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## DEVON AREA INTERNAL REPORT

**AN INVESTIGATION TO DETERMINE IF  
SOUTH MOLTON STW IS THE CAUSE OF  
ELEVATED COPPER AND ZINC  
CONCENTRATIONS DOWNSTREAM IN THE  
RIVER MOLE**

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**AN INVESTIGATION TO DETERMINE IF SOUTH MOLTON STW IS THE CAUSE OF ELEVATED COPPER AND ZINC CONCENTRATIONS DOWNSTREAM IN THE RIVER MOLE.**

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NATIONAL RIVERS AUTHORITY  
An investigation to  
determine if South Milton  
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**1. INTRODUCTION**

The River Mole is the major tributary of the River Taw and rises on Exmoor at Darlick Moors and flows south west for approximately 34 Km before its confluence with the River Taw at Junction Pool.

The River Mole has a River Ecosystem Use Class target of 2. For the purpose of this desk study, the Environmental Quality Standards (EQS's) appropriate for the protection of salmonid fish will be adopted for all sites investigated (see APPENDIX I).

**2. TERMS OF REFERENCE**

**2.1 OBJECTIVES**

A request was received from Regional Quality Planning to investigate high concentrations of dissolved copper and total zinc recorded downstream of South Molton STW (WSTW3280B) during 1994.

The aim of this investigation is to determine if metal concentrations in the final effluent are causing the EQS at the downstream site of South Molton STW as specified in the 'Ups and Downs' programme.

**2.3 PROJECT TEAM**

T. Cronin (Project Leader)  
P. Rose (Project Manager, author)

**3. METHOD**

1. Collection of water samples from South Molton STW final effluent and localised area on same dates over a period of 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 downstream of South Molton STW (WSTW3280B) between the period of 01 January 1994 and 31 December 1994 (see APPENDIX II) show the water quality to fail both EQS's:

Total zinc	12 samples	Ann. average	0.016 mg/l	EQS 0.008 mg/l
Dissolved copper	12 samples	Ann. average	0.00275 mg/l	EQS 0.001 mg/l

The total hardness average for 1994 was 43.2 mg/l, the lowest band.

Samples taken from the final effluent at South Molton STW (WSTW3280FE) and upstream at site (WSTW3280A) during 1994 were analysed for dissolved copper and total zinc content. The data set for these sites during 1994 is limited to 6 samples. The site WSTW3280A (immediately upstream of the STW) fails the EQS for dissolved copper:

Total zinc	6 samples	Ann. average	0.0025 mg/l	EQS 0.008 mg/l
Dissolved copper	6 samples	Ann. average	0.0022 mg/l	EQS 0.001 mg/l

The total hardness average for the samples taken upstream of the works discharge point during 1994 was 42.2 mg/l, the lowest band.

The only other routine monitoring site where water samples are regularly analysed for metals is above North Molton STW (R30F001). This site also fails the EQS for dissolved copper.

Total zinc	12 samples	Ann. average	0.0036 mg/l	EQS 0.008 mg/l
Dissolved copper	12 samples	Ann. average	0.0032 mg/l	EQS 0.001 mg/l

The total hardness average for the samples taken upstream of the works discharge point during 1994 was 35.6 mg/l, the lowest band.

### 4.2 INVESTIGATION DATA

For data collected during the period of the investigation (14 June 1995 to 31 October 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

Failure of the EQS at WSTW3280B for dissolved copper during 1994 was due to all samples containing concentrations marginally above the standard. The data set for above the discharge point also contains concentrations similarly above the EQS.

The 1994 failure of the total zinc standard downstream of the works was due to one sample containing an elevated concentration (0.131 mg/l). No corresponding sample was taken from the effluent or immediately upstream; as such, this exceedance cannot be attributed to the STW discharge.

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 R30F003 (see Figure 1).

During the investigation, the concentrations of dissolved copper increased by approximately 60 % at sites upstream of South Molton STW discharge up to and including Newbridge (above North Molton, see Figure 1, comparison of data from R30F003 and Newbridge). Above this area, the concentration immediately falls to below detection limits.

The area in question is known for historic mines. Indeed, upstream of the Newbridge site and D/S of the Mines Bridge site there are old mine workings and shafts near the watercourse. It is very probable that this combined with natural geology is causing the elevated metal concentrations downstream.

Many 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 concentration 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 contain concentrations below the LoD and the site is placed in the lowest hardness band.

## 6. CONCLUSIONS

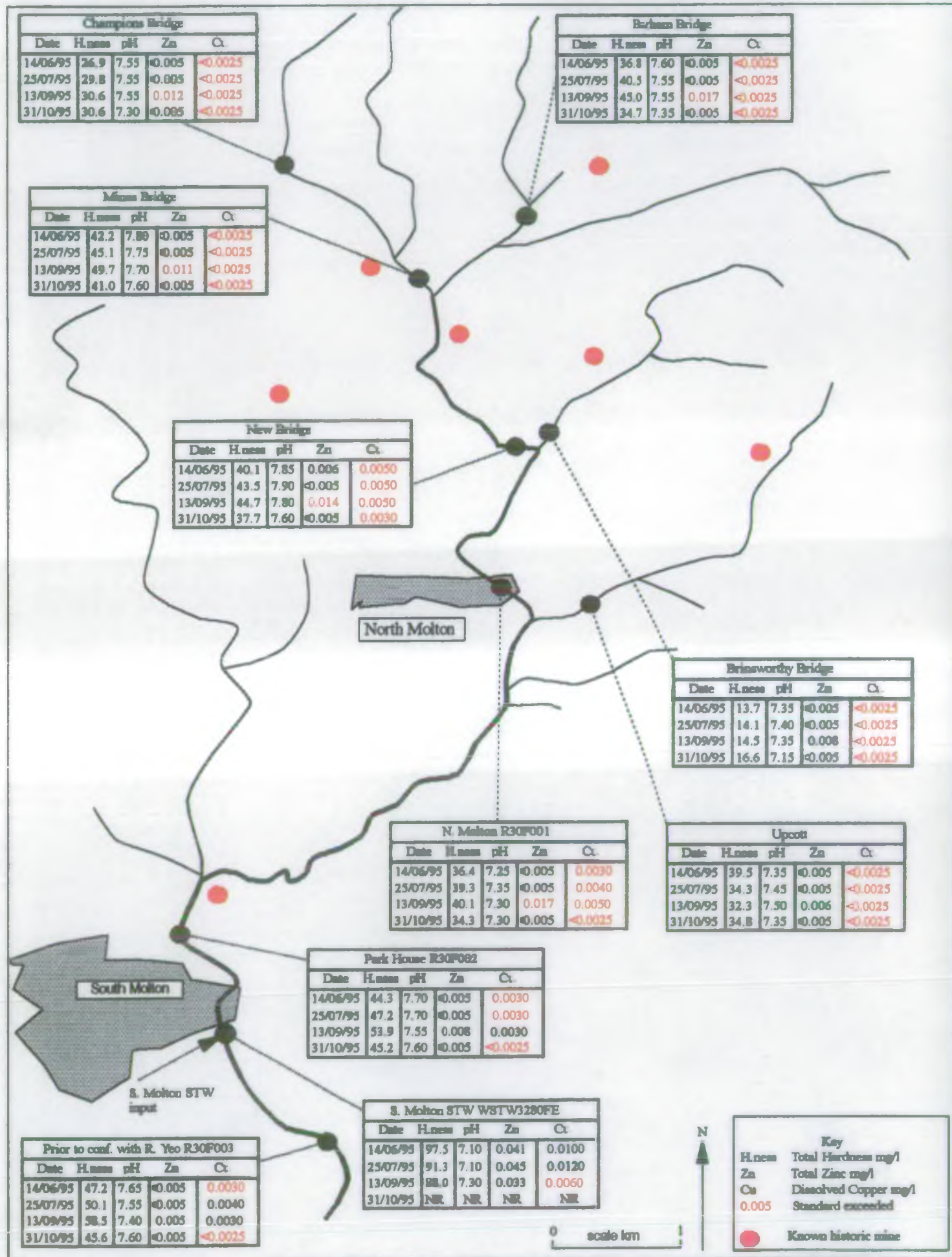
1. The exceedances of EQS's for Total Zinc and Dissolved Copper at WSTW3280B could not be attributed to South Molton STW.
2. Samples taken from sites upstream of South Molton STW contained concentrations of total zinc and dissolved copper above those recorded downstream of the final effluent point.
3. Increases of total zinc and dissolved copper concentrations in the upper reaches of the River Mole catchment are probably due to historic mine activity / natural geology.
4. Low hardness banding and relatively high detection limits of copper and zinc may result in EQS exceedance even when samples contain concentrations below detection limits.

## 7. RECOMMENDATIONS

1. Continue monitoring for dissolved copper and total zinc at routine monitoring sites on the River Mole.
2. Enquire as to possibility of setting detection limits at or below strictest water quality standards for appropriate substances.



Figure 1. Map of the River Mole showing investigation monitoring sites and results.



**APPENDIX I**



## EQSs FOR LIST II SUBSTANCES (INLAND WATERS) (I)

Table 5 continued

Parameter	Units	Value (3)		Hardness (mg CaCO <sub>3</sub> /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	$\mu\text{g Pb/l}$	25	AA,D
Chromium	$\mu\text{g Cr/l}$	15	AA,D
Zinc	$\mu\text{g Zn/l}$	40	AA,D
Copper	$\mu\text{g Cu/l}$	5	AA,D
Nickel	$\mu\text{g Ni/l}$	30	AA,D
Arsenic	$\mu\text{g As/l}$	25	AA,D
Boron	$\mu\text{g B/l}$	7000	AA,D
Iron	$\mu\text{g Fe/l}$	1000	AA,D
pH	pH values	6 to 8.5 (3)	95% of samples
Vanadium	$\mu\text{g V/l}$	100	AA,T
Tributyltin	$\mu\text{g/l}$	0.002	M,T
Triphenyltin	$\mu\text{g/l}$	0.008	M,T
Polychlorochlormethyl-sulphonamidodiphenyl ether (PCSDs)	$\mu\text{g/l}$	0.05	T, 95% of samples
Sulcofuron	$\mu\text{g/l}$	25	T, 95% of samples
Flucofuron	$\mu\text{g/l}$	1.0	T, 95% of samples
Permethrin	$\mu\text{g/l}$	0.01	T, 95% of samples
Cyfluthrin	$\mu\text{g/l}$	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 MOLE BELOW SOUTH MOLTON STW  
DIS FEATURE NOT AVAILABLE

Date	Time	Type	Purp	Mat	COPPER DISS MG/L	ZINC TOTAL MG/L	HARDNS TOTAL MG/L
110194	1130	SQMR		2F	0.0020	0.003	40.6
090294	0835	SQMR		2F	0.0030	0.004	38.9
040394	0945	SQMR		2F	0.0020	0.131	40.6
060494	1335	SQMR		2F	0.0020	0.002	42.3
270494	1000	SQMR		2F	0.0030	0.004	41.4
150694	1120	SQMR		2F	0.0030	0.003	46.4
040794	0850	SQMR		2F	0.0040	0.007	48.0
280794	1150	SQMR		2F	0.0040	0.004	44.7
290994	1040	SQMR		2F	0.0020	0.003	42.7
181094	0800	SQMR		2F	0.0030	0.003	45.2
071194	1225	SQMR		2F	0.0030	0.005	47.3

Type "C" to Continue, "P" for previous screen, "Q" to Quit ( )

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ANALYTICAL SUMMARY OF:-

RIVER MOLE BELOW SOUTH MOLTON STW  
DIS FEATURE NOT AVAILABLE

Date	Time	Type	Purp	Mat	COPPER DISS MG/L	ZINC TOTAL MG/L	HARDNS TOTAL MG/L
251194	0930	SQMR		2F	0.0020	0.004	40.6

Type "C" to Continue, "P" for previous screen, "Q" to Quit ( )

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