

**MONITORING OF ACID
WATERS. PHASE 1
INDICATOR POPULATIONS**

**R&D Progress Report P2/090/2
for the period 1st January 1998
to 31st March 1998**

M T Furse

**Institute of Freshwater Ecology
River Laboratory
East Stoke
WAREHAM BH20 6BB**

April 1998

1 TECHNICAL PROGRESS

This progress report covers the second three months of the work programme from 1st January to 31st March 1998.

1.1 Objectives

The overall objective of the full research programme is:

- To produce a standard methodology that enables the Environment Agency to assess the extent of ecological damage caused by acidification in controlled surface waters in order that they can make considered comment on short and longer term effects and on the likely effects of changes in land use.

The specific objectives are as follows:

- To produce an algorithm to differentiate biological communities into groups which reflect the effects of acidification on their environment.
- To test the algorithm using field data
- To propose monitoring guidelines for applying the algorithm nationally.
- To produce an R&D Technical Report and Project Record in accordance with the Environment Agency's Guidelines to Reporting.
- To use the project output to produce a paper for publication in a relevant scientific journal.

1.2 Work Programme and Timetable for the R&D Project

The targets and timescales for the R&D programme were set out in IFE's tender bid, as accepted by the Environment Agency. The delay in beginning the R&D study led to a revised timetable being set out in the previous project progress report (Furse and Symes, 1998) which was accepted by the Agency.

1.3 Work Programme for the Reporting Period

The intended work programme for the reporting period, as set out in the previous progress report (Furse and Symes, 1998) was as follows:

- Completion of data acquisition
- Continuation of data transfer
- Selection of 1990 RQS samples for species identification
- Continuation of data-logging

- Completion of data review
- Completion of discussions on the University of Wales system
- Commencement of identification of RQS samples
- Commencement of preliminary analyses

2 INTERIM RESULTS

2.1 Data Acquisition, Review, Transfer and Logging

For reasons outlined in the previous report, data acquisition has continued to concentrate on macro-invertebrates.

Four data-sources are currently being considered:

- Species data held by IFE
- Species data to be acquired by IFE through further analysis of samples they held in store from the 1990 River Quality Survey
- Species level data held by the Agency and collected by them using RIVPACS compatible methodologies
- Family level data collected by the Agency and its predecessors during national surveys

2.1.1 Species level data held by IFE

The availability of data from this source was described in the previous report.

2.1.2 Species level data acquired by analysis of 1990 River Quality Survey samples

As part of the terms of agreement for this collaborative R&D programme between the IFE and the Agency, IFE agreed to provide funds for the species level identification of samples from the 1990 River Quality Survey (RQS) which are held in long term store near the IFE's River Laboratory at Wareham.

The consultation letter sent to selected Agency personnel (Furse and Symes 1998) requested recommendations from each region for samples to be sorted in each of three pH value ranges;

low, $\text{pH} \leq 7.0$ to >6.0 , moderate, 6.0 to >5.3 and high ≤ 5.3 . Correspondents were sent lists of all known sampling sites from the 1990 RQS and were asked to mark these with approximately 30 sites spread across the three categories.

Two of the ten former NRA Regions in existence in 1990 (Anglian and the Devon Area of South West) returned complete or partially annotated site lists in the manner requested, four regions/areas (Southern, Northumbrian, Welsh, Yorkshire and Cornwall Area of South West) sent other forms of lists of recommended sites/rivers, North East Region supplied a list of sites they had sampled in their own internal acid water survey of 1989 and Midlands provided information directly at a requested meeting with IFE. Two Regions provided no written reply, Thames which has no known acid streams and Wessex which has relatively few. At a subsequent meeting Adrian Brown of the former Wessex NRA Region Bridgewater Office confirmed that there were no suitable acid streams in that area.

The returned information provided the initial basis for site selection. Further helpful information which assisted this process came from Graham Rutt (Welsh Region) who had applied the so-called "University of Wales" system (Rutt *et al.*, 1990) to all sites from the 1990 RQS which he considered to be acid. In the absence of pH data for all sites he found that a total hardness value of $30 \text{ mg l}^{-1} \text{ CaCO}_3$ provided an effective upper limit for acid sites.

Using data on the 1990 RQS and the 1995 General Quality Assessment (GQA) supplied to IFE by the Agency for R&D Project (EMA 036, "Analysis of 1995 Biological Survey Data: Phase 2 - Post-survey Appraisal") a list was set up of all sites common to both surveys, ordered, within each of the ten regions, by their mean annual hardness value for 1995. This list provided a second basis for site selection.

In discussion with Graham Rutt and Frank Jones, it became clear that spring was the best season for the detection of acidification effects using macro-invertebrate assemblages. This season (or winter in one sub-set of Rutt's data) was common to the sampling regimes of the UK Acid Water Monitoring Programme (Patrick *et al.*, 1995), the Welsh Acid Waters Survey (Stevens *et al.*, 1997) and the existing biological algorithms of Wade *et al.* (1989) and Rutt *et al.* (1990). Spring was also one of the two seasons sampled during the 1995 GQA and one of the two alternate seasons proposed by the IFE for test sampling of the algorithm(s) they would develop. It was therefore decided that the 100 additional samples identified from the 1990 RQS would all be from spring. This provided a third criterion for sample selection since many spring samples from the 1990 RQS were discarded before the contract between the NRA and IFE was in place to audit and store the samples.

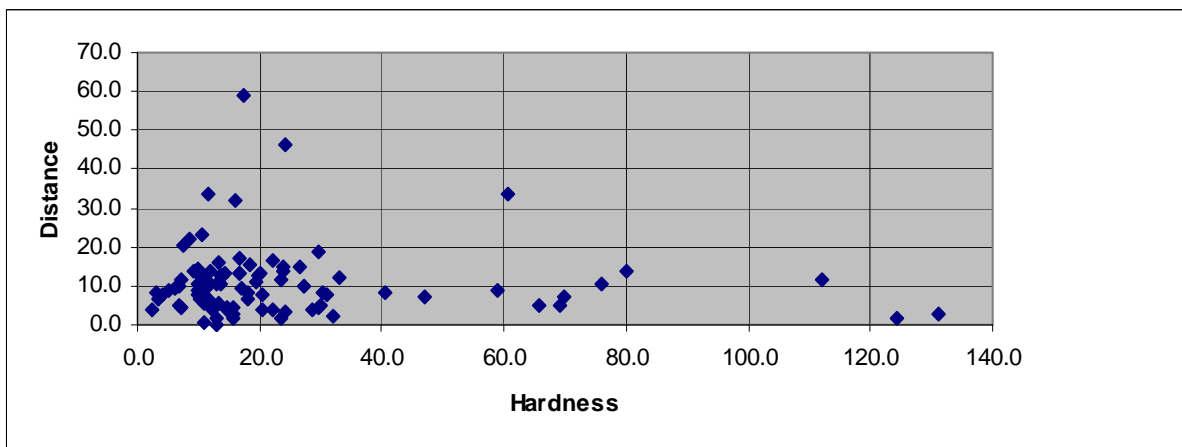
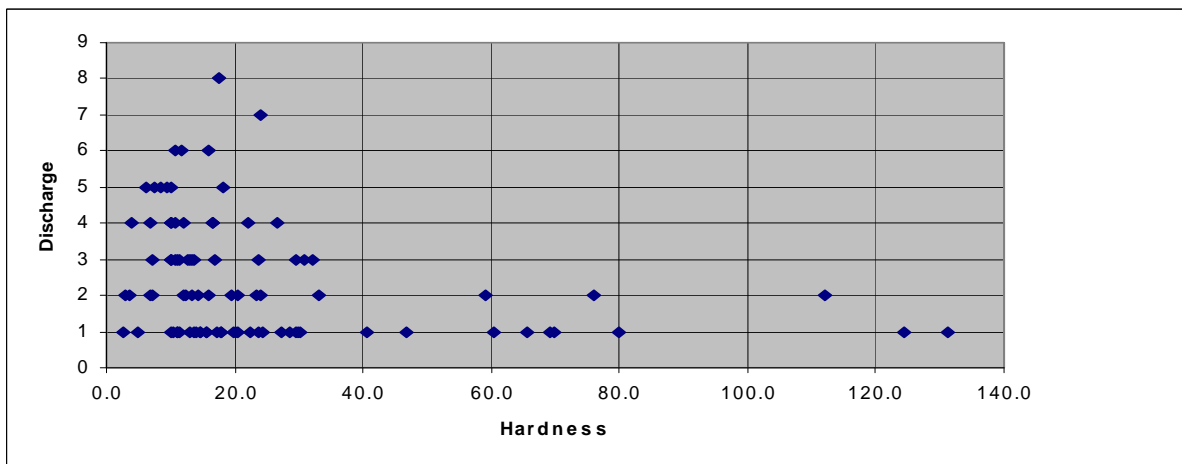
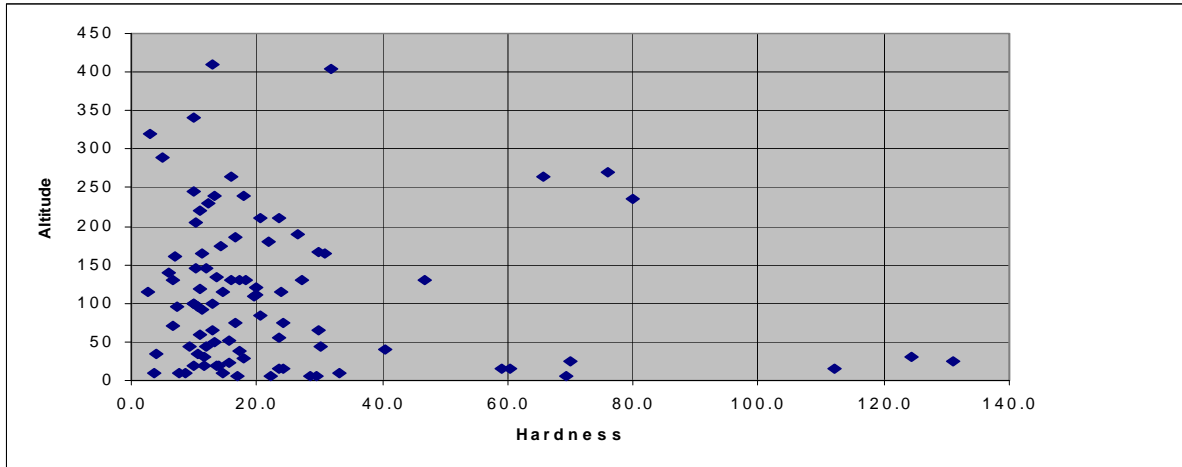
The site selection process also took into account the altitude, distance from source and discharge categories of each site, as determined from the 1995 GQA data-base, in order to get a good spread of these features.

Applying these criteria provided a list of 112 sites (Appendix 1) which were successfully retrieved from storage for consideration for identification. Additional samples were taken to forestall the need to return to the store to retrieve extra samples, which is a difficult process, and to allow for the fact that not all sites were suitably preserved or were unsuitable because of other influences on the site. Separate lists of sites from each Region will be sent to appropriate Agency staff so that they can identify sites that are subject to other confounding sources of stress. The range of environmental conditions at these sites is shown in Figure 1.

Figure 1 **The distribution of total hardness values of 112 sites, selected for further identification of their spring 1990 RQS samples, in relation to their altitude,**

distance from source and discharge (mean annual flow category). Sorting and identifying the 100 samples to be processed by IFE will begin in the next reporting period.

2.1.3 Species level data held by the Agency



Comparatively little information on existing species level information was supplied by the Agency staff during the consultation exercise

The two main sources of data wholly or partial under the control of the Agency were the data-set collected by Graham Rutt and colleagues in order to create the “University of Wales” System (Rutt *et al.*, 1990) and the results of the Welsh Acid Water Surveys (Stevens *et al.*, 1997).

Graham Rutt has kindly supplied his data-set in electronic format and he and Frank Jones (Welsh Region) have agreed to assist in the provision of data from both the first and second Welsh Acid Water Surveys (WAWS) of 1984 and 1995.

The data set supplied by Graham Rutt includes information from Welsh and North East Regions and the former Scottish River Purification Boards and was collected between 1981 and 1986.

The WAWS data are currently being upgraded to an improved format and delivery is expected once this process has been completed.

The other data held by the Agency are mainly in small data-sets. The following lists the information supplied by Environment Agency Region:

- Anglian : No information
- North East : PhD studies by Julie McNish on the buffering capacity of the streams of North Yorkshire, including the North York Moors, and by Debbie Cowen who is working on buffer zones in the afforested North York Moors area of the upper Derwent. Ann Lewis volunteered to contact Debbie Cowen to ask whether she would make her data available.
- North West : No information apparently available at species level but results made available for 116 sites where data were identified to a mixed level (mainly to genera but some to species and others to family or broader grouping) with abundance categories. These data assumed to be broadly the same as supplied to Graham Rutt for developing the “University of Wales System”.
- Midlands : Information supplied by post by Alan George and verbally during meeting between Midlands Region staff and IFE suggests that few data are likely to be available and those that are available will include work on streams subject to liming. The few data available result from work on the Hafren Forest in the early 1990's undertaken by John Gee. Alan George identified two other species level data-sets comprising five sites on the River Twrch sampled twice yearly from 1990 to date and five sites on the Severn upstream of the confluence with the Dulas sampled twice a year between 1990 and 1996. Lucy Morris is investigating the availability of data.
- Southern : No species level data available.
- South West : In her written reply, Lucy Brown said that Devon Area staff hold data on three major data-sets with between 16 and 32 sites in each. Only one of these sets is relevant and includes 32 sites sampled on the Teign, Erme,

Dart and Avon catchments in spring 1996. These streams arise on Dartmoor and are naturally acidic in their upper reaches. Some are also affected by mining activity and all possibly by acid deposition. Lucy Brown considers that eleven of the 32 sites are likely to be acidic. In a subsequent meeting between IFE and biologists from the Exeter and Bridgewater Area Offices further sites were identified on the River Okement and Cherry Brook as having species level data available. Both the animals identified and the re-constituted samples were still available and four River Okement samples and equivalent vials of samples were given to IFE in case they were of value to the project.

- Thames : No reply received but total hardness data from the 1995 GQA suggest that there are no acid sites in the Region.
- Welsh : The principal holdings are the data described above as having been used to develop the "University of Wales" system or those collected during the 1984 and 1995 WAWS.

Acquisition and logging of these data are about six weeks behind schedule and particular efforts will be made to rectify this delay in the next reporting period.

2.1.4 Family level data from national surveys

The development of a data-base holding the biological, physical and geographical results of the 1990 RQS and 1995 GQA is virtually complete but the incorporation of chemical data is still under development. The only chemical data held to date are total hardness values for the 1995 GQA sites. The rest of the chemical data remains to be acquired.

2.2 Evaluation of the University of Wales System

During the reporting period three separate meetings were held with Environment Agency biologists from the Welsh, Midlands and South West Regions. At each meeting the applicability, value and deficiencies of the "University of Wales" system (Rutt et al., 1990) were discussed. Additional comments were obtained in writing from biologists in the Anglian and North East Regions and verbally from biologists in the Midlands and South West Regions.

The system was developed by the University of Wales under contract to the former Nature Conservancy Council. In developing the system the most detailed common level of identification available from the three data suppliers, Welsh and North West NRA Regions and the Scottish Purification Boards was used.

In many cases the important families were represented by a single species as the best indicator of acidification (eg Gammaridae, *Gammarus pulex*; Baetidae, *Baetis rhodani*) so the system was often effectively working at family level.

However, in some families there was more distinction at species level than family. For example

Chloroperla tripunctata is more sensitive to acidity than *C.torrentium* according to Graham Rutt.

In Graham Rutt's view, it is likely that greater discrimination between states of acidification could be obtained from using abundance data at family level than presence/absence data at species level but that remains to be fully tested.

The system has been widely and effectively used in the Welsh Region in connection with routine regional surveys and national river quality surveys. It has also been helpful in surveying catchments about to be subjected to afforestation in order to set baseline levels prior to planting and to evaluate the potential impacts of the planting programme and in developing Catchment Management Plans (CMP's) or Local Environment Agency Plans (LEAP's)

The system was apparently never used by the Nature Conservancy Council and it is increasingly rarely used in the Environment Agency Welsh Region. Part of the reason for that is that there has been a lull in the rate of afforestation, meaning fewer special investigations have needed to be conducted, and partly because new guidelines for afforestation near water bodies has reduced their impact upon stream acidity in Graham Rutt's view. Furthermore, surprisingly, there is still no common Welsh regional policy on the detection and management of acidification.

The system was also used to evaluate the results of the 1990 RQS. Graham Rutt applied the algorithm to all sites with a total hardness of less than 30 mg l⁻¹ Ca CO₃. Each of these sites was assigned an acidification class and the results sent to biologists in each NRA Region for evaluation.

A common criticism of the system, re-iterated by North East Region in their written comments is that it fails to distinguish between acid sites and those affected by mine drainage or heavy metal pollution. Rutt's view was that this was always acknowledged to be the case, even during the systems development, and that the main purpose of the algorithm was to detect the impact of an environmental stress and to follow up this detection with a more detailed local investigation.

The written reply from Anglian was that the system did not work well in their region because many of the taxa whose absence was indicative of acidification, such as Heptageniidae, Taeniopterygiidae and Perlodidae) had a limited distribution in their Region. Thus several sites were classed as acidified purely because these taxa were absent due to the geography and habitat structure of the site. In addition, they felt that the effects of domestic and industrial discharges, salinity and low flow problems could also be interpreted as due to acidification when the "University of Wales" system was applied.

Similar concerns were expressed by Midlands Region who would have preferred a system which included some positive indicators of acidification whose presence was a key diagnostic feature, rather than a series of negative indicators significant for their absence. They preferred an algorithm developed for the Forestry Commission by the Pitlochry Laboratory because it put more weight on positive features.

A fuller review of the consultation exercise will be given in the project Technical Report.

2.3 Test Sampling for Algorithm Appraisal

The algorithm(s) under development will probably use spring data. It is therefore important that the fifteen test sites are sampled in spring and preferably in April.

The test sites were therefore selected using the following criteria:

- they encompassed a broad geographic spread
- they included sites across the three categories of acidification described above (low, medium and high)
- appropriate chemical data were available for the site for each of the previous five years, including monthly measurements of pH and conductivity, frequent measurements of total hardness and, preferably frequent measurements of aluminium, manganese and iron concentrations
- they were substantially free of other forms of environmental stress
- ease of access, preferably including available Agency “site sheets”

Environment Agency staff were consulted to assist in the selection process. The fifteen squares selected are shown in Table 1.

Table 1 The fifteen squares selected for the test sampling programme, together with their five-year mean pH.

<i>River</i>	<i>Site</i>	<i>NGR</i>	<i>Region</i>	<i>Mean PH</i>
Withey Brook	u/s Bastreet Intake	SX 2430 7640	South West	6.41
Cowsic River	Beardown Farm	SX 6028 7529	South West	6.42
West Okemont	20m u/s Vellake Br.	SX 5550 9055	South West	6.33
Plaitford Stream	u/s Plaitford Ford	SU 2779 1958	Southern	6.74
Pippingford Brk Trib	Mardens Hill	TQ 4989 3256	Southern	6.91
Nant Blaenpeleenna	u/s Middle Mine	SS 8157 9782	Welsh	6.05
Afon Irfon	Llanerch-Yrfa	SN 8330 5560	Welsh	5.38
Afon Tryweryn	u/s Llyn Celyn	SH 8383 3984	Welsh	6.45
River Severn	Cwm Ricket	SN 8610 8670	Midlands	<6
River Severn	Felindre Bridge	SN 9440 8390	Midlands	6.77
Tarn Beck	Tongue House	SD 2350 9750	North West	5.95
River Roch	u/s Summit	SD 9470 1870	North West	?
Strines Dyke	u/s Strines Reservoir	SK 2210 9080	North East	5.80
River Esk	u/s Woodhead	NZ 6510 0360	North East	6.13
Lewis Burn	Bridge	NY 6320 8920	North East	7.20

Sampling of these sites will take place in April 1998 since there will be no further opportunity for spring sampling for the duration of the contract. At each site two macro-invertebrate samples will be taken which will, between them, provide compatibility with most of the methods used in other comparable studies. One sample will be a standard, three minute RIVPACS sample and the other will be a three minute kick sample taken from a riffle. The current plan is only to identify the RIVPACS samples but the riffle samples will be retained in case both the need and the finance becomes available to deal with them.

Diatom samples will also be taken and retained for each site. Collecting will be undertaken using the TDI (Trophic Diatom Index) methodology being developed for the Environment Agency by Martyn Kelly of Bowburn Consultants. Kelly has been consulted about the most appropriate preservation techniques for long term sample storage. It is possible that these samples will be analysed by a visiting Korean worker based at IFE Windermere Laboratory.

3 PLANS FOR THE NEXT REPORTING PERIOD

The next reporting period is from 1st April 1998 (month 7) to 30th June 1998 (month 9).

- Completion of data acquisition
- Continuation of data transfer
- Continuation of data-logging
- Commencement of identification of RQS samples
- Collection of macro-invertebrate and diatom samples from the fifteen test sites
- Commencement of preliminary analyses

Particular efforts during this quarter will be directed towards the completion of the data acquisition phase in order that the data are ready for analysis as soon as the hundred 1990 RQS sites have been identified.

A Project Board Meeting has been arranged for 7th May 1998, to be held at the IFE River Laboratory.

4 FACTORS WHICH MAY AFFECT THE ATTAINMENT OF ANY TARGETS OR TIMESCALES

The slow start to the project, for reasons explained in the previous report (Furse and Symes, 1998) means that the project is still running approximately six weeks behind schedule.

It had been hoped to re-coop some of this time over the past reporting period but a commitment to get the sampling programme for another Agency R&D co-project, "Countryside Survey 2000" up and running on time meant that priority was directed to that objective.

The principal delay is in the acquisition and logging of data from sources other than IFE. This has had the knock-on effect of delaying the start of data analysis. These elements are still six weeks behind schedule but it is hoped to recover much of this time over the next quarter and all of it in the next two quarters. One element of the project, planning for test sampling, is ahead of schedule.

No delay in the total completion of the work is anticipated.

5 FINANCE

The work conducted to date has been within the agreed budget.

A financial summary for the reporting period and end-of-year out-turn may be obtained from the

IFE Finance Office approximately two months after the end of the period/financial year in question.

6 REASONS FOR ANY LIKELY UNDER OR OVERSPEND OF BUDGET

No under or overspend of the budget is currently anticipated.

7 OTHER MATTERS

None

8 REFERENCES

Furse, M T and Symes, K L (1998) Monitoring of acid waters. Phase 1 Indicator populations. R&D Progress Report P2/090/1 for the period 1st October 1997 to 31st December 1997. A Progress Report to the Environment Agency, 9pp.

Patrick, S, Monteith, D T and Jenkins A (1995) UK Acid Waters Monitoring Network: The first five years. Analysis and interpretation of the results, April 1988 - March 1993. A report to the Department of the Environment and Department of the Environment (Northern Ireland), 320pp. London: ENSIS Publishing.

Rutt, G P, Weatherly, N S and Ormerod, S J (1990) Relationships between the physiochemistry and macroinvertebrates of British upland streams: the development of modelling and indicator systems for predicting fauna and detecting acidity. *Freshwater Biology*, **24**, 463-480.

Stevens, P A, Ormerod, S J and Reynolds, B (1997) *Final report on the Acid Waters Survey for Wales*. A report to the Environment Agency, Welsh Office, Countryside Council for Wales and Forestry Authority. Volume 1: 221pp. Volume 2: unpaginated.

Wade, K R, Ormerod, S J and Gee, A S (1989) Classification and ordination of macroinvertebrate assemblages to predict stream acidity in upland Wales. *Hydrobiologia*, **171**, 59-78.

Appendix 1 The 112 sites from the 1990 RQS selected for possible species level identification by IFE.

REGIO N	SITE REFERENCE	RIVER NAME	SITE NAME	NGR	DATE
02	NRA021790	NENT	ALSTON	NY 717 467	05/04/90
02	NRA020130	WOOLER WATER	COLDGATE MILL	NT 997 248	06/03/90
02	NRA021700	EAST ALLEN	US ALLENHEADS	NY 859 450	10/05/90
02	NRA021250	NORTH TYNE	FALSTONE	NY 723 871	03/04/90
02	NRA022720	BEDBURN BURN	NEWHALL	NZ 112 320	20/04/90
02	NRA022770	ROOKHOPE BURN	EASTGATE	NY 953 386	02/04/90
02	NRA021720	WEST ALLEN	CARRSHIEL	NY 803 467	13/03/02
02	NRA020690	USWAY BURN	SHILLMOOR	NY 887 082	14/04/90
02	NRA023910	BALDER BURN	COTHERSTONE	NY 012 201	12/03/90
02	NRA021500	BOLTS BURN	BAY BRIDGE	NY 957 497	08/05/90
02	NRA021440	DIPTON BURN	B6310	NZ 146 548	08/05/90
03	NRA033KA2	DOUGLAS	300m D/S SQUIRREL BRIDGE	SD 630 117	14/03/90
03	NRA03116W	ARTLE BECK	U/S A683 BRIDGE, CATON (U/S SSO)	SD 534 646	21/03/90
03	NRA03181K	STOCK GHYLL	PTC RIVER ROTHAY	NY 372 045	09/04/90
03	NRA0318R4	BRATHAY	20m U/S BRIDGE AT CLAPPERSGATE	NT 367 035	09/04/90
03	NRA030QUO	HAWESWATER BECK	10m U/S HALFA BRIDGE	NY 518 176	08/03/90
03	NRA0300RS	MITE	40m U/S MUNCASTER MILL BRIDGE	SD 095 978	28/03/90
03	NRA0300UK	BLENG	50m D/S BLENG BRIDGE	NY 085 029	27/03/90
03	NRA031CJ8	DUDDON	U/S DUDDON BRIDGE	SD 199 882	22/03/90
03	NRA0304PG	COLEDALE BECK	OPP. CHAPEL WEST OF BRAITHWAITE	NY 229 236	19/03/90
03	NRA0302JO	LIZA	1000m U/S ENNERDALE WATER	NY 134 141	28/03/90
03	NRA03012W	MOSEDALE BECK	10m D/S DOWN IN THE DALE BRIDGE	NY 184 082	23/03/90
03	NRA0300M8	ESK	50m D/S FORD AT CROPPLE HOW	SD 130 978	28/03/90
04	NRA045010	ALPORT	CONFLUENCE WITH RIVER ASHOP	SK 141 897	
04	NRA045009	ASHOP	ABOVE LADYBOWER RESERVOIR	SK 164 878	
04		TANAT	PEDAIR FFORDD	SJ 116 245	
04	NRA041104	VYRNWY	PONTYSGAWRHYD	SJ 196 157	
04	NRA041022	AFON DULAS	U/S SEVERN	SN 951 825	
04	NRA041028	CERIST	MINOR BRIDGE (WERN)	SN 992 903	
04	NRA041034	GARNO	WIG BRIDGE, PONTDOLGOCH	SO 016 926	
04	NRA041032	TRANNON	TREFFGLYNS	SN 967 904	
04	NRA041340	OCHRE BROOK	HORTON	SJ 678 143	
05	NRA051019	PIPPINGFORD BROOK	TRIBUTARY AT HALF MOON INN	TQ 499 334	
05	NRA051018	PIPPINGFORD BROOK	WITHYHAM (D/S TRIB)	TQ 493 360	
05	NRA051017	PIPPINGFORD BROOK	POSINGFORD FARM	TQ 478 344	
05	NRA052208	EAST STREAM	A259 BRIDGE	TQ 687 080	
05	NRA054157	BLACKWATER	WELLOW MILL	SU 312 196	
05	NRA054173	DARK WATER	GATEWOOD BRIDGE	SU 433 014	
05	NRA053037	HAMMER STREAM	HAMMER LANE	SU 847 235	
05	NRA051057	LESSER TEISE	SPITZ BRIDGE	TQ 732 459	
05	NRA051044	SOMERHILL STREAM	U/S TONBRIDGE WELLS N STW	TQ 606 423	
05	NRA051073	HAMMER STREAM TRIB.	IBORNDEN PARK	TQ 842 394	
05	NRA054171	BROOKLEY STREAM	BROCKENHURST	SU 297 023	
05	NRA 054164	PENERLY WATER	PENERLY GATE	SU 373 038	
05	NRA051074	CLAY BRIDGE STREAM	CLAY BRIDGE	TQ 836 401	
05	NRA053036	MINSTEAD STREAM	A272 ROAD BRIDGE	SU 864 218	
05	NRA054170	PASSFORD WATER	LYMINGTON (AMPRESS)	SZ 317 971	
05	NRA054175	SOWLEY STREAM WEST	EAST END	SZ 365 973	
05	NRA054241	OBER WATER	ALDRIDGEHILL	SU 270 028	

REGIO N	SITE REFERENCE	RIVER NAME	SITE NAME	NGR	DATE
06	NRA062111	NEWLYN	BURYS BRIDGE	SW 446 291	
06	NRA061508	ST NEOT	TWO WATERS FOOT	SX 184 680	20/03/90
06	NRA062002	COBER	LOWER TOWN BRIDGE	SW 658 291	
06	NRA062934	RED-A-VEN BROOK	75m U/S WEST OKEMENT CONFLUENCE	SX 565 920	
06	NRA061940	CARNON	TWELVEHEADS	SW 762 421	
06	NRA061103	PLYM	CADOVER BRIDGE	SX 556 650	
06	NRA062301	RED	ROSECROGGAN BRIDGE	SW 650 420	
06	NRA062408	EAST WHEAL ROSE STREAM	BENNY BRIDGE	SW 838 572	
06	NRA061925	GWINDRA STREAM	GWINDRA BRIDGE	SW 950 530	
06	NRA061927	BODELLA BROOK	CARSELLA	SW 940 577	19/03/90
06	NRA060719	WARLEGGAN	PANTERS BRIDGE	SX 158 681	
06	NRA062519	STANNON STREAM	TRECARNE	SX 098 805	02/04/90
06	NRA060555	DANES BROOK	30m U/S HAWKKRIDGE BRIDGE	SS 858 301	02/04/90
06	NRA060607	TEIGN	55m D/S RUSHFORD BRIDGE	U/S SX 694 880	10/04/90
			CHAGFORD		
06	NRA060708	DART	10m D/S DART BRIDGE	BUCKFASTLEIGH SX 745 667	23/04/90
06	NRA060901	ERME	120m U/S STOWFORD WEIR	SX 639 571	27/04/90
06	NRA060612	BEADON BROOK	10m U/S HYNTER BRIDGE	SX 837 817	20/04/90
06	NRA060611	BEADOW BROOK	50m D/S BRIDGE	TOTTIFORD HOUSE SX 808 823	20/04/90
06	NRA060614	SOWTON BROOK	150m U/S SOWTON BRIDGE	SX 834 876	20/04/90
06	NRA060810	AVON	150m D/S GARA BRIDGE	SK 729 533	27/04/90
06	NRA060621	BECKA BROOK	100m U/S NEWBRIDGE	SX 757 800	10/04/90
06	NRA060622	LEMON	30m D/S SIG CONFLUENCE	SX 779 736	23/04/90
06	NRA060701	HARBOURNE	15m U/S ROAD	BRIDGE SX 718 624	26/04/90
			HARBOURNEFORD		
06	NRA060707	DART	20m U/S NEW BRIDGE	SX 711 709	25/04/90
06	NRA060719	WEST DART	30m U/S ROAD BRIDGE	TWO BRIDGES SX 608 751	24/04/90
06	NRA060709	DART	500m U/S RIVERFORD BRIDGE	SX 768 640	27/04/90
08	NRA08W045	NANT GWENFFRWD	D/S GWENFFRWD DISCHARGE	SS 797 964	30/03/90
08	NRA08W024	NANT-Y-CERDIN	CWFELIN	SS 858 898	18/04/90
08	NRA08W099	MARLAIS	LLANGENNECH ROAD BRIDGE	SN 562 020	21/03/90
08	NRA08N007	PENNAL	AT PENNAL ROAD BRIDGE	SJ 699 003	03/05/90
08	NRA08W045	NANT GWENFFRWD	U/S WHITWORTH MINE DISCHARGE	SS 798 975	30/03/90
08	NRA08W295	ALLTWALLIS	U/S LLANPUMPSAINT	SN421 296	24/04/90
08	NRA08W238	CLETTWR	DOLBANTAU	SN 444 405	27/03/90
08	NRA08E015	WYE	BULTH WELLS	SO 042 511	27/03/90
08	NRA08E156	MARTEG	U/S WYE	SN 952 715	28/03/90
08	NRA08E158	TARENIG	U/S WYE	SN 840 826	28/03/90
08	NRA08E157	BIDNO	U/S WYE	SN 893 803	28/03/90
08	NRA08N203	TWRCH	U/S DEE	SH 882 311	11/04/90
08	NRA08N204	LLIW	AT PEN-Y-BONT	SH 873 307	11/04/90
08	NRA08N074	LLEDR	DOLWYDDELAN	SH 737 523	28/03/90
08	NRA08N185	CEIRW	D/S MAERDY	SJ 017 446	11/04/90
08	NRA08N068	OGWEN	U/S QUARRY ADIT	SH 616 669	28/03/90
08	NRA08N188	MEDRAD	U/S CEIRW	SH 974 452	27/03/90
08	NRA08E019	COLWYN	AT BEDDGELERT	SH 590 481	23/03/90
09	NRA09T352	TONE RIVER	WASHBATTLE BRIDGE	ST 052 284	
09	NRA09T146	HORNER WATER	WEST LUCCOMBE	SS 898 459	
09	NRA09T116	DOCKENS WATER	BLASHFORD	SU 150 072	
09	NRA09T118	HUCKLES BROOK	HUCKLESBROOK FARM	SU 152 107	
09	NRA09T113	RIPLEY BROOK	SANDFORD	SU 169 016	
REGIO	SITE	RIVER NAME	SITE NAME	NGR	DATE

N REFERENCE

09	NRA09T120	UDDENS WATER	WEST MOORS	SU 080 021	
10	NRA100163	GREAT FRYUP BECK	STREET	NZ 729 047	
10	NRA100215	MURK ESK	GROSMONT	NZ 827 053	
10	NRA100130	DOVE	FARNDALE	SE 666 974	
10	NRA100148	EWDEN BECK	U/S DON CONFLUENCE	SK 297 955	19/04/90
10	NRA100206	MAG BROOK	D/S VINE PRODUCTS	SE 118 121	29/03/90
10	NRA100057	CALDER	D/S HEBDEN BRIDGE	SD 996 269	20/03/90
10	NRA100254	RYBURN	U/S BOOTH DEAN CLOUGH	SE 032 186	20/03/90
10	NRA100255	RYBURN	U/S RIPONDEN STW	SE 045 205	20/03/90
10	NRA100277	SLEDBROOK DYKE	AT SLEBROOK BD	SE 197 036	05/03/90
10	NRA100058	CALDER	U/S TANNERY	SD 896 267	20/03/90
10	NRA100183	HOLME	STEPS MILL	SE 139 128	29/03/90

DISTRIBUTION SHEET

To be completed by all Project Leaders completing commissioned research project reports. Please bind a copy of this distribution sheet as the final page in all internal (IFE) copies of the report.

1.	Title: Monitoring of acid waters. Phase 1 Indicator populations. Progress Report P2/090/1 for the period 1st January 1998 to 31st March 1998 Authors: M T Furse Report ref: RL/T04079L7/2 Master copy held by: M T Furse Report access code: N		
2.	DISTRIBUTION LIST [A)-H) standard, I) other]	No.copies	Date
A)	Contract customer:	8	29-4-98
B)	Director - Prof A.D. Pickering	1	29-4-98
C)	Asst Director - Dr J. Hilton (title page and abstract only)		
D)	River Laboratory Library	1	29-4-98
E)	Windermere Library	1	29-4-98
F)	Diana Morton (title page only + no.pages for adding to publication list)		
G)	Project leader: M T Furse	3	29-4-98
H)	Other (list below and indicate no.copies in RH column)		
	Total number of copies made	14	

REPORT ACCESS CODES

S In strict confidence - restricted access - Access to named customer(s) - (could be named restricted access individuals), IFE Directorate, Project Leader and all authors.

C In confidence - restricted access - Access to customer, IFE Directorate, Project Leader, all authors, and IFE staff with permission of Project Leader.

N 'Normal' access - Access to customer and all IFE staff. Access to visitors and general public with permission of Project Leader.

G General access - General access to anyone as required.