

## Options for Mitigation of Groundwater flooding

### 1. Controlling Groundwater Levels in the Subsurface

Engineering solutions to mitigate groundwater flooding are limited because of the large volumes of water and spatial areas involved, and because it is not contained or channelled.

#### Pumping:

Wide scale dewatering of chalk (or other) aquifers by pumping are not a viable option. Lowering the risk of flooding over large areas will not be effective due to the constraints of well installation/design and operation coupled with the sheer volume of water involved. In addition there would be significant logistical problems associated with dealing with the discharges (where you pump the water to).

The opportunity to reduce flooding by pumping groundwater will be very site specific. The cone of depression (the area in which groundwater is lowered), generally ranges from a few hundred meters to a few kilometres depending on the nature of the local aquifer (storage/permeability) and the ability to pump harder without compromising the borehole (moving the packing material/mobilising turbidity etc.).

Pumping is generally only possible with a specifically designed well field to enable cones of depression to overlap. Clearly it would not be possible to drill a large number of bespoke boreholes for this purpose and the existing borehole sites may only occasionally be situated at sites which may benefit from dewatering.

Pumping would be impractical on any large scale but it may be worthwhile for LLFAs to work with Water Companies and other key infrastructure providers to:

- a) Identify if there are any candidate sites in existence where boreholes and pumping systems are already in place (e.g. a public water supply site upstream of a village with groundwater flooding). If such sites exist then consideration can be given to setting up potential pilot studies.
- b) Consider based upon the impact and threat to existing infrastructure (electricity, gas, water etc.) whether a site-specific groundwater control/dewatering scheme could be viable in future as a contingency measure to increase resilience.

## **2. Controlling Groundwater levels at the Surface**

Where groundwater emerges as a spring it will rapidly inundate low lying areas and begin to flow following the local topography/ground levels. Impacts not immediately above the point of emergence can thus be protected in the same way as handling surface water flooding. Options exist therefore for:

- Channelling and diverting the flow of water at the surface away from sensitive downstream receptors.
- Dealing with “pinch points” where water is forced through a narrow corridor such as an existing culvert – causing water to backup and flood the vicinity.

By capturing data on the extent and behaviour of groundwater flooding within their areas during the current incident, Lead Local Flood Authorities can identify alternatives for potential overflow/diversion channels and dealing with “pinch points”.

## **3. Controlling Recharge to Aquifers**

Some of the options for management of upland areas that would have an effect on mitigating surface water flooding may (to a lesser degree) have an impact on controlling the recharge of water into aquifers and hence the potential for groundwater flooding.

Wetlands may prevent flooding by functioning as natural sponges that trap and slowly release groundwater. Woodlands may act to decrease the rate of recharge during the spring and summer due to evapo-transpiration and may increase soil moisture deficits having the effect of shortening the period over which recharge is most effective.

## **4. Dealing with the Consequences of Groundwater Flooding**

### **Strategic Actions:**

Following 2012/13 groundwater flooding event in West Dorset, Dorset County Council commissioned their own investigation of the causes of flooding in the villages of Martinstown, Winterbourne Steepleton and Winterbourne Abbas. The purpose of the study was to improve understanding of the flood risks in the area and to identify possible measures for flood alleviation. The following recommendations were made to improve management of flood risk across all three villages:

- A Community Flood Action Group to be formed to create a representative voice for flood concerns for the community and to share responsibility for management and maintenance of the South Winterbourne.
- Household level flood protection to be implemented to protect individual properties against groundwater, surface water and fluvial flooding.

- The potential for encouraging improved land management techniques in the catchment to reduce flood risk in the catchment to be explored, working in collaboration with Wessex Water and other potential partners such as the West Countries River Trust and the Farming and Wildlife Action Group South West.
- Additionally, specific recommendations were made to improve management of flood risk for each village.

We would recommend that a similar approach is adopted by LLFAs as part of the recovery phase from this incident.

### **Site Specific (Property Owner) Actions:**

Property owners and specifically householders can be encouraged to help themselves. Joint badged LGA / EA Advice is already available via our website (See <http://www.environment-agency.gov.uk/static/documents/Leisure/flho0911bugi-e-e.pdf>).

The advice includes the following:

- Floors, lower parts of walls and openings such as airbricks are the most vulnerable parts of properties and can be sealed to prevent or limit water entry.
- Sump and Pump Systems can be operated at basement and ground floor levels in buildings, but can only have a localised effect and may not be effective with large volumes of groundwater.
- Foul drainage (waste from sinks, baths and toilets) - Foul sewage systems often back up and causes problems during ground water flooding.

Contingency measures include:

- Main drainage systems - range of non-return valves are available which may be able to help a continuing problem with sewage flooding.
- Septic tanks and cess pits - trap solids and then discharge semi-treated fluid to soak away or land drains. Adding a pump to the outlet side of the tank may help and pump the sewage to high ground above the groundwater table.
- Cess pits are sealed tanks which store five or six week's worth of waste and are better protected with a concrete surround.

Other specific measures for property owners include the following, but their effectiveness will depend on the pressure exerted by the groundwater level:

- Basements - 'Tanking' materials can be applied on the outside walls to seal the walls, but this can increase water pressure which may cause structural damage
- Floors - A replacement floor constructed to a high standard with reinforced concrete and with a continuous damp proof membrane can be effective where groundwater pressures are low.
- Suspended floors - constructed with concrete (often by raising floor levels) can create a void beneath the floor which will flood before water rises to enter the house.