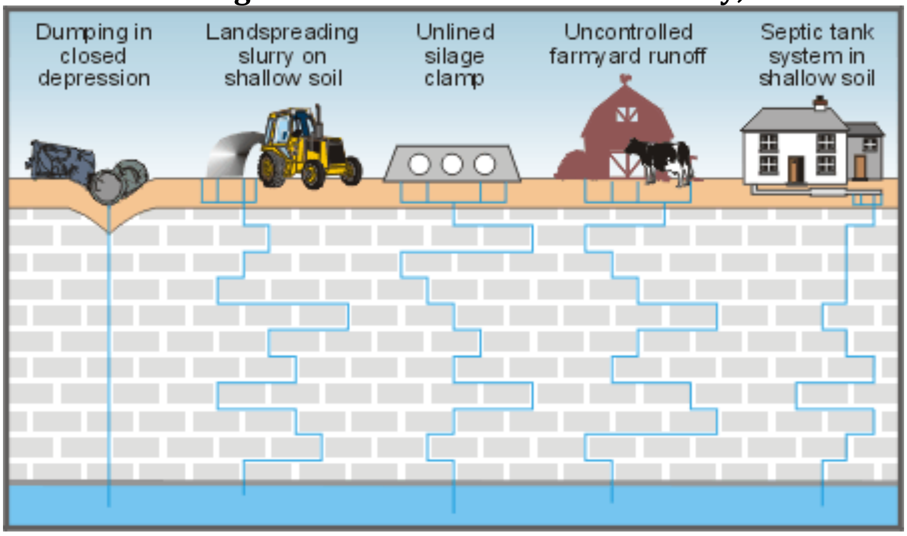
PATRICK BRIODY & SONS LTD

PRACTICAL STEPS TO PREVENT POLLUTION OF WELLS

Acknowledgement: Modified after Donal Daly, E.P.A.



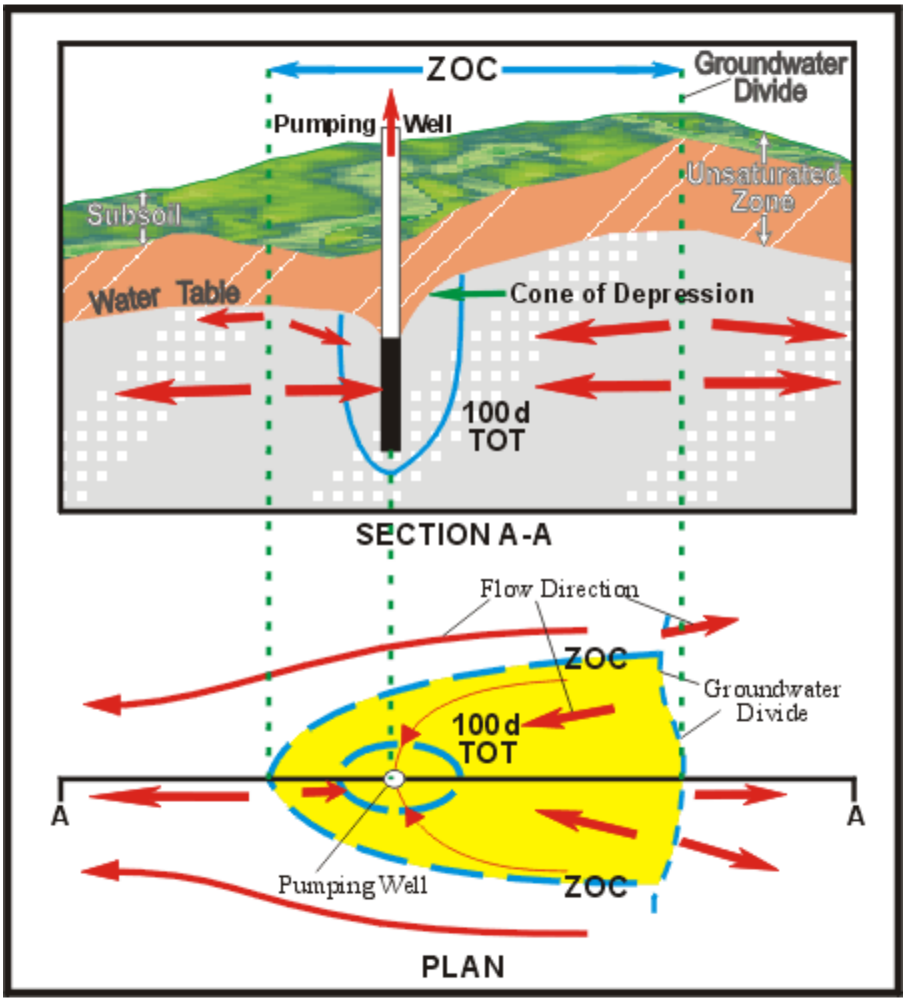
POTENTIAL POLLUTION HAZARDS IN RURAL AREAS

INTRODUCTION

Practical pollution prevention approaches depend on a variety of factors, as described below:- understanding your well,(public awareness & education) vulnerability assessments, hazard surveys to achieve proper siteing of wells. In addition monitoring of well water quality, assessments of water quality data, well construction, well sealing/sanitary protection and well disinfection ...all contribute to practical pollution prevention measures.

UNDERSTANDING GROUNDWATER FLOW TO WELLS

Prior to the start of pumping, water will have been flowing to and by the well from the up-gradient side, perhaps from a long distance – several kilometres in some instances, but usually at least tens of metres and frequently hundreds of metres. During pumping of a well, groundwater flowing by the well is drawn into the well as the nearby flowlines are directed towards the well (*see Cone of Depression in diagram below*). Pumping of the well causes some of the flowlines on the down-gradient side to reverse their direction and flow back towards the well. The entire land surface area contributing water to a well is called the zone contribution (ZOC). Contamination of a well can only occur from potentially polluting activities or hazards in the ZOC; consequently, acknowledging and understanding this area is a vital part of pollution prevention.



RECORDING WELL DETAILS

The GSI receives at least 200 queries every year from householders and engineers concerning problems with wells, eg. pollution, high iron, silting, caving-in, pump getting stuck. Assisting with these queries is frequently made more difficult by the lack of information available on the well. For householders, it is recommended that the following information should be collected and filed: Depth of well, well diameter,depth of lining specification of lining type and diametre of lining. In addition details on sealing & grouting of the well, depth to bedrock, type of subsoil, type of bedrock, water entry levels, depth to any cavities met in drilling are all important items that the Driller should record. Static water level below ground, measured pumping rate, drawdown during pumping, estimated maximum safe yield, chemical and bacteriological analysis, drilling contractor Company details, date of drilling, drilling method ....all of these items would greatly enhance all aspects of the groundwater supply from a borehole. This may seem a very comprehensive list to a householder at first glance, in fact the driller will provide most of the information and in any case it is basic information that will assist if a problem arises. If a householder is buying a house with an existing well, it is worthwhile checking on the precise location of the well, the well construction details and both water quality and quantity (output) information. If the existing water quality information is inadequate, insist on having the well tested; chemically and microbiologically.If the yield is not verified,insist on having a pumping test carried out by an independent Contractor.

VULNERABILITY ASSESSMENT

A vulnerability assessment of an area provides:

1. Information on the hydrogeological setting, in particular the permeability and thickness of the sub-soils;
2. Information needed to evaluate the degree of risk by an hazard;
3. Information that can be used in decision-making on the location of hazards, the site information requirements and the type of engineering methods needed to prevent contamination.

For example, a well located in an area with <1m of soil and subsoil over bedrock, i.e. an extremely vulnerable area, is at risk from nearby septic tank systems, land spreading, etc. in contrast, a well in an area with >10m of low permeability subsoil, i.e. low vulnerability, is well protected from contamination, and hazards such as septic tank systems and land spreading are unlikely to contaminate the well (provided surface water does not enter directly into the well). It is advisable for householders to check for outcropping bedrock and enquire about the depth to bedrock prior to buying a site, if they need to drill a well. Local authorities are advised to carry out a preliminary assessment of vulnerability prior to choosing sites for public supplies. Vulnerability maps have been completed for 9 counties- Offaly, Waterford, Tipperary (SR), Limerick, Meath, Wicklow, Clare, Laois, South Cork- and mapping has commenced in Kilkenny, Tipperary (NR), Monaghan, Roscommon and Kildare. However, a vulnerability assessment can be carried out, using the national guidelines (DELG/EPA/GSI, 1999a) on any site or area. The GSI can provide advice on this, if required.

The NSAI Bottled Water Standard recommends the casing and grout depths as shown in Table 1.

Depth to Bedrock (metres)	Overburden Permeable	Overburden Impermeable	Minimum Depth of Casing and Grout
< 10	X		15 m
10 - 15	X		5m into Bedrock
> 15	X		3m
< 7		X	12m
7 - 9		X	5m into Bedrock
> 9		X	3m into Bedrock

HAZARD SURVEYS
Local authorities are advised to identify and map existing hazards in the higher risk areas, particularly zones of contribution of significant water supply sources. This would involve conducting a survey of the area and preparing an inventory of hazards. Prior to purchasing a site or a house, householders should look at existing developments and potentially polluting activities nearby and, together with consideration of the vulnerability, assess the likely risk to the well. The treatment system on the site may be located a good distance downhill of the well, but the neighbour's system might be over the hedge, 10m away!

PROPER SITING OF WELLS AND HAZARDS
The location of wells and hazards that minimises the probability of contamination, depends on the following: *Hazard contamination loading (for example, the contaminant loading from a single house on-site wastewater treatment system is less than from a landfill); *vulnerability of the site/area: *Hydrogeology of the site/area; *Whether the hazard is inside or outside the ZOC of the well; *Distances (often called 'setback' distances) between wells and hazards; *The density of hazards; *The planning control measures for hazards; *Risk assessments and management. Groundwater Protection Schemes and appropriate Groundwater Protection Responses incorporate these above aspects and are set-out in the Joint EPA and GSI Department of Environment publication 'Groundwater Protection Schemes'. So, choose the site carefully. Be wary of using diviners. As a general rule, a well should be locate up-slope and as far as possible from potential pollution sources, such as farmyards and on-site wastewater treatment systems.

MONITORING OF GROUNDWATER QUALITY
Monitoring for contaminants provides direct information on contamination, and a lot of emphasis and perhaps even over-emphasis is given to monitoring of groundwater in EU countries. However, monitoring, while desirable and useful, only provides an indication of the presence or absence of contamination, and is inadequate by itself to ensure protection.

ASSESSMENT OF WATER QUALITY DATA
Water quality data, whether from a monitoring programme or once-off sampling, enable not only a check on the presence of contamination but also an assessment of the likely source of contamination. In assessing groundwater quality, the approach taken in the GSI is to distinguish between the terms 'contamination' and 'pollution'. Groundwater becomes 'contaminated' when substances enter it as a result of human activity. The term 'pollution' is reserved for situations where contaminant concentrations are sufficiently high to be objectionable e.g. above the EU maximum admissible concentration (MAC). As human activities have impacted on a high proportion of groundwater in Ireland, there are few areas where the groundwater is in pristine condition. Faecal coliforms, nitrates, ammonia, high K/Na ratio helps distinguish between septic tank effluent and farmyard wastes. The analyses can show potential problems and indicate likely sources but other information is needed to complete the assessment. Regular assessment is required to

prevent pollution and major incidents occurring. Parameters can be used to help indicate situations where significant contamination has occurred and action can be taken to prevent pollution.

Well Construction and Sanitary Protection Role

This is a means of preventing pollution that is within the control of the well owner who is planning to drill a new well.Where the well is already drilled limited improvements may be made including:

1. The annular space outside the casing should be filled with a suitable sealant, such as cement or cement/bentontie grout to prevent surface water runoff or shallow groundwater seeping directly into the well.

2. No unsealed openings should exist in the wall or along the joints of the casing.

3. A concrete slab, 150mm thick, should be keyed in around the casing to a distance of at least 0.5m from the casing.

4. The casing should protrude above the surface of the concrete slab.

5. A secure, watertight well cap should be fitted to prevent foreign matter or small
   animals & vermin from falling into the well.

6. A secure wellhead should be fitted on top of the manhole chamber.

7. If the general land surface around the well is depressed or susceptible to
   flooding, it should be raised and regraded so that it slopes away from the well.

8. If the well is in a field used by farm animals, it should be enclosed so that
   animals cannot get close- a distance of 10m from the well is recommended. Be weary of farm animals congregating near a well and the consequent concentration of faeces and urine in the area of the well.

TAKING RESPONSIBILITY, PUBLIC AWARENESS AND "COMMON SENSE"

'The primary responsibility for groundwater protection rests with any person who is carrying out an activity that poses a threat to groundwater'. This is the first sentence in 'Groundwater Protection Systems' (DELG/EPA/GSI 1999 (A)); it is a powerful principle that needs to be more widely accepted and followed. "Command and Control" regulations are unlikely on their own to ensure successful prevention of contamination. Therefore other alternatives, such as public education and awareness must supplement good planning regulations and enforcement. Greater awareness of the significance of hazards, such as septic tanks systems and farmyards, as a source of water pollution and as a health risk is required. Also, a greater appreciation and understanding of groundwater, which is 'out of sight, out of mind' for many people, is needed. Improved awareness would lead to a more responsible approach to environmental issues and the use of 'common sense' in dealing with wells and the possible impacts of human activities.

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