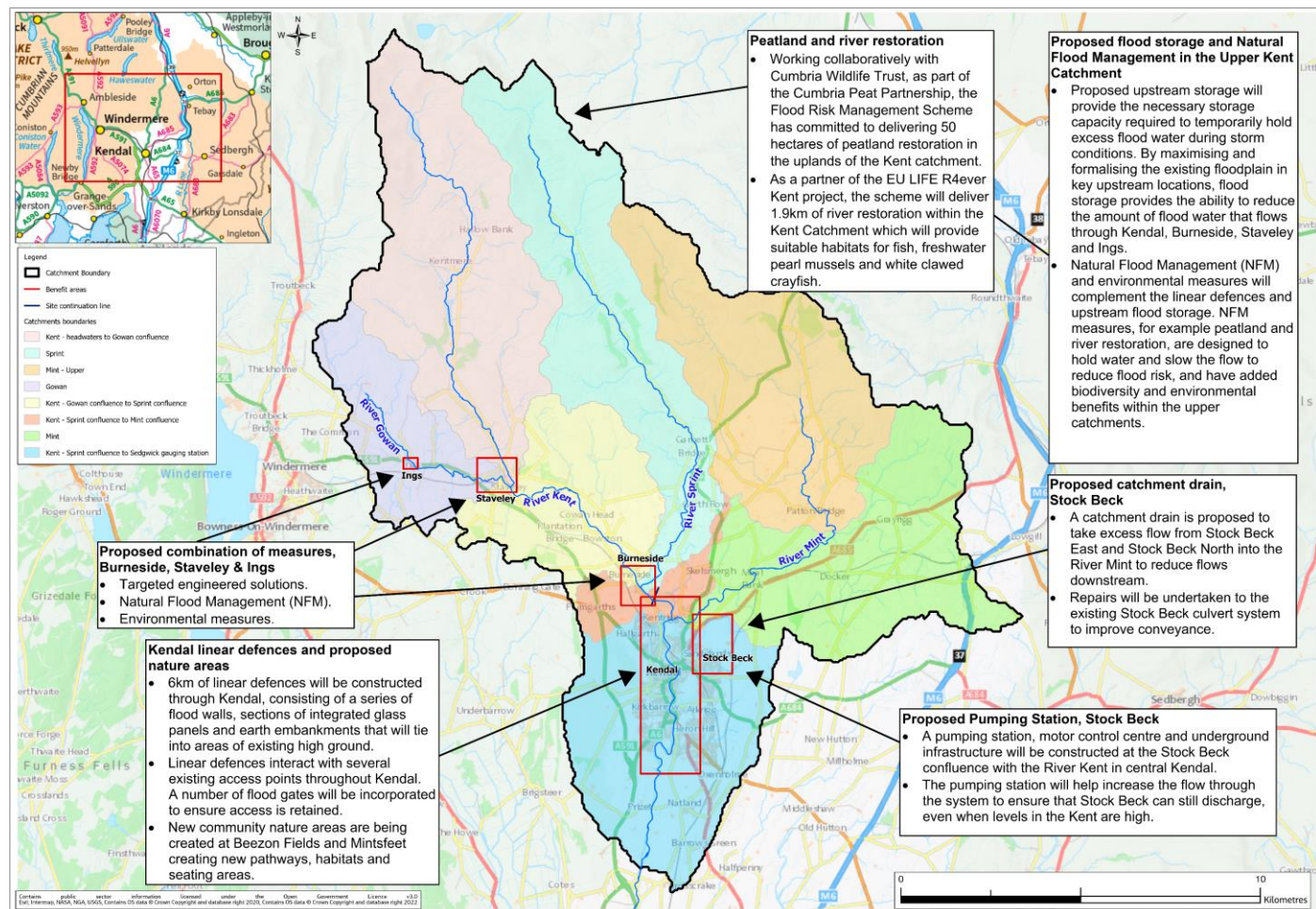


This briefing is to provide you with a summary of progress on upstream measures, a key feature of the Kendal and Upper Kent Catchment Flood Risk Management Scheme (FRMS).

Upstream measures are an essential part of the flood risk management scheme to deliver our aim to provide a 1 in 100 year standard of protection to homes and businesses at most risk in Kendal, Burnside, Staveley and Ings. This means that we aim to reduce the risk of flooding to a 1% chance in any given year.

This visual shows how upstream measures fit into the delivery of the FRMS, which will reduce flood risk to the communities downstream. This visual alongside others can be found on the [Upper Kent FloodHub](#)



We originally identified 22 potential flood storage locations, of which we have progressed Kentmere Tarn and Kentrigg as part of our early appraisal process. We have delivered extensive ground investigations and environmental surveys which have provided us with a detailed understanding of the geology and environment. These findings, together with the hydraulic modelling results (which incorporate the latest rainfall and topographic (landscape) data) have provided us with a greater understanding of the catchment. This increases our ability to deliver the right combination of measures to reduce flood risk, in the right locations.






The surveys and investigation results have identified that Kentmere Tarn remains a viable option for temporary flood storage. The complex geology at Kentrigg has shown that this is not a viable option when reviewed in more detail against The Environment Agency's key tests. These key tests check that the location and any potential design is economically viable, technically feasible, environmentally sustainable, socially acceptable and safe to deliver.

Designing a viable scheme - the Environment Agency's key tests

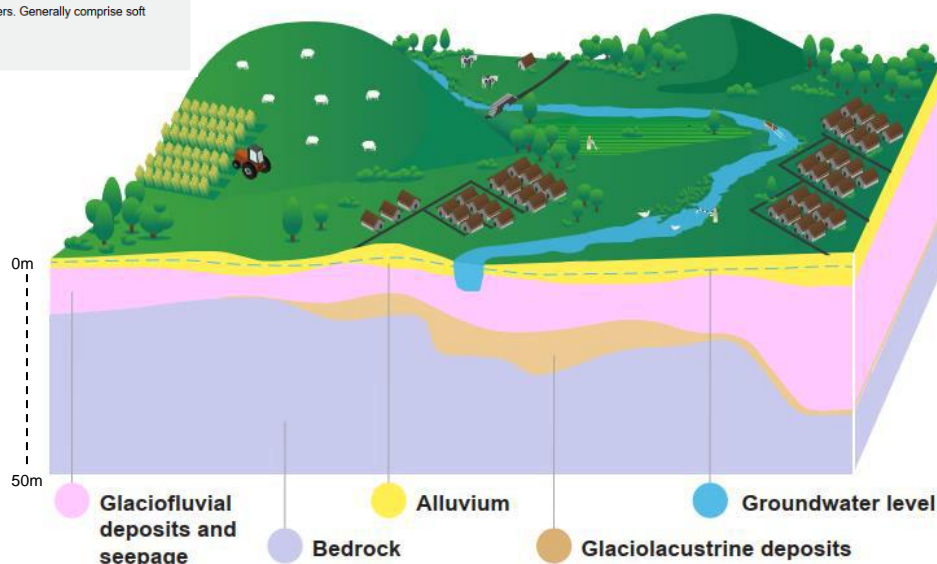
The suitability of potential flood risk measures is assessed in more detail against the Environment Agency's key tests. Throughout this process multi-criteria analysis is used to evaluate potential risks, opportunities and their likely impact. On completion of the analysis, each option is either discounted or progresses to the next stage in the design process. The key tests are outlined below;

- **Technical feasibility** – each option is assessed to ensure it is technically achievable, constructable, robust and reliable. This takes into consideration buildability, ongoing maintenance, as well as health and safety.
- **Environmental sustainability** – the potential environmental impact of each option on the natural environment is assessed, together with the appropriateness of any specific land use designations, and whether they align with the Environment Agency's strategic environmental goals.
- **Economic viability** – takes into consideration ongoing maintenance, whether the benefits would outweigh the cost, and if the cost is within the scheme's budget. Each option is also analysed to determine any other non-financial benefits they offer to the local community and environment.
- **Social acceptability** – consideration is given to landowner constraints, location within designated sites, proximity to recreational areas or public rights of way (PROW), and overall social acceptability. As the scheme progresses, we consult the community and our stakeholders on our developing proposals. We then consider and incorporate their feedback as appropriate.
- **Health and safety** – each option is reviewed to check that it can be designed, constructed and maintained safely. Identification of risks and opportunities to the wider community are also assessed and used to inform the design.

Kentrigg cross-section - geology findings

Key	
	River Kent
	Alluvium deposits formed by rivers. Generally comprises sands, gravels silts and soft clays
	Glaciofluvial deposits and seepage formed from the outwash of glaciers. Generally comprises sands, gravels, cobbles and boulders
	Glaciolacustrine deposits deposited in lakes formed during the retreat of glaciers. Generally comprise soft layers clays and silts
	Bedrock Kirkby Moor Formation – Sandstone

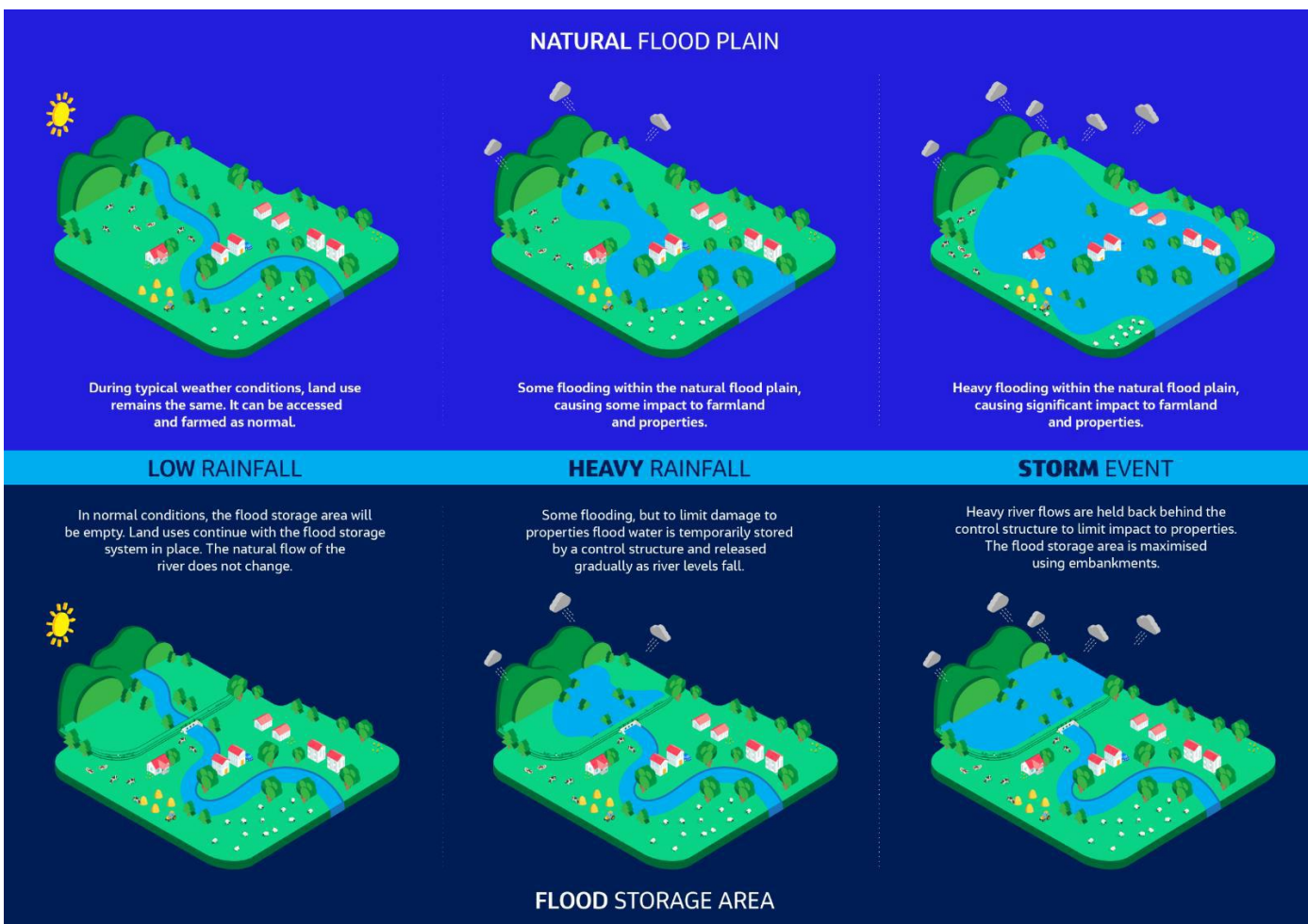
This visual illustrates the complexity of the geology within the Kentrigg study area which, due to the significant depth of bedrock (varying between 4 and 25 metres), and high permeability (meaning water can flow through quickly), brings with it additional challenges to the design and construction of flood storage. We will continue to conduct further works to identify an alternative that has better geological conditions, is less expensive, easier to design and deliver, and will have less visual impact on the surrounding landscape.



Upstream storage – how this works in storm conditions

Upstream storage, combined with linear defences is essential in reducing flood risk to downstream communities, decreasing this risk to the equivalent of a 1% chance of flooding in any given year. Proposed upstream storage areas will maximise the existing natural flood plain in storm conditions and temporarily hold excess water.

Land within storage areas can continue to be used during normal conditions and will only be utilised to hold excess flood water temporarily in extreme storm conditions. Outside of flood events the river will always have free flow, and the movement of fish and other river wildlife will be maintained. Flood storage areas generally consist of raised earth embankments, incorporating a structures to control flow downstream during extreme high river levels.



The structure of the proposed storage areas will be engineered and landscaped to blend in with the natural environment. The River Kent is ecologically very important. Working with others, we want the scheme to enhance the quality of the riverine environment and wildlife within the upper reaches, whilst reducing flood risk.

Natural Flood Management (NFM)

In combination with the proposed upstream storage and linear defences there is a desire to deliver Natural Flood Management (NFM) as a complementary measure on smaller watercourses within the catchment. This will help to slow the flow, benefitting downstream communities. NFM not only reduces flood risk, it can achieve multiple benefits for people and wildlife, helping to restore habitats, and improve water quality.

Burnside, Staveley and Ings

As part of our appraisal process, we have tested the economic viability and technical delivery of the flood risk management schemes proposed for the villages of Burnside, Staveley and Ings, against the Environment Agency’s key tests, to see which combination of measures, if any, will deliver the standard of flood protection we want to achieve.

In combination with potential flood storage areas, the mini and economic assessments for each individual village demonstrate a need to explore a variety of approaches, in addition to conventional flood defence options. This could include targeted engineered solutions, as well as Natural Flood Management (NFM) and environmental measures.



Next steps

We are currently working through the results of the surveys and investigations, with some further data required for those sites where we continue to monitor groundwater. We have extended our surveys and investigations to catchment areas of the Rivers Kent, Gowan, Sprint and Mint. We will continue to review the viability of other suitable options for flood storage against the Environment Agency’s key tests. This will ensure we design a scheme that provides the best standard of protection, together with environmental improvements, delivering the right solutions, in the right places.

The ‘Road map to delivery’ above provides an overview of the key activities and milestones which will take us to the point at which we can start construction. There will be ample opportunity for you to provide feedback as we progress with the scheme design.

Contact us and keeping up to date

Visit our online information hub at:
www.thefloodhub.co.uk/Kendal
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kendalFRMS@environment-agency.gov.uk

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