

# Borders Flood Studies

## How is flood risk managed by the Scottish Borders Council?

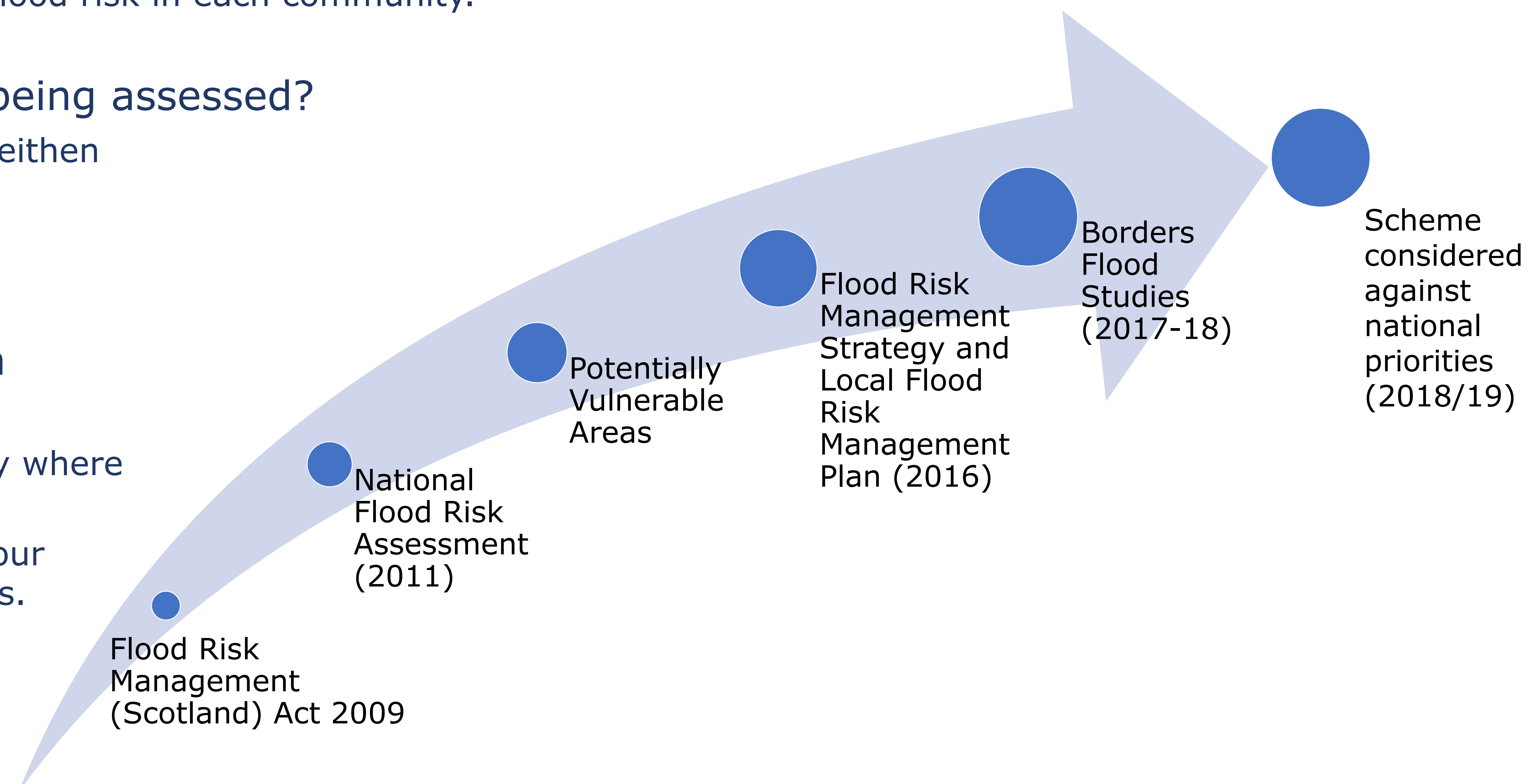
- The Flood Risk Management (Scotland) Act 2009 aims to prioritise flood mitigation across Scotland using a proactive and risk based process for assessing flood risk.
- This approach led to the preparation of SEPA's Flood Risk Management Strategies by SEPA and the Solway Local Flood Risk Management Plan developed by Dumfries and Galloway Council with input from Scottish Borders Council relating directly to Newcastleton.
- 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?

- Broughton, Peebles & 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.**



# What has been done so far?



Flood Review



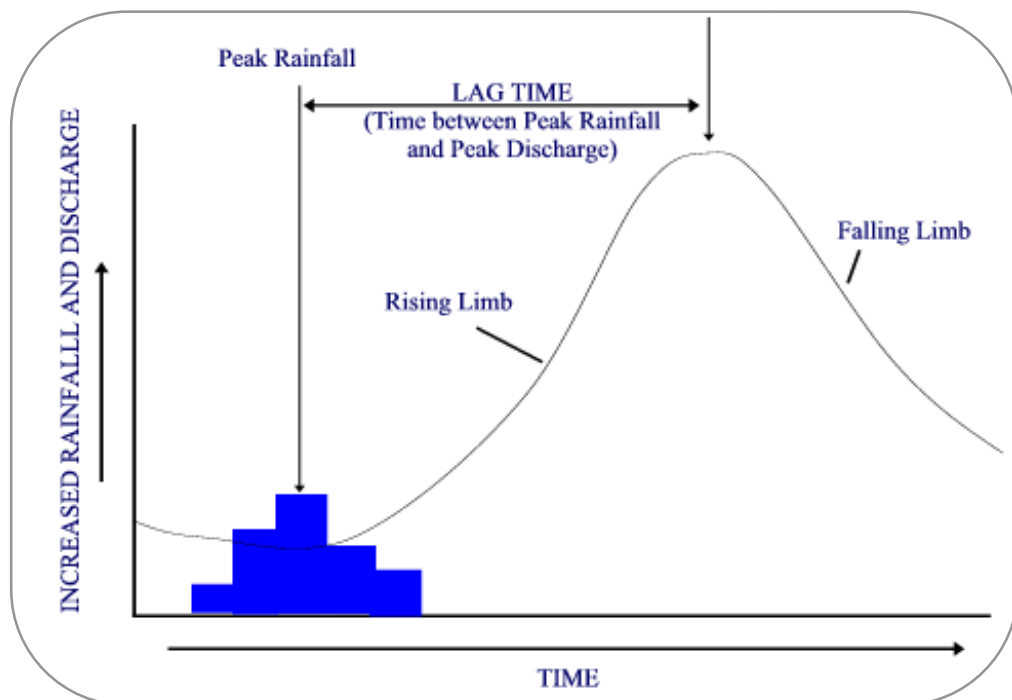
Topographic  
surveys



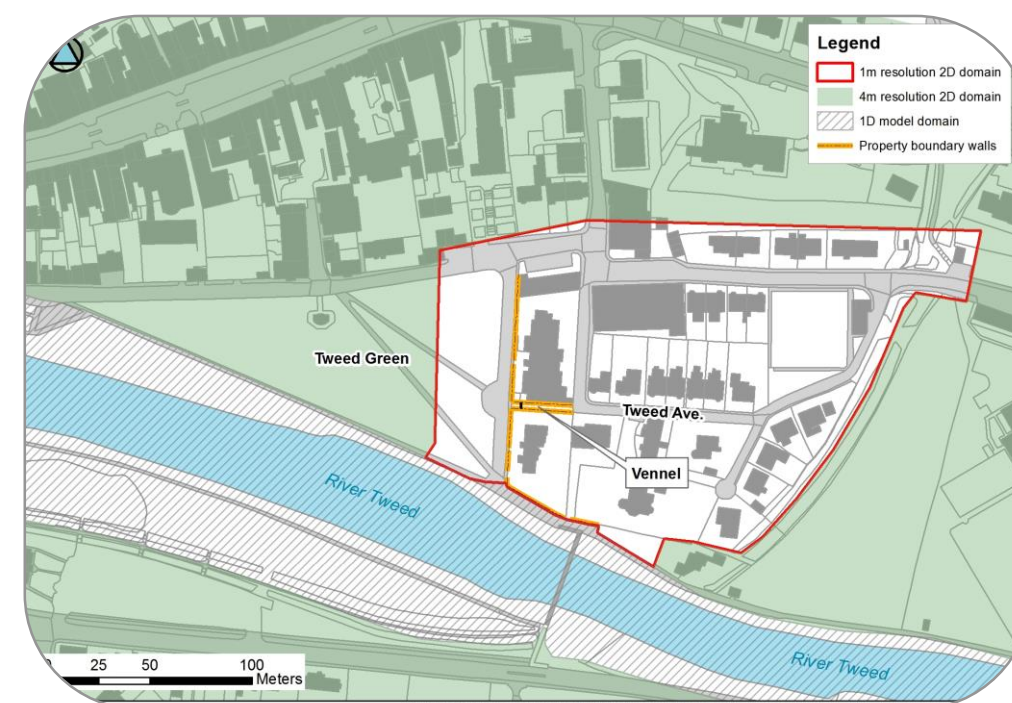
Asset  
inspections

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.

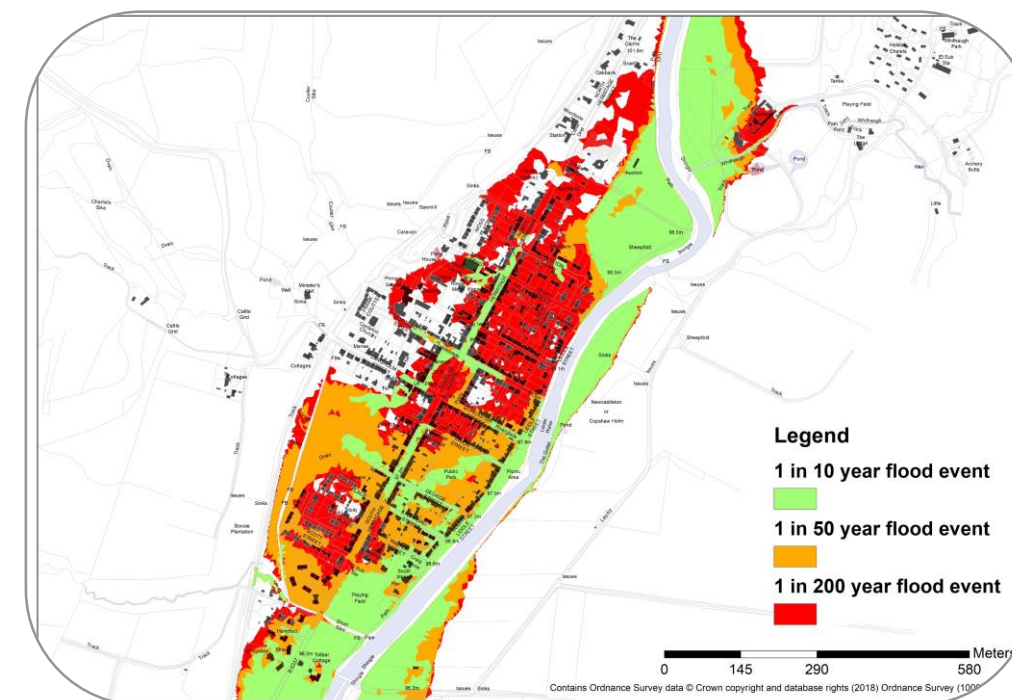
The models developed form a basis for assessing future flood levels, flood mitigation options, detailed design of schemes and the costs to deliver.



Hydrology



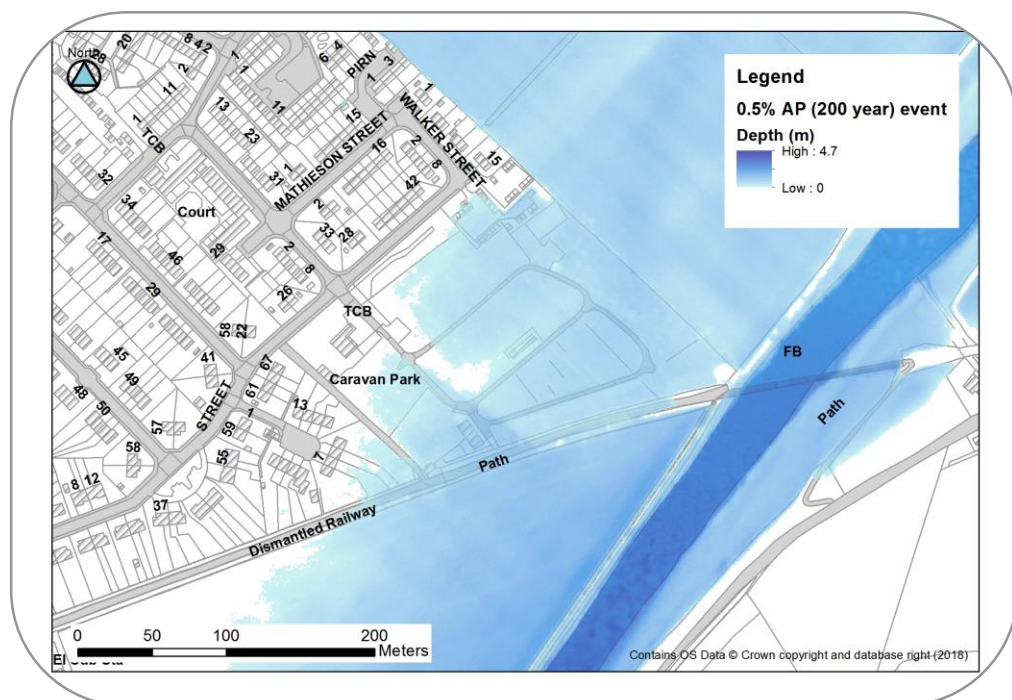
Modelling



Flood Mapping

## Return periods and annual probabilities

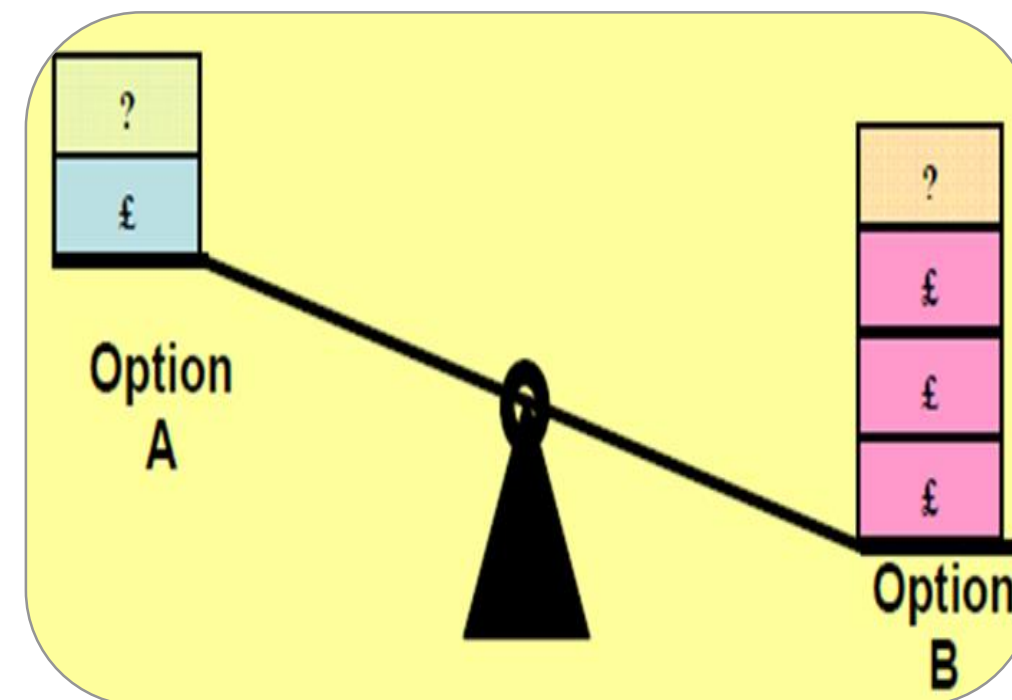
- When a river floods the severity of the flood is known as a 1 in x year flood. This terminology represents the probability of that event occurring in any year.
- For reference, the October 2005 event in Newcastleton had an estimated 1 in 15 chance of occurring in any year.
- This does not mean that the flood will occur once every 15 years; it could occur tomorrow and again next week, or not for another 50 years. But on average a flood of that severity will occur once every 15 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 | Environmental implications  | Working with natural processes   | Conservation/Restoration   | Mitigating residual risks   | Improved public awareness   | Best use of public money   |
|---------|---|--|--|---|---|--|
| 25      | Implications for RDRP will be back-up defence selected wherever possible. Minimal in-channel works. | NFM measures have been identified and can be incorporated within the scheme to provide additional benefits. Opportunities to set back defences and retain the use of Tweed Green as an amenity area.           | Defence heights likely to be raised in accordance with the scheme. Large number of gates required. | Increased defence heights and heights to be designed for at this stage rather than added on later with the scheme. Defences could be used in the future. Possible to use PUP & NFM to manage residual risk. | Options should be presented to public for comment. Storage relating to flood warning and work with residents alongside 'Resilient Communities' programme. | Highest benefit cost ratio of 1.1. Options for 75 year event provide greatest long term benefit.     |
| 36      | Implications for RDRP will be back-up defence selected wherever possible. Minimal in-channel works. | Opportunities to set back defences and retain the use of Tweed Green as an amenity area. Opportunities to enhance amenity area. Pumping stations behind defences considered to deal with secondary flood risk. | Large number of gates required.  | As above.   | Flood warning should be delivered on the River Tweed and considered if necessary in light of recommendations made and delivered as the options proposed.  | Incremental benefit cost ratio of 1.1. Options for 75 year event provide greatest long term benefit. |
| 59      | Implications for RDRP will be back-up defence selected wherever possible. Minimal in-channel works. | Implications for RDRP will be back-up defence selected wherever possible. Minimal in-channel works.  | Large number of gates required.  | As above.   | As above.   | Highest benefit cost ratio of 1.1. Options for 75 year event provide greatest long term benefit.     |
| 69      | Little to no impact.  | NFM measures have been identified and can be incorporated within the scheme to provide additional benefits.  | No improvement in standard of protection for some properties. Residual risk of flooding.           | As above.   | As above.   | Highest benefit cost ratio due to low relative costs but not a long term solution.                   |

Options  
Appraisal



Cost-Benefit



# Flood Timeline

M

MOTT  
MACDONALD

M

JBA  
consulting

## Feb 1997/Jan 2001/October 2005

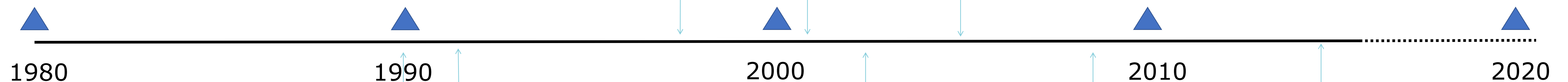
Three major flood events in Newcastleton during these years. – SEPA FRMS

## October 2005

Reported to be the worst in living memory and estimated to be correspondent with the 1 in 15 year event. It is recorded as the highest flow event on record, which has not been exceeded since. Local drainage was unable to cope with surface flows, thus resulted in water backing up the drainage network from the River.

Key info:

- 30 houses flooded, which is around 10% of local population effected.
- Large amounts of gravel built up changing the river drastically.



## January 1990

60 homes evacuated in Walter Street, Stopford Street and George Street in Newcastleton.

## January 1991

Record of significant flooding of the Liddel Water in the Newcastleton area. – SEPA FRMS

## February 2002

Roadway Flooding on Liddle Street.

## June 2008

Flooding recorded on the Strategic Flood Risk Assessment of the Scottish Borders Council, but no details on source.

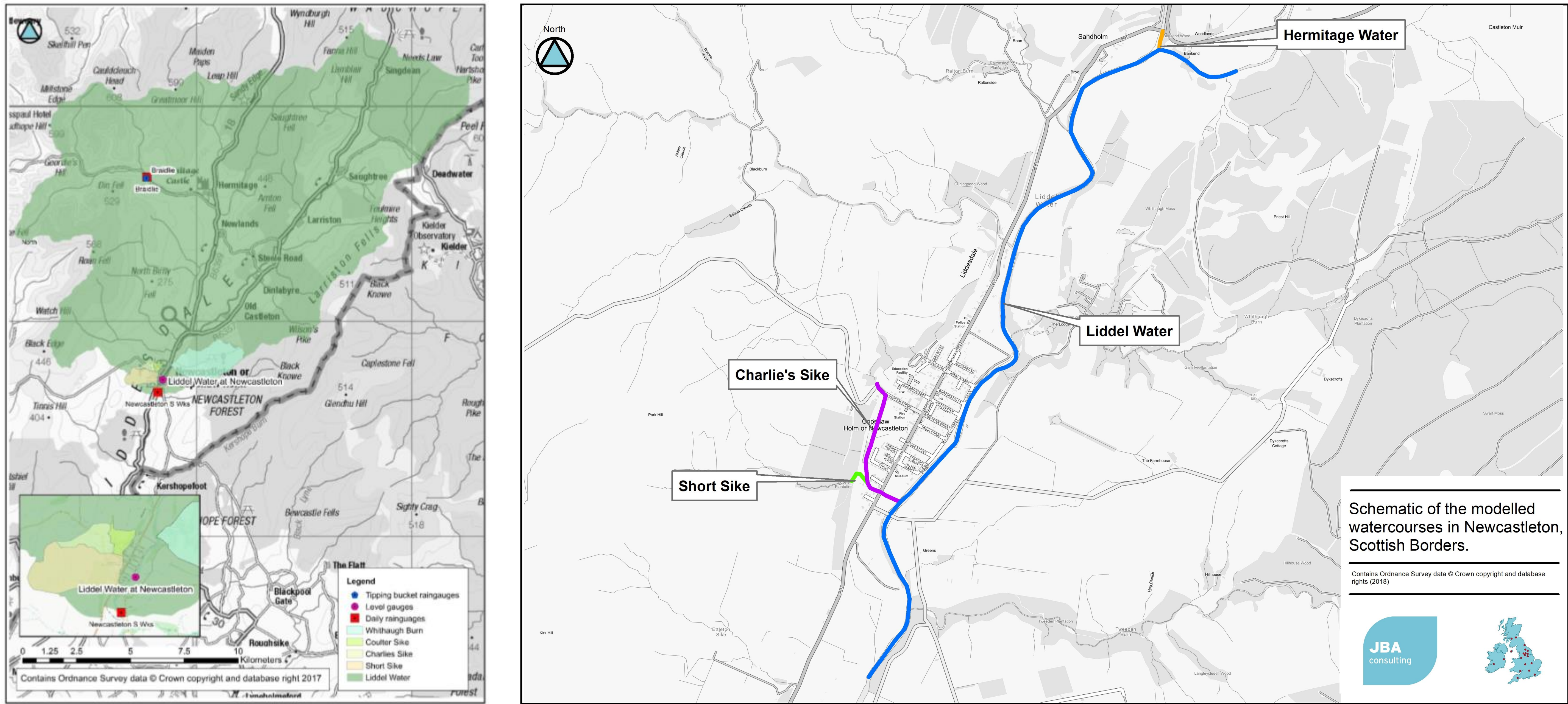
## Dec 15/ Jan 16

Storm Desmond hits, people evacuated from homes.



# Catchment & watercourses assessed

Newcastleton is primarily at risk from the Liddel Water. However, this assessment has also assessed a number of other tributaries of the Liddel Water to provide a holistic assessment of flood risk across the town. A surface water flood study is also being undertaken. The figure below shows the watercourses assessed (total modelled length of 5.6km).

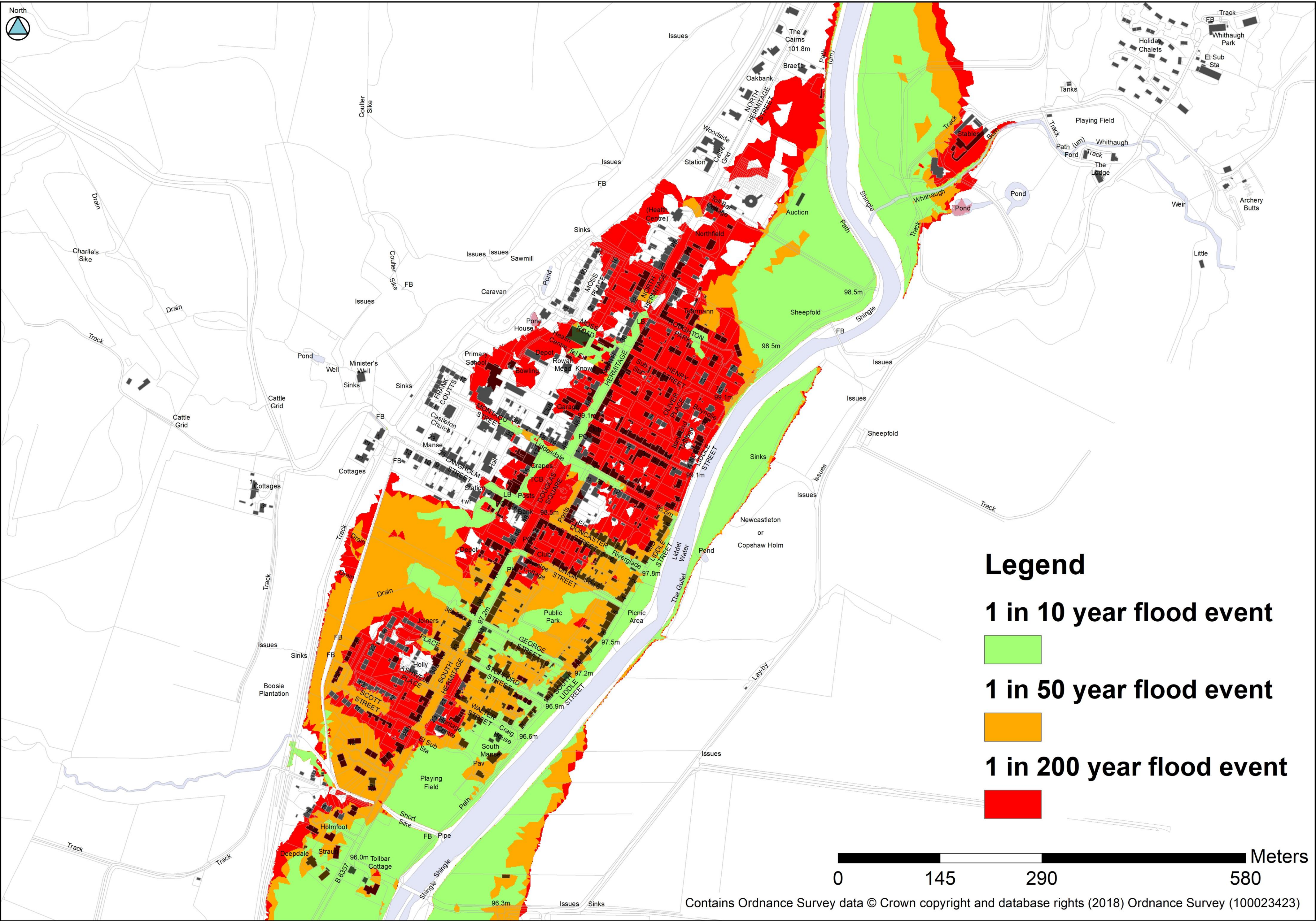


Liddel Water catchment: 208km<sup>2</sup>  
Charlie's Sike catchment area: 0.2km<sup>2</sup>  
Short Sike catchment area: 1km<sup>2</sup>

| Flood magnitude | Liddel Water Peak flow |
|-----------------|------------------------|
| 1 in 10 year    | 249 m <sup>3</sup> /s  |
| 1 in 50 year    | 345 m <sup>3</sup> /s  |
| 1 in 200 year   | 452 m <sup>3</sup> /s  |



# Flood mapping



| Property Type | Number at Risk<br>(1 in 200 year flood) |
|---------------|---|
| Residential   | 174                                     |
| Commercial    | 15                                      |

### 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 into 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 of river flooding in Newcastleton.

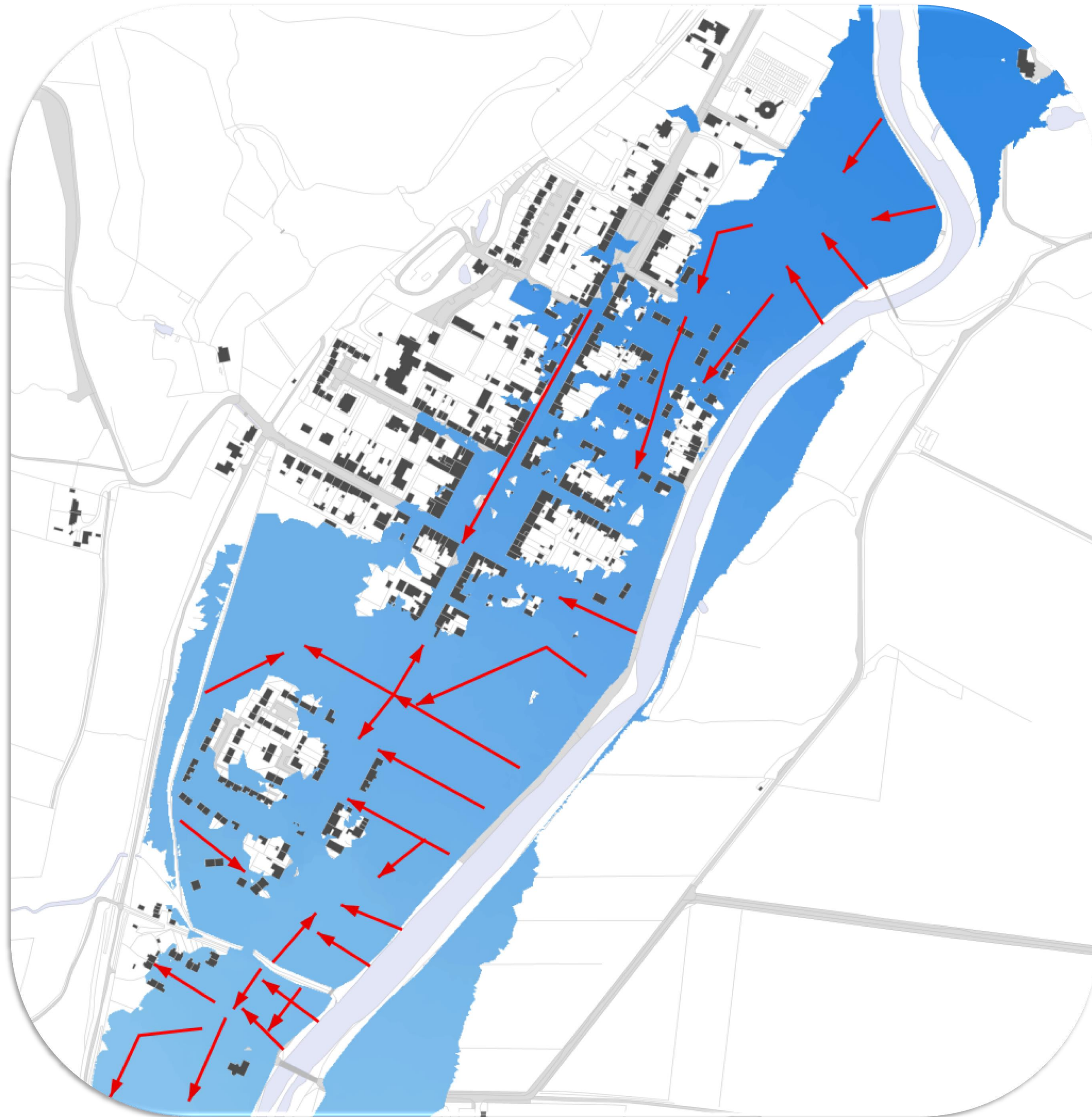
### What do the maps show?

- 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 & key constraints

Newcastleton is built on the floodplain of the Liddel Water. Out of bank flow paths, constrained key bridges and culverts and limited space between the river and properties have been identified as key constraints for flood management. The key flow paths through the town are presented below along with some features of the watercourse and floodplain.



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Many properties located on the active floodplain



Little Separation between properties and river



Constrained flow under bridges





# Options appraisal – process and long list of options

The process for selecting options assesses a wide range of possible options, which are narrowed 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 socially or politically viable.
- Flood Warning** – Unlikely to be accepted as the only flood protection measure.
- Resilience Measures**- Unlikely to be economically viable due to number of properties at risk.
- Resistance Measures**-Unlikely to be accepted as the only flood protection measure.
- Diversion**- Land surface of catchment does not promote diversion.
- Watercourse Maintenance** -Possible stretching of council resources if further maintenance proposed.
- Demountable Defences**- Option discounted due to cost relative to permanent defences.
- Storage**- Limited due to lack of suitable locations but option carried forward.
- Natural Flood Management**-Options assessed as a stand alone option for all watercourses.
- Structure Modification**- Removal or modification unlikely to bring any significant flood risk benefits.
- Direct Defences**- Feasible as a flood wall in several places on the Liddel Water and Sikes.
- Channel Modification (Liddel Water)**- Limited scope due to valley profile. Dredging of watercourse unlikely to be sustainable.
- Channel Modification (Sikes)**- Potential for floodplain creation or channel restoration on Charlie Sike.

**Least desirable option**

**Good practice and partial solutions**

**Most desirable option**



# Why not remove the gravel?

## 1) Is gravel causing a flood risk problem?

In the past gravel in some watercourses in the Border towns was intermittently removed. Furthermore, in some locations it is believed that gravel and the bed level of rivers is rising as a result of a long term build up of gravel. Whilst gravel does build up locally, these deposits are not new and the formation and erosion of gravel in Newcastleton is a **natural process** balanced over thousands of years. Indeed, the nature of gravel movement is inherently 'jerky', with gravel movement occurring particularly during high river flows.

## 2) Why is sediment in rivers important?

River sediment and their movements form **important habitats for plants and animals**. The removal of sediment can lead to a loss of, or damage to these habitats. Sediment removal can disturb the natural equilibrium of a river which can cause **serious problems with river stability**, often leading to erosion downstream.

## 3) Would removal of gravel reduce the flood risk?

While sediment removal appears a straight forward solution to flooding, evidence indicates that it does not work on large rivers moving at pace, such as many of the Borders rivers. The previous assessment in Newcastleton modelled a reduction in bed levels beneath the bridge but only lowered flood levels by 8cm for the 1 in 200 year flood. During a flood event when a river is fast flowing, the water will move material downstream and deposit in any deeper lowered sections, filling the section back to its original level very quickly. This was observed in the Bowmont Water in August 2009 when the river level was lowered by 1m; it was refilled after a flood by September.

Any additional conveyance created by a lowered river channel is therefore **very quickly lost**. For this reason it is **not considered to be a sustainable option**; expensive **repeat works** are required to maintain channel levels and additional bank stabilisation works may also be required. Furthermore, lowering the bed level on the Liddel would require a significant and **regular removal of sediment via the local road network**.

It is important to note that any sediment removal carried out in watercourses requires **regulatory legislation** enforced by SEPA and would require sufficient evidence to support any such applications for removal.

## 4) What else could be done?

We have looked at a number of other options to mitigate the flood risks on the Liddel Water and the Sikes, including the options for channel modification and restoration to improve the conveyance and flow capacity within these channels. Furthermore, natural flood management options have been investigated that may help to manage the sediment transport into the downstream reaches. Further modelling is required to investigate the benefits of these options.

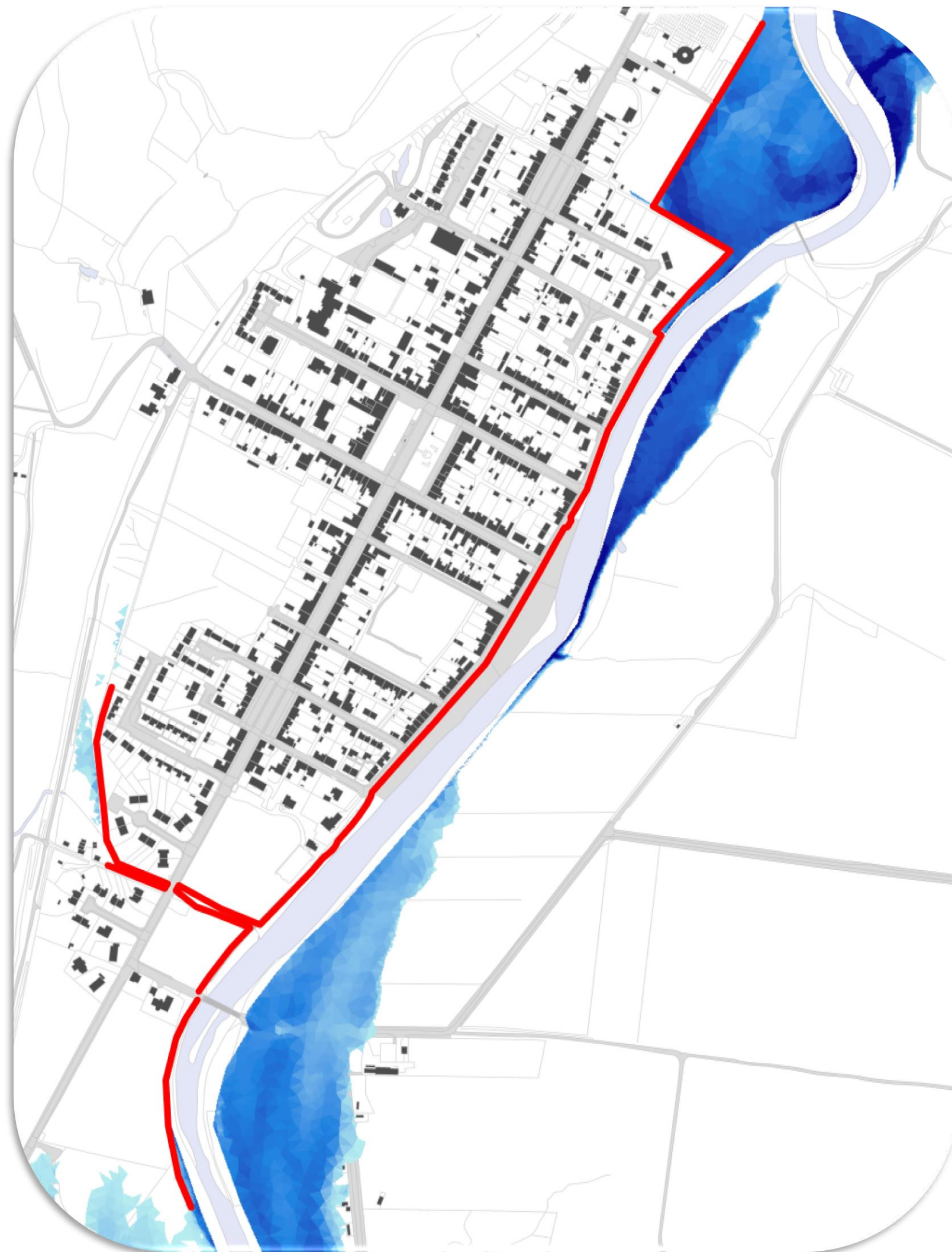




# Newcastleton – Short Listed Options

## Option 1: Construction of a suite of direct defences across Newcastleton to provide 1 in 200 year Standard of Protection

- Provision of flood walls to provide a 1 in 200 year standard of protection
- Average wall height of 1.3 m
- Estimated cost £5.2
- Estimated damage avoided £8.4m



1 in 200 year event

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## Option 2: Construction of a suite of direct defences across Newcastleton with reduced aesthetic impact (lower defence heights)

- Restrained flood walls impeding key overland flow paths but lower and variable standard of protection
- Free access to green space
- Reduced aesthetic impact on the village
- Lower wall heights (<1m)
- Estimated Cost £2.7m
- Estimated Damages Avoided £7.4m



1 in 50 year event

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# Newcastleton– Short Listed Options

**Option 3:  
Charlie's Sike Channel Restoration.  
Provides a 1 in 200 year SoP in the  
Sikes but must be combined with the  
Liddel Water options for full protection.**

- This option consists of naturalisation and restoration of the Charlie's Sike channel.
- The aim is to move the channel away from the property boundaries, naturalise channel, increase the overbank storage to contain flood volume before properties are impacted.
- Estimated cost £0.7m
- Estimated damage avoided £0.2m



**Typical example of a diversion channel**

**Option 4:  
Charlie's Sike Floodplain Creation.  
Provides a 1 in 200 year SoP in the  
Sikes but must be combined with the  
Liddel Water options for full protection.**

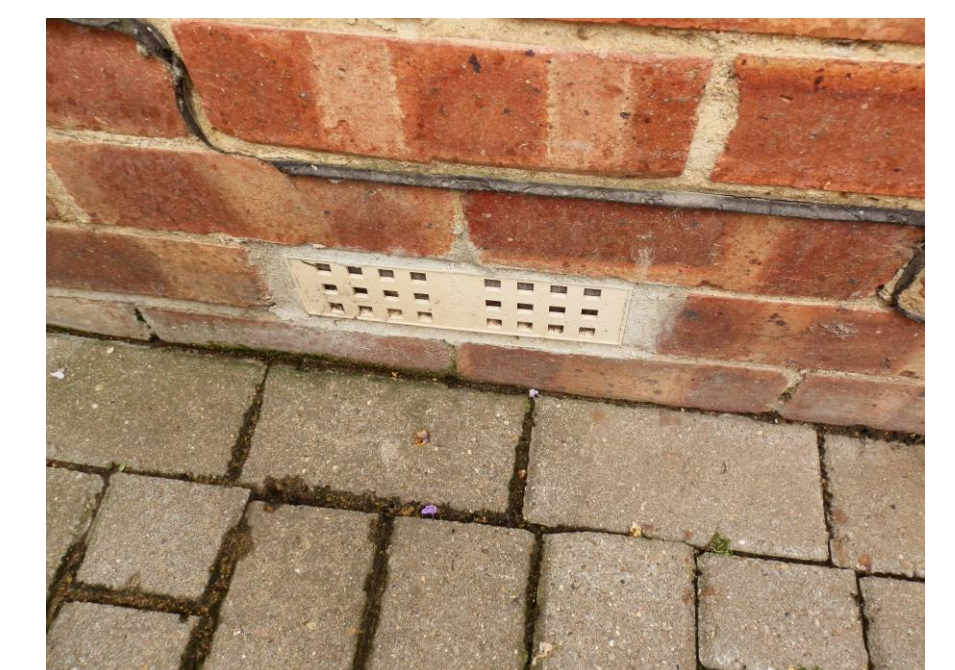
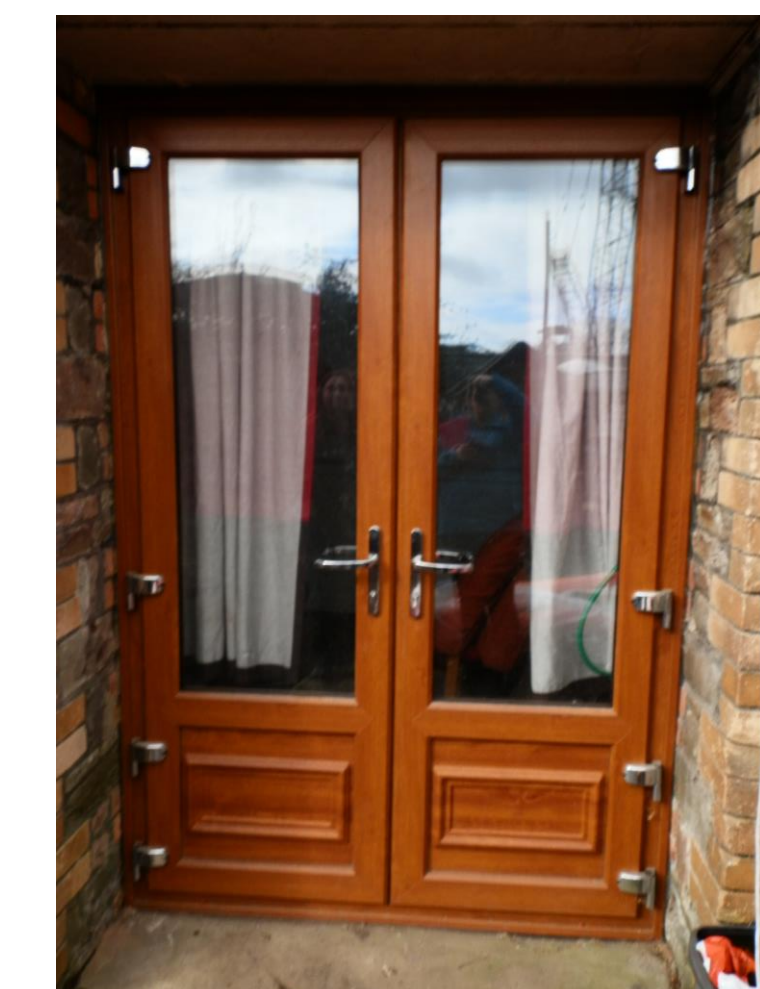
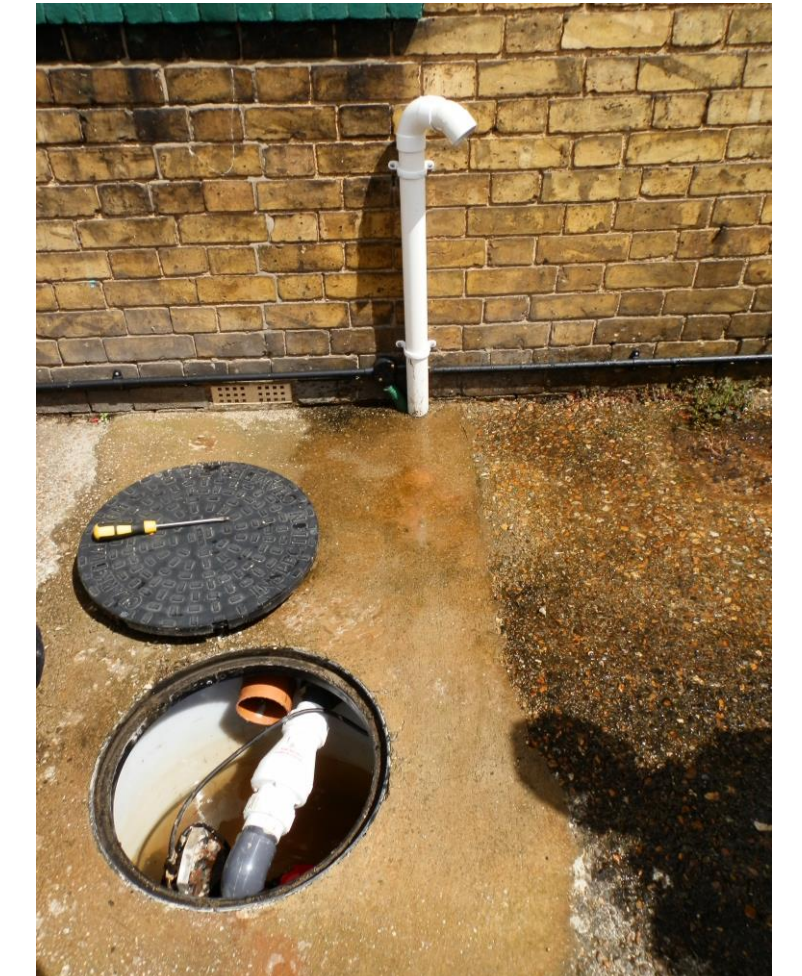
- This option creates floodplain above the 1 in 2 year water level on the North bank of the Charlie Sike to contain flood volumes before properties are impacted.
- Estimated cost £0.30m
- Estimated damage avoided £0.2m



**Typical example of channel widening**

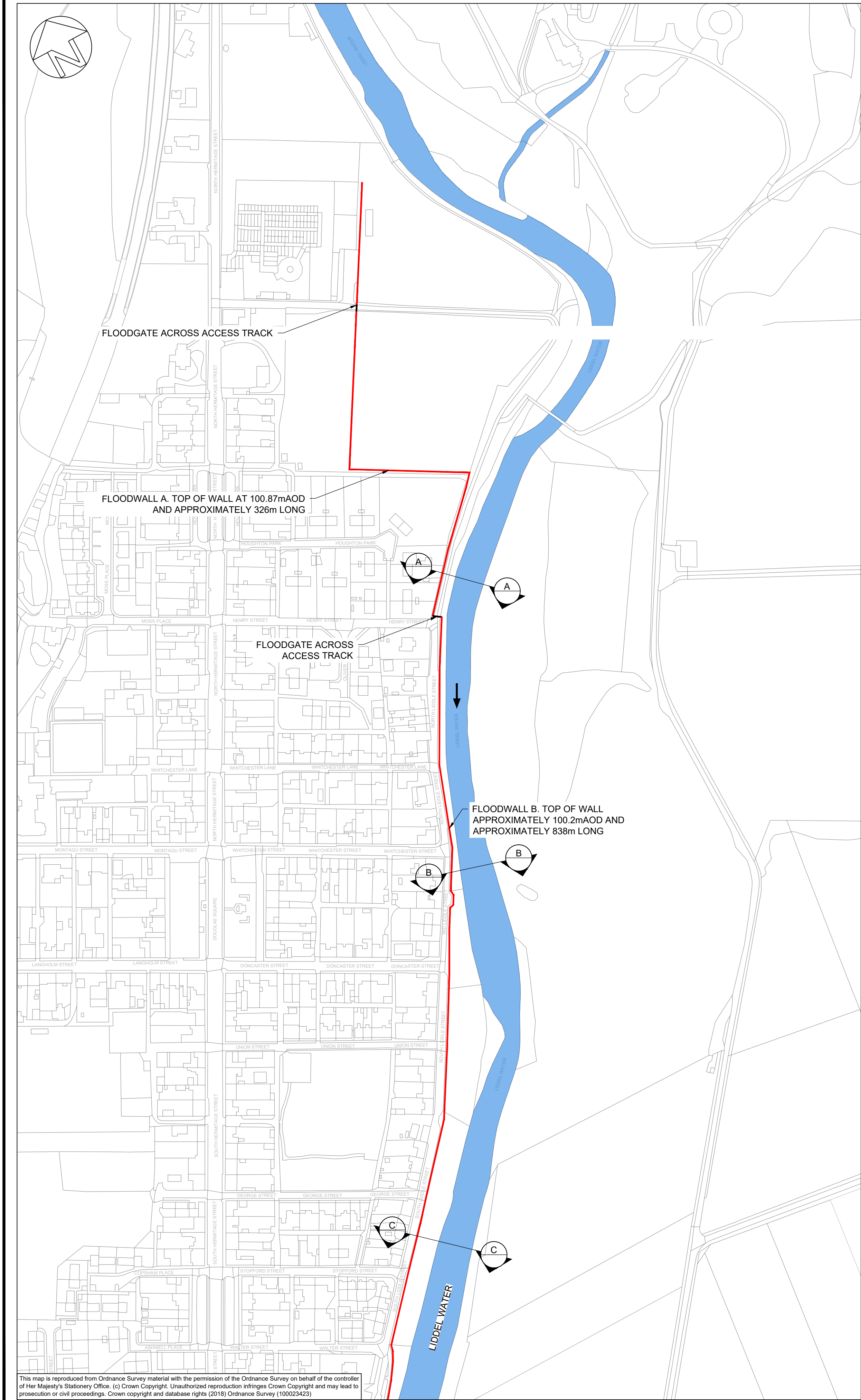
**Option 5:  
Property Level Protection (PLP)**

- Installation of property level protection measures for properties with residual risk.
- The number of properties expected to benefit from PLP is 126.



**Typical example of PLP measures**



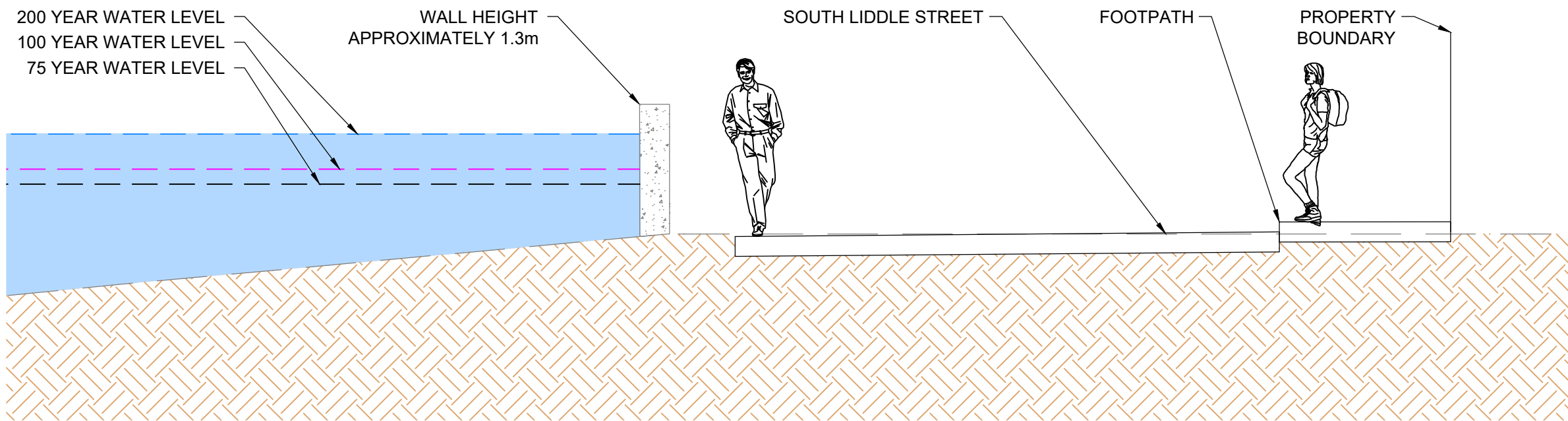
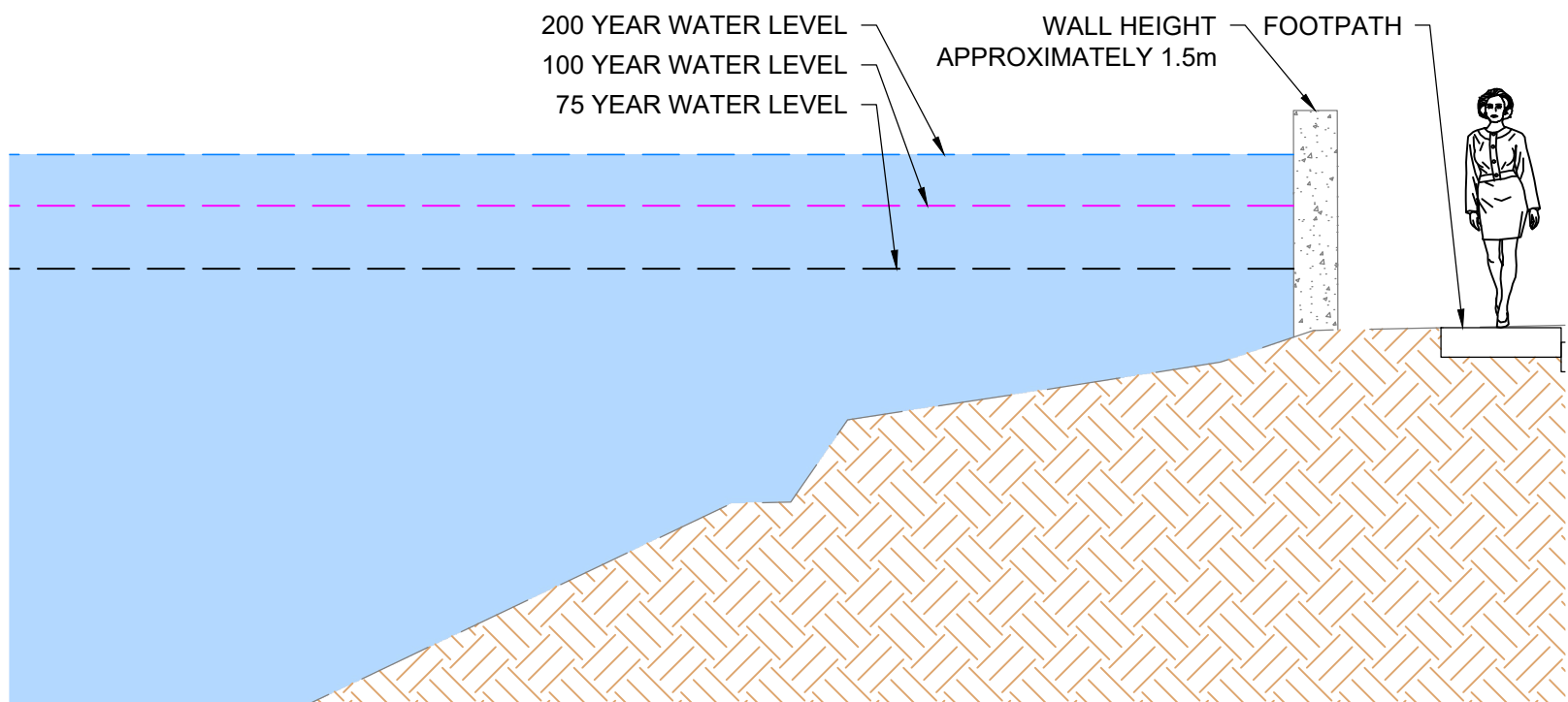
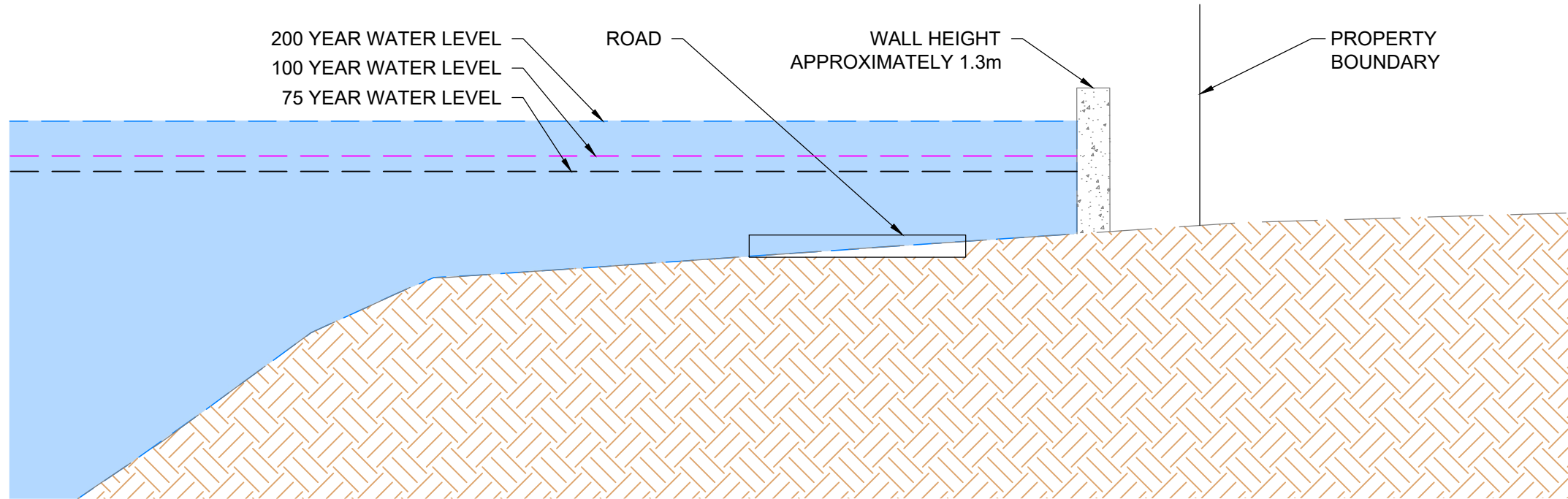


# Newcastleton

## Option 1: Liddel Water

### New suite of flood walls to provide up to a 200 year Standard of Protection.

#### Drawing 1 of 2



- OPTION 1 SUMMARY.** This option aims to provide a high standard of protection through the installation of a number of flood walls in the populated areas throughout Newcastleton. The work includes the following: (All walls include a 300mm freeboard)
- Construct flood wall along rear boundaries of properties along Houghton Park for a distance of approximately 326m, to a maximum level of 100.87m AOD (maximum height of 1.3m).
  - Installation of two flood gates along access track at the end of North Liddle Street
  - Construct flood wall along N Liddle Street, S Liddle Street and footpath until it ties in with parapet on B6357 bridge for approximately 838m, to a maximum level of 100.2m AOD (maximum height of 1.3m).
  - Construct flood wall from B6357 along Liddel Water's west bank to the stone arch bridge for approximately 171m, to a maximum level of 97.00m AOD (maximum height of 1.3m)
  - Construct flood wall from stone arch bridge along Liddel Water's west bank for approximately 171m, to a maximum level of 96.92m AOD (maximum height of 1.3m)
  - Construct flood wall along Charlie Short Sike's south bank from the parapet of the B6357 bridge for approximately 63m, to a maximum level of 97.55m AOD (maximum height of 1.2m).
  - Construct flood wall along the north bank of Charlie Short Sike on rear boundaries of properties on Buccleuch Terrace for approximately 243m, to a maximum level of 97.55m AOD (maximum height of 1.1m).
- Drawing to be read in conjunction with the following:-  
AEM-JBAU-NC-LW-IM-C-1401

| LEGEND |                      |
|--------|----------------------|
|        | WALL DEFENCE         |
|        | EXISTING WATERCOURSE |

| Comments                    |      |       |          |         |          |
|-----------------------------|------|-------|----------|---------|----------|
| Rev.:                       | Date | Drawn | Designed | Checked | Approved |
| Client Approval             |      |       |          |         |          |
| A - Approved                |      |       |          |         |          |
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| Suitable for Coordination   |      |       |          |         | S1       |

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Project

Borders Flood Studies

Title


Newcastleton  
Liddle Water: Option 1  
New Suite of Direct Defences

Client

for

M  
MOTT  
MACDONALD

M  
MOTT  
MACDONALD



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Scale

As Shown @ A1

|           |             |          |
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| Designed: | M. Mcmillan | 22/07/18 |
| Checked:  | M. McMillan | 12/09/18 |
| Approved: | A. Pettit   | 13/09/18 |

Project Number:

2017s5526

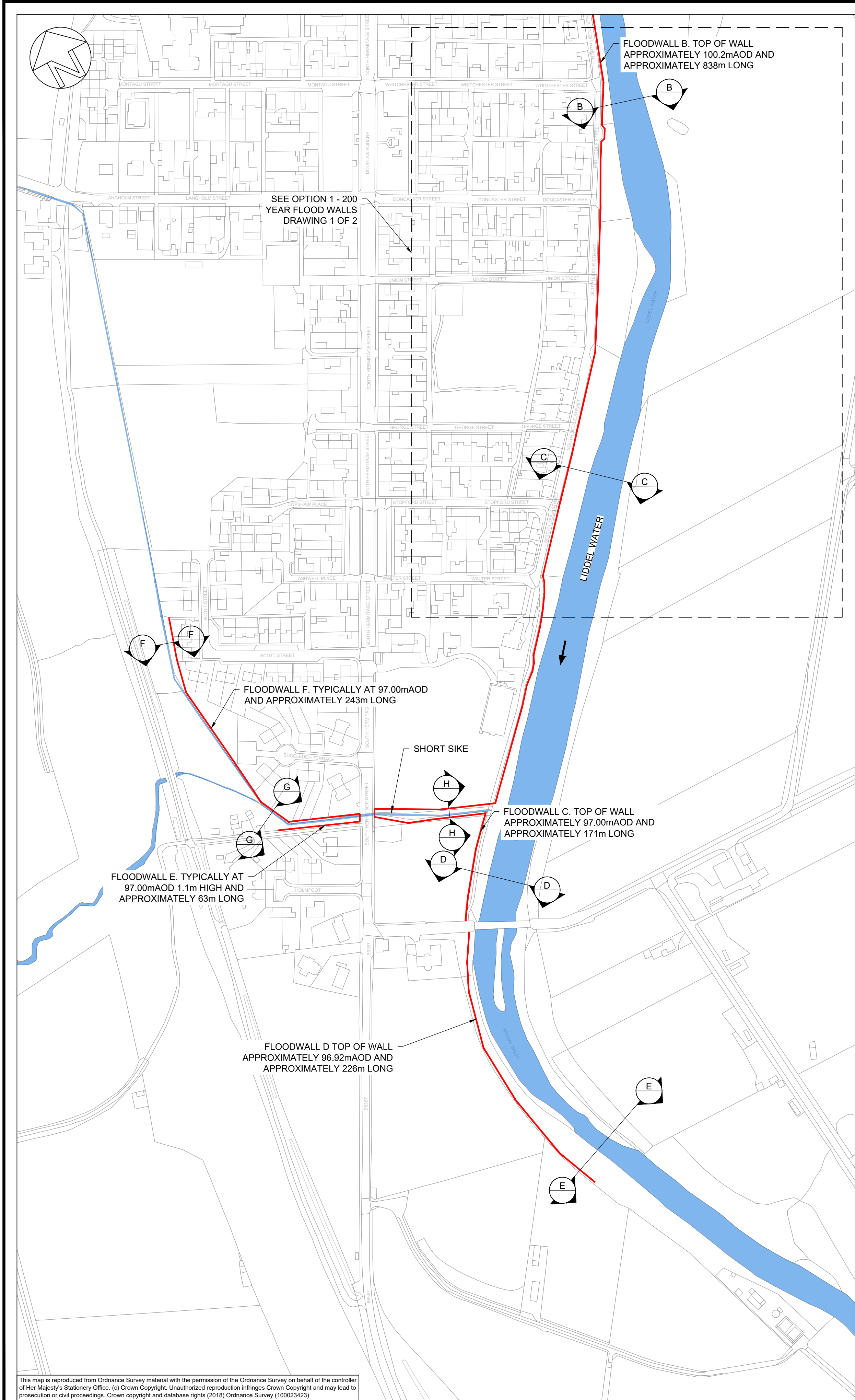
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AEM-JBAU-NC-CS-IM-C-1400

Revision

P01



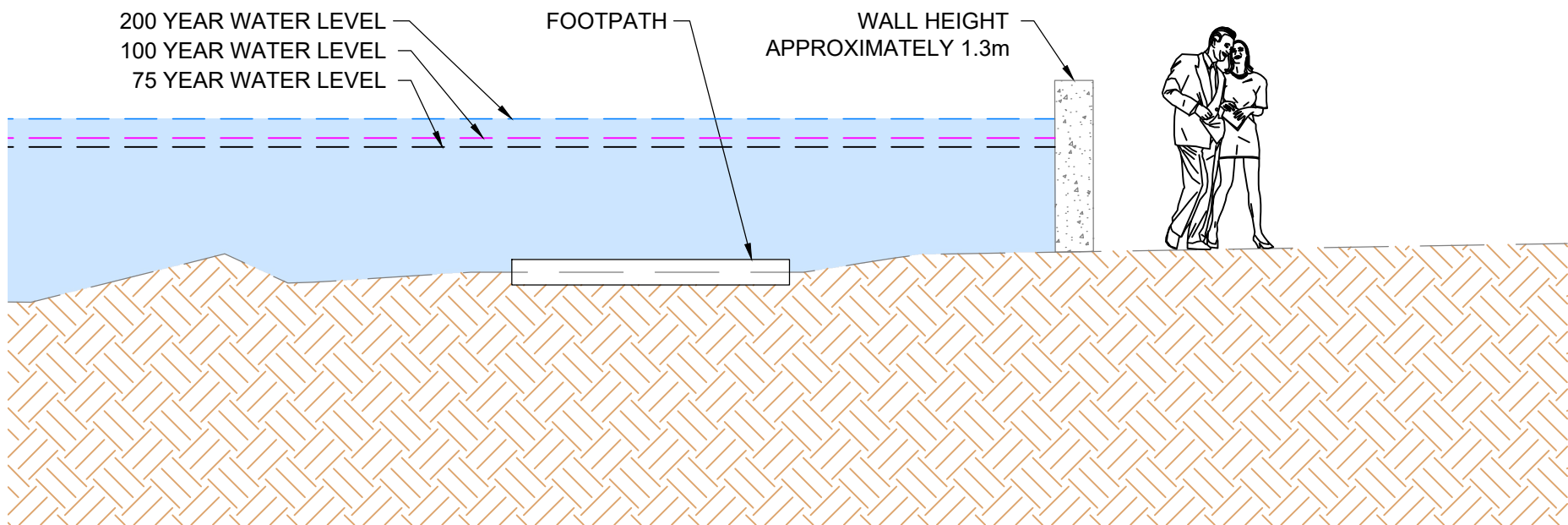


PLAN  
1:2000

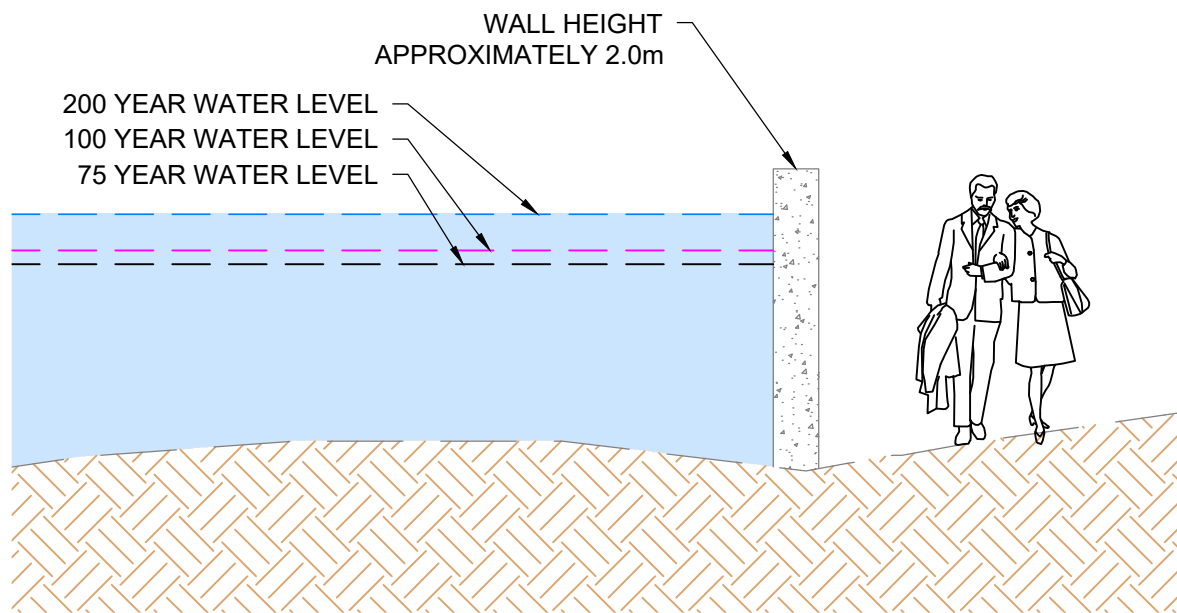
# Newcastleton

## Option 1: Liddel Water

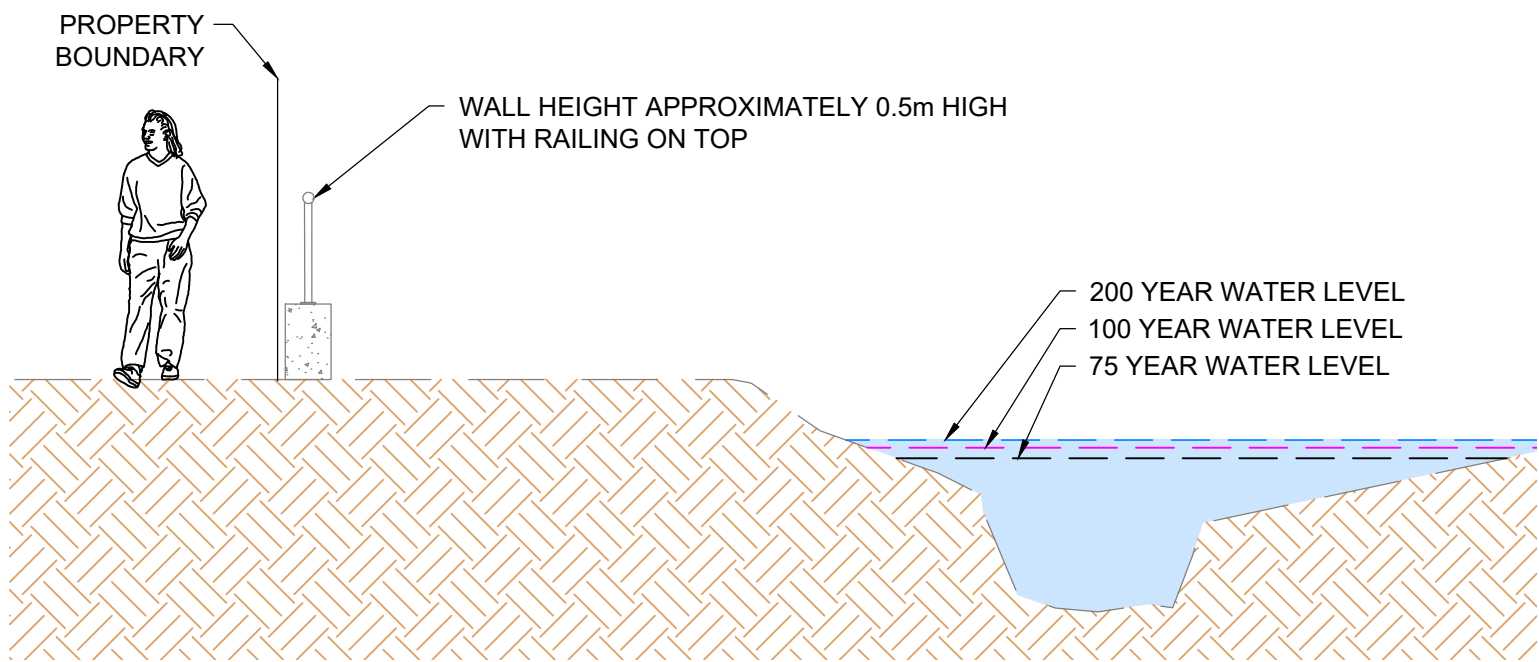
### New suite of flood walls to provide up to a 200 year Standard of Protection. Drawing 2 of 2



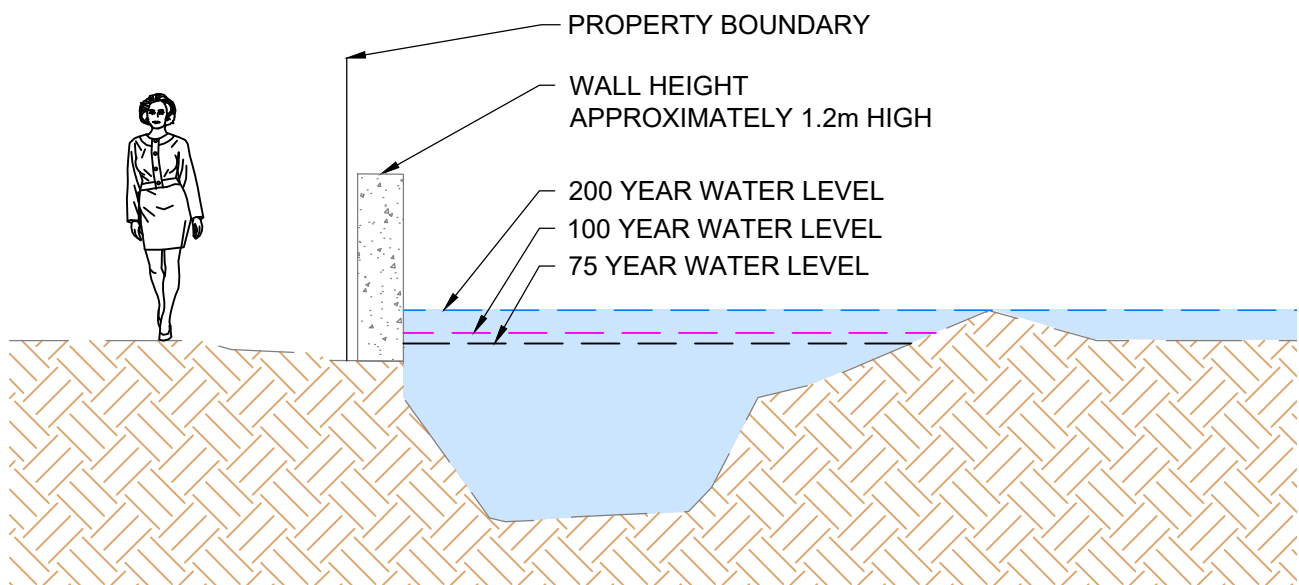
SECTION D-D



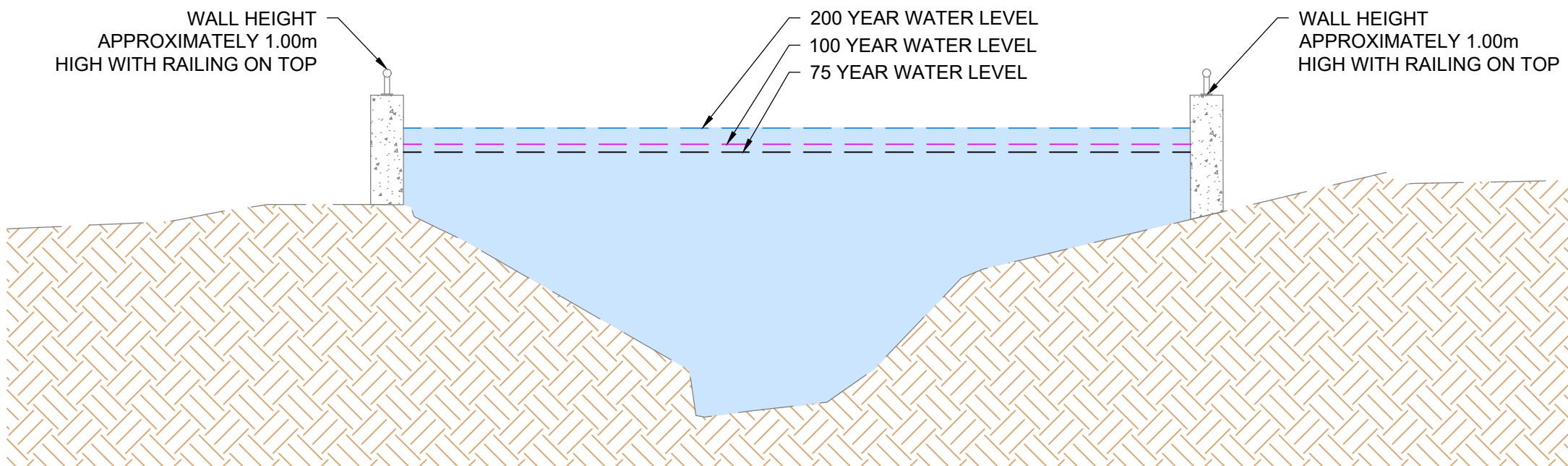
SECTION E-E



SECTION F-F



SECTION G-G



SECTION H-H

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| LEGEND |                      |
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|        | WALL DEFENCE         |
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Project



Borders Flood Studies

Title

Newcastleton  
Liddel Water: Option 1  
New Suite of Direct Defences

Client

for



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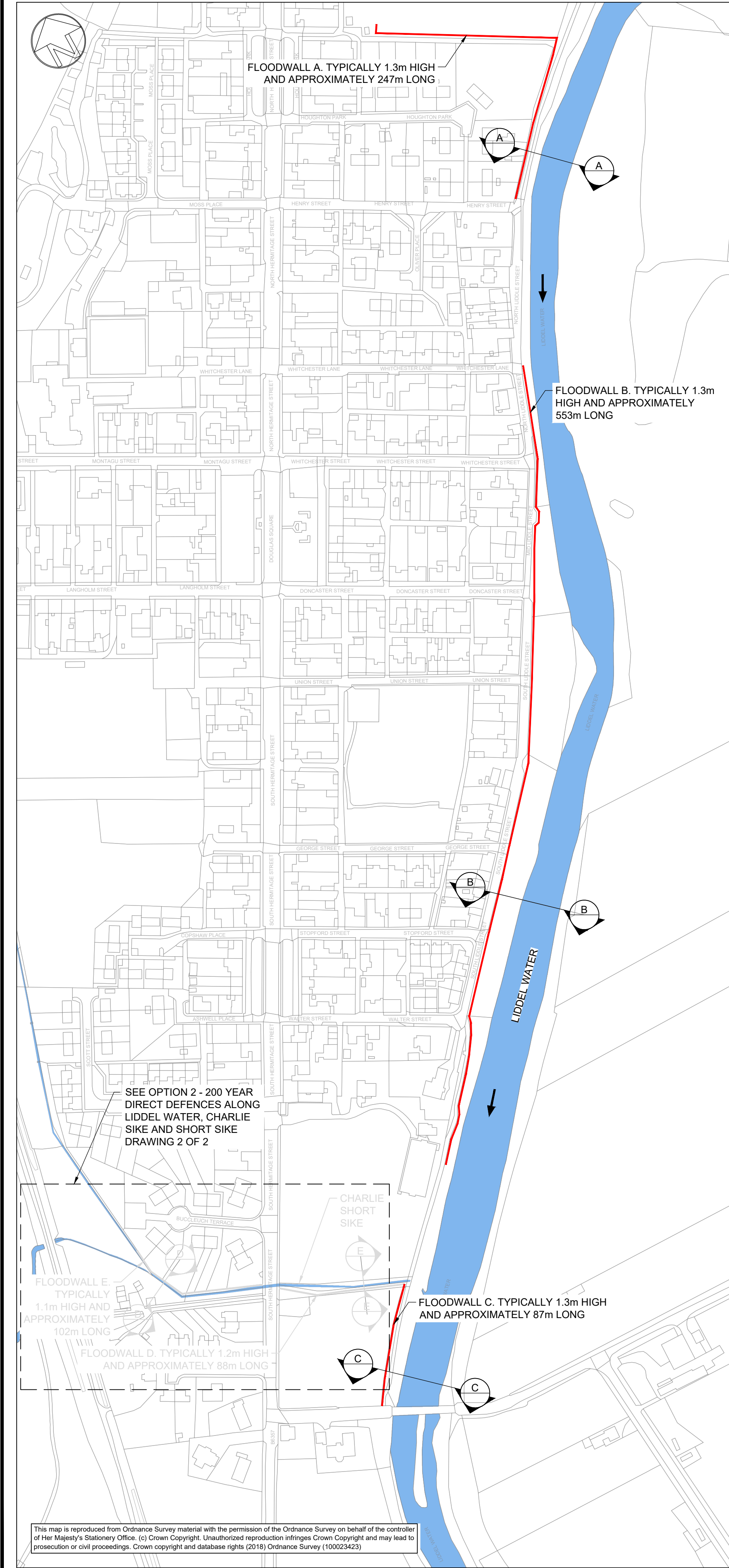
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Revision

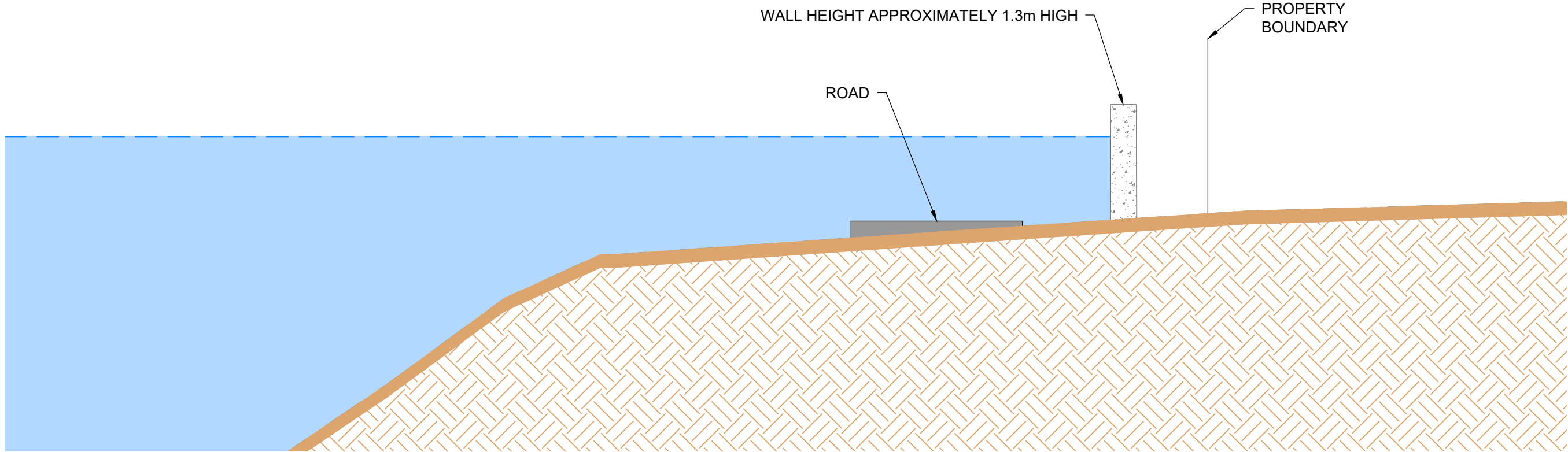
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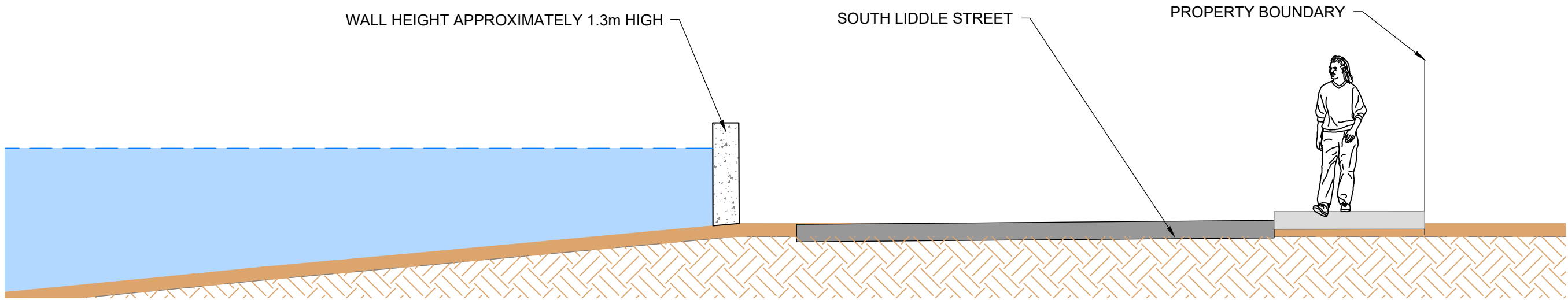


PLAN  
1:2000

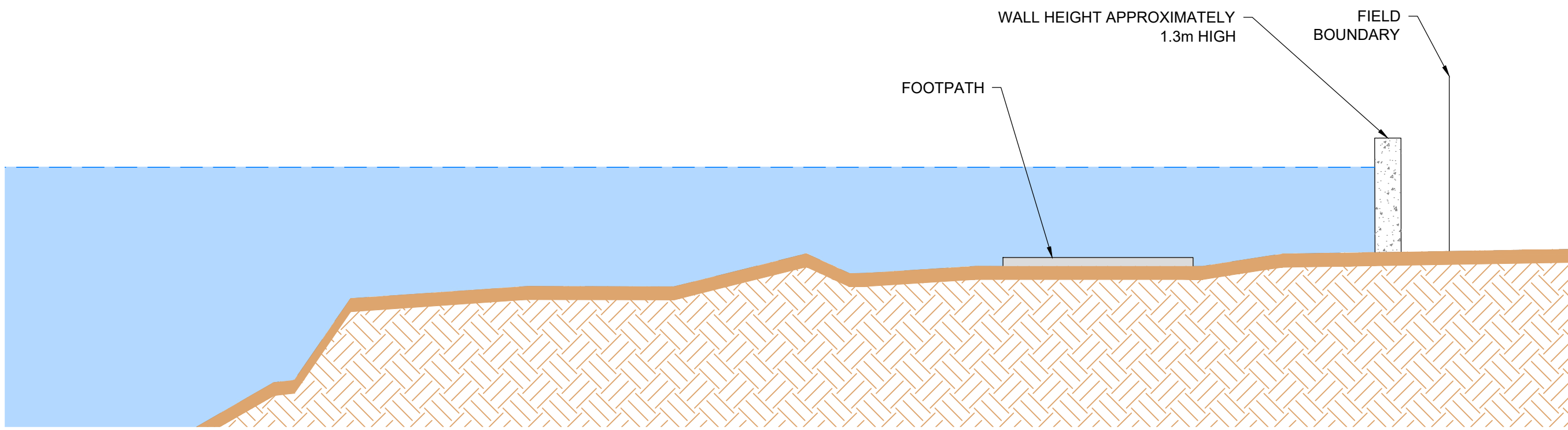
Newcastleton  
Option 2: Liddel Water  
Suite of flood walls with lower  
visual impact, but lower standard  
of protection. Drawing 1 of 2



SECTION A-A  
1:50



SECTION B-B  
1:50



SECTION C-C  
1:50


- OPTION 1 SUMMARY. This option aims to provide a high standard of protection through the installation of a number of flood walls in the populated areas of Newcastleton. The work includes the following: (All walls include a 300mm freeboard)
- Construct flood wall along rear boundaries of properties along Houghton Park for a distance of approximately 247m, to a maximum height of 100.87mAOD (maximum height of 1.3m).
  - Construct flood wall along N Liddle Street, S Liddle Street and footpath for approximately 553m, to a maximum height of 99.42mAOD (maximum height of 1.3m).
  - Construct flood wall along Liddle Water's west bank between Short Sike confluence and the stone arch bridge for approximately 87m, to a maximum height of 96.92mAOD (maximum height of 1.3m)
  - Construct flood wall along Short Sike's south bank between the Liddel Water and the B6357 for approximately 88m, to a maximum height of 96.96mAOD (maximum height of 1.2m).
  - Construct flood wall along the north bank of Charlie Sike on rear boundaries of properties on Buccleuch Terrace for approximately 102m, to a maximum height of 97.31mAOD (maximum height of 1.1m).
- Note - Defence components 4/5 are included in Drawing No. 2 (AEM-JBAU-NC-LW-IM-C-1101)

| LEGEND |                      |
|--------|----------------------|
|        | WALL DEFENCE         |
|        | 200 YEAR WATER LEVEL |
|        | EXISTING WATERCOURSE |

| Comments                    |      |       |          |         |          |
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| Rev.:                       | Date | Drawn | Designed | Checked | Approved |
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| C - Do Not Use              |      |       |          |         |          |
| Purpose of Issue            |      |       |          |         | Status   |
| Suitable for Coordination   |      |       |          |         | S1       |

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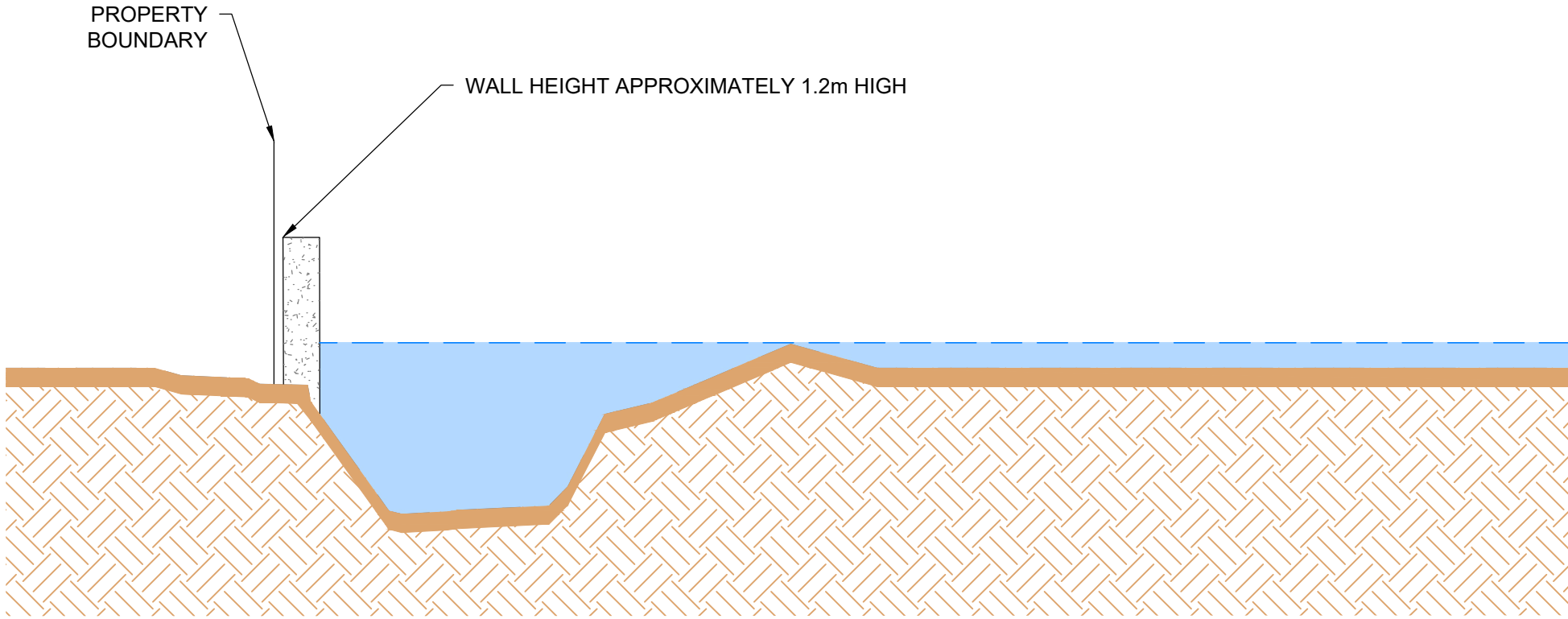
|  |               |   |          |
|--|---------------|---|----------|
| Project  |               | Borders Flood Studies   |          |
| Title  |               | Newcastleton<br>Liddel Water: Option 2<br>New Suite of Direct Defences to Provide 200 year SOP  |          |
| Client   |               | <div><div><div>M</div><div>M</div><div>MOTT<br/>MACDONALD</div></div><div>Scottish<br/>Borders<br/>COUNCIL</div></div> |          |
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|  |               | Checked: A. Pettit  | 30/07/18 |
|  |               | Approved:   |          |
| Project Number: 2017s5526  |               |   |          |
| Drawing Number   |               | Revision  |          |
| AEM-JBAU-NC-CS-IM-C-1100   |               | P01   |          |



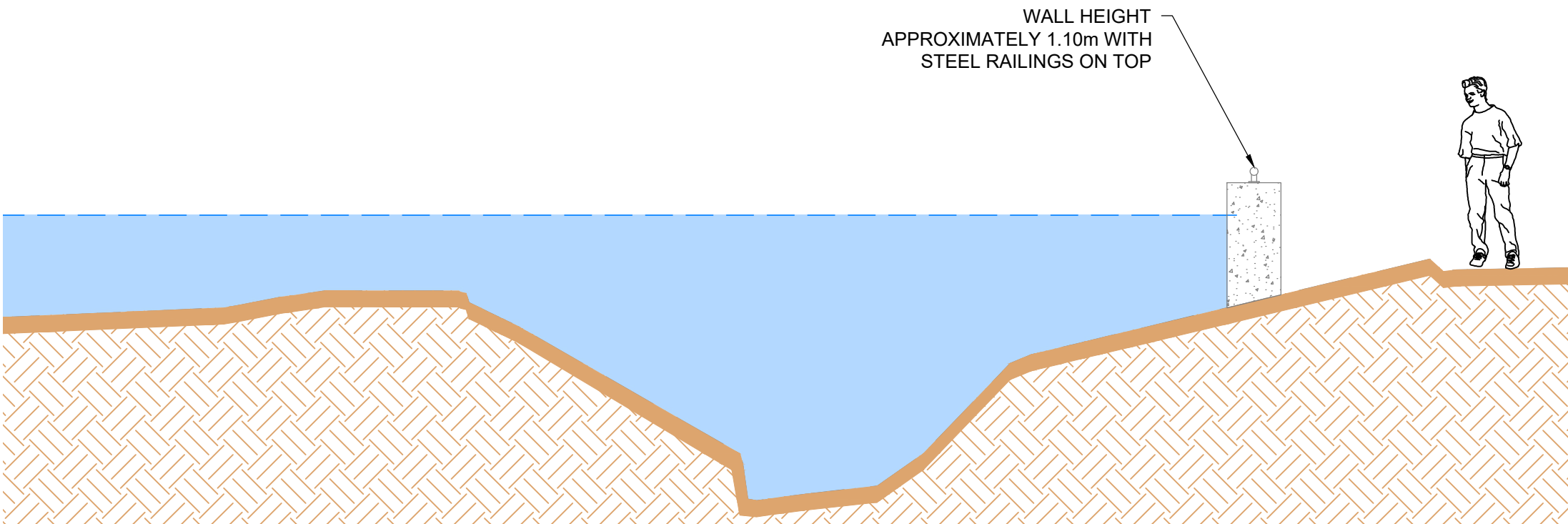


PLAN  
1:2000

Newcastleton  
Option 2: Liddel Water  
Suite of flood walls with lower  
visual impact, but lower standard  
of protection. Drawing 2 of 2



SECTION D-D  
1:50



SECTION E-E  
1:50



- OPTION 1 SUMMARY. This option aims to provide a high standard of protection through the installation of a number of flood walls in the populated areas of Newcastleton.
- The work includes the following: (All walls include a 300mm freeboard)
- Construct flood wall along rear boundaries of properties along Houghton Park for a distance of approximately 247m, to a maximum height of 100.87m AOD (maximum height of 1.3m).
  - Construct flood wall along N Liddle Street, S Liddle Street and footpath for approximately 553m, to a maximum height of 99.42m AOD (maximum height of 1.3m).
  - Construct flood wall along Liddle Water's west bank between Short Sike confluence and the stone arch bridge for approximately 87m, to a maximum height of 96.92m AOD (maximum height of 1.3m).
  - Construct flood wall along Short Sike's south bank between the Liddel Water and the B6357 for approximately 88m, to a maximum height of 96.96m AOD (maximum height of 1.2m).
  - Construct flood wall along the north bank of Charles Sike on rear boundaries of properties on Buccleuch Terrace for approximately 102m, to a maximum height of 97.31m AOD (maximum height of 1.1m).
- Note - Defence components 1-3 are included in Drawing No. 1 (AEM-JBAU-NC-LW-IM-C-1100)

| LEGEND |                      |
|--------|----------------------|
|        | WALL DEFENCE         |
|        | 200 YEAR WATER LEVEL |
|        | EXISTING WATERCOURSE |

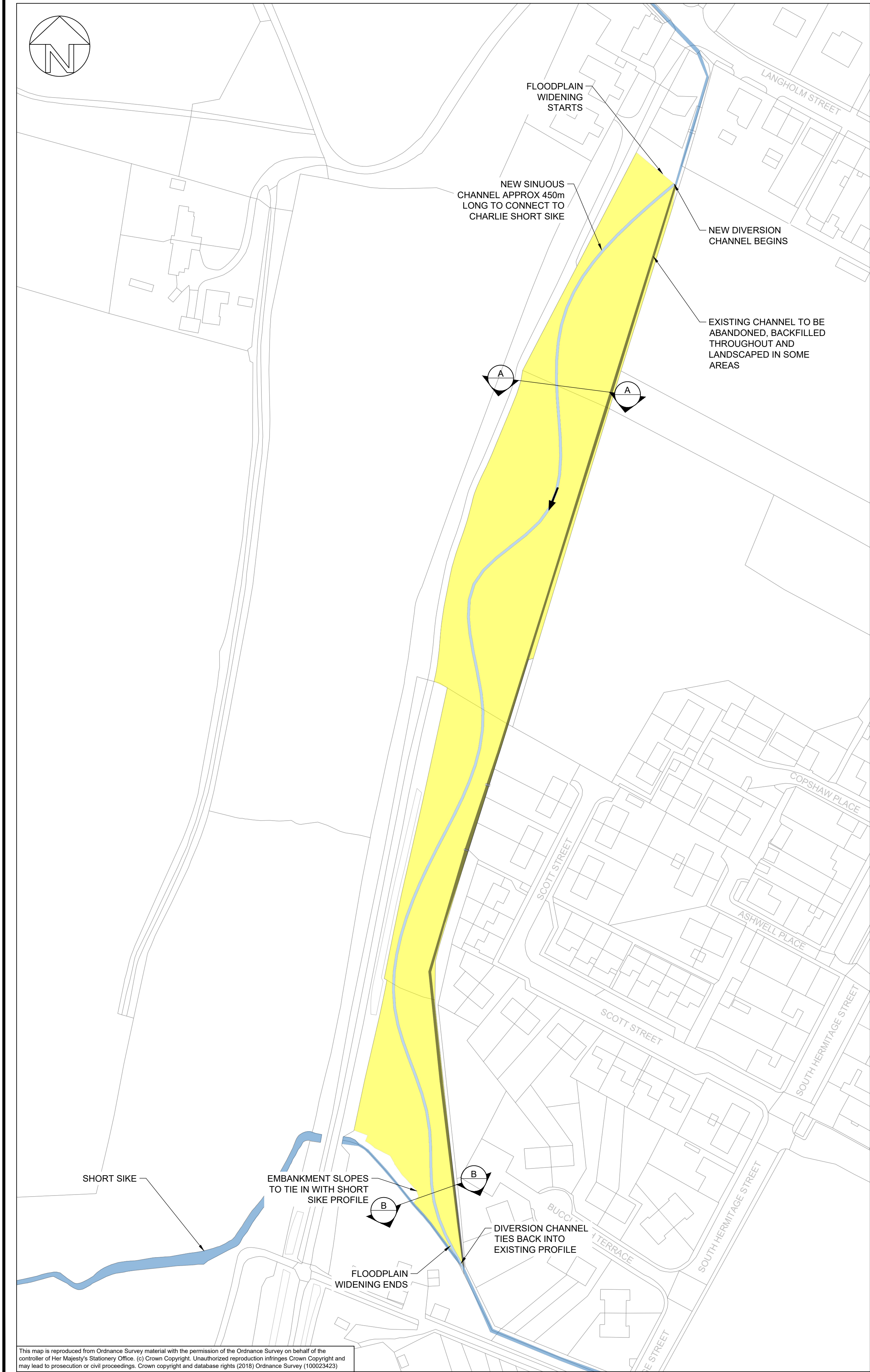
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|--|-------------|---|--|--------|------------|----------|-----------|-------------|----------|----------|-----------|----------|-----------|--|--|
| Project  |             | Borders Flood Studies   |  |        |            |          |           |             |          |          |           |          |           |  |  |
| Title  |             | Newcastleton<br>Liddel Water: Option 2<br>New Suite of Direct Defences to Provide 200 year SoP  |  |        |            |          |           |             |          |          |           |          |           |  |  |
| Client   |             | for   |  |        |            |          |           |             |          |          |           |          |           |  |  |
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| Scale  |             | <table><tr><td>Drawn:</td><td>S. Brandon</td><td>27/07/18</td></tr><tr><td>Designed:</td><td>M. Mcmillan</td><td>22/07/18</td></tr><tr><td>Checked:</td><td>A. Pettit</td><td>30/07/18</td></tr><tr><td>Approved:</td><td></td><td></td></tr></table> |  | Drawn: | S. Brandon | 27/07/18 | Designed: | M. Mcmillan | 22/07/18 | Checked: | A. Pettit | 30/07/18 | Approved: |  |  |
| Drawn:   | S. Brandon  | 27/07/18  |  |        |            |          |           |             |          |          |           |          |           |  |  |
| Designed:  | M. Mcmillan | 22/07/18  |  |        |            |          |           |             |          |          |           |          |           |  |  |
| Checked:   | A. Pettit   | 30/07/18  |  |        |            |          |           |             |          |          |           |          |           |  |  |
| Approved:  |             |   |  |        |            |          |           |             |          |          |           |          |           |  |  |
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| Project Number:  |             | 2017s5526   |  |        |            |          |           |             |          |          |           |          |           |  |  |
| Drawing Number   |             | AEM-JBAU-NC-CS-IM-C-1101  |  |        |            |          |           |             |          |          |           |          |           |  |  |
|  |             | Revision  |  |        |            |          |           |             |          |          |           |          |           |  |  |
|  |             | P01   |  |        |            |          |           |             |          |          |           |          |           |  |  |



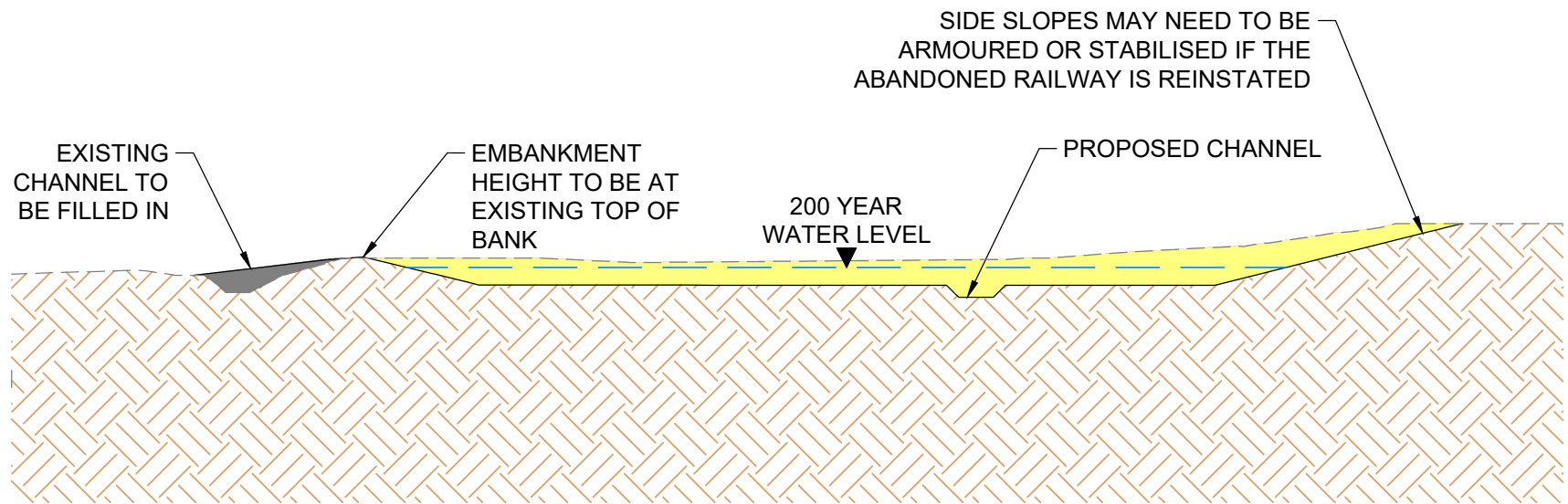


PLAN  
1:1000

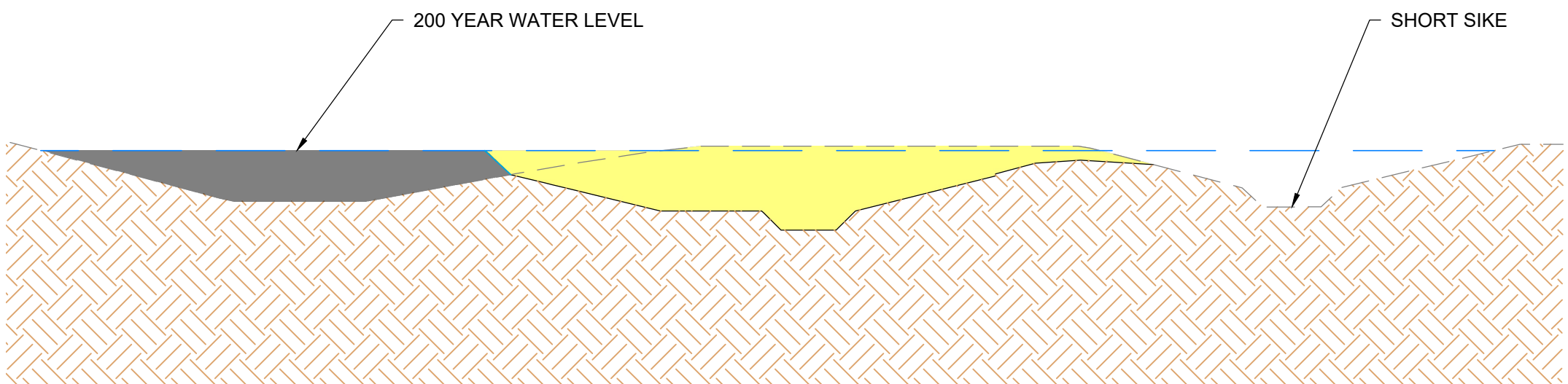
## Newcastleton

### Option 3: Charlies Sike Restoration

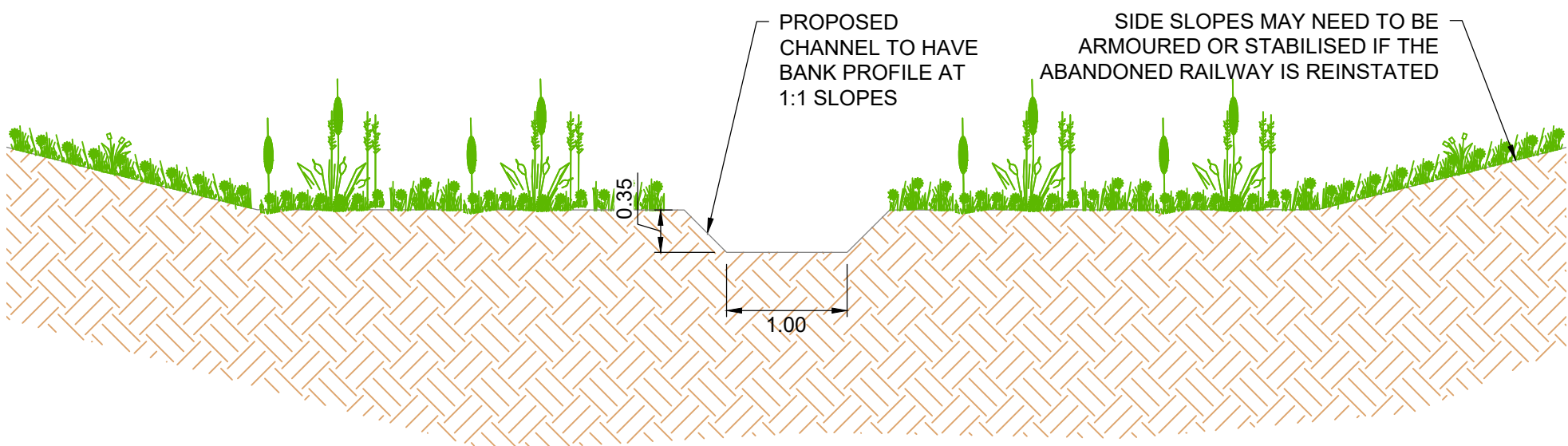
### New Open Channel & Floodplain to provide 200 year SOP



SECTION A-A  
1:200



SECTION B-B  
1:100



TYPICAL CROSS-SECTION THROUGH NEW CHANNEL  
1:50

OPTION 3 SUMMARY. The option would consist of re-sectioning of the channel of Charlies Sike and the green space along its bank to re-naturalise the channel. In the past the river bed was artificially constructed to align to a straight narrow ditch to coincide with the property boundaries. Naturalisation aims to restore rivers to a state closer to their original course by removing hard engineering and other restrictive structures. In this case, meandering straightened sections and re-grading of banks is proposed to incorporate floodplain volume for flood storage within the banks to reduce flood risk on properties.

#### LEGEND

|  |                       |
|--|-----------------------|
|  | EXCAVATED CHANNEL     |
|  | EXISTING WATERCOURSE  |
|  | PROPOSED WATERCOURSE  |
|  | ABANDONED WATERCOURSE |
|  | EXISTING GROUND       |
|  | PROPOSED GROUND       |
|  | 200 YEAR WATER LEVEL  |

| Rev.:                       | Date | Drawn | Designed | Checked | Approved |
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| Purpose of Issue            |      |       |          |         | Status   |
| Suitable for Coordination   |      |       |          |         | S1       |

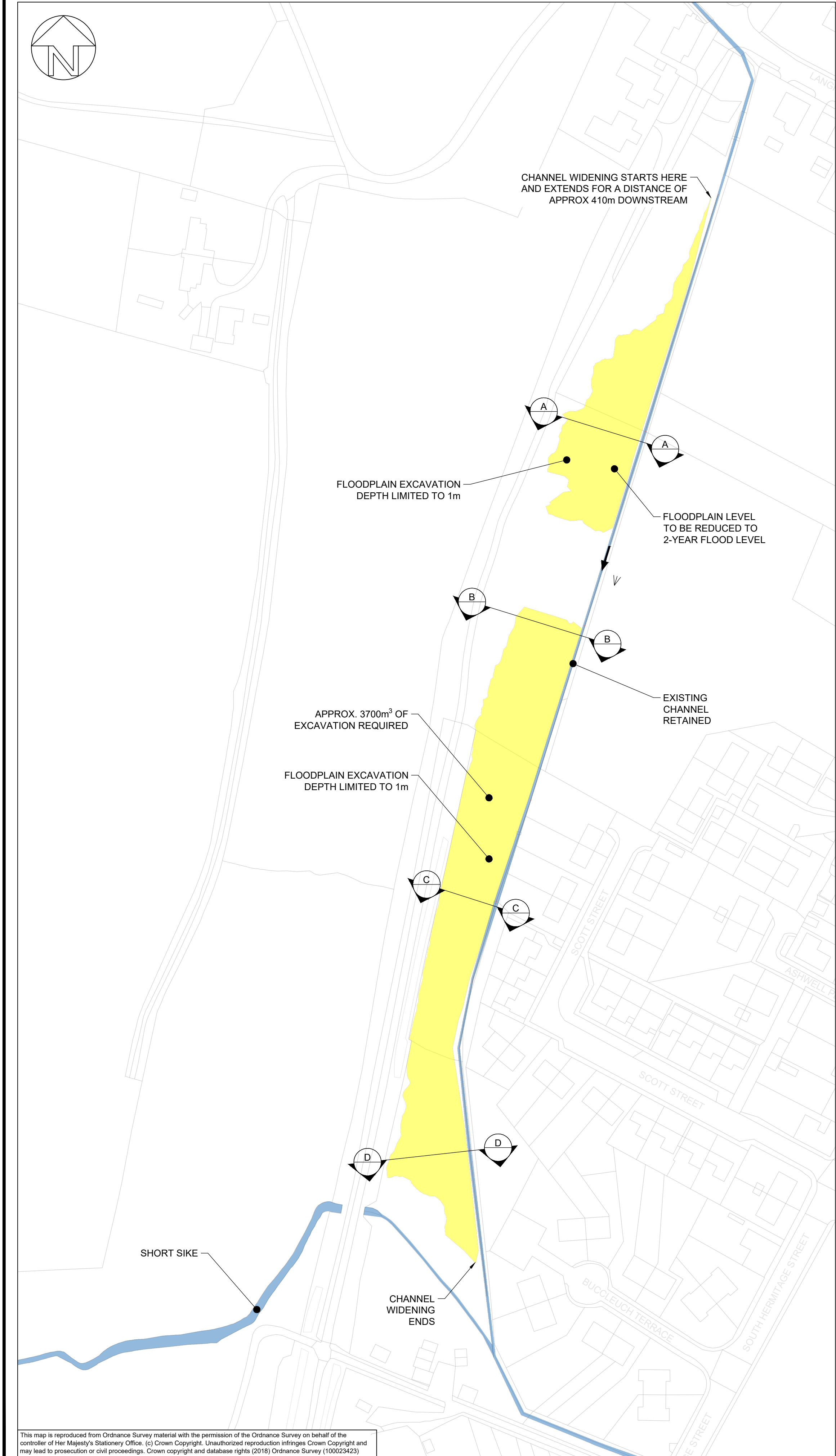
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|         |   |
|---------|---|
| Project | Borders Flood Studies   |
| Title   | Newcastleton<br>Charlie Sike: Option 3<br>New Open Channel & Floodplain |
| Client  | for   |

|  |                          |                 |
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| Checked:   | M. McMillan              | 12/09/18        |
| Approved:  | A. Pettit                | 12/09/18        |
| Project Number:  | 2017s5526                |                 |
| Drawing Number   | AEM-JBAU-NC-CS-IM-C-1200 | Revision<br>P01 |





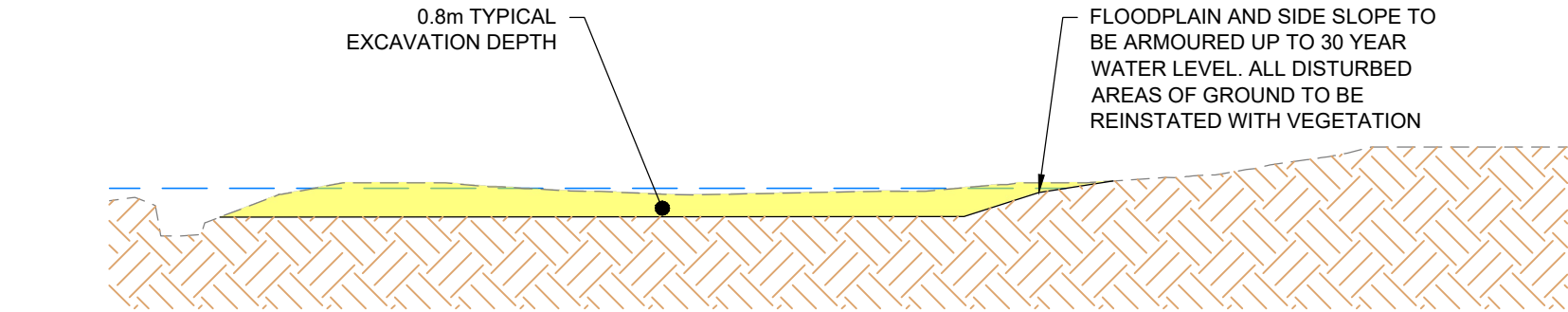
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PLAN  
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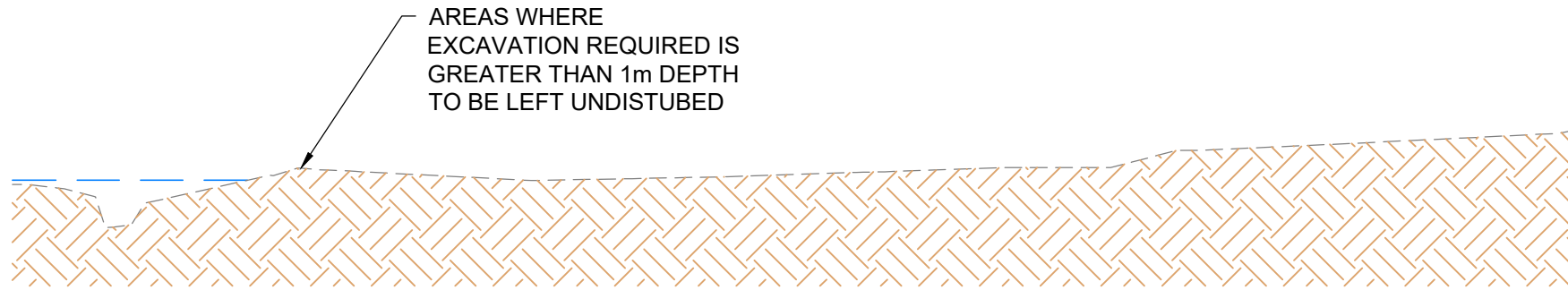
# Newcastleton

## Option 4: Charlie Sike

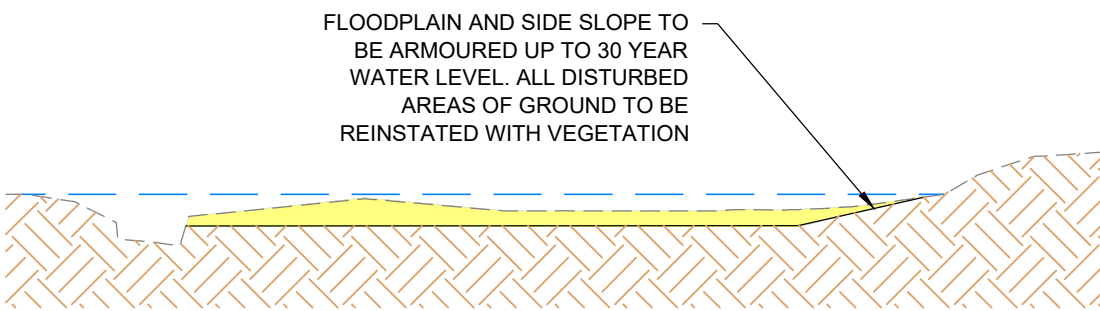
### New Floodplain to provide 200 Year SOP



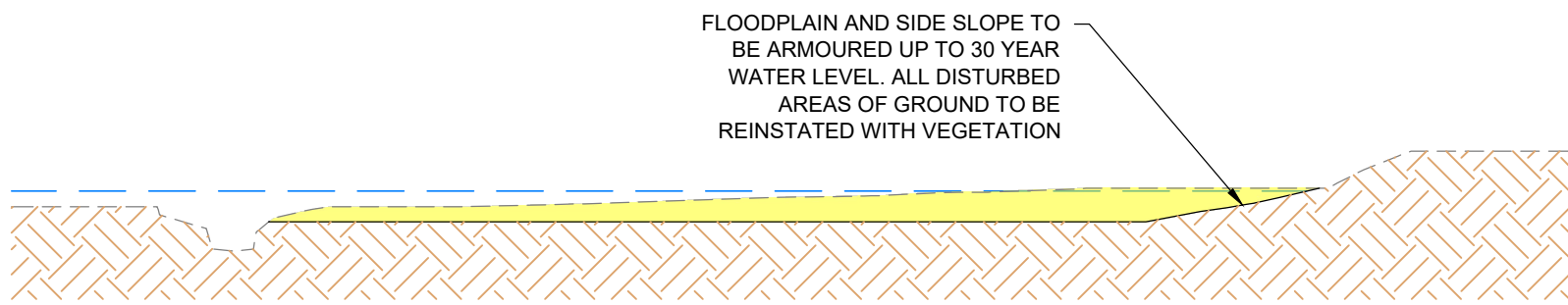
SECTION A-A  
1:200



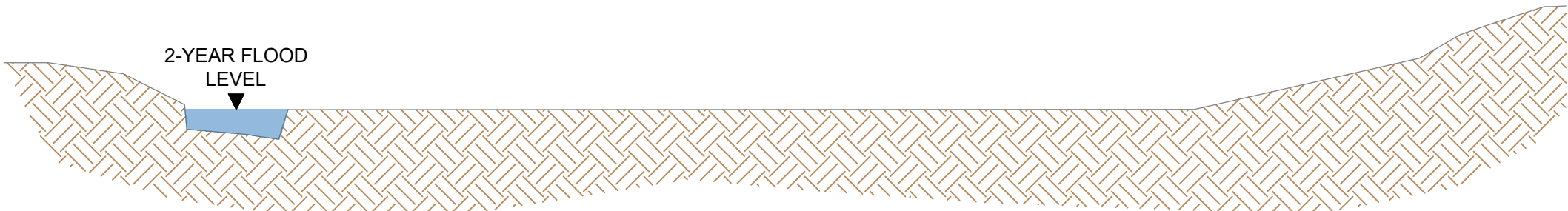
SECTION B-B  
1:200



SECTION C-C  
1:200



SECTION D-D  
1:200



TYPICAL CROSS-SECTION THROUGH FLOODPLAIN  
1:100

OPTION 4 SUMMARY. The option would consist of re-sectioning of the bank of Charlies Sike and the green space along its bank to create a floodplain away from the property boundaries. This has been created by cutting into the north bank to create a floodplain at the 2-year water level. The nature of the floodplain was limited by two parameters: (1) the maximum depth of the "cut" allowed was 1m and (2) the floodplain will need to tie into existing ground levels at a 1 in 4 slope.

#### LEGEND

- EXCAVATED CHANNEL
- EXISTING WATERCOURSE
- EXISTING GROUND
- PROPOSED GROUND
- 200 YEAR WATER LEVEL

| Comments                    |      |       |          |         |          |
|-----------------------------|------|-------|----------|---------|----------|
| Rev.:                       | Date | Drawn | Designed | Checked | Approved |
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| Purpose of Issue            |      |       |          |         | Status   |
| Suitable for Coordination   |      |       |          |         | S1       |

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Project



Borders Flood Studies

Title

Newcastleton  
Charlie Sike: Option 4  
New Floodplain

Client

for



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| Checked:  | M. McMillan | 12/09/18 |
| Approved: | A. Pettit   | 12/09/18 |

Project Number:

2017s5526

Drawing Number

AEM-JBAU-NC-CS-IM-C-1300

Revision

P01



# Option 5- Property level Protection

M

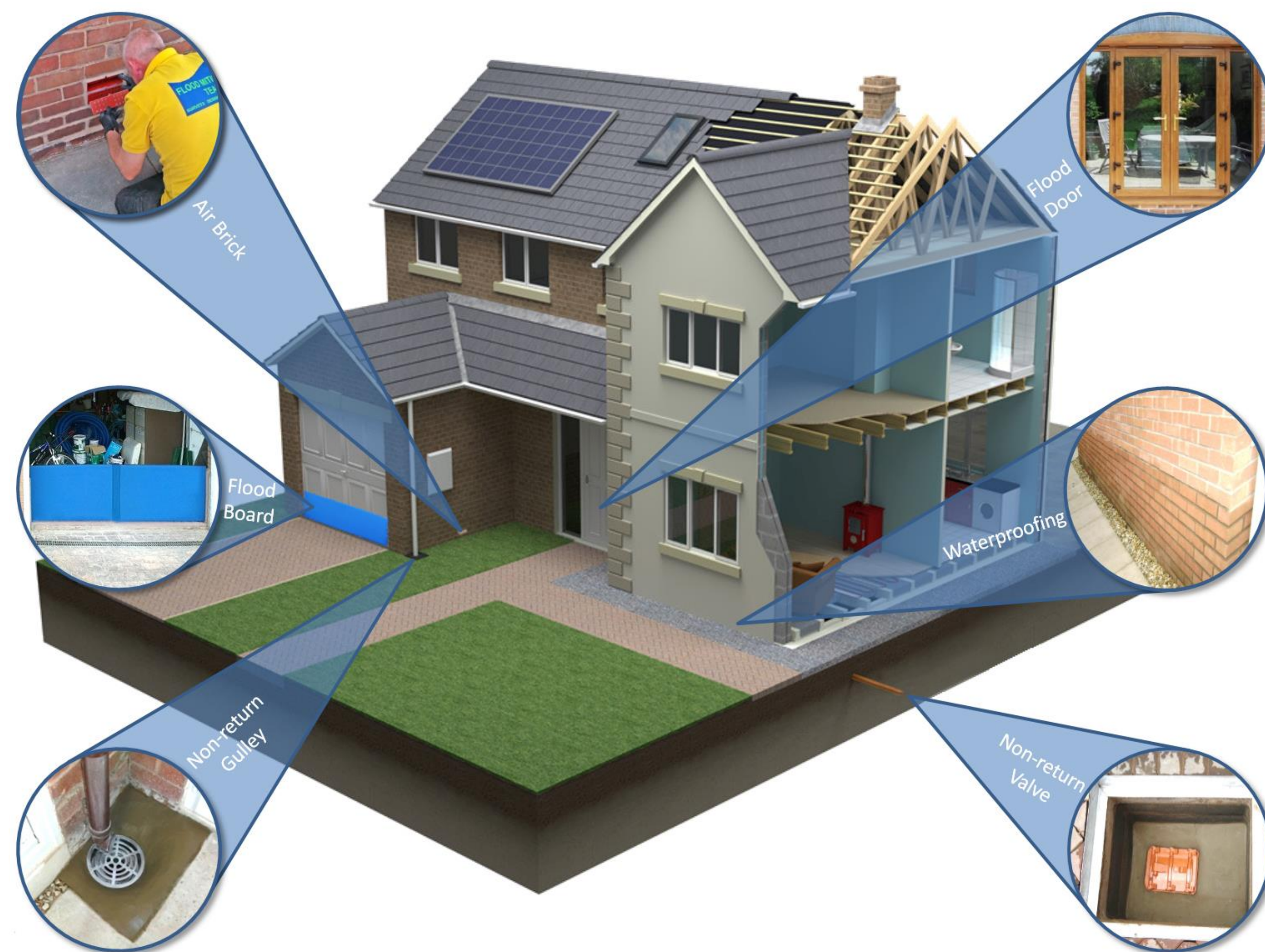
MOTT  
MACDONALD

M

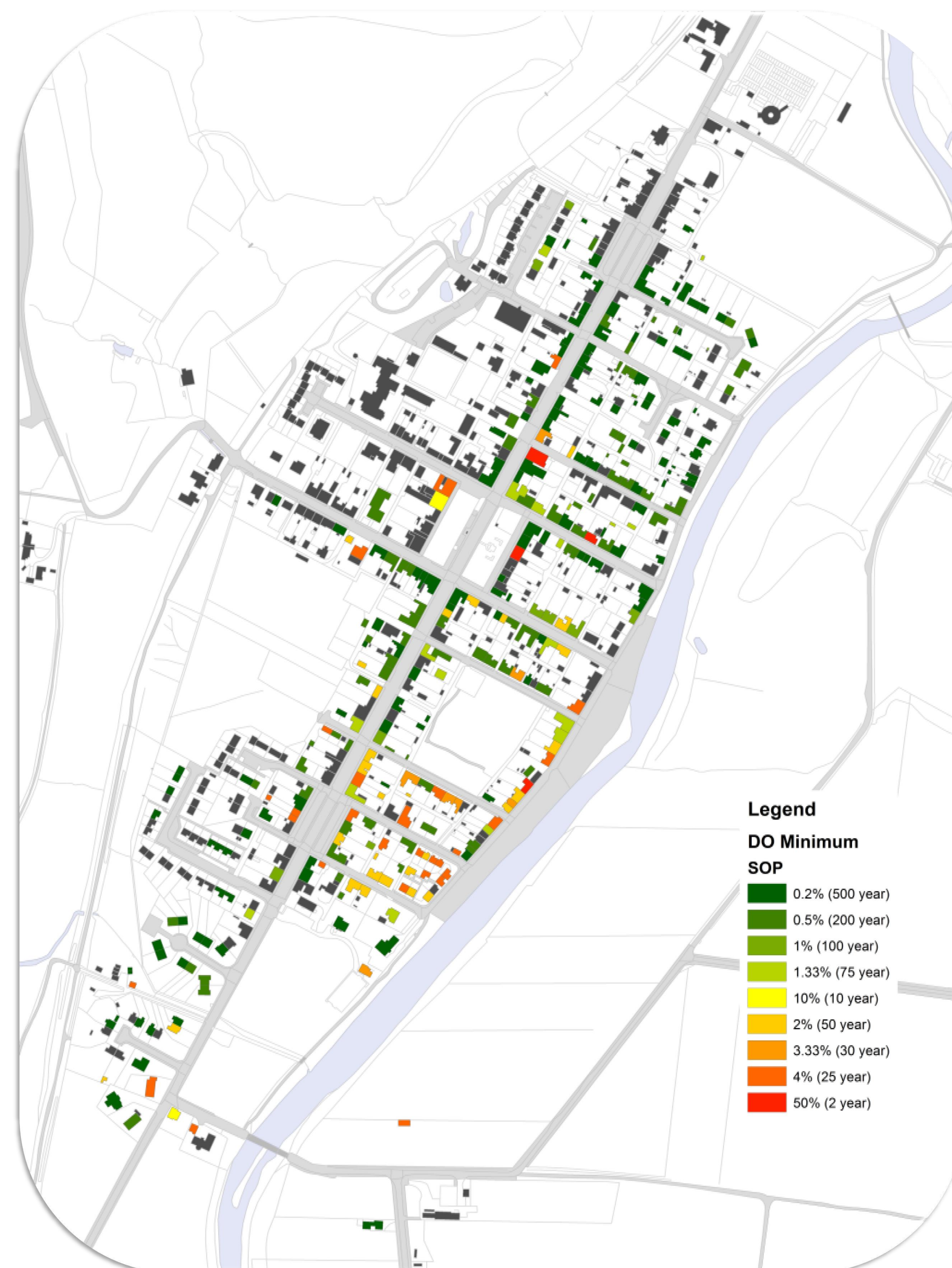
JBA  
consulting

Property Level Protection is the last form of defence before water gets into the building. Automatic PLP is proposed for each residential property - 126 in total. It can protect these properties to the 200 year flood event.

The standard of protection (SOP) map indicates the existing level of protection to each property with a SOP of less than the 500 year flood event.



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





# Preferred Option

**M****MOTT  
MACDONALD****M****JBA  
consulting**

## Summary of short listed options

|          |  |  |         |  |  |          |
|----------|--|--|---------|--|--|----------|
| Negative |  |  | Neutral |  |  | Positive |
|----------|--|--|---------|--|--|----------|

| Option<br>(Standard of<br>Protection)          | Damages<br>Avoided<br>(£m) | Environmental<br>Implications  | Working with<br>natural processes  | Constraints /<br>limitations  | Mitigating residual risks  | Improved public<br>awareness  | Best Use of Public<br>Money | Wider Benefits   |
|--|----------------------------|--|--|---|--|---|-----------------------------|--|
| Option 1 Hard<br>Defences (1 in<br>200 yr SoP) | 8.4                        | Little impact overall<br>however impact to<br>river wildlife during<br>construction. | NFM Measures have<br>been identified and,<br>subject to further<br>investigation, could<br>be incorporated<br>within the scheme<br>to provide<br>additional benefits.                                  | Average wall height at<br>approximately 1.3 m. Will<br>not obscure view of river.<br>Some areas are<br>constrained which will<br>make construction<br>difficult.                | Walls can be constructed so<br>that the option to increase the<br>height is possible in the<br>future. Linear drainage can be<br>incorporated to mitigate<br>impacts on surface water<br>flooding. | Options should be<br>presented to public<br>for comment.<br>Signage relating to<br>flooding and sand<br>bag stores could be<br>provided to help<br>defend against more<br>frequent events in<br>the short term. | BCR 1.6 (3rd)               | None   |
| Option 2 Hard<br>Defences<br>(variable SoP)    | 7.4                        | Little impact overall<br>however impact to<br>river wildlife during<br>construction. | Further modelling<br>and discussion with<br>landowners is<br>required to<br>determine the most<br>appropriate<br>measures and<br>locations for these<br>works and the<br>benefits they may<br>provide. | Average wall height <1.3<br>and less comprehensive<br>than option 1. Less of a<br>visual impact.<br>Some areas are<br>constrained which will<br>make construction<br>difficult. | Walls can be constructed so<br>that the option to increase the<br>height is possible in the<br>future. Linear drainage can be<br>incorporated to mitigate<br>impacts on surface water<br>flooding. | Residents of<br>Newcastleton should<br>be engaged in the<br>Resilient<br>Communities<br>Programme.  | BCR 2.7 (1st)               | None   |
| Option 3<br>Charlie Sike<br>Restoration        | 0.2                        | Positive increase in<br>wildlife diversity.  |  | Disposal of material has<br>potential for large<br>variations in costs.   | Maximum use of area<br>available to mitigate against<br>further increase in flows.   |   | BCR 0.3 (5th)               | Potential to<br>increase wildlife<br>diversity and<br>additional green<br>space amenity. |
| Option 4<br>Charlie Sike<br>Floodplain         | 0.2                        | Positive impact for<br>flora and fauna.  |  | Disposal of material has<br>potential for large<br>variations in costs.   | Maximum use of area<br>available to mitigate against<br>further increase in flows.   |   | BCR 0.67 (4th)              | Soft option could<br>provide better<br>aesthetic.  |
| Option 5 PLP<br>(1 in 200 yr<br>SoP)           | 6.5                        | No Impact  |  | Intrusive into people's<br>homes, will require<br>reinstallation every 25<br>years.   | Some properties may<br>experience flood depths in<br>excess of what PLP can<br>provide and decrease in SOP<br>over time. Additional<br>properties may require PLP<br>over time.                    |   | BCR 1.8 (2nd)               | None   |

## Preferred Option

The preferred option is Option 1, direct defences, which could be implemented alongside one of the options along Charlie's Sike to add additional amenity value and mitigate risks associated with the Sikes. The use of NFM may also provide additional benefits on the Sike's but additional modelling is required to evaluate these benefits.

To adapt the proposed defences to allow for the impacts of climate change (a 33% increase in flow) would require defences to be extended upstream by approximately 500m and increased in height by an average of 0.5m.



# What can we do in terms of natural flood management?

## 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.

NFM opportunities were first identified by examination of aerial photography and was confirmed with a site visit at sample locations. The NFM opportunities which have been proposed, subject to further investigation for the Liddel Water include:

- Improved land management practices
- Working within the banks (buffer strips, debris dams)
- Woodland planting
- Wetland creation and leaky barriers

The Council will need to investigate the potential benefits before working with other parties on developing these options further.



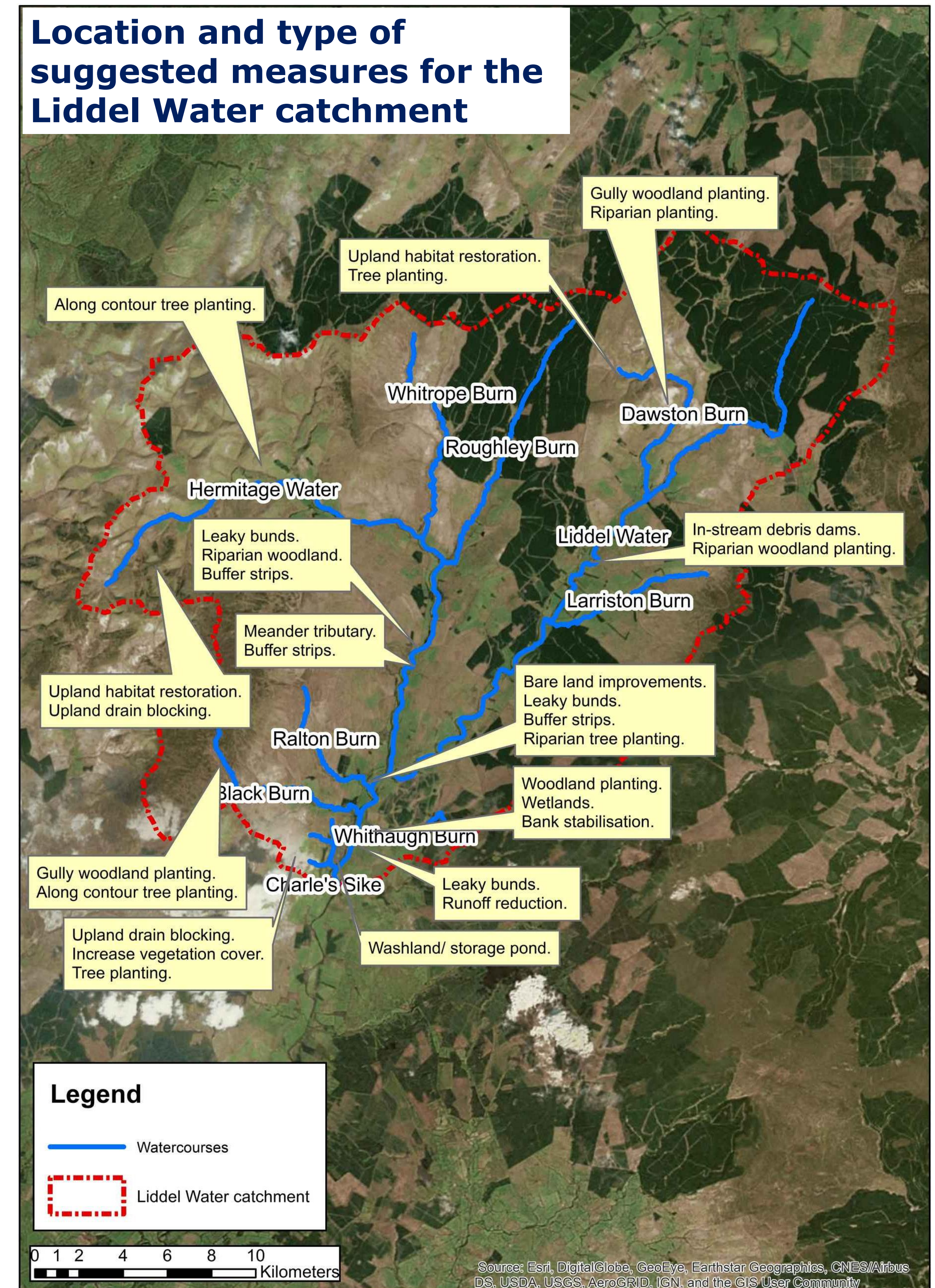
**Typical example of wetland creation**



**Typical example of in-channel debris barrier**



**Typical example of young woodland**





# What happens next?

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

