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European Union Experience Developing Nationwide Groundwater Monitoring Networks

Henning Moe and Robert P. Schreiber, CDM

Acknowledgments:
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National Groundwater Working Group
Led by Irish EPA

Goals and Overall Outline

- Basic Understanding
  - “Drivers”
  - Design Approach
  - Implementation Schedule
  - Ireland as Example
- “Takeaways”
  - Contrasts & Similarities EU vs. USA
  - Key “Lessons Learned”

Water Framework Directive → "Driver"

- EU Legislation – It's the Law (2000)
- Contrast #1 – Lack of Specific / Strong Directive in USA

Purpose of WFD

To establish a framework for the protection of:

a) inland surface waters (Rivers and Lakes)

b) transitional waters (estuaries & coastal lagoons)

c) coastal waters

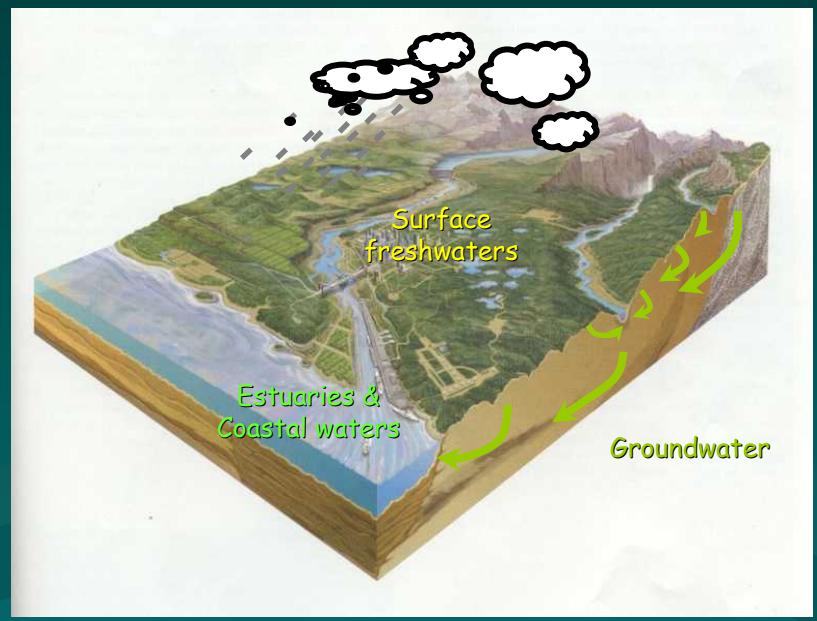
d) groundwaters

which will prevent further deterioration and protect and enhance the status of aquatic ecosystems and their dependant terrestrial ecosystems and wetlands

Contrast #2 → “Eco” focus

WFD – Overall Basis

- Foundation:
  - Watershed-based
  - Integrated monitoring
- Objectives:
  - "*Good*" status by 2015.
  - No deterioration in status.
- Implementation
  - Stakeholder involvement
  - Integrated resource management



Contrast #3 → River Basin Basis

s:

based largely on submissions of digital River Basin Districts (RBDs) from EU Member States and Norway.

e of the international RBDs shown on this map were not identified as being international by the Member s, i.e. the Adour-Garonne, Rhone and Seine in France; the Vistula in Poland; the Kemijoki and Vuoksi in nd.

the German Eider and Schlei/Trave RBDs are shared with the Danish International RBD.

of the Italian Eastern Alps RBD is shared with the Slovenian Adriatic RBD.

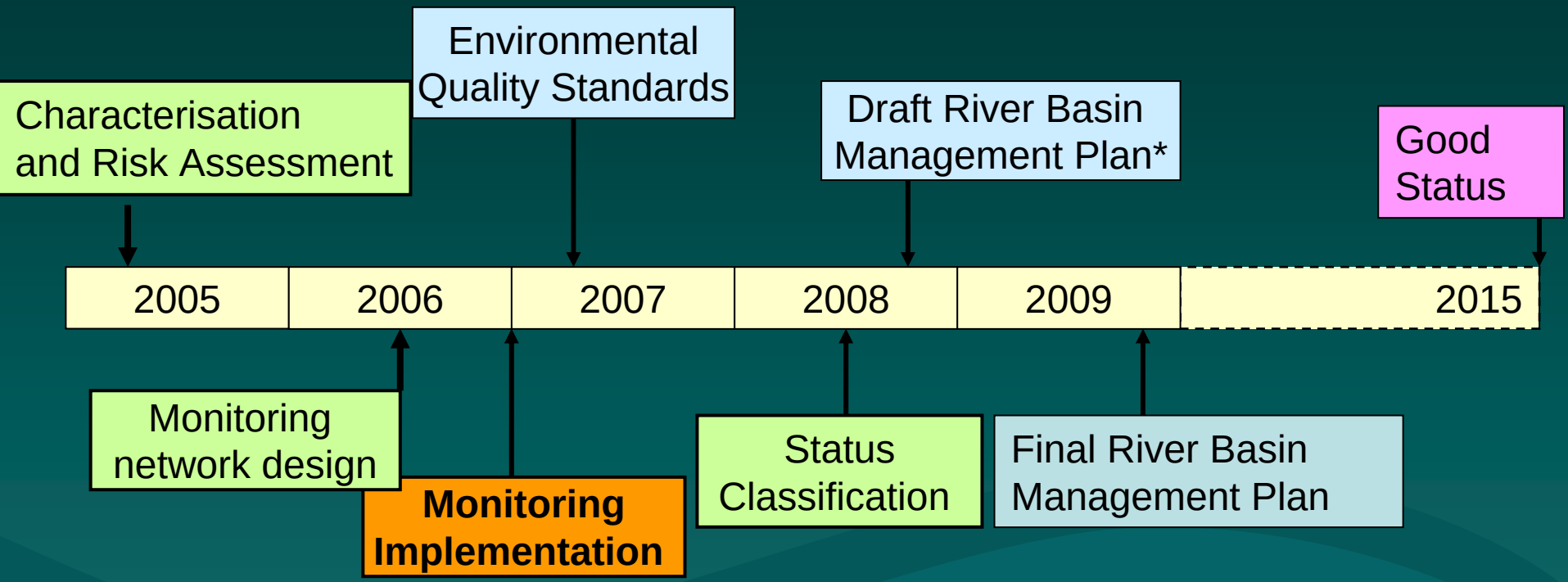
nderstood that the Tornionjoki international RBD in Finland is shared with Sweden, most likely with part Bothnian Bay international RBD. As the Bothnian Bay covers several river catchments, the Tornionjoki Bothnian Bay have been kept separate in this map.

delineation of the Finnmark RBD between Norway and Finland is currently under review.

3) These are the boundaries of the river catchments extending beyond the EU27 border. They have been derived from the Catchment Characterisation and Modelling (CCM) database, developed by the Joint Research Centre (JRC), except the boundaries for the Danube international RBD which were supplied by the International Commission for the Protection of the Danube River (ICPDR).

4) Coastal waters are defined in the Water Framework Directive (WFD) as extending 1 nautical mile from the coastline. However, some Member States have included a larger part of their coastal waters within the RBD boundaries.

Key Steps in the WFD



* Program of Measures

Contrast #4 → Integrated Monitoring & Management Basis

“Participants” → Stakeholder Involvement

European Union:

- European Commission
- European Environment Agency

National:

- River Basin “competent authorities”
- Regulators
- Local Authorities (county/regional councils)
- Relevant stakeholders/advisory groups

Key Challenges

- Establishing “status” classification criteria
- Aggressive schedule
- Diversity between and within countries

Solutions

- Intensive effort in Network Design
- Multiple 6-year “cycles”
- Commonality via EU oversight

WFD Requirements

- Network Types –
  - Quantity
  - Quality
- Monitoring Types –
  - Surveillance
  - Operational
  - Investigative

Surveillance Monitoring

- Supplementing and validating the risk assessment
- Trends → Long-term changes:
  - In natural conditions
  - From widespread anthropogenic activity
- Overall – lower density and frequency than "Operational"

Operational Monitoring

- Focused on “at risk” water bodies
- Assessing effectiveness of Program of Measures
- Higher density and frequency than Surveillance Monitoring

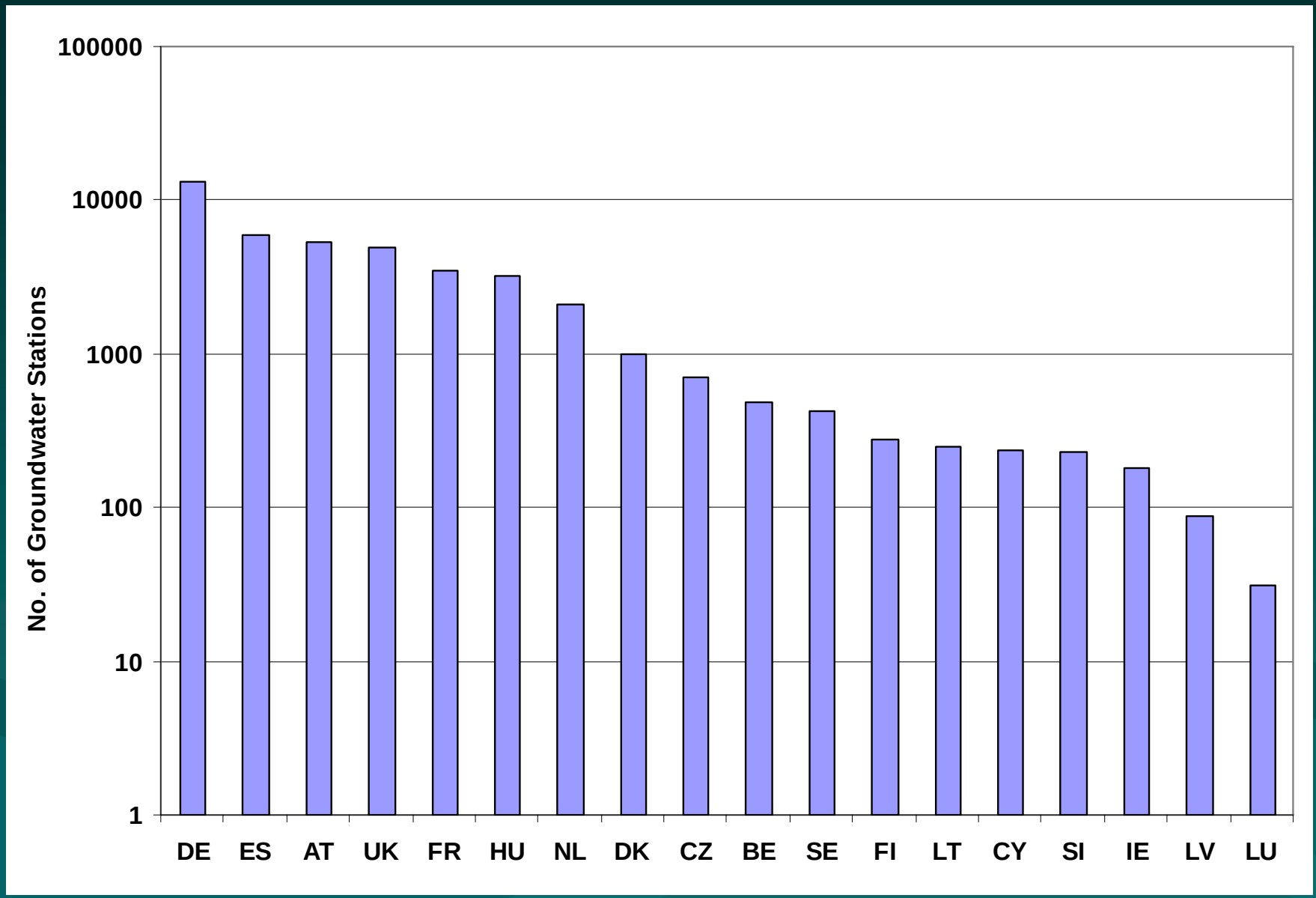
Investigative Monitoring

- Targeted purposes
- Applied research
- Specially designed programs
- Typically more intensive spatially and temporally

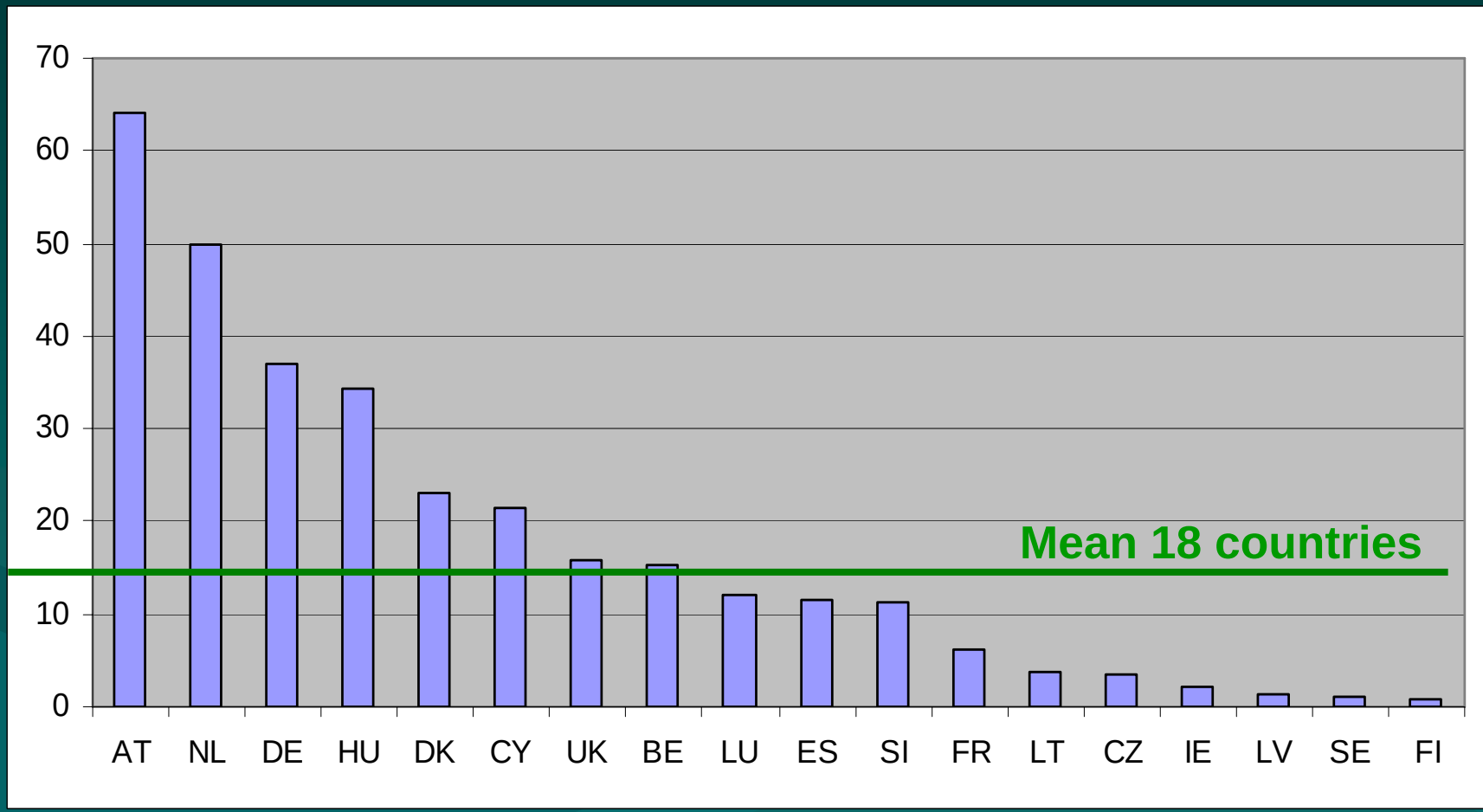
Diversity Within the EU

Different Approaches to Monitoring due to differences in:

- Pressures (patterns)
- Hydrogeology
- Monitoring concepts and past practices
- Importance of groundwater supplies


100000
10000
1000
100
10
1
No. of Groundwater Stations
DE
ES
AT
UK
FR
HU
NL
DK
CZ
BE
SE
FI
LT
CY
SI
IE
LV
LU

Density of groundwater stations; No. of stations per 1000 km^2



Ireland – Brief Case Study

Situation

- Groundwater → 25% of total public water supplies
- Groundwater abstraction pressures are growing

Number of Monitoring Stations

	Surveillance	Operational
Rivers	176	1500
Lakes	75	215
Transitional	27	53
Coastal	21	16
Groundwater	237	135

IE – Groundwater Monitoring

- WFD – a “new beginning”
- Lead monitoring authority = EPA, supported by local authorities and National Parks and Wildlife Service
- Approach evolved through consultation

  → “National Groundwater Working Group”

  - EPA
  - Geological Survey
  - Universities
  - Consulting firms

Basic Design Philosophy

- EPA focused on an optimum network, not a maximum network
- Keyword = “representative” (hydrogeology and pressures)

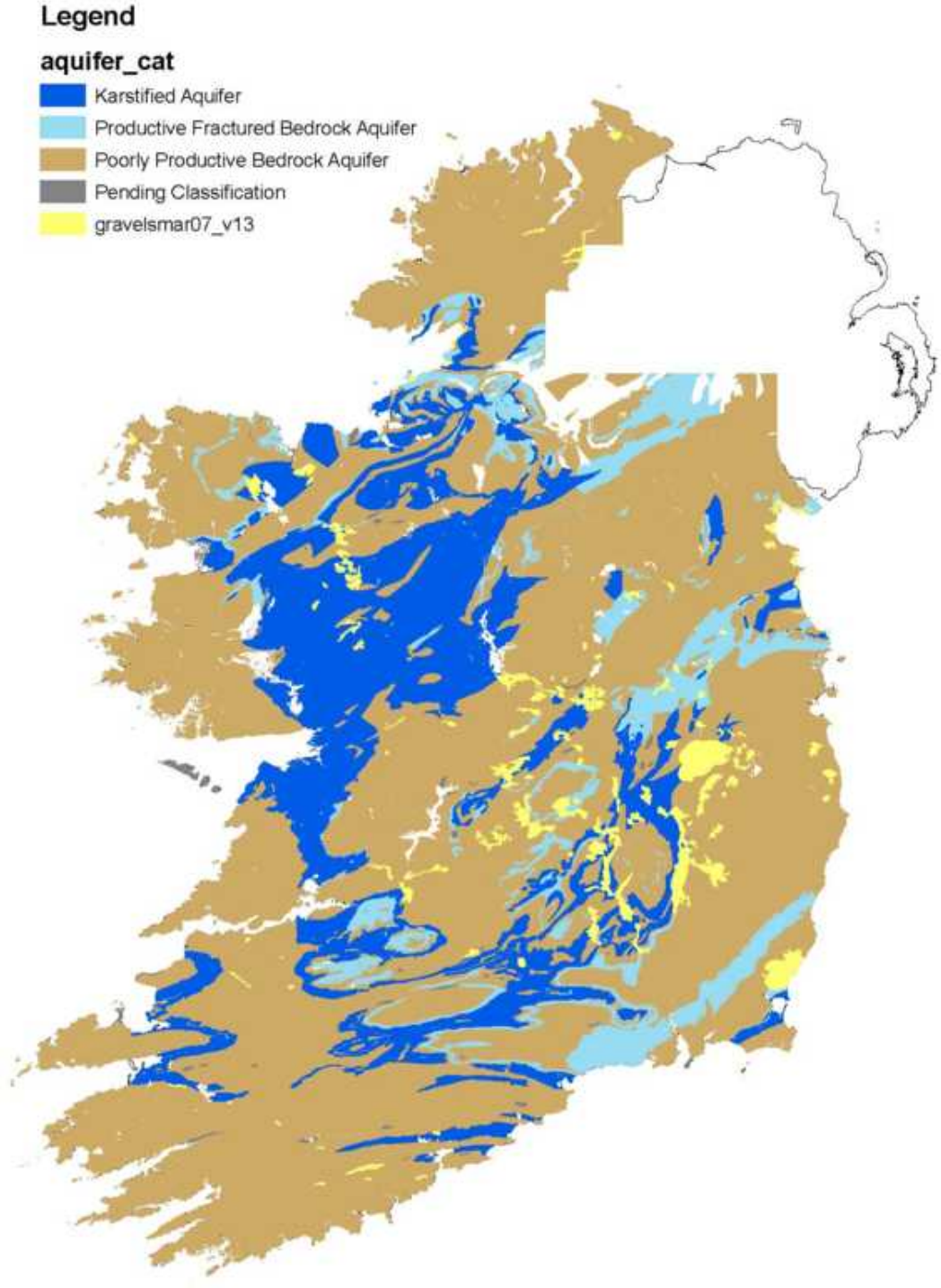
IE – Groundwater Network Design

Methodology:

- Screening of suitable wells
- Natural background levels
- “Representativity” of suitable wells
- Conceptual model
- Aquifer types
- Grouping of groundwater bodies
- Integrated monitoring (surface water, wetlands)

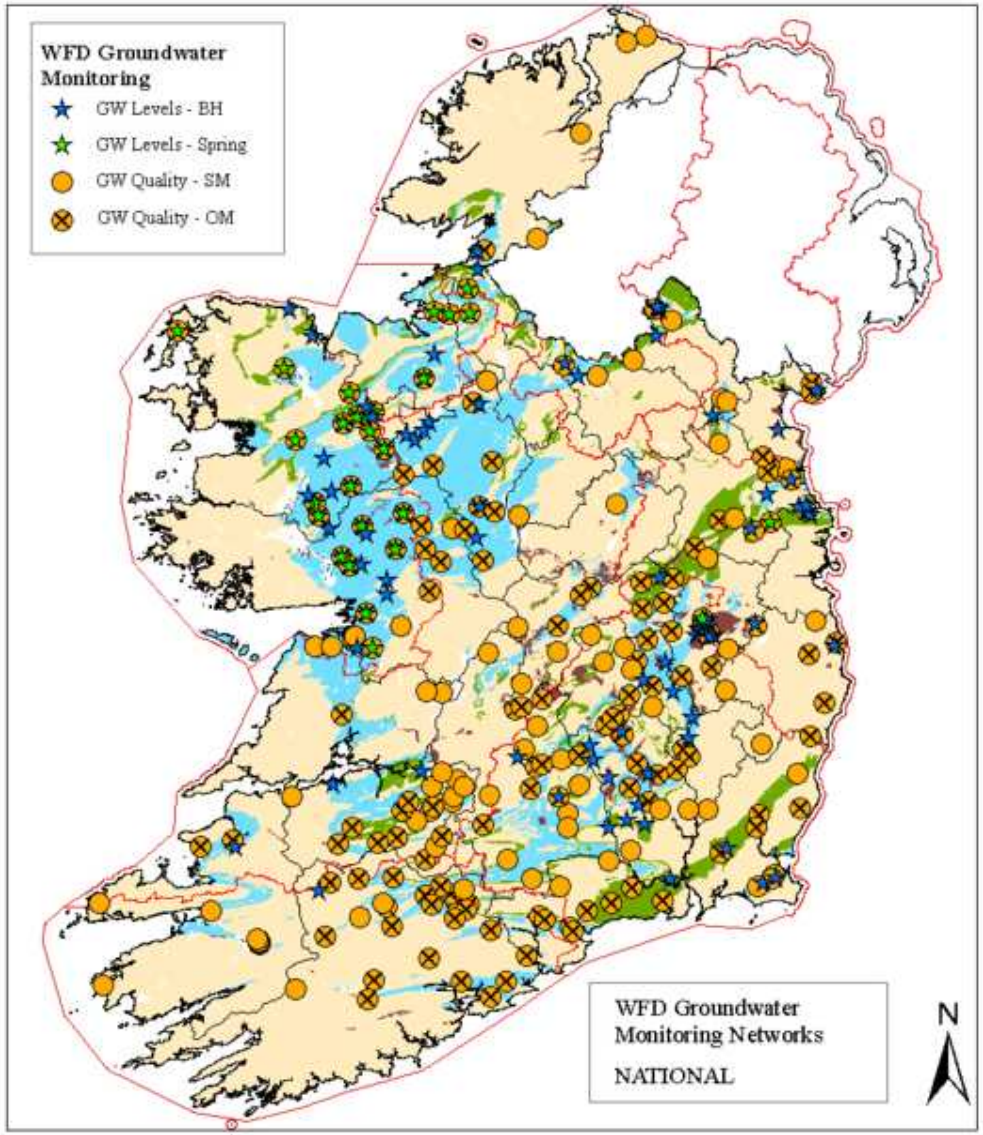
Example:

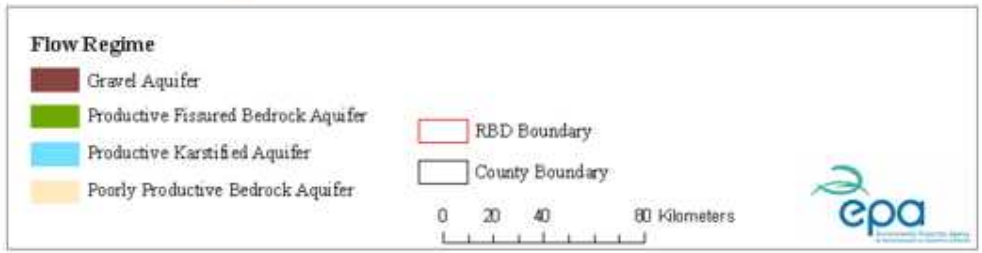
→ ‘Poorly Productive’ Aquifers (PPA)



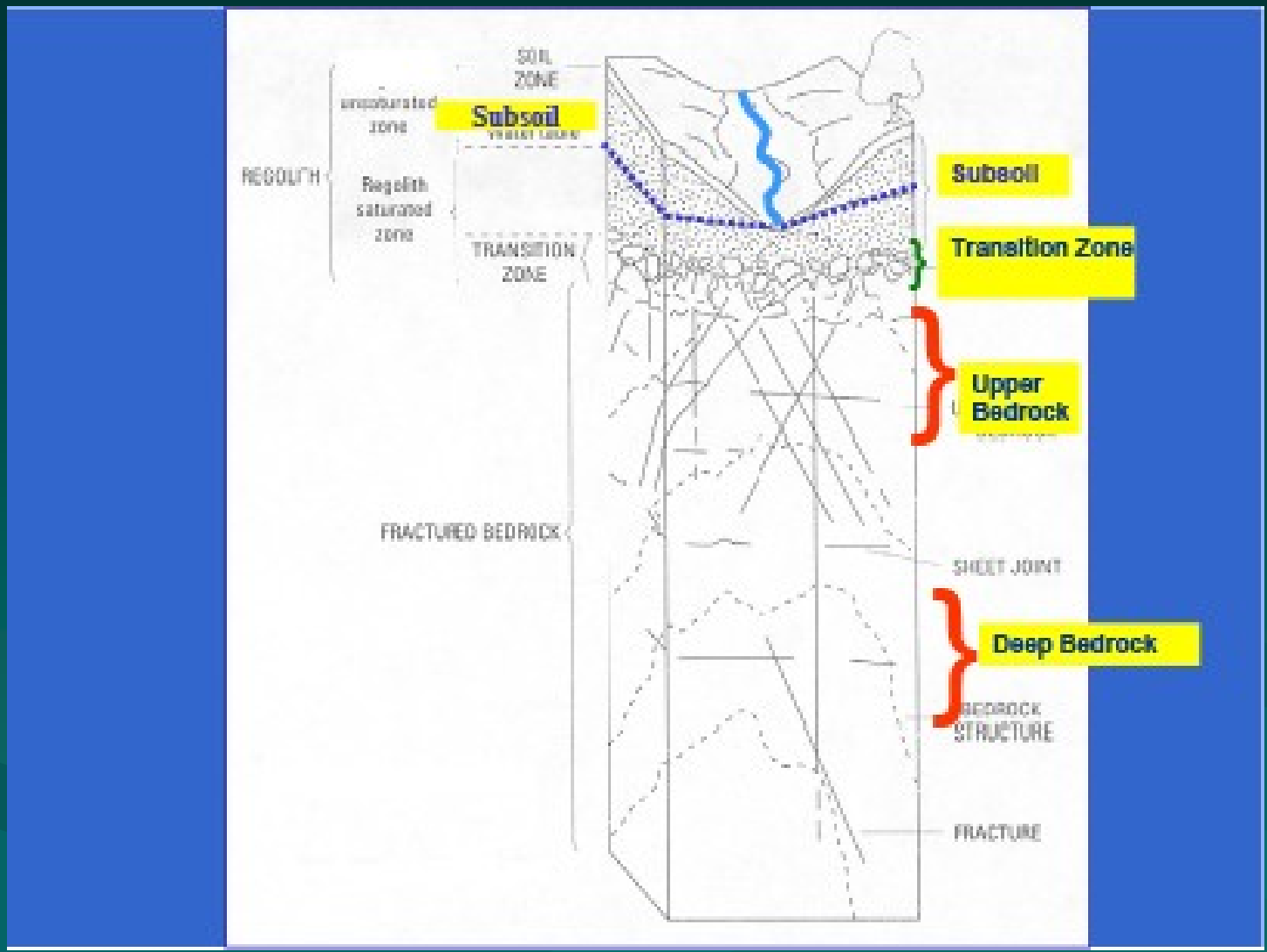
Poorly Productive Aquifers

- 2/3 of country
- Small and numerous flow systems
- Regional network infeasible
- Approach:
  → Representative pilot sites

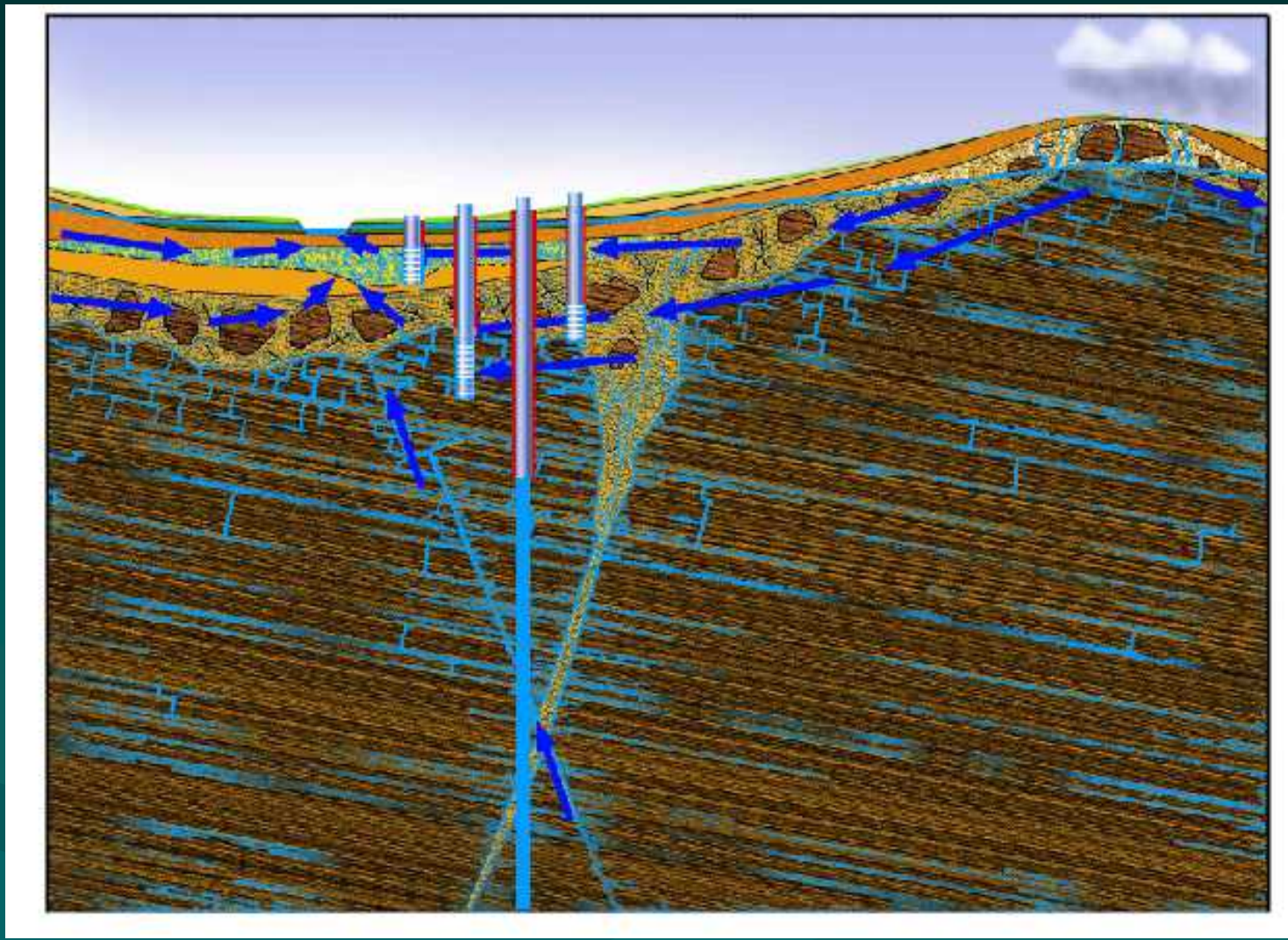

WFD Groundwater Monitoring
GW Levels - BH
GW Levels - Spring
GW Quality - SM
GW Quality - OM
WFD Groundwater Monitoring Networks
NATIONAL
N


Flow Regime
Gravel Aquifer
Productive Fissured Bedrock Aquifer
Productive Karstified Aquifer
Poorly Productive Bedrock Aquifer
RBD Boundary
County Boundary
0 20 40 80 Kilometers
epa

Poorly Productive Aquifer – Conceptual Situation



Poorly Productive Aquifer – Multiple-Depth Monitoring



IE - Lessons Learned – Part 1

Preparatory stage holds key to early implementation:

- Establish the “Competent Authority”
- Establish agreements on roles and responsibilities
- Ensure implementation bodies are briefed and consulted
- Obtain landowner agreements early on

IE - Lessons Learned – Part 2

Major Challenges:

- Resistance to new roles and methods
- Acceptance of roles and responsibilities
- Reporting requirements and structures

Key Contrasts – EU vs. USA

EU Characteristics:

- Legislative “driver” strong
- “Eco” emphasis
- River basin focus & definition for management
- Integrated monitoring – GW, surface water, ecological
- “Quantity” GW monitoring includes springs & pumping
- “Quality” GW criteria linked to pumping rate (“impact”)

Key Similarities – EU and USA

Across all monitoring types:

- Significant responsibility granted to States
- Diversity and differences between and within States
- Emphasis and efforts focused on “design”
- Difficulty agreeing on criteria & thresholds
- Resistance from certain stakeholders / sectors

Groundwater specific:

- Monitoring categories
- Design philosophy -- “optimum” not “maximum”