ENVIRONMENT AGENCY

DEVON AREA
INTERNAL REPORT

AN INVESTIGATION INTO THE BACTERIAL WATER QUALITY OF THE RIVER UMBER, N.DEVON.

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1. INTRODUCTION AND TERMS OF REFERENCE

One of the issues raised in the Environment Agency Document, *"North Devon Streams Local Environment Agency Plan"* (1996) (Ref 1), is:

Issue	Options/Actions	Action
Bathing water non-compliance due to poor quality in Wilder Brook, Hele Stream and River Umber.	☐ Undertake specific water quality investigations to identify sources of poor water quality. ☐ Carry out Task Force inspections.	EA, Farmers, SWWSL, Private Dischargers.

This report documents the work undertaken by the Devon Area Investigation Team to identify sources of bacterial contamination of the River Umber which may contribute to bathing water non-compliance.

1.1 Project Team

T. Cronin - Project Manager
Paul Salmon - Investigations Technician and Author

2. CATCHMENT DESCRIPTION AND BACKGROUND

The River Umber is approx. 5.5km long and has a theoretical mean flow of 0.359 m^3/s with a Q95 of 0.036 m^3/s. Lying entirely within the Exmoor Heritage Coast and in an Area of Outstanding Natural Beauty this watercourse discharges to the sea across Combe Martin beach. This beach has failed the imperative (I) standards of the EC Bathing Water Directive (ECBWD) in 8 of the last 11 years (including 1996). Exceedances of the ECBWD mandatory standards can, in part, be caused by bacterially polluted water discharged from the River Umber (Ref 1). The Furzepark Stream also discharges across Combe Martin Beach and can also contribute towards ECBWD exceedances.

The Umber has been the subject of 'Task Forcing' by the N.R.A. in the past. This operation aims to identify all actual and potential pollution sources in a particular stretch of river. Farm visit and pollution prevention work has helped control point source pollution from farms and led to an overall improvement in water quality in the catchment (Ref 1). There are several known discharges to the River Umber which are shown in Table 1.

SWWSL have undertaken work on improving the sewerage in Combe Martin during 1995/1996 which may have removed some pathways for sewage to enter the Umber (eg. leaking sewers). However there is no certainty that these modifications have dramatically improved the water quality of the River Umber.

The watercourse is not designated as a salmonid or cyprinid fishery under the Freshwater Fish Directive. The stream is categorised as 'good' (Class A) where monitored for biological class using the BMPW system and has a River Ecosystem class of RE1.

Combe Martin rain gauging station has average rainfall of 1300mm/year (1987 to date). Agricultural land use in the N.Devon Streams catchment (1994) comprised of mainly grassland (66.7%) and rough grazing (26.6%). In the catchment areas this report is concerned with, beef and sheep production is diversified with some dairy farming and arable production. The River Umber has an acknowledged major flooding problem in Combe Martin.

3. METHOD

Data from the 1996 bathing waters programme has been analysed by the Tidal Water Quality section of the EA (Ref 2). This analysis attributes both exceedances of the ECBWD to the River Umber. This indicates a definite need to identify sources of bacterial contamination to the River Umber to assist in improving bathing water quality post SWWSLs resewerage programme in Combe Martin.

The results of previous bacterial input studies (Ref 3) were reviewed to aid in planning survey work.
Two site visits were undertaken and sites for sampling were identified. A bacteriological sampling survey was carried out on 1 October 1996.

3.1 Bacteriological Sampling Survey - 1 October 1996

Fourteen sampling sites on the River Umber (and tributaries), and one on the Furzepark Stream, were identified and were sampled on 6 runs. These were split into 3 blocks;

Block 1: 7:00 and 8:30	(To coincide with peak morning sewage flow)
Block 2: 13:00 and 14:30	(To identify any inputs affecting daytime water quality)
Block 3: 18:00 and 19:30	(To coincide with the peak evening sewage flow)

Each of the sampling sites is listed in Table 2 and shown on Fig 1. The samples were analysed at the EA Exeter Lab for Total Coliforms, Faecal Coliforms and Faecal Streptococci (presumptive).

4. RESULTS AND DISCUSSION

4.1 Bacteriological Sampling Survey - 1 October 1996

The survey was successfully undertaken with no problems encountered.

The survey was carried out under dry weather flow conditions. Measured rainfall at Combe Martin measuring station for the survey day and the previous six days was as follows;

25 Sep	0.8 mm
26 Sep	11.5 mm
27 Sep	1.3 mm
28 Sep	12.9 mm
29 Sep	7.9 mm
30 Sep	1.1 mm
1 Oct	3.7 mm

Tables 3, 4 and 5 show the results for Faecal coliforms, Total coliforms and Faecal streptococci respectively. To aid in interpreting the results it may be useful to view them with respect to the ECBWD standards. Both the imperative and guideline standards are shown in the following matrix. It must be remembered however that the stream samples are in no way formally assessed with respect to ECBWD standards and shown for comparative purposes only.

Parameter	*Imperative Standard (cfu / 100ml)*	*Guideline Standard (cfu / 100ml)*
Total Coliforms	10000	500
Faecal Coliforms	2000	100
Faecal Streptococci	None (at present)	100

For each site a geometric mean has been calculated for each determinand and is shown in the aforementioned tables. This simple statistical calculation enables an overview of the bacterial concentrations to be made. Increases or decreases in this value from upstream to downstream sites are shown in Figures 2, 3 and 4.

The sampling results show that there are some consistently problematical stretches, with respect to bacterial inputs, most notably directly behind the beach (in the culverted section), and the lower Rosea Stream. There are other stretches which have intermittent problems and the Furzepark Stream can have bacterial concentrations exceeding those of the Umber on the beach.

Relevant observations regarding the results are given below;

i) There can be large increases in the Total and Faecal coliform concentrations in the stretches, 2 to 1, 4 to 2 and 7 to 3. Site 3 also shows high Faecal Streptococci concentrations. These sections of watercourse are directly behind the beach and will therefore have a large impact on the bacterial quality of the Umber as it crosses the beach and discharges to the sea. It is recommended that investigations into these stretches are carried out to identify any potential inputs.

ii) There is an increase in the geometric means of both Total and Faecal coliform concentrations between sites 8 and 6. However these increases are not as marked as further downstream and at no time was the ECBWD mandatory Total coliform value exceeded.

iii) Site 9 at the bottom of the Slaughter House tributary had one value exceeding the ECBWD Total and Faecal coliform mandatory levels with site 10 on the Umber having one Total coliform exceedance. This shows that the stretches immediately above these sample sites can become intermittently grossly contaminated.

iv) Sites 11, 13 and 14 (the furthest sites up-stream on the Umber system) show no evidence of gross microbial pollution and the watercourses above these sites are not thought to be a cause for concern.

v) The Furzepark Stream shows evidence of microbial pollution with 67% of Faecal coliforms exceeding the ECBWD mandatory level and also having the highest Faecal streptococci geometric mean of any site. It is recommended that the Furzepark Stream be investigated further to identify any potential microbial inputs.

vi) Even stretches that are a cause for concern regarding bacterial inputs show enormous variability in concentrations throughout the day. EG, Site 3 has Faecal coliform concentrations varying from 28000 cfu/100ml down to 280 cfu/100ml. This 2 log variation shows the temporally varying aspect of inputs above this stretch.

6. CONCLUSIONS

The survey was successfully undertaken with several stretches identified as having a detrimental affect on microbiological water quality of the Umber. Several recommendations are made and these are shown below;

i) The sites sampled close to Combe Martin Beach show large increases in Total and Faecal coliforms. It is recommended that investigations into the R.Umber directly behind the beach (up to the Rosea Stream entering the Umber) are carried out to identify any potential inputs.

Action: Local Water Quality Officer and Devon Area Investigation Team

ii) The bottom site on the Rosea Stream showed large increases in Total and Faecal coliforms and also Faecal Streptococci. It is recommended that investigations into the Lower Rosea Stream are carried out to identify any potential inputs.

Action: Local Water Quality Officer and Devon Area Investigation Team

ii) The Furzepark Stream shows evidence of microbial pollution with 67% of Faecal coliforms exceeding the ECBWD mandatory level and also having the highest Faecal streptococci geometric mean of any site. It is recommended that the Furzepark Stream be investigated further to identify any potential microbial inputs.

Action: Local Water Quality Officer and Devon Area Investigation Team

7. REFERENCES

1. Environment Agency, 1996, *North Devon Streams Local Environment Agency Plan (LEAP).*

2. Internal EA Memo, N.Babbedge to N.Morris, 20 Sept 1996.

3. NRA, 1992, *Investigations Into The Bacterial Quality Of The River Umber And Furzepark Stream, Combe Martin, North Devon*, TWU/92/20.

Table 1: Known Discharges to the R.Umber System

Name	Location	Receiving Water	Effluent Type	Folio No
Combe Martin SSO	SS 5769 4724	R.Umber	Storm and Emergency Sewage	NRA-SW-1140
Combe Martin SSO	SS 5770 4723	R.Umber	Storm and Emergency Sewage	2897/15
Wheel Farm Country Cotts	SS 5804 4465	Tributary of R.Umber	Treated Effluent	NRA-SW-6219
Pack-O-Cards CSO	SS 5833 4667	R.Umber	Storm Sewage	Letter of Intent Issued
Lorna Irwin Walk CSO/EO	SS 5788 4702	R.Umber	Storm and Emergency Sewage	To be consented
Combe Martin Beach CSO/EO	SS 5768 4725	R.Umber	Storm and Emergency Sewage	To be consented

Table 2 - Sampling Sites

No.	Watercourse	Location
1	R. Umber	On Beach
2	R. Umber	Behind 'Anglo' Petrol Station
3	Rosea Stream	Rosea Bridge
4	R. Umber	Umber Close
5	R. Umber	Barton Gate Lane
6	R. Umber	Water Lane
7	Rosea Stream	On track to W. Challacombe House
8	R. Umber	St. Peters Church (u/s of Slaughter House trib)
9	Slaughter House Stream	St. Peters Church (u/s of R. Umber)
10	R. Umber	Behind Lion Inn
11	Coulsworthy Tributary	Wood Lane
12	R. Umber	Wood Lane
13	R. Umber	Withycombe Lane
14	Yellaton Tributary	Yellaton Lane
15	Furzepark Stream	On Beach

Table 3: Total Coliform Results - River Umber Bacteriological Sampling Survey - 1 October 1996

Site No.	Total Coliforms (cfu / 100ml)						Geometric Mean	Increase from u/s site	
	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6			
1	*14000*	6100	*47000*	7700	6000	3400	9260	3969	
2	1000	8000	4900	*100000*	2000	2800	5292	2612	*
3	1727	5400	*80000*	4600	*21000*	2100	7300	6969	
4	4100	2200	1727	3000	1545	2900	2437	-168	
5	3700	2000	2000	3200	3300	2000	2605	-979	
6	9000	1818	3500	5800	2200	2900	3584	2240	**
7	290	270	171	340	320	910	331		
8	2100	2100	250	4300	440	2900	1350	-316	
9	620	440	*15000*	490	5600	410	1290		
10	2300	1727	440	660	1545	*12000*	1666	713	***
11	1636	1455	1273	1273	1182	964	1280		
12	909	1091	1091	510	480	1364	844	-33	****
13	3700	2000	540	1091	440	550	1009		
14	1636	3500	240	230	250	153	479		
15	1364	6700	7000	*25000*	5700	4000	5759		
Geometric Mean	2010	2099	2121	2355	1606	1656			

* Assumes R.Umber contributes 95% of flow and Rosea Stream 5% of flow.
** Assumes R.Umber contributes 90% of flow and Slaughter House Tributary 10% of flow.
*** Assumes R.Umber contributes 75% of flow and Coulsworthy Stream 25% of flow.
**** Assumes R.Umber contributes 75% of flow and Yellaton Tributary 25% of flow.

Note: Concentrations >99999 are represented as 100000 in the above table

Table 4: Faecal Coliform Results - River Umber Bacteriological Sampling Survey - 1 October 1996

Site No.	Faecal Coliforms (cfu / 100ml)						Geometric Mean	Increase from u/s site	
	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6			
1	*2100*	*2400*	*3500*	*6700*	*3600*	1364	2888	1391	
2	1182	*3200*	650	*11000*	730	570	1497	290	*
3	1182	*3900*	*28000*	*2500*	856	280	2064	1824	
4	*2700*	2000	600	1455	757	690	1162	-32	
5	1273	1091	1636	2000	829	770	1194	-530	
6	*4800*	1455	*2100*	*3500*	640	800	1724	971	**
7	270	260	90	260	240	490	240		
8	1545	1636	135	*3200*	99	*2100*	781	57	
9	280	310	*6300*	200	1091	135	503		
10	1545	1273	310	600	500	790	724	106	***
11	1182	1273	610	710	360	670	735		
12	750	901	610	420	510	430	580	-71	****
13	1545	1273	540	909	520	490	792		
14	100	*2800*	250	200	54	180	227		
15	730	*5700*	1000	*2500*	*3700*	*2100*	2079		
Geometric Mean	991	1484	884	1241	571	606			

* Assumes R.Umber contributes 95% of flow and Rosea Stream 5% of flow.
** Assumes R.Umber contributes 90% of flow and Slaughter House Tributary 10% of flow.
*** Assumes R.Umber contributes 75% of flow and Coulsworthy Stream 25% of flow.
**** Assumes R.Umber contributes 75% of flow and Yellaton Tributary 25% of flow.

Table 5: Faecal Streptococci Results - River Umber Bacteriological Sampling Survey - 1 October 1996

Site No.	Faecal Streptococci (cfu / 100ml)						Geometric Mean	Increase from u/s site	
	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6			
1	2200	1000	892	4100	1632	1091	1558	321	
2	2100	1009	928	1364	982	1364	1238	-388	*
3	7300	770	4800	4000	4000	6900	3793	3292	
4	1545	1273	874	2600	1727	1545	1512	35	
5	1455	1091	1273	1364	2300	1636	1477	410	
6	2300	760	910	1091	982	865	1067	373	**
7	390	360	260	2200	430	460	501		
8	1182	874	390	1018	350	901	711	-142	
9	280	450	1364	320	1182	360	535		
10	2000	790	210	630	800	2300	853	-37	***
11	991	1545	650	1054	4200	909	1260		
12	610	650	928	620	919	964	766	85	****
13	330	540	580	470	1364	1455	677		
14	1545	1818	430	520	360	490	693		
15	2300	3900	7200	730	100000	64000	8190		
Geometric Mean	1260	933	871	1106	1544	1465			

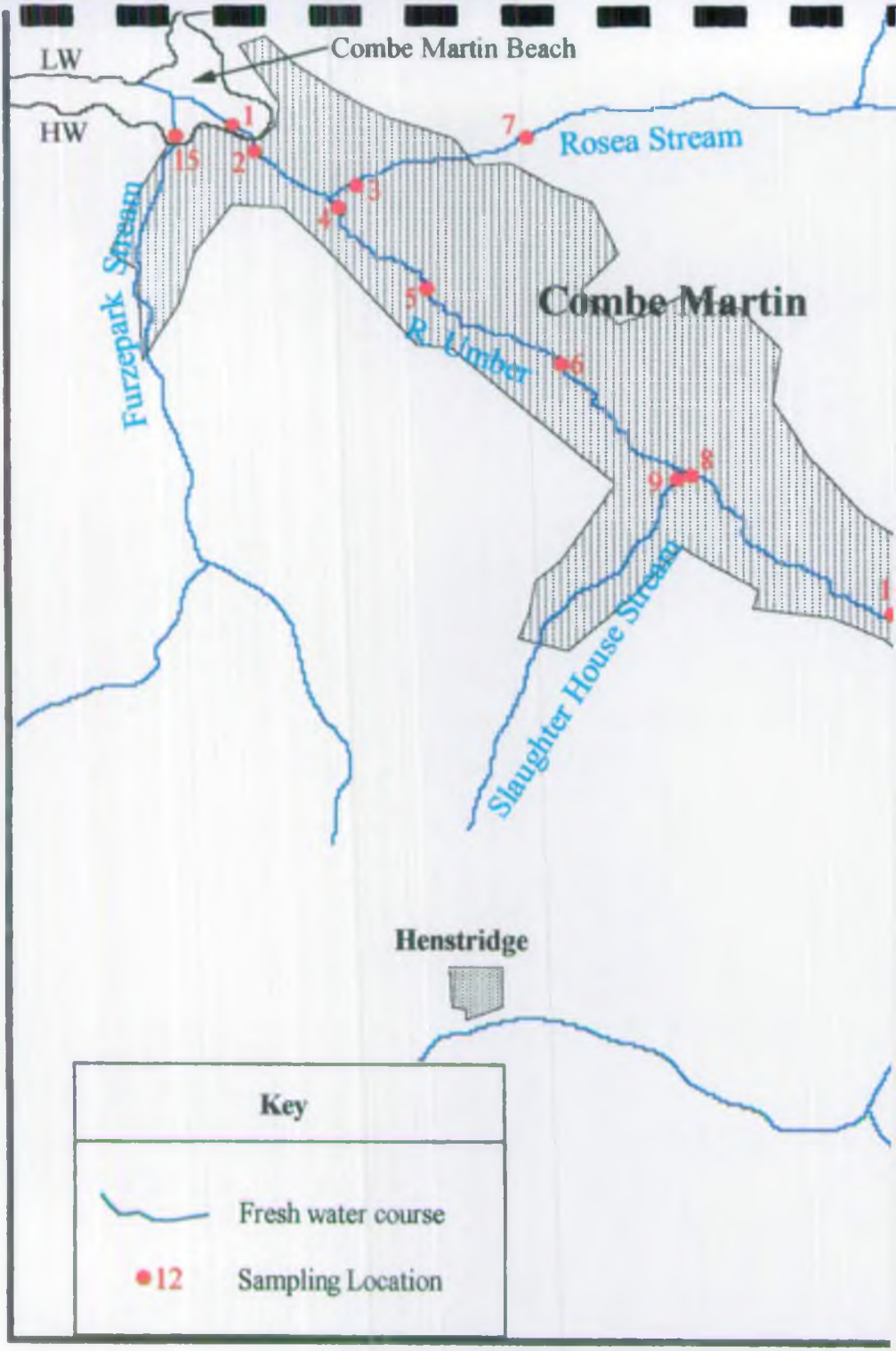
* Assumes R.Umber contributes 95% of flow and Rosea Stream 5% of flow.

** Assumes R.Umber contributes 90% of flow and Slaughter House Tributary 10% of flow.

*** Assumes R.Umber contributes 75% of flow and Coulsworthy Stream 25% of flow.

**** Assumes R.Umber contributes 75% of flow and Yellaton Tributary 25% of flow.

Note: Concentrations >99999 are represented as 100000 in the above table


LW
HW
Combe Martin Beach
Rosea Stream
Furzepark Stream
R. Umber
Combe Martin
Slaughter House Stream
Henstridge
Key
Fresh water course
12 Sampling Location

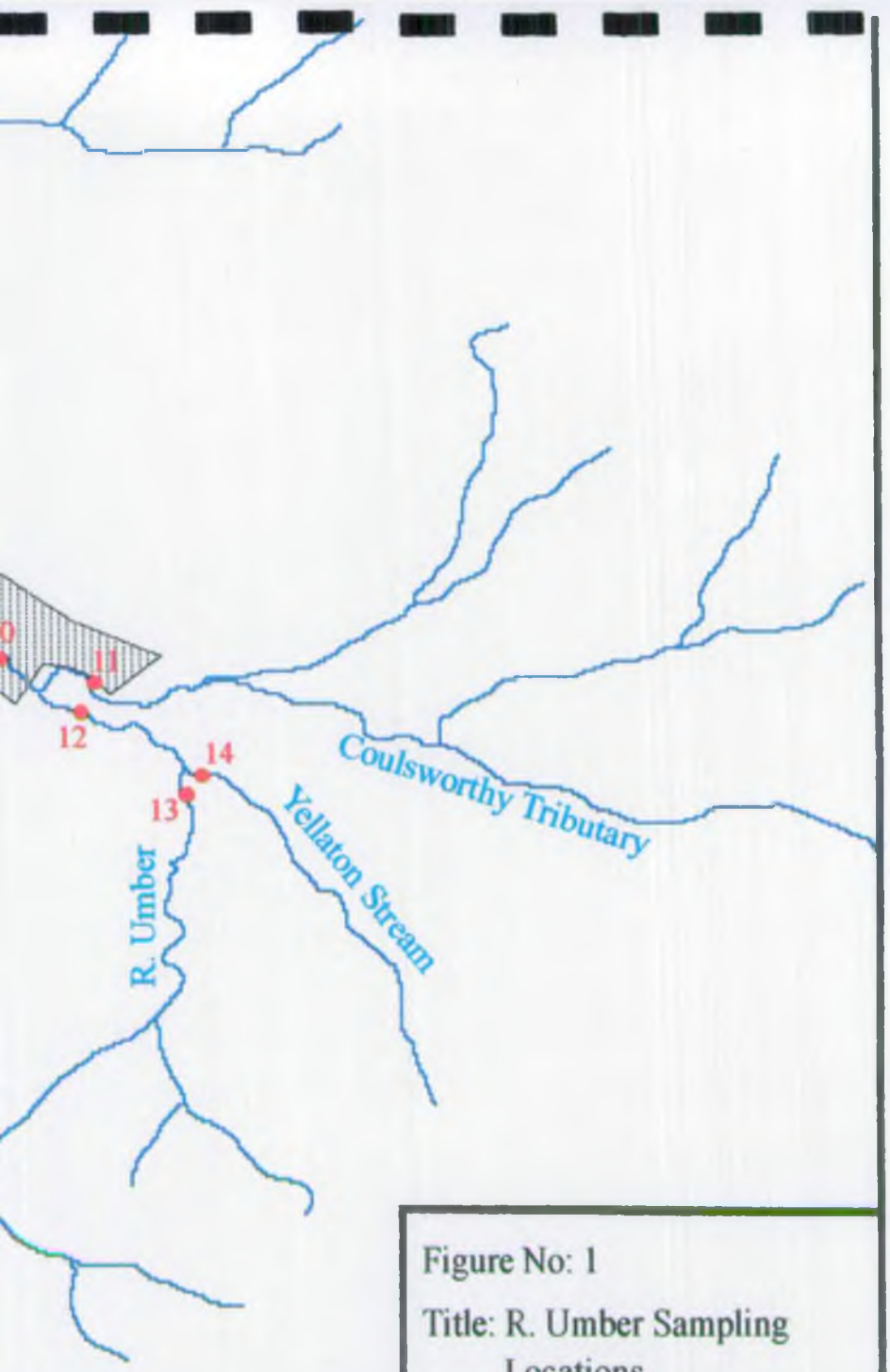
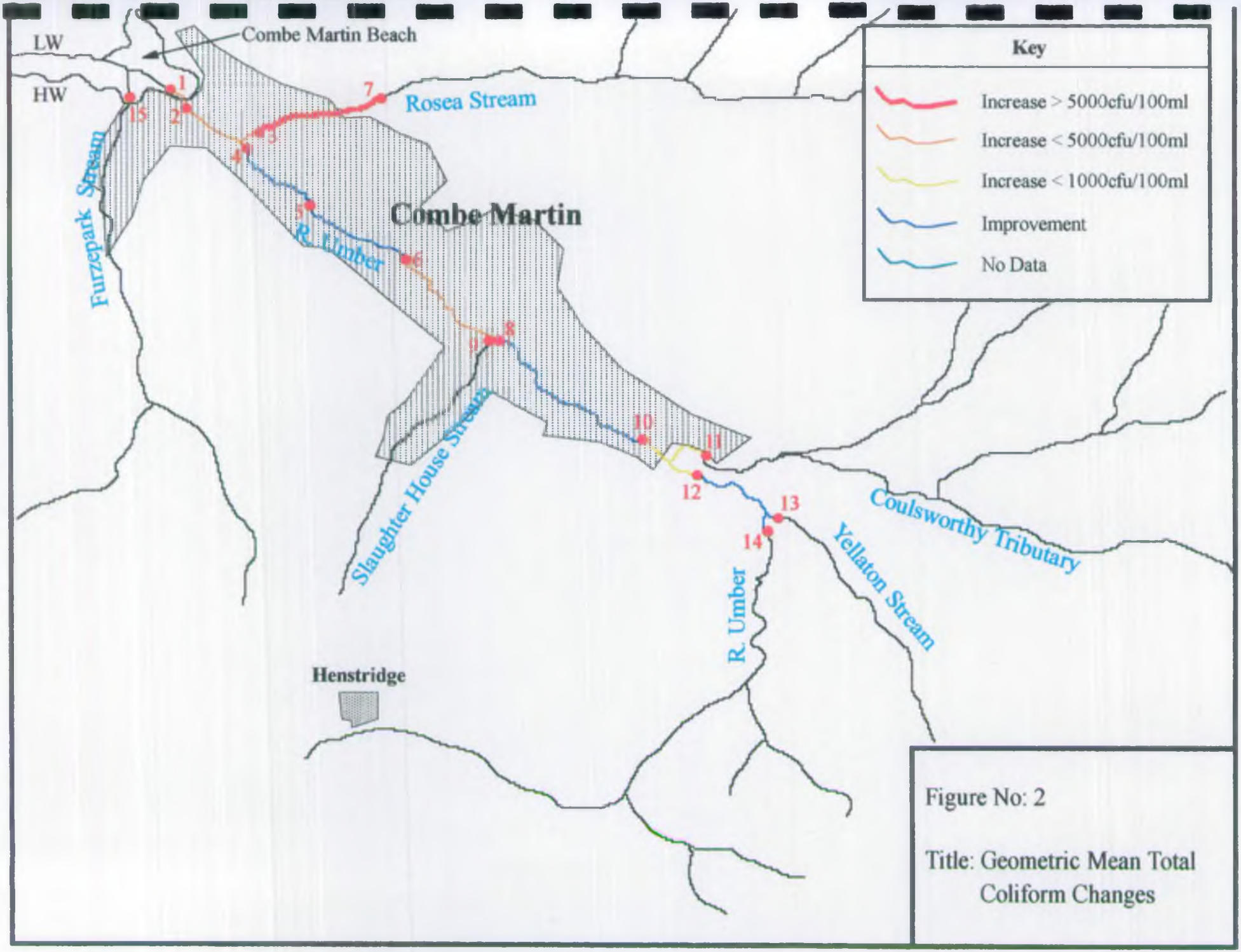
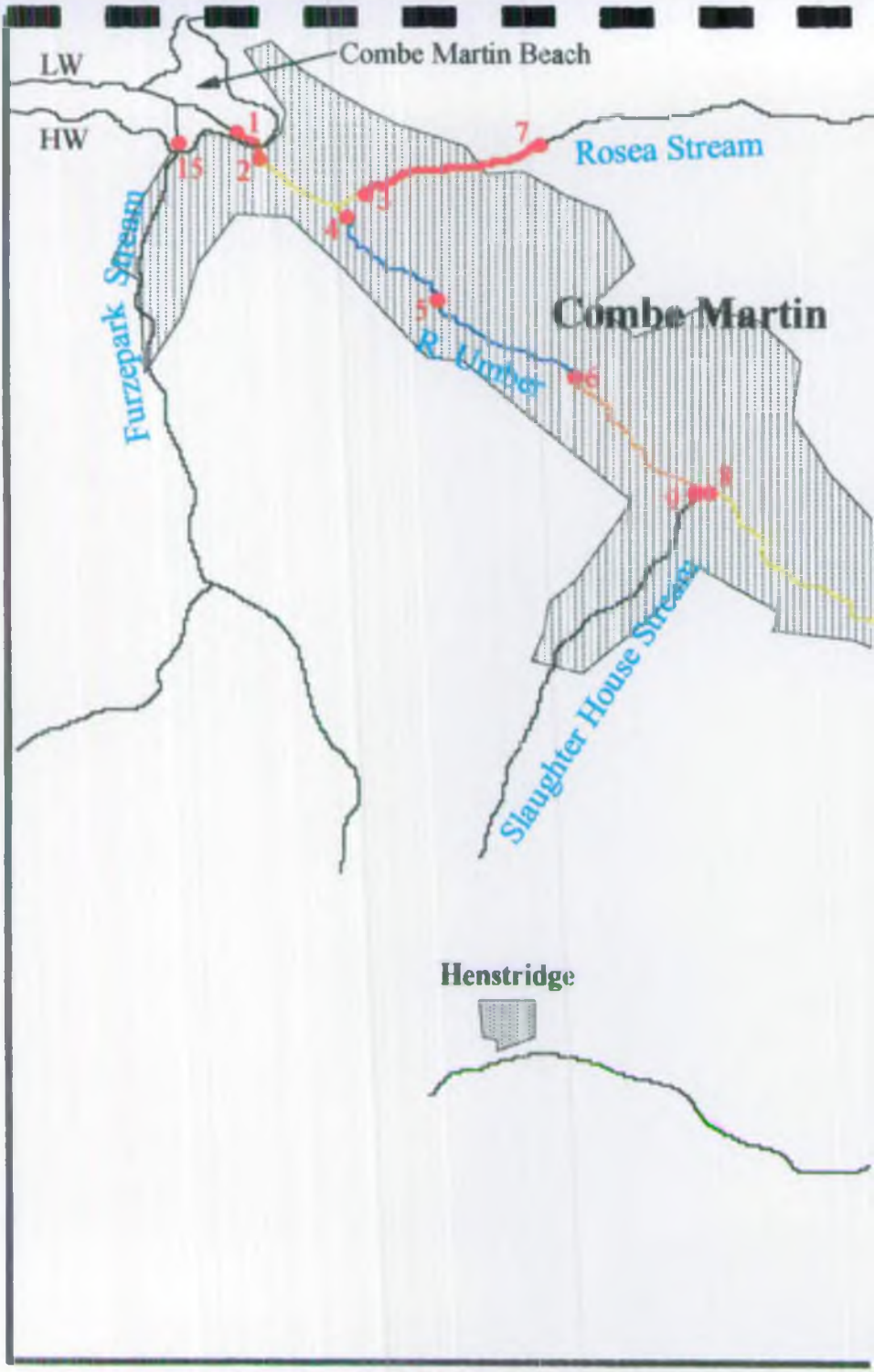


Figure No: 1

Title: R. Umber Sampling Locations


LW
HW
Combe Martin Beach
Rosea Stream
Furzepark Stream
R. Umber
Combe Martin
Slaughter House Stream
Coulsworthy Tributary
Yellaton Stream
R. Umber
Henstridge
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Key
Increase > 5000cfu/100ml
Increase < 5000cfu/100ml
Increase < 1000cfu/100ml
Improvement
No Data
Figure No: 2
Title: Geometric Mean Total Coliform Changes


LW
HW
Combe Martin Beach
Rosea Stream
Furzepark Stream
R Umber
Combe Martin
Slaughter House Stream
Henstridge
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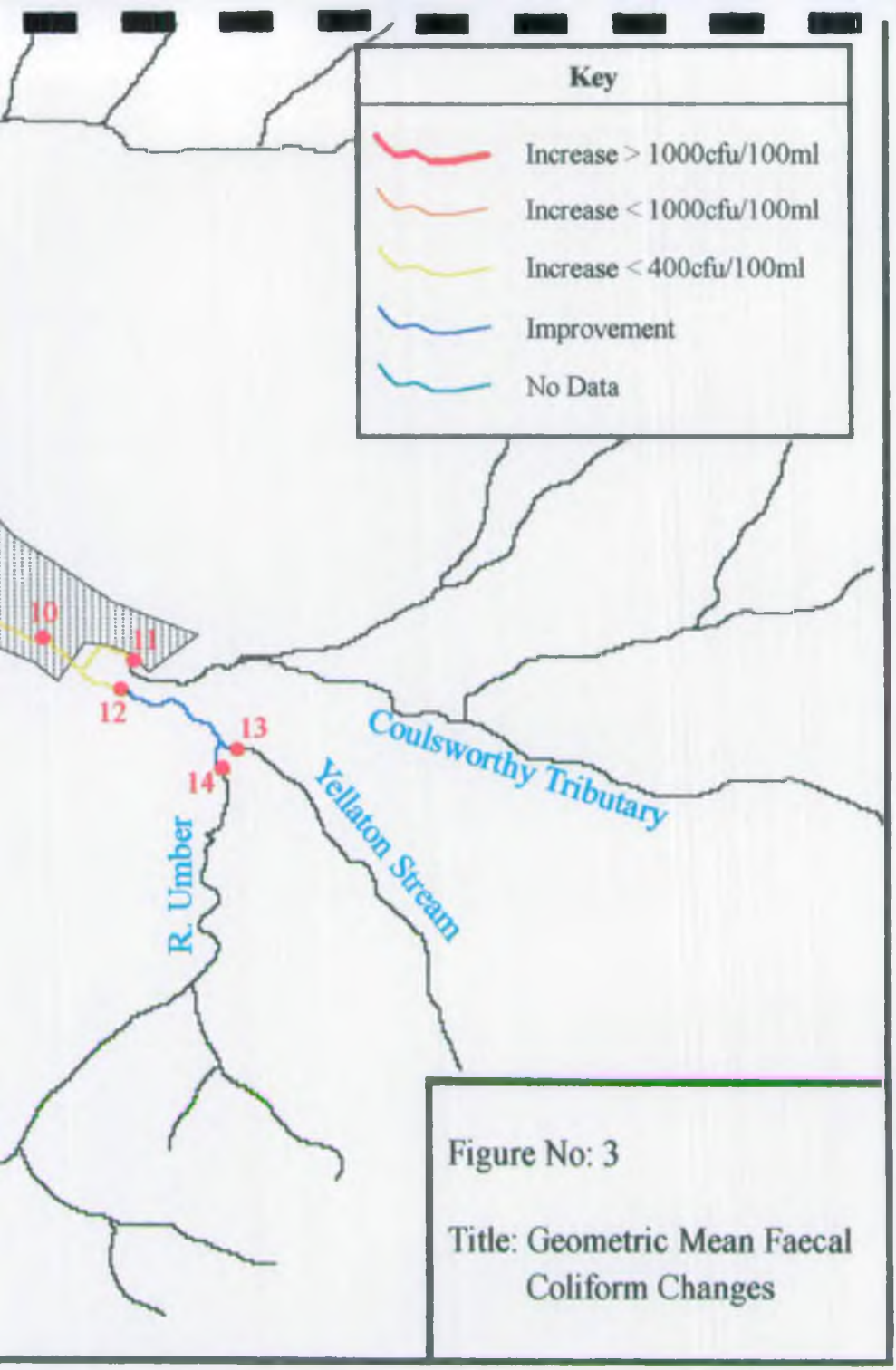
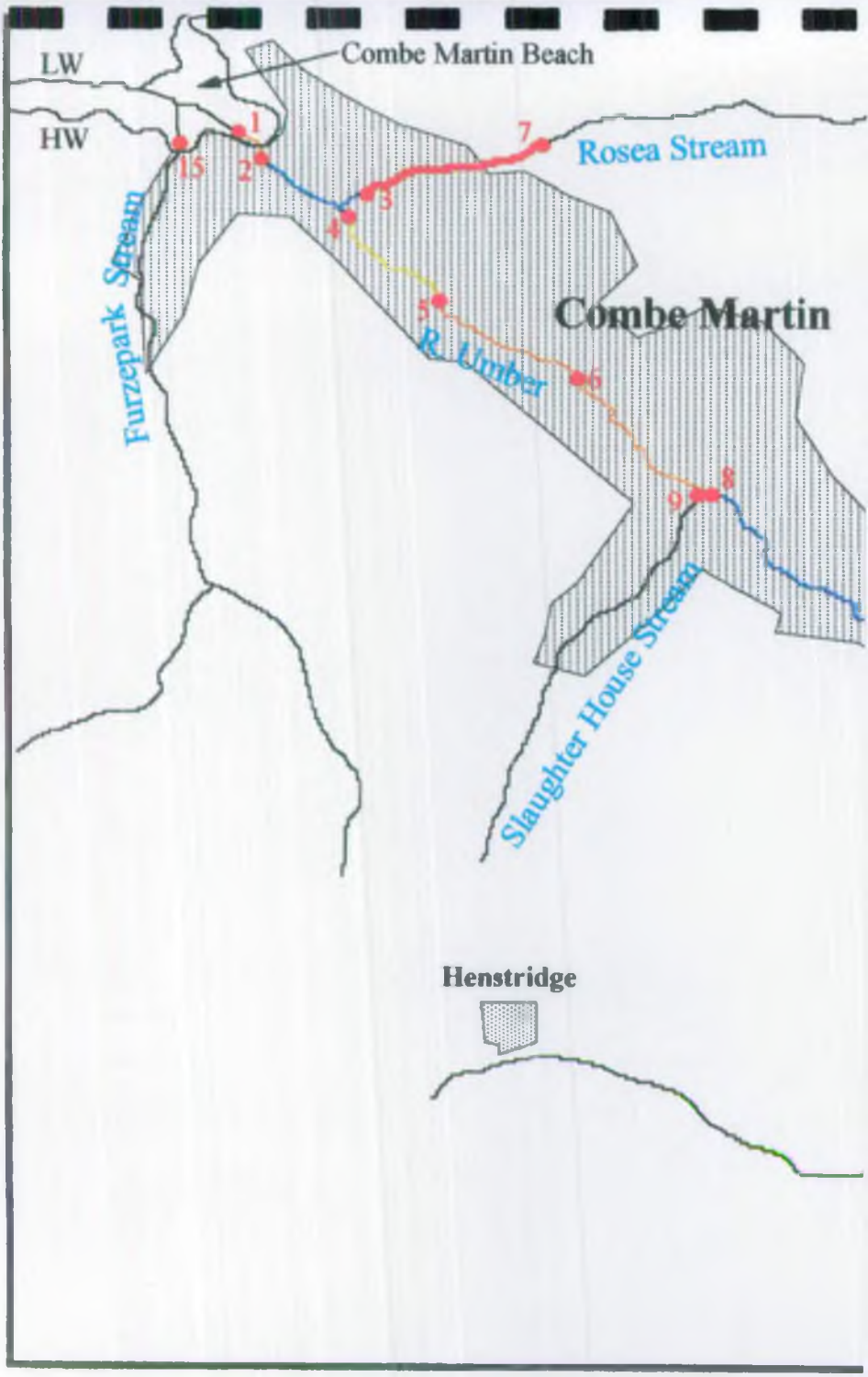


Figure No: 3

Title: Geometric Mean Faecal Coliform Changes


LW
HW
Combe Martin Beach
1
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15
Rosea Stream
Furzepark Stream
R. Umber
Combe Martin
Slaughter House Stream
Henstridge

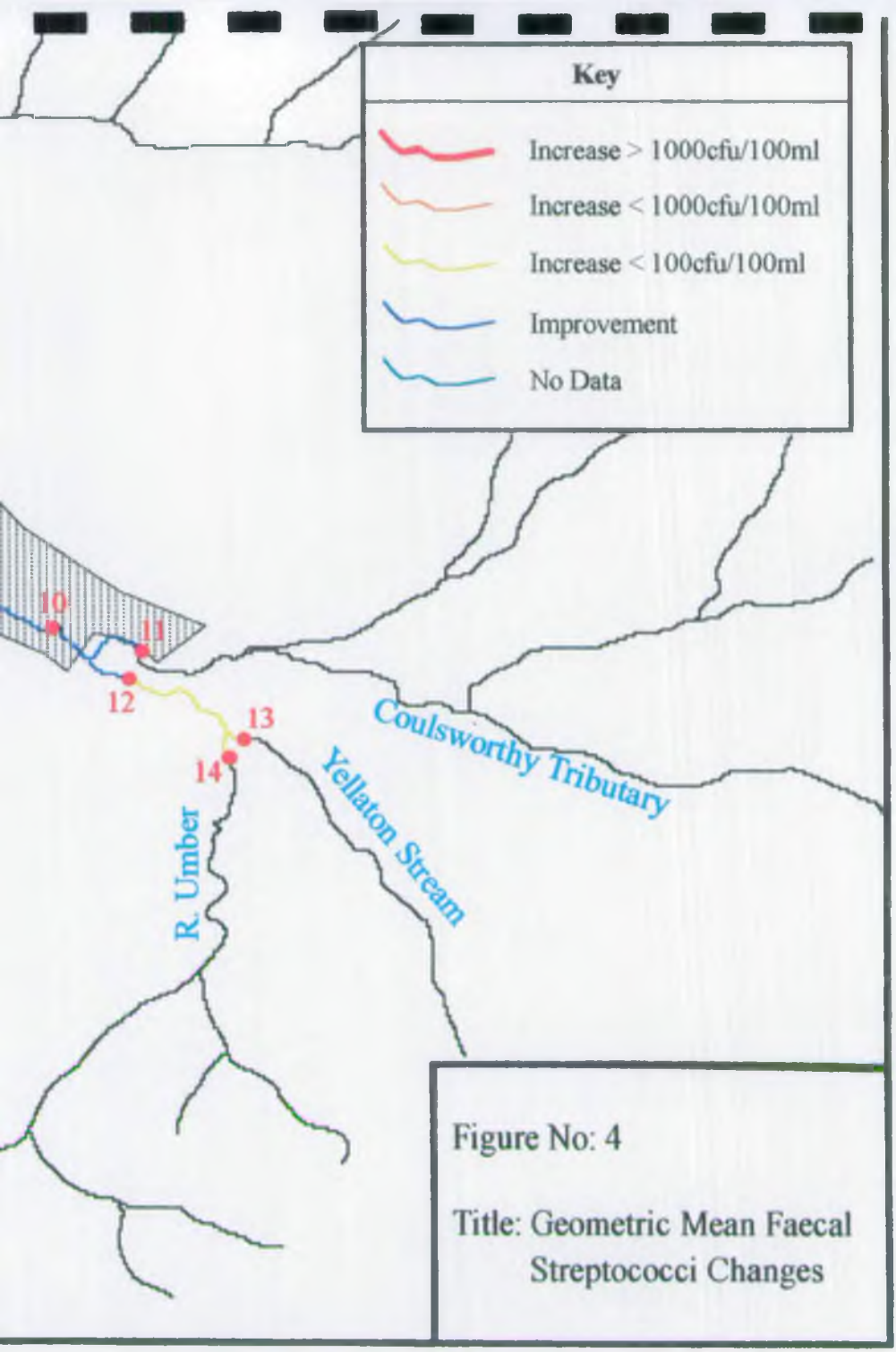

Figure No: 4

Title: Geometric Mean Faecal Streptococci Changes