Innovative Deep Drainage Solutions for Dewatering & Stabilisation of Slopes and Excavations.

Traditional methods of gravity dewatering are usually limited by its maximal economical depth 3 – 5 m (as drainage trenches or ribs). In case of subhorizontal wells, considerable length of drilling, difficulties to reach all required aquifers and problems of the site access can be considered as significant disadvantages.

Since 1986, engineers of TP.GEO have been developing the Siphon drains® system using one or more lines of vertical or inclined wells with gravity extraction of water, through continuously primed siphon pipes, allowing dewatering up to 10 m without need of electrical energy. Today, about 200 siphon drains® sites have been installed in Europe to stabilize shallow landslides areas.

Small diameter suction siphon tubes are placed into vertical drainage wells. The wells are spaced between 3 – 6 m and are sufficiently deep to provide required drawdown. The wells are dewatered using the siphon principle based on gravity drawdown up to depths 8 – 10 m. The tubes are inserted into a permanent water filled reservoir at the base of each well with an outlet downstream at an outlet manhole, situated down slope. The diameter of the tubes varies from 10 to 30 mm, for flows of 0 – 0.3 l/s per well of permeability less than $10^{-5}$ m/s.

General Principle of the Siphon Drains®

If the water level rises in the well, the flow in the tube is renewed and abstracts water out of the well. The flow continues until the water level in the well falls back to the reference level, providing that the flow rate in the siphon is sufficient to keep the siphon primed. As the water rises towards the top of the tube, the pressure falls and may reach vacuum causing creation of bubbles. Without any additional measure, the bubbles might cause break of the flow. This is avoided by using the flushing system or the solar system that flushes bubbles out by turbulent flow and controls and regulates the flow so that the siphon stays always primed. The flushing system is arranged of PVC pipes and it is placed downstream in the outlet manhole at the end of each siphon tube. The system is continually in service, easily controlled, of high efficiency.

The system can be equipped easily by additional instrumentation so it can provide:

- On-line records of ground water levels and water flows and other required data
- Alarms management system via GSM or a phone line
Applications:
- Dewatering and stabilisation of natural slopes (slope deformations, natural landslides)
- Coastal protection (coastal landlides ...)
- Dewatering and stabilisation of excavations (excavation pits, railway/ highway cuttings, open-cast coal mines ...)
- Site remediations (decontaminations ...)
- Others

LONG-TERM & PERMANENT FUNCTION

Advantages and limitations

Advantages:
- Gravity driven or poor solar energy
- Automatically running
- Continually in order
- Drainage to depths up to 10 m
- Lower permeability ground (~ 10⁻⁵ m/s)
- High inflows (0 - ~ 0.3 l/s/well)
- Easy installation + control of the system
- Time resistancy

Limitations:
- Morphology dependent
- Proper maintenance necessary

MAIN REFERENCES

2003 – 2004: ISLE OF WIGHT – Castlehaven (UK)
Large coastal landslide dewatering and stabilization.
120 Siphon Drains® + 35 Electropneumatic Drains®.
The “FLEMING AWARD” for Excellence in Geotechnical Design and Construction (2005) by the Institute of the Civil Engineers in England (ICE).

2003: GONCOURT – FRANCE
Dewatering and stabilization of a slope affected by a shallow landslide causing highway deformation.
71 Siphon Drains® – depth 12,5m.

2004: CLUJ-NAPOCA – ROMANIA
Industrial park – dewatering and stabilization of a construction area.
40 Siphon Drains® – depth 13,5m.

2005: BOTOSANI – ROMANIA
Stabilization of a cutting of a national road.
31 Siphon Drains® – depth 13,5m.

2006: AUGUEBLANCHE – FRANCE
Dewatering and stabilization of a slope affected by a shallow landslide causing highway deformation.
26 Siphon Drains® – depth 14m.

2008: GENISIAT – FRANCE
Dewatering and stabilization of a slope affected by landsliding – electrical power plant complex instability treatment.
21 Siphon Drains® – depth 12,5m.

Dewatering and stabilization of slopes of a former open-cast brown coal mine excavation pit.
255 Siphon Drains® – depth 11,5m.

TP.GEO SERVICES

- Drainage Systems Design
- Supply
- Installation
  - Earthworks
  - Drilling Works
  - Supervising
  - Flushing Systems Installation
  - Suphon Tubing Installation
  - Commissioning
  - Instrumentation
- Monitoring
- Long-term Function
- Monitoring Equipment Lend & Lease

Many Schemes Design
Long-term Design & Execution Experience
International Partnerships
Worldwide Works

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Example of Drainage Line