

Graiguenamagh Source

Extracted from:
County Kilkenny Groundwater Protection Scheme,
Volume II: Source Protection Zones (Draft. May 2002)

County Kilkenny

Groundwater Protection Scheme

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(Draft. May 2002)

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APPENDIX V: Laboratory analytical results

APPENDIX VI: Summary of trends in water quality over time for selected supply sources in Kilkenny

Overall conclusions are contained within Volume I.

15. Graiguenamanagh

15.1 Introduction

The objectives of this chapter are:

- To delineate source protection zones for the Ballyogan springs (part of the Graiguenamanagh Water Supply Scheme).
- To assist Kilkenny County Council in protecting the water supply from contamination.

The protection zones are delineated to help prioritise certain areas around the source in terms of pollution risk to the springs. This prioritisation is intended to provide a guide in the planning and regulation of development and human activities. The implications of these protection zones are further outlined in ‘Groundwater Protection Schemes’ (DELG/EPA/GSI, 1999).

15.2 Location and Site Description

According to a site location map sent to the GSI on 18th April 2002, the source comprises four springs, forming a line 230 m long in Ballyogan townland. The springs all lie close to the 170 m contour on the flanks of Brandon Hill, some 1.4 km north east of its peak.

M'C O’Sullivan Consulting Engineers (1999) indicate that the spring waters are integrated with waters from a surface water intake on the Duske River, some 1.2 km west of Graiguenamanagh to form the supply for Graiguenamanagh town. They indicate that the combined surface water and groundwater output comprises 529 m³/day.

No information is available on the sanitary protection measures at the springs. Examples of typical sanitary protection measures include fences and constructions to provide protection from wildfowl, livestock, and surface water inundation.

15.3 Summary of Source Details

GSI no.	2613NWW119
Grid ref.	270600, 141300
Townland	Ballyogan
Source type	4 springs
Development date	Unknown
Owner	Kilkenny County Council
Elevation (ground level)*	170 m OD
Depth to rock	Rock generally close to surface
Static water level	At surface
Discharge summary:	Unknown

* Estimated from Ordnance Survey contours

15.4 Methodology

Examination of spring flows, water quality, aquifer parameters, etc, was beyond the scope of the study. Protection zones were delineated on the basis of an examination of Ordnance Survey topographic maps and aerial photographs alone. As a consequence, the basis for the protection zones is more limited than for the other public supplies in this report. This may not be a significant limitation in the case of the Ballyogan springs, because the springs are located on the side of a mountain, and

protection zones in steep topographic areas would normally be based primarily on topographic features; even in the context of a more comprehensive study.

15.5 Topography and Surface Hydrology

The springs lie on the flanks of Brandon Hill within the catchment of the River Barrow (western side). The peak of Brandon Hill forms part of the regional catchment divide between the Nore and the Barrow. Upgradient of the spring, slopes are in the order of 0.25 (1 in 4), with the peak of Brandon Hill at 515 m OD. Downgradient of the springs, elevations reduce to less than 10 m OD at the Barrow River itself, which lies some 1.4 km to the north east of the springs.

There is no evidence from the Ordnance Survey 1:50,000 or 1:10,560 maps of surface water features on Brandon Hill upslope of the springs.

The Ordnance Survey contours define two minor watersheds running towards the Barrow River from the peak of Brandon Hill. These watersheds lie on either side of the Ballyogan springs, with one running 0.7 km to the north west and one running 0.5 km to the south of the springs. The aerial photographs suggest that these two minor watersheds define a pronounced, triangular-shaped bowl which is open on its north eastern side. The springs occur at the open, north eastern side of the bowl.

In the absence of groundwater level and flow data, it is assumed that this bowl controls groundwater flow to the springs and its boundaries have been used to define the source protection areas in later sections of this chapter.

15.6 Geology and Aquifers

15.6.1 Bedrock

The springs are mapped close to the boundary with two slightly different types of granite. The granites in Kilkenny are all classified as a **poor aquifer** which is **generally unproductive except for local zones (PI)**. Fracture flow is expected to be dominant and flows are expected to be concentrated in fractured and weathered zones. Given common weathering patterns, most flow is thought to be relatively shallow; concentrating in the top 10 m to 30 m of the rock profile. As a consequence, groundwater flow is expected to follow topography quite closely.

The boundary between the two types of granite may form a focus for slightly more intense weathering and, as a consequence, may act as a subsurface channel for groundwater flow. More detail on flow characteristics and aquifer classification criteria can be found in Chapter 4 of Volume I.

The granites will have been subject to a variety of different tectonic stresses, resulting in faulting and fracturing. The southern boundary of a ‘shear zone’ (band of major structural deformation) is mapped close to the location of the spring. The shear zone may be associated with increased rock fracturing and this feature might also be a focus for groundwater flow within the topographic bowl described in Section 15.5.

15.6.2 Subsoil

The area is mapped in Map 2S as ‘rock close to surface’. Subsoil materials are considered to be very thin or absent. There are no subsoil materials classified as aquifers in the area. The main significance of the subsoil materials, therefore, is in vulnerability assessments.

15.7 Groundwater Vulnerability

The concept of vulnerability is discussed in Chapter 5 of Volume I. In essence, groundwater vulnerability is dictated by the nature and thickness of the material overlying the main groundwater ‘target’. As discussed in Section 15.6, the main groundwater resource occurs within fractured granite bedrock. Consequently, the target is taken from the top of the granite, and considerations of

groundwater vulnerability concern the permeability of the whole subsoil profile and the depth to bedrock.

The subsoil in the immediate vicinity of the source is thought to be generally absent or very thin. This interpretation is based on the presence, upslope of the springs, of over 20 rock outcroppings (most of which are in excess of 200 m long). No borehole data is available to the GSI in this area.

At subsoil thicknesses of less than 3 m, bulk permeability becomes less relevant in mapping vulnerability across wide areas (as opposed to specific sites), because it becomes increasingly variable and increasingly influenced by the presence of ‘bypass flow’ mechanisms such as cracks in the subsoil. Accordingly, on the basis of the general depth to bedrock in the area, a vulnerability classification of ‘extreme’ has been assigned for the whole area upslope of the springs.

Depth to rock interpretations are based on the available data cited here. However, depth to rock can vary over a very small scale. As such, the vulnerability mapping provided will not be able to anticipate all the natural variation that occurs in an area. The mapping is intended only as a guide to land use planning and hazard surveys, and is not a substitute for site investigation for specific developments. Classifications may change as a result of investigations such as trial hole assessments for on-site domestic wastewater treatment systems. The potential for discrepancies between large scale vulnerability mapping and site-specific data has been anticipated and addressed in the development of groundwater protection responses (site suitability guidelines) for specific hazards. More detail can be found in ‘Groundwater Protection Schemes’ (DELG/EPA/GSI, 1999).

15.8 Rainfall, Evaporation and Recharge

The term ‘recharge’ refers to the amount of water replenishing the groundwater flow system. The estimation of recharge is often used in source protection delineation in order to assess if the potential catchment of the source (as defined by geological, topographic and hydrogeological constraints) is equivalent to the area required to support the discharge at the source with rainfall recharge.

However, because no measurements of discharge at the springs are available to the GSI, a water balance cannot be undertaken and the estimation of recharge is therefore not relevant in this instance.

15.9 Groundwater levels

The GSI database has no records within the surface water sub-catchment upstream of the springs.

15.10 Groundwater Flow Directions and Gradients

In the absence of borehole data or site visits, and given the aquifer conditions, the water table in the area is assumed to reflect topography, with groundwater flowing towards the spring from the watersheds to the north west and to the south and from the peak of Brandon Hill.

Hydraulic gradients are probably similar, if slightly less than, topographic gradients.

15.11 Hydrochemistry and Water Quality

No water quality data for the springs are currently available to the GSI.

15.12 Aquifer Parameters

No data are available.

15.13 Conceptual Model

This section provides a qualitative overview of the geological framework, recharge, flow and discharge patterns across the aquifer contributing groundwater to the source. It represents a summary

of the main inferences drawn in previous sections, and provides a foundation upon which the quantitative analyses required for delineating source protection areas can be drawn.

- The Ballyogan springs are fed by groundwaters flowing within the granites of Brandon Hill, which constitute a poor aquifer. The springs lie within the surface water catchment of the River Barrow, which lies to the east of the springs.
- Subsoils are thought to be generally absent or thin.
- Based on a regional conceptualisation of flow within the granite aquifer, groundwater flow to the springs is thought to be controlled by topography and by fracturing and weathering patterns within the rock mass. Most groundwater flow is thought to be relatively shallow; concentrating in the top 10 m to 30 m of the rock profile. The flow is therefore likely to follow local variations in topography, moving towards the springs from the Peak of Brandon Hill and from the minor watersheds to the north, south and west of the springs.
- Recharge to the springs is likely to originate as rainfall falling within the triangular-shaped topographic bowl which encloses the springs on the eastern flank of Brandon Hill.

15.14 Delineation of Source Protection Areas

15.14.1 Introduction

This section delineates the areas around the source that are believed to contribute groundwater to the source, and that therefore require protection. The areas are delineated on the basis of the conceptualisation of the groundwater flow pattern as described in Section 15.13.

Two source protection areas are delineated:

- Inner Protection Area (SI), designed to give protection from microbial pollution;
- Outer Protection Area (SO), encompassing the remainder of the zone of contribution (ZOC) of the source.

15.14.2 Outer Protection Area

The Outer Protection Area (SO) is bounded by the complete catchment area to the source, i.e. the zone of contribution (ZOC), and is defined as the area required to support an abstraction from long-term recharge. The ZOC is normally delineated using inferences of (a) the groundwater flow direction and gradient, (b) the rock permeability and (c) the recharge in the area.

In the case of the Ballyogan springs, information on groundwater gradients, bedrock permeability, etc is not available, and the conceptualisation is such that groundwater is expected to follow topography quite closely. Consequently, the ZOC for this source is assumed to coincide with the triangular-shaped topographic bowl which encloses the springs on the eastern flank of Brandon Hill. The boundaries of this bowl are described in Section 15.5 and depicted in Map 10.

15.14.3 Inner Protection Area

The Inner Protection Area (SI) is the area defined by a 100 day time of travel (TOT) to the source from a point below the water table and it is delineated to protect against the effects of potentially contaminating activities which may have an immediate influence on water quality at the source, in particular from microbial contamination.

Given the limited amount of information available at the source, the Inner Protection Area has been delimited by a line drawn 300 m upslope of all four springs at the source (refer to Map 10). A distance of 300 m is recommended in DELG/EPA/GSI (1999) for areas where no data are available.

15.15 Groundwater Protection Zones

The groundwater protection zones are obtained by integrating the source protection areas and vulnerability categories – giving a possible total of 8 source protection zones (see the matrix in the table below). In practice, this is done by superimposing the vulnerability map on the source protection area map. Each zone is represented by a code, e.g. **SI/E**, which represents an Inner Source Protection area where the groundwater is highly vulnerable to contamination. All of the hydrogeological settings represented by the zones may not be present around any given source. Just two groundwater protection zones are present around the source (refer to Map 10), as shown in the matrix below:

Matrix of Source Protection Zones

VULNERABILITY RATING	SOURCE PROTECTION	
	<i>Inner</i>	<i>Outer</i>
Extreme (E)	SI/E	SO/E
High (H)	<i>not present</i>	<i>not present</i>
Moderate (M)	<i>not present</i>	<i>not present</i>
Low (L)	<i>not present</i>	<i>not present</i>

The appropriate responses imposing restrictions on development are presented in the document ‘Groundwater Protection Schemes’ (DELG/EPA/GSI, 1999).

15.16 Land Use and Potential Pollution Sources

Assessments of spring water quality and existing potential hazards were outside the scope the study at the Ballyogan source. However, some examples of potential hazards in upland environments are; sheep dip disposal, livestock activity close to a supply, animal carcasses close to a supply, waste and hydrocarbon effluent from tourism developments, extractive industry, and fly tipping.

15.17 Conclusions and Recommendations

- ◆ The groundwater source for the Graiguenamanagh supply scheme is a spring, which is located in a poor aquifer on the eastern flank of Brandon Hill.
- ◆ Groundwater below the zone of contribution to the supply is generally ‘extremely’ vulnerable to contamination.
- ◆ The protection zones delineated in this chapter are based on our current understanding of groundwater conditions and on the available data. Additional data obtained in the future may indicate that amendments to the boundaries are necessary.
- ◆ It is recommended that:
 - chemical and bacteriological analyses of raw water as well as treated water be carried out regularly. The springs should be sampled and analysed separately from the surface water intake component of the public supply scheme. Sampling might be quite frequent initially (perhaps monthly), being reduced to perhaps quarterly if there is no evidence of contamination. The chemical analyses should include all major ions - calcium, magnesium, sodium, potassium, ammonium, bicarbonate, sulphate, chloride, and nitrate. More occasional analyses of other parameters such as pesticides and hydrocarbons is also recommended;
 - vulnerability to surface runoff be assessed. If necessary, a protective structure should be constructed over the spring;
 - the potential hazards in the ZOC be located and assessed.

Appendix IV: Discussion Of the Key Indicators of Domestic and Agricultural Contamination of Groundwater

A.1 Introduction

This appendix is adapted from Daly, 1996.

There has been a tendency in analysing groundwater samples to test for a limited number of constituents. A "full" or "complete" analysis, which includes all the major anions and cations, is generally recommended for routine monitoring and for assessing pollution incidents. This enables (i) a check on the reliability of the analysis (by doing an ionic balance), (ii) a proper assessment of the water chemistry and quality and (iii) a possible indication of the source of contamination. A listing of recommended and optional parameters are given in Table A1. It is also important that the water samples taken for analysis have not been chlorinated - this is a difficulty in some local authority areas where water take-off points prior to chlorination have not been installed.

The following parameters are good contamination indicators: E.coli, nitrate, ammonia, potassium, chloride, iron, manganese and trace organics.

TABLE A1

Recommended Parameters		
Appearance	Calcium (Ca)	Nitrate (N0 ₃)*
Sediment	Magnesium (Mg)	Ammonia (NH ₄ and NH ₃)*
pH (lab)	Sodium (Na)	Iron (Fe)*
Electrical Conductivity (EC)*	Potassium (K)*	Manganese (Mn)*
Total Hardness	Chloride Cl)*	
General coliform	Sulphate (S0 ₄)*	
E. coli *	Alkalinity	
Optional Parameters (depending on local circumstances or reasons for sampling)		
Fluoride (F)	Fatty acids *	Zinc (Zn)
Orthophosphate	Trace organics *	Copper (Cu)
Nitrite (N0 ₂)*	TOC *	Lead (Pb)
B.O.D.*	Boron (B) *	Other metals
Dissolved Oxygen *	Cadmium (Cd)	

* good indicators of contamination

A.2 Faecal Bacteria and Viruses

E. coli is the parameter tested as an indicator of the presence of faecal bacteria and perhaps viruses; constituents which pose a significant risk to human health. The most common health problem arising from the presence of faecal bacteria in groundwater is diarrhoea, but typhoid fever, infectious hepatitis and gastrointestinal infections can also occur. Although *E. coli* bacteria are an excellent indicator of pollution, they can come from different sources - septic tank effluent, farmyard waste, landfill sites, birds. The faecal coliform : faecal streptococci ratio has been suggested as a tentative

indicator to distinguish between animal and human waste sources (Henry *et al.*, 1987). However, researchers in Virginia Tech (Reneau, 1996) cautioned against the use of this technique.

Viruses are a particular cause for concern as they survive longer in groundwater than indicator bacteria (Gerba and Bitton, 1984).

The published data on elimination of bacteria and viruses in groundwater has been compiled by Pekdeger and Matthess (1983), who show that in different investigations 99.9% elimination of *E. coli* occurred after 10-15 days. The mean of the evaluated investigations was 25 days. They show that 99.9% elimination of various viruses occurred after 16-120 days, with a mean of 35 days for Polio-, Hepatitis, and Enteroviruses. According to Armon and Kott (1994), pathogenic bacteria can survive for more than ten days under adverse conditions and up to 100 days under favourable conditions; entertoviruses can survive from about 25 days up to 170 days in soils.

Bacteria can move considerable distances in the subsurface, given the right conditions. In a sand and gravel aquifer, coliform bacteria were isolated 100 ft from the source 35 hours after the sewage was introduced (as reported in Hagedorn *et al.*, 1981). They can travel several kilometres in karstic aquifers. In Ireland, research at Sligo RTC involved examining in detail the impact of septic tank systems at three locations with different site conditions (Henry, 1990; summarised in Daly, Thorn and Henry, 1993). Piezometers were installed down-gradient; the distances of the furthest piezometers were 8 m, 10 m and 9.5 m, respectively. Unsurprisingly, high faecal bacteria counts were obtained in the piezometers at the two sites with soakage pits, one with limestone bedrock at a shallow depth where the highest count (max. 14 000 cfu's per 1000 ml) and the second where sand/gravel over limestone was present (max 3 000 cfu's per 100 ml). At the third site, a percolation area was installed at 1.0 m b.g.l.; the subsoils between the percolation pipes and the fractured bedrock consisted of 1.5 m sandy loam over 3.5 m of poorly sorted gravel; the water table was 3.5 b.g.l. (So this site would satisfy the water table and depth to rock requirements of S.R.6:1991, and most likely the percolation test requirement.) Yet, the maximum faecal coliform bacteria count was 300 cfus per 100 ml. Faecal streptocci were present in all three piezometers. It is highly likely that wells located 30 m down gradient of the drainage fields would be polluted by faecal bacteria.

As viruses are smaller than bacteria, they are not readily filtered out as effluent moves through the ground. The main means of attenuation is by adsorption on clay particles. Viruses can travel considerable distances underground, depths as great as 67 m and horizontal migrations as far as 400 m have been reported (as reported in US EPA, 1987). The possible presence of viruses in groundwater as a result of pollution by septic tank systems is a matter of concern because of their mobility and the fact that indicator bacteria such faecal coliforms have been found not to correlate with the presence of viruses in groundwater samples (US EPA, 1987).

The natural environment, in particular the soils and subsoils, can be effective in removing bacteria and viruses by predation, filtration and absorption. There are two high risk situations: (i) where permeable sands and gravels with a shallow water table are present; and (ii) where fractured rock, particularly limestone, is present close to the ground surface. The presence of clayey gravels, tills, and peat will, in many instances, hinder the vertical migration of microbes, although preferential flow paths, such as cracks in clayey materials, can allow rapid movement and bypassing of the subsoil.

A.3 Nitrate

Nitrate is one of the most common contaminants identified in groundwater and increasing concentrations have been recorded in many developed countries. The consumption of nitrate rich water by young children may give rise to a condition known as methaemoglobinæmia (blue baby syndrome). The formation of carcinogenic nitrosamines is also a possible health hazard and epidemiological studies have indicated a positive correlation between nitrate consumption in drinking

water and the incidence of gastric cancer. However, the correlation is not proven according to some experts (Wild and Cameron, 1980). The EC MAC for drinking water is 50mg/l.

The nitrate ion is not adsorbed on clay or organic matter. It is highly mobile and under wet conditions is easily leached out of the rooting zone and through soil and permeable subsoil. As the normal concentrations in uncontaminated groundwater is low (less than 5 mg/l), nitrate can be a good indicator of contamination by fertilisers and waste organic matter.

In the past there has been a tendency in Ireland to assume that the presence of high nitrates in well water indicated an impact by inorganic fertilisers. This assumption has frequently been wrong, as examination of other constituents in the water showed that organic wastes - usually farmyard waste, probably soiled water - were the source. The nitrate concentrations in wells with a low abstraction rate - domestic and farm wells - can readily be influenced by soiled water seeping underground in the vicinity of the farmyard or from the spraying of soiled water on adjoining land. Even septic tank effluent can raise the nitrate levels; if a septic tank system is in the zone of contribution of a well, a four-fold dilution of the nitrogen in the effluent is needed to bring the concentration of nitrate below the EU MAC (as the EU limit is 50 mg/l as NO_3 or 11.3 mg/l as N and assuming that the N concentration in septic tank effluent is 45 mg/l).

The recently produced draft county reports by the EPA on nitrate in groundwater show high levels of nitrate in a significant number of public and group scheme supplies, particularly in south and southern counties and in counties with intensive agriculture, such as Carlow and Louth. This suggest that diffuse sources – landspreading of fertilisers – is having an impact on groundwater.

In assessing regional groundwater quality and, in particular the nitrate levels in groundwater, it is important that:

- (i) conclusions should not be drawn using data only from private wells, which are frequently located near potential point pollution sources and from which only a small quantity of groundwater is abstracted;
- (ii) account should be taken of the complete chemistry of the sample and not just nitrate, as well as the presence of *E. coli*;
- (iii) account should be taken of not only the land-use in the area but also the location of point pollution sources;
- (iv) account should be taken of the regional hydrogeology and the relationship of this to the well itself. For instance, shallow wells generally show higher nitrate concentrations than deeper wells, low permeability sediments can cause denitrification, knowledge on the groundwater flow direction is needed to assess the influence of land-use.

A.4 Ammonia

Ammonia has a low mobility in soil and subsoil and its presence at concentrations greater than 0.1 mg/l in groundwater indicates a nearby waste source and/or vulnerable conditions. The EU MAC is 0.3 mg/l.

A.5 Potassium

Potassium (K) is relatively immobile in soil and subsoil. Consequently the spreading of manure, slurry and inorganic fertilisers is unlikely to significantly increase the potassium concentrations in groundwater. In most areas in Ireland, the background potassium levels in groundwater are less than 3.0 mg/l. Higher concentrations are found occasionally where the rock contains potassium e.g. certain granites and sandstones. The background potassium:sodium ratio in most Irish groundwaters is less than 0.4 and often 0.3. The K:Na ratio of soiled water and other wastes derived from plant organic

matter is considerably greater than 0.4, whereas the ratio in septic tank effluent is less than 0.2. Consequently a K:Na ratio greater than 0.4 can be used to indicate contamination by plant organic matter - usually in farmyards, occasionally landfill sites (from the breakdown of paper). However, a K:Na ratio lower than 0.4 does not indicate that farmyard wastes are **not** the source of contamination (or that a septic tank is the cause), as K is less mobile than Na. (Phosphorus is increasingly a significant pollutant and cause of eutrophication in surface water. It is not a problem in groundwater as it usually is not mobile in soil and subsoil).

A.6 Chloride

The principle source of chloride in uncontaminated groundwater is rainfall and so in any region, depending on the distance from the sea and evapotranspiration, chloride levels in groundwater will be fairly constant. Chloride, like nitrate, is a mobile cation. Also, it is a constituent of organic wastes. Consequently, levels appreciably above background levels (12-15 mg/l in Co. Offaly, for instance) have been taken to indicate contamination by organic wastes such as septic tank systems. While this is probably broadly correct, Sherwood (1991) has pointed out that chloride can also be derived from potassium fertilisers.

A.7 Iron and manganese

Although they are present under natural conditions in groundwater in some areas, they can also be good indicators of contamination by organic wastes. Effluent from the wastes cause deoxygenation in the ground which results in dissolution of iron (Fe) and manganese (Mn) from the soil, subsoil and bedrock into groundwater. With reoxygenation in the well or water supply system the Fe and Mn precipitate. High Mn concentrations can be a good indicator of pollution by silage effluent. However, it can also be caused by other high BOD wastes such as milk, landfill leachate and perhaps soiled water and septic tank effluent.

Box A1 Warning/trigger Levels for Certain Contaminants

As human activities have had some impact on a high proportion of the groundwater in Ireland, there are few areas where the groundwater is in a pristine, completely natural condition. Consequently, most groundwater is contaminated to some degree although it is usually not polluted. In the view of the GSI, assessments of the degree of contamination of groundwater can be beneficial as an addition to examining whether the water is polluted or not. This type of assessment can indicate where appreciable impacts are occurring. It can act as a warning that either the situation could worsen and so needs regular monitoring and careful land-use planning, or that there may be periods when the source is polluted and poses a risk to human health and as a consequence needs regular monitoring. Consequently, thresholds for certain parameters can be used to help indicate situations where additional monitoring and/or source protection studies and/or hazard surveys may be appropriate to identify or prevent more significant water quality problems.

Parameter	Threshold mg/l	EU MAC mg/l
Nitrate	25	50
Potassium	4	12
Chloride	30 (except near sea)	250
Ammonia	0.15	0.3
K/Na ratio	0.3-0.4	
Faecal bacteria	0	0

Box A2 Summary : Assessing a Problem Area

Let us assume that you are examining an area with potential groundwater contamination problems and that you have taken samples in nearby wells. How can the analyses be assessed?

E. coli present \Rightarrow organic waste source nearby (except in karst areas), usually either a septic tank system or farmyard.

E. coli absent \Rightarrow either not polluted by organic waste or bacteria have not survived due to attenuation or time of travel to well greater than 100 days.

Nitrate > 25 mg/l \Rightarrow either inorganic fertiliser or organic waste source; check other parameters.

Ammonia > 0.15 mg/l \Rightarrow source is nearby organic waste; fertiliser is not an issue.

Potassium (K) > 5.0 mg/l \Rightarrow source is probably organic waste.

K/Na ratio > 0.4 (0.3, in many areas) \Rightarrow Farmyard waste rather than septic tank effluent is the source. If < 0.3, no conclusion is possible.

Chloride > 30 mg/l \Rightarrow organic waste source. However this does not apply in the vicinity of the coast (within 20 km at least).

In conclusion, faecal bacteria, nitrate, ammonia, high K/Na ratio and chloride indicate contamination by organic waste. However, only the high K/Na helps distinguish between septic tank effluent and farmyard wastes. So in many instances, while the analyses can show potential problems, other information is needed to complete the assessment.

A.8 References

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Appendix V: Laboratory analytical results

EPA Regional Water Laboratory, Kilkenny. Monitoring Data for County Kilkenny Groundwaters 1993 to 1999.

Source	Sampling Date	Sampling Time	To	Ref No	Sampling Location	Taken By	Lab No	EPA Ref	Stn Grid Ref	Water Supply	Public/Group/Private	Temperature 1/2/3	Odour Hazen	pH	Conductivity $\mu\text{S}/\text{cm}$	Turbidity NTU	TOC mg/l C	Ammonia mg/l N	
Spring at Paulstown Castle	29/04/1992	11:38:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle		1648	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	9.1	1	5	7.3	623	0.03		
Spring at Paulstown Castle	01/07/1992	15:55:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle		2681	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	11.4	1	5	7.4	640	0.02		
Spring at Paulstown Castle	20/08/1992	15:15:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle		3737	KIK46	S 660 570	Gowran/Goresbr./P-town	Public		1	5	7.2	600	0.02		
Spring at Paulstown Castle	18/11/1992	13:29:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle		5086	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	9.8	2	5	7.4	623	0.02		
Spring at Paulstown Castle	10/03/1993	16:00:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle		1017	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	9.6	1	5	7.3	660	0.01		
Borehole at Castlecomer Yarns	02/06/1993		Kilkenny Co. Co.	KK00300	Tap in yard at Castlecomer Yarns	J. Keohane	2269		25360 17330	Castlecomer Yarns	Private		1	15	7.5	570	1	< 1	0.01
Spring at Paulstown Castle	02/06/1993		Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle	J. Keohane	2270	KIK46	S 660 570	Gowran/Goresbr./P-town	Public		1	5	7.2	696	0.4	5.7	0.01
Borehole at Rathcash	02/06/1993		Kilkenny Co. Co.	KK02000	Joe Pykes house, Rathcash, Clara.	J. Keohane	2271	KIK55	25870 15510	Rathcash	Group		1	5	7.3	682	0.2	< 1	0.01
Springs at Bausheenmore	02/06/1993		Kilkenny Co. Co.	KK00500	At source (springs at Bausheenmore	J. Keohane	2272	KIK39	25520 14690		Private		1	5	7.3	814	0.35	0.9	0.01
Spring at Westcourt	02/06/1993		Kilkenny Co. Co.	KK00800	Spring at Earlsland, Westcourt, Callan	J. Keohane	2273	KIK91	S 407 442	Callan	Public		1	5	7.3	718	0.2	0.5	0.01
Borehole at Galmoy	03/06/1993	11:25:00	Kilkenny Co. Co.	KK00200	Leahy's House, Galmoy	P.Mullins	2292	KIK17	23020 17120	Galmoy	Group	10	1	5	7.4	790	0.2	< 1	0.01
Galmoy 35	03/06/1993	11:47:00	Kilkenny Co. Co.		M. Phelan	P.Mullins	2293				Private	10	1	5	7.4	792	0.15	< 1	0.01
Galmoy 37	03/06/1993	12:02:00	Kilkenny Co. Co.		Mr. Tom Maher's House	P.Mullins	2294				Private	11	1	5	7.4	769	0.2		0.01
Galmoy 25	03/06/1993	12:15:00	Kilkenny Co. Co.		Hennessey's at House	P.Mullins	2295				Private	10	1	5	7.3	894	0.25	0.2	0.01
Galmoy 202	03/06/1993	12:55:00	Kilkenny Co. Co.		Phelans	P.Mullins	2296				Private	11	1	5	7.4	755	0.3	< 1	0.01
Borehole at Bawnmore	03/06/1993	16:00:00	Kilkenny Co. Co.	KK0100	Phelan's house, Bawnmore	P.Mullins	2297	KIK50	22580 16610	Bawnmore	Group	12	1	5	7.3	820	0.2	0.14	0.01
Spring at Clomantagh	10/06/1993	11:40:00	Kilkenny Co. Co.	KK00900	Beside Nuenna river, 50m SE of roac	P.Mullins+J.Keohane	2395		23520 16320		Private		1	5	7.3	664	0.3		0.01
Spring at Clomantagh	10/06/1993	11:50:00	Kilkenny Co. Co.	KK00900	Beside Nuenna river, 50m SE of roac	P.Mullins+J.Keohane	2396		23520 16320		Private		1	5	7.3	677	0.35		0.01
Borehole at Dunmore	10/06/1993	12:28:00	Kilkenny Co. Co.	KK00700	C. Murray's house, Dunmore	P.Mullins+J.Keohane	2397		24910 16200	Dunmore	Group		1	5	7.4	676	0.2		0.01
Spring Toberpatrick Urlingford	15/06/1993	10:45:00	Kilkenny Co. Co.	KK01500	In chamber at source	C. Murray	2417	KIK34	23000 16350	Urlingford/Johnstown	Public		1	5	7.2	781	0.3	1.6	0.01
Borehole at Kilmanagh	15/06/1993	12:00:00	Kilkenny Co. Co.	KK01400	In pumphouse	C. Murray	2418	KIK45	23930 15250	Kilmanagh/Ballycuddihy	Group		1	5	7.5	659	0.3		0.01
Borehole at Dunmore S/G	15/06/1993	14:30:00	Kilkenny Co. Co.	KK01000	Canteen at Dunmore Sand & Gravel	C. Murray	2419	KIK53	25000 16020	Dunmore Sand & Gravel	Private		1	5	7.4	643	1.2	0.4	0.01
Borehole at Kilkenny Mar	15/06/1993	15:00:00	Kilkenny Co. Co.	KK01300	Cattle holding shec	C. Murray	2420		25070 15670	Kilkenny Mart	Private		1	5	7.6	691	0.2	0.4	0.01
Borehole at Windgar	01/07/1993		Kilkenny Co. Co.	KK01900	Overflow from borehole	C. Murray	2769		24200 13580	Farm supply	Private		1	5	7.2	382	1.5		0.37
Spring at Paulstown Castle	05/08/1993	15:55:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle		3294	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	11.6	1	5	7.3	680			0.01
Galmoy	08/11/1993	11:15:00	Kilkenny Co. Co.		Leahy's House (A 82)	P.Mullins	4754				Group	8	1	5	7.3	806	0.09		0.01
Galmoy	08/11/1993	11:45:00	Kilkenny Co. Co.		Parochial House	P.Mullins	4755				Private	9	1	5	7.3	725	0.09		0.01
Galmoy	08/11/1993	12:20:00	Kilkenny Co. Co.		Phelans, original (A 35)	P.Mullins	4756				Private	8	1	5	7.1	996	0.21		0.01
Galmoy	08/11/1993	12:40:00	Kilkenny Co. Co.		Brophy's (A 25)	P.Mullins	4757				Private	9	1	5	7.4	849	0.15		
Galmoy	08/11/1993	13:50:00	Kilkenny Co. Co.		Phelans (A 24)	P.Mullins	4758				Private	9	1	5	7.4	874	0.19		< 0.01
Galmoy	08/11/1993	13:55:00	Kilkenny Co. Co.		Hennessy's	P.Mullins	4759				Private	9							
Galmoy	08/11/1993	14:44:00	Kilkenny Co. Co.		Gannons (A 36)	P.Mullins	4760				Private	9	1	5	7.3	864	0.13		< 0.01
Galmoy	08/11/1993	14:52:00	Kilkenny Co. Co.		Maher's (A 37)	P.Mullins	4761				Private	9	1	5	7.3	816	0.14		< 0.01
Borehole at Bawnmore	08/11/1993	15:15:00	Kilkenny Co. Co.	KK0100	Phelan's house, Bawnmore	P.Mullins	4762	KIK50	22580 16610	Bawnmore	Group	9	1	5	7.3	829	0.1		< 0.01
Galmoy	08/11/1993	15:45:00	Kilkenny Co. Co.		Dan Phelan (A 202)	P.Mullins	4763				Private	9	1	5	7.3	739	0.07		< 0.01
Spring Toberpatrick Urlingford	09/11/1993	11:45:00	Kilkenny Co. Co.	KK01500	In chamber at source	P. Mullins	4776	KIK34	23000 16350	Urlingford/Johnstown	Public	10	2	< 5	7.3	808	0.22		0.01
Borehole at Castlecomer Yarns	09/11/1993	12:35:00	Kilkenny Co. Co.	KK00300	Tap in yard at Castlecomer Yarns	P. Mullins	4777		25360 17330	Castlecomer Yarns	Private	10	2	5	7.6	568	3.5		0.01
Spring at Paulstown Castle	09/11/1993	14:40:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle	P. Mullins	4778	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	11	2	< 5	7.4	648	0.24		0.01
Borehole at Clara	09/11/1993	15:15:00	Kilkenny Co. Co.	KK00400	At pumphouse	P. Mullins	4779	KIK41	25770 15530	Clara	Group	10	1	< 5	7.4	677	0.17	67.3	0.01
Spring at Westcourt	09/11/1993	16:00:00	Kilkenny Co. Co.	KK00800	Spring at Earlsland, Westcourt, Callan	P. Mullins	4780	KIK91	S 407 442	Callan	Public	10	1	< 5	7.3	722	0.21		0.01
Borehole at Dunmore	10/11/1993	10:30:00	Kilkenny Co. Co.	KK00700	C. Murray's house, Dunmore.	C. Murray	4796		24910 16200	Dunmore	Group	8.4	1	5	7.5	702	0.1		0.01
Borehole at Dunmore S/G	10/11/1993	10:55:00	Kilkenny Co. Co.	KK01000	Canteen at Dunmore Sand & Gravel	C. Murray	4797	KIK53	25000 16020	Dunmore Sand & Gravel	Private	8.1	1	< 5	7.6	635	0.7		0.01
Borehole at Kilkenney Mar	10/11/1993	11:15:00	Kilkenny Co. Co.	KK01300	Cattle holding shec	C. Murray	4798		25070 15670	Kilkenny Mart	Private	4.9	2	< 5	8	690	0.14		
Borehole at Kilmanagh	10/11/1993	12:22:00	Kilkenny Co. Co.	KK01400	In pumphouse	C. Murray	4799	KIK45	23930 15250	Kilmanagh/Ballycuddihy	Group	10	2	< 5	7.7	644	0.33		0.01
Springs at Bausheenmore	10/11/1993	14:30:00	Kilkenny Co. Co.	KK00500	At source (springs at Bausheenmore	C. Murray	4800	KIK39	25520 14690		Private	10.2	1	< 5	7.4	812	0.23		0.01
Borehole No. 9, Thomastown	10/11/1993	15:10:00	Kilkenny Co. Co.	KK01600	At pumphouse	C. Murray	4801	KIK32	25890 14160	Thomastown	Public	11	2	< 5	7.4	798	0.15		0.01
Borehole at Windgar	10/11/1993	15:50:00	Kilkenny Co. Co.	KK01900	Overflow from borehole	C. Murray	4802		24200 13580	Farm supply	Private	10.8	1	< 5	7.5	375	0.32		0.01
Borehole at Avonmore Dairy	11/11/1993	11:30:00	Kilkenny Co. Co.	KK01200	Holding tank on roof	C. Murray	4803				Private	2	5	7.8	621	0.11		0.01	
Rathcash, Clifden, Co. Kilkenny	08/12/1993	09:45:00	Kilkenny Co. Co.		Joe Pykes	J.Keohane	5212				Group		1	5	7.4	711	0.17		< 0.01
Spring at Paulstown Castle	10/11/1994	11:25:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle		5072	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	9.8	1	5	7.1	680	0.08		
Graigue, Callan.	12/01/1995		Kilkenny Co. Co.		James Robinsons well	James Robinson	212			Proposed Supply for James Robinson	Private			< 5	7.6	528	14		
Spring at Paulstown Castle	23/01/1995	15:45:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle		255	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	9.5	5			680		0.01	
Spring at Paulstown Castle	16/10/1995	15:23:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle		4410	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	11.8	1	5	7.3	595			< 0.01
Borehole at Castlecomer Yarns	08/01/1996	11:10:00	Kilkenny Co. Co.	KK00300	Tap in yard at Castlecomer Yarns	C. Murray	74		25360 17330	Castlecomer Yarns	Private	11.6	2	20	7.4	583	5.5	2	< 0.01
Borehole at Dunmore	08/01/1996	11:30:00	Kilkenny Co. Co.	KK00700	C. Murray's house, Dunmore.	C. Murray	75		24910 16200	Dunmore	Group	8	1	5	7.3	615	0.2	3.4	< 0.01
Borehole at Dunmore S/G	08/01/1996	12:00:00	Kilkenny Co. Co.	KK01000	Canteen at Dunmore Sand & Gravel	C. Murray	76	KIK53	25000 16020	Dunmore Sand & Gravel	Private	10.1	2	5	7.7	627	1.6	2.2	< 0.01
Borehole at Kilkenney Mar	08/01/1996	12:15:00	Kilkenny Co. Co.	KK01300	Cattle holding shec	C. Murray	77		25070 15670	Kilkenny Mart	Private	9.5	1	5	7.9	690	0.2	2.4	< 0.01
Borehole at Clara	08/01/1996	12:55:00	Kilkenny Co. Co.	KK00400	At pumphouse	C. Murray	78	KIK41	25770 15530	Clara	Group	11	1	5	7.3	696	0.2	4.5	< 0.01
Borehole at Rathcash	08/01/1996	13:10:00	Kilkenny Co. Co.	KK02000	Joe Pykes house, Rathcash, Clara.	C. Murray	79	KIK55	25870 15510	Rathcash	Group	8.7	2	5	7.4	708	0.1		< 0.01
Spring at Paulstown Castle	08/01/1996	14:40:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle	C. Murray	80	KIK46	S 660 570	Gowran/Gores									

EPA Regional Water Laboratory, Kilkenny. Monitoring Data for County Kilkenny Groundwaters 1993 to 1999.

Source	Sampling Date	Sampling Time	o-Phosphate mg/l P	Nitrate mg/l N	Nitrite mg/l N	Chloride mg/l Cl	Ca Hardness mg/l CaCO ₃	Alkalinity mg/l CaCO ₃	TCS	Total Coliforms per 100 ml	FCS	Fecal Coliforms per 100 ml	Sulphate mg/l SO ₄	Dry Residue mg/l	Sus_Solids mg/l	Magnesium mg/l Mg	Total Hardness mg/l CaCO ₃	Sodium mg/l Na	Potassium mg/l K	Aluminium mg/l Al	Iron mg/l Fe	Manganese mg/l Mn	Copper mg/l Cu	Zinc mg/l Zn	Chromium mg/l Cr	Lead mg/l Pb	
Spring at Paulstown Castle	29/04/1992	11:38:00	0.04	6	29				78	44	2	5					< 0.05	< 0.02	< 0.03	< 0.01							
Spring at Paulstown Castle	01/07/1992	15:55:00	0.01	5	28				13	999		5					< 0.04	< 0.02	< 0.03	0.01							
Spring at Paulstown Castle	20/08/1992	15:15:00	0.02	4.3	28							5															
Spring at Paulstown Castle	18/11/1992	13:29:00	0.03	4.6	28				340	280		5															
Spring at Paulstown Castle	10/03/1993	16:00:00	0.02	6.8	38				20	5		5					0.011	0.009	< 0.001	0.015							
Borehole at Castlecomer Yarns	02/06/1993	0.05	0.1	0.006	20				999	999	7	23.8	242	33.1	1.4	9.2	0.797	0.017	< 0.001	< 0.001							
Spring at Paulstown Castle	02/06/1993	0.06	8.2	0.005	30			305	999	999	< 1	12.3	355	9.1	3.2	0.051	0.006	< 0.001	< 0.005	< 0.001	< 0.001						
Borehole at Rathcash	02/06/1993	0.08	7.2	0.001	24			317	15	1		22.3	359	8.4	1.5	0.033	0.004	< 0.001	0.02	< 0.001	< 0.001						
Springs at Bausheenmore	02/06/1993	0.08	6.1	0.006	41			401	999	999	< 1	33.3	425	9.3	4.3	0.077	0.017	< 0.001	0.018	< 0.001	< 0.001						
Spring at Westcourt	02/06/1993	0.05	3.8	0.002	24			370	64	21	< 1	27.8	383	9.8	1.2	0.012	< 0.005	< 0.001	< 0.005	< 0.001	< 0.001						
Borehole at Galmoy	03/06/1993	11:25:00	0.01	9.4	0.002	29		350	999	999	4	83.2	399	17.1	2.7	0.027	0.026	< 0.005	0.063	0.036	< 0.001	0.011					
Galmoy 35	03/06/1993	11:47:00	0.01	10	0.003	28		350	999	999	9	96.8	393	22.8	6.5	0.006	0.022	< 0.005	0.079	0.021	< 0.001	0.001					
Galmoy 37	03/06/1993	12:02:00	0.01	5.7	0.002	21		379	999	999	3	84.8	393	20.2	2.2	0.02	0.015	< 0.005	0.111	0.005	< 0.001	0.005					
Galmoy 25	03/06/1993	12:15:00	0.007	12	0.003	22		383	275	28	25	80	433	37.9	11.7	0.009	0.036	< 0.005	0.439	0.278	< 0.001	0.016					
Galmoy 202	03/06/1993	12:55:00	0.005	5.7	0.003	22		359	20	18	7	58.8	375	26.2	10	0.019	0.021	0.012	0.151	0.027	< 0.001	< 0.001					
Borehole at Bawnmore	03/06/1993	16:00:00	0.01	6	0.002	26		398	1	1	8	102	419	21.8	5.4	0.005	0.015	< 0.005	0.068	0.03	< 0.001	< 0.001					
Spring at Clomantagh	10/06/1993	11:40:00	0.007	6.1	0.004	22		297	230		< 1	14.1	359	7.5	1.6	0.032	0.009	< 0.001	< 0.005	< 0.001	0.003						
Spring at Clomantagh	10/06/1993	11:50:00	0.02	6.5	0.003	23		318	162		< 1	14.3	369	7.6	1.6	0.037	0.008	0.001	< 0.005	< 0.001	< 0.001						
Borehole at Dunmore	10/06/1993	12:28:00	0.004	14	0.001	27		251	999	999	2	7.5	354	8.3	0.8	0.031	< 0.005	0.009	< 0.005	< 0.001							
Spring Toberpatrick Urlingford	15/06/1993	10:45:00	0.01	7.6	0.005	27		383	34	15	8	22.2	400	9.1	4.7		0.004	< 0.001									
Borehole at Kilmanagh	15/06/1993	12:00:00	0.01	4.5	0.001	19		328	175	116	7	18.9	345	8.5	1.1		0.009	< 0.001									
Borehole at Dunmore S/G	15/06/1993	14:30:00	0.01	0.2	0.006	18		313	999	999	24	19.3	333	11.3	1			0.039	< 0.001								
Borehole at Kilkenny Mar	15/06/1993	15:00:00	0.01	6.3	0.002	18		296	43	20	32		20.8	355	11	1.5		0.03	< 0.001								
Borehole at Windgap	01/07/1993	0.02	1.6	0.001	14			137	999	999	< 1		Not Vis.	20	177	6.9	1.1	0.17	0.014	0.01							
Spring at Paulstown Castle	05/08/1993	15:55:00	0.02	6	27			85			5					0.019	< 0.005	0.025									
Galmoy	08/11/1993	11:15:00	< 0.01	10.2	34	309	389			8		30.6	435	8.6	1.1	0.041	< 0.005	< 0.001	0.031	0.0005	< 0.001						
Galmoy	08/11/1993	11:45:00	< 0.01	4.4	20	247	378	999	999	11		35.9	395	11.5	1.7	0.03	< 0.005	< 0.001	0.021	0.0004	< 0.001						
Galmoy	08/11/1993	12:20:00	< 0.01	5.3	59	384	470	6	999	10		27.4	497	18.6	10.3	0.036	< 0.005	0.006	0.034	0.0004	0.003						
Galmoy	08/11/1993	12:40:00	0.003	7.2	0.01	24	300	437	24	999	14		38.1	457	12.7	1.8	0.055	0.002	< 0.001	0.062	0.0005	< 0.001					
Galmoy	08/11/1993	13:50:00	0.004	15.1	34.6	288	387		999	999	14		38.7	448	13.4	9	0.032	< 0.005	0.014	0.178	0.0005	< 0.001					
Galmoy	08/11/1993	13:55:00							50	7																	
Galmoy	08/11/1993	14:44:00	0.008	12.7	28.7	342	415	100	2	8		24.5	443	13.9	9.1	0.044	0.016	< 0.001	0.681	0.0003	< 0.001						
Galmoy	08/11/1993	14:52:00	0.007	8.8	26	309	416	999	999	7		32.4	443	8.6	1.4	0.051	< 0.005	0.002	0.026	0.0004	< 0.001						
Borehole at Bawnmore	08/11/1993	15:15:00	< 0.01	6	27.6	315	434	1	1	9		33.6	454	9	2.2	0.025	< 0.005	0.005	0.015	0.0004	< 0.001						
Galmoy	08/11/1993	15:45:00	0.006	6.4	18.3	305	389	999	999	6		22.6	398	8.7	2.7	0.038	< 0.005	0.008	0.017	0.0004	< 0.001						
Spring Toberpatrick Urlingford	09/11/1993	11:45:00	0.01	8.5	27		395	100	21	8			403														
Borehole at Castlecomer Yarns	09/11/1993	12:35:00	0.01	0.2	19		278	1	999	12			229														
Spring at Paulstown Castle	09/11/1993	14:40:00	0.01	5.8	26		296	33	18	8			314														
Borehole at Clara	09/11/1993	15:15:00	0.01	6.8	21		325	167	2	8			340														
Spring at Westcourt	09/11/1993	16:00:00	0.01	4.3	24		370	4	3	5			368														
Borehole at Dunmore	10/11/1993	10:30:00	0.01	13.6	22		296	999	999	< 1		7.3	320	9.2	0.8	0.041	< 0.005	0.001	0.035	< 0.001							
Borehole at Dunmore S/G	10/11/1993	10:55:00	0.01	0.1	17		297	84	27	12		17.5	300	12	0.9	0.106	0.229	0.003	0.043	< 0.001							
Borehole at Kilkenny Mar	10/11/1993	11:15:00	0.01	6.6	18		307	8	6	19		19	324	12	1.3	0.087	0.013	0.003	0.487	< 0.001							
Borehole at Kilmanagh	10/11/1993	12:22:00	0.01	5	19		293	8	2	< 1		16.2	300	9.3	0.9	< 0.005	0.001	0.001	0.06	< 0.001							
Springs at Bausheenmore	10/11/1993	14:30:00	0.01	6.5	30		100	100	< 1			34	381	10.1	3.5	0.009	0.001	< 0.001	0.052	< 0.001							
Borehole No.9, Thomastown	10/11/1993	15:10:00	0.02	7.3	41			999	999	2			25.4	350	18	3.5	0.017	0.002	0.002	0.565	0.001						
Borehole at Windgap	10/11/1993	15:50:00	0.02	1.7	12		173	9	5	2			17	173	8	1	0.016	0.001	< 0.001	0.075	< 0.001						
Borehole at Avonmore Dairy	11/11/1993	11:30:00	0.3	6.5	31		230	999	999	15			10.6	265	16.9	6.7	0.04	0.003	0.002	0.178	< 0.001						
Rathcash, Clifden, Co. Kilkenny	08/12/1993	09:45:00	0.011	6	0.001	23		334	999	999	8			27.8	358	8.5	1.2	0.01	0.006	0.004	0.084	0.003					
Spring at Paulstown Castle	10/11/1994	11:25:00	< 0.01	5.3	29			420	170		5					1.06	0.09	0.01	0.166								
Graigue, Callan.	12/01/1995						244							27.4	238	14.1	0.7										
Spring at Paulstown Castle	23/01/1995	15:45:00	0.01	7	25			500	290		5																
Spring at Paulstown Castle	16/10/1995	15:23:00	0.016	4	22			150	72		5																
Borehole at Castlecomer Yarns	08/01/1996	11:10:00	0.05	0.006	18.5		304	999	999	22			20.2	321	18.6	0.9	0.116	0.434	< 0.02								
Borehole at Dunmore	08/01/1996	11:30:00	< 0.001	9.5	< 0.003	20.9		257	999	999	20			6.1	338	7.7	0.8	< 0.06	< 0.02	< 0.02							
Borehole at Dunmore S/G	08/01/1996	12:00:00	< 0.001	< 0.001	0.004	19.3		311		999	36			17.5	355	11.2	0.9	< 0.06	0.15	< 0.02							

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Source	Sampling Date	Sampling Time	Cadmium mg/l Cd	Mercury mg/l Hg	Nickel mg/l Ni	Fluoride mg/l F	OMCTSiloxane µg/l	Comments1	Comments2	Comments3
Spring at Paulstown Castle	29/04/1992	11:38:00								
Spring at Paulstown Castle	01/07/1992	15:55:00								
Spring at Paulstown Castle	20/08/1992	15:15:00								
Spring at Paulstown Castle	18/11/1992	13:29:00								
Spring at Paulstown Castle	10/03/1993	16:00:00								
Borehole at Castlecomer Yarns	02/06/1993	< 0.0001						Copy to Castlecomer Yarns Ltd.		
Spring at Paulstown Castle	02/06/1993	< 0.0001								
Borehole at Rathcash	02/06/1993	< 0.0001						Copy to Rathcash G.W.S.		
Springs at Bausheenmore	02/06/1993	< 0.0001								
Spring at Westcourt	02/06/1993	< 0.0001								
Borehole at Galmoy	03/06/1993	11:25:00	< 0.0001	0.007						
Galmoy 35	03/06/1993	11:47:00	0.0001	0.001						
Galmoy 37	03/06/1993	12:02:00	0.0001	< 0.001						
Galmoy 25	03/06/1993	12:15:00	0.0001	0.005						
Galmoy 202	03/06/1993	12:55:00	0.0001	< 0.001						
Borehole at Bawnmore	03/06/1993	16:00:00	0.0001	< 0.001						
Spring at Clomantagh	10/06/1993	11:40:00	< 0.0001							
Spring at Clomantagh	10/06/1993	11:50:00	< 0.0001							
Borehole at Dunmore	10/06/1993	12:28:00	< 0.0001							
Spring Toberpatrick Urlingford	15/06/1993	10:45:00	< 0.0001							
Borehole at Kilmanagh	15/06/1993	12:00:00	< 0.0001							
Borehole at Dunmore S/G	15/06/1993	14:30:00	< 0.0001							
Borehole at Kilkenny Mar	15/06/1993	15:00:00	< 0.0001							
Borehole at Windgar	01/07/1993									
Spring at Paulstown Castle	05/08/1993	15:55:00								
Galmoy	08/11/1993	11:15:00	< 0.0001	< 0.001						
Galmoy	08/11/1993	11:45:00	< 0.0001	< 0.001						
Galmoy	08/11/1993	12:20:00	< 0.0001	< 0.001						
Galmoy	08/11/1993	12:40:00	< 0.0001	< 0.001						
Galmoy	08/11/1993	13:50:00	< 0.0001	< 0.001						
Galmoy	08/11/1993	13:55:00						Taken after well was pumped for approximately 1 1/2 hours.		
Galmoy	08/11/1993	14:44:00	< 0.0001	< 0.001						
Galmoy	08/11/1993	14:52:00	< 0.0001	< 0.001						
Borehole at Bawnmore	08/11/1993	15:15:00	< 0.0001	< 0.001						
Galmoy	08/11/1993	15:45:00	< 0.0001	< 0.001						
Spring Toberpatrick Urlingford	09/11/1993	11:45:00								
Borehole at Castlecomer Yarns	09/11/1993	12:35:00								
Spring at Paulstown Castle	09/11/1993	14:40:00								
Borehole at Clara	09/11/1993	15:15:00						167 Total Coliforms, 5 obvious coliform colonies, 162 probably coliform colonies.		
Spring at Westcourt	09/11/1993	16:00:00								
Borehole at Dunmore	10/11/1993	10:30:00	< 0.0001							
Borehole at Dunmore S/G	10/11/1993	10:55:00	< 0.0001							
Borehole at Kilkenny Mar	10/11/1993	11:15:00	< 0.0001							
Borehole at Kilmanagh	10/11/1993	12:22:00	< 0.0001					Copy to Mr. Liam Delaney.		
Springs at Bausheenmore	10/11/1993	14:30:00	< 0.0001							
Borehole No. 9, Thomastown	10/11/1993	15:10:00	< 0.0001							
Borehole at Windgar	10/11/1993	15:50:00	< 0.0001							
Borehole at Avonmore Dairy	11/11/1993	11:30:00	< 0.0001					Chlorinated sample		
Rathcash, Clifden, Co. Kilkenny	08/12/1993	09:45:00	< 0.0001							
Spring at Paulstown Castle	10/11/1994	11:25:00								
Graigue, Callan.	12/01/1995	< 0.0003						High iron and elevated manganese levels leading to high turbidity.		
Spring at Paulstown Castle	23/01/1995	15:45:00						Interference < mixed background colonies (non-coliform) on Total Coliform plate.		
Spring at Paulstown Castle	16/10/1995	15:23:00						Interference from background colonies on Total Coliform plate.		
Borehole at Castlecomer Yarns	08/01/1996	11:10:00								
Borehole at Dunmore	08/01/1996	11:30:00								
Borehole at Dunmore S/G	08/01/1996	12:00:00						Total Coliform plate overgrown with non< coliforms.		
Borehole at Kilkenny Mar	08/01/1996	12:15:00								
Borehole at Clara	08/01/1996	12:55:00						Copy to: Paddy Coogan, Clifden, Clara, Co. Kilkenny		
Borehole at Rathcash	08/01/1996	13:10:00						Copy to: Mr. Joe Pyke, Rathcash, Clifden, Co. Kilkenny.		
Spring at Paulstown Castle	08/01/1996	14:40:00								
Spring at Clomantagh	09/01/1996	10:40:00						Spring in farmyard, sample taken at surface.		
Spring Toberpatrick Urlingford	09/01/1996	11:05:00								
Borehole at Bawnmore	09/01/1996	11:30:00								

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Source	Sampling Date	Sampling Time	To	Ref No	Sampling Location	Taken By	Lab No	EPA Ref	Stn Grid Ref	Water Supply	Public/Group/Private	Temperature	Odour 1/2/3	Colour Hazen	pH	Conductivity $\mu\text{S}/\text{cm}$	Turbidity NTU	TOC mg/l C	Ammonia mg/l N	
Borehole at Galmoy	09/01/1996	12:40:00	Kilkenny Co. Co.	KK00200	Leahy's House, Galmoy	C. Murray	92	KIK17	23020 17120	Galmoy	Group	8.6	1	5	7.3	779	0.1	1.8	< 0.01	
Borehole at Kilmanagh	09/01/1996	14:20:00	Kilkenny Co. Co.	KK01400	In pumphouse	C. Murray	93	KIK45	23930 15250	Kilmanagh/Ballycuddihy	Group	8.2	1	5	7.6	645	0.1	2.3	0.021	
Spring at Westcourt	09/01/1996	15:10:00	Kilkenny Co. Co.	KK00800	Spring at Earlsland, Westcourt, Callan	C. Murray	94	KIK91	S 407 442	Callan	Public	11.1	1	5	7.3	704	0.1	2.9	< 0.01	
Borehole at Windgar	09/01/1996	15:40:00	Kilkenny Co. Co.	KK01900	Overflow from borehole	C. Murray	95		24200 13580	Farm supply	Private	11	1	5	7.4	380	0.2	< 0.12	0.023	
Spring at Carrigeen,	15/01/1996	13:00:00	Kilkenny Co. Co.		Keoghans Field, Threecastles	J. Jennings	135					2	15	8		1045			0.03	
Belview	27/02/1996	14:15:00	Kilkenny County Council		Well No.2 for proposed new water supply	Brian Connor	763			Belview proposed			5	6.8		351			< 0.01	
Belview	29/02/1996	11:45:00	Kilkenny County Council		Well No.2 for proposed new water supply	Brian Connor	822			Belview proposed			1	5	6.7	359			< 0.01	
Belview No. 2	07/03/1996	16:00:00	Kilkenny Co. Co.		Belview Proposed water supply Well No. 2	Brian Connor	973						1	5	6.7	365				
Belview No. 2	14/03/1996	11:00:00	Kilkenny Co. Co.		Belview Proposed water supply Well No. 2	Brian Connor	1050					1	5	6.7	357				< 0.01	
Belview No. 2	23/03/1996	14:10:00	Kilkenny Co. Co.		Belview Proposed water supply Well No. 2	Brian Connor	1157					1	5	6.4	290				< 0.01	
Belview No. 1	25/03/1996	15:00:00	Kilkenny Co. Co.		Belview Proposed water supply Well No. 1	Brian Connor	1130					1	5	6.5	290		0.67		< 0.01	
Belview No. 1	27/03/1996	13:00:00	Kilkenny Co. Co.		Belview Proposed water supply Well No. 1	Brian Connor	1173					1	5	6.4	289				< 0.01	
Dunmore Well	02/07/1996	10:10:00	Kilkenny Co. Co.		Readymix	C. Murray	2536					1	5	7.5	651		0.15		< 0.01	
Dunmore Wells	02/07/1996	10:15:00	Kilkenny Co. Co.		Leahy's	C. Murray	2537					1	10	8.3	413		< 0.12		< 0.01	
Dunmore Wells	02/07/1996	10:15:00	Kilkenny Co. Co.		O'Dwyers	C. Murray	2538					2	5	7.5	513		< 0.12		0.03	
Dunmore Wells	02/07/1996	10:35:00	Kilkenny Co. Co.		Tom Langtons	C. Murray	2539					1	10	7.9	350		< 0.12		0.02	
Dunmore Wells	02/07/1996	10:55:00	Kilkenny Co. Co.		McDermotts	C. Murray	2540					1	10	7.4	599		0.69		< 0.01	
Dunmore Wells	02/07/1996	11:10:00	Kilkenny Co. Co.		Nolans	C. Murray	2541					1	5	7.3	841		0.61		< 0.01	
Dunmore Wells	02/07/1996	11:30:00	Kilkenny Co. Co.		O'Neill's	C. Murray	2542					1	10	7.4	700		0.15		< 0.01	
Dunmore Wells	02/07/1996	11:45:00	Kilkenny Co. Co.		Fitzpatrick's	C. Murray	2543					1	5	7.4	737		0.53		< 0.01	
Dunmore Wells	02/07/1996	12:10:00	Kilkenny Co. Co.		Canteen in Landfill Site	C. Murray	2544					1	15	7.4	563		2.07		0.05	
Dunmore Wells	02/07/1996	12:35:00	Kilkenny Co. Co.		Holahan's	C. Murray	2545					2	15	7.4	633		1.94		0.42	
Dunmore Wells	02/07/1996	12:45:00	Kilkenny Co. Co.		Murphy's/Stacks	C. Murray	2546					2	50	7.5	689		< 0.12		0.013	
Bellview	02/10/1996	11:10:00	Kilkenny Co. Co.		Well No. 3.	Brian Connor	3853					1	5	6.6	554		0.26		< 0.01	
Bellview	03/10/1996	10:30:00	Kilkenny Co. Co.		Well No. 3.	Brian Connor	3873					1	5	6.4	565		0.2			
Bellview Water Supply	08/10/1996	10:30:00	Kilkenny Co. Co.		Well No. 3.	B. O'Connor	3971					1	5	6.5	551				< 0.01	
Spring at Paulstown Castle	09/01/1997	12:17:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle	P. Mullins	106	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	9.3	1	< 5	7.3	613	0.23	1.9	< 0.01	
Thomastown	10/01/1997	10:17:00	Kilkenny Co. Co.		Borehole No. 5	P. Mullins	111		S 589 411			9.6	1	< 5	7.1	439	0.09	1.3	< 0.01	
Borehole No. 9, Thomastown	10/01/1997	10:05:00	Kilkenny Co. Co.	KK01600	At pumphouse	P. Mullins	112	KIK32	25890 14160	Thomastown	Public	9.4	1	< 5	7.3	721	0.11	1.5		
Borehole at Dunmore	13/01/1997		Kilkenny Co. Co.	KK00700	C. Murray's house, Dunmore.	C. Murray	216		24910 16200	Dunmore	Group									
Spring at Paulstown Castle	17/02/1997	11:30:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle	C. Murray	726	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	10.3	1	< 5	7.3	607	0.6	< 0.1		
Springs at Bausheenmore	17/02/1997	12:30:00	Kilkenny Co. Co.	KK00500	At source (springs at Bausheenmore	C. Murray	727	KIK39	25520 14690		Private	10.5	1	< 5	7.3	767	< 1	< 0.1		
Spring at Westcourt	17/02/1997	14:05:00	Kilkenny Co. Co.	KK00800	Spring at Earlsland, Westcourt, Callan	C. Murray	728	KIK91	S 407 442	Callan	Public	11.3	1	< 5	7.3	702	< 1	< 0.1		
Dunmore	09/05/1997		Kilkenny Co. Co.		Doyle's	M. Daly	1936				Private		1				0.53	2		
Dunmore	09/05/1997		Kilkenny Co. Co.		Holahan's	M. Daly	1937				Private		3				1.8	0.5		
Dunmore	09/05/1997		Kilkenny Co. Co.		No. 8 Stack	M. Daly	1938				Private		3				0.1	< 0.01		
Dunmore	09/05/1997		Kilkenny Co. Co.		Well in landfill site	M. Daly	1939				Private		2					17.6		
Dunmore	09/05/1997		Kilkenny Co. Co.		Unused Borehole, Doyle's Field	M. Daly	1940				Private		2				5.4	12.1		
Dunmore	12/05/1997	10:45:00	Kilkenny Co. Co.		Readymix	C. Murray	1944					10.2	1	5	7.7	631	0.65	0.22	1.5	
Dunmore	12/05/1997	10:55:00	Kilkenny Co. Co.		O'Dwyers	C. Murray	1945					10.8	2	15	7.6	473	3.8	0.09	0.05	
Dunmore	12/05/1997	11:05:00	Kilkenny Co. Co.		Langtons	C. Murray	1946					9.7	1	15	8	352	12	0.08	0.04	
Dunmore	12/05/1997	11:15:00	Kilkenny Co. Co.		Bergin's	C. Murray	1947					9.8	2	5	7.4	656	0.42	0.33	< 0.01	
Dunmore	12/05/1997	11:25:00	Kilkenny Co. Co.		McDermott's	C. Murray	1948					10.8	2	5	7.3	615	0.39	< 0.01		
Dunmore	12/05/1997	12:00:00	Kilkenny Co. Co.		Nolans	C. Murray	1949					10.8	2	5	7.3	794	0.19	0.64	< 0.01	
Dunmore	12/05/1997	12:15:00	Kilkenny Co. Co.		O'Neill's	C. Murray	1950					10.9	1	5	7.4	700	0.42	0.09	< 0.01	
Dunmore	12/05/1997	12:30:00	Kilkenny Co. Co.		Fitzpatricks	C. Murray	1951					10.4	2	5	7.3	736	0.21	0.43	< 0.01	
Dunmore	12/05/1997	15:30:00	Kilkenny Co. Co.		Doyle's	C. Murray	1952					10.7	2	5	7.2	816	0.11	0.67	1.41	
Dunmore	12/05/1997	15:45:00	Kilkenny Co. Co.		Holahan's	C. Murray	1953					12	2		7.3	640	69	1.88	0.33	
Dunmore	12/05/1997	15:55:00	Kilkenny Co. Co.		Stacks/Murphys	C. Murray	1954					11.5	3		7.7	665	16	0.26	< 0.01	
Dunmore	12/05/1997	14:35:00	Kilkenny Co. Co.		Canteen at landfill site.	C. Murray	1955			Canteen at landfill	private	11.5	3		7.9	1.8	100		110	
Dunmore	12/05/1997	14:50:00	Kilkenny Co. Co.		New Bore at landfill site.	C. Murray	1956					12.4	2		7.2	994	6.1	7.2	0.5	
Dunmore	12/05/1997	15:10:00	Kilkenny Co. Co.		Roches Pit, new cell	C. Murray	1957					10.8	2	5	7.3	653	1.2	0.64	< 0.01	

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Source	Sampling Date	Sampling Time	o-Phosphate mg/l P	Nitrate mg/l N	Nitrite mg/l N	Chloride mg/l Cl	Ca Hardness mg/l CaCO3	Alkalinity mg/l CaCO3	TCS per 100 ml	Total Coliforms FCS	Fecal Coliforms per 100 ml	Sulphate mg/l SO4	Dry Residue mg/l	Sus_Solids mg/l	Magnesium mg/l Mg	Total Hardness mg/l CaCO3	Sodium mg/l Na	Potassium mg/l K	Aluminium mg/l Al	Iron mg/l Fe	Manganese mg/l Mn	Copper mg/l Cu	Zinc mg/l Zn	Chromium mg/l Cr	Lead mg/l Pb
Borehole at Galmoy	09/01/1996	12:40:00	0.002	9.6	< 0.003	27.7	364	999	999	20		31.8		7.9	0.8	< 0.06	< 0.02	0.061							
Borehole at Kilmanagh	09/01/1996	14:20:00	0.099	3.5	< 0.003	20.4	327	=	15	=	2	11			18.4		9.1	0.9	< 0.06	< 0.02	0.035				
Spring at Westcourt	09/01/1996	15:10:00	0.02	3.6	< 0.003	24.1	365	52	64	15			29.2		9.5	0.9	< 0.06	< 0.02	0.028						
Borehole at Windgar	09/01/1996	15:40:00	0.122	1.8	< 0.003	16	164	999	999	4			19.2		6.9	1	< 0.06	< 0.02	0.03						
Spring at Carrigeen,	15/01/1996	13:00:00	0.1	36.2	0.014	44	183				25														
Belview	27/02/1996	14:15:00	< 0.02	3.7	< 0.004	28	97	999	999							103									
Belview	29/02/1996	11:45:00	< 0.02	4.1	< 0.004	32.7	81	999	999							83									
Belview No. 2	07/03/1996	16:00:00					114	1	999							116			< 0.06	< 0.02	0.08				
Belview No. 2	14/03/1996	11:00:00	< 0.02	4.5	< 0.004	28	97	14	9										< 0.06	< 0.02	0.026				
Belview No. 2	23/03/1996	14:10:00	< 0.02	6.7	< 0.004	26	77	2	999																
Belview No. 1	25/03/1996	15:00:00	< 0.02	6.8	0.004	28	49	999	999										< 0.06	< 0.02	0.314				
Belview No. 1	27/03/1996	13:00:00	< 0.02	6.7	< 0.004	28	64	1	999																
Dunmore Wells	02/07/1996	10:10:00	< 0.02	< 0.1	0.004	20	317	999	999	29															
Dunmore Wells	02/07/1996	10:15:00	< 0.02	1.5	0.007	16	191	=	3	999	11														
Dunmore Wells	02/07/1996	10:15:00	< 0.02	< 0.1	0.009	18		999	999	14															
Dunmore Wells	02/07/1996	10:35:00	< 0.02	< 0.1	0.003	13	164	>	80	999	4														
Dunmore Wells	02/07/1996	10:55:00	< 0.02	6.5	0.001	19	283	=	3	6	15														
Dunmore Wells	02/07/1996	11:10:00	0.22	12	0.002	37	352	>	80	15	25														
Dunmore Wells	02/07/1996	11:30:00	< 0.02	7.4	0.002	28	323	999	999	15															
Dunmore Wells	02/07/1996	11:45:00	0.14	9.2	0.002	28	330	>	80	>	60	16													
Dunmore Wells	02/07/1996	12:10:00	0.03	2.6	0.041	22	250	>	80	6	25														
Dunmore Wells	02/07/1996	12:35:00	0.09	< 0.1	0.015	19	322	2	999	20															
Dunmore Wells	02/07/1996	12:45:00	< 0.02	< 0.1	0.005	21	323	=	68	999	30														
Bellview	02/10/1996	11:10:00	< 0.02	19.3	0.003	43		999	999			21.3			22.5	2.6	0.12	0.033	0.184						
Bellview	03/10/1996	10:30:00							1	999		21.3			23.3	2.8	0.087	0.034	0.112						
Bellview Water Supply	08/10/1996	10:30:00	0.01	22	0.004	41	68	=	2	999					21.3		22.8	2.8	0.087	0.029	0.074				
Spring at Paulstown Castle	09/01/1997	12:17:00	0.01	7	0.001	28	252	21	1	19															
Thomastown	10/01/1997	10:17:00	0.01	4.4	< 0.004	23	248	999	999																
Borehole No.9, Thomastown	10/01/1997	10:05:00	0.03	5.7	< 0.004	39	248	999	999																
Borehole at Dunmore	13/01/1997																								
Spring at Paulstown Castle	17/02/1997	11:30:00	< 0.02	6.4	0.01	22	245	200	22			11.5			8.7	2.6									
Springs at Bausheenmore	17/02/1997	12:30:00	< 0.02	7.1	< 0.004	26	345	>	80	50		29.5			8.7	3.6									
Spring at Westcourt	17/02/1997	14:05:00	< 0.02	4.8	0.011	20	329	3	2			23.3			8.3	0.9									
Dunmore	09/05/1997		< 0.02	11.2	< 0.004	45																			
Dunmore	09/05/1997		0.19	< 0.1	0.005	18																			
Dunmore	09/05/1997		< 0.02	< 0.1	< 0.003	21																			
Dunmore	09/05/1997		0.87	11.3	2	295																			
Dunmore	09/05/1997		0.08	3.3	0.1	29																			
Dunmore	12/05/1997	10:45:00	0.01	0.232	0.004	20			15	999															
Dunmore	12/05/1997	10:55:00	0.05	0.15	0.003	16			=	37	6														
Dunmore	12/05/1997	11:05:00	0.01	0.16	0.004	13			999	999															
Dunmore	12/05/1997	11:15:00	< 0.02	16.2	0.007	23			=	6	999														
Dunmore	12/05/1997	11:25:00	< 0.02	7.5	0.003	20			=	13	999														
Dunmore	12/05/1997	12:00:00	0.17	12	0.004	30			=	210	999														
Dunmore	12/05/1997	12:15:00	0.01	8.2	0.003	27				999															
Dunmore	12/05/1997	12:30:00	0.165	10.1	0.003	26				750	300														
Dunmore	12/05/1997	15:30:00	0.015	1.3	0.031	44			>	80	4														
Dunmore	12/05/1997	15:45:00	0.11	0.15	0.019	18																			
Dunmore	12/05/1997	15:55:00	< 0.02	0.18	2.2	19			=	16	999														
Dunmore	12/05/1997	14:35:00	3	5.6	3.8	353			>	2000	>	2000													
Dunmore	12/05/1997	14:50:00	0.5	0.9	0.41	31																			
Dunmore	12/05/1997	15:10:00	< 0.02	11	0.002	19			=	9	999														

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Source	Sampling Date	Sampling Time	Cadmium mg/l Cd	Mercury mg/l Hg	Nickel mg/l Ni	Fluoride mg/l F	OMCTSiloxane µg/l	Comments1	Comments2	Comments3
Borehole at Galmoy	09/01/1996	12:40:00								
Borehole at Kilmanagh	09/01/1996	14:20:00								
Spring at Westcourt	09/01/1996	15:10:00								
Borehole at Windgar	09/01/1996	15:40:00								
Spring at Carrigeen,	15/01/1996	13:00:00					Very high Nitrate	High Conductivity and chloride.		
Belview	27/02/1996	14:15:00					Sample taken after pumping for 1 hour.			
Belview	29/02/1996	11:45:00								
Belview No. 2	07/03/1996	16:00:00					Sample delivered to the laboratory on 8/3/96 by Finbar Coughlan			
Belview No. 2	14/03/1996	11:00:00								
Belview No. 2	23/03/1996	14:10:00								
Belview No. 1	25/03/1996	15:00:00								
Belview No. 1	27/03/1996	13:00:00								
Dunmore Wells	02/07/1996	10:10:00								
Dunmore Wells	02/07/1996	10:15:00								
Dunmore Wells	02/07/1996	10:15:00								
Dunmore Wells	02/07/1996	10:35:00								
Dunmore Wells	02/07/1996	10:55:00								
Dunmore Wells	02/07/1996	11:10:00								
Dunmore Wells	02/07/1996	11:30:00								
Dunmore Wells	02/07/1996	11:45:00								
Dunmore Wells	02/07/1996	12:10:00								
Dunmore Wells	02/07/1996	12:35:00								
Dunmore Wells	02/07/1996	12:45:00								
Bellview	02/10/1996	11:10:00					Calcium Hardness = 152 mg/l CaCO ₃	Very high nitrate.		
Bellview	03/10/1996	10:30:00					Calcium Hardness = 144 mg/l CaCO ₃			
Bellview Water Supply	08/10/1996	10:30:00					Calcium Hardness = 144 mg/l CaCO ₃	Interference from background colonies on Total Coliform plate.	Very high Nitrate.	
Spring at Paulstown Castle	09/01/1997	12:17:00					See GC/MS Purge & Trap analyses on separate sheet.			
Thomastown	10/01/1997	10:17:00								
Borehole No. 9, Thomastown	10/01/1997	10:05:00					See GC/MS Purge & Trap analyses on separate sheet.	Octamethylcyclotetrasiloxane < 0.2 ug/l.		
Borehole at Dunmore	13/01/1997						Sample for GC/MS Purge & Trap analyses only. Results on separate sheet.	Octamethylcyclotetrasiloxane 0.7 ug/l.		
Spring at Paulstown Castle	17/02/1997	11:30:00					Octamethylcyclotetrasiloxane = 0.3 ug/l.			
Springs at Bausheenmore	17/02/1997	12:30:00					Octamethylcyclotetrasiloxane = 1.7 ug/l.	K/Na Ratio = 0.41		
Spring at Westcourt	17/02/1997	14:05:00					Octamethylcyclotetrasiloxane = 1.4 ug/l.			
Dunmore	09/05/1997						Very high ammonia.	Sample taken after land-fill leachate escaped to groundwater.	Approximate ammonia concentration.	
Dunmore	09/05/1997						Strong odour and high ammonia.	Sample taken after land-fill leachate escaped to groundwater.	Approximate ammonia concentration.	
Dunmore	09/05/1997						Odour of sulphide.	Sample taken after land-fill leachate escaped to groundwater.	Approximate ammonia concentration.	
Dunmore	09/05/1997						Very high TOC, ammonia and nitrite results < serious contamination.	Sample taken after land-fill leachate escaped to groundwater.	Approximate ammonia concentration.	
Dunmore	09/05/1997						Very high ammonia and high nitrite.	Sample taken after land-fill leachate escaped to groundwater.	Approximate ammonia concentration.	
Dunmore	12/05/1997	10:45:00					Ammonia >1.5 mg/l N.	Sample taken after leachate at landfill site escaped to groundwater.	Amended report, ammonia is >1.5 and not <1.5 as reported on 15/5/97.	
Dunmore	12/05/1997	10:55:00						Sample taken after leachate at landfill site escaped to groundwater.		
Dunmore	12/05/1997	11:05:00						Sample taken after leachate at landfill site escaped to groundwater.	No coliforms detected but possible interference from suspended solids.	
Dunmore	12/05/1997	11:15:00						Sample taken after leachate at landfill site escaped to groundwater.		
Dunmore	12/05/1997	11:25:00						Sample taken after leachate at landfill site escaped to groundwater.		
Dunmore	12/05/1997	12:00:00						Sample taken after leachate at landfill site escaped to groundwater.	Interference from suspended solids on the total coliform test.	
Dunmore	12/05/1997	12:15:00						Sample taken after leachate at landfill site escaped to groundwater.	Background interference on the total coliform test.	
Dunmore	12/05/1997	12:30:00						Sample taken after leachate at landfill site escaped to groundwater.	Very high coliform levels (total and faecal).	
Dunmore	12/05/1997	15:30:00					High ammonia and nitrite concentrations.	Sample taken after leachate at landfill site escaped to groundwater.		
Dunmore	12/05/1997	15:45:00					Very turbid. High ammonia indicative of pollution.	Sample taken after leachate at landfill site escaped to groundwater.	Interference from suspended solids on the coliform tests (total & faecal).	
Dunmore	12/05/1997	15:55:00					Very turbid. High nitrite. Odour detected.	Sample taken after leachate at landfill site escaped to groundwater.	Background interference on the total coliform test.	
Dunmore	12/05/1997	14:35:00					Turbidity > 100 NTU and ammonia > 110 mg/l N.	Sample taken after leachate at landfill site escaped to groundwater.		
Dunmore	12/05/1997	14:50:00					Very high coliform levels.	Sample taken after leachate at landfill site escaped to groundwater.	Interference on the total coliform test.	
Dunmore	12/05/1997	15:10:00						Sample taken after leachate at landfill site escaped to groundwater.	Interference on the total coliform test.	

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Source	Sampling Date	Sampling Time	To	Ref No	Sampling Location	Taken By	Lab No	EPA Ref	Stn Grid Ref	Water Supply	Public/Group/Private	Temperature	Odour	Colour	pH	Conductivity	Turbidity	TOC	Ammonia
											1/2/3	Hazen			µS/cm	NTU	mg/l C	mg/l N	
Borehole at Dunmore	18/06/1997	11:45:00	Kilkenny Co. Co.	KK00700	C. Murray,s house, Dunmore.	C. Murray	2630	24910 16200	Dunmore	Group	15	15	7.4	604	0.26	0.4	< 0.01		
Dunmore	08/07/1997	14:50:00	Kilkenny Co. Co.		Stacks	M. Daly	2973					2	60	7.6	659	7.5	< 0.01		
Dunmore	08/07/1997	15:00:00	Kilkenny Co. Co.		Holohans	M. Daly	2974					1		7.3	639	72	0.4		
Borehole at Kilmanagh	01/09/1997	10:24:00	Kilkenny Co. Co.	KK01400	In pumphouse	P. Mullins	3796	KIK45	23930 15250	Kilmanagh/Ballycuddihy	Group	14.4	1	< 5	7.5	641	0.26	0.4	< 0.01
Spring at Westcourt	01/09/1997	11:17:00	Kilkenny Co. Co.	KK00800	Spring at Earlsland, Westcourt, Callan	P. Mullins	3797	KIK91	S 407 442	Callan	Public	11.9	1	< 5	7.3	701	0.14	0.28	< 0.01
Borehole at Windgap	01/09/1997	11:54:00	Kilkenny Co. Co.	KK01900	Overflow from borehole	P. Mullins	3798		24200 13580	Farm supply	Private	11.3	1	< 5	7.3	386	0.39	0.07	< 0.01
Springs at Bausheenmore	01/09/1997	13:36:00	Kilkenny Co. Co.	KK00500	At source (springs at Bausheenmore	P. Mullins	3799	KIK39	25520 14690		Private	11.9	1	20	7.4	717	2.6	3.3	< 0.01
Borehole at Dunmore S/G	01/09/1997	14:17:00	Kilkenny Co. Co.	KK01000	Canteen at Dunmore Sand & Gravel	P. Mullins	3800	KIK53	25000 16020	Dunmore Sand & Gravel	Private	13.6	1	5	7.7	645	1	0.41	< 0.01
Borehole at Dunmore	01/09/1997	14:26:00	Kilkenny Co. Co.	KK00700	C. Murray,s house, Dunmore.	P. Mullins	3801	24910 16200	Dunmore	Group	16	1	< 5	7.4	643	0.14	0.34	< 0.01	
Borehole at Kilkenney Mar	01/09/1997	15:13:00	Kilkenny Co. Co.	KK01300	Cattle holding shec	P. Mullins	3802		25070 15670	Kilkenny Mart	Private	16.7	1	60	8.4	130	27	3.2	0.03
Borehole at Galmoy	27/08/1997	11:19:00	Kilkenny Co. Co.	KK02000	Leahy's House, Galmoy	P. Mullins	3743	KIK17	23020 17120	Galmoy	Group	14.3	1	5	7.6	763	0.15	0.55	< 0.01
Borehole at Bawnmore	27/08/1997	11:39:00	Kilkenny Co. Co.	KK00100	Phelan's house, Bawnmore	P. Mullins	3744	KIK50	22580 16610	Bawnmore	Group	15.4	1	5	7.3	826	0.08	1.04	< 0.01
Spring Toberpatrick Urlingford	27/08/1997	12:05:00	Kilkenny Co. Co.	KK01500	In chamber at source	P. Mullins	3745	KIK34	23000 16350	Urlingford/Johnstown	Public	11.1	1	5	7.2	743	0.12	2.47	< 0.01
Spring at Clomantagh	27/08/1997	12:20:00	Kilkenny Co. Co.	KK00900	Beside Nuema river, 50m SE of roac	P. Mullins	3746		23520 16320		Private	12.4	1	5	7.4	638	1.6	1.01	< 0.01
Borehole at Castlecomer Yarns	27/08/1997	14:00:00	Kilkenny Co. Co.	KK00300	Tap in yard at Castlecomer Yarns	P. Mullins	3747		25360 17330	Castlecomer Yarns	Private	12	1	5	7.4	600	5.8	0.56	0.033
Spring at Paulstown Castle	27/08/1997	14:51:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle	P. Mullins	3748	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	11.9	1	5	7.3	636	0.72	1.13	< 0.01
Borehole at Rathcash	27/08/1997	15:12:00	Kilkenny Co. Co.	KK02000	Joe Pykes house, Rathcash, Clara.	P. Mullins	3749	KIK55	25870 15510	Rathcash	Group	16.9	1	5	7.4	709	0.07	0.49	< 0.01
Borehole at Clara	27/08/1997	15:30:00	Kilkenny Co. Co.	KK00400	At pumphouse	P. Mullins	3750	KIK41	25770 15530	Clara	Group	16.3	1	5	7.4	673	0.06	0.59	< 0.01
Dunmore	03/03/1998	11:10:00	Kilkenny Co. Co.		1. Billy O'Dwyers	C. Murray	1116			1. Billy O'Dwyers		9.8	1	10	7.6	473	3.7	0.03	0.073
Dunmore Group Scheme	19/05/1998	11:45:00	Kilkenny Co. Co.		2. Billy O'Dwyers	P. Mullins	2330			2. Billy O'Dwyers		17.6	1	5	7.44	636			
	19/05/1998	11:55:00	Kilkenny Co. Co.		Readymix	P. Mullins	2331					14.8	1	< 5	7.59	648			
Borehole at Windgap	09/02/1999	09:30:00	Kilkenny Co. Co.	KK01900	Overflow from borehole	Redmond Bergir	815		24200 13580	Farm supply	Private		5	7.3	330	< 0.1	< 0.2		
Spring at Clomantagh	17/02/1999	10:40:00	Kilkenny Co. Co.	KK00900	Beside Nuema river, 50m SE of roac	C. Murray	998		23520 16320		Private	10	1	5	7.3	669	0.6	4	
Spring Toberpatrick Urlingford	17/02/1999	11:00:00	Kilkenny Co. Co.	KK01500	In chamber at source	C. Murray	999	KIK34	23000 16350	Urlingford/Johnstown	Public	9.2	1	5	7.3	747	0.2	4.3	
Borehole at Bawnmore	17/02/1999	11:30:00	Kilkenny Co. Co.	KK00100	Phelan's house, Bawnmore	C. Murray	1000	KIK50	22580 16610	Bawnmore	Group	7	1	5	7.1	881	< 0.1	4.5	
Borehole at Galmoy	17/02/1999	12:00:00	Kilkenny Co. Co.	KK02000	Leahy's House, Galmoy	C. Murray	1001	KIK17	23020 17120	Galmoy	Group		1	5	7.3	776	0.4	2.1	
Borehole at Castlecomer Yarns	17/02/1999	12:50:00	Kilkenny Co. Co.	KK00300	Tap in yard at Castlecomer Yarns	C. Murray	1002		25360 17330	Castlecomer Yarns	Private	10.5	1	40	7.4	535	11.6	2	
Borehole at Dunmore	17/02/1999	14:05:00	Kilkenny Co. Co.	KK00700	C. Murray,s house, Dunmore.	C. Murray	1003		24910 16200	Dunmore	Group	7.7	1	5	7.3	663	< 0.1	1.7	< 0.2
Borehole at Kilkenney Mar	17/02/1999	15:00:00	Kilkenny Co. Co.	KK01300	Cattle holding shec	C. Murray	1004		25070 15670	Kilkenny Mart	Private	9.7	1	10	7.9	690	1.5	1.8	< 0.2
Borehole at Kilmanagh	17/02/1999	16:00:00	Kilkenny Co. Co.	KK01400	In pumphouse	C. Murray	1005	KIK45	23930 15250	Kilmanagh/Ballycuddihy	Group	7.3	1	5	7.6	658	< 0.1	3.9	< 0.2
Spring at Westcourt	14/04/1999	10:47:00	Kilkenny Co. Co.	KK00800	Spring at Earlsland, Westcourt, Callan	P. Mullins	1889	KIK91	S 407 442	Callan	Public	9.8	1	< 5	7.5	699	< 0.1	< 0.01	
Borehole at Windgap	14/04/1999	11:14:00	Kilkenny Co. Co.	KK01900	Overflow from borehol	P. Mullins	1890		24200 13580	Farm supply	Private	10.5	1	< 5	7.3	388	0.2	< 0.01	
Springs at Bausheenmore	14/04/1999	12:12:00	Kilkenny Co. Co.	KK00500	At source (springs at Bausheenmore	P. Mullins	1891	KIK39	25520 14690		Private	9.6	1	< 5	7.4	772	0.2	< 0.01	
Borehole at Rathcash	14/04/1999	14:00:00	Kilkenny Co. Co.	KK02000	Joe Pykes house, Rathcash, Clara.	P. Mullins	1892	KIK55	25870 15510	Rathcash	Group	9.4	1	< 5	7.3	722	< 0.1	< 0.01	
Borehole at Clara	14/04/1999	14:18:00	Kilkenny Co. Co.	KK00400	At pumphouse	P. Mullins	1893	KIK41	25770 15530	Clara	Group	9.6	1	< 5	7.3	695	< 0.1	< 0.01	
	07/09/1999	10:20:00	Kilkenny Co. Co.		Kenny's Well, Kilkenny City	T. Doherty	4410												
Bennettsbridge	29/03/2000	14:16:00	Kilkenny Co. Co.		New well - feeding the infiltration gallery	P. Mullins	1688			Bennettsbridge	Public	10.6	1	< 5	7.6	727			< 0.003
Borehole at Kilmanagh	27/09/2000	10:30:00	Kilkenny Co. Co.	KK01400	In pumphouse	C. Murray	5048	KIK45	23930 15250	Kilmanagh/Ballycuddihy	Group	13.8		7.3	664	0.1	< 0.003		
Borehole at Windgap	27/09/2000	12:10:00	Kilkenny Co. Co.	KK01900	Overflow from borehol	C. Murray	5049		24200 13580	Farm supply	Private	11.5		7.3	388	0.6	< 0.003		
Borehole No.9, Thomastown	27/09/2000	14:15:00	Kilkenny Co. Co.	KK01600	At pumphouse	C. Murray	5050	KIK32	25890 14160	Thomastown	Public	13.3		7.2	758	0.2	< 0.003		
Springs at Bausheenmore	27/09/2000	14:50:00	Kilkenny Co. Co.	KK00500	At source (springs at Bausheenmore	C. Murray	5051	KIK39	25520 14690		Private	11		7.1	787	0.6	0.005		
Spring at Paulstown Castle	27/09/2000	15:40:00	Kilkenny Co. Co.	KK00600	Spring at Paulstown Castle	C. Murray	5052	KIK46	S 660 570	Gowran/Goresbr./P-town	Public	11.1		7.1	656	0.4	0.016		
Spring at Clomantagh	26/09/2000	10:20:00	Kilkenny Co. Co.	KK00900	Beside Nuema river, 50m SE of roac	C. Murray	5026		23520 16320		Private	11.4	1	15	7.4	282	0.083		
Spring Toberpatrick Urlingford	26/09/2000	10:40:00	Kilkenny Co. Co.	KK01500	In chamber at source	C. Murray	5027	KIK34	23000 16350	Urlingford/Johnstown	Public	10.3	1	5	7.2	813	< 0.003		
Borehole at Bawnmore	26/09/2000	11:05:00	Kilkenny Co. Co.	KK00100	Phelan's house, Bawnmore	C. Murray	5028	KIK50	22580 16610	Bawnmore	Group	13.5	1	5	7.3	863	< 0.003		
Borehole at Galmoy	26/09/2000	12:15:00	Kilkenny Co. Co.	KK00200	Leahy's House, Galmoy	C. Murray	5029	KIK17	23020 17120	Galmoy	Group	14.7	1	5	7.4	789	< 0.003		
Borehole at Castlecomer Yarns	26/09/2000	14:00:00	Kilkenny Co. Co.	KK00300	Tap in yard at Castlecomer Yarns	C. Murray	5030		25360 17330	Castlecomer Yarns	Private	12.2	1	20	7.5	578	0.036		
Borehole at Dunmore	26/09/2000	14:25:00	Kilkenny Co. Co.	KK00700	C. Murray,s house, Dunmore.	C. Murray	5031		24910 16200	Dunmore	Group	14.7	1	5	7.4	668	< 0.003		
Borehole at Dunmore S/G	26/09/2000	14:40:00	Kilkenny Co. Co.	KK01000	Canteen at Dunmore Sand & Gravel	C. Murray	5032	KIK53	25000 16020	Dunmore Sand & Gravel	Private	12.4	1	5	7.6	660	< 0.003		
Borehole at Kilkenney Mar	26/09/2000	14:55:00	Kilkenny Co. Co.	KK01300	Cattle holding shec	C. Murray	5033		25070 15670	Kilkenny Mart	Private	14.6	1	5	7.6	708	< 0.003		
Borehole at Clara	26/09/2000	15:35:00	Kilkenny Co. Co.	KK00400	At pumphouse	C. Murray	5034	KIK41	25770 15530	Clara	Group	11.6	1	5	7.4	667	< 0.003		
Kiloshaun/Barna	03/10/2000	11:15:00	Kilkenny Co. Co./G.S.I.		GWS06	M. Daly	5218						7		663	0.015			
Tubrid Lower	03/10/2000	11:40:00	Kilkenny Co. Co./G.S.I.		GWS14	M. Daly	5219						7.2		766	0.012			
Balief Clomantagh	03/10/2000	12:00:00	Kilkenny Co. Co./G.S.I.		GWS03	M. Daly	5220						7.3		794	0.007			
Graine/Craddockstown	03/10/2000	12:30:00	Kilkenny Co. Co./G.S.I.		GWS07	M. Daly	5221						7.4		727	0.006			
Piltown (PWS07)	03/10/2000	09:45:00	Kilkenny Co. Co./G.S.I.			Ruth Buckley	5222						6.5		184	0.01			
Tullahought (GWS16)	03/10/2000	10:30:00	Kilkenny Co. Co./G.S.I.			Ruth Buckley	5223						6.3		194	0.007			
Hugginstown (GWS10)	03/10/2000	11:30:00	Kilkenny Co. Co./G.S.I.			Ruth Buckley	5224						6.7		448	0.005			
Ahenure (P																			

EPA Regional Water Laboratory, Kilkenny. Monitoring Data for County Kilkenny Groundwaters 1993 to 1999.

Source	Sampling Date	Sampling Time	o-Phosphate mg/l P	Nitrate mg/l N	Nitrite mg/l N	Chloride mg/l Cl	Ca Hardness mg/l CaCO3	Alkalinity mg/l CaCO3	TCS	Total Coliforms per 100 ml	FCS	Fecal Coliforms per 100 ml	Sulphate mg/l SO4	Dry Residue mg/l	Sus_Solids mg/l	Magnesium mg/l Mg	Total Hardness mg/l CaCO3	Sodium mg/l Na	Potassium mg/l K	Aluminium mg/l Al	Iron mg/l Fe	Manganese mg/l Mn	Copper mg/l Cu	Zinc mg/l Zn	Chromium mg/l Cr	Lead mg/l Pb								
Borehole at Dunmore	18/06/1997	11:45:00	< 0.02	10	19.7		240	999		999																								
Dunmore	08/07/1997	14:50:00	< 0.02	< 0.1	0.003	20			<	100	<	100				Visible	19.5		10.2	0.6														
Dunmore	08/07/1997	15:00:00	0.1	< 0.1	0.016	19			<	200	<	100				Visible	10.3		15.2	0.4														
Borehole at Kilmanagh	01/09/1997	10:24:00	< 0.02	4.6	< 0.004	17	270	287	>	100	>	100	7																					
Spring at Westcourt	01/09/1997	11:17:00	< 0.02	4.3	< 0.004	22	262	310		15		5	12																					
Borehole at Windgap	01/09/1997	11:54:00	0.02	2.1	< 0.004	15	144	151		6		2	4																					
Springs at Bausheenmore	01/09/1997	13:36:00	0.04	5.6	0.004	26	270	304	>	100	>	100	17																					
Borehole at Dunmore S/G	01/09/1997	14:17:00	< 0.02	< 0.1	< 0.004	21	252			480		9	36																					
Borehole at Dunmore	01/09/1997	14:26:00	< 0.02	10.6	< 0.004	19	272	272		2		999	20																					
Borehole at Kilkenny Mar	01/09/1997	15:13:00	0.09	0.5	0.018	3	64		>	160	>	120	< 1.5																					
Borehole at Galmoy	27/08/1997	11:19:00	< 0.02	16.1	< 0.004	20	228	298		1		999	19																					
Borehole at Bawnmore	27/08/1997	11:39:00	< 0.02	11	< 0.004	23	316	363	>	80		7	17																					
Spring Toberpatrick Urlingford	27/08/1997	12:05:00	< 0.02	8.1	< 0.004	22	292	332		51		9	17																					
Spring at Clomantagh	27/08/1997	12:20:00	< 0.02	7.4	0.001	18	236	276	>	160	>	120	10																					
Borehole at Castlecomer Yarns	27/08/1997	14:00:00	< 0.02	0.13	0.004	20	144	262		999		999	25																					
Spring at Paulstown Castle	27/08/1997	14:51:00	< 0.02	7	< 0.004	25	232	256	>	160	>	120	17																					
Borehole at Rathcash	27/08/1997	15:12:00	< 0.02	6.2	< 0.004	24	212	314		999		999	15																					
Borehole at Clara	27/08/1997	15:30:00	0.02	8.7	< 0.004	21	272	283		29		18	13																					
Dunmore	03/03/1998	11:10:00	< 0.02			17.6			<	206	<	40	<	1																				
Dunmore Group Scheme	19/05/1998	11:45:00	0.011	9.4		19						999	999																					
	19/05/1998	11:55:00	0.011	0.4		22						12	999																					
Borehole at Windgap	09/02/1999	09:30:00	0.05	2	< 0.003	13.3	93	148		999		999	6.1			13.9			7.2															
Spring at Clomantagh	17/02/1999	10:40:00	< 0.04	6.1	< 0.003	15.4		299		10		2	9.5		Not Vis.																			
Spring Toberpatrick Urlingford	17/02/1999	11:00:00	< 0.04	5.7	< 0.003	17.5		340		13		1	10.1		Not Vis.																			
Borehole at Bawnmore	17/02/1999	11:30:00	< 0.04	7.9	< 0.003	17.9		416		999		999	11.2		Not Vis.																			
Borehole at Galmoy	17/02/1999	12:00:00	< 0.04	11.5	< 0.003	24.5		317		29		999	13.3		Not Vis.																			
Borehole at Castlecomer Yarns	17/02/1999	12:50:00	< 0.04	0.6	< 0.003	16.7		241		999		999	18.4		Not Vis.																			
Borehole at Dunmore	17/02/1999	14:05:00		8.9	< 0.003	21.3	303	262		999		999	15.1		Not Vis.	4.5		9	0.9															
Borehole at Kilkenny Mar	17/02/1999	15:00:00	< 0.04	6.6	< 0.003	18.8	273	270		9		999	37.9		Not Vis.	14.1		11.2	1.3															
Borehole at Kilmanagh	17/02/1999	16:00:00	< 0.04	4	< 0.003	15.2	276	308		999		999	9.7		Not Vis.	12		9.2	0.8															
Spring at Westcourt	14/04/1999	10:47:00	< 0.04	4.2	< 0.004	20	288	330		1		1	11.4			24.2		8.9	0.6															
Borehole at Windgap	14/04/1999	11:14:00	< 0.04	2.2	< 0.004	13	138	174		999		999	5.6			17.9		6.6	0.7															
Springs at Bausheenmore	14/04/1999	12:12:00	< 0.04	5.7	< 0.004	23	272	360		74		2	15			30.5		8.3	2.3															
Borehole at Rathcash	14/04/1999	14:00:00	< 0.04	6.7	< 0.004	21	286	326		999		999	14			22.3		7.9	0.8															
Borehole at Clara	14/04/1999	14:18:00	< 0.04	8.5	< 0.004	19	288	318		45		2	12.8			17.1		7.8	1															
	07/09/1999	10:20:00								999		999			Not Vis.																			
Bennettsbridge	29/03/2000	14:16:00	< 0.006	5.1		22				999		999																						
Borehole at Kilmanagh	27/09/2000	10:30:00	< 0.006	3.7	< 0.001	14	288		>=	43		999	13			15	349	11	1.2	< 0.06	< 0.02	0.026												
Borehole at Windgap	27/09/2000	12:10:00	0.019	2.4	< 0.001	14	143			999		999	9.1			15	204	7.9	1.4	< 0.06	< 0.02	0.024												
Borehole No. 9, Thomastown	27/09/2000	14:15:00	0.032	5.8	< 0.001	31	293			8		1	19			22	383	18	3.5	< 0.06	< 0.02	0.138												
Springs at Bausheenmore	27/09/2000	14:50:00	0.014	6	< 0.001	23	308		>	80	>	60	20			30	431	10	3.9	< 0.06	< 0.02	0.022												
Spring at Paulstown Castle	27/09/2000	15:40:00	0.008	4.7	0.007	23	290		>	80	>	60	18			11	335	11	3.4	< 0.06	< 0.02	0.021												
Spring at Clomantagh	26/09/2000	10:20:00	0.012	1.5	0.007	6.9	83		>	80	>	60	7.8			2.4	92.8	6	6.5	0.086	< 0.02	0.189												
Spring Toberpatrick Urlingford	26/09/2000	10:40:00	0.009	7.1	0.011	20	338		>	80	>	60	15			19	416	9.4	5	0.106	< 0.02	0.48												
Borehole at Bawnmore	26/09/2000	11:05:00	< 0.006	6.7	< 0.001	18	348		>=	50		28	16			30	471	8.1	3.4	0.114	< 0.02	0.421												
Borehole at Galmoy	26/09/2000	12:15:00	< 0.006	8.2	< 0.001	21	305			999		999	18			27	416	9.6	1.4	0.082	< 0.02	0.258												
Borehole at Castlecomer Yarns	26/09/2000	14:00:00	0.077	1.1	0.003	17	150			7		999	25			17	220	43	1.7	0.664	0.536	0.152												
Borehole at Dunmore	26/09/2000	14:25:00	< 0.006	8.9	< 0.001	23	308			21	<	1	18			3.1	320	9.9	1.4	< 0.06	< 0.02	0.102												
Borehole at Dunmore S/G	26/09/2000	14:40:00	< 0.006	0.67	0.002	19	278		>=	44		999	38			14	294	12	1.4	0.063	0.273	0.076												
Borehole at Kilkenny Mar	26/09/2000	14:55:00	< 0.006	6.2	< 0.001	18	295			47		3	39			16	360	12	1.9	< 0.06	< 0.02	0.151												
Borehole at Clara	26/09/2000	15:35:00	0.03	5.9	< 0.001	18	275			5		999	16			16	340	9.7	1.9	< 0.06	< 0.02	0.068												
Kiloshauna/Barna	03/10/2000	11:15:00	0.023	5.9	< 0.001	14	360	305	>	80	>	80</td																						

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Source	Sampling Date	Sampling Time	Cadmium mg/l Cd	Mercury mg/l Hg	Nickel mg/l Ni	Fluoride mg/l F	OMCTSiloxane µg/l	Comments1	Comments2	Comments3
Borehole at Dunmore	18/06/1997	11:45:00								
Dunmore	08/07/1997	14:50:00						Total Coliforms present. Accurate count not possible due to	Suspended Solids.	
Dunmore	08/07/1997	15:00:00						Total Coliforms present. Accurate count not possible due to	Suspended Solids.	
Borehole at Kilmanagh	01/09/1997	10:24:00								
Spring at Westcourt	01/09/1997	11:17:00								
Borehole at Windgap	01/09/1997	11:54:00								
Springs at Bausheenmore	01/09/1997	13:36:00								
Borehole at Dunmore S/G	01/09/1997	14:17:00								
Borehole at Dunmore	01/09/1997	14:26:00								
Borehole at Kilkenny Mar	01/09/1997	15:13:00								
Borehole at Galmoy	27/08/1997	11:19:00								
Borehole at Bawnmore	27/08/1997	11:39:00								
Spring Toberpatrick Urlingford	27/08/1997	12:05:00								
Spring at Clomantagh	27/08/1997	12:20:00								
Borehole at Castlecomer Yarns	27/08/1997	14:00:00								
Spring at Paulstown Castle	27/08/1997	14:51:00								
Borehole at Rathcash	27/08/1997	15:12:00								
Borehole at Clara	27/08/1997	15:30:00								
Dunmore	03/03/1998	11:10:00								
Dunmore Group Scheme	19/05/1998	11:45:00								
	19/05/1998	11:55:00								
Borehole at Windgap	09/02/1999	09:30:00						Sodium and calcium for guide only.		
Spring at Clomantagh	17/02/1999	10:40:00			< 0.1					
Spring Toberpatrick Urlingford	17/02/1999	11:00:00			< 0.1					
Borehole at Bawnmore	17/02/1999	11:30:00			< 0.1					
Borehole at Galmoy	17/02/1999	12:00:00			< 0.1					
Borehole at Castlecomer Yarns	17/02/1999	12:50:00			< 0.1					
Borehole at Dunmore	17/02/1999	14:05:00			< 0.1					
Borehole at Kilkenny Mar	17/02/1999	15:00:00			< 0.1					
Borehole at Kilmanagh	17/02/1999	16:00:00			< 0.1					
Spring at Westcourt	14/04/1999	10:47:00			< 0.1					
Borehole at Windgap	14/04/1999	11:14:00			< 0.1					
Springs at Bausheenmore	14/04/1999	12:12:00			< 0.1					
Borehole at Rathcash	14/04/1999	14:00:00			< 0.1					
Borehole at Clara	14/04/1999	14:18:00			< 0.1					
	07/09/1999	10:20:00						Sample for bacteriological analyses only.		
Bennettsbridge	29/03/2000	14:16:00						This is a sample from a new well that feeds the old infiltration gallery for	Bennettsbridge water supply.	
Borehole at Kilmanagh	27/09/2000	10:30:00			3.2				VOC analysis results on separate sheet.	
Borehole at Windgap	27/09/2000	12:10:00			2.1			Total Coliforms not reported.	VOC analysis results on separate sheet.	
Borehole No.9, Thomastown	27/09/2000	14:15:00			1.8				VOC analysis results on separate sheet.	
Springs at Bausheenmore	27/09/2000	14:50:00								
Spring at Paulstown Castle	27/09/2000	15:40:00			10.3				VOC analysis results on separate sheet.	
Spring at Clomantagh	26/09/2000	10:20:00			0.6				VOC analysis results on separate sheet.	
Spring Toberpatrick Urlingford	26/09/2000	10:40:00			1.7				VOC analysis results on separate sheet.	
Borehole at Bawnmore	26/09/2000	11:05:00			0.7			Background interference on Total Coliform plate.	VOC analysis results on separate sheet.	
Borehole at Galmoy	26/09/2000	12:15:00			2.4				VOC analysis results on separate sheet.	
Borehole at Castlecomer Yarns	26/09/2000	14:00:00			0.6				VOC analysis results on separate sheet.	
Borehole at Dunmore	26/09/2000	14:25:00			1.1			Small underdeveloped colonies on Total Coliform plate.	VOC analysis results on separate sheet.	
Borehole at Dunmore S/G	26/09/2000	14:40:00			2.2				Background interference on Total Coliform plate.	VOC analysis results on separate sheet.
Borehole at Kilkenny Mar	26/09/2000	14:55:00			1.3					VOC analysis results on separate sheet.
Borehole at Clara	26/09/2000	15:35:00			2.9					VOC analysis results on separate sheet.
Kiloshaun/Barna	03/10/2000	11:15:00	< 0.0001	< 0.0001	0.008	< 0.1				Samples as part of Kilkenny Groundwater Protection Scheme.
Tubrid Lower	03/10/2000	11:40:00	< 0.0001	< 0.0001	0.015	< 0.1				Samples as part of Kilkenny Groundwater Protection Scheme.
Balief Clomantagh	03/10/2000	12:00:00	< 0.0001	< 0.0001	0.012	< 0.1				Samples as part of Kilkenny Groundwater Protection Scheme.
Graine/Craddockstown	03/10/2000	12:30:00	< 0.0001	< 0.0001	0.007	< 0.1				Samples as part of Kilkenny Groundwater Protection Scheme.
Piltown (PWS07)	03/10/2000	09:45:00	< 0.0001	< 0.0001	0.004	< 0.1				Samples as part of Kilkenny Groundwater Protection Scheme.
Tullahought (GWS16)	03/10/2000	10:30:00	< 0.0001	< 0.0001	0.002	< 0.1				Samples as part of Kilkenny Groundwater Protection Scheme.
Hugginstown (GWS10)	03/10/2000	11:30:00	< 0.0001	< 0.0001	0.002	< 0.1				Samples as part of Kilkenny Groundwater Protection Scheme.
Ahenure (PWS09)	03/10/2000	14:15:00	< 0.0001	< 0.0001	0.024	< 0.1				Samples as part of Kilkenny Groundwater Protection Scheme.

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Source	Sampling Date	Sampling Time	To	Ref No	Sampling Location	Taken By	Lab No	EPARef	Stn Grid Ref	Water Supply	Public/Group/Private	Temperature	Odour 1/2/3	Colour Hazen	pH	Conductivity μS/cm	Turbidity NTU	TOC mg/l C	Ammonia mg/l N		
Callan (PWS06)	03/10/2000	15:00:00	Kilkenny Co. Co./G.S.I.			Ruth Buckley	5226									7.3	705			0.004	
Windgap (GWS17)	03/10/2000	12:45:00	Kilkenny Co. Co./G.S.I.			Ruth Buckley	5227									6.7	267			0.007	
Highrath (GWS11)	04/10/2000	12:00:00	Kilkenny Co. Co./G.S.I.		Highrath (GWS11)	M. Daly	5260									1	5	7.1	999	0.024	
Maddoxtown (GWS12)	04/10/2000	12:30:00	Kilkenny Co. Co./G.S.I.		Maddoxtown (GWS12)	M. Daly	5261									1	5	7.2	931	0.022	
Glenmore Spring (PWS02-1)	04/10/2000	11:10:00	Kilkenny Co. Co./G.S.I.		Glenmore Spring (PWS02-1)	Ruth Buckley	5266									5	6.4	259		0.018	
Glenmore Spring (PWS02-2)	04/10/2000	13:25:00	Kilkenny Co. Co./G.S.I.		Glenmore Spring (PWS02-2)	Ruth Buckley	5267														
Cuffesgrange No. 1 (GWS13)	02/10/2000	11:00:00	Kilkenny Co. Co./G.S.I.		Cuffesgrange No. 1 (GWS13)	M. Daly	5094									1	5	7.3	772	0.011	
Ballymack (GWS02)	02/10/2000	11:20:00	Kilkenny Co. Co./G.S.I.		Ballymack (GWS02)	M. Daly	5095									1	5	7.2	800	0.004	
Newtown Kells (GWS04)	02/10/2000	11:45:00	Kilkenny Co. Co./G.S.I.		Newtown Kells (GWS04)	M. Daly	5096									1	5	7.3	789	0.007	
Caherlesk Goolaghmore	02/10/2000	12:20:00	Kilkenny Co. Co./G.S.I.		Caherlesk Goolaghmore	M. Daly	5097									1	5	6.8	459	0.008	
Paulstown (PWS7)	04/10/2000	10:30:00	Kilkenny Co. Co./G.S.I.		Paulstown (PWS7)	V. Fitzsimons	5262									1	5	7.3	676	0.016	
Tullaroan (PWS5)	04/10/2000	11:30:00	Kilkenny Co. Co./G.S.I.		Tullaroan (PWS5)	V. Fitzsimons	5263									1	5	7.5	616	0.004	
Urilingford (PWS5-S)	04/10/2000	12:30:00	Kilkenny Co. Co./G.S.I.		Urilingford (PWS5-S)	V. Fitzsimons	5264									1	5	7.2	803	0.007	
Urilingford (PWS5-R)	04/10/2000	12:40:00	Kilkenny Co. Co./G.S.I.		Urilingford (PWS5-R)	V. Fitzsimons	5265									10	7.3	825		0.094	
Thomastown BH1 (PWS01-1)	02/10/2000	10:30:00	Kilkenny Co. Co./G.S.I.		Thomastown BH1 (PWS01-1)	Ruth Buckley	5114									5	7	466		0.003	
Thomastown BH2 (PWS01-2)	02/10/2000	10:50:00	Kilkenny Co. Co./G.S.I.		Thomastown BH2 (PWS01-2)	Ruth Buckley	5115									5	7.3	748		< 0.003	
Bennetsbridge BH (PWS04-B)	02/10/2000	12:10:00	Kilkenny Co. Co./G.S.I.		Bennetsbridge BH (PWS04-B)	Ruth Buckley	5116									5	7.3	721		< 0.003	
Bennetsbridge River (PWS04-R)	02/10/2000	12:15:00	Kilkenny Co. Co./G.S.I.		Bennetsbridge River (PWS04-R)	Ruth Buckley	5117									175	8	447		0.022	
Bennetsbridge Gravel (PWS04-G)	02/10/2000	12:25:00	Kilkenny Co. Co./G.S.I.		Bennetsbridge Gravel (PWS04-G)	Ruth Buckley	5118									20	7.5	563		0.006	
Bennetsbridge Mixed (PWS04-M)	02/10/2000	12:50:00	Kilkenny Co. Co./G.S.I.		Bennetsbridge Mixed (PWS04-M)	Ruth Buckley	5119									1	5	7.4	681		< 0.003
Kilree Stoneyford (GWS08)	02/10/2000	15:00:00	Kilkenny Co. Co./G.S.I.		Kilree Stoneyford (GWS08)	Ruth Buckley	5120									1	5	7.1	866		< 0.003
Spring at Clomantagh	12/02/2001	11:00:00	Kilkenny Co. Co.	KK00900	Beside Nuenna river, 50m SE of road		633		23520 16320			Private				9.7		7.2	615	1.4	0.007

EPA Regional Water Laboratory, Kilkenny. Monitoring Data for County Kilkenny Groundwaters 1993 to 1999.

Source	Sampling Date	Sampling Time	o-Phosphate mg/l P	Nitrate mg/l N	Nitrite mg/l N	Chloride mg/l Cl	Ca Hardness mg/l CaCO ₃	Alkalinity mg/l CaCO ₃	TCS	Total Coliforms per 100 ml	FCS	Fecal Coliforms per 100 ml	Sulphate mg/l SO ₄	Dry Residue mg/l	Sus_ Solids mg/l	Magnesium mg/l Mg	Total Hardness mg/l CaCO ₃	Sodium mg/l Na	Potassium mg/l K	Aluminium mg/l Al	Iron mg/l Fe	Manganese mg/l Mn	Copper mg/l Cu	Zinc mg/l Zn	Chromium mg/l Cr	Lead mg/l Pb
Callan (PWS06)	03/10/2000	15:00:00	0.006	4.1	< 0.001	19	334	336		24		10	11.6			25.1	437	10.1	0.9	< 0.05	< 0.05	0.0014	< 0.001	0.046	0.004	< 0.001
Windgap (GWS17)	03/10/2000	12:45:00	0.062	9.6	< 0.001	15	99.7	64		1		999	6.8			2.8	75.5	7.8	< 0.3	< 0.05	< 0.05	< 0.001	< 0.001	0.039	0.003	< 0.001
Highrath (GWS11)	04/10/2000	12:00:00	0.023	5.3	0.003	49	443	436	>	80	>	60	13.5			30	566	11	5.6	< 0.05	< 0.05	0.003	0.004	0.027	0.024	< 0.001
Maddoxtown (GWS12)	04/10/2000	12:30:00	0.015	11.7	< 0.001	25	383	404		17		4	18.6			29.1	502	11.1	3.3	< 0.05	< 0.05	< 0.001	< 0.001	0.003	0.021	< 0.001
Glenmore Spring (PWS02-1)	04/10/2000	11:10:00	< 0.006	9.6	0.001	22	44	38		45		1	12.8			11.5	91.3	10.9	3.8	< 0.05	< 0.05	< 0.001	< 0.001	0.02	0.003	< 0.001
Glenmore Spring (PWS02-2)	04/10/2000	13:25:00								36		1														
Cuffesgrange No. 1 (GWS13)	02/10/2000	11:00:00	0.02	4.2	0.009	19	362	362	>	80		29	13.1			25	464	11.2	3.6	< 0.05	< 0.05	< 0.001	0.005	0.037	0.005	< 0.001
Ballymack (GWS02)	02/10/2000	11:20:00	< 0.006	6.4	< 0.001	23	345	365		52		7	13.9			36.2	494	11.7	1.5	< 0.05	< 0.05	< 0.001	< 0.001	0.035	0.005	< 0.001
Newtown Kells (GWS04)	02/10/2000	11:45:00	0.006	5.6	< 0.001	26	359	367	>	80		7	13			29.2	479	12.5	1.5	< 0.05	< 0.05	< 0.001	0.004	0.049	0.003	< 0.001
Caherlesk Goolaghmore	02/10/2000	12:20:00	0.008	5.3	< 0.001	19	197	178		51		8	10			15.5	260	9.2	2.3	< 0.05	< 0.05	< 0.001	0.003	0.046	0.004	< 0.001
Paulstown (PWS7)	04/10/2000	10:30:00	0.008	5.7	0.008	22	330	286	>	80	>	60	12.8			11.5	377	10.9	3.8	< 0.05	< 0.05	< 0.001	< 0.001	0.014	0.016	< 0.001
Tullaroan (PWS5)	04/10/2000	11:30:00	< 0.006	2.9	< 0.001	14	301	284		999		999	7.4			10	342	8.2	1.4	< 0.05	< 0.05	< 0.001	< 0.001	< 0.001	0.015	< 0.001
Urilingford (PWS5-S)	04/10/2000	12:30:00	0.006	8	0.002	18	377	369	>	80	>	60	10.7			18.5	453	8	5.9	< 0.05	< 0.05	< 0.001	< 0.001	< 0.001	0.012	< 0.001
Urilingford (PWS5-R)	04/10/2000	12:40:00	0.039	7.2	0.056	19	375	375		1080		370	15.9			13.5	430	10.8	1.1	< 0.05	< 0.05	< 0.001	< 0.001	0.013	0.021	< 0.001
Thomastown BH1 (PWS01-1)	02/10/2000	10:30:00	0.012	4.9	< 0.001	18	186	105		8		999	10.4			15.5	249	11	1.3	< 0.05	< 0.05	< 0.001	0.005	0.05	0.004	< 0.001
Thomastown BH2 (PWS01-2)	02/10/2000	10:50:00	0.037	6.2	< 0.001	30	325	320		6		1	16			22.5	417	17.6	3.3	< 0.05	< 0.05	0.001	0.013	0.046	0.006	< 0.001
Bennetsbridge BH (PWS04-B)	02/10/2000	12:10:00	< 0.006	4.3	0.002	24	320	317		17		999	28.5			25.4	424	16.1	2.3	< 0.05	< 0.05	0.004	< 0.001	0.034	0.002	< 0.001
Bennetsbridge River (PWS04-R)	02/10/2000	12:15:00	0.083	2.1	0.014	16	223	185		42000		5600	15.8			7.8	255	10.3	4.4	0.119	0.279	0.02	0.003	0.037	0.004	< 0.001
Bennetsbridge Gravel (PWS04-G)	02/10/2000	12:25:00	0.05	1.1	0.051	22	260	253	>=	76		4	21.2			10.1	301	18.3	3.8	< 0.05	< 0.05	0.066	0.037	0.042	0.005	< 0.001
Bennetsbridge Mixed (PWS04-M)	02/10/2000	12:50:00	0.02	4.5	0.009	23	311	291		104		5	23			19.2	390	16.7	3.3	< 0.05	< 0.05	0.025	0.002	0.046	0.006	< 0.001
Kilree Stoneyford (GWS08)	02/10/2000	15:00:00	0.131	15.4	< 0.001	19	397	370	>	80		60	11.3			29.9	520	11.4	3	< 0.05	< 0.05	< 0.001	0.008	0.039	0.002	< 0.001
Spring at Clomantagh	12/02/2001	11:00:00	0.015	4.1	0.002	14	305	270		15		12	34.9			6.5	331	5.5	1.3	< 0.01	< 0.02					0.031

COUNTY KILKENNY GROUNDWATER PROTECTION SCHEME

Map 8. Bedrock Geology of Source Protection Areas.



KILKENNY COUNTY COUNCIL
Comhairle Chontae Chill
Chairnáig

Mr. Tom Gunning, B.E., CEng., F.I.E.I.
Director of Services
County Hall, John Street, Kilkenny

Date	Details	Map Production	Checked
Aug 01	Initial	M44	R.B.A.V.Z
May 02	Check Draft	M44	R.B.A.V.Z
May 02	Final Draft	M44	R.B.A.V.Z
May 02	Final	M44	R.B.A.V.Z

GEOLOGICAL SURVEY
OF IRELAND
Suirbhéireacht Ghéalaíochta Éireann

Beggars Bush, Haddington Rd.,
Dublin 4

Graiguenamanagh

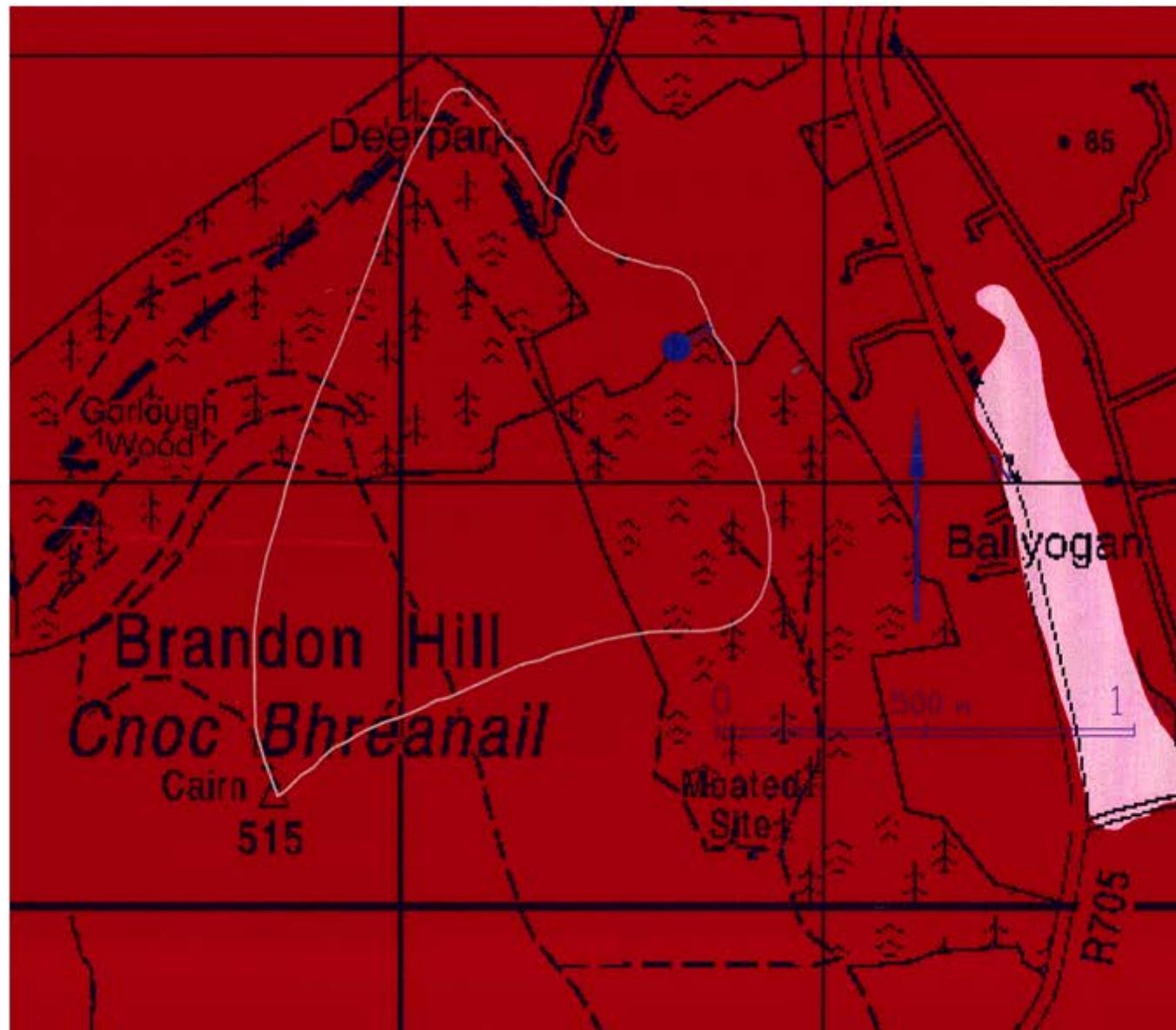
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Graiguenamanagh PSS



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COUNTY KILKENNY GROUNDWATER PROTECTION SCHEME

MAP 9 VULNERABILITY OF SOURCE PROTECTION AREAS

VULNERABILITY CLASSIFICATION

- Generally Extreme (E)
- Outcrop/Shallow rock/Karst (E)
- Generally High (H)
- Generally Moderate (M)
- Generally Low (L)

- High Yielding Spring ● Excellent Yielding Well
- Intermediate Yielding Spring ● Infiltration Gallery
- Low Yielding Spring ● Portion of Paulstown Outer Source Area lying outside Co. Kilkenny

Vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities.

The map shows the location of the first groundwater encountered (in either sand/gravel aquifers or in bedrock) to contaminants released at depth of 1-2 m below the ground surface. Where contaminants are released at significantly different depths, there will be a need to determine groundwater vulnerability using site-specific data. The characteristics of individual contaminants have not been taken into account.

This vulnerability map is designed for general information and strategic planning usage. The boundaries are based on the available evidence and local details have been generalized to fit the map scale. Evaluation of specific sites and circumstances will normally require further and more detailed assessments, and will frequently require site investigations to determine the risk to groundwater.

Project Hydrogeologist: Ruth Buckley & Cecilia Gately
Project Manager: Vincent Fitzsimons
Digital Map Production: Marie Hogan

Sources of Information

Bedrock map: Map 1: A.G. Steeman, D.C. Smith, S. McConnell and D. Tazza-Taylor
Outcrop and depth to bedrock map: Map 3: S. Hegarty, Quaternary and Geotechnical Section
Permeability map: R.Buckley and V.Fitzsimons, Groundwater Section
Soil map: M. J. Connolly, Air Force Tattonia
Subsoil Map: Map 2: S.Hegarty, Quaternary and Geotechnical Section

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KILKENNY COUNTY COUNCIL
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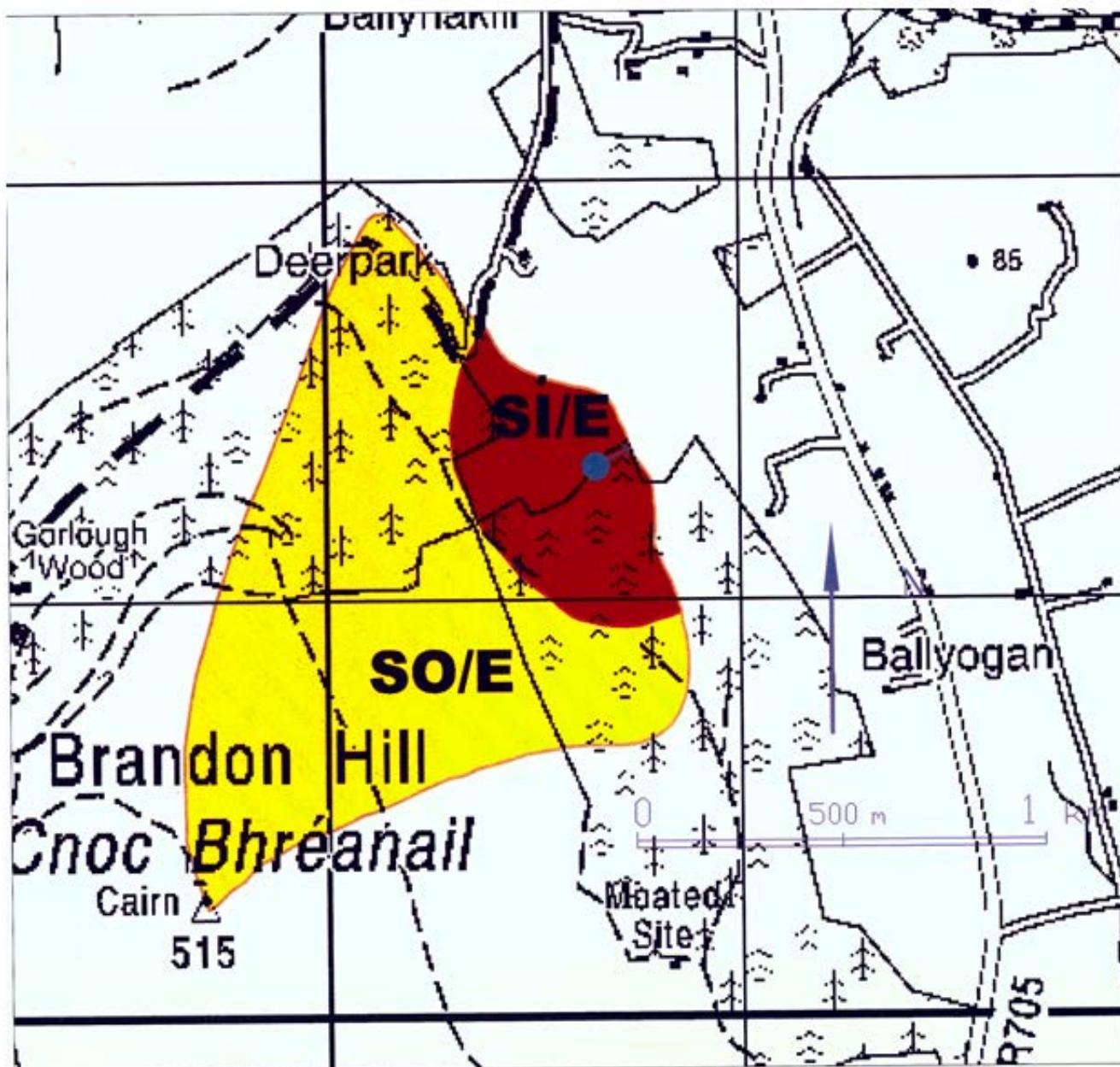
Mr. Tom O'Quinn, B.Sc., CEng, F.I.E.I.
Director of Services
County Hall, John Street, Kilkenny

SOIL	SEDIMENT	PERMEABILITY	CHARGE
SOIL	SEDIMENT	PERMEABILITY	CHARGE
SOIL	SEDIMENT	PERMEABILITY	CHARGE
SOIL	SEDIMENT	PERMEABILITY	CHARGE

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COUNTY KILKENNY GROUNDWATER PROTECTION SCHEME

MAP 10 SOURCE PROTECTION ZONES

VULNERABILITY RATING	SOURCE PROTECTION ZONES	
	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

● High Yielding Spring

● Intermediate Yielding Spring

○ Low Yielding Spring

● Excellent Yielding Well

● Infiltration Gallery

Portion of Paulstown Outer Source Area lying outside Co. Kilkenny

This Source Protection Zone map is designed for general information and strategic planning usage. The boundaries are based on the available evidence and local details have been generalized to fit the map scale. Evaluation of specific sites and circumstances will normally require further and more detailed assessments and will frequently require site investigations to determine the risk to groundwater.

The map is intended for use in conjunction with groundwater protection responses for potentially polluting activities, which lists the degree of acceptability of these activities in each zone and describes the controls necessary to prevent pollution.

Project Hydrogeologists: Ruth Buckley & Cecilia Gately
Project Manager: Vincent Fitzsimons
Digital Map Production: Marie Hogan

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Director of Services
County Hall, John Street, Kilkenny

SOIL	DEPTHL	PERMEABILITY	DEPTH
Soil 1	0-100	Very Slow	100-150
Soil 2	100-200	Slow	150-200
Soil 3	200-300	Medium	200-300

GEOLOGICAL SURVEY OF IRELAND
Suthernachá Ghleannachais Ceann



Groundwater Section
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