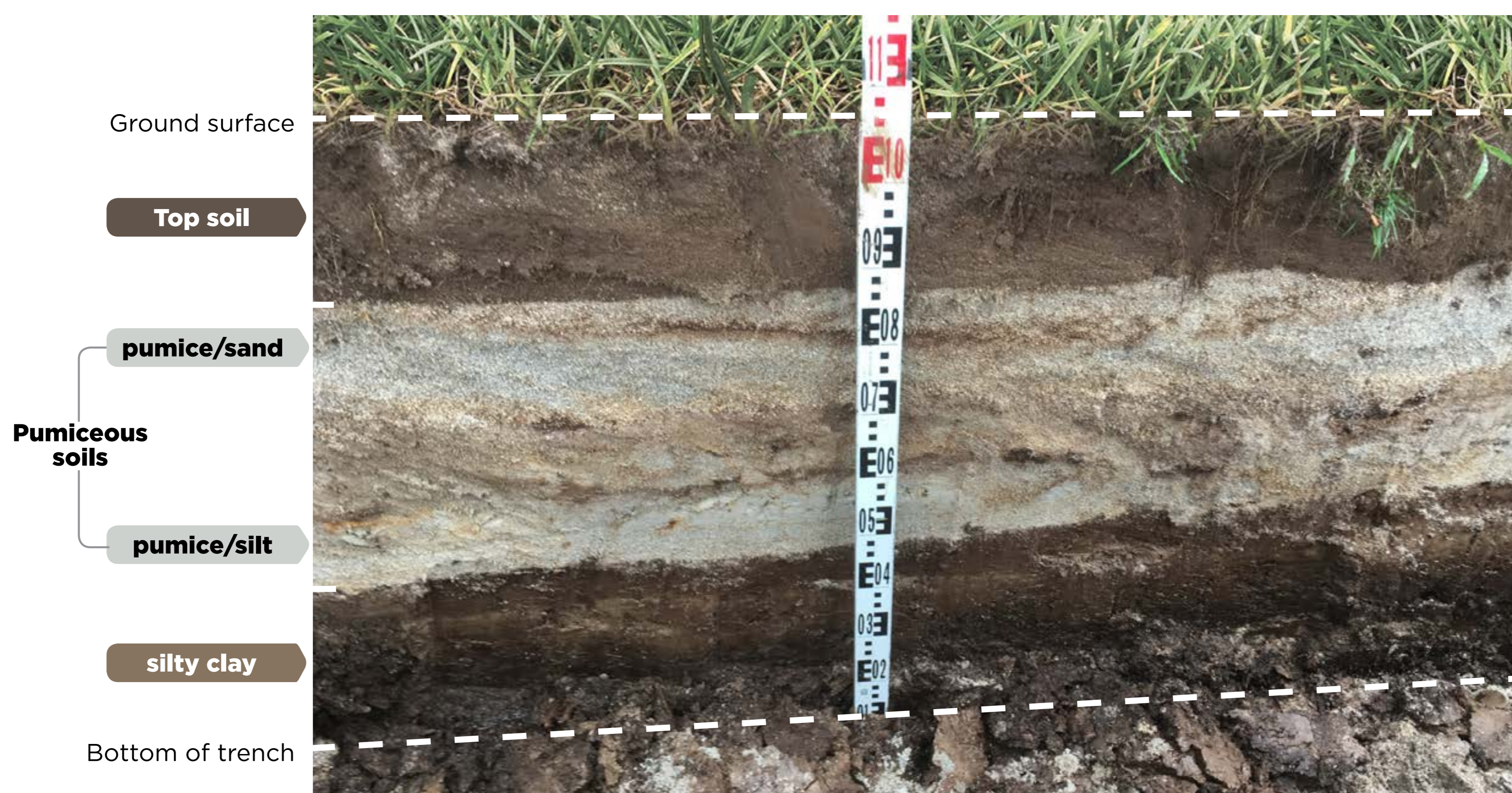


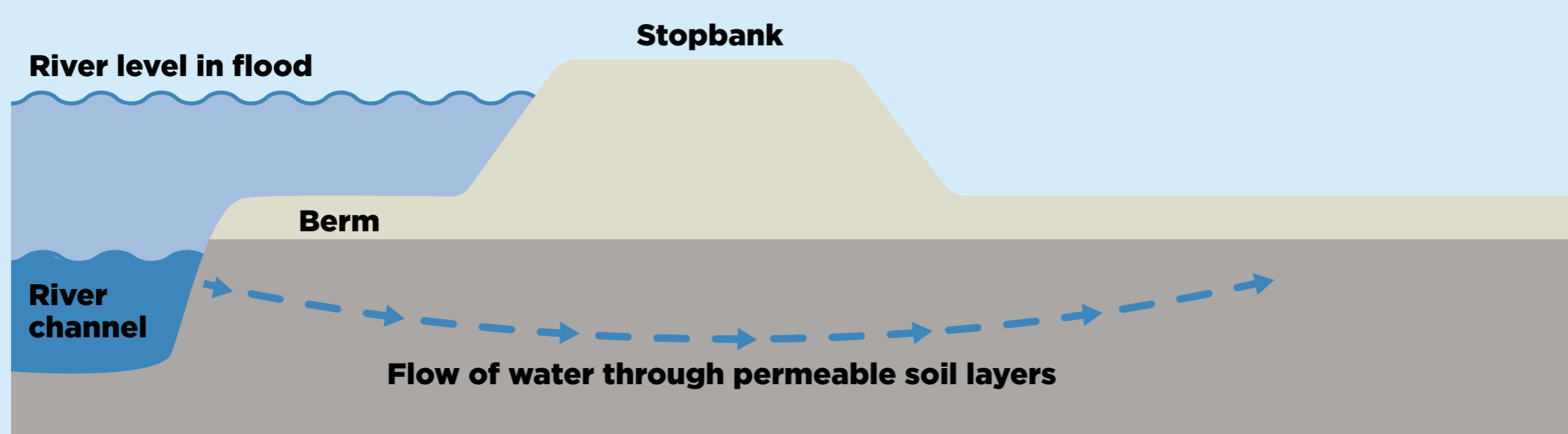
## Additional clauses applying to areas with pumiceous soils

The lower reaches of the **Kaituna, Rangitāiki** and **Tarawera Rivers** have layers of pumiceous soils that are more susceptible to piping failures beneath the stopbanks during flood events. The purpose of these specific clauses is to minimise the risk of such failures occurring.

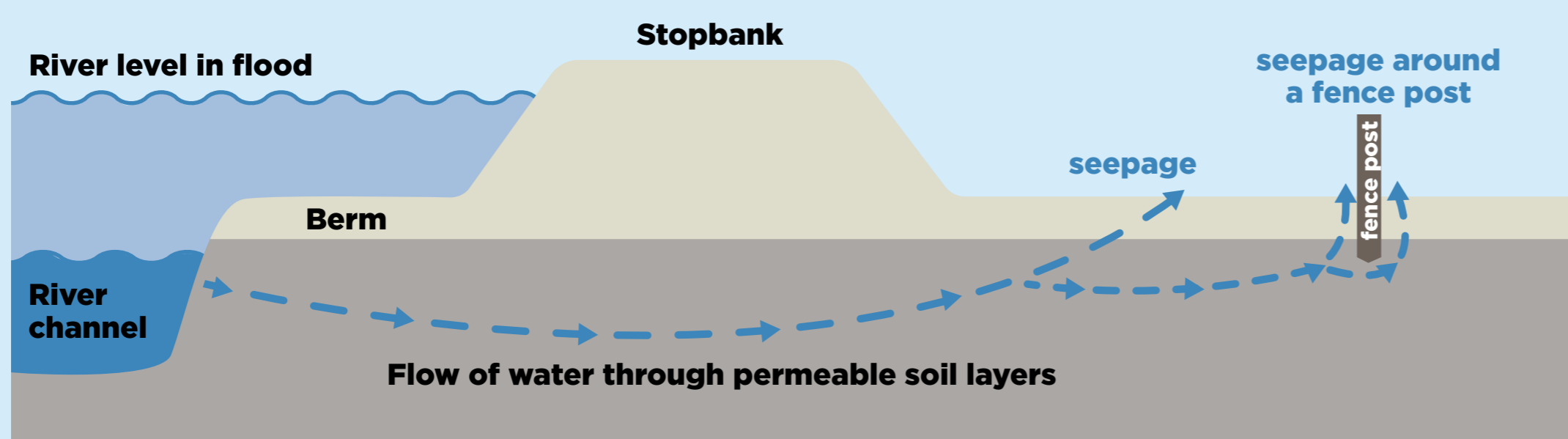
### SOIL PROFILE FROM NEAR THE CONFLUENCE OF WAIARI STREAM AND KAITUNA RIVER



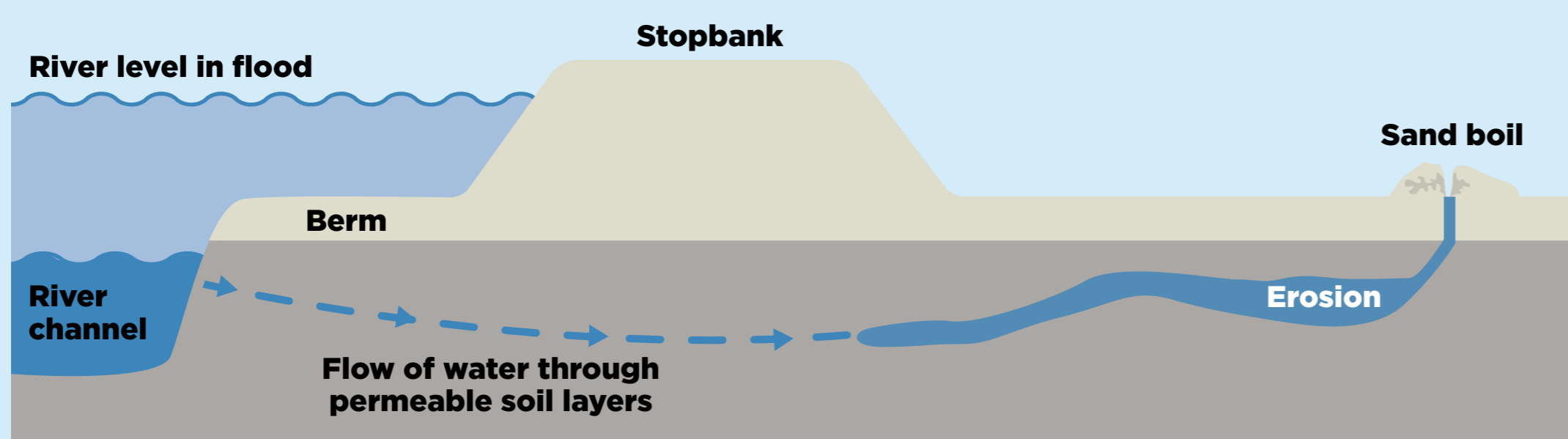
# Stopbank seepage and piping



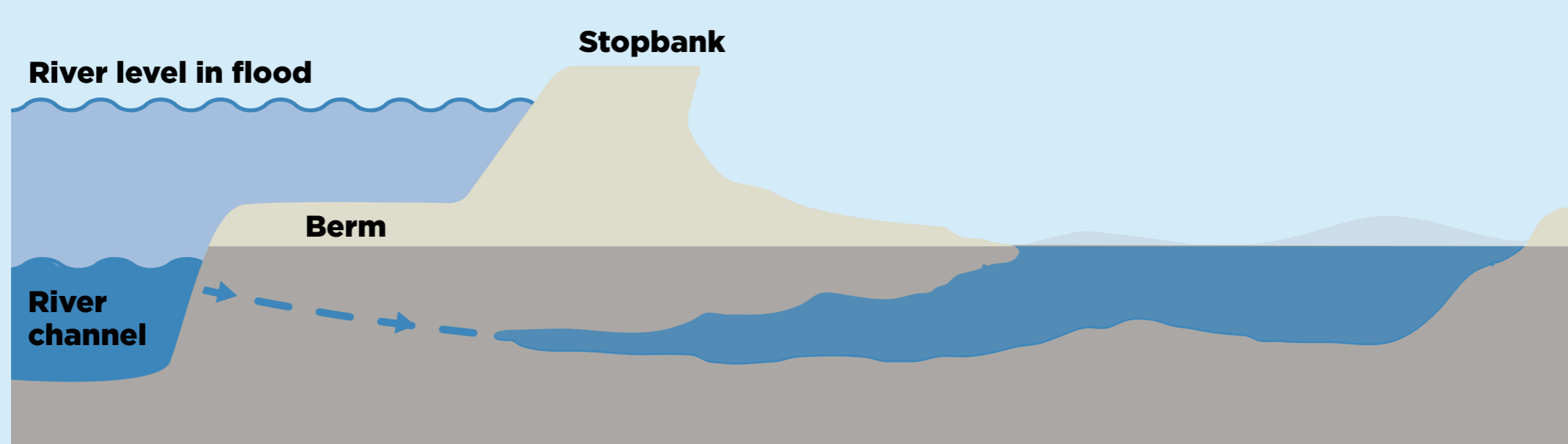
As river levels rise during a flood event there is more pressure on the river bank, berm and stopbank and this increases the rate of water flowing through permeable soil layers beneath the stopbank. (Permeable soils allow water to easily flow through them e.g. sand, pumice.)



This water can seep out to the ground surface when a permeable soil layer comes close to the surface, or where something penetrates into a permeable soil layer creating a pathway to the surface (e.g. fence post, building foundations or a tree).



When seepage flow is sufficient enough to carry soil particles to the surface we see 'sand boils' forming and resulting in 'piping' or backward erosion of soil from the foundations of the stopbank.



Piping can enlarge very quickly and potentially result in stopbank instability and collapse.

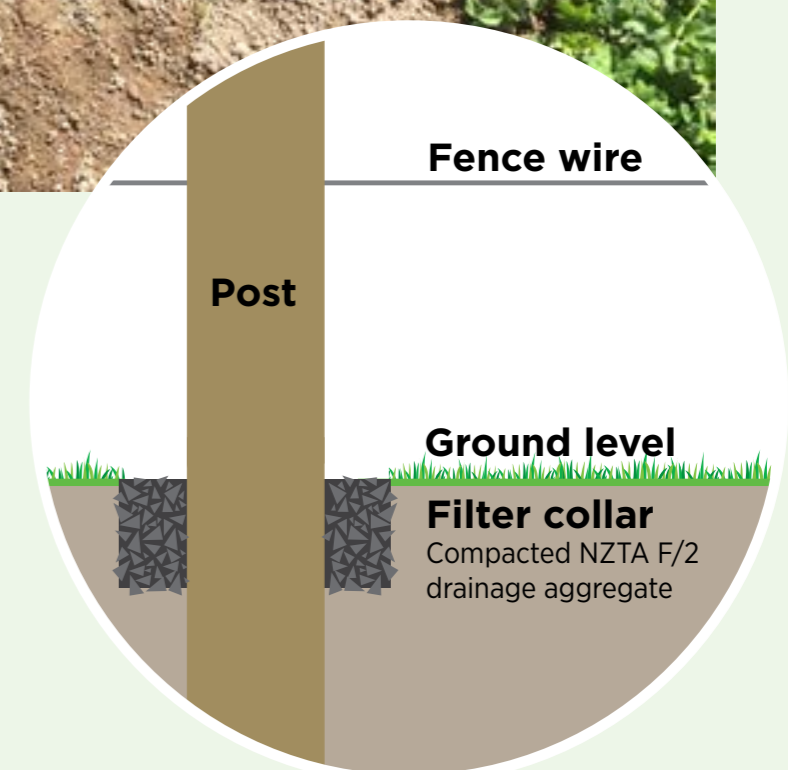


# Ground disturbing activities in the vicinity of a stopbank can increase the risk of piping developing.

Piping usually develops where there are soils with contrasting permeability. This is common in the Bay of Plenty with permeable volcanic and sandy alluvial deposits layered between impermeable peat, silt and clay layers. In the lower Kaituna, Tarawera and Rangitāiki Rivers however these soils are also underlain by pumiceous, highly permeable, sands and gravels.

Ground disturbing activities can include:

- Digging
- Fencing
- Foundations
- Ploughing
- Infrastructure for land use intensification e.g. orchard development
- Shelter belt planting



If there is any risk of posts penetrating permeable sand layers, and creating a seepage path to the surface, a filter collar of NZTA F/2 drainage aggregate can be installed around the post at ground level. Filter collars allow water to escape while trapping soil particles and preventing backward piping erosion.

