Flood Risk Management Options

The flood study considered various potential ways of managing the flood risk within Blackford. A long list of potential actions was initially reviewed to remove those that were clearly not feasible. Potential actions were appraised on technical, environmental, social and economic grounds. The diagram below summarises the potential actions that were considered:

Direct Flood Defences				
Flood Walls/embankments				
Conveyance improvements				
Diversion channels (to take higher flows of water)				
Channel modifications (i.e. dredging and/or 2-stage channels)				
Culvert upgrades and/or removal				
Upstream Storage				
Creating areas to store and attenuate water upstream of Blackford so as to reduce fleading within the town				
reduce hooding within the town.				
Natural Flood Management				
Using natural features in the landscape to store and attenuate water:				
Sediment Management				
Runoff reduction Channel/floodplain restoration				
• Channel/hoodplain restoration				
Property Level Protection (PLP)				
 Flood gates and doors; manual and automatic air brick covers 				
Preference for passive measures (i.e. automatic air brick covers and flood doors)				
Retro-fitting flood resilience measures to flooded properties (elevated				
plugs, hard floors, waterporof renders)				
Floodline Non-structural measures				
Application of national/local planning policies				
Social Environment Protocion Agency 02 AE 000 1100 Community flood warning system				
UJ4J J00 II00 floodlinescotland.org.uk				

Feasible actions were considered further and combined to into four potential options:

- 1. Maintenance/small works;
- 2. Property level protection (PLP);
- 3. Direct flood defences and PLP
- 4. Diversionary channels, direct flood defences and NFM.

Each option has varying levels of benefit. Only two of the options (options 3 and 4) met the study objective of reducing flood risk to all of the identified properties at risk.

The assessment included an economic appraisal (cost benefit analysis) of the options. In managing flood risk, the Council must have regard to the economic impact of its actions. The cost of a flood scheme can't exceed the benefits, i.e. the benefit/cost ratio must be greater than 1.0. Due to the varying levels of benefits, the benefit/cost ratios only form part of the final overall assessment.

The below table summarises the options assessment:

Table 1: Option Appraisal Summary Table

	Option 1	Option 2	Option 3	Option 4
	Maintenance plus small flood defence ancillary works (The Cross and Abercairney Place)	Property Level Protection (PLP) (residential properties only)	Direct Flood Defences (Tullibardine & Highland Spring) + Property Level Protection (PLP) (residential properties)	Diversion Channel (Danny Burn / Back Burn / Kinpauch Burn) plus Direct Defences (Highland Spring) plus Natural Flood Management
All properties protected (200 year event)?	No	No	Yes	Yes
Initial Capital cost	£841,769	£192,000	£4,635,345	£7,098,740
Benefit:Cost Ratio	1.4	2.9	1.77	1.44
Assessment of option	Option doesn't fully meet study objectives.	Option doesn't fully meet study objectives.	All properties offered a degree of protection but see below.	All properties defended – plus benefit to the A9.
	Only defends The Cross and Abercairney	PLP not suitable for non-residential		
	Place. Other properties still at risk.	properties, which therefore remain at risk.	Flood protection provided by PLP relies on measures being installed properly by	Diversion works are remote from the village thereby reducing impact (both
	Repeated dredging not recommended on environmental grounds.	Flood protection relies on measures being installed properly by homeowners (in	homeowners (in advance of flooding), and suitable maintenance.	during construction and longer-term).
		advance of flooding), and suitable		Visual impact of direct defences also
		maintenance.	Typical life span of PLP around 20-30 years before replacement required also.	limited.
		Typical life span of around 20-30 years		NFM opportunities through reuse of
		before replacement required.	Uptake of PLP measures is historically poor.	material claimed on site during construction.
		Uptake of PLP measures is historically poor.		
			PLP only effective up to certain flood	Potential for multiple benefits
		Only effective up to certain flood depths	depths (typically 0.6m). – modelled 1 in	(biodiversity/habitat creation/amenity)
		(typically 0.6m) – modelled 1 in 200 year	200 year flood depths are up to 0.4m (for	along diversion routes and NFM.
		flood depths are up to 0.4m (for residential properties).	residential properties).	
	Option 1 is not recommended	Option 2 is not recommended	Option 3 is not recommended	Option 4 is recommended

The draft flood study has recommended that Option 4 be taken forward. Further details of this option are shown on the plan on the next page. It is important to note that whilst option 4 has been recommended, it does not preclude other action being considered as part of future design work.



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NFM - bunds across floodplain to increase storage.

1. Diversion channel for high flows from Danny Burn to

2. Diversion channel for high flows from Back Burn to

3. Diversion channel for high flows from Kinpauch Burn

5. Natural flood management (NFM) measures to increase floodplain storage on upper Allan Water