MUSSELBURGH FLOOD PROTECTION SCHEME Where are we now? – Options Appraisal Process

Stage	2019
2. Information	
3. Options	
4. Outline Design	
5. Approvals	
6. Detail Design	
7. Procurement	
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	Apr May
Long List	
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MUSSELBURGH FLOOD PROTECTION SCHEME Developing and Appraising the Options















MUSSELBURGH FLOOD PROTECTION SCHEME Long List - Early Discounted Options

General REJECTION Assessment Guidelines

Economics	Capital cost likely to significantly exceed ELC BCA by inspection, unlikely to qualify for SG no likely alternative funding so
Technical	Clearly unfeasible from a technical or constru- or likely to have little impact on reducin
Environment	Significant likely impact on the environment, of not being able to accept or mitigate, or
Social & Stakeholders	Proposal which is likely to result in insurmour or will result in significant residual risks w adequately mitigated (e.g. flood risk
Health & Safety	Implementation results in unacceptable risk maintenance or demolition workers or

*NOTE: Please speak to a member of the project team if you would like to view the full long list RAG analysis showing all options identified, appraised and rejected.





Summary of Proposed REJECTED Options*







Turner & Townsend

CONSULTANCY



MUSSELBURGH FLOOD PROTECTION SCHEME Long List - Early Discounted Options

Weir Removal

- Adverse impact on established river ecology
- Potential increase in flood risk downstream
- Adverse geomorphological impacts sediment moves from upstream to downstream, potential erosion and undermining of existing structures
- Flood risk benefit not significant
- However, weir modification may be considered as part of Forth Catchment wide initiative to improve fish passage







Fluvial Dredging

- Unsustainable requires constant maintenance
- Access can be difficult requires low flows
- Adverse geomorphological impacts can cause sediment deposition and erosion elsewhere (risk of undermining existing structures)
- Flood risk benefit not significant negligible reduction in water levels











Devastating ecological impacts – destroys riverbed habitats





MUSSELBURGH FLOOD PROTECTION SCHEME Short-listed Options

- Direct defences either walls or embankment depending on location
- Bridge raising and replacement
- Upstream flood storage
- Underground pumping stations
- Pinkie Burn various options
- Coastal defences

*NOTE: Please speak to a member of the project team if you would like to view the full long list RAG analysis showing details of all options identified, appraised and considered for further assessment.



Summary of Short-listed Options*









MUSSELBURGH FLOOD PROTECTION SCHEME Proposed Short-list: Direct Defences (Walls)

- Ideal for situations where space for the defence is limited
- Ideal for urban and built-up areas where the defence can be tailored to suit and enhance the local infrastructure and landscape
- Generally require minimal maintenance
- Reliable form of defence and requires no human intervention

Design consideration: River Esk defence alignment [Please complete our questionnaire to give your views on these options]

Option A: In-river defences

Option B: Set-back defences



- Usually doesn't affect existing services
- More trees can normally be retained
- Existing dilapidated river walls are demolished/replaced/buried
- + Access to amenity riverbanks is maintained
- **Connection to the river is severed**
- Higher flood defence walls views of the river can be cut off, but this could be offset by incorporating glass panels in flood defence walls



- be used
- Lower flood defence walls views of the river can be maintained
- Often means that trees need to be cut down to accommodate the defences
- Often requires services in the footpath or along road verges to be diverted
- Access to riverbanks can be affected, but ramps, stairs and flood gates can be incorporated

Allows more of the existing flood plain to

Design consideration: wall cladding/finishes



Formed concrete (textured rock effect)











Brick cladding



MUSSELBURGH FLOOD PROTECTION SCHEME Proposed Short-list: Direct Defences (Embankments)

Flood defence embankments can be constructed as an alternative to walls in some locations. Some key features of embankments are:

- Ideal for rural settings or landscaped areas where space permits (as a rough guide, a 1.5 metre high embankment typically requires a footprint at least 9 metres wide)
- Can be designed to enhance the surrounding landscape and incorporate riverside footpaths
- Can incorporate ramps and stairs to maintain access
- Are generally visually unobtrusive in riverside settings once grass has established





Typical Embankment Detail



*Key design consideration – embankment footprint can be significant (depending on height and side slopes) and as such can reduce the area of useable 'flat' land adjacent to the river















MUSSELBURGH FLOOD PROTECTION SCHEME Proposed Short-list: Bridge Raising and Replacement

In Musselburgh, there are seven bridges along the River Esk between Musselburgh Golf Course and the estuary. Each bridge must be assessed carefully to determine the most appropriate flood risk option, which could include:

- **Do nothing –** where the existing bridge does not significantly affect flood risk impact upstream or downstream
- **Removal** of the existing bridge only feasible where a suitable alternative route is available
- **Raising** the existing bridge by modifying the supports to allow more flow through
- **Replacement** of the bridge at a higher level, new location or with a single span (no central supports)













Goose Green (New Street) Footbridge



SSEB (Electric) Bridge

Station Road (Olive Bank) Bridge





MUSSELBURGH FLOOD PROTECTION SCHEME Proposed Short-list: Upstream Flood Storage

New Flood Storage Areas

Flood storage areas upstream of the town are designed to temporarily hold back much of the floodwater during extreme weather. The storage area controls the release of water passing downstream through the town to an acceptable level.

In Musselburgh however, the lack of suitable storage sites upstream means that flood storage alone will not protect the town from flooding, but it may help to reduce the height of direct defences throughout the town.



Kirkland Bridge Flood Storage Area, White Cart **Flood Prevention** Scheme, Glasgow





Flood Storage using Existing Assets

It is also possible to modify existing reservoirs to store more water upstream. There are six existing reservoirs in the catchment upstream of Musselburgh that could be considered and will be assessed for suitability.











St Mary's Loch in Selkirk is an example of a natural reservoir that has been engineered to store flood water. The new water management system allows the loch to store the equivalent of 620 Olympic swimming pools' worth of water, which helped protect properties downstream during Storm **Desmond in December 2015.**



MUSSELBURGH FLOOD PROTECTION SCHEME Proposed Short-list: Pumping Stations

When flood defences are constructed, existing overland drainage paths to the river become blocked, and so it is necessary to provide alternative drainage arrangements. Where required, surface water pumping stations can be installed at low points along the direct defences. This helps to discharge excess surface water that could potentially become trapped behind the new flood defence.

Key features of pumping stations are:

- All equipment is below ground making pumping stations completely unobtrusive
- They are fitted with automatic level sensors and monitoring systems so that no manual intervention is required to deploy the pumps when required
- Also applicable to coastal environments to deal with wave overtopping







Water begins to pond on landward side of defence and drains into pumping station

Pumping station









River level high during flood event

Non-return flap valve closes when pumping station not operating to prevent backflow

Water pumped back into river



MUSSELBURGH FLOOD PROTECTION SCHEME Proposed Short-list: Pinkie Burn Options

Options for the Pinkie Burn include:

- Increasing the capacity or cleaning out / maintenance of the existing culvert
- Maintenance to the outlet on the Esk, including a non-return flap valve to prevent backflow
- Regrading/reprofiling the land within Pinkie St. Peter's play fields to reduce flood risk to the sports pitches
- Pumping stations to deal with surface water and groundwater issues **High flows on the Pinkie Burn**







- Extreme fluvial (river) event: 0.5% AEP / 1 in 200 year plus climate change occurring at same time as minor tidal (coastal) event: 50% AEP / 1 in 2 year plus climate change
- Floodwater spills onto playing fields upstream of Linkfield Rd culvert to depths of less than 1 metre
- Culvert manhole surcharging occurs at racecourse buildings and Goose Green
- Pinkie Burn flood event inundation is less than that experienced during the extreme coastal (North Sea) and fluvial (River Esk) events
- Extreme tidal (coastal) event: 0.5% AEP / 1 in 200 year plus climate change occurring at same time as **minor fluvial** (river) event: 50% AEP / 1 in 2 year plus climate change
- Floodwater spills onto playing fields upstream of Linkfield Rd culvert to depths of less than 1 metre
- Culvert manhole surcharging occurs at racecourse buildings and Goose Green
- Pinkie Burn flood event inundation is less than that experienced during the extreme coastal (North Sea) and fluvial (River Esk) events











MUSSELBURGH FLOOD PROTECTION SCHEME Proposed Short-list: Coastal Defences



Design consideration: coastal flood defence options (west of the River Esk estuary)

[Please complete our questionnaire to give your views on these options]

Option A: Lower defence, some wave overtopping

- Lower defence height allows access to the beach to be maintained and minimises visual impact
- Small amount of wave overtopping occurs, but this can be pumped back into the sea





Option B: Higher defence, no wave overtopping

- + Wave overtopping restricted and no requirement for pumping
- Higher defence reduces visibility of the beach and impacts on accessibility

Musselburgh Lagoons old sea wall is not owned by East Lothian Council and does not form part of the scope for the FPS. Our ecology team have identified that the wall must be preserved in the future to protect important links and lagoon habitats.

Example coastal defence wall, Blackpool

Example low height coastal defence, North Wales

MUSSELBURGH FLOOD PROTECTION SCHEME Next steps

Gather feedback from public exhibition and review comments, concerns and suggestions

Prepare feedback report summarising project team's responses to feedback

Feedback Questionnaires

We would really appreciate if you could take the time to complete a questionnaire to provide your views and comments on the options presented today – your feedback will be taken into account in determining the Preferred Scheme for Musselburgh.

Thank you

Public Exhibition No. 2

A further public exhibition is planned for **Spring/Summer 2020** where we will present the proposed Preferred Scheme for Musselburgh – look out for event adverts nearer the time.

Focussed follow-up events to discuss key issues

Identify any potential objections to the Scheme

Finalise the options, taking into account feedback from all consultation events

Further Information

If you would like to discuss anything in more detail, please speak to one of the project team.

We are also pleased to have representatives from the following at the exhibition today:

- Scottish Environment Protection Agency (SEPA) Floodline
- Scottish Flood Forum
- East Lothian Council Emergency Planning Team

FAQs

Please pick up one of our FAQ sheets as you leave the exhibition which includes some common FPS questions and project team contact details.

