PAPER 10

River Impact Modelling - The effects of Intermittent Discharges - results from a study on a 5km river reach.

by

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TO BE ISSUED AT CONFERENCE

Specific observations that were made during the data collection programme are :-

- Past rainfall, river flow and continuously monitored quality data should be studied prior to embarking on data collection. This will provide valuable guidelines to the frequency and nature of spill events and the influence on river water quality, thus allowing sampling regimes to be optimised.
- Security of equipment is a major problem for river sites, where expensive equipment may need to be left unmanned.
- Good communication with the laboratory performing the water quality analyses is required, which must be prepared to analyse samples whenever they arrive at the laboratory.
- A good pre-storm warning system is required, even so it is difficult to plan for storm events.
- Interference to measuring techniques should be considered, as during storm events this may also vary.
- Storm event data collection is considerably more resource demanding than dry weather data, both in terms of frequency of sampling to gain sufficient resolution of parameter variations and in laboratory analyses.
- In certain cases it may be desirable to perform a preliminary study before selecting a sophisticated water quality model. This may include a DO and ammonia monitoring programme, a modelling exercise using an existing sewer hydraulic model, or a simplified water quality model.

Observations From Data

The storm event data proved to vary dynamically throughout the storm events. Ammoniacal nitrogen and nitrate concentrations did not play an important role in terms of water quality processes in the reach studied. This data will not be presented here.

Within the river reach studied, the physical characteristics of the channel varied considerably. Certain sub-reaches were characterised by steep shallow wide channels, others with slow flowing deeper waters. It was noticeable that the impact upon Dissolved Oxygen (DO) from the interaction of oxygen demanding material and reaeration from the air-water interface during the storm events can be linked directly to the sub-reach characteristics. Figure 2 shows the observed DO concentrations at four sites. It is interesting to note that the DO at site U does not drop during the storm event, even though the BOD concentrations are very high, as shown in Figure 3. It is proposed that this is due to high rates of reaeration at site U and insufficient time for the BOD to have a detrimental impact on the river DO. The oxygen demanding material at site U is assumed to derive from CSOs and surface water sewer outfalls within the sewerage system.

At Sites A, C & D there is a significant impact on the DO with a pronounced transient sag being apparent. The worst storm DO impact occurs at least 5 km downstream of the works. The river downstream of the works is visually less prone to high rates of reaeration than at site U, and the material impacting upon this reach will be older than that at site U due to increased residence and travel times through the sewerage and works. This means that any oxygen demanding material will have had a chance to utilise DO.

In a very slow flowing reach, a significant loss of BOD material from the water phase was observed, which was considerably greater than that which may be attributed to degradation and associated DO depletion. It was further observed that a delayed oxygen demand persisted long after the storm hydraulic loading had ceased. This suggests sediments may be important to receiving watercourses during storm events.

Figure 4 shows the river discharge, BOD and DO at site C. It is interesting to note that the measured DO recovers during the storm event even though the BOD remains high. This may be explained at least in part, when other data are considered, by the reaeration ability of the receiving watercourse changing considerably during a storm impact. The reaeration ability is principally a function of the hydraulic state of the watercourse, thus as the hydraulics vary during a storm event so does the reaeration ability. In this case study it was concluded that the rate of reaeration increased during the storm event, which may not be the case in all receiving watercourses. However, if this mechanism had not been represented in a river impact assessment, the capacity of the receiving watercourse to assimilate oxygen depleting material may have been considerably underestimated.

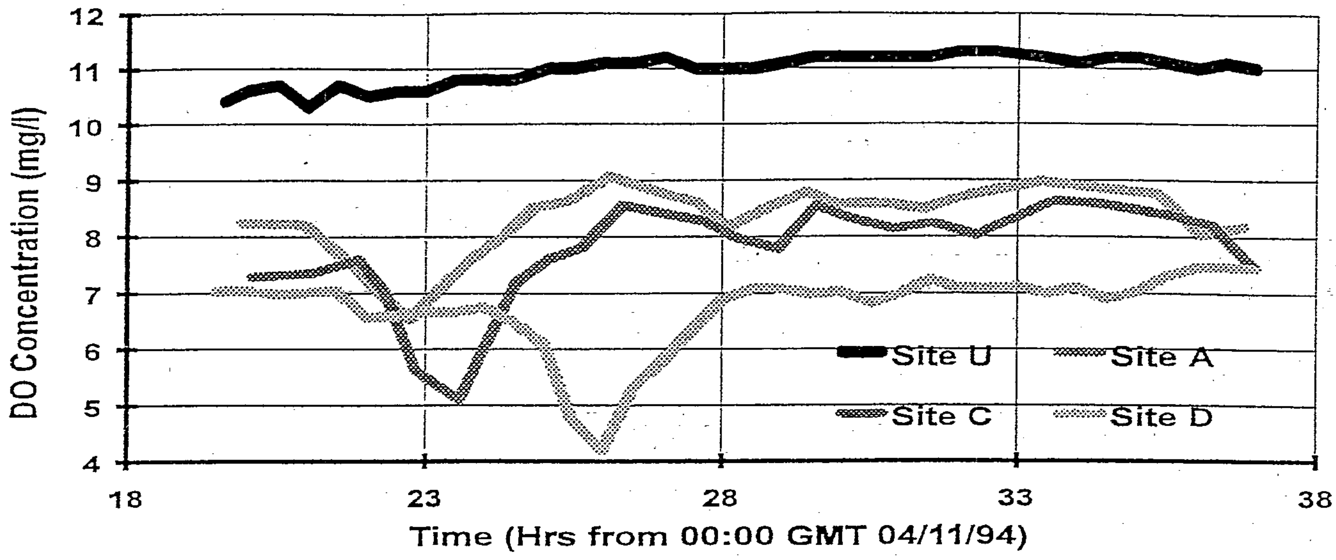

Figure 2: Dissolved Oxygen Variation {04/11/94}

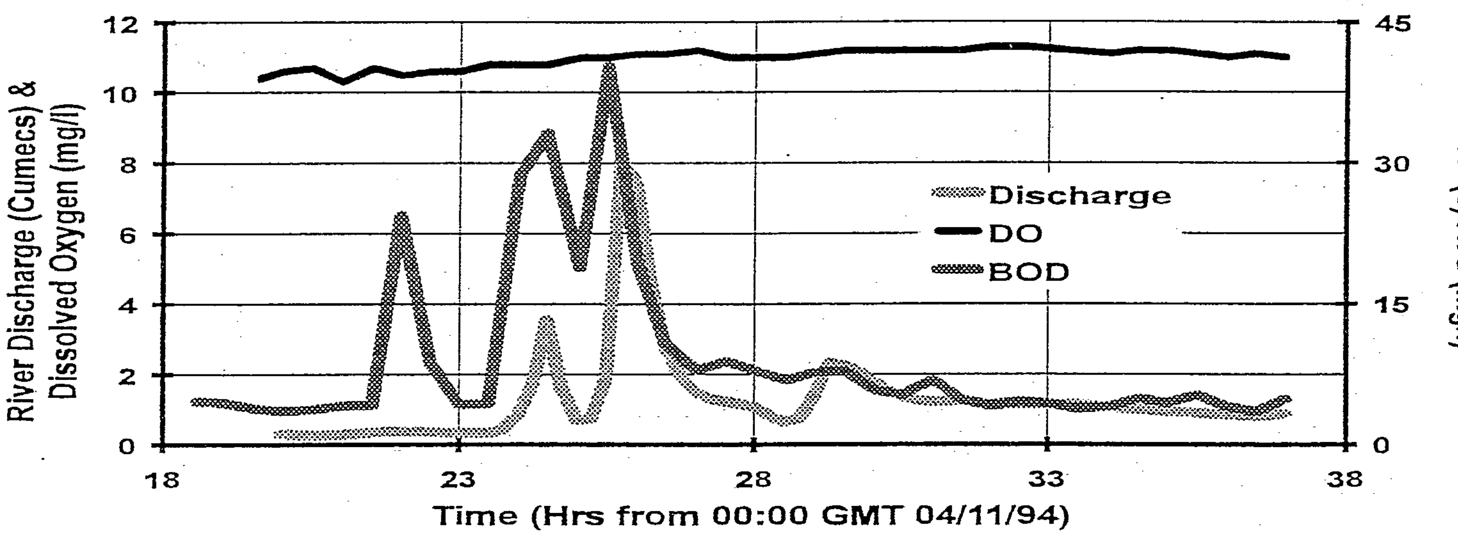

Figure 3: Storm Event Parameter Variations at Site U {04/11/94}

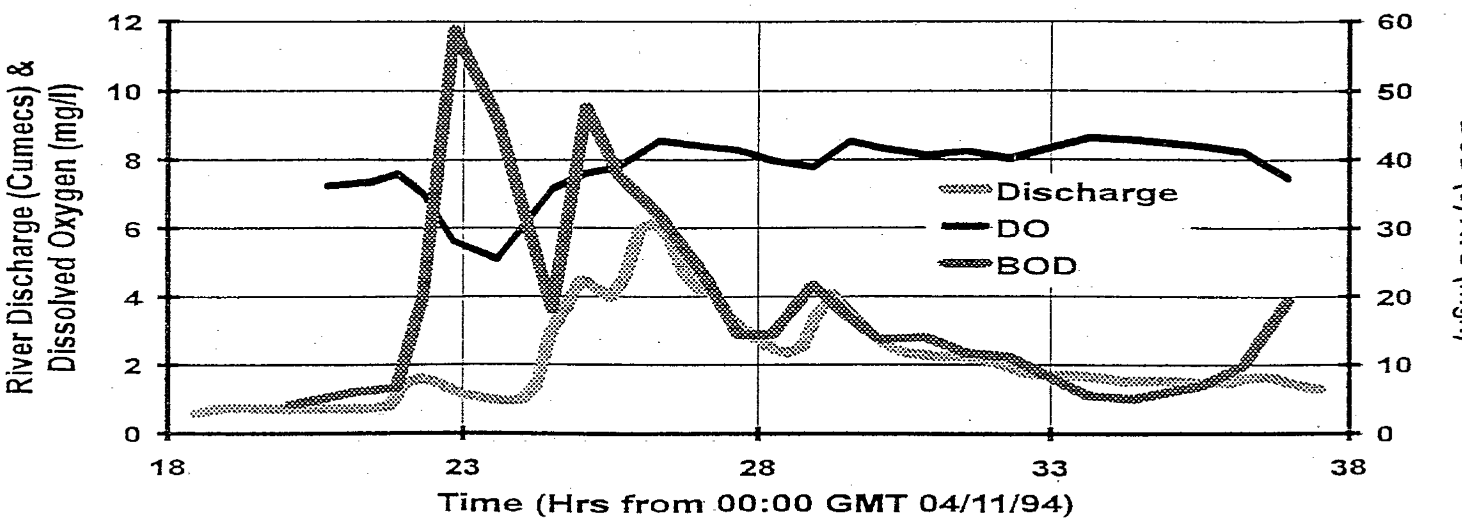

Figure 4: Storm Event Parameter Variations at Site C {04/11/94}