# Monitoring Groundwater

## A New Beginning

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- My objective in this presentation is to pick out some highlights.

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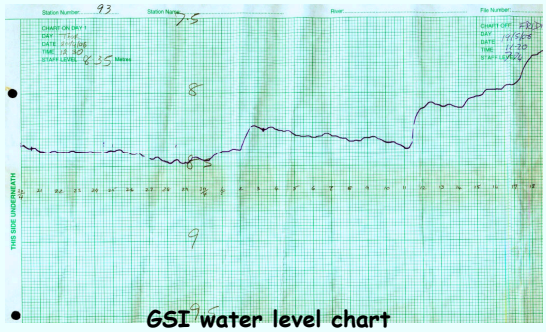
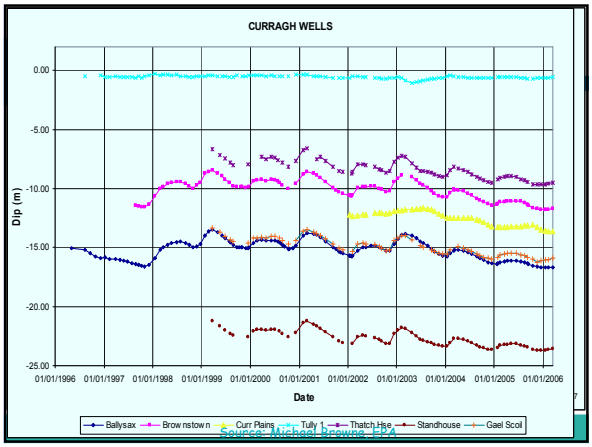


GSI water level chart for a well in north Roscommon




Source: Michael Browne, EPA

## Past and Present

### Groundwater (raw) Quality Monitoring

- **GSI Monitoring**
  - Over last 35 years GSI undertook sampling, (analysed by the State Laboratory) and assessments in various regions (e.g. Nore Basin) and counties (e.g. Offaly, Clare, Laois, Kilkenny, Waterford)
- **EPA National Network**
  - Initiated in 1995.
  - 300 locations sampled twice yearly
  - Results and trends summarised in EPA Water Quality Reports every 3 years.
- **Special Studies by Academics & Consultants**
  - Numerous

- Is the current situation adequate?
- Not really!!

## The Future
### Implementing the Water Framework Directive

- Monitoring is a vital component & requirement of the WFD
  - A comprehensive network must be in place by 22 Dec 2006
- Monitoring essential to implementation of the Daughter WFD Directive – the new Groundwater Directive (GWDD)

- Consequently, we now have the opportunity for
- "A New Beginning"

## Acknowledgement

The lead monitoring authority is the EPA, supported by local authorities and the National Parks and Wildlife Service.

However, the approach to groundwater monitoring has evolved from discussions among the WFD Groundwater Working Group.

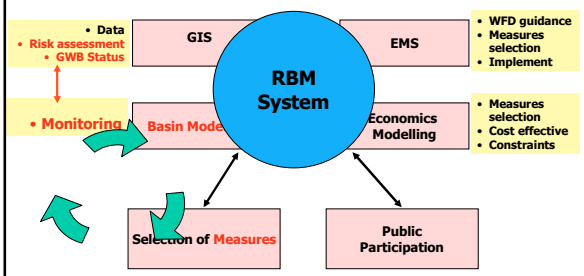
It has been a colloborative effort involving staff in the EPA, GSI, universities and consultancies.

## The Future
### "A New Beginning" (1)

Monitoring is NOT an end in itself!!

It is a (critical) stage in a process.

## Key components of a River Basin Management System




- So, monitoring is just one component, albeit a critical one, of a
- River Basin Management System

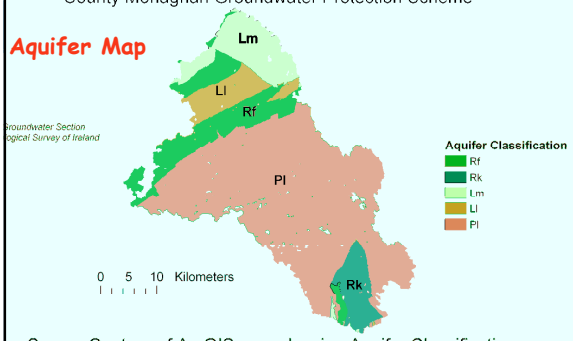
## The Future
## "A New Beginning" (2)

- Monitoring is very expensive - time, staff, laboratories, equipment, etc.
- Our focus is on an optimum network, not a maximum network!!
- Many countries have extensive networks; we are aiming for a 'representative' network.
- In essence, the network must be representative of both the hydrogeology (e.g. groundwater flow regime, soil type, vulnerability) and pressures (e.g. livestock units, tillage, urban areas) in Groundwater Bodies.

**To aid our decision-making and "new beginning", we have for the first time good quality 'layers' (maps) of relevant geosciences info in GISs**

County Monaghan Groundwater Protection Scheme

**Aquifer Map**

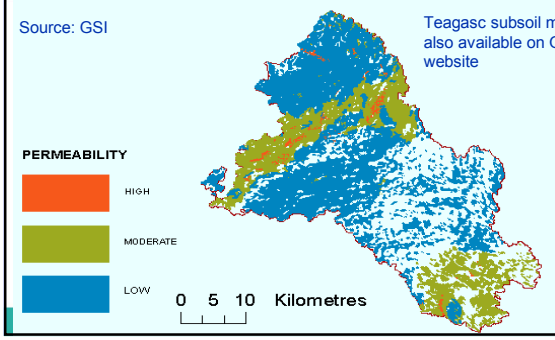



Screen Capture of ArcGIS map showing Aquifer Classification

## Subsoil Permeability

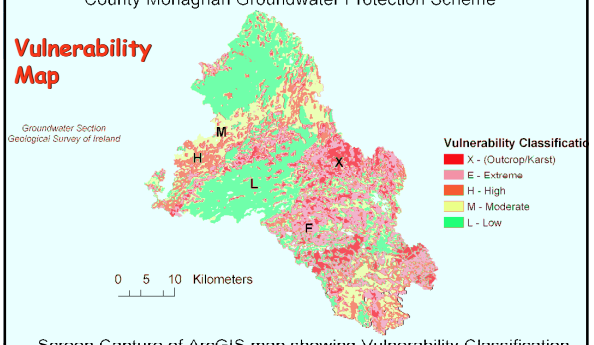
Source: GSI

Teagasc subsoil map also available on GSI website




County Monaghan Groundwater Protection Scheme

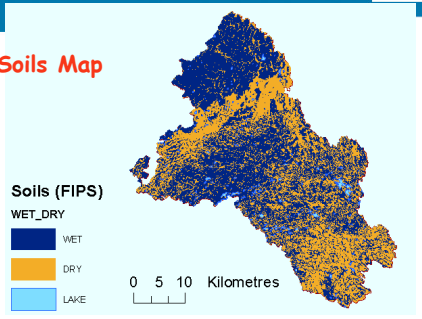
**Vulnerability Map**




Screen Capture of ArcGIS map showing Vulnerability Classification

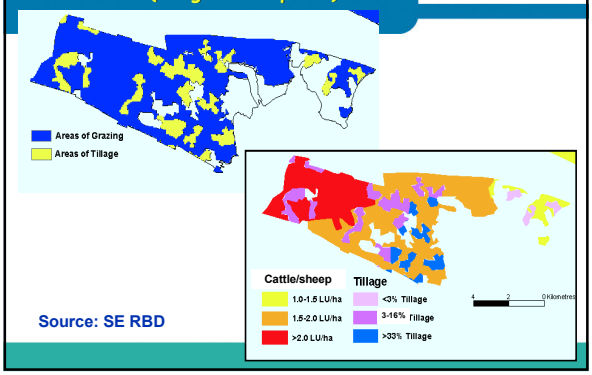
## Soils in Monaghan classified as 'Wet' or 'Dry'

**Soils Map**




Source: Teagasc/FIPS/EPA

## Pressures (Dungarvan Aquifer)




Source: SE RBD

- Consequently, with these 'layers' of information in a GIS, we now have the basis for designing "representative", "optimum" monitoring networks
- ++++++

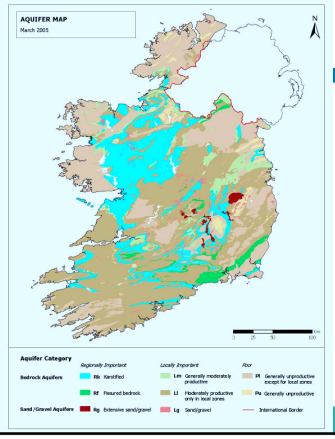
## The Future "A New Beginning" (3)

Monitoring 'Poorly Productive Aquifers"

– A New Approach

## Aquifer Map

Source: GSI

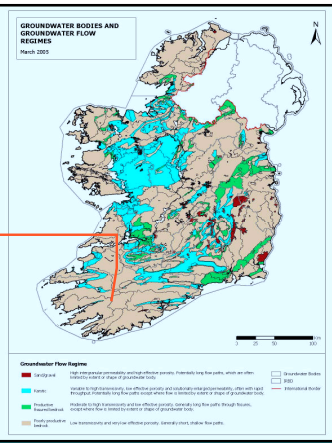



## Groundwater Flow Regimes

Source: GSI

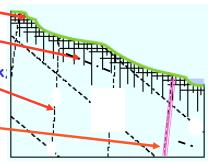
Poorly productive aquifers

Underlies ~70% of country




## Poorly Productive Aquifers

- Underground flow paths are relatively short, typically 10's – 100's metres
- 4 potential pathway categories:
  - An upper weathered zone;
  - An interconnected fissured zone;
  - Larger isolated fissures in massive rock;
  - Permeable fault zones.

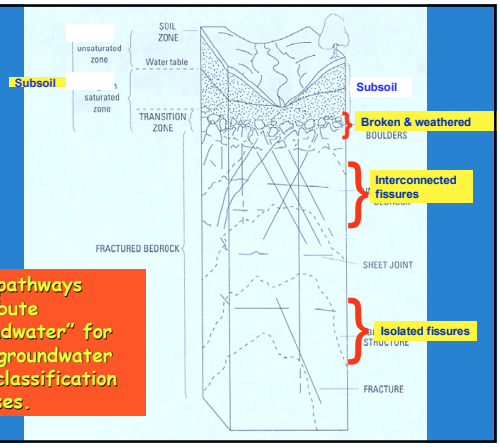


## Weathered zone as fluid pathway

Weathered/broken rock zone at top of bedrock aquifer (Poor Aquifer)

## Weathered/broken rock zone as fluid pathway

Hook Head, Co. Wexford

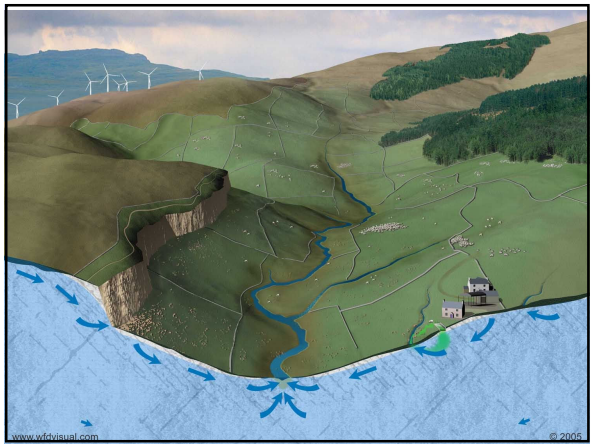


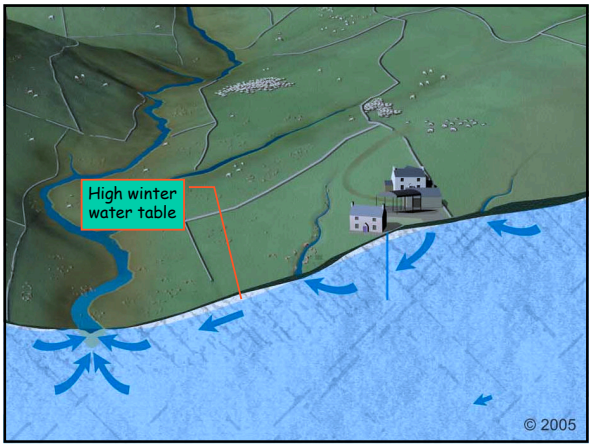

All 3 pathways contribute "groundwater" for WFD groundwater body classification purposes.

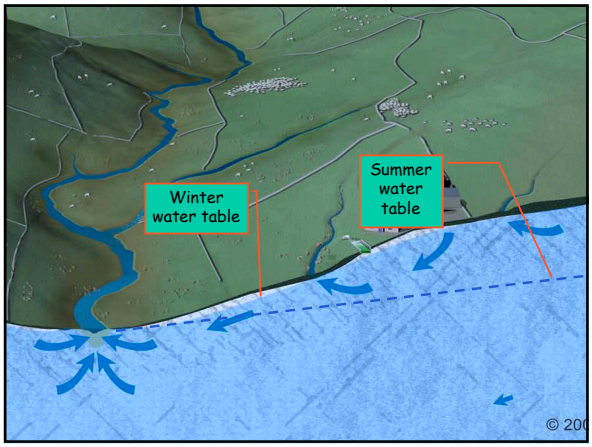
Therefore, all 3 pathways (+ fault zones) need to be monitored!!

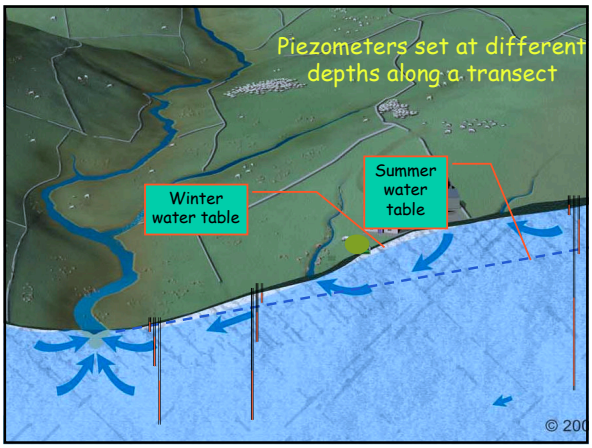
## Our Monitoring Approach

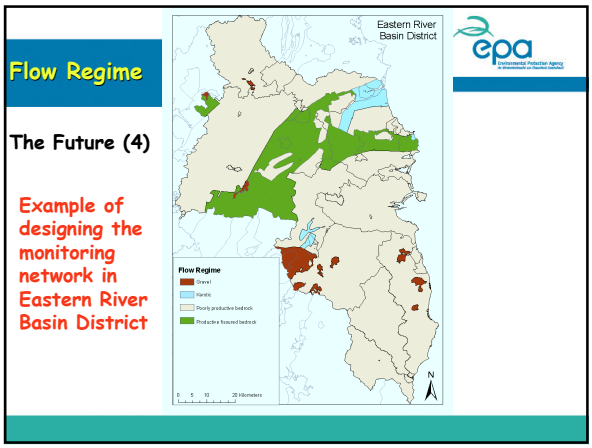
- Ten poorly productive typology settings, e.g. impure limestones; Namurian ssts & shales; ORS; granites; highly metamorphosed rocks; weakly metamorphosed rocks. (Not all areas chosen yet)
- Piezometers set at different depths in specially drilled boreholes.
- A min. of 3 piezometer nests along a transect in each setting.
- Hydraulic testing will be undertaken.
- Data loggers will be installed.
- Water samples taken; levels monitored.

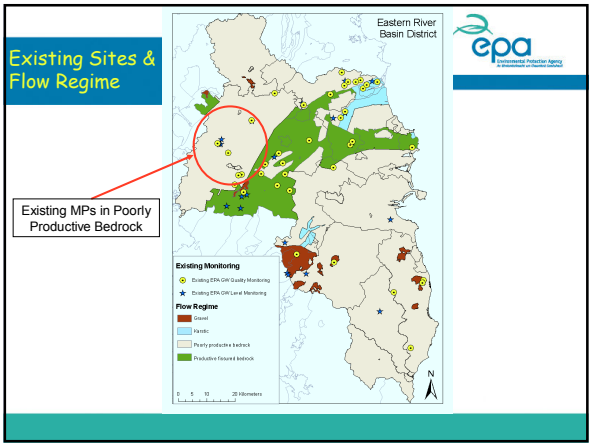


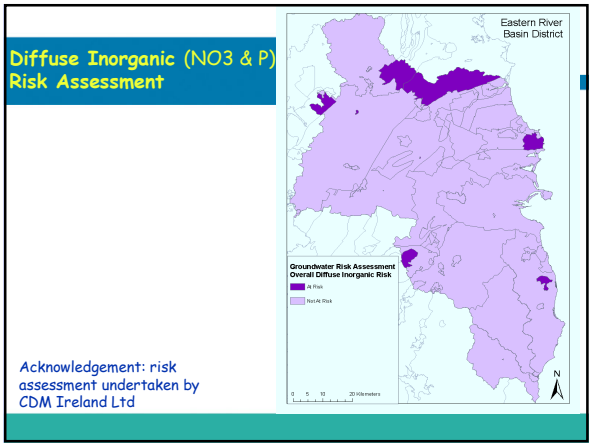

High winter water table
© 2005


Winter water table
Summer water table

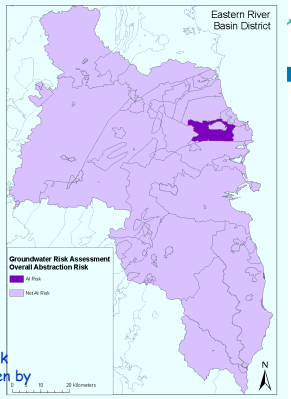

Piezometers set at different depths along a transect
Winter water table
Summer water table


Flow Regime
The Future (4)
Example of designing the monitoring network in Eastern River Basin District
Eastern River Basin District
epa


Existing Sites & Flow Regime
Existing MPs in Poorly Productive Bedrock
Eastern River Basin District
epa


Diffuse Inorganic (NO3 & P) Risk Assessment
Acknowledgement: risk assessment undertaken by CDM Ireland Ltd
Eastern River Basin District

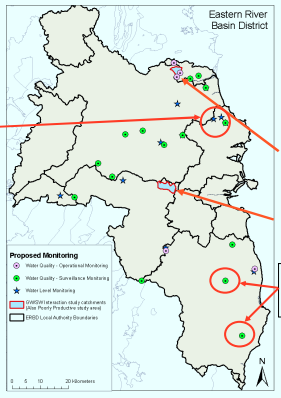
## Abstraction Risk Assessment




Acknowledgement: risk assessment undertaken by CDM Ireland Ltd

## Proposed Network

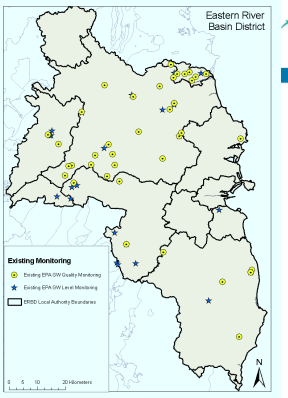
Monitoring locations at BOTR will be more substantial than shown



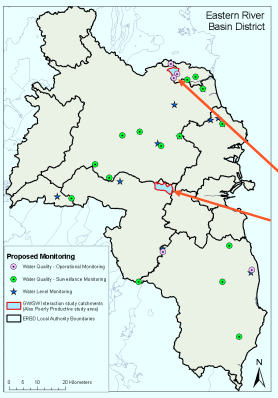

Poorly productive areas where ~ 18 piezometers will be installed

Large abstractions in Poorly Productive Bedrock

## Existing EPA Sites




## Proposed Network

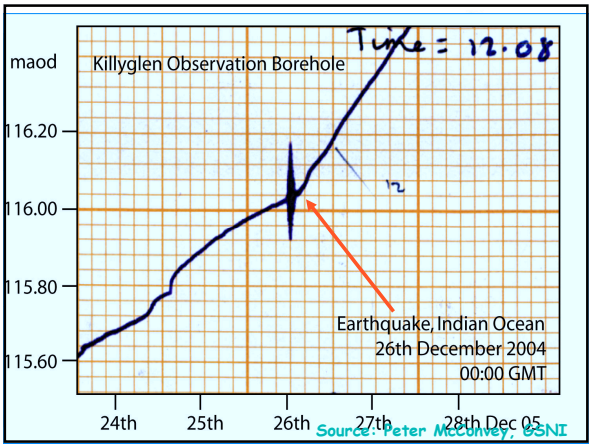



Poorly productive areas where ~ 9 piezometers will be installed

## The Future Summary

- Expanded and improved groundwater quality and water level networks will commence in early 2007 & should be fully in place by end 2008.
- The cost will be > €2million.
- This will aid our understanding of gw chemistry, quality and flow systems in Ireland, and their relationships to land use practices.
- They will provide the basis for understanding and evaluating WFD programmes of measures.

- Exciting, challenging
- times ahead!!
- And, it represents
- significant progress.


maod
Killyglen Observation Borehole
Time = 12.08
116.20
116.00
115.80
115.60
12
Earthquake, Indian Ocean
26th December 2004
00:00 GMT
24th
25th
26th
27th
28th Dec 05
Source: Peter McConvey, GSNI