Environmental Protection Report

Hartland Streams Catchment River Water Quality Classification 1991

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Suggestions for improvements that could be incorporated in the production of the next Classification report would be welcomed.

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RIVER WATER QUALITY IN THE HARTLAND STREAMS CATCHMENT

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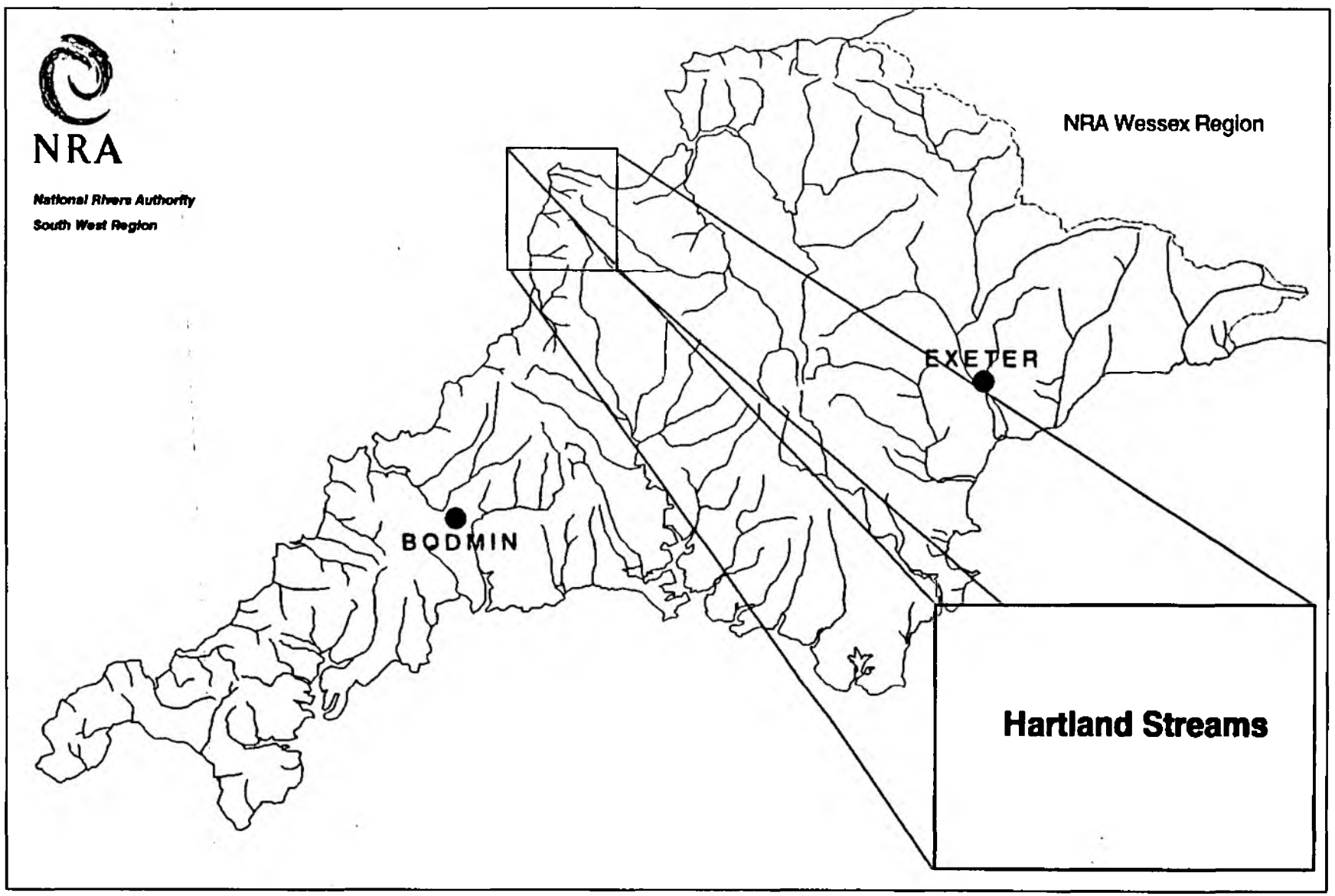
National Rivers Authority
South West Region



1. INTRODUCTION

Monitoring to assess the quality of river waters is undertaken in thirty-four catchments within the region. As part of this monitoring programme samples are collected routinely from selected monitoring points at a pre-determined frequency per year, usually twelve spaced at monthly intervals. Each monitoring point provides data for the water quality of a river reach (in kilometres) upstream of the monitoring point.

Each water sample collected from each monitoring point is analysed for a range of chemical and physical constituents or properties known as determinands. The analytical results for each sample are entered into a computer database called the Water Quality Archive.

Selected data are accessed from the Archive so that the quality of each river reach can be determined based on a River Classification System developed by the National Water Council (NWC), (7.1).

This report presents the river water quality classification for 1991 for monitored river reaches in the Hartland Streams catchment.

2. HARTLAND STREAMS CATCHMENT

The Welcome Stream and the Abbey River flow over a distance of 6.7 km and 9.5 km respectively from their source to the tidal limits, (Appendix 8.1). Water quality was monitored on both watercourses at one site at approximately monthly intervals.

Each sample was analysed for a minimum number of determinands (Appendix 8.2) plus additional determinands based on local knowledge of the catchment. In addition, at selected sites, certain metal analyses were carried out.

The analytical results from all of these samples have been entered into the Water Quality Archive and can be accessed through the Water Resources Act Register, (7.2).

3. NATIONAL WATER COUNCIL'S RIVER CLASSIFICATION SYSTEM

3.1 River Quality Objectives

In 1978 River Quality Objectives (RQOs) were assigned to all river lengths that were part of the routine monitoring network and to those additional watercourses, which were not part of the routine network, but which received discharges of effluents.

For the majority of watercourses long term objectives were identified based on existing and assumed adequate quality for the long term protection of the watercourse. In a few instances short term objectives were identified but no timetable for the achievement of the associated long term objective was set.

The RQOs currently in use in the River Hartland Streams catchment are identified in Appendix 8.1.

3.2 River Quality Classification

River water quality is classified using the National Water Council's (NWC) River Classification System (see Appendix 8.3), which identifies river water quality as being one of five quality classes as shown in Table 1 below:

Table 1 - National Water Council - River Classification System

Class	Description
1A	Good quality
1B	Lesser good quality
2	Fair quality
3	Poor quality
4	Bad quality

Using the NWC system, the classification of river water quality is based on the values of certain determinands as arithmetic means or as 95 percentiles (5 percentiles are used for pH and dissolved oxygen) as indicated in Appendices 8.4 and 8.4.1.

The quality classification system incorporates some of the European Inland Fisheries Advisory Commission (EIFAC) criteria (Appendix 8.3) recommended for use by the NWC system.

4. 1991 RIVER WATER QUALITY CLASSIFICATION

Analytical data collected from monitoring during 1989, 1990 and 1991 were processed through a computerised river water quality classification programme. This resulted in a quality class being assigned to each monitored river reach as indicated in Appendix 8.5.

The quality class for 1991 can be compared against the appropriate River Quality Objective and previous annual quality classes (1985-1990) also based on three years combined data, for each river reach in Appendix 8.5.

The river water classification system used to classify each river length is identical to the system used both in 1985 and 1990 for the Department of the Environment's Quinquennial River Quality Surveys. The determinand classification criteria used to determine the annual quality classes in 1985, subsequent years and for 1991 are indicated in Appendices 8.4 and 8.4.1.

The river quality classes for 1991 of monitored river reaches in the catchment are shown in map form in Appendix 8.6.

The calculated determinand statistics for pH, temperature, dissolved oxygen, biochemical oxygen demand (BOD), total ammonia, un-ionised ammonia, suspended solids, copper and zinc from which the quality class was determined for each river reach, are indicated in Appendix 8.7.

5. NON-COMPLIANCE WITH QUALITY OBJECTIVES

Those monitored river reaches within the catchment, which do not comply with their assigned (RQO), are shown in map form in Appendix 8.8.

Appendix 8.9 indicates the number of samples analysed for each determinand over the period 1989 to 1991 and the number of sample results per determinand, which exceed the determinand quality standard.

For those non-compliant river reaches in the catchment, the extent of exceedance of the calculated determinand statistic with the relevant quality standard (represented as a percentage), is indicated in Appendix 8.10.

6. GLOSSARY OF TERMS

RIVER REACH	A segment of water, upstream from sampling point to the next sampling point.
RIVER LENGTH	River distance in kilometres.
RIVER QUALITY OBJECTIVE	That NWC class,which protects the most sensitive use of the water.
95 percentiles	Maximum limits, which must be met for at least 95% of the time.
5 percentiles	Minimum limits, which must be met for at least 95% of the time.
BIOLOGICAL OXYGEN DEMAND (5 day carbonaceous ATU)	A standard test measuring the microbial uptake of oxygen - an estimate of organic pollution.
pH	A scale of acid to alkali.
UN-IONISED AMMONIA	Fraction of ammonia poisonous to fish, NH^3.
SUSPENDED SOLIDS	Solids removed by filtration or centrifuge under specific conditions.
USER REFERENCE NUMBER	Reference number allocated to a sampling point.
INFERRED STRETCH	Segment of water, which is not monitored and whose water quality classification is assigned from the monitored reach upstream.

7. REFERENCES

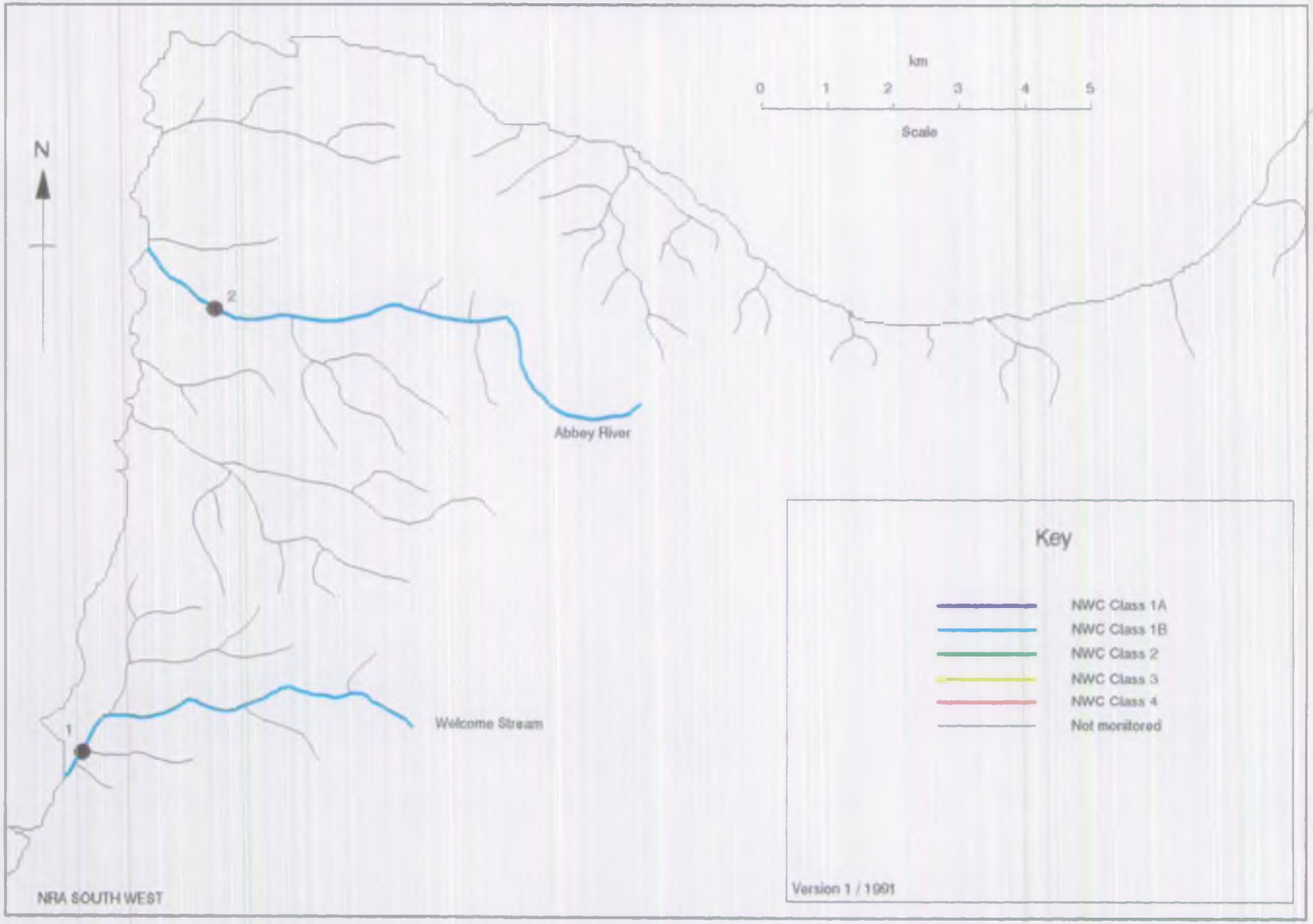
Reference

7.1 National Water Council (1977). River Water Quality: The Next Stage. Review of Discharge Consent Conditions. London.

7.2 Water Resources Act 1991 Section 190.

7.3 Alabaster J. S. and Lloyd R. Water Quality Criteria for Freshwater Fish, 2nd edition, 1982. Butterworths.

Hartland Streams
River Quality Objectives



Appendix 8.1

BASIC DETERMINAND ANALYTICAL SUITE FOR ALL CLASSIFIED RIVER SITES

pH as pH Units

Conductivity at 20 C as uS/cm

Water temperature (Cel)

Oxygen dissolved % saturation

Oxygen dissolved as mg/l O

Biochemical oxygen demand (5 day total ATU) as mg/l O

Total organic carbon as mg/l C

Nitrogen ammoniacal as mg/l N

Ammonia un-ionised as mg/l N

Nitrate as mg/l N

Nitrite as mg/l N

Suspended solids at 105 C as mg/l

Total hardness as mg/l CaCO3

Chloride as mg/l Cl

Orthophosphate (total) as mg/l P

Silicate reactive dissolved as mg/l SiO2

Sulphate (dissolved) as mg/l SO4

Sodium (total) as mg/l Na

Potassium (total) as mg/l K

Magnesium (total) as mg/l Mg

Calcium (total) as mg/l Ca

Alkalinity as pH 4.5 as mg/l CaCO3

NWC RIVER QUALITY CLASSIFICATION SYSTEM

River Class	Quality criteria	Remarks	Current potential uses
	Class limiting criteria (95 percentile)		
1A Good Quality	(i) Dissolved oxygen saturation greater than 80% (ii) Biochemical oxygen demand not greater than 3 mg/l (iii) Ammonia not greater than 0.4 mg/l (iv) Where the water is abstracted for drinking water, it complies with requirements for A2* water (v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)	(i) Average BOD probably not greater than 1.5 mg/l (ii) Visible evidence of pollution should be absent	(i) Water of high quality suitable for potable supply abstractions and for all abstractions (ii) Game or other high class fisheries (iii) High amenity value
1B Good Quality	(i) DO greater than 60% saturation (ii) BOD not greater than 5 mg/l (iii) Ammonia not greater than 0.9 mg/l (iv) Where water is abstracted for drinking water, it complies with the requirements for A2* water (v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)	(i) Average BOD probably not greater than 2 mg/l (ii) Average ammonia probably not greater than 0.5 mg/l (iii) Visible evidence of pollution should be absent (iv) Waters of high quality which cannot be placed in Class 1A because of the high proportion of high quality effluent present or because of the effect of physical factors such as canalisation, low gradient or eutrophication (v) Class 1A and Class 1B together are essentially the Class 1 of the River Pollution Survey (RPS)	Water of less high quality than Class 1A but usable for substantially the same purposes
2 Fair Quality	(i) DO greater than 40% saturation (ii) BOD not greater than 9 mg/l (iii) Where water is abstracted for drinking water it complies with the requirements for A3* water (iv) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)	(i) Average BOD probably not greater than 5 mg/l (ii) Similar to Class 2 of RPS (iii) Water not showing physical signs of pollution other than humic colouration and a little foaming below weirs	(i) Waters suitable for potable supply after advanced treatment (ii) Supporting reasonably good coarse fisheries (iii) Moderate amenity value

3 Poor Quality	(i) (ii) (iii)	DO greater than 10% saturation Not likely to be anaerobic BOD not greater than 17 mg/l. This may not apply if there is a high degree of re-aeration	Similar to Class 3 of RPS	Waters which are polluted to an extent that fish are abse only sporadically present. May be used for low grade industrial abstraction purposes. Considerable potential for further use if cleaned up
4 Bad Quality		Waters which are inferior to Class 3 in terms of dissolved oxygen and likely to be anaerobic at times	Similar to Class 4 of RPS	Waters which are grossly polluted and are likely to cause nuisance
X		DO greater than 10% saturation		Insignificant watercourses and ditches not usable, where the objective is simply to prevent nuisance developing

Notes (a) Under extreme weather conditions (eg flood, drought, freeze-up), or when dominated by plant growth, or by aquatic plant decay, rivers usually in Class 1, 2, and 3 may have BODs and dissolved oxygen levels, or ammonia content outside the stated levels for those Classes. When this occurs the cause should be stated along with analytical results.

(b) The BOD determinations refer to 5 day carbonaceous BOD (ATU). Ammonia figures are expressed as NH_4. **

(c) In most instances the chemical classification given above will be suitable. However, the basis of the classification is restricted to a finite number of chemical determinands and there may be a few cases where the presence of a chemical substance other than those used in the classification markedly reduces the quality of the water. In such cases, the quality classification of the water should be down-graded on the basis of biota actually present, and the reasons stated.

(d) EIFAC (European Inland Fisheries Advisory Commission) limits should be expressed as 95 percentile limits.

* EEC category A2 and A3 requirements are those specified in the EEC Council directive of 16 June 1975 concerning the Quality of Surfa Water intended for Abstraction of Drinking Water in the Member State.

** Ammonia Conversion Factors

($mg\ NH_4/l$ to $mg\ N/l$)

Class 1A	$0.4\ mg\ NH_4/l = 0.31\ mg\ N/l$
Class 1B	$0.9\ mg\ NH_4/l = 0.70\ mg\ N/l$
	$0.5\ mg\ NH_4/l = 0.39\ mg\ N/l$

NWC RIVER CLASSIFICATION SYSTEM

CRITERIA USED BY NATIONAL RIVERS AUTHORITY - SOUTH WEST REGION FOR NON-METALLIC DETERMINANDS

River Class	Quality Criteria
1A	Dissolved oxygen % saturation greater than 80% BOD (ATU) not greater than 3 mg/l O Total ammonia not greater than 0.31 mg/l N Non-ionised ammonia not greater than 0.021 mg/l N Temperature not greater than 21.5 C pH greater than 5.0 and less than 9.0 Suspended solids not greater than 25 mg/l
1B	Dissolved oxygen % saturation greater than 60% BOD (ATU) not greater than 5 mg/l O Total ammonia not greater than 0.70 mg/l N Non-ionised ammonia not greater than 0.021 mg/l N Temperature not greater than 21.5 C pH greater than 5.0 and less than 9.0 Suspended solids not greater than 25 mg/l
2	Dissolved oxygen & saturation greater than 40% BOD (ATU) not greater than 9 mg/l O Total ammonia not greater than 1.56 mg/l N Non-ionised ammonia not greater than 0.021 mg/l N Temperature not greater than 28 C pH greater than 5.0 and less than 9.0 Suspended solids not greater than 25 mg/l
3	Dissolved oxygen % saturation greater than 10% BOD (ATU) not greater than 17 mg/l O
4	Dissolved oxygen % saturation not greater than 10% BOD (ATU) greater than 17 mg/l O

STATISTICS USED BY NATIONAL RIVERS AUTHORITY - SOUTH WEST REGION

Determinand	Statistic
Dissolved oxygen	5 percentile
BOD (ATU)	95 percentile
Total ammonia	95 percentile
Non-ionised ammonia	95 percentile
Temperature	95 percentile
pH	5 percentile 95 percentile
Suspended solids	arithmetic mean

NWC RIVER CLASSIFICATION SYSTEM

CRITERIA USED BY NATIONAL RIVERS AUTHORITY – SOUTH WEST REGION FOR METALLIC DETERMINANDS

SOLUBLE COPPER

Total Hardness (mean) mg/l CaCO3	Statistic	Soluble Copper* ug/l Cu Class 1	Class 2
0 – 10	95 percentile	< = 5	> 5
10 – 50	95 percentile	< = 22	> 22
50 – 100	95 percentile	< = 40	> 40
100 – 300	95 percentile	< = 112	> 112

* Total copper is used for classification until sufficient data on soluble copper can be obtained.

TOTAL ZINC

Total Hardness (mean) mg/l CaCO3	Statistic	Total Zinc ug/l Zn Class 1	Class 2	Class 3
0 – 10	95 percentile	< = 30	< = 300	> 300
10 – 50	95 percentile	< = 200	< = 700	> 700
50 – 100	95 percentile	< = 300	< = 1000	> 1000
100 – 300	95 percentile	< = 500	< = 2000	> 2000

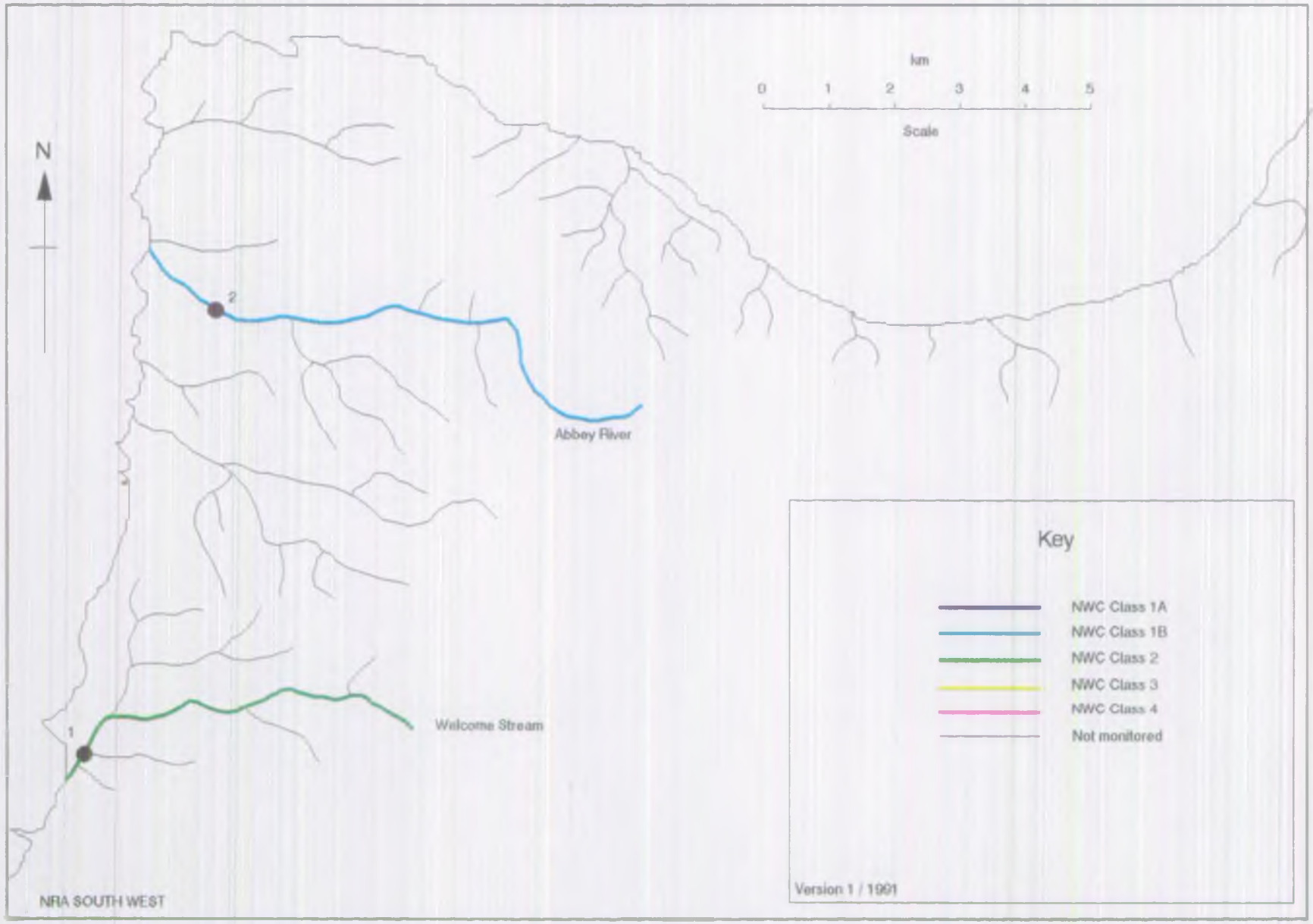
NATIONAL RIVERS AUTHORITY - SOUTH WEST REGION
1991 RIVER WATER QUALITY CLASSIFICATION
CATCHMENT: HARTLAND STREAMS

1991 Map Position Number	River	Reach upstream of	User Reference Number	National Grid Reference
1	WELCOMBE STREAM WELCOMBE STREAM	THE HERMITAGE NORMAL TIDAL LIMIT (INFERRED STRETCH)	R28A005	SS 2168 1836
2	ABBEY RIVER ABBEY RIVER	HARTLAND ABBEY MEAN HIGH WATER (INFERRED STRETCH)	R28A003	SS 2380 2492

Reach Length (km)	Distance from source (km)	River Quality Objective	85 NWC Class	86 NWC Class	87 NWC Class	88 NWC Class	89 NWC Class	90 NWC Class	91 NWC Class
6.2	6.2	1B						N	2
0.5	6.7	1B						N	2
7.9	7.9	1B						1B	1B
1.6	9.5	1B						1B	1B

Appendix 8.5

Hartland Streams
Water Quality - 1991



Appendix 8.6

NATIONAL RIVERS AUTHORITY - SOUTH WEST REGION
1991 RIVER WATER QUALITY CLASSIFICATION
CALCULATED DETERMINAND STATISTICS USED FOR QUALITY ASSESSMENT
CATCHMENT: HARTLAND STREAMS

River	Reach upstream of	User Ref. Number	RQO	Calculated Determinand Statistics used for Quality Assessment																	
				pH Lower		pH Upper		Temperature		DO (%)		BOD (ATU)		Total Ammonia		Union. Ammonia		S.Solids		Total Copper		Total Zinc	
				Class	5%ile	Class	95%ile	Class	95%ile	Class	5%ile	Class	95%ile	Class	95%ile	Class	95%ile	Class	Mean	Class	95%ile	Class	95%ile
WELCOMBE STREAM	THE HERMITAGE	RZ8A005	1B	1A	7.2	1A	7.9	1A	15.5	1A	83.0	1A	3.0	1A	0.270	1A	0.010	1A	6.3	2	50.0	1A	50.0
ABBEY RIVER	HARTLAND ABBEY	RZ8A003	1B	1A	7.2	1A	8.0	1A	16.8	1A	88.2	1B	4.6	1A	0.174	1A	0.010	1A	8.1	1A	34.6	1A	39.5

Appendix 8.7

Hartland Streams
Compliance - 1991

Appendix 8.8

NATIONAL RIVERS AUTHORITY – SOUTH WEST REGION
1991 RIVER WATER QUALITY CLASSIFICATION
NUMBER OF SAMPLES (N) AND NUMBER OF SAMPLES EXCEEDING QUALITY STANDARD (F)
CATCHMENT: HARTLAND STREAMS

River	Reach upstream of	User Ref. Number	pH Lower		pH Upper		Temperature		DO (%)		BOD (ATU)		Total Ammonia		Union. Ammonia		S.Solids		Total Copper		Total Zinc	
			N	F	N	F	N	F	N	F	N	F	N	F	N	F	N	F	N	F	N	F
WELCOMBE STREAM	THE HERMITAGE	R28A005	17	-	17	-	17	-	17	-	17	-	17	-	16	-	17	-	17	1	17	-
ABBEY RIVER	HARTLAND ABBEY	R28A003	31	-	31	-	31	-	31	-	31	-	31	-	29	-	31	3	26	1	26	-

Appendix 8.9

NATIONAL RIVERS AUTHORITY - SOUTH WEST REGION
1991 RIVER WATER QUALITY CLASSIFICATION
PERCENTAGE EXCEEDENCE OF DETERMINAND STATISTICS FROM QUALITY STANDARDS
CATCHMENT: HARTLAND STREAMS

River	Reach upstream of	User Ref. Number	PERCENTAGE EXCEEDENCE OF STATISTIC FROM QUALITY STANDARD									
			pH Lower	pH Upper	Temperature	DO (%)	BOD (ATU)	Total Ammonia	Un-ionised Ammonia	Suspended Solids	Total Copper	Total Zinc
WELCOMBE STREAM	THE HERMITAGE	R28A005	-	-	-	-	-	-	-	-	25 %	-
ABBEY RIVER	HARTLAND ABBEY	R28A003	-	-	-	-	-	-	-	-	-	-

Appendix 8.10