

01 Introduction

Welcome to the public consultation event for the Lochgilphead Flood Study. The purpose of the event is to inform you of the work we have done so far and to gather your feedback on the provisional short list of sustainable flood management options.

Why are we here?

Lochgilphead, and the surrounding area, has been identified as a Potentially Vulnerable Area (PVA) by the Scottish Environment Protection Agency (SEPA). PVAs are defined as catchments identified to be significantly impacted by flooding either now, or in the future, as a result of climate change. In the case of Lochgilphead, the PVA assessment has found the primary sources of flooding are from surface water, from the Badden Burn and from the sea. It is also a key conclusion of the PVA assessment that coastal flooding is likely to increase the future.

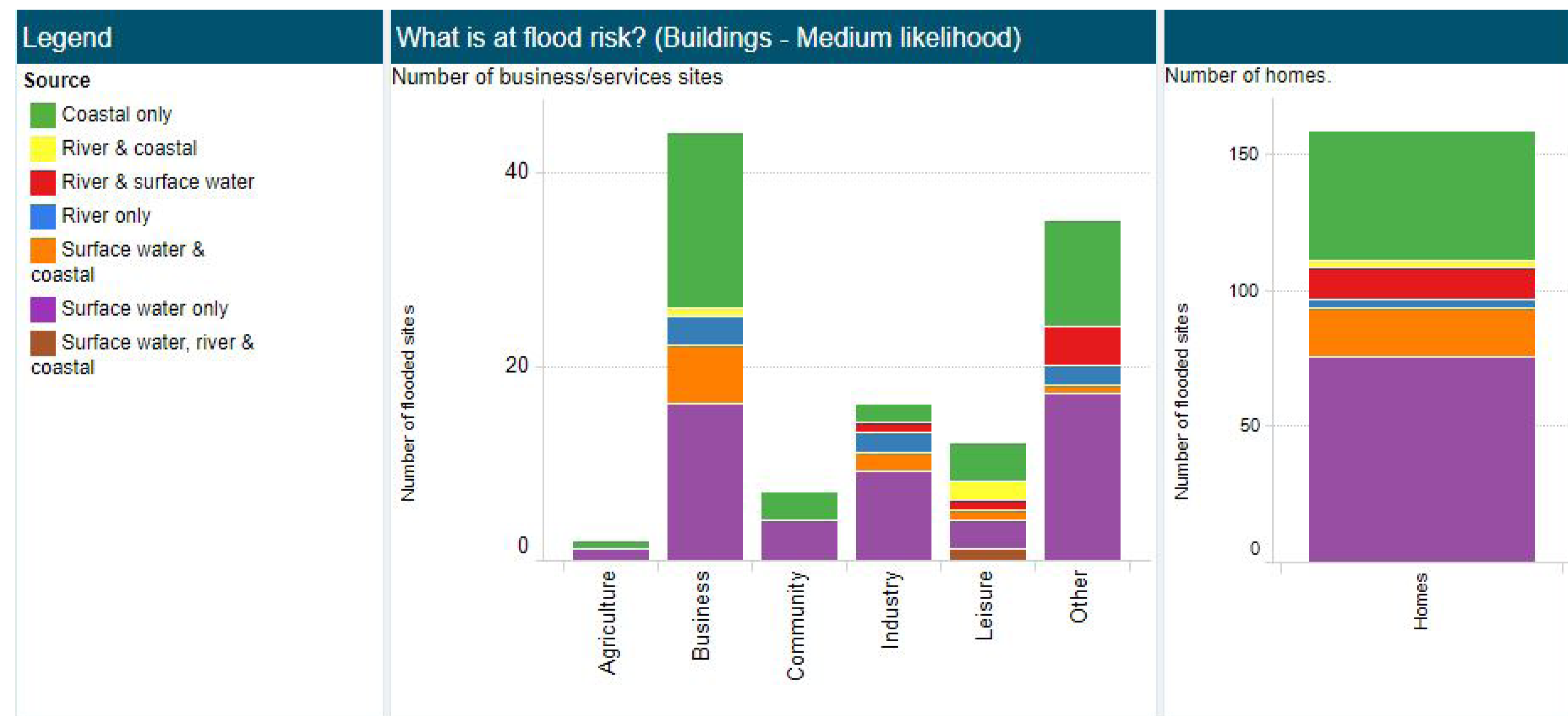
AECOM have been commissioned by Argyll and Bute Council to investigate the extent of river and coastal flood risk and develop sustainable options to reduce this risk.

What have we done so far?

The Lochgilphead Flood Study commenced in May 2018 and we undertook our first public consultation event in July to gather local flood knowledge. Since then, we have been working to fully understand the flood risk in Lochgilphead and how these risks could be minimised. We have done this by:

- Assessing the historic flood data and flood accounts
- Undertaking detailed river and coastal computer modelling
- Mapping the flood risk within Lochgilphead
- Developing a long list of viable flood options for Lochgilphead
- Selecting a short list of preferred options based on key criteria and in consultation with key stakeholders

At this point, we want to consult with you on the provisional short-listed options. Your views will help us identify an appropriate way to manage flooding in Lochgilphead now, and into the future.



Flooding from the Badden Burn on the A816, north of Lochgilphead, 2014

SEPA - Potentially Vulnerable Area summary for Lochgilphead and surrounding area

02 Coastal flood risk in Lochgilphead

Through the work we have done so far, we have established that coastal and river flooding are independent from each other, and that they are unlikely to occur at the same time. This allows us to look at each source, coastal and river, separately.

Defining coastal flood risk

Flood risk can be defined in terms of Annual Exceedance Probability (AEP) or Return Period. Both refer to the probability of tidal conditions of the same magnitude occurring each year. For example, a 1 in 200 year Return Period sea level will have a 1 in 200, or 0.5% AEP chance of happening in any given year.

In order to assess coastal flooding in Lochgilphead, we have undertaken computer modelling of the intertidal area as well as the wider Loch Fyne area. The modelling utilised numerous topographic datasets and includes tidal conditions such as waves and tidal surge. This modelling has allowed us to establish extreme sea levels at Lochgilphead for a range of AEP events both now and in the future based on available climate science predictions. Sea level is expected to rise by 0.65m by the end of the century in Lochgilphead

The sea levels produced from the coastal computer modelling were applied to a computer model of the land around Lochgilphead that would be used to establish both coastal and river flooding within the study area.

The 0.5% AEP coastal event flood maps, both present day and with climate change, are shown on this poster. A range of other AEP event flood maps can be viewed by speaking to one of the project team.

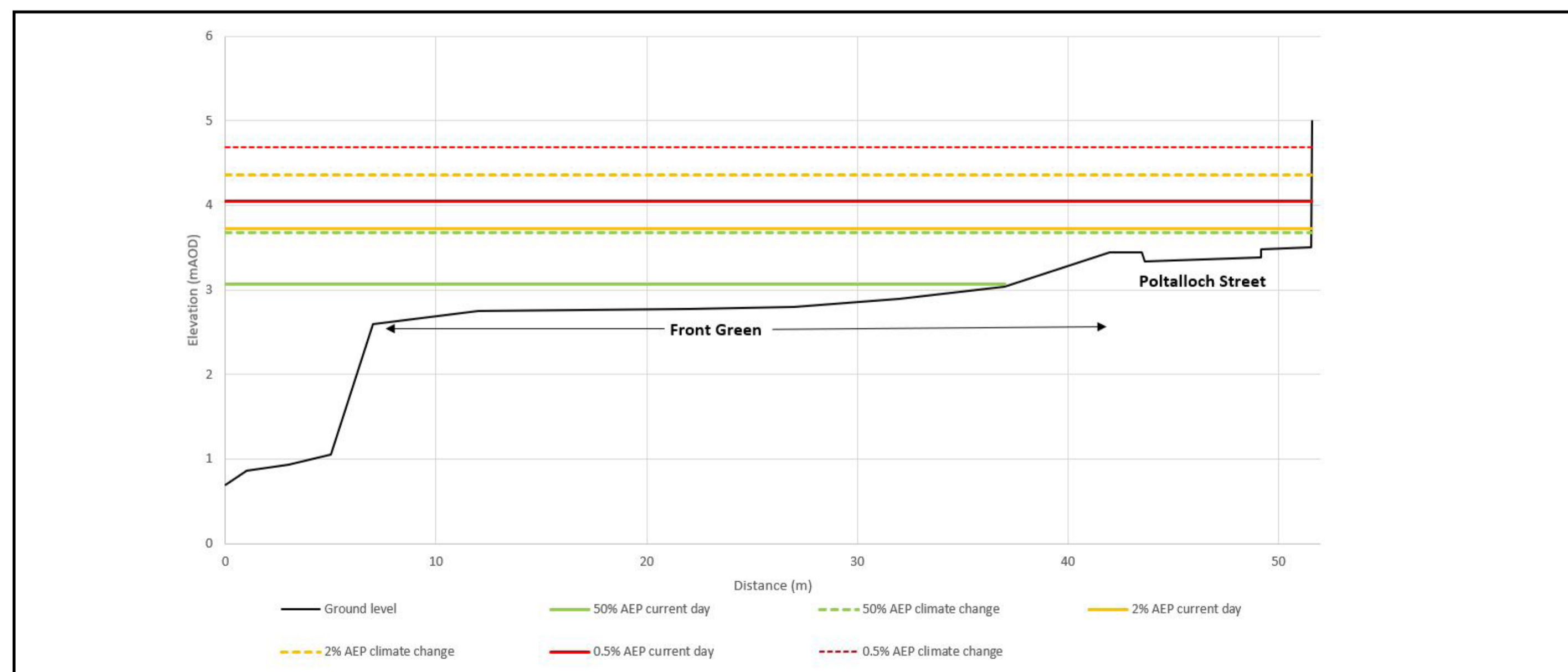
An indicative cross section through the Front Green can also be seen on this poster. This aims to aid the visualisation of flood depths for a range of AEP events as well as highlighting the predicted impact of climate change on sea levels.

Flood risk in numbers for a 0.5% AEP event, with and without climate change

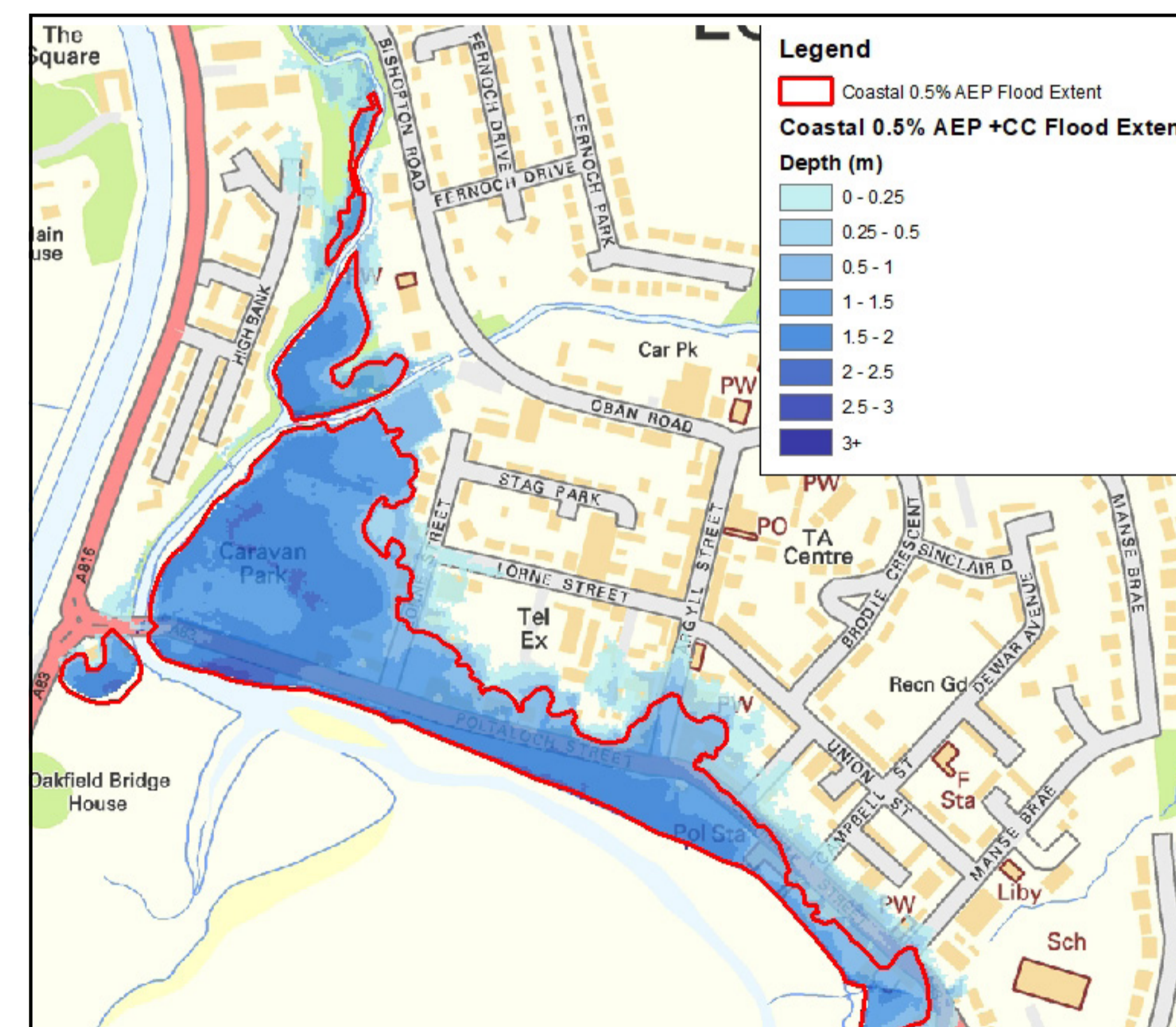
- 83 properties within the 0.5% AEP event present day flood extents in Lochgilphead
- 165 properties within the 0.5% AEP event + climate change flood extents in Lochgilphead
- Flood risk to a number of roads including Pottaloch Street and Argyll Street.

What about my property?

By all means look up your property on the flood maps shown here. You should remember, however, that the computer modelling was carried out on a large scale that is not specific to any one property. No detailed account is taken of localised features such as kerbs and garden walls etc. which in reality may affect localised flow paths.



Indicative section through Front Green



Coastal flooding in Lochgilphead

03 River flood risk in Lochgilphead

Flood risk can be defined in terms of Annual Exceedance Probability (AEP) or Return Period. Both refer to the probability of a flow of the same magnitude occurring each year. For example, a **1 in 200** year Return Period flow will have a **1 in 200**, or 0.5% AEP chance of happening in any given year.

Within this river assessment, several watercourses were considered. The Badden Burn was assessed from Cairnbaan to Loch Gilp with the Cuillarstich Burn assessed up to Manse Brae. Any spill from the Crinan Canal that could contribute to river flood risk was also assessed.

Defining river flood risk from the Crinan Canal

Although not part of the natural catchment of the Badden Burn, spill over one of the Crinan Canal waste weirs does enter the burn's catchment.

For this reason, a simplified computer model of the Crinan Canal, including surveyed lock gate and weir levels, was constructed to establish flows entering the Badden Burn catchment for a range of AEP events both now and in the future.

This spill from the canal was then applied to the computer model of the land around Lochgilphead that would be used to establish both coastal and river flooding within the study area. It was found that the Crinan Canal contributed to overall flood volumes in the Badden Burn catchment but had limited influence on flood extents.

Defining river flood risk

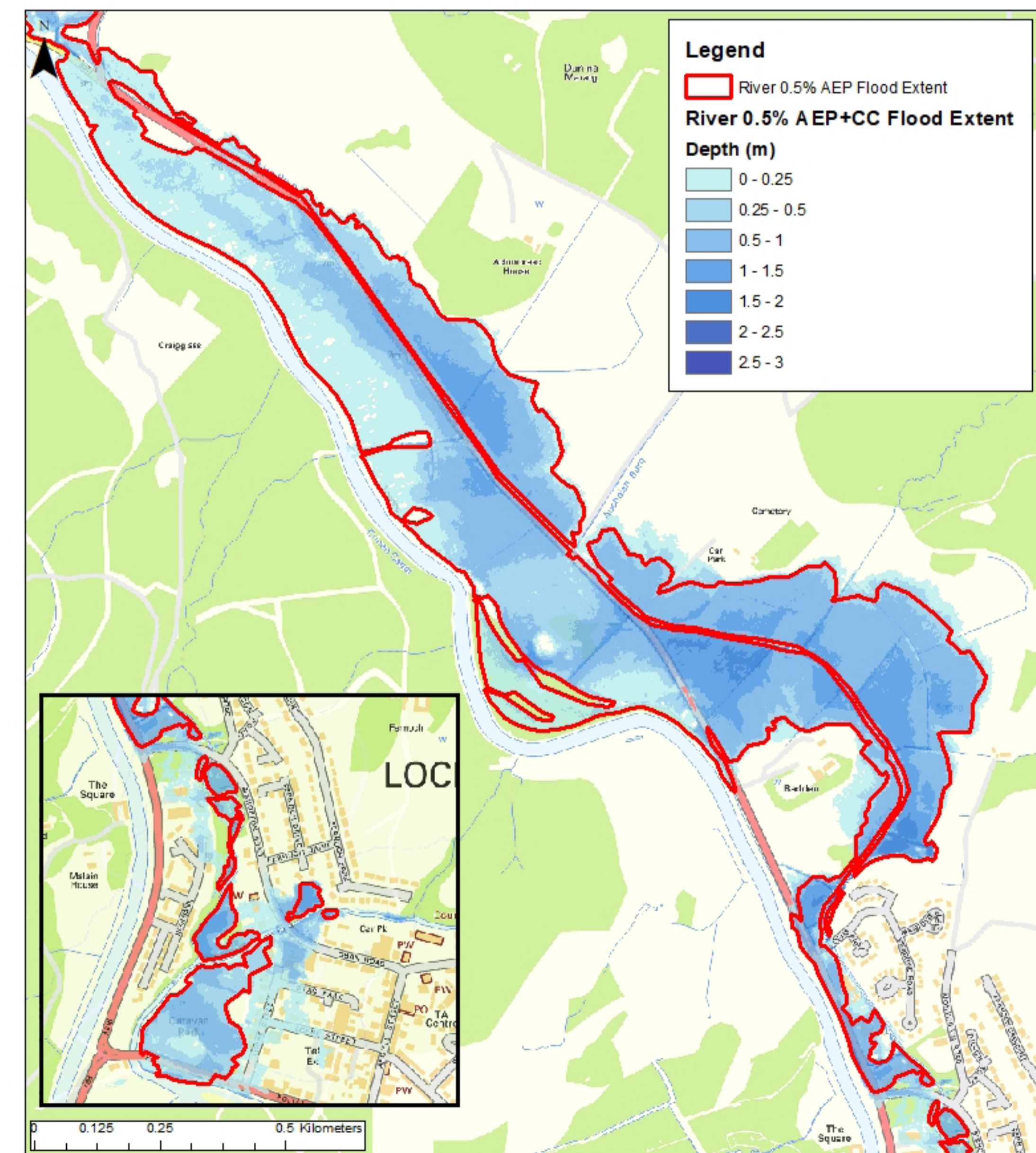
In order to assess river flooding in Lochgilphead, we have undertaken a review of the contributing catchments of the two watercourses that run through the town, the Badden Burn and the Cuillarstich Burn. Flows for each of the catchments were established for a range of AEP events both now and in the future.

These inflows were then applied to the computer model of the land around Lochgilphead that would be used to establish both coastal and river flooding within the study area.

River flooding, which includes spill from the Crinan Canal, is seen to be extensive on the A816 upstream of the Meadows, at the caravan park and around Lorne Street, with smaller pockets of flooding also located around Bishopton Road. The 0.5% AEP river event flood map, both current day and with climate change, is shown on this poster. A range of other AEP event flood maps can be viewed by speaking to one of the project team.

Flood risk in numbers for a 0.5% AEP event, with and without climate change

- 36 properties within the 0.5% AEP event present day flood extents in Lochgilphead
- 85 properties within the 0.5% AEP event + climate change flood extents in Lochgilphead
- Flood risk to a number of roads including Bishopton Road and the A816



River flooding in Lochgilphead

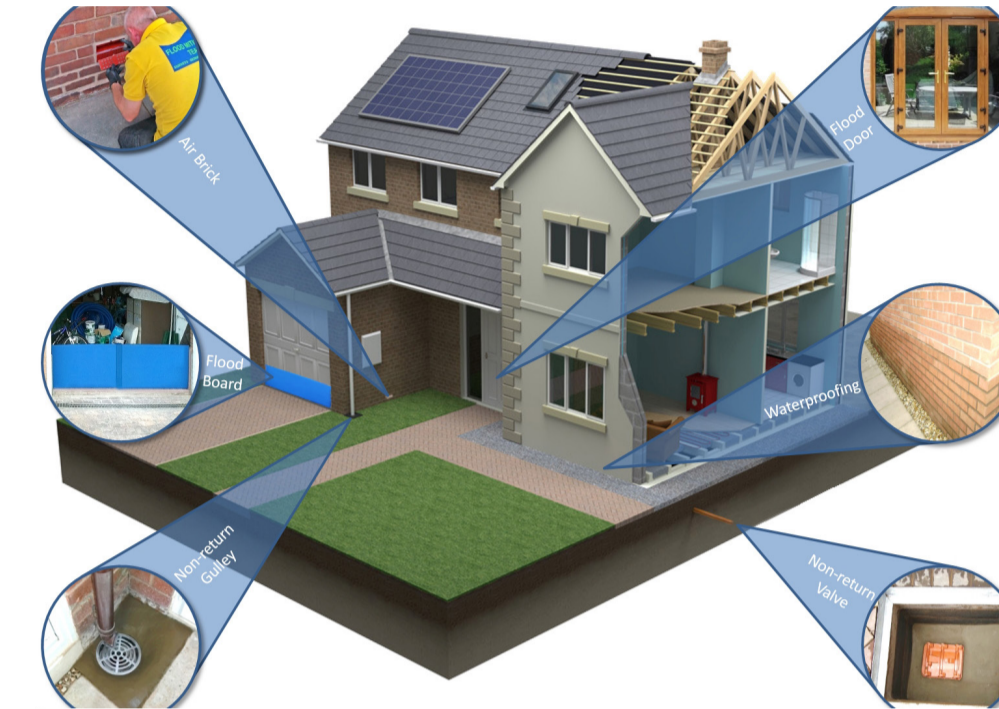
04 What options have we considered?

Once we confirmed the existing river/coastal flood risk using the latest modelling techniques and data, we looked at potential ways to reduce this risk by creating a long list of options.



Set back coastal embankment

It was assessed that a coastal embankment could be installed within the Front Green area to protect Lochgilphead from coastal flooding. This embankment could also continue up the Badden Burn to protect from a combination of river and coastal flooding. Installing an embankment would incur substantial cost as a significant length of defence is required and could reduce Lochgilphead's connection with the sea. However, an embankment is less expensive than a flood wall and is visually less intrusive. Landscaped features could be built into an embankment such as seating, a walkway along the top and children's play areas to address some of the visual issues.



Flood resilient properties and Property Level Protection (PLP)

Properties within the flood risk area would be retrofitted with resilience measures or employed with PLP. These options accept there is a flood risk and properties are adapted to better withstand flooding, with measures including lifting of electrical sockets and flood proof paint and flooring. PLP can be employed to protect individual properties from flooding through pathways such as doors and windows, brickwork and sewage systems. The success of PLP is also heavily dependent on the correct choice of PLP and its installation, operation and maintenance.



Raise coastal wall at existing defence line

To prevent overtopping along the existing sea wall, it could be raised to create a barrier to high sea levels. This would increase the standard of coastal flood protection for all receptors, but it would incur significant cost as well as being highly disruptive due to the likely need to substantially re-build the existing defences. Furthermore, this could reduce Lochgilphead's connection with the sea and result in impacts on various environmental and social receptors.



Land reclamation

Infilling of an area of the intertidal mudflats to provide more space for coastal defence options was investigated. The primary purpose of this land reclamation is for flood defence purposes in locations where space is limited, i.e. behind the police station. Whilst this option provides better access and more space for the engineering works, the connection to the sea and potential impacts on environmental and social receptors remain as with the other coastal defence options.



Canal management

Altering the current Crinan Canal operations could reduce flooding on the A816 and areas around the caravan park. Lowering the required trigger water level in the canal before flow discharges to the sea, would reduce spill over the waste weir, which currently contributes to flooding on the A816.

This is a non-engineered option, which keeps costs and land-take low, whilst also having minimal impact on the canal ecosystem and commercial elements. This option is something that could be investigated further with Scottish Canals by partnership working to determine suitable options.



Tidal Barrage

A tidal barrage would seek to stop high sea levels affecting the Front Green and southern areas of Lochgilphead. This structure could run between the pier to the west and existing wall to the east. The tidal barrage would remain open for the majority of the year, only closing when high sea levels were forecasted.

A structure of this scale would be extremely costly and would significantly affect the character and appeal of the area. In addition, it would likely impact local environmental and ecological receptors and commercial interests.



Natural Flood Management options

Natural Flood Management options are a sustainable approach to flood risk which could provide amenity value.

Wetland creation along the Badden Burn would aim to reduce flood risk by providing small scale attenuation areas that also provide habitat benefits. However, it is unlikely to provide significant reductions in flooding to Lochgilphead during extreme events.

Salt marshes could be developed within the intertidal area with the aim of reducing coastal flood risk. They would create a natural buffer by dissipating wave energy and thus reducing wave heights. However, it is unlikely this option would provide significant flood benefits as wave heights were small and this option would not protect against high sea levels.



Culvert/bridge upgrades

Upgrading of bridges and culverts on the Badden and Cuillarstich Burns could help reduce the risk of river flooding in various locations. By upgrading the structures, capacity could be increased, which may result in less out of bank flooding.

However, large bridges are costly to upgrade, and can cause major disruption due to access and road closures. The bridges and culverts in Lochgilphead were seen to have a reasonable capacity and it is unlikely that upgrading them would provide significant benefits.

05 Which options are provisionally short listed?

Tidal flooding often presents fewer potential flood options as the issues are related to water levels, rather than flood volume. Options are therefore largely focussed on blocking high water levels from reaching properties. Alternatively, options to address river flooding can aim to divert or block floodwater or manage flood volumes.

Coastal Direct defences

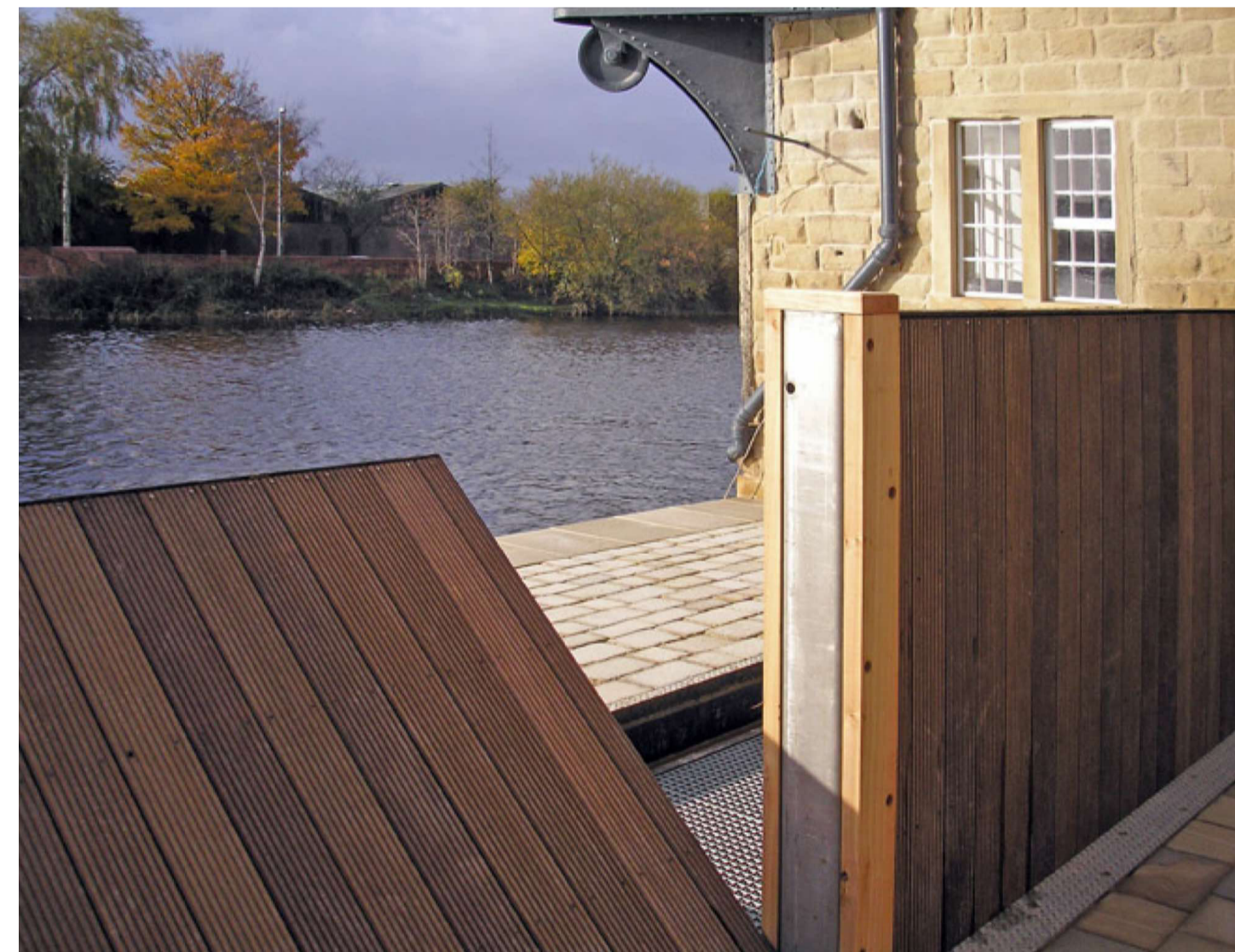
Direct defences in some arrangement, either wall, embankment or combination, are likely to form part of the preferred coastal option. The preferred location, either along the existing defence line or set back in the Front Green, will be chosen based on a feasibility assessment of each location and the consultation feedback.

Regardless of location, there are ways the visual impact of defences could be minimised. Options include using glass topped walls, utilising demountable or flip up defences or building landscape features into embankments.

Another approach would be to develop a combination of approaches in one overall scheme; selecting the most appropriate flood option for each location. Gates could be installed where access is required, flip up or demountable walls may be preferable across visually sensitive sections and traditional defences may be appropriate at less sensitive locations.



Glass topped defences



Flip up defences

Canal Management

The A816 north of Lochgilphead has a history of flooding which can result in road closures. The flooding of this road can be attributed to out of bank spill from the Badden Burn and also spill over the Crinan Canal waste weir near Cairnbaan.

By altering current canal operations, such as changing the required trigger water level in the canal before flow is discharged out to sea, spill over the waste weir could be reduced, which in turn would reduce the frequency and flood volumes on the A816. This measure could be investigated further by undertaking partnership working with Scottish Canals to determine practical options.



Change in operation of the Crinan Canal

PLP and flood resilience

As part of a wider scheme, and particularly in the short to medium term, PLP could play an important role in reducing coastal and river flood risk. Small scale property interventions, such as flood doors, flood windows and airbrick valves, can protect properties from flood depths up to 0.6m and could be particularly useful in locations where only isolated properties are affected.

In tandem with PLP, flood resilience measures, such as raising sockets and using water resilient materials, could offer a means of further reducing flood damage to property.

River direct defences

Direct defences could be installed along sections of the Badden and Cuillarstich Burns to protect against areas of Lochgilphead against river flooding.

It is likely that any direct defences on the watercourses would be around the caravan park area and could act as a defence against both coastal and river flooding

06 What are the next steps?

Further development of the provisionally short-listed options will be undertaken utilising feedback from the stakeholder group and this public consultation as well as additional assessments of the technical, legal, economic and environmental considerations.

Once we have undertaken all of our assessments, we will be back for another public consultation to present the preferred flood solution for Lochgilphead later in the year.

A report containing details of the current and future flood risk and recommendations for the management of coastal and river flood risks in Lochgilphead will be produced. The results of this study will be compared to the results of other flood studies being undertaken across Scotland, and this will identify a priority list for flood protection works. This is a competitive process and prioritisation, and therefore flood scheme funding, is based on how economic the presented flood solutions are (i.e. the option costs vs value of damages they offset).

In the meantime, if you want to learn more about flood risk and how you can better prepare yourself, please ask the project team for information on written resources and flood related organisations.



How to provide your feedback?

The project team welcome your comments on the Lochgilphead Flood Study.

You can provide your feedback in various ways. A questionnaire is available for you to leave your comments today at the event. Alternatively, you can email morag.hutton@aecom.com with any queries or comments.

