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DEVON AREA INTERNAL REPORT

AN INVESTIGATION TO DETERMINE IF GREAT TORRINGTON STW IS THE CAUSE OF ELEVATED COPPER AND ZINC CONCENTRATIONS IN THE RIVER TORRIDGE

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AN INVESTIGATION TO DETERMINE IF GREAT TORRINGTON STW IS THE CAUSE OF ELEVATED COPPER AND ZINC CONCENTRATIONS DOWNSTREAM IN THE RIVER TORRIDGE.

1. INTRODUCTION

The River Torridge rises in north west Devon in the Baxworthy Cross area and flows for approximately 95 km to outfall to Bideford Bay at Appledore immediately to the north of Bideford. The catchment area is relatively large covering some 838 km². Major tributaries of the Torridge are the River Yeo, River Okement, River Lew and the River Waldon.

The routine monitoring site downstream of Great Torrington Sewage Treatment Works (STW) R29B004 is designated under the EC Dangerous Substances Directive and has a River Ecosystem Use Class target of 2. For the purpose of this desk study, the Environmental Quality Standards (EQS's) of the appropriate for the protection of salmonid fish will be adopted (see APPENDIX I).

2. TERMS OF REFERENCE

2.1 OBJECTIVES

A request was received from Regional Quality Planning to investigate non-compliance of the EC Dangerous Substances Directive 1994 for zinc and copper concentrations in river water taken at the routine monitoring site Rothern Bridge (R29B004) downstream of Great Torrington STW.

The aim of this investigation is to determine if metal concentrations in the final effluent are resulting in the downstream routine monitoring site failing the EQS.

2.3 PROJECT TEAM

T. Cronin (Project Leader)
P. Rose (Project Manager, author)
R. Pearson (Technician / graphics production)

3. METHOD

1. Collection of water samples from Torrington STW final effluent and localised area on same dates over a period of 5 months to build a comparable data set.

2. Analysis of routine water quality data to establish any trends and / or relationships between water quality and other factors such as rainfall and drought.

4. RESULTS

4.1 HISTORIC DATA

Analysis of routine water quality metals data taken at Rothern Bridge (URN R29B004) between the period of 01 January 1994 and 31 December 1994 (see APPENDIX II) show the water quality to fail the standards marginally:

Total zinc	12 samples	Ann. average	0.0104 mg/l	EQS 0.008 mg/l
Dissolved copper	12 samples	Ann. average	0.00175 mg/l	EQS 0.001 mg/l

The total hardness average for 1994 was 47.9 mg/l, the lowest band.

Samples taken from the final effluent at Great Torrington STW or at the sites specified in the 'Ups and Downs' programme during 1994 were not analysed for zinc or copper content.

The routine monitoring site upstream of the final effluent monitoring site (R29B043 at SS 4821 1911) was analysed for total zinc and total copper concentrations only and provides a very limited data set (4 samples). (Total copper concentration at this site compared to dissolved copper concentration at Rothern Bridge).

Total zinc	4 samples	Ann. average	0.0215 mg/l	EQS 0.008 mg/l
Total copper	4 samples	Ann. average	0.0035 mg/l	EQS 0.001 mg/l

The total hardness average for 1994 was 46.175 mg/l, the lowest band (using total hardness results from corresponding metals samples only).

4.2 INVESTIGATION DATA

For data collected during the 5 months of the investigation (21 June 1995 to 01 November 1995) see Figure 1. For the purpose of this study, the pass or fail at each site has been calculated on the hardness of each sample taken.

5. DISCUSSION

The historic data show the exceedances at the monitoring site downstream of the STW to be marginal. The hardness band calculated is the lowest available and so even relatively low concentrations of copper and zinc were resulting in exceedances. Since there were no data available from samples collected from the STW effluent, it is not possible to attribute the exceedances to the STW discharge.

The routine data collected from upstream of the discharge, although limited to 4 samples, actually contained higher concentrations of zinc and copper than downstream of the final effluent discharge point, again indicating the exceedances at R29B004 not to be caused by Great Torrington STW.

The data set obtained during the investigation has enabled direct comparison to be made of water quality up and down of the STW whilst taking the quality of the effluent into account.

Firstly, although there were concentrations of copper and zinc above current levels of detection (LoD) within the discharge (total zinc LoD 0.005 mg/l, dissolved copper LoD 0.0025 mg/l) there was no appreciable impact downstream of the works at R29B004. Indeed, concentrations upstream were if anything slightly elevated (see Figure 1).

Some exceedances within the data set collected during the investigation were due to a combination of low hardness band and the LoD. If a sample falls into the lowest hardness band and contains copper concentrations below the LoD, the sample will effectively exceed the standard whether taken at face value or even half face value. The implications of this are that a site will fail the standard for dissolved copper if all the samples contains concentrations below the current LoD and the site is placed in the lowest hardness band.

From the investigation data set, both dissolved copper and total zinc concentrations increase slightly up the catchment. The reason for this is probably due to natural geology of the area.

6. CONCLUSIONS

1. The exceedances of the EQS's for total zinc and dissolved copper at Rothern Bridge (R29B004) are not attributable to Great Torrington STW.

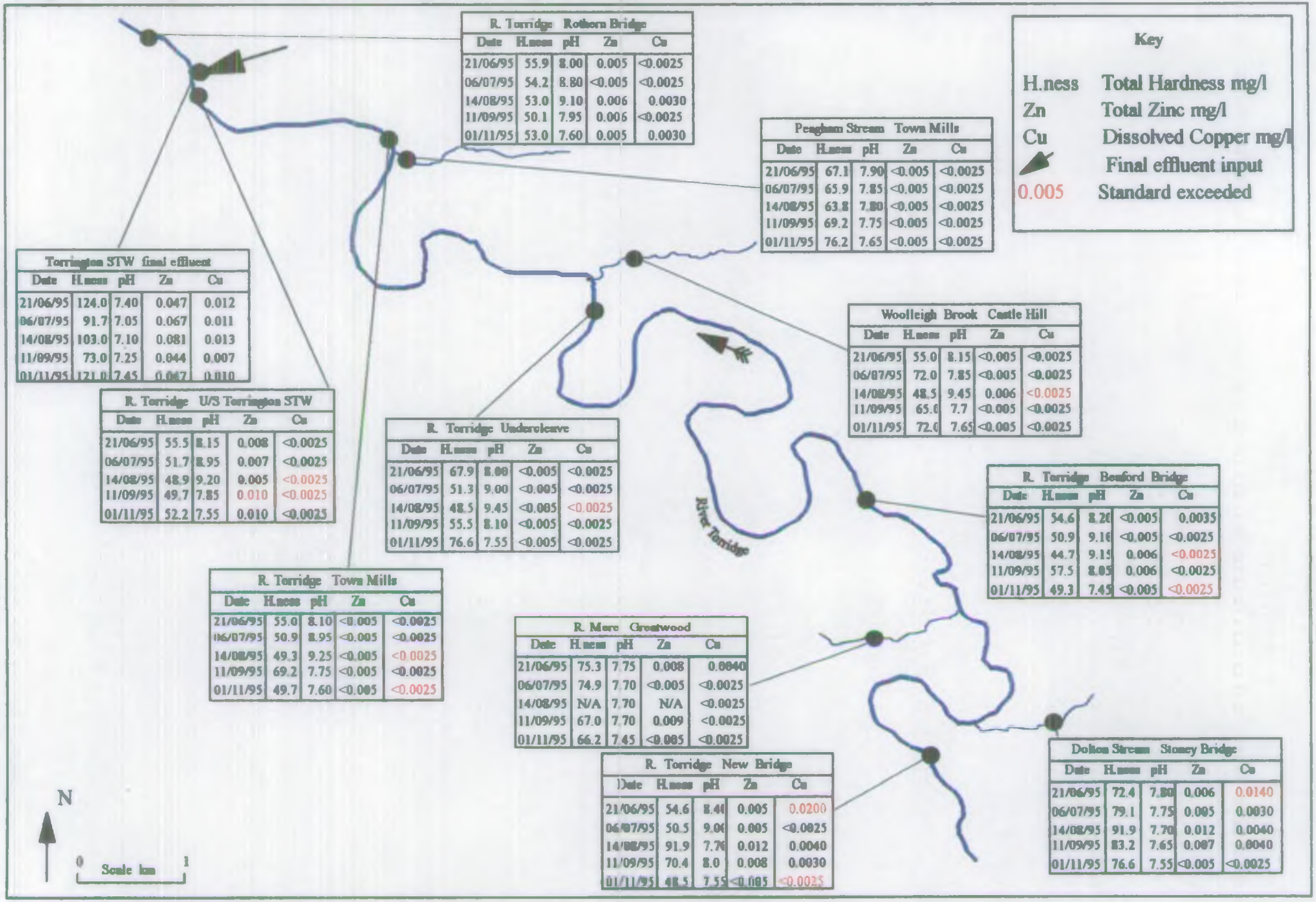
2. Low hardness banding and relatively high detection limits of copper may result in EQS exceedance even when samples contain concentrations below detection limits.

3. Slight increases of copper and zinc concentrations up the River Torridge are probably due to natural geology.

7. RECOMMENDATIONS

1. Enquire as to the possibility of setting detection limits at or below strictest EQS's for appropriate substances.

Figure 1. Map of Lower River Torridge showing investigation monitoring sites and results.



APPENDIX I

EQSs FOR LIST II SUBSTANCES (INLAND WATERS) (1) Table 5 continued

Parameter	Units	Value (3)		Hardness (mg $CaCO_3$/l)	Status (2)
		A Std	B Std		
Lead	µg Pb/l	4	50	0 to 50	AA,D
		10	125	50 to 100	
		10	125	100 to 150	
		20	250	150 to 200	
		20	250	200 to 250	
		20	250	>250	
Chromium	µg Cr/l	5	150	0 to 50	AA,D
		10	175	50 to 100	
		20	200	100 to 150	
		20	200	150 to 200	
		50	250	200 to 250	
		50	250	>250	
Zinc	µg Zn/l	8	75	0 to 50	AA,T
		50	175	50 to 100	
		75	250	100 to 150	
		75	250	150 to 200	
		75	250	200 to 250	
		125	500	>250	
Copper	µg Cu/l	1	1	0 to 50	AA,D
		6	6	50 to 100	
		10	10	100 to 150	
		10	10	150 to 200	
		10	10	200 to 250	
		28	28	>250	
Nickel	µg Ni/l	50	50	0 to 50	AA,D
		100	100	50 to 100	
		150	150	100 to 150	
		150	150	150 to 200	
		200	200	200 to 250	
		200	200	>250	
Arsenic	µg As/l	50		All	AA,D
Boron	µg B/l	2000		All	AA,T
Iron	µg Fe/l	1000		All	AA,D
pH	pH values	6 to 9		All	95% of samples
Vanadium	µg V/l	20	20	0 to 200	AA,T
		60	60	200+	
Tributyltin	µg/l	0.02		All	M,T
Triphenyltin	µg/l	0.02		All	M,T
Polychlorochlormethyl-sulphonamidodiphenyl ether (PCSDs)	µg/l	0.05		All	T, 95% of samples
Sulcofuron	µg/l	25		All	T, 95% of samples
Flucofuron	µg/l	1.0		All	T, 95% of samples
Permethrin	µg/l	0.01		All	T, 95% of samples
Cyfluthrin	µg/l	0.001		All	T, 95% of samples

EQSs FOR LIST II SUBSTANCES (TIDAL WATERS) Table 5 continued

Parameter	Units	Value (1)	Status
Lead	μg Pb/l	25	AA,D
Chromium	μg Cr/l	15	AA,D
Zinc	μg Zn/l	40	AA,D
Copper	μg Cu/l	5	AA,D
Nickel	μg Ni/l	30	AA,D
Arsenic	μg As/l	25	AA,D
Boron	μg B/l	7000	AA,D
Iron	μg Fe/l	1000	AA,D
pH	pH values	6 to 8.5 (3)	95% of samples
Vanadium	μg V/l	100	AA,T
Tributyltin	μg/l	0.002	M,T
Triphenyltin	μg/l	0.008	M,T
Polychlorochlormethyl-sulphonamidodiphenyl ether (PCSDs)	μg/l	0.05	T, 95% of samples
Sulcofuron	μg/l	25	T, 95% of samples
Flucofuron	μg/l	1.0	T, 95% of samples
Permethrin	μg/l	0.01	T, 95% of samples
Cyfluthrin	μg/l	0.001	T, 95% of samples

Notes:

(1) National environmental quality standards recommended for the UK.

(2) AA = Annual Average; D = Dissolved; T = Total; M = Maximum Allowable Concentration

(3) A Std denotes standards for the protection of sensitive aquatic life
B Std denotes standards for the protection of other aquatic life

APPENDIX II

ANALYTICAL SUMMARY OF:-

RIVER TORRIDGE AT ROTHERN BRIDGE

Date	Time	Type Purp	Mat	ZINC TOTAL MG/L	COPPER DISS MG/L	HARDNS TOTAL MG/L
200194	1300	SQMR	2F	0.009	0.0010	46.0
100294	0945	SQMR	2F	0.005	0.0010	46.8
030394	1300	SQMR	2F	0.006	0.0010	46.0
310394	1010	SQMR	2F	0.025	0.0020	38.5
060594	1410	SQMR	2F	0.005	0.0010<	53.4
280694	1140	SQMR	2F	0.006	0.0020	53.6
250794	1455	SQMR	2F	0.004	0.0020	54.2
260894	1040	SQMR	2F	0.006	0.0020	55.5
101094	1410	SQMR	2F	0.004	0.0020	52.2
311094	1435	SQMR	2F	0.014	0.0030	43.1
171194	0940	SQMR	2F	0.008	0.0010	49.3

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ANALYTICAL SUMMARY OF:-

RIVER TORRIDGE AT ROTHERN BRIDGE

Date	Time	Type Purp	Mat	ZINC TOTAL MG/L	COPPER DISS MG/L	HARDNS TOTAL MG/L
071294	1200	SQMR	2F	0.033	0.0030	36.0

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