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**DEVON AREA
INTERNAL REPORT**



**ENVIRONMENT
AGENCY**

**INVESTIGATION INTO FARM
POLLUTION AT WHEDDON CROSS**

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(CATCHMENT 05G)**

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Investigation into Farm Pollution at Wheddon Cross

1.0 Introduction

Intermittent pollution events at North Wheddon Farm, Wheddon Cross (see Fig 1) were reported to the Environment Agency. Devon Area Investigations Team were requested to deploy monitoring equipment to measure and document any further polluting incidents.

The affected stream runs between two stables in the farm's courtyard. It feeds a trough that supplies drinking water to the horses then flows through a culvert into a pond in the field below the Farm. During an incident the stream and pond were reported to be green and have a foul smell. The trough (Appendix 1) was reported to have filled up with sediment due to the pollution.

The stream flows into the River Quarme, which is a tributary of the River Exe. The River Quarme has a River Ecosystem Use Class of 1 (RE1) (ref. 7.0). This is defined as 'Water of very good quality suitable for all fish species' and as such it has very stringent restrictions on the concentrations of pollutant permitted in it, see appendix 2 for RE standards table.

The aim of this investigation was to collect data showing polluting events in the stream at North Wheddon Farm.

1.1 Project team

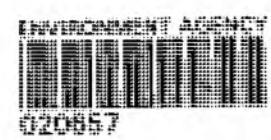
Project Manager – Trevor Cronin
Project Leader – Stuart Hunter
Project Officer – Robin Pearson

2.0 Method

The intermittent nature of the pollution presented problems. These were time of travel from the office and being able to sample during a polluting event. To overcome these problems a probe that monitors continuously was installed in the stream at North Wheddon Farm. The probe was monitoring for a month from the middle of November to the middle of December 1998.

The pollution was reported by the farm occupant to occur predominantly during wet weather. Deployment of the probe for this period would hopefully coincide with some rainfall events.

The probe (YSI 6920) was calibrated on the 18th November in the laboratory. A record of the calibration was made, see appendix 2. On the 19th November 1998 the probe was installed at North Wheddon Farm after a suitable location was identified. This was in the trough. The trough was chosen as it provided safe and convenient access for maintenance and had constant flow in a depth that covered the probes. The probe was secured upright in a cage which was held in place in the trough using fencing pins, see plates 1 & 2. The probe was set to measure five determinands: temperature (degrees Celsius), total ammonia (mg/l), dissolved oxygen (%), conductivity (microsiemens/cm) and turbidity (NTU). A measurement was taken every 5 minutes.



On the 27th November 1998 the site was revisited, the probe was removed and the data downloaded to a laptop. New batteries were added and the reading interval was changed to 15 minutes to conserve power and extend battery life. Subsequent visits were made on the 8th December and finally on the 18th December when the probe was removed and brought back to the laboratory.

During each site visit, samples from the trough were taken for laboratory analysis. At the same time as a probe reading, in situ measurements were made using a hand held WTW. A comparison of results can be seen in table 1.

On return to the lab the probe was placed in calibration solutions to assess any drift in the readings during deployment, see appendix 4 for results.

3.0 Results

The results showed intermittent pollution events over the period the probe was deployed. Three events were recorded:

The first: Started at 22:00 on 22nd November and finished at 04:15 on the 24th November. This was the longest event and had a number of peaks of ammonia during the incident. The maximum-recorded concentrations of ammonia were lower than the other two subsequent events. Ammonia peaked at 4.94 mg/l at 11:15 on 23rd November.

The second: Started at 05:25 on 24th November. The event reached a maximum concentration of ammonia of 11.11 mg/l at 08:10 on 24th November. The ammonia concentration decreased rapidly and dropped back within class limits at 10:20 on 25th November.

The third: Started at 06:30 on 28th November. The maximum ammonia concentration was 9.79 mg/l at 08:30 on 28th November. The concentration decreased back within class limits at 23.30 on 29th November.

Events one and two have been recorded as separate, however the concentration of ammonia recorded only decreased as low as 0.3 mg/l between events. This concentration is above the RE1 standard of 0.25 mg/l. They could be classed as one pollution event lasting almost 4 days.

Sample 2 (Table 1) was taken during a polluting event. The stream appeared green in colour and a pungent odour was emanating from it. The probe reading at the time of sampling was 3.9 mg/l and laboratory analysis found the total ammonia concentration to be 5.03 mg/l, clearly showing that the probe was recording the event. The readings throughout deployment were very stable and as shown (see appendix 4) on return to the lab the amount of drift when placed in calibration solution, during deployment is minor.

When the probe was removed on 18th December the base of the probe where the readings are made, was under approximately 3 cm of silt. The results show the probe became fouled by silt on 8th December at 12:00, all results after this time have been disregarded as erroneous.

The complete results in graphical form can be seen in Fig 2. As can be seen the collected data is of very good quality. Stable readings were recorded during periods of good water quality. During incidents corresponding peaks and troughs in all determinands were recorded. Peaks of ammonia and comparative results from the probe and two samples are shown on the graph.

4.0 Discussion

The results obtained from the probe clearly show polluting events taking place. The stream has an RE1 classification; this is the highest standard for a watercourse. The concentrations of ammonia recorded by the probe were as high as 11.11 mg/l, the maximum for an Ecosystem Class 1 (RE1) watercourse is 0.25 mg/l over 40 times lower than 11.11. This level of pollution has a detrimental effect on the organisms that live in the stream, removing species sensitive to pollution.

The high concentrations of ammonia and the drop in the percentage of dissolved oxygen measured by the probe. Plus the volume of sediment that collected in the trough indicates that large volumes of an organic pollutant (such as farm waste from livestock) entered the stream during the investigation.

The probe appeared to have a larger margin of error at lower concentrations of ammonia e.g. sample 3 (Table 1), Lab analysis 0.043 mg/l, probe reading 0.18 mg/l. As concentrations of ammonia increased readings appear to become more accurate. This can be seen in sample 4 which had a concentration of 0.347 mg/l the probe read 0.33 mg/l. The data collected by the probe is of very good quality. The differences found between laboratory analysed samples and probe readings were within the manufactures quoted margins of error for this type of water quality monitoring probe.

The results for each determinand measured on the probe show a correlation with each other. As ammonia concentrations rose there was a corresponding rise in conductivity and turbidity and an expected drop in the percentage of dissolved oxygen in the stream. As stated previously (3.0 Results) the probe became fouled towards the end of its deployment. The level of deposition of solids combined with chemical and physical changes in the stream indicate a decline in water quality conducive with organic pollution up stream of the sampling point.

This investigation cannot isolate the exact location where the pollution was originating. The Environment Protection Officer is aware of the polluter and attributes all pollution events to Dunkery View. Dunkery View is situated at the head of the stream, approximately 200 metres from North Wheddon Farm.

5.0 Conclusions

The pollution is most probably organic farm waste from Dunkery View. The method of entry of pollutant to the stream is not established. The most likely route is either:

Direct discharge of waste to the stream.

Inadequate waste storage facilities (leading to leakage into the stream).

6.0 Recommendations

The Environment Protection Officer to discuss remedial steps required to prevent further contamination of the stream with the owner of Dunkery View. These could include:

- Advice on on-site sewage disposal options.
- Advice on safe containment of farm wastes.
- Advice on minimisation of pollution.

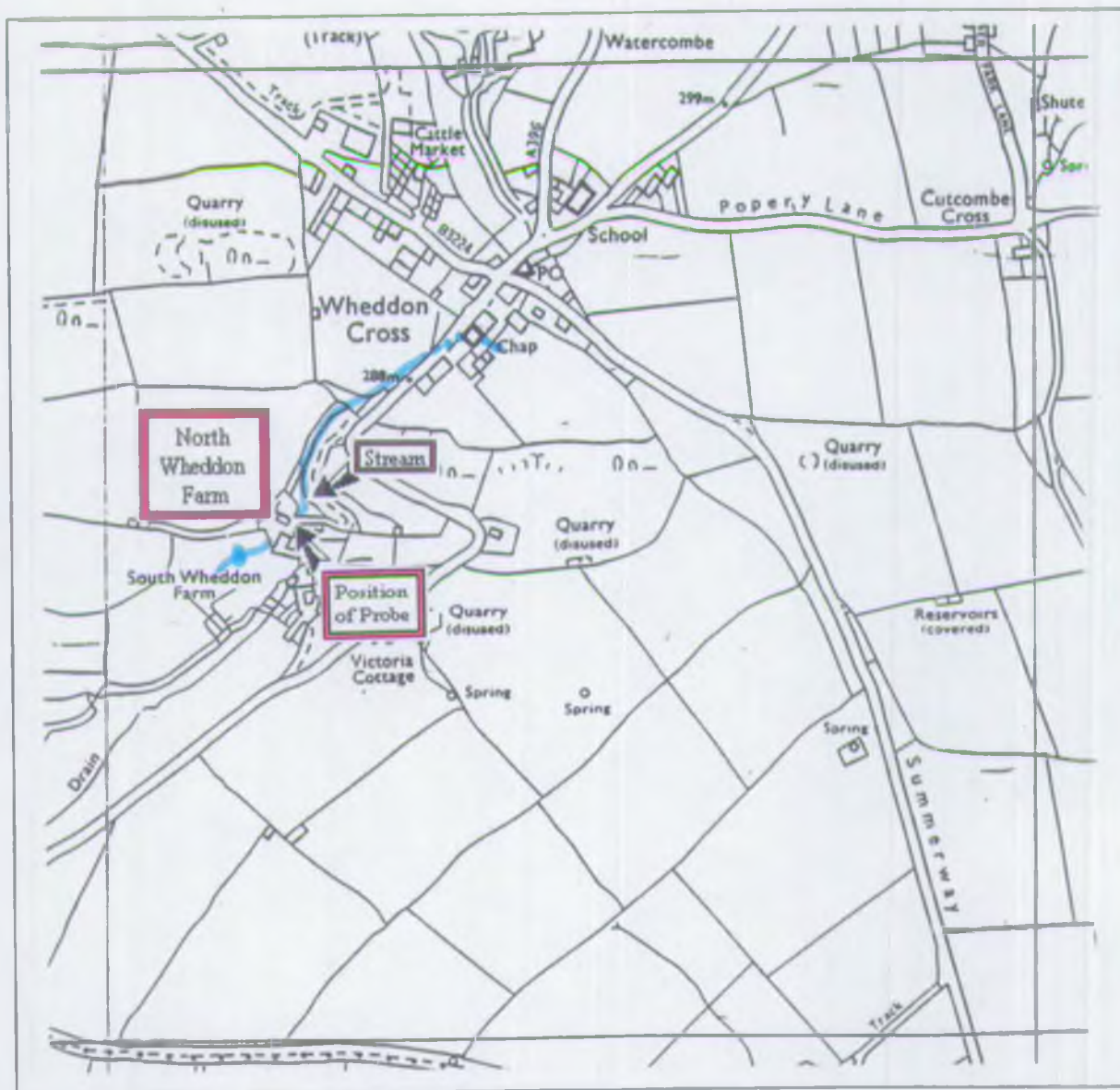
ACTION: Environment Protection Officer

7.0 Reference

National River Authority, South West Region. December 1995. *River Exe Catchment Management Plan Consultation Report.*

Figure 1

Map Showing Wheddon Cross and North Wheddon Farm



North Wheddon Farm SS9220 3860

Table 1

Tables Comparing Probe Results with those of Lab analysed samples and WTW hand held meters

Sample 1
19/11/98 @ 11:45

Determinand	Analysis		
	Probe	Lab	WTW
pH	7.63	7.9	7.72
Conductivity us/cm	298	277	307
Turbidity NTU	12.22	7.6	-
Temperature C	8.71	-	8.5
D.O. %	92.7	-	97.1
Total NH3 mg/l	0.27	0.113	-

Sample 2
23/11/98 @ 11:45

Determinand	Analysis		
	Probe	Lab	WTW
pH	7.98	7.9	-
Conductivity us/cm	428	402	
Turbidity NTU	32.3	26.1	-
Temperature C	9.07	-	-
D.O. %	86.5	-	-
Total NH3 mg/l	3.9	5.03	-

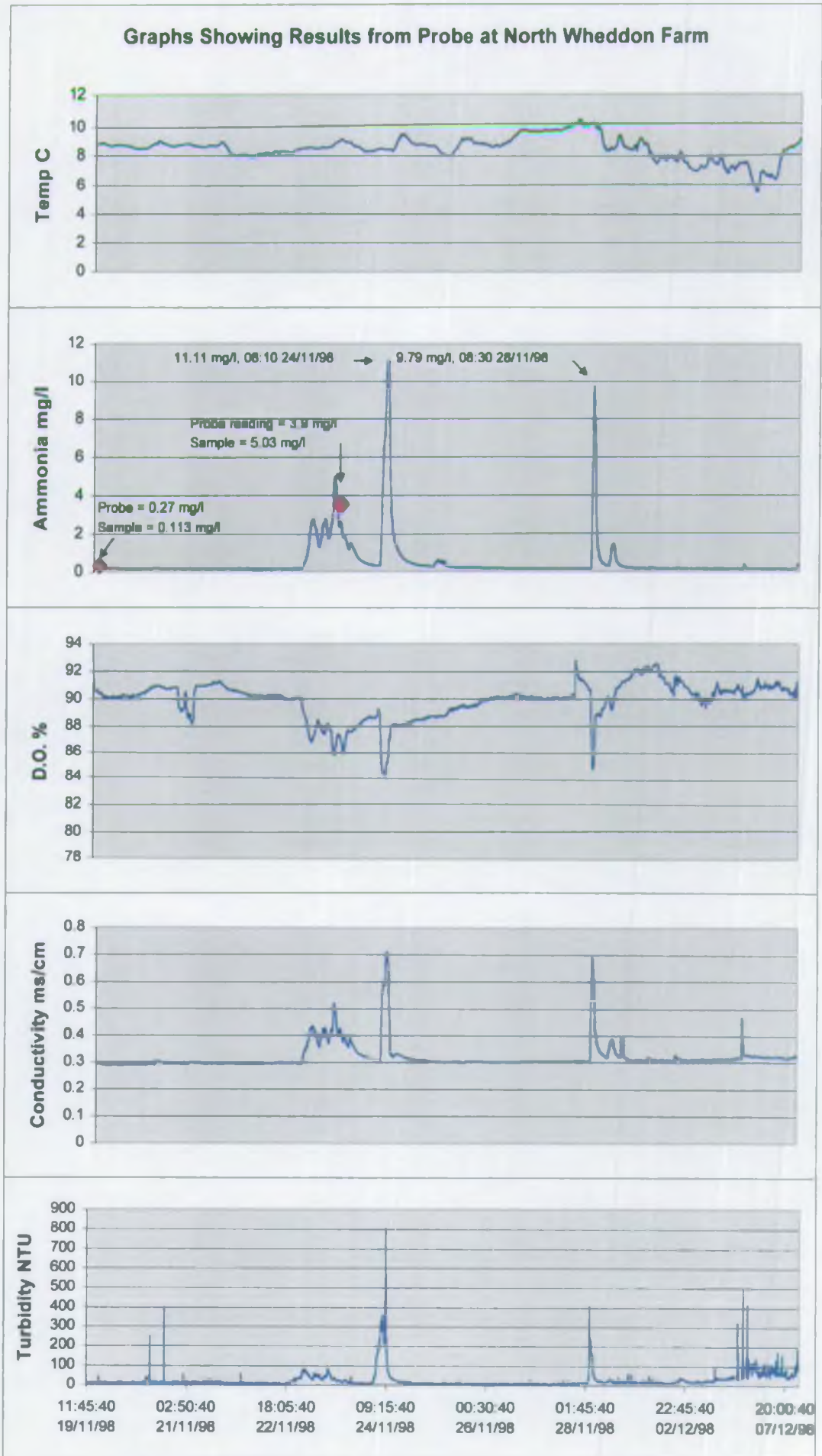
Sample 3
27/11/98 @ 12:00

Determinand	Analysis		
	Probe	Lab	WTW
pH	7.95	7.95	7.92
Conductivity us/cm	306	284	318
Turbidity NTU	19.97	12.3	-
Temperature C	10.22	-	10.5
D.O. %	92.3	-	95.6
Total NH3 mg/l	0.18	0.043	-

Sample 4
08/12/98 @ 12:00

Determinand	Analysis		
	Probe	Lab	WTW
pH	7.95	7.9	7.86
Conductivity us/cm	321	298	333
Turbidity NTU	82.29	40.2	-
Temperature C	9	-	8.9
D.O. %	90.4	-	93.2
Total NH3 mg/l	0.33	0.347	-

Figure 2



APPENDICES

Appendix 1

Plate 1

Plates 1 & 2 Showing Position of Probe at North Wheddon Farm



Plate 2



Plate 3

Showing Probe in Trough



The trough which stream runs into, which is usually full of clear water.

Standards For The Five River Ecosystem Use Classes

Use Class	DO % sat 10%ile	BOD (ATU) mg/l 90%ile	Total Ammonia mgN/l 95%ile	Un-ionised Ammonia mgN/l 95%ile	pH 5%ile & 95%ile	Hardness mg/l Ca CO ₃	Disolved Copper ug/l 95%ile	Total Zinc ug/l 95%ile	Class Description
1	80	2.5	0.25	0.021	6.0-9.0	≤ 10 >10 and ≤ 50 >50 and ≤ 100 >100	2 22 40 112	30 200 300 500	Water of very good quality suitable for all fish species
2	70	4.0	0.6	0.021	6.0-9.0	≤ 10 >10 and ≤ 50 >50 and ≤ 100 >100	2 22 40 112	30 200 300 500	Water of good quality suitable for all fish species
3	60	6.0	1.3	0.021	6.0-9.0	≤ 10 >10 and ≤ 50 >50 and ≤ 100 >100	2 22 40 112	300 700 1000 2000	Water of fair quality suitable for high class coarse fish populations
4	50	8.0	2.5	-	6.0-9.0	≤ 10 >10 and ≤ 50 >50 and ≤ 100 >100	2 22 40 112	300 700 1000 2000	Water of fair quality suitable for coarse fish populations
5	20	15.0	9.0	-	-	-	-	-	Water of poor quality which is likely to limit coarse fish populations

Appendix 3

Calibration of YSI 6920 Probe on the Day before Deployment, 18 November 1998

Determinand	Calibration Solution	Reading Before Calibration	Reading After Calibration
Dissolved Oxygen %	Saturated Air	98.7	100.0
Conductivity us/cm	1000	1014	1000
pH	7	6.98	7.00
	4	4.07	4.00
Turbidity NTU	0.0	-1.1	0.0
	100.0	96.8	100.0
Ammonia mg/l	100	134.0	100.1
	1	2.066	0.988
	1	0.429	0.988

Appendix 4

Readings from Probe in Calibration Solutions on Return to Laboratory 18 December 1998

Determinand	Calibration Solution	Reading After Calibration	Reading on Return to Laboratory
Dissolved Oxygen %	Saturated Air	100.0	94.9
Conductivity us/cm	1000	1000	942
pH	7	7.00	7.15
	4	4.00	4.05
Turbidity NTU	0.0	0.0	0.2
Ammonia mg/l	100	100.1	79.6
	1	0.988	0.29