

Table S1 Characteristics of sampling periods for the Ngongotaha (Ngo) and Puarenga streams (Pua; Fig. 3). h, duration of sampling period in hours; $Q_{\max}$, maximum discharge ($\text{m}^3 \text{s}^{-1}$) sampled; 24-h EMC, event mean concentration based on 24-h continuously-sampled period when discharge was greatest; Q_{avg} , average hourly discharge during 24-h continuously-sampled period when discharge was greatest ($\text{m}^3 \text{s}^{-1}$); TN, total nitrogen; TP, total phosphorus; TSS, total suspended sediments; VSS, volatile suspended sediments. ‘–’ indicates that determinand was not measured.

Stream	#	Date	Sampling frequency (h)	h	Q _{max}	24-h EMC (mg L ⁻¹)							Q _{avg}	Notes
						TN	TP	NO ₃ ⁻ N	NH ₄ ⁻ N	PO ₄ ⁻ P	TSS	VSS		
Ngo.	1	16 – 18 Dec ‘10	2.0	46.00	1.5	1.03	0.055	0.84	0.016	0.034	4.80	–	1.4	
	2†	21 – 24 March ‘11	1.0	74.25	2.7	0.93	0.076	0.79	0.027	0.050	14.42	3.51	2.2	
	3	12–16 Dec ‘11	1.5 – 2.0	121.50	3.1	1.26	0.083	0.85	0.043	0.044	22.56	8.040	2.6	One gap of 3.75 h
	4	7–8 Jan ‘12	1.0	25.00	18.0	1.63	0.237	0.70	0.056	0.043	170.71	31.82	6.0	
	5*	02–04 March 2012	1.0	47.50	2.4	1.03	0.085	0.85	0.011	0.028	8.47	5.83	2.3	Falling limb not fully sampled
	6‡	15–17 July 2012	1.0	50.50	13.1	1.66	0.235	0.68	0.035	0.029	198.10	41.37	7.5	One gap of 7 h during rising limb.
Pua.	1	11–13 May ‘10	1.0–2.0	24.00	3.8	1.34	0.127	0.81	0.072	0.033	–	–	2.5	One gap of 12 h during pre-event base flow. 5 h overlap between # 1 and # 2
	2	13–15 May ‘10	1.0	24.00	6.5	1.54	0.172	0.80	0.077	0.026	–	–	2.6	
	3	24–27 May ‘10	2.0	67.00	15.6	2.54	0.316	0.96	0.498	0.056	–	–	10.2	
	4	01–04 Aug ‘10	1.0	71.50	5.0	1.53	0.194	0.79	0.084	0.021	–	–	3.7	Rising limb not fully sampled
	5	25–27 Aug ‘10	1.0	47.50	2.9	1.38	0.075	0.91	0.076	0.031	13.85	–	2.5	

6	18–21 Jan ‘11	1.0	73.25	2.6	1.13	0.156	0.87	0.053	0.037	39.59	–	2.2	
7†	21–24 March ‘11	1.0	71.50	4.8	1.27	0.135	0.86	0.060	0.075	55.98	14.35	3.7	
8	10–13 Aug ‘11	1.0	70.00	3.4	1.30	0.130	0.89	0.067	0.053	35.67	–	2.9	
9	03–05 Oct ‘11	1.0	50.25	4.7	1.41	0.184	0.80	0.088	0.028	93.18	–	3.8	
10	10–13 Oct ‘11	1.0	71.00	8.3	1.49	0.225	0.76	0.106	0.031	128.14	–	6.8	
11	08–09 Jan ‘12	1.0	27.25	7.4	1.44	0.097	0.80	0.126	0.021	37.73	8.61	5.1	
12	12–13 Jan ‘12	1.0	26.00	5.3	1.20	0.109	0.85	0.076	0.053	–	–	4.4	Rising limb not fully sampled
13*	02–04 March ‘12	1.0	48.00	3.7	1.18	0.141	0.74	0.055	0.026	31.20	10.45	2.9	
14‡	15–17 July ‘12	1.0	48.00	6.5	1.37	0.201	0.75	0.111	0.027	112.88	27.13	4.7	

Table S2 Characteristics of observed hysteresis loops in concentration–discharge data for the Ngongotaha (Ngo) and Puarenga streams (Pua). Parameter p is a response factor ($\text{g m}^{-6} \text{h}^2$) that quantifies the magnitude and direction of the hysteresis loop and g is a loop gradient term (g s^{-1}) (see Fig. 7). Numbered events shown in Fig. 3, symbols denote events for which both streams were simultaneously sampled. ‘ $\times$ ’ indicates that no hysteresis was evident from visual inspection of scatterplots. Time, length of sampling period; Q_{base} , mean discharge for samples collected prior to rising limb; Q_{max} , maximum discharge sampled; TN, total nitrogen; TP, total phosphorus; TSS, total suspended sediments.

Stream	Event #	Time (h)	Q _{base} (n) (m ³ s ⁻¹)	Q _{max} (m ³ s ⁻¹)	TN		NO ₃ -N		NH ₄ -N		TP		PO ₄ -P		TSS	
					<i>p</i>	<i>g</i>	<i>p</i>	<i>g</i>	<i>p</i>	<i>g</i>	<i>p</i>	<i>g</i>	<i>p</i>	<i>g</i>	<i>p</i>	<i>g</i>
Ngo.	2†	72.75	1.6 (11)	2.7	×	×	×	×	×	×	×	×	×	×	-3.62	57.34
	3	84.25	1.7 (9)	3.1	-1.74	2.95	0.03	1.55	-0.10	0.16	-0.13	0.22	-0.02	0.08	×	×
	5*	47.50	1.9 (6)	2.4	0.49	2.22	0.64	2.07	×	×	0.42	0.59	×	×	36.97	29.64
	6‡	50.50	2.0 (3)	13.1	×	×	0.01	1.23	×	×	×	×	0.01	0.04	51.97	453.61
Pua.	4	71.00	1.9(2)	5.0	-0.21	2.90	-0.03	1.22	-0.02	0.22	×	×	×	×	-	-
	5	47.50	2.2 (5)	2.9	×	×	×	×	×	×	×	×	×	×	×	×
	6	73.25	1.8 (5)	2.6	×	×	×	×	×	×	×	×	×	×	×	×
	7†	71.50	2.2 (11)	4.8	×	×	0.20	1.11	0.01	0.12	0.02	0.47	0.01	0.23	-34.15	273.23
	8	35.0	2.2 (16)	3.4	×	×	×	×	×	×	-0.04	0.51	0.03	0.06	-34.00	309.30
	9	49.25	2.7 (1)	4.7	-0.89	5.36	-0.08	1.69	-0.13	0.39	-0.18	0.97	×	×	-34.48	632.62
	10	71.00	2.2 (7)	8.3	-0.23	3.62	-0.13	1.72	-0.04	0.28	-0.01	0.57	×	×	×	×
	13*	48.00	2.1 (5)	3.7	-0.28	2.97	×	×	×	×	×	×	-0.01	0.07	-37.43	198.50
	14‡	48.00	2.0 (2)	6.5	-0.04	2.51	×	×	-0.04	0.31	0.07	0.49	×	×	69.16	336.18

Table S3 Error in estimated 24-h loads of total nitrogen (TN) total phosphorus (TP) and total suspended sediment (TSS; not measured in all events) relative to measured loads conveyed in the Ngongotaha (Ngo) and Puarenga streams (Pua) during events shown in Fig. 3. Symbols denote events for which both streams were simultaneously sampled. Loads were derived using measured discharge (Q) and concentration data, estimated using regression models that incorporate discharge and other hydrological variables (L_{hydrol} ; Puarenga Stream TN and TP only), concentration–Q rating curves (L_{rating}), event mean concentrations calculated using data for other events (L_{ratio}) and mean values for samples collected during a routine monthly monitoring programme (L_{avg}). Q_{max} , maximum discharge sampled. Q_{avg} , average hourly discharge during 24-h period ($\text{m}^3 \text{s}^{-1}$). Calculated TP L_{hydrol} was not derived for Puarenga event # 14 due to soil moisture probe malfunction.

Stream	#	Q _{max} (m ³ s ⁻¹)	Q _{avg} (m ³ s ⁻¹)	TN load error				TP load error				TSS load error			
				L _{hydrol}	L _{rating}	L _{ratio}	L _{avg}	L _{hydrol}	L _{rating}	L _{ratio}	L _{avg}	L _{hydrol}	L _{rating}	L _{ratio}	L _{avg}
Ngo.	1	1.5	1.4		-9%	32%	-5%		90%	183%	7%		-6%	2446%	99%
	2†	2.7	2.2		16%	53%	5%		-11%	119%	-23%		-17%	737%	-34%
	3	3.1	2.6		-14%	12%	-22%		2%	82%	-29%		-29%	441%	-58%
	4	18.0	6.0		5%	-21%	-40%		6%	-45%	-75%		197%	-49%	-94%
	5*	2.4	2.3		6%	40%	-5%		-15%	92%	-31%		50%	1302%	13%
	6‡	13.1	7.5		-5%	-23%	-41%		-15%	-45%	-75%		-37%	-61%	-95%
Pua.	1	3.8	2.5	-7%	-3%	8%	-7%	-7%	-16%	13%	-43%				
	2	6.5	2.6	-24%	-20%	-10%	-32%	-23%	-35%	-16%	-50%				
	3	15.6	10.2	-39%	-50%	-47%	-57%	-16%	-31%	-61%	-75%				
	4	5.0	3.7	-12%	-34%	-7%	-28%	-29%	-30%	-25%	-56%				
	5	2.9	2.5	-10%	-8%	-1%	-20%	37%	52%	99%	14%	58%	271%	-10%	
	6	2.6	2.2	14%	14%	24%	-2%	-18%	-37%	-8%	-45%	-63%	30%	-68%	
	7†	4.8	3.7	12%	14%	16%	-13%	21%	6%	8%	-37%	-9%	-3%	-78%	
	8	3.4	2.9	-17%	5%	11%	-15%	5%	-3%	12%	-34%	-4%	50%	-65%	
	9	4.7	3.8	-19%	2%	1%	-22%	-27%	-23%	-24%	-54%	-49%	-46%	-87%	
	10	8.3	6.8	16%	16%	-3%	-26%	-16%	-15%	-38%	-62%	33%	-66%	-90%	
	11	7.4	5.1	2%	8%	1%	-23%	83%	85%	51%	-12%	200%	40%	-67%	
	12	5.3	4.4	-3%	21%	21%	-8%	33%	36%	29%	-22%				
	13*	3.7	2.9	17%	16%	25%	-6%	-15%	-12%	4%	-39%	0%	73%	-60%	
	14‡	6.5	4.7	12%	12%	6%	-19%		-21%	-29%	-57%	-28%	-58%	-89%	

Table S4 Summary of regression models used to estimate the concentration of total nitrogen (TN), total phosphorus (TP) and total suspended sediment (TSS) in the Ngongotaha and Puarenga streams over a two year period. Q_i , discharge ($\text{m}^3 \text{ s}^{-1}$) at time i ; rain_6 , sum of rainfall (mm) in the previous 6 h ($\log_{10} + 1$ transformed); soil, soil moisture (%) (square-root transformed). Root mean squared error of estimates was calculated for a bootstrapped sample ($n = 10000$) drawn from measured data. α denotes statistical significance.

Stream	Dependent variable (mg L^{-1})	Regression model	n	r^2	RMSE (untransformed units; mg L^{-1})	α
Ngongotaha	$\log_{10}$ TN	$0.321 \times \log_{10} Q_i - 0.090$	247	0.72	0.13	<0.001
	$\log_{10}$ TP	$0.801 \times \log_{10} Q_i - 1.666$	260	0.68	0.027	<0.001
	$\log_{10}$ TSS	$2.296 \times (\log_{10} Q_i)^{0.740}$	256	0.85	38.49	<0.001
Puarenga	$\log_{10}$ TN	$0.239 \times \log_{10} Q_i - [0.096 \times (Q_i/Q_{i-3 \text{ h}})] + 0.108$	581	0.23	0.27	<0.001
	$\log_{10}$ TP	$0.632 \times \log_{10} Q_i - [2.01 \times (Q_i/Q_{i-1.5 \text{ h}})] + 0.018 \times \text{rain}_6 - 0.096 \times \text{soil} - 0.397$	608	0.39	0.042	<0.001
	$\log_{10}$ TP	$0.5549 \times \log_{10} Q_i - 1.193$	654	0.30	0.045	<0.001
	$\log_{10}$ TSS	$2.018 \times \log_{10} Q_i + 0.437$	507	0.65	24.81	<0.001
		$2.161 \times (\log_{10} Q_i)^{0.626}$	507	0.60	27.64	<0.001

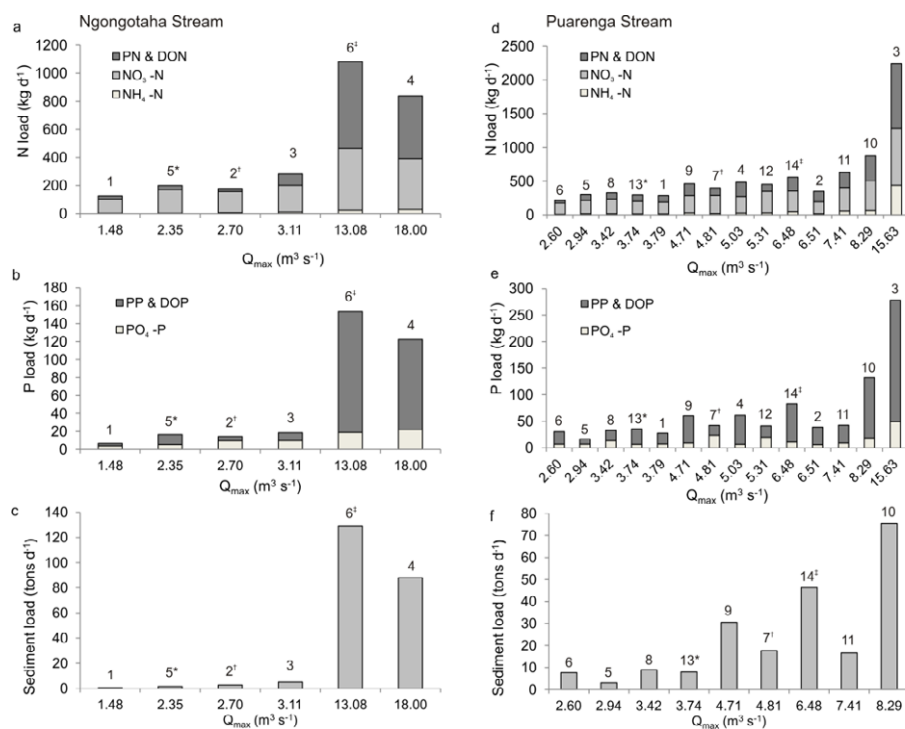


Figure S1 Measured 24-h loads of nutrients and suspended sediments conveyed in the Ngongotaha (a–c) and Puarenga (d–f) streams. PN, particulate nitrogen; DON, dissolved organic nitrogen; PP, particulate phosphorus; DOP, dissolved organic phosphorus; Q_{max} , maximum discharge sampled. Numbers above bars denote event numbers in Fig. 3, superscript symbols denote events for which both streams were simultaneously sampled.