

TYNE MODELLING OVERVIEW

Why we do modelling

In order for us to understand the fluvial flood risk to a community we need to carry out hydraulic modelling. The results of which gives us a visual representation on a map of the predicted extent of flooding under different river flow conditions and the predicted depth. Historic flooding is taken into account and where possible the models are calibrated using real flood event data. This is done by using the recorded event flows and surveyed wrack mark levels.

Where flood defences have been constructed in a community we carry out 'defended' and 'undefended' model runs. Where there are structures such as screens and bridges we also carry out an assessment of blockage risk and do further model runs to predict the impact of blockages. Model runs to determine the impact of maintenance activities such as gravel removal are also carried out where required.

The flood maps shown on our website are produced using **undefended** model runs and **without blockages**.

What the model results are used for

In order for us to obtain funding to carryout maintenance on Main Rivers, justify new schemes or improve or replace existing defences we need to demonstrate the benefits. We also need to provide evidence that the work is cost beneficial. To demonstrate the benefits we use the results of the models. The benefits of carrying out an activity or intervention are based on the damage avoided by doing the work. We have several ways of calculating damages based on the level of assessment required. The basis of which is using a financial value for the damage at each property based on the modelled depth and frequency of flooding.

Types of models

There are many different types of models and software that we use to provide us with the understanding of flood risk.

The majority of the existing models that we have are either 1D or 1D-2D linked models and are for Main Rivers and have been created at the location of communities at risk of flooding. We have some integrated models, which include representation of the sewer network and surface water drainage system, fully 2D and sediment transport models.

We are working closely with our Lead Local Flood Authority partners and Northumbrian Water and where we jointly feel that integrated models are required we will seek funding for this work in the future.

Models for the River Tyne and tributaries

We do not have one model for the River Tyne but a collection of models which are either 1D or 1D-2D linked. Some of the communities have more detail than others depending on when the original model was designed and for what purpose. In total our models cover approximately 150Km of the River Tyne and its tributaries and 46 communities. A plan showing model coverage is attached.

Data required for the models

To build the models we need information on the flows required to run through the model (hydrology) and the physical shape or geometry of the river channel itself and any structures present in or across the river channel. We get the geometry by carrying out surveys of the channel, structures and flood plain. LIDAR or drone survey data can also be used.

Calculating the hydrology is a more complex process and we use guidance such as the 'Flood Estimation Handbook'. In order to determine the flow associated with a certain return period for example a 1 in 100 year event (1% chance of occurring in any one year) statistics are used as well as the recorded data from gauging stations. When a large flood occurs it alters the statistics and it may be necessary to recalculate the flows for the return periods.

What have you done so far?

Since the flooding in December 2015 we used the existing model data that we have to carry out high level economic assessments in the communities that flooded to determine if we could justify any new schemes or improvements to existing defences. For the majority of the communities it was not cost beneficial however for those that were we submitted bids for funding under our Medium Term Plan.

We also carried out an assessment of the hydrology of the December 2015 events internally which showed it was an extreme event. This triggered the need for us to review the hydrology in more detail and to assess what was required to update our understanding of flood risk in the communities affected in December 2015.

What is involved in the Recovery Modelling: Tyne Valley Update work?

To update our understanding of flood risk at the communities which flooded in December 2015 we recognised the need to review and revise the hydrology and to investigate in more detail if our existing hydraulic models are fit for purpose or if improvements or even a new model was required.

We have commissioned JBA to carry out this work for us and the reporting has been split into four volumes for delivery. A summary of what is included in each volume is attached.

Volume one:

- Reviewing the hydrology of the 2015 flood event.
- Reviewing the flows we have used in our existing models for the Rivers Tyne and South Tyne.
- A detailed analysis of the likely return period of the December 2015 event.

Volume two:

- Updating model inflows where the hydrology significantly differs from those used in the existing models.
- The updated model inflows can be incorporated into future improvements to the models.

Volume three:

- An assessment of flood volumes and how the existing models replicated the events at specified communities.
- The influence of Kielder Reservoir.

Volume four:

- Recommendations on how the models can be improved in certain locations (subject to future funding) and how we could improve flood warning and resilience.

It was not possible based on the funding available and the timescales to carry out a detailed review of every single model we have so we focused on the communities which suffered the greatest flooding in December 2015.

What will be produced as part of the Recovery Modelling: Tyne Valley Update?

JBA have produced a report which is in four volumes as described above.

It is important to re-emphasise that the Tyne model update did not involve updating or improving the modelling itself, rather an in-depth review of the existing models has been carried out and recommendations provided for future improvements.

We asked JBA to provide us recommendations for how we could potentially improve the performance of the models in specific locations that were flooded in the winter floods. The specific locations we asked them to look at were Haydon Bridge, Riding Mill, Ovingham, Warden, Corbridge and Hexham. We asked JBA to look specifically at how we can better represent flood risk from all sources (not just Main Rivers as is the case with the existing models) and we asked them to focus on resolving performance issues we have identified with the models.

What will happen next?

Following the floods we completed high level economic assessments for all communities affected by flooding to see if future schemes were economically feasible. Unfortunately it showed that in the majority of locations future works would not be economically viable due to the low level of risk and benefits (either due to communities already having a significant standard of protection or due to the relatively small number of properties affected by such an exceptional scale flood event).

Once we have the final reports from JBA we will conduct an interim review of the economic assessments to see if the updated hydrology and flow data produced by JBA affects the economic assessments. In this review we will also include new survey data that we have gathered since the floods to update the information. If, as a result, schemes show the potential to be cost beneficial we will look to add them into the FCRM programme of work, however under government partnership funding rules it is likely that significant financial contributions would be required. It is also unlikely that any government funding for any schemes would be available before 2021/22 as we have a national 6yr programme of works which is currently fully allocated.

Will the recommendations in Volume 4 of the study be progressed?

We submitted a bid for funding to carry out improvements to the models in certain locations as a result of the winter floods. Current indicative allocations suggest we will have a budget of up to £120k in the 17/18 financial year to carry out improvements to the models. If this funding is confirmed then we will look to collect additional survey data and implement the recommendations suggested by JBA in Volume 4 of this study at the following locations:

- Ovingham & Bywell
- Riding Mill
- Haydon Bridge
- Warden
- Corbridge

Following this work to improve the models in 17/18 (subject to confirmation of the funding) we would then look to review the economic assessments for flooded communities for a final time to assess whether the new data and modelling affects the potential viability of a future scheme.

How can communities get involved?

All partners and communities involved in the Tynedale Flood Initiative meetings were given the opportunity to comment on the draft scope of the Tyne model update. We are now in the process of sharing with the communities and partners the four draft reports which are the outputs of this work.

Once we have conducted the interim and final reviews of the economic assessments we will share the results with the communities. Where it looks like there could be the potential for a scheme in the future we will engage with the community about funding, options, timescales etc. This is the stage where we could look to incorporate natural flood management and any other options into the project appraisal stage.

Regardless of whether potential schemes are viable or not any of the updated information we have in terms of return periods, standards of protection, flows/volumes, survey data can be made available to communities for them to use. This information could be used to develop/update community flood plans.

We asked JBA to make recommendations for where we could improve Flood Warnings. If/when we do improve the Flood Warning Service in a community we will engage with the communities affected.

Key dates

- **Now** - Consultation on draft reports.
- **March 2017** - Circulation of final reports.

- **March 2017** - Confirmation of final allocations and whether we have been allocated the funding to take forward the model improvements.
- **End of June 2017**– Interim review of economic assessments will be complete.
- **Throughout 17/18** - If funding is available (bullet above) these model improvements will be completed through 17/18
- **Summer 2018**– Final review of economic assessments will be complete following updated modelling.

South Tyne

During summer 2016 we were made aware of the potential opportunity for additional funding towards flood risk management schemes. We were asked to submit bids for this potential funding opportunity over the summer months. In North East area we submitted bids for 19 projects, of which 6 were located in the Tyne and South Tyne catchments. These bids included communities that flooded in December 15 which showed the potential to be economically feasible. These were

- Brigwood (Haydon Bridge),
- Lipwood,
- Warden South,
- Tyne Mills (Hexham)
- Bridge End (Hexham).

The bids also included a project looking to develop and deliver natural flood management opportunities on the small sub-catchments of the River Tyne.

It was initially thought that somewhere in the region of £350m would be available nationally for these additional bids. However as part of the Autumn Statement it was announced that Government had decided to target this additional funding towards transport, rather than flood risk. In conclusion, £20m of the £350m originally available was targeted to flood risk and this was allocated to schemes in other parts of the country with no schemes in the North East being funded.

As a result the schemes listed above have been submitted for addition to the National FCRM 6yr programme. Any funding for these works will be beyond 2020/21 and significant financial contributions will be required in order for them to progress.

Natural Flood Management

As mentioned above we did make an additional bid for funding to develop and deliver natural flood risk management opportunities on the sub catchments of the River Tyne, however this bid was unsuccessful.

In November 2016 the Secretary of State announced £15m funding for Natural Flood Management (NFM). However, again the project for sub-catchments of the Tyne was unsuccessful in securing any of this funding.

Following a Ministerial request £1m of the £15m is to be made available to local groups for NFM. We are awaiting further information but we believe that the bidding process will be on an open competition basis for local groups and catchment partnerships for NFM with a maximum value of £50k.

We proactively support investigating opportunities for NFM where there is the clear benefit in doing so. Our general approach is to consider NFM techniques alongside traditional flood risk options within the appraisal stage of project development. This has been the case at Lustrum Beck and Acomb where we have considered NFM alongside other options for flood risk.

Northumbria Regional Flood & Coastal Committee (RFCC) have also provided funding for a NFM expert who sits within the Environment Agency and looks for opportunities for NFM across the 6yr FCRM programme.