



Bradford Initial assessment report

Apperley Bridge

November 2016

Using this template

The standard headings and tables in this template should be modified to meet the requirements of each Initial Assessment. The sites may have diverse issues and constraints and problems and the standard template is therefore just a guide on typical requirements but flexibility is allowed to amend/ add headings as required

Hidden guidance

The template contains various pieces of guidance covering content, use of tables etc. The guidance is shown in **blue text** and can be turned 'on' to assist in the writing stages or 'hidden' for viewing or when printing the document. You can switch between 'hidden' and 'on' and back to 'hidden' at any time.

To show/hide the guidance click on the ¶ icon on the MS Word toolbar.

If the hidden text does not disappear off the screen when the ¶ icon is clicked, go to: Tools>Options>View Tab and uncheck the 'Hidden text' box.

It is advisable to work with the hidden text turned on, as this helps to format new text and to avoid deleting the hidden text itself.

Auto-updating of contents page

The contents page will update to reflect changed information in the main text and tables. To update right click on the relevant area of the contents page, to highlight it, and select 'Update Field' to access the update option.

To enable these updating features to be created, the document contains specific text types and "fields". These are Headings 1, 2, 3 & 4; fields in the table labels and in the appendix labels. When editing the document, take care to maintain these aspects.

Inserting new headings

To insert new headings in the main text go to: Format>Styles and Formatting to open the styles box. Insert the new headings, highlight it and click on the appropriate Heading level in the 'Pick formatting to apply' box. Paragraph text can be inserted and formatted in a similar way.

Inserting new tables

Table labels should be added by Insert>Reference>Caption and selecting 'Table' from the drop down 'Label' box. This will insert the Table title with the correct number and the caption can be typed in after the label. Tables can then be cross referenced from the text by Insert>Reference>Cross Reference and selecting the appropriate reference type and caption from the drop down box and list.

Numbering paragraphs

All paragraphs should be numbered sequentially as sub-sets of the section number. Prompts for paragraph numbering are provided as 'Start writing here' after which pressing <return> will automatically provide the next paragraph number.

1 Initial Assessment Report

Scheme or
project
location
name

Yorkshire Area Initial Assessment:
Apperley Bridge



River Aire, Apperley Bridge

Date

November 2016

Version

2

Version control

Version	Status	Signed off by:	Date signed	Date issued
1	Draft	G Fardell	29/09/2016	29/09/2016
2	Final	G Fardell	19/10/2016	19/10/2016

Contact Details

Role	Name	Post Title
Project Sponsor		
Senior User		
Senior Supplier		
Project Executive		
Project Manager		

Sign Off

Form completed by:	Name:	Title: Project Manager	Signature:	Date:
Project Executive Approval:	Name:	Title: Project Team Leader	Signature:	Date:
Senior User Approval:	Name:	Title:	Signature:	Date:
Project Sponsor Approval:				

CONTENTS

INITIAL ASSESSMENT REPORT

1.1	Introduction and background.....	3
1.2	Problem and objectives.....	5
1.3	Benefits.....	5
1.4	Options	6
1.5	Initial environmental assessment	12
1.6	Consultation.....	12
1.7	Economic summary and preliminary preferred option.....	12
1.8	Project Scoring.....	14
1.9	Further work requirements	15
1.10	Conclusions and Recommendation.....	15
Table 1.1	Number of Properties at Risk (based on current outlines)	6
Table 1.2	Project costs (£k)	11
Table 1.3	Key environmental impacts, mitigation and opportunities	12
Table 1.4	Benefit-cost assessment	13
Table 1.5	Risks and mitigation	14

APPENDICES

Appendix A	Site visit report
Appendix B	Option cost details
Appendix C	Benefit details
Appendix D	Economic appraisal
Appendix E	Constraints table
Appendix F	Environmental Checklist
Appendix G	Figures

1.1 Introduction and background

1.1.1 Background

In May 2016 CH2M were commissioned by the Environment Agency, on behalf of Bradford Metropolitan District Council, to undertake Yorkshire Area Initial Assessments report for Apperley Bridge providing guidance on measures to reduce flood risk and potential funding availability. Site visit for this Initial Assessment was undertaken on 18th July 2016. This report has been made based on information from the site visit and previous studies and reports that are relevant to this Initial Assessment.

1.1.2 Description of Location

Apperley Bridge is a village located in the north-east of the City of Bradford in West Yorkshire. The Leeds and Liverpool Canal and the River Aire run through the village. A location plan of the site is shown in Appendix G in Figure 1. The area belongs to the River Aire at Esholt and Apperley Bridge Flood Warning Area.

The study area is classified within the 80% most deprived area in the country. There are no properties within the 10% most deprived classification.

1.1.3 Description of Watercourses and Geology

There are two watercourses within the study area; the River Aire flowing west to east and Carr Beck flowing south to north.

The River Aire is a major watercourse in Yorkshire flowing from Malham in the Yorkshire Dales, through the urban areas of Bradford and Leeds, before joining the River Ouse at Airmyn. The Aire is approximately 114km in length from its source to its confluence.

The River Aire is a natural channel within the study area, with no formal flood walls or embankments. There are two bridges crossing the River Aire in Apperley Bridge.

Carr Beck is an ordinary watercourse, flowing south to north, and joins the River Aire adjacent to Waterloo Crescent. The beck is culverted beneath the Leeds and Liverpool Canal and Parkin Lane before discharging into the River Aire as an open channel. It is believed that a number of surface water drains discharge into Carr Beck from Apperley Bridge.

The underlying bedrock of the Area of Apperley Bridge is Millstone Grit, overlain by lower coal measures. Ground condition could be described as freely draining slightly acid loamy soils.

1.1.4 History of Flooding

Apperley Bridge is prone to flooding and there have been a number of historical incidents. Apperley Bridge was flooded during the significant flood incidents that affected the Upper Aire Catchment in 2000, 2012 and 2015.

The area located between the River Aire and Leeds and Liverpool Canal was flooded during the December 2015 flood incidents. There was a flood warning issued for that area on 12 and 25th of December 2015. 22 residential properties were flooded.

Apart from December 2015, since 2000 there have been two other flood incidents in Apperley Bridge. During the October – November 2000 floods, due to prolonged heavy rainfall water levels at the River Aire were higher than any on record with return periods in excess of 100-years. 6 properties were affected.

Another flood event took place in 2002, between July and August, when high water level at the Rvier Aire and surface water issues, caused flooding in Apperley Bridge. During 2 days the amount of rainfall was equivalent of two months average rainfall.

Apperley Bridge also has a significant history of surface water flooding. The surface water system currently discharges into the River Aire and Carr Beck. However, during times of high water levels in the River Aire, the drains cannot discharge and water backs up in the system and surcharges.

1.1.5 Summary of modelling analysis

In 2008 hydraulic and hydrological modelling of the Upper River Aire was completed by JBA to support the development of the Flood Risk Management Strategy. For this study the River Aire was modelled from High Hill Weir upstream of Gargrave to Fleet Weir downstream of Leeds. The Upper River Aire model is a 1D hydrodynamic ISIS model containing 1922 nodes.

This 2008 study aimed to define flood risk within this area and identify potential flood risk management options. This informed the Flood Risk Management Strategy for the Upper Aire which proposed flood risk management options for the short, medium and long-term. These recommendations included proposals to progress a flood management scheme for defences at Apperley Bridge.

1.1.6 Drivers, Constraints and Opportunities

The study area falls under the Aire CFMP, and is covered by sub-area 3 - Worth and Aire. A link to the Aire CFMP can be found here: <https://www.gov.uk/government/publications/river-aire-catchment-flood-management-plan>. The designated policy for the area at risk is Policy Option 5: Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.

The following drivers, constraints and opportunities have been identified within the study area.

Political Drivers	Summary Description
Catchment Flood Management Plan	Aire CFMP 2010
Catchment Flood Management Policy	Policy 5 – Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.
Economic Drivers	Summary Description
Funding Time Constraints	Must be obtained within 6 year programme of capital investment
Technological Drivers	Summary Description
Improved Public Safety	Via reduced flood risk
Environmental Constraints	Summary Description
Sites of Special Scientific Interest (SSSI)	Leeds - Liverpool Canal SSSI - 1.9 kilometres to the east of area of interest
Special Area of Conservation (SAC)	Leeds - Liverpool Canal
Ancient Woodland	There is an ancient woodland called Calverley Wood 300 metres to the east/ south-east from Apperley Bridge
Tree Preservation Orders	There are some trees protected by TPO. If any work to trees within the designation will require written permission from the council prior to any works taking place on them.

1.2 Problem and objectives

1.2.1 Problem

The site is at risk of fluvial flooding due from the River Aire and Carr Beck. There are approximately 60 properties at risk within the study area.

There is also a known surface water flooding issue within the study area. During times of high river levels the surface water drainage cannot discharge and backs up causing flooding to nearby properties.

There are no formal flood defences walls or embankments at Apperley Bridge. The farm land upstream of Apperley Bridge on the right bank is designated washland.

Based on all the available information, EA had estimated that the December 2015 flood event has 1.3% – 1% annual exceedance probability (AEP). It means, that an event has between 1 in 80 and 1 in 100 chance of occurring in any single year.

During December 2015 flood event the peak water levels at the Kildwick gauge station was 4.219m, just below the highest recorded level recorded which was for the 2000 flood event.

1.2.2 Objectives

The primary objective of this initial assessment is to undertake a scoping study in the area to identify the flood risk issues and viable solutions for the affected properties and to identify any other potential flood risk management measures which are consistent with the current CFMP policy.

The purpose of this report is to lay the groundwork and, where applicable, provide a business case for future appraisal. The report aims to achieve the following:

- Confirm the need for a project;
- Identify the issues and Political, Environmental, Societal, Technological, Legislative and Economic (PESTLE) drivers and opportunities related to the need;
- Identify the options to address the need and problem;
- Demonstrate that viable options exist based upon the available information;
- Provide sufficient information to allow the packaging and optimisation of packages of future appraisal, design and construction packages;
- Provide sufficient information for the appraisal scope to be prepared;
- Make an assessment on the deliverability of the project;
- Provide a basis/starting point for discussion with communities and partner organisations for use in the development of potential schemes and negotiations regarding funding contributions.

1.3 Benefits

In this area the primary benefit associated with a reduction in flood risk would be the reduction in economic damages to properties. This in turn would reduce disruption to local transport, businesses, private residences and other infrastructure.

Social benefits relate primarily to a reduction in stress, health effects (including risk to life) and loss of memorabilia for those at risk.

An appraisal period of 100 years is assumed, over which the current Standard of Protection of existing assets is expected to decrease as a result of climate change.

Table 1.1 shows the properties at risk within the study area.

Table 1.1 Number of Properties at Risk (based on current outlines)

Property Type	Flood Risk	Number of Properties
Residential	≥1 in 25 year (4% AEP) (Very Significant Risk)	0
	<1 in 25 year (4% AEP) ≥1 in 75 year (1.33% AEP) (Significant Risk)	37
	<1 in 75 year (1.33% AEP) ≥1 in 200 year (0.5% AEP) (Moderate Risk)	23
Non-Residential	≥1 in 25 year (4% AEP) (Very Significant Risk)	0
	<1 in 25 year (4% AEP) ≥1 in 75 year (1.33% AEP) (Significant Risk)	1
	<1 in 75 year (1.33% AEP) ≥1 in 200 year (0.5% AEP) (Moderate Risk)	1

Detail of the methodology used for assessing the benefits of each option is detailed in Appendix C.

1.4 Options

A longlist of options has been compiled. The table on the following page shows the large range of longlist options considered and the reasoning for or against them being taken forward to the shortlist of options to be assessed.

Category	Long List Option	Water Course / Areas Affected	Description	Take Forward for assessment?	Reasoning / Notes / Past Study Reference
Do nothing	Do nothing		All operational and maintenance activities cease	Yes	Required to support development of business case and benefit cost ratios.
Do minimum	Do Minimum		Continue with current operational and maintenance activities.	Yes	Required to support development of business case and incremental b/c ratio.
Non-structural (by EA)	Improved flood warning		Enhanced flood warning to allow residents to prepare plus appropriate implementation of flood action plans	No	Not funded via the capital programme. A Flood warning system is already in place for Waterloo Crescent. Improving the current system would require further modelling which is beyond the scope of this study.
Non-structural (by EA)	Flood action plans		Improved direction of reactionary flood defence measure (fire crews, temporary pumps, etc.)	No	Apperley Bridge is already within a Flood Warning and Flood Alert area.
Property level protection	Property level protection		Protection to individual properties (e.g. via air brick covers, door guards etc).	Yes	Passive solutions to be considered as an option (flood doors, automatic airbricks)
Operational (by Others)	Improve operation/design		Improve operation/design of assets not owned by the EA	No	No third party assets affecting fluvial flood risk in the study area.
Urban drainage	Improve urban drainage.		Improved surface water drainage system.	Yes	Surface water caused flooding during the Dec 15 event due to high levels in the Aire.
Structural	Earth bunds		Flood bund	No	Insufficient space at Waterloo Crescent.
Structural	Flood walls		Flood walls	Yes	It can be considered as an option as it could reduce the risk of flooding directly from the River Aire.
Structural	Conveyance		Channel deepening or widening	No	Shoal clearance was made - 300 tonnes of stones and soil were removed
Structural	Conveyance		Supplementary bypass channel(s,	No	Insufficient space in Apperley Bridge for

Category	Long List Option	Water Course / Areas Affected	Description	Take Forward for assessment?	Reasoning / Notes / Past Study Reference
			tunnels or floodway		bypass channel.
Structural	Conveyance		River restoration and/or pinch point improvements (bridges, culverts and weirs)	No	No significant pinch points identified.
Flood storage area	Online		Use of active structures and re-profiling to store water online. (River Worth).	Yes	Online flood storage area North of Haworth. The Upper Aire SFRA identified two potential storage areas on the River Worth upstream of Keighley. Use of these sites would reduce peak flows in Keighley increasing the standard of protection provided by the Worth scheme.
Flood storage area	Online		Use of active structures and re-profiling to store water online. (River Aire).	Yes	As part of the Leeds FAS Phase 2 study upstream storage is being considered. The storage being proposed can potentially deliver further benefits to Bradford
Flood storage area	Offline		Gravity or pumping to offline storage area	No	Majority of flooding not from the river, reduction of flow volume is not necessary.
Floodplain storage	Washlands-type scheme		Enhance/increase natural floodplain attenuation with cascade of passive storage areas in existing floodplain	Yes	The playing fields opposite Waterloo Crescent could be used for floodplain storage. Also there is the opportunity for flood storage upstream of Apperley Road.

1.4.1 Shortlisted options description

Do Nothing

The Do Nothing option is defined as taking no action whatsoever; under this option all management activities would cease, including maintenance and repair work to existing assets.

Under this assumption, the natural deterioration of the river channel will occur, leading to an increase in flood risk. There are no assets within the study area to be considered.

There could be some advantages of this option in the form of habitat creation due to wetting of dry areas and naturalisation of channel, however, this is also likely increase the risk to people and wildlife.

The Do Nothing option is not to be taken forward as a viable option as it results in an unacceptable increase in flood risk to people and property due to failure and deterioration of assets and blockages to the channel, however it is required to be assessed in order to develop the business case.

Do Minimum

The Do Minimum option is defined as the minimum level of action or intervention necessary to continue to maintain the current defences while feasible to do so. The Do Minimum does not include capital works and so reverts to do nothing once the defences fail or need upgrading.

The current maintenance regime is simply a bi-annual site walkover, one in the summer and one in the winter to identify ad-hoc channel works. No regular channel works are carried out.

Option 1 – Property Level Protection

This option considers providing property level protection measures for the properties that were affected by the December 2015 flood event. PLP can take the form of barriers in doorways, non-return valves fitted to drains, and airbrick/vent covers. Properties can also be made more flood resilient, using waterproof plaster, solid concrete floors or tiled floor coverings in order to reduce the amount of time and money needed to recover from a flood event.

The EA have requested the use of passive measures to maximise the effectiveness of the measures, ensuring the measure are installed at times of flooding.

Property level protection prevents water entering the property but water will still retained by the building structure. Furthermore, PLP does not provide any wider environmental benefits and does not prevent the flooding of areas surrounding the property. It is assumed that the option will offer a 1.3% (1 in 75 year) AEP standard of protection.

There are currently no properties in the very significant flood risk category, therefore this option will not be eligible for FDGiA funding.

Option 2– Improvements to urban drainage

There are known drainage issues in Apperley Bridge, especially around the confluence of the River Aire and Carr Beck. Anecdotal evidence suggests that the surface water flooding is caused by high water levels in the River Aire preventing the system discharging.

There is not enough information on the existing drainage assets to be able to fully assess the flood risk at this time but it is recommended that this option is considered in further studies.

Potential solutions could range from relatively cheap options like installing flap valves to prevent river water backing up into the drainage system to more expensive options like increasing system capacity by oversizing pipes or installing a pumping station or alternatively by providing attenuation using SuDS measures.

Option 3 – Linear Defence

This option involves the construction of linear flood defence along the right bank of the River Aire, tying into the high ground of the Leeds and Liverpool Canal embankment. The defence alignment will also need to run along both banks of Carr Beck, from the confluence with the Aire to the culvert under the canal, to prevent water backing up from the Aire and overtopping the beck's bank.

The flood defence will be formed of a flood wall along the banks of Carr Beck and the River Aire due to space constraints but an earth embankment can be used to cross the playing fields to tie into the canal embankment.

Limited water level data is available for this assessment, therefore a nominal defence height of 1m was assumed for this option, further analysis will be required to refine the defence height if the option is carried forward.

A plan of the proposed linear defence location is shown in Appendix G – Figure 2.

This option is a permanent structure and does not require operation. The defence offers a 1% (1 in 100 year) AEP standard of protection, this will move the properties to the moderate risk band. Note it could be optimised to provide other standards in a more detailed assessment.

Further modelling would be required in order to assess the impact of removal of flood plain due to the construction of this flood bund on communities further downstream. Compensatory flood plain storage may be required, adding to the costs of the scheme. It must be ensured that the compensatory storage is hydraulically linked to the flood plain lost, otherwise the benefits from it may not be fully realised.

Option 4 – Flood storage areas (River Worth)

The 2014 Upper Aire SFRA identified a site near Lord Lane north of Haworth that could potentially be used as a flood storage area. This option provides a reduction in flood risk from the River Aire further downstream. The SFRA estimated the use of this area could potentially result in a 7% reduction in peak Aire flow and a 50mm reduction in flood depths in Leeds.

The impact of this storage area on Apperley Bridge will be to reduce flood risk however significance of the impact is uncertain. This option can be used in conjunction with other options, for example reducing the scale of flood defences.

The scheme will also provide a reduction in flood risk beyond the study. As a result the benefit-cost ratio for the option will be artificially low, being limited to the Apperley Bridge benefits. Therefore the economic analysis for the option is not presented in this report but the option should be considered in any future studies.

Option 5 – Flood storage areas (River Aire)

The Leeds FAS Phase 2 scheme has identified three locations that could be potentially used as flood storage areas; Keighley Holden Park, Marley Bridge and Rodley. The Rodley site is downstream of our study area but the other two sites could potentially provide benefits for Apperley Bridge. The Upper Aire FRMS has estimated a reduction of 300mm to 400mm for a 1% (1 in 100 year) AEP event at Leeds Station. The impact at Apperley Bridge, however, is uncertain but is expected to have significant impact on peak water levels.

The scheme will also provide a reduction in flood risk beyond the study boundaries for this Initial Assessment. As a result the benefit-cost ratio for the option will be artificially low, being limited to the Apperley Bridge benefits. Therefore the economic analysis for the option is not presented in this report but the option should be considered in any future studies.

Option 6 – Floodplain storage

This option considers maximising the potential floodplain storage. There are currently two designated washland sites identified by the EA; the sports ground on the left bank and the agricultural land upstream of the site on the right bank.

The proposal is to lower the existing ground level of these washland areas to allow the areas to fill earlier and store a larger quantity of floodwater, reducing the water levels. The agricultural land upstream of the study area is significantly larger than the sports ground and will cause a greater reduction in water levels and has been selected as the preferred site for the storage area. The option is to reduce the existing levels of the site by 1m and creating circa 131,000m³ additional storage. It is assumed that the option will offer a 1.3% (1 in 75 year) AEP standard of protection.

A plan of the proposed floodplain storage area location is shown in Appendix G – Figure 3.

This option requires testing in the hydraulic model to confirm its viability and effectiveness. The option is technically feasible however there are risks associated with gaining land owner consent. The standard of protection provided by this scheme is highly uncertain until further modelling is carried out.

1.4.2 Costs of options

The costs for the options were calculated using the Environment Agency’s Project Cost Tool and Long Term Costing Workbook. The maintenance and operation costs relate to mechanical maintenance of the assets to Target Condition 3.

It is assumed that a major replacement of assets will be required at some point during the appraisal period after the initial construction phase. The timing of these replacements is based on the EA’s Asset Deterioration Guidance (2013), and the assumptions are outlined in Appendix B.

An appraisal period of 100 years has been used. A detailed breakdown of costs across this period is included in Appendix B.

Table 1.2 shows the build-up of costs for all options.

Table 1.2 Project costs (£k)

Item	Do Minimum	Option 1	Option 3	Option 6
Construction Costs		240	2,290	5,710
Environment Agency staff		40	170	220
Consultant fees (appraisal)		20	120	130
Consultant fees (design)		60	330	630
Consultant fees (construction)		0	140	230
Site investigation & survey		0	90	40
Land purchase		0	20	60
Optimism Bias (44%)		160	1,380	3,100

Item	Do Minimum	Option 1	Option 3	Option 6
TOTAL		510	4,520	10,130
Annual Operation and Maintenance Costs (including optimism bias)	1.1	1.1	1.5	1.1

There are insufficient data on the existing surface water assets to be able determine the existing flood risk for Option 2, therefore the benefit-cost assessment has not be completed as part of this study but should be considered in future studies.

The upstream storage options on the River Aire (Option 5) and River Worth (Option 4) will provide a reduction in flood risk beyond in Apperley Bridge and beyond the study boundaries for this Initial Assessment. As a result the benefit-cost ratio for the option will be artificially low, being limited to the Apperley Bridge benefits. Therefore the economic analysis for the option is not presented in this report but the option should be considered in any future studies.

1.5 Initial environmental assessment

The main impacts of each option are summarised in Table 1.3:

Table 1.3 Key environmental impacts, mitigation and opportunities

Key positive impacts	Key negative impacts	Mitigation/ enhancement opportunity
Option 1		
Reduced risk of flooding.	Option only protects properties and not surrounding land.	
Option 3		
Reduced risk of flooding.	Construction work takes place alongside watercourse. Risk of pollution incidents and disruption to area during construction.	Best practice should be followed including referring to EA Pollution Prevention Guidance.
Option 6		
Reduced risk of flooding.	Construction work takes place alongside watercourse. Risk of pollution incidents and disruption to area during construction.	Best practice should be followed including referring to EA Pollution Prevention Guidance.

1.6 Consultation

The options in this appraisal were developed in consultation with the Environment Agency and Bradford MDC. No public consultations were held at this stage as the work is a high-level assessment of potential options. Stakeholder engagement will take place at subsequent stages of the project.

If this project is taken forward for further appraisal it is recommended that consultation is focused on, but not limited to, the following:

- Residents in the area at risk
- Landowners and developers for the upstream storage option.
- Riparian landowners, especially owners of riverside walls acting as informal defences

1.7 Economic summary and preliminary preferred option

Table 1.4 summarises the economic assessment carried out for all options. The calculations for PV benefits are shown in Appendix D. The options are ordered by the assumed benefits (lowest benefit first).

This benefit values are estimates based on the methodology detailed in Appendix C. There is significant uncertainty in these estimates, which are based on Weighted Annual Average Data (WAAD) from the Multi-Coloured Manual (MCM, 2015/16). If this project progresses to further appraisal the benefits of these options should be more accurately assessed though hydraulic modelling and use of the more detailed flood depth / damage data from MCM.

Table 1.4 Benefit-cost assessment

	PV costs (£k)	PV benefits (£k)	Av. BCR	Incr' BCR	Option for iBCR calc	Comments
Do Minimum	30	Low 1,222	37.1			Highest ABCR
		Mid 1,630	49.4	-	-	
		High 2,037	61.7			
Option 1	1,060	Low 1,456	1.4	0.2	Do Minimum	1.3% (1 in 75 year) AEP SoP
		Mid 1,941	1.8	0.3		
		High 2,426	2.3	0.4		
Option 3	4,660	Low 1,475	0.3	0.1	Do Minimum	1% (1 in 100 year) AEP SoP
		Mid 1,966	0.4	0.1		
		High 2,458	0.5	0.1		
Option 6	10,190	Low 1,456	0.1	0.0	Do Minimum	1.3% (1 in 75 year) AEP SoP
		Mid 1,941	0.2	0.0		
		High 2,426	0.2	0.0		

The Do Minimum scenario has the highest ABCR justifying the continuation of the current maintenance regime.

There are insufficient data on the existing surface water assets to be able determine the existing flood risk for Option 2, therefore the benefit-cost assessment has not be completed as part of this study but should be considered in future studies.

The upstream storage options on the River Aire (Option 5) and River Worth (Option 4) will provide a reduction in flood risk beyond in Apperley Bridge and beyond the study boundaries for this Initial Assessment. As a result the benefit-cost ratio for the option will be artificially low, being limited to the Apperley Bridge benefits. Therefore the economic analysis for the option is not presented in this report but the option should be considered in any future studies.

Option 1, Property Level Protection, is the only other option with an ABCR greater than parity. The option can be carried forward to the next stage however it is not eligible for FDGiA funding. The Flood and Coastal Resilience Partnership Funding (EA) document states that property level protection can be funded under OM2 if they are within the very significant risk category. There are no residential properties in the very significant category in Apperley Bridge therefore the option will need to be wholly funded by another funding stream e.g. local levy funding.

1.7.1 Funding and contributions

Due to the FDGiA funding rules option 1 is not eligible for GiA funding. Other potential funding sources identified include:

- Community Infrastructure Levy
- Benefitting local businesses
- Council Tax
- Local Enterprise Partnerships

1.7.2 Key delivery risks (economic, social and environmental)

Key delivery risk and recommendations for mitigating these risks are shown in the table below.

Table 1.5 Risks and mitigation

Risk	Key Mitigation
Insufficient 3 rd party Funding available to allow scheme to progress	Assess potential funding options before progressing scheme appraisal further.
Uncertainty in benefits estimates	More detailed assessment of the benefits should be undertaken if the site moves forward to further appraisal.
Uncertainty in costs	More detailed assessment of the costs should be undertaken if the site moves forward to further appraisal.

1.8 Project Scoring

The data used in this assessment has been subjected to a RAG assessment. RAG status reporting is used to indicate the level of confidence in the data used in each aspect of the assessment, using the traffic light system. This gives a three figure score with the first number being the number of reds (showed as a letter R)), where there is significant uncertainty or challenges. The second and third numbers are the numbers of amber (A) and greens (G). The results are shown below:

- A – Problem Definition: The fluvial and surface water flooding mechanisms are well understood but no hydraulic modelling data has been used in the assessment – **AMBER**
- B – Economic Case: The benefits assessment has been based on moving properties from flood risk bands and weighted average annual damages – **RED**
- C – Funding: The options are likely to require external funding. Alternative funding sources have been identified – **AMBER**
- D – Engineering case: Solutions taken to outline design and are tried and tested defence options – **AMBER**
- E – Permissions & Consents: Solution are unlikely to require unusual permissions or consents – **GREEN**
- F – Environmental sensitivities: Initial environmental assessments has been completed based on outline options – **AMBER**
- G – Opportunities: Some potential opportunities for partnership working but minimal environment opportunities – **AMBER**

Model.	Econ.	Funding	Eng.	Permission	Env.	RAG	Opps.
--------	-------	---------	------	------------	------	-----	-------

A	B	C	D	E	F		G
2	3	2	2	1	2	141	2

1.9 Further work requirements

If the project is taken forward for further appraisal it is recommended that the following work is carried out **before the SOC is developed**:

- Further investigation in Option 2 – Improvements to urban drainage. Work will involve the complete of asset and condition survey of existing surface water network. Once the network has been survey it would be possible to identify the causes of the surface water flooding and propose mitigation measures.
- Investigate the impacts of upstream storage options proposed by the Leeds Phase 2 PAR and Upper Aire SFRA. The findings should be used to review and update the economic assessment.
- Option 6 – upstream storage will have benefits outside of the study area. Hydraulic modelling of this option should be carried out to assess if the changes in downstream water level potentially provide additional benefits.

1.10 Conclusions and Recommendation

Based on the evidence provided, it is understood the main risk of flooding within Apperley Bridge is fluvial from the overtopping of river banks along both the River Aire and Carr Beck and surface water flooding, the existing flood risk is moderate to high. There was significant flooding in the area during Boxing Day 2015 from Carr Beck. Anecdotal evidence also suggests that there is a significant risk of surface water flooding which needs to be investigated in future.

The economic analysis shows that the Do Minimum scenario is beneficial and that the current maintenance regime should be continued. The current maintenance regime is simply a bi-annual site walkover, one in the summer and one in the winter to identify ad-hoc channel works. No regular channel works are carried out.

Option 1, property level protection is the highest scoring Do Something option, however due the funding rules is unable to gain any FDGiA funding.

It is recommended that the flood storage options are considered further in a wider strategic assessment as they could benefit a large areas on the Upper Aire.