

# Groundwater Regulatory Guidance

## Ground Source (Borehole) Geothermal Heating / Cooling Systems

Note 002

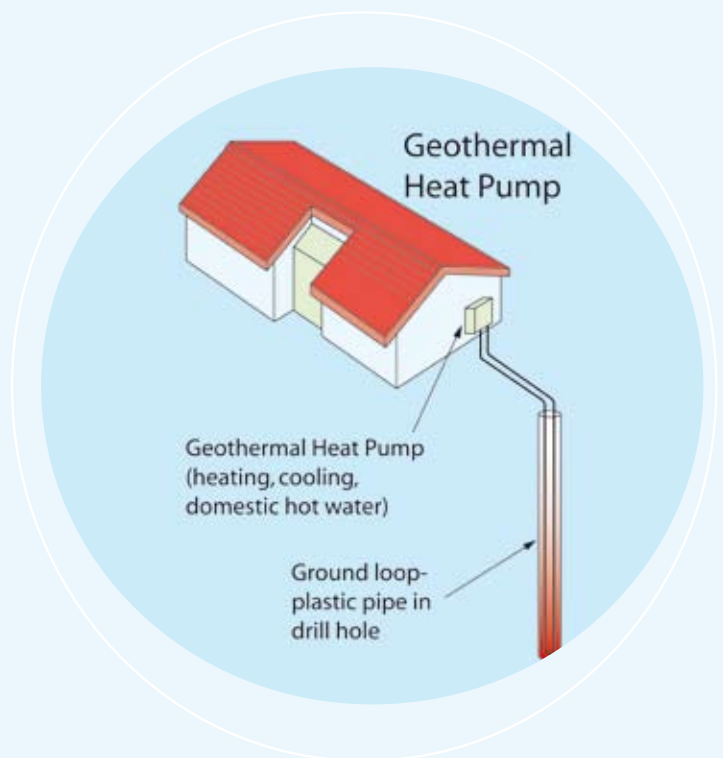
### What are they?

Concerns over climate change have led to an increased focus on energy technologies that reduce the emission of carbon dioxide. Ground Source Heat Pump (GSHP) systems are one such technology which uses temperature differences between the ground or groundwater and the target building to be heated and / or cooled. The objective being to achieve a more sustainable and energy efficient temperature management system. Such systems can be used both in domestic or commercial settings, generally being more viable in new-builds. In recent years there has been considerable interest in these systems and many are now being installed. Both EU and UK legislation recognises that heat can cause pollution and should be controlled. Inappropriate design, construction and operation of such systems can also create a risk of other forms of environmental impact e.g. groundwater contamination and hence there is a need to consider regulatory requirements and guidance.

Three main design options exist for ground source geothermal systems

- **shallow ground burial** where the heat transfer occurs through pipe work (loop) laid within the upper soil zone
- **open water** where the heat transfer occurs via pipe work emerged in a river or lake
- **borehole** where heat transfer occurs deeper in the ground or via groundwater contained within the sub-surface

This guidance note deals with **borehole** geothermal systems only.



## Two main types of borehole systems are used:

### Closed Loop

- This is where the pipe work 'loop' is entirely sealed
- No direct interaction with the ground or groundwater in the borehole and the fluid (e.g. refrigerant) within the loop occurs
- The borehole is either left open or sealed with grout cement

### Open Loop

- This is where water is abstracted and enters the loop system at one end and is discharged at the other end
- The abstraction and discharge usually occurs from/to the same underground strata but the discharge can also be routed away elsewhere
- The borehole is usually left open

### Purpose of this guidance note

Both types of borehole GSHP systems involve potential interaction with the water environment. There is a need to clarify the regulatory requirements and procedures associated with these types of works. This note is intended to be a quick reference guide for those considering such systems.

## Types of system & regulatory requirements:

Unless a suitable borehole or well is already available it would be usual for a new borehole (or boreholes) to be constructed as part of the installation for both types of system. Poorly constructed boreholes can represent a rapid by-pass pathway for pollutants to reach groundwater. In addition care must be taken when drilling the borehole to avoid pollution. It is important that boreholes are properly sited, designed, drilled and completed by a reputable contractor. Further information on borehole drilling can be found in guidance notes produced by the Environment Agency of England and Wales<sup>(1)</sup>, the Geological Survey of Northern Ireland (GSNI)<sup>(2)</sup> and the Institute of Geologists of Ireland<sup>(3)</sup>.

A summary of environmental protection controls in regard to such systems within the Northern Ireland Environment Agency (NIEA) responsibility is given below.

### Closed Loop Systems

- You will not normally require any specific authorisation or consent to operate a closed loop system.
- Where possible non-polluting chemicals should be used in the system to minimise the pollution risk.
- Drilling and completion of the borehole should follow best practice with secure headworks to ensure prevention of pollution via the borehole.

Although not a requirement, NIEA would welcome details of where the borehole is constructed along with a copy of the borehole and construction logs (normally produced by the drilling contractor).

It should be noted that under the Minerals (Miscellaneous Provisions) Act 1959, records from boreholes drilled to a depth of greater than 15 m must be forwarded to the Geological Survey of Northern Ireland<sup>(2)</sup>.

## Open Loop Systems

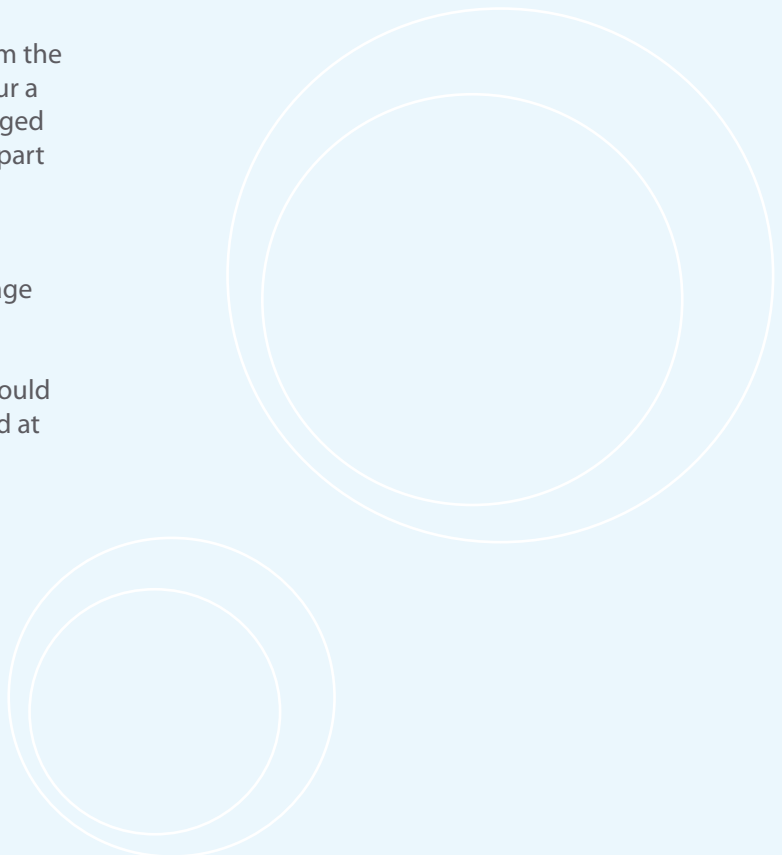
- As these types of system can pose more of a pollution risk to the environment, we expect adequate prior site investigation. This should include an environmental / hydrogeological risk assessment and method statements for the construction & operation of the system. These may need to be provided as part of the planning process.
- Systems which abstract less than 20 m<sup>3</sup> per day do not require an abstraction licence but must comply with Permitted Control Activities conditions<sup>(4)</sup>. Abstractions over 10 m<sup>3</sup> per day must be notified to NIEA Water Management Unit.
- Systems that require abstraction of water of more than 20m<sup>3</sup> per day will require an abstraction licence from the NIEA Water Management Unit; this may incur a fee.
- If you intend to discharge the water back to where you take it from, this may not require consent to discharge<sup>(5)</sup>, subject to confirmation being obtained to this effect in writing from NIEA Water Management Unit. In all other cases a consent to discharge (to surface water or underground stratum) must be sought from the NIEA Water Management Unit; this will incur a fee. Information on abstracted and discharged water quality will generally be required as part of the consent application process.
- Where discharge is to be to the foul sewer, consent should be sought from the sewerage undertaker.
- Suitable pollution prevention measures should be employed in and around the system and at the headworks.

## Please note:

It may also be a requirement of The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999, that an environmental impact assessment be conducted for any deep drillings, in particular geothermal drilling, where the drilling is to be undertaken within 100 metres of any waterway or water in underground strata (see Schedule 2 of Planning Regulations).

## References:

- (1) Water supply borehole construction and headworks - guide to good practice ([www.environment-agency.gov.uk](http://www.environment-agency.gov.uk))
- (2) Borehole and water well drilling. ([www.bgs.ac.uk/gsni](http://www.bgs.ac.uk/gsni))
- (3) Guidelines on Water Well Construction. ([www.igi.ie](http://www.igi.ie))
- (4) The Water Abstraction & Impoundment (Licensing) Regulations (Northern Ireland) 2006
- (5) The Water (Northern Ireland) Order 1999



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