KEMNAY FLOOD STUDY

Aberdeenshire COUNCIL

1. Welcome & overview

The **Kemnay Flood Study** has been carried out to understand the current and future flood risk in the area, and to identify practical options to help reduce that risk.

Flooding can cause a serious disruption to homes, businesses, infrastructure, and the environment. By studying how flooding happens in Kemnay, we can make informed decisions about the most effective ways to manage and reduce flood risk.

Who is involved?

Binnies (part of RSK Group) on behalf of **Aberdeenshire Council** has completed a draft **Flood Study.**

We would appreciate your involvement in the development of this Flood Study as local knowledge and community feedback are an important part of this work.

What does the study cover?

- **How** and **why** flooding happens in Kemnay
- How flood risk might evolve in the future due **climate change**
- **Possible measures** to manage and reduce the impacts of flooding
- **Recommendations** for next steps

What are the key objectives of the study?

- **Reduce the risk of flooding** to homes, business and main transport links from both surface water and watercourses
- **Prepare for climate change**, which is predicted to produce more intense and frequent rainfall events in the future
- Help to **protect watercourses** from pollution
- **Improve local green spaces**, habitats and biodiversity, contributing to enhanced placemaking
- **Enable economic development**

This Flood Study has been developed in consultation with key organisations such as **SEPA** and **Scottish Water** to define a strategy identifying the most appropriate and cost-effective opportunities to mitigate flood risk.

Where are we now?

We have completed the technical analysis and reviewed a range of possible flood risk management options. These posters share the results and our recommendations, and explain what happens next.

Figure 1. River Don at Kemnay

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2. Understanding flooding at Kemnay

Kemnay was affected by **significant localised flooding** in 2016, 2020 and 2022, and therefore has been identified as a **Potentially Vulnerable Area**, which makes it a national priority for flood risk management.

Main sources of flooding in Kemnay

Flooding in Kemnay can happen for different reasons. The Kemnay Flood Study looks at how these causes interact and affects homes, businesses, infrastructure, and the surrounding environment.

- **River flooding** — When the River Don rises above its banks during periods of heavy and prolonged rainfall.
- **Surface water flooding** — When intense rainfall overwhelms the drainage system and water cannot flow away quickly enough.
- **Interaction between rivers and drainage** — When high river levels make it harder for surface water to drain away, causing water to back up in streets and low-laying areas.

Why flooding happens here

Kemnay's location on the **River Don** means that it is exposed flooding during significant storm events. Certain parts of the village are also on low ground or close to natural flow paths, making them more vulnerable when rainfall is heavy.

Climate change and future risk

The study also considers how climate change could affect flooding in the future. Higher rainfall intensity and more frequent extreme weather events may increase the **likelihood** and **severity** of flooding over time.

Under the **Flood Risk Management (Scotland) Act 2009**, Kemnay was designated as a **Potentially Vulnerable Area** (PVA 02/06/16) due to river and surface water flooding within the **North East Local Plan District** (LPD 6).

Actions to manage flood risk are contained within the published Noth East Flood Risk Management Strategy, and this includes the requirement for a Flood Protection Study.

Further information at https://www2.sepa.org.uk/frmstrategies

River flows, return periods and probabilities

River flows are measured in **cubic metres per second** (m^3/s), and we often refer to the largest flow as the "**peak flow**".

To describe how **unusual** or **likely** a flood is, we use the terms "**return period**" and "**annual exceedance probability**" (AEP). These are simply ways of expressing the **chance** of a flood of a certain size happening in **any given year**.

For example: a 1 in 200-year flood (also called a 0.5% AEP event) means that the estimated peak flow at the River Don would be around $372m^3/s$. This does not mean such flood happens only once every 200 years. Instead, it means that in any single year, there is a 0.5% chance of a flood of that size (or larger) occurring.

Flooding is a natural process, and chance does not follow a strict calendar. It is entirely possible to experience two "1 in 200-year" floods within just a few years –or even within the same year.

In short: Return periods and AEP are statistical tools to describe how likely a flood is, not a prediction of when it will happen. Floods can occur at any time, and their frequency is based on probability, not fixed timelines.

Figure 2. River Don high water levels at Kemnay

Figure 3. Flooding at Milton Meadows

Figure 4. Flooding and temporary barriers at Kembhill Park

3. Predicted flood risk

To understand Kemnay's current and future flood risk, we used a **hydraulic model**. This computer-based tool simulates how water moves through the River Don, local burns, drainage network and overland during heavy rainfall and high river flows.

What the model tells us

- It predicts where flooding is most likely to occur, how deep the water could get, and how fast it might flow.
- It allows us to test different storm scenarios, including those that are more likely (e.g.: 1 in 10-year events) and those that are rarer but more severe (e.g.: 1 in 200-year events).
- It helps identify which areas are most at risk today and how this could change in the future.

Scenarios we tested

- **Present day** — representing the current situation without climate change.
- **Future climate change** — factoring in predicted increases in rainfall and river flows.

Why this matters

The model provides the evidence needed to explore possible flood management options. By understanding the extent and severity of flooding, we can focus efforts where they will have the greatest benefit.

Using a combination of the reported flood history; responses to the public questionnaire submitted in September 2024; and predicted flood outlines produced by the integrated catchment model, two flooding 'hotspots' were defined. These are shown on Figure 1 with the hotspots located at:

- HOTSPOT 1: **Kembhill Park**
- HOTSPOT 2: **Milton Meadows**

Flood maps

A number of flood maps representing maximum flooding extent and depth for a range of return periods were considered for the Flood Study. You can view these flood maps on the Council's consultation website: **www.KemnayFloodStudy.info**

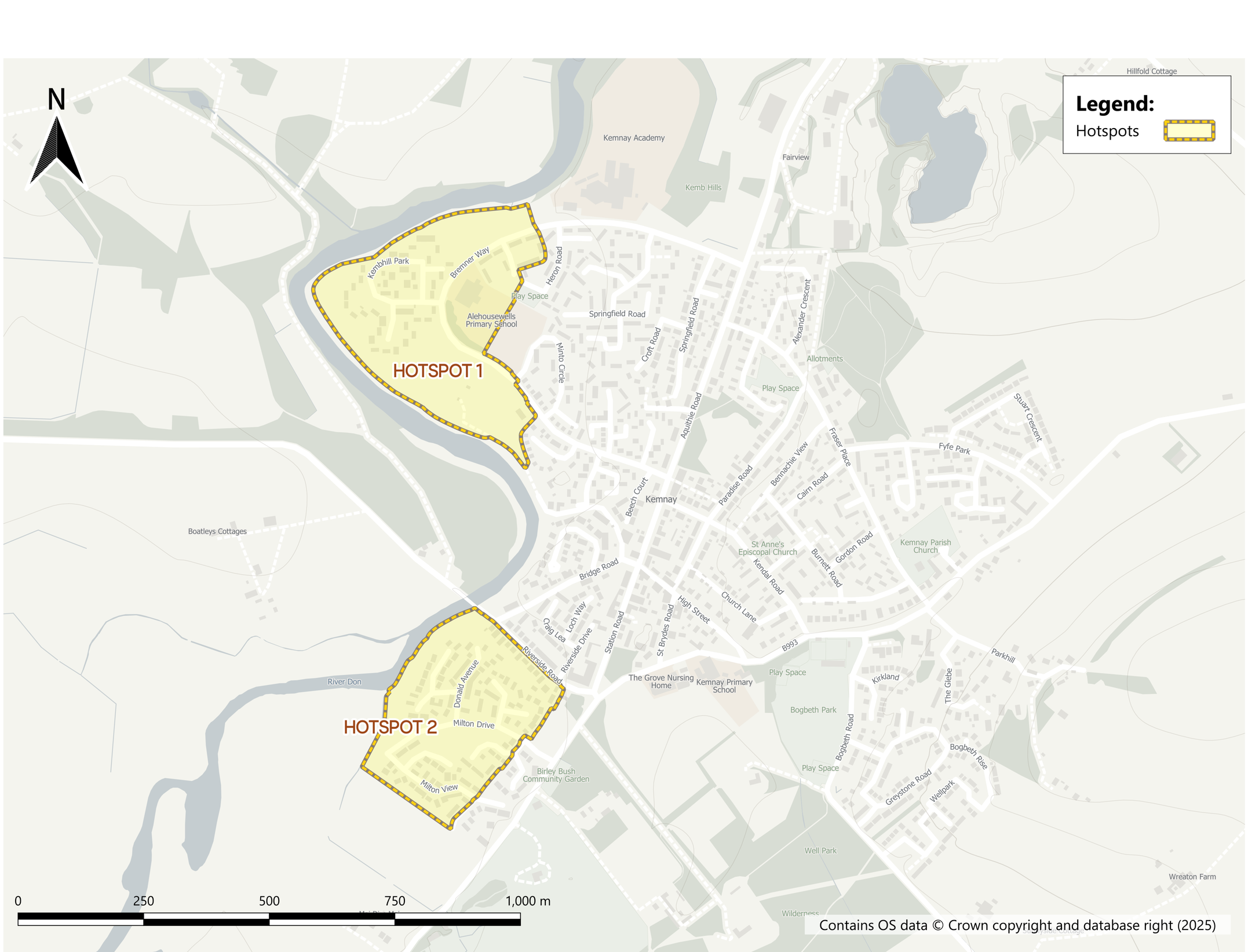

Figure 5. Flooding hotspots across Kemnay

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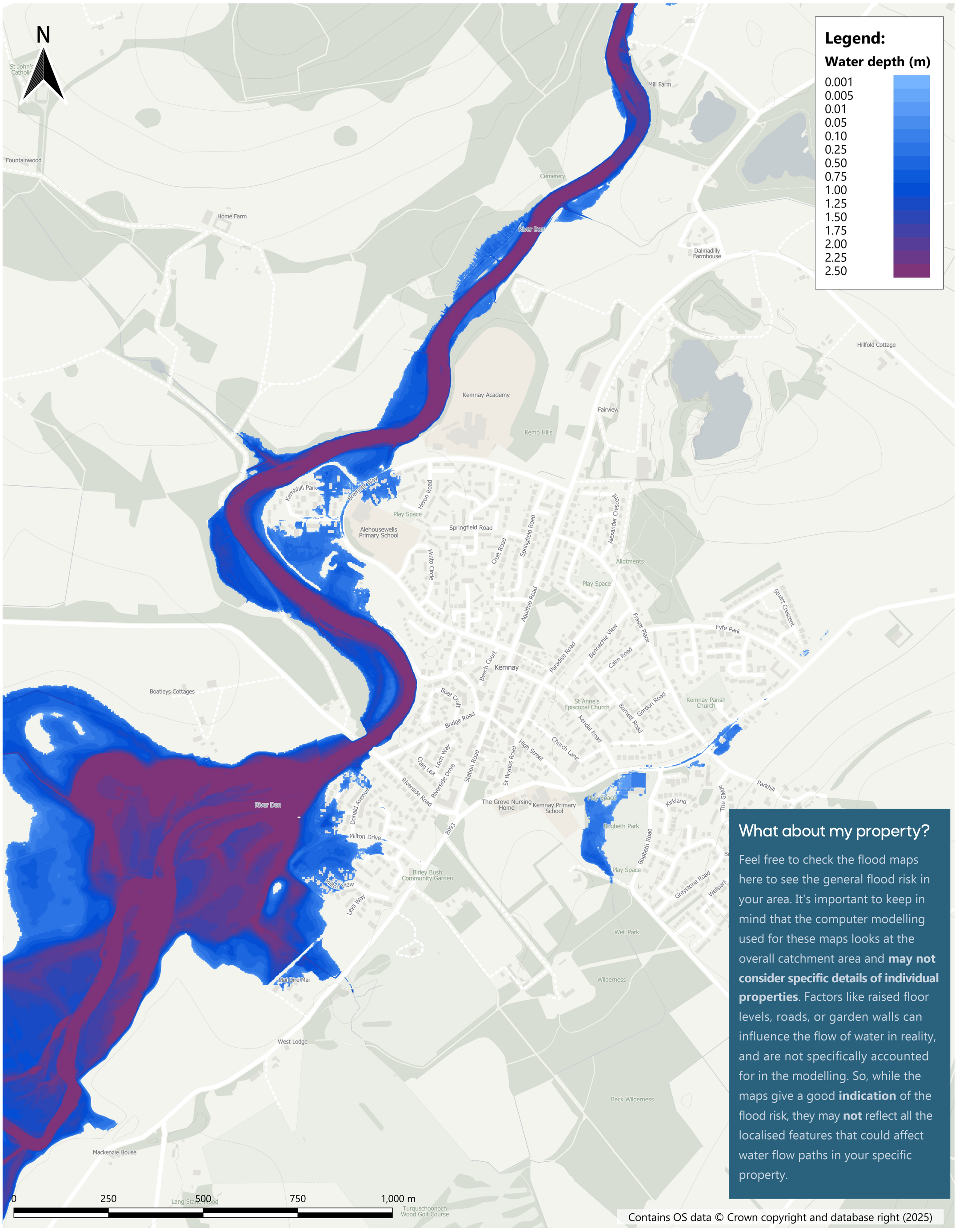
Flood map – 1 in 200-year return period 30-hour duration rainfall event



What about my property?

Feel free to check the flood maps here to see the general flood risk in your area. It's important to keep in mind that the computer modelling used for these maps looks at the overall catchment area and **may not consider specific details of individual properties**. Factors like raised floor levels, roads, or garden walls can influence the flow of water in reality, and are not specifically accounted for in the modelling. So, while the maps give a good **indication** of the flood risk, they may **not** reflect all the localised features that could affect water flow paths in your specific property.

Figure 6. Flood map 1:200-year, 30-hour duration storm

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4. Flood risk management

To develop options for managing and, if possible, reducing flood risk in Kemnay, we followed a series of steps.

1. Available information and a hydraulic model were used to identify the flooding issues within the catchment. These findings serve as a **baseline** for evaluating options to manage flood risk.

2. A **long-list** of measures was considered that could be taken to reduce or manage the flood risk. This was screened to remove measures that were clearly unfeasible, leaving an initial short list of potential actions.

3. We conducted a high-level scoring exercise to evaluate the options and produce a final **short-list** of those that are most feasible. This helped us eliminate measures that were not practical or viable for the situation.

4. We conducted a detailed **appraisal** of the final short-listed options using the hydraulic model. This involved evaluating their performance under different scenarios, considering their implementation requirements, compatibility with other policies and plans, and their potential to achieve the objectives of the Flood Study.

5. Based on the results of the appraisal, we selected **recommended options**. Factors such as effectiveness, affordability, environmental and social impacts were considered during the selection process.

Multi-criteria assessment

Options are evaluated against a range of criteria to determine their suitability, including **technical**, **environmental**, **social** and **economic** feasibility.

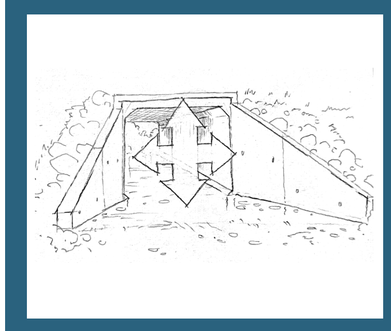
In managing flood risk Aberdeenshire Council is required to have regard to the economic impact of its actions. For an option to be considered viable, the costs must not exceed the benefits, i.e. the **benefit-cost ratio** (BCR) must be greater than 1.

What was considered in the long-list?

A range of different actions were considered when producing the long-list. Actions can be classified under the following the categories:

◀ Direct Defences

This group of measures includes construction of flood walls and embankments.



◀ Conveyance Improvements

Including channel modifications and culvert up-grades to increase flow capacity.

◀ Upstream Storage

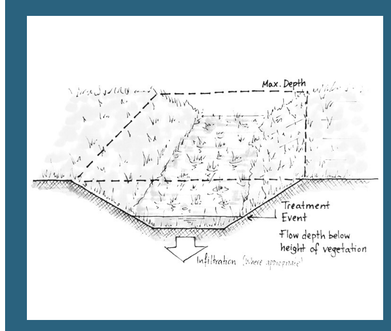
Measures to create new or upsize existing stor-age were considered.

◀ Natural Flood Management (NFM)

NFM techniques work with natural processes to manage flood risk, and work on the principle of slowing the flow down in the upper catchment.

◀ River Restoration

Within this group are included actions such as wetland creation, floodplain recovery or re-meandering.



◀ SuDS elements

Sustainable Drainage Systems (SuDS) are ele-ments with innovative design to collect, store and treat overland flows. These aim to imitate the natural drainage processes. Examples are: Ponds, swales, green roofs or rain gardens.

◀ Non Structural Measures

These consist of policies, regulations and prac-tices that aim to reduce the exposure and vul-nerability of communities to flooding.

5. Short list of options

This is summary table of the shortlisted options considered in the flood study:

Option	Benefit-Cost Ratio (BCR)
Option 1 — Embankment and flood wall at Kembhill Park	1.3
Option 2a — Embankment at Milton Meadows	0.7
Option 2b — SuDS pond at Milton Meadows	1.4
Option 3 — Upstream storage area on River Don	0.1
Option 4 — Wetland area downstream Kembhill Park	0.2

Figure 7. Shortlisted options

OPTION 1. Embankment and flood wall at Kembhill Park

The preferred option includes:

- Building a flood embankment (bund) about 125 metres long,
- Building a flood wall about 120 metres long.

Together, these will connect to the existing natural high ground in the area. The embankment is expected to be around 11 metres wide, although this could be reduced once ground investigations are carried out during the detailed design stage.

Figure 8. Existing bund at Kembhill Park

Figure 9. Properties at Kembhill Park

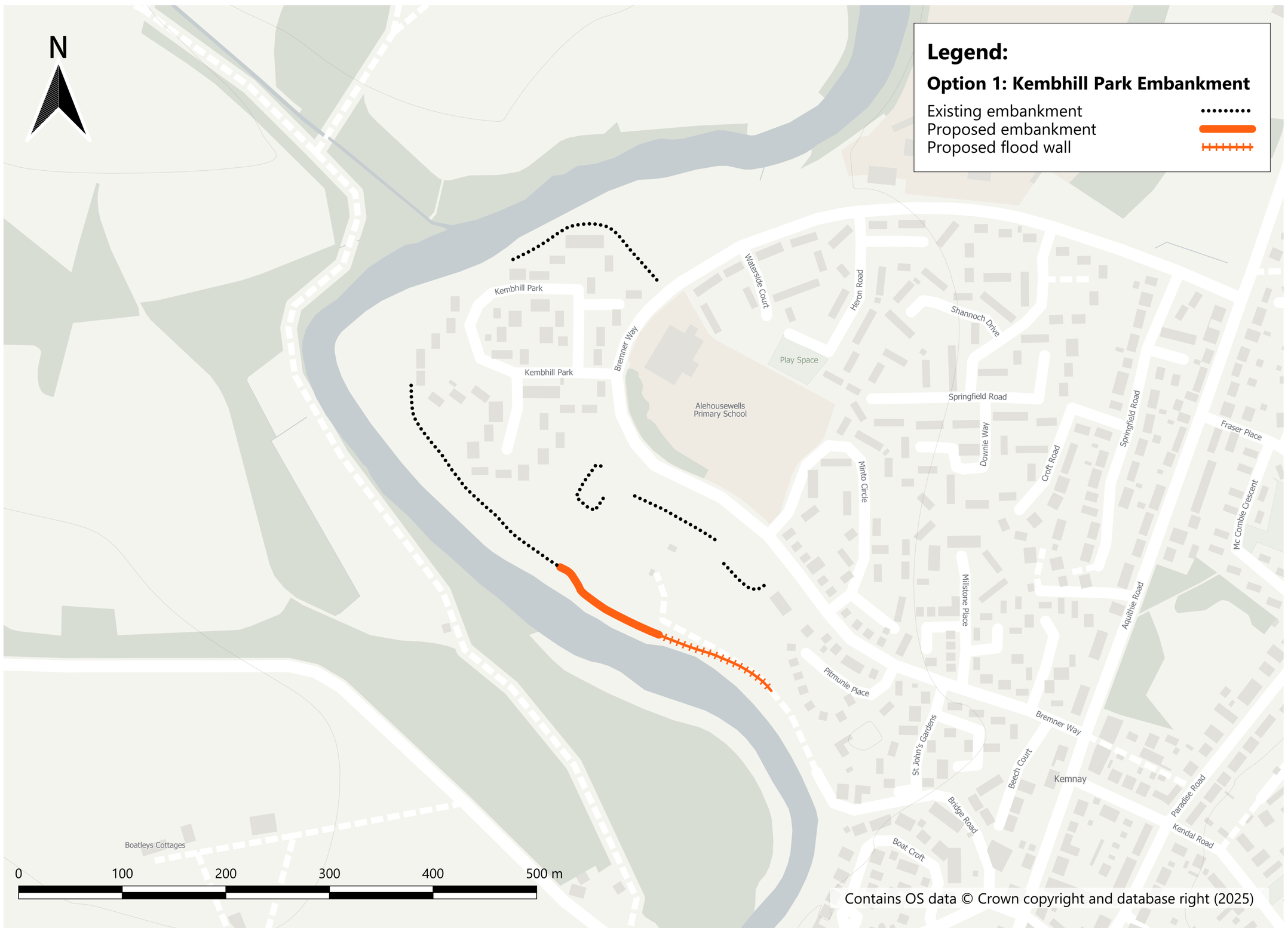


Figure 10. Option 1, embankment and flood wall at Kembhill Park

OPTION 2b. SuDS pond at Milton Meadows

This option is an evolution of Option 2a, which proposed constructing a flood embankment at Milton Meadows to replace the existing topographic bund. However, the economic appraisal showed a low benefit-cost ratio (BCR = 0.7). The hydraulic model revealed that a significant amount of flooding damages were caused by surface water accumulating in the area. High river levels in the River Don prevented the surface water system from discharging effectively, leaving the drainage network almost unusable.

Option 2b addresses this issue by mitigating surface water accumulation at Milton Meadows. The proposal involves installing new drains and manholes to collect runoff and convey it to a specially designed SuDS pond. This pond would store excess water and release it safely once river levels recede, ensuring the system functions effectively.

- The pond would cover around 3,000 m^2 and be up to 1 metre deep.
- It could store around 3,250 m^3 of water.
- If water levels in the River Don are low enough, the pond can safely release water back to the river.

There is also an opportunity to design the pond as a permanent water feature, adding value for wildlife and creating a green space for local residents, if this is something the community would like to see.

Figure 11. Green area at Milton Drive

Figure 12. Artistic representation of the SuDS pond at Milton Drive

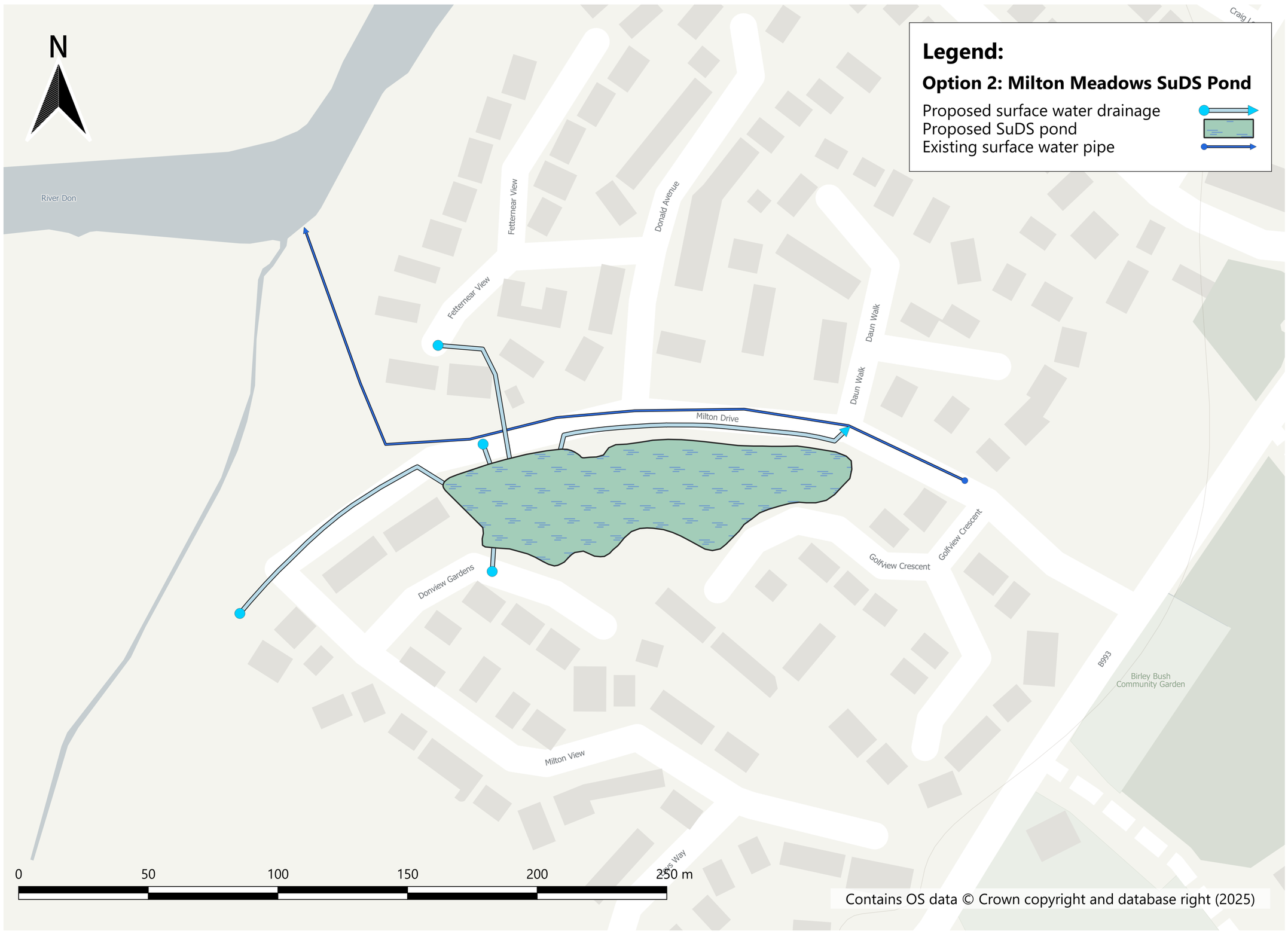


Figure 13. Option 2b, SuDS pond at Milton Meadows

6. Summary of the study findings & recommendations

The Kemnay Flood Study has given us a much clearer understanding of the flood risks within the catchment. To achieve this, we collected and reviewed extensive data, carried out surveys, and developed a detailed integrated hydraulic model to improve the accuracy and reliability of the flood predictions. Now we have a clearer picture to make informed decisions to reduce the flood risk at Kemnay.

We built a combined 1D-2D hydraulic model to assess study area. This model incorporates the watercourses, sewer network and overland flood flows, enabling us to understand how these systems interact. It also allowed us to estimate flood damages and evaluate the economic impacts of different mitigation options over a 100-year period.

From the four shortlisted options, two provide cost-effective flood mitigation and are recommended for implementation:

- **Option 1** involves the construction of an embankment and flood wall at Kembhill Park (BCR = 1.3).
- **Option 2b** involves the construction of SuDS pond at Milton Meadows (BCR = 1.4).

Option	Option 1	Option 2b
Capital cost	£694,977	£617,426
Total estimated **cost** across a 100-year lifespan	£974,453	£906,847
Estimated **flood damages avoided** across a 100-year lifespan	£1,271,197	£1,273,738
Benefit-cost ratio	**1.3**	**1.4**
Multi-criteria assessment score	59%	53%

7. Feedback & next steps

We encourage any feedback on the proposals, and will seek to incorporate the views of the local community into the proposals where we can.

The Kemnay Flood Study will then be updated and finalised. The conclusions of the plan will then be reported to the relevant Committee. Thereafter, the Council will seek to secure funding and any relevant regulatory approvals to implement the recommendations of the report.

Contact details

For further information on the Kemnay Flood Study please contact:

Flooding Team

Aberdeenshire Council, Viewmount,
Arduthie Road, Stonehaven, AB39 2DQ

Tel: **03456 081205**

Email: **flooding@aberdeenshire.gov.uk**

Thank you!

We would like to thank you for your attendance and comments today. Community involvement is a key part of flood risk management and your views are appreciated

Any comments or questions?

Please speak with a representative from Aberdeenshire Council or Binnies.