

What is Groundwater?

Groundwater is a general term that refers to any water found beneath the surface that fills pores or cracks in the underlying soil and rocks.

When rain falls on the surface, some of the water may run off directly over the surface into rivers, streams and drains, some may evaporate and some may be taken up by plants. However, a significant proportion of the rain that falls across the South East of England is absorbed by the soil, and subsequently seeps into deeper layers of soil and rock below the surface.

At a certain depth below the ground, the soils and rock will become saturated with the water that has seeped through from above. The boundary between this deeper, permanently saturated ground and the shallower, drier ground above is known as the water table. An illustration of the water table is shown in Figure 1.

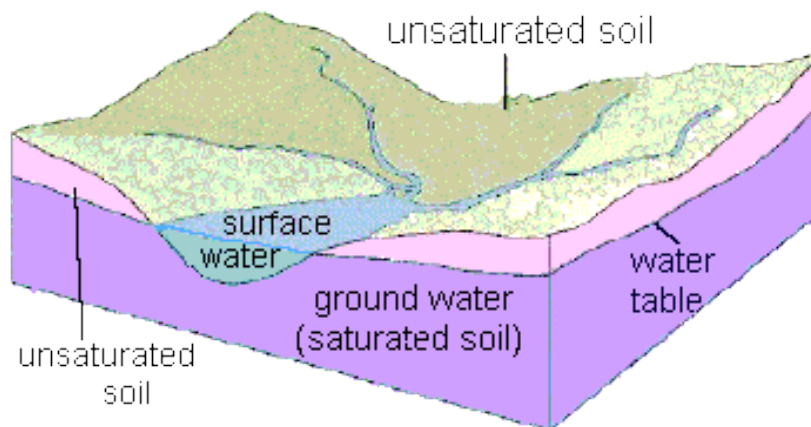


Figure 1 Groundwater (<http://water.usgs.gov/edu/earthgw.html>)

The depth of the water table is not fixed; it may rise or fall depending the time of year and how much rain has fallen. In areas where the water table reaches the surface, groundwater may emerge as springs and flow along the surface to streams and rivers.

The saturated ground beneath the water table can contain vast quantities of groundwater in features known as aquifers. Aquifers exist where the saturated rock is permeable and allows the groundwater to flow through it relatively easily. Aquifers are large underground reservoirs which can be extensive, regional features comprised of saturated rock, such as chalk or sandstone, or smaller features comprised of saturated sand or river gravels in valley bottoms (underlain by less permeable rocks).

In the South East of England, around 70% of our drinking water is extracted directly from aquifers. They are therefore a very important resource, protected and monitored by the Environment Agency.

What is groundwater flooding?

Groundwater flooding has the potential to occur in Kent after prolonged periods of unusually high rainfall (such as that experienced over the winter of 2013/14). During such periods, more water than usual infiltrates through the ground, raising the water table above its normal depth below the surface.

At low-points on the surface (where the water table is typically at a shallower depth anyway), the water table can reach the surface. This can cause groundwater to emerge, and can potentially lead to groundwater flooding. Some of the mechanisms of groundwater flooding are illustrated in Figure 2.

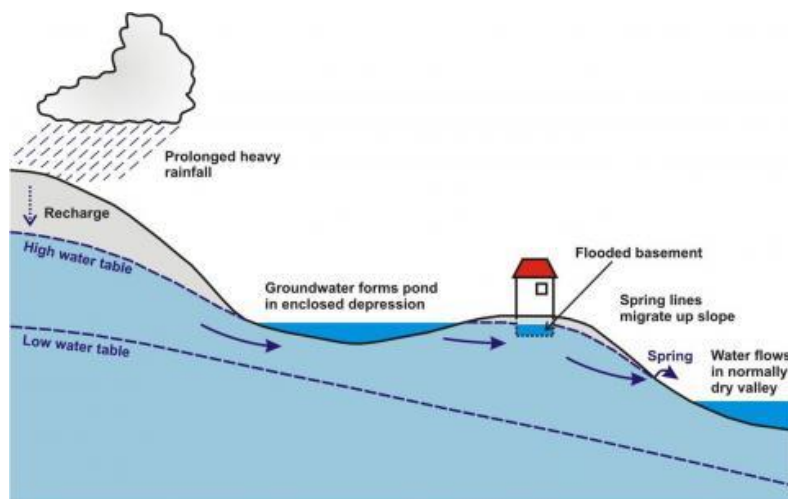


Figure 2 Groundwater flooding (<http://www.jbaconsulting.com/node/679>)

The areas which tend to be most prone to groundwater flooding are typically situated in low areas on or near aquifers (the size and higher permeability of which means that the volumes of water that emerge can be very large).

It should be noted that groundwater flooding can occur wherever the underlying soil and geology can become saturated with water. What the ground is made of will influence how quickly groundwater starts to emerge.

Once the groundwater reaches the surface, it can often be very difficult to differentiate between groundwater flooding and flooding from other sources. For example, additional rainfall that falls on already saturated soil will not be absorbed and will flow across the surface, just like the groundwater that has emerged through springs. An increase in the amount of groundwater emergence will also lead to an increase the volume of water flowing in rivers; this additional water in the river might lead to an increased risk of the river flooding.

The conditions that lead to a higher groundwater level may also mean that sewers are unable to function efficiently. For example, if the water table rises above the level at which a sewer has been laid, water may seep into the sewer through joints and manholes, reducing its capacity to carry its normal load. This can lead to an increased risk of sewer flooding.

Groundwater flooding generally takes longer to subside owing to the large volume of water that has to flow away to lower the water table.

What can be done to prevent groundwater flooding?

Unfortunately the options available to the authorities and land-owners to manage groundwater and any associated flooding are limited.

Whilst the risk of river, tidal and surface water can be reduced by building structures (embankments, walls, dams, etc.) to keep water away from areas where it will have an unwanted impact, it is presently impossible to construct effective defences to prevent the broad-scale emergence of groundwater.

In some instances groundwater flooding can be reduced by installing pumps to extract groundwater to lower the water table; however, such measures only have a very localised effect, and there is still the problem of having somewhere to discharge the water once it is extracted from the ground (because local watercourses and drains are likely to be already full). Figure 3 below depicts this process.

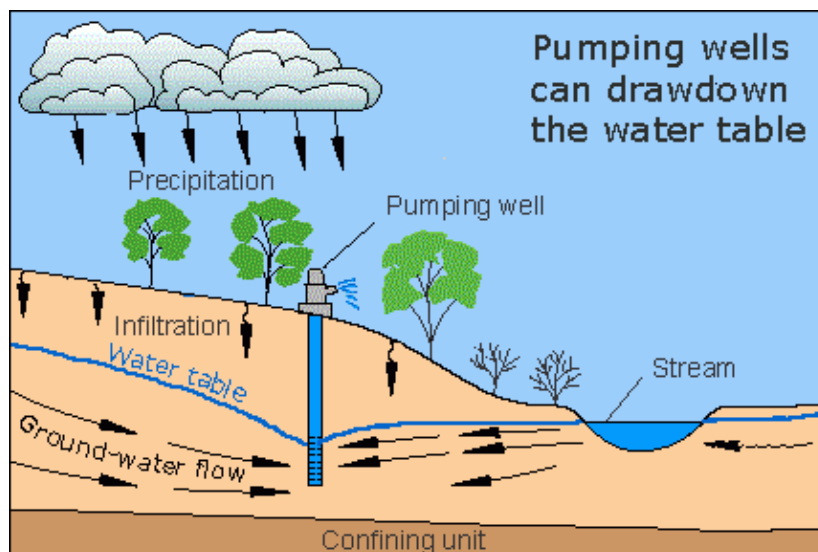


Figure 3 Groundwater pumping (<http://water.usgs.gov/edu/earthgwaquifer.html>)

Unfortunately this approach cannot be taken to manage the risk from groundwater flooding across an entire region owing to the sheer volume of water that would require pumping. To illustrate this, Figure 4 shows a comparison of the total amount of groundwater worldwide compared to the amount of water found in rivers and lakes.

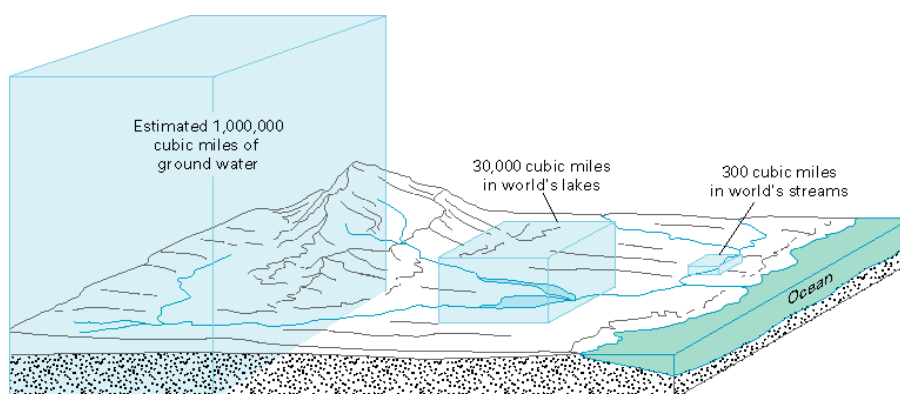


Figure 4 Worldwide comparison of the distribution of liquid freshwater. (<http://pubs.usgs.gov/gip/gw/compar.html>)

What can I do to protect my property from groundwater flooding?

The options available to home owners to reduce the risk/impact of groundwater flooding are also relatively limited.

If you have a basement which is frequently flooded and you would like to use it for storage or as a living area, it may be possible to 'tank' it. This involves sealing the basement with a water-proof membrane to prevent water seeping through the walls and floor. It should be noted that preventing the ingress of water can cause more damage than it prevents owing to the force the water can exert on the basement walls. If this option is being considered, a structural engineer should first assess the potential implications.

It may also be possible to install a sump with a pump to extract the water from the lowest point as it accumulates, but again there can be issues with structural damage and water disposal.

Once the water reaches the surface, the options available for the protection of your property will be the same as those available for the management of surface water.

In the case of groundwater flooding, sandbags may not prove to be an appropriate form of defence. For example, sandbags cannot be used to prevent the direct inundation from groundwater, and if internal groundwater flooding is already being experienced, they may prevent water from leaving your property. If groundwater or surface water is present and flowing over land towards the property, using sandbags to keep water out of a large area can cause the water to infiltrate into the ground and re-emerge on the inside the area being protected. They are generally only useful for protecting individual properties across their threshold where there is no water already present within.

Please contact your local authority to discuss whether sandbags are a suitable option for your property before they are deployed.

Who should I contact?

Kent County Council is the lead local flood authority for Kent (LLFA), with a role to oversee local flooding, defined as flooding from groundwater, surface water and ordinary Watercourses.

Kent County Council will monitor groundwater flood events to build an improved picture of areas prone to groundwater flooding and will promote appropriate resistance and resilience measures in these areas. To report or discuss a groundwater flooding event, please contact flood@kent.gov.uk, or call 03000 414141.

The Environment Agency has an overview of all sources of flooding and supply information in the form of monitored groundwater levels (<http://goo.gl/hzRjA3>) and an explanatory briefing note (<http://goo.gl/ZbO9HP>). In some areas that have historically experienced groundwater flooding, the Environment Agency provides a groundwater alert or warning service.

Where can I find out more?

If you would like more detailed information on groundwater flooding in your area, you can contact your local authority who may well hold records of its emergence within their district.

The Chronology of British Hydrological Events website holds information for many areas (<http://www.trp.dundee.ac.uk/cbhe/welcome.htm>), and your local library may also hold records of other historical local flood events.

The latest water situation report for the South East can be found at <https://www.gov.uk/government/publications/water-situation-report-south-east>; this provides information on the general level and state of the groundwater across the region, along with river levels and rainfall totals.

The Environment Agency provides a free flood warning service for many areas at risk of flooding from rivers and the sea. In some parts of England they can also tell you when flooding from groundwater is possible. Further information can be found at <http://apps.environment-agency.gov.uk/wiyby/37835.aspx>, or by phoning 0845 988 1188. If a flood alert for groundwater is available for your area, it does not necessarily mean that your property is definitely at risk.

The Government's advice on how to prepare for flooding and what to do if it does occur can be found at <https://www.gov.uk/prepare-for-a-flood>.

A more detailed explanation of some common features affecting the flow of groundwater and its emergence can be found at <http://blogs.egu.eu/geosphere/2013/09/17/back-to-basics-on-groundwater/>.