u>Environmental</u> • No post construction environmental impacts [Interviewee S&R 1]. • No impact on notable species [Refs 1, 2, 3 & 7].. • Impact on the natural environment was minimised during construction and niche habitats created in the finish of the walls. This has enhanced the environmental benefits achieved by the FAS. They have been successfully colonised providing environmental enhancement of the foreshore area [Refs 1, 2, 3 & 7]. • Niche habitats were worth doing and have created interest; school children go down to look at them [Interviewee S&R 2]. • The niches were monitored for a year or so afterwards and biologically returned some statistically	There were no adverse environmental impacts. In addition the niche habitats incorporated into the wall design has proved successful, further monitoring would be required to prove this statistically but the molluscs like them. Use of innovative techniques such as the flood glazing has ensured no impact on the Conservation Area

Evaluation objectives	Findings	Impact evaluation
• Have the vertical habitat opportunities created been successful? • Has the scheme had any impact on the Cultural Heritage, archaeology, Conservation Area and material assets?	significant results. This isn't a big deal for the resident or visiting community. We have proved the molluscs like it though [Interviewee S&R 3]. • Ecological enhancement of hard coastal structures can be inexpensive to implement and post-construction monitoring has demonstrated its effectiveness for increasing the numbers and species present [Ref 6]. • There has been no detrimental impact on the Conservation Area, heritage, archaeology or material assets [S&R 7]. • The level of public art was noted in the PCR as being reduced. This was in agreement with the community and parish council to adapt the proposals so more in keeping [Interviewee S&R 1].	and listed buildings. <u>Timescale</u> Benefit realised on completion of scheme for areas such as surface water flood risk. For niche habitats these were monitored and shown to have realised benefits after 18 months.
13) To determine whether the scheme had any impact on the landscape or visual amenity of the area, in terms of built and natural environment. • How has it enhanced public areas? • How has it promoted the contribution made by the tidal FAS to the character of the village?	<u>Technical</u> • After one flood the foreshore material had relocated causing some access steps to move away from the FAS wall at the downstream end of the scheme. These were subsequently removed and the foreshore material has returned covering the exposed foundations [Interviewee S&R 2]. <u>Environmental</u> • No adverse impacts [Interviewee S&R 1]. <u>Social</u> • The Landscape Architects appraised the entire frontage from both aspects (i.e. seaward and landward) and worked out where the best finishes would be best placed, and where lower cost treatments would suffice. The community had been worried that the character of the village would be destroyed by the imposition of a uniform flood defence. But this didn't happen and the approach enabled cost savings as well as community acceptance. Communities are very concerned about what something will look like. If we can reassure them that the finished appearance is being taken very seriously from the outset (and not parked until detailed design) then they are more likely to accept the outline design. Finished appearance should not be left until detailed design; it is integral to the acceptability of the options under appraisal. [Interviewee S&R 3]. • Visual impact of the tidal defence walls was a sensitive issue, as they partially blocked the impressive sea views. Incorporating flood defence glazing resolved objections to the scheme raised by local residents, whilst still achieving the required wall height and protection. The flood defence glazing proved a popular	The use of a landscape architect linked with the level of community engagement has resulted in a scheme that fits the community, their expectations, needs and the visual integrity of the area. The selection of Option 2h rather than Option 1e (optimum cost: benefit score) responded to community needs, managed the visual impact and ensured planning approval. Community requests for enhancements were delivered via the scheme such as seats and planters. Due to their involvement with these aspects the community have taken ownership of these aspects. Innovative techniques such as flood glazing reduced the visual impact.

Evaluation objectives	Findings	Impact evaluation
	solution with the local community, helping to minimise the impact of the scheme [Source C]. • Work that has been done has been tastefully done [S&R 7]. • 'Ain't spoilt the view out of my window' [S&R 7]. • They needed to strike the balance. What the Environment Agency has done has been a good compromise, overall enhanced the appeal of the place; tastefully done [S&R 7].	<u>Timescale</u> Benefit realised on completion of scheme.
14) To determine the impact of the scheme on the commercial and recreational viability of the area including tourism, regeneration, local economy and the viability of Teignmouth port.	<u>Technical</u> • Ferry operation accommodated by use of gate and surface water flood risk in the same area resolved [Ref 2]. <u>Economic</u> • Businesses have invested money in the foreshore area and it is now known as a foodie place [Interviewee S&R 4]. • Probably added to house values as no longer blighted as being at flood risk as defended by the FAS [S&R 7]. • The FAS has tidied the place up, this has helped the economy. In conjunction with the FAS the Clipper Café has invested and has gone from a greasy spoon to one of the nicest eating places in Shaldon with about 50 staff on the books [S&R 7]. <u>Social</u> • It has be recognised that the FAS has enhanced the area in keeping with its surroundings [Interviewee S&R 1] • The eight (public) telemetered gates continue to allow access to and use of the foreshore, including for the ferry to Teignmouth [S&R 2]. • Shaldon is now classed as a defended flood plain and not at risk for insurance purposes so you can get insurance [S&R 7].	Listening to the community and designing their needs into the scheme, for example floodgates rather than a continuous wall, has maintained the link with the foreshore. Therefore the impact on recreation minimal and on tourism has been beneficial due to the FAS enhancing the area. There may have been economic benefit but this has not been quantifiable. However, the feel good factor created by the improved environment and look of the foreshore has supported independent investment such as improvements at the Clipper Café. <u>Timescale</u> Benefit realised over the intervening four years since the completion of scheme.
15) To determine whether the scheme was effective in	<u>Technical</u> • Use of resin injection to stabilise existing foundations [Source F] rather than replacing existing structures entirely.	Maximising the use of existing structures and designing the FAS to allow the wall height to be raised at year 40 increased the scheme's

Evaluation objectives	Findings	Impact evaluation
maximising sustainability.	<u>Environmental</u> • Use of locally sourced stone to provide a high quality aesthetically pleasing finish [S&R 1]. • The final design received many commendations on the high quality of finishes and landscaping [Ref 2]. <u>Social</u> • Community support for and ownership of the tidal FAS and greater understanding of the risk [Interviewee S&R 1, 2 and 6]	sustainability. At year 70 the wall must be replaced to ensure the SoP meets the required standard. The community engagement and resultant trust and support for the FAS has meant that community flood wardens operate the eight floodgates. Without this the resource requirements for RMA to operate the gates would have made the FAS unsustainable. <u>Timescale</u> Benefit realised on completion of scheme with the agreement with the Parish Council. Have continued to be realised and should be further realised as year 40 when the wall height is increased.
16) To determine whether any unexpected benefits have arisen from the scheme (e.g. technical, economic, environmental, social, and psychological).	<u>Economic</u> • Enhancements have resulted in businesses investing the area and it now being known as a foodie place, attracting more visitors [Interviewee S&R 2 & 4]. • Solutions to surface water flooding issues were discussed during the development of the tidal FAS PAR and detailed design. The bottom line was always that the tidal FAS would not make surface water flooding worse but it could not fund solutions to it. However, by involving others such as the water company and highways and considering the risk from surface water flooding relating to the tidal FAS especially at Horse Lane, improvements did happen and surface water flooding is no longer a problem (apart from Ringmore Brook see 9 below) [Interviewee S&R 1]. • Quay area has been enhanced, as have the properties that received the flood windows and doors without loss of the link to the estuary [Interviewee S&R 1]. <u>Technical</u>	Unexpected benefits achieved are: • resolution of the surface water flooding issues, apart from Ringmore Brook that has been improved but not resolved • increased safety due to rationalisation of beach access points and continuous wall along the estuary edge • improved stakeholder relationships • ownership and operation of

Evaluation objectives	Findings	Impact evaluation
	• The scheme has formalised the access routes to the foreshore making it clearer and with ramps and handrails so improved safety [Interviewee S&R 1]. <u>Environmental</u> • Viewing and access points have enhanced and improved the use of the area [Interviewee S&R 1]. <u>Social</u> • Relationships with other stakeholders, contractors and between the community and the contractors have had a knock on benefit to other work such as the Teignmouth FAS [Interviewee S&R 1]. • Knowledge and experience sharing have helped with other FASs [Interviewee S&R 1 & 6]. • Community are aware of how lucky they are to have had a scheme put in especially when other communities locally e.g. Topsham are flooded [Interviewee S&R 6]. • Community have used it for other benefits such as closing the gates to prevent driftwood removal for Bonfire Night celebrations [Interviewee S&R 6]. • FAS walls reduce flood risk but they also remove access to the beach during floods so increasing passive safety [Interviewee S&R 1]. • Concerns about closing the gates reducing amenity but local arrangements are possible for access even during a flood to mitigate this [Interviewee S&R 1]. <u>Psychological</u> • It has all been a positive benefit [Interviewee S&R 4]. • The FAS is a comfort especially to newcomers [S&R 7]. • Flooding was treated holistically and some long-standing surface water flooding issues could be dealt with, which the community appreciated [S&R 3]. • There is a heightened awareness in the community about the flood risk due to their involvement with the design and now the post scheme operation of the gates [Interviewee S&R 1].	the scheme by the community • improved amenity (street furniture, renovation of ferry shelter) and enhance aesthetics contributing to the local economy through increased use of the area • looking at all flooding issues holistically secured additional resources (local levy) to try and resolve all the issues • no longer blighted as a defended flood plain which has boosted confidence in house buying and economic investment • sharing of learning and its influence on subsequent schemes such as Teignmouth. <u>Timescale</u> Benefit realised on completion of scheme for some aspects, such as enhanced aesthetics, and for others, such as reduced blight, over the intervening four years or has increased over time.
17) To determine whether any unexpected disbenefits have	• No disbenefits [Interviewee S&R 4]. <u>Economic</u> • By adhering to the rules rather than finding a bit of money to resolve the final outstanding surface water	Not finding a bit more money or including it in the tidal FAS to resolve the Ringmore Brook fluvial flooding issue, rather than just local

Evaluation objectives	Findings	Impact evaluation
resulted from the scheme (e.g. technical, economic, environmental, social, and psychological).	flooding issue at Ringmore Brook, what is otherwise a fabulous example of a successful FAS in terms of design, community support and buy-in, landscape enhancement and environmental improvement continues to be blighted. Some improvements were done during construction using local levy funding but using some underspend from the overall scheme would have resolved all rather than all but one of the flood (from all sources) issues in this community. The tidal FAS has not made the situation any worse [Interviewee S&R 1]. <u>Social</u> • Due to the significant community engagement up front and during appraisal and delivery of the FAS, the community still have an expectation that this can still be provided, but the resource isn't there so there can be difficult conversations and hard to manage expectations [Interviewee S&R 6]. • Feelings about the FAS are still mixed, with those whom can be affected by the gates being closed e.g. gig team, venting their frustrations at the volunteers that close the gates in order to protect the whole community from the flood risk. The volunteers take on a huge burden [Interviewee S&R 6]. • No disbenefits [S&R 7]. • Post-scheme issues include: ○ Boats moored in locations restricting closure of the gates ○ Complaints from people unable to access the foreshore when the gates are closed ○ Issues with the telemetry status still existed and on inspection it was found that the gate bolts were not being sufficiently tightened to trip the switch [Ref 2].	levy to improve it. Expectation management is key. Members of the community who were not involved in the decisions about the scheme may never be in favour of it. This can lead to conflict, frustration and be detrimental should further investment to manage flood risk be needed again. <u>Timescale</u> Disbenefit realised on completion of scheme when first surface water flood happened and when gates were obstructed, on-going.
18) To determine the lessons arising from the ex-post evaluation.	<u>Social</u> • Process is key. The public participation process provided synergistic impetus to the professional discipline of the project team. There was a huge amount of work done behind the scenes to this end, and I think that the community acceptance of the scheme was better for it. Neither communications nor technical excellence alone could perhaps have secured the same level of positive outcomes [Interviewee S&R 3]. • Upfront community engagement helps to save time during construction and to get ownership and buy in after for the operation of a scheme such as closing gates, but only by those involved [Interviewee S&R 6, Ref 2]. • Discussing all concerns not just focussing on your task can bring multiple benefits at not huge add on	Early, open, high quality community engagement linked with integrated team working is critical to success. This is success in design, construction and post-construction benefits delivery. Starting with everything on the table not just your task can bring additional benefits to you, your task and the concerns / needs of others. This could be funding,

Evaluation objectives	Findings	Impact evaluation
	cost e.g. the surface water flooding improvements [Interviewee S&R 1, Ref 2].	resolving other flood issues or ensuring the design meets all needs so will not be opposed. Timescale For most aspects the benefit was realised on completion of scheme. However, even when this was the case the value of the benefit and related benefits such as blight and its link to house purchasing has continued to be present if not increase.

Sources of information

The following sources of information were obtained from the Internet search and have been referenced in Table 6.

Table 7: Sources of information obtained through desk review, interviews and Internet search

Sources of information
Interviewees
Interviewees S&R 1 to S&R 6
References
Ref 1: Environment Agency (10 July 2008) Shaldon and Ringmore Project Appraisal Report Version 6
Ref 2: Environment Agency (9 September 2015) Shaldon and Ringmore Tidal Defence Scheme End Project report v2
Ref 3: Atkins (April 2008) Environment Agency Shaldon and Ringmore Tidal Defence Scheme Environmental Scoping Report
Ref 4: Atkins (4 June 2007) Geomorphology memo to Environment Agency
Ref 5: Teignbridge District Council (28 September 2009) Development Control Committee – Decisions Made by Committee at the Meeting held on 28 September 2009
Ref 6: www.ecrr.org (2013) Enhancing our water environment – a guide to managing flood risk sustainably: Case Study: Preserve and improve water's edge and bank side habitats – Shaldon Intertidal Habitat Enhancement
Ref 7: Institute of Environmental Management and Assessment www.iema.net/qmark (2013) EIA Quality Mark Case Study – Shaldon and Ringmore Tidal Defence Scheme
Websites
Source A: http://www.envirotech-online.com/news/environmental-analysis/7/breaking_news/environment_agency_revises_shaldon_and_ringmore_tidal_defence_application/5335/
Source B: http://www.waterbriefing.org/home/water-issues/item/2057-green-light-for-shaldon-and-ringmore-tidal-defences
Source C: http://www.defencedoors.com/news.htm
Source D: http://www.geograph.org.uk/snippet/5731
Source E: http://www.atkinsglobal.co.uk/en-GB/media-centre/news-releases/2011/group/2011-10-14
Source F: http://www.h2ox.net/Case-Studies/Case-Study-Ground-Stabilisation/Shaldon-and-Ringmore-Tidal-Defense---Case-Study

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Unless stated all images were photographed Thursday 15th September 2011 by Robin Stott.

Summary and conclusions

Ex-post evaluation as defined in Phase 1[9] assesses:

a) *The extent to which the benefits stated in the appraisal have been realised together with an account of why or why not*

b) *The extent to which any unanticipated benefits have occurred.*

With regard to the Shaldon and Ringmore Tidal Defence Scheme, it is clear from the ex-post evaluation that the benefits stated in the appraisal have been realised, with the exception of the public art and local tide gauge. For these community engagement and discussion about the public art has resulted in this being reduced but still delivering the objective of maintaining the link with the estuary and increasing understanding of the tidal flood risk. With regard to the local tide gauge, the current systems are working, again in part to the level of community engagement and understanding. This meant that the extra provision of the local gauge to reinforce the close gate orders was not needed, the trust established between the community and agencies made this obsolete.

Ex-post evaluation has shown that unanticipated benefits have arisen particularly in terms of community ownership of the flood risk and operation of the scheme. In addition the learning and understanding gained at Shaldon and Ringmore due to the upfront, open, encompassing and continued community engagement created benefits during the construction phase, for the operation of the scheme and for other tidal defence schemes, such as Teignmouth, due to the transfer of learning about community engagement and community trust on the work that was being proposed. Whilst this is not a benefit within the community of Shaldon and Ringmore it has affected other communities and mutual support and learning can have benefits to all parties involved, both short and long term. The counter to this is the resource requirements and expectations placed on different agencies. Due to the high level of community engagement during the project appraisal there is some perception that this resource is still available to the community even though the scheme is now completed. The key learning point is expectation management, so everyone knows what can happen, when and why or not; and the empowerment of communities so that they become self-sustaining.

The full impact of the tidal FAS at Shaldon has yet to be realised as the FAS has not yet been tested to its design standard or near to that standard. However, in terms of the primary objective to build a scheme to manage tidal flood risk to people and property in Shaldon and Ringmore, this has been achieved.

In conclusion, carrying out ex-post evaluation of Shaldon illustrated significant successes, due to understanding what the community and others needed from the outset and planning this in and working together as a team. Because of this the disbenefits were minimal and relate to resource limitations and parties not involved in the PAR and detailed design stages. Understanding the context and history of the location is key, early engagement meant that there was thorough planning in of objectives, (above and beyond the standard requirements) that met all involved parties needs, and these could then be evaluated for. Ex-post evaluation of Shaldon and Ringmore has also shown that at some levels and for some aspects the learning has been passed on, for example the sharing of community operation of the floodgates with Teignmouth. It seems that most of the learning that has been shared has been about the positives, however some of the negatives may be equally valuable if shared. Although this may just be a reflection on the timescale of when the learning point was realised. For example the point about expectation management after the

[9] Collingwood Environmental Planning (2015) Enhancing Ex-Post Evaluation of Flood and Coastal Erosion Risk Management Strategies and Schemes. Report to Defra.

scheme is completed, is being learnt now (four years after completion) whereas the point about community engagement was learnt four to eight years ago during the appraisal and delivery phases.

Appendix 3: Upton upon Severn Flood Alleviation Scheme ex-post evaluation case study

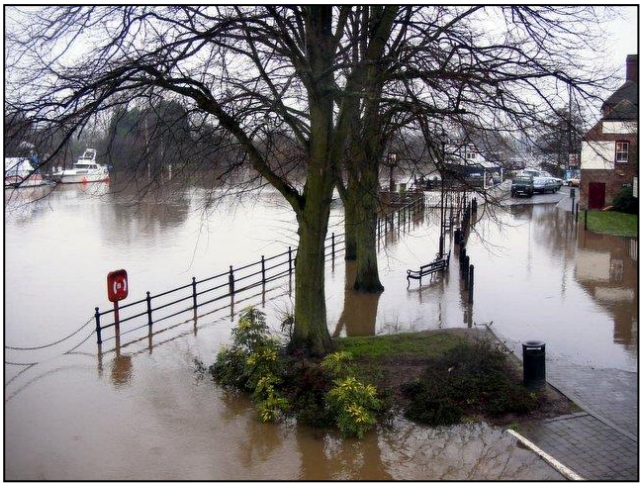
Introduction

Background to the scheme

Upton upon Severn is a historic market town situated on the River Severn in Worcestershire (16km downstream of Worcester and 10km upstream of Tewkesbury). The historic town centre is designated as a Conservation Area and is popular with tourists. The River Severn provides recreational opportunities and is also popular with tourists; river cruises leave the quay and the Waterfront area is used for festivals.

Upton had a long history of flooding with 70 flood events occurring between 1970 and 2010 and was referred to as 'the most flooded town in Britain'[10]. The areas at most risk of flooding were within the Waterfront and New Street areas. The two main roads serving the town were also at risk of flooding and in the 2007 floods the town became an island with the only access in and out of the town was by boat.

A trial of temporary defences was carried out along the Waterfront from September 2006. The trial protected 26 properties from flooding to a level of a 1 in 75 year chance. The temporary defences were expensive to operate and labour intensive to deploy. Furthermore, during the major flood event of July 2007, the temporary defences were unable to be deployed in time due to severe traffic disruption which delayed the barriers from arriving on site. Therefore, the deployment of temporary defences was not considered sustainable in the long term.



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The preferred policy for Upton upon Severn, identified in the River Severn Catchment Flood Risk Management Plan (CFMP)[11], was to reduce existing flood risk management actions. As the area did not fall within any strategic options for the River Severn, the Upton upon Severn Flood Alleviation Scheme (FAS) was considered a stand-alone project.

Scheme appraisal objectives

The project objectives were to[12]:

a) Reduce the flood risk to the optimum economic level
b) Optimise use of asset and incident management resources
c) Minimise adverse environmental impacts
d) Enhance the built and natural environment
e) Maximise sustainability
f) Minimise construction, maintenance and public health and safety risks
g) Improve passive safety thus reducing residual risk.

[10] http://www.bbc.co.uk/news/uk-england-18783297
[11] Environment Agency (2009) River Severn Catchment Flood Management Plan. Summary Report. https://www.gov.uk/government/publications/river-severn-catchment-flood-management-plan
[12] PAR page 8

Baseline

Baseline options for New Street and Waterfront have been taken as the 'Do Nothing' options in the PAR[13].

For New Street the 'Do Nothing' option was the same as the 'Do Minimum'. The flood warning services would continue but there were no maintenance commitments and temporary defences were not deployed to this area.

At Waterfront the 'Do Nothing' option was to exclude the deployment of temporary defences. There were no maintenance commitments to this area.

Preferred option

The preferred options for the New Street and Waterfront areas identified in the Project Appraisal were:

a) *At New Street a flood banks, wall and flood gates reducing risk to a 0.66% AEP (1 in 150 year SoP) of flooding in any given year to 26 properties. It includes a 200mm freeboard allowance. This was chosen as it reduces the flood risk and minimises the loss of flood storage in the flood plain, it also has least affect on the sports pitches. It also has a higher benefit cost ratio than the lower standards of protection.*
b) *At Waterfront a flood wall (up to 1.6 m high) with flood gates will reduce the risk of flooding to a 0.66% (1 in 150 year SoP) for 28 properties. It includes a 200mm freeboard allowance. This has been chosen as it provides a permanent solution without the need to deploy the temporary defences and it offers the highest benefit cost ratio.*

The preferred options were considered to meet the original objectives because they:

a) Reduced the flood risk to the optimum economic level: The options reduced the risk to a 0.66% AEP (1 in 150 year SoP) of flooding in any given year, offering the best Cost/Benefit Ratio
b) Optimised use of asset and incident management resources: The defences were permanent solutions and would not require additional Environment Agency resources during an event, once the flood gates were closed
c) Improved passive safety thus reducing residual risk
d) Minimised adverse environmental impacts
e) Enhanced the built and natural environment
f) Maximised sustainability
g) Minimised construction, maintenance and public health and safety risks
h) Created the opportunity for further future regeneration of the Waterfront area.

Objectives for the preferred option were not stated in the PAR. In order to undertake the ex-post evaluation objectives have been drawn from information contained in the PAR about the preferred option[14] Table 1.

[13] PAR pages 20 and 21.
[14] PAR Section 2.7 on Choice of Preferred Option

Table 1: Preferred Option objectives

Primary objective
• To reduce the risk of flooding to a 0.66% AEP (1 in 150 year SoP) in any given year to 26 properties at New Street and 28 properties in the Waterfront area.
Economic
• To deliver a scheme at New Street that offers higher benefit cost ratio than lower standards of protection and a scheme at Waterfront that offers the highest benefit cost ratio.
Technical
• To allow for adaptation to climate change by increasing the cross section of the additional footprint of the flood banks by 300mm. • To use construction methods that minimise adverse impacts on the surrounding buildings and infrastructure.
Environmental

• To minimise the following identified adverse environmental impacts:
  ○ Visual impact of the banks and walls on views from properties and footpaths;
  ○ Change to the character of the Conservation Area and listed Building settings;
  ○ Disruption to residents and businesses during the works.
• To provide environmental mitigation to minimise adverse impacts by:
  ○ Preparation of a detailed stag beetle mitigation strategy;
  ○ Provision of bat and bird boxes and deadwood piles;
  ○ Brick facing to flood walls;
  ○ Replacement shrub and tree planting;
  ○ Archaeological watching brief;
  ○ Improvements to the landscape and pedestrian access along the Waterfront including providing street furniture and safe access to the riverside walkway;
  ○ Burying the overhead power cable under playing fields;
  ○ Woodland planting to rear of bunds at New Street to restrict views into properties.
• To provide environmental enhancement measures by:
  ○ Contributing to a community playground and locating a skate park within the defences to improve recreation opportunities;
  ○ Creation of marginal bankside habitats;
  ○ Provision of board walks, kissing gates and an interpretation board to the area between Old Street and the playing fields.

Scheme completion

The works on the two parts of the scheme were staggered[15]. Construction of the New Street phase began in February 2011. Part of the scheme involved building an earth embankment using clay from the nearby Upton Marina. A new flood wall was also constructed and a flood gate installed across New Street. The scheme at New Street was opened on 25 November 2011.

The scheme at Waterside was designed to scheme defend 64 properties with a 1 in 150 chance of flooding in any given year. It involved construction of a permanent flood wall with glass panels 450 millimetres high along its length to maintain the view of the river. Pedestrian gates were included to enable access to the river side of the wall. Regeneration features included raised walkways and a pedestrianised Waterfront area. The scheme at Waterside was opened in July 2012.

[15] See: https://www.gov.uk/government/publications/upton-upon-severn-flood-risk-management-scheme/upton-upon-severn-flood-risk-management-scheme

Purpose of ex-post evaluation

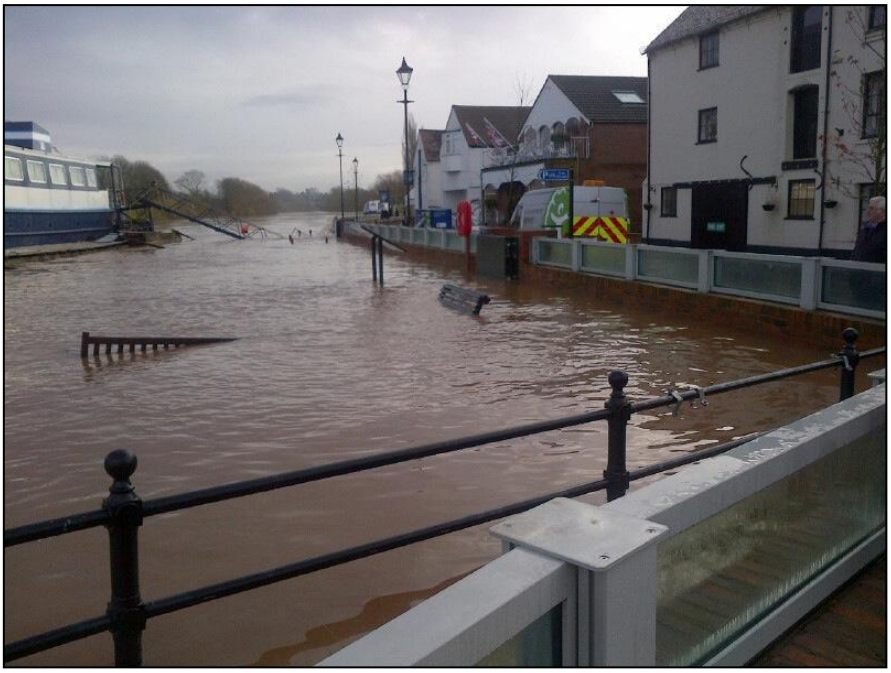
Ex-post evaluation as defined in Phase 1[16] assesses:

c) *The extent to which the benefits stated in the appraisal have been realised together with an account of why or why not*

d) *The extent to which any unanticipated benefits have occurred.*

The purpose of this ex-post evaluation of Upton upon Severn FAS Case Study is to help inform possible approaches to ex-post evaluation of FCERM schemes. In particular, the Case Study will investigate how existing data and approaches (quantitative and qualitative) could be used within ex-post evaluation and what new data or approaches might be needed going forward.

The Case Study considers the longer term benefits (outcomes and impacts) arising from the scheme. It does not review project management processes which are evaluated as part of the Post Project Review and / or within a Post Project Appraisal.



Flood defence in Upton upon Severn, November 2012 © Environment Agency

Ex-post evaluation objectives and framework

Expected benefits arising from the scheme were identified in the PAR as part of the options appraisal[17]. These benefits along with the scheme objectives have been used to prepare ex-post evaluation objectives and an evaluation framework in the form of a retrospective[18] logic model.

[16] Collingwood Environmental Planning (2015) Enhancing Ex-Post Evaluation of Flood and Coastal Erosion Risk Management Strategies and Schemes. Report to Defra.
[17] PAR page 26 and Tables 6a (New Street) and 6b (Waterfront).
[18] A logic model would normally be developed at the start of a project.

Ex-post evaluation objectives and questions

Ex-post evaluation objectives have been developed from the objectives for the preferred option (in Table 1) along with a set of evaluation questions (Table 2). In addition, there are three 'standard' evaluation questions covering unanticipated benefits and disbenefits and lesson learnt. It should be noted that the ex-post evaluation will only consider those aspects of the scheme objectives that relate to the medium and long term outcomes and impacts of the scheme (and not aspects relevant to immediate post project evaluation).

Table 2: Upton FAS ex-post evaluation objectives and questions

Evaluation objective
Evaluation objectives developed from the objectives of the preferred option
10) To determine whether the scheme was effective in managing flood risk in Upton upon Severn.
11) To determine whether the scheme was effective in maximising sustainability.
12) To determine whether the scheme minimised any environmental impacts. a. What has been the visual impact of the banks and walls on views from properties and footpaths? b. Has the scheme changed the character of the Conservation Area?
13) To determine whether the scheme enhanced the built and natural environment. a. How has the scheme enhanced the built environment? b. How has the scheme enhanced the natural environment?
14) To determine the impact of the scheme on the commercial and recreational viability of the area including tourism, regeneration, and the local economy. a. How has the scheme affected the recreational use of the area? b. How has the scheme affected tourism, regeneration and the local economy?
15) To determine how the FAS has impacted on the local community. a. Has it met their needs now and for the future? b. How has public awareness of tidal flood risk changed? c. How has it affected safety?
Standard ex-post evaluation objectives
16) To determine whether any unexpected benefits have arisen from the scheme (e.g. technical, economic, environmental, social, and psychological).
17) To determine whether any unexpected disbenefits have resulted from the scheme (e.g. technical, economic, environmental, social, and psychological).
18) To determine the lessons arising from the ex-post evaluation.

Retrospective logic model

A retrospective logic model (Table 3) has been developed based on information contained within the Project Appraisal Report. The purpose of setting out the predicted benefits arising from the proposed scheme (the preferred option) in a logic model is to provide a framework for evaluating the benefits (outcomes and impacts) of the scheme.

The preferred option was selected as it met the appraisal objectives and provided at benefit/cost ratio greater than 1.

Table 3: Logic model for the preferred option for Upton upon Severn FAS

Context	Inputs	Activities	Outputs	Outcomes	Impacts
The Issue addressed and the context in which it is located[19]	What is invested	The tasks and works undertaken	What has been produced?	Short and medium term outcomes	Long-term and wider outcomes
• Reduce the flood risk to the optimum economic level. • Optimise use of asset and incident management resources. • Minimise adverse environmental impacts. • Enhance the built and natural environment. • Maximise sustainability. • Minimise construction, maintenance and public health and safety risks. • Improve passive safety thus reducing residual risk.	• Project team time and skills. • EA funding of £4,480K towards project costs. • £250K from Worcestershire Council to raise a section of the A4104. • £50K from Malvern Hills District Council towards enhancement of the Waterfront. • £5K from the Town Council for local enhancement work.	• Scoping Consultation Document (May 2008) & responses. • Consultation with statutory bodies, local landowners and residents. • Project Appraisal Report including appendices covering Economic Appraisal (Appendix E), Environmental Action Plan (Appendix G). • Construction of flood banks and flood wall along New Street with a flood gate across the road and a minor section of road raising of the A4104. • Construction of a flood wall along the Waterfront with ramps, steps and flood gates for access.	• Flood banks and flood wall along New Street with a flood gate across the road and a minor section of road raising of the A4104. • Flood wall along the Waterfront with ramps, steps and flood gates for access.	<u>Technical</u> • New Street technical benefit: 0.66% AEP (1 in 150 year SoP) standard reduces the risk to 26 properties. • Waterfront technical benefit: wall height 1.6m reducing the risk to 0.66% AEP (1 in 150 chance) to 28 properties <u>Economic</u> • New Street economic benefit: Benefit £1,818k; Cost £1,806k; B/C Ratio: 1.01[20]; Incr. B/C: 9.74 • Waterfront economic benefit: Benefit £3,652k; Cost £2,650k; B/C Ratio: 1.38; Incr. B/C: 4.37 <u>Environmental</u> • New Street	<u>Technical</u> • New Street technical benefit: 0.66% AEP (1 in 150 year SoP) standard reduces the risk to 26 properties. • Waterfront technical benefit: wall height 1.6m reducing the risk to 0.66% AEP (1 in 150 chance) to 28 properties <u>Economic</u> • New Street economic benefit: Benefit £1,818k; Cost £1,806k; B/C Ratio: 1.01; Incr. B/C: 9.74 • Waterfront economic benefit: Benefit £3,652k; Cost £2,650k; B/C Ratio: 1.38; Incr. B/C: 4.37 <u>Environmental</u> • New Street

[19] The context is provided by the objectives of the project appraisal.
[20] Other options had a benefit cost ration of less than one.

Context	Inputs	Activities	Outputs	Outcomes	Impacts
				environmental issue: visual impact of bank and floodgate from residential properties and footpath. • Waterfront environmental impact on Conservation Area and views of the river interrupted, particularly obscuring view from the area outside the Swan Inn <u>Other</u> • New Street other benefit: meets Defra indicative standard and could easily be adapted for climate change. • Waterfront other impact: the height of the wall was a planning consideration	environmental benefit: visual impact of bank and floodgate from residential properties and footpath. • Waterfront environmental impact on Conservation Area and views of the river interrupted, particularly obscuring view from the area outside the Swan Inn <u>Other</u> • New Street other benefit: meets Defra indicative standard and could easily be adapted for climate change. • Waterfront other impact: the height of the wall was a planning consideration

Ex-post evaluation approach

The approach to this ex-post evaluation Case Study involved:

- Formulation of evaluation questions – based on scheme objectives and information in the PAR (see Table 1)
- Identification of benefits – from the PAR
- Investigation of benefits – involving desk based review of documents and data and stakeholder interviews
- Impact evaluation of benefits and disbenefits

Identification of benefits and disbenefits

The predicted benefits and disbenefits (negative impacts) arising from the scheme for ex-post evaluation have been identified from the PAR and are included in the outcomes and impacts columns of the Logic The PAR also identified a range of issues, for example through the environmental assessment that would need to be addressed by the scheme.

The actual benefits and disbenefits resulting from the scheme were investigated through desk research and stakeholder interviews.

Desk review

The desk review covered two aspects:

- Review of available documents relating to the scheme for information on benefits. The PAR was the only document obtained.

c) Internet search for information

This involved searching for information on the Upton FAS using key words and phrases:

- Upton upon Severn Flood Alleviation Scheme
- Flooding in Upton (2014, 2012)

Stakeholder interviews

Stakeholder interviews were used in combination with the information gathered through the desk research. Altogether nine stakeholder interviews were held with stakeholder representatives.

Stakeholder identification

The Flood and Coastal Risk Manager for the area and the Project Manager for the scheme (as identified in the PAR) were contacted for information and contact details of other relevant stakeholders.

Emails requesting interviews were sent to 18 further contacts that included: Environment Agency staff involved in different aspects of the scheme; local residents, landowners, and businesses; the County, District and Town Councils; and Upton Flood Forum.

Stakeholder interview approach

A semi-structured approach was taken with interviews, which were undertaken by phone or Skype. Following an introduction to the purpose of the case study and ex-post evaluation, interviewees were asked about the benefits of the scheme from their perspective and involvement in the project. A set of standard prompts (Appendix 4) were used to guide and prompt discussions as appropriate.

Impact evaluation of benefits

A theory-based approach has been used to evaluate the benefits (outcomes and impacts) arising from the scheme. As there is no actual counterfactual for comparison with the intervention, the 'do-nothing' scenario, identified in the PAR, provides a 'predicted counterfactual'. This theory based approach involves:

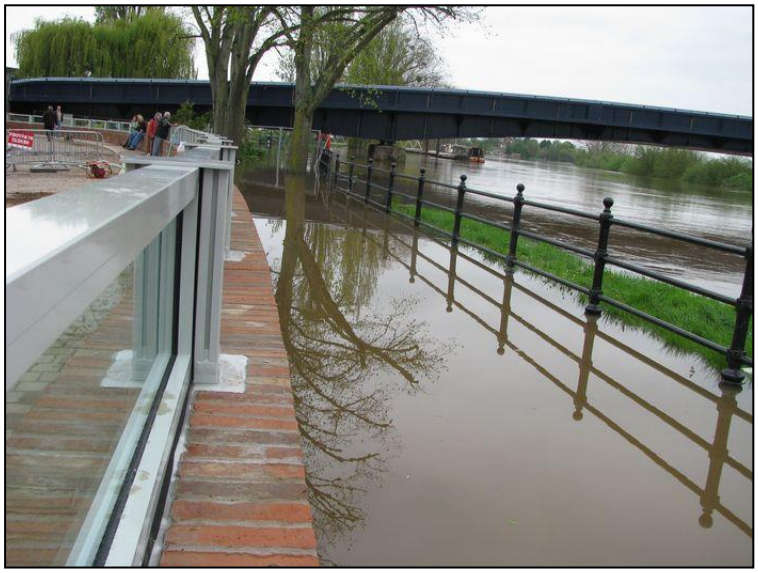
- Theory of change evaluation – by understanding the connections and links between the components of the logic model scheme, in particular the outputs (scheme intervention) and the observed outcomes and impacts.
- Realist evaluation – by understanding the perceptions of stakeholders on the effect (benefits and disbenefits) of a scheme.

Findings and evaluation of benefits

Findings from the desk review and stakeholder interviews in response to the evaluation questions have been summarised in Table 4 ('Findings' column). Sources of information obtained and referenced in Table 4 are listed in Table 5.

At the time the scheme was being developed there were different views in the community about whether it would provide improved benefits to the town or not (Interviewee U1). There were issues around how the scheme would look and interruption of views of the river. Up to the point of construction there was an about a 50:50 split in the community as to whether or not it was a good idea (Interviewees U1 & U3).

An evaluation of the benefits resulting from construction of the scheme is also provided in Table 4 ('Impact evaluation' column).



Flood wall in action, April 2012 © Jackie Surtees

Table 4: Evaluation of the benefits and disbenefits/issues identified through the desk research and stakeholder interviews

Evaluation objectives	Findings	Impact evaluation
1) To determine whether the scheme was effective in managing flood risk in Upton upon Severn.	Technical • New Street flood gate first closed during a flood event in April 2012 (Source A). • Whole scheme tested during February 2014 flood event when the flood gates were put into operation and the defences stood up to protect the town (Source B). The flooding reached the level of the bottom of the glass panels (Source C). The water was 5.4m above its normal level (although it has been much higher than this in the past (2007)) (Source B). • Flood defences have been tested but not to the level of the 2007 floods e.g. houses in the New Street area and also the pubs along the river front would have flooded. Properties in the flood defence area have not flooded since the scheme has been in place. The scheme has defended the town and kept it open (Interviewee U3). • Some residents in the Upton area feel that the new defences push water into other areas (Source C). • The design of the scheme did not protect everyone and there are people on the outskirts of the town who are still at risk. However there has been no increase in risk to these households, although perceptions differ. Some of these households have been helped by the Local Authority with individual property protection schemes (interviewee U1). • The scheme was not offered to people on the opposite side of the river, who are still subject to flooding, however the scheme has not increased their flood risk (Interviewee U3). • There is a misconception amongst some people that if they had not flooded before then they would be at risk of flooding with the scheme in place but this is not the case (Interviewee U3). • The scheme has meant that businesses operating on the river front have not had to close during flooding and clean up with consequent impact on business (Interviewee U3). • An anecdotal impression from one property owner is that the water rises a lot faster than before the bund was built (Interviewee U4).	Technical • The scheme has been tested during flood events and in particular in February 2014 when flooding was 5.4m above its normal level and no properties were flooded. Therefore, the output of having the New Street and Waterfront schemes in place has resulted in the anticipated outcomes. • Although some people perceive that the scheme has increased the likelihood of flooding to properties outside of the area protected by the scheme, the modelling showed this not to be the case[21]. • As there are no longer the issues with deploying the temporary barriers (including the potential for the barriers not to be erected in time), the risk of failing to protect properties and residents at risk has been reduced through construction of the scheme. Economic • Prior to the scheme deployment of temporary defences diverted operational resources[22] (an estimate

[21] PAR page 18.
[22] PAR page 17.

Evaluation objectives	Findings	Impact evaluation
	• The A4104 floods more quickly (interviewee U4). • People have been surprised at the amount of ground water on the playing field on the dry side of the bund (Interviewee U4). <u>Economic</u> • Following construction the EA is responsible for maintaining the banks and inspecting for deterioration and damage (Interviewee U2). • Sometimes the gates are closed just in case of flooding (Interviewee U3). • When there is a period of heavy rain and flood is forecast or water levels are raised at a point to operate assets, then the incident room is opened. Before the scheme was in place, installation of temporary barriers needed to be considered around 2-3 days before a flood event in order to get the barriers loaded onto HGVs and transported to site. There would be times when the barriers would be loaded at depot and then never leave as the water levels would not get to the levels for deployment. Sometimes it would get to the point of parking the barriers close to the site (e.g. at New street car park) in readiness but they would not be deployed. (In such cases security would be required, if the barriers were left overnight in the car park, to prevent the aluminium from being stolen). If deployed, 8-10 people would be required to erect the temporary defences. Therefore prior to the scheme, the incident room was probably opened more frequently, including for H&S reasons with people in site, putting up barriers and monitoring the barriers and the floods (Interviewee U5). • There is no longer a risk of the temporary barriers being stuck on the M5 in their transfer from the storage site to Upton and not arriving in time to deal with the flooding (Interviewee U5). • Once the temporary barriers were up, 2-4 people would be required to check whether the barriers were leaking or stolen (Interviewee U5). • With the scheme in place it is now a question of whether to close the five gates. Gates are not all closed at the same time. New Street gate needs closing quite early. There has been the need to gain confidence in the gates performing during a flood event. Initially 2-3 people were on site to watch the gates for seepage and to manage the situation with pumps. Over the years the approach to managing the gates has been rationalised and now a more reactive approach is	of the costs for temporary defences was taken into account in costing options in the PAR[23]). Since the scheme has been in place incident management resources have continued to decrease with knowledge and experience of the way in which the scheme performs. <u>Timescale</u> • Benefits were realised on completion of the scheme. • Flood events have tested the scheme post completion. The ex-post evaluation has provided a means of reflecting on the operation of the scheme.

[23] PAR page 23.

Evaluation objectives	Findings	Impact evaluation
	taken (Interviewee U5). • The scheme is not completely passive and early on required quite a lot of management. However, as people (including the EA) have got to know the scheme, management has been rationalised. There has been more partnership working than in the past. It was probably more difficult to get partners involved in putting up the temporary defences as this was a specialised area of work. With the scheme the interventions are smaller, such as closing gates and pumping seepage, and so there is more opportunity to work with partners (Interviewee U5). <u>Social</u> • Some property owners at Dunns Lane chose to be on the river side of the wall and not to benefit from the scheme. Closing of the Dunns Lane gate is left to the last minute to allow access for residents. However, there is a disadvantage to them when the gate is closed as they need to gain access to their property by parking and then walking (Interviewee U5).	
2) To determine whether the scheme was effective in maximising sustainability.	<u>Technical</u> • The embankment at New Street was built using clay extracted from the building of a new marina at Upton Marina (Source E + Interviewee U7). • Use of local clay (from across the river to Upton) provided economic benefits for the scheme and also for the marina (Interviewee U7). <u>Environmental</u> • There were known buried archaeological remains from the desk assessment. Little trial trenching was possible prior to construction due to the limited space between the wall and the road. As a consequence there was a watching brief on the project. During construction a mid-nineteenth century cemetery was found and so a licence was required to exhume human remains. This came through very quickly because of the good relationship with Historic England and so did not have a huge impact on the scheme. A Community Liaison/Heritage Day was held around the excavation site and a viewing platform was built for people including school children to see the excavation taking place. Some people commented that, although they didn't like the scheme, they could see that the EA was acting in a positive and environmentally sustainable way. In addition, it was interesting that a community outreach event on heritage became an	<u>Technical</u> • The continued deployment of temporary defences was not considered sustainable in the long term[24]. • Use of clay from Upton Marina was a sustainable and beneficial use of a material that potentially would otherwise go for disposal. <u>Environmental</u> • Archaeological work proceeded sensitively enabling buried artefacts and information to be retrieved and providing ongoing educational and research opportunities.

[24] PAR page 17

Evaluation objectives	Findings	Impact evaluation
	opportunity to promote the EA and flood risk issues (Interviewee U8 & EA, 2012).	<u>Timescale</u> • Benefits were realised on completion of the scheme.
3) To determine whether the scheme minimised any environmental impacts. a. What has been the visual impact of the banks and walls on views from properties and footpaths? b. Has the scheme changed the character of the Conservation Area?	<u>Environmental – visual impact</u> • The aesthetic appearance of the Waterfront flood wall and the need for it to blend with the look and atmosphere of the town was a concern to the local community. Glass viewing panels on top of the flood wall were used to enhance its appearance and use of reclaimed bricks helped it to blend with the town. The aluminium components of the glass panels were powder coated to a colour specified by the client. The design of glass sitting on top of the flood wall was a result of consultation with the local community and collaborative working between client and contractors (Source D). <u>Environmental – built</u> • The scheme has not impacted on the Conservation Area; it is sympathetic (Interviewee U3). • Five pedestrian gates were included in the permanent flood wall at Waterside to enable access to the river (Sources E & F). • In addition to the five pedestrian access gates the scheme design included (Jacobs, 2011): ○ A footway along the northern side of West Waterside and Dunn's Lane to ensure continuity of the footway along the river ○ Features to minimise vehicular and vulnerable road user conflicts along Waterside: a short section of pedestrian only footway on Waterside; a loading bay for the Swan Hotel and disabled bays. <u>Economic</u> • Compensation has been paid for losses of agricultural land and impacts on businesses as a result of the construction of the scheme. For example, turnover of businesses on the Waterfront were affected at the time of construction works and during recovery following construction (Interviewee U2). <u>Recreational</u> • A small amount of playing field has been lost to the scheme but playing areas have been	<u>Environmental – visual impact</u> • A major concern with the scheme from local people was the visual impact of the scheme. This was taken into account in the design with inclusion of glass panels on top of the wall and use of reclaimed bricks. Overall the scheme is not considered to have an impact on the Conservation Area but instead is considered to fit with the local area. <u>Environmental – built</u> • The scheme included design features to minimise adverse environmental impacts, such as pedestrian access gates and footpaths. <u>Environmental – natural</u> • The impact on stag beetle habitat was mitigated by moving the dead tree and placing on the ground. Newly created stag beetle habitat also helped compensate for the loss of the standing dead tree. <u>Timescale</u> • Benefits were realised on completion of the scheme. • The ex-post evaluation has provided

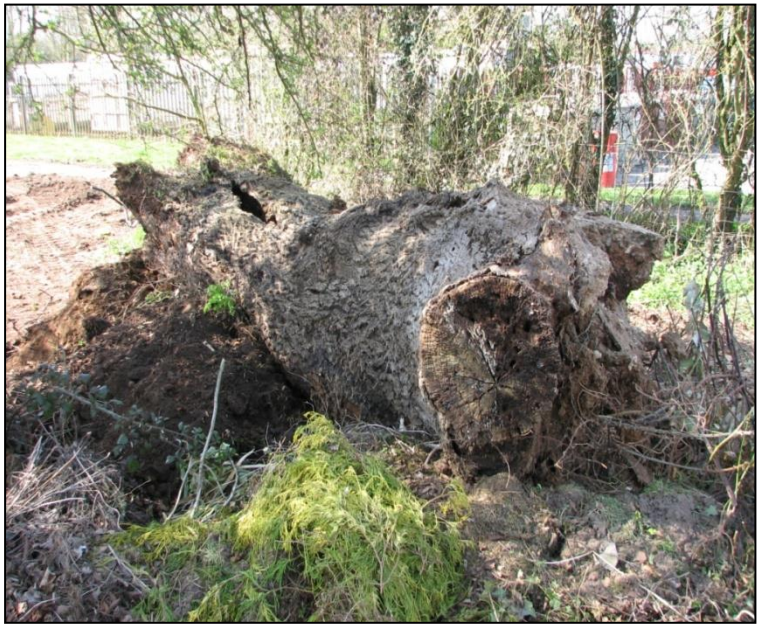
Evaluation objectives	Findings	Impact evaluation
	established in adjacent fields (Interviewee U3). • People who use Hanley Road think it should be protected or raised (Interviewee U4). • One gate is perhaps in the wrong place (on a stretch from the bridge to the King's Head) which had been relocated on request (Interviewee U4). • The glass on top of the wall has enabled views of the river to be maintained (Interviewee U5). • Early engagement with Historic England about the scheme and what would be possible proved helpful. A benefit was that a baseline of understanding and principles was established (e.g. principles about the viability of permanent demountable defences). This practice has since been taken up by other projects (interviewee U8). <u>Environmental – natural</u> • A standing dead tree on the edge of Upton, that provided stag beetle habitat, had to be moved and laid on the ground. Stag beetle habitat was created by constructing a log pyramid in the ground. Both the tree and stag beetle habitat were located in a nearby resident's garden by agreement. There is no known ongoing agreement for the maintenance of stag beetle habitat into the future (Interviewees U8 & U9).	a means of reflecting on the visual and aesthetic impact of the scheme over time.
4) To determine whether the scheme enhanced the built and natural environment. a. How has the scheme enhanced the built environment? b. How has the scheme enhanced the natural environment?	<u>Environmental – built</u> • The works uncovered various artefacts including evidence of river crossings dating back to the Civil War (Source E). • As part of the scheme and working with the council, a road was raised so that there would always be access in and out of the town during time of a flood. This road raising would not have happened if the scheme had not gone ahead (Interviewees U1 & U5). • The wall takes up much less room than the temporary barriers (when deployed) (Interviewee U5). <u>Environment – visual/amenity</u> • The wall along the river front has upgraded the area which previously was looking 'tired'. Provision was made for flowers so that now it 'looks a picture' (interviewee U3). • There are more tubs/planters for flowers with the new wall – for Upton in Bloom. There are now extra lamp posts (12 in total) and the scheme paid for baskets on each (Interviewees U4 &	<u>Environmental – built</u> • A road was raised as part of the scheme, allowing ongoing vehicular access during floods. This would not have gone ahead without the scheme. Thus the scheme has resulted in ongoing benefits that would not have occurred otherwise. • Construction and raising of the pavement by the wall and resurfacing of the road has enhance the appearance of the area. • The river front has been upgraded and no longer looks 'tired'.

Evaluation objectives	Findings	Impact evaluation
	U5). • Trees were planted to enhance the area (Interviewee U5) however there was an issue at the time as they had been planted too close to the wall and had to be moved (interviewee U9). • The scheme included re-building pavements and re-surfacing roads so the appearance of the space has been improved. The footpath on the dry side of the wall has been raised so that people can see over the wall (Interviewee U5).	<u>Environment – visual/amenity</u> • The new wall by the river includes more areas for planting flowers for Upton in Bloom and there are more lamp posts (12) with flower baskets. In addition trees were planted. These features are reported to have enhanced the appearance of the area. <u>Timescale</u> • Benefits were realised on completion of the scheme. • The ex-post evaluation has provided a means of reflecting on whether or not the scheme has enhanced the built and natural environment.
5) To determine the impact of the scheme on the commercial and recreational viability of the area including tourism, regeneration, and the local economy. a. How has the scheme affected the recreational use of the area? b. How has the scheme affected tourism, regeneration and	<u>Recreational</u> • The town relies on festivals and events throughout the year. In the past festivals have been cancelled due to flooding and with temporary defences in place but with the scheme festivals can go ahead during times of flooding (Interviewees U1 & U5). <u>Economic</u> • The flood scheme was reported to bring 'confidence back into the town' evidenced by a reduction in the number of empty shops (Source F). • It has been reported (anecdotally) that turnover of water front businesses has increased (Interviewee U1). • Properties are selling that have previously flooded (interviewee U3). • Prior to the scheme, if people heard on the news that Upton was flooded they would not come to the town and so business would suffer. However, the news did not always portray the real situation and made it out to be worse than it was (Interviewee U6).	<u>Economic</u> • The scheme has resulted in an upturn in the local economy as evidenced by an increase in business revenue and fewer empty shops in the town. Furthermore there has been no need to cancel festivals and events, which again provide revenue. <u>Timescale</u> • Benefits were realised on completion of the scheme, although the economic gains have increased since.

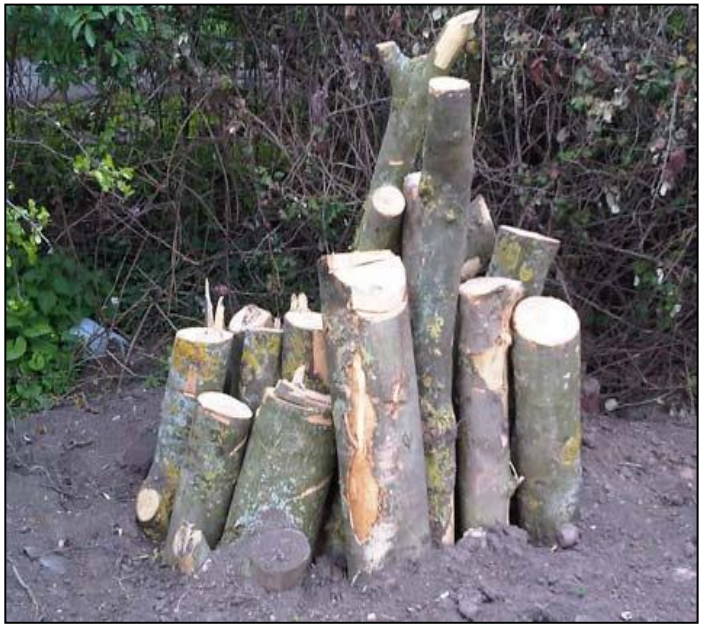
Evaluation objectives	Findings	Impact evaluation
the local economy?		
6) To determine how the FAS has impacted on the local community. a. Has it met their needs now and for the future? b. How has public awareness of tidal flood risk changed? c. How has it affected safety?	<u>Social</u> • A Community Liaison/Heritage Day was held around the archaeological excavation site. A viewing platform was created to see the excavation taking place. The day was also used to inform people about the Flood Scheme (Interviewee 8). <u>Psychological</u> • People have said that it is nice not to worry when a flood comes up, when they know it has rained and first thing they do is to look on the EA website for flood information (Interviewee U3). • People feel safer (Interviewee U4).	<u>Psychological</u> • The presence of the scheme has resulted in many people feeling safer and no longer worrying about flooding. <u>Timescale</u> • Benefits were realised on completion of the scheme although feelings of well-being have developed since.
7) To determine whether any unexpected benefits have arisen from the scheme (e.g. technical, economic, environmental, social, and psychological).	<u>Economic</u> • The Swan pub was against a wall as they thought it would ruin their view of the river. However, the road that previously ran in front of the pub has been pedestrianised and now they enjoy additional outside space (Interviewees U3 & U5). • There has been no impact on being able to change buildings insurance companies so insurance is still an issue (Interviewee U3). • Visitors to Upton are interested in the flooding – it becomes a tourist attraction (Interviewee U6). <u>Social</u> • A time capsule was placed into the flood wall in the Waterside area of the town on 27 April 2012 to mark the construction of the new flood defences. The time capsule contained artefacts from the Kinds Head pub, drawings and letters from children at Upton Primary School and other items provided by the local community (Source E & Interviewee 8). • Some people who were against the scheme have since said that the scheme is better than anticipated and have complimented the scheme (Interviewees U3 & U4). Only one person said that the scheme should not have been done (interviewee U4). • The bund around the playing field has created an auditorium for people playing and watching	<u>Economic</u> • Economic benefits have been accrued by businesses operating along the river. <u>Social</u> • A time capsule was buried by local school children to mark the construction of the defences. This would not have happened without the scheme. • Careful design resulted in the majority of people being in favour of the scheme compared to when the scheme was being proposed. • An unexpected effect and benefit of the bund was that it created an auditorium around the playing field. • The wall with the glass panels has

Evaluation objectives	Findings	Impact evaluation
	football or cricket. The bund provides a place to sit (Interviewee U3). • The wall along the river front (with the glass panels on top) is wide enough to sit on and put beer glasses on, so provides a focal point (Interviewees U3 & U4). • Everyone is waiting for the water to come up to the glass to see the fish! (Interviewee U4). • People come to view when a flood comes up (interviewee U4).	provided a feature for sitting on or resting beer glasses. <u>Timescale</u> • Some of the benefits were realised on completion of the scheme (e.g. the time capsule). Other benefits have been realised since (e.g. use of the bund around the playing field as a sitting area to view sport).
8) To determine whether any unexpected disbenefits have resulted from the scheme (e.g. technical, economic, environmental, social, and psychological).	<u>Environmental</u> • King's Head river terrace has a gate perhaps to stop people walking in front of their property – if you reach the gate you have to retrace your steps (Interviewee U4). • There was an issue with large stones on the playing field following construction. The topsoil had to be removed for construction works and then replaced; stones came to the surface, which is normal, but the presence of the stones were not considered safe for those playing rugby and so they had to be removed. The issue was resolved (Interviewee U5).	<u>Environmental</u> • Some limitation to access along the river frontage in the vicinity of the King's Head has been reported. <u>Timescale</u> • Disbenefits occurred on completion of the scheme.
9) To determine the lessons arising from the ex-post evaluation.	• Principles of good practice were established in the development of the scheme design, which were passed on (by word of mouth) to people working on other projects. These principles included: early engagement of stakeholders resulting in partnership working on good and acceptable design; and using heritage as a tool to engage people in talking about the flood defence scheme (Interviewee U8). • With the Multi-Coloured Manual there is a focus on UK PLC with regards to the economy, however it is also important to consider the impact on the local economy (Interviewee U5). • Good relationships developed as a result of consultation with the local community enabling, local community input to the scheme design and the Upton in Bloom display to go ahead during construction (Interviewee U9).	• The good working practices developed through early engagement with stakeholders and the local community resulted in a scheme going ahead that was accepted by all parties. It also enabled smooth running of the construction phase when issues arose and quick solutions were required (e.g. the need for a licence to exhume human remains). <u>Timescale</u> • For many aspects the benefits were realised on completion of the

Evaluation objectives	Findings	Impact evaluation
		scheme. However, the consequential impact of these benefits has been realised with time. A few benefits, such as use of the bund around the playing field as a seating area and the social interaction with the use of the wall were unexpected and came to light post scheme completion.



Relocated tree © Environment Agency



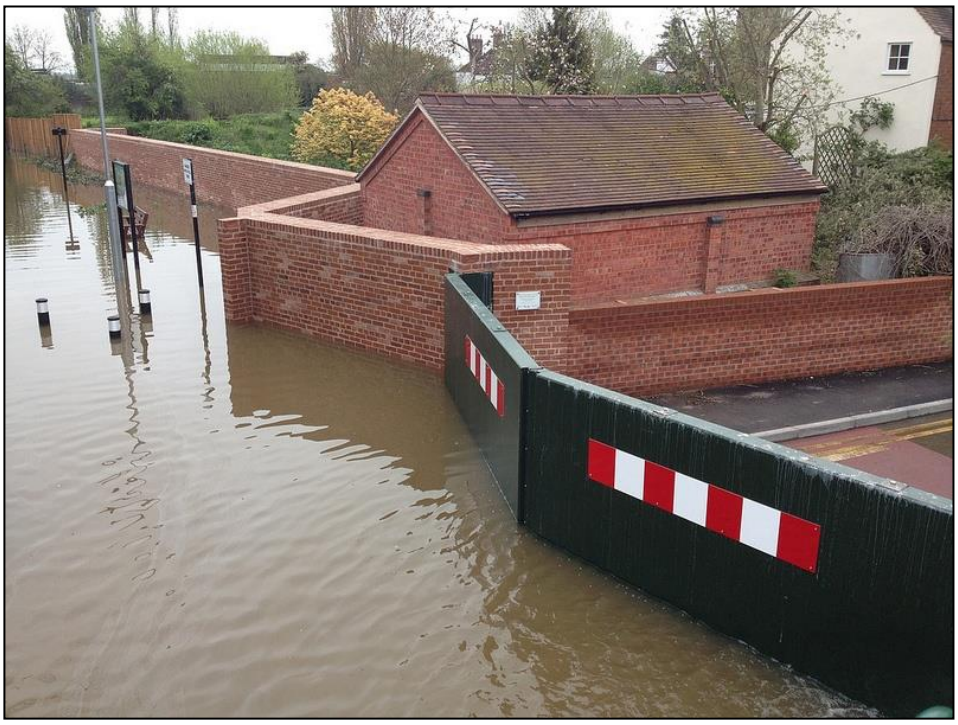
Log pyramid © Environment Agency

Sources of information

Table 5 lists sources of information obtained from the Environment Agency and through internet searches, and which are referenced in Table 4. Note that interviewees have been referenced as 'U' for 'Upton' and numbered.

Table 5: Sources of information obtained through references desk review and internet search

Sources of information
Interviewees
Interviewees U1 to U9
References
Environment Agency (2012) Upton upon Severn Time Capsule.
Jacobs (2011) Design Stage Non-Motorised User (Vulnerable Road Use) report.
Websites
Source A: http://www.upton.uk.net/archives/floods/apr2012/0apr2012.html
Source B: http://www.bbc.co.uk/news/uk-england-hereford-worcester-26132459
Source C: http://www.theguardian.com/uk-news/2014/feb/13/flooding-hero-status-environment-agency
Source D: http://www.wholebuild.co.uk/building-product/environmental-consultants/article/flood-defence-scheme-for-upton-town
Source E: http://www.theinformationdaily.com/2012/04/24/time-capsule-will-mark-construction-of-flood-scheme
Source F: http://www.worcesternews.co.uk/news/9817834.Flood_scheme_marks_new_start_for_town/



Flood gate in action at New Street, Upton upon Severn, April 2012 © Jackie Surtees

Summary and conclusions

Ex-post evaluation as defined in Phase 1[25] assesses:

c) The extent to which the benefits stated in the appraisal have been realised together with an account of why or why not

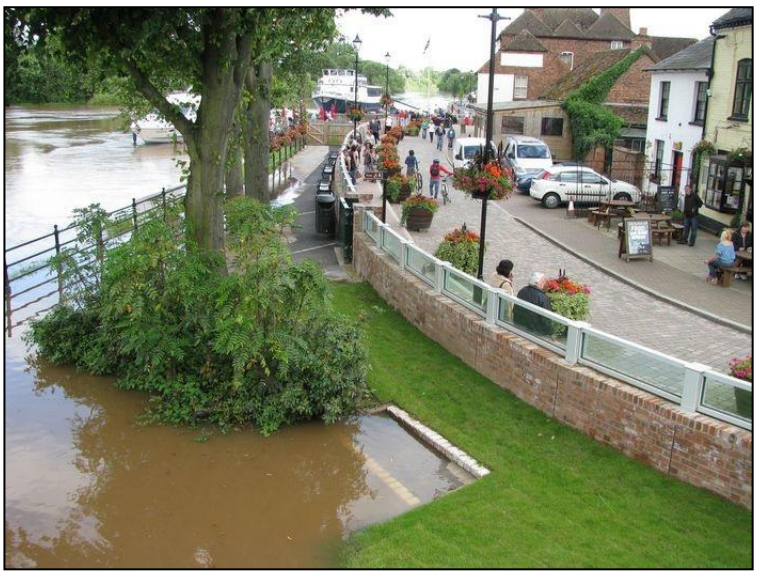
d) The extent to which any unanticipated benefits have occurred.

With regard to the Upton upon Severn FAS the benefits as stated in the appraisal had been realised. The scheme had stood up to flood events preventing flooding of properties. The operation of the scheme (closing gates, pumping of groundwater and clean up on the river side of the wall) had involved less staff than with the deployment of the temporary defences. This was an ongoing benefit of the scheme.

There have been unanticipated benefits to businesses operating along the river front with regard to trade and the environmental and social setting. Furthermore the bund has created an auditorium around the playing field. The only reported disbenefit related to restricted access in the vicinity of one of the businesses on the river front.

The overall finish and effect of the scheme resulted in the vast majority of people welcoming the defences, compared to a 50:50 split, for and against, at the time they were proposed. Good community engagement enabled input to a scheme that was acceptable to local residents and businesses. Similarly, early engagement with stakeholders resulted in benefits during construction as well as overall agreement on the scheme design. This learning on community and stakeholder engagement was passed on to other schemes.

The usefulness of the ex-post evaluation is that it has shown that the scheme was a success and that the benefits identified in the appraisal have been realised. In addition, the scheme has not only been welcomed by the community but has resulted in additional benefits.



Upton upon Severn flood defence wall, July 2012 © Jackie Surtees

[25] Collingwood Environmental Planning (2015) Enhancing Ex-Post Evaluation of Flood and Coastal Erosion Risk Management Strategies and Schemes. Report to Defra.

Appendix 4: Ex-post evaluation interview questions

These questions were used to guide discussions during the stakeholder interviews and were intended to explore the medium and long term benefits/disbenefits (outcomes and impacts) arising from the scheme.

1. What benefits have arisen from the scheme? Please describe. [*Prompt: technical/physical (eg reduced flooding, damages avoided), economic (eg cost savings from fewer homes flooded, economic growth), environmental (eg habitat creation), social (eg community cohesion) or psychological (eg mental well being from reduced flooding) benefits that may have arisen from any aspect of the scheme*.]

2. For each benefit mentioned...

   2a. Who has benefited from this?

   2b. How have they benefited?

   2c. When was the benefit realised? Or has the benefit still to be realised? [*Prompt: immediately, soon after, couple of years after scheme completion or ongoing*.]

   2d. How do you know the benefit has been realised and to what extent? (what Baseline measures were taken, how have change been monitored, how has the benefit been measured and why was this level set as the success level, did you have to do anything in addition to the normal work you do for such a scheme if so what and how and at what cost/time implications?)

3. What disbenefits (disadvantages) have resulted from the scheme? Please describe. [*Prompt: technical/physical (eg no improvements to flooding issues, defences resulted in flooding elsewhere), economic (eg negative impact on business), environmental (eg visual appearance of defences, views interrupted, access difficulties), social (eg community disrupted) or psychological (eg ongoing stress) disbenefits that may have resulted from any aspect of the scheme*.]

4. For each disbenefit (disadvantage) mentioned...

   4a. Who has been adversely affected?

   4b. How have they been affected?

   4c. When did the disbenefit arise? [*Prompt: immediately, soon after, couple of years after scheme completion or ongoing*.]

   4d. How do you know the benefit has been realised and to what extent? *[Prompt: What baseline measures were taken? How has change been monitored? How has the benefit been measured and why was this level set as the success level? Did you have to do anything in addition to the normal work you do for such a scheme and if so what and how and at what cost/time implications?*]

5. Are any benefits still to be realised / anticipated? How do you know this? When do you anticipate they will happen? [*Prompt: What do you think means they haven't been realised yet? Is it just time?*]

6. Has the scheme been tested in terms of it's anticipated level of flood protection, and if so, how and when? [*Prompt: flooding event, practice event to shut flood gates) and dates*.]

7. Do you have any other points / comments to make about the scheme / the benefits both realised and not realised and the value of looking back to see if things have worked as assume during the project appraisal stage?

8. Do you have any documents other than the Project Appraisal Report that would be useful to us (eg End Project Report, Post Project Appraisal, local newsletters etc)?

9. Do you have any suggestions of who else we should contact about benefits or disbenefits arising from the scheme?