An applicants guide to water supply boreholes

Version 1
May 2010

SEPA acknowledges the use of material from the Environment Agency to produce parts of this document.

1. Introduction

This guide provides general advice to people wishing to construct groundwater abstraction boreholes. It outlines what authorisation is required, how to conduct a water features survey, if required, and best practice for borehole location and construction.

2. Authorisation

2.1 Do I require SEPA authorisation to construct and abstract water from a borehole?

The Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR) require that groundwater abstractions be authorised either by general binding rules, registration or licence. Details of what level of authorisation is required for different types and scales of activities are provided in the *Controlled Activities Regulations: A practical guide*. CAR application forms can be found on the SEPA website.

2.2 Do I require any other authorisation?

If your borehole is over 15m deep then you must give prior notification to the British Geological Survey and give your records to them once drilling is complete.

If your borehole is within a mining area you will need approval from the Coal Authority to drill in the coal measures.

3. Water features survey

3.1 Do I need to carry out a water features survey?

You need to provide SEPA with information so that it can make an assessment of the impact that your abstraction will have on the water environment. For abstractions of groundwater greater than 50m^3/d your application needs to be accompanied by a water features survey and that forms part of the information required for that assessment. This will enable SEPA to identify all the water features which your abstraction may affect.

3.2 How do I complete a water features survey?

To complete the water features survey any of the water features listed in Annex 2 which are present within, or intersected by, a circle of radius specified in Table 1 should be detailed on the water feature survey identification form (WAT-FORM-10) and identified on an up-to-date map of convenient scale, preferably one based on the Ordnance Survey Landplan® 1:10 000 series. A walk-over survey is required to identify some of the water features including wetlands. Guidance on how to complete the survey for wetlands is included in Annex 2. Some of the features can be identified by using local knowledge and maps. Some organisations, such as Scottish Natural Heritage, may have relevant information, and some useful addresses are given in Annex 3.

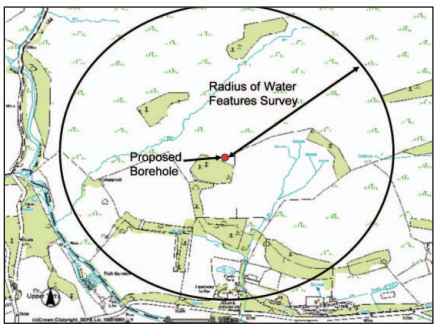


Table 1: Radius of survey for water features

Abstraction rate (m^3/d)	Minimum radius (m)
50-500	850
>500	1200

3.3 What precautions should I take?

When investigating other water supplies care must be taken to avoid contamination from you or your measuring and monitoring equipment.

You must also take care when investigating boreholes and other water features and apply appropriate health and safety precautions.

4. Borehole location and construction

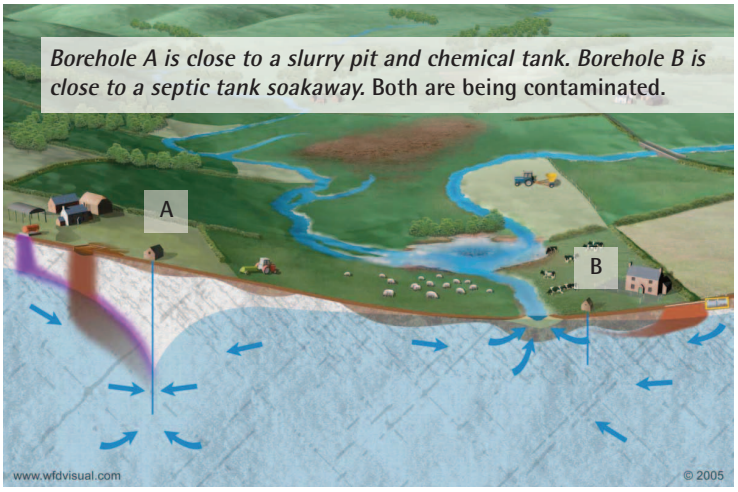
4.1 How do I find out if I will get the quantity and the quality of water I need from my borehole?

Hydrogeological consultants, some experienced well drillers and the British Geological Survey may be able to help provide information. A fee may be charged.

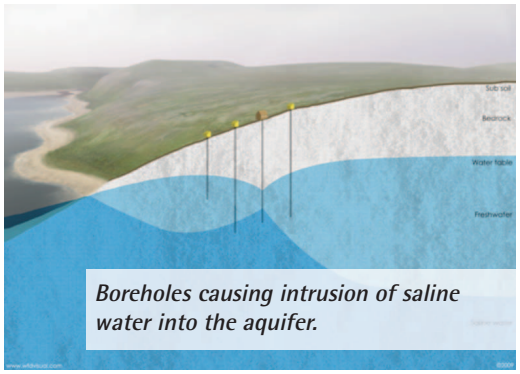
4.2 Where should I locate my borehole?

To avoid pollution of your borehole it should be located away (up slope and at least 50m) from sources of contamination such as septic tanks, poorly drained areas which receive contaminated run-off and slurry pits.

To avoid any reduction in stream or spring flow, or water level in nearby wetlands and other abstractions, and to avoid 'pulling in' seawater into the aquifer, your borehole should be located as far as possible from the coast, and any wetland, steam/river, spring and other abstractions. Annex 1 provides further information on borehole best practice location and construction.



Borehole A is close to a slurry pit and chemical tank. Borehole B is close to a septic tank soakaway. Both are being contaminated.



Boreholes causing intrusion of saline water into the aquifer.

4.3 How do I avoid contamination of my borehole?

Poorly constructed – not housed/ fenced and poor fitting cap.

Following the borehole location guidance above will help prevent contamination of your borehole. However, many boreholes become contaminated as a result of poor construction. Often boreholes are completed below ground in manholes – putting them at risk of contaminated run-off directly entering the borehole. To avoid this SEPA recommends that, if possible, boreholes be completed above ground and the casing is adequately grouted. Annex 1 provides further information on borehole best practice location and construction. Care must also be taken when drilling boreholes to avoid contaminating groundwater or nearby rivers, for example, by using inappropriate drilling fluids or poor disposal of drilling fluids. Annex 1 provides some advice on where and how best to construct and complete your borehole. Following these guidelines will help to protect your abstraction from pollution and minimise the risk of having to re-locate or retrofit your borehole following completion.

Well constructed borehole – housed, good fitting cap

Annex 1. Best practice borehole location and construction

Table 2: Best practice borehole location and construction

	Good practice	Bad practice	Objectives
Location	Remote from (at least 50m) and up-slope of any pollution sources. As far as possible from wetlands, springs, abstractions and the coast (you may be required to undertake further investigation if there are any abstractions or water dependant wetlands within the radius of the water features survey (WFS) specified in Table 2).	At low points where contaminated drainage can collect. Close to or down slope of sources of pollution eg – fuel/chemical tanks, storage/handling areas, septic tanks. Close to another abstraction borehole[1], groundwater dependant wetland or coast.	To minimise the risk of pollution to the abstraction[1]. To minimise unacceptable impacts on the environment and other water users.
Water well drilling	Drilling fluids should be free from contaminants and, as far as practical, be limited to clean water, air and approved foaming agents.	Use of potentially contaminated equipment, eg may have been used to drill boreholes on contaminated sites or has been lying on ground occupied by livestock.	To minimise the risk of contaminants being introduced by the drilling equipment or fluids.
Permanent casing: type	British Standard, oil industry (API) standard or waterwell standard casing[2].	Drainage or sewer pipes.	To seal off shallow, unstable or contaminated ground. To seal off and to prevent tracking shallow groundwater and surface water via the borehole to the water table. To prevent interconnection of different aquifer layers. To prevent uncontrolled artesian discharges.
Permanent casing: material	Steel[3]/waterwell grade plastic.	Plastic casing if installed in holes which may be liable to collapse.	
Permanent casing: jointing	Welded, screwed and socketed.	Push-fit.	
Permanent casing: diameter	Large enough to allow installation of dip tube(s) as well as rising main and power cable. Small enough to provide an annulus of at least 50mm to allow effective pressure grouting[4].	Too small to allow installation of dip tube(s). Too large to allow effective pressure grouting of annulus between casing and borehole wall.	
Permanent casing: depth	Normally to penetrate unconsolidated materials and inserted at least 3m into solid rock. A greater depth may be necessary to seal off unstable or contaminated ground or different aquifer units[5].	Casing too shallow so that ingress of water from contaminated horizons occurs.	
Flange/ seals	Threaded joint. Square-cut casing, welded flange. Flange and bolted borehole cap with neoprene seal[6].	No seal/flange plate/rough cut casing. Cut off too close to base of chamber.	

[1]The Environmental Health Department of the local authority has responsibility for checking the quality of private water supplies, and has powers to condemn sources unfit for human consumption.
[2]The casing strength should be designed to suit the ground conditions and installation depth.
[3]Steel is more rigid, robust and does not bend.
[4]Requires a large enough diameter borehole from the outset. Reductions may be necessary because of unstable ground.
[5]Additional secondary casing or a slotted screen with or without a gravel pack may be required in unconsolidated aquifers or unstable ground.
[6]Essential if the borehole is artesian.

Table 2: Best practice borehole location and construction (continued)

	Good practice	Bad practice	Objectives
Grouting	Pressure grouted from base of permanent casing up to surface. Allow minimum of 24 hours for grout to set before drilling deeper. Minimum annulus 38mm.	Grout poured form surface. Casing just driven not grouted. Drilling recommended before grout has set and hardened[7].	To seal off and prevent tracking of contaminated shallow groundwater and surface water via the borehole to the water table.
Completion	Above ground either in a pump house or protected area not subject to traffic.	Below ground, and not sealed.	To prevent water or contaminated drainage accumulation in the manhole chamber, by minimising water entry and providing drainage out of the manhole chamber.
Manhole: chamber[8] \base	Concrete, 150mm thick.	Concrete <100mm or natural ground.	
Manhole: sides	Precast concrete sections, engineering brick or waterproof rendered brick/blockwork (bonded to base).	Brick or blockwork, not waterproofed.	
Manhole: cover	Load bearing to suit traffic. Cover frame haunched and bonded to sides. Water-tight seal.	Lightweight cover (potentially damaged by traffic). Frame not sealed to sides.	
Manhole: drain	25mm ID min diameter with vermin screen, leading to surface outlet or effective soakway[9].	No drain, no soakaway, blocked drain or manhole constructed below the water table or in waterlogged or poorly drained ground.	
Manhole: chamber backfill	Low permeability material such as clay.	High porosity material in waterlogged and poorly drained ground.	
Dip tubes[10]	25mm ID min. dia. Bottom 3m perforated at 100mm centres. Base with plug/bar to prevent dipper running out of dip tube. Bottom at least 2m below the pump intake level or sufficiently below water table to accommodate future changes in water level (pumping and natural). Removable plug in top.	None provided. Not deep enough. Open ended (allows dipper to run out of bottom). Not perforated.	Safe access to allow reliable water level measurement. Prevent splashing/high level seepages giving spurious readings. Sealed to prevent contamination of borehole, artesian discharge or gas escape as appropriate. A dip tube is a standard condition of a groundwater abstraction licence.

[7]Many boreholes have been found to have a cavity at the base of the permanent casing. This is likely to be due to poor grouting or not drilling deeply enough into solid ground before inserting the permanent casing.
[8]Where an above ground completion is not possible.
[9]A soakaway will not work effectively if the manhole chamber is constructed in low permeability ground or below the water table.
[10]Two dip tubes should be considered where water level measurement is to be by manual dip meter and data logger.

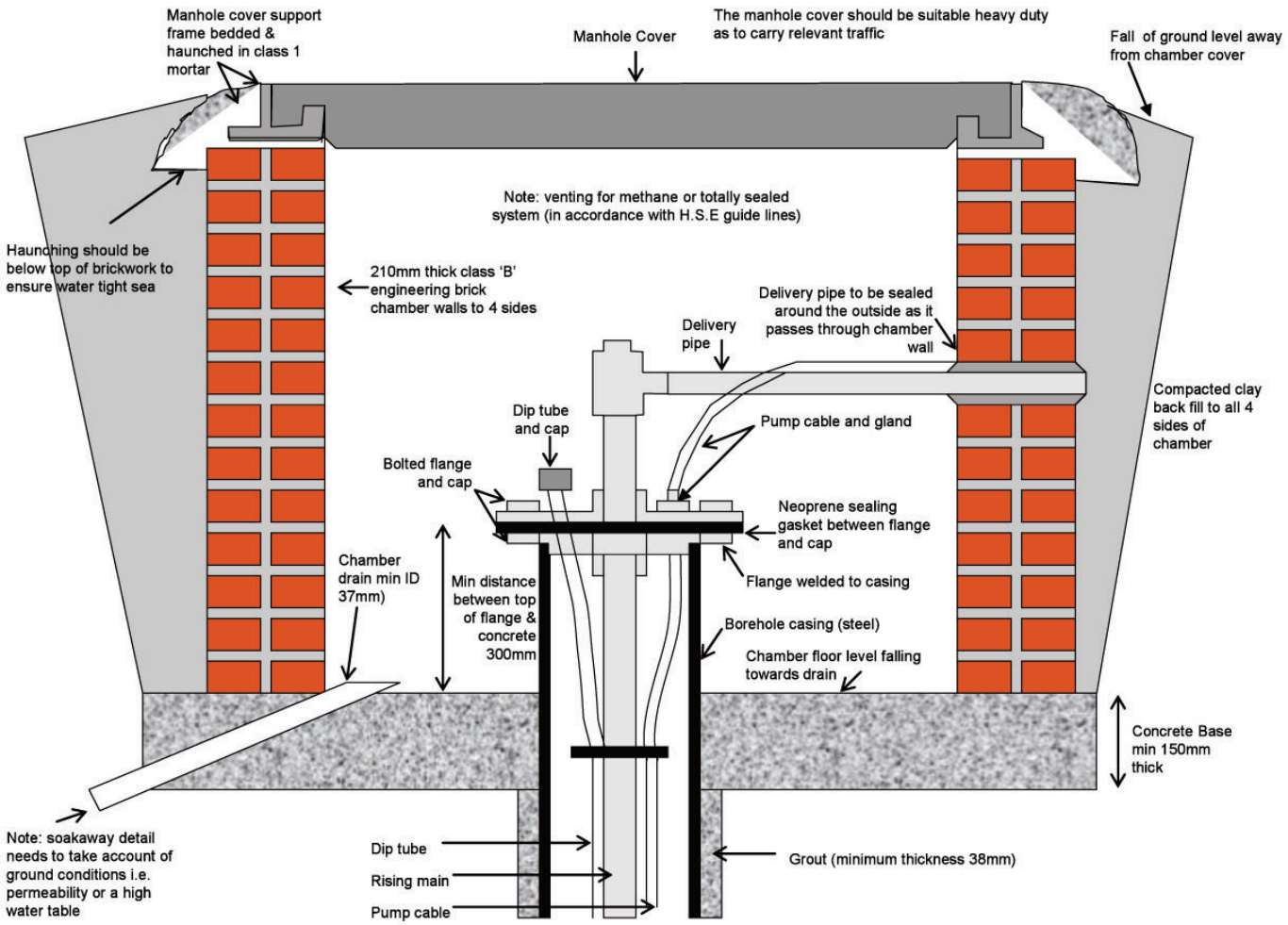
Table 2: Best practice borehole location and construction (continued)

	Good practice	Bad practice	Objectives
Venting	Either totally sealed system for artesian boreholes or manhole chamber/building and storage vessels vented according to guidance from HSE[11]. Borehole completed above ground or in an open atmosphere.	Siting in a building or a chamber which would constitute a confined space. Potential source of ignition from electrical equipment (including switchgear and lights) close to borehole or in a confined space (where there is a risk of gas accumulation).	To avoid risk of accumulation of toxic or explosive gases in borehole chamber storage vessels or buildings[12].
Flow meter and sample tap	Flow meter should be accurate, located close to the source, away from the pump, not to be bypassed. Well maintained. Sample taps should be located close to the source and prior to any treatment.	Flow meter fitted on short pipe runs, close to bends and valves. Sample taps placed after treatment.	Where required by SEPA a meter should be calibrated, installed and maintained to ensure accurate measurement of abstraction quantities. A sample tap allows samples to be undertaken and is a standard condition of a SEPA abstraction licence.
BH Log	Geological log using BS5930 method and details of construction.	No records of geology or borehole construction.	Aids future maintenance. Aids SEPA in regulatory duties to protect resource in future.

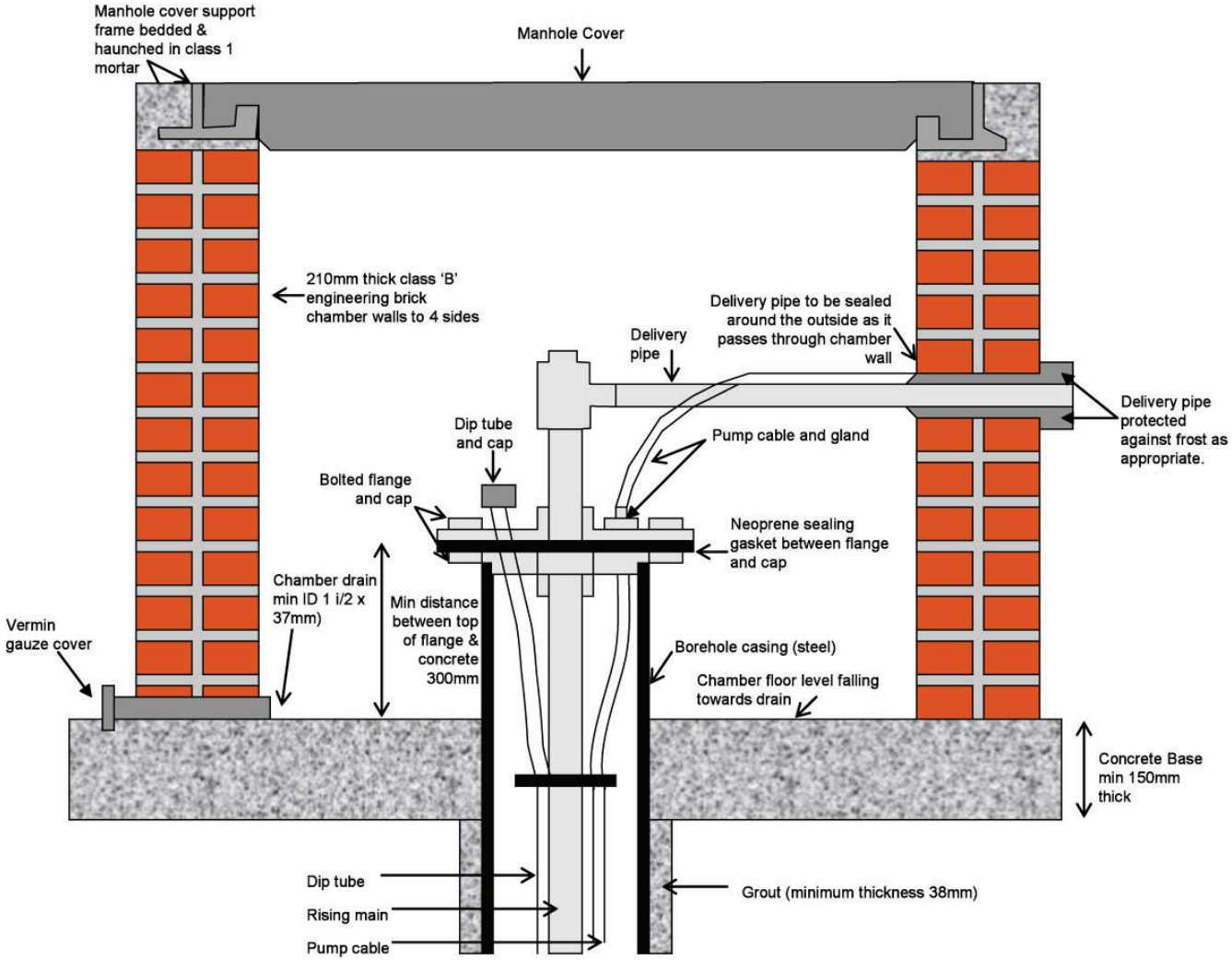
[11]Health & Safety Executive – *Water Boreholes – Potential Hazard from Methane Evolution* HSE 847/4 July 1990. If a methane problem is envisaged the HSE should be contacted for advice.

[12]Methane can be found naturally or be derived from landfills or other sources. Hydrogen sulphide and carbon dioxide can be emitted naturally. These pose a potential hazard where access is necessary into a confined space.

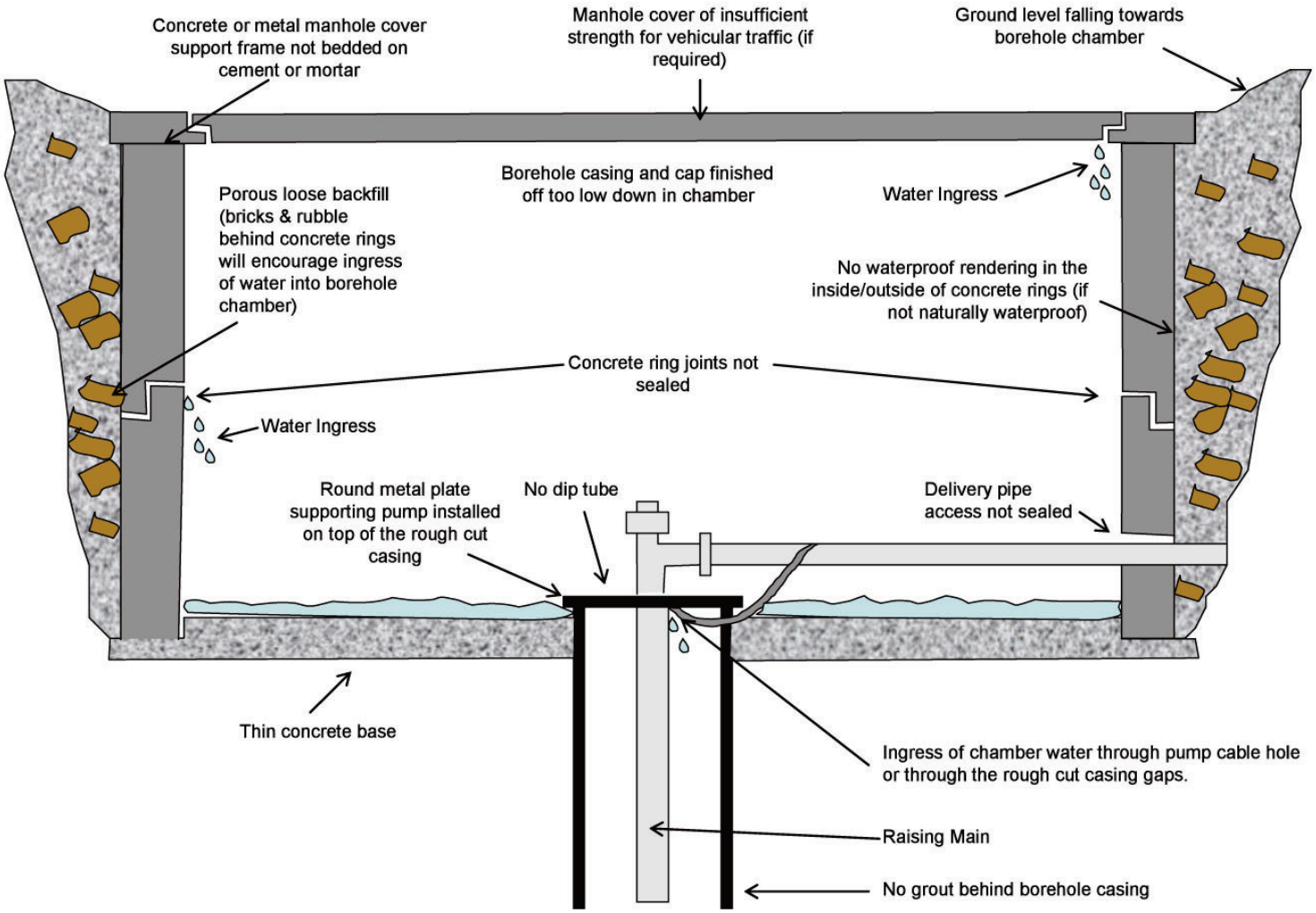
Below ground completion – acceptable good practice
(only where an above ground completion is impractical)



Above ground completion – recommended good practice



Below ground completion – example of bad practice



Annex 2. Water features to be identified

Table 3: Water features to be identified within the radius of the water features survey

	Water features to be identified if within radius of water feature survey
1.	Rivers, burns or streams (including river control structures, ie weirs, locks, sluices).
2.	Lochs, lochans or ponds with a surface area of more than 50m^2 or where their ecology or use could be adversely impacted by the abstraction (including fish farms and water sports areas).
3.	Canals, navigation channels or reservoirs.
5.	Seepage pits (catchpits for springs).
6.	Wetlands. To identify wetlands a site walkover will be necessary. This need not be by someone with professional training at this stage, although further investigations may be necessary. The survey should be completed using wetland typology guidance available on the SNIFFER website. This includes guidance on how to complete a walkover survey and identify general wetland types.
7.	Coastlines and coastal lagoons.
8.	Areas of saline or areas of potentially contaminated groundwater.
9.	Boreholes and wells, specifying use and construction details.
10.	Surface water and groundwater abstractions.
11.	Springs and seepages.
12.	Large discharges to surface waters (eg water utility water treatment works).

Annex 3. Contact names and addresses

Local authorities

Your local authority may keep a register of all households that are not on public mains supply and will have a register of some abstractions of less than 10 m^3/day. They may also hold information on local and UK biodiversity action plans and local conservation areas.

Scottish Water

Scottish Water holds information on the location of those public water supplies administered by them.

Scottish Water
PO Box 8855
Edinburgh
EH10 6YQ

www.scottishwater.co.uk

Scottish Natural Heritage (SNH)

SNH can supply details of Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs) that lie within the area of influence of your proposed abstraction.

12 Hope Terrace
Edinburgh
EH9 2AS

www.snh.gov.uk

The British Geological Survey (BGS)

BGS can supply information concerning the location of some boreholes but, as it is not obligatory to register boreholes less than 50 feet deep, its database is not exhaustive.

Murchison House,
West Mains Road,
Edinburgh
EH9 3LA

www.bgs.ac.uk

The Coal Authority (CA)

The CA can supply information on historic coal mining activities that may have resulted in groundwater of poor quality.

The Coal Authority
200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.coal.gov.uk

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