Objection Letter - Mr Briggs

As a consequence of not having definitive and detailed plans with regard to proposed works at 19 Bridgefield, Mr Briggs has concerns with regard to the proposed height of the proposed new self-elevating wall on the north side of the Carron Water opposite his property. In addition, due to the fact that the enclosed plan is not definitive, the distance of the gap between the proposed new flood wall on the south side of the Carron Water and the northmost wall of 19 Bridgefield, Stonehaven is unknown: however, such a gap could give rise to potential damp ingress problems to the building.

It is noted that this proposed new flood wall to the north of Mr Briggs' existing northernmost wall would be constructed primarily of concrete with stone cladding and Mr Briggs has concerns with regard to access to and responsibility for the future repair and maintenance of both this new wall as well as his northmost wall.

In essence, the effect of your Council's proposed works will be to narrow the Carron Water which at times of high rainfall / potential flood will subsequently result in a high water level – hence an excessive proposed height for the walls both the north and south sides of the Carron Water. Further Mr Briggs considers that your Council's proposals with regard to the self-elevating walls will require to rely on mechanical elements – which could fail and may indeed exacerbate the situation.

Mr Briggs questions why rock armour modification has been omitted. Particulary as Appendix F of the M MacDonald Report indicates that a 2m widening would have a noticeable effect of lowering flood heights downstream of the White Bridge.

Mr Briggs questions why rock armour modification has been omitted, particularly as Appendix F of the Mott for M MacDonald Report indicates that a 2 metre widening would have a noticeable effect of lowering flood heights downstream of The White Bridge.

Mr Briggs questions why there has been no modelling or possible river mouth modification e.g. at other widths up to 16.2metres, the original width of the river mouth at mean tide levels including the effects of flow and velocity to upstream, water levels and including also the modelling of the HR Wallingford preferred option. It is noted that "some material" will be removed from below The Bridgefield Bridge including the old bridge buttresses: however, Mr Briggs asks how much material will indeed be removed and why has the re-profiling not been detailed in the plans or modelled to show its effect.

Whilst it does seem likely that lowering the bed level at The Bridgefield Bridge by removing part of the erosion protecting invert would result in lower design water levels upstream, the document appears not to quantify that effect: further, Mr Briggs has not seen any model analysis of the effect of the breadth of this proposed lowering. Thus, Aberdeenshire Council is requested to produce a similar figure to that available for other changes showing the effect on upstream levels for a range of lowered breadth and also for the proposed cross-section at The Bridgefield Bridge.

The Flood Alleviation Study indicates that upstream storage is possible at several points and whilst it is accepted that this would not in itself prevent flooding, it would nevertheless offer a degree of protection and thus would help attenuate the peak flow and thus "reduce the height and extent of direct defences required in the town". Mr Briggs questions why the study indicates

that more detailed investigations will be needed to assess the feasibility of this option, why these investigations have not been pursued.

Mr Briggs suggests a possible solution of a "spreading surface" which would be created by introducing a "bulge" in the rock armour – this being an area of lower-lying loose material where wave energy can dissipate – this would help attenuate upstream waves on the assumption that the rock armour remains.

There appears to be some model evidence that by allowing the Carron Water to discharge more freely into the sea results in lower upstream water levels. The results of a model run with an increase in channel breadth of 2 metres is available by Mr Briggs questions what is the effect on an even greater increase up to the point where there is no channelling and just a natural outlet. Thus Aberdeenshire Council is requested to re-examine this modelling through a range of openings.

Mr Briggs is of the view that some of the information within the documentation now presented was not available at the Public Consultation exercise earlier this year and / or the information presented at that time is now inconsistent with the formal proposals. Accordingly, these inconsistencies are, at the very least, misleading.

Mr Briggs is of the view that all modern flood alleviation schemes should examine and where possible, maximise the use of upstream storage so as to reduce design flows downstream and hence design defence levels. Whilst there is reference to upstream storage having been investigated (see bullet point above) but dismissed. Mr Bridggs is of the view the Aberdeenshire Council should provide data and model results showing the effect of the storage situations studies together with a full review of the storage options considered.

Mr Briggs is of the view that it is incumbent on Aberdeenshire Council to review all reasonable options and to report on these as there is considerable emphasis nowadays on sustainability and managing flows before they reach urban . built-up areas. Further reconstruction of walls and banks should be regarded as a last resort as if they are over-topped or otherwise fail then the consequences can be somewhat disastrous. Flood defences which require to be operated, and thus rely on a mechanical operation and / or a human action are not, in Mr Briggs view, sustainable.

Response

1. Scope of Evidence

1.1. This is the scope of evidence regarding the objection to Stonehaven Flood Protection Scheme from Mr Briggs.

1.2. This evidence will describe the works to 19 Bridgefield, the design consideration for the works, how the integrity of the existing structure has been given a priority in the design and why the works are suitable.

1.3. This evidence will explain the hydrological studies undertaken for the scheme, identifying the magnitudes of the design flows used in the scheme and describing why upstream storage is not suitable.

1.4. The design flows have been used to derive the heights of the flood walls and this evidence will describe how this has been undertaken and how modifications to the river corridor have been considered to minimise wall heights as well as the use of self-raising barriers.

1.5. This evidence will explain the impact of waves and why the configuration of the entrance is important to minimise the wave impact.

2. Works to 19 Bridgefield

2.1. 19 Bridgefield is located just upstream of Bridgefield Bridge on Carron Water. 19 Bridgefield is a Category C listed historic structure and the fabric of the building is important to its listing.

2.2. The wall is exposed to the river and the elements and will continue to deteriorate. The existing wall of 19 Bridgefield has been repaired with cement mortar and has a concrete beam just above water level, as can be seen in Figures 1 and 2.

Figure 1

Figure 2

2.3. The existing walls of 19 Bridgefield on the river are old and not structurally strong enough to withstand flood events over the 100 year lifetime of the scheme. Therefore engineering intervention is required to maintain the integrity of the existing walls.

2.4. The proposed works adjacent to 19 Bridgefield have been considered in detail, aiming to maintain the fabric of the existing building with as minimal intervention as possible. An external intervention was proposed and agreed with Historic Scotland as the most suitable option. The other option of internal intervention was considered difficult, with significant health and safety risks of basement working, and would significantly alter the fabric of the building. An external intervention also means minimal disruption to the landowner.

2.5. The works to 19 Bridgefield are described in draft with drawings by Appendix Q: Interventions to 19 Bridgefield. Following comments received from Mr Briggs, the drawing MMD-345087-C-DR-00-XX-8105 regarding works to 19 Bridgefield was adjusted before being included in the flood Risk Management (Scotland) Act 2009 application. Additional information in included in Appendix Q: Interventions to 19 Bridgefield was provided to Mr Briggs following further comments received.

2.6. The external intervention provides a structurally independent reinforced concrete retaining wall and will be finished with a natural stone render system sympathetic to the area.

2.7. To minimise damp, a cavity between the new wall and 19 Bridgefield will provide ventilation to the existing wall and allow for natural breathability to the lime pointing and stonework.

2.8. Water may get behind the wall from moisture or ground water. A drain at the foot of the cavity will be installed to drain any water away from the wall.

2.9. It is proposed that the existing cement based mortar is fully removed and replaced with a hydraulic lime mortar in order to maintain the integrity and durability of the wall. Following the installation of the impermeable flood wall in front of the existing wall, it is consider that very little further deterioration to the wall render will take place as the existing wall will be protected from the seasonal weather elements by the enclosure by the new flood wall (mortar deterioration is mainly due to removal of minerals over time from an permeable mortar due to repeated wetting and drying which occurs with a lime mortar).

2.10. The Council would be responsible for maintaining the completed flood wall, the owner would be responsible for the maintenance of their building.

2.11. To maintain light to the existing door and windows seen on the property façade it is proposed that self-cleaning glass flood windows will be integrated into the new wall. New windows would be provided for 19 Bridgefield, with the ability for these to be cleaned from the inside. The owner would be responsible for cleaning the windows on 19 Bridgefield.

3. Hydrological Studies and Design Flows

3.1. The scheme is for alleviating fluvial flooding from the Carron Water and Burn of Glaslaw in Stonehaven.

3.2. Scottish Government provides guidance on how to appraise Flood Protection Schemes and allows economically beneficial schemes to be constructed. The 1 in 200 year level of protection has been the desired target as it aligns with current guidance on development within Scottish Planning Policy and would allow for future development within areas protected to the 200 year standard form all flooding.

3.3. The scheme is influenced by Scottish Planning Policy (SPP) which sets out the risk framework for flooding and flood risk to development.

3.4. SPP states "All land is to some degree susceptible to flooding. The likelihood of a site being flooded is measured in terms of probabilities per annum, which range from very low (close to 0% probability) to very high (up to 100% probability)." SPP identifies that land with an annual probability of flooding less than 0.5% is suitable for development, i.e. a low to medium risk area. The proposed flood defences for Carron Water are designed for the 0.5% Annual Probability flood event in line with SPP. The design event is the 0.5 % flood (200 year flood) from the River Carron and the Glaslaw Burn. That is an event that could be expected to be met or exceeded 0.5 % of any year.

3.5. The design flood magnitude has a 0.5% chance of being met or exceeded in any year.

3.6. SEPA recommend an allowance for future climate change to be included in a flood protection scheme design. In line with the Government UK Climate predictions (UKCP09) for the Stonehaven area, the design flow includes a 33% increase in flows as described in Appendix B - Option Development and Economic Appraisal.

3.7. The assessment of river flows originating upstream on Carron Water was made using procedures given in the Flood Estimation Handbook (FEH). This handbook is acknowledged as the current best practice guide for hydrological studies in the UK. The assessment is described in the Hydrology and Hydraulic Modelling Report.

3.8. The FEH Statistical Method was used for Carron Water with the observed data from the local SEPA river gauging station on the Carron Water near Green Bridge. The FEH rainfall runoff method was used for the Burn of Glaslaw, due to no river gauging station being present. These methods are used as standard practice and the methodology was agreed with SEPA.

3.9. The design flooding event, combining flow from Carron Water and Burn of Glaslaw, has a flow magnitude of 78m^3/s downstream of the confluence. In comparison to the design flood event, flow magnitudes of 31m3/s and 42m3/s were determined for the 2012 and 2009 events, respectively. Flow in River Carron was estimated to be 24 m3/s and 37m3/s for 2012 and 2009 events respectively (based on flows at Carron gauge). Flow in Glaslaw Burn was estimated to in excess of 5.7 m3/s for 2012 event based on anecdotal evidence.

3.10. Flooding has occurred on the Carron Water on a number of occasions, as identified in the Stonehaven December 2012 Flood Event Review. In comparison to the design flood event, flow magnitudes of 31m^3/s and 42m^3/s were determined for the 2012 and 2009 events, respectively. Flow in River Carron was estimated to be 24 m3/s and 37m3/s for 2012 and 2009 events respectively (based on flows at Carron gauge). Flow in Glaslaw Burn was estimated to be in excess of 5.7 m3/s for 2012 event based on anecdotal evidence.

3.11. Appendix B - Option Development and Economic Appraisal compares the options of direct defences, upstream storage and a combination of storage and walls. The report identifies that a storage only option on the Carron Water would not be sufficient to alleviate flood risk in the town without some further works. Chapter 5 economic appraisal indicates that a storage option would cost in the order of £26M compared to the £16M direct defences cost. The storage option considered was not economically viable with a benefit cost ratio of less than 1 and was not considered further.

4. Hydraulic Modelling and Wall Heights

4.1. Flood water levels on the Carron Water have been assessed using a computer model. The model was built using TUFLOW hydraulic modelling software, an industry standard program. The model represents the river channel, the adjacent floodplain, and structures, such as bridges and the downstream rock armour. The model was calibrated against the 2012 flood event.

4.2. Overall, the TUFLOW model gives a reasonable representation of flood levels for the range of flood flows used in the design.

4.3. The hydraulic model allows a range of options to be assessed and compared with the design water levels determined by selecting those works most beneficial in comparison to the physical constraints on site.

4.4. The TUFLOW model has been modified to look at options to remove constraints in order to reduce wall heights. In the section between White Bridge and Bridgefield Bridge the capacity of the channel has been increased by lowering the channel, lowering under Bridgefield Bridge (by 0.2m, as shown on drawing MMD-345087-C-DR-00-XX-8104) and by proposing a new culvert (2.5m x 1.5m) under the gardens on the northern bank.

4.5. The modelled options are detailed in Appendix F: Hydrology and Hydraulic Report with Figure 2.3 showing the model with the removal of material under Bridgefield Bridge. 0.2m is the maximum that can be lowered under Bridgefield Bridge to give any long term benefit: a deeper excavation would be lower than the existing bed level downstream and would therefore be likely to fill in again in the future through natural deposition.

4.6. Widening the rock armour at the outlet was one option considered. This was presented to Mr Briggs during the objection period and included as evidence with the response to the objections Appendix H: Hydrology and Hydraulic Modelling Addendum A. The report identified that widening the rock armour had a similar effect on flood water levels, in the Arbuthnott Street section, as raising Beach Bridge. The TUFLOW model showed that whilst Beach Bridge could be retained if the channel was widened by 5m or more downstream of Beach Bridge, Aberdeenshire Council chose to raise Beach Bridge instead of widening the river.

4.7. The topographic survey shows that the crest level of the rock armour is at approximately 3.83mAOD. The peak flood level under Beach Bridge is predicted to be 4.3mAOD with a design level of 4.6mAOD (the level including freeboard). Therefore during an extreme flood event the water level is much higher than the rock armour, limiting water level increases due to flow.

4.8. Wall heights on the northern side of the river (opposite 19 Bridgefield) have been mitigated through the use of self-elevating barriers. These barriers are activated through water pressure and do not relay on mechanical methods.

4.9. On the south side of the river the existing walls are higher than the northern side as shown in Figure 3. The lowest walls are not high enough to provide the necessary flood protection and need to be replaced with higher walls. The strength of the higher part of all the walls is also unknown and is a mismatch of materials, repairs and construction. The new wall will be designed to act as a flood wall and form a consistent finish.

Figure 3

4.10. Along 75m of the 125m of the length between White Bridge and Bridgefield Bridge the existing wall is high and above head height. The new wall will be a similar height to the existing high walls or will be next to existing buildings. Of the remaining 50m, 25m is proposed to be a self-raising barrier in order to maintain the views of the Category A St James the Great Church, an important historic landmark. The remaining 25m is required to be higher than the existing wall, but will be similar in height to the other walls in the area.

4.11. The level of the top of the wall is as it was reported for the FPO application and public exhibition of the flood protection scheme in 2015. The new wall will form a consistent style for the whole 125m length.

5. Waves

5.1. Photographs show waves in the river channel at high tides when there are waves at sea Appendix G: River Carron Rock Armour Study

5.2. The current rock armour alignment protects against direct waves propagating in the channel by reducing the wave energy. The effect of an open channel can be observed to the north of Carron Water at the mouth of the River Cowie, where larger waves can be observed in the mouth of the channel because there is no rock armour.

5.3. Straightening the channel would expose properties to greater wave heights as the wave energy would not be dissipated by the rock armour. To allow for this the wall heights would need to be higher if the rock armour was removed.