

Cemetery Development Services Limited

APSE... Groundwater Management
“Grey water: the law is black and white!”

April 2018

Space Information		
SPACE ID:	Sections:	Total spaces: 23922
103.1.5	Block:	Total burials: 19009
103.1.6	Lot:	Total markers: 48
103.1.7	Grave:	Total deeds: 30
103.2.1		
103.2.2		

Deed	Permission	Care Fund
Ownership:	Burial	Marker

Burial ID:	RUR-1-001-1254	Edit	Close
Burial Type:	Grave - Full Size	Add	Delete
Burial Date:	06/15/1926		
Interred:	Hier. Paane	Info	
Relationship:	HUSBAND		
Authorized By:			
Funeral Home:	Funeral Home		
Remarks:			
Marker Used:	S		
Vault Name:	Unknown		



**Cemetery
Development
Services**

Groundwater Protection

Protection of groundwater is not advisory, it is the law!





Groundwater Protection

Underground and under threat

Groundwater:

- It provides water for rivers, wetlands and water supplies.
- It supplies tap water for 16 million people across England and Wales.
- It sustains the flow and ecology of our rivers, particularly in dry weather.
- It is important for both industry and agriculture.
- In some places, it may be the only practical source of fresh water.



Groundwater Protection

Underground and under threat

The volume of stored groundwater is enormous. The sandstone aquifer under the Vale of York and the Chalk aquifer in Hampshire each cover nearly the same area as Greater London. Each stores at least 5,000 billion litres. In comparison, Europe's largest man made lake, Kielder reservoir in Northumberland, stores 200 billion litres.

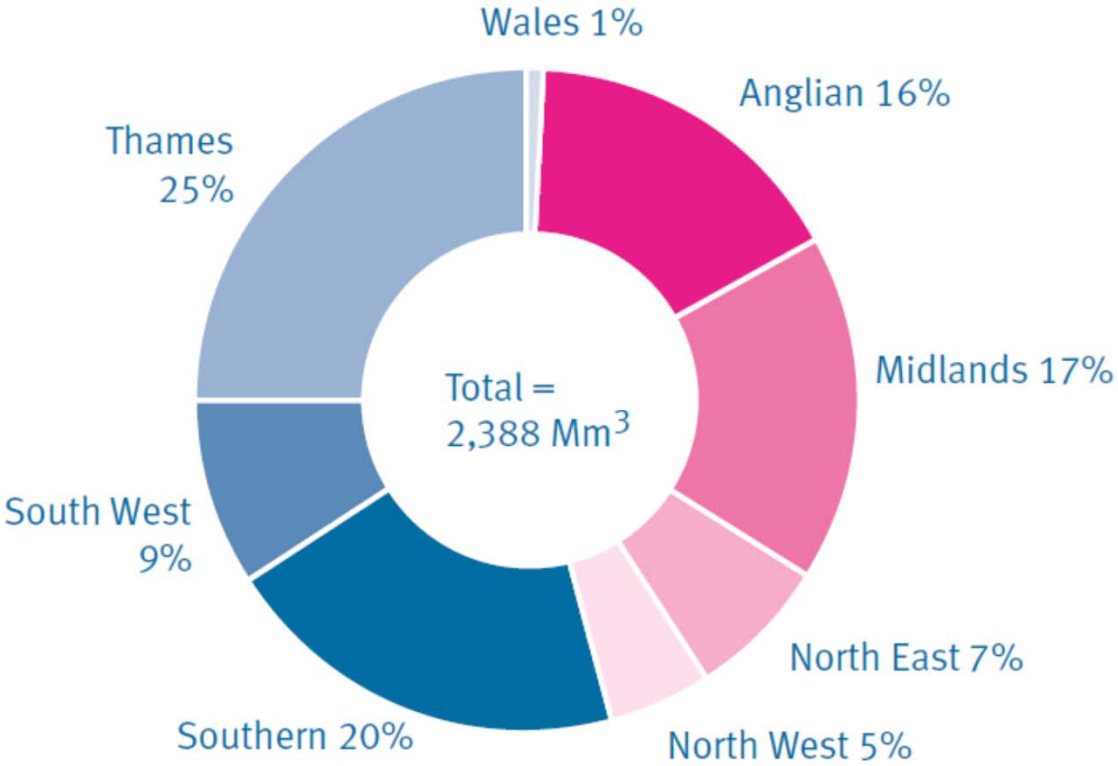
1.3 billion litres are used in Greater London everyday.

Groundwater Protection



Groundwater abstraction

Percentage of total abstracted

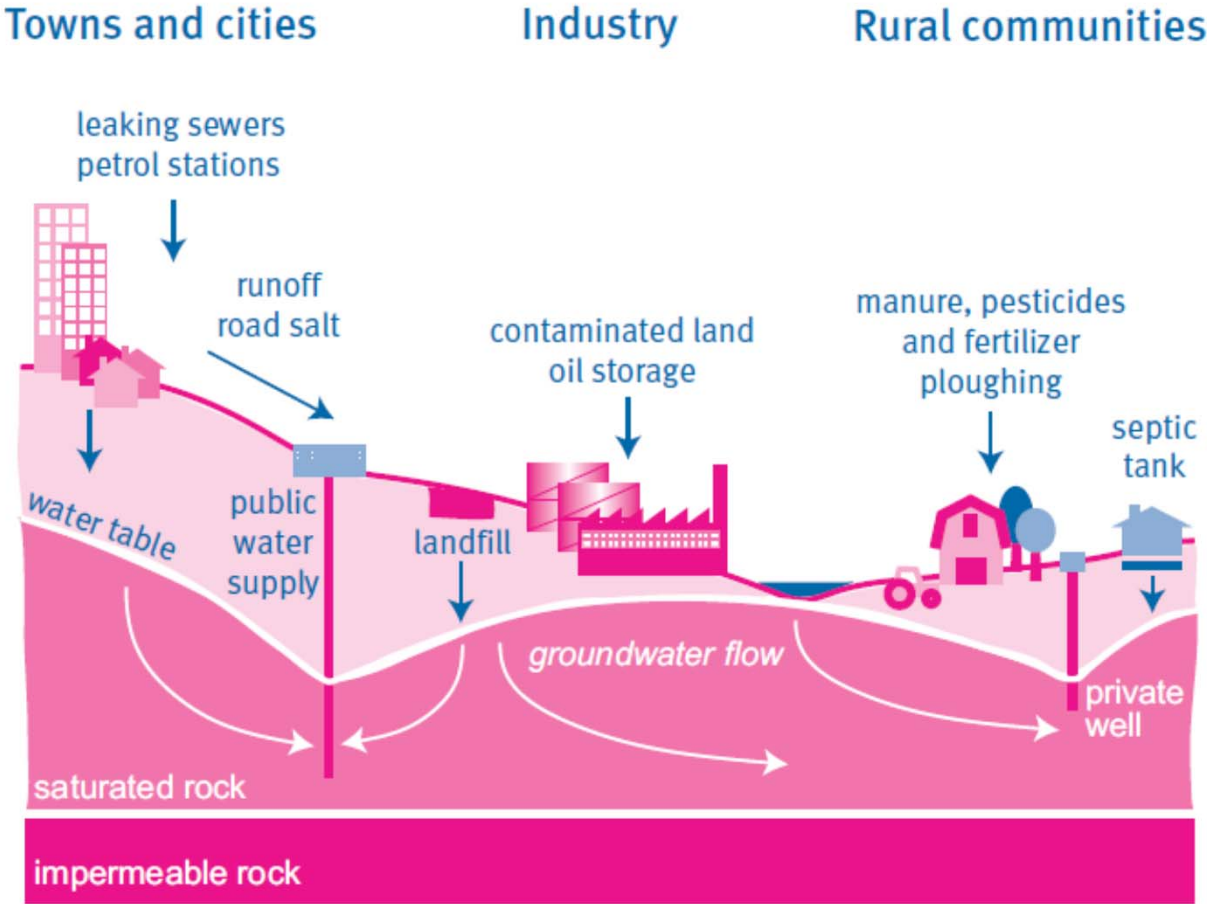


Environment Agency

Groundwater Protection



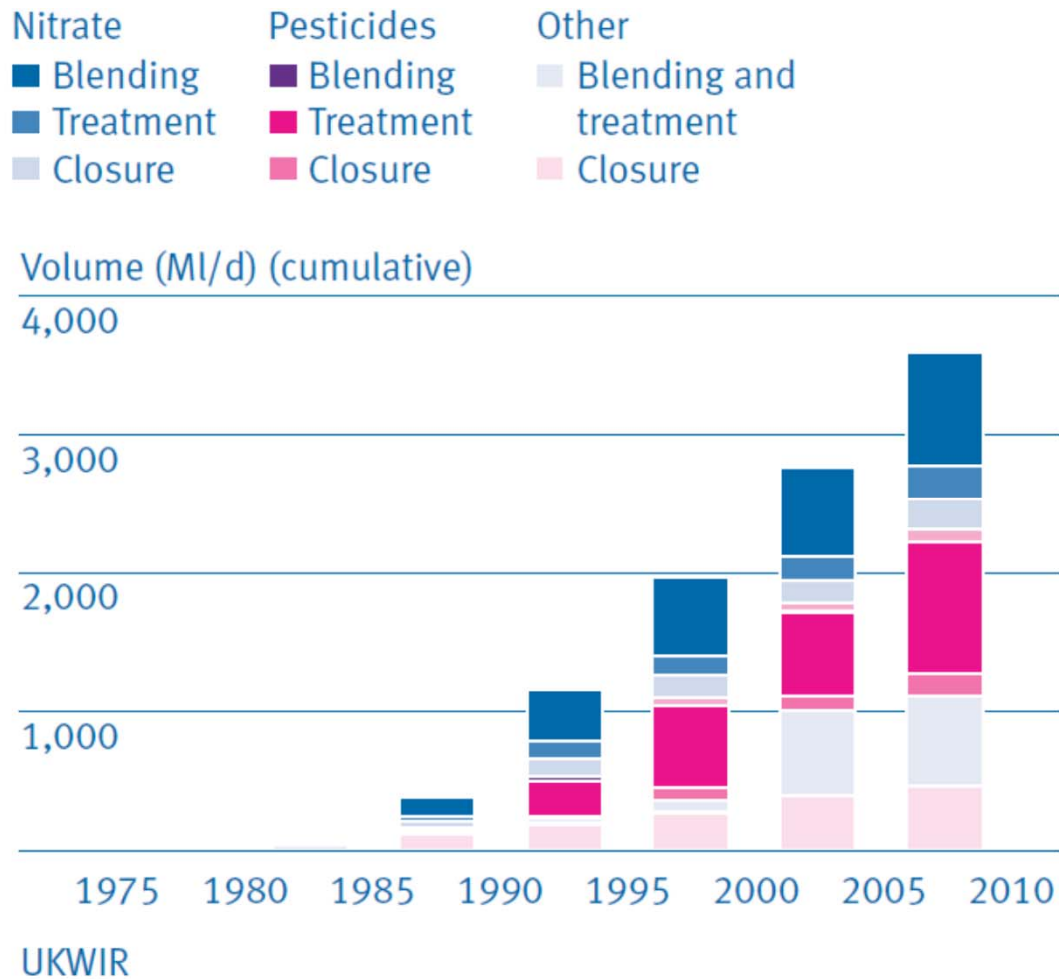
Threats from pollution



Groundwater Protection

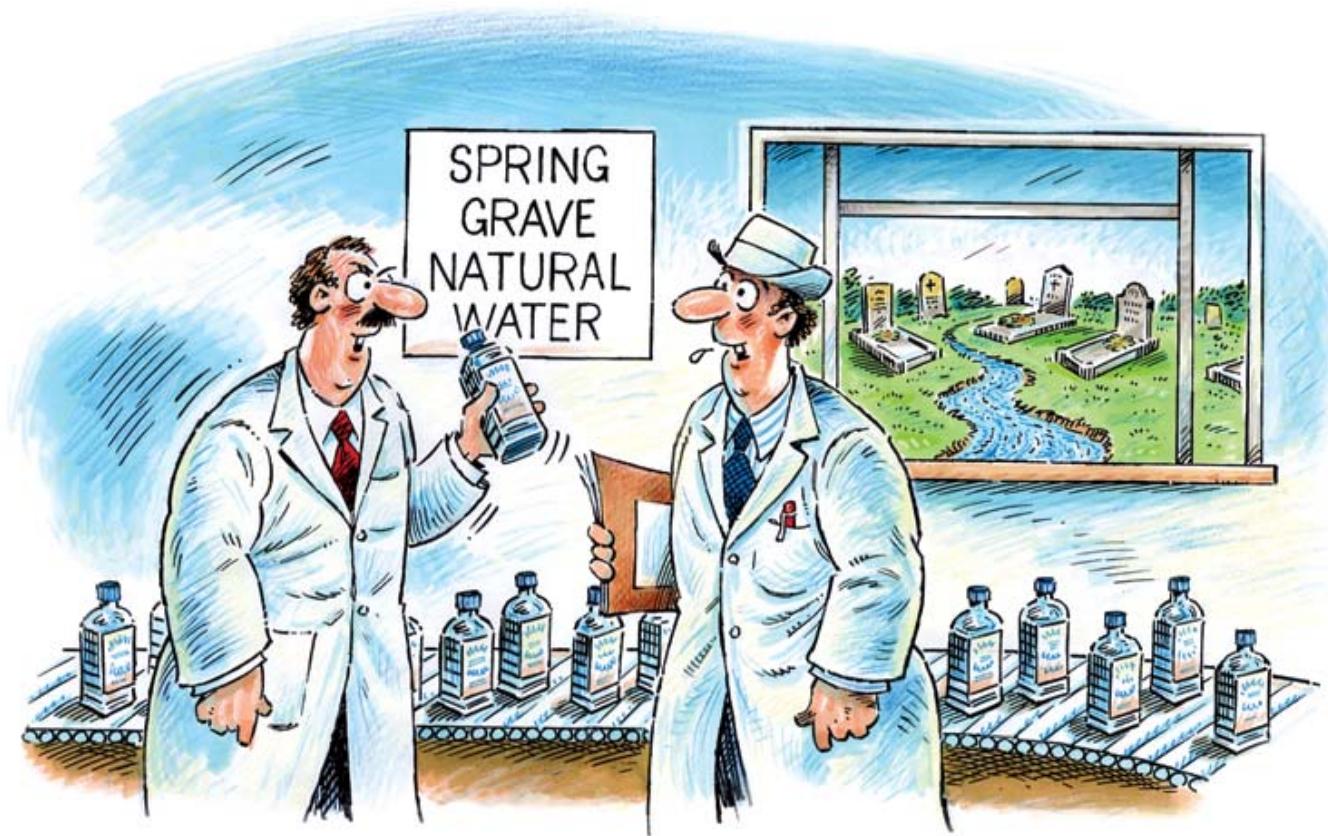


Public groundwater supply affected by pollution



Groundwater Protection

Polluted soil: water can be fatal





Grey water contaminants from cemeteries

Bacteria

- Faecal streptococci
- C.difficile
- C.tetani
- Pseudomonas aeruginosa
- Botulism
- Leptospirosis
- Other coliform and clostridia

Virus

- Hepatitis

Protozoa

- **Cryptosporidium**

Organic elements and compounds

- Formalin
- Ammonium
- Sulphides
- Chlorides
- Mercury

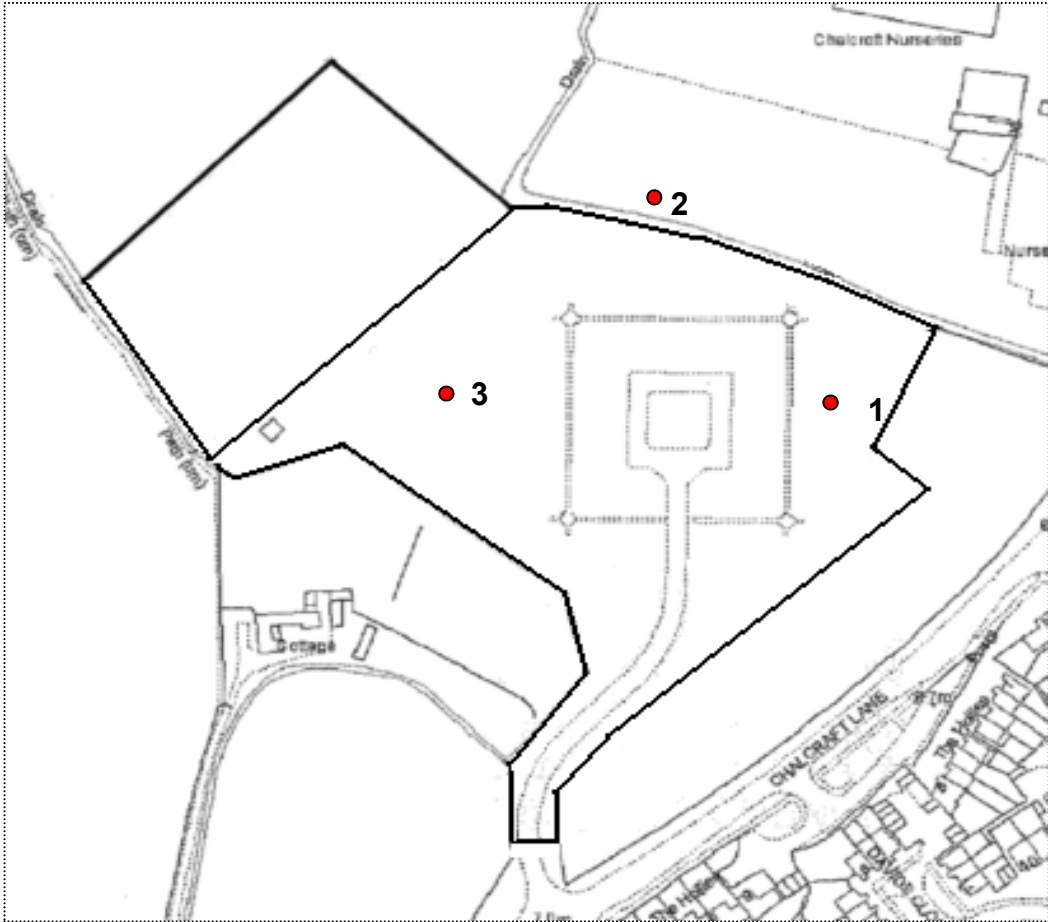
Prions

CJD

Groundwater Protection



Grey water contaminants from cemeteries



Map showing piezometer position

KEY	
●	Piezometer ID number and position

Location	BOD mg/l	COD mg/l
1	5	162
2	17.4	215
3	170	1810

Groundwater Protection



Location	BOD mg/l	COD mg/l
1	5	162
2	17.4	215
3	170	1810

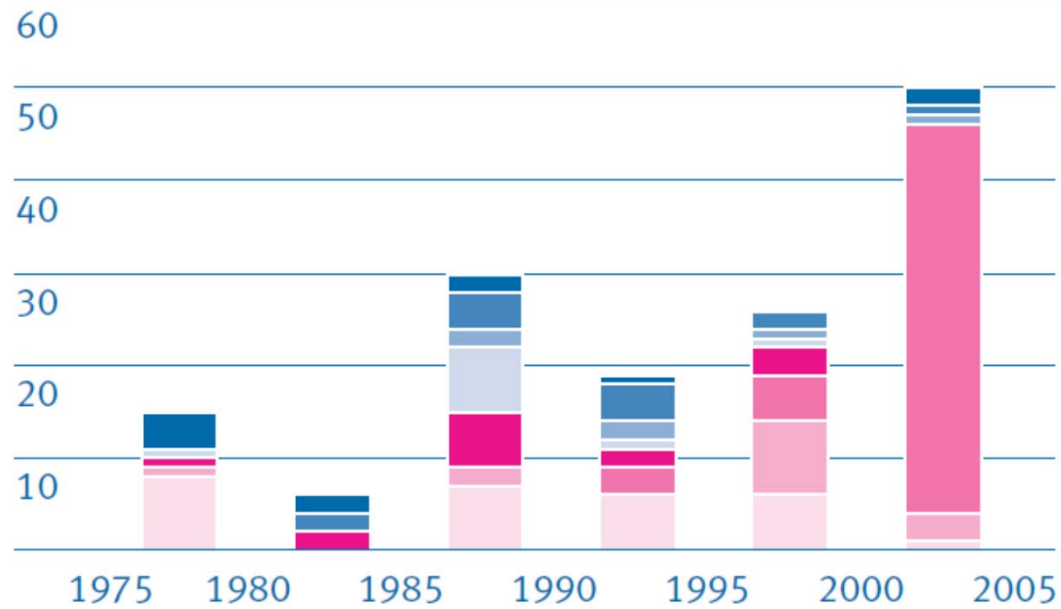
	Safe Limit mg/l
BOD	30
COD	250

Groundwater Protection

Groundwater sources closed due to pollution

- Salinity
- Misc point source
- Hydrocarbons and solvents
- Iron/manganese
- Other micro
- Cryptosporidium
- Pesticides
- Nitrate

Number of sources



UKWIR

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Familiar scenario?



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Groundwater Protection



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Guidance

Cemeteries and burials: groundwater risk assessments



“....some sites with existing planning permission, such as existing cemeteries, may need some form of intervention to control groundwater levels. For example, artificial drainage and abstraction for removal. You must collect any artificially drained groundwater, treat it as contaminated, and dispose of it as foul water”



“Manage existing cemeteries to limit environmental impact. For example, use methods such as artificial drainage to reduce the risk and meet the minimum requirements where possible. Any extension to an existing site must comply with the [requirements for new cemeteries and extensions](#). All existing sites should have an appropriate [risk assessment](#)”



Groundwater Protection

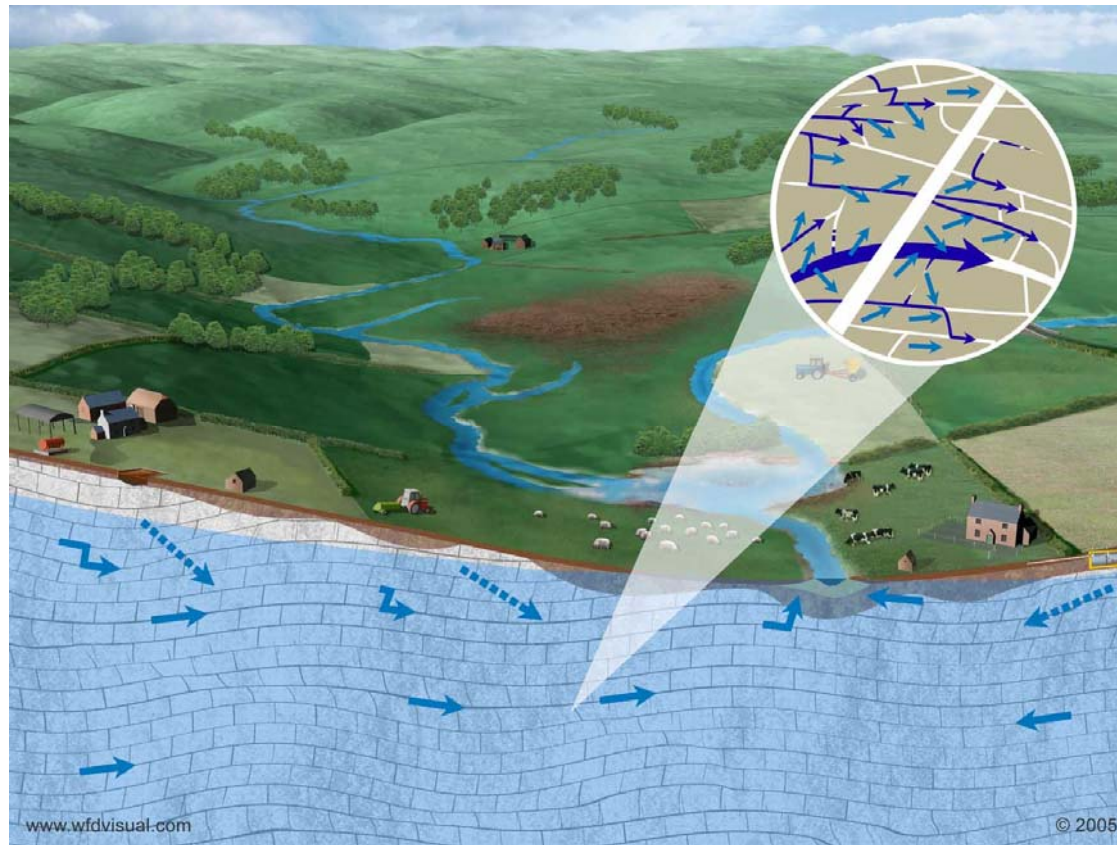
Undertaking a risk assessment

Assessment tools

Groundwater Protection

Site risk assessment

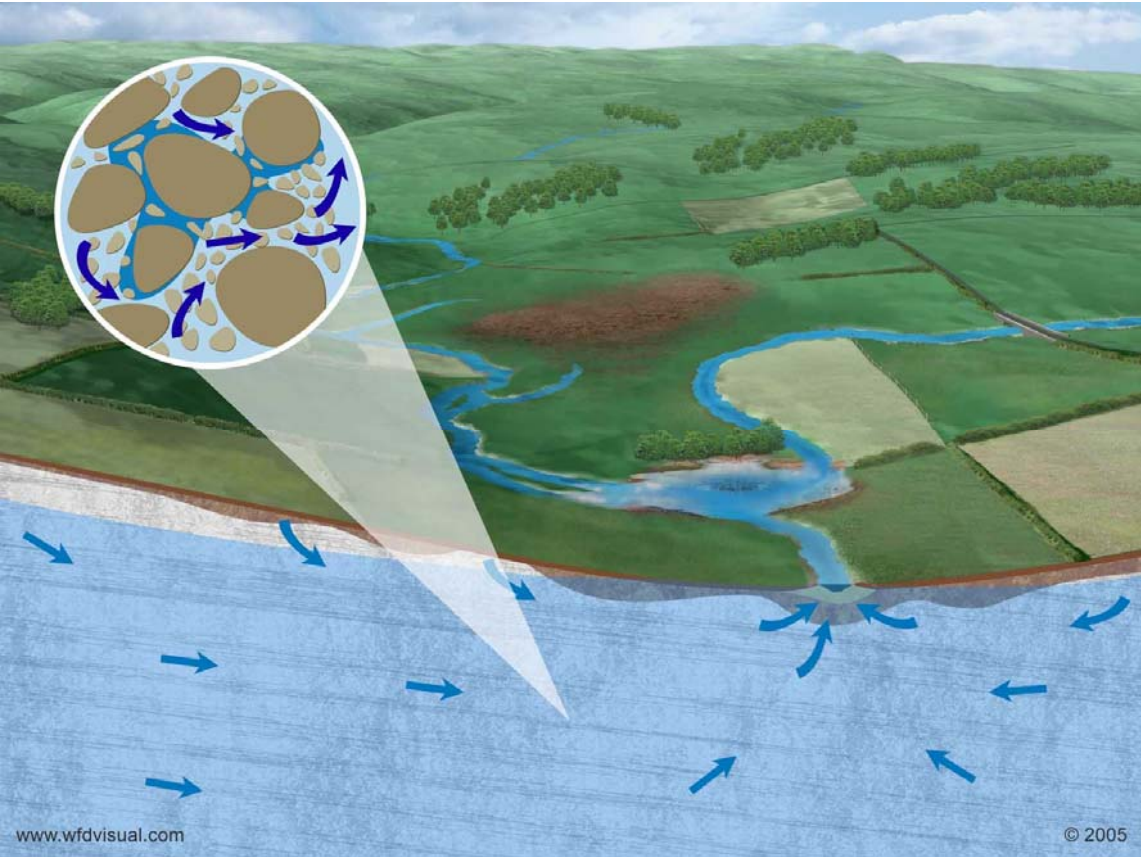
Fractured or fissured soils, high risk of groundwater pollution due to rapid movement of leachate.



Groundwater Protection

Site risk assessment

Granular soils, lower risk of groundwater pollution due to slow movement of leachate and higher CEC.

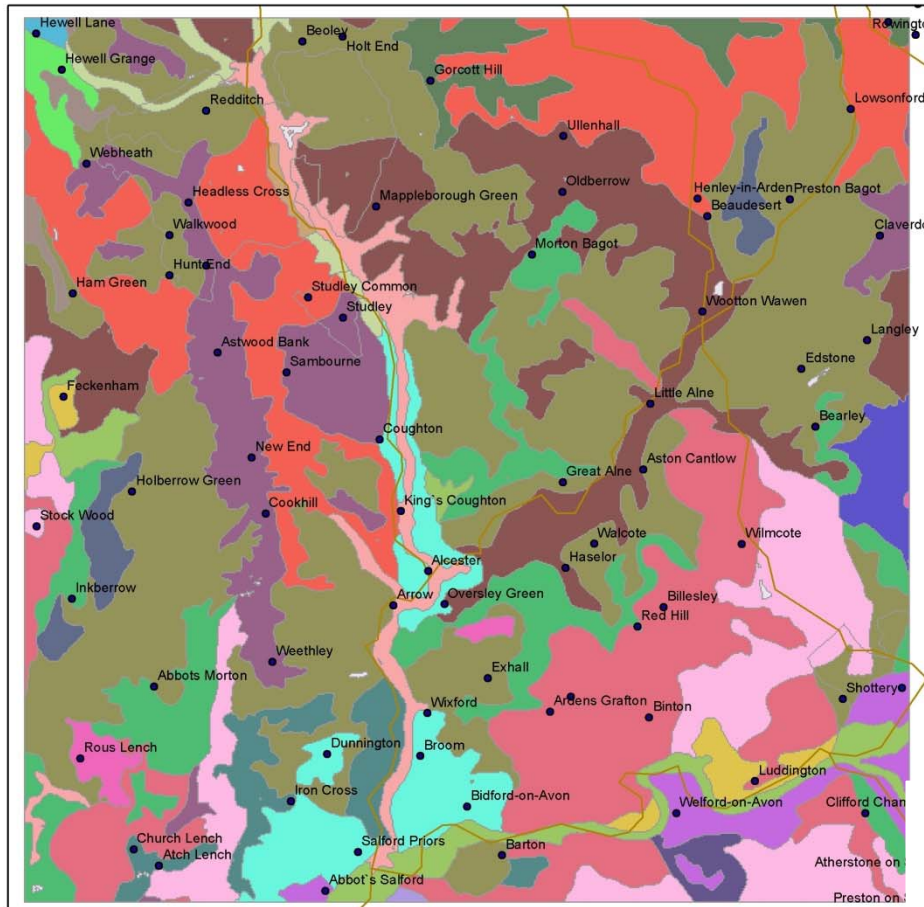


Groundwater Protection



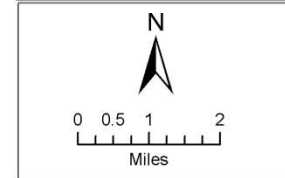
Site risk assessment

Soil survey maps provide information of near surface soil type and characteristics to help determine water movement and pollution absorption.



Legend

ARROW	FLADBURY 2
BISHAMPTON 2	FLINT
BRIDGNORTH	LAKE
BROCKHURST 1	OAK 1
BROCKHURST 2	RAGDALE
BROMSGROVE	RIVINGTON 1
CLIFTON	SALOP
COMPTON	SALWICK
DENCHWORTH	WHIMPLE 3
EVESHAM 2	WICK 1
EVESHAM 1	WICKHAM 2
FLADBURY 1	WIGTON MOOR
	WORCESTER

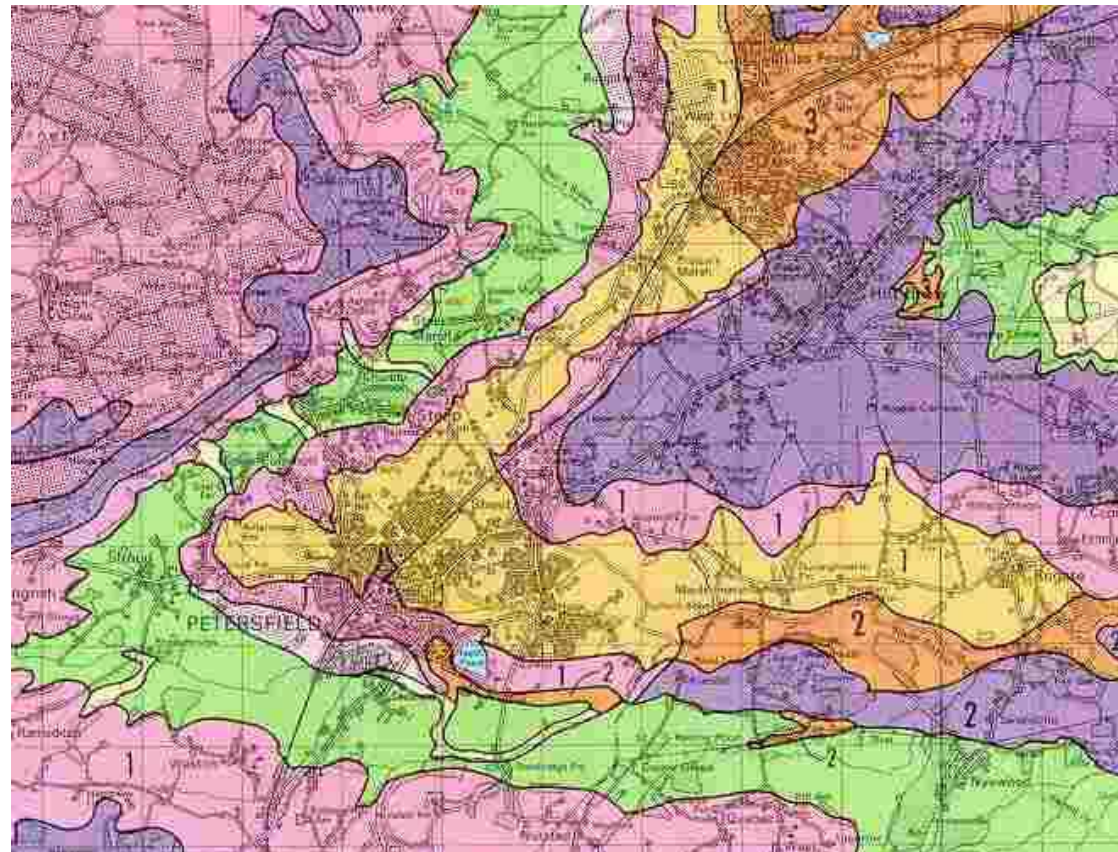


Groundwater Protection



Site risk assessment

Soil survey in conjunction with geology maps help to construct groundwater vulnerability maps.



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Groundwater vulnerability superficial

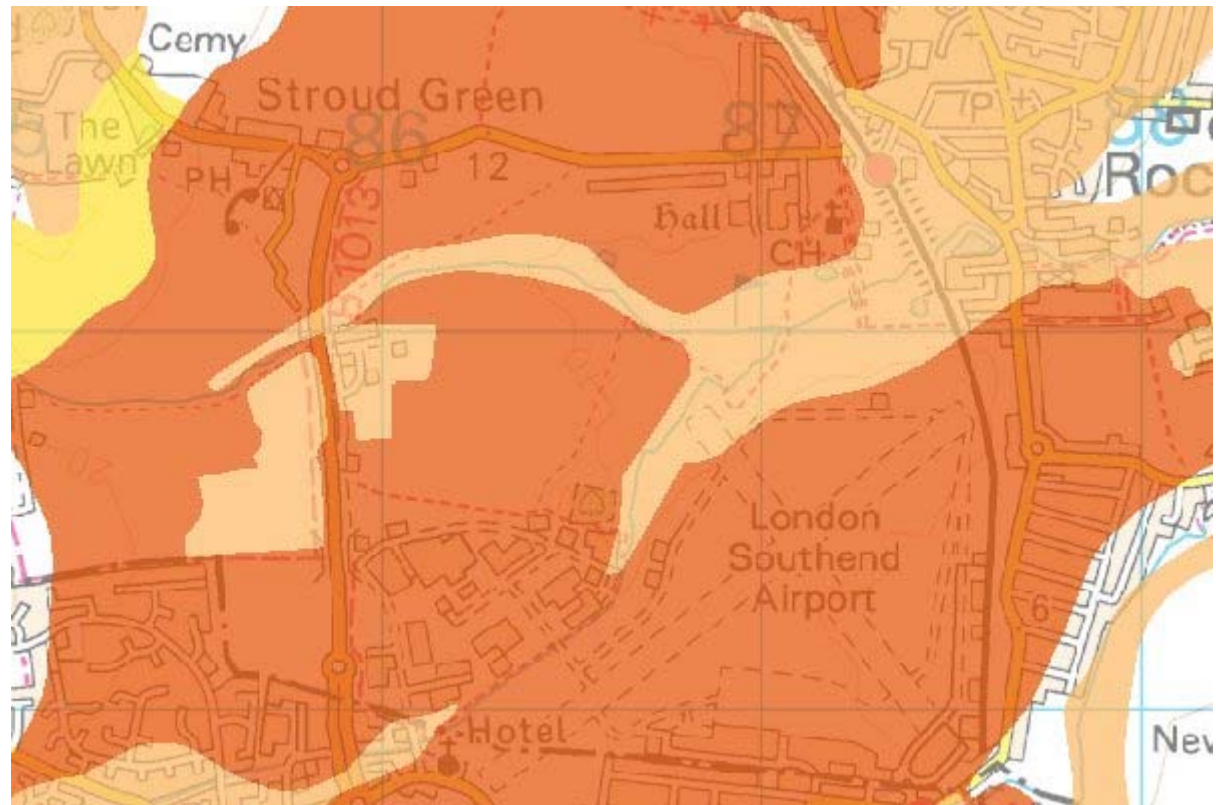
Principal
Secondary A
Secondary B
Secondary undifferentiated
Unknown





Groundwater vulnerability bedrock

Principal
Secondary A
Secondary B
Secondary undifferentiated
Unknown

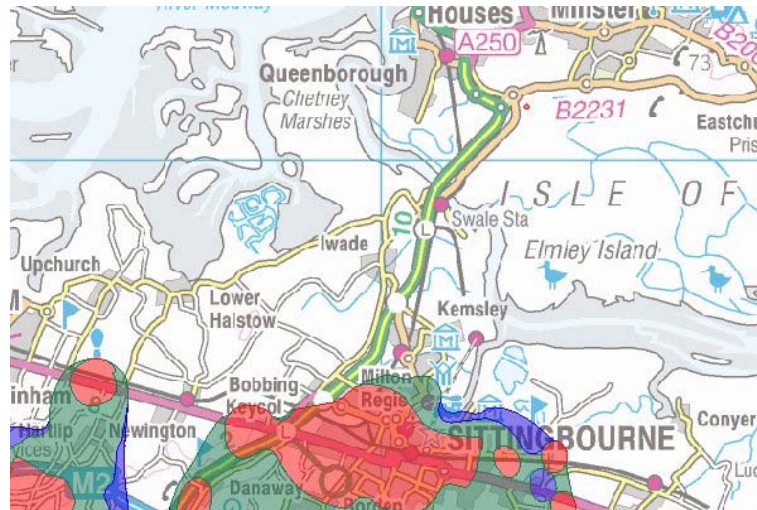


Groundwater Protection

Site risk assessment

Source Protection Zones

One of the most important tools for site selection and new developments are the Source Protection Zone models. These indicate the minimum, area of protection required around abstraction points.



Each zone has three subdivisions for each source (EA (1996)), moving out from the source

these are:

- **Zone I (Inner Source Protection);**
- **Zone II (Outer Source Protection);**
- **Zone III (Source Catchment).**

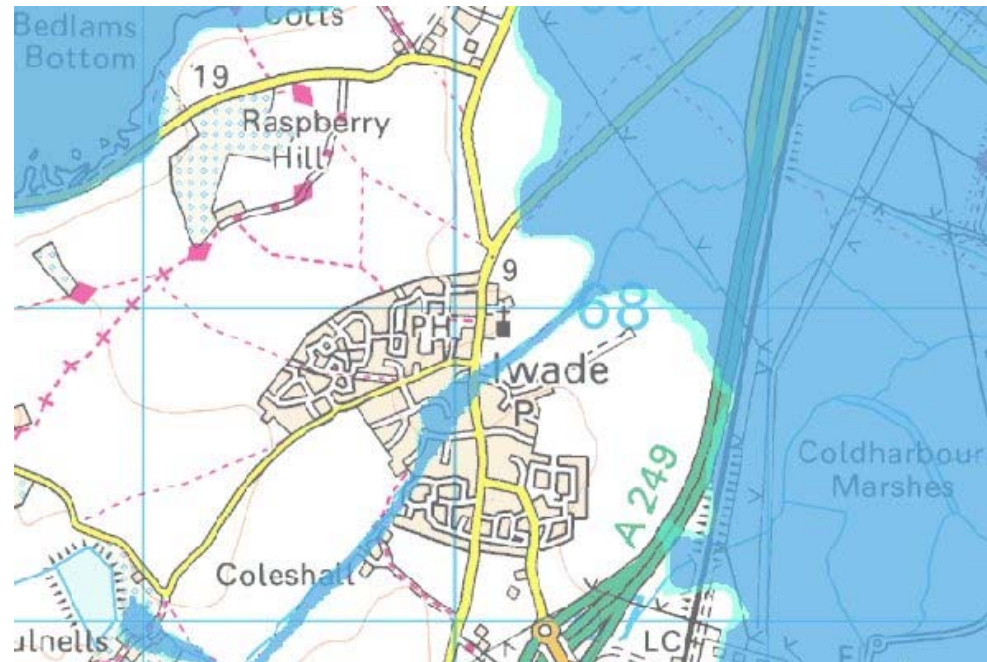
Groundwater Protection



Site risk assessment

Flood risk

Other tools worthy of consideration are flood risk maps. Flooding of a contaminated site can be a major cause of surface water pollution. All new developments should consider the exposure and risk to flooding in 1:100 year cycles.





The Law

Under EA GP3 guidelines, the undertaking of CLRA and Groundwater Audit's should only be undertaken by qualified personnel with environmental or other suitable earth science qualifications.

Groundwater Protection



The Law

P12-1 Planning

We will object to the siting of any new cemetery, or the extension of any existing cemetery, within any SPZ1 or 250m from the source, whichever is the greater distance.

P12-2 Planning


We will object to or may refuse to permit new or existing cemeteries planned for use in mass casualty emergencies if they are in SPZ1 or within 250m of the source abstraction, whichever is the greater distance. Where there may be a risk of disease transmission into groundwater we will extend our objection to SPZ2 or 250m, whichever is the greater distance.

P12-3 Planning

Outside the zones of objection above we will apply a risk-based approach to assessing the suitability of sites. We will place a high priority on protecting groundwater within major/principal aquifers and groundwater catchments for drinking water supply, see Figure 1.1. If at all possible we seek to avoid new cemetery developments for greater than 100 graves in these areas except where the thickness and nature of the unsaturated zone or impermeable formations beneath the site protect groundwater. Note that all cemetery developments and burials must maintain an unsaturated zone below the level of the base of the grave(s). We will work with the local authorities to identify alternative options where necessary.

P12-4 Influencing

We would not expect to be consulted on home burials or sites used for single burials but would expect that the site should conform to the requirements set out in the burials guidance (Environment Agency, 2006).



Groundwater Protection

The Law

Town and Country Planning Acts and Regulations (various dates)

- used by Local Authorities and the Secretary of State to control developments and land use in their area. Local authorities may apply conditions to ensure that groundwater is protected.

Water Resources Act 1991 – S161A Anti Pollution Works Notices

- gives EA powers under s161A of the Water Resources Act 1991 and the Anti-Pollution Works Regulations 1999 allowing Works Notices to be served to prevent or remedy pollution of controlled waters, and under the Groundwater Regulations 1998 to prevent pollution of groundwater.

Waste Framework Directive (75/442/EEC)

- The European Commission has communicated with government and indicated that for ethical reasons human corpses cannot be defined as substances or objects which might be subject to a discarding operation. As a consequence, EU waste legislation does not apply to human cemeteries.

Groundwater Regulations 1998

- Burial of human corpses can result in discharge of listed substances to groundwater. They are therefore covered by the requirements of the Groundwater Regulations. Individual burials spaced out over time will only release trivial amounts of listed substances. These are considered to fall under the *de minimis exemption*. Large numbers of burials (>100 per annum) in a short time, or the cumulative effects of many individual burials may cause groundwater pollution. **In this case the EA will where appropriate use their powers under the Groundwater Regulations to control or prohibit the burial. This has specific relevance to policy P12-2 but will apply more generally.**



Groundwater Drainage

- **Conclusion**

- Groundwater protection is a ***statutory*** requirement
- Undertake detailed survey to understand all issues and likely costs
- Ensure that a full groundwater monitoring system is in place before and after cemetery drainage and construction
- Existing cemeteries should be undertaking risk assessments and/or monitoring groundwater as a matter of course
- Ensure all pollution risk is mitigated from the surface to final outlet