Water Quality Event Monitoring

Regional Natural Resource Management in Queensland

ID: WQEM 0628

Event Summary Load Calculation

Lower Burnett (DPI Research Station, Kalkie) October 2005

Introduction

This fact sheet presents Event Mean Concentration (EMC), sediment and nutrient to discharge relationships and load estimates for samples collected following a storm event (15th October 2005 – 16th October 2005), at the DPI Research Station at Kalkie.

Methodology

Six samples (table 1) were collected from a culvert transporting runoff from the DPI Station at Kalkie, during and after 91 mm of rainfall (figures 1 and 3). Discharge ($m3s^{-1}$) was measured using a float gauge and stage-height measurements (mm) when water samples were collected (figure 2). The farm manager released flow at 10am on the 16th October from a farm dam, causing the bimodal flow. Quality controls indicated that variations in flow measurements were 4-7% r.s.d., that background nutrient concentrations associated with sampling equipment were below in-stream concentrations, and that nutrient concentrations were measured with a precision of 7% r.s.d. or below (table 1).

Hourly discharge ($m3s^{-1}$) was modelled on hourly rainfall (mm) lagged by 1 hour, assuming that the flow rate slowed exponentially after rainfall ceased (10pm on the 15th October), and also after the dam release. Rainfall data was sourced from the Bundaberg Automatic Weather Station (http://www.bom.gov.au/cgi-bin/show_prod.cgi?IDQ65519).

To extrapolate hourly concentrations (mgl^{-1}), cumulative rainfall (mm) was related to the six concentration measurements (mgl^{-1}; See supplementary data WQEM 0628S) using a linear function (See Supplementaty data WQEM 0628S figures 1-4, table 2). NOx didn't relate to rainfall, so the sequence of measured concentrations was used. The hourly concentrations were multiplied with modelled hourly discharge, to obtain hourly loads, which were then added to obtain the total load generated by this event (table 3). Event mean concentrations (EMC) were calculated by dividing total event loads by the event flow volume (table 3).

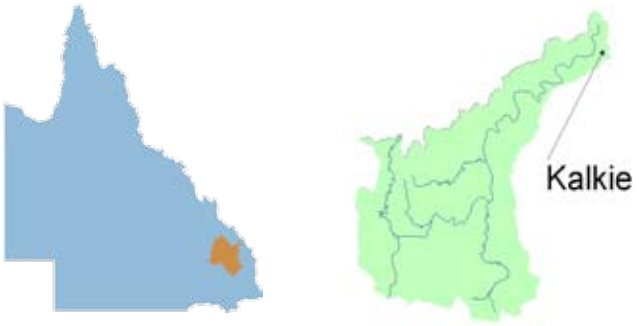

Figure 1. DPI Research Station sampling location in the Lower Burnett.

Flow Event Description

Localised rainfall occurred between Bundaberg and Bargara, during the afternoon to late evening of the 15th October, 2005. This was a typical, early wet-season flush (figure 2) of a small coastal sub-catchment, with an underlying geology of basalt, highly fertile and permeable soils (ferrosols with minor hydrosols), low relief topography with gentle slope (<10), and high rainfall relative to the region (1080mm per year). The predominant landuse is sugar cane horticulture, with some citrus, and importantly the drainage has been modified to efficiently capture and reuse water and nutrient runoff. Controlled release from the farm dam occurred after rainfall had stopped.

Catchment:	Kalkie Research Station; Burnett Catchment
Location:	24o 50′ 45″ S, 152o 24′ 08″ E
Catchment Area:	2.5 km^2
Dominant Land Use: (upstream of gauge)	The experimental farm grows sugar cane and citrus, and has 3 dams (12ML, 4ML, 0.5ML). The upper part of the sub-catchment drains an asphalt go-cart track.
Event Duration:	15/10/2005 – 16/10/2005

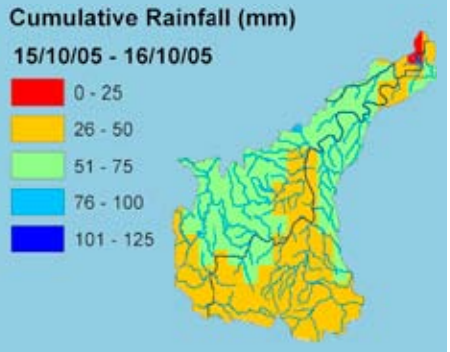

Figure 2. Cumulative rainfall during the event.

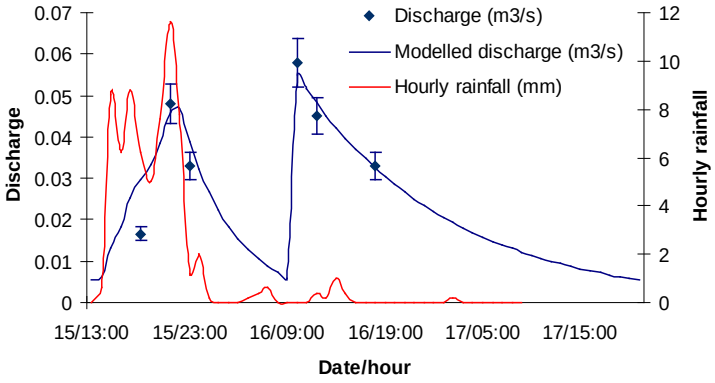

Figure 3. Rainfall, discharge and sample collection at Kalkie.

Table 1. Quality Control Samples

	TP mg/L as P	TN mg/L as N	TKN mg/L as N	FRP mg/L as P	NO_x mg/L as N	NH_3 mg/L as N
Precision of a field replicate	% r.s.d.	% r.s.d.	% r.s.d.	% r.s.d.	% r.s.d.	% r.s.d.
	7	5	4	6	0	0

Results

Relatively high concentrations of N and P, especially NH3 (up to 16 mgl^{-1}) and FRP (up to 3.6 mgl^{-1}), were measured on the rising limb (Figure 2). It was possible to negatively correlate nitrogen concentrations with rainfall, except for NOx. Phosphorus was not significantly related with rainfall, and this association is speculative. Of note, the final sample featured a sharp increase in conductivity (from about 570 to 1060 µScm-1 at 25° C), with concomitant increases in pH, hardness, salts, and some metals (Cu, Zn, Mn), and a decrease in turbidity. This is plausibly groundwater rising through the soil profile, and entering surface drainage.

Table 2. Parameters (a & b) derived by relating rainfall with N, & P for the October 2005 event at Kalkie Research Station.

	TP	TN	TKN	FRP	NH_3	NO_x
a	-0.13	-0.46	-0.41	-0.13	-0.34	n.a.
b	11	38	34	10	26	n.a.

Table 3. Estimated load and event EMC for the October 2005 Event at Kalkie Station

Flow Total (ML)	5	
Number of Samples	6	
Maximum Discharge (m3/s)	0.06	
Period of Record (years)	117	
	Load (T)	EMC (mg/L)
TP	0.008	1.424
TN	0.049	9.172
TKN	0.044	8.227
FRP	0.006	1.100
NH3	0.027	5.053
NOx	0.005	0.903

For Further Information

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www.wqonline.info

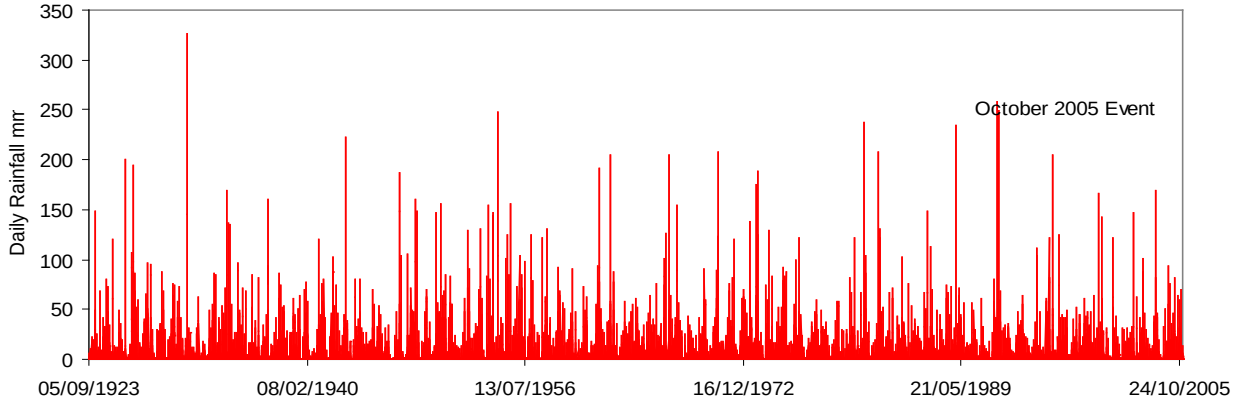

Figure 4. Lower Burnett River, October 2005 event sampled at DPI Research Station at Kalkie, in context to historical (mean daily) discharge.

To reference this information sheet:

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