

Executive Summary for Long Plantation Watercourse

A phase 1 (scoping report) on the flooding issues was undertaken in 2003 for The Dams area of Filey. At that stage it was determined that a more detailed options appraisal report was justified. This, current report represents a detailed mathematical modelling exercise that has been undertaken to determine the causes, extents and frequency of flooding. Mitigation options have also been assessed and costed.

General Conclusions

Flooding to the properties in the Wharfedale housing estate is frequent justifies the designation of Long Plantation Watercourse as a Critical Ordinary Watercourse. The most recent flood occurred in 10th August 2002 when flooding was experienced to 47 properties in Wharfedale estate. The flooding was from a combination of Long Plantation Watercourse and sewer incapacity. This event has been estimated to have a return period of 15-20 years.

Hydrological assessments have determined that the flow along Long Plantation Watercourse is 1.1 m³/s for the 100 year return period event and 1.3 m³/s for the 200 year event. The existing bank-full capacity of the channel is estimated to be approximately 0.5m³/s, or a 10 year return period event. This excludes any allowance for debris or culvert blockages that would reduce this capacity significantly.

Hydraulic modelling predicts that flooding is first experienced by 3 properties for a 1 in 10 year return period. The 3 properties at the end of Fewston Close flood as a result channel incapacity along the stretch and low bank levels. This rises to 6 properties for the 25 year event and 22 properties for 100 year event. Flood depths of up to 300mm are predicted for some properties for the 1 in 100 year event.

Specific Causes of Flooding

The hydraulic analyses have revealed that there are a number of contributing factors to flooding in the area caused by various mechanisms. The table below summarises the causes, extents and locations of the flooding and these are described in more detail in subsequent paragraphs.

Summary of the locations, causes and mechanisms of flooding in the study area

Location	No. of Properties affected (100 yr event)	Causes	Return Period for Start of flooding
Fewston Close Wharnciffe Place Barden Place Rivelin Way	22	Limited capacity of channel Run-off from school fields.	10 years
Allotment Gardens Culvert		Surcharged culvert with potential to cause flooding when blocked	
Pasture Crescent Culvert		Surcharged culvert with potential to cause flooding when blocked	
New Development Culvert		Surcharged culvert with potential to cause flooding when blocked	

The incapacity of the channel upstream of the Dams area is a direct cause of flooding. The uneven gradient of the channel and dense vegetation are the main problems. The gradient causes the flow to back up and flooding the Wharfedale housing estate.

The three culverts are surcharged for events greater than 1 in 10 year, but the channel has the capacity to contain the flow. However, if the culvert inlet is blocked by debris this will lead to flooding of the surrounding area.

Mitigation Measures Proposed

A number of mitigation measures were assessed, tested and costed as summarised in the table below. (Options 1 and 2 represent do nothing and do minimum respectively but have been rejected.) A range of return periods were also assessed and the 100 year Standard of Protection was considered to be the most cost-beneficial for the preferred scheme.

Summary of mitigation measures and cost benefit assessments

Option	3 (Flood Embankment)	4 (Storage)	5 (Channel widening & re-profiling)
General Maintenance	1. Installation of new trash screen to all culverts 2. Regular maintenance to remove any debris from channel which may cause blockages 3. Maintenance of channel to control the growth of vegetation		
Protecting Properties in Wharfedale Housing Estate	Construct embankments along the right bank from Wharnclyffe Place to Rivelin Way (approx 200m) to alleviate flooding of the housing estate.	Construct bunds along the left hand bank to attenuate the run-off across the school fields. The school fields will act as storage.	Undertake channel widening along Long Plantation Watercourse from Wharnclyffe Place to Rivelin Way (approx 200m) to obtain a wider 2-stage channel. Also re-profiling of the channel bed.
Cost Benefit Ratio (100 yr SoP)	2.4	1.44	3.2
DEFRA Priority Scores (100 yr SoP)	12.5	7.9	15.4

Ecological considerations

The presence of Great Crested Newts in the Dams Lakes is likely to have a considerable impact on the type, extent and timing of work in this channel and a licence would probably be required. As the preferred option proposes works at least 100m from the lakes, it may be that extensive works would be permitted, following an ecological survey to ascertain the exact extent of habitat required by the Great Crested Newts.

Selection of Proposed Scheme

There is little to separate the schemes for options 3 and 5 in terms of costs. Therefore cost benefit ratios and a consideration of the risks associated with the schemes have been considered in order to make a decision on the preferred option.

In conclusion, option 5 is the preferred scheme based on the higher cost benefit ratio and the greater ecological benefit, once the scheme is complete. This scheme designs flooding out of the system by widening and re-profiling the existing channel. The new channel is proposed as a two-stage system accommodating normal and storm flows without detriment. Before the channel is widened, re-profiling is required as the channel gradient is uneven, causing some 'pinch' points that result in the flows backing up and flooding.

Recommendations

In terms of the selection of freeboard and factors of safety regarding channel design, a Manning's n of 0.08 (to simulate a highly vegetated channel) indicated increased water levels of 200-300mm for the 100 year design event. It is recommended that this robustness should be accommodated for in the design as a minimum freeboard for the proposed works.

It is also recommended that a series of trash screens be constructed along the watercourse and at all culvert entrances (downstream of the Dams area) and that a strict maintenance regime is adopted to ensure that the channel bed and sides remain essentially free from dense vegetation.

It should be noted that the model has not been calibrated although it has been verified. As the watercourse is considered to be small with heavy vegetation, a higher Manning's n than would normally be utilised should be assigned in design and that robust and adequate factors of safety considered.

The major risks associated with the proposed solution are the ecological constraints associated with close proximity of the Dams area and presence of great crested newts. Consultations with all relevant bodies will also be a requirement combined with a habitat survey. There is, therefore, a risk that the preferred option could be subject to change.