

Surface water flooding: Potential Interventions (Continued)

Birchcliffe Road

Flooding Mechanism: Flow channelled down Wadsworth Road and Sandy Gate Lane onto Birchcliffe Road area.

Option 1: Improve drainage along Birchcliffe Road to accommodate flows from the specified event by adding in SuDS

Key Considerations:

- This may increase the flooding issues in different locations.
- Intrusive measure which may have associated costs
- Assessment must be carried out on existing drainage arrangement to assess the suitability of employing a new system
- Addition of new drainage systems will result in additional requirements for maintenance

Option 2: Improve drainage behind properties on Birchcliffe Road which runs parallel to Keighley Road. There appears to be a build-up in this location due to the restriction caused by the terrace of houses. SuDS can be installed in the form of gullies to carry the specified flow towards St. Johns Close and continue its path through Birchcliffe Road / Keighley Road towards Hebden Water

Key Considerations:

- This has the potential to increase the flooding elsewhere in the system
- Addition of new drainage systems will result in additional requirements for maintenance
- This measure may only partially addressing the flooding in the area

Option 3: Divert flows before they reach the area by diverting flow on Sandy Gate Lane into Nutclough Reservoir. Divert flows on Wadsworth Road towards Machpelah Screen.

Key Considerations:

- Diverting flows to Nutclough may require structural works to the reservoir to increase the capacity.
- Diverting flows to Machpelah Screen may increase scour of channel and deposit significant amounts of debris at screen.

Spring Grove and Foster Lane

Flooding Mechanism: Discharge from Keighley Road

Option 1: Improve drainage along Spring Grove and Foster Lane by adding an increased capacity highway drain to aid in conveying flow to Hebden Water

Key Considerations:

- Intrusive option with costs depending on what existing drainage is in the area
- Additional drainage will require maintenance

Option 2: A cross slope catchwater could be constructed above Hurst Road to funnel flows to Nutclough Reservoir. This would contribute to reducing flows reaching Hurst Road

Key Considerations:

- Land is largely agricultural. Would require landowner cooperation.

Option 3: Re-profiling the Keighley Rd junctions to keep flows on Keighley Rd and then dealt with using other described measures downstream

Key Considerations:

- This solution conveys the flow to a flooded area downstream

Peckett Well

Flooding Mechanism: Overland flow from east/north east

Option 1: A considerable area of upland contributes to flooding in this area. Natural flood management may be suitable to increase storage and delay peak flows. Flows may be captured close to source by runoff attenuation features or wetland creation in the headlands or slowed in formed channels using leaky dams.

Key Considerations:

- NFM measures should be subject to hydrological analysis to prevent the increase of river flooding.
- May be difficult to quantify impact. Other benefits should be considered.
- Measures may be vulnerable and less effective in larger events.

Option 2: Divert flow travelling down Peckett Well / Keighley Road via cross drains to Slack House Lane

Key Considerations:

- This option will involve drainage ditches to be added in and will have associated maintenance costs
- This option has potential to increase a flooding risk in another area.
- The relative ground levels of the diversion route may preclude this option.

Option 3: Reprofiting Keighley Road using speed bumps will help to enhance the existing flow paths by diverting flow off Keighley Road into Peckett Well Clough.

Key Considerations:

- Speed bumps will have additional highways maintenance requirements
- Diversion may increase risk to other areas

Dodd Naze

Flooding Mechanism: Discharge from Rowland Lane

Option 1: Rowland Lane experiences high volume and velocity discharge during storm events, which has historically caused damage to the road. Drainage upgrades will be required along the road. Flow could be diverted around the estate by use of a physical flood wall along the eastern entrance of the estate. This will allow flow to continue around the estate and re-join the natural channel formed to the south of Wadsworth Lane. This will continue to Machpelah Screen and to the River Calder. As it is assumed this water volume naturally drains in this direction it is unlikely it will create any volume issues at Machpelah Screen.

Key Considerations:

- The drainage barrier will require additional modelling to determine height
- By diverting the flow hence removing the obstruction caused by Dodd Naze estate the peak flows through Machpelah Screen may be increased
- There will be a high capital cost associated with these works
- Flows to Machpelah screen are known to carry significant volumes of debris during flood, causing it to become blocked and spill onto Burnley Road. Additional works on the watercourse may be required to minimise scour, or to reduce the impact of debris at the screen.
- This option may require installation of a culvert

Option 2: To avoid disruption to the natural topography, the flow could continue to enter the Dodd Naze estate and improvements to the drainage in the area could suffice to allow the flow to convey through the area and continue through the naturally formed route south of the estate

Key Considerations:

- The upgraded drainage will require additional maintenance and the system will be sensitive to malfunctions during operation
- Improving the drainage will reduce the obstruction caused by Dodd Naze estate and the peak flows through Machpelah Screen may be increased
- There still may be localised flooding where the capacity of the upgraded drainage is exceeded

Option 3: There is potential to reprofile the park located to the east of the estate to provide storage for the flood water entering the estate. Reprofiting will aid in the diversion of the flow around the area. This will collect the water entering from Rowland Lane, by adding a low-level outlet / spillway the water can be directed to flow towards the naturally formed channel.

Key Considerations:

- There will be a large volume of excavation associate with this option and associated high costs.
- Diverting additional flows to Machpelah Screen may require further works to the capacity of the screen and culvert.

Option 4: A considerable area of upland contributes to flooding in this area. Natural flood management may be suitable to increase storage and delay peak flows. Flows may be captured close to source by runoff attenuation features or wetland creation in the headlands or slowed in formed channels using leaky dams.

Key Considerations:

- NFM measures should be subject to hydrological analysis to prevent the increase of river flooding.
- Measures may be vulnerable and less effective in large events.

Chiserley (East)

Flooding Mechanism: Convergence of flows

Option 1: Drainage along Popples Lane could be improved and then diverted to Nutclough before it reaches the area

Key Considerations:

- Diversion may increase risk to properties close to Ibbot Royd Clough.

Option 2: As this area is high up on the catchment, the flooding may be addressed by implementing several NFM measures on the upstream waterways of the catchment. The channels have identified as part of the surface water modelling. Flows may be captured close to source by runoff attenuation features, wetland creation in the headlands or slowed by planting cross slope tree shelter belts in formed channels using leaky dams .

Key Considerations:

- NFM measures may be vulnerable in times of increased peak discharges
- NFM measures should be subject to hydrological analysis to prevent the increase of river flooding.

Heptonsall

Flooding Mechanism: Runoff from hillside becomes trapped behind houses

Option 1: A considerable area of upland contributes to flooding in this area. Natural flood management may be suitable to increase storage and delay peak flows. Flows may be captured close to source by runoff attenuation features, wetland creation in the headlands or slowed by planting cross slope tree shelter belts in formed channels using leaky dams .

Key Considerations:

- NFM measures should be subject to hydrological analysis to prevent the increase of river flooding.
- Measures may be vulnerable and less effective in large events.

Old Town and Wainsgate

Flooding Mechanism: Flow from Wainsgate down Old Town Mill Lane. Overland flow from uplands over Parrock Lane and down track. Flow down Slack House Lane onto Wainsgate Lane.

Option 1: Divert flow at the east of the area along Wainsgate Lane and add drainage collection mechanism along the road and Old Town Mill Lane to convey flood away from the area and continue down the hill side to Hebden Bridge

Key Considerations:

- Additional drainage will have additional responsibility for maintenance on the council

Option 2: Speed bumps along Slack House Lane/ Wainsgate Lane will enhance the natural course of flow by diverting flows off the road. Similar additional works will be required on Keighley Road to pick up diverted flow

Key Considerations:

- Speed bumps will have additional highways maintenance requirements
- Diversion may increase risk to other areas

Chiserley (West)

Flooding Mechanism: Convergence of flows

Option 1: Flow entering the estate from Old Laithe can be diverted around the eastern boundary improving drainage along Old Laithe Lane. This can be achieved by additional drainage ditches of hard structures diverting flow toward the natural channel discharging to Nutclough Reservoir. This will not be changing the natural course of the water, but will remove the obstruction caused by the estate. Drainage along Popples Lane could be improved and then diverted to Nutclough before it reaches the area

Key Considerations:

- By removing the obstruction, it may contribute to a higher peak discharge through Nutclough Reservoir creating additional pressure on the embankments spilling arrangements
- The solution may require the acquisition of land or material to build hard defences
- The upgraded drainage on Popples Lane will require additional maintenance and the system will be sensitive to malfunctions in the operation
- Diversion may increase risk to properties close to Ibbot Royd Clough.

Option 2: The localised ponding in the area may be addressed by improvements to the drainage in the area.

Key Considerations:

- As this option removes the obstruction, it may contribute to a higher peak discharge through Nutclough reservoir creating additional pressure on the embankments spilling arrangements
- The upgraded drainage will require additional maintenance and the system will be sensitive to malfunctions in the operation

Option 3: As this area is high up on the catchment, the flooding may be addressed by implementing several NFM measures on the upstream waterways of the catchment. The channels have identified as part of the surface water modelling. Flows may be captured close to source by runoff attenuation features, wetland creation in the headlands or slowed by planting cross slope tree shelter belts in formed channels using leaky dams .

Key Considerations:

- NFM measures may be vulnerable in times of increased peak discharges
- NFM measures should be subject to hydrological analysis to prevent the increase of river flooding.

Midgehole Road and Lee Mill Road

Flooding Mechanism: Ponding behind properties

Option 1: Improve drainage along Midgehole Road and Lee Mill Road to transfer the specified flow through and then discharge into Hebden Water

Key Considerations:

- Increasing drainage capacity along the road may have added maintenance requirements

Hurst Road

Flooding Mechanism: Overland and flow from hillside

Option 1: As this area is high up on the catchment, the flooding may be addressed by implementing several NFM measures on the upstream waterways of the catchment. The channels have identified as part of the surface water modelling

Key Considerations:

- NFM measures should be subject to hydrological analysis to prevent the increase of river flooding.
- NFM measures may be vulnerable in times of increased peak discharges

Option 2: The properties(s) may be protected by diverting the flows around the affected area allowing the water to return to its natural course.

Key Considerations:

- The will be difficulty in diverting the flow through an area where it will not cause additional harm