

How is flood risk managed by the Scottish Borders Council?

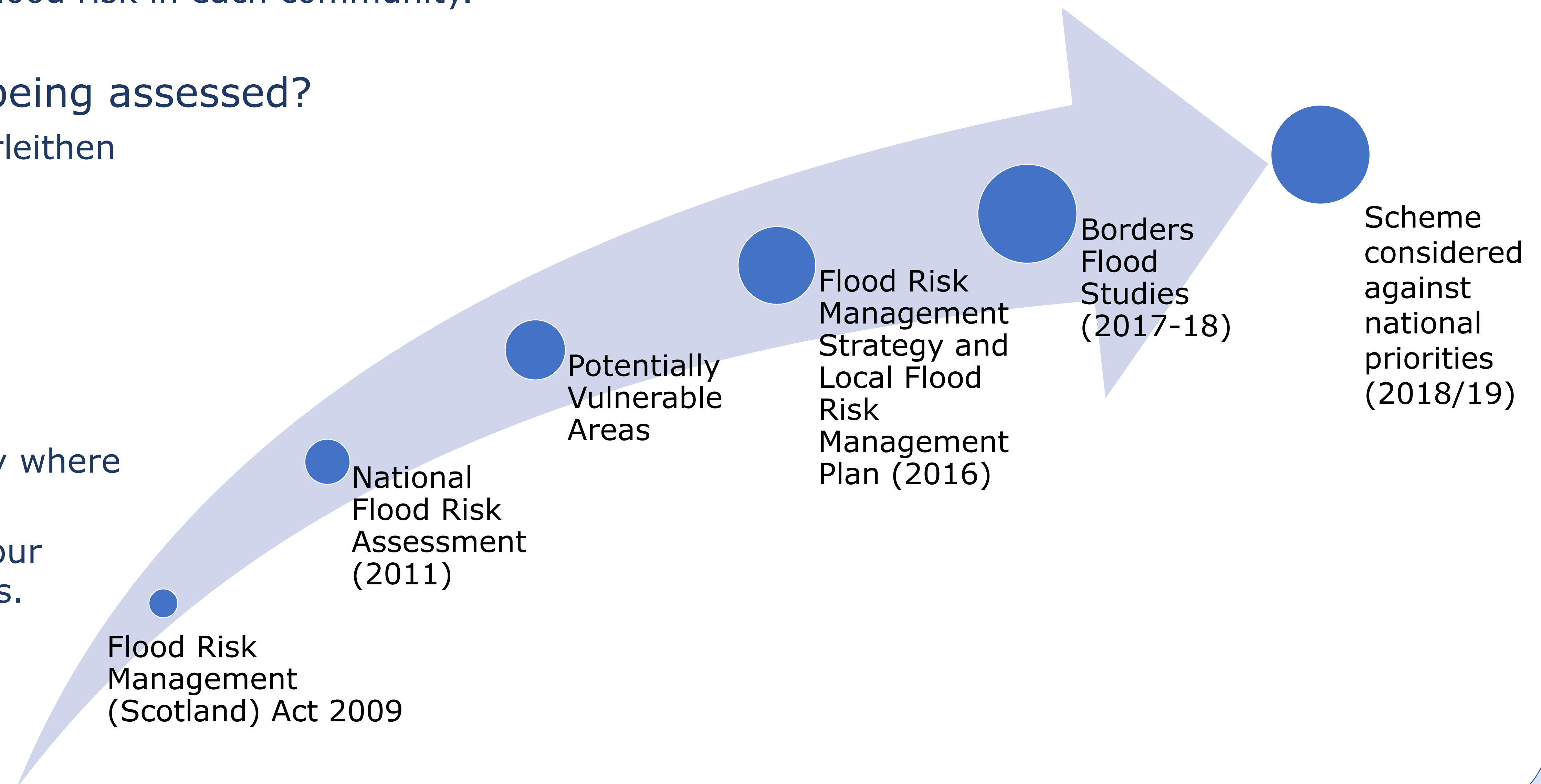
- The Flood Risk Management (Scotland) Act 2009 aims to prioritise flood mitigation across Scotland using a proactive and risk based process for assessing flood risk.
- This approach led to the preparation of SEPA's Flood Risk Management Strategies by SEPA and the Tweed Local Flood Risk Management Plan developed by the Scottish Borders Council as the Lead Local Authority for the Tweed Local Plan District.
- These plans identified specific communities as being at risk and in need of a detailed flood study to help inform the management of flood risk in each community.

Which communities are being assessed?

- **Peebles**, Broughton & Innerleithen
- Newcastleton
- Earlston

How will Flood Protection Schemes be prioritised?

- SEPA will prioritise nationally where funding should be allocated.
- The reports and findings of our study will inform this process.



What are the study objectives?

1) Develop better understanding of flood risk in the community

- Create, update or develop new/existing flood model information;
- Determine existing flood risk;
- Develop improved flood mapping;

2) Develop recommendations for management of flood risk

- Develop a range of options to manage flood risk, including structural and non-structural options;
- Appraise actions to manage flood risk (consider the pros and cons and economic viability for all proposed options);
- Recommend options for the future management of flood risk;

3) Select a preferred approach to manage flood risk in each community and identify recommendations that the Council will take forward

- SEPA will prioritise nationally where funding should be allocated;
- The reports and findings of our study will inform this process.

4) Engage partners and stakeholders

- **Today's consultation.**

Why choose a 200 year standard of protection?

- Scottish Planning Policy requires new build properties to have a 200 year standard of protection
- This standard is accepted as low risk by the flood insurance companies.
- A higher standard of protection will mean the scheme will be considered more favourably by SEPA's scheme prioritisation making funding more likely

What has been done so far?



Flood Review



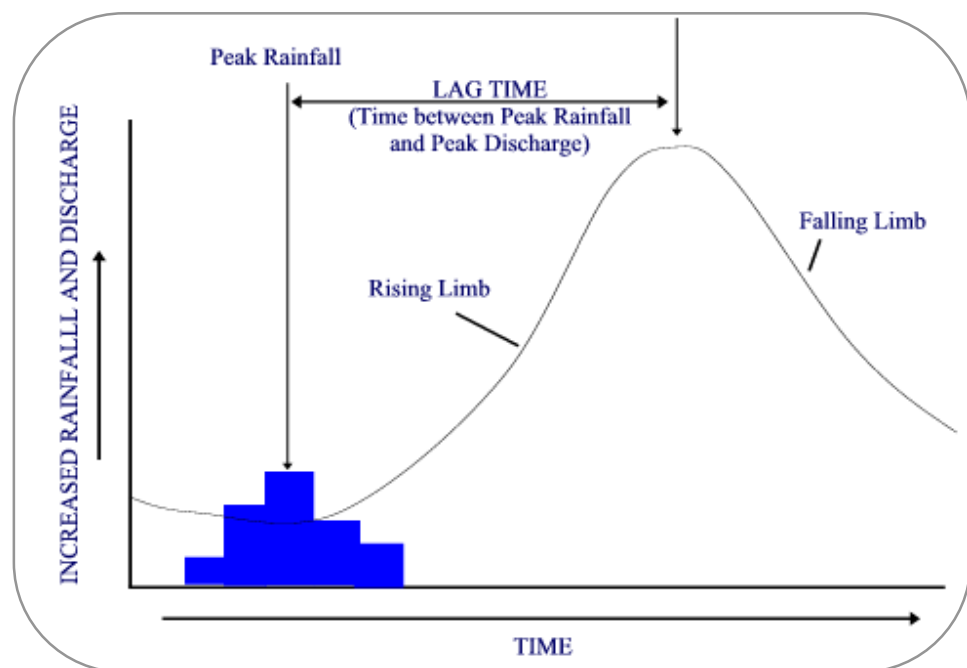
Topographic
surveys



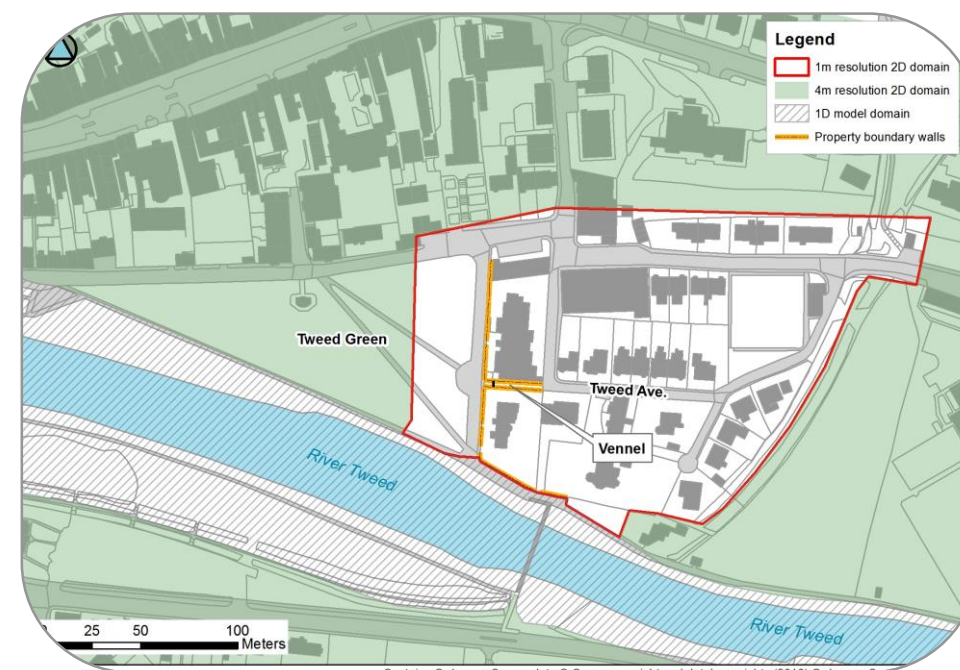
Asset
inspections

The studies aim to better assess current flood risks in the community by undertaking a review of past flood events; generating updated and detailed flood maps, determining the likely risk to different properties; and to propose a set of mitigation measures to reduce the flood risk to an acceptable level.

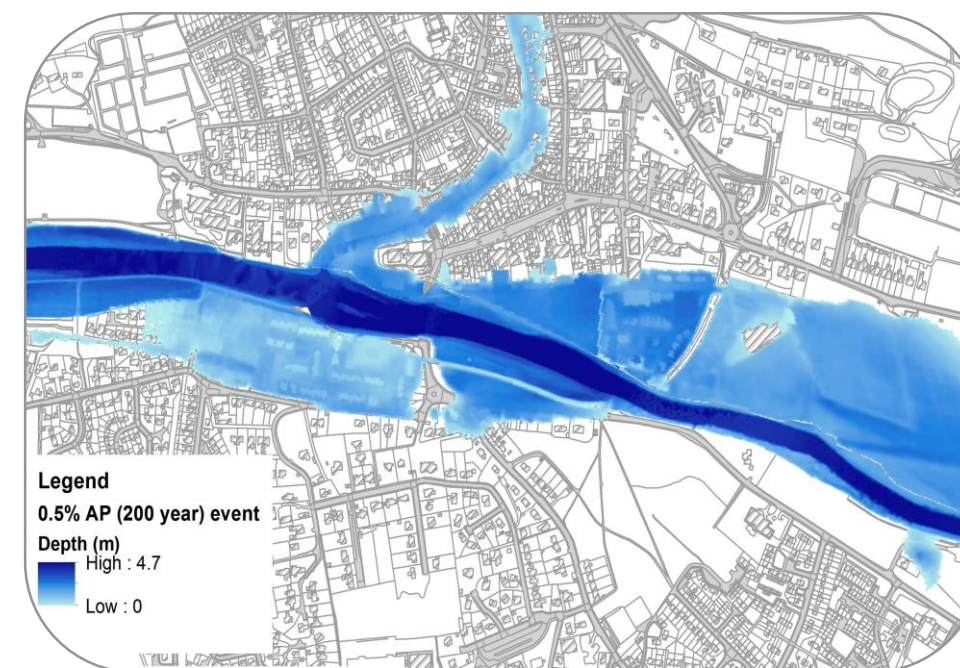
The models developed form a basis for assessing future flood levels, flood mitigation options, detailed design of schemes and the costs to deliver.



Hydrology



Modelling



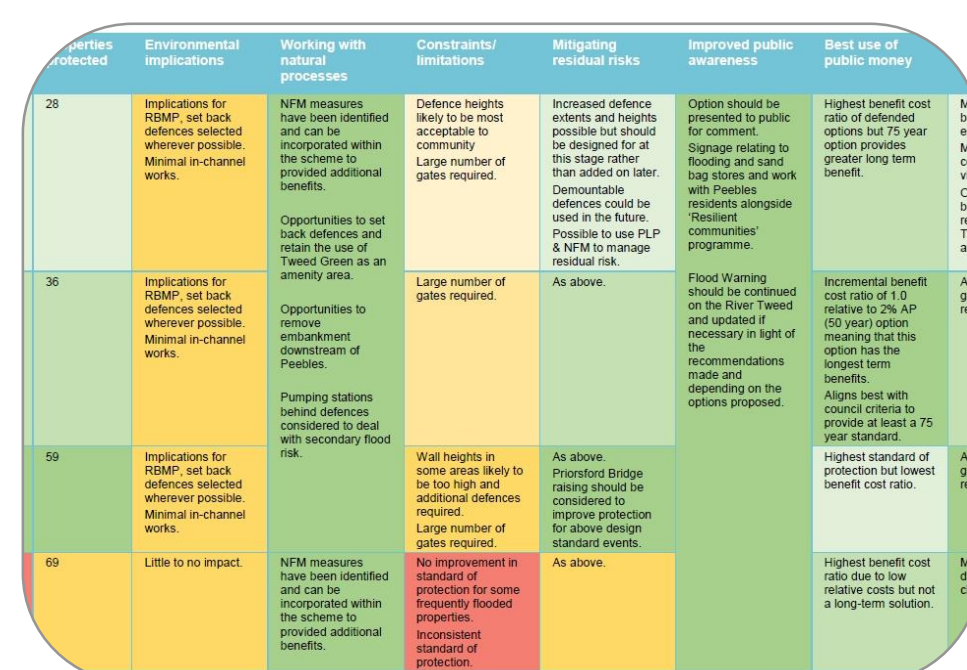
Flood Mapping

Return periods and annual probabilities

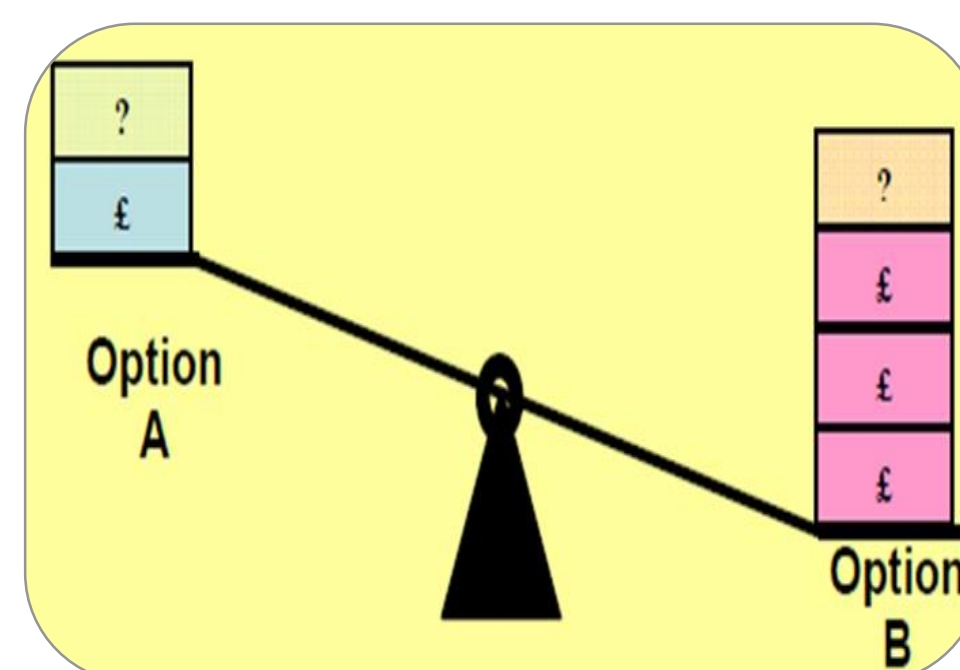
- When a river floods the severity of the flood is known as a 1 in x year flood. This terminology represents the probability of that event occurring in any year.
- For reference, the December 2015 event (Storm Frank) on the River Tweed in Peebles had a 1 in 55 chance of occurring in any year.
- This does not mean that the flood will occur once every 55 years; it could occur tomorrow and again next week, or not for another 200 years. But on average a flood of that severity will occur once every 55 years.
- For example, there is a 1 in 100 (or 1%) chance of a flood exceeding the 100 year flood in any one year.



Properties at
risk

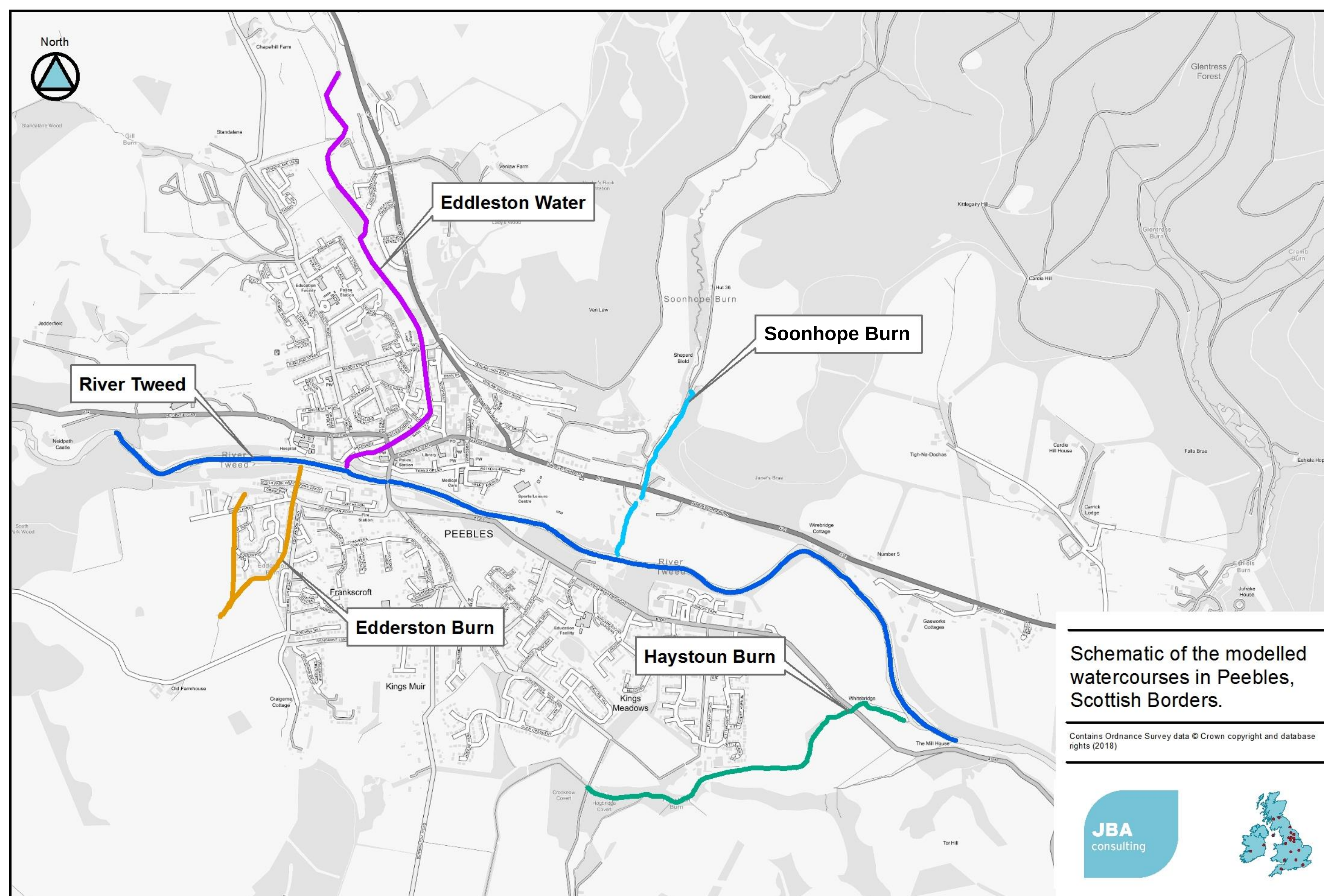


Options
Appraisal

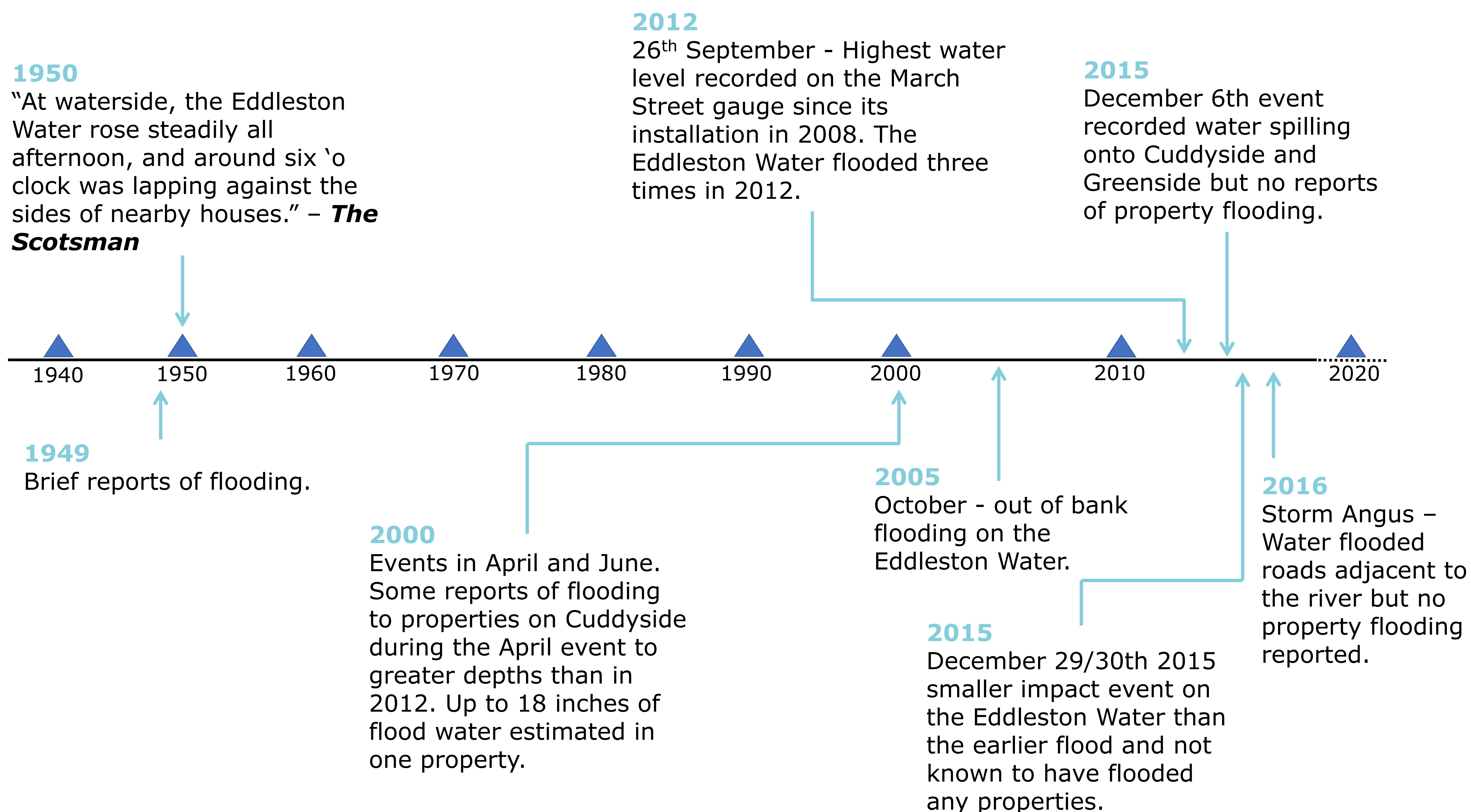


Cost-Benefit

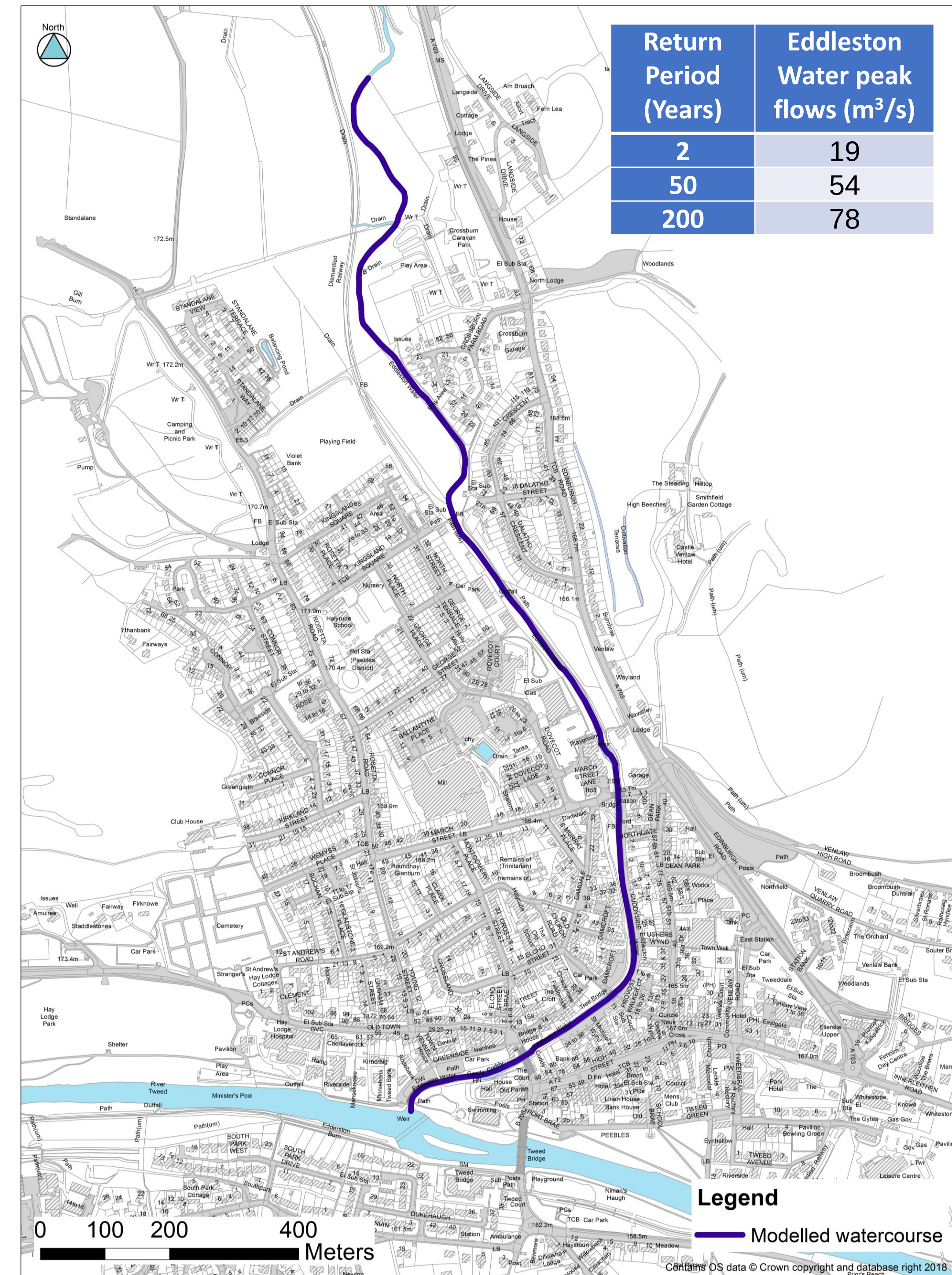
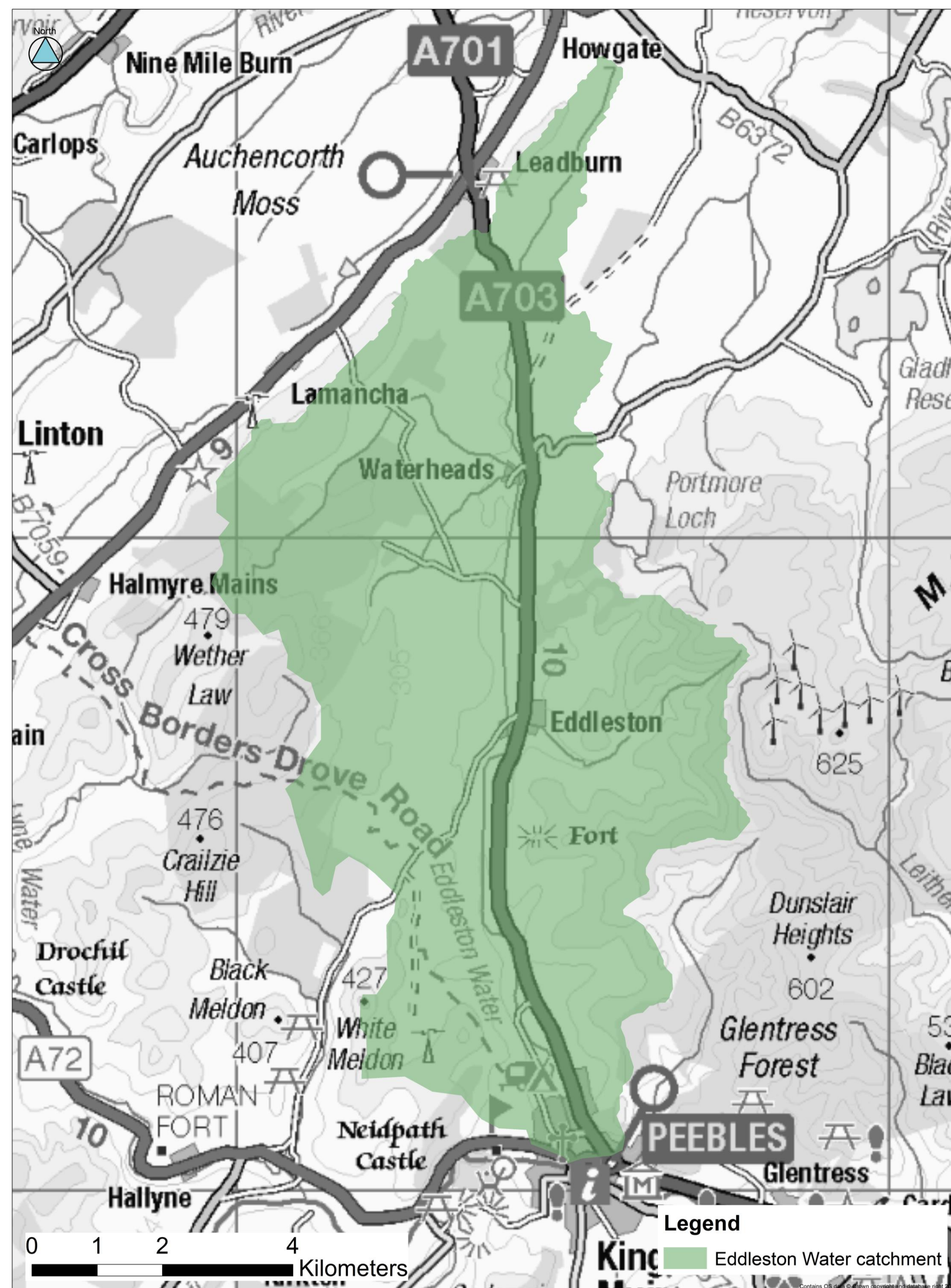
Peebles is at flood risk from the River Tweed, Edderston Burn, Eddleston Water, Soonhope Burn and Haystoun Burn. Each of the watercourses has its own mechanism of flood risk and the individual watercourses were therefore studied independently. The River Tweed is the largest of the assessed watercourses with a catchment area of 700km² followed by the Eddleston Water (70km²), Haystoun Burn (23km²), Soonhope Burn (9.5km²) and finally the Edderston Burn with a catchment area of under 2km². Some of the watercourses such as the Eddleston Water and the River Tweed have a long history of flooding whereas others have little available flood history.



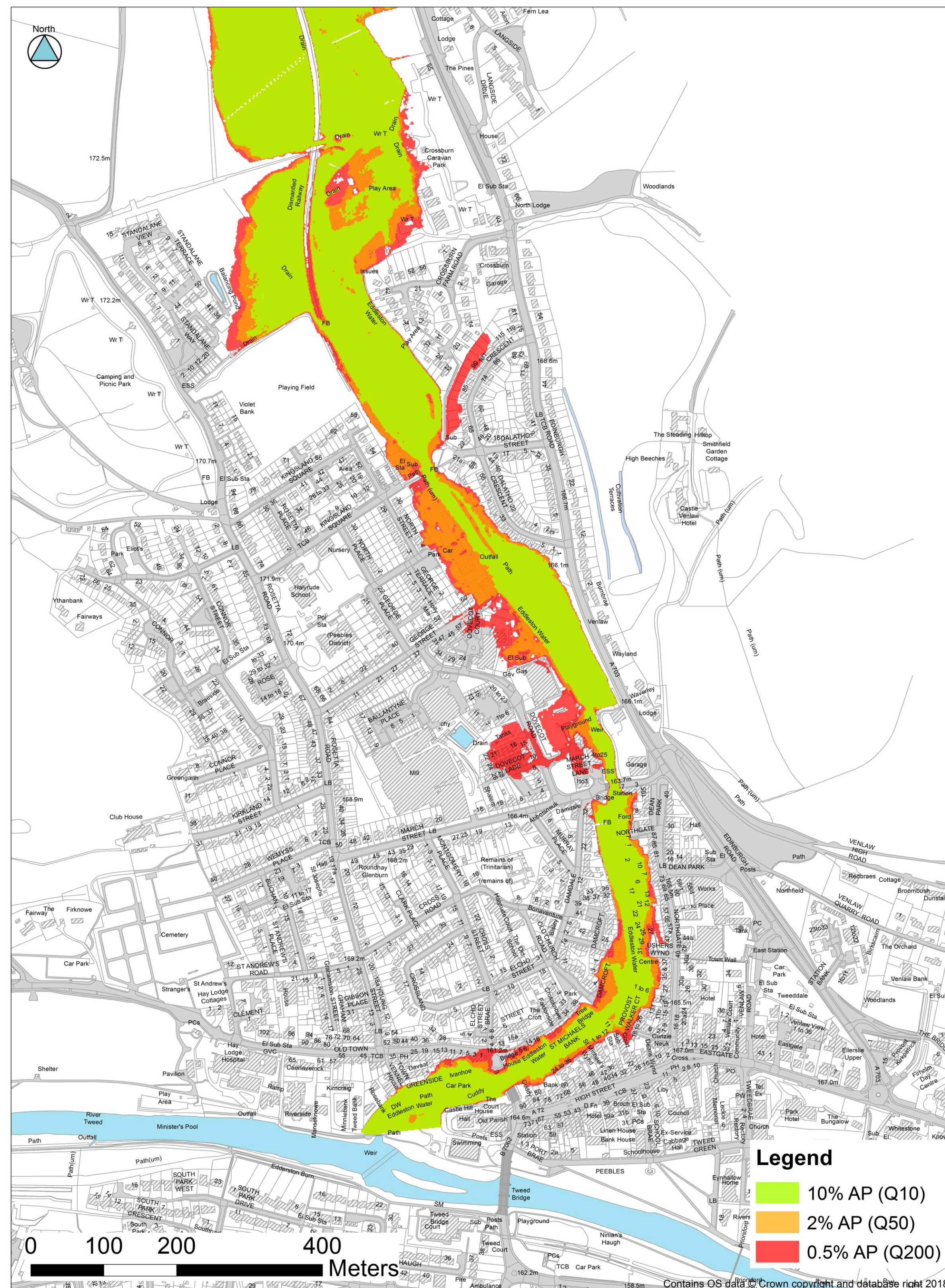
There is a long history of flooding from the Eddleston Water from the 1700's through to present day with the Cuddyside often the first to be affected.



The Eddleston Water has a catchment area of 70km² extending from Howgate to the River Tweed in Peebles. The Eddleston Water was modelled from its entrance into Peebles to its confluence with the River Tweed. The figures below show the catchment and the length of modelled channel.



Flood mapping – Eddleston Water



Property Type	Number at Risk (1 in 200 year flood)
Residential	73
Commercial	9

How do we create these flood maps?

- A physical survey captured the measurements of river channels, banks and structures along each watercourse.
- These measurements were input to a computer model, along with calculated river flows for a range of storm events.
- This model produced a flood level which was then applied to a 3D representation of the land surface and buildings. The outcome resulted in a detailed flood map.

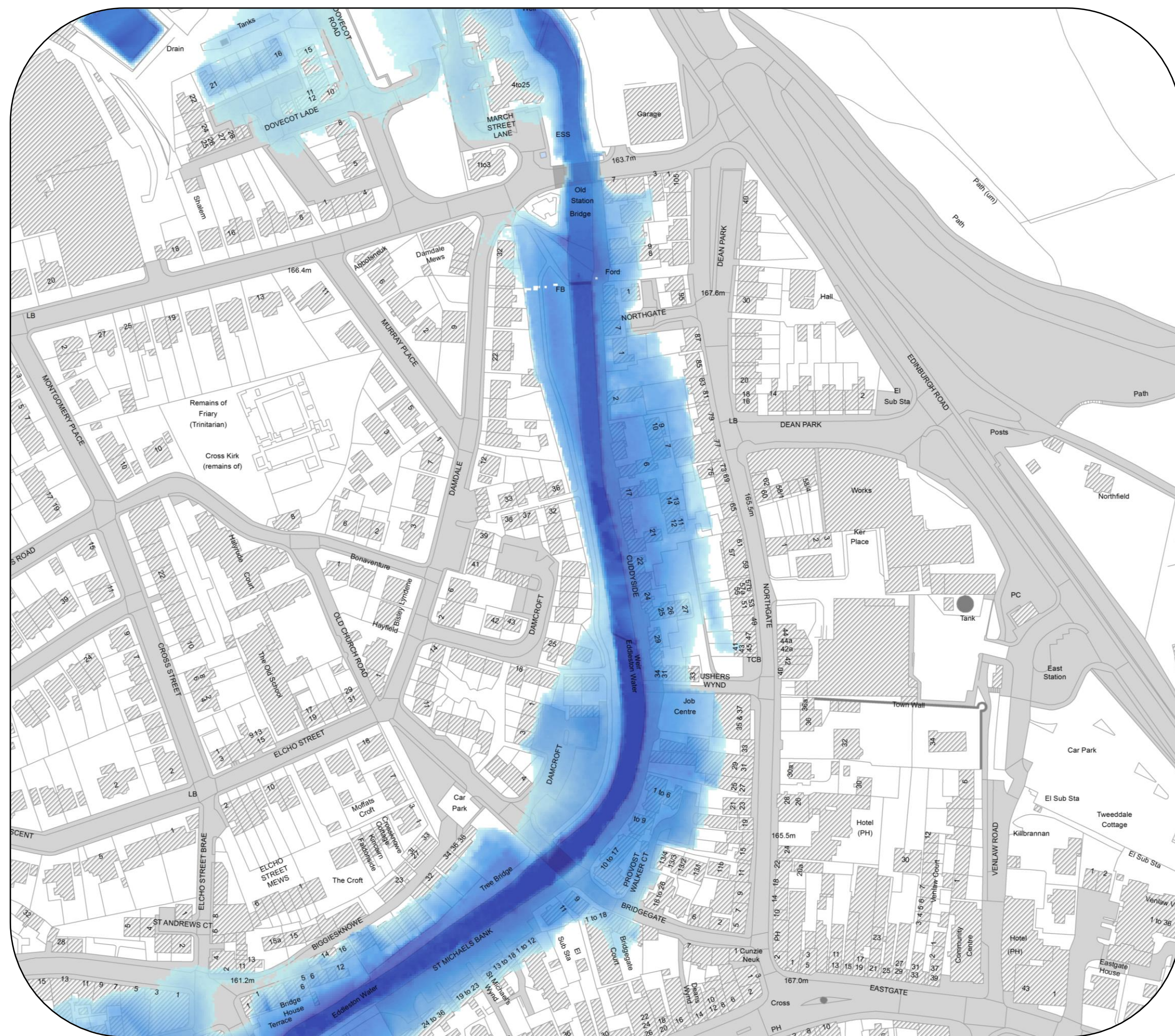
What do the maps show?

- The mapping indicates the predicted flooding for a given flood magnitude.
- The 1 in 10 year map shows what is expected to be inundated for a flood that is likely to occur once every 10 years (or with a probability of 10% in any one year).
- The 1 in 200 year represents a flood event with a probability of 0.5% in any year.

Flood mechanisms and key constraints - Eddleston Water

Out of bank flow paths, key structures and constraints were identified. Within Peebles flooding of the Eddleston Water causes flooding of footpaths and roads during small events but begins to threaten properties on Cuddyside, St Michaels Bank and Greenside as flood levels rise. Due to the constrained channel there are few complex flow paths, out of bank floodwater generally stays within 40m of the channel in which it would usually flow.

Several weirs and bridges cross the river and cause constrictions to flood flows.



Floodplain flows



Weirs on the watercourse



Bridges capable of constraining flood flows

Eddleston Water Options appraisal

– Long list of options

The process for selecting flood mitigation options involves assessing a wide range of possible measures and narrowing it down to a short list according to whether the options are technically, environmentally and socially acceptable. Those that are short listed are shown in the following posters. The full list of options assessed is provided below:

- **Relocation** - Relocation or abandonment of properties not usually socially or politically viable but phased abandonment may be an option for the lowest lying properties.
- **Flood Warning** – Flood warnings on the Eddleston Water should be maintained.
- **Resistance Measures** – Property level protection is well suited to the shallow flood depths expected from the Eddleston Water.
- **Resilience Measures** - Unlikely to be economically or socially viable.
- **Watercourse Maintenance** – Council should continue the scheduled maintenance regime.
- **Natural Flood Management** – Eddleston Water Project already underway which aims to reduce flood risk and deliver wider environmental improvements.
- **Storage** – There is no land upstream of Peebles suitable for the storage of flood waters without inundating properties or roads.
- **Control structures** – Lack of floodplain to hold back large flows. Environmental and maintenance implications likely outweigh the small benefit.
- **Demountable Defences** – Permanent defences would be less expensive and reduce the burden on council resources compared to demountable alternatives.
- **Direct Defences** – A number of walls could contain flows on the watercourse to a medium standard of protection.
- **Channel Modification** – Not capable of delivering long-term benefits.
- **Diversion channel** – No suitable route for the diversion around the properties at risk.
- **Structure Modification** – The three weirs and Bridgegate Bridge have been shown to reduce flood conveyance.

Most desirable options

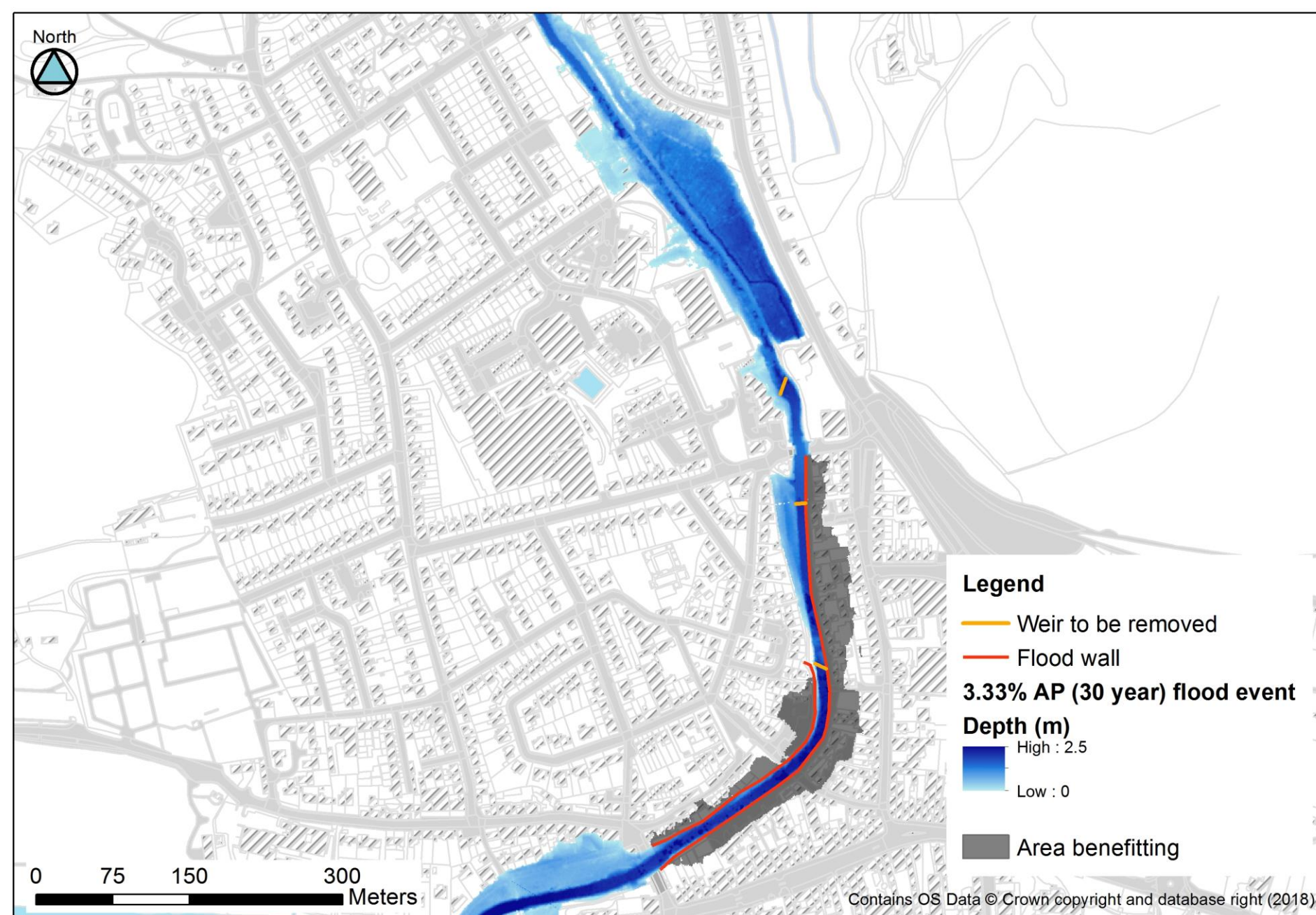
Good practice and partial solutions

Least desirable options

Eddleston Water – Short Listed Options

Option 1: Direct flood defences (flood walls) and removal of three weirs

- This option provides a 30 year standard of protection by removing weirs and constructing flood defence walls.
- Wall heights up to 1.5m but in places up to 400mm lower than Option 2.
- Some adaptation to climate change could be possible by further raising wall heights.
- Estimated cost £4.4m
- Estimated damage avoided £2.2m



Proposed flood defences

See adjacent technical drawings for further details for these options



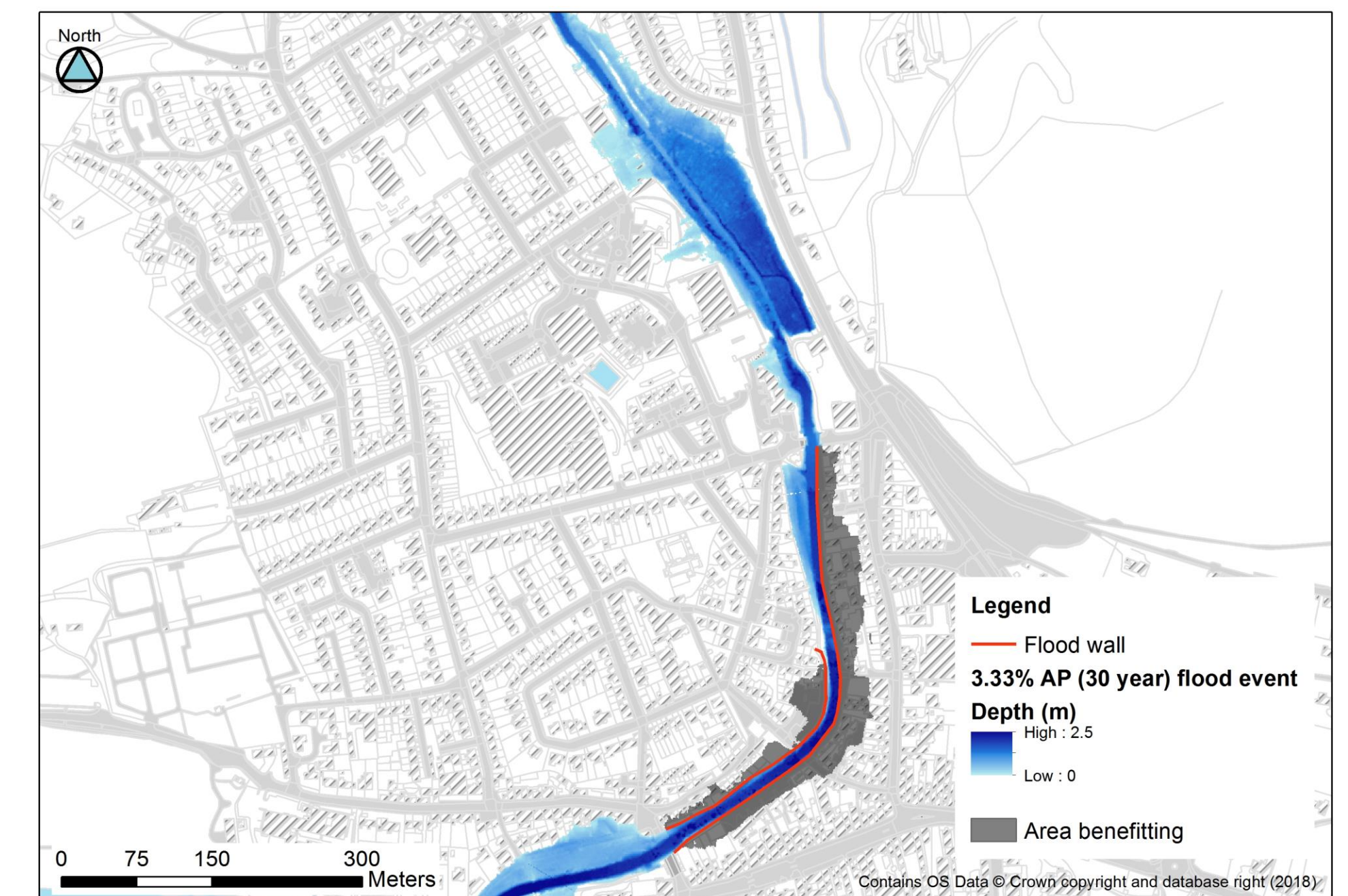
Typical example of a flood wall



One of the weirs to be removed

Option 2: Direct flood defences (flood walls)

- This option provides a 30 year standard of protection but involves slightly higher walls than Option 1.
- Average wall height 1.5m.
- Some adaptation to climate change could be possible through weir removal and bridge raising but wall heights would likely need to rise.
- Estimated cost £5.1m
- Estimated damage avoided £2.2m



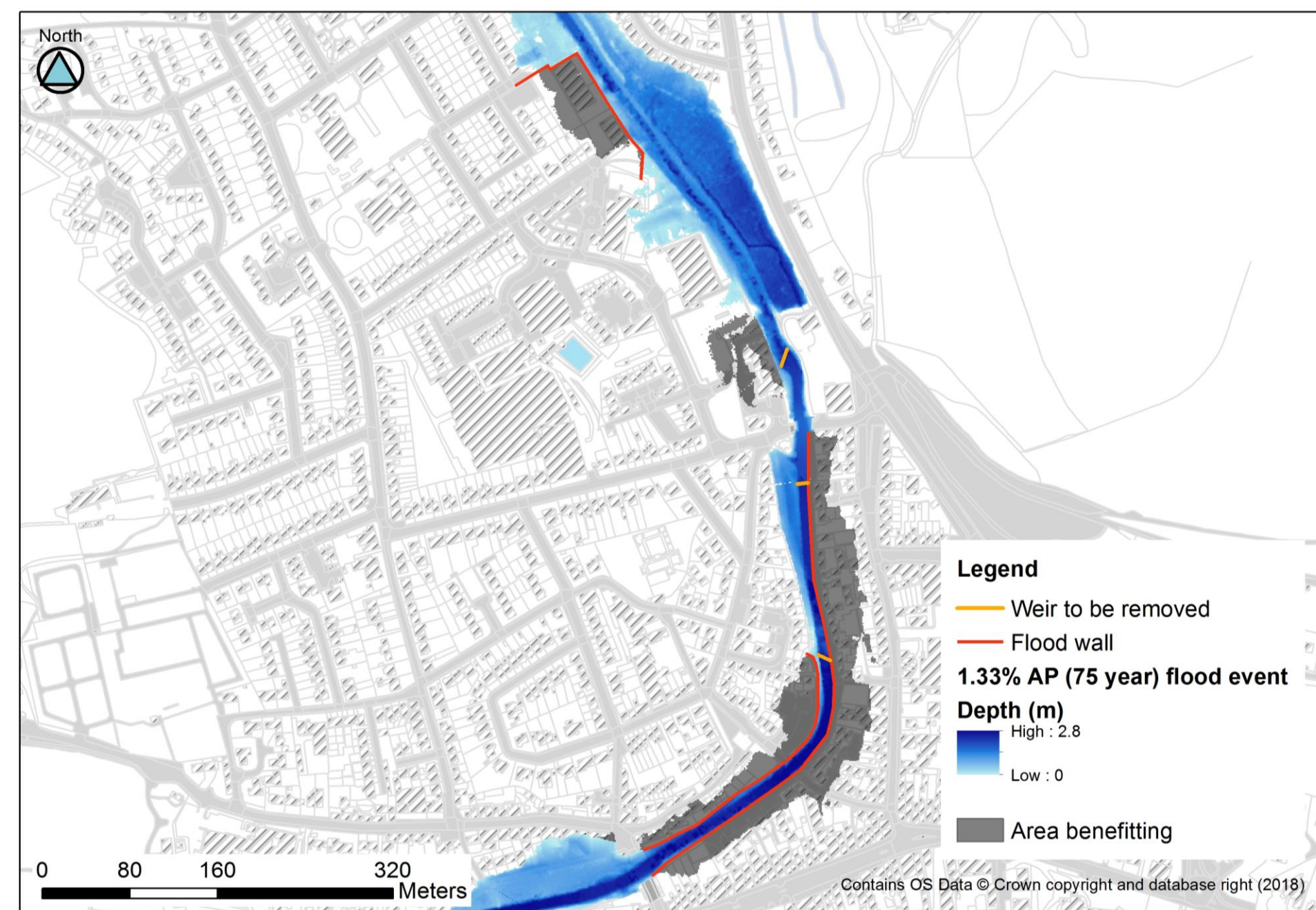
Proposed flood defences

Eddleston Water – Short Listed Options

Option 3:

Direct flood defences (flood walls), raising of Bridgegate Bridge and removal of three weirs

- This option provides a 75 year standard of protection through raising of walls, replacement of Bridgegate Bridge with a higher structure and removal of the weirs.
- Average wall height 1.5-1.8m.
- Climate change adaptation is not likely to be possible given the high walls that would be needed. NFM may reduce the impact of climate change.
- Estimated cost £6.3m
- Estimated damage avoided £2.8m



Proposed flood defences



Bridgegate Bridge – little clearance for flood waters below

See adjacent technical drawings for further details for these options

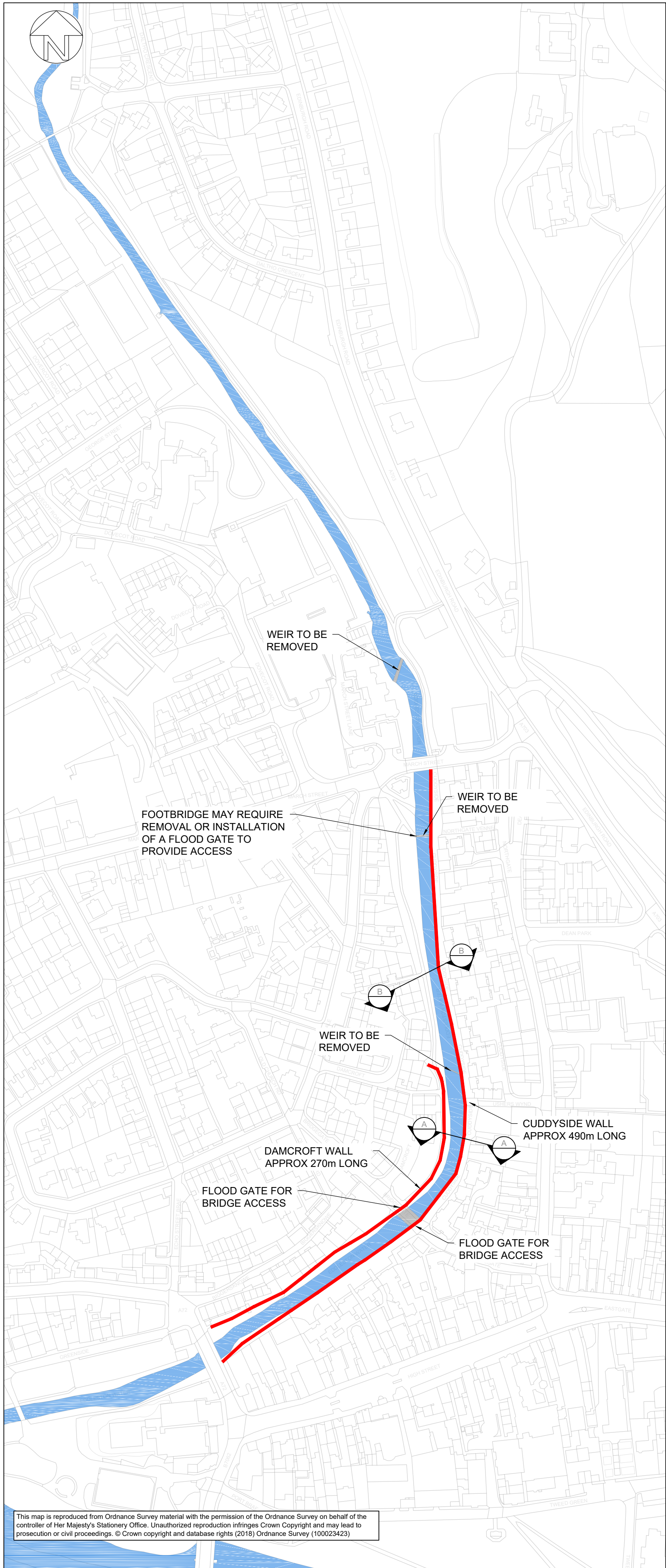
Option 4:

Property Level Protection

- Automatic PLP installed in all 73 properties at flood risk to protect to at least the 5 year flood event (49 of these properties would be protected to the 200 year event). PLP would involve surveying each property to identify water entry points and recommending appropriate products such as self-sealing doors and air vents as well as non-return valves on plumbing.
- Estimated cost £1.8m
- Estimated damage avoided £2.5m



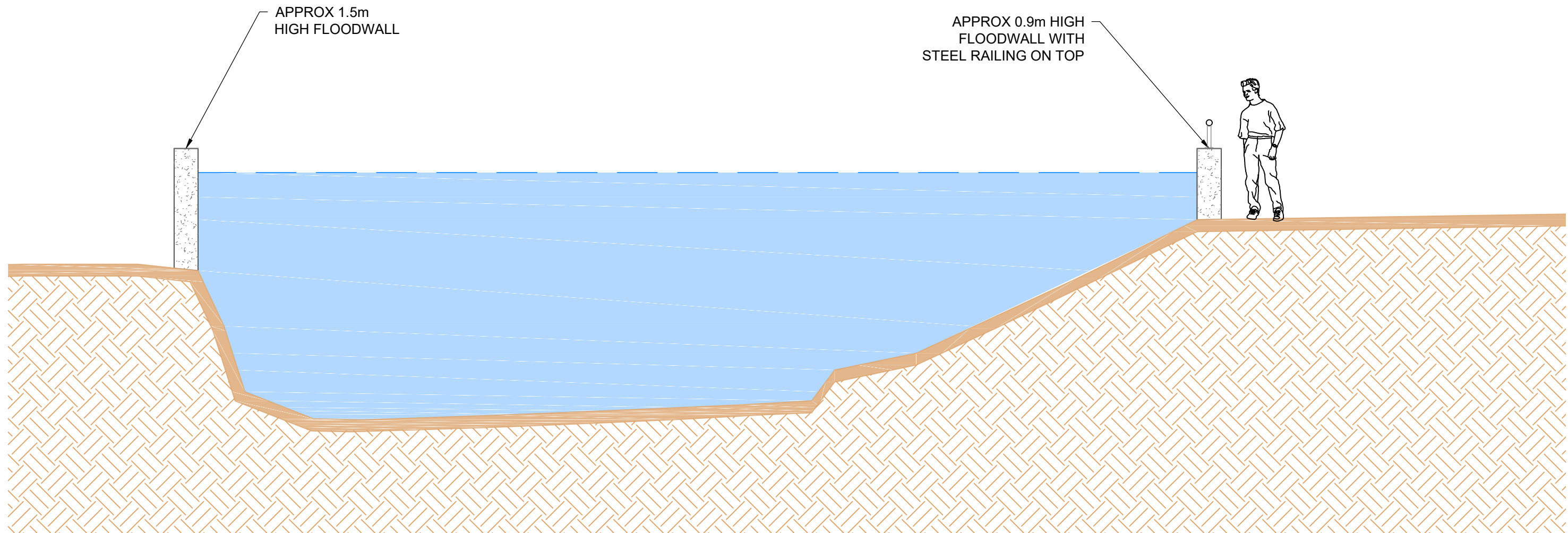
Typical examples of PLP



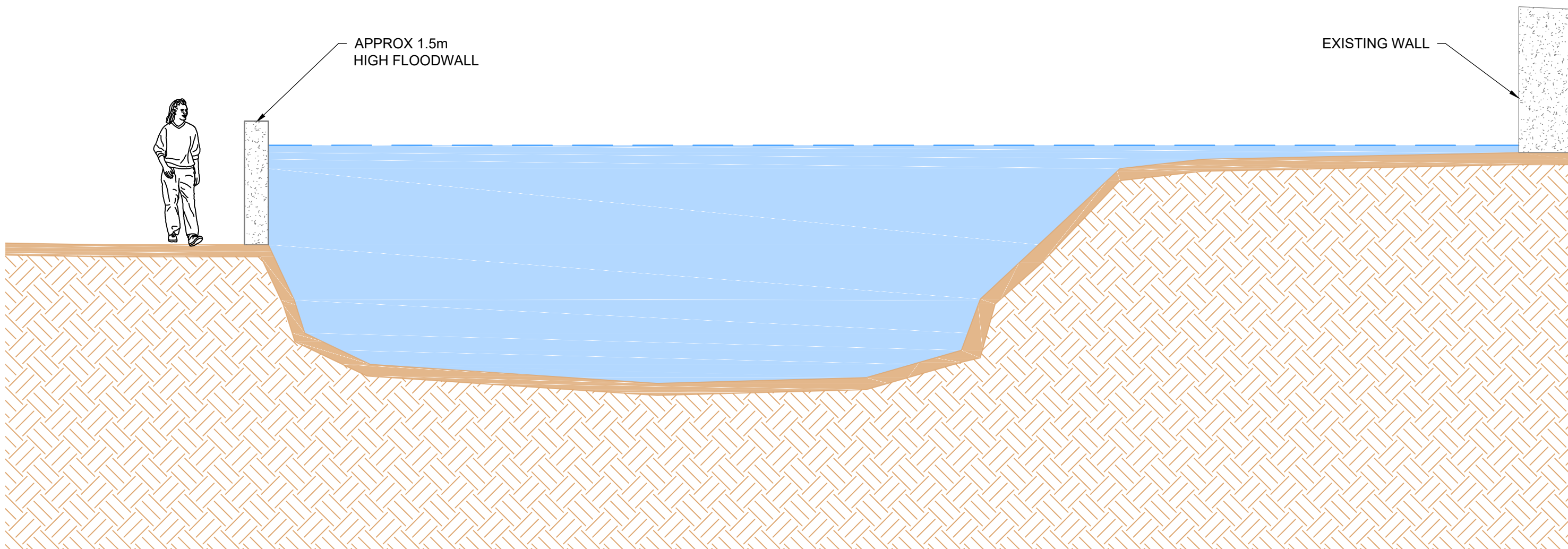
Peebles

Option 1: Eddleston Water

30 Year Direct Defences & Weir Removal



SECTION A-A: FLOOD DEFENCE WALLS ON BOTH SIDES OF THE WATERCOURSE
1:50



SECTION B-B: FLOOD DEFENCE WALL ON CUDDYSIDE
1:50

OPTION SUMMARY. Direct defences along both banks of the watercourse through Peebles. This option involves the installation of flood walls and the removal of three weirs to reduce the required wall heights. A 1 in 30 year standard of protection is achievable.

LEGEND	
	30 YEAR WATER LEVEL
	EXISTING WATERCOURSE
	CONCRETE FLOOD WALL

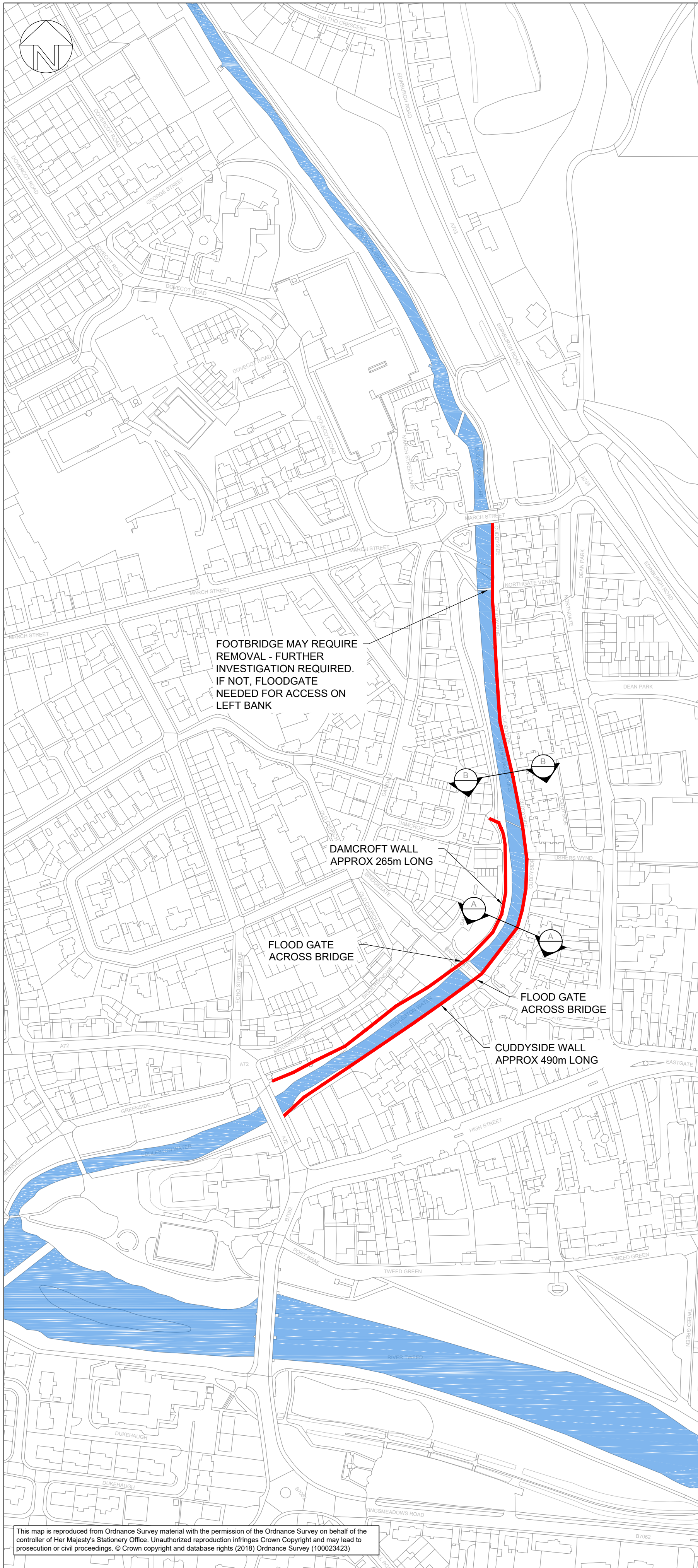
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Purpose of Issue				Status	S1
Suitable for Coordination					

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Project	Borders Flood Studies				
Title	Peebles Eddleston Water: Option 1 (30 Year Direct Defences and weir removal) Plan and sections for				
Client					

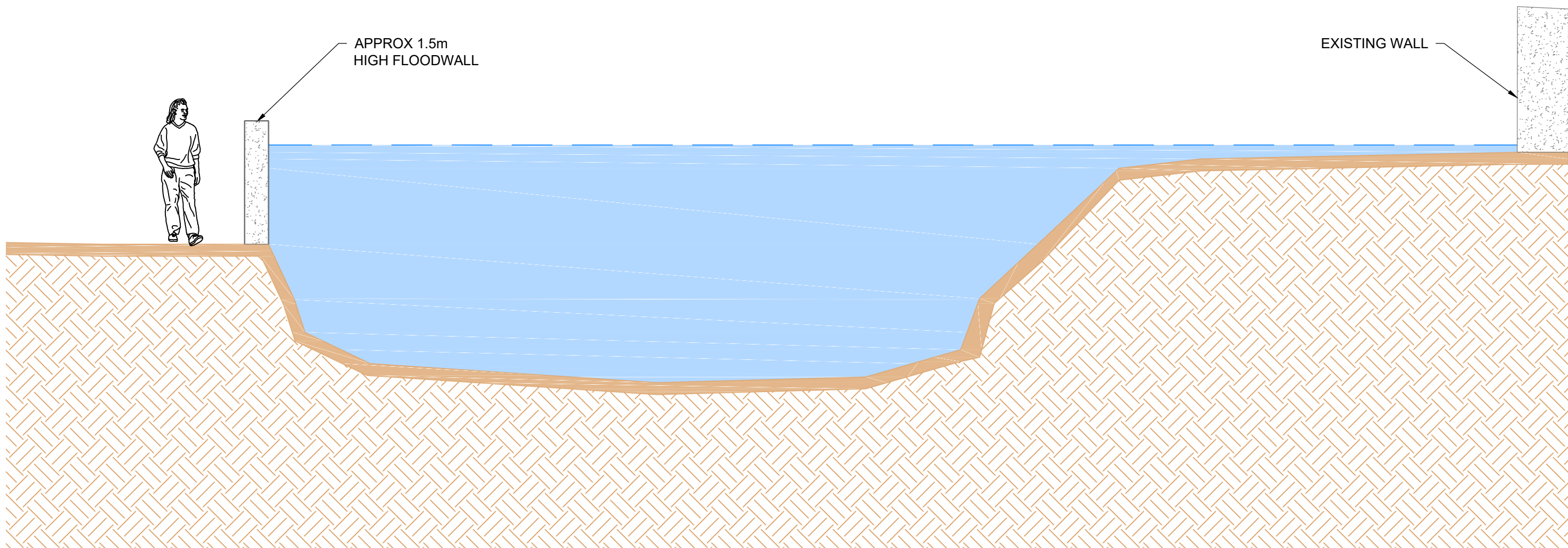
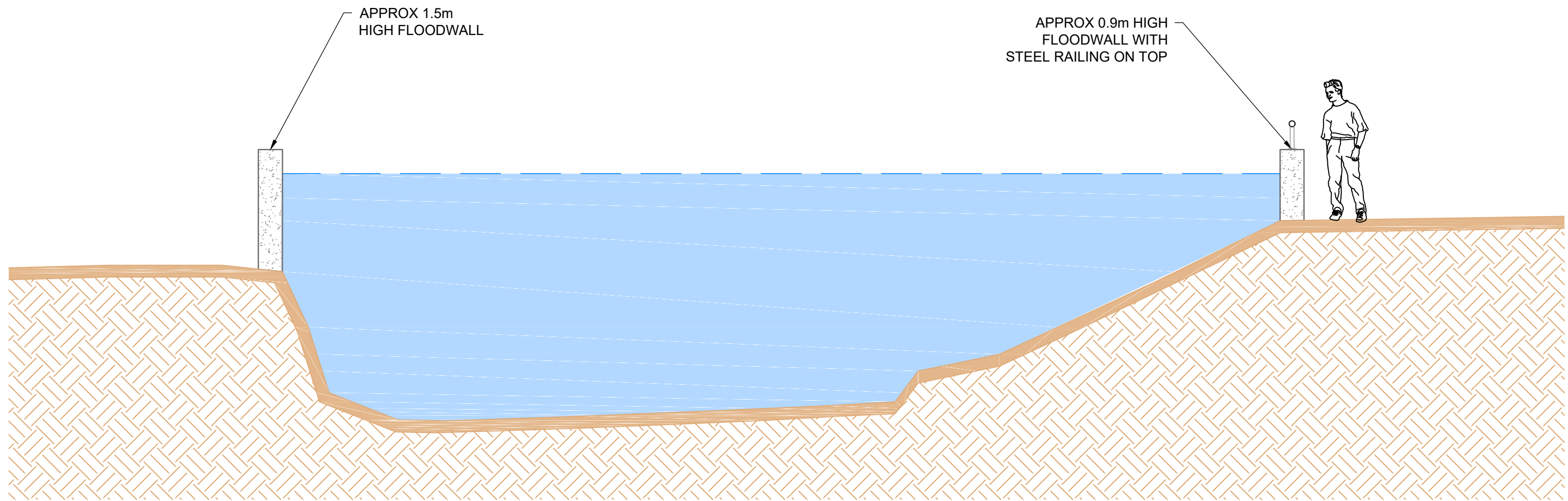
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Project Number:		2017s5526	
Drawing Number		AEM-JBAU-PB-EW-IM-C-1301	Revision P02



Peebles

Option 2: Eddleston Water

30 Year Direct Defences



Option Summary: Direct defences along both banks of the watercourse through Peebles. Wall heights raised to give a 1 in 30 year standard of protection.

LEGEND

- 30 YEAR WATER LEVEL
- EXISTING WATERCOURSE
- CONCRETE FLOOD WALL

Comments					
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Client Approval					
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B - Approved with Revisions					
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Purpose of Issue				Status	S1

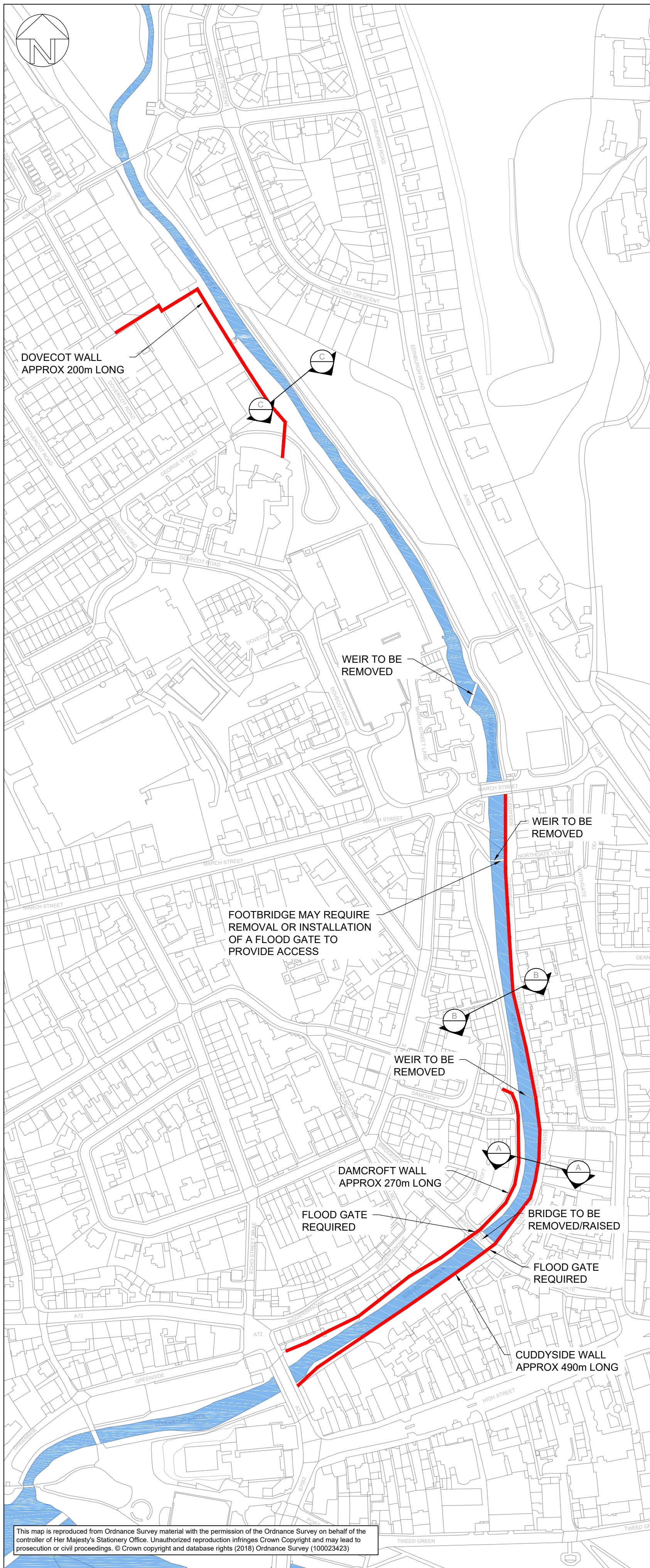
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Project		Borders Flood Studies	
Title		Peebles Eddleston Water: Option 2 (30 Year Direct Defences) Plan for	
Client			

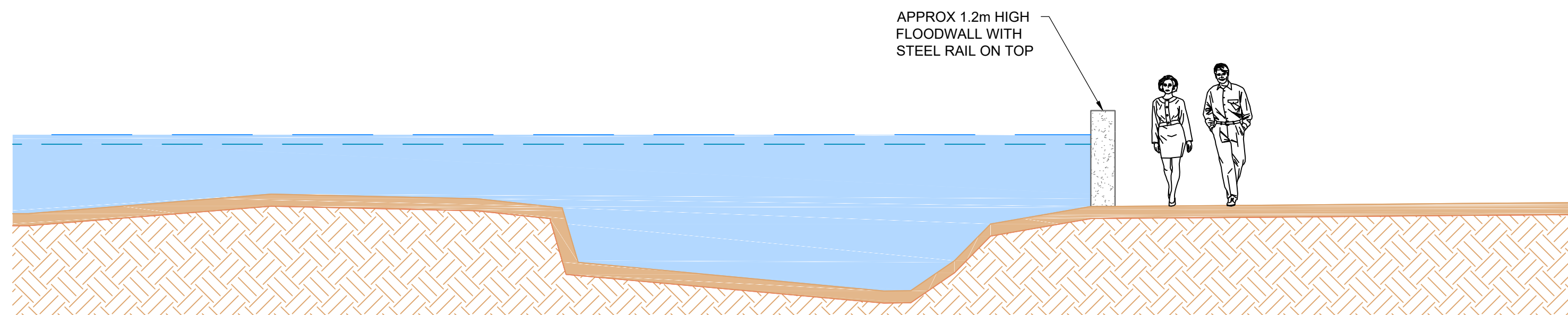
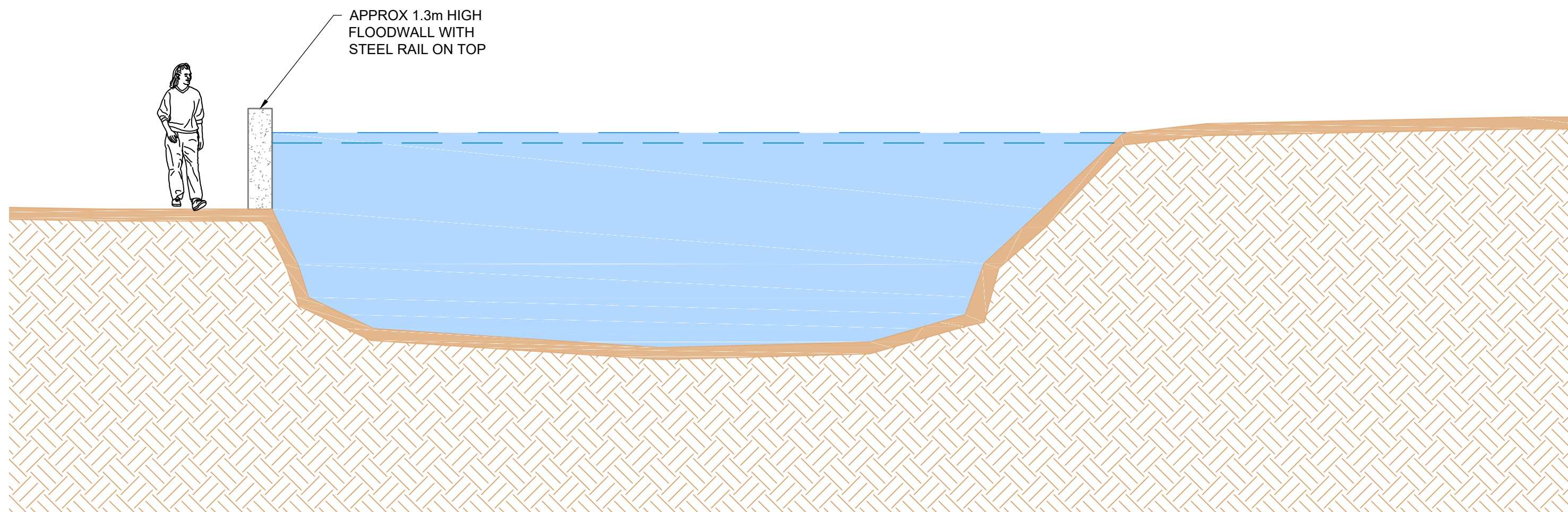
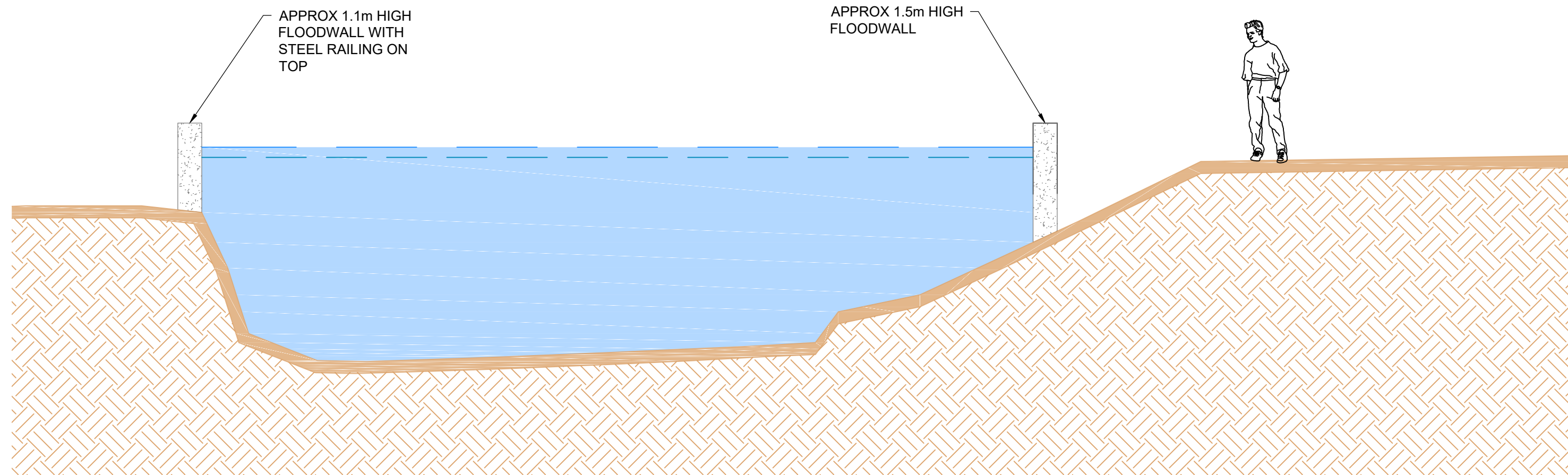
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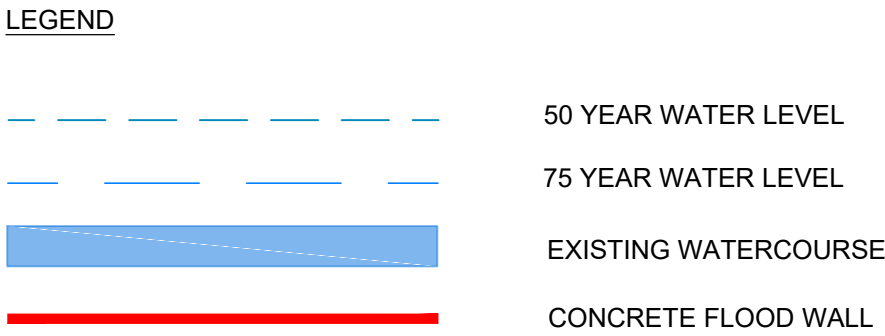
Peebles

Option 3: Eddleston Water

75 Year Direct Defences, with Bridge & Weir Removal



OPTION SUMMARY. Direct defences along both banks of the watercourse through Peebles. This involves the installation of flood walls in addition to the removal of three weirs and replacement of Bridgegate bridge with a structure with a higher soffit. These additional works reduce the flood wall height and give a higher standard of protection.



Comments					
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Purpose of Issue				Status	S1

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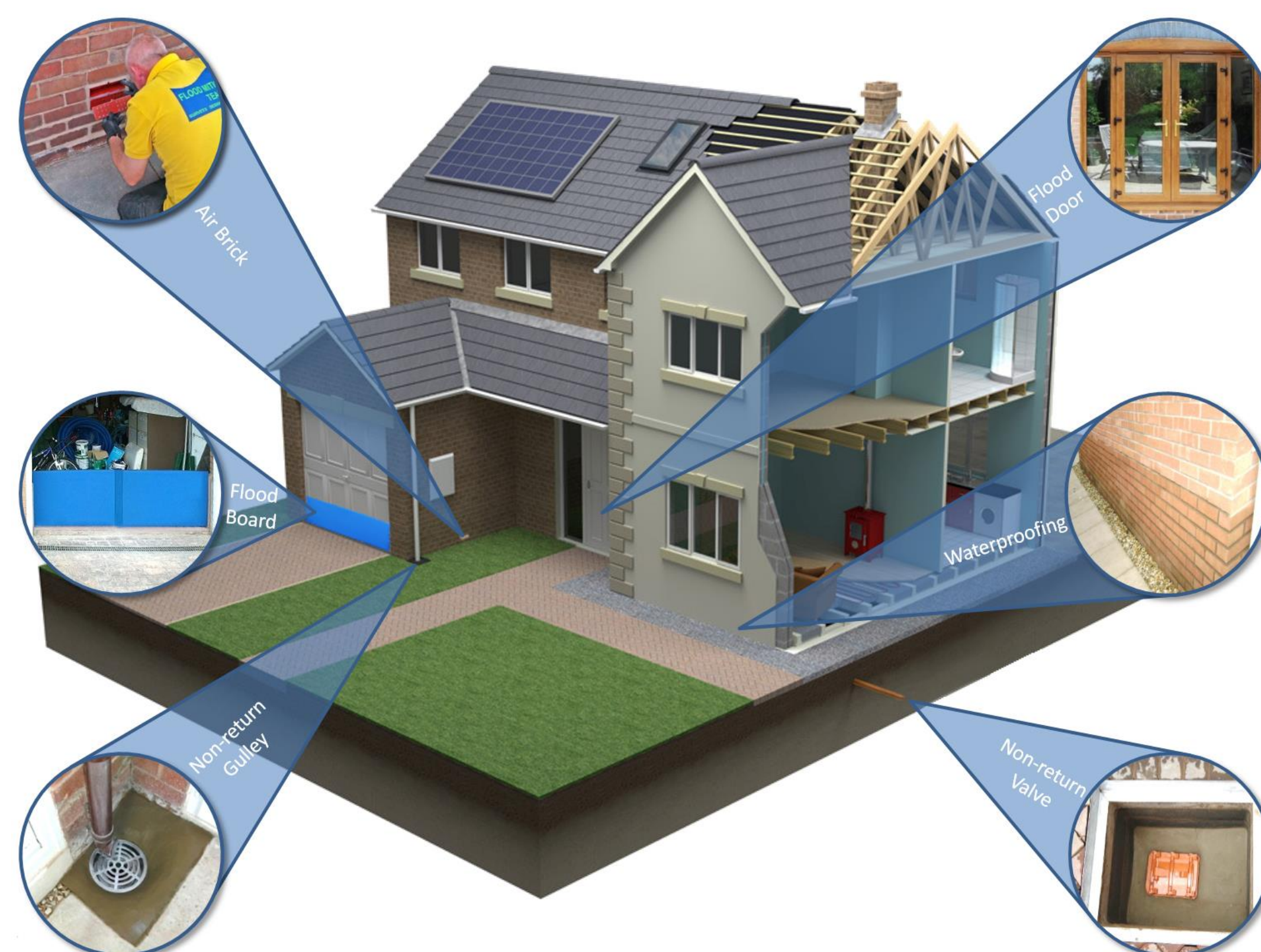
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Project		Borders Flood Studies													
Title		Peebles Eddleston Water: Option 3 (75 Year Direct Defences with bridge and weir removal) Plan for													
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Option 4 – Property Level Protection

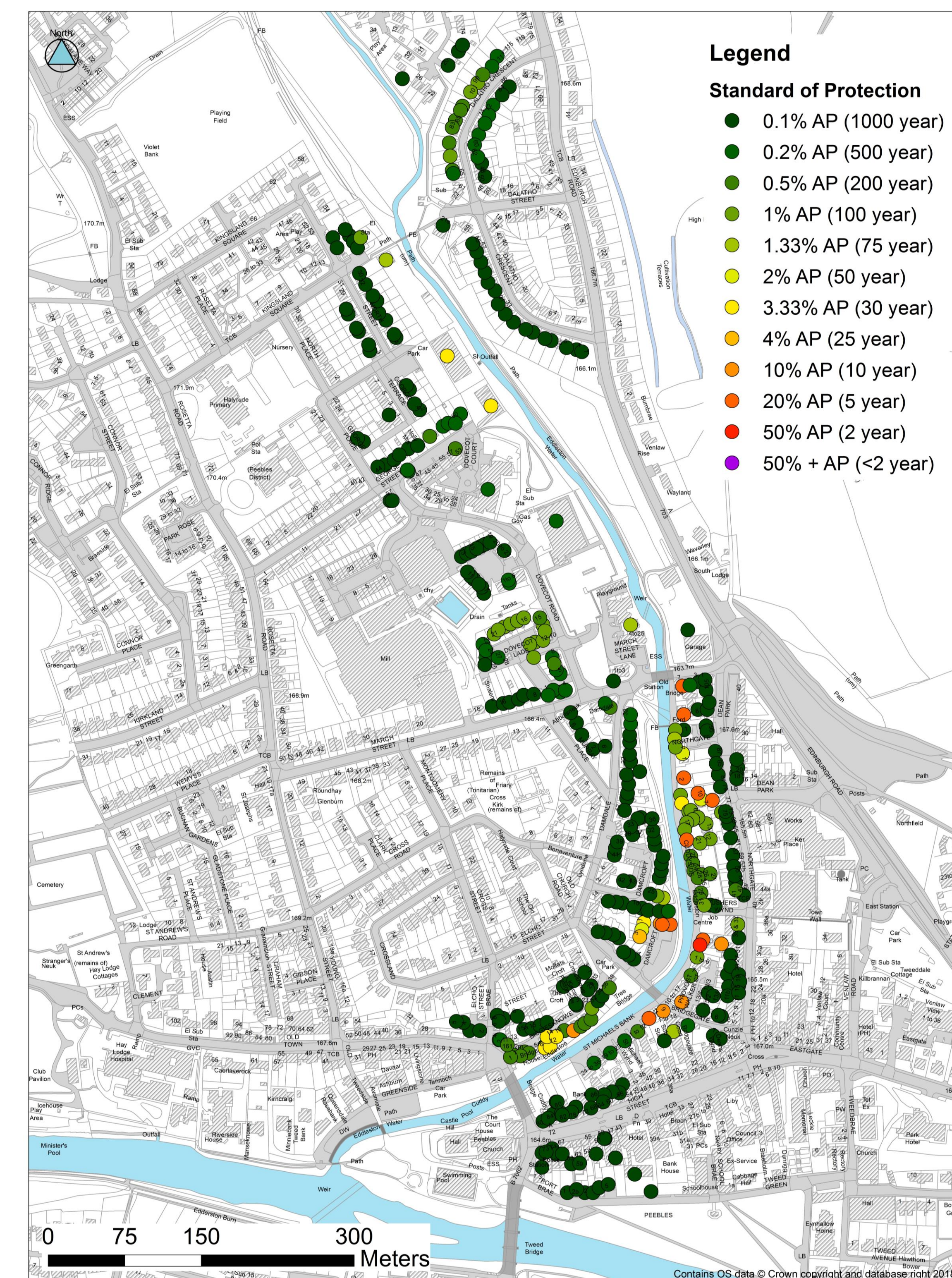
PLP is the last form of defence before water gets into a property. Automatic PLP measures mean that the property is always protected by, for example, watertight doors rather than having to insert waterproof door guards when floods are forecast. PLP can protect properties on the Eddleston Water from at least the 1 in 5 year flood event but 49 properties will also be protected up to the 1 in 200 year flood event.

The standard of protection (SOP) map indicates the existing level of protection each property in the flood study has.



Examples of how Property Level Protection can mitigate the risks of flood inundation (image courtesy of Whitehouse Construction Co. Ltd)

Standard of protection map



The standard of protection (SOP) map indicates the existing level of protection for each property in the flood study.

Preferred Option for Eddleston Water

Summary of short listed options

Option (Standard of protection)	Properties protected	Environmental implications	Working with natural processes	Constraints/ limitations	Mitigating residual risks	Improved public awareness	Best use of public money
Direct Defences with weir removal (3.33% AP - 30 year)	19	Some implications for RBMP due to walls on riverside. Minimal in-channel works but some bank reinforcement likely to be needed.	NFM measures have been implemented on the Eddleston Water as part of the Eddleston Water Project. Improvements in watercourse condition have already been witnessed and initial findings suggest positive flood risk management benefits are being realised.	Large flood defences for the number of properties protected. 1.5m height on Cuddyside likely to be at the limit of acceptability.	Not likely to be possible to increase wall heights further to account for climate change. Some residual risk mitigated by Eddleston Water Project NFM measures.	Options should be presented to public for comment. Signage relating to flooding and sand bag stores and work with Peebles residents alongside 'Resilient communities' programme. Flood Warning should be continued on the Eddleston Water and updated if necessary.	Not cost effective due to expense of defences.
Direct Defences (3.33% AP - 30 year)	19						
Direct Defences with weir removal and bridge raising (1.33% AP – 75 year)	30			High flood walls required, particularly on Cuddyside. Bridge removal and replacement required which will cause disturbance and flood gates needed across bridge following works.			
PLP (20% AP – 5 year)	49 at the 0.5% AP (200 year) flood event	Little to no impact.	Opportunities to set back Tweed defences, remove embankments and install further NFM measures in Tweed sub-catchments.	Little improvement in standard of protection for some properties. Intrusive for owners of properties selected and reinstallation required every 25 years. Roads not protected.	NFM measures already introduced or structural flood defences likely to be the only means of increasing resistance to flooding.	Flood Warning should be continued on the River Tweed as well as the Eddleston Water.	Only option with a benefit cost ratio over 1.
Combined Direct Defences, weir and bridge raising option with River Tweed scheme (1.33% AP – 75 year)	66	Minimal in-channel works but some riverside walls. Set back defences on River Tweed where possible.		Large number of gates required on the River Tweed scheme.	River Tweed walls could be raised further to reduce future flood risk.		Highest standard of protection for a scheme that is cost-beneficial on the Eddleston Water.

Negative Neutral Positive

Preferred Options and recommendations

The only cost-effective option for the Eddleston Water is the PLP option but this is not the best long-term option.

Combining one of the structural direct defences options with the cost-beneficial River Tweed direct defences option would be a better long-term solution.

The short term recommendations are:

- Awareness raising for flooding.
- Setup new sandbag store nearer the Eddleston Water.
- Manage vegetation on the banks and in-channel.

What is natural flood management?

Natural flood management (NFM) is when natural processes are used to reduce the risk of flooding by slowing flows and storing water within the catchment. It is however difficult to quantify the reduction in flow that these types of measures can deliver. NFM also offers additional wider benefits by restoring habitats and improving water quality.

The Eddleston Water Project is a joint research initiative led by Tweed Forum and involving SEPA, the Scottish Government, Dundee University and Scottish Borders Council among other key partners. As well as general river restoration a number of practical NFM works have been undertaken to explore how changes in land management might reduce flood risk in the communities downstream (such as Peebles).

So far the project has improved the condition of the watercourse and there is evidence that flood flows during small flood events have been reduced.

Re-meandering works at Lake Wood, between Eddleston and Peebles



Typical example of a meandered channel



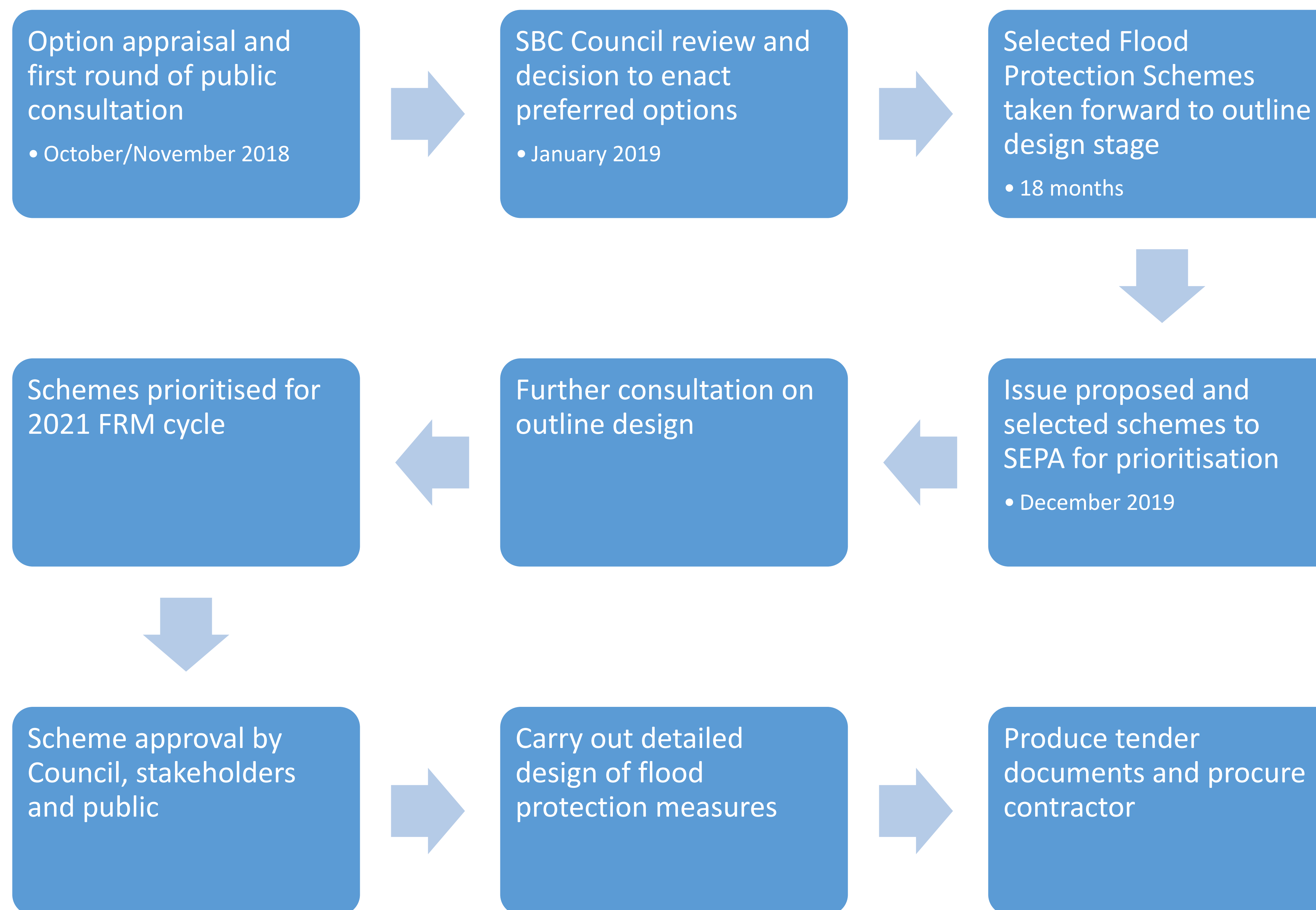
Typical example of in-channel debris barrier



Typical example of young woodland



The following sets out the Council wide steps required to progress preferred options to a Flood Protection Scheme



These posters and further information are available at: www.bordersfloodstudies.com