Theme 2

Factors Influencing Slope Stability in Laos

2.2 – Climate and Rainfall

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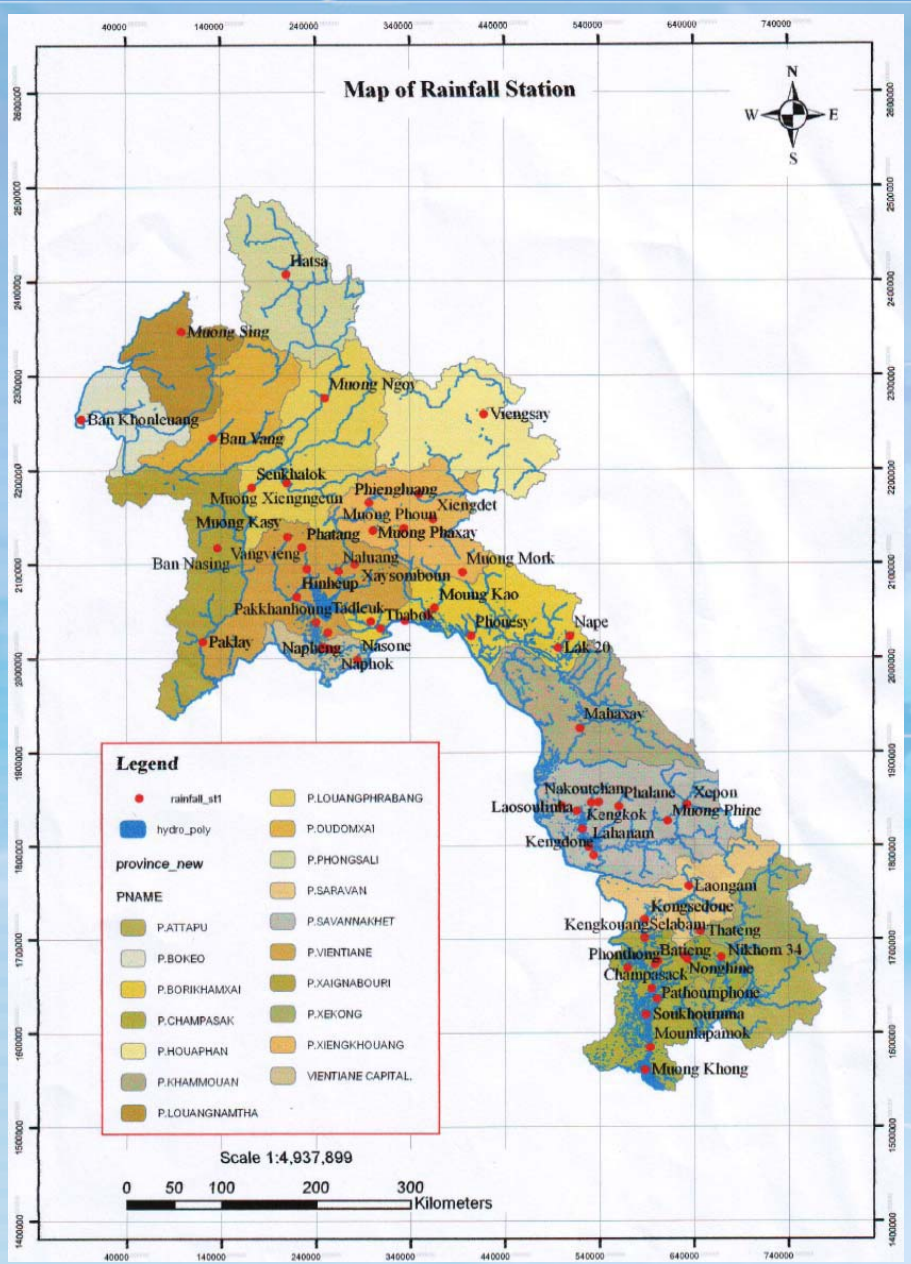
Laos Climate – main points

- Tropical monsoon climate, with a pronounced rainy season from May through to October.
- A cool dry season from November through February, and a hot dry season in March and April.
- Generally, monsoons occur at the same time across the country, although that time may vary significantly from one year to the next.
- Widespread, extreme rainfall often associated with typhoons tracking inland from South China Sea or Gulf of Thailand.

Location of Rain Gauge Stations



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Rain Gauge Records

- Many rain gauge stations have records for last 15 years and longer.
- Records are sufficient for frequency analysis for rain storms with return period of 1 in 20 years.
- Suitable for small scale drainage design on slopes.

Limitations:

- Stations usually located in towns (for convenience) and rainfall in mountains can vary significantly.
- Few continuous recording rain gauges exist.

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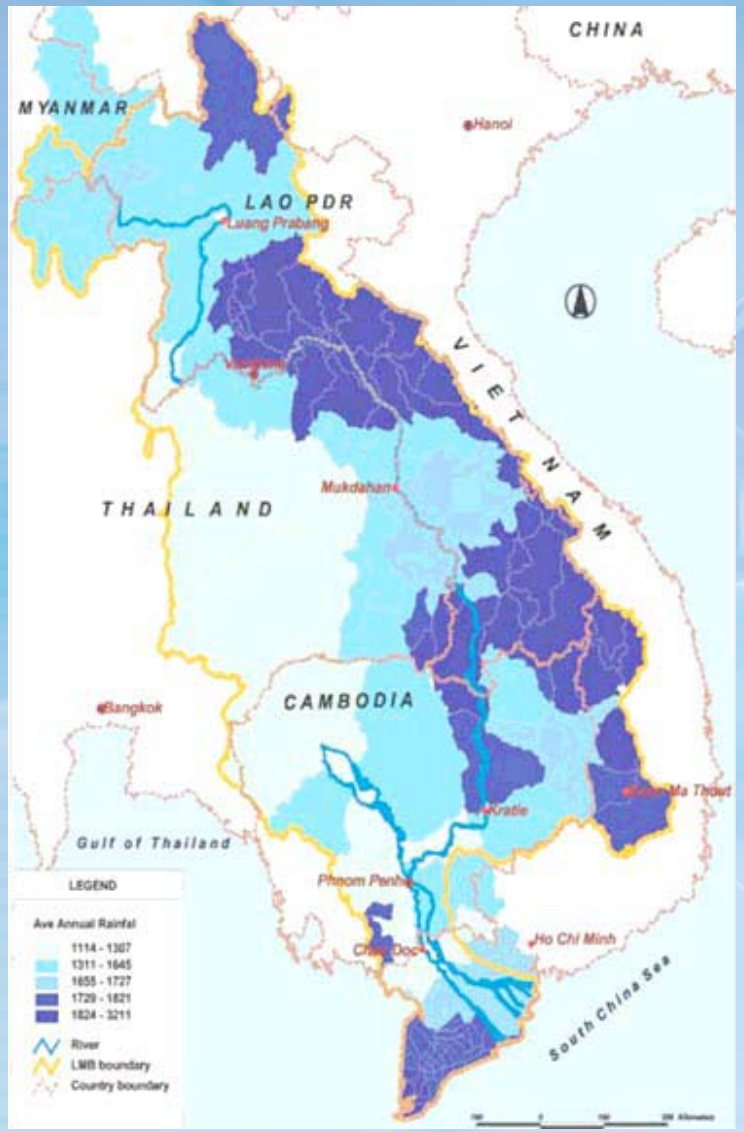
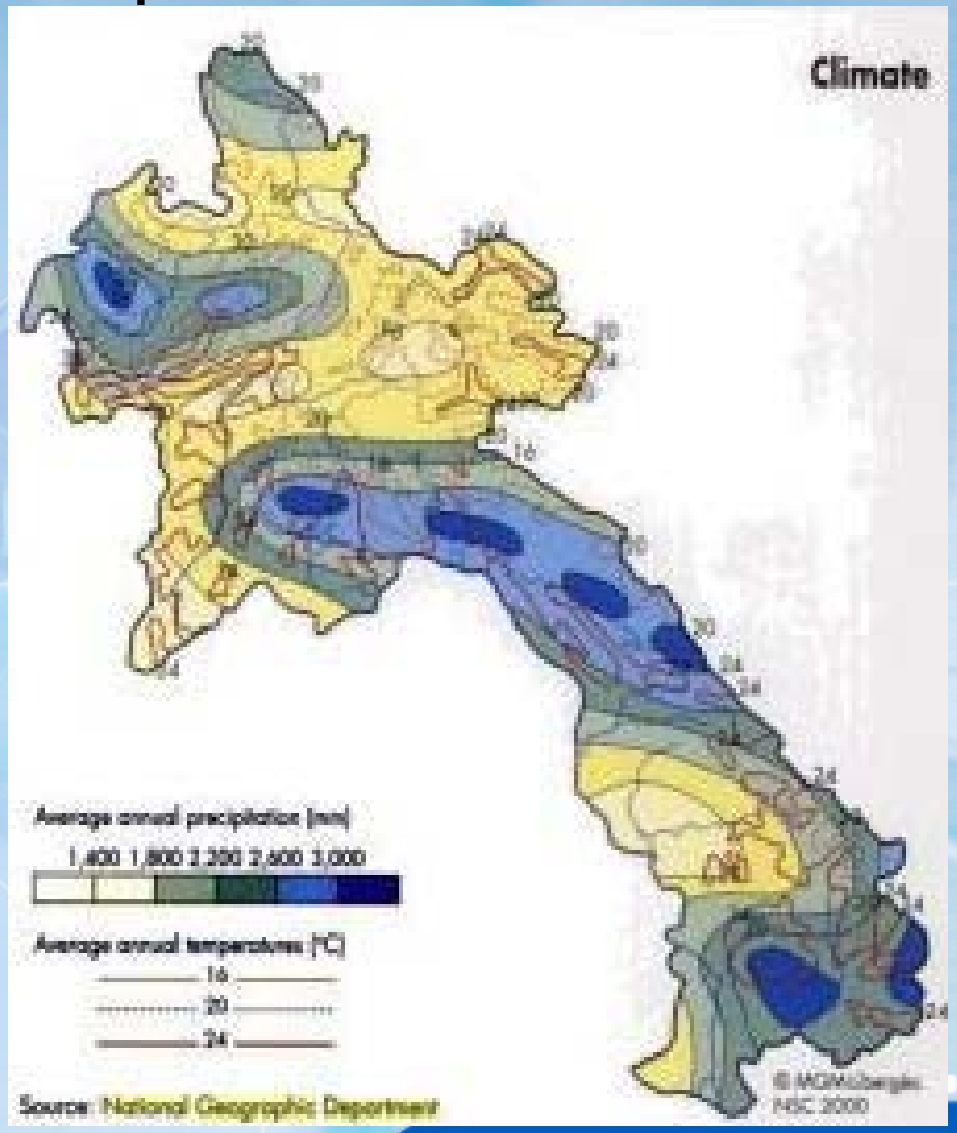
Rainfall Maps





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Slope Instability and Rainfall

- Monsoon storms characterised by initial high intensity rain which falls away.
- Typhoons are characterised by lower intensity rain which is sustained for much longer.
- Slope failures can occur as a result of a build up of significant rainfall over a period of a few days or even a week, or can be attributed to a single high intensity event.

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Influence of Groundwater

Groundwater levels can rise after extended periods of rain or after shorter, intense storm events.

Rising Groundwater can:

- Increase the weight (bulk density) of the soil and therefore increase the forces driving slope failure.
- Reduce the effective strength of the soil and therefore decrease the forces resisting failure.

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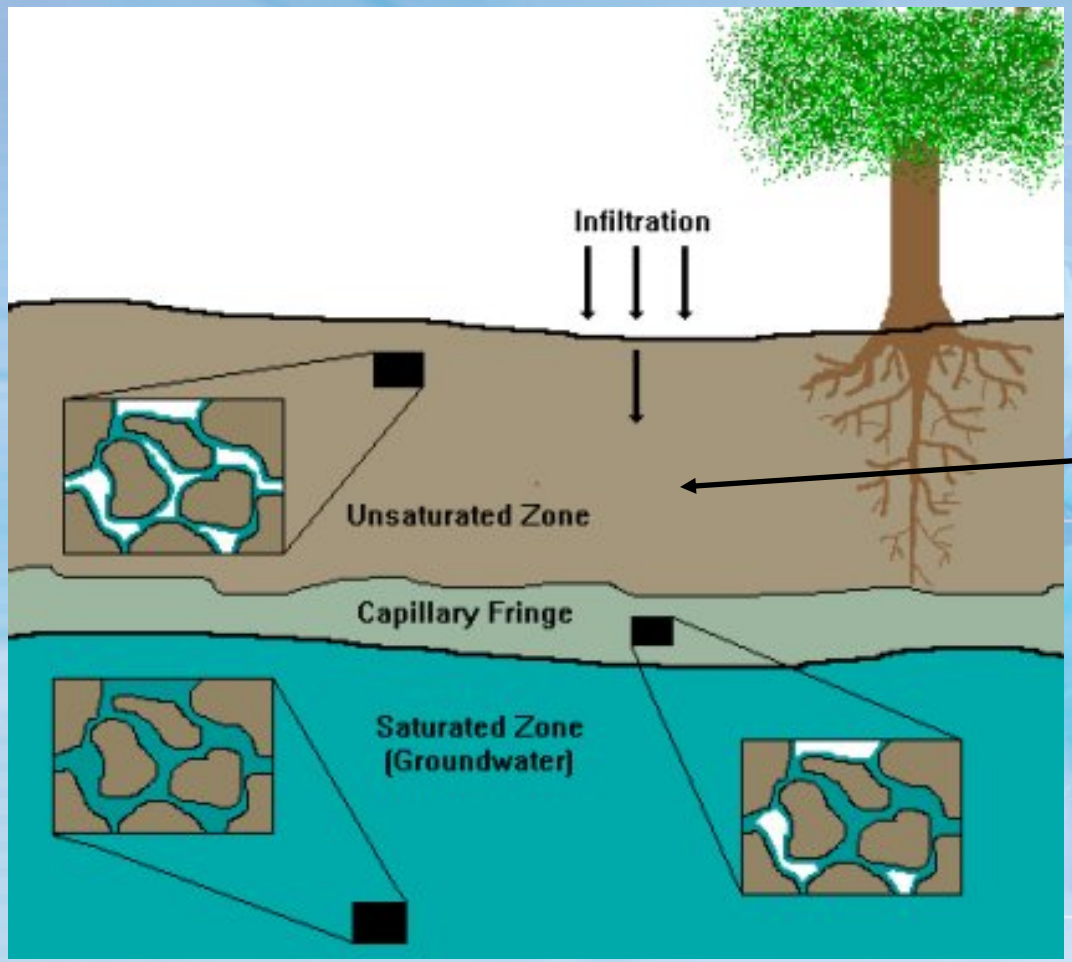
‘Saturated’ and ‘Semi-Saturated’ Soils



Many Tropical Residual Soils will exist for much of the year in a ‘Semi-Saturated’ state i.e. in the ‘Unsaturated Zone’

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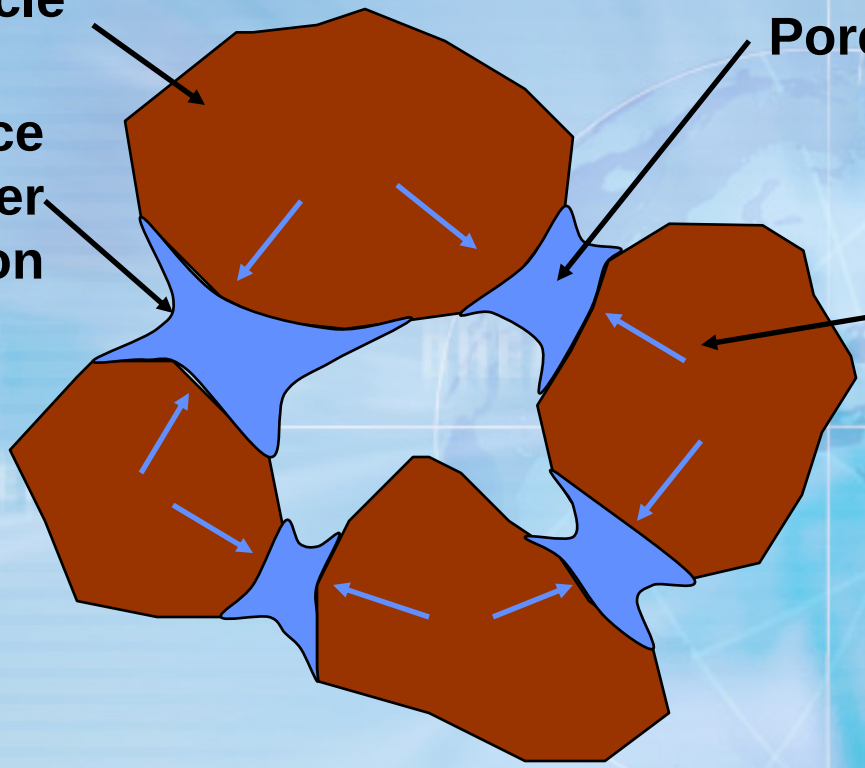
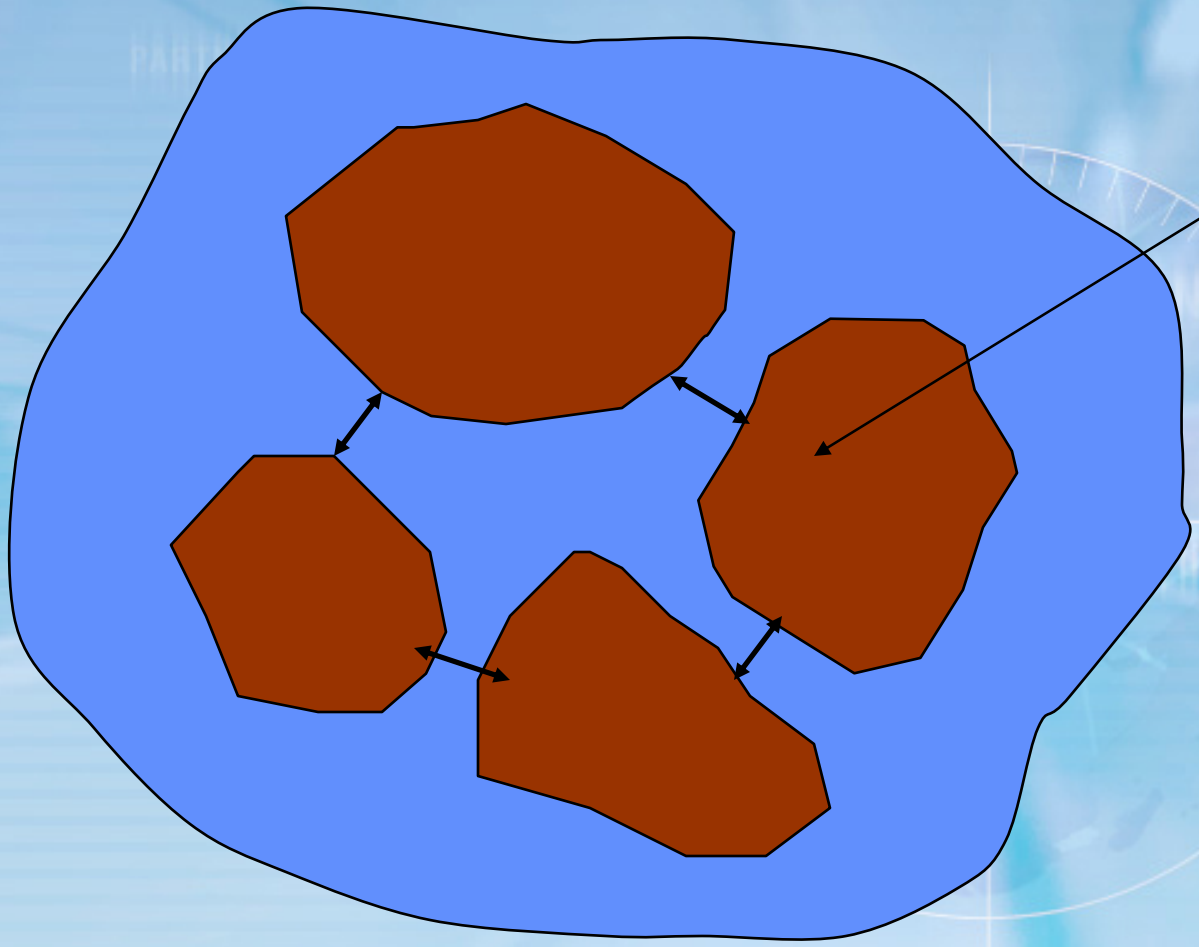
Pore Suction in Unsaturated Soil



Positive Pore Water Pressure in Saturated Soil



Soil particles forced apart by pore pressure

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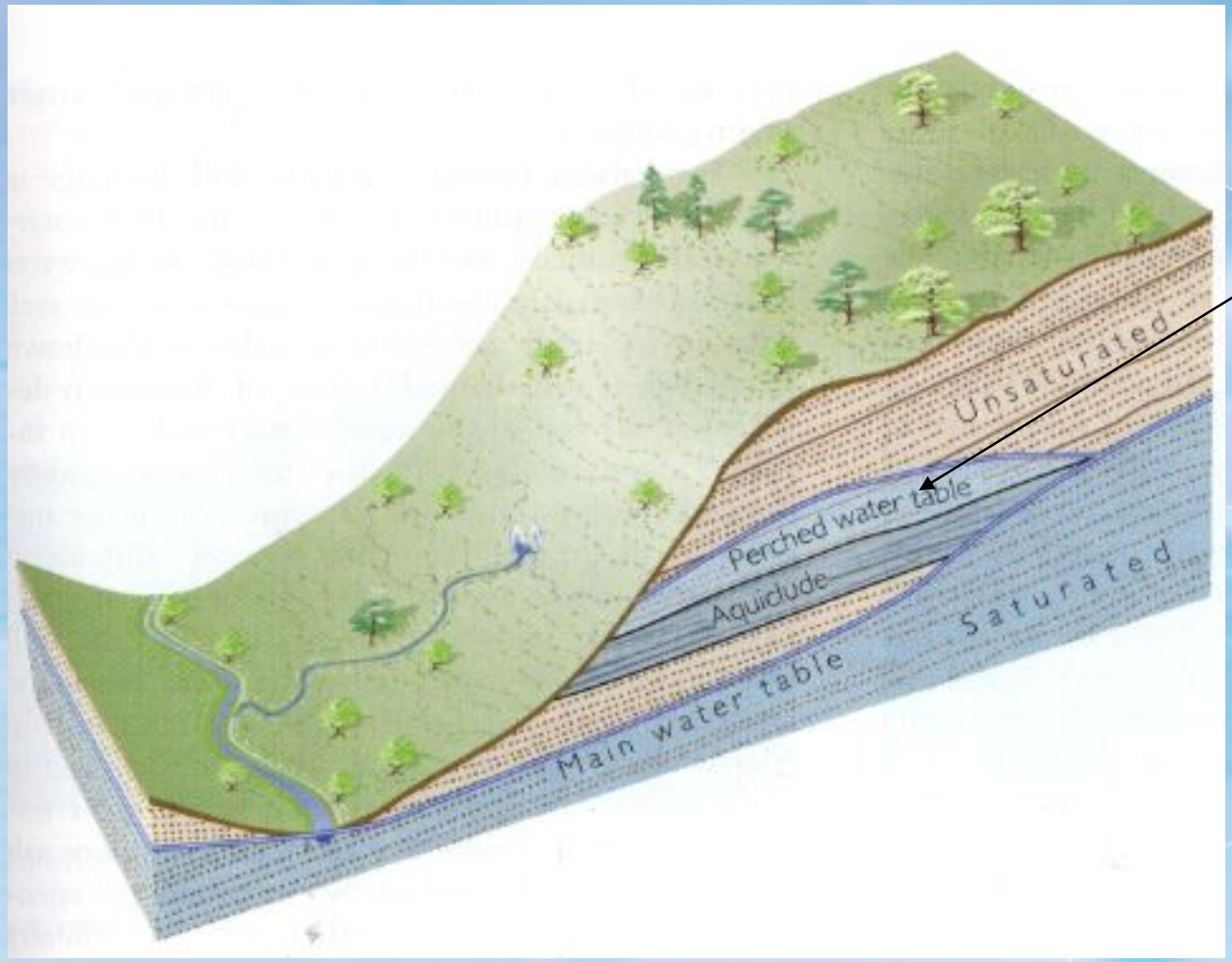
Perched Groundwater



Perched ground water

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Shallow Landsliding, Lantau Island Hong Kong