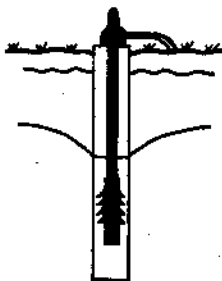


THE GSI GROUNDWATER NEWSLETTER

NUACHTÁN SCREAMHUISCE SGÉ



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Edited by: Donal Daly.

No. 15. March, 1990

IN THIS ISSUE

NITRATES IN SURFACE WATER AND GROUNDWATER

Over 40% of the country is probably not suitable naturally - geologically or hydrogeologically - for the safe disposal of septic tank effluent. Yet location of septic tank systems in these areas has occurred, leading to surface water and groundwater contamination problems. Recently two systems, designed for the disposal of effluent from single dwellings, have been launched - the Biocycle and Puraflo systems (see pages 5 and 6). These may well provide an answer to many of the pollution problems associated with septic tank systems. They each cost £2,500-£3,000.

SUCCESSFUL DRILLING AT LANESBOROUGH

NEWS FROM ABROAD

"Climatic Extremes and their Effects on Water Resources" is the theme of the 1990 IAH Portlaoise seminar (page 8). This is particularly topical now as evidence for the "greenhouse effect" and its consequences is growing. The seminar will examine the effects of droughts and floods on both groundwater and surface water.

SEPTIC TANK EFFLUENT TREATMENT

The GSI maintains a national archive of earth science information, which is now being collated, assessed and produced on 1:25,000 scale bedrock maps. John Morris describes the availability and content of these maps on page 7.

GSI GEOLOGICAL MAPS

PORTLAOISE SEMINAR

The value of groundwater as a source of water supply has been proven yet again by successful drilling in Co. Roscommon (see article by Donal Marron on page 3). The assumed extension of the Burren limestone aquifer west of the Shannon from Co. Longford is now proven.

IAH NEWS

A questionnaire is enclosed with this issue of the Newsletter to enable the updating of the mailing list and to receive suggestions for improvements. If you find the Newsletter useful and wish to continue receiving it, you should return the questionnaire.

Editor.

GROUNDWATER POLLUTION

NITRATE LEVELS IN THE BALLYWATER CATCHMENT, CO. LOUTH

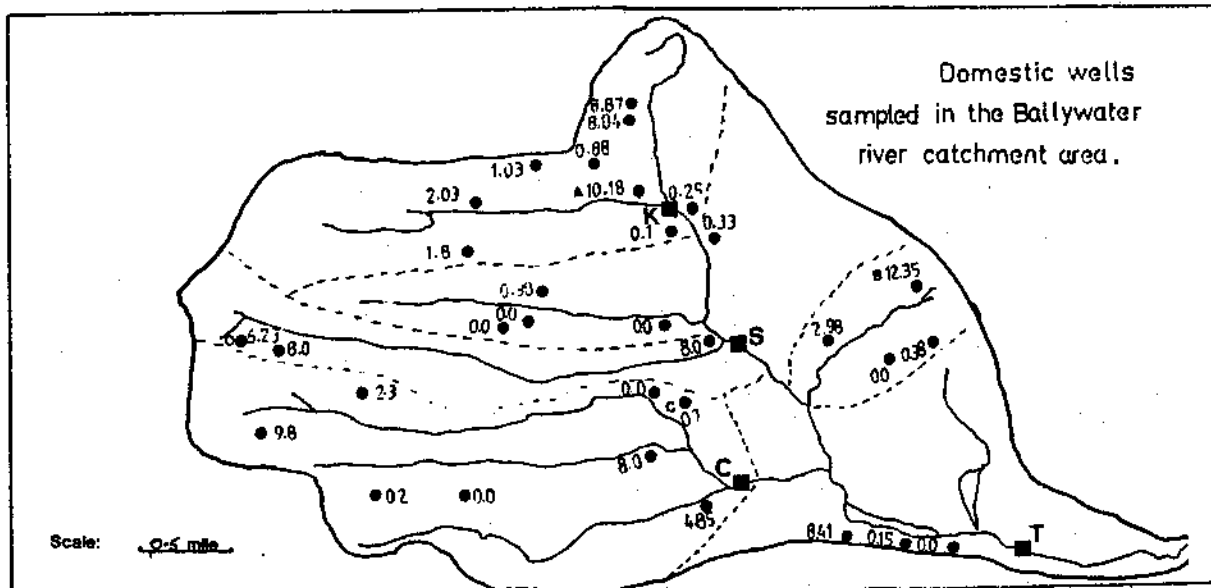
A study was carried out on the nitrate levels in both surface and groundwater sources in the Ballywater catchment area, Termonfeckin, Co. Louth, as part of my undergraduate thesis. It consisted of a six month duration weekly sampling survey at four stations on the river from October 2nd 1988 to March 26th 1989. The means and ranges of nitrate values from all four sampling stations are given in the table below.

MEAN AND RANGE OF NITRATE VALUES AT THE SAMPLING STATIONS OVER THE SIX MONTH PERIOD FROM OCTOBER 1988 - MARCH 1989

SAMPLING STATION	MEAN mg/1 NO ₃ -N	RANGE mg/1 NO ₃ - N
Termonfeckin (T)	4.7	1.8 - 7.2
Kiltallaght (K)	6.4	3.3 - 8.4
Sandpit (S)	5.2	2.7 - 7.8
Channelrow (C)	3.8	2.7 - 7.3

When graphed, the nitrate levels were found to correlate with the weekly precipitation values from the nearby rainfall station.

Groundwater from thirty four wells in the catchment were sampled in February 1989 and the nitrate levels are given in the figure below. It was discovered that in 23 (67%) of the wells sampled nitrate levels were below the E.C. guideline limit of 5.6 mg/1 NO₃⁻ -N. One well had a nitrate level above the maximum acceptable limit of 11.3 mg/1 NO₃⁻ -N.



A survey of wells and potential pollution sources was carried out. With the aid of multiple regression analysis and full chemical analyses by the State Laboratory of 6 samples, it was concluded that poor siting of wells and agricultural wastes in farmyards were the main causes of contamination.

Audrey Mooney, Department of Geography, St. Patrick's College, Maynooth.

THE CAUSE OF PERRIER'S PROBLEMS IS SOLVED.

Hydrotechnica, a consultancy in Shropshire, England, has discovered how benzene, a cancer-causing substance, contaminated Perrier's bottled water. The water itself is pure, but the gas that makes Perrier fizz was contaminated by hydrocarbons, including benzene. Both water and gas come from the same underground source, but since 1956, they have been drawn up separately. The benzene arises naturally from reactions between carbon dioxide and vegetable and animal matter trapped in the rocks. The problem arose when staff failed to renew a filter of activated charcoal which was exhausted.

Source: New Scientist. 24th February 1990. No 1706

Editor.

GROUNDWATER DEVELOPMENT

EXTENSION TO LANESBOROUGH LIMESTONE AQUIFER

Longford County Council has for some years been abstracting large volumes of groundwater from wells located at Rathcline on the east bank of the Shannon some 2 miles south of Lanesborough. This development is based on abstractions from a clean well bedded "Burren" type limestone which underlies much of this region. While the overburden cover is much more extensive here than in the true Burren area of north Clare and South Galway there are numerous bedrock exposures, with many well developed karst features visible in the Rathcline district.

Up to recently the Lanesborough limestone aquifer had only been tested on the eastern bank of the Shannon with high yielding wells at Rathcline and at the E.S.B. power station at Lanesborough. However, a recent groundwater investigation exercise by Roscommon County Council at Ballyleague has proven the extent of this prolific aquifer west of the Shannon.

The investigation included a surface resistivity survey followed by trial and production wells. The geophysical survey identified a promising resistivity "low" which was investigated by a 150mm. trial well completed to a depth of 61m. A subsequent pumping test confirmed a yield in the order of 1,000m³/day and the later production well was successfully tested at a yield of 2,000m³/day.

This result has added significantly to the available potable water supplies in the area and has underpinned the view that the "Burren" type limestone along the Shannon constitutes a major groundwater aquifer. It is encouraging to solve a local community's need and at the same time add to the knowledge of regional groundwater resources.

Donal Marron, Kevin T. Cullen Hydrogeological and Environmental Services

NEWS FROM ABROAD

GROUNDWATER POLLUTION: A MAJOR ENVIRONMENTAL ISSUE IN THE U.S.

The 1988-1989 Environmental Geology Committee of the Association of American State Geologists looked at the magnitude and type of environmental geology problems occurring across the country. For the purposes of the survey "environmental geology" was defined as the interaction of geologic factors, materials, and processes with, and their impacts on, current or projected human activities. A questionnaire was distributed to each state geologist. When asked to name the five major current and future environmental geology problems, groundwater and groundwater pollution ranked highest. Many states are now committing time and money to groundwater pollution and aquifer mapping.

Source: Geotimes, December, 1989.

Editor.

NEW JERSEY: THE "LANDFILL OF OPPORTUNITY"!

The environmental pollution problems, particularly from hazardous-waste sites has resulted in New Jersey being dubbed as the "Landfill of Opportunity". Out of 1163 sites on the Superfund National Priority List, 106 are in New Jersey and another 2000 locations are on the state's list of known or suspected hazardous-waste sites. However the chief groundwater pollution problem in New Jersey is not hazardous waste but is the unregulated disposal of wastes into home, industrial and commercial septic tank systems. These pose the greatest risk to public health, especially in coastal-plain aquifers where permeable sandy soils dominate and the majority of people rely on private wells for water supply.

The agency responsible for hazardous waste sites is the New Jersey Department of Environmental Protection (NJDEP). They employ 145 geologists. The New Jersey Geological Survey is part of this agency and employs about 20% of the NJDEP geologists. Traditional geology must have an environmental application in New Jersey and so field geologists frequently work with other scientists who require information to assess pollution incidents. "Without a knowledge of the geologic framework, accurately predicting groundwater flow in polluted areas is like shooting in the dark," says state geologist Haig F. Kasbach. "What we need is reliable mapping and basic data collection first: then we can apply that information to our problems. However this requires long-term planning and financial commitment from the legislature, which has many other short-term priorities," Kasbach explained. The Geological Survey has an interdisciplinary bureau, - the Bureau of Groundwater Resources Evaluation - which uses the skills of geologists, hydrogeologists, geophysicists and geographic information system (GIS) specialists. As concern for the environment is high in New Jersey and promises to remain so, geologists will continue to be needed to help solve many of the environmental problems.

Source: Goldstein, M. 1989. Geotimes, pp. 15-16

Editor.

UNITED STATES: EFFECT OF GROUNDWATER CONTAMINATION ON HOME VALUES

An assessment of home values in the town of Twin City, Nebraska, after groundwater contamination had occurred, gave the following valuation reductions:

\$19,000 for properties which had levels of contamination severe enough to require the use of bottled water.

\$12,000 for properties with trace levels that were under the threshold to require bottled water

\$3,000 for properties in an area determined to have high potential risk.

Source: The Groundwater Newsletter of the Water Information Centre, Inc. Vol. 18, No. 16.

Editor.

SEPTIC TANK EFFLUENT TREATMENT

THE BIOCYCLE SYSTEM: THE WIZARD OF OZ ARRIVES IN IRELAND

A chance viewing of the Australian television programme Beyond 2000, by a Dublin engineer has led to a new design in wastewater treatment being recently launched onto the Irish market. Christened the Biocycle, this system incorporates four separate concepts of wastewater treatment in one compartmentalised tank. These four concepts are as follows:-

1. Receiving chamber (anaerobic or septic).
2. Diffused aeration chamber.
3. Clarification or settlement chamber.
4. Chlorination and irrigation chamber.

Manufactured in Ireland by Biocycle Ltd. of Balydoyle Industrial Estate, the Biocycle unit has a total capacity of 5000 litres for service to the average sized dwelling. Made from fibreglass or concrete, this Australian designed unit is currently being evaluated by the Environmental Science Unit, Trinity College under field conditions at Swords Co. Dublin.

The receiving chamber operates on similar lines to a septic tank where anaerobic conditions predominantly prevail in the removal of heavy solids. Passage to the adjoining chamber is by means of a submerged baffle, where 4 diffuse aerators are strategically placed, to handle a hydraulic loading of 2800 litres per day, or 0.7 Kg. B.O.D.; assuming an influent B.O.D.5 strength of 250 mg/l. The aeration chamber contains submerged biological media to assist in providing suitable conditions for growth of oxidising and nitrifying micro-organisms.

From the aeration chamber, the wastewater flows into the clarification tank where quiescent conditions allow for the settlement of lighter solids. By means of the venturi principle, the unit is designed to return settled material from this chamber back to the primary tank. This process is operated off the main air supply to the aeration chamber, and ensures a constant return of activated or aerated sludge to assist in the carbonaceous breakdown in the primary tank. Floating scum from the clarification chamber is also returned by this method.

The wastewater in the clarification chamber is drawn off below surface level and flows via a Chlorinator to the pump chamber. It is similar in design to the concept of Onsite chlorination tested by the U.S. E.P.A., where all wastewater comes in contact with two perpendicular stacks

containing calcium hypochlorite tablets. These stacks are adjustable by the user to the desired residual chlorine level, and to the hydraulic loading envisaged. Under normal household usage, each stack containing 29 tablets (70% active) is designed for 156 days treatment.

After chlorination, the wastewater passes to the pumping chamber which has a capacity of 300 litres and contains the irrigation pump and the warning alarm system. Designed to ensure a minimum retention period of 30 minutes at 0.5 mg/l free available chlorine, the pumping routine is regulated on a float switch from within the unit. Failure of the float-control pump to operate will activate the high water alarm in the control panel in the owners dwelling. The pumping system is designed to achieve a hydraulic head of approx. 4-50 metres, which can be very advantageous in rural settings where site contours prevent normal gravity flow.

The system also incorporates a rather untried option in Ireland of wastewater disposal - irrigation. The treated effluent is discharged by the pump through a 25mm hydrodare piping which is simply laid in the area of the garden to the owners wishes. Self tapping microjet sprayheads are inserted in the piping at regular intervals and with 25 such sprayheads the pump is capable of discharging up to 200 litres in a 10 minute period. More preferable irrigating locations are shrubberies, but play areas are not recommended.

The ongoing study of the Biocycle unit in Swords has revealed very good B.O.D. and suspended solids removal rates. After initial teething problems, recent effluent samples from this plant have had a final B.O.D.5 and suspended solids levels in single figures. Nitrification has not been achieved to any great extent. The short retention time of 2-3 days would appear to be the limiting factor for the optimum growth of the nitrifying bacteria, Nitrosomonas and Nitrobacter. Bacteriological examinations of the wastewater at different stages in the plant has revealed very good reductions in total and faecal coliforms in the final effluent.

The plant at Swords is in operation since September 1989 and serves a normal sized house with five occupants. There has been no mechanical faults with the unit to date and early indications would appear to suggest that this system has a role to play in the treatment of onsite wastewater.

The telephone number of Biocycle Limited is (01) 391000.

Dave O'Brien, Eastern Health Board

THE PURAFLOW SEPTIC TANK EFFLUENT TREATMENT SYSTEM IS LAUNCHED.

Mr. R. Molloy, T.D., Minister for Energy, officially launched the Puraflow Septic Tank Effluent Treatment System on 28th February. This System, which was developed by Bord na Mona, consists of a sump, pump and a group of specialised peat fibre biofilter modules which incorporate effluent distribution and odour control facilities. The system is designed to treat domestic sewage from individual dwellings, but can be expanded to suit hotels, caravan sites and small housing estates. Over 25 Puraflow Systems have been installed to date.

The telephone number of Puraflow limited is (0903)4200.

Donal Daly, Geological Survey of Ireland.

THE 1:25,000 GEOLOGICAL SURVEY OF IRELAND BEDROCK GEOLOGY MAP SERIES.

The demand from diverse groups for modern geological maps of Ireland has increased dramatically in recent years and in response, the GSI has embarked upon the production of two systematic series of bedrock geological maps: a regional, 1:100,000 scale series and a district, 1:25,000 scale series described here.

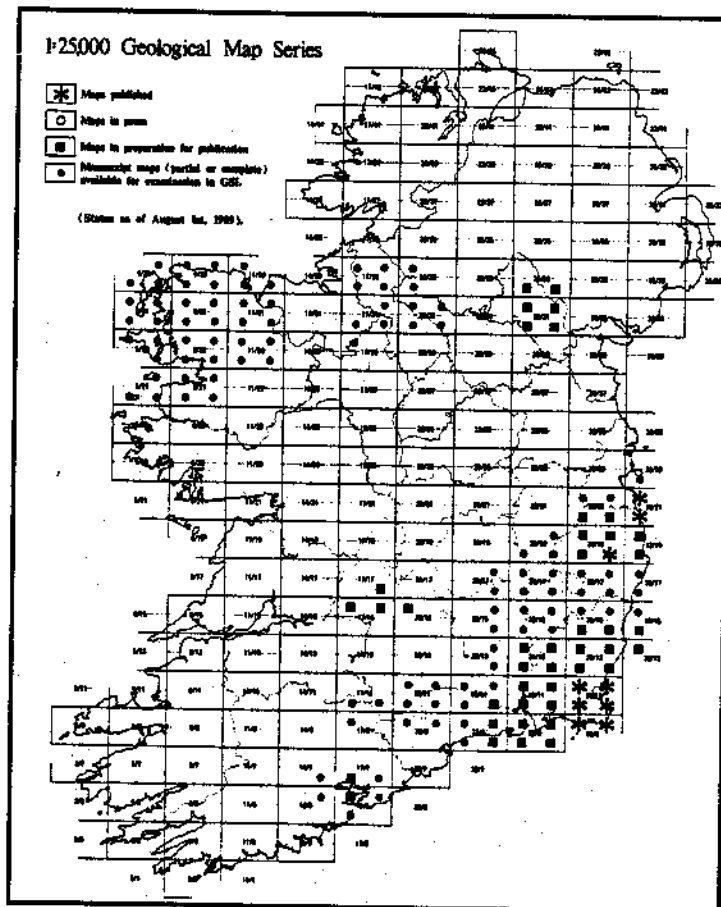
The topographic base for the 1:25,000 series consists of a Transverse Mercator projection of montaged and photo-reduced pre-1922 1:10,560 (six-inch scale) maps with a superimposed national grid (Fig. 1). Individual sheets in the series cover an area of 10x15km and are grouped into blocks of four, indexed by columns, from 2 to 35, and rows from 1 to 45. Thus the block containing Malin Head in Co. Donegal is indexed 23/45 and individual sheets by compass quadrant, eg. 23/45SE, 23/45SW and so on (Fig 1). To simplify this otherwise somewhat cumbersome reference system, the GSI is applying informal names to each individual sheet.

The advantages of this scale are several: they provide the same level of topographic detail as the 1:10,560 series; they provide for accurate on-the-ground location of data points; and they provide the potential for full two-way integration between computerised databases and maps. The geological maps are produced as dye-line copies in order to facilitate rapid, low cost production with the additional benefit that they may then be periodically updated easily and cheaply. A single hand-coloured, heat sealed reference copy of each sheet will also be available for consultation in the GSI.

The maps show: all known outcrop areas, including drill holes; structural and lithological data for individual outcrops or outcrop areas; intrusions; and geological boundaries, based principally on lithostratigraphic divisions (primarily formations and groups). Summary descriptions of formations are included in the legend, along with age data where available. A fuller description of the lithostratigraphic units, as well as the general geology of the region, is provided in reports accompanying groups of adjoining or closely spaced sheets. Reports produced to date include a certain amount of descriptive information about noteworthy geological features within the area of the sheets, and it is intended that, with time, more of such information will be provided in the reports.

Production status maps are produced periodically to reflect progress in the preparation, availability and production of maps. Figure 1 shows the status as of August 1st, 1989. Two reports have been published to date: MRS 88-1, to accompany six sheets in SE Co. Wexford and MRS 88-2 to accompany three sheets in NE Leinster.

John Morris, Geological Survey of Ireland.



I.A.H. NEWS

PORTLAOISE MEETING: "CLIMATIC EXTREMES AND THEIR EFFECTS ON WATER RESOURCES".

The 10th Annual Groundwater Seminar will be held on the 1st/2nd (Tuesday/Wednesday) of May at the Kileshin Hotel, Portlaoise. The theme for this years meeting is "Climatic Extremes and their Effects on Water Resources".

The first day will begin with two lectures on the World and Irish climate and what the future might bring. These will be followed by contributions from four speakers who will discuss existing river and groundwater flow and quality and the normal variations that take place. They will also consider the changes which are likely to occur in the event of either significant global warming/cooling. The Tuesday session will conclude with lectures on flood warning/prevention in a city in the southeast of Ireland and experiences in Africa and the Middle East.

The second day will concentrate on the implications of climatic extremes on a number of economic activities and the problems for those confronted with them. The meeting will conclude with a lecture by Rick Brassington from the National Rivers Authority and will deal with his experiences in Britain. The other contributions will be given by scientists/engineers from the public and private sectors and the universities.

In the light of the unusual weather patterns we appear to have had over the last decade, this meeting should provide much useful information for those concerned with most aspects of water resources. The theme is very topical at the moment and we hope to have a lively seminar with wide ranging discussions.

If you have not received an application form please contact Catherine Coxon (01-697082) or Richard Thorn (071-43261).

Eugene Daly, Treasurer, Irish Group I.A.H.

DAVID BURDON COMMEMORATION LECTURES

In memory of our late President Dr. David J. Burdon, the Irish Group of IAH is organising a series of lectures to be known as the "David Burdon Commemoration Lectures".

The general theme will be "trends in hydrogeology".

Leading international hydrogeologists will be invited to Ireland to give the lectures, which will be delivered at different venues throughout the country.

So far, preliminary approaches have been made to speakers from Czechoslovakia, Denmark, Spain and the USA.

The first speaker is to be Dr. Philip LaMoreaux from the USA. Phil LaMoreaux is a highly experienced hydrogeologist having worked in both the public and private sectors in the USA and has extensive work experience in many parts of the world. He is a former World President of IAH and currently Chairman of the IAH Commission on Hazardous Wastes.

He plans to be in Ireland from May 6th to May 12th 1990 and is scheduled to give the following lectures.

1. Legal and hydrogeological aspects of hazardous waste disposal in the USA.
Venue: GSI Dublin, May 7th at 6.15pm.
Contact person: Bob Aldwell, Geological Survey of Ireland.
2. Hydrogeological and geotechnical aspects of hazardous waste disposal sites.
Venue: University College, Cork. May 9th at 8 p.m.
Contact person: David Orr, Dept. of Civil Engineering, U.C.C.
3. Problem of hazardous waste disposal in limestone regions.
Venue: Sligo RTC. May 10th at 8 p.m.
Contact person: Richard Thorn, Sligo RTC.

Bob Aldwell, President, Irish Group of IAH

TECHNICAL MEETING "LANDFILL GAS AND LANDFILL LINERS"

The first IAH (Irish Branch) Technical Meeting on topical groundwater issues was held on 6th March 1990 at the GSI. It was attended by 17 engineers, hydrogeologists and environmental scientists.

Kevin Cullen introduced the meeting by showing a series of slides of a vast containment site under construction in the Netherlands using the most up to date techniques. A 2.5mm thick HDPE membrane is used to contain the leachate. It was welded at the joints, covered by 0.15m sand in the base and carefully at the sides. High density polyethelene pipes laid in the sand and carefully sealed through the membrane were used to collect the leachate. Great attention was paid to the welding of the joints, which was not permitted if the temperature fell below 5°C. The welds were physically tested to 5 bar pressure. The leachate was taken to collection chambers and treatment. The law in the Netherlands states that the liner has to be 1m above the highest groundwater level. The liner is estimated to last 150 years. The construction cost of the site was £16 per square metre.

Kevin pointed out that a more sophisticated and expensive method is used in Germany using a second deeper membrane with a leak detection system between the membranes.

He showed an interesting feature of waste being mined from an old and pollution-causing site and being hauled to a new containment site. Is this a foretaste of things to come here also?

Following the slide show an informal discussion commenced and many topics were raised including:

Gas control; leachate collection, treatment and disposal on-site of leachate; liability for gas migration outside sites; gas venting and generation of electricity; incineration; use of cutaway bogs; recycling paper, PVC, glass and tin cans; rate of waste increase in Dublin (estimated at 2% per head, per year); the merits of natural and synthetic liners.

Clayey till or boulder clay sites were considered to have potential but the use of till for intermediate cover is difficult to use in wet conditions so sand is preferable.

The general consensus was that, in the future, only containment sites would be acceptable environmentally.

Harry McEvoy, Geological Survey of Ireland.

CONTRIBUTIONS FOR THE NEXT ISSUE OF THE NEWSLETTER

The GSI Groundwater Newsletter aims to improve communication among the many scientists and engineers involved with groundwater. It includes news, developments, reviews and opinions on all aspects of groundwater - exploration, development, management, water quality, pollution and energy. It is published at three-monthly intervals.

Your contribution to the dialogue would be welcome. These should reach the Geological Survey before 20th May 1990. All items should be as short (maximum 350 words), interesting and newsworthy as possible

The contributors are responsible for the content of the material in this newsletter.

The views expressed are not necessarily those of the
Geological Survey of Ireland.