



Oban Flood Study Report 3A: Options Appraisal - Long-List to Short-List



December 2019

Oban Flood Study

Report 3A: Options Appraisal - Long-List to Short-List

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EXECUTIVE SUMMARY

An options appraisal has been carried out to explore a broad range of potential flood management measures for Oban. One of the main aims is to generate a suite of preferred options which may be taken forward as part of a funding application for a formal flood scheme for Oban.

The options appraisal is a two-stage process. The current report, representing the first phase, takes a strategic approach to generate a long-list of measures and then distils these into a short-list of measures. The short-listed measures are then taken forward for further development and assessment in the second phase of the appraisal, designed to identify the preferred option combination (presented in *Report 3B: Options Appraisal – Economic Appraisal and Report 3C: Conceptual Designs and Factsheets*).

As part of the long-list to short-list process, a Flood Management Toolbox has been developed, including surface water, waterbody engineering, natural flood management, coastal and other structural and non-structural options. With the understanding developed through catchment, watercourse and coastal characterisation, aided by stakeholder engagement, a long-list of options was generated. These options ranged from traditional engineered solutions such as flood walls and changes to existing structures, to less conventional options such as tunnelling floodwater directly to the sea, in-channel placement of large woody structures and strategically placed tidal reefs.

Flood management zones were developed to focus effort on strategic locations where benefits could be optimised in the most cost-efficient way. A range of potentially suitable measures for each zone were identified as part of the long-listing process; a process which was guided by consultation with Argyll and Bute Council, the community and other stakeholders.

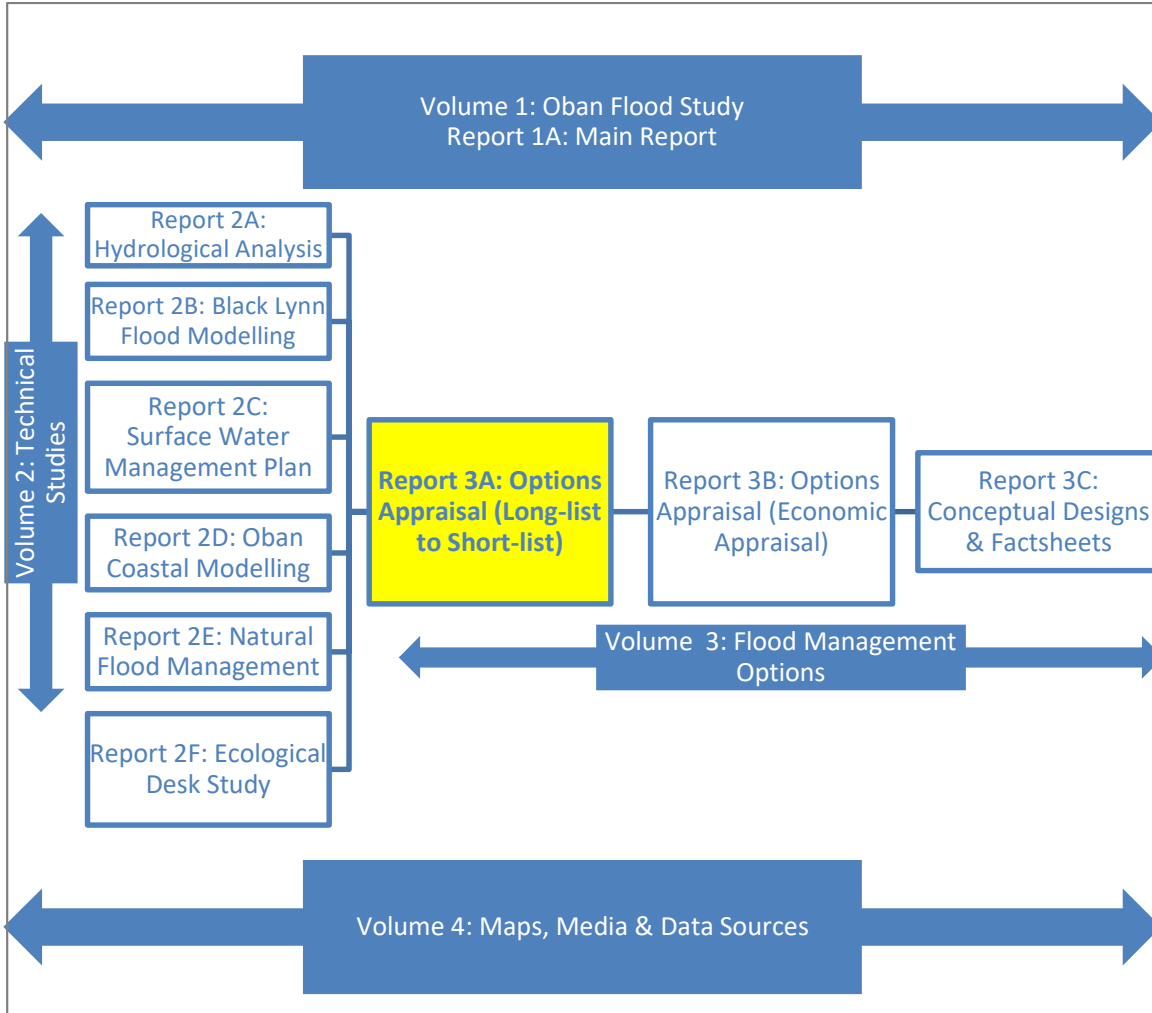
Through screening and multi-criteria analysis, this long-list was distilled to a short-list. The criteria used to evaluate each option included potential effectiveness in reducing flood risk, technical performance, land use compatibility, cost, environmental impacts, social impacts and regulatory requirements. The multi-criteria analysis scores were ranked to establish the short-list of options. The short-listed options cover a range of functions, specifically targeting storage and attenuation of floodwaters, routing of overland flows or defence against flooding. The short-list was reviewed and refined following consultation with key stakeholders and the community.

As well as the short-listed measures which would be core to a potential flood scheme, other recommendations are drawn out for implementation by the Council, community and other stakeholders. Measures to promote community awareness, adaptation and resilience are emphasised as being an important first line of defence and a means to support adaptation to future climate change. To promote this initiative, available support or funding mechanisms should be communicated, with a co-ordinated and proactive approach considered to be essential. This may be achieved through the formation of a local community action group, or forum, with a specific focus on flooding, including representation from Argyll and Bute Council and other key stakeholders.

Additionally, recommendations are also made for surface water management, channel and structure maintenance, and several other site-specific measures, which will require partnership working between Argyll and Bute Council and Scottish Water.

OBAN FLOOD STUDY REPORT MAP

The context of the current report within the wider Oban Flood Study is highlighted in yellow as shown below.



Contents

Executive Summary	i
Oban Flood Study Report Map.....	ii
1 Introduction.....	4
1.1 Terms of Reference	4
1.2 Scope of Report.....	4
1.3 Report Usage.....	4
2 Method.....	5
3 Options Appraisal	6
3.1 Flood Management Toolbox	6
3.2 Long-List of Options	6
3.3 Screening of Long List Options	6
3.4 Multi-Criteria Assessment.....	11
3.5 Short-List of Options	12
3.6 Non Short-listed Measures for Further Consideration.....	15
4 Options Development.....	18
5 Conclusions & Recommendations	19
References	i
Appendices.....	ii

Appendices

- A Flood Management Zones
- B Long List of Options
- C Multi-Criteria Scoring System
- D Multi-Criteria Analysis of Options
- E Interactive Options Maps

Figures

Figure 2.1 Options Appraisal Process.....	5
Figure 3.1 Concept of Strategic Flood Management Sequence	12
Figure 3.2 Operational Area at North Pier	16
Figure 3.3 Oban Ferry and Railway Terminals (Photo source: Wikipedia)	16

Tables

Table 3.1 Flood Management Toolbox for Oban (<i>underlined text denotes hyperlink to further information</i>).....	7
Table 3.2 Key Functions of Flood Management Zones	13
Table 3.3 Short-listed Flood Management Measures for Priority Flood Management Zones.....	14

1 INTRODUCTION

1.1 Terms of Reference

An appraisal of flood management options has been carried out as a key part of the Oban Flood Study, which has been commissioned by Argyll and Bute Council (herein referred to as the Council). This report outlines the first part of the options appraisal: the identification of a long-list of flood management options followed by screening and multi-criteria analysis to generate a short-list of options.

This Options Appraisal has been prepared within the context of the Oban Flood Study and should be read in conjunction with *Report 1A: Main Report*. The outputs of this study are used to form the basis of the subsequent hydraulic modelling and economic appraisal of short-listed options (*Report 3B: Options Appraisal – Economic Appraisal*).

1.2 Scope of Report

A strategic approach is required to achieve optimum flood risk reduction for Oban in a cost-effective manner. Key to this is a comprehensive understanding of flooding dynamics developed through the various technical assessments and stakeholder consultation. The options appraisal process begins with identification of potential flood risk management measures, ranging from traditional engineered solutions such as flood walls to more sustainable and natural measures such as wetland restoration. The resulting 'long-list' of measures also includes unconventional options, such as tunnelling floodwater directly to the sea or strategically placed tidal reefs.

Through a structured process designed to target and prioritise measures, the aim of the options appraisal is to derive a short-list of options to be taken forward for further development as part of a potential flood alleviation scheme which, if successful, would be funded primarily through the Scottish Government's General Capital Grant. Emphasis is also given to other recommendations which may be taken on independently of the flood scheme, by the Council, the community and other stakeholders.

1.3 Report Usage

This report has been prepared as part of the Oban Flood Study commissioned by Argyll and Bute Council and should not be used beyond this context without their permission.

It is important to note that the assessment has been prepared in the context of a catchment-scale flood study and as such is designed to identify flood management options at a strategic level. It is not intended to identify specific flood mitigation measures for individual properties.

If this report is to be submitted for regulatory approval more than 12 months following the report date, it is recommended that it is referred to EnviroCentre Ltd for review to ensure that any relevant changes in data, best practice, guidance or legislation in the intervening period are integrated into an updated version of the report.

2 METHOD

The methodology undertaken to appraise options for the Oban Flood Study has been designed with reference to the following key guidance documents:

- Options Appraisal for Flood Risk Management: Guidance to Support SEPA and the Responsible Authorities (Scottish Government, 2016); and
- Local Authority Flood Study Checklist (SEPA, 2018).

The options appraisal process is outlined in Figure 2.1.

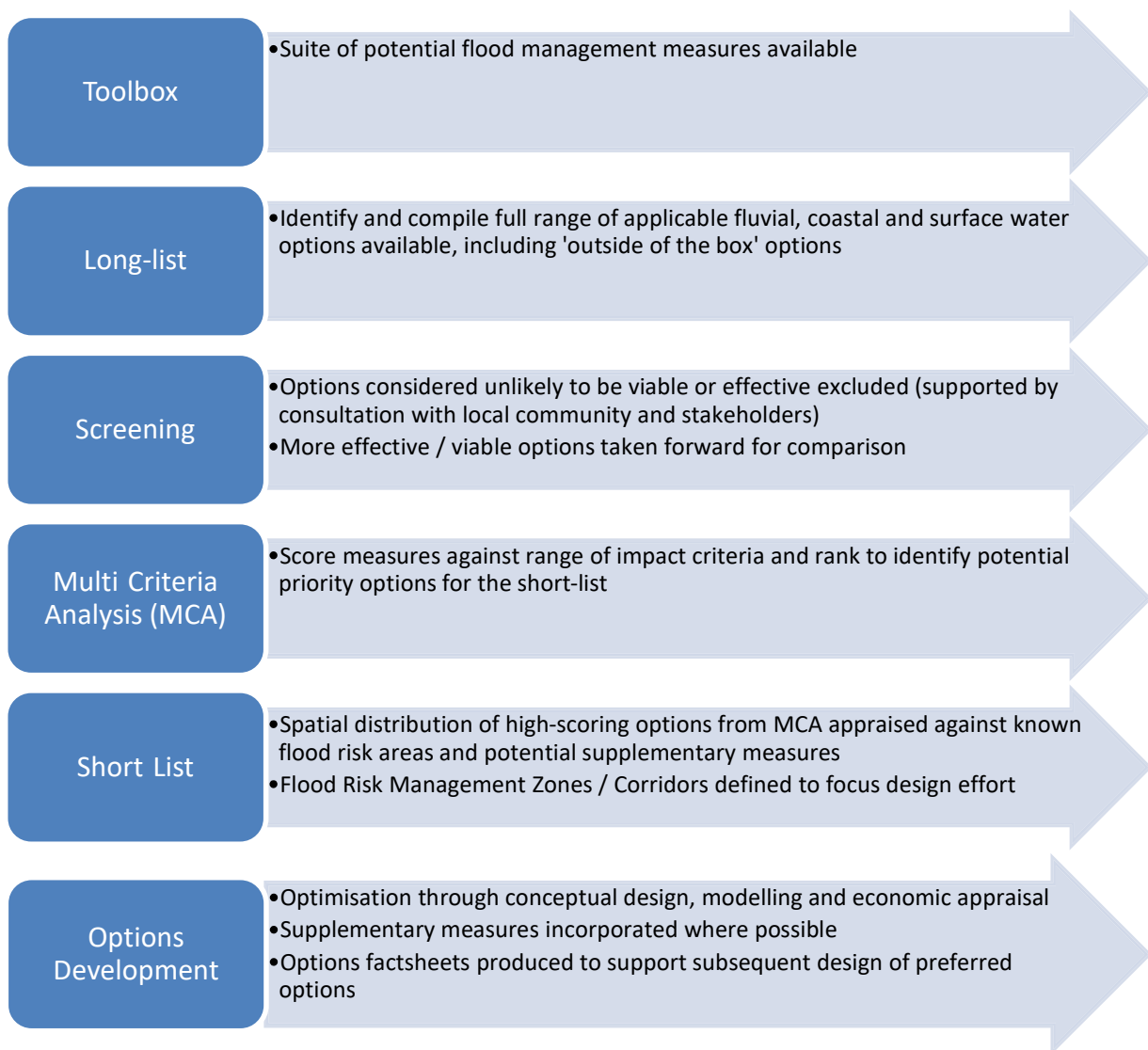


Figure 2.1 Options Appraisal Process

3 OPTIONS APPRAISAL

3.1 Flood Management Toolbox

A flood management toolbox has been developed, with measures grouped under the following headings:

- Surface Water;
- Waterbody Engineering;
- Natural Flood Management (NFM);
- Coastal;
- Other: Structural; and
- Other: Non-structural

The toolbox is provided in Table 3.1, which includes hyperlinks to sources of further information.

3.2 Long-List of Options

The catchment was divided into hydrologically distinct zones depending upon the flood source being considered (sub-catchments; surface water management zones (SWMZ); fluvial corridors; and coastal strips). These zones are displayed in Appendix A.

A long list of potential flood risk management options appropriate to each of the zones was identified and is contained in Appendix B.

3.3 Screening of Long List Options

An initial screening was undertaken on the long list of potential flood risk management options identified, which is included within Appendix B.

Flood management options available in each zone were considered individually and scored between values 1 (high) and 3 (low) for potential effectiveness in flood terms of reduction in flood risk and flood damages at the strategic scale. This process is based on the understanding developed through various technical studies carried as part of the Oban Flood Study (*Report 2B: Black Lynn Flood Modelling; Report 2C: Surface Water Management Plan; Report 2D: Oban Coastal Flood Modelling; and Report 2E: Natural Flood Management*), expert judgement and consultation with the community and stakeholders. There is a degree of subjectivity to this process and so it is important that results are interpreted with due care.

Options scoring 3 were screened out before the MCA on the basis of one or more of the following:

- Relative impact on flooding at catchment scale would be minor;
- Limited benefits in terms of flood damages reduction;
- Limited opportunities for implementation / conflicting land use; and/or
- Implementation would be associated with disproportionate costs / negative impacts.

This options screening has been based on understanding of catchment characteristics, interpretation of hydrological and hydraulic models produced as part of the study, and stakeholder consultation.

The scoring is presented in Appendix B, and an interactive (layered pdf) map showing the potential locations of long-list measures is provided in *Drawing 170506_051, Appendix E*.

Table 3.1 Flood Management Toolbox for Oban (*underlined text denotes hyperlink to further information*)

Type	Action	Description
Surface Water Options		
Property-level	<u>Rainwater Harvesting</u>	Capture & storage of water from roofs and hardstanding areas in small features at property level e.g. water butts.
	<u>Green Roofs</u>	Vegetated roofs to intercept rain and attenuate runoff.
Local level	<u>Additional Interception</u>	Additional gully pots and strip drains.
	Interception Traps	Enhanced gully pots designed to intercept sediments, particularly in steep areas.
	<u>Permeable paving</u>	Porous or permeable paving surfaces designed to encourage infiltration to underground attenuation.
	<u>Enhanced underground void space</u>	Base course with high void space below permeable paving cap, discharging via infiltration and/or to an underdrain system.
	<u>Infiltration Basin</u>	Vegetated depression designed to store runoff & encourage infiltration (usually dry except periods of heavy rain).
	<u>Swale</u>	Shallow vegetated channel designed to attenuate / convey flows and encourage infiltration.
	<u>Rain Garden</u>	Small, shallow depression, or container, with water tolerant vegetation designed to encourage infiltration and evapotranspiration.
	<u>Bioretention systems</u>	Vegetated water management features within a Sustainable Drainage System.
	<u>Proprietary cellular tree pits</u>	Urban tree planting system with extensive underground water storage capacity.
	<u>Evapotranspiration</u>	Vegetation planting to intercept and attenuate runoff.
	<u>Overland Conveyance</u>	Collection and conveyance of runoff towards watercourses using green infrastructure techniques or existing linear features.
	<u>Grass filter strip</u>	Grass buffer intercepting runoff from paved areas before entering watercourses.
<u>Filter drains</u>	Shallow trench containing stone/gravel to intercept lateral flows. Attenuates and conveys water towards discharge point, with potential for infiltration.	
Catchment level	<u>Wetland</u>	Well vegetated shallow pool with attenuation capacity above permanent storage level, discharging to drainage network.
	<u>Pond</u>	Deeper permanent pool with less vegetation than a wetland, discharging to drainage network.
	<u>Attenuation Basin</u>	Vegetated dry pond with restricted outlet to detain and attenuate runoff under storm conditions.
	<u>Extended Detention Basin</u>	Temporary storage of stormwater, with restricted outlet structure to detain and attenuate runoff and promotes settlement of pollutants.
Surface Water Network	Orifice Plates	Flow restrictor designed to regulate rate of discharge.
	<u>Pipe Resizing</u>	Increased or decreased conveyance capacity of pipes at targeted locations.
	Upstream Attenuation Tank	Underground attenuation tank with outlet control; inflow from surface water interception.

Type	Action	Description
	In-line Attenuation Tanks	Underground attenuation tank with outlet control; suitable for connection to existing storm and combined sewers.
	Drainage Network Offline Storage	Diversion of surface water to storage tanks or alternative storage features in the existing drainage network.
	<u>Sewer Separation</u>	Separation of storm and combined sewer networks, with revised storm sewer network discharging to watercourses.
	<u>New Outfall to Watercourse</u>	Increase capacity or build new pipes for surface water discharge.
	Wastewater Treatment Works Upgrade/Pump Upgrade	Increase pump and Wastewater Treatment Works capacity to increase capacity in trunk combined sewer.
Waterbody Engineering Options		
Reservoir Management	<u>Increase reservoir capacity</u>	Enhance storage capacity e.g. by revising outlet control levels.
	<u>Active reservoir management e.g. drawdown</u>	Strategic discharges of stored water ahead of predicted periods of heavy rain to release storage capacity.
Flood Defence	<u>Build embankments / walls</u>	Permanent engineered barrier.
	<u>Modify / maintain existing embankments / walls</u>	Enhancements / repairs to existing flood defences.
	<u>Land-raising (+ compensatory storage as appropriate)</u>	Raising ground levels above predicted flood levels (ensuring loss of floodplain storage offset by creation of new floodplain at suitable alternative location).
Floodplain Storage	<u>Floodplain storage cells</u>	Formation of new floodplain storage areas where suitable.
	<u>Remove embankments</u>	Restoration of floodplain storage capacity by breaching or removal of existing defences, where suitable.
	<u>Set-back embankments</u>	Relocation of embankments to allow more storage of water in riparian / floodplain area.
	<u>Channel modification to promote out of bank flow</u>	Lowering of banks to encourage increased utilisation of floodplain storage where suitable.
Channel capacity	<u>Clearance (vegetation management / targeted sediment management)</u>	Channel maintenance to maintain hydraulic efficiency and conveyance capacity of channel and structures.
	<u>Form two-stage channel</u>	Benching out of channel banks to form inset floodplain / flood conveyance area.
	<u>Bypass channel / diversions / tunnels / supplementary pumping</u>	Diversion of excess floodwater away from key flood risk receptors.
Structural modification	<u>Blockage prevention measures</u>	Measures to intercept trash or sediments upstream of structures.
	<u>Reconfigure / modify structures</u>	Modification of structures to reduce blockage risk e.g. removal or piers or enhancing capacity
	<u>Remove structure</u>	Removal of structures where appropriate alternative available.

Type	Action	Description
Natural Flood Management Options		
Catchment Woodland (non-floodplain)	<u>Woodland restoration / creation</u>	Extensive tree planting to enhance rainfall interception and infiltration to soils, reduce suspended sediment loadings and contribute large woody material to watercourses.
	<u>Linear buffer woodlands (e.g. Cross-slope hedgerows / woodland strips / Toe slope buffer strips)</u>	Strategically planted linear buffer strips to intercept overland flows and suspended solids, encouraging runoff attenuation and infiltration.
	<u>Gully woodland</u>	Riparian planting in upland gullies to intercept rain, slow overland flows, reduce sediment contributions and encourage infiltration. Large woody materials can increase roughness and create dams, slowing in-channel flows.
Catchment Wetlands (non-floodplain)	<u>Wetland restoration / creation</u>	Restoration (e.g. through ditch blocking) or creation of waterlogged areas which attenuate release of runoff and suspended solids.
	<u>Blanket peat restoration</u>	Restoration of conditions required for growth of <i>Sphagnum</i> mosses & other peatland species, e.g. through ditch blockage & reduced grazing.
Land Management	<u>Sustainable land & soil management practices / Min till techniques</u>	Land management measures to conserve soil structure / stability and promote carbon capture e.g. contour ploughing, winter cover crops.
	<u>Grazing/poaching management</u>	Reduced grazing density and avoidance of bankside poaching e.g. by providing alternative watering points.
	<u>Agricultural & upland drainage modifications</u>	Reduced maintenance / strategic modifications to drainage to reduce runoff rates & improve soil moisture retention.
	<u>Overland sediment traps / vegetated buffer strips / toe slopes to intercept sediment / water</u>	Linear features strategically placed to intercept runoff & suspended solids.
	<u>Constructed farm wetlands / ponds</u>	Creation of wetlands / ponds to intercept runoff and sediments.
River & Floodplain Restoration	<u>Riparian buffer strips / woodland</u>	Vegetated areas to slow runoff rates and intercept suspended solids.
	<u>River morphology & floodplain restoration / reconnection</u>	Restoration of river processes and increasing utilisation of floodplain storage potential.
	<u>Washlands / offline storage ponds</u>	Floodplain storage features for attenuation of floodwaters.
	<u>Instream structures e.g. LWM dams or flow deflectors</u>	Structures designed to slow flows, reduce erosion and/or introduce morphological diversity.
	<u>Channel erosion management</u>	Measures to protect high risk eroding banks and/or reduce sediment loadings in the channel.
	<u>Floodplain woodland / woodland strips / hedgerows</u>	Increased vegetative roughness over floodplain to increase water retention, debris interception and infiltration.
	<u>Floodplain roughening / interception features e.g. LWM barriers</u>	Constructed 'leaky barriers' at strategic locations over floodplain to increase retention, intercept debris and encourage infiltration.

Type	Action	Description
Coastal Options		
Onshore measures	Set-back flood wall	Defence set back from shoreline.
	<u>Demountable defences</u>	Demountable gates / temporary barriers erected ahead of predicted flood events (set back from shoreline).
Shoreline defence	Raise flood wall (permanent)	Raise crest level of existing defences.
	<u>Demountable defences</u>	Demountable gates / temporary barriers erected ahead of predicted flood events (along shoreline).
	Streetscaping / landscaping to divert / contain floodwaters	Strategic modification to roads, paths and/or landscape to divert water away, or prevent water from reaching flood risk receptors.
Intertidal	<u>Rip-rap / groynes</u>	Large boulder structures designed to dissipate / deflect wave energy & reduce overtopping / erosion.
	<u>Reclamation</u>	Extension of land to move shoreline seaward.
	<u>Beach re-charge</u>	Import of appropriate beach sediments to dissipate wave energy and protect shoreline.
	<u>Lagoon</u>	Shallow body of water protected from full coastal wave action by a barrier island or reef.
Offshore wave control structures	<u>Pontoons / Breakwaters</u>	Linear structure to reduce intensity of inshore wave action, reducing erosion and forming safe anchorage for boats.
	<u>Artificial reef</u>	Artificial submerged structure to dissipate wave energy.
	<u>Tidal barrage</u>	Dam-like structure to limit tidal / wave forces entering bay.
Other: Structural Options		
Access provision	By-pass roads / diversions	Alternative access provision e.g. temporary road diversions or permanent options (e.g. potential Oban Development Road).
Flow Routing	<u>Streetscaping / landscaping to divert / contain overland flows</u>	Strategic diversion of overland flows away from flood risk receptors.
Asset Management	Routine maintenance / management / upgrades of drainage network	Regime of routine maintenance and planned upgrades to targeted parts of the drainage network.
	<u>Watercourse maintenance / management</u>	Regime of routine and responsive channel maintenance, with particular focus on key structures and high risk areas.
Property level measures (retro-fit)	<u>Protection (e.g. flood walls, demountable flood gates, raise threshold levels)</u>	Permanent and demountable measures to prevent water ingress to buildings e.g. flood gates, vent covers.
	<u>Resilience (e.g. concrete floors, raised electrical networks)</u>	Permanent measures to improve ability of building to withstand flooding e.g. water resistant materials.
Relocation / managed retreat	<u>Relocate flood risk properties / assets out of flood risk zone</u>	Relocation of flood risk receptors where cost of flood protection unviable.

Type	Action	Description
Other: Non-structural Options		
Monitoring, forecasting & warning	Flow / rainfall gauging station	Monitor water levels in watercourses / local rainfall.
	<u>Flood Alert systems & dissemination mechanisms</u>	Public dissemination of flood warnings to minimise impacts of predictable flooding.
Community adaptation	<u>Community education / information sharing / awareness raising</u>	Community awareness to encourage implementation of mitigation measures and minimise damage.
	<u>Emergency response planning</u>	Emergency response planning e.g. communication lines, flood kits, evacuation/rescue procedures.
	<u>Business Continuity planning</u>	Planning to minimise impacts of businesses and employees.
	<u>Community Flood Action Groups / Plans</u>	Community support and action groups, and plans to encourage awareness, co-ordinated approach and active participation.
	<u>Resilient community plans</u>	Plans to improve resilience and emergency planning at community level.
	<u>Flood insurance provision</u>	Flood insurance advice and cover.
Land Use Policy	Improved adherence	Adherence to existing local and national planning policies in relation to flooding and drainage.
	Increase stringency	Increase stringency of local guidance and policies in relation to flooding and drainage.
	Clarify responsibilities for existing surface water management infrastructure (including Sustainable Drainage Systems (SUDS))	Ensure responsibilities for management of drainage and flood risk are clearly understood.
Further study	Improve understanding of risks & impacts	Further assessment and modelling to understand potential risks & impacts.
	Outline / detailed design	Further design to refine flood management proposals.

3.4 Multi-Criteria Assessment

Long-list measures with a score of 1 or 2 were taken forward for multi-criteria analysis (MCA) to help refine this long list down to a smaller number of measures considered appropriate for further consideration. The MCA is a decision support framework to appraise an array of potential flood management measures against a suite of criteria reflecting the broader impact of any given measure.

The scoring guide is presented in Appendix C. Scores range between -2 (significant negative impact) and +2 (significant positive impact). A score of 0 is applied whether there is either no measurable effect or where the significance of the pros and cons are considered equal. Due to flood management being the key driver behind the study, criteria covering technical performance in terms of flood protection, scale of impact and the safety of the most vulnerable receptors are double weighted.

The allocation of scores to the MCA is based on solid understanding of the flood risk problem, the implications of potential flood management measures and consultation with the local community and stakeholders. The MCA is designed to be a decision support framework which provides indicative rather than conclusive results, and it is important that the outcomes of the MCA are carefully interpreted in this context.

The MCA matrix provided in Appendix D allows the options to be effectively ranked to inform the identification of measures that can be considered further.

3.5 Short-List of Options

3.5.1 Short-listing Strategy

The highest ranking options from the MCA were critically examined, with a focus on their spatial distribution in relation to key flood risk areas. Key actions, or clusters of actions, were used to define Flood Risk Management Zones or Flood Risk Management Corridors. The aim is to target flood management efforts where it is most needed, and in the most cost-effective manner.

The flood management measures proposed within each zone have different sets of functions, depending upon their location relative to the source and receptors of flood risk. Strategic management of floodwater requires a sequential approach with a focus on sustainability, as illustrated by Figure 3.1.

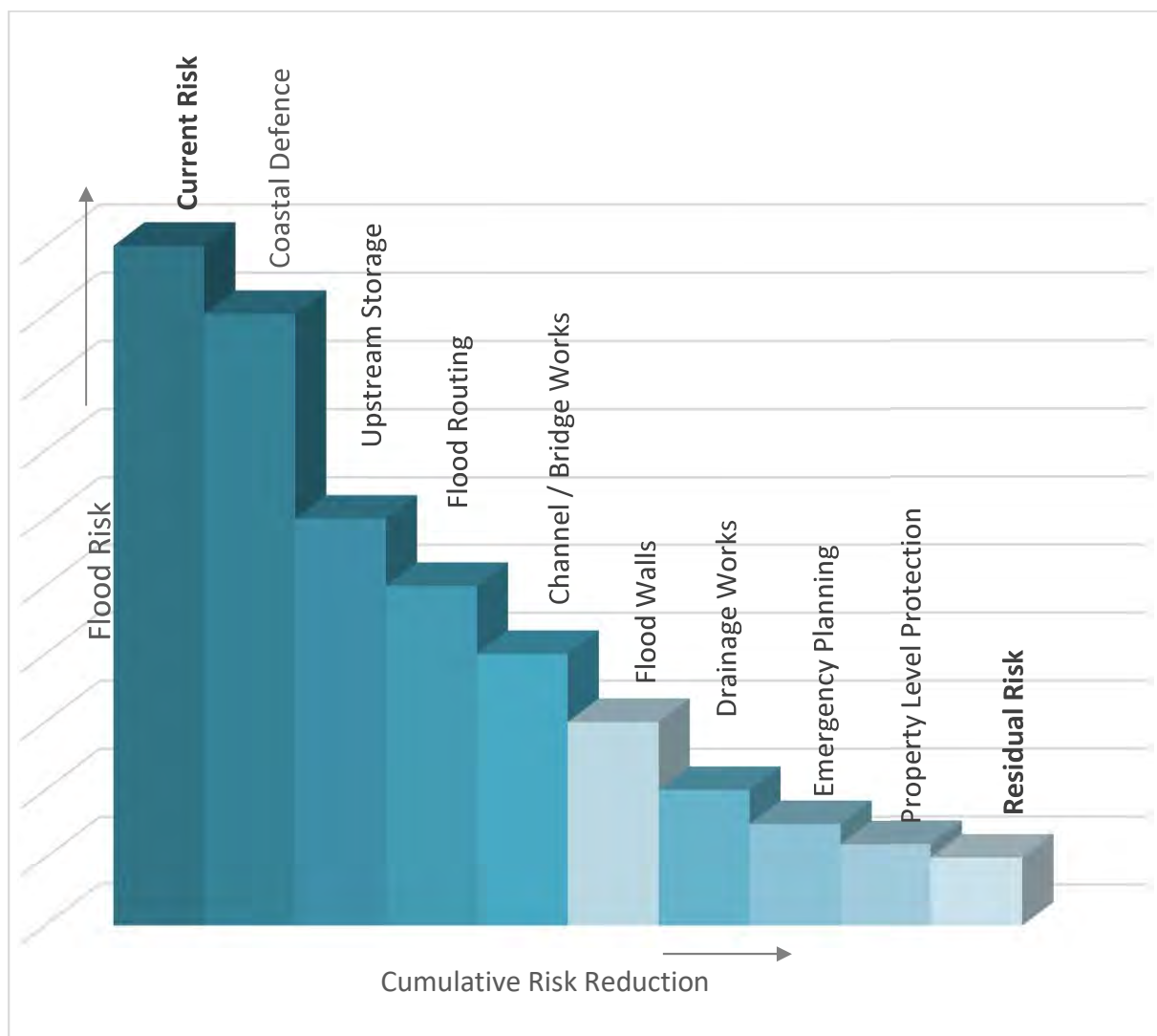


Figure 3.1 Concept of Strategic Flood Management Sequence

In general terms, the most sustainable and cost-effective approach is to prioritise storage and attenuation of floodwater at source (upstream) or where it is considered 'safer' and less damaging to store water in the urban area e.g. parks or greenspaces. This lessens or delays the catchment flood response, reducing the volume of floodwater reaching flood risk areas and potentially reducing the scale of engineering interventions required

downstream. Next in the sequence is the efficient routing or conveyance of floodwaters through flood risk areas to minimise the accumulation of water and associated damage and disruption.

When it is no longer possible to ‘store or move’ floodwater, the final measure is defence. The main exception to this strategy is coastal flood risk management, where it can be less feasible to control tidal flood processes, meaning that defence is the primary measure adopted. Engineered flood defences are considered the least sustainable of the measures available, although sustainability can be improved through the inclusion of adaptation and resilience measures. The last column on Figure 3.1 illustrates the point that there is expected to be an element of residual risk, which must be given due consideration in the development of flood management measures.

Table 3.2 shows how this sequential strategy has been applied to Oban through the flood management zones identified by this study (mapped in Appendix A).

Table 3.2 Key Functions of Flood Management Zones

Key Functions of Flood Management Zones		Target Functions					
		Sustainable Drainage	Storage / Attenuation	Routing	Conveyance	Defence	Adaptation & Resilience
Flood Management Zone	Oban Bay Coastal Strip					✓	✓
	Corran Esplanade Coastal Strip					✓	✓
	Lochavullin / Black Lynn Corridor	✓			✓	✓	✓
	Millpark Corridor	✓				✓	✓
	Glenshellach Corridor	✓	✓	✓			✓
	Miller Road Corridor			✓			✓
	Mossfield Zone (plus associated Dalintart Flood Routing Corridor)		✓	✓			✓
	Glencruitten Corridor		✓				
	5-Way Junction	✓	✓	✓	✓		✓
	Upper Catchment	✓	✓				
	Catchment-wide	✓	✓				✓

3.5.2 Short-List

The primary options taken forward for further development are illustrated on (*Drawing 170506_050, Appendix E*) and listed in Table 3.3. These are core measures which are recommended for further exploration in support of a formal flood scheme. The potential supplementary measures listed may either be incorporated within the application for the formal flood scheme, or be implemented independently by the Council or individual property owners, potentially with support from alternative sources such as the Scottish Flood Forum (SFF) or Scottish Water.

The potential effectiveness of NFM measures is explored further in *Report 2E: Natural Flood Management*.

Table 3.3 Short-listed Flood Management Measures for Priority Flood Management Zones

Flood Management Zone	Primary / Short-term Measures	Supplementary / Longer-term Measures
Oban Bay Coastal Strip	<ul style="list-style-type: none"> • Raise level of existing flood wall (incorporating potential for future adaptation e.g. scope to add on transparent panels). • Flood gates where access required. 	<ul style="list-style-type: none"> • Property-level protection. • Local drainage maintenance / improvements.
Corran Esplanade Coastal Strip	<ul style="list-style-type: none"> • Raise current wall level, with land reclamation where required to create sufficient width for working zone / foundations. • Alternatively, form embankment extending into intertidal area, creating a wider access strip for pedestrians. • Flood gates where access required. 	<ul style="list-style-type: none"> • Property-level protection. • Local drainage maintenance / improvements. • Incorporation of multi-functional land use e.g. increase public amenity space and aesthetic value.
Lochavullin / Black Lynn Corridor, incorporating Lochavullin SWMZ	<ul style="list-style-type: none"> • Flood walls on both banks to defend against combined fluvial & coastal flood risk. • Market Street Bridge replacement (with focus on widening and soffit raising).* • Soroba Lane Bridge replacement (with focus on widening and soffit raising).* • Black Lynn channel capacity improvements. • Local drainage improvements including pumping station upgrade. 	<ul style="list-style-type: none"> • Channel & drainage maintenance. • Property-level protection • Access diversions. • Long-term planning strategy to avoid most vulnerable uses.
Millpark Corridor	<ul style="list-style-type: none"> • Flood defences on right bank. 	<ul style="list-style-type: none"> • Local drainage improvements.
Glenshellach Corridor	<ul style="list-style-type: none"> • Floodplain restoration and temporary flood storage area at Lon Mor. • Local drainage improvements e.g. retrofit SuDS. 	<ul style="list-style-type: none"> • Property-level protection. • Long-term planning strategy to protect functional floodplain and ensure incorporation of SuDS for any future development.
Miller Road	<ul style="list-style-type: none"> • Formalised routing of floodwater overtopping Miller Road culvert using streetscaping. 	<ul style="list-style-type: none"> • Channel & structure maintenance. • Property-level protection. • Community awareness. • Access diversions. • Longer-term planning strategy to increase culvert capacity when due for replacement.
Mossfield Zone	<ul style="list-style-type: none"> • Temporary flood storage area at Mossfield stadium to store excess water from Alltan Tartach (maintaining multi-functional use). 	<ul style="list-style-type: none"> • Temporary flood storage at Rugby pitches (maintaining multi-functional use). • Potential drainage revision to optimise balance between flood storage and maintenance of playable sports pitches.
Upper Catchment (Soroba, Glenshellach & Alltan Tartach sub-catchments)	<ul style="list-style-type: none"> • Natural Flood Management: catchment woodland, riparian woodland. 	<ul style="list-style-type: none"> • Wetland / peat restoration. • Channel / floodplain restoration.

* Hydraulic modelling has shown that the Market St and Soroba Lane bridges are the two most significant bottlenecks in the Black Lynn (Report 2B: Black Lynn Flood Modelling).

3.6 Non Short-listed Measures for Further Consideration

3.6.1 Context

Several options which have not been short-listed may still have the potential to bring about significant local benefit. These have been assessed to not be suitable for incorporation within the formal flood scheme application for one or more of the following reasons:

- Adverse benefit cost ratio anticipated;
- Measure ineligible for formal flood scheme funding;
- Highly localised benefit;
- Optimal functioning not reached within funding timescales; or
- Conflicting land uses or land ownership matters requiring further exploration.

The following sections highlight options that are considered to merit independent implementation or further development outwith the government flood scheme application. Alternative sources of funding may be available for these measures (e.g. Scottish Water, Forestry Scotland, Scottish Natural Heritage, commercial businesses, transport providers, private landowners or the Oban Common Good Fund).

3.6.2 Community Adaptation and Resilience

One of the most important recommendations is that focus is given to community adaptation and resilience. This is one of the quickest measures to implement, providing the community some level of protection over the short-term. It is also seen as a means to support adaptation to future climate change.

Key measures include:

- Community awareness;
- Flood alerts (e.g. Scottish Environment Protection Agency Floodline or locally-operated);
- Community flood action planning / emergency planning; and
- Property-level protection (such as flood gates, air brick covers, raised electrical networks).

More information and valuable support on community flood planning, adaptation and resilience measures is available through the [Scottish Flood Forum](#) (SFF). This organisation was involved in a community consultation event in Oban in January 2019, and have openly offered to provide additional support to the community and/or individuals wherever required.

3.6.3 Coastal Operational Areas

Two Operational Areas along the coastline are shown in Appendix A and illustrated by Figure 3.2 and Figure 3.3. Given the active use of these areas, it is understood that direct flood defences such as walls are likely to be unpractical and potentially unsafe for boat users. For the most part, the properties along the operational areas are commercial and by their nature are classified as least vulnerable developments. *Drawing 170506_100 (Appendix E)* illustrates the distribution of land use vulnerability in the study area.

The ferry and railway terminals are both located within the operational area and are classified as essential infrastructure. To some extent these features are water compatible, although it is likely that temporary transport disruption would occur during extreme floods. Appropriate use of flood alerts and flood planning, together with property level protection are recommended in these areas.



Figure 3.2 Operational Area at North Pier



Figure 3.3 Oban Ferry and Railway Terminals (Photo source: [Wikipedia](#))

3.6.4 Surface Water Management Zones

The long-list of options appraised includes the range of options recommended by *Report 2C: Surface Water Management Plan*. Local drainage modifications are also likely to be required alongside any core measures taken forward as part of a formal flood scheme. Beyond this, the remaining measures which have not been short-listed will remain valid and it is recommended that these are taken forward through collaborative working between the Council and Scottish Water, as appropriate.

A targeted approach is recommended, focussing on areas with the highest surface water flood risk and on potential opportunities to upgrade the system as new developments arise, or as certain elements reach the end of their design life. A long-term programme of improvements is recommended, which would enable adaptation in line with predicted climate change. Routine drainage maintenance is also a key recommendation to ensure optimum functioning of the system.

3.6.5 Channel Network

Routine channel and structure maintenance is recommended, with a focus on key flood risk areas highlighted by *Report 2B: Black Lynn Flood Modelling*. Pro-active management of Japanese knotweed and other invasive non-native species will be an important element of this.

3.6.6 Glencruitten Corridor

A series of opportunities exist along the Glencruitten Corridor to implement temporary flood storage and natural flood management measures (e.g. channel / wetland restoration, riparian woodland), whilst maintaining multiple uses through the golf course. Complexities associated with multiple land ownership, and conflicting land use, have meant that this option has not been short-listed at the current time. This option may become viable in future and as such, this option should be considered as part of future local development planning strategies.

3.6.7 Dalintart Corridor

Through the course of the study, it was highlighted that there may be an opportunity to relieve flood risk pressures along the Alltan Tartach and Miller Road by re-routing a portion of floodwater from the Mossfield area. The floodwater would be routed overland from the south-east of Mossfield along the south of Dalintart, over or under Soroba Road, and into the Soroba Burn. This route aligns with one of the corridors which has been under consideration for a number of years for the potential Oban Development Road. Combining these opportunities may present a longer-term opportunity to deliver on multiple objectives.

3.6.8 5-Way Junction

One of the flood hotspots highlighted by the Council at an early stage in the study was the 5-Way Junction, an important access point along the Longsdale Burn. This is a highly localised flooding problem which causes local access issues but property damage is not considered significant enough to warrant inclusion within a formalised flood scheme. The following potential measures are recommended for independent implementation by the Council:

- Formalised flood storage over road & flood routing using streetscaping;
- Channel and structure maintenance;
- Replace / remove informal crossings & channel engineering works upstream;
- Access diversions;
- Property-level protection;
- Community awareness; and
- Longer-term culvert upgrade.

4 OPTIONS DEVELOPMENT

Short-listed options are subsequently taken forward for conceptual design (*Report 3C: Conceptual Design and Factsheets*), by incorporating considerations such as:

- Summarising the main components required to deliver effective flood mitigation measures;
- Potential 'add-on' measures to supplement key measures (e.g. long-list measures, such as surface water management improvements, which may not necessarily have been short-listed but may still work effectively, particularly where cost-efficiencies are available when measures are combined within defined working zones);
- Need for further stakeholder engagement e.g. consultation with landowners, Transport Scotland, Scottish Water, utility providers.
- Opportunities to access funding from alternative sources, such as the Forestry Grant Scheme or local community funds;
- Tie-ins to existing features to ensure comprehensive protection is achieved e.g. at the interface between fluvial flood defences and existing bridge structures or access points;
- Drainage implications (e.g. potential for flood walls to obstruct overland paths for excess surface water, causing an accumulation of floodwater on the 'wrong' side of the flood wall and necessitating a change in local drainage arrangements);
- Access logistics (e.g. for delivering the works, maintain access through flood defences);
- Engineering requirements (e.g. specialist structural or geotechnical input to the design of measures, or where careful design around utilities or protected features may be required);
- Potential Standard of Protection achievable / requirements for freeboard;
- Licensing / permit requirements e.g. Controlled Activities Regulations (CAR), or Planning Permission;
- Health & safety implications during construction or operational phases;
- Potential opportunities to derive other environmental benefits such as habitat or aesthetic improvements;
- Need for further surveys (e.g. protected species, geotechnical, topographic, structural or drainage) and assessments (e.g. Environmental Impact Assessment (EIA) or refined hydraulic modelling); and
- Need for enabling works, such as Japanese Knotweed control in the Black Lynn.

The aim of the conceptual designs and associated costing is to:

- Support the economic appraisal (*Report 3B: Options Appraisal -Economic Appraisal*) and ensure that the proposed measures are cost-effective over the lifetime of the scheme (i.e. reduction in economic damages is greater than the cost of implementation);
- Provide the Council with sufficient information to support the decision over which suite of measures should be prioritised and taken forward for funding application;
- Inform the General Capital Grant funding allocation process carried out by SEPA on behalf of the Scottish Government;
- Inform landowners and other stakeholders about the proposed measures to enable effective dialogue; and
- Guide any subsequent outline or detailed designs & costings for options taken forward for implementation.

The conceptual designs of all short-listed options are presented in *Report 3C: Conceptual Designs and Factsheets*, with key information on the potential benefits, costs and implications of the preferred options detailed within factsheets.

5 CONCLUSIONS & RECOMMENDATIONS

The flood study has highlighted a broad range of measures that would be available to reduce flood risk in Oban. This 'long-list' of options has been distilled into a 'short-list' of priority measures through screening and multi-criteria analysis. The short-listed options cover a range of functions targeting storage and attenuation of floodwaters, routing of overland flows or defence against flooding. Flood management zones have been defined to focus effort on strategic locations where benefits could be optimised in the most cost-efficient way. These options would be central to the flood scheme being put forward for the Government funding application.

Beyond these core measures, measures which were not short-listed may still have potential to offer a significant reduction in flood risk and should be considered for incorporation within longer term plans for the area e.g. planning policies, maintenance routines or community development plans (e.g. potential Oban Development Road).

Non-core measures may be implemented independently e.g. by landowners, the local community or other stakeholders. To promote this initiative, available support or funding mechanisms should be communicated (e.g. Scottish Flood Forum, Scottish Rural Development Programme, LEADER, National Heritage Lottery Fund or Forest Carbon).

To ensure optimal uptake and effective implementation of a wide range of additional flood management measures, a co-ordinated and proactive approach will be essential. This may be achieved through the formation of a local community action group or forum with a specific focus on flooding, including representation from Argyll and Bute Council and other key stakeholders.

It is important for the community and other stakeholders to be aware that the extent and standard of protection afforded by flood management measures will be limited, leaving a certain amount of 'residual risk'. As predicted climate extremes intensify over future decades, maintaining this standard of protection will become more and more challenging, requiring a solid maintenance regime and continuing community awareness and adaptation.

REFERENCES

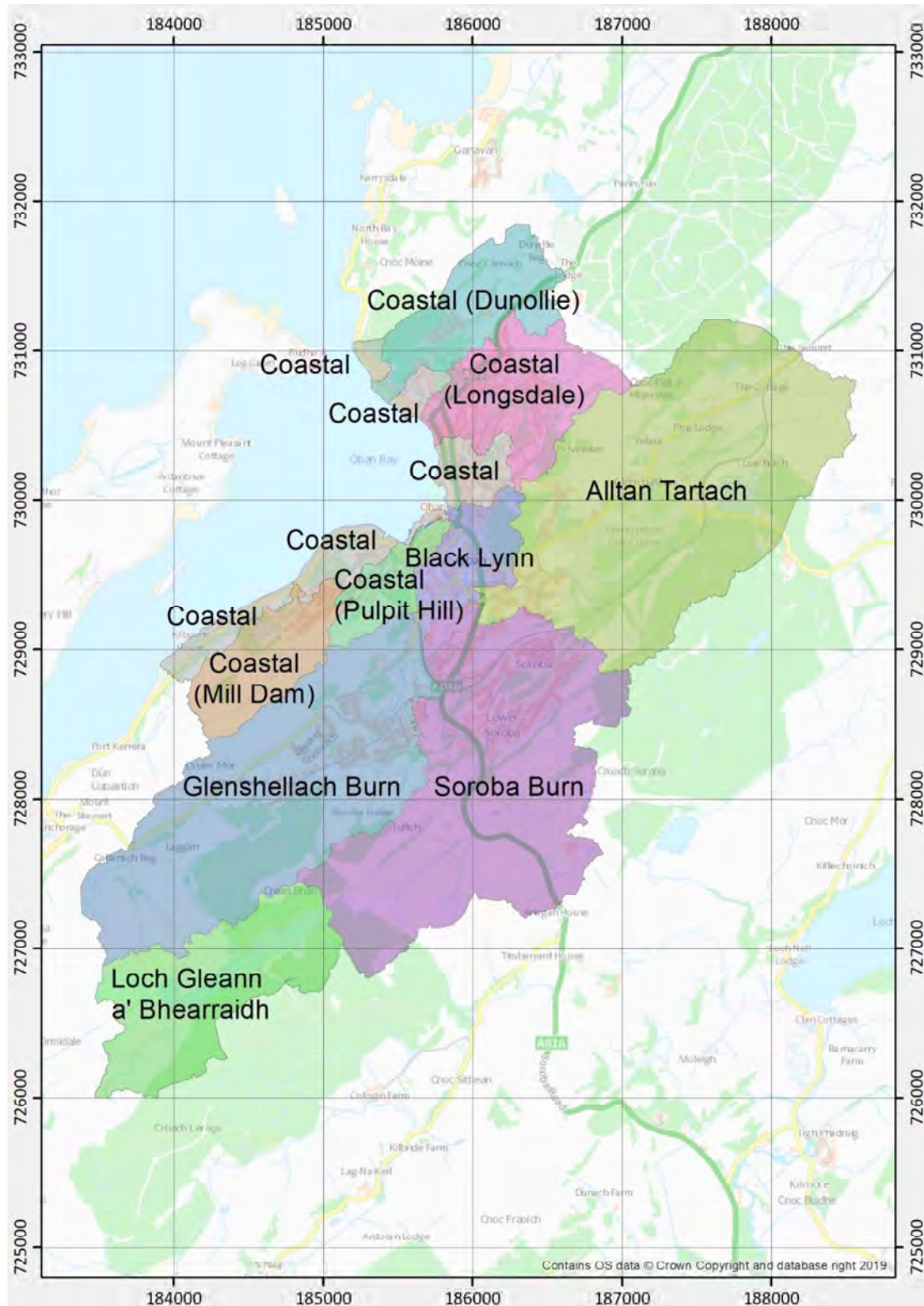
- Scottish Government (2016). *Flood Risk Management (Scotland) Act 2009: Options appraisal for flood risk management: Guidance to support SEPA and the responsible authorities*. SEPA. Retrieved from <https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2016/06/guidance-support-sepa-responsible-authorities/documents/00500974-pdf/00500974-pdf/govscot%3Adocument/00500974.pdf>
- SEPA (2018). *Local Authority Flood Study Checklist*. SEPA.

APPENDICES

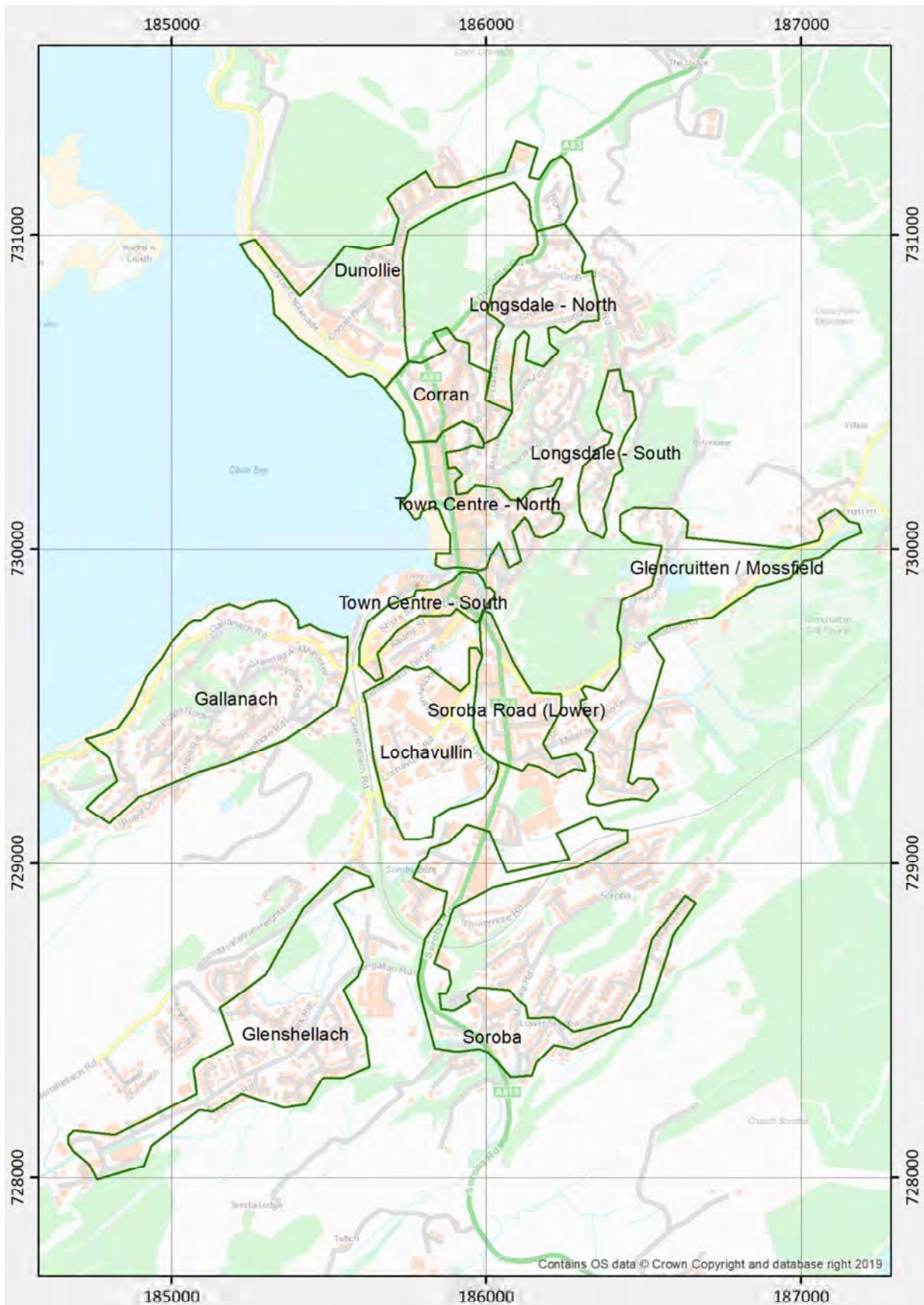
A FLOOD MANAGEMENT ZONES

The following figures define the flood management zones assessed in the scoring matrices in Appendix B.

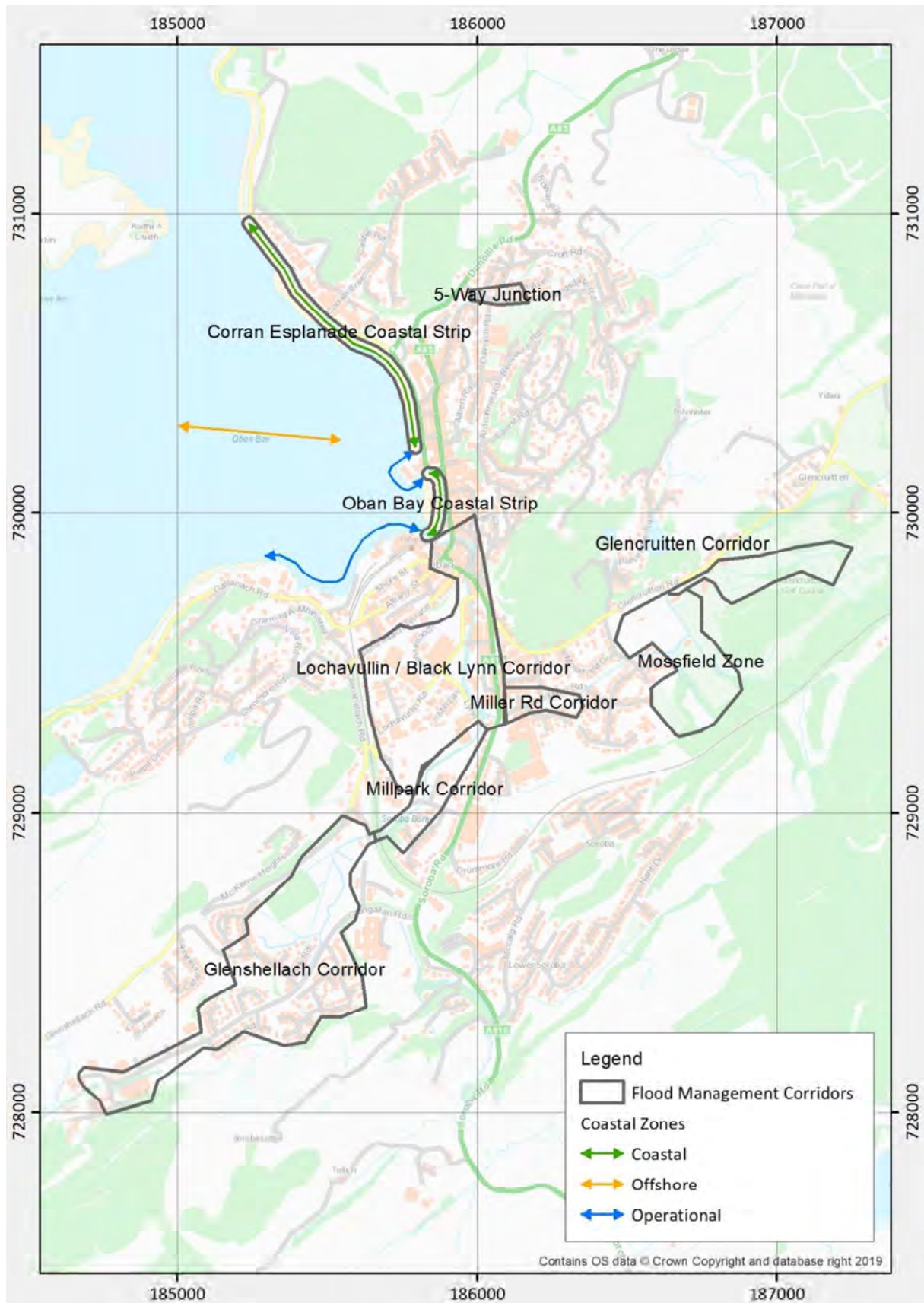
Sub-catchments



Surface Water Management Zones (SWMZ)



Flood Management Corridors and Coastal Zones



B LONG LIST OF OPTIONS

Long-list Options Identification & Screening

Key:	1: High Potential	2: Moderate Potential	3: Low Potential
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Focus	Option	Surface Water Management Zones (SWMZ) (Ctrl + click to view map)										Screening Comment		
		Glenshellach	Scroba	Gallanach	Lochavullin	Glencruitten / Mossfield	Scroba Road (Lower)	Town Centre - South	Dunollie	Longdale - North	Longdale - South		Corran	Town Centre - North
Property-level	A.1 Rainwater Harvesting			2		3								
	A.2 Green Roofs			2		3								
Local level	B.3 Rain Garden			1		2								
	B.4 Bioretention systems			1		2								
	B.5 Proprietary cellular tree pits			1		2								
	B.6 Evapotranspiration			1		2								
	B.7 Overland Conveyance	1	2	2		3	2		2	2	2	2		
	B.8 Grass filter strip			3		3								
	B.9 Filter drains	2	3	3		3	3		3	3	3	3		
	B.10 Additional Interception	3	2	2	3	3	2		2	2	2	2	2	
	B.11 Interception Traps	3	1	2	2	3	1		2	2	2	1	2	
	B.12 Permeable paving			3		3								
	B.13 Enhanced underground void space	2	2		3	3				2		3	2	
	B.14 Infiltration Basin			3		3								
	B.15 Swale	1	1	1	3	2	2		1	1	1	1	2	
	Catchment level	C.17 Wetland	1	1		1	1				1		1	2
		C.18 Pond	1	1		1	1				1		1	2
C.19 Attenuation Basin		2	2		2	2				2		1	2	
C.20 Extended Detention Basin		1	1		1	1				1		1	1	
Surface Water Network	D.22 Pipe Resizing	2	1		3	2				2		2	2	
	D.23 Upstream Attenuation Tank	3	2		3	3	2	1		3		3	3	
	D.24 In-line Attenuation Tanks	3	2		3	3	2	1		3		3	3	
	D.25 Drainage Network Offline Storage	2	1		3	2	2	1		2		2	2	
	D.26 Sewer Separation	2	1		3	2	2	1		2		2	2	
	D.27 New Outfall to Watercourse	1	1		3	2				1		2	2	
	D.28 WWTW Upgrade/Pump Upgrade						2	1		2		2	2	

See Report 2C: Surface Water Management Plan for more detail on scoring / screening

Focus	Option	Sub-catchments								Screening Comment		
		Alltan Tartach	Black Lynn	Glenshellach Burn	Loch Gleann a' Bhearraidh	Soroba Burn	Coastal (Dunollie)	Coastal (Longsdale)	Coastal (Mill Dam)		Coastal (Puljot Hill / Gallanach)	Coastal (Other)
Reservoir Management	Increase reservoir capacity	3	3	3	1	3	3	3	3	3	3	Consultation was undertaken with Scottish Water on the potential for reservoir management to support flood management. Loch Gleann a' Bhearraidh was identified as the only reservoir in the study area with significant potential for flood management, although it was highlighted that this would conflict with current management regime; Polvinster Loch (Alltan Tartach catchment) is disused for health and safety reasons, and is not considered viable for flood management by Scottish Water.
	Active reservoir management e.g. drawdown	3	3	3	1	3	3	3	3	3	3	
Flood Defence	Build embankments / walls	1	1	3	3	1	3	3	3	3	3	Individual options assessed in light of number of potential fluvial flood risk receptors that would benefit from direct defences.
	Modify / maintain existing embankments / walls	3	1	3	3	3	3	3	3	3	3	Options assessed on presence / absence of existing defences & number of potential risk receptors.
	Land-raising (+ compensatory storage as appropriate)	3	2	3	3	3	3	3	3	3	3	Land use planning presumes against land-raising over the functional floodplain, particularly greenfield sites. Considered a last resort for individual properties / brownfield sites.
Floodplain Storage	Floodplain storage cells	1	1	1	3	1	3	3	3	3	3	Availability of significant floodplain in upper catchment is limited due to steep terrain. Availability also very limited through urbanised areas where most low-gradient areas are already developed.
	Remove embankments	3	1	3	3	3	3	3	3	3	3	The only substantial embankments are located along the Black Lynn, particularly in the Lochavullin area.
	Set-back embankments	3	1	3	3	3	3	3	3	3	3	
Channel capacity	Channel modification to promote out of bank flow	1	3	1	3	3	3	3	3	3	3	Availability of significant floodplain in upper catchment is limited due to steep terrain. Availability also very limited through urbanised areas where most low-gradient areas are already developed.
	Clearance (vegetation management / dredging)	3	1	3	3	3	3	3	3	3	3	The Black Lynn has been identified as the only reach where vegetation or sediment accumulations currently have potential to impact upon flood risk.
	Form two-stage channel	3	1	3	3	1	3	3	3	3	3	Channels in the upper catchment are generally small and natural in character. Modification in these locations is not considered appropriate given the limited potential impact re-profiling would have. Through the urban areas channel confinement limits potential for benching out to create second stage.
Structural modification	Bypass channel / flood routing / tunnels / supplementary pumping	1	2	3	3	1	3	3	3	3	3	Options assessed based on engineering and economic feasibility, as well as the number of potential fluvial flood risk receptors that would benefit from the measure.
	Blockage prevention measures	2	3	3	3	3	3	3	3	3	3	Following consultation, site walkovers and modelling, blockage prevention measures are considered to have a localised / limited benefit on flood damages at strategic scale, particularly if routine channel maintenance is carried out.
	Reconfigure / modify structures	2	1	1	3	3	3	3	3	3	3	Options assessed based on the number of potential fluvial flood risk receptors that would benefit from a structural modification. Lower scores where benefits would likely be localised / minor at strategic scale.
	Remove structure	3	3	3	3	3	3	3	3	3	3	Structure removal requires the feature to be redundant and/or to have a suitable alternative present / possible. Option assessed based on the number of potential fluvial flood risk receptors that would benefit from structural removal. Lower scores where benefits would likely be localised / minor at strategic scale.

