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PRIVATE WATER SUPPLIES RISK ASSESSMENT

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WHAT WE'LL TALK ABOUT

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- Based on a ppt by our Dr Phil Ham
- History of Boreholes
  - Different Types of Boreholes
- Risk Assessment
  - Why should we do it
  - What's really important
  - How to do it – the practicalities
- Case Studies
- Questions

TYPES OF BOREHOLES

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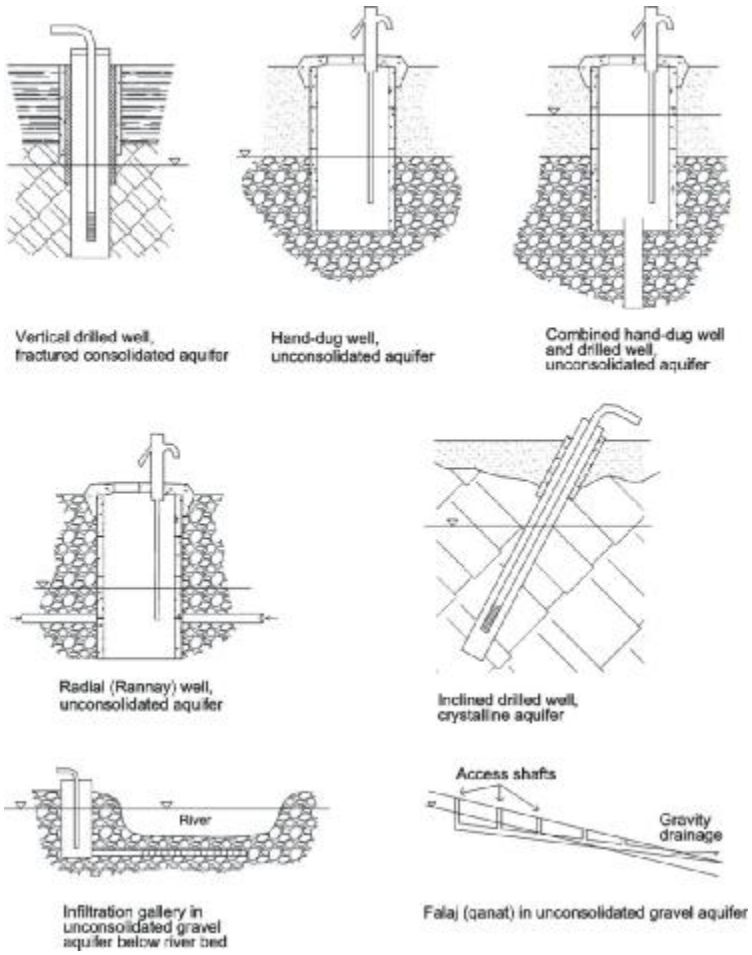
- Lots of different types:
  - Vertical, horizontal, inclined
  - Shallow or deep
  - Hand dug, drilled or a combination
  - Unconsolidated strata, hard rock
  - All with a different design and construction



GROUNDWATER SYSTEMS

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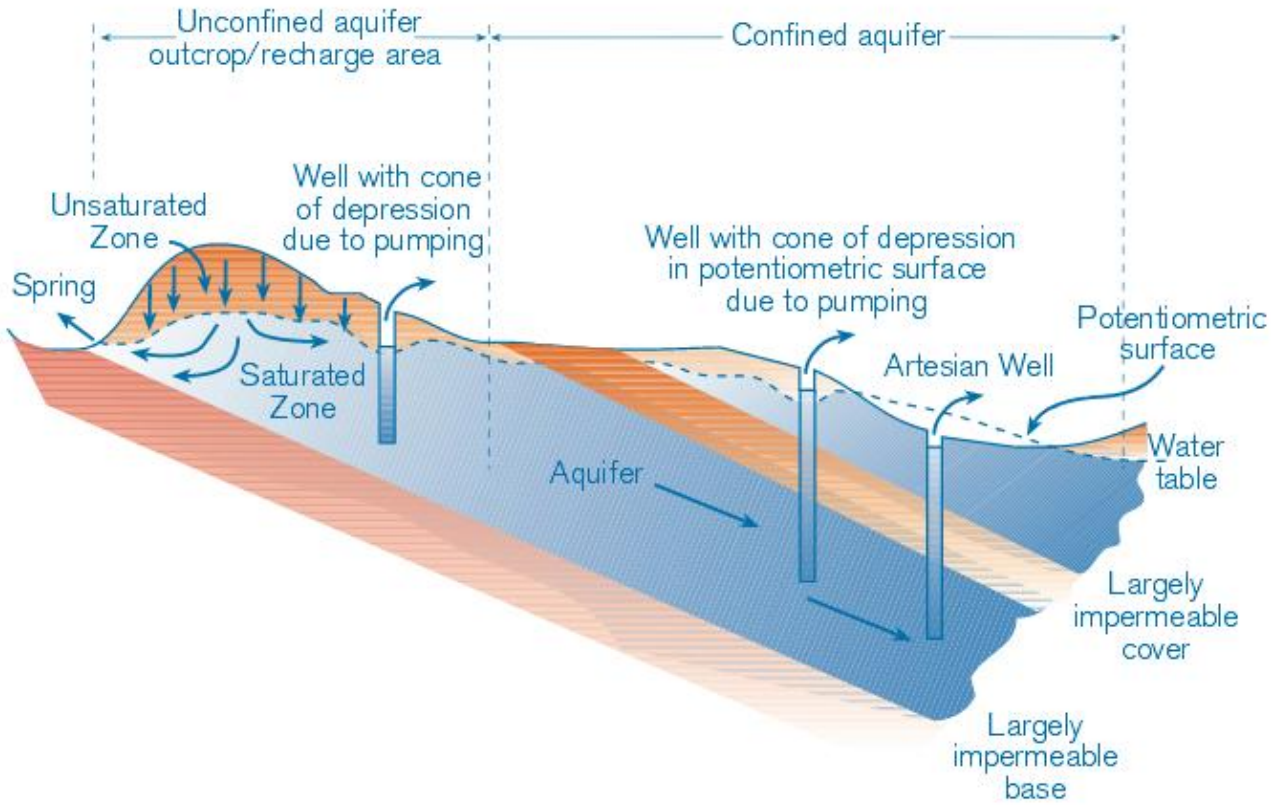

HOW OLD ARE BOREHOLES?

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- Boreholes have been around for a long time
  - A well in Cyprus apparently dates to between 7,000 and 9,500 BC (Fagan, 2011)
  - The shallow Hemudu well in the lower Yangtze coastal plain in China has been dated to c.3,700 BC (C14 age for the wooden piles around the well; Zhou et al. 2011)
  - "… Isaac's servants dug in the valley and found there a well of springing water….." (Genesis 26:19)

WHAT DO BOREHOLES LOOK LIKE?

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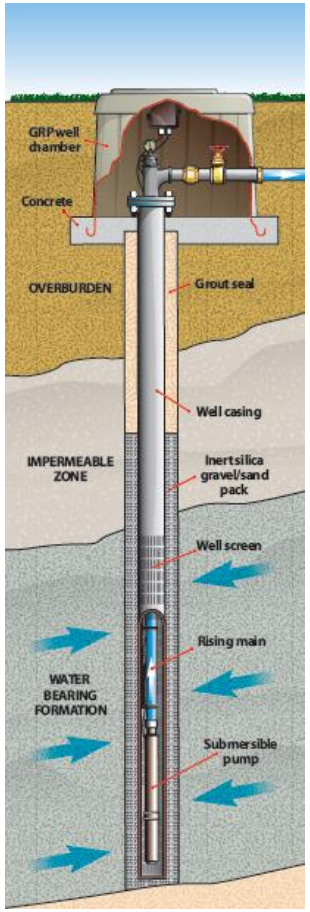
- They can be difficult to spot!
- The most important bit is below ground



WHAT DO BOREHOLES LOOK LIKE?

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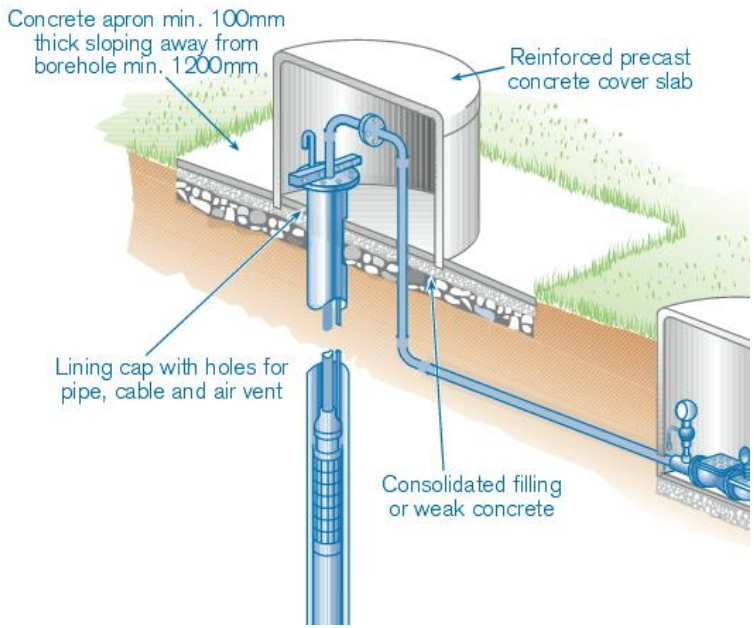
- If you're lucky…



HOW DO BOREHOLES WORK?

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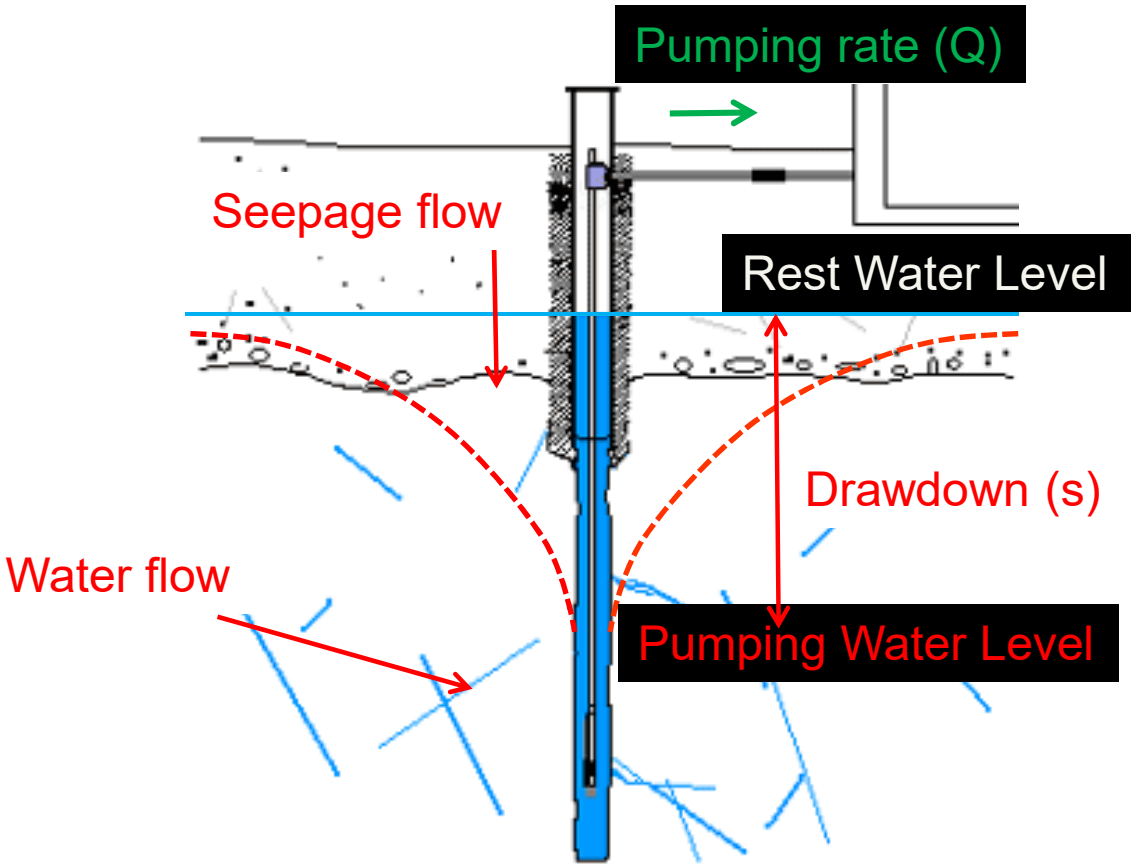

WHEN IS A BOREHOLE NOT A BOREHOLE?

- Catchpits – these are the dangerous ones

These are not springs!!!

WHEN IS A BOREHOLE NOT A BOREHOLE?

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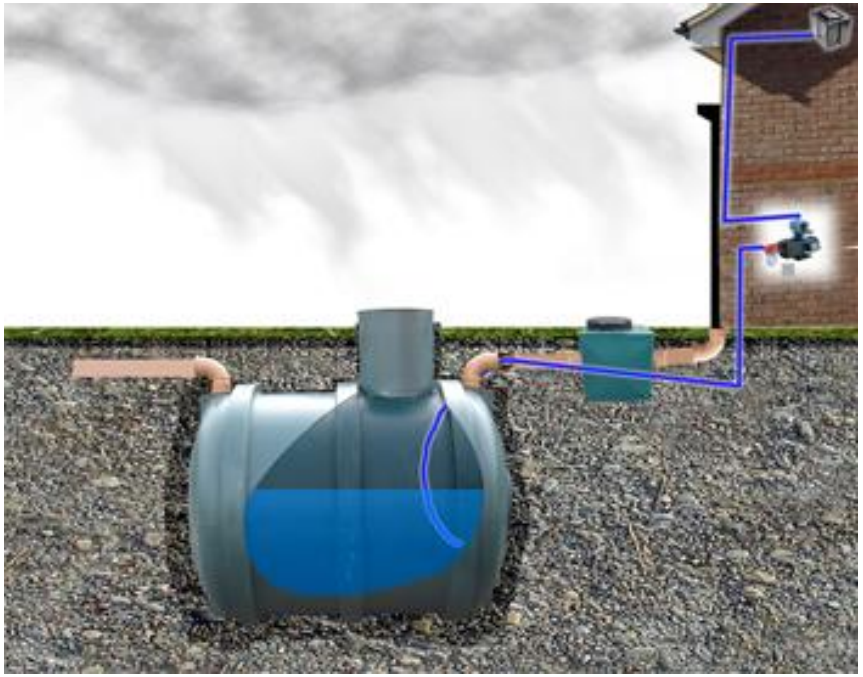
- Cisterns (rainwater harvesting)



WHEN IS A BOREHOLE NOT A BOREHOLE?

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RISK ASSESSMENT - RATIONALE

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- Methodology developed following the outbreaks of *E. coli* O157 in the 1990's
- Fundamentally, risk assessment should help keep drinking water safe
- Support compliance monitoring
- Statutory requirements
  - PWS Regs.
- Tools available to help
  - PWS technical manual
  - Main focus should be on site setting

THE CHALLENGES

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- Understanding boreholes is a fundamental part of risk assessment …but **NOT** a key criteria for being **an EHO**!
- EHOs will generally be interested in small, domestic supplies – these are often the most obscure
- Does the water need to wholesome for the intended use?

DOMESTIC BOREHOLES

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- Essentially unregulated
- No planning permission required
- No other local authority intervention
- No Environment Agency consent or licence required (if <20m^3/day)
- There is only a statutory requirement to register boreholes>15m in depth with the BGS – archive function only
- Guidance for construction and standards for well materials but no statutory requirements…**YET!**

WHAT'S REALLY IMPORTANT

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- Understanding as much as possible about boreholes without getting too 'techie'
- Environmental setting
  - What's physically going on around the source
- Borehole construction
  - Is there a sanitary seal?
- Keep it simple – if it doesn't feel right, it's probably not

FOUR S' IN ASSESSMENT

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- Every borehole risk assessment should consider:
  - Environmental **S**etting
  - Potential for **S**urface water ingress
  - Whether there is a **S**anitary seal
  - Common **S**ense

ENVIRONMENTAL SETTING

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- Geological (below ground) setting
  - Permeable or poorly permeable soil/rock
  - Connection between ground surface and borehole
- Surface water features
  - Nearby rivers, streams, lakes, ponds
- Other features
  - Septic tank, fuel storage, chemical storage, traffic, farm yard …
  - Nearby land use, e.g. agriculture, quarrying, manufacturing…

OTHER FEATURES

- Septic tanks
  - If you're on a PWS, you've probably got one
  - Type, age and construction
  - Point of discharge/overflow
  - Location relative to PWS
- Quarries & Mine workings
  - Hydraulic connections
  - Type of operations
  - Location relative to PWS

SURFACE WATER INGRESS

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- Are the headworks sealed?

SANITARY SEAL

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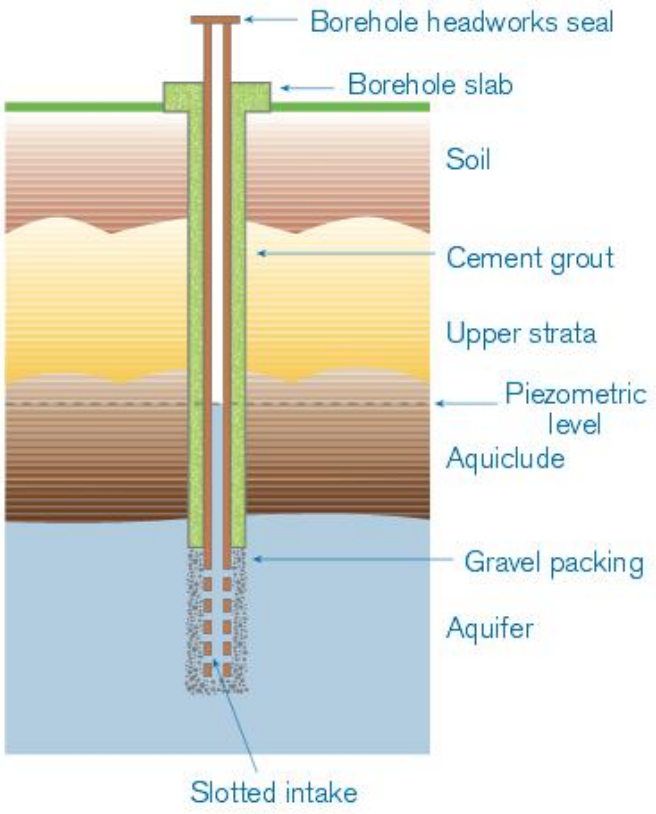
- Prevents ingress of surface water/shallow groundwater
- You can't see a sanitary seal
- Drilling logs and diagrams will help but need professional interpretation.
- If there isn't one, there may be **NOTHING** that the operator **CAN DO**.



COMMON SENSE

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- How does it look and feel?
- Relevant historical information
- Sampling results – if there is a consistent problem with failure, why?
- If there is consistent compliance, is there an issue or a problem?
- What is practically achievable?

CASE STUDY 1

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- A large estate in East Anglia has 27 water supply boreholes targeting the unconfined Chalk Group.
- Of these boreholes, 8 are used to provide a domestic water supply to approximately 150 properties across the estate, supplying 450 people at maximum occupancy.
- The quality of water in these boreholes is tested regularly by the local Environmental Health Officer.

METHODOLOGY

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- Obtained as much information as possible about the supply ahead of the visit– understand the site setting
- Each source was then visited to assess condition and treatment systems
- An assessment was carried out with the help of the proformas in the PWS technical manual, **BUT** with some additional interpretation

FINDINGS

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- Source 1 - Largest source
- 77 properties supplied by borehole
- 214 people at maximum occupancy
- 32m^3/day water use
- Borehole is located in an old tower
- Surrounded by grass fields and woodland
- No polluting activities
- UV and nitrate treatment at source – all appropriately maintained
- Borehole is sealed and has no access
- Borehole drilled to 87m in the 1920's
- History of compliance

WHATS THE RISK?

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- What did the tools say?
  - Proformas worked quite well
- The real risks are low
  - Good handle on site setting
  - No sanitary seal, but source is well protected
  - No surface water ingress
  - Appropriate and properly maintained treatment kit, history of compliance…

CASE STUDY 2

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- Small commercial supply in Lancashire, providing water for a farm and B&B. Maximum occupancy ~15 people.
- Single borehole.
- Limited testing since ~2009
- Lots of treatment equipment – all fully maintained
- Fantastic records and maintenance schedules
- Everything you could see looked clean & tidy
- But…

CASE STUDY 2

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- What about the source?

CONCLUDING REMARKS

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- Don’t be scared by boreholes and don’t be scared by risk assessment
- Use the tools as guidelines but make your own assessment
- Think about the 4 S’s
- If actions are required - think about what’s practically achievable
- Get specialist support when required