

Date:	18 th July 2023
To:	Dr. Sally Mackenzie
From:	cbec eco engineering UK Ltd
Project:	River Dee Valley Restoration
Subject:	Flood Risk Assessment

1. INTRODUCTION

1.1 PURPOSE OF STUDY

The aim of this project is to undertake a detailed design study for the proposed restoration of a 3.6 km reach of the River Dee, between Allanquoich and Allanmore, west of Braemar. This will involve full or partial embankment removal along the river left bank, re-instating channel-floodplain connectivity and thereby improving the quality of in-stream and floodplain habitats at the landscape scale. The study site can be seen in Figure 2.1.

As part of this study, this flood risk assessment (FRA) has been completed in support of the proposed construction, assessing any flood risk concerns raised by the proposed scheme in accordance with Scottish Planning Policy (SPP).

1.2 SCOPE OF STUDY

The assessment is a comprehensive, risk-based assessment of potential flooding from all possible sources, including fluvial flooding from adjacent watercourses, groundwater and surface water runoff. The assessment also identifies and examines the residual flood risk to the site and any neighbouring properties. The aim of this report is primarily to consider flood risk and satisfy requirements under SPP.

Data and information have been obtained from the following sources:

- SEPA; 19/06/2023
- Aberdeenshire Council; 19/06/2023
- North East Local Plan District - Local Flood Risk Management Strategy (LFRMS);
- River Dee Catchment Flood Management Plan (CFMP)
- topographical survey data;
- hydraulic modelling results

2. BACKGROUND INFORMATION

2.1 DEVELOPMENT SITE

The development site can be seen in Figure 2-1 below:

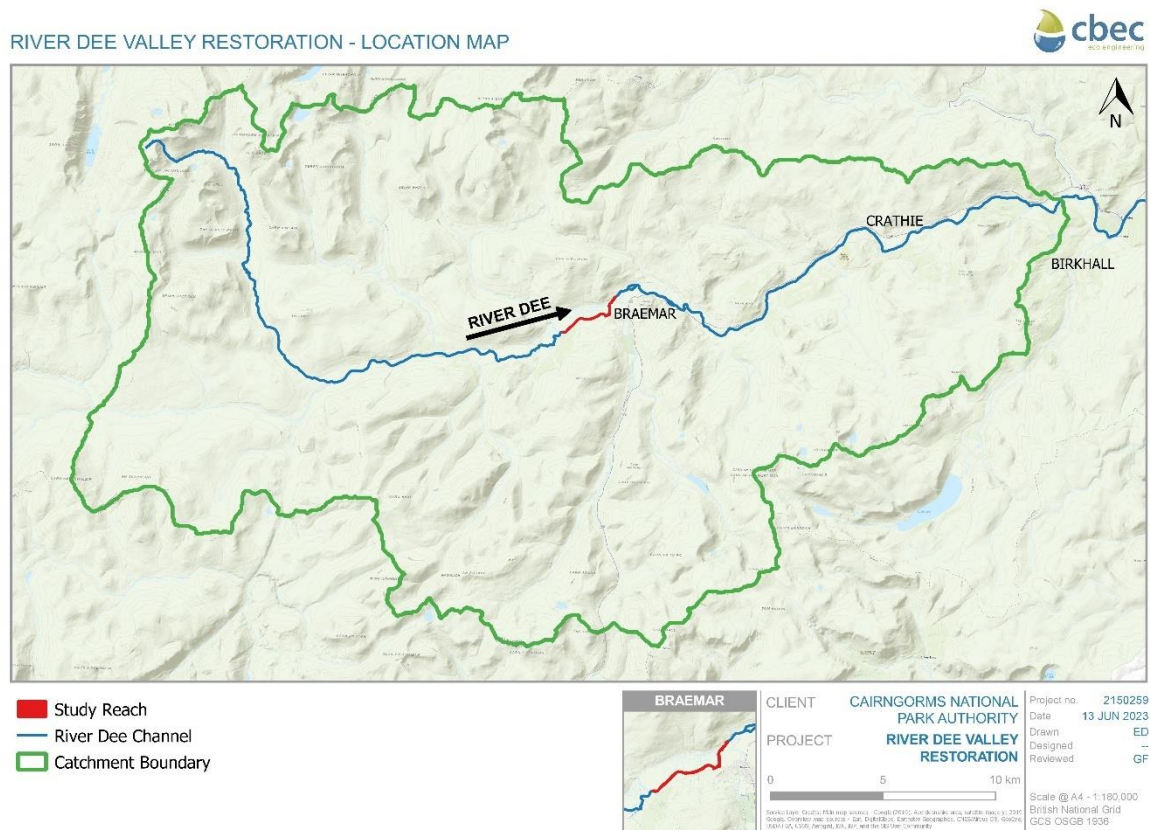


Figure 2-1 Development site location

The site is rural and situated along the River Dee just west of Braemar within the Cairngorms National Park. The approximate grid reference for the upstream extent is NO 12259 90688 and the downstream is NO 14608 92166. The closest village is Braemar which resides to the south east of the downstream extent of the study area. The Lin of Dee Road runs parallel to the River Dee along the entire study extent.

The study area is situated in a fairly steep valley (an elevation map is shown in Figure 2-2) where the bedrock geology of the study area within the channel is predominantly Glen Spean Subgroup Psammite. However, there are small areas of Felsite, Pelite, and Granite sporadically situated within the floodplain. This generally means the catchment is fairly impermeable.

RIVER DEE - EXISTING CONDITIONS DEM SURFACE

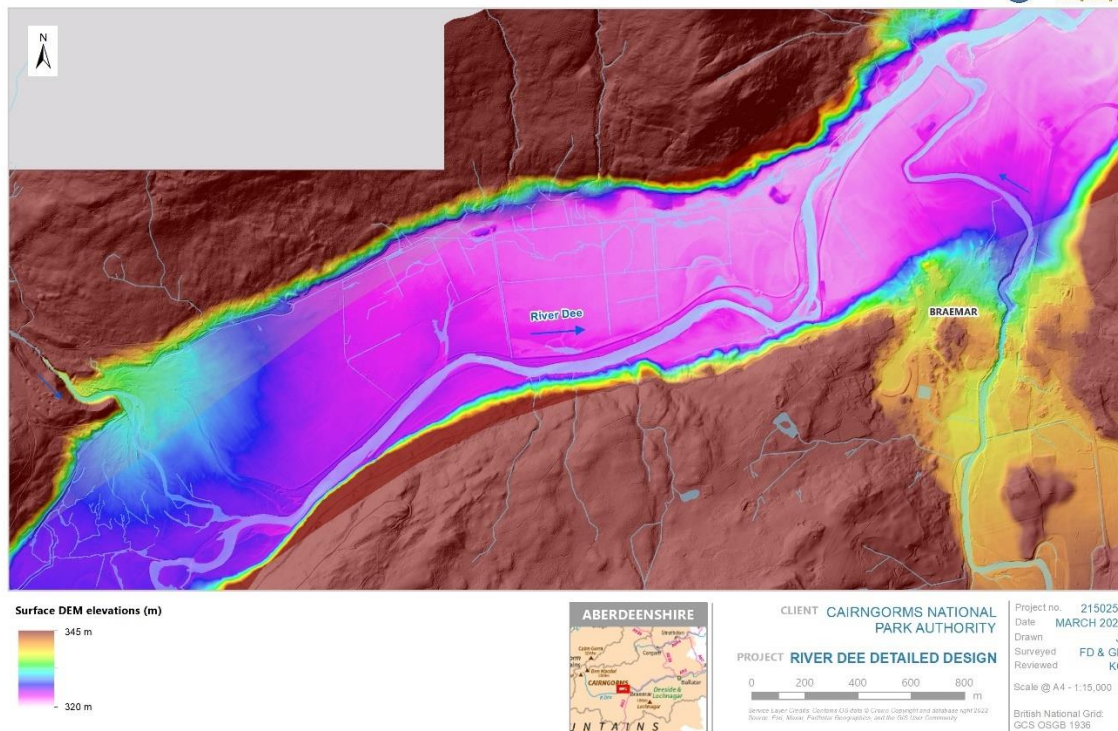


Figure 2-2. Elevation map of study site.

2.2 DEVELOPMENT PROPOSALS

Partial or full removal of the embankment along the northern bank of the River Dee has been proposed within the study extent. Several restoration options have been considered, as detailed in the accompanying 'River Restoration Design Report'. A high-level options map for the full embankment removal option is presented in Figure 2-3 for context. The final preferred option offers a compromise between partial and full removal, with the majority of the embankment being removed and all hard bank protection on river left removed. Further details regarding the final design are provided in the main project report.

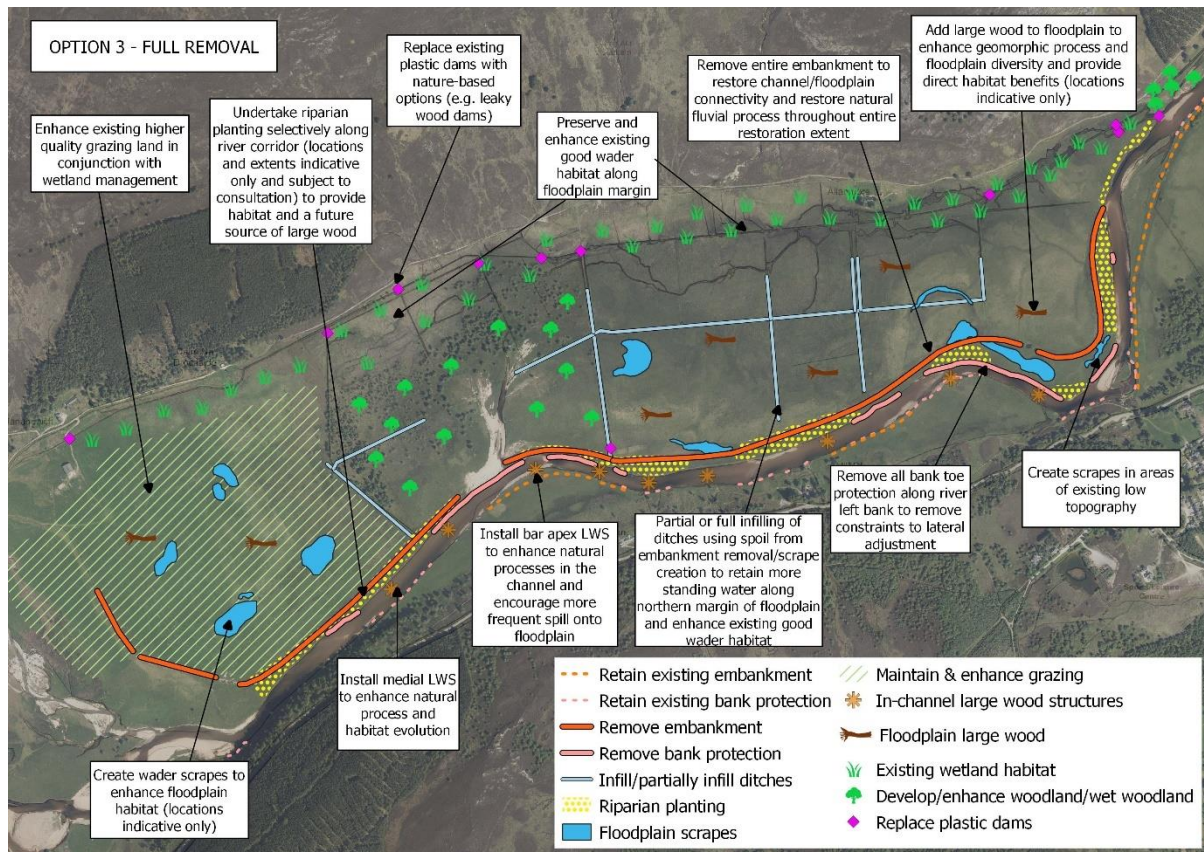


Figure 2-3. Full embankment removal design proposal.

3. STATUTORY CONSULTATION

3.1 SCOTTISH ENVIRONMENT PROTECTION AGENCY (SEPA)

SEPA was approached regarding any known local flood risk or historic flooding records in the area, of which they noted 10 of the 12 recorded flood events along the River Dee were related to fluvial flooding. However, these flood events occurred along differing reaches of the River Dee and no information specific to the site is noted.

Full correspondence with SEPA is reported in Appendix A of this Flood Risk Assessment.

3.2 ABERDEENSHIRE COUNCIL

Aberdeenshire Council was approached regarding any known local flood risk or historic flooding records in the area.

Full correspondence with the Council is reported in Appendix A of this Flood Risk Assessment.

4. PLANNING POLICY

4.1 NORTH EAST LOCAL PLAN DISTRICT - LOCAL FLOOD RISK MANAGEMENT STRATEGY (LFRMS)

The North East Local Plan District LFRMS was prepared and submitted in December 2022. It does not mention any specific issues with the River Dee at Braemar, nor any specific objectives for the catchment beyond attempting to reduce flood risk where possible.

4.2 DEE CATCHMENT FLOOD MANAGEMENT PLAN (CFMP)

The Dee Catchment Flood Management Plan was prepared and submitted in November 2007. The proposed development site lies in headwaters of the River Dee, situated within the Cairngorms. Therefore, there is no specific policy unit allocated to this section of the River Dee. The Cairngorms National Park Authority (CNPA) ensure the aims listed below are collectively achieved:

- To conserve and enhance the natural and cultural heritage of the area
- To promote sustainable use of the natural resources
- To promote understanding and enjoyment of the special qualities of the area by the public
- To promote sustainable economic and social development of the area's communities

The proposed restoration is not designed to specifically reduce flood risk, but is in line with restoring a more natural flow regime and thus satisfies the requirements of this policy.

4.3 SCOTTISH PLANNING POLICY

Scottish Planning Policy (SPP) seeks to reduce the impact of flooding on new developments, by expecting developers and planning authorities to err on the side of caution in decision making whenever flooding is an issue. In particular, it requires that no new developments should be built on the functional floodplain, defined as having a greater than 0.5% chance of flooding in any given year. Exceptions may exist where the development location is essential for operational reasons, or cannot be placed elsewhere.

The proposed development lies within the functional floodplain. However, due to the nature of the measures proposed the restoration design cannot be placed in an area of lower flood risk, thus this satisfies the requirements of the SPP.

5. ASSESSMENT OF FLOOD RISK

5.1 FLUVIAL FLOOD RISK

5.1.1. SEPA Flood Risk Map

The SEPA flood map, shown in Figure 5-1, reveals that the development site is located within the functional floodplain, at high risk of flooding (a 10% chance of occurring each year). The primary source of flooding to the site is fluvial, deriving from the River Dee.

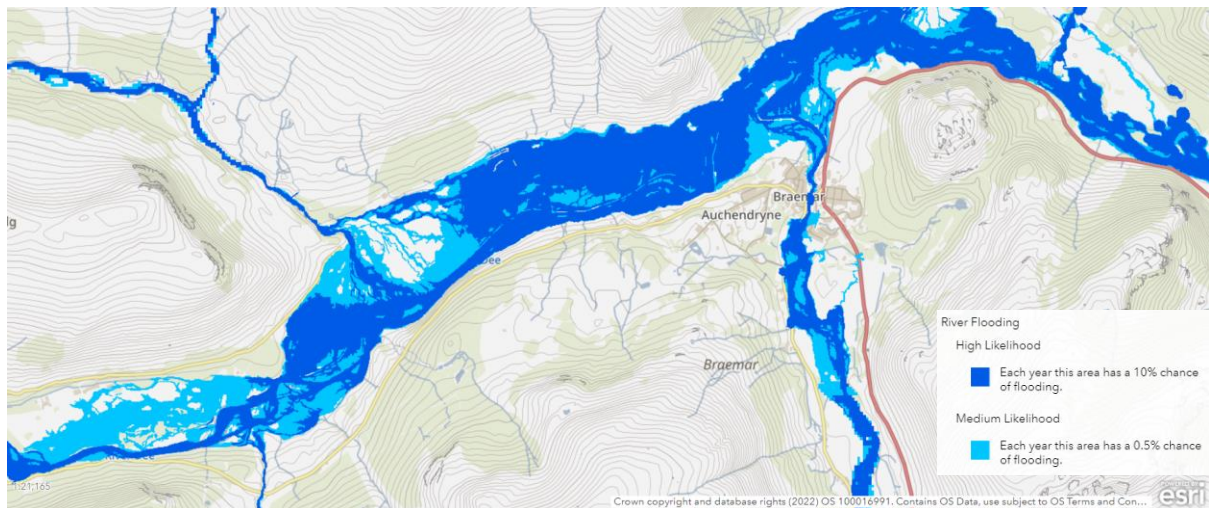


Figure 5-1. SEPA flood zone map - [SEPA Flood Maps \(arcgis.com\)](https://arcgis.com).

5.1.2. Historic flooding

There are no current online records available regarding historic flooding along the River Dee. SEPA and Aberdeenshire Council have been contacted and their response is provided in Appendix A.

5.2 HYDRAULIC MODELLING

As part of the design project, hydraulic modelling of the Dee at the site was undertaken by cbec. The stretch of river at the project site was modelled as existing, and then with the proposed design implemented. The pre- and post-design scenarios have been compared, to assess the potential change to flood risk that might occur because of the proposed restoration.

A full discussion of the hydraulic modelling is included in the main project report.

The 1 in 10 year results are shown in Figure 5-2, the 1 in 200 year in Figure 5-3 and the 1 in 200 year plus 37% climate change in Figure 5-4.

The results show the extents of the flooding remains constrained within the valley floodplain, defined by the steep-sided terrain, for all events, with no change between the existing and design scenarios. The maximum depth on the floodplain does increase for the design scenario, which is expected given the nature of the restoration scheme.

There is one property close to the floodplain, Allanmore (see Figure 5-5), potentially at risk of flooding. The property itself appears to be on higher ground, outwith the flooded area, but the access road both to the east and west are affected. The risk does not change though in the proposed design case.

There is a barn, owned by Allanquoich Farm, shown in Figure 5-6, within the floodplain. This is the case both for the existing and design scenarios, and the risk does not change in the design scenario.

The pass-forward flow hydrographs at the downstream extent of the model were assessed. These demonstrate the flow leaving the project site, and are used to estimate the potential effect on downstream flooding the proposed design might have. The hydrographs are shown in Figure 5-7 to Figure 5-9. The 200 year and 200 year plus climate change events show negligible difference in the flow hydrographs, suggesting that the design will have no impact on downstream flooding. Figure 5-9 suggests this is the case for all events, except the 1 in 2 year, which indicates a slight attenuation in the rising limb of the hydrograph in the design case. The peaks remain the same. This may potentially mean a slight attenuation of the 1 in 2 year event downstream of the site, but the effect is very minor.

RIVER DEE - MODELLING RESULTS - WATER DEPTH - 10Y RETURN PERIOD

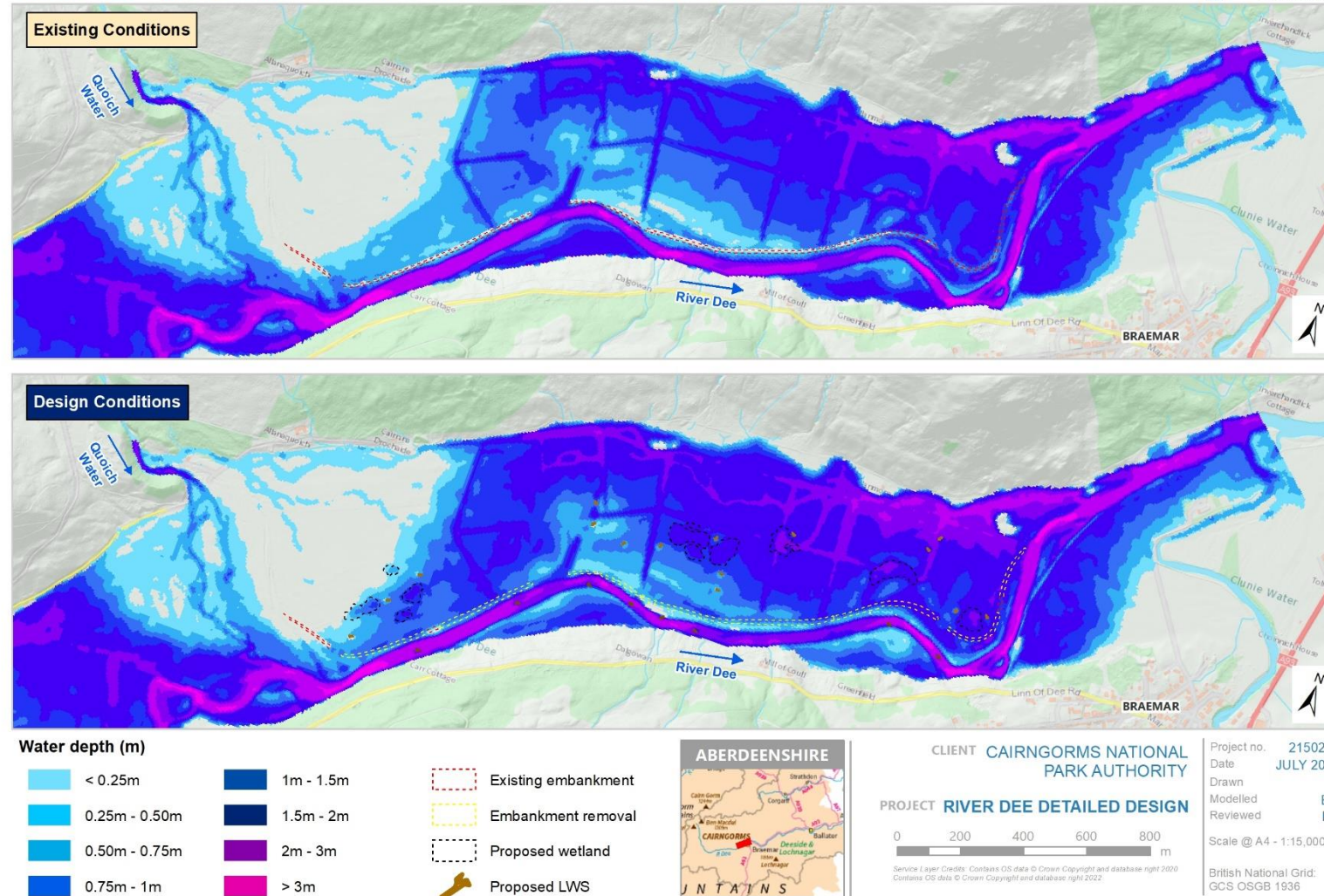


Figure 5-2. Comparison of 1 in 10 year (10% annual chance of occurring) flood results.

RIVER DEE - MODELLING RESULTS - WATER DEPTH - 200Y RETURN PERIOD

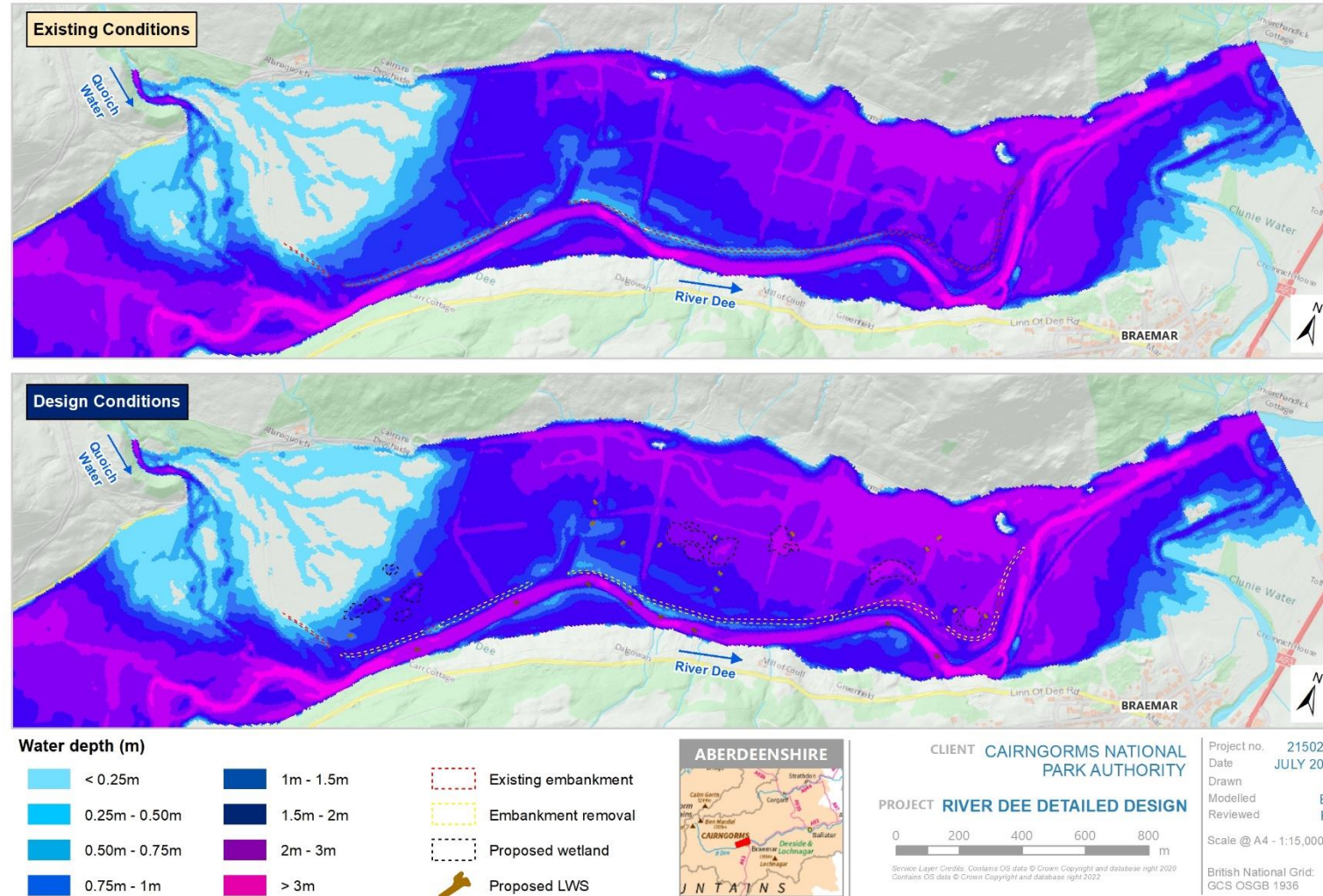


Figure 5-3. Comparison of 1 in 200 year (0.5% annual chance of occurring) flood results.

RIVER DEE - MODELLING RESULTS - WATER DEPTH - 200Y RETURN PERIOD + CLIMATE CHANGE

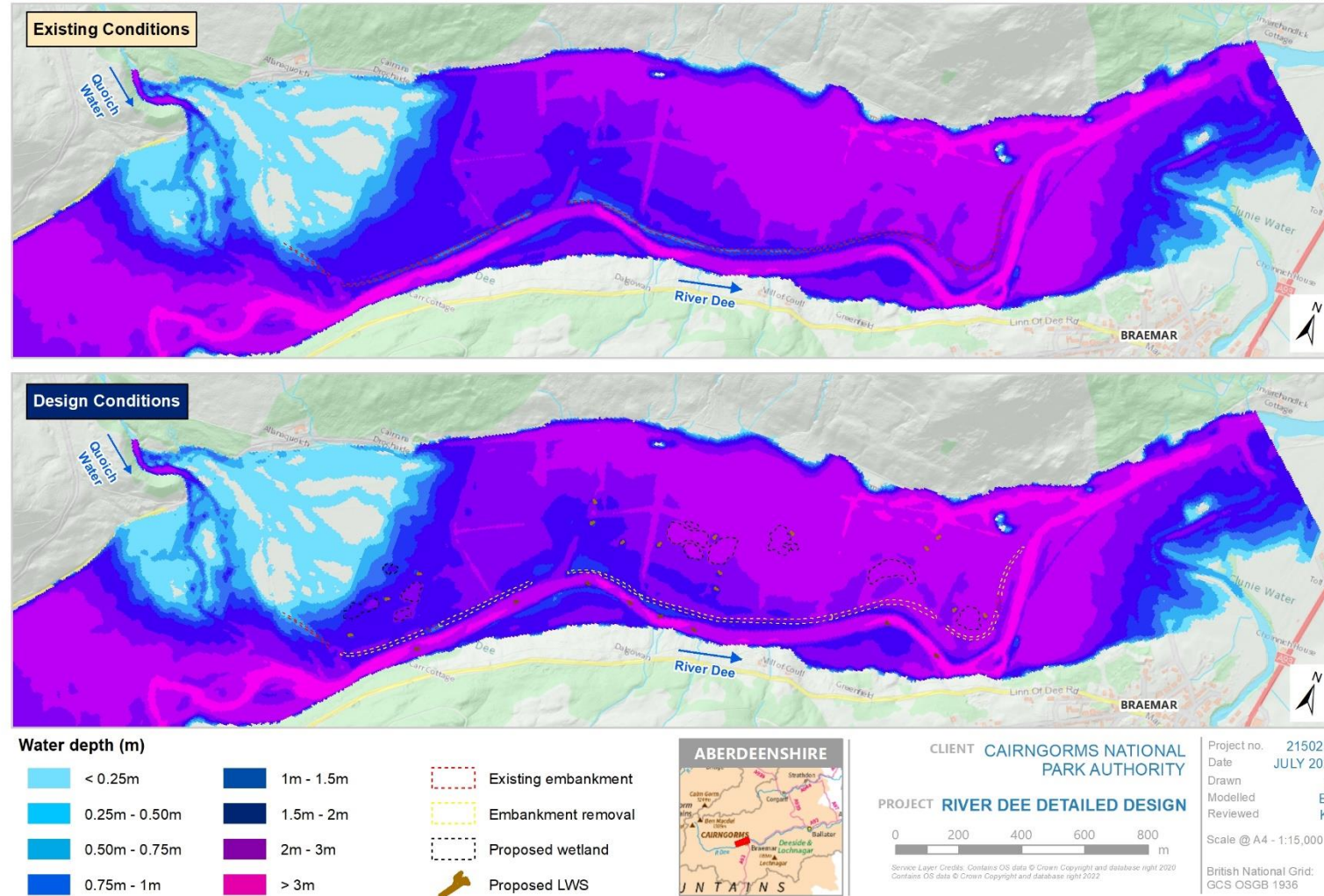


Figure 5-4. Comparison of 1 in 200 year (0.5% annual chance of occurring) plus 37% climate change flood results.



Figure 5-5. Allanmore property, close to the floodplain.



Figure 5-6. Allanquoich Farm barn, situated within the floodplain.

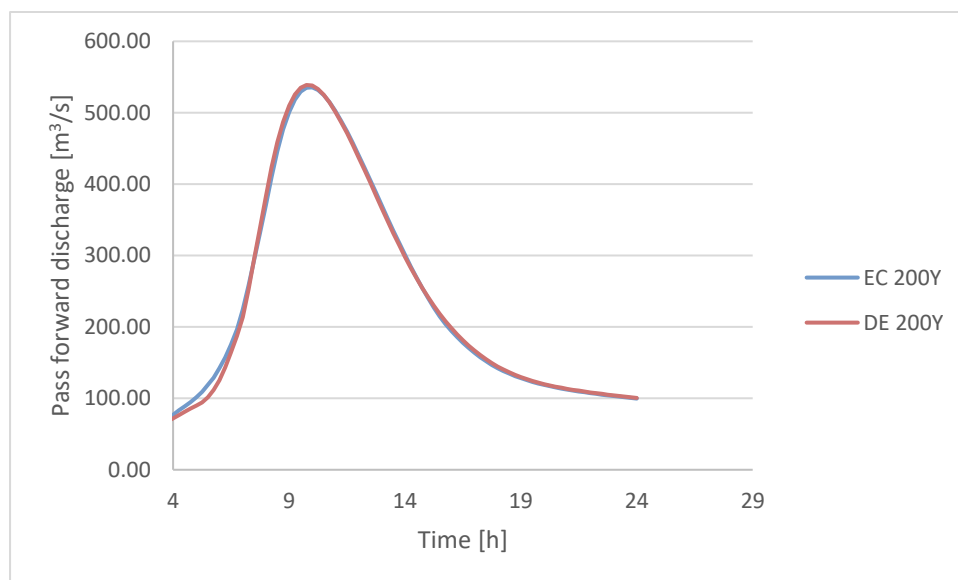


Figure 5-7. Pass-forward flow hydrographs for existing and design cases, for the 1 in 200 year event.

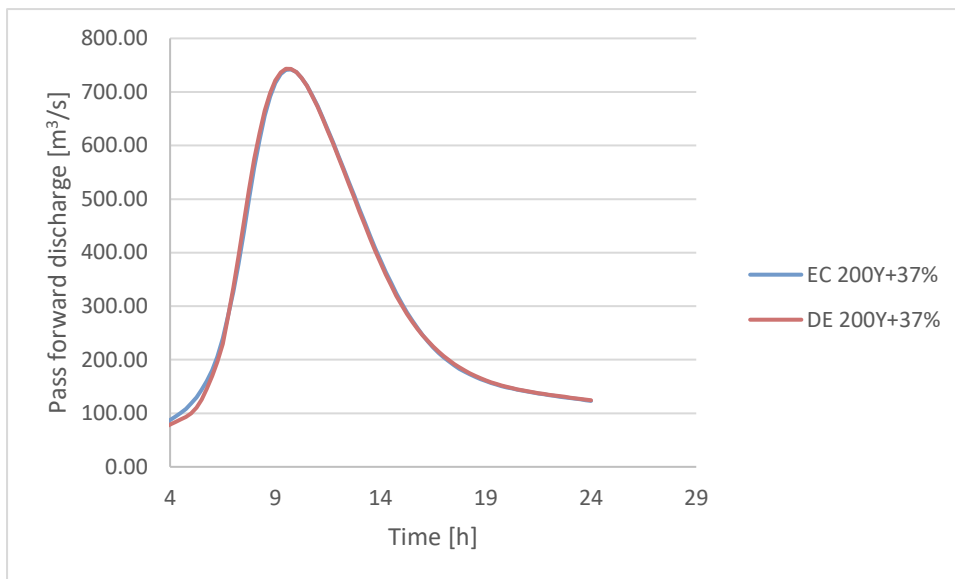


Figure 5-8. Pass-forward flow hydrographs for existing and design cases, for the 1 in 200 year plus 37% climate change event.

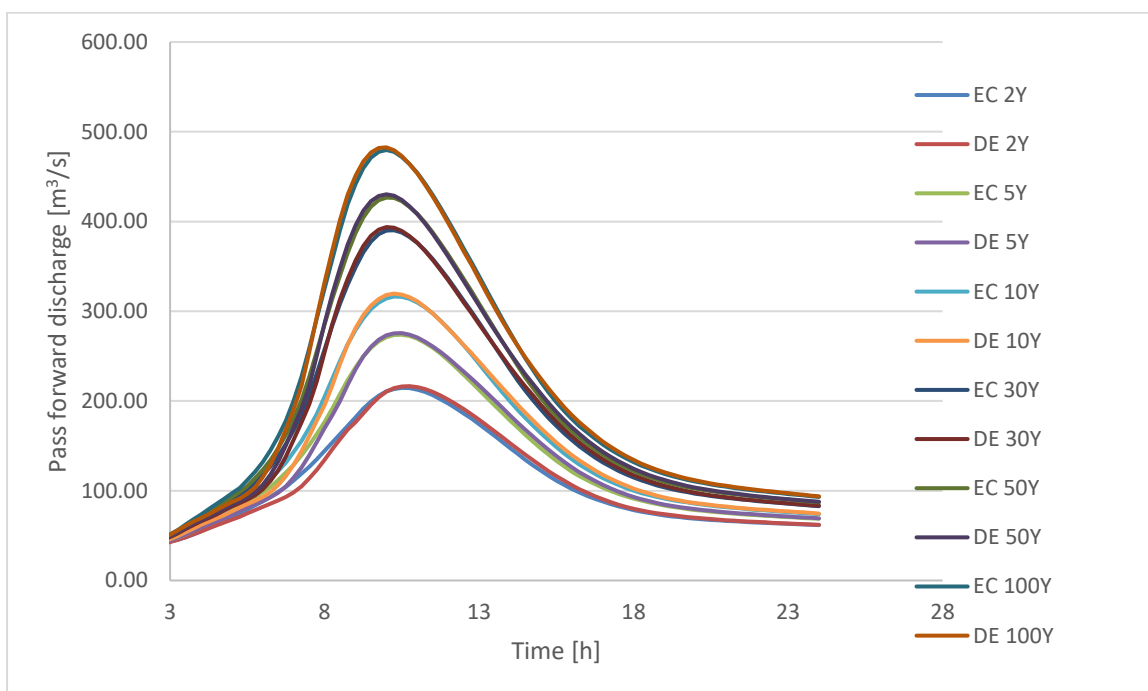


Figure 5-9. Comparison of pass-forward flow hydrographs for all events.

5.3 SURFACE WATER FLOOD RISK

5.3.1. Surface water flood risk to the scheme

While the primary source of flooding to the proposed scheme is fluvial, Figure 5-10 highlights the risk of surface water flooding to the site.

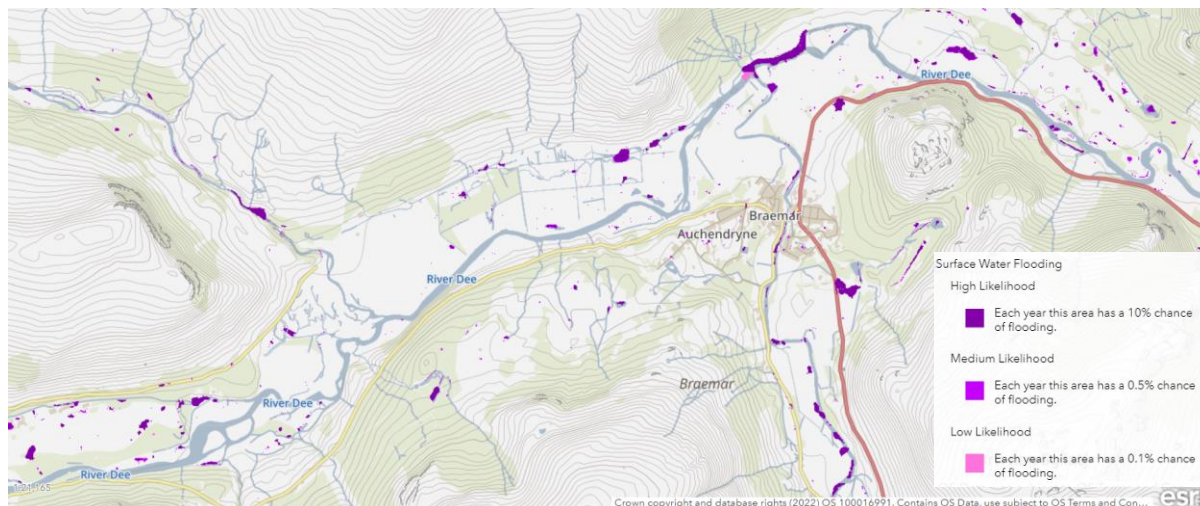


Figure 5-10 SEPA Surface water flood risk map - [SEPA Flood Maps \(arcgis.com\)](https://arcgis.com)

The areas where surface water flooding poses a risk are classified in four categories as follows:

- High - A flood event is likely to occur in the defined area on average once in every ten years (1:10). Or a 10% chance of happening in any one year.
- Medium - A flood event is likely to occur in the defined on average once in every two hundred years (1:200). Or a 0.5% chance of happening in any one year.
- Low - A flood event is likely to occur in the defined area on average once in every thousand years (1:1000). Or a 0.1% chance of happening in any one year.

5.3.2. Surface water flood risk from the scheme

As the site is currently Greenfield and will remain Greenfield after the construction of the proposed development, and all proposed works are contained within the existing channel, it is unlikely that the proposed works will have any impact on the surface water flood risk.

5.4 GROUNDWATER

5.4.1. Groundwater flood risk to the scheme

North East Local Plan District LFRMS shows the development area to be in an area of low groundwater flood risk. However, there are no known groundwater flooding issues in the area, neither historic nor predicted to change due to climate change. Due to the nature of the development, risk of groundwater flooding is negligible.

5.4.2. Groundwater flood risk from the scheme

As the proposed development will not add any hardstanding areas or impact any potential groundwater sources or flow paths therefore, there will be no increase in groundwater flood risk caused by the development.

5.5 STRUCTURES

There is one structure upstream of the site, included in the model. This is a small bridge over the Quoich Water. Model results show that the deck is approximately 600 mm above the peak 1 in 200 year plus 37% climate change water level though. This does not change in the design scenario, so the structure is not considered a risk factor.



Figure 5-11. Bridge at Quoich Water.

5.6 SEWERAGE INFRASTRUCTURE

No properties are within the scheme site, thus there is deemed to be no impact on any sewerage infrastructure.

5.7 MITIGATION OPTIONS

The hydraulic modelling indicates a general increase in flood depths in the floodplain, but no other impacts on flood extents or downstream flows have been found. The increase in floodplain depths is commensurate with the restoration measures, but there are no flood receptors affected by this. As such, no flood mitigation measures are necessary.

6. CONCLUSIONS

This report has presented an assessment of flood risk following the proposed implantation of a river restoration scheme on the River Dee, near Braemar. The primary source of flooding is the River Dee itself.

The nature of the restoration scheme being associated with the river channel means itself is affected by flooding as default. The main focus of concern around flood risk is instead that the proposed design does not adversely affect any flood receptors, nor increase the potential for flooding outwith the site.

As part of the overall project work, a hydraulic model was developed by cbec. The results of this have been used in this report to assess the potential impact the design may have on flood risk.

The results have shown there is a general increase in peak flood depths within the floodplain, but no increase in flood extents (and so no increase in number of receptors affected, or increase in risk to receptors already affected). An assessment of flow hydrographs at the downstream extent has also shown there is no predicted impact on flooding downstream of the site, barring a potential slight attenuation of the 1 in 2 year flood, following implementation of the design.

In conclusion, this report has not found any cause for concern regarding flood risk, following the proposed restoration scheme being developed.