

Grangemouth Flood Protection Scheme

Community Briefing Note



Falkirk Council

ch2mSM

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Title: Grangemouth Flood Protection Scheme

Responsible Department: Falkirk Council - Development Services

Author: Falkirk Council and CH2M

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Glossary

Direct defence - flood wall or flood embankment structure.

Flood Embankment – earth embankment with impermeable core; height of embankment is sufficient to stop water from the river channel / Forth Estuary overtopping the structure. The exact shape / appearance is yet to be determined.

Flood Wall – concrete wall structure; height of wall is sufficient to stop water from the river channel / Forth Estuary overtopping the structure. The exact shape / appearance is yet to be determined.

Flood Storage Area (FSA) - area of land where water could be stored during a storm. Under normal conditions, the flood storage area (FSA) would remain dry. During heavy rainfall events water discharging from the FSA would be controlled to manage water levels in the river downstream of the FSA, which would reduce the height and lengths of defences required.

Potentially Vulnerable Areas (PVA) – catchments identified as being at risk of flooding and where the impact of flooding is sufficient to justify further assessment and appraisal.

COMAH - Control of Major Accident Hazards

MAHP - Major accident hazard pipelines – classification of a pipeline under the Civil Contingencies Act (2004) and COMAH Regulations. Under the Pipelines Safety Regulations (1996) a ‘major accident’ means death or serious injury involving a dangerous fluid or gas.

NFM – Natural Flood Management

Ramsar – Intergovernmental treaty for the conservation of Wetlands and their resources.

SPA - Special Protected Area

SSSI - Site of Special Scientific Interest

SNH – Scottish Natural Heritage

UNESCO - United Nations Educational, Scientific and Cultural Organization

PLI – Public Local Inquiry

CH2M – Falkirk Council's flood and drainage term consultant and designers of the Grangemouth FPS.

1. Introduction

This briefing note has been developed for informing communities in the Falkirk area on the development of the Grangemouth Flood Protection Scheme (the scheme).

This briefing note will be initially issued to the following Community Councils and Community Groups who are likely to be directly affected by the Scheme:

- Bainsford, Langlees and New Carron Community Council
- Bo'ness Community Council
- Grangemouth (Including Skinflats) Community Council
- Larbert and Stenhousemuir Community Council
- Lower Braes (covering Lauriston, Westquarter and Redding) Community Council
- Polmont Community Council
- Communities Along the Carron Group
- Friends of Rannoch Park
- Friends of Zetland Park
- Falkirk Community Trust
- Falkirk Historic Society

This list is not exhaustive and other community groups will be issued with the community briefing note upon request. All community groups / councils will be invited to consultation events.

Falkirk Council elected members were issued with a briefing note on the Scheme on 9 October and were invited to attend a briefing event on 4 August 2017.

If you require any further information regarding this briefing note or the Scheme, please contact:

- 1) Sharon Agnew—Falkirk Council's Senior Flooding Officer. Email: sharon.agnew@falkirk.gov.uk
- 2) Alan McGowan—CH2M Project Manager. Email: alan.mcgowan@ch2m.com
- 3) Richard Meeson—CH2M Project Engineer. Email: richard.meeson@ch2m.com

2. Scheme Background

Following completion of the National Flood Risk Assessment in 2011 by the Scottish Environment Protection Agency (SEPA), Scottish Government published plans which identified '*Potentially Vulnerable Areas*' (PVAs) across fourteen Local Plan Districts in Scotland. Within the Forth Estuary Local Plan District which encompasses Falkirk, Grangemouth, Lauriston, Denny, Redding, Dunipace, Cumbernauld, Carron and Stenhousemuir; 26 PVAs were identified. In 2015, the Flood Risk Management Strategies were published by SEPA that covered the fourteen local plan districts and this subsequently led to the publication in 2016 of Local Flood Risk Management Plans. Both the strategy and local flood risk management plan for the Forth Estuary area identified the need for a flood protection scheme to reduce flood risk to Grangemouth and the surrounding area.

The Scheme has been identified as the number one ranked flood protection scheme by Scottish Ministers and would attract 80% funding of eligible scheme costs from the Scottish Government once it becomes operational in accordance with the Flood Risk Management (Scotland) Act 2009.

CH2M are Falkirk Council's term consultant to advise on flooding and drainage matters and are currently developing the design of the Scheme through to Statutory Consents. This includes carrying out the appraisal of different flood risk management options, consultation, recommending a preferred option, undertaking the outline design and carrying out an environmental impact assessment.

2.1. Sources of Flooding

Grangemouth is principally at risk from river and coastal flooding.

2.1.1. River Flooding

River flooding can be defined as flooding which occurs because of the inability of a watercourse to convey the flow and volume within its channel. The river flood risk to the Grangemouth area is principally from three main water courses; the River Carron, River Avon and Grange Burn which flow through urban areas and out into the Forth Estuary.

2.1.2. Coastal Flooding

Coastal flooding has two main flooding mechanisms; coastal inundation and wave overtopping. Coastal inundation is flooding of low-lying land, caused by coastal water levels rising during extreme tides / weather events. Wave overtopping occurs when a wave meets a structure or shallow body of water, causing wave height to increase above the surrounding ground level.

The location of Grangemouth on the banks of the Forth Estuary mean large parts of the petrochemical works, the port and low lying residential areas in and around Grangemouth are at significant risk from coastal flooding.

The project team have identified several flood defence options that will provide flood protection, up to a 1 in 200-year event (0.5% chance of flooding to this level happening in any given year). Over 3,000 residential and non-residential properties, including schools and nursing homes, as well as important national infrastructure are currently at flood risk from a 1 in 200-year event. The scheme would significantly reduce flood risk to these properties and infrastructure.

3. Legislation

The scheme is being promoted by Falkirk Council under the Flood Risk Management (Scotland) Act 2009. The Act sets out specific requirements that local authorities must follow regarding the development and promotion of a flood protection scheme.

Once the scheme is confirmed, Falkirk Council can enter land which is not owned by Falkirk Council to construct flood defences. The Act provides a mechanism for compensating affected parties for any loss suffered. There are several other statutory consents that are required before the scheme could be constructed e.g. Marine Licence, Controlled Activity Regulation licence etc.

4. Key Scheme Stages and Programme

Delivery of flood protection schemes is commonly split into several stages as noted in Table 1.1, together with the status of the Grangemouth project.

Scheme Stage	Current Status
1. Initiating project	Complete
2. Information gathering	Ground investigations in petrochemical works ongoing
3. Option appraisal	Nearing completion
4. Outline design	Just starting
5. Statutory consents	Not started
6. Detailed design	Not started
7. Construction works	Not started

Table 1.1 Status of Key Stages of the Scheme

Table 1.2, outlines the programme for delivering the scheme, it should be noted that the programme assumes no PLI is required. If a PLI is required this would elongate the programme, with considerable delay to construction works commencing.

STAGE	2015	2016	2017	2018	2019	2020	2021
2: Information gathering Topographic surveys Geotechnical investigations Initial ecology survey	■						
3: Option Appraisal Consider range of options Economic Appraisal Identify preferred scheme		■	■				
4: Outline Design Develop outline scheme design			■	■			
5: Statutory Consents Obtain statutory consents					■		
6: Detailed Design Enabling works / utility diversions Develop detailed design					■	■	■
7: Construction Works Scheme Construction work is estimated to take 5-10 years, end of 2021 earliest construction work.							→

Table 1.2 Scheme Programme

4.1. Options Considered and Option Appraisal Process

Due to the size of the project, the Scheme has been divided into six discreet areas referred to as flood cells. Each cell is a geographic area where there is a risk of flooding and works for the flood protection scheme may be carried out.

- Upper Carron (Flood Cell 1)
- Lower Carron (Flood Cell 2)
- Harbour (Flood Cell 3)
- Grange Burn and Flood Relief Channel (Flood Cell 4)
- Avon (Flood Cell 5)
- Estuary Frontage (Flood Cell 6)

The location of each Flood Cell can be found in the plan contained in Appendix A.

Plans showing the proposed defence alignment and height of defences for each Flood Cell can be found in Appendix B.

The section below briefly sets out the options considered at the option appraisal stage for each of the individual flood cells. All options provide a 1 in 200-year standard level of protection.

4.2. Upper Carron Flood Cell

Three options have been considered for the Upper Carron Flood Cell:

4.2.1. Option A

This option would involve direct defences (see plan in Appendix B). Where possible direct defences would be grass-covered embankments, however, several constraints such as lack of space, in channel working and utilities mean some defences will be wall structures. The precise defence alignment and choice of defence type is not yet confirmed and will be identified at the outline stage of the project; which will depend on available space, land use (both current and proposed), ground conditions (e.g. soil strength, type, contamination) and utilities. The alignment of some defences is likely to be very near residential properties.

4.2.2. Option B

The extent and height of defences remain relatively unchanged from Option A. This option considers realigning part of the River Carron on the south bank through an area of community

woodland. Realigning the channel would create a wider corridor for constructing direct defences which would be located further away from residential properties. The realignment provides opportunities for habitat creation and further environmental improvements. A significant constraint to this option is the number of buried pipes and overhead power lines which are likely to need to be diverted, some of which will have significant cost and time implications. Through discussions with utility companies the project team have deemed it not appropriate to pursue this option any further, so it has been discounted.

4.2.3. Option C

Flood storage was initially considered for this cell. However, due to the very high flows on the River Carron (for a 1 in 200-year event), two flood storage areas would be required as well as some direct defences downstream of the flood storage areas. From initial investigations, multiple utilities (high voltage overhead power lines and high-pressure gas mains which are classified as *MAHP* are present within the proposed flood storage areas). Through discussions with the relevant utility companies it is not economical or practical to divert these. It was therefore deemed not appropriate to pursue this option any further; this option has been discounted.

4.3. Lower Carron and Harbour Cells

Direct defences are the only feasible option within these cells, see Appendix B. The principal driver in determining the type of direct defence is space on the existing bank to construct defences. The effects of climate change should be considered with the potential for sea level rise and wave overtopping along the estuary frontage, as this may require some defences to be a wall with revetment in front. Some of the existing defences within the port area maybe incorporated / modified into the scheme.

4.4. Forth Estuary Cell

Due to limited space and the required height of defences, direct defences are the only option being considered for this cell, see Appendix B. The alignment and type of defence will be confirmed at the outline design stage. It should be noted that the interface with the Forth Estuary may impact the alignment of defences. Discussions with SNH are ongoing regarding construction work next to and within the Forth Estuary which is designated a SPA.

This option requires defences along the edge of the Forth Estuary and ties into existing earth embankments. This option is subject to the integrity of existing embankments acting as flood retaining structures.

4.5. River Avon Cell

Due to limited space on the existing bank and the required height of defences, direct defences are the only feasible option and will require defences on both banks, see Appendix B. The alignment and type of defence will be confirmed at the outline design stage. It should be noted that the proximity of the petrochemical plant to the proposed defences will dictate the alignment of defences as space on the existing bank is very limited.

4.6. Grange Burn Cell

Within this cell a range of options have been investigated, several constraints are likely to impact each option:

- number and proximity of utilities within Grangemouth,
- limited space on the existing bank to construct defences,
- proximity to roads / buildings,
- social and visual impact of constructing direct defences through an urban area is likely to have an adverse impact, and
- proximity to / impact on UNESCO World Heritage Site.

The proposed options for this Cell have been divided into three principal options:

4.6.1. Option A – Direct Defences

The extent of direct defences covers both banks of the Grange Burn, with some direct defences along the left bank of the Flood Relief Channel.

Grassed covered embankments will be the preferred type of direct defence, particularly upstream of Zetland Park where there is more space to construct embankments. Downstream of Zetland Park, it is likely a wall structure will be required due to the limited space on the bank and proximity / number of utilities.

4.6.2. Option B – Flood Storage on the Westquarter Burn

Involves the construction of a flood storage area on the Westquarter Burn, immediately upstream of the A9. Controlling the discharge from the flood storage area, would reduce the flow downstream and allow most flow to be diverted from the Grange Burn into the Flood Relief Channel. There is a substantial reduction in the extent and height of direct defences compared to options A and C. It should be noted that the Flood Storage Area is very close to the Antonine Wall (World Heritage Site) and discussions with Historic Environment Scotland are ongoing – refer to Section 6 (Key Constraints). A control structure would be required on the Grange Burn, immediately downstream of the M9 to divert most of flows into the Flood Relief Channel. To provide flood protection from coastal flooding, a ‘tidal barrier’ at the mouth of the Grange Burn would be needed to limit extreme tidal events backing up the Grange Burn. Both these structures have operational risk associated with them.

4.6.3. Option C – Direct defences around Zetland Park

The extent of defences covers most of the right bank of the Grange Burn with defences around the perimeter of Zetland Park and some defences on the left bank. The defences around the perimeter of Zetland Park allow the park to be used as temporary flood storage. Grass covered embankments will be the preferred type of direct defence, particularly upstream of Zetland Park where there is more space to construct embankments. Downstream of Zetland Park, it is likely a wall structure will be required due to the limited space on the bank and proximity / number of utilities.

4.7. Option Appraisal Process

The option appraisal process considered a wide range of options. Using a multi-criteria-matrix, each of the options (outlined above) was assessed against economic, technical, environmental and social criteria, which are linked to the Scheme Objectives (and can be found on the Scheme website - www.grangemouthfloodscheme.com).

4.8. Early Discounted Options

During the option appraisal stage several potential options were considered and subsequently discounted. Some of the early discounted options have been included in Table 1.3:

Option	Reasons for discounting
Tidal barrier across the Forth Estuary	Very high cost and likely significant environmental impacts. The barrier would not address river flood risk and therefore fluvial flood defences would still be required.
Dredging of water courses	Very limited benefits and would require frequent re-dredging. Would not remove the requirement for flood defences and would have significant impacts on the foundations of existing structures. Dredging would not reduce the coastal flood risk.

Option	Reasons for discounting
Catchment scale NFM	Very unlikely to significantly reduce the magnitude of low probability (high flow) flood events.
Optimising storage in Carron Valley Reservoir	Location of the reservoir is too far up the catchment. The very large area of land draining into the River Carron downstream of the reservoir would still generate very high flows in the channel which would require flood defences.

Table 1.3 - Early Discounted Options

4.9. Option Appraisal Summary

From the option appraisal, Cell 4 is the only cell where there are options remaining:

- Cell 4 - Flood storage option on the Westquarter Burn which reduces the extent and height of direct defences through Grangemouth, or direct defence through Grangemouth with or without using Zetland Park for temporary flood storage.

5. Key Constraints

The development of the scheme is influenced by many factors which are likely to constrain the proposed scheme design. Outlined below are some of the main constraints identified by the project team at the option appraisal stage which may influence the identification of the preferred scheme:

- **Utilities**
Interface between the proposed flood defences and utilities pose significant challenges. To manage this risk at the option appraisal stage, a '*Utility Stakeholder Group*' was initiated to help identify major utility constraints, such as above / below ground pipes and cables; additionally, several large diameter, high pressure (>50 bar) pipelines traverse the Grangemouth area. Where possible the alignment of direct defences will avoid direct clashes with utility pipelines / cables; however due to the limited space on the banks this will not always be possible. It is likely that some utility apparatus will need to be diverted or protected to allow the flood protection scheme to be built. Some pipelines around the petrochemical plant are classified as *MAHP* and have been viewed as a significant constraint which cannot be moved. Where the proposed alignment of direct defences is close to *MAHP*, efforts will be made to move defences away from such pipelines. Discussions are ongoing with utility companies and petrochemical stakeholders to identify *MAHP* and find out what constraints might be imposed when construction work is near them.
- **Environmental**
The Forth Estuary is designated a *Ramsar*, *SPA* and a *SSSI* due to the inter-tidal habitat which supports a wide range of protected species. Due to the limited space along the boundary of the Forth Estuary it is highly likely construction works will be required within environmentally protected areas. From initial discussions with *SNH* it is considered highly likely that the Scheme will have a '*significant adverse*' impact on the *SPA*, therefore environmental mitigation will need to be considered. It is likely compensatory habitat will need to be created as construction work within the *SPA* is unavoidable.
- **Cultural Heritage**
The Antonine Wall is a designated International UNESCO World Heritage Site. Some of the proposed defence options for Cell 4 are within the World Heritage Site buffer zone. There is a general presumption against development within the vicinity of the buffer zone that may adversely affect the line, setting or amenity of the Antonine Wall. It should be noted that Option B (Flood Storage Area) in Cell 4 is very close to the Antonine Wall. From initial discussions with Historic Environment Scotland, they have significant concerns relating to Option B (Flood Storage Area). Discussions with Historic Environment Scotland are ongoing at present to try and identify a solution which is acceptable to them.

6. Consultation

6.1. Stakeholder Groups

During the option appraisal stage three Stakeholder Groups were initiated (Core, Utility and Industrial – petrochemical plant). The purpose of initiating the stakeholder groups was to begin engaging with key stakeholders who may significantly influence the form and design of the scheme. Additionally, two workshops have taken place with Falkirk Council officers to gauge their views and comments during the option appraisal stage.

6.2. Falkirk Council Elected Members

A Falkirk Council elected member briefing took place on 4 August, with elected members invited to attend.

6.3. Other Community Councils / Groups

This community briefing note is being circulated to only local community councils / groups that have been identified by the project team and Falkirk Council as likely to be directly affected by the Scheme i.e. construction of flood defences. Other community councils and groups are welcome request a copy of the community briefing note from Falkirk Council. If you would like further information on the scheme please contact Sharon Agnew (Falkirk Council), Alan McGowan or Richard Meeson (both CH2M).

Please take this briefing note as an invite from the project team, who are more than happy to meet with you to discuss the scheme; alternatively, you are welcome to attend the public consultation events (see section below).

6.4. Consultation Event No. 1

Public Consultation is due to take place at:

- **Caron & Carronshore Bowling Club (Carronshore) - 11:00 am to 7:30 pm on Tuesday 27 February 2018.**
- **Bowhouse Community Association Centre (Grangemouth) – 11:00 am to 7:30 pm on Thursday 1 March 2018.**

The public consultation events will provide an opportunity for the wider public to view the proposed options and comment on the Grangemouth Flood Protection Scheme. The events will provide background information to the scheme as well as information on future work.

To help advertise the public consultation events, Falkirk Council would ask you to promote the public consultation events within your local community and encourage people to attend. Over the coming weeks the project team will be promoting the public consultation events, however, the project team acknowledges the importance of having the support of the local community in this process.

To promote the scheme and as a method of communicating large amounts of information to members of the public, a scheme web-site has been developed; www.grangemouthfloodscheme.com. This provides a wide range of information on the scheme; please feel free to promote this website to your local community.

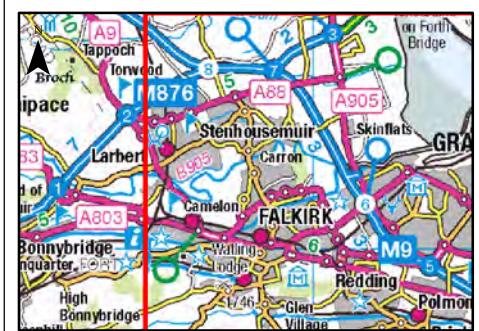
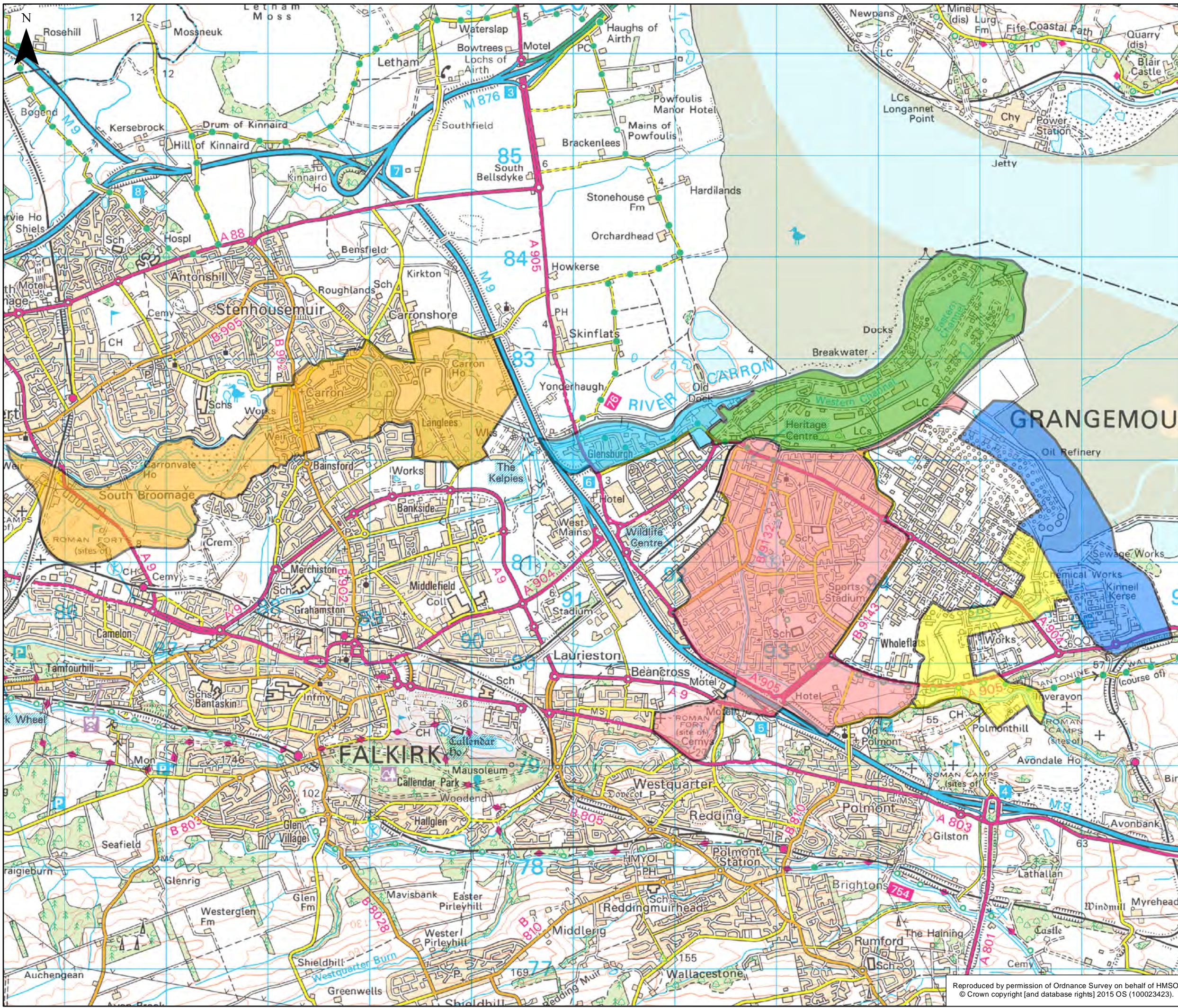
7. Preferred Scheme

Once the option appraisal is complete, the project team will be able to identify a preferred scheme which will be submitted to Falkirk Council for council approval. Once this process has happened, a public exhibition will take place, promoting the preferred scheme. The preferred scheme will be

progressed to the outline design stage, where more information on the design / alignment of defences will be developed and further consultation events held.

Appendix A

Cell Layout



Appendix B

Proposed Flood Cell Options

Upper Carron

Option A – Direct Defences Only

Direct Defences

2.9 km

Direct Defences

0.8 km

Option B – Direct Defences and Realignment of the River Carron

Direct Defences

2.9 km

Direct Defences

0.8 km

Channel Realignment

1.7 km

Option C – Direct Defences and Flood Storage Areas

Direct Defences

2.9 km

Direct Defences

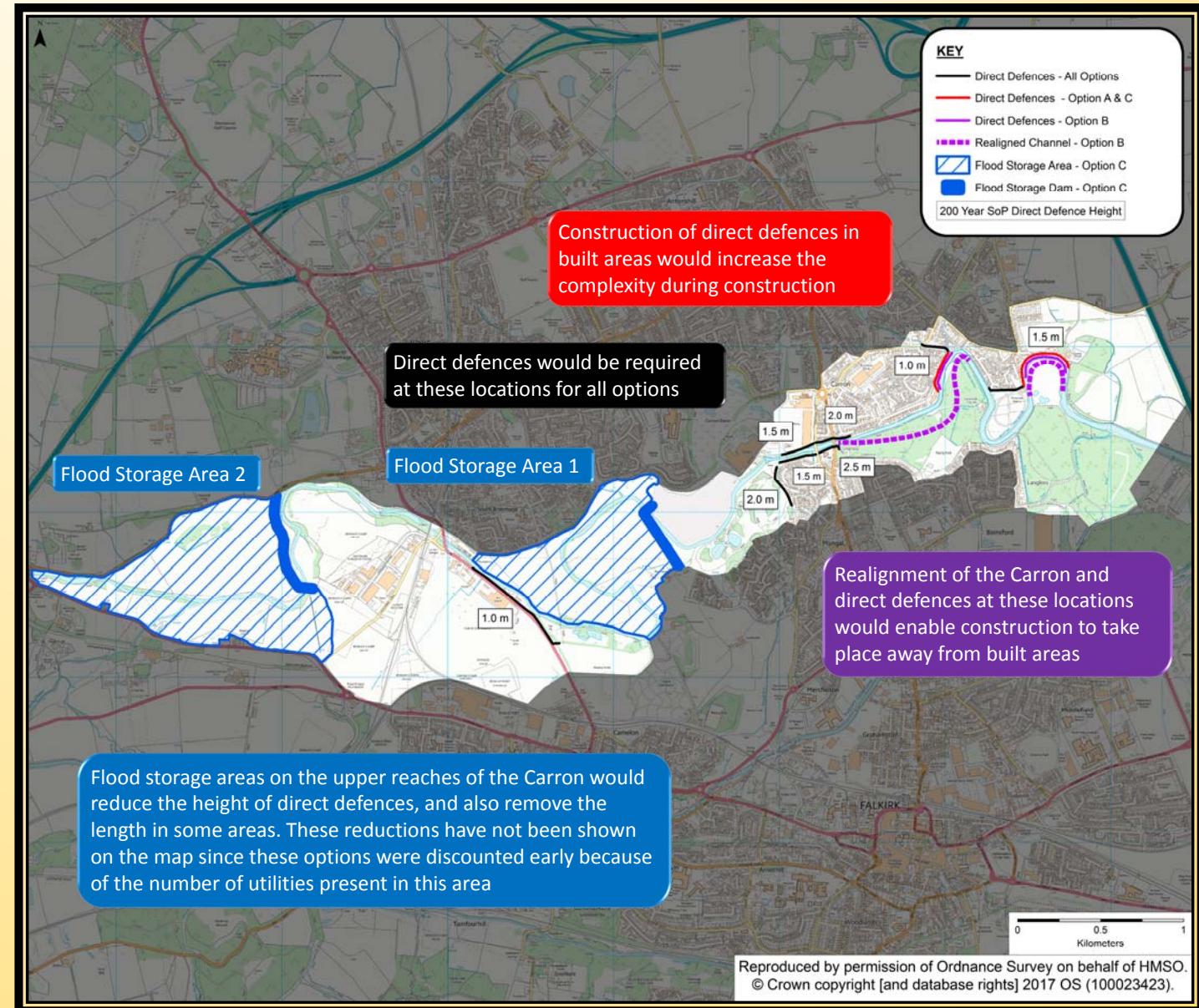
0.8 km

Flood Storage Area 1

0.6 km²

Flood Storage Area 2

0.9 km²



Lower Carron and Harbour

Lower Carron– Direct Defences

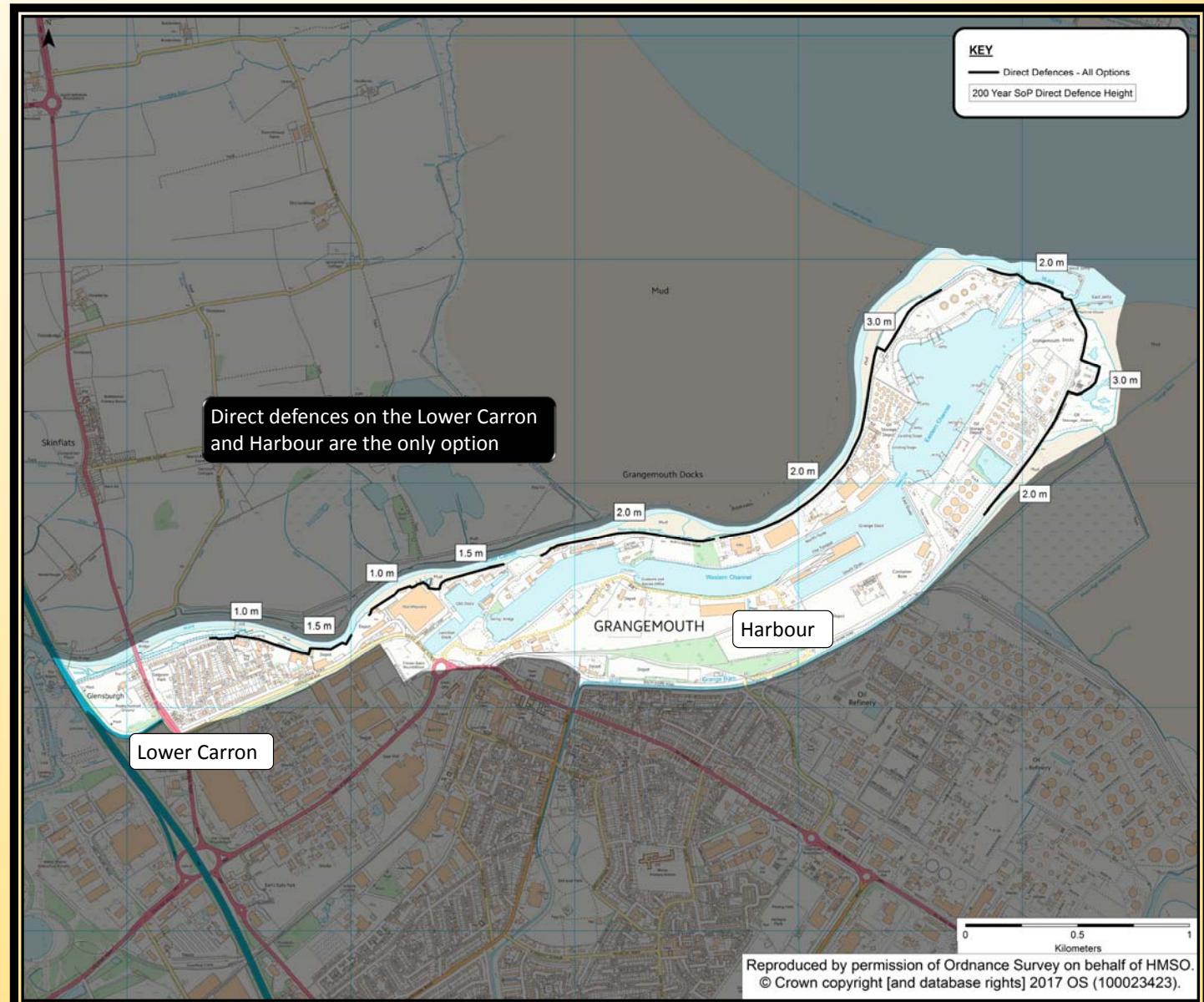
Direct Defences

1.5 km

Harbour – Direct Defences

Direct Defences

4.1 km



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Please note: The proposals on display at this event are still under development and may be subject to change. Images and visualisations are indicative only, and the completed Scheme may differ.

Grange Burn

Option A – Direct Defences Only

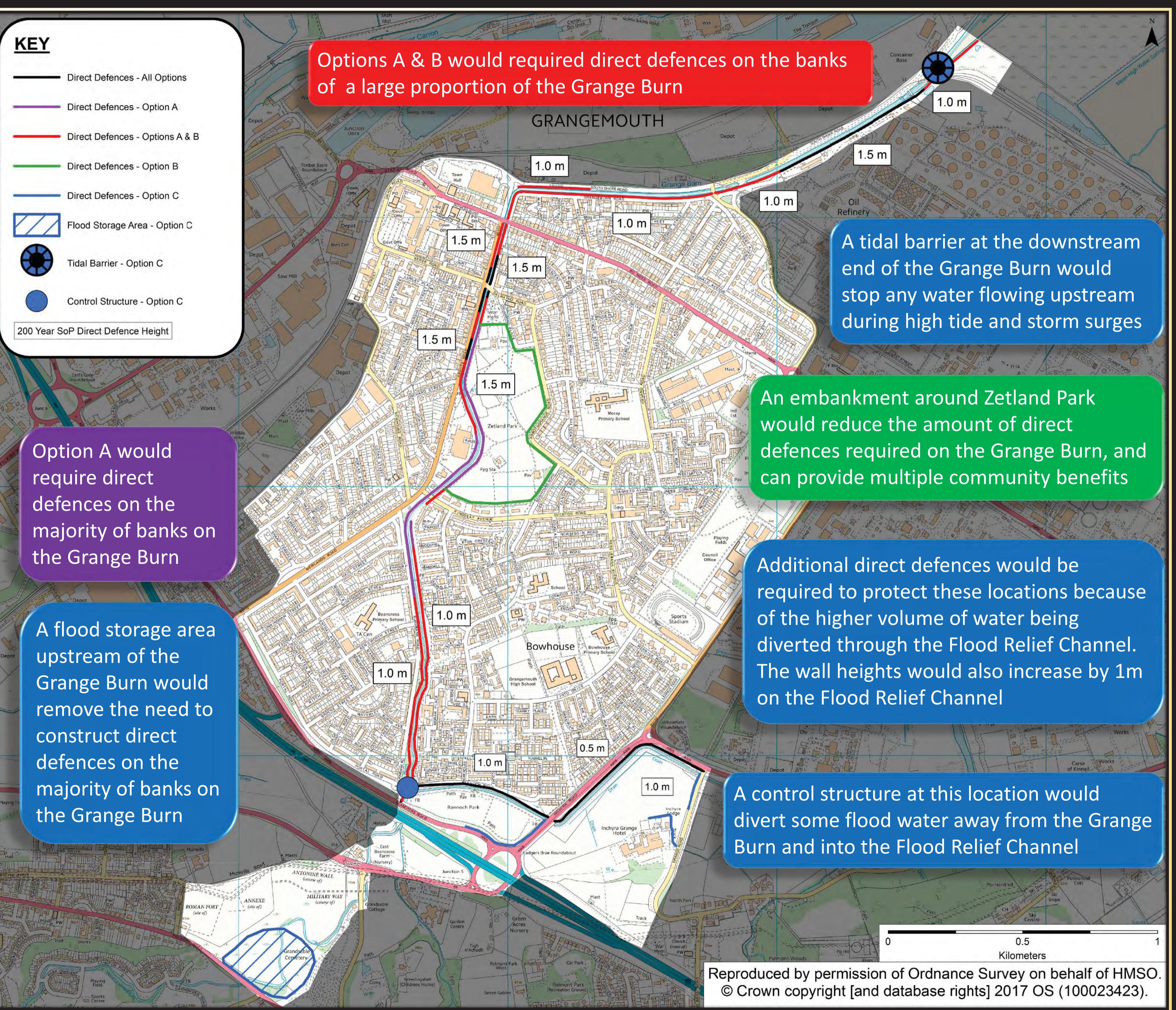
Direct Defences	2.3 km
Direct Defences	4.0 km
Direct Defences	1.8 km

Option B – Direct Defences and Zetland Embankment

Direct Defences	2.3 km
Direct Defences	4.0 km
Zetland Embankment	1.3 km

Option C – Direct Defences and Flood Storage Areas

Direct Defences	2.3 km
Direct Defences	2.1 km
Flood Storage Area	0.7 km ²
Tidal Barrier	1 No.
Control Structure	1 No.



Forth Estuary and Avon

Forth Estuary – Direct Defences

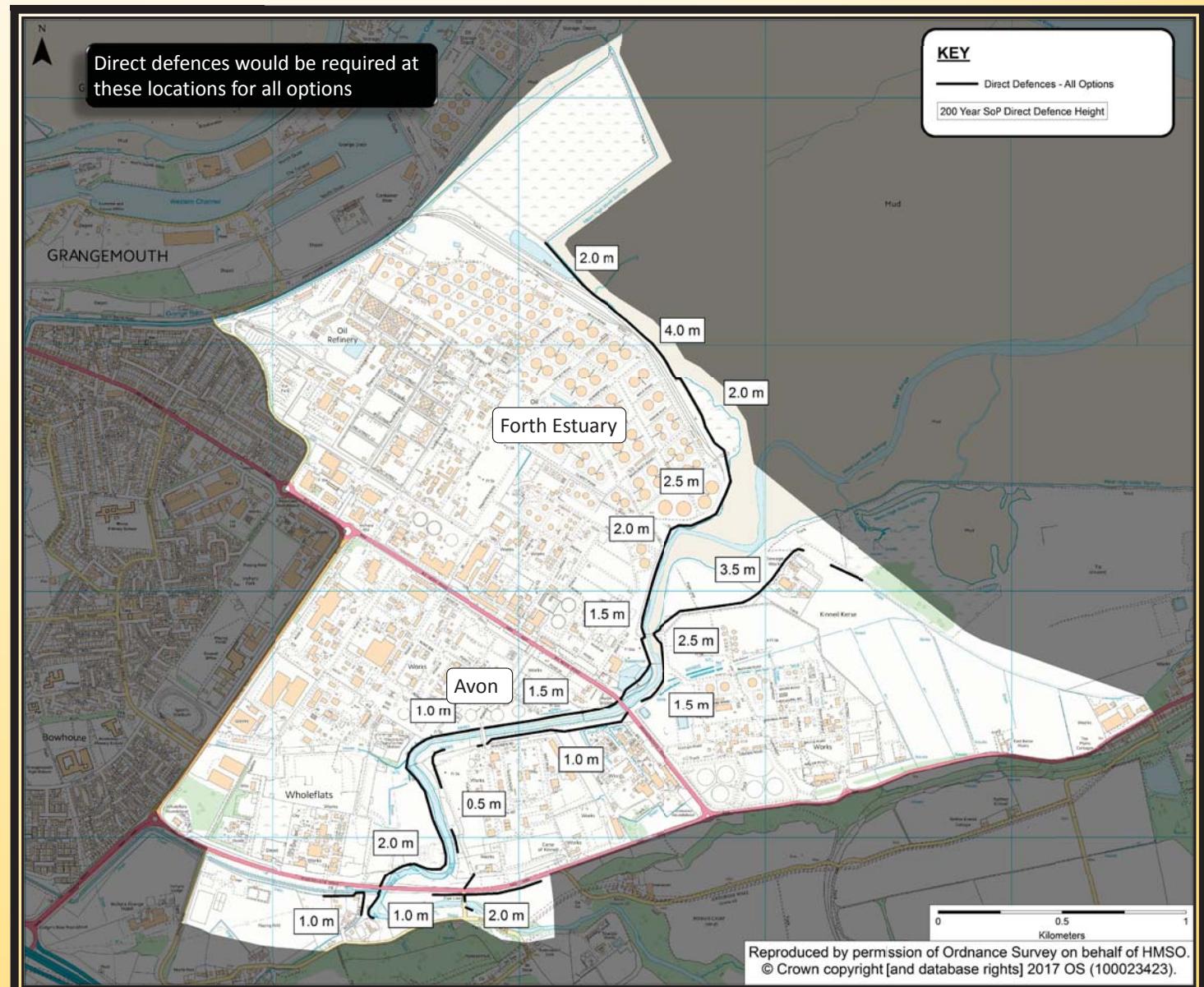
Direct Defences

3.7 km

Avon – Direct Defences

Direct Defences

3.6 km



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Further information:
www.grangemouthfloodscheme.com