Board 1: An Introduction to the Public Exhibition

Introduction

Welcome to the public exhibition event for the proposed Newton Stewart Flood Protection Scheme.

The aims of this event are to:

- Provide information on flood risk within the town;
- Outline the proposals by the Council for a flood scheme;
- Explain the process by which the flood scheme design is progressing;
- Give an opportunity for you to ask any questions to those involved in the scheme design; and
- Gather information on public opinion regarding the scheme progression

Public Exhibition

The flow chart to the right describes each board on display.

The boards provide information on the process leading to, and justification of any decision.

There will be opportunity to leave your comments for consideration in the next stage of the design process.

If you have any questions, please speak to a representative from the design team, who are available throughout the exhibition.

Terminology

Some technical terms are used to describe the study outcomes in this exhibition. These are:

Return Period
The chance of a particular flood happening in any one year. Usually expressed in the following format: *1:200 year storm*.

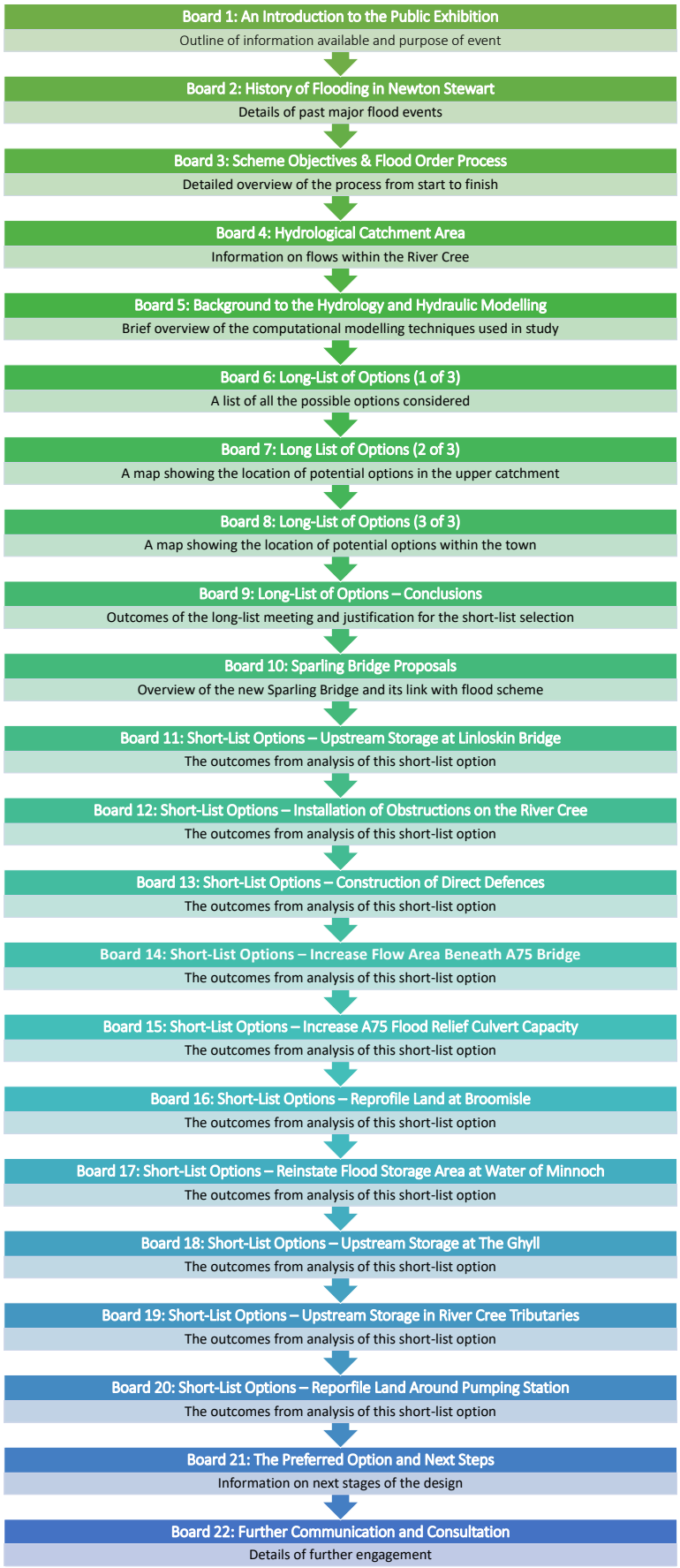
This means that there is a probability of 1/200, or 0.5% of the corresponding storm flow being met or exceeded in any one year.

Computational Model
A mathematical model of the river and floodplain, used to estimate flood levels.

Predicted Flood Outline
The outline that the computational model estimates will flood for the stated return period storm event.

Benefit-Cost Ratio (BCR)
The ratio of estimates flood damages that are avoided by a possible flood scheme to the cost of implementing that scheme.

For a scheme to qualify for Scottish Government funding, a value greater than 1.00 is required. The greater the value, the more beneficial the scheme.



Board 2: History of Flooding in Newton Stewart

Introduction

Flooding from the River Cree and Penkiln Burn has in the past caused widespread damage within Newton Stewart.

A selection of images illustrating the scale of the problem are shown.

These images have been submitted to Dumfries & Galloway Council by members of the public.

History of Flooding in Newton Stewart

Newton Stewart has suffered from repeated flooding in the past, including the following major recent events:

- **November 2012:** Major flood event;
- **December 2013:** Peak flow of 290m^3/s in the town; and
- **December 2015:** Similar magnitude to 2012 event

Board 3: Scheme Objectives & Flood Order Process

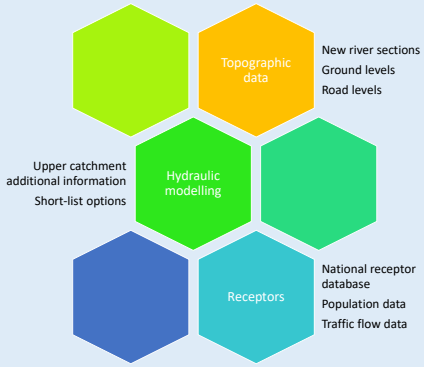
Work Completed to Date

Produce long-list of options
- Consider all possibilities
- Examine initial feasibility

→ **Assess long-list of options**
- Define criteria for assessment
- Analysis of option

→ **Stakeholder engagement**
- Industry, regulatory and community consultation
- Decision on short-list

Additional Data Obtained



Current Stage of Work

- Decision on preferred Option
  - Thursday 30th November
  - Friday 1st December
  - Saturday 2nd December
- Public exhibition
- Detailed investigation
  - Environmental statement
  - Geotechnical ground investigation
  - Controlled Activity Regulations (CAR) pre-application
  - Construction and method statements
  - Planning statement
- Outline design
- Consultation
  - **Regulatory**: SEPA, SNH, Historic Scotland, DGC Planning Department
  - **Industry:** Scottish Water, fisheries
  - **Community**: Cree Valley Community Council (CVCC), Cree Valley Flood Action Group, and landowners

Scheme confirmation if outline design outcomes are satisfactory to stakeholders

Future Work

Scheme confirmed by DGC → DGC approval process → FPS approval → Advertise & notify community → Objection period (28 days) → Submission to DGC to confirm scheme (6 weeks)

- Local press
- Statutory stakeholders
- Landowners
- Those affected by the construction

Can objections be resolved? (8 weeks)
- No → Public Inquiry (Significant Delay) → Decision by Scottish Ministers
- Yes, with no/minor changes

Scottish Ministers – Deemed Planning Consent → Community Notification → Tender & Construction

Board 4: The Hydrological Catchment Area

Hydrological Catchment Area

Within the catchment area north of the town, rain falling will ultimately reach the River Cree (if not evaporated).

The catchment area north of the River Cree at the town centre is 370km^2.

Extreme River Flows

For the 1:200 year storm event, the estimated flow at the gauging station in Newton Stewart is 520m^3/s. This is equivalent to 6,500 bathtubs a second.

The 1:200 year storm event is a common standard of protection in Scotland.

A computational model was used to estimate the maximum flow possible in the River Cree before any buildings within the town would flood. This flow has been estimated to be 195m^3/s.

Future Climate Change

River flows and extreme coastal water levels will consider the potential for future climate change in the design process.

The computational river model will be used to assess the influence of estimated future climate change on the scheme design.

Catchment Management

Land use inside the catchment area can affect the speed with which water will reach the river.

Urban areas increase runoff rates because the surfaces are generally impermeable and smooth.

Other land uses within the catchment area can affect the runoff to the river. However, during the most extreme events water will flow over soil into the river at high rates.

Coastal Influence

The flood risk can be made worse by the influence of the coast.

Design of the scheme will take account of the influence of water from both hydrological catchment area and the coast.

Extreme storms will be considered for the worst case event from the river, the worst case event from the coast *and* a worst case combination of river and coast.

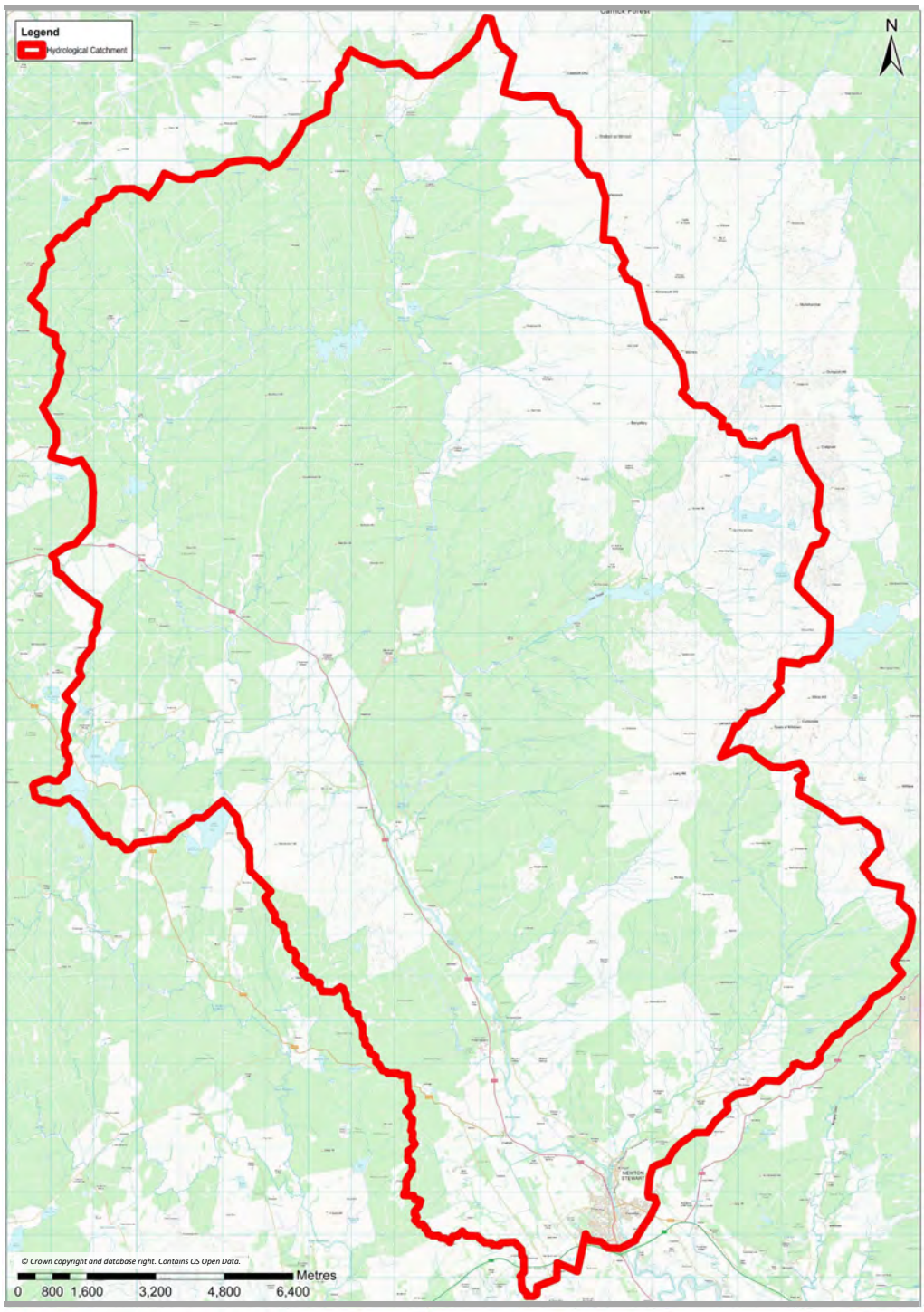


Figure 4-1: *Hydrological Catchment Area*

Board 5: Background to the Hydrology & Hydraulic Modelling

Information Input to Computational Model

Computational river models consist of the following information:

- Ground and road levels, gathered using survey and remotely sensed data (Figure 5-1);
- River sections, which are gathered through survey of the river channel (shown in Figure 5-2); and
- Information on historical flows in the river, gathered from the gauging station in Newton Stewart (Figure 5-3).

Figure 5-1: Drone for Remotely Sensing Ground Levels

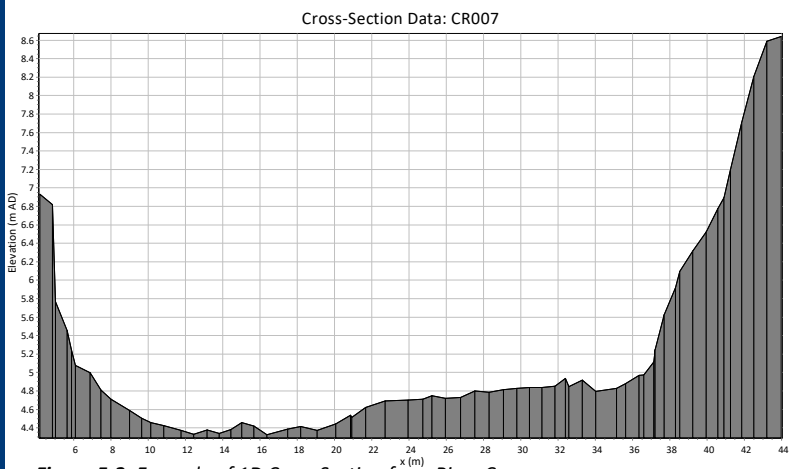


Figure 5-2: *Example of 1D Cross Section from River Cree*

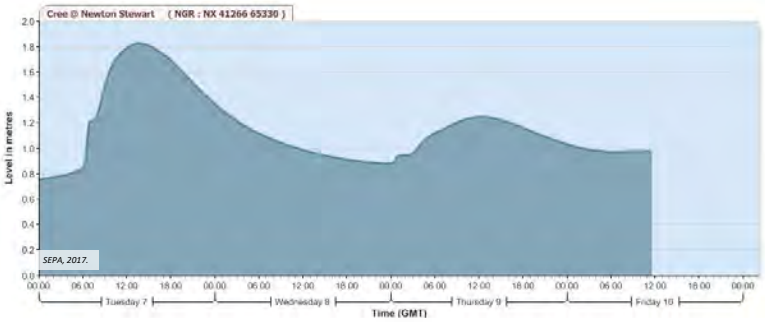


Figure 5-3: *Output Data from Gauging station at Newton Stewart*

Information Output from Computational Model

The river model produces the following:

- Water levels and velocities along the river
- Mapping to indicate areas of flooding (Figure 5-4).

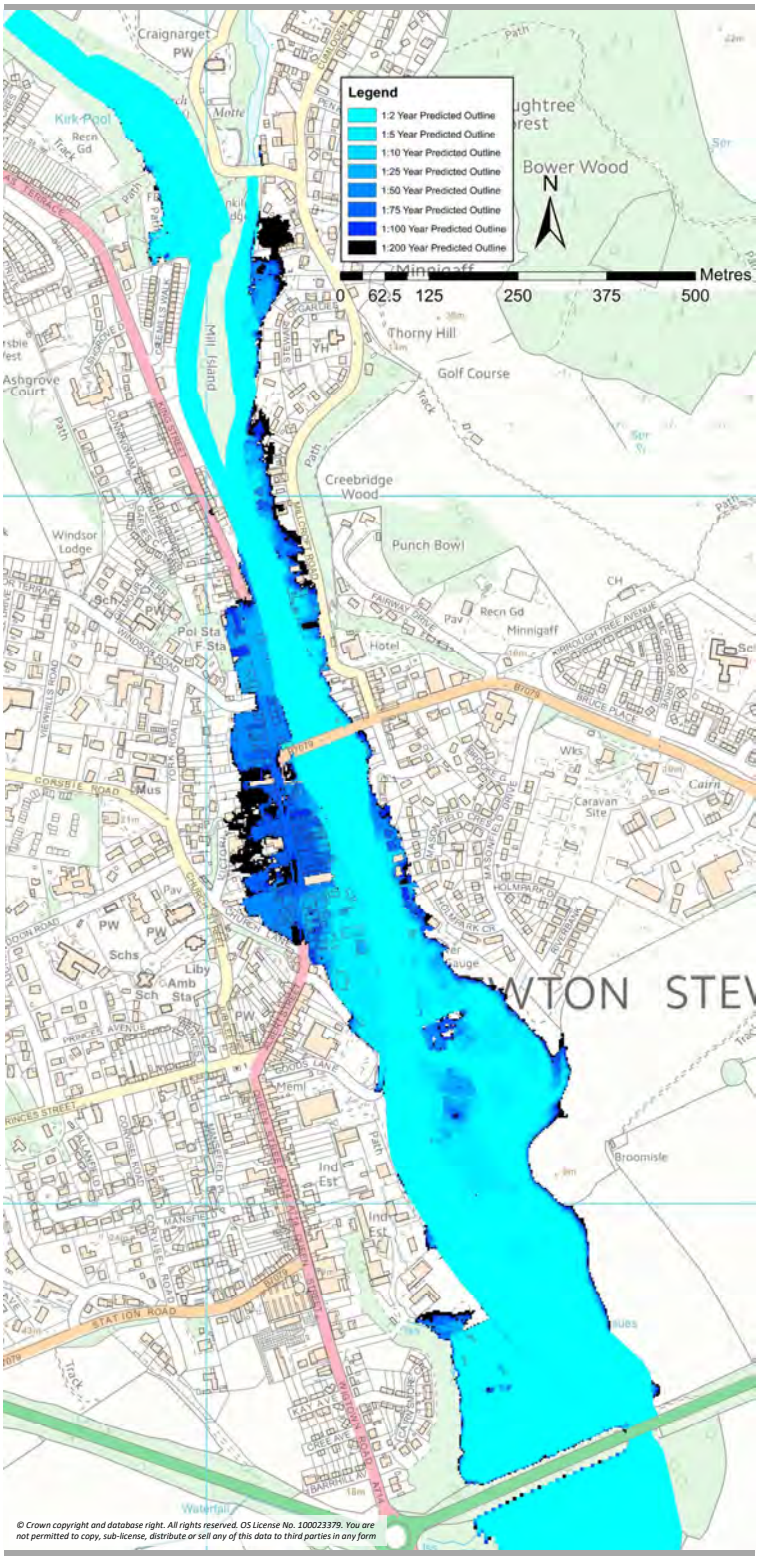
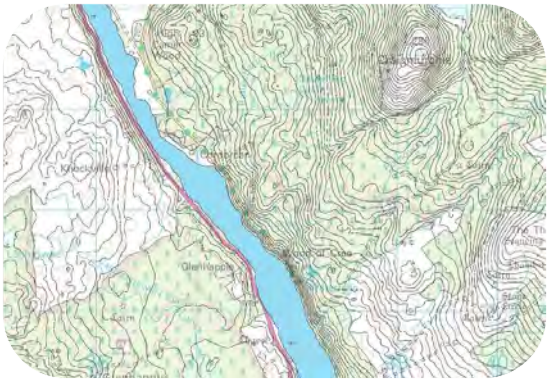


Figure 5-4: *Baseline Predicted Flood Outlines*

Board 6: Long-List of Options (1 of 3)



Options Considering Upstream Storage

See **Board 7** for locations

- Option 1: Upstream Storage at Glenhapple
- Option 2: Upstream Storage at Linloskin Bridge
- Option 3: Upstream Storage at Frankie Hill
- Option 4: Installation of Obstructions on the River Cree
- Option 5: Installation of Obstructions on Penkiln Burn

Options Involving Direct Defences

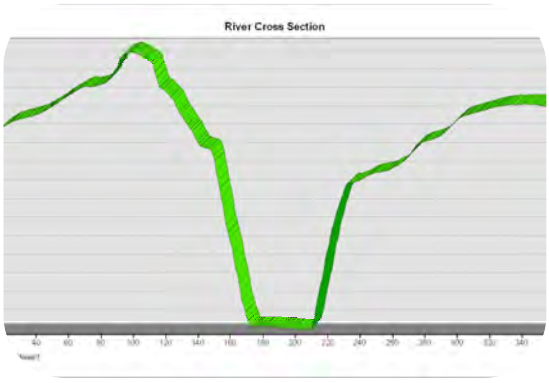
- Option 6: Construct Direct Defences

See **Board 8** for locations

Options at the A75 Embankment

See **Board 8** for locations

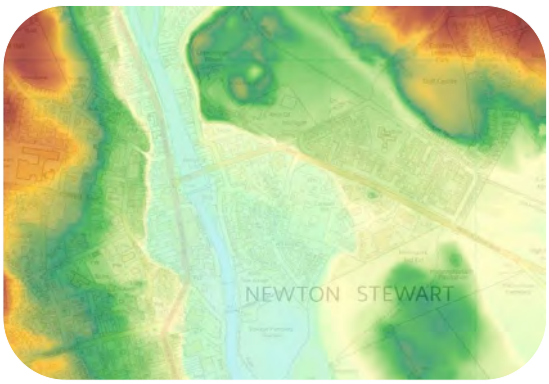
- Option 7: Increase Flow Area Beneath A75 Bridge
- Option 8: Removal of A75 Embankment
- Option 9: Increase Flood Relief Culvert Capacity



Options in the River Channel

- Option 10: Removal of Gravel Berm
- Option 11: Removal of In-Line Weir (Town)
- Option 12: Removal of In-Line Weir (Upstream)
- Option 13: Reconnect Penkiln Burn & River Cree Upstream
- Option 14: Remove Mill Island
- Option 15: Remove Sediment Around Key Structures
- Option 16: Divert Penkiln Burn
- Option 17: Dredging of River
- Option 18: Disconnect Former Mill Lade

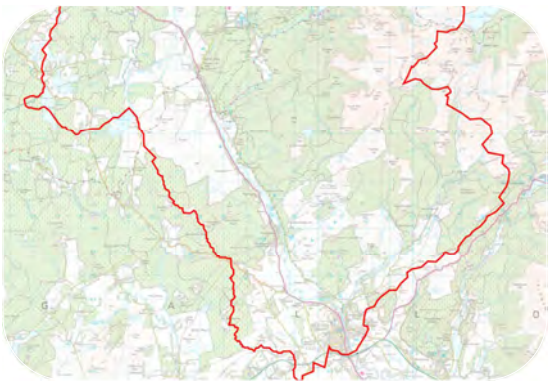
See **Board 8** for locations



Options to Reprofile Land

See **Board 8** for locations

- Option 19: Reprofile Land at Broomisle



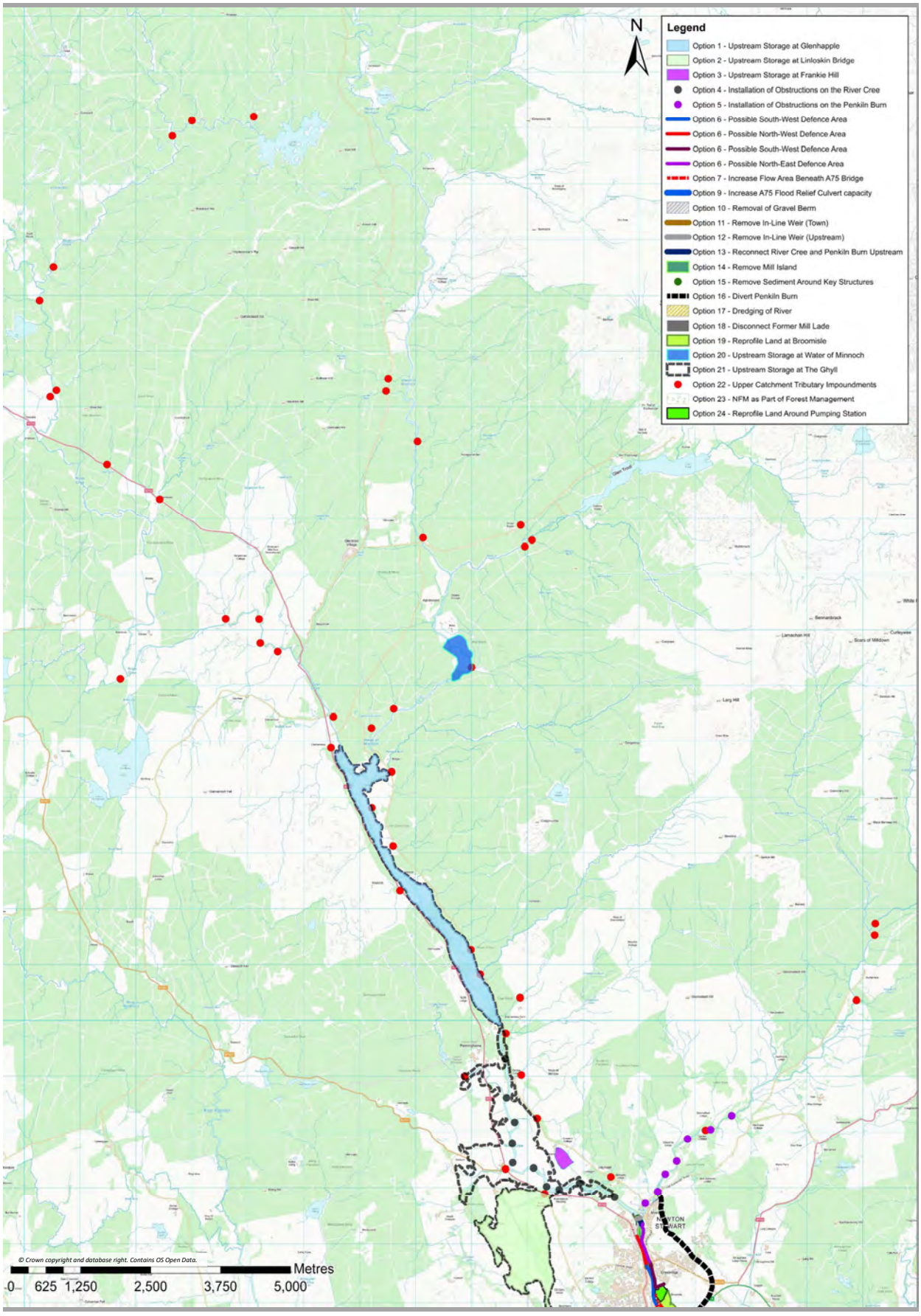
Options Suggested by Cree Valley Community Council (CVCC)

- Option 20: Reinstate Flood Storage Area at Water of Minnoch
- Option 21: Upstream Storage at The Ghyll
- Option 22: Upstream Storage on River Cree Tributaries
- Option 23: Natural Flood Management as part of Forest Management
- Option 24: Reprofile Land Around Pumping Station

See **Boards 7 & 8** for locations

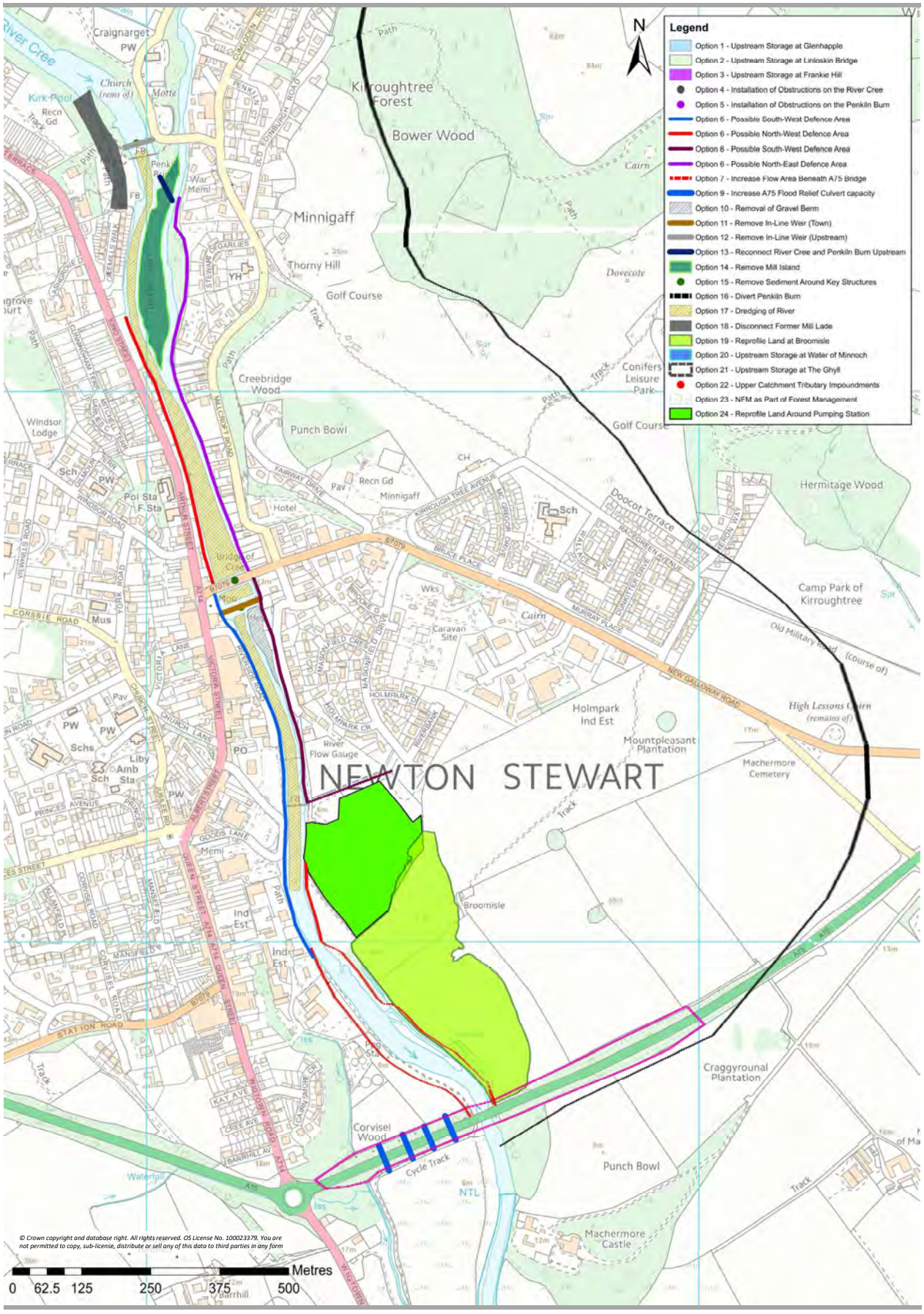
Board 7: Long-List of Options (2 of 3)

Figure 7-1:
Long-List of Options (Upper Catchment)



Board 8: Long-List of Options (3 of 3)

Figure 8-1:
Long-List of Options (Town)



Board 9: Long-List of Options - Conclusions

Introduction

The options shown in boards 6 to 8 were the list of all possible options that could be considered for a flood scheme in Newton Stewart.

An initial screening of options to highlight those with the greatest merit was carried out, and a short-list of options was formed using the process shown below.

Consultation with Stakeholders

This process takes place throughout the scheme design.

A community event was held with Cree Valley Community Council in August 2017 to discuss possible options.

An event where all stakeholders to discussed long-list options and decided upon the short-list was held in September 2017, with the following organisations:

- Cree Valley Community Council
- Cree Valley Flood Action Group
- Scottish Environment Protection Agency (SEPA)
- Scottish Natural Heritage (SNH)
- Forestry Commission
- RSPB
- Galloway Fisheries

During this period, the Newton Stewart Flood Protection Scheme newsletter was launched, providing the wider public with information on scheme progress.

A number of written queries have also been received, and taken into consideration in the design.

Compile Ranking Matrix

A process by which all options can be compared with each other is to rank them to a set of established engineering criteria.

The criteria used, and presented to the stakeholders to assist in decision making, were:

- Technical feasibility
- Economic benefits
- Environmental aspects
- Social impact

The ranking matrix was also used to screen for options where unacceptable risks were perceived to be present.

Discount Non-Viable Options

The following long-list options were considered non-viable by the stakeholders at the meeting held in September 2017:

- Option 1: Upstream storage at Glenhapple
- Option 3: Upstream storage at Frankie Hill
- Option 4: Installation of obstructions on the Penkiln Burn
- Option 8: Removal of A75 embankment
- Option 10: Removal of gravel berm
- Option 11: Removal of in-line weir (town centre)
- Option 12: Removal of in-line weir (upstream)
- Option 13: Reconnect Penkiln Burn & River Cree upstream
- Option 14: Remove Mill Island
- Option 15: Remove sediment from key structures
- Option 16: Divert Penkiln Burn
- Option 17: Dredging of river
- Option 18: Disconnect former mill lade
- Option 23: Upstream forest management

Reasons for discounting options included the following:

- Minimal impact on flood risk in town
- Prohibitively costly/complex engineering work
- Concerns regarding environment
- Concerns regarding structure stability

Remaining Options Form Short-List

Those options which remain formed the short-list.

Short-list options are subject to more detailed analysis and computational modelling.

To provide further information, each short-list option is described in detail on boards 11 to 20.

Board 10: Sparling Footbridge Proposals

Figure 10-1: Old Sparling Bridge; debris building and flood waters backing up

Old Sparling Bridge

Following severe flooding in April 2012, a flood study was commissioned by Dumfries and Galloway Council.

The flood study found that raising the deck of the old Sparling Bridge would reduce peak water levels upstream during flood events.

To reduce the immediate risk of backing up of flood waters, the old Sparling Bridge was removed in November 2016.

Figure 10-1 shows the problems relating to the old bridge.

Replacement Footbridge

Removal of the old footbridge has created an opportunity to install a replacement bridge in a position better suited to the needs of Newton Stewart.

The Cree Valley Community Council and Dumfries and Galloway Council undertook a public engagement process to consider the siting of the replacement bridge.

The community voted for the new bridge to be constructed 100m downstream of the former bridge.

The new bridge will be a steel truss form to accommodate a shared pedestrian and cycle way. Figure 10-2 shows an example of the bridge that will be provided.

Figure 10-2: Example of New Bridge Type

Board 11: Short-List Options – Upstream Storage at Linloskin Bridge

Introduction

Linloskin Bridge has been considered as a possible storage area for water upstream.

The possible area flooded to provide storage is shown below in Figure 11-1.

Water could be diverted from the River Cree into this storage area and then released when the storm ends.

Option Conclusion

Stakeholder option decision:

- Option not progressed
- Low decrease in flows
- No reduction in properties flooded
- Not beneficial in conjunction with any other options

Option Discussion

Stakeholder option discussion points:

Advantages of Option
- Provides 1.3 million m³ storage volume
- Storage area not on the River Cree – no effect on ecology

Disadvantages of Option
- Large inundated area, possible land ownership issues
- Possible ecological issues on Challoch Burn
- Presence of potentially infilled quarries in area

Other Points Raised
- Construction work would be required on/around road bridge to accommodate option

Impact on Flood Risk
- No reduction in receptors
- Decrease in flows of 0.15 m³/s in town

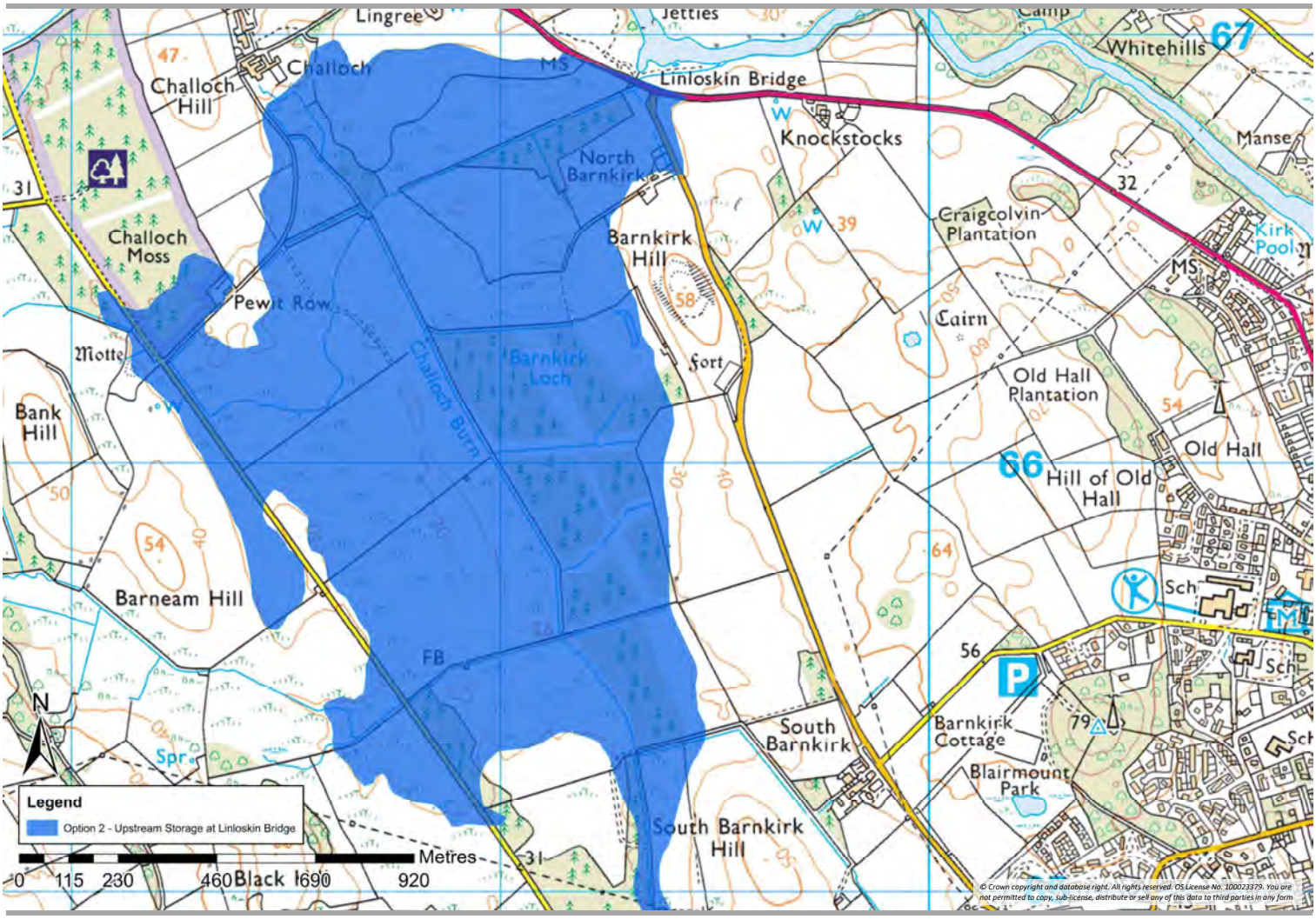


Figure 11-1: *Possible Inundated Area for Upstream Storage at Linloskin Bridge*

Board 12: Short-List Options – Installation of Obstructions on the River Cree

Introduction

This option has the potential to reduce water levels within the town.

It would be achieved through the installation of obstructions on the River Cree, upstream of the town.

Option Discussion

Stakeholder option discussion points:

Advantages of Option
- Upstream of town
- Minimal construction work in urban area
- Water held back before reaching town

Disadvantages of Option
- Change in sediment transport dynamics in river
- Impediment to passage of protected fish species
- Harmful to local ecology

Other Points Raised
- Strict licensing under Environmental Regulations (CAR), which would limit this option

Impact on Flood Risk
- No reduction in receptors

Option Conclusion

Stakeholder option discussion:

- Option not progressed
- No reduction in properties flooded
- Potential for morphological change to be introduced
- Significant ecological concerns

Figure 12-1: *River Cree Upstream of Newton Stewart*

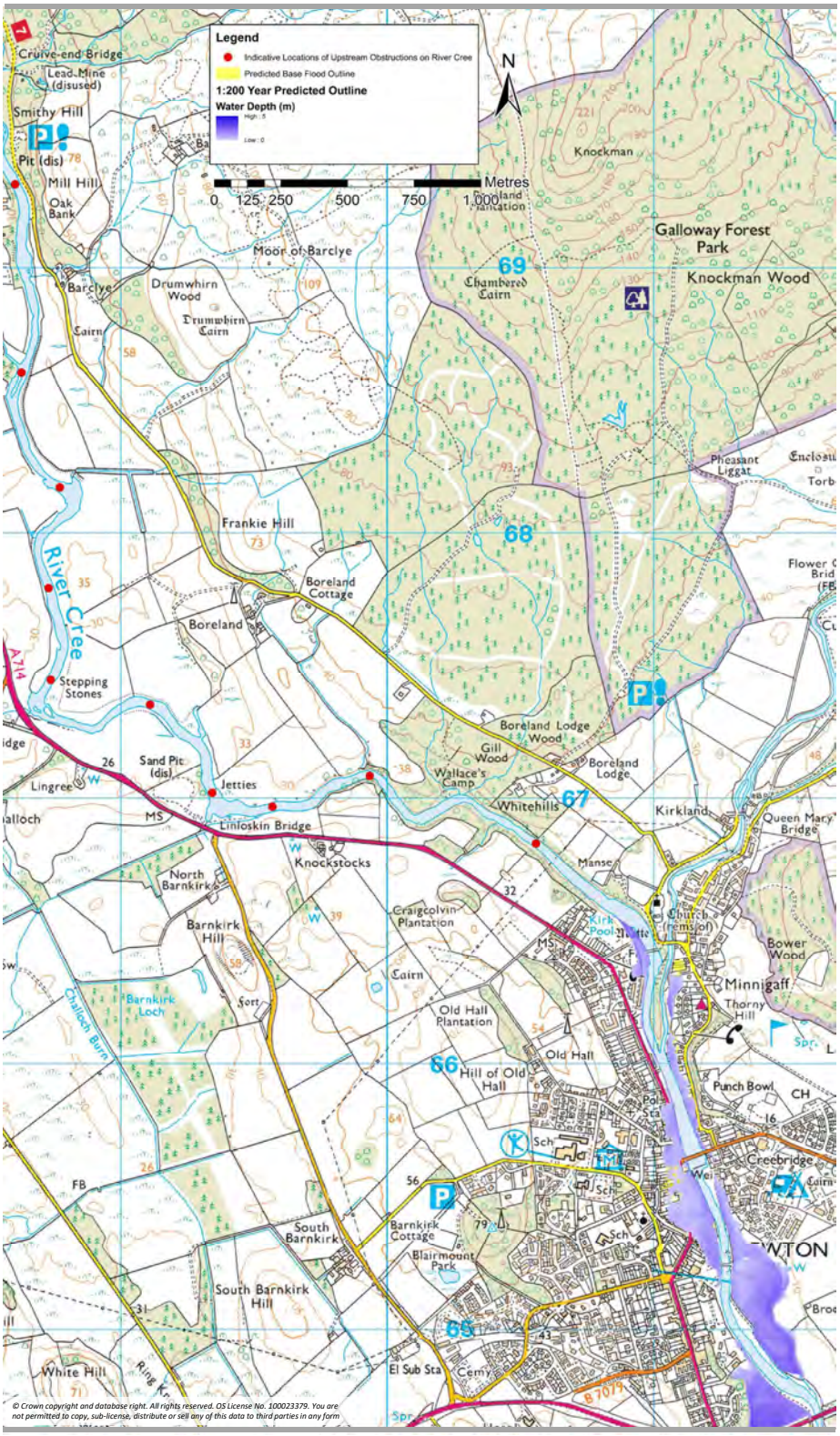


Figure 12-2: *1:200 Year Predicted Flood Outline – Installation of Obstructions on River Cree*

Board 13: Short-List Options – Construction of Direct Defences

Introduction

Construction of direct defences can be targeted to the most at-risk areas of the town.

Any implementation of direct defences would be landscaped to suit the surrounding area, with potential tie-in to the new Sparling Bridge that has been proposed.

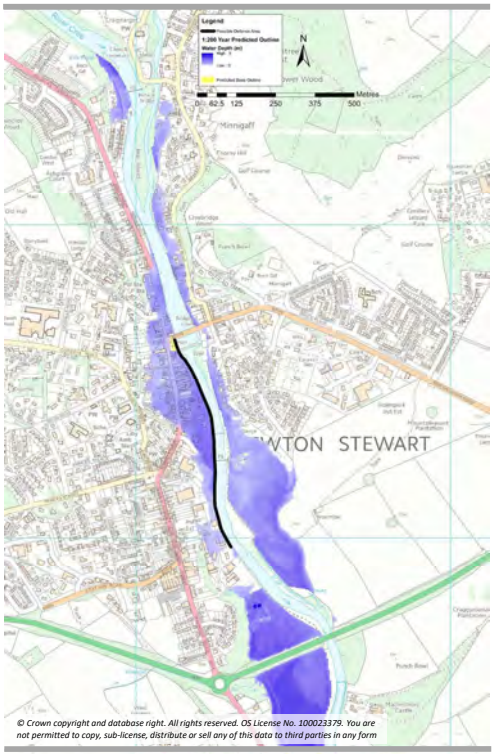


Figure 13-1: Direct Defences (South-West)

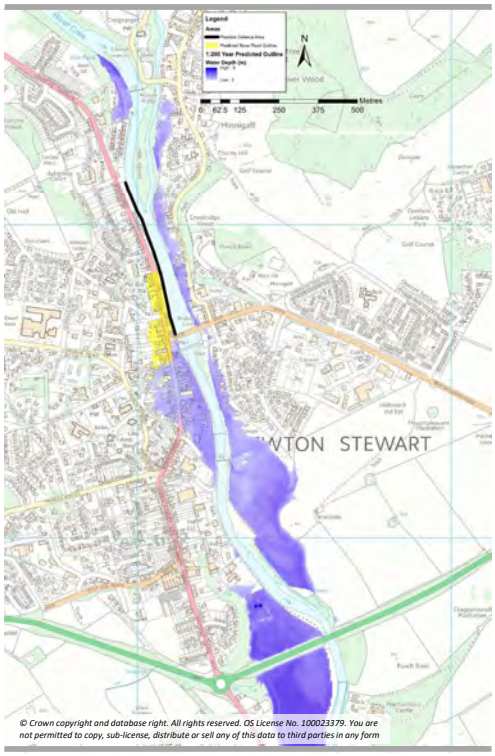


Figure 13-2: Direct Defences (North-West)

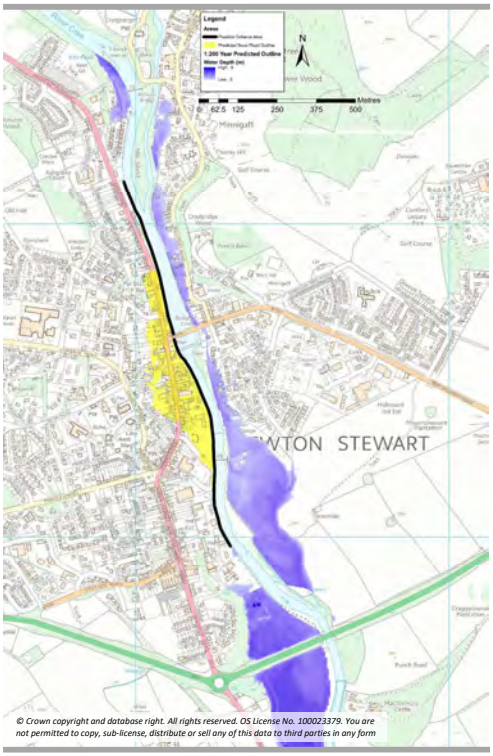


Figure 13-3: Direct Defences (West)

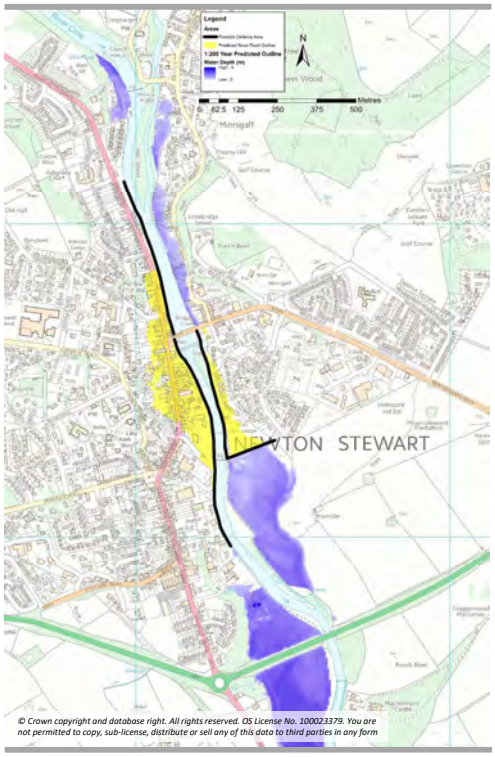


Figure 13-4: Direct Defences (West & North-East)

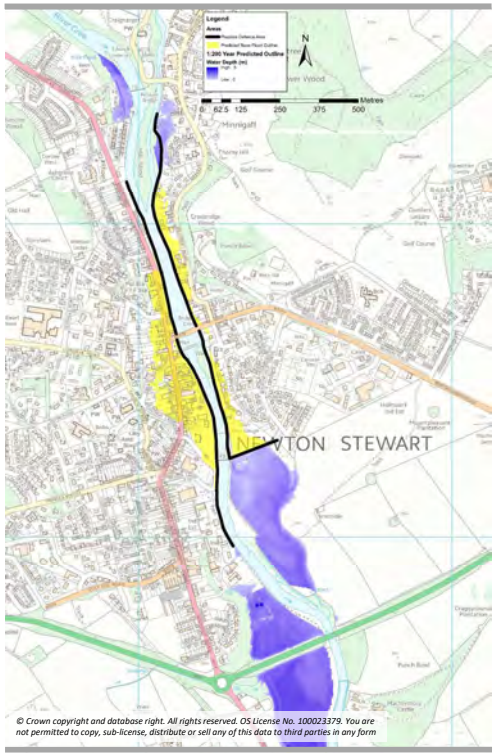


Figure 13-5: Direct Defences (All Areas)

Option Discussion

Stakeholder option discussion points:

Advantages of Option

- No ecological impacts on river, as construction is out of channel
- Design of defences can be part of larger landscaping exercise

Disadvantages of Option

- Engineering work takes place in town itself
- Water levels may rise elsewhere, requiring mitigation measures

Other Points Raised

- Defence heights would range 0 – 2.5m, but typically 1.5m in the town

Impact on Flood Risk

- Up to 106 receptors brought out of risk at 1:200 year event
- BCR of 1.24 for walls on west bank
- BCR > 0.80 for walls additional to west bank

Option Conclusion

Stakeholder option decision:

- Progress option to outline design
- High reduction in flooded receptors
- Positive BCR

Board 14: Short-List Options – Increase Flow Area Beneath A75 Bridge

Introduction

The A75 embankment is a barrier to flow across the floodplain.

Ground levels on the river banks beneath the bridge rise, increasing water levels upstream, shown in Fig 14-1 below.

Figure 14-1: *View from A75 Bridge During Flood (Looking Upstream)*

Option Discussion

Stakeholder option discussion points:

Advantages of Option
- Construction work at the A75 bridge only
- Provides relief where there is a barrier to flow

Disadvantages of Option
- Area of work near to SSSI, possible constraints
- Stability work on A75 bridge may be needed

Other Points Raised
- Cost of option is very low, therefore benefit-cost ratio outcome is very high for decrease in water depths

Impact on Flood Risk
- No reduction in receptors
- Reduces water levels upstream
- BCR of 9.84

Option Conclusion

Stakeholder option decision:

- Progress option to outline design
- Simple solution
- Can mitigate water level increase due to direct defences

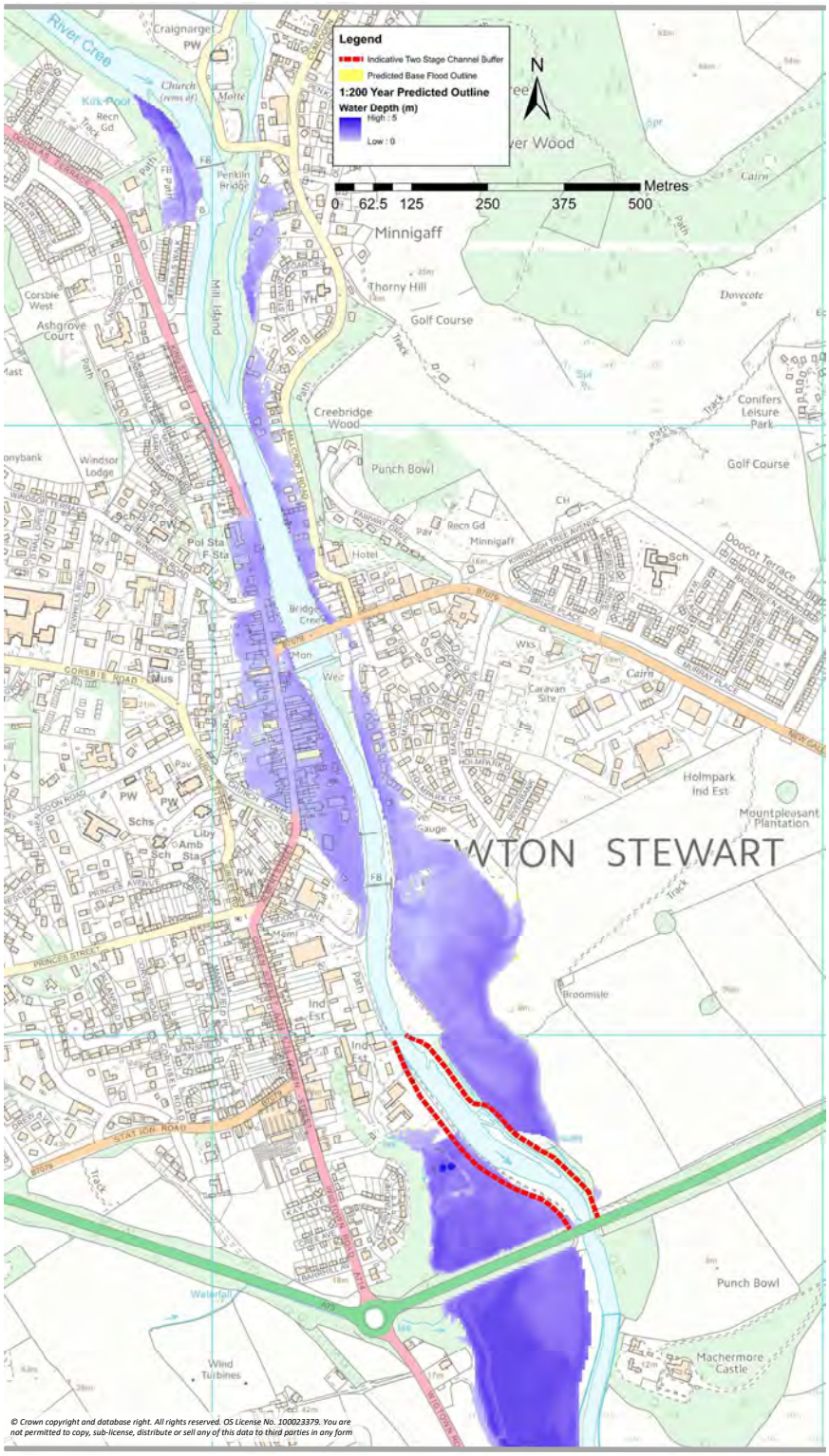


Figure 14-2: *1:200 Year Predicted Flood Outline – Increase Flow Area Beneath A75 Bridge*

Board 15: Short-List Options – Increase A75 Flood Relief Culvert Capacity

Introduction

In previous feasibility study it was found not to yield any benefit.

Re-visited in new study with land reprofiling to divert water towards existing culverts during times of flood; addition of new flood relief culverts; and upsizing of existing ones.

Option Discussion

Stakeholder option discussion points:

Advantages of Option
- Upgrade of an existing flood prevention feature
- Provides relief where there is an existing barrier to flow

Disadvantages of Option
- Significant and costly ground investigation work needed
- Risks in working beneath active major road

Other Points Raised
- Flood outline insensitive to changes in this area
- Topography causes water levels to rise and flood town before spilling towards flood relief culverts

Impact on Flood Risk
- No reduction in receptors
- BCR of 0.14 found

Figure 15-1: *Newton Stewart Flood Relief Culverts – Summer 2017*

Option Conclusion

Stakeholder option decision:

- Option not progressed
- Topography prohibits effective operation of culverts
- No reduction in properties flooded
- Not beneficial in conjunction with any other options

Figure 15-2: *1:200 Year Predicted Flood Outline – Increase A75 Flood Relief Culvert Capacity*

Board 16: Short-List Options – Reprofile Land at Broomisle

Introduction

Broomisle considered for potential storage of water backing-up from behind A75 embankment.

Involves lowering of ground to facilitate storage of greater volume of water – expanding the area that currently floods.

Option Discussion

Stakeholder option discussion points:

Advantages of Option
- Simple design solution of lowering land to allow flooding
- May provide additional amenity value through new wetland

Disadvantages of Option
- Large volumes of earthworks would change landscape
- Area already subject to flooding due to A75 embankment

Other Points Raised
- Potential for infilled quarries and gravel pits on the site.

Impact on Flood Risk
- No reduction in receptors
- BCR found to be 0.09.

Option Conclusion

Stakeholder option decision:

- Option not progressed
- No reduction in receptors
- Land already floods

Figure 16-1: *View of land at Broomisle*

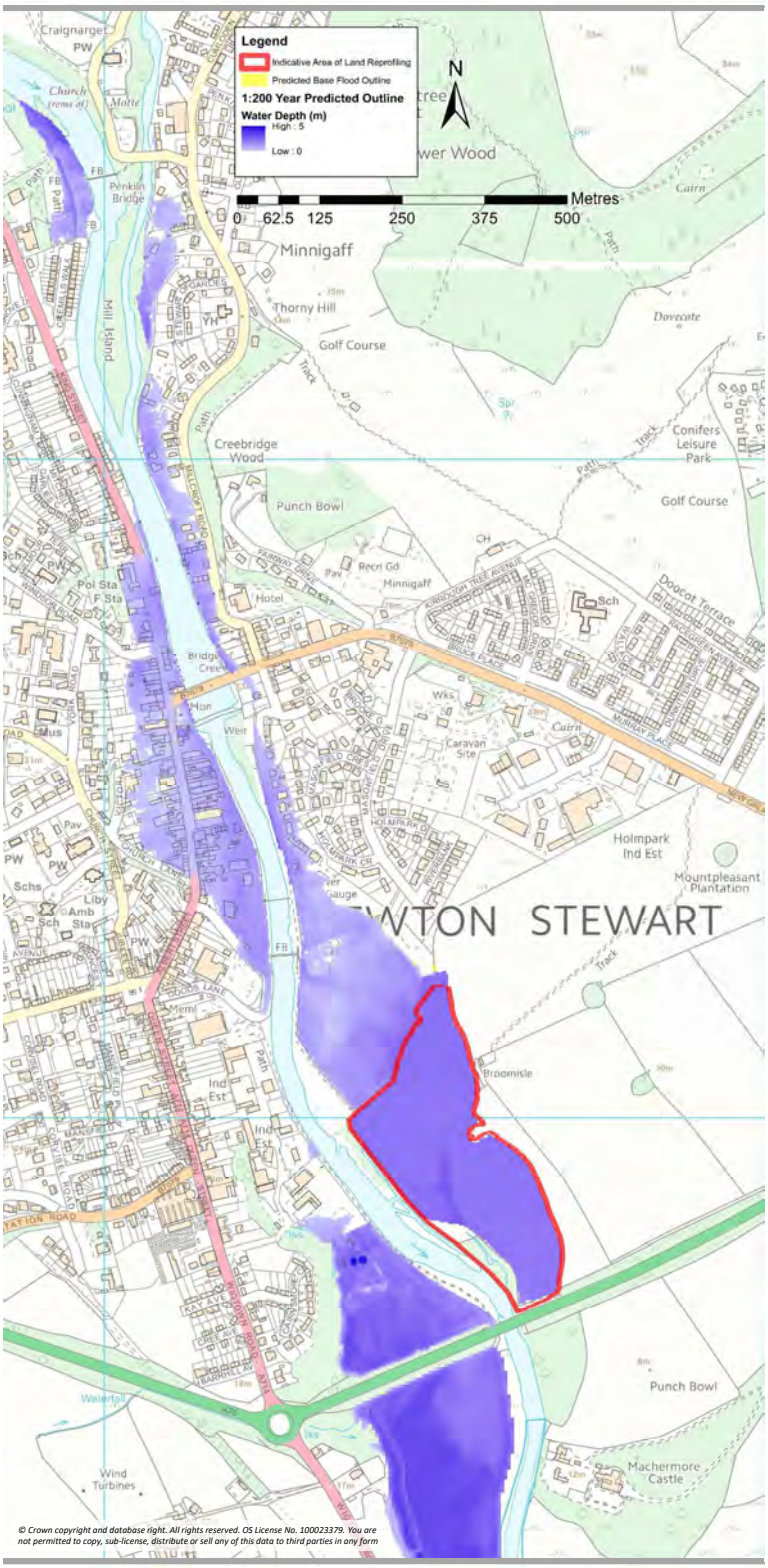


Figure 16-2: *200 Year Predicted Flood Outline – Reprofile Land at Broomisle*

Board 17: Short-List Options – Reinstate Flood Storage Area at Water of Minnoch

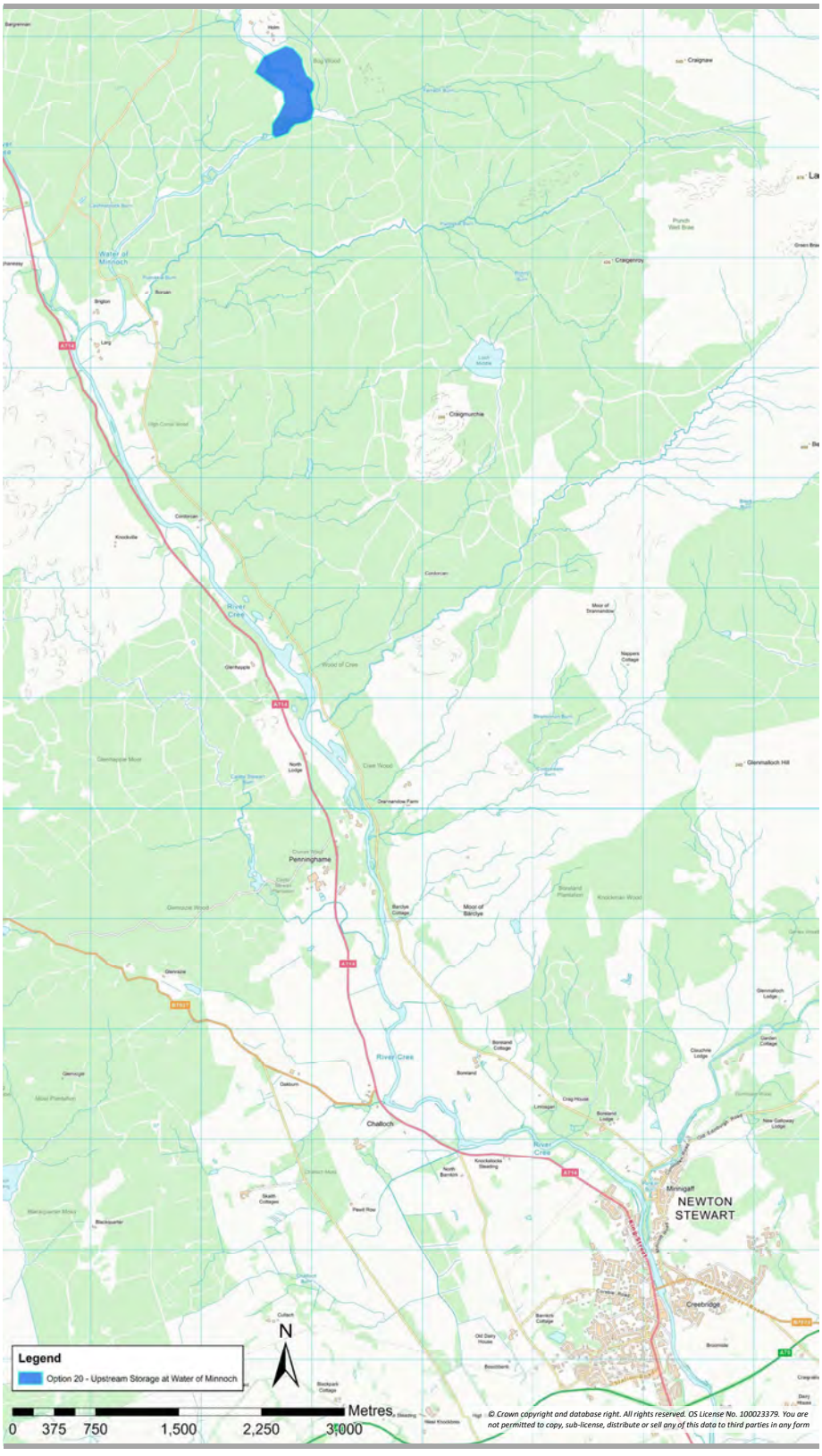


Figure 17-1: *Possible Inundated Area for Flood Storage Area at Water of Minnoch*

Introduction

A former flood storage area within the forest on the Water of Minnoch was identified.

This would hold 0.5 million m^3 in the upper catchment as storage.

An impoundment structure would be required, along with a flow restriction and overflow.

Option Discussion

Stakeholder option discussion points:

Advantages of Option

- Provides storage far from Newton Stewart

Disadvantages of Option

- On main line of river, possible negative influence on protected species of fish
- Difficulties in access to the area for construction

Other Points Raised

- Potential ongoing maintenance issues due to access and land ownership

Impact on Flood Risk

- Modelling indicates width of impoundment required to begin to reduce receptors in town is 230m – significant in comparison to width of river.
- Severe space restrictions prohibits construction of above impoundment
- No impact on receptors for smaller structures

Option Conclusion

Stakeholder option decision:

- Option not progressed
- Access difficulties
- Maintenance difficulties
- Low impact on flood risk for a feasible scaled option of intervention

Board 18: Upstream Storage at The Ghyll

Introduction

Considered as storage where steep-sided valley at Ghyll area can be impounded. Large impoundment structure would be needed (approx. 8 – 10m height) to facilitate option.

Figure 18-1: *1:200 Year Predicted Flood Outline – Upstream Storage at The Ghyll*

Option Discussion

Stakeholder option discussion points:

Advantages of Option

- Large volume of storage available upstream of town
- High impact on flood risk downstream

Disadvantages of Option

- Requires diversion of nearby roads/bridges
- Inundated area may require purchase of up to 20 large properties upstream of the town
- Impoundment creates barrier to protected species of fish

Other Points Raised

- Former lead mine identified in inundation envelope, posing potential contamination risk.

Impact on Flood Risk

- Up 133 receptors brought out of risk at 1:200 year event
- BCR value of 0.54 found

Option Conclusion

Stakeholder option decision:

- Option not progressed
- Undesirable effects of relocating people in properties brought into inundation area
- High cost and significant work associated with dam construction and ancillary works

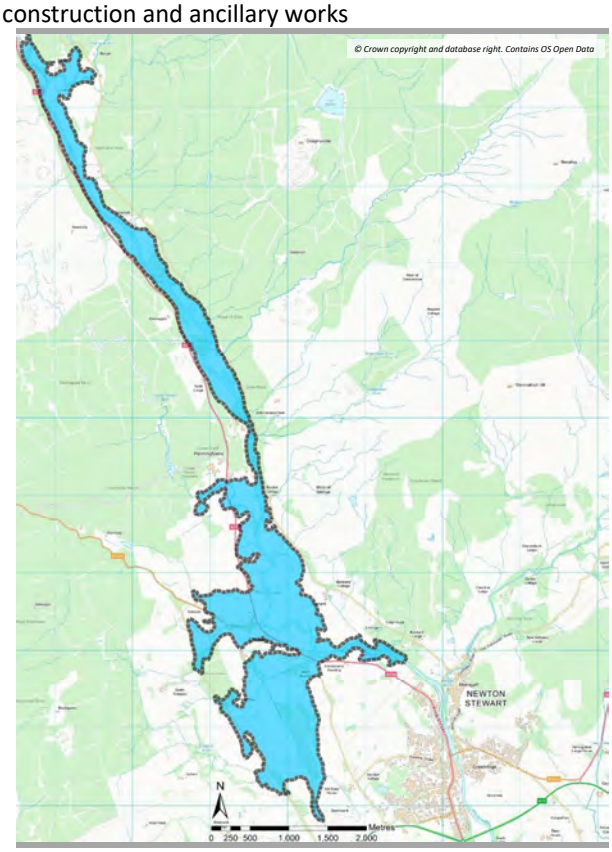


Figure 18-2: *Potential Upstream Storage from The Ghyll*

Board 19: Short-List Options – Upstream Storage in River Cree Tributaries

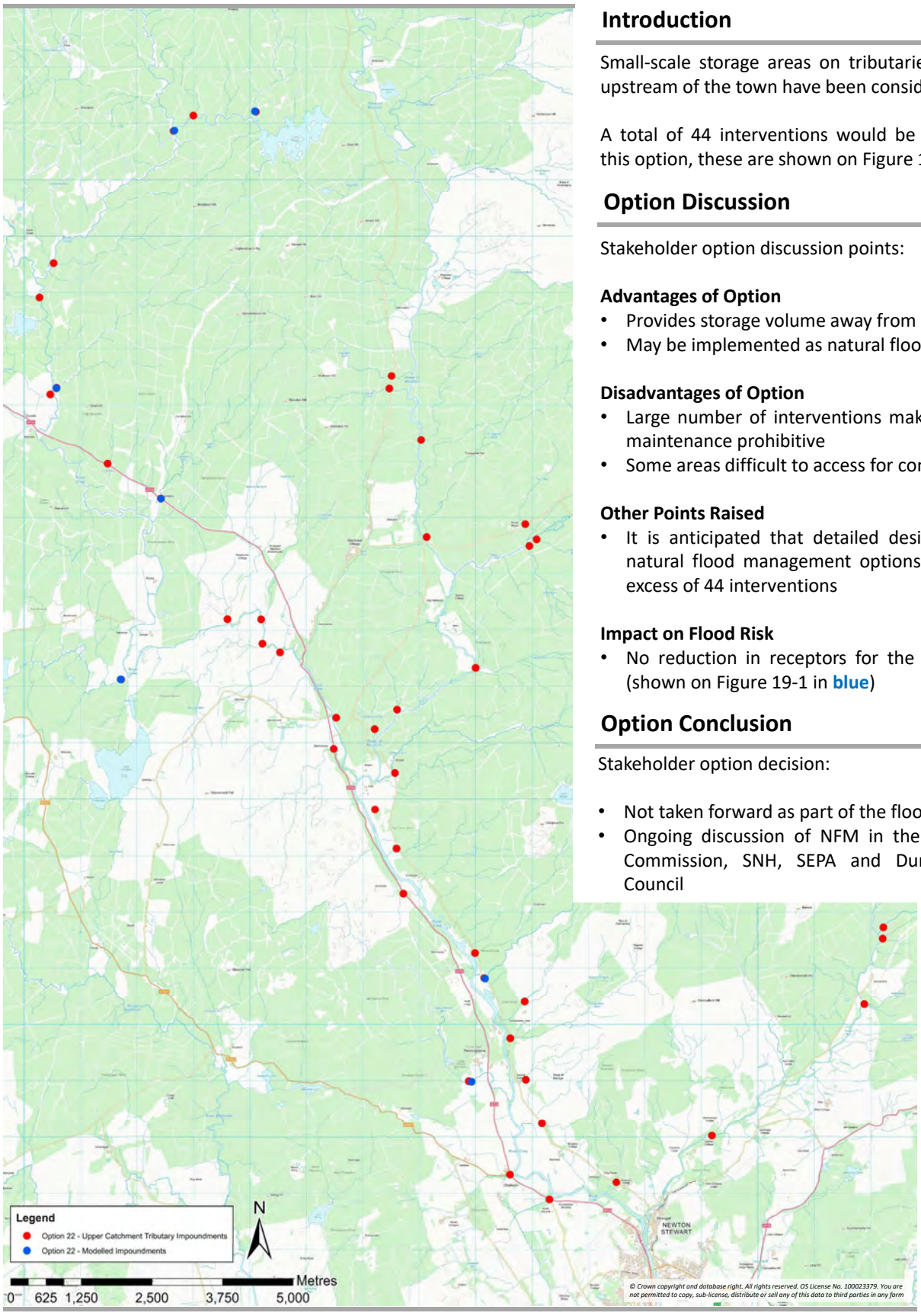


Figure 19-1: Upstream Storage in River Cree – Potential Impoundment Locations

Introduction

Small-scale storage areas on tributaries of the River Cree upstream of the town have been considered.

A total of 44 interventions would be needed to facilitate this option, these are shown on Figure 19-1 in **red**.

Option Discussion

Stakeholder option discussion points:

Advantages of Option

- Provides storage volume away from Newton Stewart
- May be implemented as natural flood management

Disadvantages of Option

- Large number of interventions makes construction and maintenance prohibitive
- Some areas difficult to access for construction

Other Points Raised

- It is anticipated that detailed design – particularly of natural flood management options – would require in excess of 44 interventions

Impact on Flood Risk

- No reduction in receptors for the 7 options modelled (shown on Figure 19-1 in **blue**)

Option Conclusion

Stakeholder option decision:

- Not taken forward as part of the flood scheme.
- Ongoing discussion of NFM in the area with Forestry Commission, SNH, SEPA and Dumfries & Galloway Council

Board 20: Short-List Options – Reprofile Land Around Pumping Station

Introduction

The pumping station on the east side of the river presents a barrier to flow over part of the floodplain.

Further investigation has shown pumping station is situated on flood plain, causing a barrier to flows.

Option Discussion

Stakeholder option discussion points:

Advantages of Option
- Mitigation of the presence of pumping station without having to remove it

Disadvantages of Option
- Removal of areas associated with pumping station not possible

Other Points Raised
- Must tie-in with new Sparling Bridge at this location

Impact on Flood Risk
- Up to 2 receptors brought out risk at the 1:200 year storm
- BCR of 1.48 found

Option Conclusion

Stakeholder option decision:

- Option partly progressed to outline design - smaller area
- Can be designed to enhance the option increasing flow area beneath A75 bridge
- Increases flow on floodplain opposite to areas of current high flood risk
- Can mitigate water level rise from construction of direct defences

Figure 20-1: *Pumping Station*

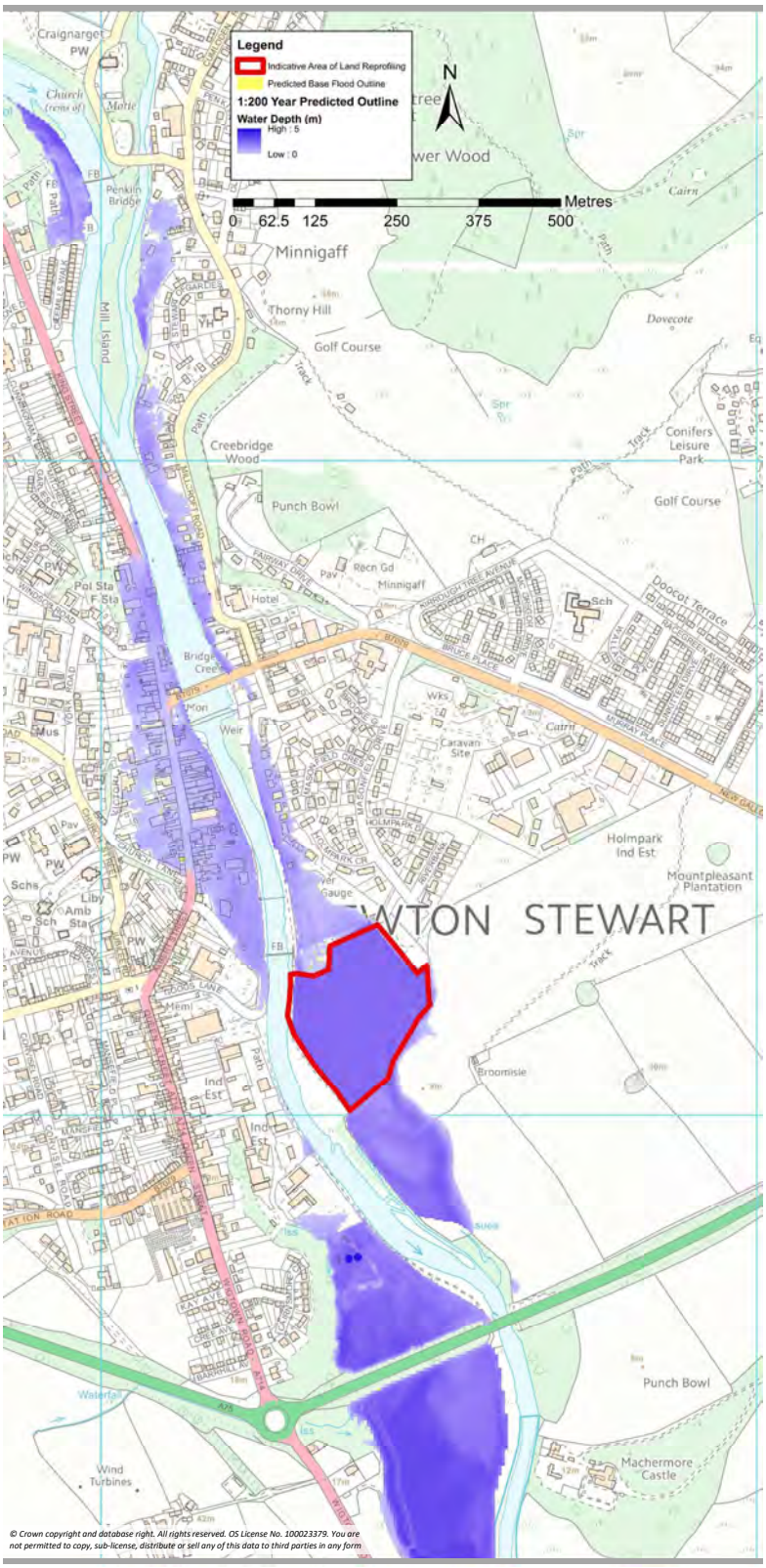


Figure 20-2: *1:200 Year Predicted Flood Outline – Reprofile Land Around Pumping Station*

Board 21: Preferred Option & Next Steps

Preferred Option

The preferred option has been chosen and indicative locations can be seen on Figure 21-1:

- Direct defences at locations to be determined during outline design (possible locations shown) – **Option 6 (see Board 13)**
- Increase flow area beneath A75 bridge
- Two stage channel to facilitate increased flow area, extending upstream to pumping station **Options 7 & 24 (see Boards 14 & 20)**
- New Sparling Bridge to tie-in with the above interventions

Next Steps

The next step in the process is the *outline design*.

Further investigative work will be carried out to ascertain precisely where interventions can be sited, and how they can be constructed.

Further detailed computational modelling and cost-benefit analysis will be carried out as well, ahead of the *detailed design*.

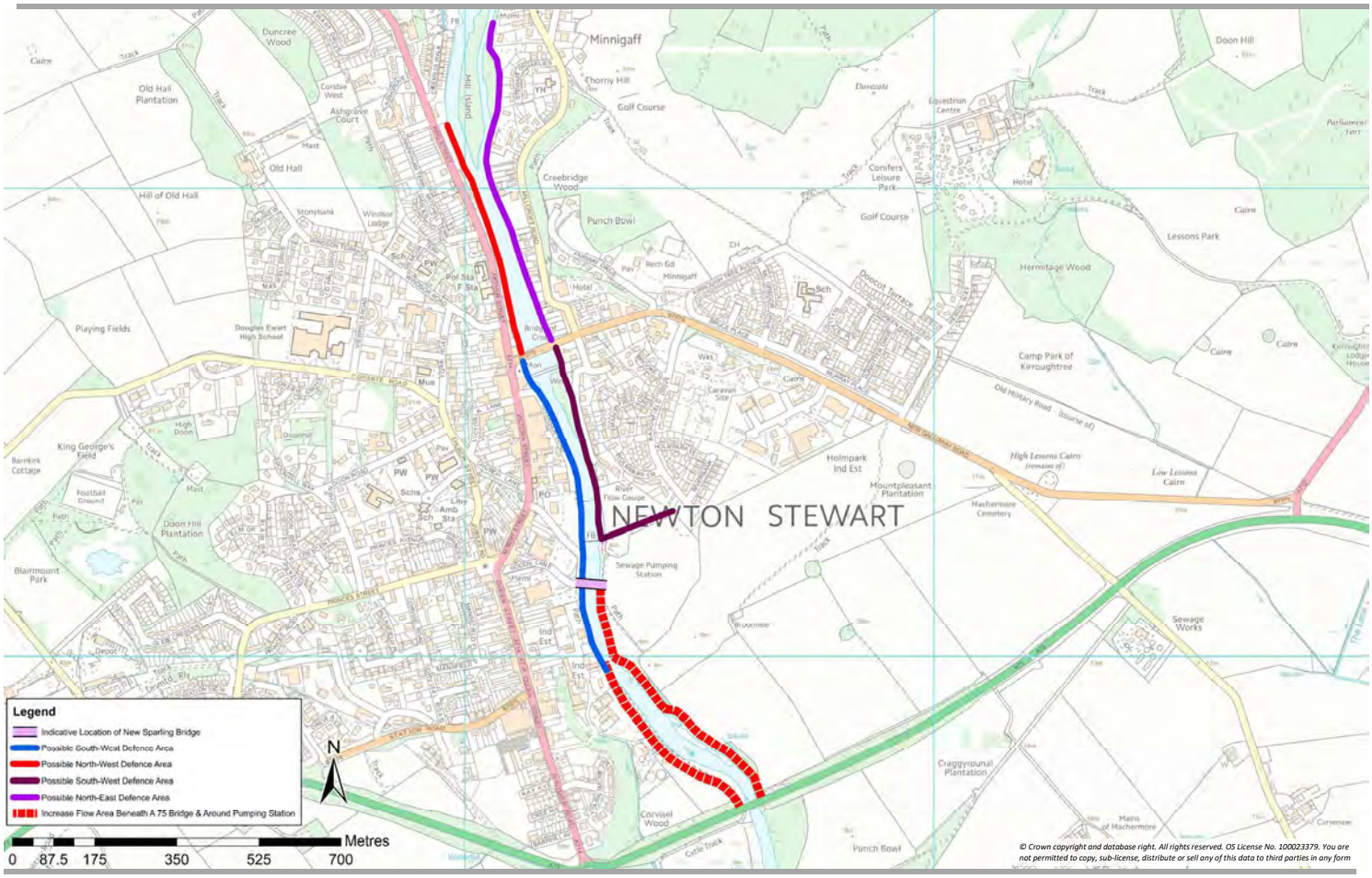


Figure 21-1: *Preferred Option – Indicative Locations of Interventions*

Ground Investigation Works

A key aspect of the next stage of the design is to better understand the ground upon which the above interventions will be built.

To permit this, detailed investigation of the ground conditions will be carried out in Newton Stewart through December 2017 to January 2018 at the following locations:

- Along the west riverbank, throughout the town (including along riverside road)
- Along the east riverbank, to the south of the Bridge of Cree
- On land to the south of the pumping station
- On Goods Lane adjacent to the river (and also on the bank opposite to this location) for the new Sparling Bridge

Ground investigation works will involve the use of heavy plant, with some temporary road/pathway closures while work at a specific site is carried out.

Board 22: Further Communication & Consultation

Public Exhibition Event

Thank you for attending this public exhibition event for the Newton Stewart Flood Protection Scheme. We hope you have found it useful.

If you have any questions, or would like further explanation on any of the boards – please let one of the design team know.

A survey to provide feedback is available – please speak to one of the design team if you have not had a chance to fill this out.

Further Communication

Further newsletters will be provided to the community to update on progress as the scheme progresses.

Any immediate queries can be made at any time by writing to Dumfries & Galloway Council.

A further public exhibition event is planned for March / April 2018 to report on the outcomes of the next stage of the process (outline design).

Ongoing Consultation

The process of consultation is constantly ongoing through the design of the scheme.

Dumfries & Galloway Council, Cree Valley Community Council, SEPA, SNH, Scottish Water, Forestry Commission, Galloway Fisheries and RSPB will all continue to be consulted as the outline design progresses.

Flood Warning Scheme

A real-time flood warning scheme is currently available in Newton Stewart, run by SEPA.

Sign up for flood warnings direct to your phone at the below address, or scan the QR code:
http://www.floodlinescotland.org.uk/flood-warning-schemes/river-cree-flood-warning-scheme/

Floodline
Scottish Environment Protection Agency
0345 988 1188
floodlinescotland.org.uk