

The Impact of On-Site Wastewater Treatment for Small Community Developments on Groundwater Quality



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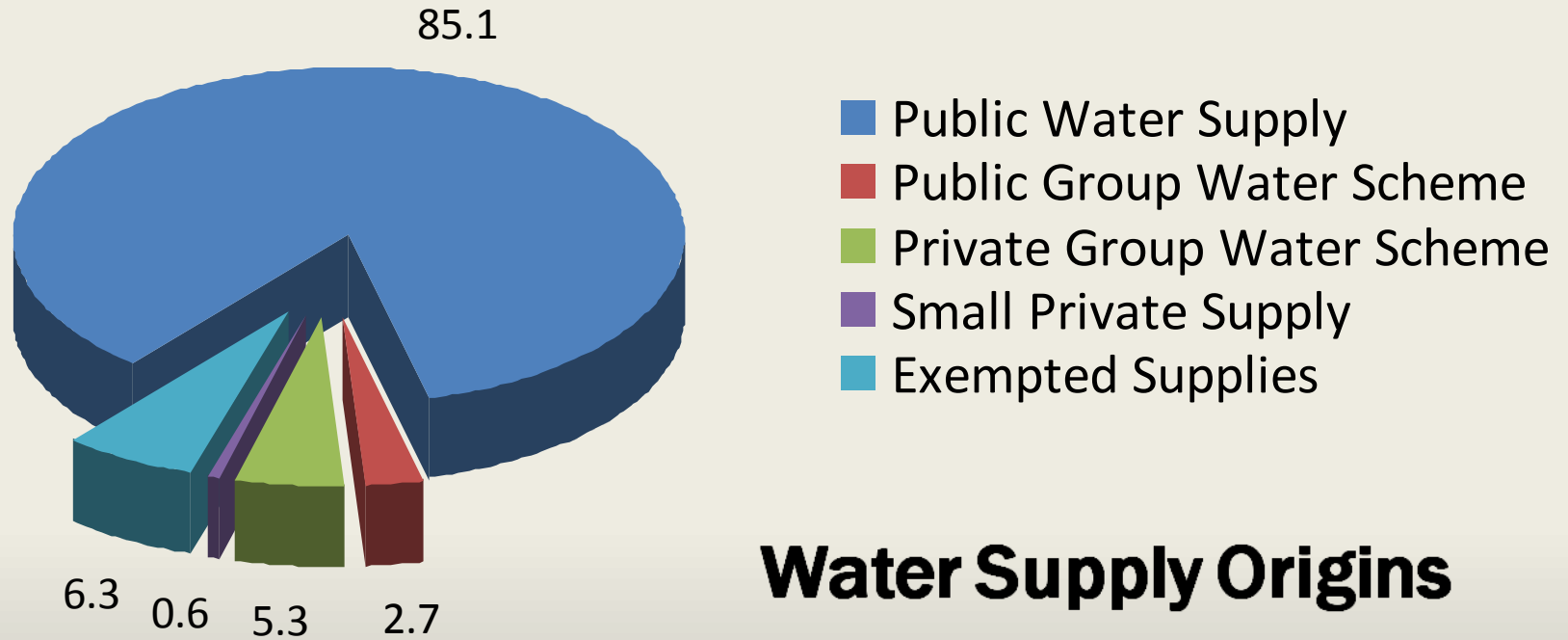


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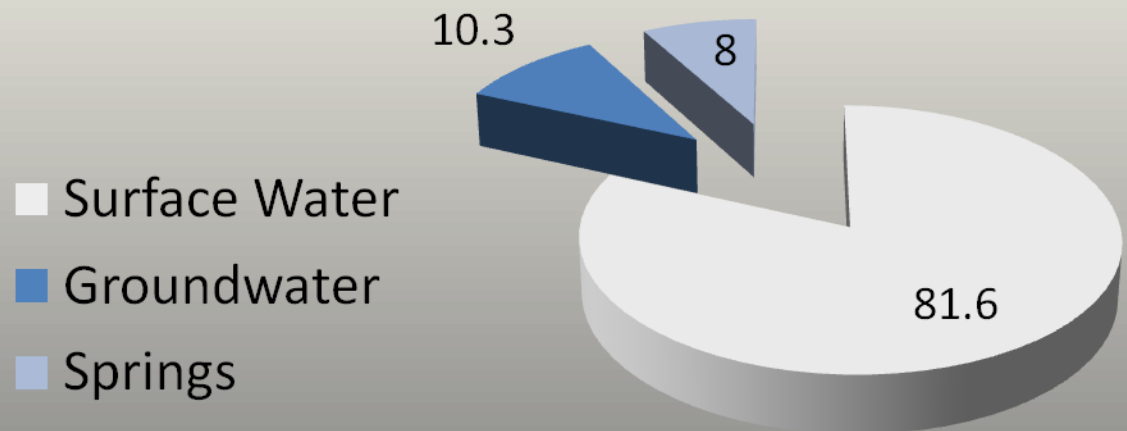


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Drinking Water Supply in Ireland



Water Supply Origins



GROUNDWATER CONTAMINATION



GROUNDWATER LEGISLATION

Recent Developments

- **EU 1975 Directive on waste (75/442/EEC) - National governments must ensure that waste is properly disposed of without damaging human health or the environment**
- **2009 - European Court rules against Ireland over non-compliance with Directive 75/442/EEC - Standards and Inspection of Septic Tanks (with the exception of Cavan!)**
- **Local County Councils introducing and enforcing new bye-laws in a non-uniform manner**
 - **Cavan County Council – Legally complying with legislation for maintenance and inspections**
 - **Wexford County Council – Enforcing new bye-laws for cluster developments**
 - **Fingal County Council – Introduced legal bye-law only**

CURRENT PRACTICE

- **New EPA Code of Practice - Wastewater Treatment and Disposal Systems Serving Single Houses (2009)**
 - **Dr Cormac O'Suilleabhain, TCD, Dr Niall O'Luanaigh, TCD**
- **Details the required approach for individual Treatments System Design and Performance**
- **Various approaches with Local Councils for inspection and maintenance**
- **Density of Systems?**

447,718 PRIVATE INDIVIDUAL TREATMENT SYSTEMS IN IRELAND



TREATMENT SYSTEM DENSITY



**WHEN ARE DEVELOPMENTS
WITH SINGLE TREATMENT
SYSTEMS TOO DENSE?**



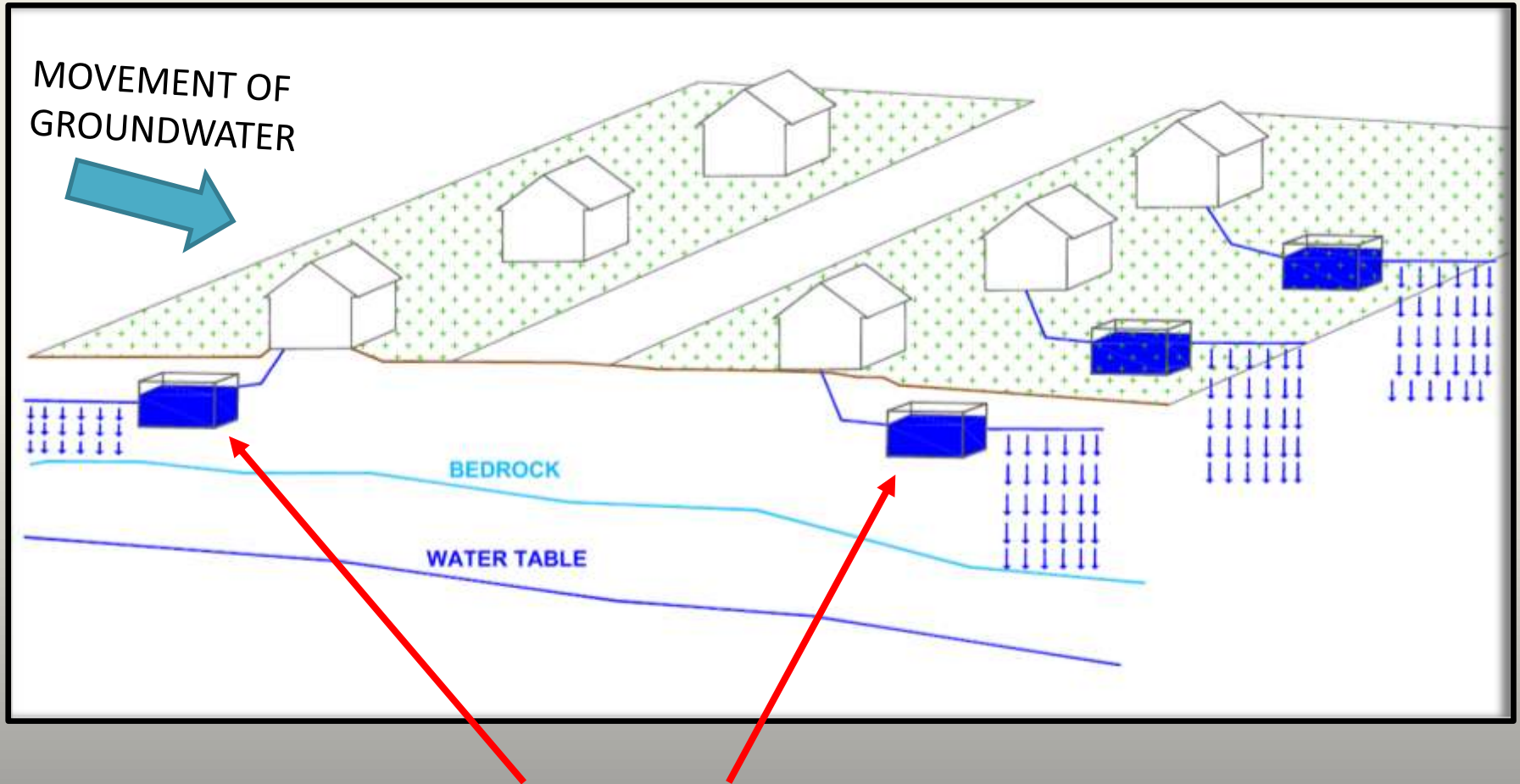
RESEARCH DRIVERS

- **Currently no code of practice which gives guidance on density of individual treatment systems**
- **European legislation on protection of groundwater quality – ability to identify areas of high risk**
- **Need to protect our groundwater resources for future use**
- **Current practice is non-uniform across the country and may lead to inconsistent planning policies**

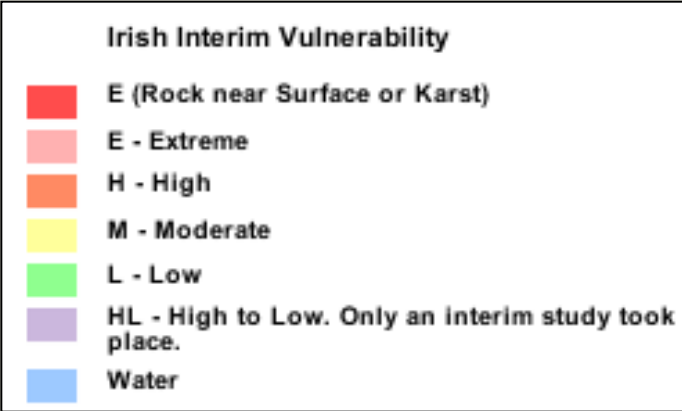
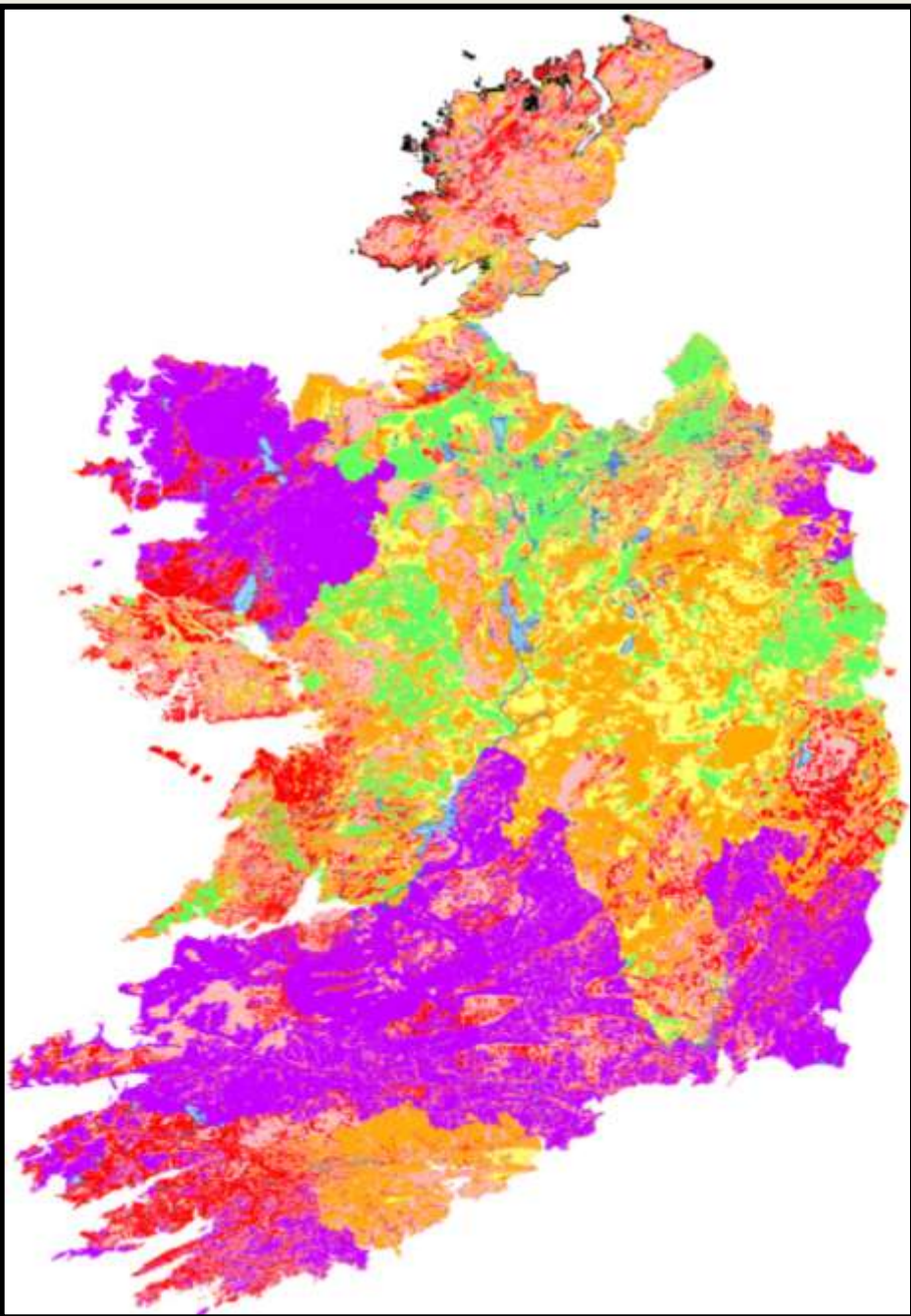
RURAL CLUSTER SYSTEM



CONCEPTUAL CROSS-SECTION



EXISTING TREATMENT SYSTEMS



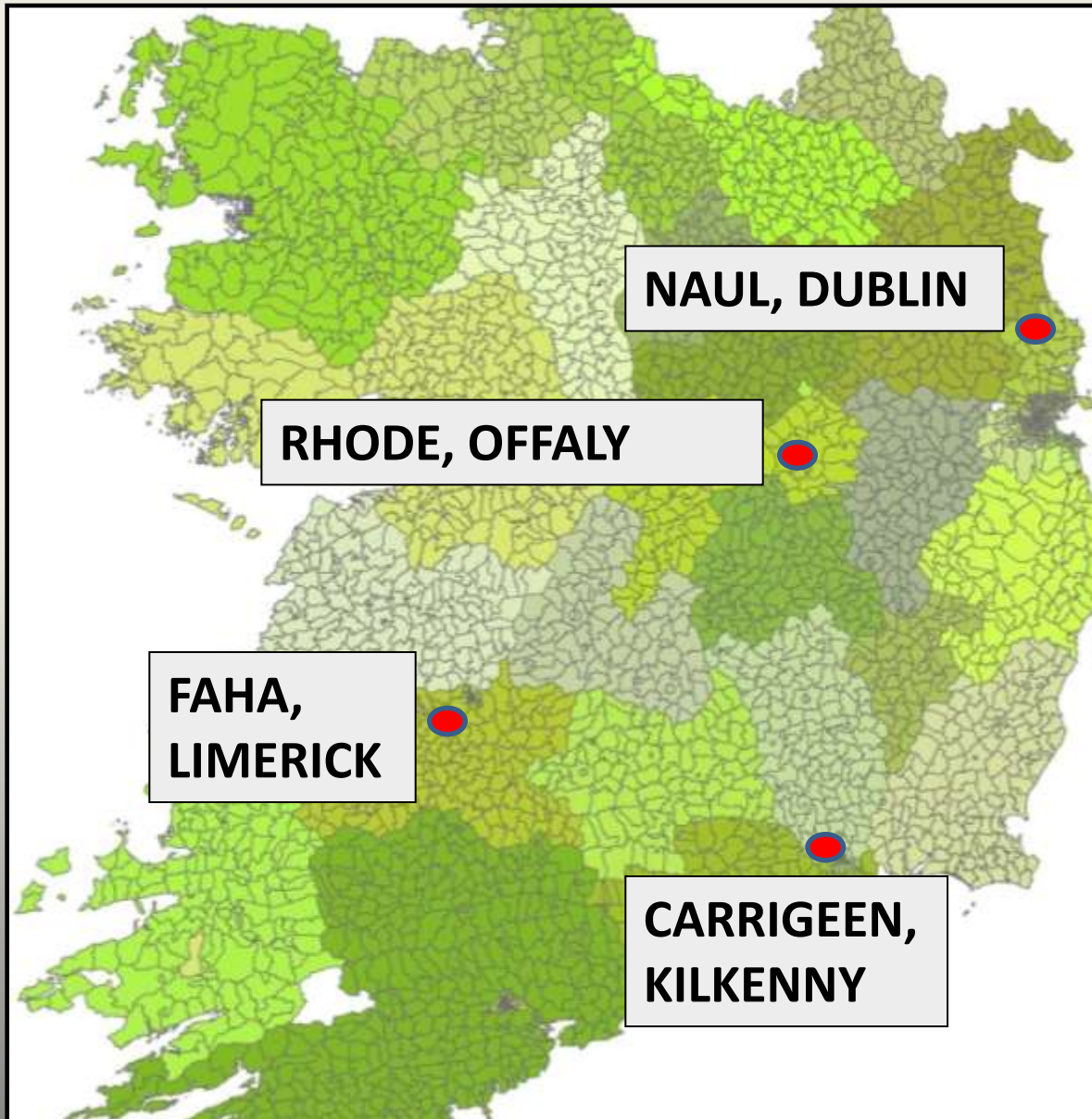
GROUNDWATER VULNERABILITY

- FOUR CATEGORIES
- INTERIM MAPPING

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	> 3.0m	3.0 - 10.0m	3.0 - 5.0m	> 3.0m	N/A
Moderate (M)	N/A	> 10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	> 10.0m	N/A	N/A

Notes: (1) N/A = not applicable.
 (2) Precise permeability values cannot be given at present.
 (3) Release point of contaminants is assumed to be 1-2 m below ground surface.

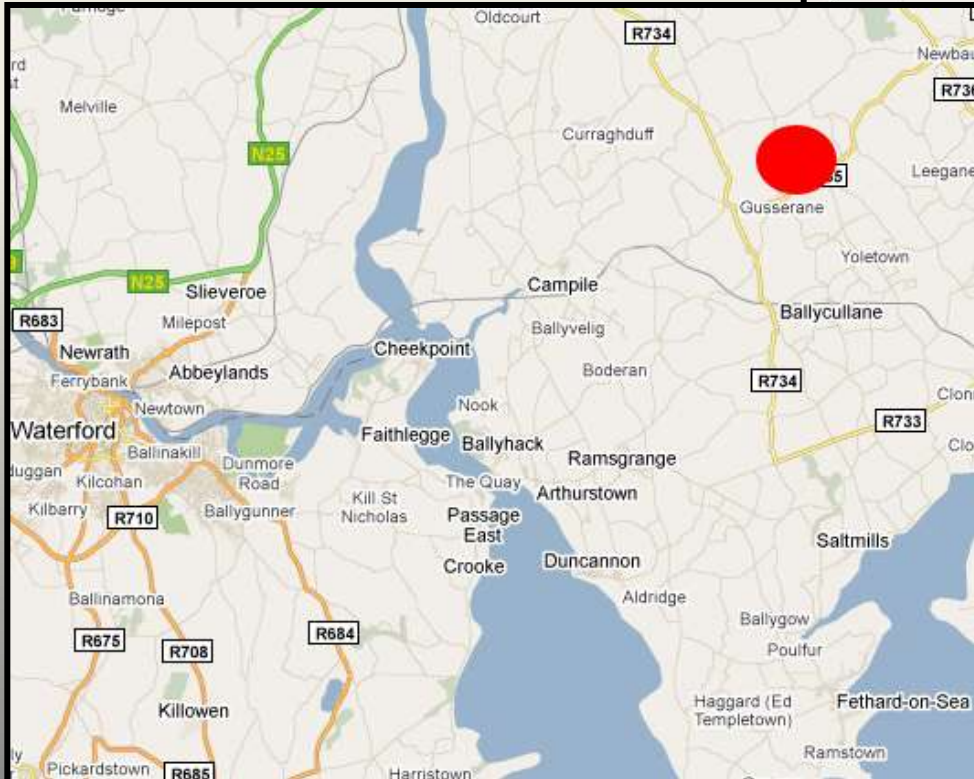
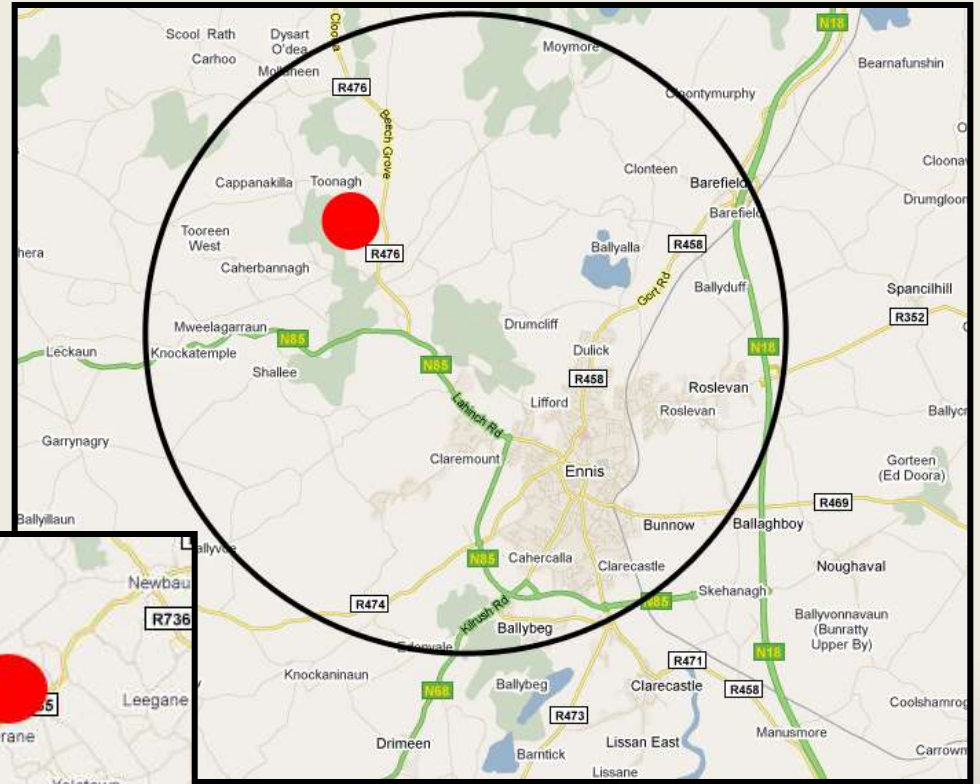
STUDY SITES



- FOUR STUDY SITES SELECTED
- VARYING AQUIFER VULNERABILITY
- LOCALLY IMPORTANT OR REGIONALLY IMPORTANT AQUIFERS

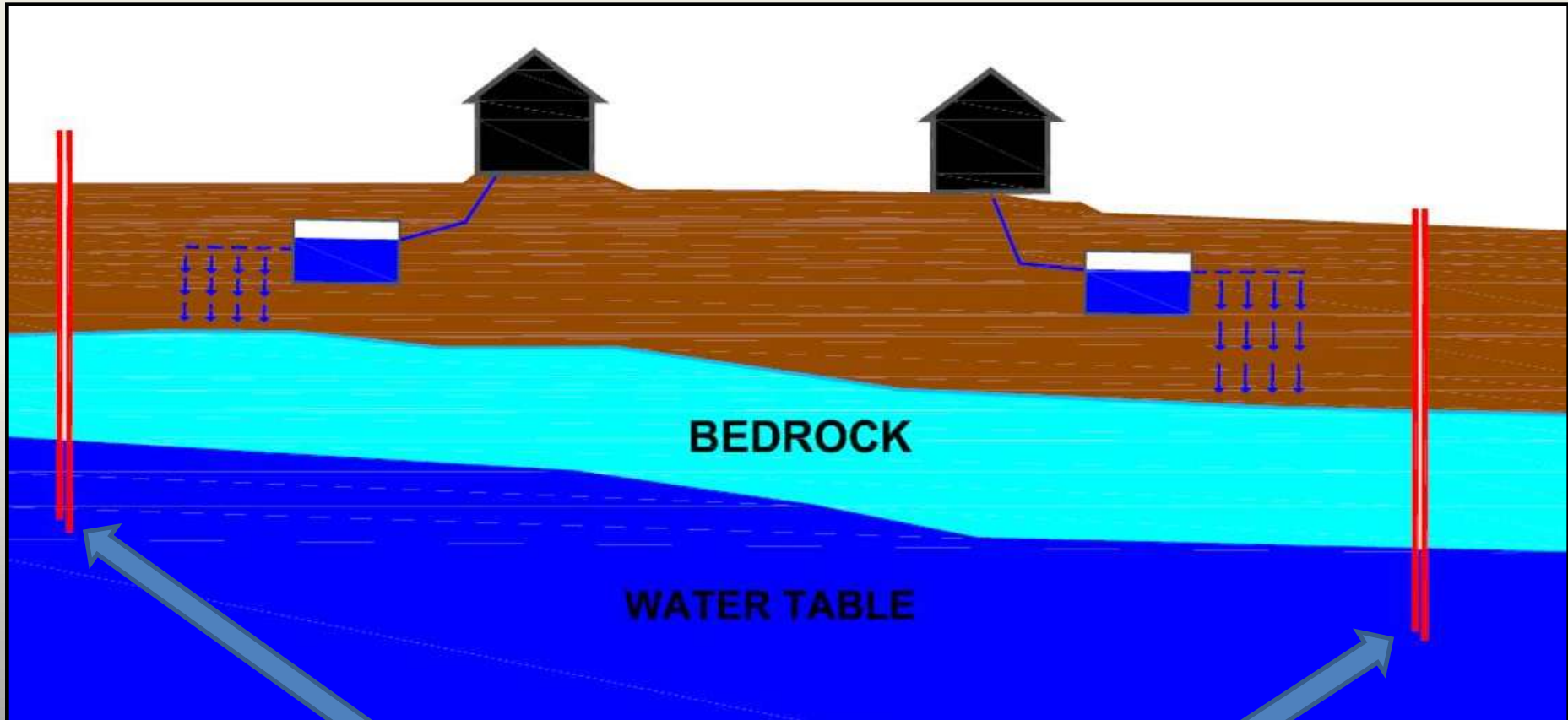
ADDITIONAL SITES

**TOONAGH, ENNIS SPRINGS
CO. CLARE**



GUSSERANE, CO. WEXFORD

SAMPLING BOREHOLES

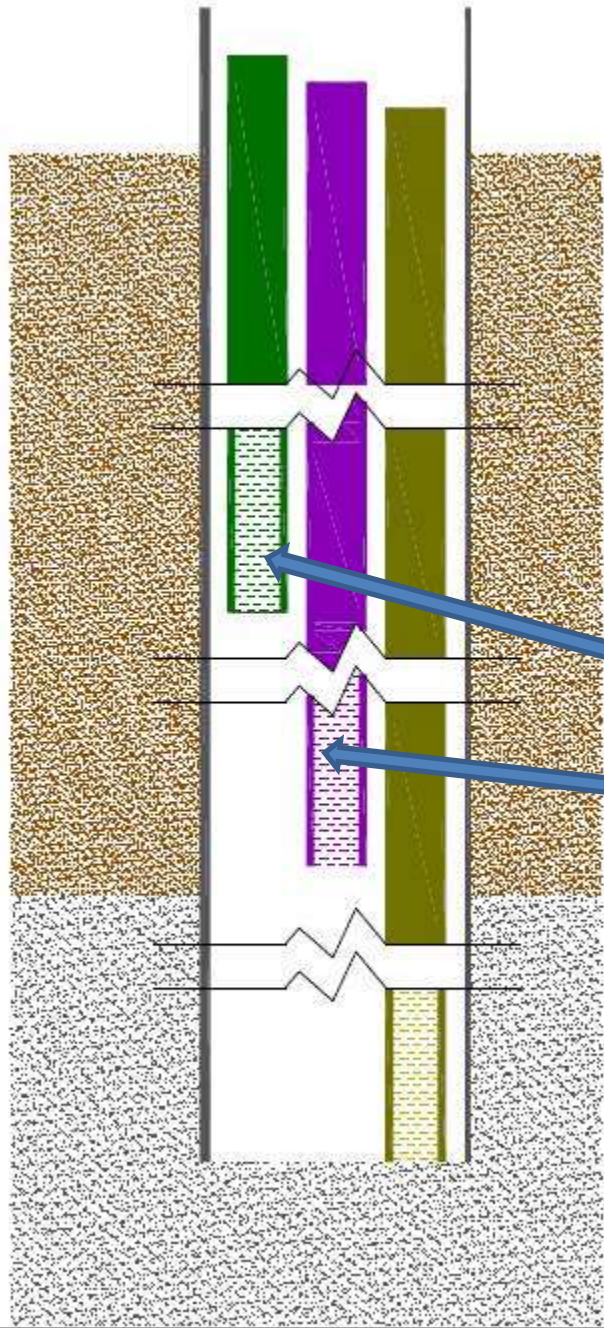


**UPSTREAM AND DOWNSTREAM
MONITORING POINTS**

RURAL CLUSTER SYSTEM



NESTED PIEZOMETERS SETUP



- EACH INTERVAL IS GROUTED TO ENSURE INDEPENDENCE

OPEN SLOTTED SECTION AT
THE BASE

PIEZOMETERS WITH GEOSOCK



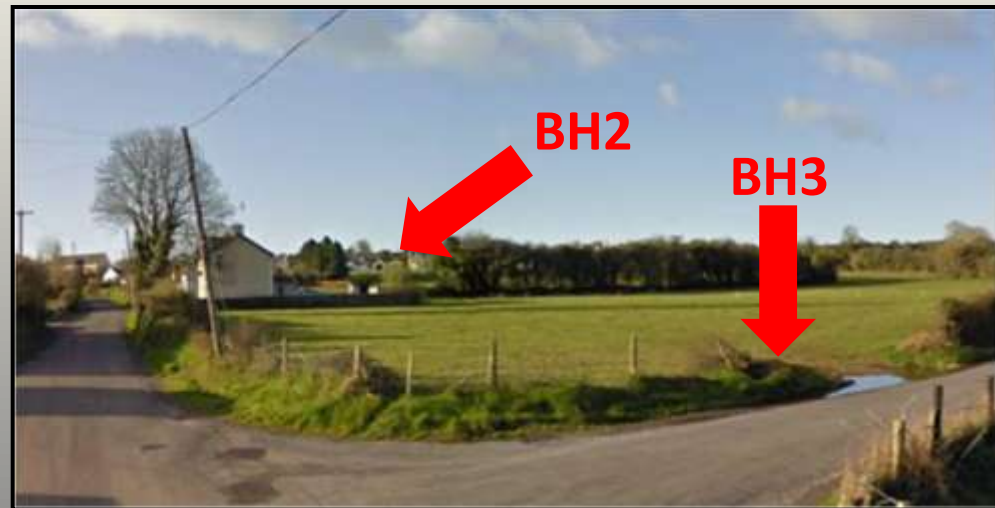
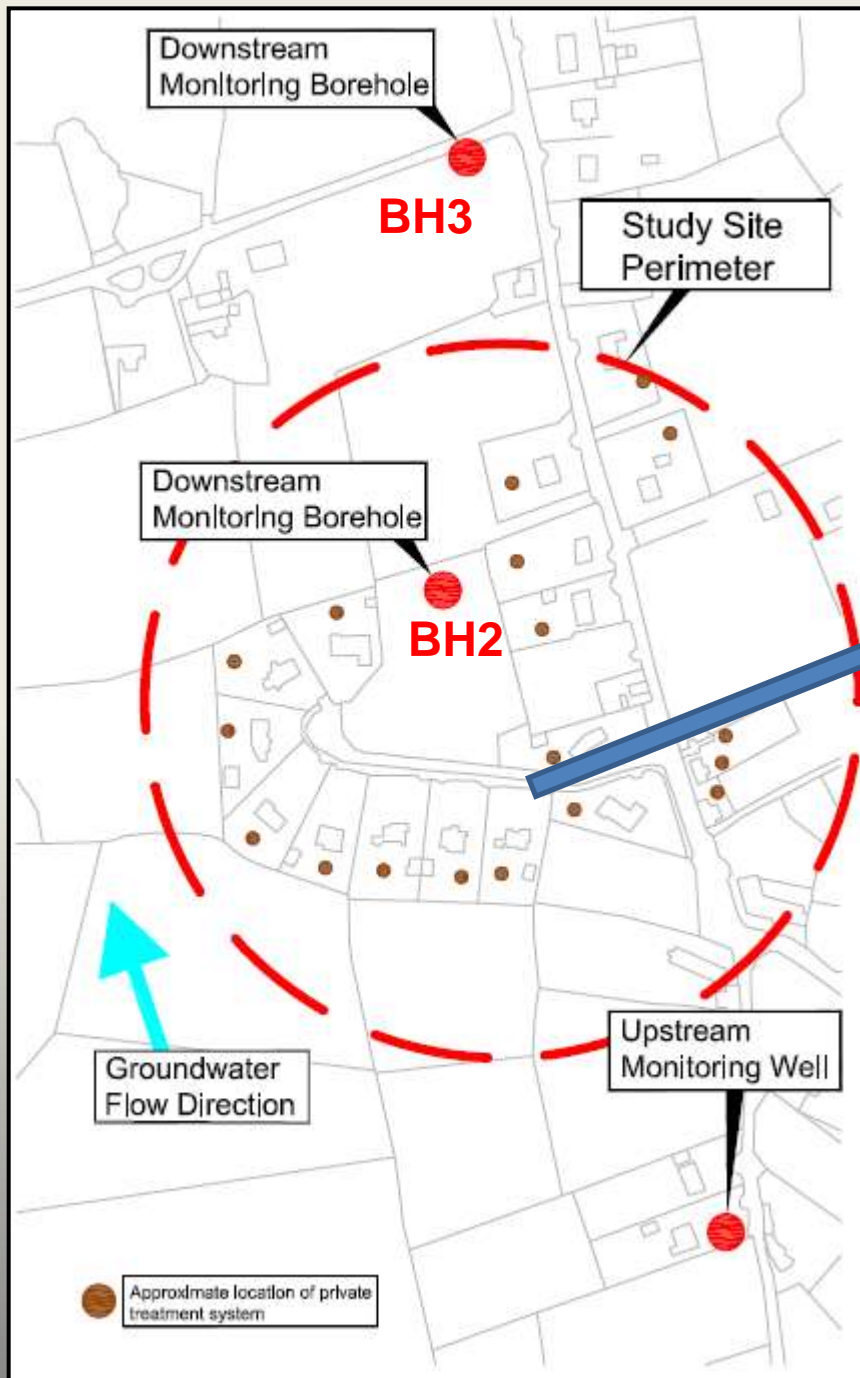
NESTED PIEZOMETERS DURING CONSTRUCTION



A COMPLETED BOREHOLE

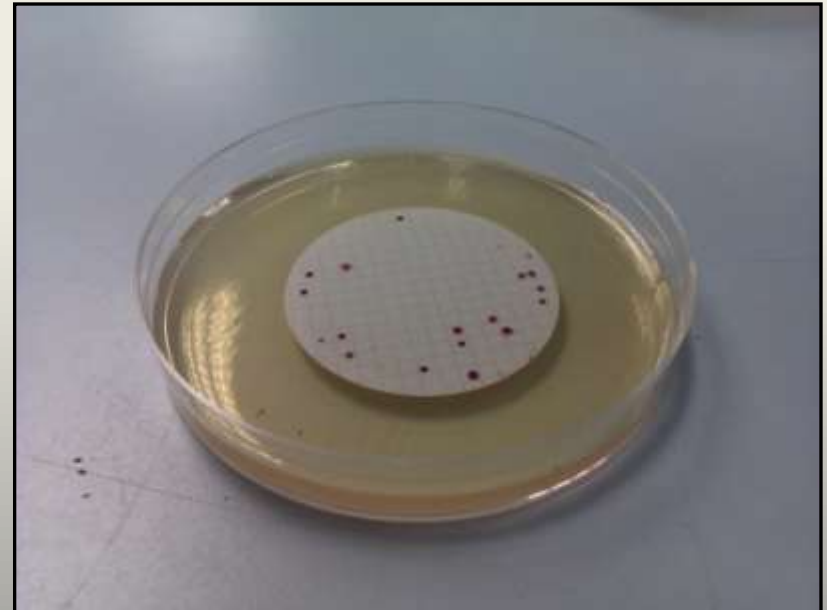


SITE LAYOUT



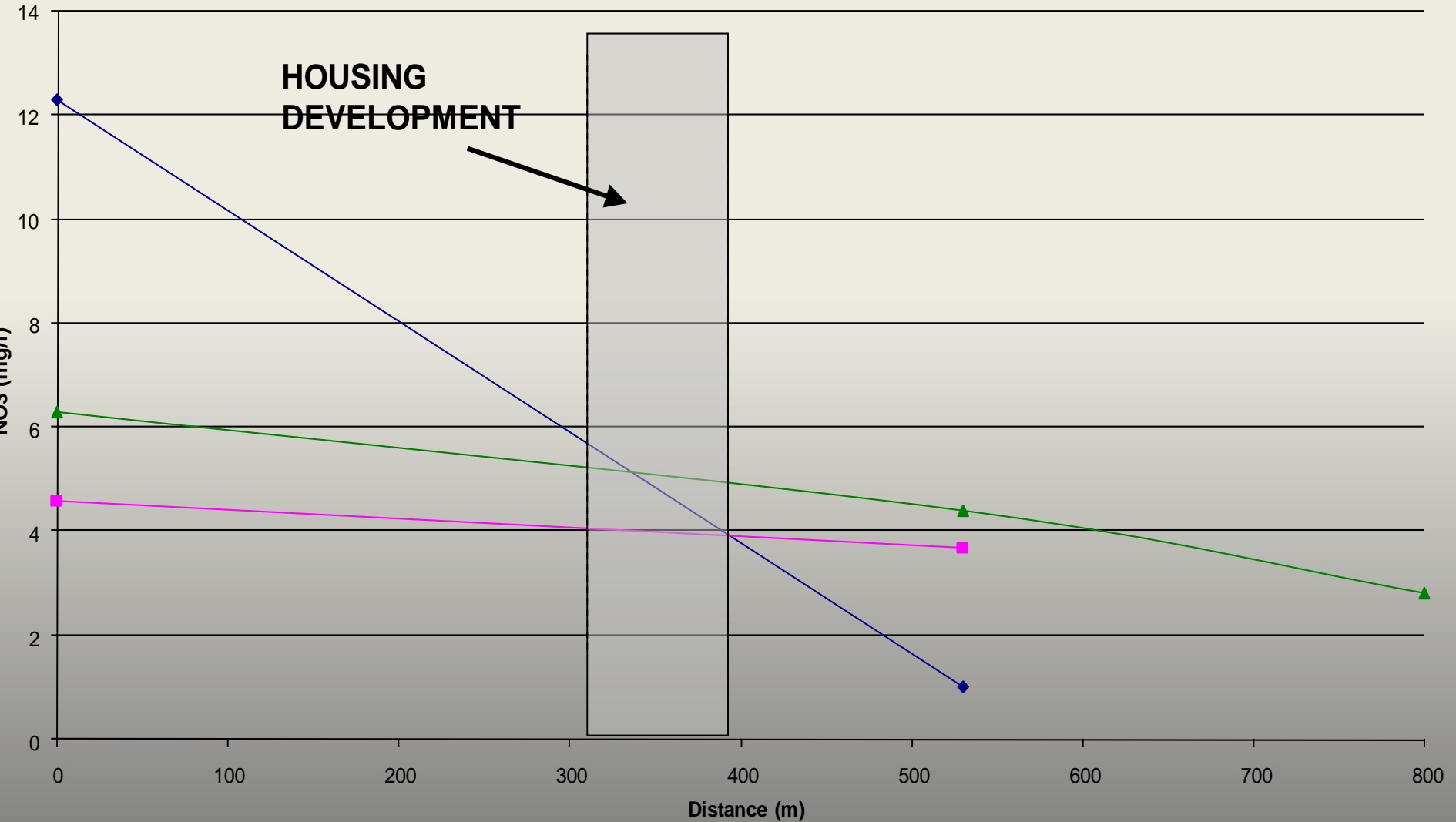
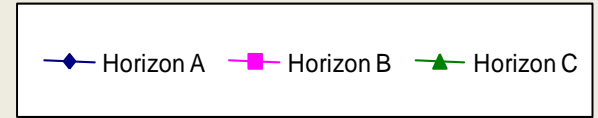
SAMPLING METHODOLOGY

- Monthly Sampling Frequency
- Temperature, Electrical Conductivity and pH
- Microbiological Analysis
 - Faecal Coliforms
 - Faecal Streptococci
- Inorganic Analysis
 - Nitrates
 - Nitrites
 - Ammonia
 - Total Nitrogen
 - Total Phosphorus
 - Hardness
 - Other Metals



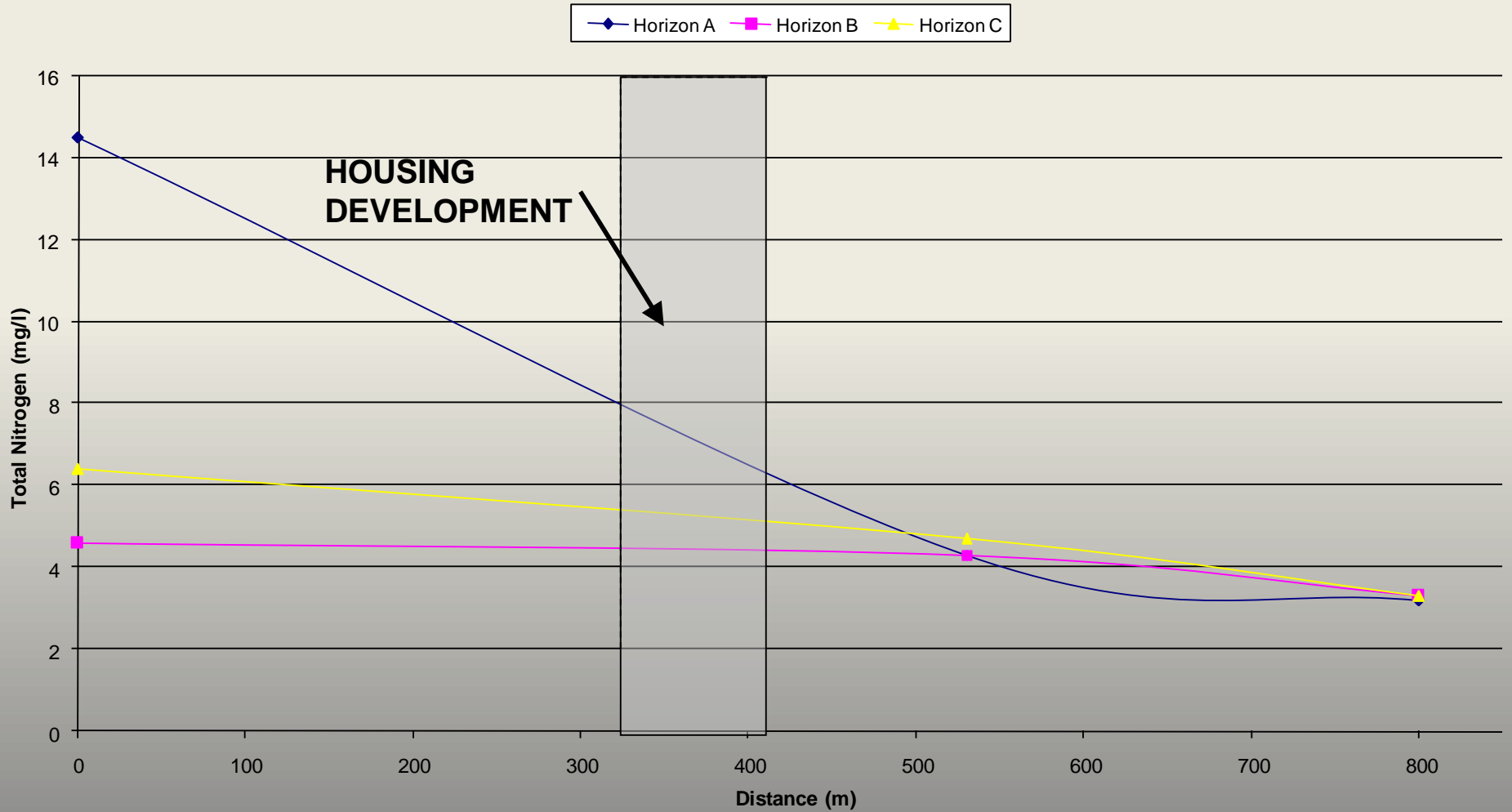
RESULTS - TO DATE

Nitrate Levels At Rhode, Offaly



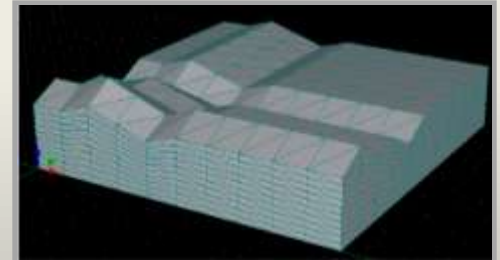
RESULTS - TO DATE

Total Nitrogen at Rhode, Offaly



CONCEPTUAL MODEL

- Calibrate model with site specific data – suction lysimeters
- HYDRUS 3D – Unsaturated Zone
- MODFLOW – Saturated Zone
- ArcGIS used with census data to predict areas of high vulnerability



CONCLUSIONS

- Groundwater is becoming an increasingly more important resource in Ireland
- No guidance on density of systems – varying planning polices
- Prediction model needed to give guidance for future planning and protection of groundwater resources