GROUNDWATER PROTECTION POLICIES AND LAND USE PLANNING

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RoI:Regulatory Roles

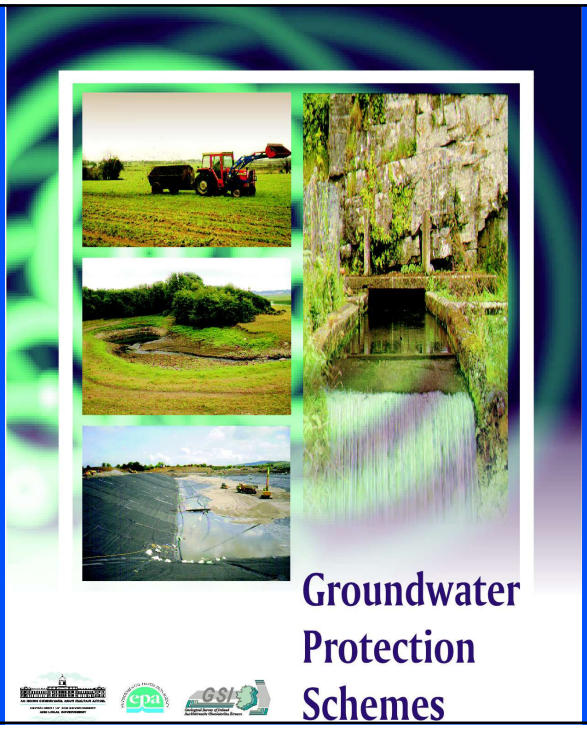
- Primary responsibility for management and protection of water resources rests with the Local Authorities and the Environmental Protection Agency (EPA) in the implementation of the Water Pollution Act and Regulations.
- The Geological Survey of Ireland (GSI) provides valuable hydrogeological technical support and prepares Groundwater Protection Schemes for Local Authorities.

RoI:Regulatory Roles

- The EPA in association with the GSI and DELG draft Groundwater Protection Responses for potentially polluting activities e.g. landfills, landspreading of organic wastes, onsite systems for single houses, (storage tanks, farmyards, motorways - in the future).
- The Department of the Environment and Local Government (DELG) is responsible for the development of policy in this area.

RoI Groundwater: A Major Resource

- 20-25% of drinking water overall
- >50% in many counties
- maybe >200,000 wells drilled; 10's thousands in use
- several 100s of new wells drilled each year
- Substantial resources unused



Groundwater Protection Schemes

Two Main Components

1. *Land Surface Zoning*,
   giving groundwater protection zones

2. *Groundwater Protection Responses* for potentially polluting activities
   - **degree of acceptability**
   - **conditions/restrictions**
   - **investigation requirements**

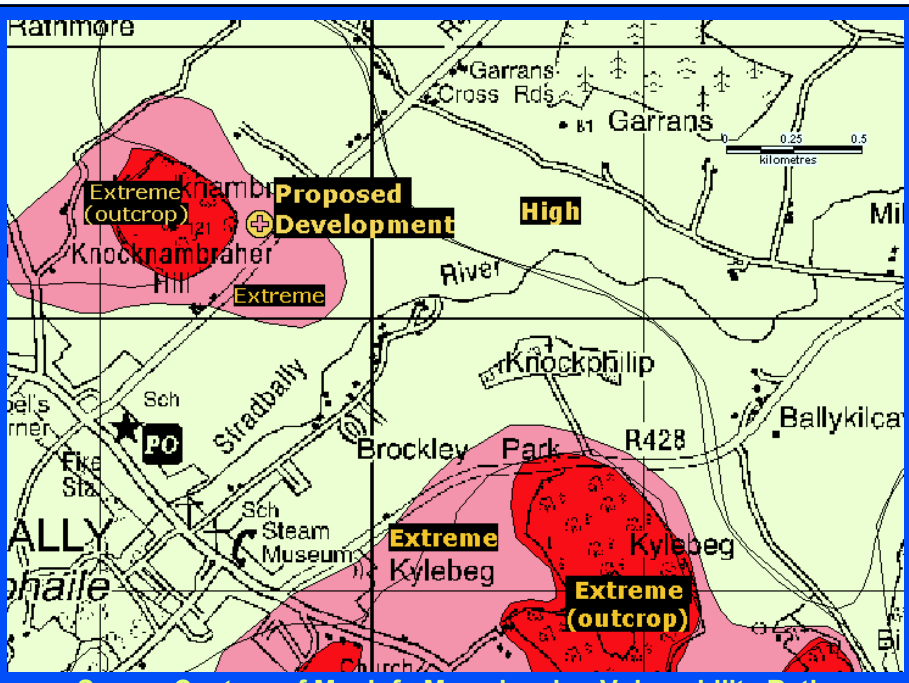
Both are encompassed in a GIS

Land Surface Zoning Component

3 Main Elements

- Division of the entire land surface on the basis of the Vulnerability of the underlying groundwater to pollution
- Delineation of Source Protection Areas (SPAs)
- Delineation of Aquifers

These elements combine together to give
Groundwater Protection Zones

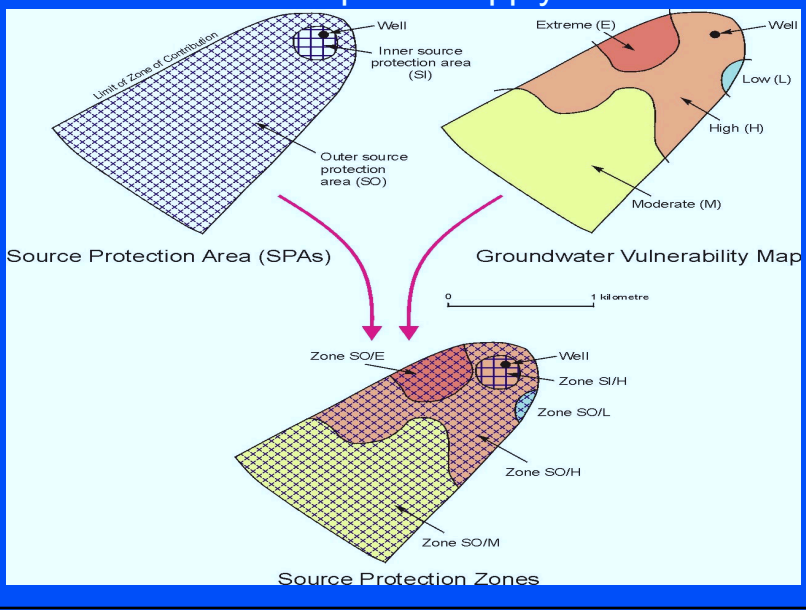


Screen Capture of MapInfo Map showing Vulnerability Rating

Source Protection Areas (SPAs)

- Inner Protection Area
  - to protect against microbial pollution
  - based on 100-day time of travel (ToT)
- Outer Protection Area
  - encompasses ZOC of source
- Boundaries of SPAs
  - Based on horizontal flow

Delineation of source protection zones (SPZs) around a public supply well



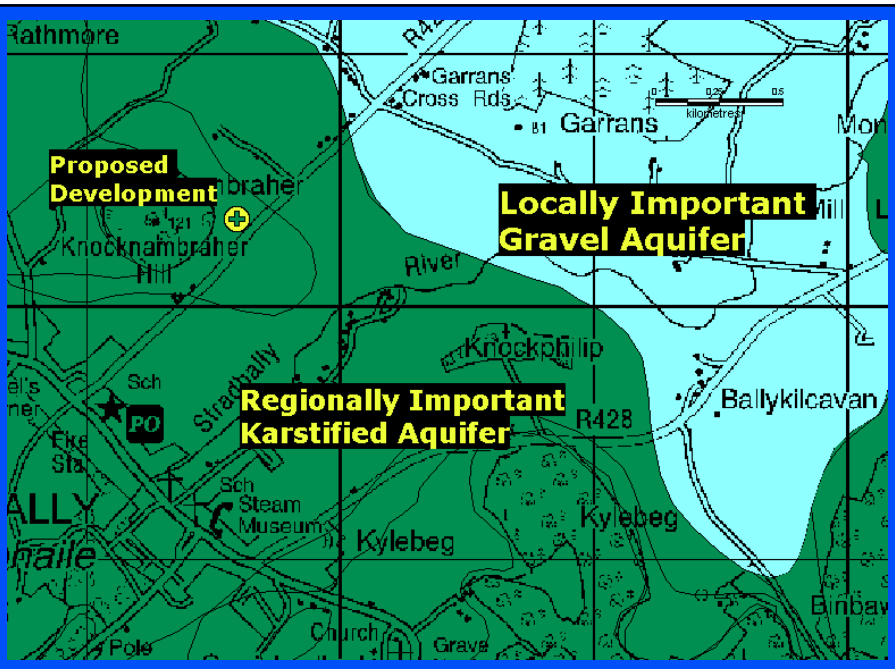
Matrix of Source Protection Zones

Obtained by superimposing the Vulnerability Map on the Source Protection Area Map

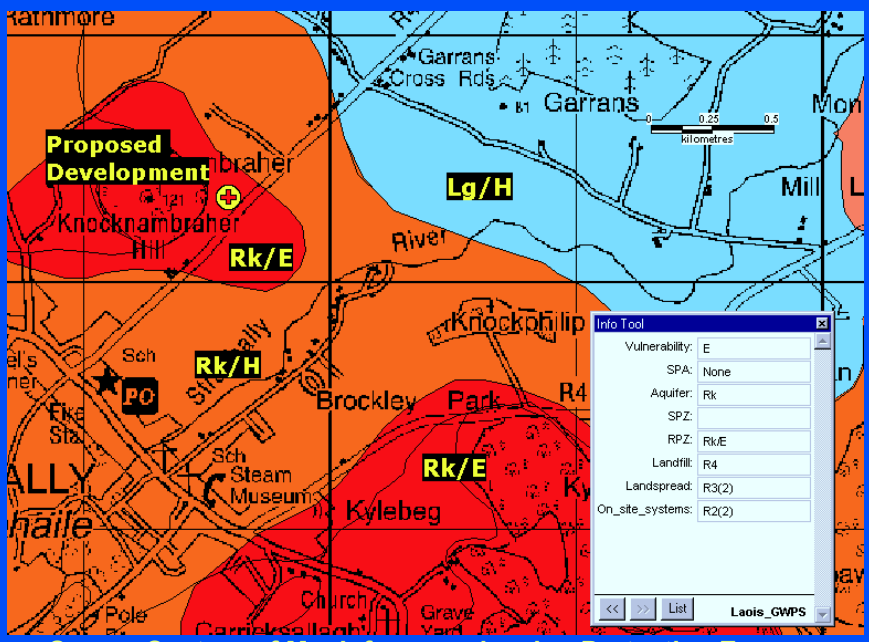
VULNERABILITY RATING	SOURCE PROTECTION ZONE	
	Inner (SI)	Outer (SO)
Extreme (E)	SI/E	SO/E
High (H)	SI/H	SO/H
Moderate (M)	SI/M	SO/M
Low (L)	SI/L	SO/L

Aquifer Categories

- Regionally Important (R) Aquifers
  - (i) **Karstified limestone aquifers (Rk)**
  - **(ii) Fractured bedrock aquifers (Rf)**
  - **(iii) Extensive sand/gravel (Rg)**
- Locally Important (L) Aquifers
  - **(i) Sand/gravel (Lg)**
  - **(ii) Bedrock which is generally moderately productive (Ll)**
  - **(iii) Bedrock which is moderately productive only in local zones (Lm)**
- Poor (P) Aquifers
  - **(i) Bedrock which is generally unproductive except for local zones (Pl)**
  - **(ii) Bedrock which is generally unproductive (Pu)**



Screen capture of MapInfo map showing Aquifer Classification



Screen Capture of MapInfo map, showing Protection Zones and Responses for a proposed development.

Matrix of Resource Protection Zones

Obtained by superimposing the Vulnerability Map on the Aquifer Map

VULNERABILITY RATING	RESOURCE PROTECTION ZONES					
	Regionally Important Aquifers (R)		Locally Important Aquifers (L)		Poor Aquifers (P)	
	Rk	Rf/Rg	Lm/Lg	L1	P1	Pu
Extreme (E)	Rk/E	Rf/E	Lm/E	L1/E	P1/E	Pu/E
High (H)	Rk/H	Rf/H	Lm/H	L1/H	P1/H	Pu/H
Moderate (M)	Rk/M	Rf/M	Lm/M	L1/M	P1/M	Pu/M
Low (L)	Rk/L	Rf/L	Lm/L	L1/L	P1/L	Pu/L

Groundwater Protection Response Matrices

By consulting a response matrix, a planner or developer can determine:

- whether or not a development is likely to be acceptable on that site;
- the further investigations that may be necessary to reach a final decision;
- the planning and licensing conditions that may be necessary

Response Matrix for On-site Systems for Single Houses

VULNERABILITY RATING	SOURCE PROTECTION AREA		RESOURCE PROTECTION AREA Aquifer Category					
			Regionally Imp		*Locally Imp.*		*Poor Aquifers*	
	Inner (SI)	*Outer (SO)*	*Rk*	*Rf/Rg*	*Ln/Lg*	*Ll*	*Pl*	*Pu*
Extreme (E)	R3^2	R3^1	R2^2	R2^2	R2^1	R2^1	R2^1	R2^1
High (H)	R2^4	R2^3	R2^1	R1	R1	R1	R1	R1
Moderate (M)	R2^4	R2^3	R1	R1	R1	R1	R1	R1
Low (L)	R2^4	R1	R1	R1	R1	R1	R1	R1

R2^2

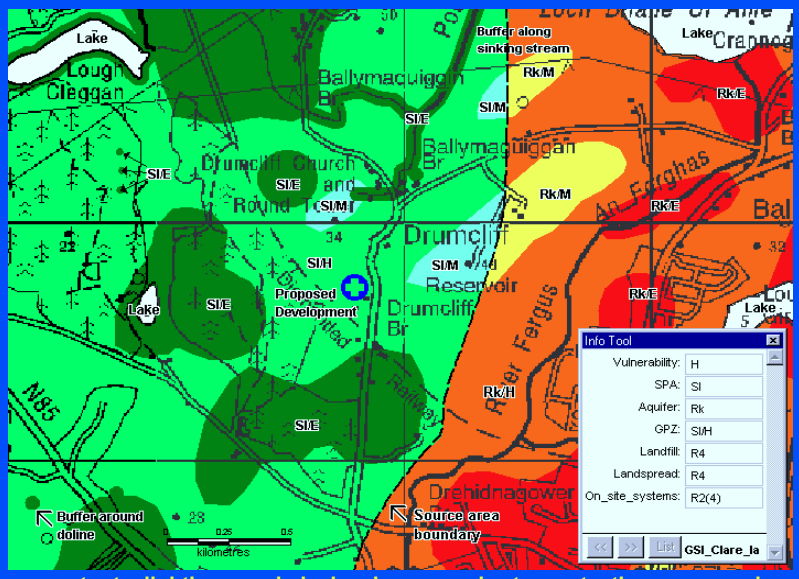
Response - R2^2

Acceptable subject to normal good practice and the following additional condition:

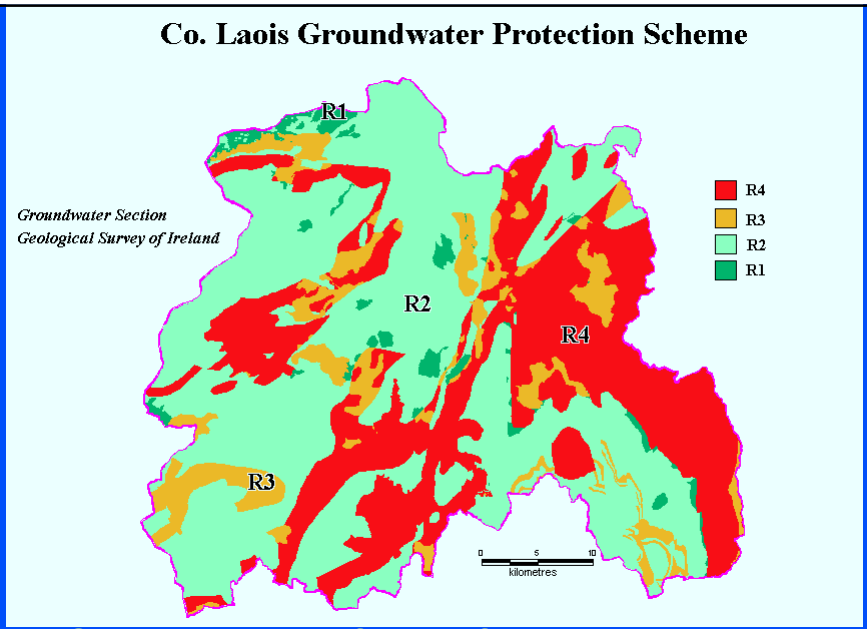
1) There is a minimum thickness of 2 m unsaturated soil/subsoil beneath the invert of the percolation trench of a conventional septic tank system;

OR

1) An intermittent filter, constructed wetlands or a mechanical aeration system with a polishing filter, as described in EPA (2000) must be used



Screen output, slightly amended, showing groundwater protection zones and responses for a proposed development in a source protection area of a karst spring



Screen capture of MapInfo map showing responses for Landfill sites

NI:Regulatory Roles

- Primary responsibility for management and protection of water resources rests with Environment and Heritage Service (EHS), an Agency within the Department of Environment
- EHS presently source hydrogeological technical support from Geological Survey of Northern Ireland (GSNI) and the related British Geological Survey (BGS)

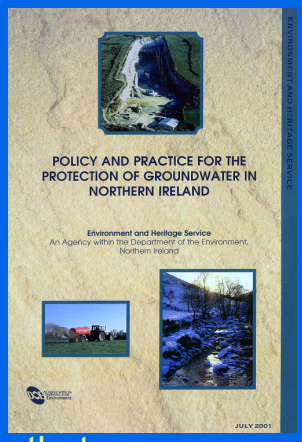
Factors influencing approach in NI compared with RoI

- Significantly less reliance on groundwater for public supply ~ 8% hence historically lower priority to assess and manage
- However still several thousand private wells
- Areas of fast flow karstic limestone less extensive
- More influenced by approaches taken by UK regulators for 'consistency'

Drilling of water well

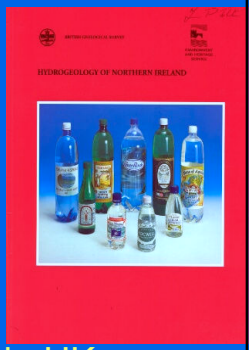
Groundwater Protection Policy

- Published in 2001
- Follows general concepts used in UK and RoI
  - Resource Protection
  - Source Protection Zones
- Policy statements outlining EHS position regarding activities that may impact groundwater flow or quality



NI Regional Vulnerability Map (Resource Protection)

- British Geological Survey carried out first comprehensive hydrogeological reconnaissance survey in 1992-94
- From this work Regional Groundwater Vulnerability Map produced in 1994 in association with SSLRC/DARD
- Approach based upon that developed for Environment Agency in UK



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Vulnerability Classes

Geological Classes	Soil Classes (Leaching Potential)
Highly Permeable	High
	Intermediate
	Low
Moderately Permeable	High
	Intermediate
	Low
Weakly Permeable	Not assessed

Increasing Vulnerability

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Regional Vulnerability Map

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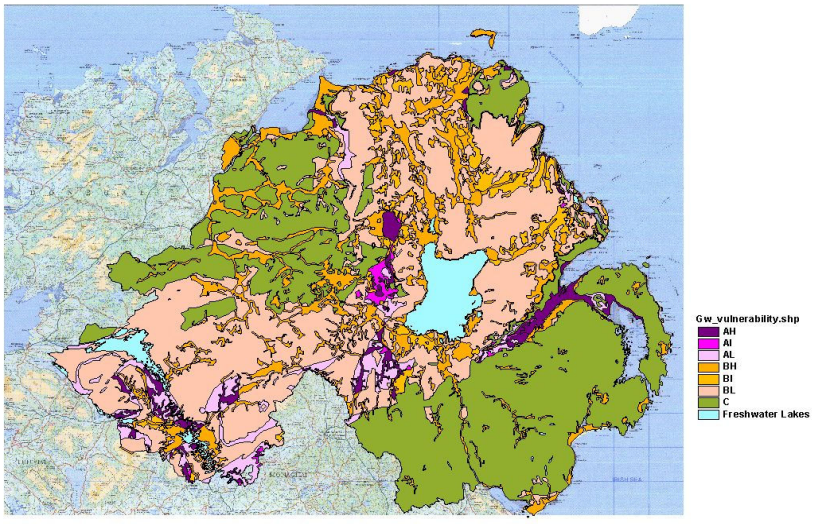

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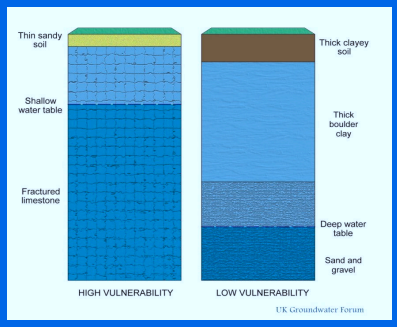
Use of Map

- Drift not assessed due to scale of map and significant local variability/limited data



- Useful for strategic decisions with respect to development and land use
- For specific developments will generally require interpretation of more local / site specific data

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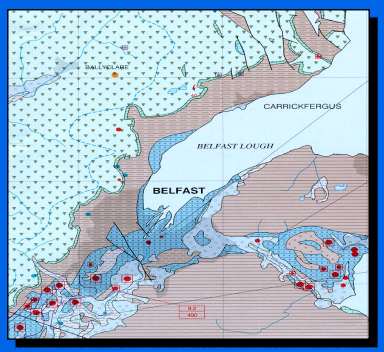
Future for NI

- Assessment of impact of land use on groundwater resources less precisely defined in NI than RoI due to different environmental protection priorities and hydrogeological conditions



- Recent legislation and increasing awareness of relationship between groundwater and surface water changing this

Water Framework Directive

- EC Water Framework Directive requires a comprehensive assessment of all waters including groundwater to be undertaken
- Member States must aim to achieve ‘good status’ for all waters by 2015
- By 2004 initial ‘characterisation’ of all waters must be complete

Water Framework Directive

- For groundwaters part of the analysis required will be to better understand the relationship between soils and subsoils (drift) with underlying aquifers especially regarding the degree of protection offered from surface activities
- Also need to consider role of groundwater as a pathway, potentially transferring contaminants within a catchment to surface waters

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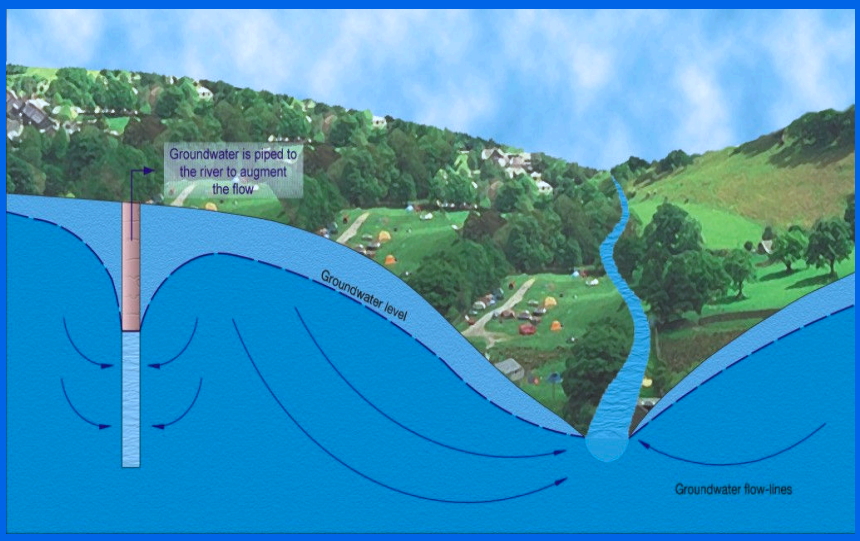
Groundwater as a pathway



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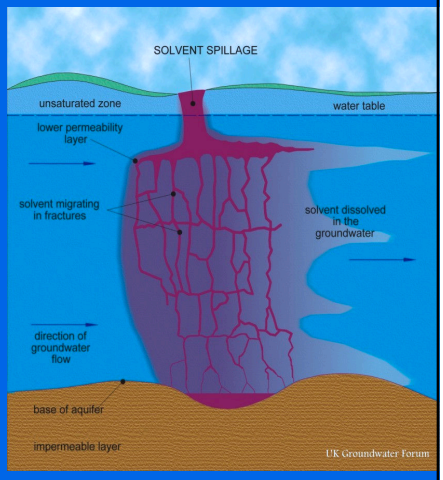
Future

- Part of the characterisation will be to identify pressures that groundwater may be subject to in a particular area

- This will necessarily require a spatial assessment of land use with respect to potential for qualitative or quantitative impacts, for example;
  - agriculture (nitrates)
  - urban (hydrocarbons, solvents)



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Pressures on Groundwater

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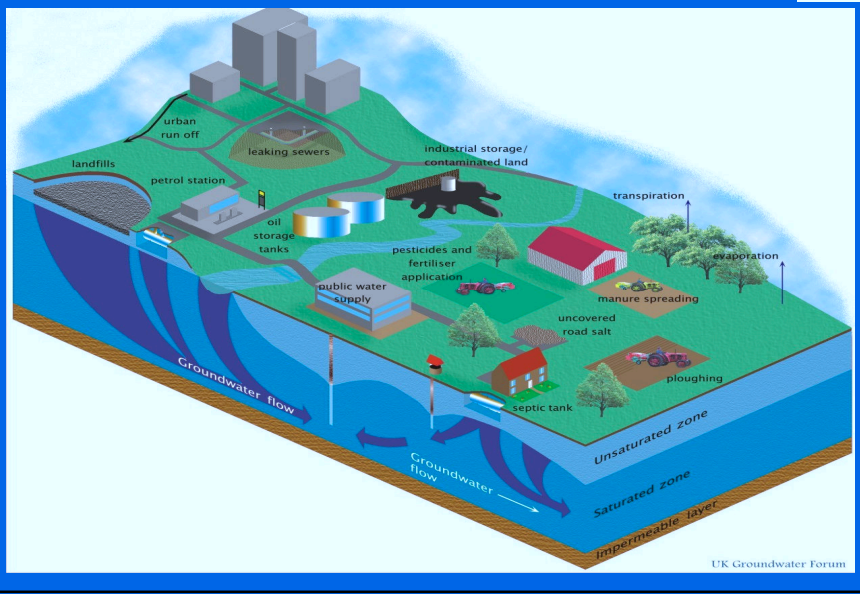

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Conclusions

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- Good planning requires accessible reliable information on relevant issues
- Geoscientific information is often vital
- Irish GWPS
  - Is a means of integrating geological and groundwater data into landuse planning and decision-making on environmental management

GSI

epa

Future for NI and RoI

- Resources will be applied to meeting the requirements of the Water Framework Directive in the next 3-5 years
- Will significantly increase our understanding of the inter-relationship between land use and potential impact upon groundwaters and associated ecosystems
- Significant amount of data will become available in GIS format allowing a variety of analysis

Future for NI and RoI

- Opportunity will exist to develop more comprehensive, targeted and user friendly guidance for developers and planners
- Opportunity also to make geological/hydrogeological information more accessible to the general public
- Help lead to better integration between river basin and land use planning to meet statutory environmental objectives