

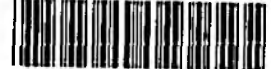
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VARIABILITY OF EFFLUENT QUALITY OF
ACTIVATED SLUDGE TREATMENT PLANTS
IN AVON AND DORSET

WATER QUALITY INVESTIGATIONS UNIT

SEPTEMBER 1992

VARIABILITY OF SEWAGE TREATMENT WORKS FINAL EFFLUENT
ACTIVATED SLUDGE PLANTS IN AVON AND DORSET

1 INTRODUCTION

In the Water Quality Investigations Unit report "Variability Of Sewage Works Final Effluent" (September 1991) it was recommended that the investigation should be extended further in order to confirm that the general patterns in effluent quality which were observed are applicable to all works. In particular, activated sludge treatment works should be targeted as only two were monitored during the previous investigation.

2 SAMPLING SITES

Following discussion with area staff, a number of activated sludge treatment works in Dorset were selected for investigation. These are listed as follows.

Webbs Country Foods treatment plant.
Tarrant Crawford Sewage Treatment Works.
Poole Sewage Treatment Works.
Lytchett Minster Sewage Treatment Works.

All these plants utilise activated sludge processes and all have recent problematical histories. Both Poole and Lytchett Minster were undergoing improvement works at the time of the survey.

A summary of the nature and flows of the waste received at each of the treatment plants and of the consent to discharge limits is shown in Table 1.

3 SAMPLING METHODS

The investigation covered a two week period from 18 June to 1 July 1992. At each treatment works, 500ml samples of final effluent were taken at two hourly intervals. These samples were then combined to give four hourly composites which were submitted to Exeter laboratory for analysis.

4 RESULTS

4.1 The results for BOD, ammonia and suspended solids for each treatment plant are presented in Figures a to d.

4.2 Incremental rainfall data was collected from the nearest available recording station to each site. The daily rainfall (00.00 hrs - 23.59 hrs) was calculated and is presented in Table 2.

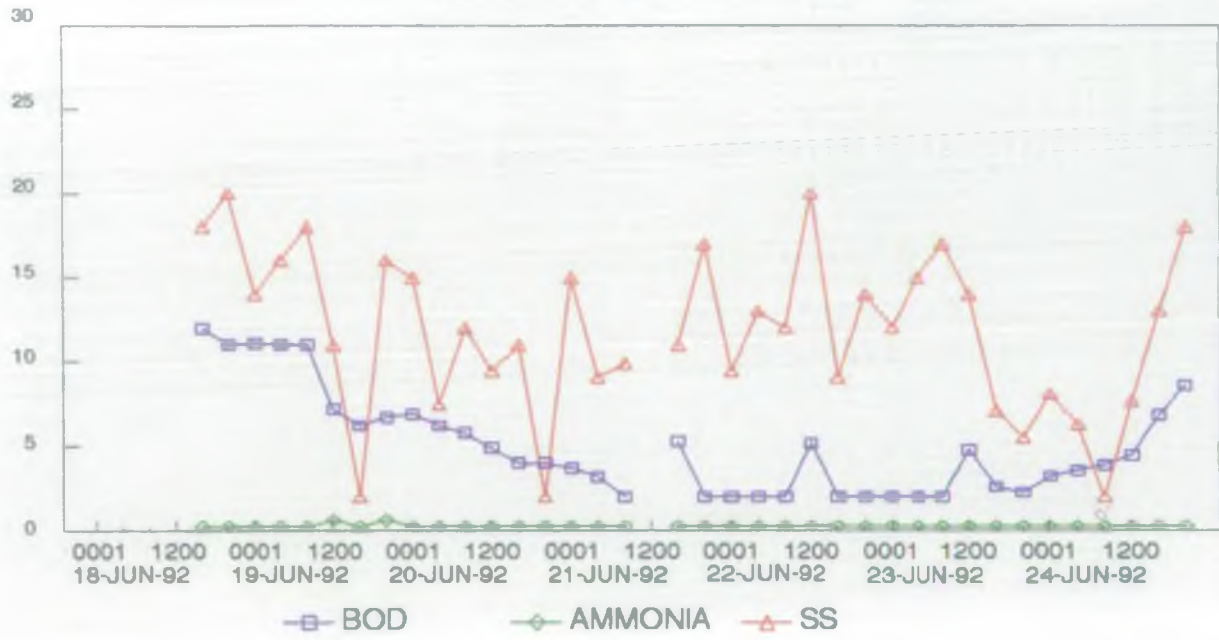
TABLE 1.

Nature of crude effluent and treatment methods at each works					
Treatment works	Approximate Dry weather flow (m ³ /day)	Nature of the crude effluent	Treatment methods	Consent conditions (mg/l) BOD S.S NH ₃	Other information
Webb Country Foods		Trade effluent from a poultry processing plant	Dissolved Air Flotation	20 30 20	Between 1989 and 1992 there have been 6 breaches prosecutions and cautions
Tarrant Crawford STW	3204	Domestic effluent and trade effluent from Blandford Forum	Activated Sludge (Passavant)	20 30 15	During 1991/1992 there were 4 breaches of consent
Poole STW (combination of Poole Eastern and Poole Western)	Eastern = 27500 Western = 8500	Trade and Domestic effluent	Activated Sludge	Poole Eastern 50 55 35 Poole Western 50 50 30	This STW was undergoing improvement works at the time of the survey
Lytchett Minster STW	1475	Domestic effluent	Activated Sludge (oxidation ditch)	30 40 50	This STW was undergoing improvement works at the time of the survey

FIGURE a.

WEBBS COUNTRY FOODS

18 JUNE 1992 TO 24 JUNE 1992



25 JUNE 1992 TO 1 JULY 1992

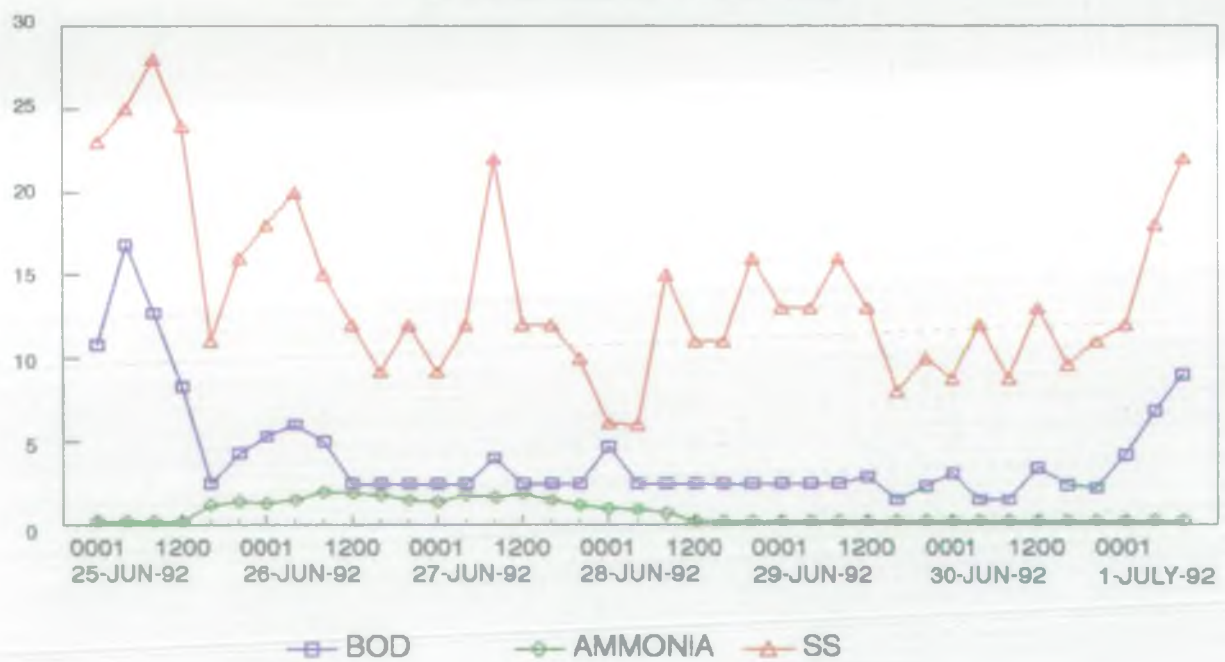
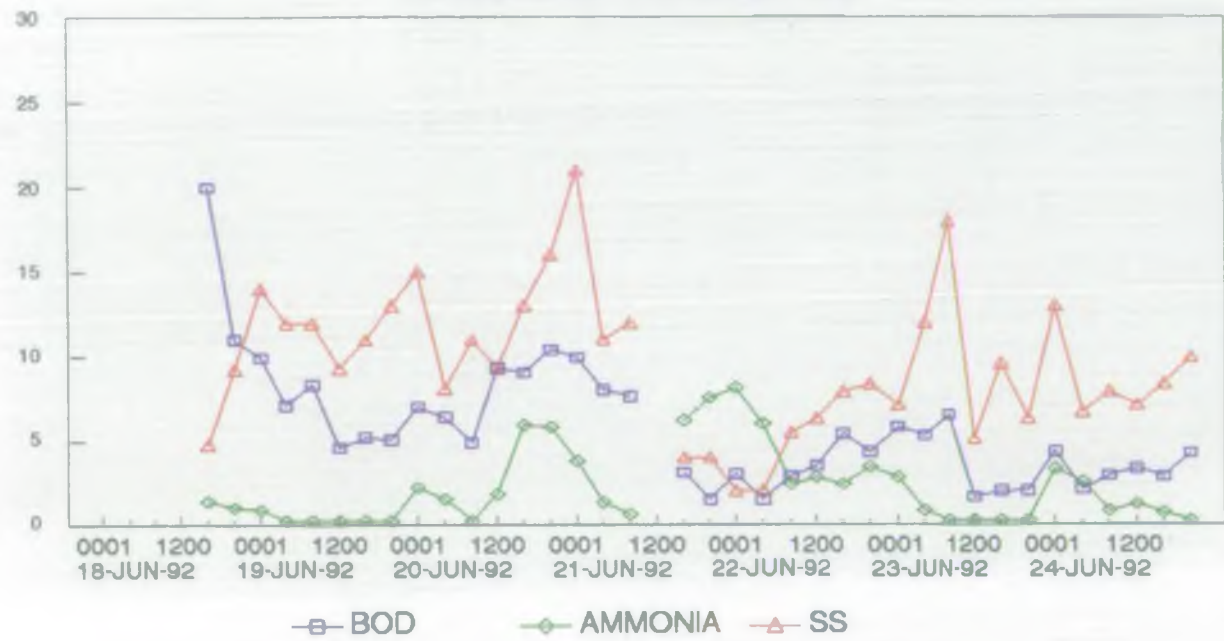


FIGURE b.

TARRANT CRAWFORD SEWAGE TREATMENT WORKS

18 JUNE 1992 TO 24 JUNE 1992



25 JUNE 1992 TO 1 JULY 1992

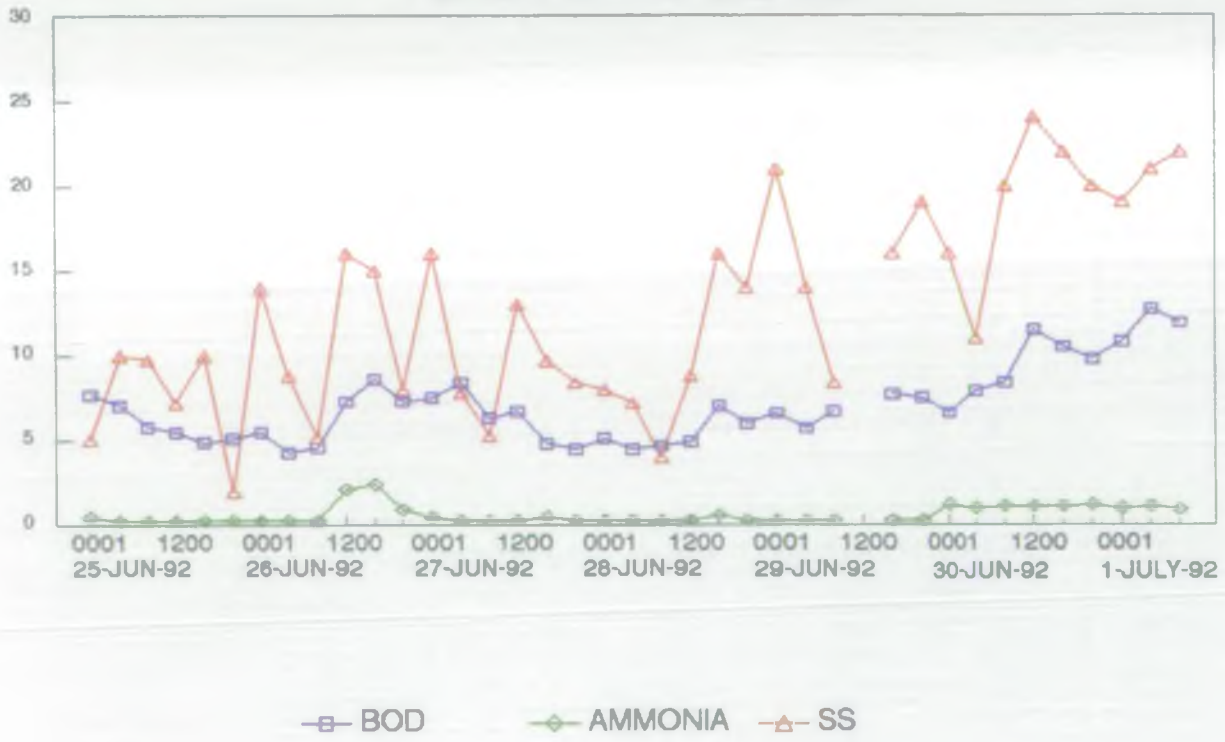
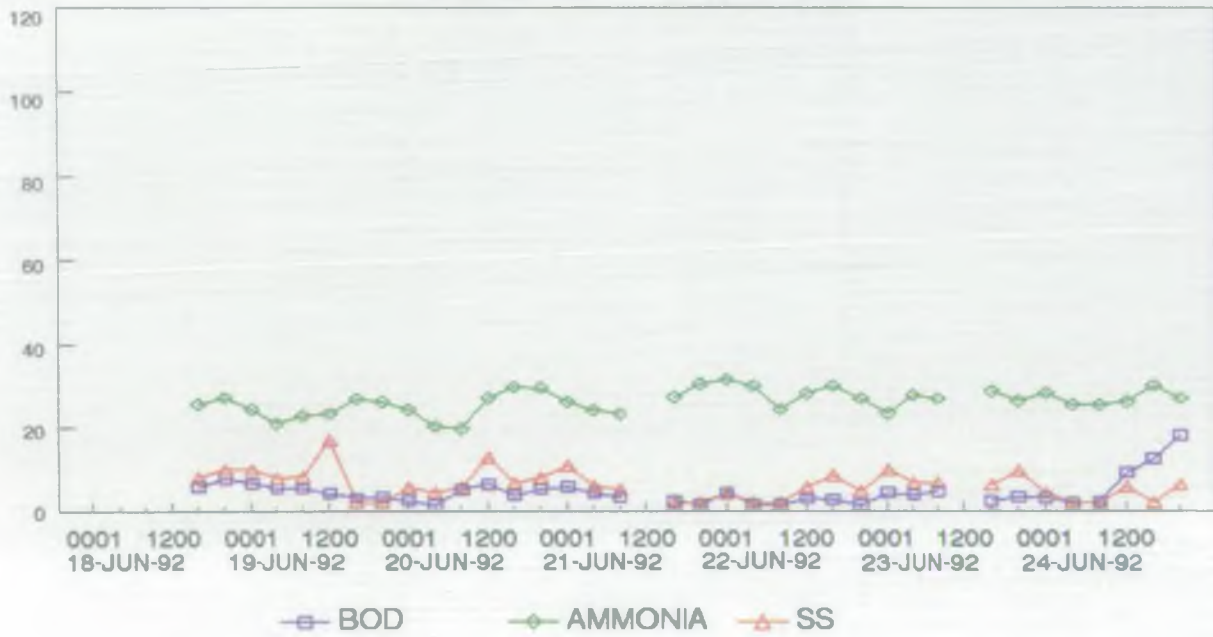


FIGURE c.

POOLE SEWAGE TREATMENT WORKS

18 JUNE 1992 TO 24 JUNE 1992



25 JUNE 1992 TO 1 JULY 1992

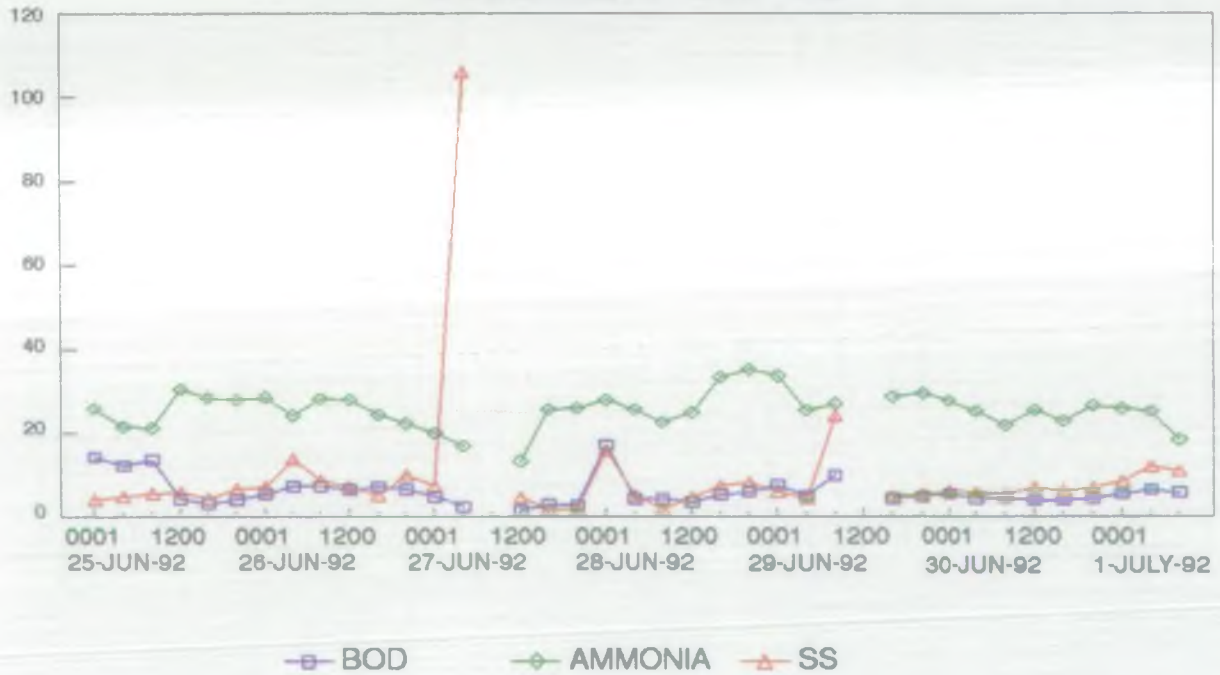
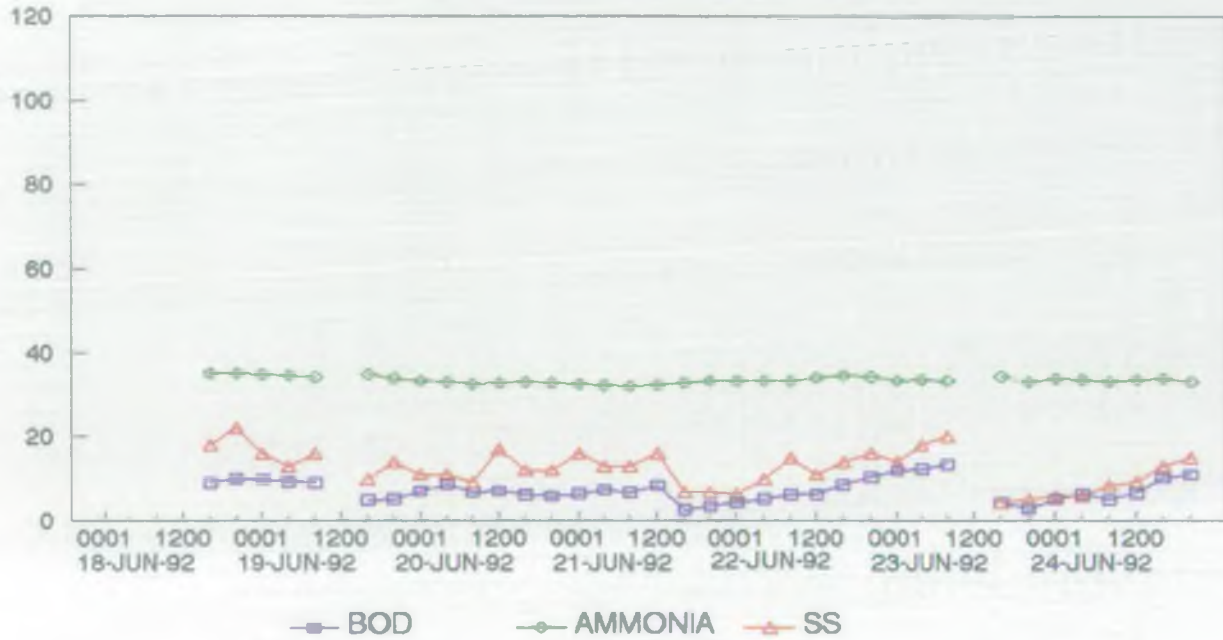


FIGURE d.

LYTCHETT MINSTER SEWAGE TREATMENT WORKS

18 JUNE 1992 TO 24 JUNE 1992



25 JUNE 1992 TO 1 JULY 1992

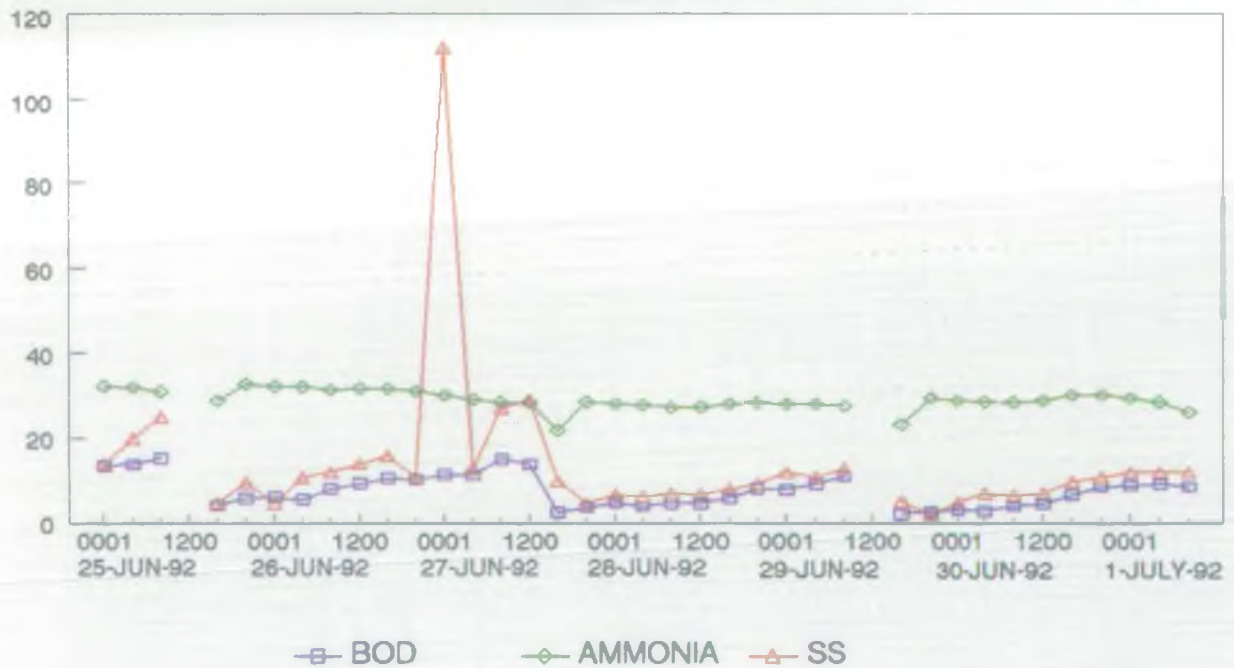


FIGURE e

WEBBS COUNTRY FOODS
DISTRIBUTION OF SAMPLES DURING THE DAY
1988 - 1990

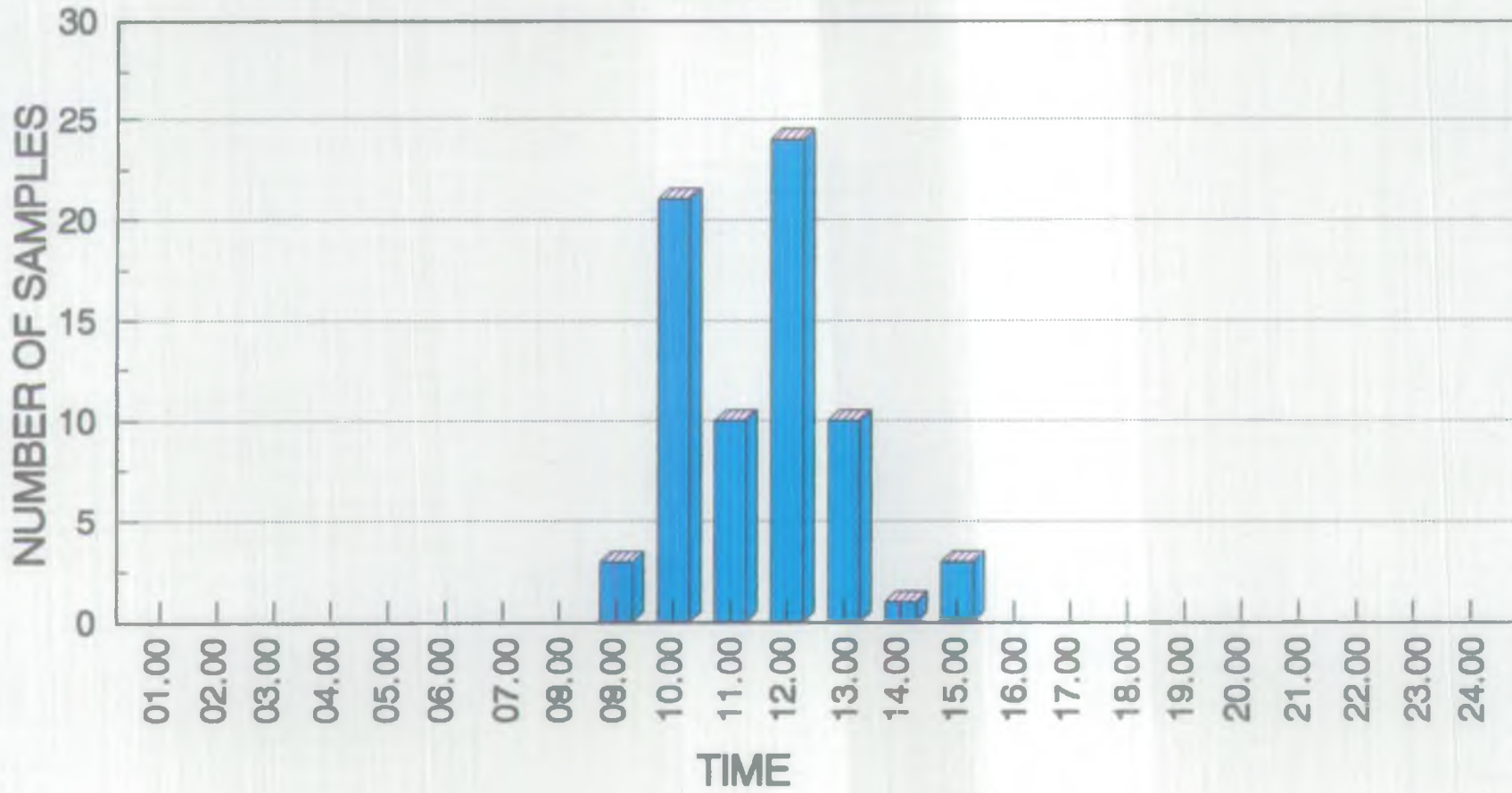


FIGURE f

TARRANT CRAWFORD
DISTRIBUTION OF SAMPLES DURING THE DAY
1988 - 1990

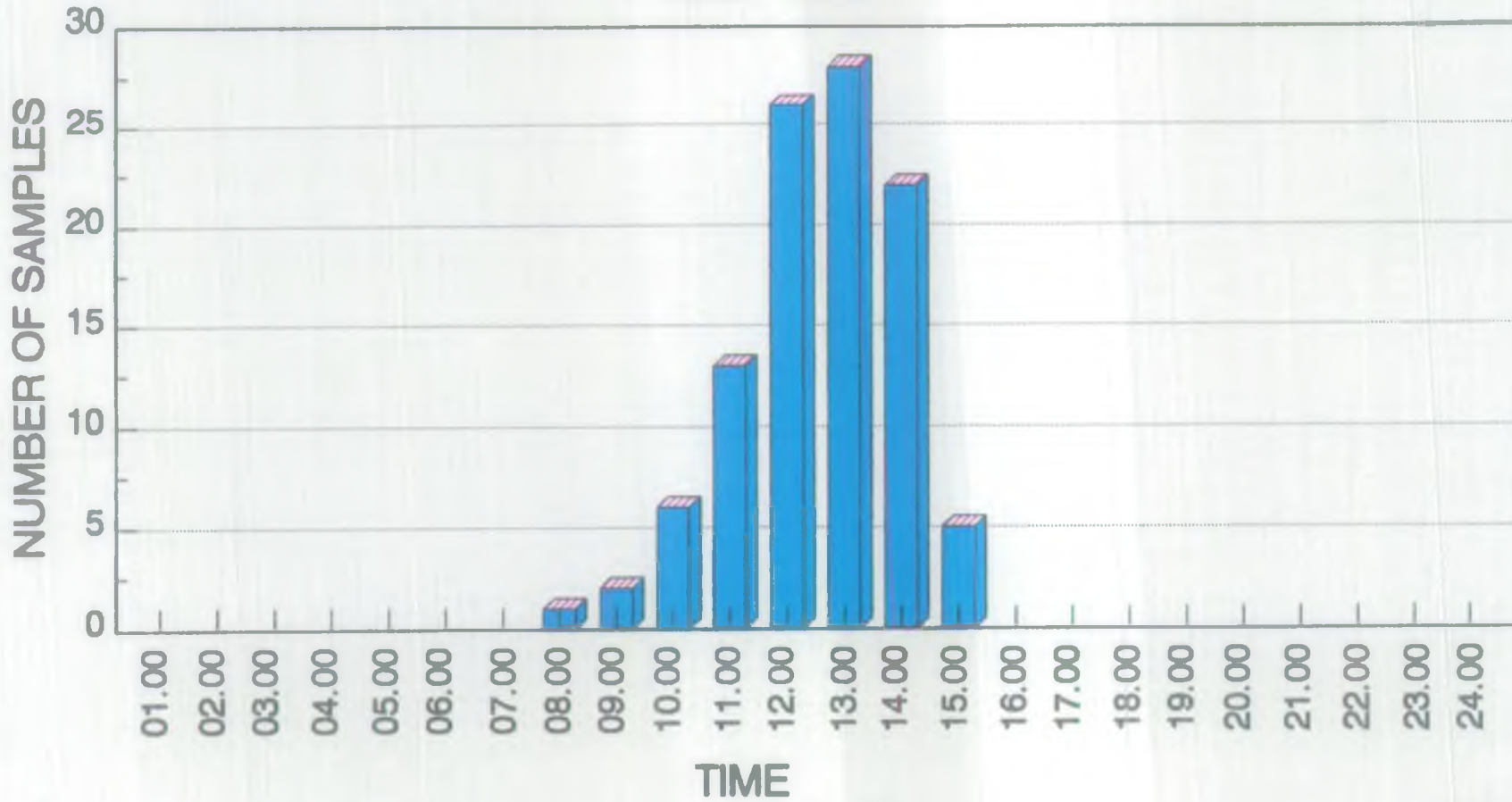


FIGURE g

POOLE STW
DISTRIBUTION OF SAMPLES DURING THE DAY
1988 - 1990

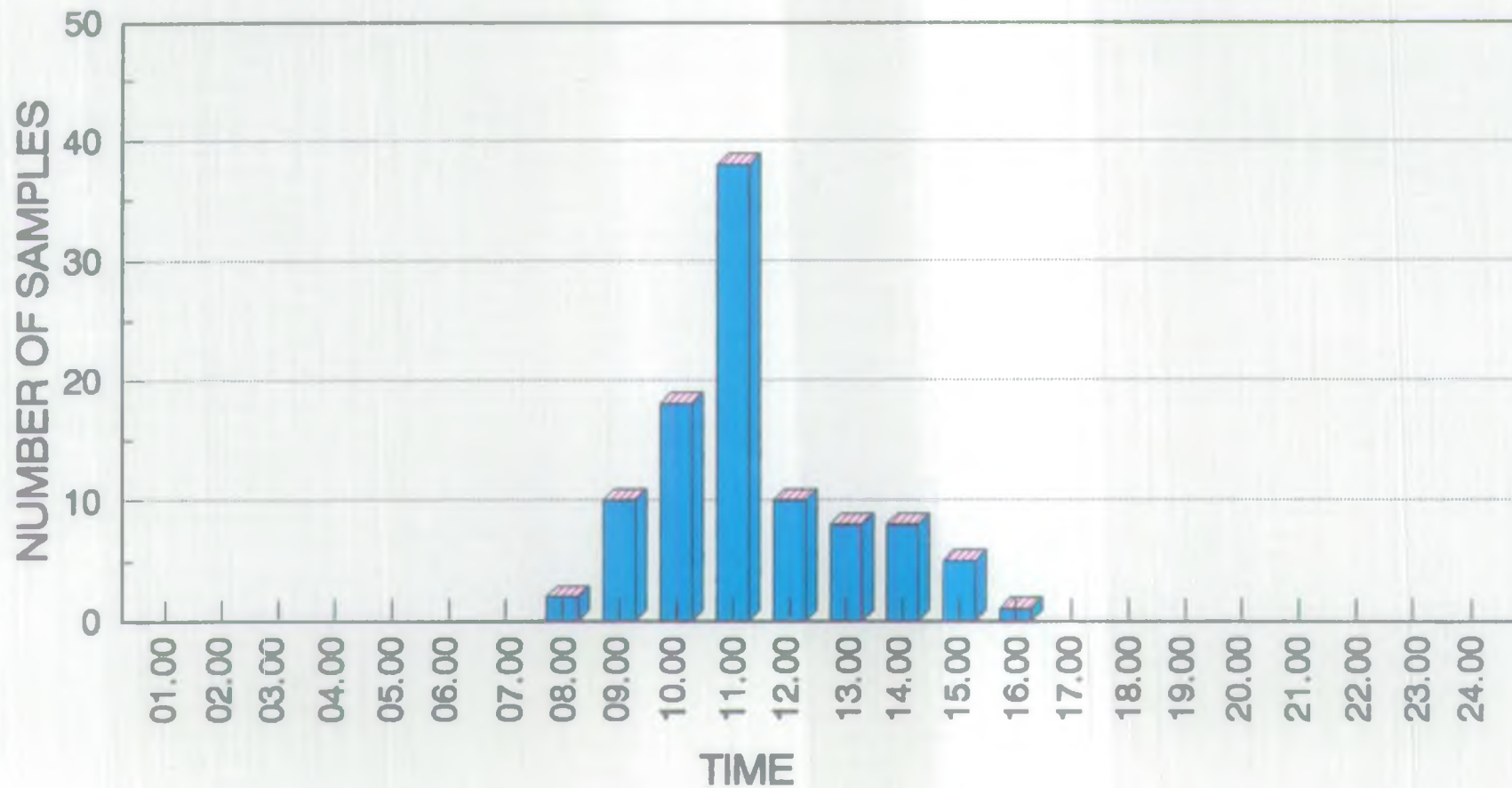
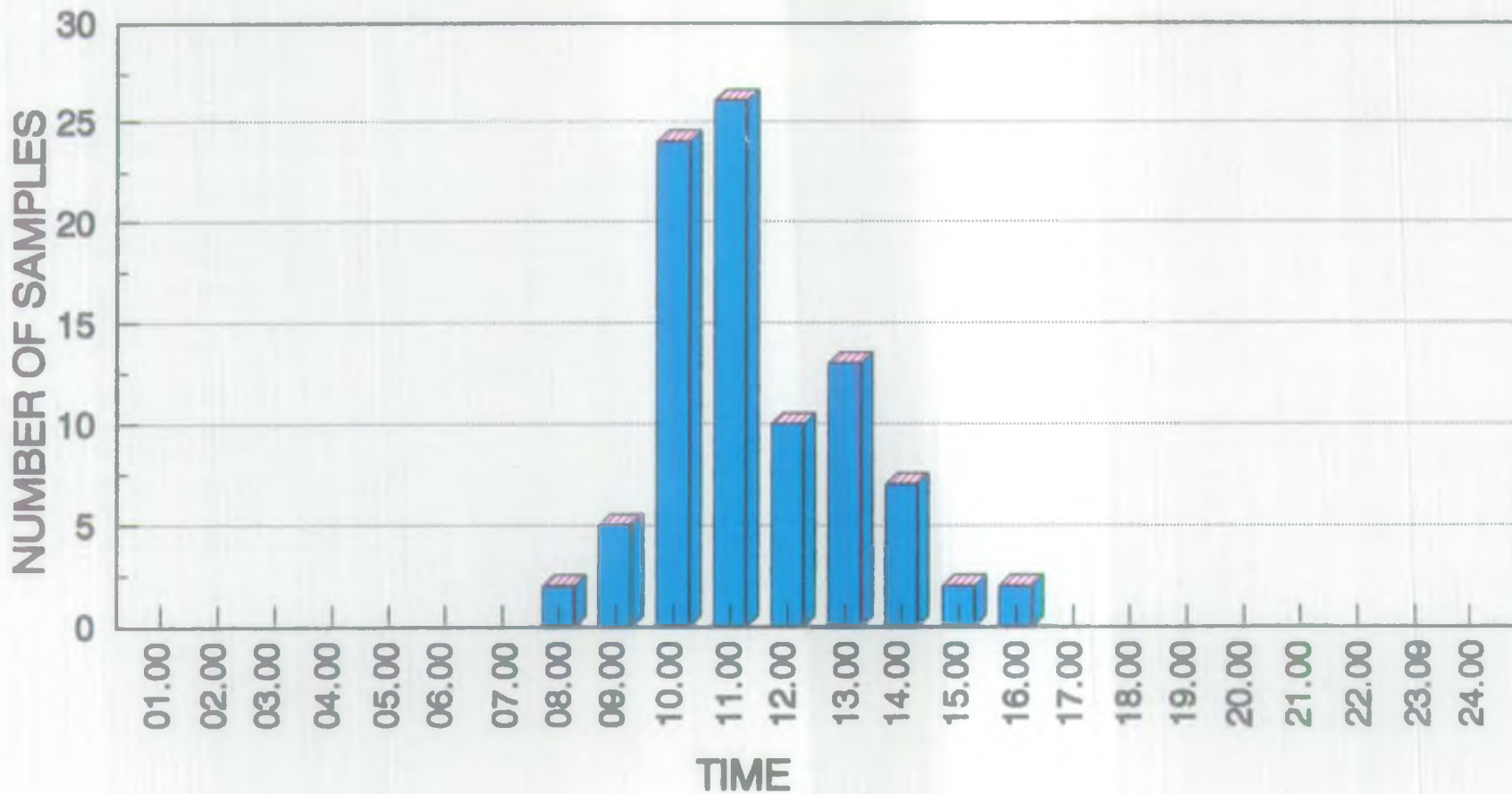


FIGURE h

LYTCHETT MINSTER STW
DISTRIBUTION OF SAMPLES DURING THE DAY
1988 - 1990



4.3 To assess the historical sampling strategies, at the works under investigation, the times of day when routine audit samples were taken from 1988 - 1990 have been plotted on frequency distribution histograms (Figures e to f).

4.4 WEBBS COUNTRY FOODS (Figure a)

Although variation in the effluent quality was observed at this site this did not appear to follow any regular pattern. No breaches of consent occurred and only on one occasion (at 04.00 on 25 June 1992) did BOD and suspended solids concentrations approach the consent limits. Ammonia levels remained low during the entire survey.

4.5 TARRANT CRAWFORD (Figure b)

During the first week (18 to 24 June 1992) the ammonia concentration appeared to follow a disrupted daily cycle, reaching a maximum concentration of 8.1 mg/l at 00.00 hrs on 22 June 1992. During the second week no cyclical variation in concentration was observed and ammonia remained at an average concentration of 0.7 mg/l. Throughout the entire survey, suspended solids and ammonia concentrations remained within the consent limits. However, the consent level for BOD (20 mg/l) was reached but not exceeded at 16.00 hrs on 18 June 92.

4.6 POOLE (Figure c)

At this works there was a clear cyclical variation in ammonia concentration, around an average of 26 mg/l, with troughs and peaks occurring during the mornings and evenings respectively. The highest concentration detected (35 mg/l) occurred at 20.00 hrs on 28 June 92. BOD and suspended solids concentrations remained well within consent, apart from one occasion (04.00 hrs on Saturday 27 June 1992) when suspended solids levels reached 106 mg/l.

4.7 LYTCHETT MINSTER (Figure d)

BOD and suspended solids concentrations appeared to fluctuate over a 48 hour period with levels beginning to rise steadily at 16.00 hrs in the afternoon and dropping abruptly 48 hours later. This cycle is not followed by ammonia which remained at a steady concentration of about 31 mg/l throughout the entire survey. One breach of consent occurred at 00.00 hrs on Saturday 27 June 1992 when the suspended solids concentration reached 112 mg/l.

TABLE 2
DAILY RAINFALL mm

DATE	SITE			
	WEBB'S COUNTRY FOODS	TARRANT CRAWFORD STW	POOLE STW	LYTCHETT MINSTER STW
19 June 1992	2	1.5	1	1.5
29 June 1992	1	0.5		0.5
30 June 1992	2	2.5	5	2.5
1 July 1992	5	9	6	9

5 DISCUSSION

5.1 VARIATION IN EFFLUENT QUALITY

From the results it appears that, with the exception of ammonia concentrations observed at Poole, there was no diurnal variation in effluent quality at any of the treatment plants investigated. There was also no significant deterioration in effluent quality at weekends.

During the study all four of these activated sludge works generally produced good quality final effluent. The only breaches of consent limits during the entire investigation were for suspended solids and occurred at Poole and Lytchett Minster STW's at approximately the same time on 27 June 1992. There is no obvious explanation for these high concentrations, particularly as no rain fell in the area at that time.

An unusual 48 hour cycle in effluent quality was observed at Lytchett Minster with BOD and suspended solid concentrations appearing to be greatest at 08.00 hrs every other day. The reason for this is unclear but it may be caused by management activities at the sewage works.

Comparison of these results with those from the previous report suggests that the diurnal variation in final effluent found in conventional biological filtration does not appear to be present at activated sludge based treatment plants.

5.2 SAMPLING TIMES

Observation of the Histograms (figures e to f) shows that, historically, most of the samples from these sites have been collected during normal "office" hours ie between 09.00 hrs and 17.00 hrs.

Table 3 - Percentage of Samples taken between 09.00 hrs - 17.00 hrs.

Webbs Country Foods	100Z
Tarrant Crawford	99Z
Poole	98Z
Lytchett Minster	98Z

Although no obvious patterns in effluent quality was observed during this survey the worst quality (when consent levels were exceeded or approached) effluent was generally detected in the late evenings and early hours of the mornings. Had the survey samples been taken exclusively between 09.00 and 17.00 the periods of poorest effluent quality would have probably escaped detection.

6 RECOMMENDATIONS

- 6.1 A proportion of samples should be taken at weekends. The activated sludge treatment works studied generally produced good quality effluent throughout the survey period. However, the only two breaches of consent which did occur (at Poole and Lytchett Minster) took place during a weekend. These breaches would not have been detected had sampling only been carried out during normal "office hours".
- 6.2 The period of the day in which routine audit final effluent samples are collected should be extended to cover a twenty four hour period.
- 6.3 This study indicates that these works may not need high priority out-of-hours sampling, but the recent history of problems from some of them should also be taken into account when the target sites for such sampling are selected.