



CRAIGIE BURN FLOOD STUDY

4. OPTION DEVELOPMENT

Amey Consulting have considered a wide range of potential options for managing the risk of flooding within the Craigie Burn catchment.

How do we develop options?

To develop options for managing and, if possible, reducing flood risk in the Craigie Burn catchment, we followed a series of steps:

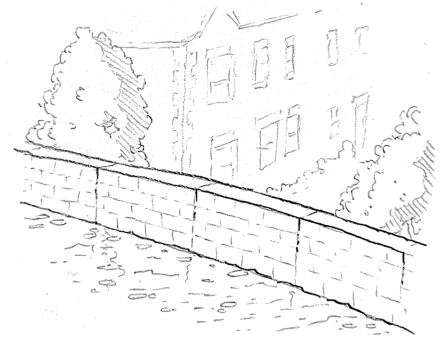
1. The flooding issues were defined by the initial flood modelling work, which served as a **baseline** to consider potential options to manage flood risk in the catchment.
2. A **long list** of potential actions was considered that could manage or reduce the risk of watercourse flooding. This list was screened to remove actions that were clearly not feasible, leaving an initial short list of potential actions.
3. Next, we conducted a scoring exercise to evaluate the potential options and produce a final **short-list** of those that are most feasible. This helped us eliminate measures that were not practical or viable.
4. We conducted a **detailed appraisal** of the final short-listed options using the hydraulic model. This involved evaluating their performance under different flooding scenarios, considering their implementation requirements, compatibility with other policies and plans, and their potential to achieve the objectives of the flood study.
5. Based on the results of the appraisal, we selected a **recommended option**. Factors such as effectiveness, affordability, environmental and social impacts were considered during the selection process.

What was considered?

A range of structural and non-structural options were considered, including:

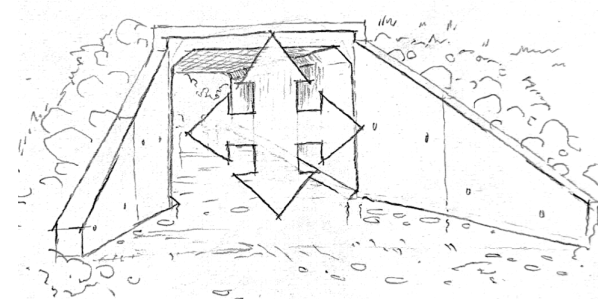
Direct Flood Defences

This includes the construction of flood walls and embankments.



Conveyance Improvements

This includes river channel modifications/culvert upgrades to increase flow capacity where capacity is limited or at pinch points.



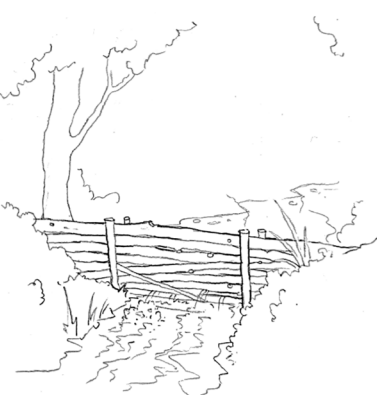
Upstream Storage

Measures to create new, or upsize existing, flood storage areas were considered.



Natural Flood Management (NFM)

NFM techniques work with natural processes to manage flood risk, and work on the principle of slowing the flow of water down in the upper catchment. Measures include, tree planting, field ditch/drain blocking, leaky barriers and channel re-profiling.



Non-structural measures

This includes property flood resilience measures and flood warning schemes

These were considered separately from the structural measures.

The 'flashy' nature of the Craigie Burn means that limited warning time is available to make a formal flood warning scheme feasible. The community is working with the Scottish Flood Forum to install a rivertrack system that will help to improve personal resilience to flooding.

Residents and businesses are encouraged to consider flood resilience measures for their properties.

Option Appraisal

The appraisal shortlist considered 13 options consisting of individual or combined actions.

These options were developed and tested within the hydraulic flood model to quantify the benefits and costs associated with each.

In managing flood risk, Perth & Kinross Council is required to have regard to the economic impact of its actions. For an option to be considered viable, the costs must not exceed the benefits, i.e. the benefit/cost ratio (BCR) must be greater than 1.0.

The calculated BCR's are listed in the table below. Only two options have been found to manage the existing flood risk in a sustainable and cost-effective manner within the catchment.

One factor in this is the significant benefit already provided by the existing Perth flood protection scheme within the catchment.

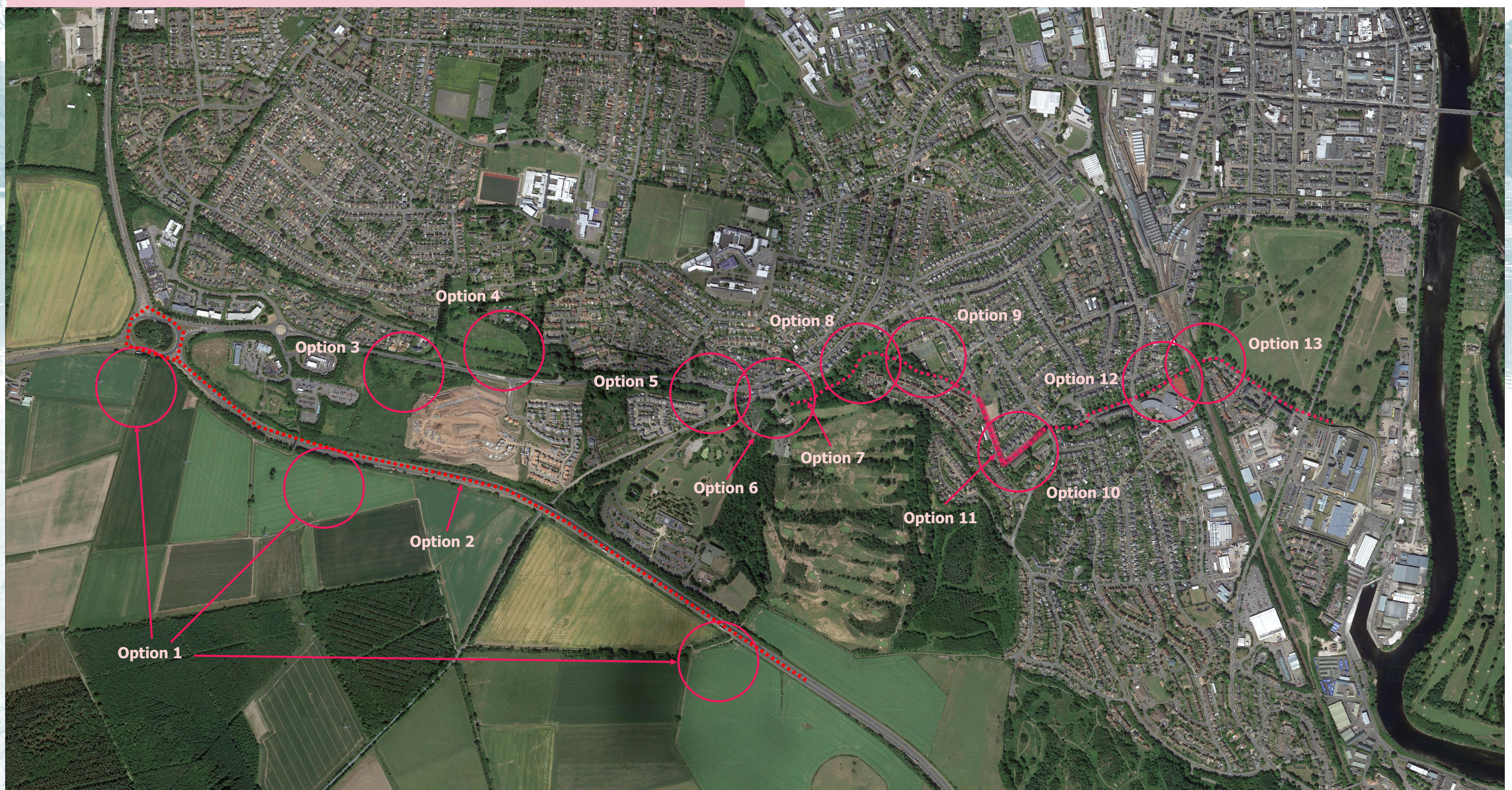
A summary of the detailed appraisal of the short list is shown in the table below:

Short-list of options	Benefit Cost Ratio
Option 1 - Upstream Storage and NFM South of M90	<1
Option 2 - Improved drainage on M90 and Broxden area	Not assessed*
Option 3 - Improved Storage at A93 Glasgow Road ('Wet' Ponds)	0.66
Option 4 - Improved Attenuation at Perth FPS Storage Area ('Dry' Ponds)	Not assessed*
Option 5 - Necessity Brae (Cherrybank) Culvert Upsizing and Storage Area	Not assessed*
Option 6 - Buckie Brae Culvert Upgrade	Not assessed*
Option 7 - Channel Modifications from Buckie Braes to South Inch	<1.00**
Option 8 - Attenuation Low Road to Woodside Crescent	0.60
Option 9 - Orchard Place Direct Defences	Not assessed*
Option 10 - Queen's Avenue Culvert Upsizing	1.39
Option 11 - Balmoral Place and Queen's Avenue Channel Modification + Queen's Avenue Culvert Upsizing	1.42
Option 12 - Croft Park Direct Defences and South Inch Spill Mechanism Reprofiling	Not assessed*
Option 13 - Croft Park South Inch Spill Mechanism Reprofiling	0.88

* Not assessed—options discounted through initial review of short list due to limited benefit, downstream detriment or excessive cost.

** Option 7 doesn't include costs for culvert upgrades/bank stabilisation—including these brings the BCR below 1.0

The location of the short-listed options are shown in the plan below:





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5. RECOMMENDED OPTION

Recommended Option

The draft flood study recommends Option 11 as described below:

- Upgrading the Queen's Avenue Culvert:** The replacement of the culvert beneath the access to the residential properties at Queen's Court. The existing culvert isn't big enough to handle the flow of water during heavy rain, so it is recommended this be increased in size. This would significantly reduce flood risk in this area by allowing the 1% AEP flood flow to pass through unimpeded.
- Channel modification (Balmoral Place and Queens Avenue):** Increasing the culvert capacity and removing the existing constraint will also reduce the amount of sediment being deposited in this section of the Craigie Burn. The bed could then potentially be lowered by approximately 200mm, increasing the channel capacity. This would be subject to further investigation (to ensure that this would not undermine any river bank structures), and would require consultation with other stakeholders.

AEP	Properties at risk	
	Current situation	Recommended option (11)
50%	0	0
20%	7	1
10%	14	2
3.33%	27	7
2%	42	16
1.33%	43	18
1%	47	25
0.5%	57	39

Table above displays the benefits of this option during a range of design flood events

The capital cost of implementing this option is estimated to be **£0.31M**, but the benefits outweigh the costs, with a **benefit-cost ratio of 1.42**. This recommended option is a cost-effective and beneficial solution to reduce flood risk and protect the properties in the area.

It is important to note that this option does not completely remove the risk of flooding in the catchment, although it significantly increases the flow capacity at this location (from the 20% AEP event to the 1% AEP flood event) as shown on the flood map below.



Maintenance

Riparian landowners have a responsibility to maintain the bed and banks of any watercourse as it passes through their property.

However the Council carries out regular **maintenance** activities to ensure that the watercourses are free from **debris** and **vegetation** that may increase flood risk. The council has a well established maintenance program that includes periodic **inspections**, **cleaning** of culverts and screens, and **removal of blockages**.

The maintenance activities have a **considerable impact** in terms of reducing the flood risk within the catchment and represent good value for money.

It is important to understand that even with ongoing maintenance to keep watercourses clear, natural materials like branches, leaves, and other debris can still find their way into urban watercourses during heavy rainfall events, resulting in blockages. The channel of any watercourse only has a finite capacity which will be exceeded during more extreme rainfall events.

Removing all flood risk?

Flooding is a natural phenomenon that can never be entirely prevented. The impacts of climate change are also increasing the frequency and intensity of rainfall events.

The study has confirmed that it isn't feasible to address all areas of flooding in the catchment. The appraisal considered combining the options including upstream storage, culvert/bridge upsizing and channel conveyance improvements (dredging) to completely remove flooding from the watercourse (for the 0.5% AEP event)

Due to the integrated nature of the flood risk in the catchment, it was found that flooding would still occur due to surface water/ sewer flooding. See adjacent table.

AEP	Properties at risk	
	Current situation	Watercourse flood risk removed
50%	0	0
20%	7	1
10%	14	1
3.33%	27	5
2%	42	11
1.33%	43	12
1%	47	13
0.5%	57	15



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6. NEXT STEPS

Summary of Study Findings

The **Craigie Burn Flood Study** has improved our understanding of the mechanisms and risks of flooding in the catchment. We collected data, undertook surveys, and gathered information to improve the reliability and accuracy of the predicted results from our model. We have a clearer picture to make informed decisions on how the risk of flooding should be managed in the future.

There is already significant flood storage within the catchment — the **Perth Flood Scheme** was completed in 2002 and includes flood walls and flood storage areas which have significant benefit along the Craigie Burn. On-going maintenance regimes help to further reduce overall flood risk.

The nature of the flooding in the catchment is integrated, meaning that the flood risk can be associated with the watercourses, surface water, the sewer network or a combination of these. The flood risk is therefore complex, and it has not been possible to identify an option that will completely remove the risk.

An option has been recommended to address the existing channel capacity around Queen's Avenue, while also benefitting the areas downstream at Queen Street and Windsor Terrace. The channel would be able to handle the 1% AEP flood flow; a significant improvement from the 20% AEP flow it currently conveys.

The Craigie Burn responds rapidly to rainfall events. This limits the potential for any formal flood warning scheme, however community-led schemes are on-going to increase preparedness for flooding. Community resilience is an essential part of managing flood risk in future. Residents are actively encouraged to consider property flood resilience measures to help reduce the impacts of future flooding.

Perth Surface Water Management Plan

The study has identified areas that are at risk of flooding from surface water. These areas face challenges when it comes to managing surface water.

Amey Consulting have also been appointed to deliver the Perth Surface Water Management Plan (SWMP), which is currently on-going. This plan aims to assess the impact of surface water flooding and investigate potential measures for the areas of highest risk across Perth.

The SWMP is taking a comprehensive approach to evaluate different potential strategies for dealing with surface water flooding. The goal is to develop practical solutions that can help manage the risk of future flooding events caused by heavy rainfall.

The Council will provide further updates on this project in due course.

Next Steps

The Council will review any comments raised today and a 'Question & Answer' report will be provided to the community in due course. Amey Consulting will then finalise their flood study and the Council will report the outcome to the next available Climate Change and Sustainability Committee. The findings will also be reported to SEPA for inclusion and prioritisation in the next Tay Local Flood Risk Management Plan for 2028-2034.

Thank you!

**We would like to thank you for your attendance and comments today.
Community involvement is a key part of flood risk management and your views are appreciated**

Any comments or questions?

Please speak with a representative from Perth & Kinross Council or Amey Consulting.

How can you provide your feedback?

Comment forms are available to fill in and return, either during the event, by post or (preferably) by **e-mail**.

These display boards are also available online on the Council's consultation hub until Friday 14 July, and comments can also be recorded online. Please visit: <https://consult.pkc.gov.uk/communities/craigieburn>
(Link can be accessed by scanning the QR code)



Further information

Further information on tackling flooding can be viewed on the Council's website at www.pkc.gov.uk/flooding

For any further information or queries please contact:

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