International Association of Hydrogeologists
(Irish Group)
14th Annual Seminar
Killeshin Hotel, Portlaoise

April 19th - 20th 1994

Water Pollution - Law, Practice and Planning

Tuesday 19th April

Time	Topic	Speaker & Organisation
10.00am	Registration and coffee	
11.00am	Open Address and Welcome	K. Cullen IAH President
11.15am	Law & Water Pollution	Dr. Y. Scannell Trinity College, Dublin
11.45am	Civil Liability for Groundwater Pollution. The Cambridge Water Company Case.	B. Misstear, Groundwater Development Consultants
12.30pm	Questions and Discussion	
1.00pm	Lunch	
2.00pm	Case Histories & Experiences (approx 25 minutes each)	M.Lavelle, Cork Co. Co. M. O'Keeffe, Dublin Co. Co. S. Sheil, N.W.R.F.B. T. Foy, Dublin Corporation S.D. Lyness, D.o.E N.Ireland
4.15pm	Coffee	
4.30pm	Water Pollution & Planning	J.Reid, Reid Associates
5.00pm	Questions & Discussion	
5.30pm	Close of session	

	Drinks Reception	Sponsored by E.P.S. Ltd.

Wednesday 20th April

Time	Topic	Speaker & Organisation
9.00am	Laboratory Consistency	C. Concannon Environmental Protection Agency
10.00am	Questions & Discussion	
10.30am	Coffee	
11.00am	Mallow Energy Park	P.Walsh, Cork Co. Co.
11.20am	Natural impurities in Groundwater	K.Cullen, K.T. Cullen & Co.
		P.Bennett, H E S Ltd.
	"Carbon Dating Groundwater"	D.Ball, Consultant
12.00 noon	Bottled Waters and Public Awareness	D. Byrne Bottled Water Association
12.30pm	Questions & Discussions	
12.50pm	Close of Seminar	K.Cullen President IAH
1.00pm	Lunch	

Golf outing at the Heath Golf Club, Wednesday 20th April. All are welcome - tee reserved from 2.30pm.

IAH PORTLAOISE SEMINAR, APRIL 1994

Welcome Address

Water Pollution - Law, Practice and Planning

Groundwater is only one part of the hydrological cycle and those practising in hydrogeology are but a small fraction of the many professions involved in water pollution. The theme and content of this seminar is designed to span all aspects of water pollution from the controlling laws and planning regulations to the practice on the ground. Hopefully the papers to be presented and the subsequent discussions will be of interest to the broad range of delegates attending the seminar.

The Irish Group of the International Association of Hydrogeologists welcomes you all here today and thanks you for your support of our seminar. This, our 14th annual seminar carries on the tradition of discussing a wide range of topics which are relevant to practising engineers, scientists and administrators alike. The IAH also thanks all the speakers who have given their time to prepare very comprehensive papers and to deliver their lectures to us over the next 2 days. The IAH would also like to thank all the companies who support the seminar with commercial stands and hopefully their efforts will be rewarded by orders.

While the seminar is devoted to the business of information dissemination and technical discussion, the social aspect of this annual gathering is equally important. The IAH would like to thank our sponsors, E.P.S. Ltd. for the reception this evening and K.T. Cullen & Co. Ltd. for the golf outing tomorrow, and hopes everyone will enjoy themselves.

This years seminar was organised by;

Mr. Kevin Cullen, K.T. Cullen & Co. Ltd.	President
Mr. David Ball, Consultant	Secretary
Ms. Suzanne O'Sullivan, ERA-Maptec Ltd.	Treasurer
Mr. Frank Clinton, Environmental Protection Agency	Principal Seminar Officer

ASPECTS OF THE LAW RELATING TO GROUNDWATER POLLUTION

Yvonne Scannell,
M.A., Ll M.(Cantab.). PH.D., F.T.C.D., Barrister.
Consultant, Environmental Law Group,
Arthur Cox, Solicitors, 42 St. Stephens Green, Dublin 2.
18 April 1994

The Main Legal Controls over Groundwater Pollution

This paper merely addresses some of the more interesting controls over groundwater pollution which I shall discuss today. A fuller discussion of this topic may be read elsewhere.[1]

LOCAL GOVERNMENT (PLANNING AND DEVELOPMENT) ACTS 1963-93

Under these Acts, local authorities who are also planning authorities are empowered to control through their development plans the location of developments likely to cause water pollution, and to refuse permission for, or to permit subject to controlling conditions, developments which may generate water pollution. Some local authorities use groundwater protection schemes as part of the planning process.[2] Under these schemes, regions, such as local authority areas, are subdivided into three zones corresponding to regionally important aquifers (Zone 2) , locally important aquifers (Zone 3) and poor aquifers (Zone 4). A code of practice lists the generally acceptable and unacceptable activities in each zone. Maps accompanying planning applications must show septic tanks and percolation areas, bored wells and other features in the vicinity of the structure or land to which the application relates.[3] Planning permission may be refused for any development if it would endanger public health or if the local sewage facilities are overburdened or required for other permitted developments. Thus water quality control is to some extent integrated into the physical planning process.

In 1982 however, the Minister for the Environment advised planning authorities that:

> *In general, it is no longer appropriate that a planning permission should contain conditions setting out in detail the standards which effluents should meet: such standards can more appropriately be included in a licence under the 1977 Act which, unlike planning conditions, is subject to periodic review.*[4]

Planning authorities have been advised by circular on attaching conditions regulating septic tank drainage arrangements from single houses and in so doing have been advised to consult the IIRS *Recommendations for Septic Tank Drainage Systems Suitable for Single Houses* (S.R. 6: 1991).[5] Where more than one house is involved,

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1 See Scannell, Environmental Law, Kluwer 1994. Due for publication in July 1994.

2 GSI Groundwater Newsletter, January 1994, 3-5.

3 Local Government (Planning and Development) Regulations 1994, article 23(a).

4. Development Control Advice and Guidelines, 1982, 45, 46.

5. Circular PD 1/92, 8 January 1992.

septic tanks are expected to comply with BS 6297: 1983. But most planning authorities are now unlikely to set effluent or water quality standards as conditions to planning permissions where these matters will be dealt with in a licence granted under the Local Government (Water Pollution) Acts 1977-90. They do however continue to prescribe some kinds of process standards and controls for effluents from septic tanks, many of which are exempt from the licensing requirements of section 4 of the Local Government (Water Pollution) Act 1977.

Conditions relating to water pollution attached to planning permissions will lapse when a licence under Part IV of the Environmental Protection Agency Act 1992, is granted in respect of the same discharge. Planning authorities and An Bórd Pleanála are prohibited by section 98 of the Environmental Protection Agency Act 1992, from refusing planning permission on the grounds that activities from a development licensed or licensable under Part IV of that Act would cause environmental pollution or from granting permission subject to environmental pollution control conditions.

LOCAL GOVERNMENT (WATER POLLUTION) ACTS 1977-90

Scope Under these Acts (hereafter called the Water Pollution Acts), local authorities, as defined therein,[6] have primary, but not exclusive, responsibility for ensuring the preservation, protection and improvement of water quality. Because of the fundamental changes which the 1977 Act wrought on Irish water pollution law, section 33 thereof provided that different provisions might be brought into force on different dates. Much of the Act came into operation on 1 May, 1977 but sections 4 and 16, which require the licensing of discharges to waters and sewers, did not come into operation until 1 October, 1978 and 1 January, 1979 respectively. All sections of the Act other than sections 25 are now in force. Sections in the 1977 Act will be described as amended by the 1990 Act but care should be taken to ensure when the relevant section in the 1990 Act was been brought into force.[7]

In section 1 of the 1977 Act 'waters' are defined so as to include:

(a) any (or any part of any) river, stream, lake, canal, reservoir, aquifer, pond, watercourse or other inland waters, whether natural or artificial,

The inclusion of an aquifer in the above definition and the further definition of an aquifer in section 1 as 'any stratum or combination of strata which stores or transmits groundwater' means that the Acts apply to the vast bulk of groundwaters. Pollution is nowhere defined but 'polluting matter' is very widely defined in section 1 to include:

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6. Local Government (Water Pollution) Act 1977, S.1.
7 All the 1990 Act was in force by 1 November 1992.

any poisonous and noxious matter and any substance (including any explosive, liquid or gas) the entry or discharge of which into any waters is liable to render those or any other waters poisonous or injurious to fish, spawning grounds or the food of any fish, to injure fish in their value as human food, or to impair the usefulness of the bed and soil of any waters as spawning grounds or their capacity to produce the food of fish, or to render such waters harmful or detrimental to public health or to domestic, commercial, industrial, agricultural or recreational uses.

This definition is unusual and progressive in that it sets up a system of water pollution control based on injury to stated beneficial uses of waters. The Minister for the Environment has power to extend the powers of local and sanitary authorities under these Acts to the Environmental Protection Agency

Main Controls

The main legal controls over pollution established under the Water Pollution Acts are powers under section 3 of the 1977 Act to prosecute for causing or permitting the entry of polluting matter to waters, licensing requirements for the discharge of trade or sewage effluents to waters, unless the discharge is made by a sanitary authority or is exempted from licensing requirements. Exemptions from the licensing requirements are contained in the Local Government (Water Pollution) Regulations 1978.[8] These are:

(i) domestic sewage not exceeding five cubic metres in any 24 hour period which is discharged to an aquifer from a septic tank or any other disposal unit by means of a percolation area, soaking pit or any other method;

(ii) trade effluent discharged by a sanitary authority in the course of the performance of its powers and duties, other than from a sewer.

These exempted discharges are by virtue of section 3(5)(a)(iii) subject to some control under section 3(1), but only if they fail to comply with any relevant standards prescribed under section 26, or section 59 of the Environmental Protection Agency Act 1992.

It should be noted that, once again, sanitary authorities are not subject to the same controls as the private sector in respect of discharges of trade effluents although they may in future be liable to comply with any standards prescribed under the

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8. S.I. Nos. 108 of 1978; hereafter called the 1978 Regulations.

European Communities Act 1972, or section 59 of the Environmental Protection Agency Act 1992, or in EC directives which have come into force.

Special Provisions for Aquifers

Special provisions governing the discharges to aquifers are contained in Part VI of the Local Government (Water Pollution) Regulations 1992[9] which were enacted, inter alia, to implement EC directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances[10]. Applications for licences to discharge to aquifers must be accompanied by the results of a prior investigation unless it can otherwise be shown to the satisfaction of the local authority that the harmful substance in the trade or sewage effluent is present in such a quantity and concentration as to obviate present or future danger of deterioration in the quality of the water in the aquifer. If undertaken, the prior investigation must include an assessment of the environmental impact of alternative methods of disposal of the harmful substance and a great deal of information on the aquifer to which the proposed discharge is to be made. A quality standard of zero milligrams per litre applies to trade and sewage effluent discharged to an aquifer in respect of a harmful substance.but a different quality standard can be prescribed for harmful substances specified in the *First Schedule* where:

(a) the results of the prior investigation show that the aquifer waters are permanently unsuitable for specified beneficial uses and all practical technical precautions have been to prevent the entry of the harmful substances to other waters so as to avoid the risk of the waters being affected by the harmful substance so as to endanger human health or water supplies, harm living resources and the aquatic ecosystem or interfere with the use of the water for domestic, agricultural, fisheries, commercial, industrial or recreational purposes or

(b) the licence application is made for the reinjection into the same aquifer of water used for geothermal purposes, water pumped out of mines and quarries or water pumped out for civil engineering works.

A different quality standard can be prescribed for harmful substances specified in the *Second Schedule* where all practical precautions are observed to prevent water in the aquifer being affected by the harmful substance so as to create a risk of the waters being affected by the harmful substance so as to endanger human health or water supplies, harm living resources and the aquatic ecosystem or interfere with the use of the water for domestic, agricultural, fisheries, commercial, industrial or recreational purposes.

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9 S.I. No. 271 of 1992.

10 O.J. L 20, 26 January 1980.

A quality standard of zero milligrams per litre applies to trade and sewage effluent discharged to an aquifer in respect of a harmful substance specified in the First Schedule which might be caused or permitted to enter the water as a result of any disposal or tipping of the substance or any material containing the substance or any activities on or in the ground.

Many sanitary authorities will soon be obliged to comply with the standards prescribed in EC directive 91/271/EEC on urban waste water treatment.[11] The Environmental Protection Agency has powers under the Environmental Protection Agency Act 1992, in relation to discharges of sewage effluents by sanitary authorities[12] and the Minister has power to make regulations setting standards for such discharges and requiring sanitary authorities to obtain an authorisation for discharges from the EPA under section 59 of that Act.

Water Quality Management Plans

Section 15 of the 1977 Act deals with water quality management plans. A local authority or two or more local authorities may make a water quality management plan for any waters situated in their functional areas or which adjoin those areas. Making a plan is mandatory if the Minister for the Environment directs. Plans may cover any waters in or adjoining the functional area of the local authority. Plans must contain such objectives for the prevention and abatement of water pollution and such other provisions as the local authority considers necessary. A plan may not contain any provision which is inconsistent with regulations made under section 26. Local authorities are bound to have regard to water quality management plans when considering licence applications and when carrying out functions which could be relevant to water pollution control but they are not prohibited from contravening an objective in a plan as they are when operating the provisions of planning legislation. When formulating policies for plans, local authorities are obliged to take account of any quality objective drawn up and published by the EPA under section 75 of the Environmental Protection Agency Act 1992.

Plans deal mainly with the effects of BOD from discharges from sewerage systems and industries to surface waters. To date plans have not considered regulating the effects on water quality of non-point sources of pollution, particularly agricultural activities, the leaching of contaminants from the soil into groundwater, water conservation and habitat protection. Some consideration of the effects of non-point

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11. O.J. L135, 30 May 1991. See Environmental Protection Agency Act, 1992, s.59.

12. Environmental Protection Agency Act 1992, ss. 59, 60, 61, 63, 66, 67, 68, 75.

pollution from septic tanks appears in development plans, some of which now incorporate aquifer protection policies.

Plans are based on the environmental quality objectives/environmental quality standards approach to water quality management. They provide a framework (somewhat akin to development plans with respect to land-use) for prescribing effluent discharge standards for individual discharges . It is likely that future plans will be prepared by adopting the 'Best Practicable Environmental Option' approach[13] to waste disposal so that the discharge to waters of waste which could be disposed of in a more environmentally friendly way, or which could be used for beneficial purposes, will be limited.

Enforcement

There has been a marked increase in the levels of enforcement of the 1977 Act is recent years. In 1988, 14,347 investigations into suspected breaches of section 3 of the 1977 Act were carried out by local authorities. Of these 13,865 concerned agricultural wastes and 278 industrial wastes. There were 955 investigations into suspected breaches of section 4 of the 1977 Act in the same year. Of these, 194 concerned agricultural discharges and 730 industrial discharges. There were 48 prosecutions for contravening section 3, 39 of which are successful and 20 prosecutions for contravening section 4 of which 15 were successful. Letters of advice or warnings were issued in 8,617 cases. Seven successful prosecutions were taken for contraventions of section 16 of the 1977 Act. Fines imposed ranged from £0-£1,500 and costs awarded ranged from £0-£2,635.

Regular reports on the level of enforcement of the Water Pollution Acts are given in the Environment Bulletin published by the Department of the Environment.

Powers to Mitigate and Remedy the Effects of Pollution

Section 10 of the 1977 Act, gives any person the right to seek an order from the 'appropriate court' requiring the person responsible for causing water pollution contrary to sections 3(1) and 4(1) of the 1977 Act, described above, to mitigate or remedy the effects thereof in the manner and within such period as the court specifies. The 'appropriate court' will depend upon the estimated costs of complying with the court order sought and can be the District, Circuit or the High Court.

Section 10(1)(a) and section 83 of the Environmental Protection Agency Act 1992, provide that where the court is satisfied that another person is or has contravened

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13. McCumiskey, Water in Ireland, ERU, 1991, 47.

section 3(1) or 4(1) it may make an order directing that other person to do one or more of the following, that is to say:

(I) to terminate the entry or discharge within such period as may be specified in the order, or

(II) to mitigate or remedy any effects of the entry or discharge concerned in such manner and within such period as may be specified in the order, or

(III) to pay to the applicant or such other person as may be specified in the order a specified amount to defray all or part of any costs incurred by the applicant or that other person in investigating mitigating or remedying the effects of the entry or discharge concerned.

The court has very wide powers as to the kind of orders it may make. including express powers under section 10(8) to order the replacement of fish stocks, the removal of polluting matter from waters, the making or financing of alternative arrangements for water supplies and the making good of any damage to plant or equipment or to any water abstraction or treatment works and any consequential losses incurred by any person by reason of the entry of polluting matter into waters.

Applications for section 10(1) orders may be brought in a summary manner and the court may, if it thinks fit, make an interim or interlocutory order.[14] The person named in the order must be given an opportunity of being heard by the court.[15] Failure to comply with a court order is an offence which can be prosecuted by the person who sought the order and which is punishable by a maximum fine of £1,000 and/or six months imprisonment.[16]

If the defendant fails to comply with a court order, the local authority or Regional Fisheries Board in whose area the waters concerned are situated has power under section 10(4) to take any steps specified in the order to mitigate or remedy the pollution at the expense of the defendant.

Alternatively, a local authority, instead of applying to the court under section 10(1), may serve an order under section 10(5) on any person specified in section 10(1)(a) requiring the termination of the entry or discharge and the mitigation or remedying of any effects of the entry or discharge in such manner and within such period as the notice may specify and requiring any of the measures specified under section 10(8) to be taken. Failure to comply with this order entitles the local authority to take 'any steps it considers necessary' to secure the termination, mitigation or remediation of the effects of pollution and to recover the costs from the person served

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14. 1977 Act, s.10(1)(e).
15 Ibid., s.10(3)(a).
16. Ibid., s.10(2).

with the notice. This power is not exercisable by Fisheries Boards but they can always seek section 10(1) orders.

A recent example of the successful use of this section is *Meath County Council v Thornton*[17] where the High Court made an order under section 10 requiring a waste disposal company and a director thereof to remedy or abate environmental damage caused to groundwaters by the improper and unauthorised operation of a waste disposal site. The court also made an order under section 11 requiring the company and the director to defray the costs of providing an alternative potable water supply to persons whose well water was contaminated by percolation of leachate from the waste disposal site.

Section 11: High Court Orders

Section 11(1) of the 1977 Act, as amended in 1990 and by section 83 of the Environmental Protection Agency Act 1992, provides that when the High Court is satisfied on the application of any person, whether or not that person has an interest in the waters concerned, that there has been, is, or is likely to be, a contravention of sections 3(1)or 4(1) of the 1977 Act , or that polluting matter has escaped, is escaping or is likely to escape accidentally from premises to waters, it may inter alia, prohibit the illegal entry or discharge, require the taking of preventive measures, and make such other provision as the Court considers appropriate.

This section may be used to prevent contraventions of section 3(1) and 4(1) of the 1977 Act to prevent, or mitigate potential pollution. The High Court order may be addressed to, inter alia, any person who through no fault of his own has custody or control of polluting matter or trade or sewage effluents liable to cause water pollution. It may therefore be an appropriate remedy where, for example, water pollution is liable to be caused by improper waste disposal, underground storage tanks, or contaminated land.

Applications for section 11 orders may be made by motion and the High Court may make such interim or interlocutory order and such order as to costs as it considers appropriate.[18]

Notices to Prevent or Control Pollution

Where it appears to a local authority that it is 'necessary' to do so in order to prevent or control water pollution, it may serve a written notice under section 12 of the 1977 Act,

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17 *Meath County Council v Padraic Thornton Waste Disposal Ltd, Irish Times*, 15 January 1994.

18. Ibid., ss.10(2), 10(3).

as amended in 1990, on any person having custody or control of any polluting matter on premises in its functional area requiring specified measures to be taken .

This section is aimed primarily at non-point sources of pollution, particularly at agricultural waste disposal facilities.

Failure to comply with a section 12 notice is a criminal offence punishable by a maximum fine of £1000 and/or six months imprisonment.[19] It also entitles the local authority to take any steps it considers necessary to prevent polluting matters entering waters at the expense of the defaulter.

In 1988, 986 section 12 notices were served, of which 943 related to agricultural premises and 27 to industrial premises. Prosecutions were taken in 23 cases and 17 of these were successful.

Section 13: Action to Prevent Pollution

Section 13 of the 1977 Act, as amended in 1990, provides that local or sanitary authorities may when they consider it 'necessary' to do so for the purposes of preventing, mitigating or remedying water pollution or removing polluting matter from waters, drains or sewers, take such measures (including the giving of assistance, whether financial or otherwise, to others and the procuring of the taking of measures by others) as they consider appropriate for those purposes and to dispose of any such polluting matter as they think fit.

This section therefore empowers local and sanitary authorities to take clean-up and restorative measures after polluting incidents and to take preventative measures against further pollution. It is particularly appropriate for dealing with oil pollution. It enables authorities to clean up beaches and take action on the seashore and the foreshore both inside and outside their jurisdictions. Authorities may take the measures themselves or pay others, for example, environmental groups or residents' associations, to do so.

Expenditure incurred in carrying out the measures is recoverable from any person whose acts or omissions (being acts or omissions which that person ought reasonably to have foreseen would or might necessitate the taking of those measures by the authority) to the extent (if any) that the acts or omissions were necessitated by him.

Local authorities took action under section 13 on 33 occasions in 1988.

Section 20: Civil Liability for Pollution

A polluter is liable at common law for any damage to persons or property caused by pollution.[20] However, section 20 of the 1990 Act places this liability on a statutory

19. 1990 Act, s.24 (2).
20. See Macrory, Water Law (London 1985) 50-56, Howarth, Water Pollution Law (London 1988) 62-118.

footing by providing that damages are also recoverable in some circumstances when trade or sewage effluents or other polluting matter enter waters and cause injury, loss or damage to a person or the property of a person. The persons liable to pay these damages are:

(a) the occupier of any premises from which the effluent or polluting matter originated unless the entry to waters was caused by an act of God or the act or omission of a third party over whose conduct the occupier had no control, being an act or omission that such occupier could not reasonably have foreseen and guarded against, or

(b) any person whose act or omission occasioned the entry of polluting matter to the waters where the act or omission, in the opinion of the court, constitutes a contravention by that person of a provision of the 1977 or 1990 Acts.

Damages or losses are not recoverable where the entry of trade or sewage effluents or polluting matters to waters is by virtue of anything specified in section 3(5) of the 1977 Act, or under or in accordance with a licence under section 4 of the 1977 Act, or section 171 of the Fisheries (Consolidation) Act 1959, or Part IV of the Environmental Protection Agency Act 1992.

This statutory remedy is wider than the common law remedies available to those with property rights attaching to rivers and other watercourses in that it is not necessary for a plaintiff to prove a proprietary connection with the polluted waters. It is narrower in that certain statutory defences are provided which are not always available to those sued at common law.

Common Law Liability for Groundwater Pollution

I understand that this will be dealt with by the next speaker.

CIVIL LIABILITY FOR GROUNDWATER POLLUTION: THE CAMBRIDGE WATER COMPANY CASE AND ITS IMPLICATIONS

Bruce Misstear (Groundwater Development Consultants Ltd) and Paul Ashley (Consultant)

Introduction

This paper concerns the recent landmark English legal case of Cambridge Water Company v Eastern Counties Leather Plc and v Hutchings and Harding Ltd. The case was first heard in the High Court, then the Court of Appeal and finally decided by the House of Lords in December 1993. The authors provided technical evidence for Eastern Counties Leather (ECL). It is believed that this is the first case this century in which common law principles have been applied to groundwater pollution in England. The final judgement is therefore of considerable importance, not only with respect to liability for groundwater pollution in England, but also to the current debates in Europe on civil liability for environmental damage. Moreover, principles established in English case law may have persuasive effect in Ireland, and so the Cambridge Water Company case should be of direct interest in Ireland also.

This paper will set out the background and chronology of the case, describe the technical issues of hydrogeology and groundwater pollution, and then consider the legal arguments and findings of the courts and the House of Lords. The paper will conclude with a discussion of some of the technical and legal implications, especially those that may be of most relevance to Ireland. Perhaps the authors should also say in this introduction that they present this paper as practising hydrogeologists, not lawyers.

Chronology

Sawston is a large village about 7 km south of Cambridge in eastern England (Figure 1). The village has a long history of leather processing, and ECL was founded as a tannery in 1879, at a site on the village's southern edge. Tanning, as such, was discontinued before any of the events described in this paper occurred, and, at the present day, the company is mainly concerned with the production of high quality chamois leathers from imported tanned hides. The essential sequence of events related to the case, together with certain relevant other dates, are set out in Table 1.

It is particularly worth noting from this chronology the relative dates when the presence of trace amounts of trichloroethene (TCE) and tetrachloroethene (also known as perchloroethylene, or PCE) in the aquatic environment became of concern to the scientific and regulatory community, compared to the dates of upgrading by ECL of its cleaning and effluent treatment systems, and compared to the dates of purchase and use of the Sawston Mill borehole by Cambridge Water Company (CWC).

Table 1
Chronology

1879	ECL founded. No chlorinated solvents in existence.
1958	ECL introduces TCE as a solvent for cleaning leather.
1960's	Early 60's: ECL introduces PCE as a replacement for TCE. Mid to late 60's: improvements to drainage and waste systems at ECL site.
1975	US Environmental Protection Agency cites TCE and PCE as drinking water contaminants. First major public recognition of potential hazards.
1976	CWC agrees to purchase Sawston Mill borehole from local paper factory: purchase completed in 1977.
1970's	ECL introduces bulk storage for solvent (to replace 40 gallon drums) in about 1976, and purchases new cleaning machinery in 1978, with improved solvent distillation equipment.
1976	Closure of Thomas Evans Ltd, leather processor in Sawston. Hutchings and Harding Ltd (HHL), another leather processor, moves from central Sawston to former Thomas Evans site (Figure 1).
1979	CWC starts abstracting from Sawston Mill. No analysis for PCE carried out.
1980	EC drinking water quality directive (80/78/EEC) makes no specific reference to TCE or PCE, other than as generic organochlorine compounds. A 'guide level' for organochlorine compounds of 1 µg/l was given, but no 'maximum admissible concentration' was set.
1983	PCE detected in water supply by a local laboratory developing testing methods for TCE and PCE. Sawston Mill was pinpointed as the source (125 µg/l) by CWC and by Anglian Water Authority (AWA) as the then regulatory body, and closed down in October. The borehole was subsequently pumped to waste to control PCE migration in the aquifer.
1984	AWA detects high levels of PCE and TCE in ECL site borehole.
1984	AWA conducts investigations into contaminant migration routes in Sawston area: boreholes at 12 sites.
1984	World Health Organisation (WHO) sets "tentative guideline values" for TCE (30 µg/l) and PCE (10 µg/l).
1986	CWC commences proceedings against ECL and HHL.
1987	British Geological Survey (BGS) commences research investigation around ECL site.
1989	UK drinking water standards specify 'maximum concentrations' of TCE (30 µg/l) and PCE (10 µg/l).
1991	CWC action against ECL and HHL fails in High Court.
1992	CWC appeal against decision in respect of ECL succeeds in Appeal Court.
1993	ECL appeal against Appeal Court decision succeeds in House of Lords.

Characteristics of solvents

TCE and PCE share the common characteristics of all related chlorinated solvents, such as carbon tetrachloride and 1,1,1-trichloroethane. They are volatile, denser than water, of low viscosity, and are poorly soluble in water (Table 2).

Table 2

Comparison of solvent properties with water

	Specific gravity	Absolute viscosity (cp)	Solubility in water (mg/l)
Water	1	1	-
PCE	1.63	0.9	200
TCE	1.46	0.57	1100
Carbon tetrachloride	1.59	0.97	785
1,1,1 - Trichloroethane	1.35	0.84	720

These properties cause a solvent release to behave in a characteristic way in the subsurface. It tends to migrate rapidly downwards, much more rapidly than water in soil or rock of identical permeability. On reaching the water table, it continues to migrate downwards until it reaches an effectively impermeable bottom to the aquifer. A formation that is normally an aquiclude may be permeable to a liquid of this type, and care must be taken in interpreting hydrogeological data to predict the behaviour of chlorinated solvents.

In the saturated zone of the aquifer, the solvent will slowly dissolve in the passing groundwater flow. Because the solvents are poorly soluble in water, and because the accepted water quality standards are set very low, a moderate quantity of solvent is capable of contaminating a large area of aquifer over a long period of time.

Chlorinated solvents such as PCE degrade slowly under anaerobic conditions, but hardly at all in the presence of oxygen. PCE degrades initially to TCE, which in turn degrades to other intermediate products, including vinyl chloride.

Hydrogeology

The Sawston area is underlain entirely by Chalk bedrock, dipping gently from north-west to south-east (Figure 2). The base of the Chalk and the underlying Gault Clay outcrop in Cambridge north of the area. The Gault Clay is believed to be about 70 m below the ECL site, and about 50 m below the Sawston Mill site. There is a strip of recent alluvium along the valley of the river Cam, extending to the ECL site where it is about 7 m thick.

The Chalk is a major aquifer in the UK, particularly in eastern England where it may locally constitute the main or sole source of public water supply. CWC, for example, owns only Chalk

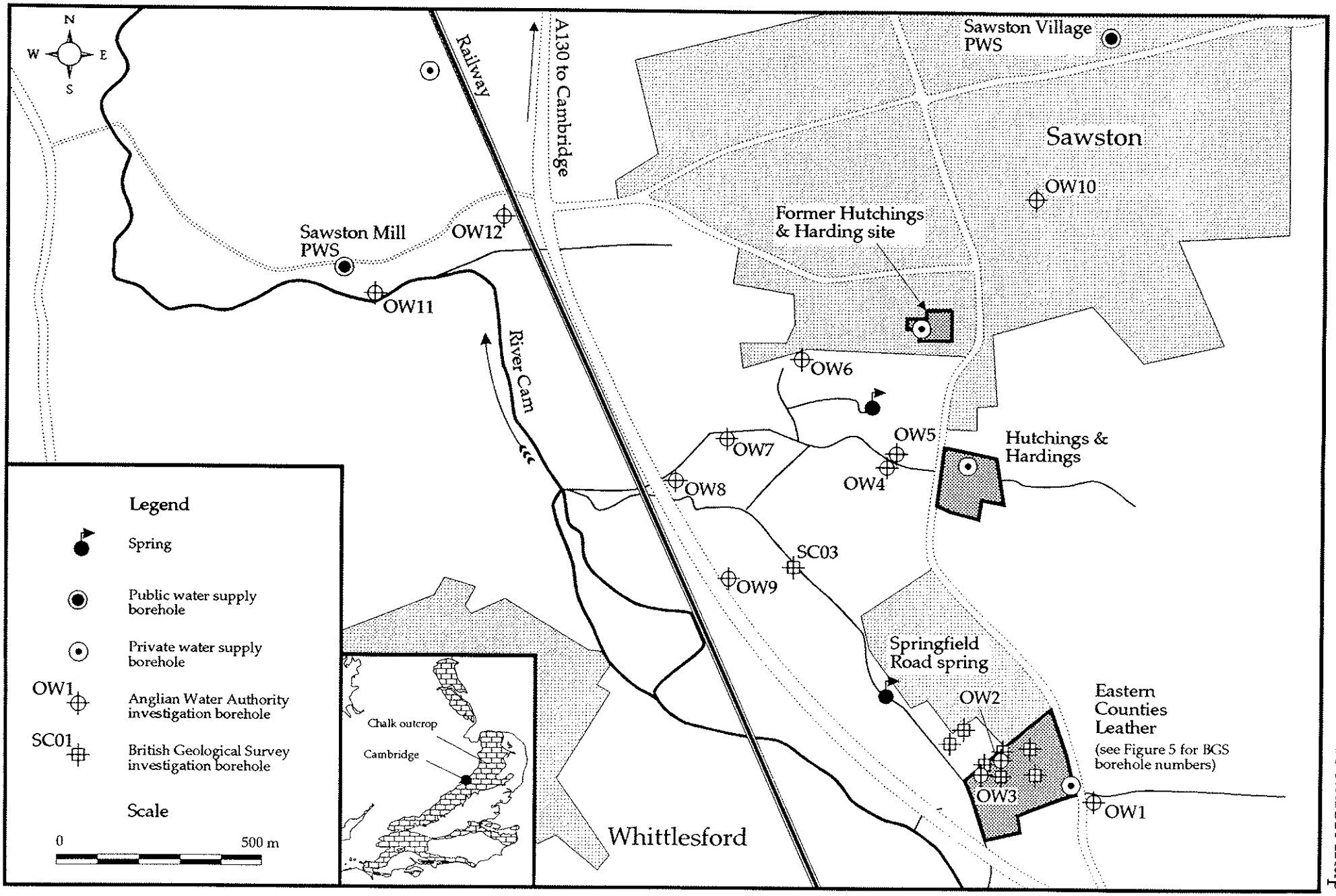
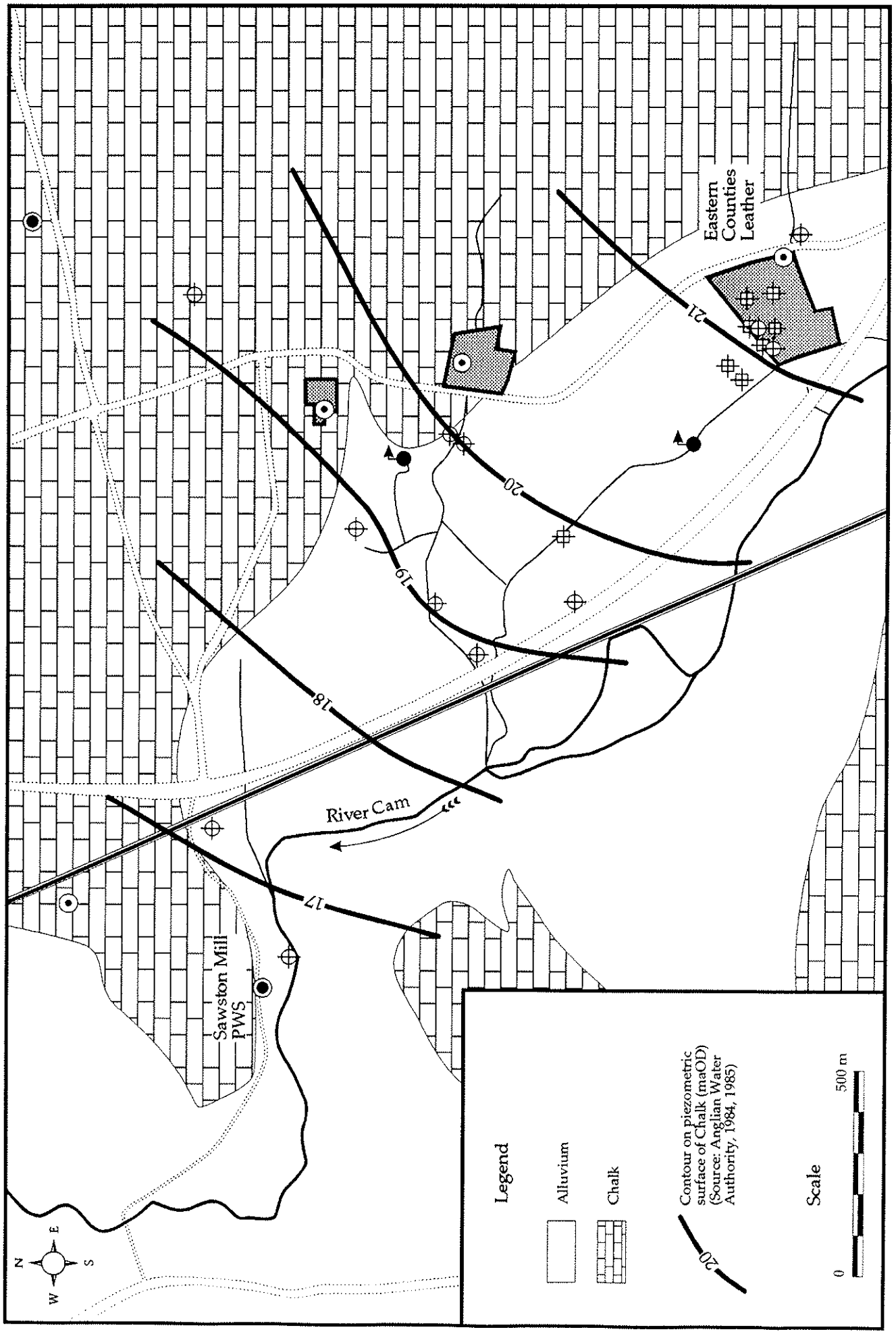


Figure 1
Location map

Figure 2
Geology and Chalk piezometry



groundwater sources. The Chalk is a "dual-porosity" aquifer: the main groundwater flow is through highly transmissive fractures and solution-fissures, which occupy a small volume of the strata in percentage terms. However, the low permeability intergranular pores, typically of 1 μm diameter, may occupy up to 50% of the bulk volume, and thus contain a large amount of water. Wells drilled in the Chalk aim to penetrate one or more fissure zones, thereby creating a high-yielding source. Wells which do not penetrate such a zone are very low-yielding.

Groundwater flow in the Sawston area is from south-east to north-west along the valley of the Cam. Formerly, the groundwater discharged into the Cam and from local springs, such as the one at Springfield Road near the ECL site. Now, a considerable proportion of the flow is intercepted by water supply wells such as Sawston Mill and others in the area.

Although the Chalk is generally unconfined, there is some evidence that the main body of the aquifer is partly isolated from water in the shallow drift, as a result of the development in its upper layers of low-permeability "putty chalk": soft weathered chalk, formed by freezing and thawing at the end of the last ice age.

Pollution investigations

AWA investigations

The first investigations into the sources of contamination at Sawston Mill were conducted by AWA in its capacity as regulator of drinking water quality and environmental water quality. Boreholes were drilled at 12 locations, at the ECL site, near Sawston Mill and in between, including the HHL site (Figure 1). In recognition of the distinction between the shallow and deep groundwater systems, some of the sites contained two boreholes, one shallow and one deep. Water samples from all the boreholes and from local surface water sources were analysed for PCE. Figure 2 shows the piezometric surface in the deep Chalk: a similar pattern was found for the shallow groundwater system.

Figure 3 shows the results of analysis of the deeper Chalk groundwater samples, and Figure 4 shows the results from the surface water samples. It is noticeable that, although there were high concentrations of PCE in the boreholes at the ECL site, in the Springfield Road spring, and in boreholes and springs near the HHL site, the boreholes between these locations and Sawston Mill failed to detect any major plume of contamination. Even in the borehole (OW11) about 100 m upstream of Sawston Mill there were no detectable levels of PCE contamination. These results are evidence of the difficulty of tracing contamination in fissured aquifers.

BGS investigations

The BGS investigations were conducted as a part of a research project studying synthetic organic contaminants in UK aquifers, and have been reported in detail elsewhere (Lawrence and Foster, 1991 and Lawrence et al 1992). The investigations included:

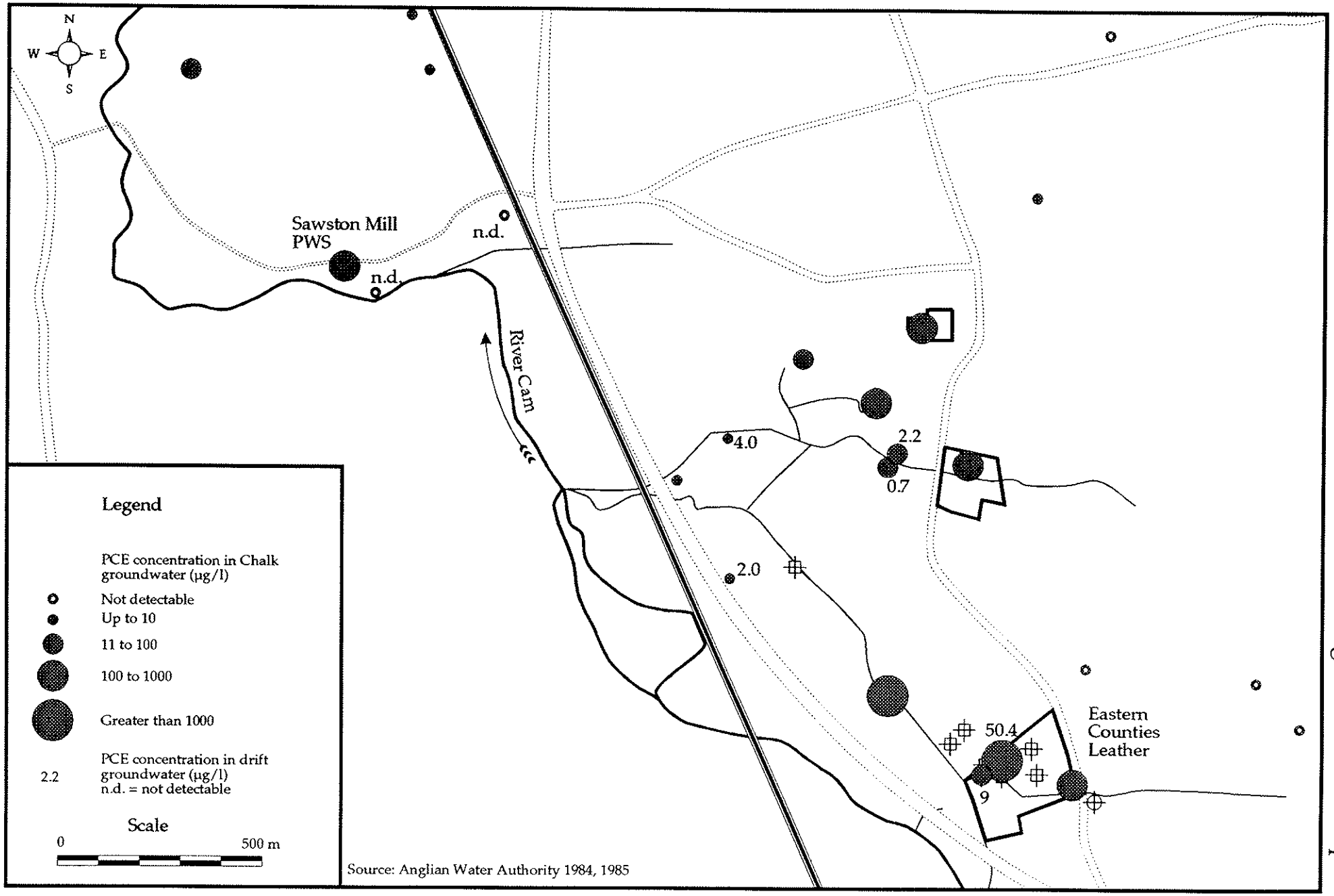


Figure 3
PCE concentrations in groundwater samples

Figure 4
PCE concentrations in surface water samples

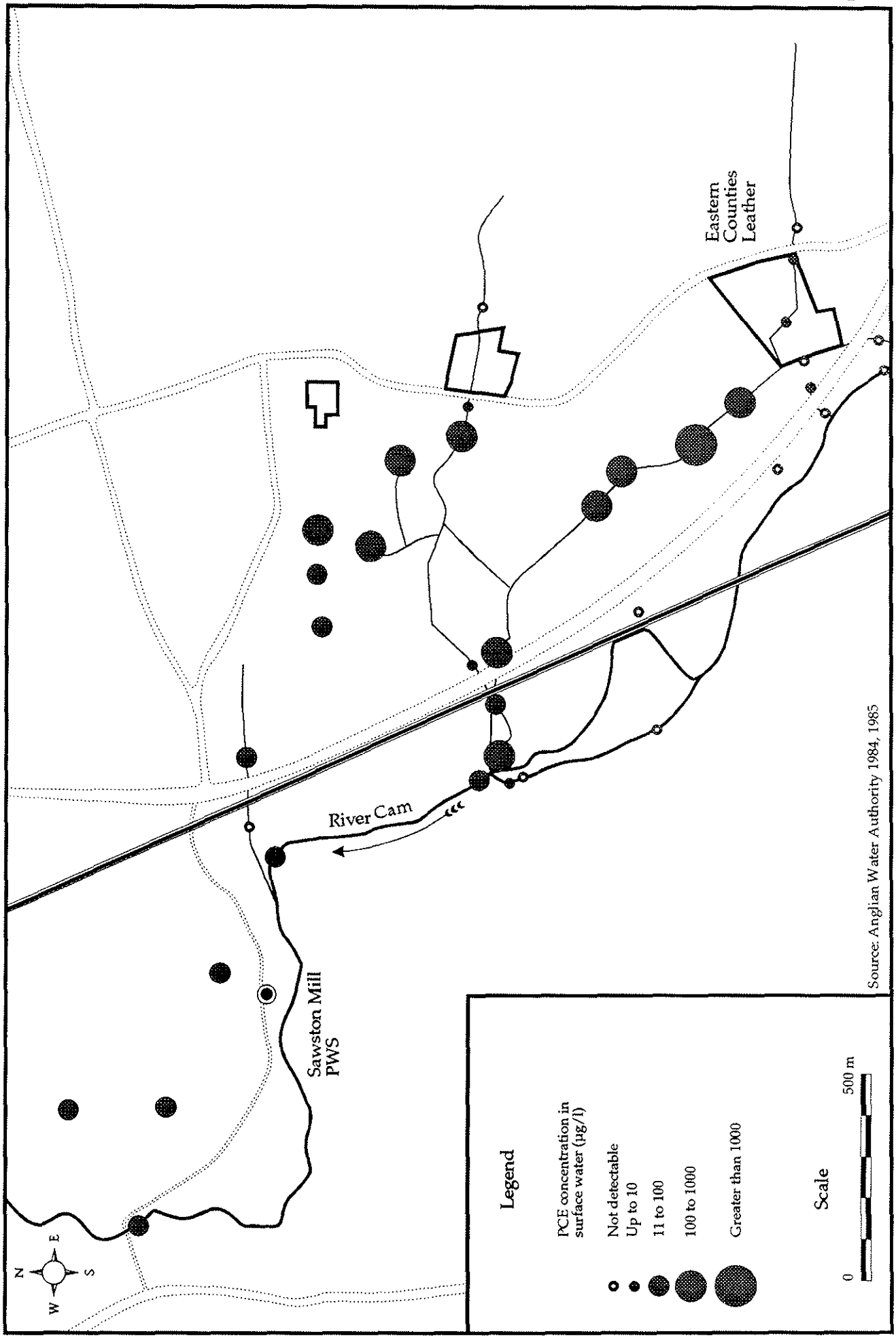
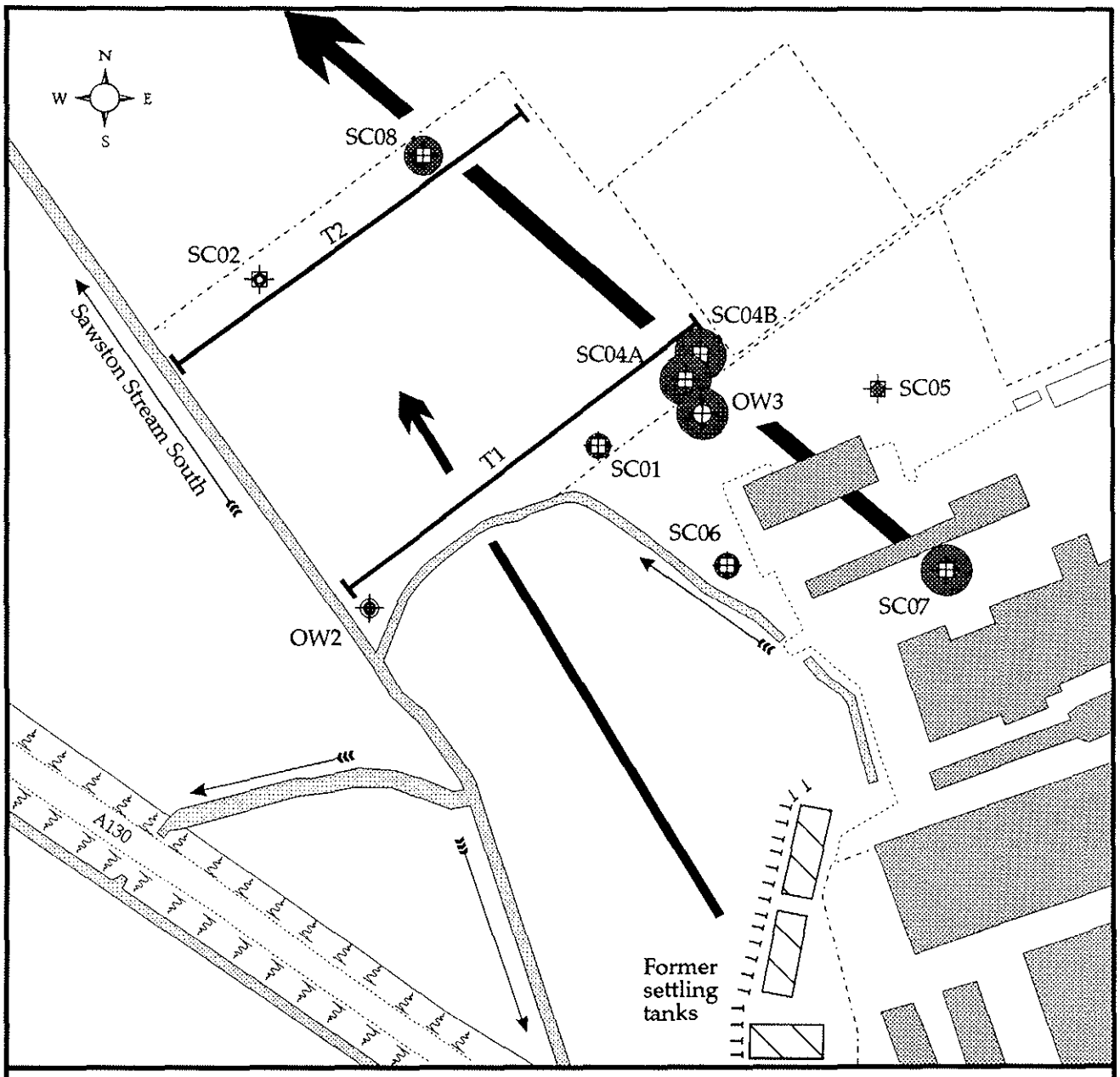


Figure 5
Maximum PCE concentrations in Chalk groundwater at ECL site



Legend

Maximum PCE concentration in Chalk groundwater (µg/l)

- Not detectable
- Up to 100
- 101 to 1000
- 1001 to 10000
- Greater than 10000

OW1 Anglian Water Authority investigation borehole

SC01 British Geological Survey investigation borehole

British Geological Survey soil gas survey traverse

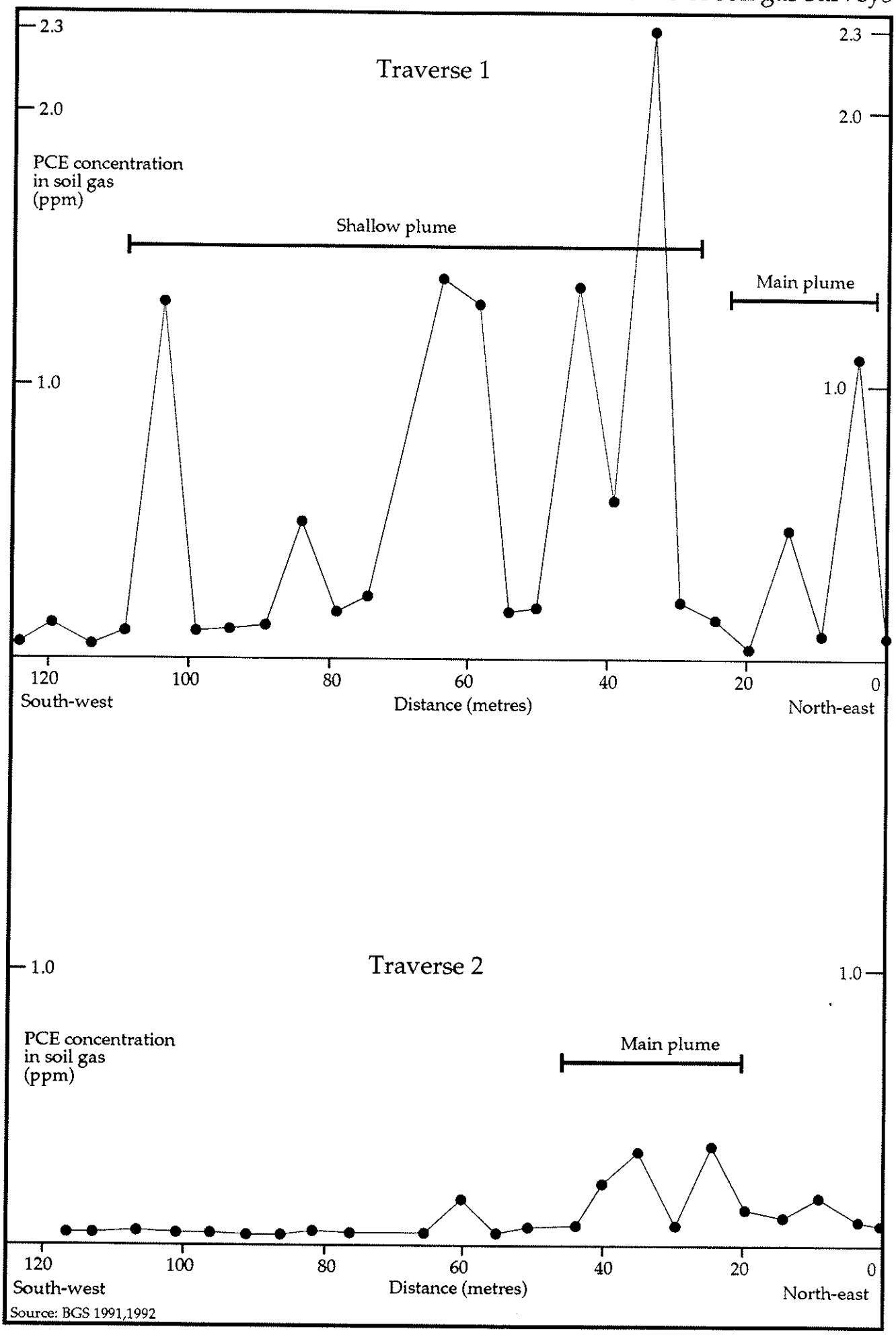
Probable plume direction

Scale

0 100 m

Source: BGS 1991,1992

Figure 6
Results of soil gas surveys



- logging and depth sampling of Sawston Mill and other boreholes;

- drilling ten boreholes, mainly on and adjacent to the ECL site to determine vertical distribution of PCE in core samples and in the fissure water;

- a tracer test in boreholes OW11 and OW8 near the Sawston Mill site, to determine actual contaminant migration rates;

- a soil gas survey of part of the ECL site.

The results are summarised here for completeness, but are based on the original BGS reports.

The data are mainly of relevance to the ECL site. Figure 5 shows the maximum concentrations of PCE found in boreholes below 20 m depth, which indicate that the PCE is migrating along a very narrow plume to the north-west. The soil gas survey in the same area (Figure 6) did not produce clear results, but is consistent with the same picture, however, once a broad, shallow plume emanating from the direction of the former effluent settling tanks, which does not appear to extend far, is discounted.

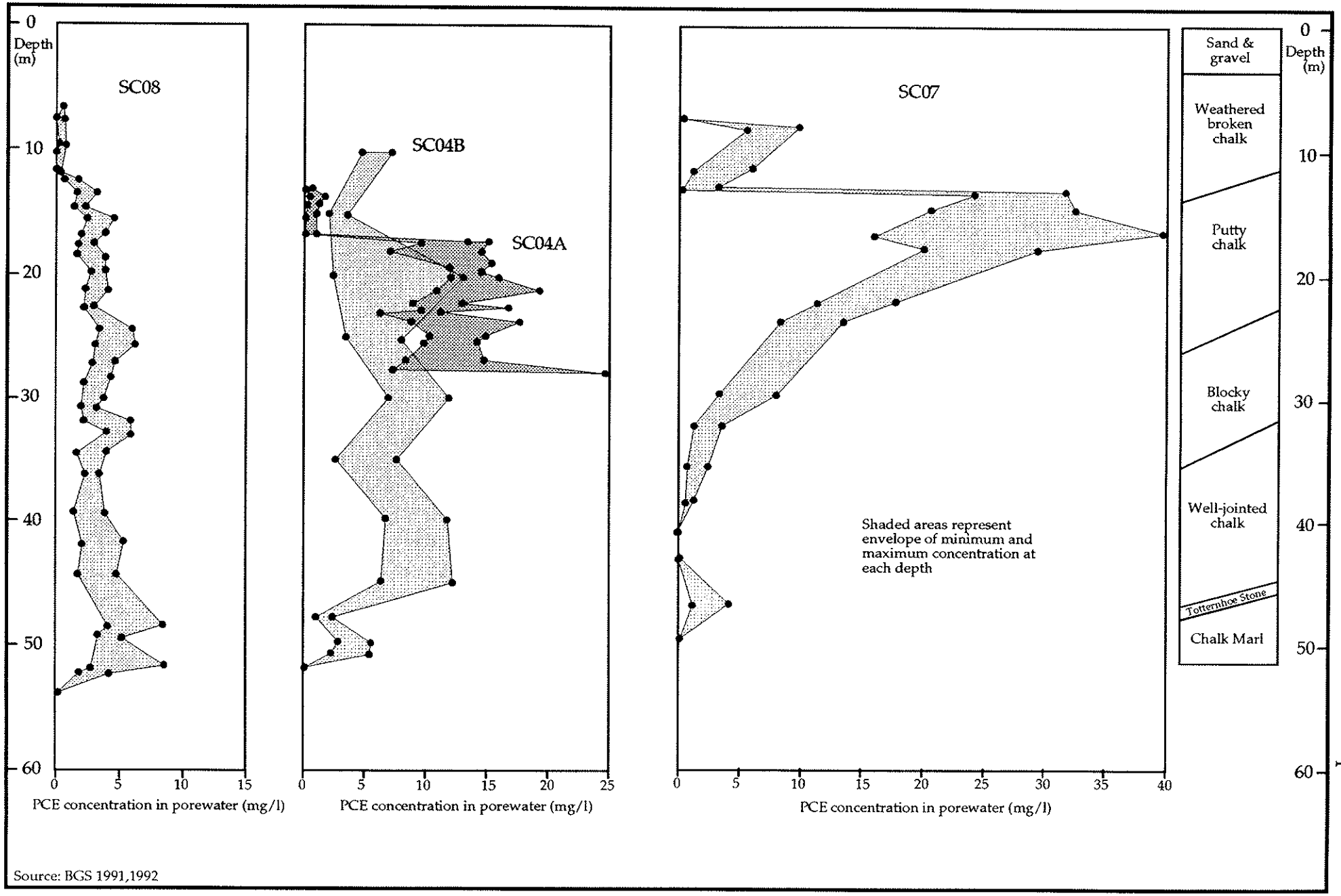
Figure 7 shows the vertical distribution of PCE in pore water samples from the three boreholes situated along the line of the plume. The data suggest that the PCE entered the aquifer upstream of SC07 and was initially held up by the shallow layer of "putty chalk" as it moved laterally downstream. By the time it reached SC04A/SC04B it had penetrated through the putty chalk to the main aquifer, and there is some evidence from SC08 that it reached another low-permeability layer at 50 m depth. The concentrations of PCE found in SC07 (40 mg/l in some samples) are consistent with the presence of neat PCE in the rock, an observation which may also be true for SC04A (25 mg/l).

The borehole logging and tracer test studies showed that the main groundwater flow zones are in and above the Totternhoe Stone, which lies at about 46-52 m depth below the ECL site and 25-36 m depth below Sawston Mill. The tracer tests showed that the groundwater velocity near Sawston Mill averages 8 m/d. It is worth noting as evidence of the difficulty of such tests, that the tracer injected into OW11 was not detected in Sawston Mill, about 100 m distant.

The results of the investigations of AWA and BGS, although unsuccessful in demonstrating a clear flow path between the ECL and HHL sites on the one hand and the Sawston Mill borehole on the other, provide sufficient information to conclude that the ECL site, at least, is a likely source of the PCE in the water supply.

Age and travel time of the pollutant

It was clearly of importance to establish, if possible, the travel time for PCE from the ECL site to Sawston Mill, so that, for example, the date of a polluting incident could be compared with the implementation of relevant legislation.



Source: BGS 1991,1992

Figure 7 Profiles of PCE concentrations in pore waters

The BGS tracer tests imply a travel time of about 250 days from the ECL site, although a longer time may be more realistic, considering that the flow rates were measured in the centre of the Cam valley near to the abstracting Sawston Mill borehole. However, the period for PCE to migrate from the surface down to the main aquifer is much more difficult to estimate, as there are no data pertaining to migration rates through the low permeability putty chalk. Periods in excess of several years are quite conceivable, but remain speculative.

The contaminant concentrations in Sawston Mill borehole have remained roughly steady since first detection at about 150-300 µg/l, which suggest that PCE was present in the Sawston Mill water for some time before first detection.

From indirect evidence, it can be concluded that spillages at the ECL site would be more likely to have occurred in the earlier years of PCE/TCE use, when the solvent was delivered and handled in drums rather than in bulk storage piped to the cleaning machines. Similarly, losses from the aqueous effluent system were more likely in the 1960's than in the late 1970's, by which time ECL had remodelled its effluent treatment system and was using more modern cleaning machines.

Estimates of the quantity of PCE that must have been released to the ground vary considerably, but, based on the quantities pumped from Sawston Mill since 1984, and on the flow rate from the Springfield Road spring, at least 5770 kg (3600 litres) had been removed from the aquifer by 1989. The BGS data show that considerable quantities remain in the ground. These considerations suggest that PCE losses were more likely to have occurred as a series of small leaks, than the several major spillages which would be necessary to account for this amount of PCE.

The Case in Law

The High Court

The case was heard in the High Court in January 1991, and the judgement delivered by Ian Kennedy Justice some 6 months later. Before considering its content, it is interesting for the hydrogeologist to note the style of the judgement. Although the document is 65 pages long, and without headings, it is well written and the technical issues are summarised particularly clearly, thus highlighting the need for the technical expert also to be able to communicate in a simple and effective way. Kennedy J's description of the Chalk aquifer serves as a good example:

> *'Whereas the surface of the ground slopes gently down from ECL to Sawston Mill and the Cam, the "courses" of the chalk (its lines of deposition) are in the opposite plane, the seemingly impossible flow of ground water being achieved by the weight of water up-catchment, for the catchment extends many miles to the south'.*

ECL admitted, on the balance of probabilities, that the pollution derived, at least in part, from its works. Kennedy J found that this pollution occurred through accidental spillages in the years prior to 1976 when the solvent was delivered in 40 gallon drums and moved around the site using forklift

trucks (this practice ceased with the introduction of bulk storage in 1976). Kennedy J found that pollution also originated from the HHL works, but he could find no evidence of this pollution having a measurable effect on the Sawston Mill borehole. The legal arguments therefore focused mainly on the case against ECL.

The plaintiff brought the case on three grounds: strict liability under Rylands v Fletcher, negligence and nuisance. The Victorian case of Rylands v Fletcher (1866) concerned the escape of impounded water from a reservoir which flooded a neighbour's land. In his judgement, Blackburn J ruled:

> *'We think that the true rule of law is, that the person who for his own purposes brings on his lands...anything likely to do mischief if it escapes, must keep it in at his peril, and, if he does not do so, is prima facie answerable for all the damage which is the natural consequence of its escape'.*

Over the years the application of this ruling has been generally limited to situations where the use of the land has been considered to be "non-natural". In the present case Kennedy J concluded that the storage of solvents at a tannery of long standing such as ECL did not constitute a non-natural use of the land:

> *'In reaching this decision I reflect on the innumerable small works that one sees up and down the country with drums stored in their yards. I cannot imagine that all those drums contain milk and water, or somelike innocuous substance. Inevitably that storage presents some hazard, but in a manufacturing and outside a primitive and pastoral society such hazards are part of the life of every citizen'.*

The case therefore failed on Rylands v Fletcher.

Negligence and nuisance were essentially considered together, and the main issue here was one of foreseeability of the damage caused by the escape of solvent from the site. Kennedy J found that a responsible site supervisor at ECL in the early 1970s would not reasonably have foreseen that small spills of solvent would lead to pollution of the aquifer downstream. The case therefore also failed on the grounds of negligence and nuisance.

The fact that actual damage only occurred on the introduction of the relevant water quality regulations in the 1980s clearly influenced the decision. Kennedy J added:

> *'There must be many areas within England and Wales where activities long ceased still have their impact on the environment, and where the perception of such impact depends on knowledge and standards which have been gained or imposed in more recent times. If it is right as a matter of public policy that those who were responsible for those activities, or their successors, should now be under a duty to undo that impact (or pay damages if a cure is impractical), that must be a matter for Parliament. The common law will not undertake such a retrospective enquiry'.*

There was considerable comment on this judgement in the popular and technical press, not least from members of the water industry who considered that it undermined the "polluter pays" principle, and indeed, that it constituted a "polluters' charter".

The Court of Appeal

CWC appealed against the decision of the High Court, and the Court of Appeal gave its judgement in November 1992. The lead judgement was given by Lord Justice Mann.

Whereas much of the legal argument at the Court of Appeal was again on the issue of strict liability under Rylands v Fletcher, the judgement centred on the grounds of nuisance and, in particular, on another Victorian case, Ballard v Tomlinson (1885). That case concerned the pollution of a brewer's well by sewage effluent disposed of down his neighbour's well, the court finding that the defendant had interfered with the natural right of the plaintiff to abstract unpolluted groundwater from beneath his land.

The Court of Appeal concluded that the present case was 'not distinguishable' from Ballard v Tomlinson. Mann LJ noted:

> *'It is also immaterial that Tomlinson's filth was deliberately put into his well whilst the PCE was spilt by accident....It was sufficient that the defendant's act caused the contamination'.*

and added:

> *'we cannot attach any importance to the fact that the appellant suffered damage only when quality standards were raised three years after its abstraction commenced and many years after the respondent had ceased to spill PCE'.*

The appeal was therefore allowed and damages of approximately £1 million plus legal costs were awarded to CWC. The question of quantum had been decided in the High Court by Kennedy J in the event that his judgement might be overturned on appeal. Kennedy J supported the plaintiff's case on quantum, which was to claim the costs of developing a replacement borehole source, as opposed to the (cheaper) alternative of providing suitable water treatment facilities at Sawston Mill. The plaintiff argued successfully that the treatment technology was not well proven at the time when the decision on the future of the water supply was made.

This verdict by the Court of Appeal of no-fault liability for historic pollution raised enormous concerns within industry. In particular there were concerns that insurance companies would not be prepared to provide environmental liability coverage.

The House of Lords

Owing to the importance and potential ramifications of the case, ECL successfully petitioned the House of Lords to decide on the case. The appeal was heard in October 1993, and the leading judgement was given by Lord Goff in December.

The House of Lords decided that the recovery of damages in nuisance depended on foreseeability, and that the same principle should be applied to strict liability under Rylands v Fletcher. Lord Goff agreed with the earlier conclusion of Kennedy J that ECL could not have reasonably foreseen the consequences of the escape of solvent from its property. Therefore ECL's appeal was allowed.

The House of Lords also considered the argument that ECL should be strictly liable for damages on the grounds that pollution is still occurring from the pools of solvent deep within the Chalk aquifer beneath its site, and the consequences of this are now all too foreseeable. Lord Goff rejected this argument on the basis that the solvent is clearly beyond the control of ECL.

Although not a deciding factor in this ruling, Lord Goff did not agree with Kennedy J's earlier decision on the issue of non-natural use of the land:

> *'Indeed I feel bound to say that the storage of substantial quantities of chemicals on industrial premises should be regarded as an almost classic case of non-natural use.'*

Lord Goff, however, agreed with the opinion of Kennedy J that strict liability in such cases should be a matter for Parliament and statute:

> *'Like the judge in the present case, I incline to the opinion that, as a general rule, it is more appropriate for strict liability in respect of operations of high risk to be imposed by Parliament, than by the courts. If such liability is imposed by statute, the relevant activities can be identified, and those concerned can know where they stand'.*

The many reactions to the House of Lords verdict were well represented at a seminar in London in January 1994, organised by Berrymans, solicitors for ECL. In his introduction, Mr P Taylor of Berrymans summarised the case by saying *'with the advantage of Lord Goff's lucid and logical judgement we can see now that Kennedy J reached the right answer for the wrong reasons and that the Court of Appeal reached the wrong answer for the wrong reasons'*. A water industry view was given by Mr M Swallow of the Water Companies Association: *'It was a bad day for their (Cambridge Water's) customers, but it was not an unmitigated disaster....It is not a polluters' charter, but equally it is not the full "polluter pays" principle'*. Mr A Lees of Friends of the Earth, in considering the foreseeability aspect, commented: *'Have people not heard of aquifers or hydrogeology or the immiscibility of solvents in water?'*. The insurance industry was obviously much relieved by the decision; Mr V Rance of the Association of British Insurers said *'we would find it impossible to operate under a system which retrospectively changed the rules against which insurance is provided'*.

Implications

A number of points arising from the case are given below. These are wide ranging, and both legal and technical. No overall conclusions are drawn; rather the points are raised for discussion.

1 Ireland, like the UK, has a common law and so civil liability for environmental damages would normally be considered through case law. As with the Cambridge Water Company case, actions would usually be taken under the headings of Rylands v Fletcher, negligence and nuisance. Therefore the arguments in the CWC case, especially the importance of foreseeability in the final decision, may now influence the arguments in any future cases in Ireland brought under the same headings. A useful discussion of civil liability for environmental problems in Ireland is given by Polden, as part of a wider survey of environmental liabilities in Europe (Edited by Brealey, 1993).

2 The importance of foreseeability in the CWC case raises the question: how foreseeable is foreseeable? No doubt this will be a matter of much argument in future cases concerned with historic pollution.

3 Two European initiatives are relevant to the issue of historic pollution, the Council of Europe's 'Convention on civil liability for environmental damage resulting from activities dangerous to the environment' (the Convention), published in March 1993, and the European Commission's 'Green Paper on remedying environmental damage' (the Green Paper), also published in March 1993. The House of Lords considered the CWC case in the context of current European developments, referring specifically to the Convention. A major aim of the Convention is to make operators of dangerous activities liable for the costs of environmental damage. However, this liability is not to be retrospective. In this respect, Lord Goff argued that it would *'be strange if liability for such (historic) pollution were to arise under a principle of common law'*. It should be added that neither the UK or Ireland have ratified the Convention to date.

4 The Green Paper is a discussion document, without firm recommendations. It may (eventually) be followed by an EC directive, but this is by no means certain. The Green Paper supports the polluter pays principle, and considers two methods of recouping the costs of environmental remediation: civil liability and joint compensation systems. With respect to the former, it favours strict (no-fault), joint and several liability, but questions whether this should apply to situations where the pollution was unforeseeable, and so the document appears to be consistent with the House of Lords decision in this last respect. On joint compensation systems, the Green Paper suggests that these should be funded by the economic sectors involved in the processes that cause the damage. The USA Superfund system is reviewed, with the aim that the EC should avoid its pitfalls. The Green Paper also considers the problems of setting appropriate levels (and costs) of remediation. Notwithstanding these difficulties, the authors favour the broad principles of having two methods of compensation as outlined in the Green Paper.

5 What about clean-up of the pollution in the aquifer around Sawston? The CWC case was only concerned with damages suffered by the water company owing to the loss of its borehole; the issue of clean-up was not relevant. This does not mean that an action for clean-up will not be taken in the future. Under the Water Resources Act, 1991, the National Rivers Authority (NRA) has the powers to take a suit against a polluter to recover the costs of clean-up by the NRA or its agent. It is understood that similar powers could be available to local authorities in Ireland under the Local Government (Water Pollution) Act, 1977, and 1990 Amending Act.

6 There has been considerable interest recently on the subject of groundwater protection zones. In England and Wales this has been formalised by the introduction in 1992 of the NRA 'Policy and Practice for the Protection of Groundwater'. The policy considers both resource vulnerability and source protection zones (SPZs). A programme is underway to define SPZs around 1500 major groundwater abstractions, and 750 have already been subject to preliminary studies. Groundwater protection schemes are also being introduced in Ireland, and studies by the Geological Survey of Ireland and a number of colleges are in progress (see, for example, GSI Newsletter Nr 24, January 1994). However, there are difficulties in defining SPZs in fissured aquifers, and the CWC case serves as a good illustration. Despite the (unusually) large amount of data available it proved difficult to define the catchment of the polluted borehole with confidence; for example, there was considerable debate as to whether the HHL site fell within the catchment of Sawston Mill borehole - different assumptions on average transmissivity values and contouring of groundwater levels produced different interpretations. If this is a problem where a lot of data are available, then consider the difficulty if SPZs are challenged by developers as a matter of routine. These difficulties suggest to the authors that, in dealing with fissured aquifers at least, most emphasis should be placed on resource vulnerability assessments.

7 The complexity of the hydrogeology also has implications on the amount and quality of evidence required for different types of legal case, as described in an earlier paper (Misstear and Ashley, 1993). If a case were brought in criminal law rather than civil law, then this would be decided on burden of proof rather than balance of probabilities as in the present case. This could be difficult in a case such as Sawston; for example, no PCE was ever detected in borehole OW11 located upstream of the Sawston Mill borehole, and only 100 m from it. Considerably more information would therefore have been required to prove beyond doubt the connection between the tannery and the polluted well.

8 In the introduction the authors made it clear that this was a paper on a legal case by hydrogeologists rather than lawyers, so perhaps the last word should be on the general role of hydrogeologists as expert witnesses. The authors would strongly advocate that, whether advising a plaintiff or defendant, the hydrogeologist should provide independent, objective (and expert) evidence, pointing out the weaknesses as well as the strengths of the client's position. By being objective, the evidence is more likely to carry weight if the case goes to court, and hence the mitigating circumstances of a client's position may receive proper recognition.

Acknowledgements

The authors would like to thank Ms Sarah Shemmings of Berrymans, London and Mr Peter Polden of A & L Goodbody, Dublin for reviewing this paper.

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IAH PORTLAOISE SEMINAR, APRIL 1994

SEWERAGE LEGISLATION IN IRELAND

By
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There are two essential issues; LIABILITY and LICENSING

A "sewer" in legislation is defined as a Local Authority sewer ie. vested in or controlled by the Sanitary Authority. The Public Health (Ireland) Act 1878 defines "Drain" and "Sewer" as follows.

"Drain" means any drain of and used for the drainage of one building only or of premises within the same curtilage, and made merely for the purpose of communicating therefrom with a cesspool or other like receptacle for drainage, or with a sewer into which the drainage of two or more buildings or premises occupied by different persons is conveyed:

"Sewer" includes sewers and drains of every description, except drains to which the word "drain" interpreted as aforesaid applies, and except drains vested in or under the control of any authority having the management of roads and not being a sanitary authority under this Act.

Curtilage is "a little garden, yard, field or piece of void ground, lying near and belonging to the messuage".

From the above the inference is that a pipe serving one premises (building) is a drain and one serving more than one is a sewer. This was generally confirmed in Court cases. The Public Health (Ireland) Act describes which sewers are vested in the Sanitary Authority.

"All existing and future sewers within the district of a sanitary authority, together with all buildings, works, materials, and things belonging thereto, except

(1) Sewers made by any person for his own profit, or by any company for the profit of the shareholders, and

(2) Sewers made and used for the purpose of draining, preserving, or improving land under any local or private Act of Parliament, or for the purpose of irrigating land; and

(3) Sewers under the Authority of any commissioners of sewers appointed by the Crown.

shall vest in and be under the control of such sanitary authority".

The "for profit" section in 15 (1) above has given rise to a lot of difficulty. The following comments are from case law :-".... a sewer made for the purpose of realising a profit, above and beyond, and independently of, any sanitary purpose". "and where he intended to receive, and did receive, payment direct to him from the persons using his sewers for the benefit of his sewers, and where he has, by reason of his expenditure, received direct remuneration for the expenditure. Now, what difference does it make, if one has got so far, whether the profit is obtained in actual money by selling the right to use the drain, or by selling that which is got out of the drain? It seems to me there is no difference in principle, but only a different way of getting at the profit". "The public sewer is obviously meant here to indicate a sewer which serves the public generally, and has or may have an indefinite number of houses connected with it, either directly or because branch sewers come into it: whereas the "private drain" serving two or more houses is that of which the natural use is confined to those houses, and with which other houses belonging to other owners could not be connected without the consent of the persons through whose land it runs. A drain of this character is generally an economical substitute for separate drains for each of the houses served by it to the public sewer". " It has been clearly held that the vesting is not a giving of the property in the sewer and in the soil surrounding it to the local authority, but giving such ownership and such rights only as are necessary for the purpose of carrying out the duties of a local authority with regard to the subject-matter". "A sewer may still be vested in the local authority for all the purposes which are expressed in s. 13 and the following sections of the Act 1875, and yet the private owner may for the purposes of abating a nuisance be under the obligations which are imposed upon him by s. 19 of the Act 1890 and s. 41 of the Act of 1875".

The 1948 Sanitary Services Act defines combined and separate drains but does not define sewers, so, the 1878 definition still stands.

The expression "combined drain" means a single private drain used for the drainage of two or more separate premises.(1948) The expression "separate drain" means a drain used for the drainage of the whole or part of one separate premises only.(1948) The expression "separate premises" means a separate building with its curtilage (if any) or a separate plot of ground not being the curtilage of any buildings.

11.1 A combined drain shall, for the purposes of the Acts be deemed to be a drain and not to be a sewer. (1948)

11.2 Every combined drain which was, immediately before the commencement of this Part of this Act, vested in a sanitary authority by virtue of section 15 of the Act of 1878 shall, on such commencement, cease to be so vested.(1948)

Combined drains were a new concept - a halfway house between drains and sewers. The "drains" category has been subdivided into "combined" and "separate" categories.

The reference to "combined drains" being previously vested in the Sanitary Authority changes the concept from that existing pre 1948 where sewer had a wider definition .

It has the effect of reclassifying small sewers as combined drains and returning them to private ownership, which was a major change from the 1878 legislation which said:-

"All such property, real and personal, including all interests, rights, and easements in, to, and out of property, real and personal (including things in action), as belongs to or is vested in any sanitary authority as the sanitary authority of any district under the Sanitary Acts, shall continue vested in such authority, subject to all debts, liabilities, and obligations affecting the same property". (1878)

The 1948 Act seems to confer right of private ownership.
12.7 An order under this section shall not provide for the drainage of any separate premises by means of an existing drain which is the property of a person not the owner of such premises unless either that person has consented to such provision or he is under an obligation enforceable at law to allow the drainage of such premises by means of such drain.(1948)

Dublin Corporation constructed a sewer in a corporation estate in the County Council area. A member of the public had an accident and sued both local Authorities. He succeeded against Dublin County Council. "The claim against the Council, however, succeeds. The drain constructed by the Corporation was a "sewer" within the meaning of s.2 of the Public Health (Ireland) Act, 1878. A grid or grating in the road to drain off surface water is part of a "sewer". (see White -v- Hindley Local Board (1875) L.R. 10 Q.B.219). Although the road had not been taken in charge by the Council at the time of the accident, the somewhat anomalous situation was that the "sewer" had vested in it by virtue of s. 15 of the Act of 1878. Under s. 17 of that Act there was an obligation imposed on it to keep in repair all sewers belonging to it. There was a breach of this obligation, as it had not been kept in repair, because the sewer was without its grid. There was therefore a breach of its statutory duty for which the plaintiff is entitled to claim damages.

In Ireland therefore, we have effluent discharge pipes which are :-
(a) vested in the Local Authority,
(b) Private sewers made for profit,

(c) Statutory body sewers (eg. I.D.A. sewers),
(d) Combined drains and
(e) Private drains.

The sanitary authority is responsible for maintenance of vested sewers only.

Some questions arise :-

(a) If a pipe in the documentation, drawings, planning permission or discussions with the Local Authority is referred to as a sewer does this mean that the pipe vests in the Local Authority? This seems unreasonable but the following legal decision could be worrying. "A line of pipes intended to serve in the future for the disposal of the sewage of houses to be built at the sides of a new street, and the plans of which were submitted to the local authority as those of a sewer and passed by them as those of a sewer, vests in the authority as a sewer, although no houses have in fact been built at the sides of the street and the line of pipes has never been used for drainage,so that they have power under s.18 of this Act(1878) to connect it with their other sewers and use it for the carriage of drainage discharged by the latter.

(b) At what size does a "combined drain" become a "sewer"? Difficult question! Unanswered for the 46 years that the legislation is in force. In my opinion a pipe serving more than 5 or 10 properties would have to be considered as a sewer. A combined drain allows for licensing, a sewer means liability for maintenance

LICENSING

The 1977 Water Pollution Act introduced a system of trade effluent discharge licensing. It recognised discharges to waters, and sewers and defined Waters and Sewer as follows:

"waters" includes-
(a) any (or any part of any) river, stream, lake, canal reservoir, aquifer, pond, watercourse or other inland waters, whether natural or artificial,
(b) any tidal waters, and

(c) where the context permits, any beach, river bank and salt marsh or other area which is contiguous to anything mentioned in paragraph (a) or (b), and the channel or bed of anything mentioned in paragraph (a) which is for the time being dry, but does not include a sewer.

Trade effluent discharges to waters are regulated by licences under section 4.
4(1)(a) Subject to subsection (2), a person shall not, after such date as may be fixed for the purpose of this subsection by order made by the Minister, discharge or cause or permit the discharge of any trade effluent or sewage effluent to any waters except under and in accordance with a licence under this section.
The date fixed was 1/10/78 (S.I. No. 16 of 1978)

Discharges to "waters" should be monitored at the point discharge into the waters.

"sewer" has the same meaning as in the Local Government (Sanitary Services) Acts, 1878 to 1964, and includes sewage treatment or disposal works of a sanitary authority.(1977)

Trade effluent discharges to Local Authority sewers are regulated by licences under section 16.
16 (1) A person other than a sanitary authority shall not, after such date as may be fixed for the purpose of this section by order made by the Minister, discharge or cause or permit the discharge of any trade effluent or other matter (other than domestic sewage or storm water) to a sewer, except under and in accordance with a licence under this section granted by the sanitary authority in which the sewer is vested or by which it is controlled.
The date fixed was 1/1/79 (S.I. No. 16 of 1978)
The issue of a licence does not, in itself, give permission for the discharge.(1977 WPA sec 16.12)

In some locations, industrial premises discharge to a sewer laid by an Industrial Estate developer. An anomaly existed concerning the control of effluent discharges to these private sewers.
The 1990 Water Pollution Act addressed this issue.

22.-1 A sanitary authority may declare by order that a specified combined drain shall become and be a sewer for the purposes of the Principal Act and this Act and, whenever it does so, the drain concerned shall, upon the commencement of the order concerned, become and be a sewer for those purposes.

The Explanatory and Financial Memorandum referring to the legislation explains the purpose and the rationale :-

Section 22 gives discretionary powers to a sanitary authority to make an order declaring a combined drain to be a sewer for the purposes of the 1977 Act. (A combined drain is a drain serving two or more premises but which is not part of the system of public sewers).

Under the 1977 Act, trade and sewage effluent discharge to waters are licensable under section 4 while discharges to sewers require a licence under section 16. Accordingly, where effluents are discharged to a combined drain, they are not amenable to individual control under the existing provisions - a licence may be issued only in respect of the eventual discharge of the combined effluent from the drain to waters or to the public sewers. In such circumstances, difficulties may arise in identifying the person responsible for breaches of conditions attached to the licence issued in respect of the combined effluent discharge from the drain. Where a combined drain is declared to be a sewer, trade and sewage effluent discharges will be subject to individual licensing under section 16 of the 1977 Act, with conditions appropriate to the type of effluent involved.
Declaring that a "combined drain" shall become a sewer for the purposes of the Water Pollution Acts confers licensing power without liability.

Section 2 defines "combined drain" as meaning a drainage system, or a system of such pipes, that is not vested in or controlled by a sanitary authority and is used to convey trade effluent or other matter (other than storm water) from two or more premises to any waters or to a sewer.(1990)

Licensing Authorities issue licences for discharges to vested sewers or combined drains (which have been designated sewers for the purposes of the 1990 Water Pollution Act). Accordingly Licensing of effluent discharges in Private Industrial Estates can cause problems unless the view is taken that the 1990 Water Pollution Act designated the effluent pipe as a combined drain, since it seems that the purpose of the legislation was to address this issue.

The following questions need to be answered before issuing a licence :-

(a) Is the sewer vested in the Local Authority?
(b) Is it a sewer made by an individual or a company for profit?
(c) Is it a sewer "made and used for the purposes of draining, preserving, or improving land under any local or private Act of Parliament"?
(d) is it a combined drain?
(e) is it a separate drain?

If the answer to (a) or (d) is yes, then the discharge is licensable under section 16 of the Water Pollution Act.

All Planning Permissions for effluent discharge pipes in Industrial Estates should have maintenance conditions imposed on the development including the drainage. To consider the piping as a combined drain facilitates licensing. The Explanatory and Financial memorandum referring to the 1990 Water Pollution Act seems to infer that this is correct.

Further issues have also arisen:-
A developer services land and sells sites to different industries.

(a) Is there an obligation on the Licensing Authority to ensure that the sewer is not leaking before issuing a licence? Most sewers are probably defective to a greater or lesser extent.

(b) If groundwater is contaminated by licensed discharges to a defective non-vested pipe, who is liable? In my view the owners of the pipe!

(c) Does the authority of the Licensing Authority to issue licences for discharges into a "private" pipe infringe the constitutional rights of the owner of the pipe?
No! A licence does not of itself permit a discharge.

(e) Are licences to discharge to I.D.A. effluent discharge pipes valid under present legislation?

FIREWATER RUN-OFF

TYPICAL LICENCE CLAUSE

Within three months of the issue of this licence, the Licensee shall submit results of a study to be undertaken by an approved body outlining the possible effects of runoff in the event of a fire on site. Following examination of this study, the Licensing Authority may indicate additional measures which must be taken by the Licensee in order to protect the surrounding waters against possible pollution from such an event. The cost of this study shall be borne by the Licensee.

The issues to consider include ;-
What is the hazard?
What is the risk of that hazard occurring?
If the hazard occurs what can be done to reduce the effects?
The design considerations have included, Different water requirements:

2 hours fire hydrant flow of 150l/sec - 190l/sec U.K. Home Office
12,800 l/min for 90 mins
Fire Officers
10M3 water per tonne of product stored

A number of firewater retention ponds have been constructed in Cork from a quarter of a million gallons to one and a half million gallons capacity

TYPICAL GROUNDWATER CLAUSE

The Licensee shall agree a programme of groundwater monitoring with the Licensing Authority. This monitoring shall include the testing of a well on site at least once per annum for the following parameters: conductivity, chloride, iron, manganese, pH,Total Organic Carbon or total oxygen demand, ammonia, nitrate and such other parameters as may be indicated by the Licensing Authority. The Licensing Authority reserve the right to alter the frequency of such testing.

Not withstanding the above, the Licensee shall monitor the well once per annum for the full range of solvents in use or stored at the time of such monitoring and for such solvents as may have been used in the past on site.

References:-

Local Government (Water Pollution) Act (S.1. No. 1 of 1977)
Local Government (Water Pollution) (Amendment) Act (S.I. No. 21 of 1990) Clause 22. - (1). Section 2-definitions

Explanatory and Financial Memorandum (January, 1989).
The Public Health (Ireland) Act, 1878 .
Vanston Pages 15, 18, 22, 23, 24, 37, 38, 39. 336, 337.
Local Government (Sanitary Services) Act, 1948 S.1. No. 3 of 1948.
The Irish Law Reports, Page 129 to 133 (1992) Merriman -v- Dublin County Council High Court 29/11/91.

ENVIRONMENTAL PROTECTION IN PRACTICE - WICKLOW COUNTY COUNCIL.

IAH SEMINAR, PORTLAOISE, 19-20th APRIL, 1994.

The paper presents a general picture of the main water resources in County Wicklow and the measures currently undertaken by the Local Authority to monitor and protect those resources in the light of its powers and obligations under national and European legislation, with particular reference to the Local Government (Water Pollution) Acts, 1977-90.

1. Introduction.

1.1 The Environment Section of Wicklow County Council was formally established by the County Engineer in 1984, following my own appointment to the County as a Senior Executive Engineer in June of that year. Prior to then, little activity had been undertaken in respect of implementation of the 1977 Water Pollution Act, though provision had been made for an environmental laboratory in the construction of the new County Buildings at the beginning of the eighties. Also - and unusually for a rural county at the time - a full-time chemist had been appointed to the staff, though only at assistant level. Ten years later, there are two chemists reporting to the Senior Executive Engineer, one of whom deals mainly with air pollution and environmental impact assessment, the other with water pollution and water quality in general, assisted by a field technician and a laboratory technician. A further engineer, technician and clerk-of-works cover refuse collection and solid waste, including Toxic & Dangerous waste arisings.

1.2 With the exception of routine monitoring for compliance with the EU Drinking Water and Bathing Water Regulations, which is carried out by the Eastern Health Board on an agency basis, virtually all monitoring and analysis work undertaken by the Council is done in-house, rather that having recourse to the Regional Laboratory network, or semi-state and private agencies. The current throughput in the laboratory is c.1000 samples per annum, mainly for chemical analysis, though some microbiological is also carried out, and the work programme has been expanded in recent years to include analysis of selected heavy metals following the purchase and commissioning of an atomic absorption spectrophotometer.

1.3 The main elements of the sampling programme relate to river monitoring, sewage effluents (public treatment plants), and trade effluent discharges. There is also some limited monitoring of existing landfill sites, as well as groundwater and other emergency monitoring arising from investigation of pollution incidents which have tended to be mainly agricultural in origin. The "sub-letting" to the Eastern Health Board c. 2 years ago, of monitoring required under the Drinking Water Regulations was the inevitable consequence of expanding activity in all these areas.

2. Protection of Water Resources in the County.

2.1 The principal rivers in the county, as well as the location of public water supplies (groundwater and surface water sources), are shown on the attached map (Fig.1). The topographical nature of the county is such that rivers rising to the eastern side of the Wicklow mountains run rapidly to the Irish sea (e.g. The Vartry or the Avonmore catchments), while those rising on the western side form the headwaters or tributaries of larger catchments (e.g. the Liffey and the Slaney), so that one must be aware of the downstream abstractions and other uses in adjoining authorities. This is particularly so in the case of the Liffey and the Slaney, where Water Quality Management Plans have been drawn up in cooperation with those authorities, and adopted under Section 15 of the 1977 Water Pollution Act. Wicklow is also a party to the Barrow Plan, by virtue of the Greese tributary. In addition, there has been a suggestion of the need for a Management Plan for the Vartry river which, while located entirely within the county, has major importance as a water supply source for both Dublin and Wicklow, is a designated river under the Fisheries Directive, and has significant tourist & amenity value with reference to the Mount Usher Gardens at Ashford.

2.2 The other designated rivers in the county are the Dargle and the Slaney, and these, together with 14 no. of the main non-designated rivers and tributaries, are monitored on a regular basis to protect against any deterioration in water quality. The sampling frequency has been reduced from monthly to every two months in the case of stations on the three designated rivers, given the consistent quality of earlier results, and the remaining rivers are subject to quarterly monitoring. Additional river monitoring is carried out from time to time in response to specific requirements. Overall, the quality of rivers in Wicklow is good in terms of both biological and chemical ratings. This is as one would expect, given the rapid progress to the sea in east Wicklow, and the major users being downstream of the county bounds in other cases. The Avoca river is the exception, and its particular problems are discussed later.

2.3 Ironically, the two largest surface water sources of public water supply in the county, the Poulaphuca (Blessington) and Vartry (Roundwood) reservoirs are legislatively under the control of Dublin Corporation, though Roundwood, in feeding the Stillorgan reservoir, supplies approximately one third of its 77,250 cu.m daily output to a substantial area of north-east Wicklow - c. 22750 cu.m/day, serving Bray, Greystones, Kilcoole, Newtownmountkennedy, the Wicklow/Ashford area and various smaller villages on route. In addition, Arklow UDC has its own supply (3590 cu.m/day) and Wicklow County Council itself operates 30 water supply schemes, with outputs varying from 18 - 820 cu.m/day, delivering a further 6150 cu.m/day throughout the county. Numerically, the Council's supplies are fairly evenly divided between surface water (16 no.) and groundwater (14 no.) sources. This is deceptive, however, and even a cursory glance at the volumes produced from the different sources will immediately confirm a different picture (see following Table) -

TABLE 1.
PUBLIC WATER SUPPLIES IN COUNTY WICKLOW.

	source	cu.m/day	
N-E Wicklow (from Roundwood/Vartry)	surface water	22750	
Wicklow (other)	surface water (16 no.)	4190	
	groundwater (14 no.)	1960	**(6% of total)**
Arklow UDC	surface water	3590	

2.4 It will be seen, therefore, that protection of surface water sources is obviously the greater concern though, generally, source pollution has tended to be isolated and usually due to specifically identifiable causes. Groundwater pollution problems which have arisen to date have tended to relate mainly to contamination of untreated single-house or group-scheme boreholes, rather than public supply sources. and usually caused by nearby agricultural activities. Where Council supplies are contaminated, appropriate corrective measures are introduced, including public warnings where necessary. In the case of private supplies, owners are notified and recommended to take corrective action having regard to the Drinking Water Regulations. The polluters are followed up under the Water Pollution Acts.

2.5 For a comprehensive overview of the county's water supplies, I would refer you to the data contained in the recent EPA "Report for the Year 1991 on the Quality of Drinking Water in Ireland". I have extracted the more significant of these results, both good and bad, and summarised them for information in Table 2. In commenting on these results, the figures for colour reflect the upland, peaty nature of many of the county's water supply sources, the limited size of which makes treatment for colour removal non-viable. The bulk of coliform exceedances (15 no.) occurred in one supply - a small (75 cu.m/day) rural surface water source with cattle drinking upstream - and remedial measures since then have gradually improved the position. Other exceedances are mainly single or twice-yearly occurrences, usually as a result of chlorinator malfunction. Inclusion of the results for heavy metals confirms, incidentally, that, having acquired an atomic absorbtion spectrophotometer, the laboratory is actually putting it to some use -

TABLE 2.
1991 DRINKING WATER QUALITY RESULTS

parameter	no. of samples	no. of exceedances
Colour	178	37 (21%)
Coliforms	354	39 (11%)
Ammonium	140	2 (1.4%)
Nitrates	140	0
Nitrites	143	0
Heavy Metals	34	0

3. Environmental Control.

3.1 So far, I have given a general picture of the main water resources in County Wicklow, and the measures currently being undertaken by the Local Authority, through its Environmental Section, to monitor and protect those resources in the light of its statutory obligations. The following Tables give details of the various environmental control measures carried out to date under the Local Government (Water Pollution) Acts, 1977-90 with regard to licensing under Sections 4 and 16, and notices issued under Section 12.

3.2 The first Table gives the number of Section 4 applications received, and their fate. Both licence reviews related to pharmaceutical companies, and the Council's decision (to grant subject to amended conditions) was appealed by the Licensee and by third parties in both cases - a sign of changing times? -

TABLE 3.
SECTION 4 LICENCES - DISCHARGE TO WATERS.

Total licence applications received to date				53 no.
No. of applications	- granted	....	27 no.	
	- refused	....	2 no.	
	- on hand	....	3 no.	
	- f.i.r.	....	5 no.	
	- on appeal	....	1 no.	
			38 no.	
	- withdrawn	....	15 no.	
			53 no.	
Total applications for licence review received to date				2 no.
No. of licence reviews granted			**2 no.**	

3.3 The next Table gives a breakdown of the applications by category. As will be seen, the range of licensable operations is wide. As well as the pharmaceutical plants and the IFI fertiliser manufacturing plant at Arklow, the miscellaneous categories also include a rendering plant, a printing works and the proposed interpretative centre for the Office of Public Works at Luggala, which is currently the subject of a further information request. The large number of tourist & leisure applications is not surprising, given Wicklow's position as "the Garden of Ireland" and the BES incentives of recent years. The number of fish farms is noteworthy, also, though four of these are in the same ownership, and the balance includes the Salmara cage-rearing unit relocated from Poulaphuca to Loughnahanagan, below the ESB station at Turlough Hill -

TABLE 3A.
SECTION 4 LICENCE APPLICATIONS BY TYPE.
(excluding applications closed or withdrawn)

pharmaceutical	2 no.
fertiliser manufacture	1 no.
food processing	4 no.
quarrying/minerals	3 no.
other industrial	3 no.
fish farms	6 no.
tourist & leisure	9 no.
housing schemes	3 no.
misc. other	7 no.
	----------
	38 no.

3.4 Hard on the heels of the 1992 Water Pollution Regulations (S.I. no. 271 of 1992), with their onerous provisions in respect of discharges to groundwater (and whether by coincidence or just bad timing), there has been a perceptible increase in the number of recent applications proposing final effluent disposal by this method, as can be picked up in the following Table -

TABLE 3B.
SECTION 4 EFFLUENT DISCHARGE OUTLETS.

	river	**lake**	**sea**	**groundwater**	**TOTAL.**
granted	21 no.	1 no.	4 no.	1 no.	27 no.
refused	-	-	1 no.	1 no.	2 no.
"live"	6 no.		-	3 no.	9 no.
	27 no.	**1 no.**	**5 no.**	**5 no.**	**38 no.**

3.5 The next two Tables give details of Section 16 licence applications received, and their fate. Again, it may be noted that the Council's review decision was appealed by the Licensee to An Bord Pleanala, who granted it subject to agreed modifications in the Council's conditions -

TABLE 4.
SECTION 16 LICENCES - DISCHARGE TO SEWERS.

Total licence applications received to date				22 no.
No. of applications	- granted	....	10 no.	
	- refused	....	-	
	- on hand	....	-	
	- f.i.r	....	1 no.	
	- on appeal	....	-	
			11 no.	
	- withdrawn	....	11 no.	
			22 no.	
Total applications for licence review received to date				1 no.
No. of licence reviews granted			**1 no.**	

3.6 Examination of the admittedly small number of licenses by type shows a fairly even spread between the chemical/pharmaceutical and food industries in the main categories -

TABLE 4A.
SECTION 16 LICENCE APPLICATIONS BY TYPE.
(excluding applications closed or withdrawn)

chemical/pharmaceutical	....	3 no.
food industry	....	5 no.
other industrial	....	3 no.
		11 no.

3.7 The following Table gives a year-by-year breakdown of notices issued by the Council under Section 12 of the Act, generally the result of complaints received through the Area Engineer's office or third parties, or alternatively picked up during routine monitoring field-trips by Environment staff. As will be seen, while the late summer of 1987 has now gone into the annals as that crucial point in our history when the media suddenly discovered the fish kill, and the Minister of the day the farm survey, Wicklow had already struck out for Damascus the previous year, and was mopping up the worst areas by the time word came from "on high" -

TABLE 5.
SECTION 12 NOTICES SERVED, 1984 - 1993.

year	no. of notices served
1984	2 no.
1985	11 no.
1986	38 no.
1987	36 no.
1988	7 no.
1989	1 no.
1990	2 no.
1991	4 no.
1992	5 no.
1993	3 no.
	109 no.

3.8 Table 5A gives the breakdown of notices issued by category. In common with most counties, by far the greatest number of notices were served on the farming community -

TABLE 5A.
SECTION 12 NOTICES CATEGORISED BY TYPE.

agricultural	....	....	90 no. (82.5%)
trade & industrial	....	....	12 no. (11.0%)
hotel & leisure	....	....	3 no.
misc. (incl. septic tanks)		....	4 no.

3.9 It will be seen from the percentage compliance figures in the next Table, however, that the farmers of Wicklow are a fairly responsible lot. This is due, in no small measure, to the Council's setting up of a Consultative Committee with representatives from the local IFA, the Eastern Regional Fisheries Board, and other interested parties, with the specific aim of tackling agricultural pollution in a concerted and co-operative manner. This committee met regularly during the mid-to-late eighties, and was, in the main, successful in achieving results while avoiding negative confrontation -

TABLE 5B.
SECTION 12 NOTICES - COMPLIANCE.

notices complied with in full	81 no. (74.5%)
notices partially complied with	9 no. (8.0%)
notices not complied with	8 no. (7.5%)
further inspections required	8 no. (7.5%)
legal proceedings pending	2 no.
file closed	1 no.
	109 no.

3.10 Having mentioned the 1987/88 Farm Survey, the final Table gives a brief overview of farms visited during the period 1984 - 1989, with assessment of pollution risks being fairly evenly divided between low, medim and high. Initial visits were followed up either by issuing advisory letters, or by Section 12 notices where required. Subsequent visits showed remedial works having been undertaken in most cases. The number investigated (385 no.) represents about 40% of the total number of farms in the county -

TABLE 6.
FARM INVESTIGATIONS, 1984 - 1989.

Reason for investigation -

water pollution complaints	....	123 no.
planning applications	....	116 no.
1987/88 farm survey	....	146 no.
		385 no.

Assessment of risk -

low	....	123 no. (32%)
medium	....	143 no. (37%
high	....	119 no. (31%)

4. Some Comments on Practice and Experience in Wicklow.

4.1 The Avonmore/Avoca Catchment.

The Avoca has the dubious distinction of being among the most polluted rivers in Ireland, and is classed as "incapabale of supporting fish life" along its lower reaches, due mainly to discharge of both contaminated surface run-off and "permanently unusable" groundwaters from the abandoned mines area below the Meeting of the Waters. This is compounded by the discharge of ammonia and nitrate from the IFI plant at Shelton further downstream. Water quality in the Avonmore and Aughrim catchments upstream is excellent, however, and the Council has adopted different licensing strategies to deal equitably with this situation - The restraining factor in the Avonmore and Aughrim catchments is that the receiving waters should comply with Fisheries Directive and Category A1 Surface Water standards, whereas in the lower, heavily polluted reaches of the Avoca itself, licenses are framed on the theoretical basis that the river should meet Category A3 Surface Water standards, assuming the upstream mines pollution did not exist. The Avoca is presently the subject of a Catchment Conversion Project, being carried out under the EU LIFE Programme. This contains a number of pilot schemes to tackle the unique pollution problems of the area, which, if successful, will lead to a review of the licensing policy at a future date. In the interim, the present approach is a reasonable compromise.

4.2 Licence Appeals.

There has been a noticeable increase in the number of licence decisions being appealed to Bord Pleanala in the last 2-3 years, though whether this means we are getting better, or merely tougher, is a matter for debate. More often than not, the Board's decision has mirrored the Council's original conditions, usually with only minor amendments, though I have noticed a discrepancy in the wording of the decision whereby in some cases the Board "hereby grants", and in other cases "hereby directs Wicklow County Council to grant" the licence. This throws up the questions (a) whether there is a statutory period within which the Council must give effect to the Board's decision in the latter case, and (b) what are the legal implications for licences presumed to be in place in the former?

4.3 Phased improvements.

Where compliance with licence conditions requires extensive upgrading or installation of new treatment facilities to meet volume and concentration limits in the discharge from existing premises, Wicklow has gone for phasing of improvement works, with a set period to completion, and with or without interim limit values. Improvements in housekeeping, e.g. separation of uncontaminated surface waters is encouraged, and more recent licences are placing greater emphasis on waste reduction and recycling, to minimise the volumes being discharged (see Fig.2).

4.4 Dual sampling-stations.

A feature introduced in licences for some of the larger companies in the last few years is the provision of dual sampling stations inside and outside the licensee's boundary, to enable us to have independent access in effluent monitoring without interference. Inspiration for this came from reading of Kerry County Council's experience with one of its larger meat-processing companies, and was first put into practice in Wicklow when the said company expanded in our direction. Forewarned is forearmed - when the condition was appealed by the licensee, An Bord Pleanala confirmed the opinion that an independent monitoring station was altogether a faster and more accurate method of measurement than having to scan the discharge through binoculars from the bushes on the opposite riverbank.

4.5 Charging.

Where discharges to sewers are concerned, the application of a charging system such as the Mogden formula or its variants can demonstrate dramatically to a licensee the wisdom of installing pretreatment facilities. For older sewer systems (which are unlikely to be able to handle problem effluents anyway), Mogden is of little use, and an alternative would be to equate the BOD of the effluent to that of an equivalent number of houses, and multiply the domestic sewer service charge by this number. Crude, but effective - In a recent case in Arklow, where no pre-treatment was proposed, the annual licence charge using this method would have been £11,130. In contrast, if the effluent were pre-treated to, say, domestic strength, the charge would reduce to £1,350. In the event, the contribution was set at £3,000 per annum for the initial three years, and the company put on notice for the future by inclusion of an appropriate condition in the licence (see Fig.3).

4.6 Prosecutions.

My experience would be that these should be avoided if at all possible. They are time-consuming and tedious; the Law Agent doesn't usually share your sense of urgency; the absolute proof requirement because a criminal offence is involved allows no margin of error; frequently these days, you will find yourself up against a Senior Counsel; and even if you can manage to get past all the legal technicalities and prove the case, the level of fines can make you seriously wonder why you bothered. In any case, reduction or elimination of the pollution threat is of more value than a guilty verdict, and pre-submission meetings, on-site discussions and the consultative, reasonable approach will generally get better long-term results. In short, the courts should be a last, rather than first resort, though of course there is always the individual who wont respond to anything else.

4.7 Discharges to groundwater.

As mentioned earlier, there has been an increase in applications for discharge to groundwater as a means of effluent disposal, usually because a surface water isn't available, and justified by inclusion of one or other of the various new "miracle" systems which clean up the effluent that other systems wont reach! We know from experience, however, that such a disposal method can be problemmatic enough even from single-house drainage systems. Accordingly, the discharge of effluent - even highly treated and polished effluent - from large-scale housing developments, leisure complexes or the above-mentioned interpretative centres, most of which have the population equivalents of the average Irish village, will call for, at minimum, the continued assistance of good hydrogeologists, and place increased importance on the quality of their investigations. There is every likeliehood that Wicklow, being in effect part of the greater Dublin development area, will find itself confronting this problem more and more, particularly given the requirements of the 1992 Regulations.

5. Conclusions.

5.1 Integrated licensing.

With the increasing onslaught of new environmental legislation over recent years, it is becoming more difficult to view any single control mechanism such as the Water Pollution Act in a "stand-alone" situation. In particular, since the introduction of Environmental Impact Assessment, integrated pollution control makes a lot of sense, and it will be interesting to see how the Environmental Protection Agency approaches this when it works itself into its licensing role. I feel strongly that the time is ripe for amending the legislation in the case of the non-EPA regulated industries also, so that Local Authorities deal with planning, effluent discharge, air emissions and solid waste disposal in a single integrated permit. This is the Japanese approach, and it makes sense - As things stand here at present, what is in effect the same set of documents may require to be processed by the Local Authority - and, of course, by An Bord Pleanala and the Courts as well - on four separate occasions. One can have the feeling of galloping to a standstill, and it is so unnecessarily time-consuming.

5.2 The need for flexibility.

Hand in hand with this integrated approach, I would like also to see us getting away from the inflexibility which appears to be so much a part of European environmental legislation. What's sauce for the Rhine may not necessarily be sauce for the Slaney and, for example, one might question

a) the wisdom which requires us to build secondary treatment plants for recently completed, properly designed, long-sea outfalls, such as at Bray and Wicklow Town;

b) the futility of applying the same rigidity in the approach to sludge disposal for the small (400-500 p.e.) package treatment units dotted around rural Wicklow as for the large-scale municipal works serving Dublin, Copenhagen and Hamburg; or, finally,

c) effluent discharge regulations such as those presently being drafted for the fertiliser industry, which are based on uniform emissions rather than waste assimilative capacity, and which are fine if all that matters is fulfilling fair competition objectives (but we should avoid a situation whereby the standard that protects the larger waterways pollutes the smaller).

In summary, where flexibility can be beneficial, it should be allowed, and we should never lose sight of the fundamental virtues of reasonableness, practicality and common sense.

Muiris O'Keeffe, B.E.
EUR ING, C. Eng, F.I.E.I.

april '94.

MODIFICATIONS TO TREATMENT PROCESSES

The licensee shall carry out appropriate modifications and improvements to the existing effluent treatment system so as to achieve compliance with the requirements of this licence.

The licensee shall implement specific measures for the reduction of waste ammonia and nitrate and the treatment of these determinands to the standards set out in condition.

The required modifications and improvements to the effluent treatment system shall be implemented by means of a phased programme of works to be agreed with the Licensing Authority (see Condition 6 hereunder), and shall be fully completed and operational within eighteen months of the date of issue of this licence.)

FURTHER ASSESSMENT

To determine the most effective method of implementing the above modifications and improvement works, the Licensee shall commission a comprehensive report on its effluent processes, to include -

i) a technical and economic evaluation of the options available to ensure compliance with the conditions of this licence.

ii) proposed time-scale and programme of work, including phasing, for the completion of the required improvement works within the specified time limit, and

iii) proposals for the improved operation of the premises so as to maximise reduction in waste volumes arising.

FUTURE CHARGING

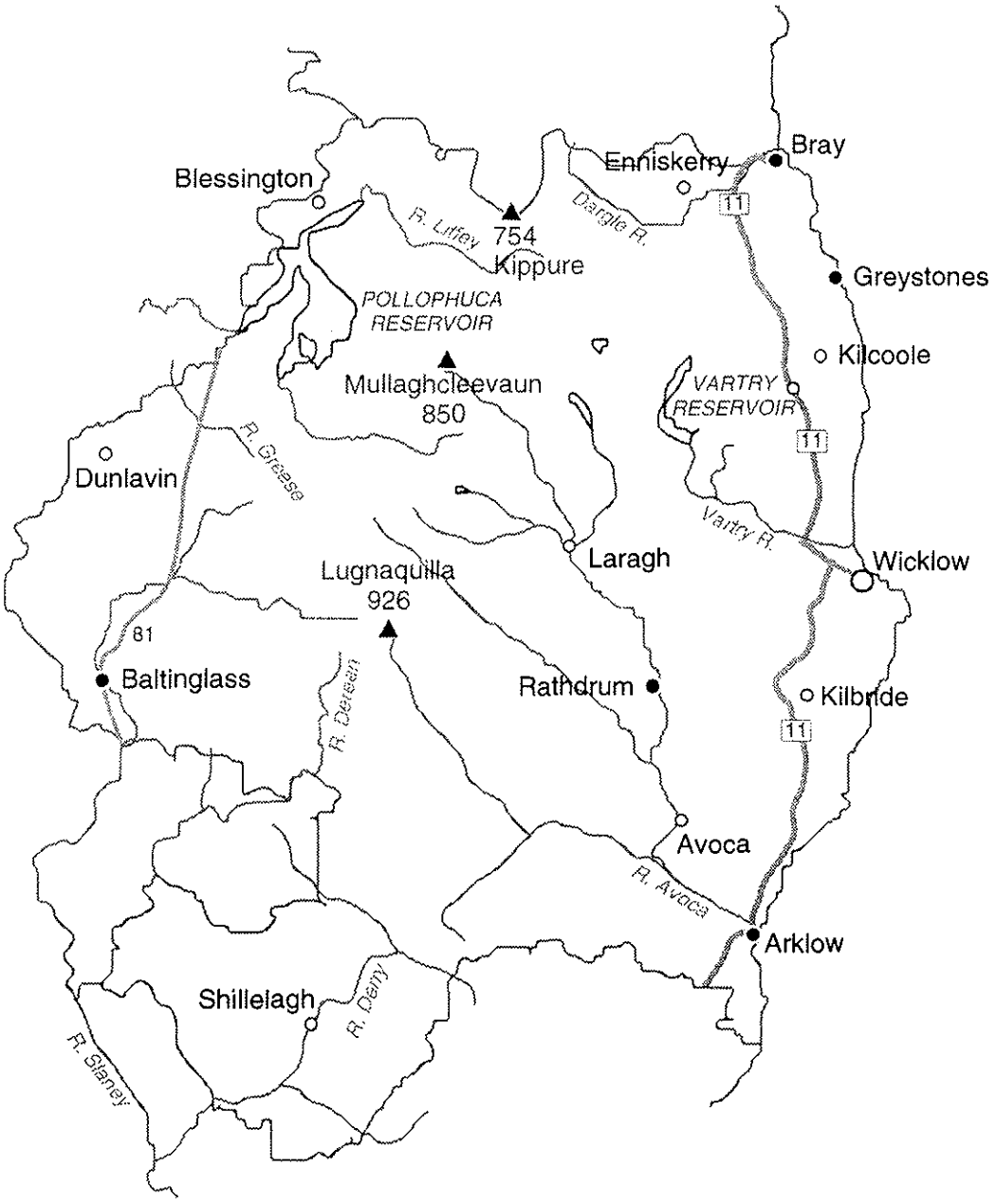
On completion of the Arklow Urban Wastewater Treatment Plant, the above contribution shall be revised having regard to the degree of effluent pre-treatment, if any, in place at the Licensee's premises. The revised level of contribution shall be computed by the Licensing Authority on the basis of either:-

(a) the prevailing domestic service charge rate for the equivalent number of houses, based on organic loading, or

(b) the organic and suspended solids loading on, and sludge handling and disposal f rom, the treatment plant of the Licensee's effluent as a proportion of the total effluent loading on the plant, or

(c) such other method as may be in accordance with guidelines for such charges published in the intervening period.

County Wicklow



The Tropic Status of Lough Conn

An investigation into the causes of recent Accelerated Eutrophication

Summary of the above report published by
Mayo County Council

by Siobhan Crinion Sheil
The North Western Regional Fisheries Board

for

International Association of Hydrogeologists

14th Annual Seminar

19th April 1994

INTRODUCTION:

The "Trophic status of Lough Conn" report was published as a result of work carried out by the Lough Conn Committee. This Committee comprised representatives from:

Mayo Co. Co.
Environmental Protection Agency
Central Fisheries Board
N.W.R.F.B
Teagaisc
Dept. Agriculture
Bord na Mona
Coillte
Dept. Marine

The report is unique in that:

(a) Such a detailed study has never been done in Ireland on a lake which is at such a very early stage of eutrophication and

(b) The study was carried out in co-operation with so many environmentally orientated state and Semi-State bodies.

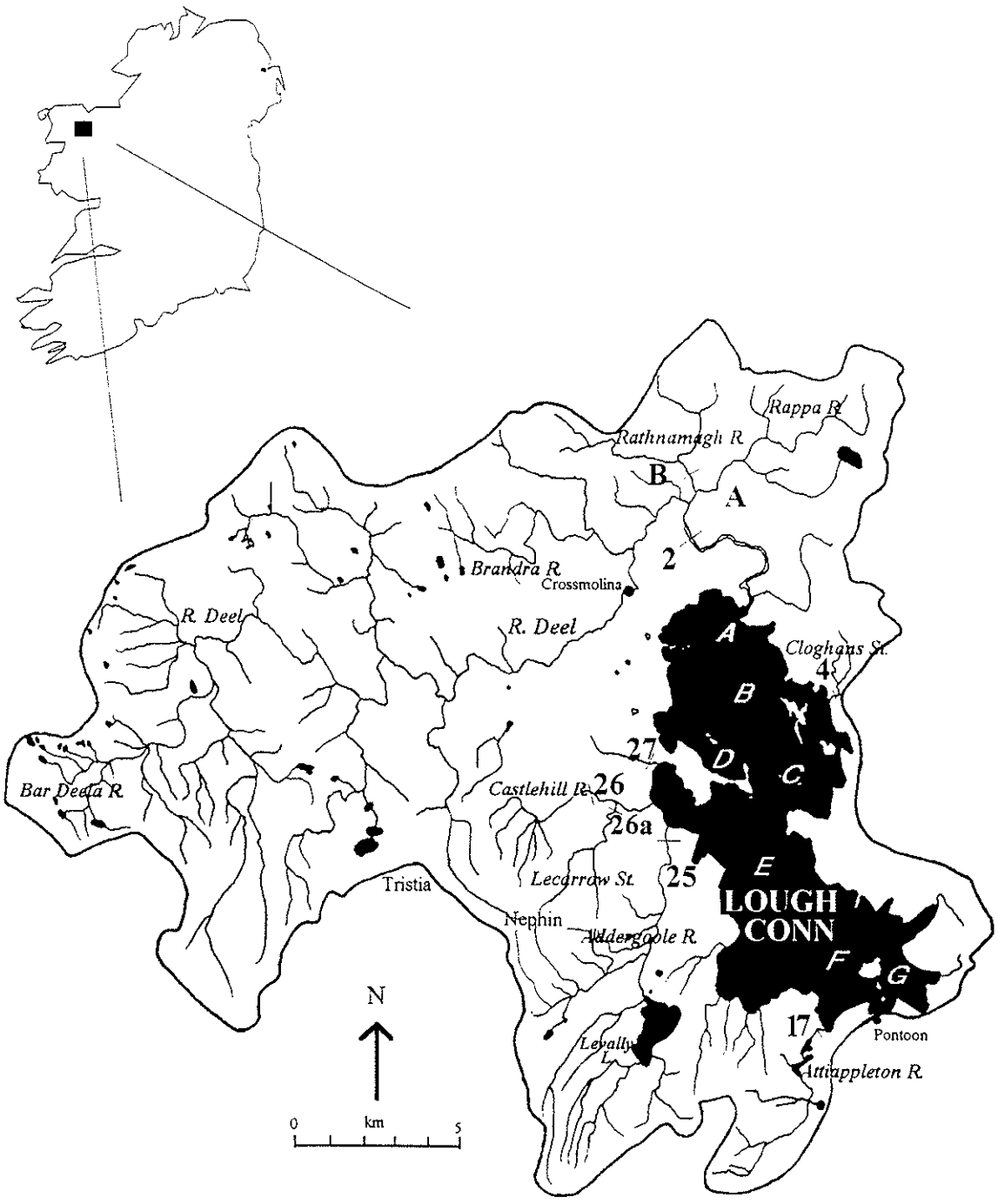
The N.W.R.F.B. has been involved with this study from its initiation and, indeed, before this study began the Board along with other Semi-State organisations e.g. the AFF (ERU and now EPA) and the CFB had been monitoring Lough Conn to varying degrees since the 70's, however the methods used did not indicate any major changes in the lake water quality over the years.

This Board first became anxious in the mid 80's regarding Conn's water quality due to an increase in the frequency and longevity of algal blooms in the lake. In 1987 the lake produced a bloom in early December. Early work by the Board did indicate that algal blooms in specific bays could be caused by phosphate loadings to that bay and may not be reflected in mid lake water quality sampling procedures.

A major algal bloom in May, 1990, caused considerable concern amongst anglers and subsequently to the Central and North Western Regional Fisheries Boards. Mayo Co. Co. and the then ERU (now EPA) also become concerned. This resulted in the setting up of a phosphate loading study in Lough Conn in September 1990. This was the first step towards the Lough Conn committee and the subsequent Lough Conn report.

LOUGH CONN:

Lough Conn is a large angling lake in Co. Mayo. It is 50 km2 in area and has a stock of over 500,000 Brown Trout. In recent years a number of changes have occured within the



Lough Conn Catchment showing stream sampling sites (A, B, 2, 4, 17, 25, 26, 26a, 27) and main lake sampling stations (*A–G*).

lake which would indicate a deterioration in water quality, these include:

1. Increased algal blooms in shallow water.

2. Occurence of algal slimes on nets and fishing lines.

3. Virtual disappearance of the lakes large stock of Arctic char.

4. An increase in the average size of trout in the lake.

The fact that eutrophication trends have not yet shown up in mid lake samples (e.g. increasing chlorophyll) does offer some hope that we are looking at very early stages of eutrophication which can be reversed by managment action.

Phosphate loading to the lake

Since phosphates is the limited nutrient in aquatic freshwater systems, a phosphate loading study was put into place immediately. All of the main feeder streams to the lake were sampled weekly for phosphate levels. This provided the data to prepare a phosphate budget for the lake.

Running concurrently with this scientific study, a management programme was required so that action could be taken to prevent any further deterioration of the lake thus avoiding the Sheelin and Ennell scenarios of the past. The management programme was drawn up by the Lough Conn Committee and resulted in the drawing up of a series of recommendations which would abate and possibly reverse the eutrophication trends within the lake.

In carrying out this study, we were at a unique advantage in that a previous phosphate, baseline study had been carried by AFF between 1979 & 1982 which allowed the committee to compare the phosphate loadings to the lake over a 10 year period. It was in fact concluded that phosphate loading had doubled over this 10 year period (between 79-82 and 90-91).

Investigations:

The investigators took two approaches to pinning down the causes of the change.

* Firstly, they examined the spatial and temporal patterns of phosphate inputs - which rivers and streams contributed the highest loadings and when did these high loadings occur?

* Secondly, they examined a range of activities in the catchment which were likely to affect phosphate inputs - farming, forestry, sewage treatment, commercial peat harvesting, etc.

By comparing the results of the chemical investigations with known changes in land use they attempted to pinpoint the source of the additional phosphate.

Wet weather phosphate run-off

The investigation revealed that, compared to the baseline survey in 1979-1992, a striking change has occured in the two most important rivers flowing into Lough Conn. In both the Deel and Addergoole rivers there is now a huge increase in phosphate run-off following heavy rainfall. This was particularly notable in the autumn months. During the period 1979-192 phosphate levels were not affected by rainfall. This increase in phosphate concentration during wet weather was the most crucial factor in accounting for the big increase in phosphate loading.

Fertiliser and slurry wash-off

If phosphate concentration increases while river flow rate is increasing then phosphate loading will increase very dramatically in wet weather - because phosphate loading is calculated by multiplying flow volume by concentration. This phenomenon indicated to the investigators that fertilisers and/or slurries are being washed off fields and farmyards into the rivers whenever it rains heavily. This did not happen as often 10 years previously or it would have shown up in a similar fashion in the baseline survey of 1979-1982. Thus, from the initial analysis it was apparent that agricultural run-off could be an important phosphate source. The increase in fertiliser and slurry wash off in wet weather was attributed to a major change in agricultural practice within the catchment. In the past 10 years over 5 million has been spent on winter housing for cattle. This has resulted large amounts of slurry accumulating in the slatted houses' storage units. Frequently this stored slurry is spread on the land in the autumn - unfortunately often coinciding with heavy rainfall which simply washes it into streams and rivers. Many farmers actually wait for rain in order to 'wash it in' rather than spreading it when dry weather is forecast. Summer wash-off has also been recorded during the study - for example in two very wet days samples in early summer 1993 the equivalent of 6 tonnes of 10:10:20 NPK fertiliser was washed down the Deel River into Lough Conn. This was followed by an algal bloom in the lake.

*Sector-by-sector phosphate loads

A detailed analysis of all likely phosphate sources is included in the report covering:

* agriculture
* forestry
* Crossmilina sewage
* Bord na Mona bogs
* rural septic tanks

and a range of other less likely possibilities. The present P contribution from each of the main sources at present was determined as follows:

Sector	kg P per year	% of Base-load
Agricutural Run-off	21,063	230
Forestry	1,900	21
Urban Sewage	1,250	14
Rural Septic Tanks	1,500	16
Bord na Mona Peat	145	2
Estimated Background Natural Run-off	9,142	100
Total	35,000	383

There has been increase in phosphorus from a number of sources - forestry and sewage treatment - but these are relatively small in comparison with the increase in agricultural input.

*Detailed recommendations for action

Recommendations are made for each sector - all with the aim of reducing phosphate inputs to the lake. A large number of points are made with repect to agriculture which was believed to be the biggest source of the phosphate inputs to the lake. Some key recommendations of the Committee are:

* implementation of integrated nutrient management planning by farmers in the catchment

* to change the timing of slurry spreading

* investment in additional slurry spreading equipment in order to increase flexibility in a region where slurry spreading opportunities are limited by high rainfall

* improved nutrient management practices in forestry

* improved control of rural septic tanks

* improved fencing of rivers and riparian zone management

* elimination of sheep over-grazing within the catchment

* phosphate removal and improved secondary treatment at Crossmolina sewage treatment works

* improved control of peat silt

* an ongoing research and monitoring programme for the catchment

Most of the problems in the catchment appears to be due to EC and Government funded farm modernisation schemes. It is hoped that the new EC Agri-Environment Programme will fund substantial aspects of the remedial measures required. Further investment is required to reverse the adverse environmental impact of the earlier programmes. Without remedial action it can only be expected that Lough Conn will undoubtedly undergo further accelerated eutrophication.

Finally targets are set for judging the success of a clean-up programme:

* reduction of the measured phosphorus input to less than 18 t P
* restoration of charr populations to 1984 levels
* elimination of shallow water blooms and algal scums
* reduction in average size of trout to 1 lb.

Conclusion:

The study clearly identified a doubling of the phosphate loading to the lake. The principal sources of phosphate came from agricultural (230% of the base load) followed by forestry (21% of baseload) rural septic tanks (16%) Crossmilina sewage treatment works 14% and Bord na Mona bogs (21%).

The study also identified the Deel River and the Addergoole River as the main contributers of phosphate with the Cloghans River also adding an unnaturally elevated input. These rivers run through the more fertile soils within the catchment and so represent a large proportion of intensive agricultural farms.

Even though the largest loading comes from agriculture all sources of input needs to be equally addressed. It was concluded also that it is the spreading of agricultural waste rather than point source of discharges that are contributing to this large increase in phosphate loading associated with high rainfall events. Normally, with point source discharges, rainfall would dilute these discharges and a large drop in phosphate concentration would be evident. Whilst agricultural grant aid has been sufficient in the past to remove many point sources of agricultural pollution there has been no initative in this regard for land spreading of agricultural wastes (5 million has been spent in the Lough Conn catchment since 1987 upgrading farmyards and animal housing).

Crossmolina sewage treatment plant needs to be modernised and upgraded to include phosphate removal. However, a plant serving such a small population (<2,000) does not come under the EC Urban Waste Water Directive and the EC cohesian funding schemes. Monies may be made available under the structural funding schemes. However, it is quite likely that a new plant will not be built until after the year 2000.

Regarding forestry, it was stated in the Lough Conn report that there should be no more forestry plantations on peatland, since the nature of the soil (peat) does not allow absorption of phosphate fertiliser. Unfortunately, the situation now is that, especially with the private afforestation scheme, assistance will be made available for planting on peats in accordance with the new grant aid schemes proposed by the Dept. of Agriculture Food and Forestry.

The results of the Lough Conn study emphasise the benefits of an ongoing baseline lake monitoring programme in general. The importance of having access to adequate data in solving water quality management problems is clearly apparent. Unfortunately, few lakes in Ireland are as well placed as Lough Conn when it comes to having adequate historical information on water quality.

The importance of implementing the recommendations is vital. The Lough Conn Committee has now become a Management Committee which will oversee and chart the progress of the reommendations on a sectoral basis. Progress reports should be issued regularly.

DUBLIN CORPORATION

DRAINAGE DIVISION

WATER POLLUTION CONTROL

Anthony Foy Senior Executive Engineer

19th April 1994

DUBLIN CORPORATION
DRAINAGE DIVISION
CIVIC OFFICES
FISHAMBLE STREET
DUBLIN 8

POLLUTION CONTROL - DUBLIN CORPORATION

Anthony Foy, Senior Executive Engineer, Dublin Corporation.

Introduction

In this paper I intend to outline the types of pollution incidents which arise from time to time in the Dublin Corporation area. While no two pollution incidents are ever totally alike, there are similarities as to the causes of the incidents, the effects of pollution resulting, and the methods adopted to eliminate and prevent similar events in the future.

Types and Origins

Every pollution incident reported to Dublin Corporation is immediately investigated. Many incidents are discovered as part of our routine monitoring of rivers and of the discharges into them. Others are reported by members of the public and this is a vital component involving public participation in pollution abatement. Unfortunately, many such incidents reported by the public do not yield results as either the pollution is too slight to trace, such as runoff from roads, or the cause of the pollution would have stopped before our staff commenced investigations. However, public involvement is to be welcomed, as responsibility for pollution control cannot be seen as resting solely with the enforcing authorities.

All reported incidents are recorded and annual returns are submitted to the Department of the Environment. An analysis of the returns over the past five years provides some useful indications of the types of incidents. Classified under "Other" includes petrol retail outlets and other oil distribution centres, and sewer overflows. For example, in 1993 there were four incidents involving service stations and four involving major oil distribution installations.

TABLE 1

CLASSIFICATION OF POLLUTION INCIDENTS 1989 - 1993
A - Agricultural I - Industrial O - Other

YEAR	SECTION 3				SECTION 16(1), 16(7)			
	A	I	O	TOTAL	A	I	O	TOTAL
1989	1	23	37	61	-	104	8	112
1990	-	15	29	44	-	72	15	87
1991	-	11	21	32	-	41	16	57
1992	-	29	50	79	-	13	9	22
1993	-	20	72	93	-	19	18	37

Industrial Pollution

While there is little heavy manufacturing industry located in Dublin, there is a significant concentration of industry , chiefly in the foods and drinks sector. An indication of the extent of industrial activity can be obtained from a study of trade effluent discharges to sewers. There are currently 200 No.

licences under Section 16 of the Local Government (Water Pollution) Act, 1977 and there are another 100 No. applications for licences to be processed. Discharges range from small printing works discharging less than 1 m^3/day to large industrial discharges such as Arthur Guinness & Co discharging 8,650 m^3/day. Of a Dry Weather Flow of 260,000 m^3/day at Ringsend Treatment Works, trade effluent discharges represent just 6% (16,000 m^3/day). Of the Biochemical Oxygen Demand (B.O.D.) at Ringsend, amounting to 69,420 Kg/day (Population Equivalent 1.16 x 10^6), trade effluents account for 45% of the total. The licensing of trade effluent discharges ensures that pollution due to industrial activity is controlled.

Due to the availability of sewers all but three trade effluent discharges are to sewers. There are three Section 4 licences for discharges of cooling water from power generation. While discharges of cooling water to waters might appear to be relatively innocuous, such thermal discharges, particularly to estuarine waters require careful consideration.

As a consequence of having trade effluent discharges to sewers, the possibility of pollution arising from discharges exceeding their permits does not occur, as would happen were the discharges to waters. This does not imply that trade effluent discharges are not carefully monitored. The Corporation has an extensive programme of trade effluent monitoring which involves sampling discharges a number of times annually. The primary responsibility for monitoring trade effluents rests with the industry concerned and it is common practice for many industries to carry out their own monitoring programme.

Types of Pollutant

It is uncommon to find that a trade effluent is the cause of pollution from industrial premises. The most frequent pollutant that occurs in Dublin is without doubt oil, in its many forms. Of the total number of investigations in 1993, 30 No. related to oil. Incidents involving oil can usually be divided into two broad categories:

(1) Leakage / spillage from tanks
(2) Leakage from pipeline

Leakage / Spillage from Tanks

Tanks, whether storing oil or other product, are liable to spillages and leakages. If pollution is to be avoided, therefore, all tanks must be located within a liquid retaining structure, that is, a bund. In order for a bund to be liquid retaining it should be properly constructed with a concrete base and walls. Generally, incidents involving tanks which resulted in pollution, happened, not because the tanks were not located within a bund, but rather because the bund was inadequate.

Some of the more common problems associated with bunds are:

(i) bund walls permeable
(ii) drainage provided for bund
(iii) inadequate or no floor in bund.

The most serious incident involving a spillage of 12,000 gallons of heavy fuel oil occurred during a transfer of oil from one tank to another. The tanks were both located within a bunded area but the receiving tank did not have sufficient spare capacity resulting in an overflow into the bund. Oil escaped from the bund and initially entered the site foul drains. Approximately 4,000 gallons of oil were subsequently recovered from the primary settlement tanks at Ringsend Treatment Works. However, the foul drain involved was badly corroded and oil flowed from it into an adjacent storm water drain discharging to a surface water sewer outfalling to the Liffey. The company involved had plugged the foul drain but in doing so it accelerated the overflow into the storm water drain. In the order of 3,000 to 4,000 gallons of oil entered the Liffey and contaminated 4km of quay wall and the oil slick affected a major portion of the estuary.

Another serious incident, which happened last year, involved a spillage of about 1,500 gallons within a bund. The premises is located adjacent to the Liffey and due to the inadequacy of the bund floor oil seeped through the ground and entered the river. The company involved considered that its bund provided protection to contain spillages but it was totally incapable of retaining oil. The subsequent cleanup was a difficult operation due to the location and the affected ground was treated by bioremediation.

Header Tanks and Stand-by Generators

The need to bund bulk storage tanks is generally accepted. Bulk tanks are usually located in fairly conspicuous places and are difficult to ignore or forget. Header tanks, however, are usually located in inaccessible places on roofs or on raised platforms. Tanks in such locations tend to be neglected when it comes to pollution preventative measures.

Header tanks are tanks into which oil or product is pumped from a bulk tank. The header tank then feeds a boiler or other appliance by gravity. The header tank is usually provided with a level control switch to cut off the supply from the bulk tank when the level reaches a predetermined level. Malfunctioning of the control devices can result in the total contents of the bulk tank being pumped to the header tank. The header tank will then overflow allowing oil or product to enter adjacent drainage unless precautions are taken. This can be done by locating the header tank inside a bund with a return from this bund to the bulk tank bund.

Pipelines

Pipelines, whether distributing oil or product, are usually located below ground and therefore they tend to be ignored until a problem arises. There is little point bunding tanks when the pipelines from these tanks can allow the tanks to empty if a fault develops in the pipeline. Pipelines can suffer corrosion or structural failure and should receive careful design and be constructed to endure the operational conditions. Where a pipeline must be located below ground a secondary containment system should be provided where possible.

Tanker Off Loading

When a tanker is offloading to a storage tank the potential exists for a serious pollution incident. A failure in a delivery line or of a coupling could result in the tanker emptying its contents in a uncontrolled manner. This can be avoided by ensuring that offloading is carried out in a designated area where the drainage in that area can be isolated during the offloading operation.

Shut-off Valves on Drainage Outfalls.

When a pollution incident occurs on an industrial premises the first priority is to contain the pollution on site. This can be most effectively done by providing shut-off valves on drainage connections to sewers, especially the surface water sewer. A shut-off valve enables the industry to take immediate action to limit the extent of any pollution, in the case of an incident.

Petrol and Oil Retail / Distribution Outlets.

Petrol retail outlets or service stations have been a frequent source of pollution. In many incidents the causes are similar to those on industrial premises involving tanks or pipelines. Absence of bunds or inadequate bunds are the most common faults. However, the general practice in service stations is to locate storage tanks below ground. In very many cases such tanks are not provided with any means to contain any leakage from the tank. In the event of a problem the contents of an unprotected tank can gain access to surrounding soil and ground-water. Usually the first sign that anything is wrong are complaints of smells in neighbouring properties or oil contamination of storm water discharges in local streams.

Locating and identifying the source of oil pollution in a service station can be a difficult and prolonged exercise, involving pressure testing of tanks and pipelines. Where a tank is found to be faulty it must be replaced. Underground tanks should be located in an impermeable concrete crypt to similar specification as above ground bunds, and with appropriate systems to detect leaks. Alternatively, the tanks may have a double wall construction with a detection system. A number of recently constructed service stations have been provided with secondary containment systems for tanks and pipelines.

Bulk Distribution Depots

Almost all the major oil companies have bulk distribution facilities, usually located in Dublin Port. However, there are subsidiary distribution centres outside of the port area and there are other major handlers of oil such as ESB and Iarnród Éireann. Here again the importance of adequately bunded tanks is vitally important. Unless all tanks have totally impervious floors and walls the consequences of any spillage can be serious. Due to the large quantities stored in this type of installation, a loss from a tank where there is inadequate containment is likely to result in extensive contamination of soil and waters. The recovery of product in such circumstances can be extremely difficult and prolonged. Pollution can only be

prevented by providing for the worst case scenario and ensuring that adequate measures have been provided to cope with such a situation.

In all operations involving the handling of oil, either off-loading or filling of vehicles, every possible precaution must be taken to avoid spillages. One of the most persistent pollution problems which we have to deal with involves an installation with extensive oil storage and distribution lines and multiple fill points for vehicles. Storm water drainage from the site is subject to constant oil contamination and as a consequence the discharge is treated in settlement tanks to separate oil from the water. In periods of heavy or persistent rainfall the separation tanks are unable to cope with the flows and hence the discharge is liable to contain unacceptably high oil levels. In this instance there is no easy solution, but improved handling procedures on the site will reduce the extent of oil contamination, as will improved awareness of the consequences of inadequate control and treatment.

Dublin Corporation Bunding Guidelines

The Corporation became aware that the problem which existed with regard to pollution from tanks was not that tanks were not in bunds but rather that the bunds did not do the job intended, that is retain any spilled oil inside the bund. There appeared to be a degree of confusion as to the purpose of a bund and its construction. It was decided to set out in detail the requirements that bunds would be required to meet. The Drainage Division in Dublin Corporation devised its own guidelines for the bunding of overground storage tanks. The guidelines set out to cover details of the construction of a bund which would be capable of retaining the tank contents in the event of tank failure. The guideline was specified as a requirement in planning applications dealt with by the Division and as a condition in trade effluent licences. The guideline has been in operation for a number of years and is gradually becoming the acceptable norm for tank bunding.

Essentially the guideline specifies the form of construction necessary to construct a liquid retaining concrete structure. Details relate to the construction of the base and walls of the bund. In order to facilitate the storage of rainwater within the bund the bund should have a capacity equivalent to the total volume of the tank(s) located within plus a depth of 200 mm of rainwater. The underlying principle regarding bunds has been that the bund must be capable of retaining the contents of the tank(s) and so prevent contamination of drains, waters, or soil.

Separate Drainage Systems

Dublin has two major drainage networks

(i) Greater Dublin Drainage System (GDDS)

(ii) North Dublin Drainage System (NDDS)

GDDS serves the southern and western suburbs and the city areas bounded by the two canals. It consists of the oldest and original sewerage system and the relatively recent Grand Canal Tunnel sewer. It outfalls to the Liffey estuary following primary treatment at Ringsend Treatment Works. The NDDS which

serves the northern suburbs was constructed in the 1950's and outfalls at Howth via a deep sea outlet.

Drainage in Dublin is generally on what is referred to as the separate system. In a separate drainage system the storm water and waste water are collected and disposed of separately. The storm water is disposed via the surface water sewer system to local streams and rivers. The waste water is disposed via the foul sewer system, whether GDDS or NDDS.

The NDDS is fundamentally a separate system while large sections of the GDDS, particularly the older sections, are combined systems (i.e. storm water and waste water collected in the one system). However, even the NDDS is not totally separate, and with infiltration contributing to storm water ingress to both GDDS and NDDS, both systems are subject to surcharge during rainfall. In order, therefore, to prevent flooding of premises during rainfall, storm overflows are provided on foul sewers. A storm overflow is basically a connection from the foul sewer to a nearby surface water sewer which allows excess flow in the foul sewer to be diverted to the surface water sewer under conditions of heavy rainfall. Due to the incidence of sewage overflows surface water sewers are subject to periodic sewage contamination. In theory, this can be tolerated as rivers are assumed to be swollen during rainfall and any sewage inflow would be greatly diluted.

Even if the operation of storm overflows in conditions of heavy rainfall was tolerable the unfortunate reality is that very many operate at low flows in the foul sewer and cause significant water pollution. Occasionally this is due to overflows being set at unnecessarily low levels or due to blockage or obstruction in a foul sewer. Proper and adequate maintenance is essential to contain the extent of unnecessary storm overflow operation.

Under EC Directive (91/271/EEC) on Urban Waste Water Treatment pollution from sewer overflows must be limited. There are various techniques available, such as retention basins, but even these devices alone will not provide the total solution. In many cities, such as Dublin, much of the sewerage system is an aging asset and operating below its maximum efficiency. Development over the years has resulted, in many instances, in discharges to sewers exceeding the capacity of the sewers. Providing secondary treatment at sewage outfalls, as required by the Directive, will reduce pollution in receiving waters but the sewerage collection systems cannot be ignored.

Pollution of surface water collection systems by overflows from foul sewers is unavoidable at present, but the integrity of the separate drainage system must be maintained if pollution is to be controlled. Industrial premises which apply for trade effluent licences are subjected to a rigorous inspection of their drainage arrangements to detect whether there is any contamination of the surface drains by waste water. Larger industrial premises would be required to carry out regular inspections and sampling of their surface water drains.

Residential Areas

Analysis of surface water sewer discharges indicate a persistent level of contamination by domestic waste water. This

is apparent in surface water sewers serving residential areas, as well as residential / industrial areas. A recent survey of two residential areas in Dublin found that between 40 - 50% of houses inspected had connections of waste water to storm water drains. The connections included discharges from washing machines, dishwashers, sinks, and baths, most had been inadvertently connected to the surface water system by householders. There is nothing to suggest that the particular areas investigated were unusual in any way, indeed this problem is widespread throughout residential areas.

Conclusion

It has not been possible to go into great detail in a paper of this duration. I hope I have given some indication of the types of pollution incidents which occur in the Dublin Corporation area and the methods employed to deal with them and to reduce the likelihood of a recurrence.

CONTROL OF GROUNDWATER POLLUTION IN NORTHERN IRELAND

DES LYNESS, BSc CBiol MIBiol
Principal Scientific Officer
Environment Service, Department of the Environment for Northern Ireland

LEGISLATION

The Environment Service of the Department of the Environment for Northern Ireland was formed towards the end of 1990. It amalgamated the former Conservation Service and the Environmental Protection Division. The Environment Service has responsibility for developing and implementing environmental policy in Northern Ireland, including the control of pollution of water. The provision of potable water supplies is the responsibility of the Department's Water Executive.

The main legislation used to control water pollution in Northern Ireland is the **Water Act (N.I.) 1972.**

There are in addition EC Directives 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances, and 91/676/EEC, concerning the protection of waters against pollution caused by nitrates from agriculture.

EFFLUENT DISCHARGE

Section 1 of the Water Act says that the Ministry shall (a) promote the conservation of the water resources of Northern Ireland; (b) promote the cleanliness of water in waterways and underground strata. The Environment Service fulfils its statutory obligations by controlling discharges through effluent discharge consents, by monitoring water quality, by education and proactive pollution prevention measures, and by enforcement.

Sections 7 and 8 of the Act require any person wishing to make a discharge of any trade or sewage effluent to a waterway or into any underground stratum, respectively, to have a consent from the Department for that purpose. The application for consent must be advertised in the local gazette. The Department can impose such conditions on the quality and quantity of effluent as it considers proper. In 1993 the Department processed some 2,000 consent applications for domestic dwelling septic tank. The majority of which, if granted, would involve a discharge to underground stratum. There are no trade effluent discharges to substratum.

WASTE DISPOSAL

Before a waste disposal site can obtain a licence to operate it must first obtain planning permission and a Water Act consent. The need for the latter can be waived if appropriate. All applications for the disposal of domestic waste, medical surgical and veterinary waste, sewage sludge, commercial and industrial waste must be accompanied by a hydrogeological assessment of the site. The Department operates a policy of leachate containment and treatment before discharge. There are 73 major landfills in Northern Ireland, 28 run by Local Authorities and 45 operated privately.

CONTAMINATED LAND

The department is also consulted where sites, for example, closed petrol stations or fuel depots, are being redeveloped and the vendor or developer seek advise as to current environmental standards as applied to ground and groundwater contamination. A UK working group is currently looking to set standards for dangerous substances in groundwater.

WATER ABSTRACTION

The Water Act (Section 14) allows the Department to make regulations to control the abstraction of waters from underground strata or waterways other than the sea. Until recently the Department has not perceived there to be a need to take these powers of control due to the ample rainfall experienced in Northern Ireland. Charges for non-domestic supplies of mains water are however inducing farmers and industrialists to consider private sources of supply. Indeed advice from the Geological Survey of

Northern Ireland suggests that the number of private borewells is increasing considerably. Directive 91/6476 has also focused attention on the need to safeguard underground aquifers from pollution. The Department is about to review the Water Act and views on the need for abstracting licensing have been sough through a consultation paper published in December 1993.

HYDROGEOLOGICAL MAPPING

The Department in recognising an urgent need to acquire baseline data on the hydrogeochemistry and physical hydrogeology of its major and minor aquifers engaged the British Geological Survey to carry out a study. The contract commenced in April 1992 and will be completed in August 1994. The projects objectives are;

1. To collate the available hydrological information and to present it published as the Hydrogeological Map of Northern Ireland (1:250,000) complete with inset figures of related information.
2. To identify hydrological units and establish their broad resource potential in terms of the water balance and annual abstraction.
3. To establish a borehole and well database and set up a network of representative boreholes and wells for water level and water quality monitoring.
4. To establish the baseline major ion chemistry of the groundwaters with particular reference to the nitrate concentrations.
5. To prepare an aquifer vulnerability map.

NITRATE VULNERABLE ZONES

The Nitrate Directive establishes a framework for action to reduce nitrate concentrations in affected areas by designating nitrate vulnerable areas. Following a years monthly monitoring at 29 Water Executive borehole abstractions the Environment Service is considering whether or not there is a need to designate any nitrate vulnerable zones. A zone will be designated if trends show that nitrate concentrations will exceed the 11.3mg NO_3 N/I standard by 1999. The Department of Agriculture for Northern Ireland is currently drafting a code of good agricultural practice as requested by the Directive.

POLLUTION INCIDENTS

The lack of dependence of Northern Ireland on groundwater for potable supply has perhaps meant that short term incidents of pollution go mostly undetected. The actual numbers of incidents brought to the attention of the Department that have impacted on public supplies are very low. In the past five years the author can only recall one. This involved a County Tyrone spring source which had to be withdrawn from supply due to contamination by farm slurry. The offending farmer had applied slurry to his lands some 500 metres away. This was normal practice and an activity which until this occasion had not apparently caused any problem. It was believed that heavy rainfall soon after the application of the slurry had washed slurry into field drains. The water source was only out of supply for a short time until bacteriological samples proved negative and a taste panel declared no taints or smell. The farmer was prosecuted.

Most of the problems associated with potable groundwater supplies are related to natural phenomenon such as high levels of manganese and iron. One source in County Tyrone caused a mixture of annoyance and amusement. The supply was from a particularly deep well, the water from which was very hard and rich in sulphate. Due to the lack of use the water in the mains system tended to become anaerobic and the sulphate was reduced to sulphide which formed black iron sulphide. A local hostelry used this water which when added to whiskey precipitated out the iron sulphide. A miracle of turning Bushmills whiskey into Blackbush was declared!

In terms of major contamination of aquifers there has been none of recent note. It has been declared that aquifers under Belfast are no longer suitable for abstraction due to the now obsolete Gas Works. Localised ground contamination from spills of oil or chemicals do arise, mostly at commercial premises but some have arisen on farms, along roadways following road traffic accidents, and over the years a number at private dwellings where central heating tanks have leaked, ruptured or have overflowed during filling. A number of private wells have been contaminated and taken out of supply until cleaned. Methods of cleaning have involved digging out the contaminated ground, pumping and flushing, and bioremediation.

EMERGENCY RESPONSE

The Environment Service provides a 24 hour service to respond to pollution incidents brought to its attention.

The Department's Water Pollution Incident Procedures set out action to be taken for all incidents. An integral part of the Procedure is the Northern Ireland Water Use and Amenity Areas Northern Ireland 1989 map. This map contains information on the location and type of conservation and amenity areas in Northern Ireland and all surface and groundwater abstraction owned by the Department, fish farms and industry. The map is used to provide if necessary early warning to water users downstream of a pollution incident.

Under Section 13 of the Water Act the Department has powers to carry out such operations as it considers appropriate to prevent entry of a pollutant into a waterway or water contained in underground strata, or to remove and dispose of the pollutant. Under this Section any expenses reasonably incurred by the Department can be recovered from the polluter as a contract debt.

The Environment Service maintains a central stockpile and 16 strategically placed trailers containing a wide array of equipment for the purposes of cleanup. While the Department will initiate a first strike response it will expect an identified polluter to complete the cleanup under the supervision of Environment Service staff.

Over the past year a number of major oil spills have been dealt with and cleanup costs have ranged from hundreds of pounds to tens of thousands of pounds. Ground spills are by far the most difficult to deal with. The Environment Service is currently dealing with an incident in a County Antrim town. The spill was first detected in surface water in 1992 and is still ongoing. No source has yet been detected even after extensive investigation. The Department is not aware of any impact on groundwaters as a result of this spill.

SUMMARY

Depending on ones outlook, Northern Ireland is blessed with ample rainfall and consequently surface water is the main source of potable water supply. For a number of reasons, however, interest in the abstraction of groundwater is increasing.

With this in mind and with EC Directives requiring the protection of groundwater the Department of the Environment for Northern Ireland is taking measures to enable it to control abstractions, to monitor groundwater quality and to prevent pollution of groundwater.

To date in Northern Ireland pollution incidents involving the contamination of groundwater are few. The Department will continue to control effluent discharges by Water Act consent and through enforcement measures if necessary. Efforts towards education and proactive pollution prevention continue to increase.

IAH PORTLAOISE SEMINAR, APRIL 1994

WATER POLLUTION AND PLANNING

by
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This paper is concerned with the issue of how far the controls provided for under the Local Government (Planning and Development) Acts, 1963 - 1993 can be used to control and prevent water pollution. It is generally recognised that the Planning Acts constitute an effective system of control across a broad range of environmental issues despite the fact that the legislation is primarily drafted as a system to resolve and regulate competing uses of land.

There would also appear to be reluctance on the part of planning authorities to develop their role in this area.[1] This reluctance on the part of planning authorities and local authorities to develop their role and use the Planning Acts as a mechanism to assist in the protection of water quality derives to some extent from the reluctance of central Government and the Department of the Environment in particular to encourage such a role to be developed, and indeed the Department of the Environment have through their circular letters discouraged planning authorities from further developing their role in this area[2].

Another major weakness of the Planning Acts in the control of water pollution is the range of statutory bodies which have responsibilities in the area of water quality. This overlapping and duplication of responsibility takes place not only at local level but also at regional and national level. The result of this is that planning authorities are often unclear as to the precise responsibilities of these various statutory bodies and consequently they are often not afforded an opportunity or are not aware of the opportunities to make an input into the various policies/decisions of a planning authority .

The other major weakness of the Planning Acts is that they contain large scale exemptions and some of these exemptions relate to developments with a significant potential for pollution. These exemptions contained in the Planning Acts mean that often developments which are important sources of pollution are outside the general controls contained in the Acts.
Of Course it is recognised that the Planning Acts constitute quite a rigid framework and are not in themselves suitable for the total control of water pollution and in particular are unsuited to

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1 So for instance, the aesthetics or the design of buildings which alluded to only in minor way in the legislation receives considerable attention now in most development plans but the issue of the control and prevention of water pollution which is specifically provided for in the Planning Acts, receives virtually no attention in most development plans.

2 See Minister Circular Letter Development Control Advice and Guidelines, 1982.

the control of specific effluent because of the nature of planning conditions in that they are not reviewable. However, it is suggested that the Planning Acts do make provision greater than is

presently recognised for the control of water pollution. There is considerable potential in the Planning Acts for such water pollution controls to be expanded. It is considered that the role of Planning Authorities could be expanded considerably in this regard.

However, it with a certain degree of concern that recent developments in the area of environmental protection are now viewed, in particular the provisions bringing[3] into force the Environmental Protection Agency. This legislation suggests that the policy which has been pursued by central Government of separating controls under the Planning Acts from those of water pollution, air pollution and waste are being emphasised so that the entire of water pollution will now be considered separate from the planning issues of the same development. It is somewhat ironic that these EPA licences will now be referred to as an "integrated licence" whereas in fact under the existing system, water pollution and planning control were integrated to a much greater extent and the system which has now been proposed it could be argued to constitute a step back in terms of introducing an effective system of water pollution control.

This paper then will consider each of these aspects and will hopefully draw them together at the end to suggest how in fact the Planning Acts can be used more effectively to improve the existing system of water pollution control.

The Relationship of Planning to Water Pollution Control

The extent to which the Planning Acts can be used to control and prevent water pollution has been considered by the Department of the Environment in the Development Control Advice and Guidelines of 1982 Paragraph 11.624 states as follows:

"Prior to the coming into operation of the Local Government (Water Pollution) Act, 1977 the planning system was heavily relied on, in relation to the establishment of industry and other development, to control the discharge of effluent to waters and to set standards for such effluent. The enactment of the separate water pollution legislation does not release the planning authority of the duty to consider the water pollution aspects entirely but they should do so only to the extent that such aspects could affect the land in question in a fundamental way. In general, it is no longer appropriate that a planning permission should contain conditions setting out in detail the standards which effluent should meet; such standards can be more appropriately be included in a licence under the 1977 Act and which, unlike planning conditions, is subject to periodic review."
This paragraph goes onto to say that it is desirable that planning and water pollution aspects of

[3] The 1992 Environmental Protection Agency Act

major proposals are dealt with in a coordinated and consistent manner and with this in view a planning authority should encourage applicants for permission to make applications simultaneously for the necessary authorisation under other codes[4].

Local Authorities are not bound by these circulars but are bound to have regard to such circulars and they tend generally to be followed by such authorities in their determinations of planning applications.

The Department of the Environment then considers that the water pollution aspect of a particular development should only be taken into account where it might affect the use questioned in a fundamental way. Otherwise effluent and the general waste arising from such development should not be considered within the planning control process. There is a great degree of confusion and uncertainty within the planning profession as to the extent to which the water pollution aspects of a particular development should be considered under the Planning Acts and how the Water Pollution Acts should be integrated into the development control procedures of the Planning Acts. This has led to a great degree of variation in planning decisions where issues of potential water pollution arise. Some planning decisions are in effect an integrated licence which deals in detail with the planning and water pollution aspects of the particular development. The existence of the water pollution legislation[5] makes such types of planning decisions undesirable and even illegal.

Other local authorities take a different view. They consider that the water pollution aspects of a development should not be considered at all. The whole water pollution aspect then tends to receive a very low priority. It is often not considered in the application and certainly not the subject of any conditions. This is unsatisfactory from a number of aspects but particularly from the point of view of a potential developer for it is very difficult to know when applying for planning permission the extent to which the water pollution aspects of the development are to be provided in the documentation accompanying the application.

To what extent then is the issue of water pollution a valid consideration under the Planning Acts?

The Planning Acts and Water Pollution

In general planning permission is required for all development unless it is specifically exempted (the issue of exempted development will be considered later in the paper). Such developments which are not exempted must be authorised by the grant of planning permission.

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[4] This of course will no longer be possible for those applications which are subject to the provisions of the Environmental Protection Agency. Even under the Planning Acts and Water Pollution Acts applications would not always be considered by the same authority.

[5] The Local Government (Water Pollution) Acts, 1977 - 1990

By virtue of Section 26 of the Local Government (Planning and Development) Act, 1963 where application is made to a planning authority in accordance with permission regulations for permission for the development on land:

"..... the planning authority shall be restricted to considering the proper planning and development of the area of the authority (including the preservation and improvement of the amenities thereof)."

It is suggested that any consideration of the proper planning and development of an area must include an analysis of the impact of a development on the existing water regimes both surface and underground. Certainly Ireland would not appear to be as aware of the considerable importance of ground water as is the case in certain other European Countries. These are a valuable resource and their protection of such deposits should be of fundamental concern in any assessment of the proper planning and development of an area. Similar criteria should apply to surface water These again are a valuable resource, not only for the development of industry and employment in general but in the entire assessment of the proper planning of an area. It is clear from that part of Section 26 that the impact of a development on water pollution should clearly be an integral part of the assessment of any planning application.

However, Section 26(1)(b) goes on to to indicate that regard must be had "to the preservation and improvement of the amenities of an area". " Amenities" are not defined in Section 2 of 1963 Act[6] however amenities are considered under Part IV of Schedule II of the 1963 Act[7] and paragraph 11 of the that Schedule includes:

"Prohibiting, regulating and controlling the deposit or disposal of waste materials and refuse, the disposal of sewage and the pollution of rivers, lakes, ponds, gullies and the sea shore."

It is clear then that amenities as referred to under Section 26 can refer to and include the possible polluting impact of a proposed development having regard to the definition of the term under Schedule 3, Part IV of the 1963 Act.

It would appear then that Department of the Environment's circular which would restrict the extent to which water pollution should be considered as part of any planning application does not give the emphasis to this aspect of development control which it deserves under the relevant provisions of Section 26.

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[6] Section 2 contains the definitions relating to the various words which are used in the Act.

[7] This Section relates to what objectives a planning authority may include in their development plan.

Section 26 goes on to state that in assessing a planning application regard must be had to the provisions of the development plan. Part IV of the Third Schedule to the 1963 Act which has already been referred to, sets out the purposes for which objectives may be indicated in the development plan. Under Part Iv which deals with amenities, specific objectives may be made iner alia in relation to the "prohibition, regulation and control of the pollution of rivers, lakes, ponds, gullies and the sea shore". If such objectives were included in the development plan then it would be mandatory on local authorities to have regard to such provisions in dealing with planning applications. In the assessment of all new developments the impact on water pollution would be required to be taken into account, having regard to the specific objectives contained in the development plan as well as to the other requirements already indicated.

It would appear from this Part of the of the Third Schedule that the legislature had in mind that planning authorities would include in their development plans specific objectives for the control and regulation of water pollution and specific objectives in relation to the control of pollution which might be liable to damage bodies of water within the in jurisdiction. However, again perhaps partly from the influence of the Department of the Environment, development plans tend not to place a great emphasis on water pollution controls. Local authorities consider that such objectives are probably better provided for in water quality management plans which are provided for under the 1977 Water Pollution Act[8]. However, it is clear from the Third Schedule that local authorities can make specific objectives in the development plan dealing with water pollution and indeed that such objectives were specifically provided for within the planning code.

A development then involving granted contravention of such objectives would constitute a material contravention of the development plan and would require specific approval of the local authority members before any such application could be granted. Local authority decisions have been set aside by the Courts on the grounds that the development was granted without the required material contravention being carried out; in this regard see cases like Sharpe -v- Dublin County Council[9] or Griffin -v- The Galway County Manager[10].

The inclusion of such provisions in the development plan would have a further much more important significance. It is clear that the 1977 to 1991 Water Pollution Acts allow local authorities to be exempted from large elements of the controls provided for in this legislation. This is a major weakness of the legislation because local authorities are often significant polluters in their own right. If such provisions were included in the development plan this would be a major control on the kinds of development that local authorities could carry out

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8 These Water Quality Management Plans are not subject to a mandatory review and consequently are generally not reviewed.

9 1989 IR 701

10 31 October 1990

which might give rise to water pollution as they would be required to comply with the provisions of the development plan. Decisions of a local authority can be challenged and will be set aside by the Courts were they to contravene a fundamental provision of the development plan. For instance in McGarry -v- Sligo County Council 1989 IRLM the Supreme Court held that a local authority landfill site constituted a material contravention of the Council's development plan and the Council was prohibited from proceeding with the development because of this contravention. Further, in O'Leary -v- Dublin County Council[11] the County Council was prevented from developing an itinerant halting site in an area identified being of high amenity in the county development plan and in that O'Hanlon J drew an analogy with private sector developments: "the development would clearly have been a contravention of the development plan if it had been submitted by a private developer". It was therefore also a contravention of the development plan despite the fact that it was being carried out by the local authority itself. It is clear then that if there were specific objectives in the development plan relating to water pollution which are provided under Part IV it would not only create greater control on private sector development but it would also have a major impact on controlling local authority development which would appear in general outside the ambit of control of the Water Pollution Acts. This is all the more important given that water quality management plans provided for under the water pollution legislation are rarely updated unlike county development plans which are reviewed at five year intervals.

It is also clear from Section 12 of the 1990 Local Government (Planning and Development) Act and the Third Schedule of that Act that the assessment of water pollution is not only a matter to be considered in any assessment of a planning application but it may also be the basis of refusal of permission where it is considered that the development may give rise to water pollution. paragraph 7 of the Third Schedule (which lists reasons for refusal of permission which will exclude compensation) provides that if the proposed development would cause serious: ".... water pollution... or pollution connected with the disposal of waste" then compensation will not be payable.

Furthermore, under the Fourth Schedule which lists conditions which may imposed on the granting of permission without the payment of compensation, paragraph 22 provides that any condition prohibiting, regulating or controlling the deposit or disposal of waste materials and refuse, the disposal of sewage and the pollution of rivers, lakes, ponds, gullies and sea shore "will not give rise to compensation claims". It is then suggested that not only should the assessment of the impact of a proposed development be considered in terms of its impact on water pollution but the Act makes it clear and indeed makes it quite easy for local authorities to refuse planning permission on the basis of its impact on water pollution. The Act would also appear to provide that conditions regulating and controlling water pollution are perfectly valid within a planning decision. The fact that such conditions or reasons for refusal are specifically

[11] 1989 IRLM 768 (SC)

excluded from the requirement to pay compensation should make it very attractive for local authorities to include such conditions or reasons for refusal in dealing with planning applications in general.

Environmental Impact Assessments

Section 26A provides that a planning authority shall when dealing with an application for permission for development of land in respect of which an environmental impact statement has been submitted. have regard to that statement.

The Second Schedule of the EC (Environmental Impact Assessment) Regulations 1989 set out the information to be contained in an such a statement and this specified information includes at paragraph 2 (c) a description of likely significant effects, direct and indirect, on the environment of the development and this includes its possible impact, among other aspects on..... water . The Regulations go on to provide that where significant adverse effects are identified with respect to any of the specified criteria listed then it must include a description of measures envisaged in order to avoid, reduce or remedy those effects. Local authorities then are bound to have regard to the impact of developments and particularly large developments on water quality, Of course, indirectly its impact on water will have effect on some of the other elements to be taken into account like flora, fauna, soil, climate and landscape. Therefore the EIA Regulations have emphasised the necessity for local authorities to consider this impact of developments and have stressed the need to protect water quality.

Finally, it is a fundamental provision of the Planning Acts that the public be given access to information on all the aspects of the development. One of the fundamental impacts of many developments is its potential to cause pollution. Consequently not only should the information submitted and the application be adequate to allow members of the public to make an adequate assessment of the likely potential threat of a particular proposal but the public notice should also inform the public where such a risk is possible. A planning application that does not provide adequate details on the pollution potential of a particular development and does not include adequate details on the type of effluent to be generated, the type of treatment to be proposed and the location of and the precise point at which discharge is to be located may not meet the requirements of the 1977 Regulations which deals with the requirements for the making of a valid application. Such an application may be invalid and may be subject to judicial review on this basis.

Summary

What has been argued so far is that the assessment of the potential impact of proposed development on waters should be a central concern of planning authorities dealing with

planning applications. This derives not only from Section 26 in terms of the proper planning and development of an area but also from the definition of amenities, the preservation and protection of which the local authorities are specifically charged with under the provisions of Section 26, and also from the fact that local authorities are given power to include specific objectives in relation to water pollution in their development plans. It is also desirable that such provisions be included so as to force local authorities to have greater regard to water pollution in developments which they themselves are carrying out.

Finally under the Environmental Impact Assessment Regulations and under the requirements for the making of valid planning application it is necessary that the documentation submitted to a local authority to give adequate information of the impact of the proposed development on.

What still requires to be clarified then is the extent to which a local authority should consider the water pollution aspects of a proposed development, I have already indicated that I would consider that the circular letter which states that water pollution need only concerned where it affects land use in a fundamental way probably states the matter at too low a level. I would argue that what should be determined at the planning application stage is whether the development is appropriate in the context either of surface or of ground water conditions or whether it will be possible to control the proposed development so as not to give rise to any adverse impact on water sources, that is, whether the proposed development has the capacity to deal adequately with any waste water which might be generated so as not to give rise to pollution or to potential pollution.

Conditions relating to the precise nature or treatment of the effluent, the kind of conditions contemplated by the Water Pollution Act are not appropriate to a planning permission.
Conditions like design and provision of meters, gauges, manholes, inspection chambers, the taking of samples for analysis, maintaining of records and furnishing of such information to the local authority, measures for the prevention of a discharge in the event of a breakdown and conditions relating to the nature, composition, temperature volume, rate, method of treatment and location of the discharge are better left to be dealt with under the Water Pollution Licence.

These conditions are specifically provided for under the Water Pollution Act and it is more appropriate that conditions of this type should be contained under a water pollution licence. This derives from the fact that a planning application and the conditions relating to same are immutable and are not subject to review once granted, except by the submission of a of planning application. However, conditions under the Water Pollution Act are subject to review and where particular types of treatment or particular types or volume of discharge are seen to be causing a problem then the licence can be reviewed and the conditions can be amended accordingly. Furthermore, it does allow for changes over time to be taken into account and with increased development discharging say into a particular water course then a higher standard of treatment may be appropriate.

The Administration of Water Pollution Controls and Planning

The Department of the Environment Development Control Advice and Guidelines goes on to state that it is preferable that applications made under the Water Pollution Acts should be dealt with simultaneously with applications mad for development under the Planning Acts. It is desirable that controls provided for under the Water Pollution Acts and control under the Planning Acts should be integrated to the greatest possible extent and in many local authorities this does occur. An integrated decision will mean that there will be no conflict between the conditions imposed on the planning permission and the conditions imposed in the discharge licence and developers will know at the time of granting of the planning permission the type of plant and equipment required to comply with the discharge licence. The public will have access to all the required information when the planning permission is granted because they will also have access to the conditions granted under the Water Pollution Act.

In the local authorities dealing with both sets of controls it is the environmental section that will advise a planning authority on the water pollution aspects of a proposed development. They will also of course be dealing with the formulation of the conditions under the Water Pollution Acts and therefore by dealing with both sets of applications at the same time this will avoid duplication on the part of the local authority and will be more effective and more efficient system of dealing with both applications.

However the reality is that such an integrated approach to the assessment of development under both sets of legislation is not always easy and is not always possible. The main difficulty arises from the fact that there may be two different local authorities dealing with applications under the Planning Acts and under the Water Pollution Acts. Under the Planning Acts a planning authority may be an Urban District Council, a Borough Corporation, a County Borough Corporation or a County Council. [12] The local authorities responsible for the administration of the Water Pollution Acts, however, are only the County Council and the County Boroughs [13]. Therefore, in effect there could be two separate local authorities often dealing with the same development from a planning and water pollution point of view.

[12] Therefore in a county like Louth, for example, there will be four different types of planning authorities. There will be the County Council of Louth, there will be the Corporation of Drogheda and there will be the Urban District Council of Dundalk. Or for example in County Galway there will be the County Council which cover the County of Galway and there will be the County Borough of Galway which deals with the City of Galway.

[13] Therefore, to go back to the example in County Louth, if an application is made to Louth County Council for a Water Pollution Act licence the local authority which will be dealing with the planning aspects may not be Louth County Council. If the application is made for a development say in Dundalk Urban District, it will be the Dundalk Urban District Council.

The small urban authorities who will be dealing with planning will have their own development plans which will be separate always from the county development plan of the larger local authority dealing with the Water Pollution Act. There is often a degree of tension between the smaller local authorities ad the larger.

When a planning application is submitted there is a statutory obligation on the planning authority to refer the it to particular statutory agencies with a particular interest in the water pollution aspects of the development. At local level, as was already pointed out, an Urban District Council may be looking at the water pollution aspects of a proposed development from a planning point of view whereas a County Council may be looking at the same development from the water pollution point of view. The application will be referred to a Regional Fishery Board who will have concerns in relation to water quality as it effects fish life.

It is also clear that a Health Board has also some considerable responsibilities for monitoring water quality and they will often do their own assessment of water quality from a public health point of view.

Often also the Office of Public Works will have a particular responsibility for the drainage of rivers and for navigation controls. It has recently passed by-laws in relation to the controls along the River Shannon, for example. It will have a particular interest in the protection of water quality and how developments will affect waters in rivers and canals over which it has jurisdiction.

Furthermore, the EBB has jurisdiction over certain waters by virtue of the Electricity Generation Act of 1945. They also under that Act have powers to prosecute and to monitor water quality and again a planning authority dealing with a planning application would have to have regard to the jurisdiction of the EBB where they might effect water quality.

Whether a proposed development is an exempted development or not is not a matter for any of these organisations but is a matter for An Bord Pleanala who will determine whether in fact the proposed development has adequate facilities for the storage of effluent so as to render the development exempted.

At Central Government the control of water pollution is divided between different government departments[14].

[14] Primary responsibility being centred in the Department of Environment but with the Department of Agriculture, the Department of Health and other Government bodies having certain responsibilities in the area of water protection.

The effect of these exemptions is to remove from the formal controls under the Planning Acts a range of buildings with significant pollution potential and therefore the ability of the Planning Acts to be a mechanism for the control of water pollution is significantly weakened.

These exemptions were modified to some extent in 1985 so that development would not be exempted unless there were adequate effluent storage facilities to serve the structure having regard to its size, use, location and the need to avoid water pollution. If there are inadequate effluent storage facilities attached to any of these buildings then, regardless of size, the proposed development will not be exempted[18].

The assessment of adequate effluent facilities is to be made having regard to the size, use and location and the need to avoid water pollution and therefore it is not possible to state in general whether in fact effluent storage facilities for any development will always be adequate. It would very dangerous then for a farmer to construct a building without first at least discussing the proposal with the particular local authority and indeed given that the statutory responsibility for determining whether the development is exempted lies with An Bord Pleanala to make sure that there is not doubt that any such development is exempted under the provisions of the Planning Acts.

However, this exemption relates only to effluent storage facilities and the Regulations do not refer to the need to spread the said effluent in a manner which does not cause water pollution. In other words,it might be possible to construct a very large effluent storage facility which would be adequate to serve the development having regard to its size, use and location but there is a not a corresponding duty contained under the Regulations to spread such effluent without giving rise to water pollution. This is a major weakness of this set of controls under the exempted development regulations. If there are to be such large scale exemptions for agricultural development then it should primarily be the responsibility of the developer to show that not only are there adequate storage facilities but that any effluent which is generated by the development can be disposed of so as to make sure that it is spread in such a way as not to cause any water pollution or not to be likely to cause any water pollution.

The Environmental Protection Agency

The EPA approach involves specifying certain types of development which will require an integrated licence and where these particular types of development are specified (and the list in this regard is contained in the schedule of the EPA Act of 1992). The system will operate on the basis that the EPA will deal with all aspects of air, water and waste arising from a proposed

[18] However, as has already been stated the matter as to whether a development is or is not an exempted development is a matter for An Bord Pleanala. The proper procedure in such cases is to refer the matter to the Bord under Section 5 of the Local Government (Planning and Development) Act, 1863 and these references are a frequent response where there is a degree of conflict between the developers perspective and that the local authority.

It is therefore difficult for a planning authority in trying to assess the broad implications of the impact of a proposed development on water quality to be sure precisely where the responsibility for water control rests given the variety of the various bodies which have some input[15].

Exempted Developments

A major weakness of the Planning Acts as a mechanism for the protection of water quality is the range of exempted developments which are provided for under the Acts whereby certain types of development will be exempted from the requirement to obtain planning permission.

For the most part these are developments of a minor nature that would have no impact on water quality, like a small extension to dwelling houses, or the provision of advertising structures and similar types of development. However the regulations contain significant exemptions relating to agricultural buildings.

Under the 1977 Regulations Part III, classes 7,8 and 9 contain significant exemptions in relation to agricultural buildings.[16]

There is a further argument that if the provisions in Section 4(1)(a) of the 1963 Act are read in a particular way it might be permissible to use any of these buildings for agricultural purposes as Section 4(1)(a) provides that the use of any building for the purpose of agriculture is in itself exempted development[17].

The effect of these exemptions is to remove from the formal controls under the Planning Acts a range of buildings with significant pollution potential and therefore the ability of the Planning Acts to be a mechanism for the control of water pollution is significantly weakened.

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15 Many of these organisations, who often have great expertise, are as a result excluded and their expertise and advice are not always called upon. It is therefore absolutely essential that some reorganisation of responsibilities or at least clarification occurs so as to make sure that the various statutory bodies which have some input of control or protection of water quality be integrated to a significantly greater extent.

16 It is permissible for example to construct a building for the keeping and housing of pigs, cattle, sheep or poultry which has a floor area not exceeding 300m^2 and any ancillary provision for effluent storage. A similar exemption relates to the provision of roofless cubicles, open loose yards, self feed silos, feeding aprons, assembly yards, milking parlours, sheep dipping units, etc. Again, a total floor area of 300m^2 can be constructed without the requirement to obtain planning permission and the exemptions are much greater if the agricultural building proposed is a building not coming within either of the two classes already mentioned. Again it is permissible to construct a building up to 300m^2 but in fact this provision allows for buildings up to 900m^2 to be constructed without the requirement to obtain planning permission in certain circumstances.

17 Given the pollution potential of agricultural buildings and the nuisance value attached generally to such development it is difficult to reconcile the extent of the exemptions given under the 1977 Regulations to agricultural buildings when one compares with the similar exemption for the rather innocuous extension to a domestic dwelling house which extensions if they exceed an area greater than 23m^2 will require planning permission. Indeed there are no exemptions at all contained in the legislation whereby any industrial buildings can be extended even for light industrial buildings. If the proposed building to be extended even by a square metre then planning permission will be required.

development and the planning authority will be required to deal with the planning aspects of the proposed development. Indeed under the provisions of the EPA Act, Section 98(b)(1), a planning authority in dealing with an application for permission or an approval for any development shall not consider any matter relating to the risk of environmental pollution from the activity. This means then that aspects like water pollution and the disposal of waste should not form any part of an assessment of the planning aspects of a proposed development.

This in my view will lead to a very difficult situation for planning authorities in dealing with planning applications.

The First Schedule lists the kind of activities which will require an integrated licence under the provisions of the 1992 EPA Act. For example, under point 6.1 of that Schedule the rearing of pigs in installations whether within the same complex or within a 100m of that complex where the capacity exceeds 1000 units (3,000 units on some soils) will also require an integrated licence[19].

However, where such an application is submitted to a planning authority it will generally be accompanied by an environmental impact statement [20]. The planning authority is expressly prohibited from considering issues like the water pollution and waste aspects arising from this proposed development. They will be restricted to considering the planning aspects of the development. It seems to me virtually impossible to consider a planning application for a development of say a 1000 unit pig rearing installation without having regard to the type of waste that will be generated and the type of water pollution impacts that would be associated with such development. The environmental impact statement accompanying the application should contain a description of the likely significant effects both direct and indirect on the environment of the development explained by reference to its possible impact on human beings, flora, fauna, soil, water , air climate, landscape and the interaction between these. However a planning authority in assessing this environmental impact statement cannot have regard to those aspects which deal with water pollution or waste and therefore the effectiveness of an EIS in this context must surely be open to question.[21]

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19 The rearing of poultry in installations whether within the same complex or within a 100m of the complex where the capacity exceeds 100,000 units will require an integrated licence under the EPA Act.

20 It would appear that the thresholds in relation to pig rearing units for instance, correspond precisely with those which require an Environmental Impact Assessment under the the 1989 EC EIA Regulations.

21 What will happen is that local authorities will continue to operate as they have done and will continue to look at the water pollution aspects of development which are submitted to them for planning permission. They will also in many instances have to include conditions which will deal with the disposal of waste to some extent at least, as even if one was to comply with the requirements of the EPA legislation, some matters like smells and residential amenities for example, will require some assessment of the impact of waste and waste disposal. However, the whole situation of the confused nature of water pollution legislation is simply magnified by the introduction of the EPA and the method which will be used within that Agency to deal with waste and water pollution to the exclusion of the local authority which will be dealing with the planning application. It always struck me that the proper approach for the EPA would have been to deal with an integrated licence which would not only deal with the planning aspects but also with the water pollution aspects and determine the entire applications as a single entity but perhaps with schedules to the licence, some of these schedules should be capable of review and others not. However the path taken has been to add an additional layer of bureaucracy on to the existing controls procedures and it will mean that the current contacts that often exist between water pollution agencies and planning authorities will not be replicated given the geographical distance between many of these authorities.

Of course, for those developments which are not specified in the schedule to the EPA Act the local authority will continue to operate as it has always done so that the layer of complexity of the entire water pollution control system has now been intensified to an extent far beyond what was the case before the EPA and this is hardly the proper solution in all the circumstances of the case.

CONCLUSION

It is generally accepted that the controls under the Planning Acts can and should be used more effectively to deal with the issue of water pollution. It should operate in such a way as to integrate as assessment of the water pollution potential of the proposed development into the planning control process.

In granting planning permission it would therefore be assumed that the proposed development should be capable of being controlled in a reasonable way so as not to give rise to the threat of water pollution. It would be a statement to the effect that in the context of the location and the type of the proposed development it is reasonable, having regard to the threat to water pollution, that it should be located where it has been proposed.

However such planning permissions should not deal with the precise treatment or the nature of the effluent as this is the proper preserve of conditions under the Water Pollution Acts. Conditions under the Planning Acts are not suitable for dealing with the nature of the effluent because they are immutable and are not subject to review. If the Planning Acts are to be more effectively used to control water pollution there needs to be rationalisation on the part of the authorities in dealing with licences under the Water Pollution Acts and planning permission under the Planning Acts. It is considered that the authorities dealing with both sets of permissions should be the same so that they can liaise closely and ensure that the approaches on both points are integrated to the maximum possible extent.

Further there needs to be at least a clarification of the role of other statutory bodies like Health Boards, the Office of Public Works, Fisheries Boards, EBB etc. who have functions in relation to the protection and control of water quality and if at all possible a rationalisation of these functions [22]

The range of exemptions under the Planning Acts needs to be reduced and in particular the range of agricultural exemptions needs to be eliminated if the Planning Acts are to control water pollution effectively. If such is not possible then at least some provision requiring those

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[22] Something like the National Rivers Authority in England might be an appropriate model on which to base such an organisation. However again such an organisation should correspond in as far as possible with the particular planning authority.

developments which may be exempted to show to the relevant authority that they will not give rise to any threat of water pollution should be built in rather than the present inadequate system of showing that they have adequate facilities for the storage of effluent.

In my view, also the Environmental Protection Agency should be reconstituted so as not to be a separate organisation acting independently of local authorities but should be integrated so as to work with the local authorities not only with those developments specified but other developments which may because of unique circumstances existing be particularly sensitive.

A single organisation then which would have access to the advice and expertise which would be contained in the EPA but would still be operating at a local level would be highly effective in ensuring that the planning and water pollution aspects of a proposed development were assessed to the maximum possible extent. It is surely possible to come up with a system whereby there would be a single permit system which could be set out in schedules of the planning, water pollution, air pollution and waste provisions and which would be integrated in this fashion. It would also be possible under such a system to design some of these schedules to be capable of being reviewed. This would have major advantages for developers who would be required only to make a single application and would be aware that it would be assessed in an integrated way. It would have advantages for the local authority in that it would rationalise the staff available to deal with those applications and would avoid the duplication which presently exists.

Environmental organisations would have all the information on a particular development at their disposal and would not need to fight a number of different battles for a particular development. For Forbairt it would be a major selling point to foreign industry to be able to say that there is only be one control system in operation which deals with all the planning, water pollution, air pollution and waste aspects of a proposed development. The situation at present with the confusion as to the precise role of planning authorities vis-a-vis water protection, the general protections for potentially major polluting developments like agricultural buildings, the duplication of statutory bodies with responsibility for water pollution controls not conducive to the prevention of water pollution nor to the proper assessment and control of developments likely to give rise to such pollution. Recent initiatives likes the foundation of the EPA have to some extent exacerbated these problems rather than resolved them.

CONSISTENCY OF LABORATORY DATA

Introduction

Many studies have shown that analytical results are frequently subject to serious errors and often at the low concentrations found in water analysis. Incorrect analytical data can give rise to misleading interpretations of information and can adversely affect decision-making processes. This can be particularly significant in the area of water analysis where data has been obtained to monitor adherence to some compliance standard. From a global perspective it is becoming increasingly clear that activities in one country can have a serious impact in other countries or even continents, and it is therefore essential that laboratories in different countries be able to mutually compare analytical data with confidence.

Approach

A laboratory must have a *Quality Assurance* programme in place in order to help ensure the quality of its data. The usual features of such a programme are

Internal Quality Control
External Quality Control
Accreditation

INTERNAL QUALITY CONTROL

Appropriate internal and external quality control procedures help to provide confidence in analytical results. Correct use of internal quality control procedures allow a laboratory to have confidence in results produced by individual methods and by individual analysts.

Elements of an Internal Quality Control Programme

Define analytical objectives for each test.

Choose *appropriate* written analytical methods. Should choose validated methods.

Have in place a programme for maintaining and calibrating instruments, balances, incubators, ovens etc.

Ensure accuracy of standard solutions including appropriate use of blanks.

Estimate within-laboratory precision using spiking recovery and replicate analyses.

Establish quality control charts.

EXTERNAL QUALITY CONTROL

This is best illustrated by a brief description of the inter-laboratory calibration programme for local authority and regional laboratories which was set up in 1993 under the STRIDE (Science and Technology for Regional Innovation and Development in Europe) programme for Ireland.

1. Introduction

An intercalibration quality control programme for laboratories engaged in environmental testing was established at the beginning of 1993 under Measure 2 of the Environment Sub-Programme of the EC STRIDE Operational Programme for Ireland 1991-1993.

Inter-laboratory calibration which is also known as proficiency testing, collaborative testing and round robin testing is an essential component of a laboratory's quality control programme. It supplements the laboratory's own intra-laboratory quality control system as a means of detecting and guarding against errors which would otherwise lie undiscovered.

The International Standards Organisation (ISO) has recently published a protocol on harmonised proficiency testing which sets out minimum procedures for organisations running proficiency testing schemes.

Proficiency testing is defined in the ISO protocol as "the system for objectively checking laboratory results by an external agency. It includes comparison of a laboratory's results at intervals with those of other laboratories, with the main object being the establishment of trueness".

Need for Proficiency Testing

It may be necessary to demonstrate the quality of a laboratory's analytical results to a number of agencies in order to show that the laboratory can produce consistently reliable results on a continuing basis. These may include staff and management within the laboratory itself or the parent organisation, its clients (anyone who uses the data e.g. DOE, EC), accreditation bodies (e.g. Irish Certification and Laboratory Accreditation Board known as ICLAB) and regulatory bodies (e.g. EPA, Local Authorities).

Proficiency testing provides an independent and objective means of assessing and confirming the continuing reliability of laboratory data.

2. EPA/STRIDE Programme

Status of Programme

The intercalibration programme was operated from the ERU laboratory at Pottery Rd. and funded by STRIDE until the end of 1993, but with the long term intention that these exercises would become the basis for a continuing national programme to be implemented by the Environmental Protection Agency which has now been established.

Section 66 of the Environmental Protection Agency Act 1992 provides for the establishment by the Agency "of, an analytical quality control programme involving its own laboratories, laboratories provided and operated by local authorities and such other laboratories as it deems appropriate from which data are submitted to the Agency".

The STRIDE programme finished at the end of 1993 but the EPA have undertaken to continue the intercalibration programme for the present year at least.

Aims of STRIDE Inter-laboratory Programme

The main objective of the programme under STRIDE was to measure each laboratory's performance with the aim of improving the quality of data.

An additional and related objective was to encourage participating laboratories towards accreditation in accordance with the ICLAB scheme. In this context it is important to point out that the EPA Act also stipulates that laboratories which supply environmental data to the Agency may be required to be accredited under I.S./EN45001 which is standard developed by the European Commission for the accreditation of testing laboratories. It should also be appreciated that participation in a programme of inter-laboratory comparisons is an important requirement for laboratory accreditation.

Participants

Participation in the programme under STRIDE was confined to local authority and regional laboratories but with the intention that when the programme would acquire official status under the EPA Act it would be broadened to include all laboratories sending data either directly or indirectly to the Agency. For 1994, the participants will also include some of the larger laboratories doing agency or contract work for local authorities. Communication with participants is usually with the person who is designated by each local authority as being in immediate charge of the laboratory and is in the form of a report at the end of each round and an occasional letter or newsletter. Telephone contact is often made when there are particular problems with the data and advice is offered where appropriate. Feedback from the laboratories is encouraged so that participants can be involved in contributing to the development of the scheme. A meeting of participants was held in November 1993 and it is intended to follow this with further periodic meetings.

Test samples

Up to four categories of sample were distributed with each round as follows:

Category 1 was a natural drinking water type sample with analysis required for the routine EC Drinking Water parameters i.e. Colour, Turbidity, pH, Conductivity, Aluminium, Iron, Fluoride, Total Hardness, Chloride, Alkalinity, Sulphates.
(Certain common parameters in this category, e.g. odour, taste, chlorine residual and temperature which are not readily amenable to intercalibration were not included in the programme).

Category 2 was an environmental type sample to be analysed for BOD, COD, Ammonia, Nitrate, Nitrite. Orthophosphate. In this category is now included a sample for Suspended Solids analysis where the contents of a vial containing a mixture of soluble and insoluble substances is mixed in water and filtered in the usual way.

Category 3 contained the common trace metals in a solution of distilled water.

Category 4 consisted of known concentrations of the common nutrients (ammonia, nitrate and phosphate) in distilled water.

Generally, duplicate analyses were requested in order to arrive at some estimate of within-laboratory precision. Analysts were urged to give no more or no less attention to the intercalibration samples than to the routine day to day samples as the exercise was intended to measure the *average* performance of the laboratory.

Sample Matrix

According to the ISO protocol the test samples must be generally similar in type to the laboratory samples that are routinely analysed, both in respect of the composition of the matrix and the concentration range of the determinand. This was adhered to as far as possible but there are some parameters where difficulties did arise. Samples requiring metals analysis containing substantial amounts of suspended solids, for example, require a considerable degree of work-up prior to the actual analysis whereas the intercalibration sample was made up in distilled water.

Frequency of Samples

The ISO protocol indicates that sample distribution frequency should be between two weeks and four months. A frequency of greater than two weeks would lead to some laboratories viewing proficiency testing as a substitute for internal quality control and it is believed that a distribution frequency of much less than four months would "lead to unacceptable delays in identifying analytical problems, it will be difficult to monitor meaningful trends in a laboratory's performance and the impact of the scheme on the participants is likely to be small".

The frequency of the STRIDE distributions was approximately once every two months which is consistent with the ISO proposals.

Development of Programme

Because of the large number of laboratories (now 41) participating in the water and waste water area of the intercalibration programme, it was necessary to divide the laboratories into two groups. A schedule was drawn up for each group with the intention that each laboratory would receive six sets of samples, at about two-monthly intervals, by the end of 1993. Five rounds of chemical samples and one round of bacteriological samples were distributed according to the schedule and a report issued to the individual laboratories for each round. Each laboratory was issued with a confidential code number which allowed it to compare its performance with the other laboratories. The participation rate in the programme was almost 100%.

A set of samples for Smoke and SO_2 analysis was also distributed to those laboratories engaged in air measurements.

Performance Assessment

For each parameter the operator's result was compared with the results of the other participants and the *true value.*

Bias estimate is given by $x - X$
where x is an operator's result and X is the true value.

Depending on the analyte either (a) or (b) was used to arrive at the best estimate of the true value.

(a) mixing known concentrations in matrix
(b) averaging results from the participants (after exclusion of outliers)

Most proficiency testing schemes compare the bias estimate (as defined above) with a target value for standard deviation (σ) that forms the criterion of performance.
A common approach is to use the z score system as given by

$$z = (x-X)/\sigma.$$

Clearly the value of σ chosen is crucial and can be arrived at in several ways:

(a) Estimation of the actual variation (s) from the data from each round after elimination of outliers. A value of s and consequently z will thus vary from round to round.

(b) The value of σ could be given as an estimate of the precision required for a specific task of data interpretation. This is the most satisfactory criterion providing all the participants are using the data for the same purpose because it relates directly to the requirements of the data. This is frequently used in legislation where method performance characteristics are often specified (e.g. EC Surface Water Regulations, 1989, Part IV).

(c) Where a standard method is prescribed for the analysis, σ could be taken as the standard deviation obtained during collaborative trials.

(d) The value of σ could be fixed arbitrarily based on a perception of how laboratories either should or do perform. Unfortunately, perceptions and hence of course σ can change with time thus disturbing the continuity of the scoring scheme. However, this approach can have certain advantages particularly where the main objective is to improve performance.

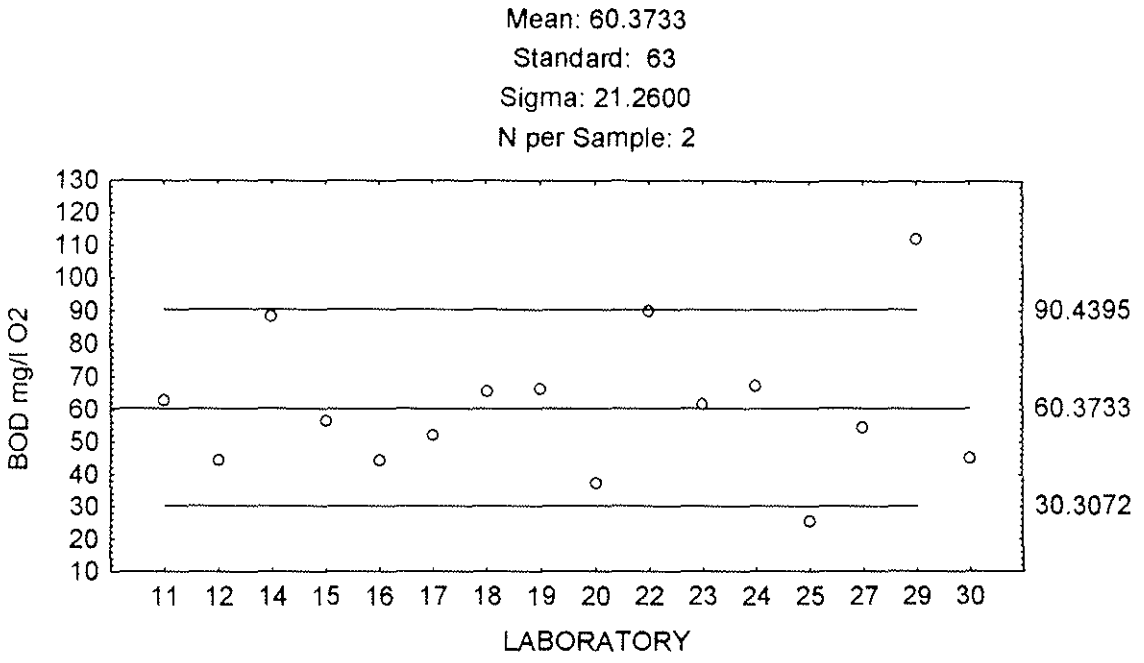
Interpretation of z scores

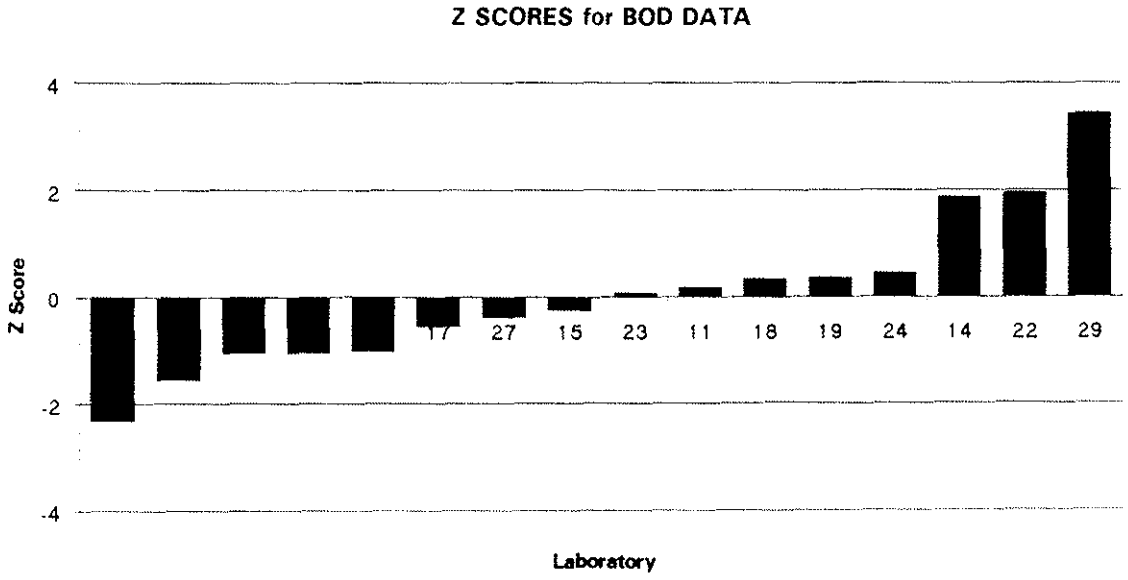
If X and σ are given as estimates of the population mean and standard deviation then, assuming that the underlying distribution is normal then z would be approximately normally distributed with a mean of zero and a standard deviation of zero. It can be readily appreciated that a value of $|z| < 1$ would be very common and $|z| > 3$ would be relatively unusual in a well behaved system. Generally a $|z|$ score of < 2 corresponding to a variation of two standard deviations and which would equate to the "warning levels" on a quality control chart are taken as a robust cut-off value.

In the case of the EPA programme the main objective to date has been to improve performance and awarding of scores on a pass or fail basis has not been a priority.

Examples of Evaluation of Performance

The example given below shows a typical presentation of the individual means of the BOD data from one of the rounds illustrating in the first plot both the standard or target concentration and overall mean along with tolerance levels of two standard deviations. The sample was artificially spiked to give a target concentration of 63. It can be seen that, in this case, the target value and the mean are so close as to make almost no difference. The second plot shows the distribution of the z values for the same data.





Air Analyses

One round of distributions took place for Sulphur Dioxide and Smoke measurements in the context of the Air Quality Standards Regulations 1987 and the EC Directive 80/779/EEC.

The exercise consisted of the distribution of samples as follows:

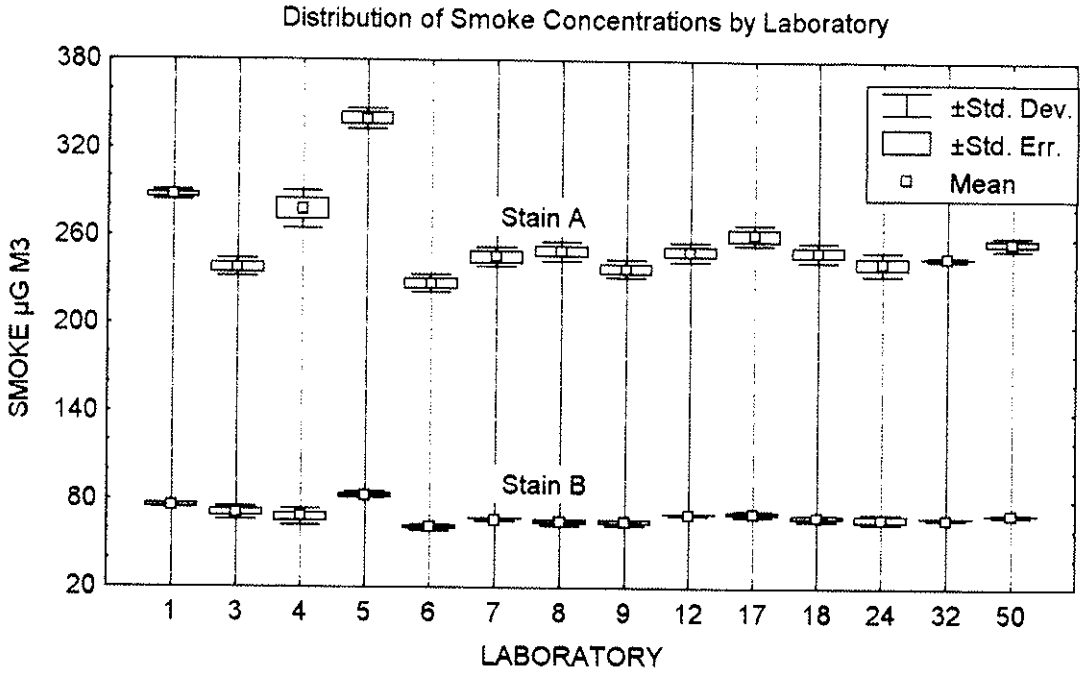
1. SO_2 Measurements

A sample of a weak acid of approximately the same strength as a typical SO_2 sample was distributed by post to the participating laboratories towards the end of October 1993. The participants were asked to titrate the samples within a week of receipt.

2. Smoke Measurements

At around the same time, a set of normal smoke stains which were generated at a typical measurement station was circulated among the participants. Analysts were asked to post the sample stains to the next laboratory on the distribution list on completion of their measurements.

The data for the smoke distributions are given below and it can be seen that overall agreement was quite good in the majority of cases.



LABORATORY ACCREDITATION

Laboratory accreditation is a formal recognition that a laboratory is competent to carry out specific tests. Laboratory accreditation is operated in this country by the Irish Certification and Laboratory Accreditation Board (ICLAB).

Laboratories which are accredited are required to operate with technical and commercial integrity and be able to demonstrate that they can perform the analyses for which they are accredited competently, with the required degree of accuracy and with impartiality. In turn, accreditation by ICLAB demonstrates that a laboratory has been thoroughly assessed by a team of specialists and has been recognised by an independent national body as competent. Accreditation by ICLAB establishes that a laboratory is operating in accordance with European Standard EN45001, "General Criteria for the Operation of Testing Laboratories", for a specific range of tests. The EN45001 Standard is part of the EN45000 series of European Standards developed for the accreditation of testing laboratories by the European Commission and published by CEN/CENELEC.

Laboratory accreditation provides, among other things, a widely recognised *external* verification that a suitable QA scheme is in place.

In order to qualify for accreditation laboratories much satisfy a range of criteria in the following areas:

- Organisation and Management- The organisational structure in which the laboratory operates must be fully described. A staff organisational chart is usually required.

- Quality Audits and Reviews:- Laboratories are required to maintain a system of periodic internal quality auditing to check on implementation and effectiveness of internal quality control procedures.

- Equipment:- Should be suitable for the analysis and be properly maintained.

- Staff:- Including qualifications and training of named individuals who are deemed competent to carry out specific tests.

- Methods and Procedures:- These must be fully written up and revised as appropriate.

- Handling of Samples There must be a procedure for the reception, registration, storage, and identification of samples.

- Measurement Traceability and Calibration:- There must be a satisfactory system for calibrations of tests. This should include participation in an external quality control scheme.

- Laboratory Accommodation and Environment:- These should be maintained in a suitable condition and must not adversely affect the test. Access to testing areas must be controlled.

- Complaints:- A documented policy and system of recording complaints relating to the laboratory must be in place.

- Records and Reports:- There must be a policy on issuing reports as well as maintenance and retention of records.

Sub Contracting of Tests These should be for exceptional tests only and, whenever practical, using an accredited sub contractor.

The above mentioned criteria must be set out in a Quality Manual which is available to laboratory staff and which must remain relevant and up to date.

The accreditation process comprises a number of different stages.

STAGE 1 Familiarisation with the documentation from ILAB.

STAGE 2 An internal review should be carried out to establish to what extent the laboratory's own procedures and documentation match up to the requirements of ILAB.

STAGE 3 The deficiencies identified in Stage 2 should be corrected and the Quality Manual written up.

STAGE 4 Application should then be made to ILAB after which an assessor who is acceptable both to the applicant and to ILAB is appointed. At this stage a fee is also assessed. It is usually desirable that a final internal review or audit be carried out just before the external assessment.

It is estimated that the preliminary work prior to formal application would generally take around 12 months and may take considerably longer if the laboratory is particularly busy and if a large number of tests are required to be accredited. It is important to emphasise that it is not necessary that all tests carried out by the laboratory be accredited at the same time. It is quite acceptable to obtain accreditation for a small number of tests initially and then at a later stage to apply for a larger number of tests according to requirements.

If the assessment is satisfactory, a Certificate of Accreditation will be granted by ILAB. In many cases, however, minor deficiencies will be discovered which may require a return visit by the assessor before accreditation is granted. In order to ensure that laboratories maintain ILAB standards, the laboratory may be subject to periodic surveillance visits which are often unannounced. It will be seen that the process of undergoing and maintaining accreditation is not to be undertaken lightly. For most laboratories there would be a very substantial amount of preparatory work involved in this process particularly in the areas of calibrations and documentation and perhaps also with equipment and accommodation and environment.

CORK COUNTY COUNCIL

NORTHERN DIVISION

Economic Feasibility Study

For

NATURAL ENERGY CENTRE

AT

MALLOW

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Mallow.

This Study was part-funded by the Altener Programme

LIST OF CONTENTS

SUMMARY

OF

ECONOMIC FEASIBILITY STUDY OF

NATURAL ENERGY CENTRE PROPOSALS FOR MALLOW.

1. OBJECTIVE OF THE STUDY:-

The purpose of this present Study is to ascertain the financial viability of a Natural Energy Park located in Mallow Town. This Study would examine each of the proposals made in the 1991 Report and establish if these were viable in the case of Mallow. Further relevant ideas were to be investigated and information obtained about similar centres already established in Europe e.g. Wales, Greece, Denmark, etc. The Study was to incorporate the costing of the proposals, both the capital and annual running costs as well as establishing the job potential of the Project.

In November 1993 Cork County Council engaged a firm of Consultants, CAAS Environmental Services Ltd., to undertake this Study, the energy part of which they sub-contracted to Hyperion Ltd.

This Study was to be carried out in two phases, Part 1 is now complete and is now summarised below.

(2) BACKGROUND TO STUDY

(a) History of the Mallow Spa

One of the earliest references to the Mallow Spa was by Dr. Charles Smith, the historian of Cork City and County in 1749. He described some of the cures reportedly related to drinking the Spa Water and this resulted in the doctors, at that time, advising their patients to go to Mallow to "take the waters". Mallow soon became known as the "Bath of Ireland". Mallow developed initially as a medical spa and people went there for cures.

Facilities were developed locally for the visitors, initially medicinal, but entertainment was also provided for the patients and soon the social (tourist) content became as popular as the medicinal aspect. Various "Assembly Rooms" were built where dining, wining and dancing was the order of the day, giving rise to the famous song, "The Rakes of Mallow". The present day "Spa House" was built in 1828. The Mallow Spa was in full operation from 1725 - 1850, by which time fashions and the political scene had changed and Mallow fell out of favour as a resort.

(b) Scientific Investigation of Mallow Springs

The warm springs at Mallow are classified as Low Temperature Geothermal Springs. They have been subjected to scientific investigations going back to Dr. Rutty in 1757, who published "Mineral Waters in Ireland", which was a scientific/medical publication. Geological investigations began in 1834 and the more recent work in the 1980's and 90's has been promoted and funded by Cork County Council and the E.C.

Investigations were carried out by Geological Surveyors of Ireland and geological/hydrogeological consultants and drilling contractors, as well as the Geology Department of University College, Cork. The end result of these recent investigations is that there are now two production wells in Mallow which together are capable of producing 30,000 gallons per hour of water at $20^{o}C$. (N.B. $10^{o}C$ is the standard temperature in this County for groundwater). Part of the water from one of these wells is used to heat the Mallow Swimming Pool.

In 1991 a detailed technical feasibility study was carried out by the County Council into the alternative uses of this natural resource. Essentially the findings of that report can be summarised as follows:-

(a) The development of a Natural Energy Park in Mallow and

(b) The promotion of spa tourism to the level it currently enjoys in some European Countries.

(c) Current Altener Study

In 1993, Cork County Council applied for grant aiding under the E.C. Altener Programme to fund the carrying out of a detailed financial viability study of the Natural Energy Park proposals.

Notice of grant approval under Altener was received in October, 1993. This financial viability study was commenced immediately and the final report was completed in April, 1994.

A summary of the main findings of this report is now summarised in the following chapters.

3. PROPOSED ENERGY TECHNOLOGIES FOR THE CENTRE:-

The purpose of the Natural Energy Centre is to demonstrate natural energy technologies and to facilitate research and development into these technologies. As yet there is no Natural Energy Centre in Ireland (unlike other Countries in the E.U. see Chapter 7) and Mallow being the only town in the country with a geothermal resource is the ideal location for such a Centre.
A summary of the proposed technologies to be addressed in the Natural Energy Centre are as follows:-

(a) Use of Geothermal Water:- This resource, unique in Ireland in an Urban Area, has immediate applications in the areas of (1) home heating (2) aquaculture and (3) horticultural developments.

(b) Solar Energy:- This is regarded as feasible as it can be incorporated into existing and newly renovated buildings in the Town.

(c) Photovoltaics:- This is the conversion of light energy into power. It can be used for a wide use of domestic and commercial activities e.g. in water pumping, lighting, refrigeration, telecommunications and leisure activities.

(d) Biomass:- This involves the growing of energy producing crops which are particularly appropriate for growing on set-aside land. Demonstration and research into the production and processing of biofuels would have local potential e.g. biofuels from oil seed rape, etc.

(e) Hydro Power:- The possibility of low-head turbine research and demonstration is applicable in the case of Mallow, on the Blackwater.

(f) Wind Power:- Research and demonstration into single mast windmills could be done in the Mallow context.

(g) Energy Conservation:- Demonstration of energy efficient buildings, energy auditing, energy rating, etc., would be an important aspect of the Parks activities.

Because this proposed Centre will be located in an Urban Area, which in itself is unique in Europe, demonstration of these technologies will be integrated into the existing town fabric. An example of this already in place, is the Urban District Council swimming pool, being heated by a heat pump using water from one of the geothermal wells. Plans are in hand to refurbish the swimming pool and active consideration is being given to the incorporation of other natural energy technologies into this building. This is an example of the type of demonstration projects that we envisage.

4. COMMERCIAL POTENTIAL OF THE CENTRE:-

(a) Natural Energy Research Centre:-

In 1992 a report on the future of renewable energies in Europe was presented to the European parliament. A vote on the recommendation to support further research and development on renewable energies resulted in 240 in favour and 0 against the proposal. A major result of this vote has been an increase in the budget for research, development and demonstration on renewable energy in the period 1994 - 1998.
This is a major opportunity for Irish researchers to obtain funding and to develop their expertise.

Research and development in renewable energies in Ireland has produced some very successful results but its true potential has been restricted mainly to:
* inconsistency of funding
* systems which were installed were only operated for the duration of the experiment (typically 3 years)
* the turnover of research staff has been high as most researchers completed the work as part of their post graduate studies.
* new contracts could not be obtained due to the unavailability (or poor operation) of installed systems
* researchers were responsible for the day to day maintenance and administration of systems in addition to their research duties.

The Natural Energy Centre could be used as a base where renewable energy systems could be operated and maintained by the staff of the centre and the researchers could concentrate on their specific experiments. This would ensure that any investment in renewable energy systems could be used for long term research and that research groups with a small number of specialists could undertake high quality research using the facilities of the centre.

The success of the park as a base for research and development in renewable energies will depend on the links it establishes with Irish research groups. In view of the increased budgets for this research the timing for such a joint venture is ideal.

(b) Training, education and consultancy:-

The most relevant market for the above services is the developing countries. Funding for these services come from the Irish Department of Foreign Affairs and International Organisations such as the United Nations (WHO, UNESCO, FAO, World Bank). In addition to the above every developed country has a programme to support the developing countries and these are willing to buy services in renewable energies for developing countries. The concept of the energy centre should be described to these organisations and an overview of their special requirements should be compiled. The marketing of the energy centre to International Organisations could be done through conferences which are organised on 'renewable energies for developing countries'.

At home, the market should be pursued in conjunction with RTCs and Universities who could assist in the development of syllabi and short courses and accredit them (in some cases formally), thus raising their credibility, particularly in the early stages of Centre development.
Marketing should be approached through
* Direct mailshots to schools
* Telephone calls to relevant staff
* Free publicity through a paced programme of special activities.

(c) Support structures for manufacturing etc:-

The manufacture of environmental products has for long been seen by the European Commission as a possible vehicle of regional development. In practice, this has proved to be difficult to implement as a policy, not least because the potential customers, many of whom lie in the European core areas, require a build, install and maintain package which is difficult to operate from the European periphery. It may be, therefore, that most success will be had in the development of component products related to alternative energy, rather than complete systems. In any event, the existence of a 'showcase' for Irish products will be a definite advantage.

Identification of manufacturing opportunities as a result of the demonstration and experimental work which the Centre will undertake could be done. Also exploitation of these niche markets using contacts built up through the activities of the Park could be achieved.

(d) Tourism development:-

It is important that the market for the Natural Energy Centre be addressed and clearly identified. This market would appear to be comprised of a number of clear segments, linked either to the Centre itself or to the proposed health tourism product, though these overlap in some cases.

1. The Spa tourism market, based for the most part, but not exclusively, on continental European visitors

2. The green tourist interested in alternative energy or 'clean' energy. (The combination of a Spa holiday and a foreign holiday for European visitors)

3. The Schools market, for the educational aspects of alternative energy

4. Scientific visitors
5. Gracious living tourists
6. Family day-trippers

(e) Other Sources of Income:-

1. Courses on renewable energy.
2. Sale of information.
3. Sale of products.
4. Sale of services.
5. Product testing facilities.
6. Sourcing of components.
7. Energy Auditing.

5. FORM/STRUCTURE OF THE ENERGY CENTRE:-

This chapter sets out the physical infrastructure required by the Park under the following headings:

* New or refurbished central building facilities
* New or refurbished ancillary building facilities
* Free standing energy related hardware
* New energy efficient demonstration buildings
* Refurbished energy efficient demonstration buildings
* Installed equipment (in buildings etc)

It also sets out the requirements regarding the physical proximity of activity and buildings to each other as well as to the town, and linkages to industrial plant and to proposed tourism developments within the town as well as proposed urban renewal programmes.

Because this Centre is going to be located in the Urban Area, particular emphasis will be given to incorporating as many elements of the Centre as possible into the existing town structure. This will be achieved by building new structures in vacant plots within the town and/or refurbishment of existing buildings. Recently Mallow has been designated as an Urban Renewal Area which means that there will be major financial inducements available for investors/developers.

6. LINKS WITH THIRD LEVEL INSTITUTIONS:-

Six ways in which these Institutions can usefully interact with the park have been identified.

The first three of these relate to training and educational needs that could be fulfilled by the Park:

1. Purchase of support services and technical infrastructure from the Park.

2. Provision of specialist research staff for contracts won by the Park from Europe and elsewhere.

3. Use of the Park facilities for teaching, under and postgraduate research.

The last three relate to services that the Institutions could provide for the Park.

1. Assistance in establishment of the basic facilities of the Park.

2. Assistance in the marketing of the Park.

3. Provision of teaching staff for day and residential courses at the Park.

The presence of permanent technical staff, maintaining and operating the various research facilities will provide the researchers from third level institutions with continuity in the maintenance and monitoring of research equipment.

7. LINKS TO INDUSTRY:-

Energy consumption in industry can be a significant part of the annual turnover so any potential savings in this would be of major benefit to industry. Other advantages to industry are as follows:

(1) Ready access to research and consultancy services related to natural energy.

(2) Assistance and information on applying for EU funding.

(3) Supplying information on all aspects of energy e.g. conservation, energy auditing etc.

For suppliers and manufacturers of renewable energy components, the Centre would provide:
(a) Information on potential markets
(b) Centre for sales and display of products
(c) Independent testing and accreditation facilities.

For consultants in the field of renewable energy it is intended that the Centre would provide the following:

1. Information on the market
2. The issue of an accredited list of consultants
3. Information on sources of renewable energy components
4. Up-to-date technical know how and library facilities.

8. SIMILAR CENTRES IN EUROPE:-

There are several Renewable Energy Centres in Europe which are similar in theme to what we propose e.g. Centre for Alternative Technology in Wales, Folkecentre in Denmark, Centre for Renewable Energy Systems in Greece and the Nordic Centres. Of particular interest are the Centres in Wales and Denmark.

Centre for Alternative Technology in Wales:

The Centre for Alternative Technology is situated near Machynlleth in Mid-Wales. It has been open to the public for twenty years.

It is located on a forty acre site and has working displays of wind, water and solar power, low energy buildings and organic growing.

The activities of the Welsh Centre, which has 100,000 visitors annually, include the following (a) Educational and Residential Courses (b) Trading Activity (shops etc) (c) Dissemination of information and (d) Informative and expert services. In 1992 the total income for the Centre amounted to £750,000 approximately.

Folkecentre in Denmark:

The objectives of the Folkecentre are to promote the dissemination of know-how and information and to develop renewable energy technologies designed for manufacturing in small and medium scale industries.

Over the past 8 years the Folkecentre claims to have acquired in depth knowledge on solar energy, wind energy, bio-gas and co-generation, as well as integrated systems. The Folkecentre has also designed several systems for third world conditions. All systems are of a modular design and can be adapted to local conditions in Denmark and in other countries.

The Folkecentre is organised with technical divisions for wind energy, solar energy, bio-gas/co-generation, measurements and 'green technologies'. The international division organises training programmes, conferences, international co-operation projects and issues the newsletter Renewable Centres Worldwide. Since 1990 the international division has developed a significant number of contacts between enterprises in Denmark and in eastern Europe in the area of renewable energy. It is part of a worldwide network of renewable energy centres.

The Folkecentre for Renewable Energy is an independent institution, supported by the Government and Local Authorities since 1983. Half the annual turn-over is core funding and the other half is obtained as project funding from Danish and International organisations.

A key to the success of the Centre was the extent to which the Local Authority were prepared to back the venture, together with the extent of co-operation of third level and other research institutions.

The Centre regards itself as a service institution with prototypes and experiences being passed on to the private sector.

PART 2:-

Presently the Study is on-going into the financial and manpower elements of the Centre.

ACKNOWLEDGEMENTS

I would like to thank the following who have been associated with this Study:-

Mr. Jonathan Blackwell, CAAS Environmental Services Ltd., 8, Merrion Sq., Dublin 2.

Dr. Sean McCarthy, Hyperion, Main Street, Watergrasshill, Co. Cork.

Mr. Brian Connor , Brian P. Connor and Associates, Tramore, Co. Waterford.

I would like to especially thank Mr. Michael O'Brien, A./Deputy County Engineer, who has been most helpful and who has been associated with various projects on the geothermal water for many years.

I would finally like to thank Mr. Brendan Devlin, County Engineer, for allowing me to present this paper.

IAH PORTLAOISE SEMINAR, APRIL 1994

IMPACT OF GEOLOGY ON GROUNDWATER QUALITY

by
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Abstract

Groundwater resides in a variety of geological regimes which import certain "finger print" characteristics on the groundwater abstracted from these aquifers. For example, the extensive limestone aquifers found throughout Ireland are characterised by hard groundwater with elevated levels of calcium and a pH in the range 7-8. These hard groundwaters contrast with the lower mineralised groundwaters found in the sandstone and volcanic aquifers found in Cork and Wexford.

Groundwaters in less prolific aquifers often display quite dramatic quality variations in comparison to the more regional aquifers. For example, the Wicklow granite and the enclosing meta sediments often display a low pH (5.5) and very elevated levels of iron and manganese. Similarly, the gypsum bearing limestones found in Counties Monaghan and Cavan provide groundwater with a particularly high hardness and sulphate concentrations.

These natural impurities provide a challenge to those using these groundwaters as the treatment processes are often complicated and labour intensive. However, in the absence of alternative water supplies these groundwaters can provide the only available supply of potable and process waters.

IAH PORTLAOISE SEMINAR, APRIL 1994

NATURAL IMPURITIES IN GROUNDWATER : NORTHERN IRELAND

by
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There are a number of problematical impurities of natural origin in various aquifers in Northern Ireland which render the water unsuitable for certain purposes, and even unusable in some cases. Such impurities include:-

(i) iron/manganese - both in shallow sand / gravel and deeper rock aquifers

(ii) salinity - as intrusion around coasts and in very deep aquifers

and (iii) sulphate (Ca & Mg)- mainly in evaporite bearing Carboniferous strata but also locally in Permo-Triassic aquifers.. (Sulphate rich water is used preferentially to make beer at the only major brewery in Belfast).

But perhaps the most unusual problem is the presence of excessive levels of fluoride in groundwater in Carboniferous limestone in a small area of southwest Fermanagh. It first came to attention in the early 1950s through dental research which noted some cases of mottling of tooth enamel in Co Fermanagh suggestive of dental flourosis (which was known from other parts of the world). This led C. McKay of the School of Dentistry, Royal Victoria Hospital, Belfast to conduct a survey of the fluoride content of all the public water supply sources in Northern Ireland plus some 1329 well and spring sources which were in everyday use for private, domestic supply (Sci. Proc. R. Dublin Soc, B, Vol 3, pp 221-49, 1974).

McKay's survey revealed that most of the public water supplies have a low fluoride content usually not greater than 0.1 ppm, although with a significant proportion in the 0.2-0.3 ppm range. None of the Co. Fermanagh public supplies exceeded 0.1ppm. However, the picture as far as private sources was concerned was quite different. In counties Antrim, Armagh, Derry, Down, and Tyrone a small but significant number of wells were found to have fluoride levels of 0.4-0.6 ppm with one well (75 ft. deep) in Tyrone, near Aughnacloy, having 1.4 ppm. In Fermanagh, a few wells containing over 0.4 ppm F were found more or less throughout the county, while several wells near Newtownbutler had around 1.0 ppm. Also a concentration of wells with abnormally high contents up to 5.0 ppm were found on the southern shores of Upper Lough Erne.

McKay followed this up with an epidemiological study of the dental condition of school children in the area (Ulster Med. J., Vol. 43, pp 41-4, 1974.) Some 212 children aged between 5 and 14 years from the four primary schools in the district were dentally examined, their home drinking water analysed for fluoride (none had piped water supplies), and some new high fluoride wells identified one with a level of 10.0 ppm (150 ft. deep). Of the 212 children involved, 150 used well water containing less than 1.0 ppm fluoride, while the others used water ranging from 1.0 to 6.0 ppm. The dental health of the high fluoride group was much better than that of the low fluoride group, over the entire age range.

It was also noted that the high fluoride wells were all much deeper than average, mostly more than 50ft., pH of the high fluoride water was usually not less than 8.0, with elevated hardness, Na and Cl content.

In 1989, we tried to replicate Dr McKay's sampling of wells in the critical area. Fourteen groundwater samples from wells and springs around Knockninny Hill were submitted to EOLAS for determination of fluoride content. Although no very high values were observed, four samples each had 0.3 mg/l F, and one each of 0.4, 0.5 and 0.6 mg/l, but it is possible that none of our sites had been sampled by McKay.

More recently a deep groundwater which is being bottled from a source between Newtownbutler and Clones has been found to contain 2.9 mg/l fluoride.

Groundwater Carbon Dating

David M. Ball

Hydrogeologist

IAH Groundwater Seminar Portlaoise April 1994

This paper is an introductory note on the the environmental isotope Carbon -14 in groundwater, and refers to the initial findings of some recent Radiocarbon dating I have done in Co. Meath. It is also prompted because Dr Ede Hertlendi from Debrecen in Hungary is due to carry out an environmental isotope sampling programme here in August this year.

Carbon commonly occurs in groundwater as the carbonate or bicarbonate ion or as dissolved CO_2 in the form of carbonic acid.

Carbon occurs as three isotopes. Carbon-12 is the abundant stable isotope form (98.89% of terrestrial carbon). Carbon -13 is also a stable isotope (1.11%). Carbon-14 is a radioactive isotope, with an abundance of approximately 10^{-10} %.

Carbon-14 is continuously created in the atmosphere by the action of cosmic rays on nitrogen nucleii. Carbon -14 has a half life of 5730 years. An example of the relationship between time and the decay curve is given as Figure 1.

Radiocarbon dating involves the measurement of all three isotopes, and also an understanding of the origin of the carbon in the water and the processes of solution and dissolution that effects carbonates in the subsurface. I use the term 'subsurface' deliberately because conditions in the soil as well as the groundwater system have a bearing on the amount and origin of carbon available in a groundwater sample. The whole natural hydrochemical process that has controlled the carbon contained in a groundwater sample appears complex. It can be simplified, but even a full simple explanation is beyond the scope of this note.

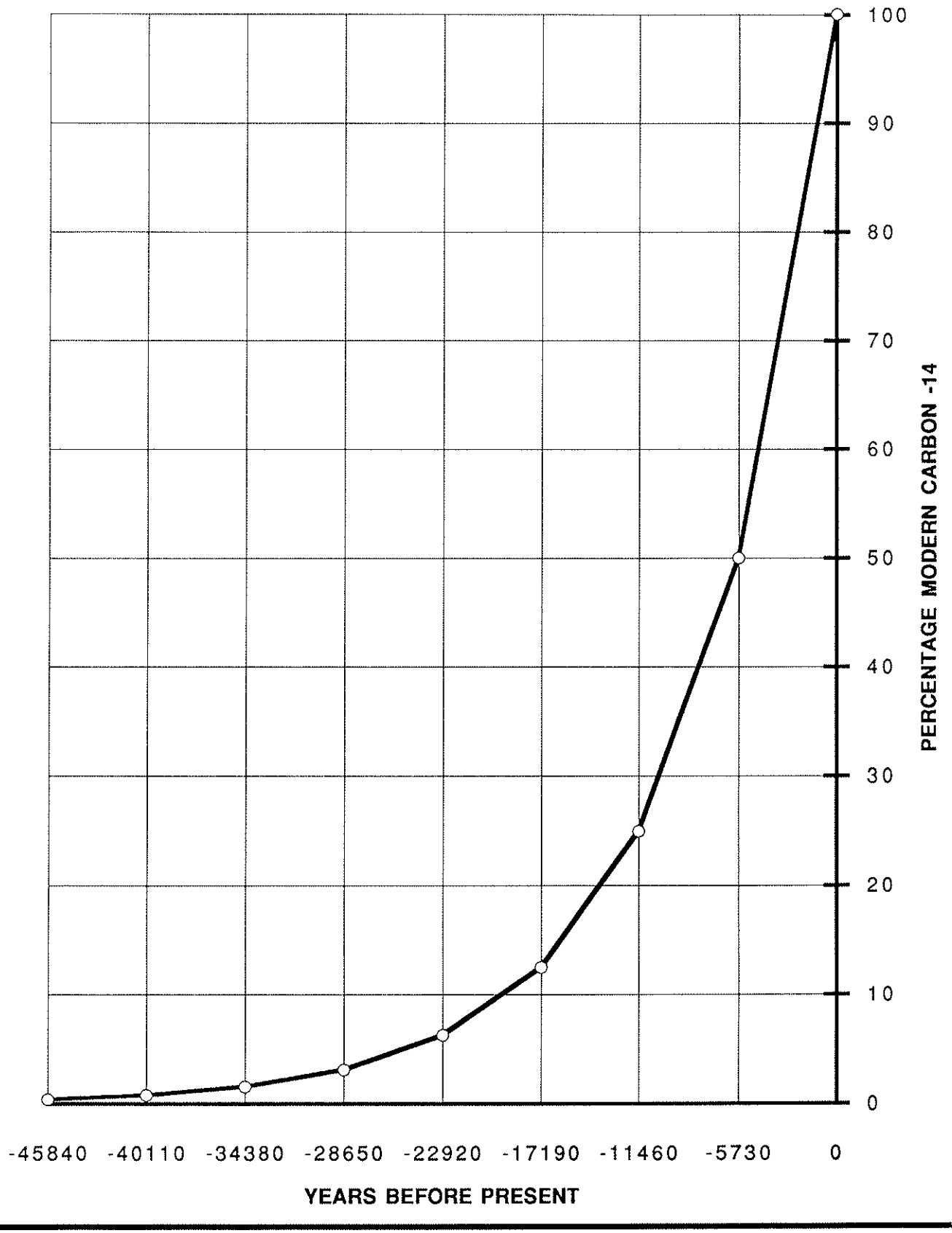
Sketch Figure 2 illustrates a natural carbon pathway from the atmosphere to groundwater and the changes that take place to the Carbon-13 values en route. Carbon-13 values are expressed as parts per thousand relative to the ratio between C-12 and C-13 in an American Belemnite international standard for marine limestone.

Carbon-14 sampling, and sample preparation requires several pieces of readily available equipment but considerable care is required in sample preparation to avoid contamination by modern carbon.

The volume of water sample required can be 200 litres or more. The objective is to precipitate out from the water the equivalent of at least 6 gms of elemental carbon. It is therefore important to know the alkalinity of the water before sampling. The 200 litres are dosed with Sodium hydroxide, Ferrous sulphate and Barium Chloride. A precipitate of barium carbonate and sulphates forms on the bottom of the container. Usually 8-10 hours is needed for full precipitation. The precipitate is decanted off and sent to a laboratory for measurement of the radioactivity and the C-12/C-13 ratio. The precipitate sample (usually a brownish sludge) is converted into benzene and placed in a lead encased emission counter. The lead casing is one of the steps taken to reduce the amount of background cosmic emissions entering the counter chamber. There are many radioactive emissions per hour from very young groundwater samples. But if the water is

FIGURE 1`

CARBON-14 RADIOACTIVE DECAY CURVE AND GROUNDWATER AGE



very old, say 30,000 years plus, then counting takes place over several weeks in order to distinguish with confidence the infrequent emissions from the sample, from the background radiation entering the counter.

The results are presented by the laboratory as percentage modern carbon and uncorrect age determinations. The uncorrected ages can be misleading and require correction or checking. There are two main reasons for this.

The first reason for correction is hydrochemical.

Carbon -14 is not only lost through radioactive decay with time. It can be lost by precipitation in the aquifer, and perhaps subsequently replaced by inert ie ancient non radioactive carbon from the aquifer material. Carbon-14 is more readily precipitated than Carbon-12 because it is a heavier isotope. Conversely Carbon-14 is less readily dissolved for the same reason. This process is termed isotopic fractionation. The Carbon-14 values therefore need to be corrected for this fractionation, if it has taken place.

The evidence for isotopic fractionation is gained by measuring the Carbon-13 level in the water sample. Carbon-13 is subject to isotopic fractionation because it is also a heavier isotope, but it does not diminish by radioactive decay. So if the Carbon-13 level at the outcrop at the time of recharge is either known, or can be confidently assumed, and the Carbon-13 is measured in the groundwater sample used for Carbon dating, then by a mathematical formula the ages can be corrected. A lot of work has gone into refining the hydrochemical models for correcting Carbon-14 ages. The models became more complex during the 1970's and 1980's but now effort to refine the models has nearly ceased because the significance of weak hydrogeology has been exposed as significant.

The hydrogeology is the second reason for correction or checking the apparent Carbon-14 age. The problem is the common problem of a mixed sample. My experience has been that groundwater is stratified in the aquifer. Often older water underlies younger water in the column of aquifer penetrated by the borehole. A borehole that has an open hole section of say 100 metres is likely to draw upon groundwater which differs in age and hydrochemistry from top to bottom of the hole. Usually this is not recognised in routine groundwater hydrochemistry, but in isotope work it is critical.

Reference to the Carbon-14 decay and age curve attached shows that, for example, an age determination on a 50 : 50 mix of young shallow groundwater with deep 40,000 year old water would give a result that completely masked the significant contribution of the older water. The uncorrected Carbon-14 age of the mixed sample would be 5,700 years, not some mid way age of around 20,000 years.

Many, if not most, of the boreholes drilled in Ireland have been completed without a competent cement grout fully sealing off the annulus around the outside of the pump chamber casing. The result is that recent shallow water from the overburden and upper aquifer can pour down the outside of the casing and mix with older waters drawn from deeper in the aquifer.

The onus is very clearly on hydrogeologists to ensure that they are confident of the integrity of the borehole construction and adequately understand the aquifer zone from which the groundwater is drawn. I stress this point because David Drew, on behalf of Dr Hertlendi, has asked hydrogeologists and engineers to propose boreholes suitable for isotope sampling this summer.

I have been able to do a small piece of Carbon -14 work recently in Meath.

I do not have the freedom at the moment to describe the borehole location or owner. However the hole was drilled through Silurian grits and shales. The depth of the pump chamber casing was 40 metres. The prolific yield at the overburden-weathered bedrock contact was completely grouted off by the 7.5

CARBON PATHWAY FROM ATMOSPHERE TO DEEP GROUNDWATER

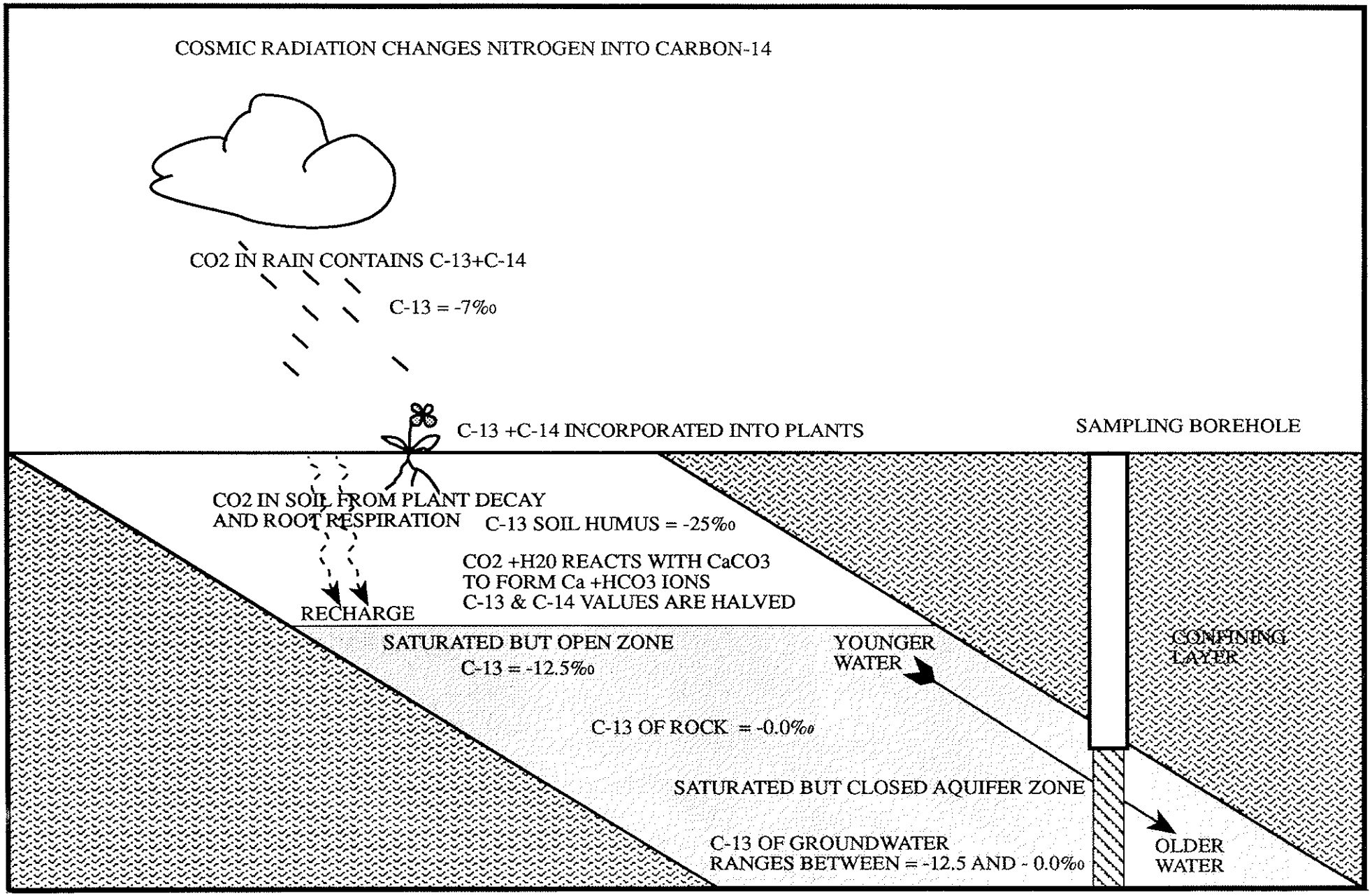


FIGURE 2

tonnes of cement injected from the base of the casing annulus.

The open hole drilled beyond the casing was completely dry for a further 70 metres until a small fracture was encountered. Drilling continued to significant fractures and abundant calcite veins at 133 metres. The hole finished at 170 metres. I am reasonably confident that there are just two sets of producing fractures (110 and 133 m.) but I do not know the proportion of flow from each.

I have taken two C-14/C-13 samples. They have been analysed in Harwell and Cambridge with confirmation of C-13 by New Zealand. The programme is on-going but the preliminary results show that the uncorrected Radiocarbon date is 34,000 years old. A basic correction gives an age of 25,000 - 28,000 years.

It is interesting for the imagination to reflect that at the time this water was entering the aquifer Woolly Mammoths, Giant Irish deer, Lemmings and Spotted Hyenas were living in Ireland. It was about the time of the Derryvree Interstadial.

I conclude by suggesting that these preliminary results should provide hydrogeologists in Ireland with encouragement to proceed with further Carbon-14 dating and also other environmental isotope work to determine the age and relative speed of our groundwater systems. I suggest we also use other stable isotopes such as Oxygen-18 and Deuterium to establish the temperature and evaporation conditions taking place during recharge thousands of years ago. The information that can be obtained from isotope studies is of interest to us in helping to understand the hydrochemical stratification in the aquifers, but it could also be a very important contribution by Irish hydrogeologists to Quaternary studies in general and the scientists and archaeologists working on reconstructing the palaeoenvironments that shaped the country.

References:

A full set of references on Carbon -14 dating of groundwater would be 5 pages long.

I recommend a recent paper:-

Cheng, S. 1992 'Reaction-Path Formulation of a Simple Dissolution Model for Radiocarbon Dating Groundwater' *Radiocarbon, Vol.34, No.3,* pp 646-653

and a standard text

Fritz, P., and Fontes, J.-Ch., eds., 1980 *Handbook of Environmental Isotope Geochemistry, Vol 1,* New York, Elsevier Science Publishers 545 pages.

BOTTLED WATERS - PUBLIC AWARENESS & STANDARDS

DERMOT J. BYRNE, DIRECTOR, BOTTLED WATERS ASSOCIATION OF IRELAND

One of the facts of life which we learn at a very early age is that anything medicinal and likely to do you good will probably have a nasty taste. It is ironic therefore, that the soft drinks industry which daily meets the needs of and gives pleasure to millions around the world in part owes its origin to water treatment as a preventative medicine. In the middle ages untreated drinking water was likely to be polluted and, in the absence of public health services, a primary source of infection or even epidemic.

The advent of lemons introduced in Northern Europe by the twelfth century Crusaders led to the recognition of this fruit and the subsequent discovery of lemon juice as an antidote to scurvy.

This led to the development of soft drinks as we know them today.

Of course not all water available in the middle ages was contaminated. Spa and spring waters whose healthful or at least harmless qualities had been authenticated by prolonged usage were numerous but usually remote from urban populations. The spa, originally conceived as a healthy bathing facility based on dissolved mineral salts, developed social pretentions and became accepted as a feature of the social season when one "took the waters".

Spring water, however, was purely for drinking, being sourced from underground springs were much less vulnerable to polluting influences and "pure spring water" was bottled and distributed over considerable distances.

OVERVIEW OF THE MINERAL WATER INDUSTRY IN THE E.U. COUNTRIES

During the last few years, the European consumption of mineral water has increased steadily. Mineral water now holds the first place amongst non-alcholic drinks.

This industry is growing: today, 500 firms employ 45,000 staff. The perspectives of development will remain extremely interesting as long as mineral water continues to respond to the needs of the population in terms of health, well-being, safety and taste.

As can be seen from the following chart European per capita consumption varies enormously with three countries exceeding the 100 litre annual consumption per capita with the Netherlands, Denmark, Ireland and the United Kingdom propping up the consumption league table.

ITALY	124 litres
FRANCE	105 litres
BELGIUM	105 litres
GERMANY	85 litres
AUSTRIA	81 litres
SPAIN	58 litres
PORTUGAL	40 litres
GREECE	22 litres
NETHERLANDS	15 litres
DENMARK	12 litres
U.K.	8 litres
IRELAND	6 litres

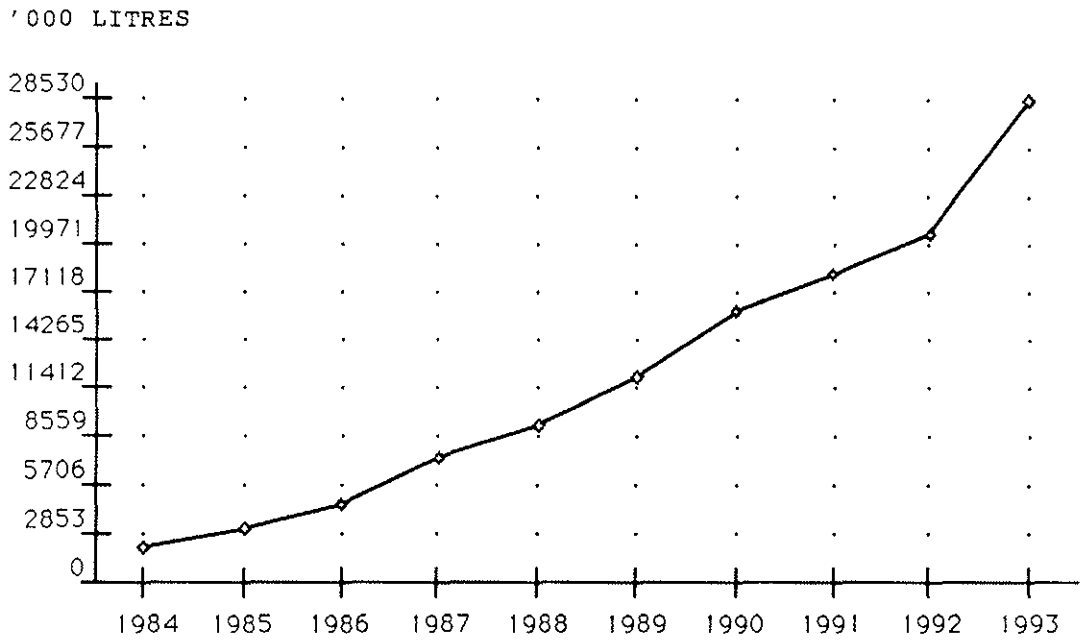
CHANGING CONSUMER ATTITUDES

In the early years in Ireland bottled waters were seen as an ideal romanticised drink. The first reaction to it by consumers was that of a chic multi-national type drink preferred by sophisticated yuppies and bimbos!

The scene has changed significantly since then to the present day where bottled waters are available in virtually all grocery/CTN and pub outlets. The image of yuppism associated with the product is gradually diminishing resulting in a situation where bottled waters are being considered more and more a mainstream unisex product.

GROWTH IN IRELAND

As can be seen from the next chart the market has grown spectacularly in the last ten years.



EXPORTING

Exporting Irish bottled waters is another phenomenal growth area with output almost level with the litreage produced for the domestic market.

It is not surprising to note that common with other sectors over 90% of all Irish bottled waters go to Great Britain and Northern Ireland.

Notwithstanding spectacular growth over the last decade, the Bottled Water Market in Ireland is still relatively small at 28.5 million litres compared with the 270 million litres of carbonated soft drinks.

In fact taking all the "soft drink" categories together including juices and others, bottled waters only represent 7% of total consumption.

CONSUMER ATTITUDES

The prediction of increasing growth in future years will come as a result of

greater interest in health and diet issues

stricter drink driving laws

growing concerns about the safety of tap water

fashion and imagery

Turning to the health and diet syndrome, bottled waters have much in the way of positive attributes such as no calories, no sugar, no additives and no alcohol.

REASONS FOR PURCHASING BOTTLED WATERS

24% of respondents in a 1993 survey stated that they are worried about the quality and safety of tap water. 11% are diet and health conscious while the remaining 8% claim it is due to stricter drink driving laws.

Research indicates that of respondents who drink bottled water 57 surveyed considered "refreshing"; "liked the taste"; or preferred these to alcohol or carbonated soft drinks. Bottled waters are felt to be thirst quenching.

Turning from the positive to the negative· what are the reasons for not drinking bottled waters

Of those who claim they did not drink bottled water and gave a reason 39% said it was because tap water was free and conveniently available. 27% considered bottled water to be too expensive 26% simply do not like it and the remaining 8% gave other reasons such as having preferences for tea, coffee, minerals and even alcohol.

Now what are the reasons why consumers choose a particular brand.

Of the respondents who indicated why they choose a particular brand, 42% said it was due to the brand name, 28% due to its availability, 15% said it was due to taste and the remaining 15% said it was due to quality.

Some claim they can differentiate between brands on the degree of carbonation.

NATURAL MINERAL WATERS AND SPRING WATERS

Now we come to the mystery of the perceived consumer differences between Natural Mineral Water Status and Spring Water.

The question is easily answered with only 5% claiming to know the difference. There is limited understanding or relevance to technical values. This result is somewhat disappointing considering that each producer claims attaining NMW status is an advantage and endorsement of quality standards. You might say what's the advantage if 95% of consumers still do not know the difference.

There is little understanding of minerals, there is casual mention of calcium (bones), minerals in other cases suggest coal, aluminium, iron, etc.

To sum up: the public's perception or perhaps lack of perception of there being any difference between spring vs. mineral water hence the descriptive bottled water. The trade, so as to avoid confusion with traditional "minerals" which include lemonade, orange drinks, etc., both here and in the U.K. have adopted "bottled waters" as the descriptive which in turn had led to consumers utilising this sectoral naming.

PRICES IN THE LICENCED TRADE

In the licenced trade 93% consider prices to be too high. Unlike other retail sectors, as more producers enter the industry the price will not become more competitive as vintners tend not to pass on purchase savings to their customers.

One cannot be too complacent in respect of prices in the grocery trade as 70% of respondents claim that prices of water are too high. This obviously arises from the fact that tap water is free!

LEGISLATION

Legislation has been to a large degree responsible for the terminology used today in official circles.

However, there are definitive differences effected by the content of legislation covering the following:

NATURAL MINERAL WATER
SPRING WATER
TABLE WATER
SODA WATER
TAP WATER

The main elements of the Natural Mineral Water Directive 80/777/EEC regulated in Ireland by S.I. No. 11 of 1986 read as follows:

* NO TREATMENT OTHER THAN FILTRATION

* CONTAINS NATURALLY OCCURRING MINERALS AND BENIGN MICRO-ORGANISMS

* REQUIRES TYPICAL MINERAL ANALYSIS/SOURCE TO BE OFFICIALLY REGISTERED

* SPECIFIC LABELLING REQUIREMENTS IN ADDITION TO STANDARD LEGISLATION

  - proper product description - "Natural Mineral Water"
  - geographic identification of source
  - mineral analysis must be shown or be available on request to the public

* REGULATIONS REQUIRE TAMPER EVIDENT SEALS

* REGULATED BY IRISH NATURAL MINERAL WATER REGULATIONS S.I. NO. 11 OF 1986

OTHER BOTTLED WATERS
(includes Spring Waters)

E.C. DIRECTIVE 80/778

* MAY BE DRAWN FROM A VARIETY OF SOURCES INCLUDING UNDERGROUND OR SURFACE WATERS AND BOTTLED IN ACCORDANCE WITH E.C. DIRECTIVE 80/778

* MAY BE TREATED OR PROCESSED

* MAY CONTAIN NATURALLY OCCURRING MINERALS AND BENIGN MICRO-ORGANISMS

* MAY BE DESCRIBED AS "SPRING", "NATURAL", "PURIFIED" WATER

* MUST MEET STANDARD LABELLING LEGISLATION WHEN BOTTLED

* MAY CARRY VOLUNTARY COMPOSITION ANALYSIS AND HAVE TAMPER EVIDENT SEALS

* REGULATED BY THE DEPARTMENT OF THE ENVIRONMENT MAY 1983

This Directive in covering the quality of water intended for human consumption affects both waters used in the production of food and that consumed directly by the public.

TABLE WATER

Here we enter an area of confusion as the Revenue Commissioners when excise was applied classified carbonated soft drinks as "other table waters"!

In Germany specific regulations apply to such a sector the main disciplines cover the restriction of additives to:

1. Sodium Chloride and Calcium Chloride
2. Sodium Carbonate and Sodium Hydrocarbonate
3. Calcium Carbonate and Magnesium Carbonate
4. Carbon Dioxide

There is a further guideline stating that table water should only be softened or produced from seawater in such a way that the content of Calcium and Magnesium do not remain lower than 1.5 millimole per litre and acid capacity not lower than 1.5 millimole per litre.

Finally we come to the traditional SODA WATER, simplicity itself water and Sodium Bicarbonate.

LEGISLATIVE FRUSTRATION

The European Commission have been beavering away in endeavouring to extend much of the disciplines of the Natural Mineral Water Directive to include Spring Water. This has met with firm resistance from those countries who influenced the shape and content of the Directive.

However, consumers, M.E.P.s and indeed the Commission itself are in the interest of consumers anxious to see spring waters conforming to specific standards, as we in this country have done in developing and implementing a standard covering both.

Provided that the criteria can be met experience has shown that today's spring water will invariable be tomorrow's natural mineral water. The fact that it takes at least two years to attain the latter status prompts newcomers to start life as spring water.

It is under present circumstances difficult to control certain aspects of labelling as spring water in Ireland is not classified as a foodstuff whereas Natural Mineral Waters are.

BOTTLED WATER STANDARD I.S. 432 ... 1992

During 1989 the then Minister for Food, Mr. Joe Walsh expressed his desire to optimise food and beverage growth and protect producers prior to and post 1992. He suggested a range of product sectors to the National Standards Authority of Ireland with a view to encouraging the adoption of standards.

Producers of bottled waters at that time agreed in principle that the acceptance of such a standard would also be a protection for the trade and consumers and it would help the enormous export potential for Irish bottled waters. Its existence will have a significant bearing on the attitudes and quality safeguards of new arrivals to the sector. The dangers of cowboy entrants would thus be overcome to a large degree.

The creation and adoption of a standard endorsed and certified by an internationally recognised body such as the N.S.A.I. and the possession of such credentials would ease acceptance in the international market.

Over two years of detailed consultation between the N.S.A.I., bottled water producers and hydrological and other technical experts resulted in the standard being approved by the appropriate Government Departments and the Seal was granted on the 20th of May 1992.

The following covers the scope of the disciplines outlined in the 52 page standard:

1. Well construction, protection, monitoring and management.
2. Defining and monitoring the surface catchment area.
3. Observation boreholes.
4. Pumping and water quality testing.
5. Treatment and hygiene.
6. Materials in contact with product water.
7. Maintenance of bulk water dispensers.
8. Packaging and labelling.
9. Specification for water.

The development of the standard confirms members of the Bottled Waters Association of Ireland's commitment to ensuring that bottled waters produced in Ireland bear no risk to public health.

The standard will have a major influence on ensuring that groundwater remains unpolluted.

It has to be said that the standard applies equally to Natural Mineral Waters and Spring Waters excepet in the case of the latter some treatments are permitted under existing legislation.

POLICING OF STANDARD

The standard is not intended to replace nor does it replace the E.C. Directive on NMW so it is effectively a trading standard which defines what is required by a company to demonstrate that the product is safe and it does address the requirements necessary to meet everything which is contained in the NMW Directive.

The question may be raised as to how the standard will he policed.

The standard requires analysis of at least four samples of water taken seasonally when the water table is at its maximum, its minimum and approximately half way between these levels and the water table is increasing and decreasing.

For those companies who have NMW Status the inspections and analysis are conducted at the same time and companies who had been granted certification will if necessary have this withdrawn in the event of failure to meet the requirements dictated by the standard.

Incidentally the standard cost the industry £15,000 to develop and in case it may be felt that this exercise was the work of the larger producers, the following listing of companies involved in the development illustrates a number of large, medium and small producers.

Aquaporte Ltd.
Ballygowan Spring Water Co. Ltd.
De Braam Mineral Water Co. Ltd.
Cavan Mineral Water Co. Ltd.
Corcorans of Carlow Ltd.
Glenpatrick Spring Water Co. Ltd.
Kerry Spring Water
Kilkenny Spring Water Co. Ltd.
James McDaid & Sons Ltd. (Donegal)
Tipperary Natural Spring Water Co. Ltd.

There are of course additional financial implications for companies wishing to attain certification and maintain such which would cover application fees, pre certification inspection, an annual certification fee which will vary taking into account whether the company concerned has or has not already achieved NMW status.

HOW CAN LEGISLATION & STANDARDS HELP THE BOTTLED WATER INDUSTRY?

Whilst there is consumer confusion in respect of the differences between Natural Mineral Waters and Spring Waters, the fact that both are looked upon as bottled waters would seem an acceptable compromise in the minds of the producer and the paying public.

However, the main benefit as of now to those in the industry is that adherence to the demands of both legislative requirements and the specific standard should influence the perceptive trade buyer of being fully confident in stocking and promoting bottled waters which feature the I.S. 432 label.

Its existence will also hopefully make the new comers more conscious of the necessity of conforming to such disciplines, otherwise they will come up against a dam of resistance in respect of stocking by the multiples and other major retail groups both here and in export markets.

So to sum up, there are positive indications that this youthful sector has significant potential, with so many positive attributes but negative vibes are also in evidence.

One of the problems associated with a product such as bottled waters is that as far as consumers are concerned there is very little in the way of perceived differential between the various waters, so one is dependent very much on positive image making, through advertising and promotion to cultivate a uniqueness for any particular water.

To avoid bottled waters becoming a commodity, brand owners must continue to actively promote because the generic product itself does not have viability on its own.

Such essential support plus the adherence to legislative requirements and I.S. 432 that are rigidly implemented as required should ensure an enduring future for this 100% Irish Industry.

Slainte!

The following tenproducers are currently members of the Bottled Waters Association of Ireland:

Aquaporte Ltd.

Ballygowan Spring Water Co. Ltd.

De Braam Mineral Water Co. Ltd.

Clada Soft Drinks Ltd. (Galway Spring Water)

Wm. J. Dwan & Sons Ltd. (Irish Spring Water)

Glenpatrick Spring Water Co. Ltd.

Kerry Spring Water Co. Ltd.

Kilkenny Spring Water Co. Ltd.

James McDaid & Sons Ltd. (Donegal Spring Water)

Tipperary Natural Spring Water Co. Ltd.

The Association is affiliated to U.N.E.S.E.M., the European Natural Mineral Water Association.

DJB/MO
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