Table 1. Information on soil sampling sites.

Sample Code	Soil Type	Location, sampling and site description.	Lat.	Lon.	Alt. (m)	Dist. (km)	River Zone, Reach
Highland Soils							
FRS01	Rendoll	Soil pit in un-mined, steep, vegetated slope near Ok Tedi mine. Carbonate bedrock.	-5.1979	141.1360	1907	886	Gravel, Forested
FRS03	Rendoll	Soil pit in bench location along steep slope above Ok Tedi mine. Carbonate bedrock.	-5.2079	141.2111	573	877	Gravel, Forested
FRS02	Inceptisol	Soil pit in small bench in a hill slope near Ok Tedi mine. Siliciclastic bedrock.	-5.2170	141.1726	1678	882	Gravel, Forested
FRS05	Inceptisol	Soil pit along road between Kiunga and Tabubil. Siliciclastic bedrock.	-5.3340	141.2778	331	834	Gravel, Forested
FRS06	Ultisol	Soil pit along the Kiunga-Tabubil road off ridge top. Tertiary clastic bedrock.	-5.5731	141.2570	119	810	Gravel, Forested
FRS07	Ultisol	Soil from cut bank in stream channel of Ok Tedi tributary. Heavily vegetated with ferns and grasses. Tertiary clastic bedrock.	-5.6805	141.1483	89	794	Gravel, Forested
Unweathered Alluvium							
FRS04	Entisol	Surface sand from terrace along the Ok Tedi River representing recent over bank deposit downstream from Ok Tedi mine.	-5.2922	141.2288	381	858	Gravel, Forested
FRS08a	Entisol	Surface mud and sand from the bank of the Ok Ted River adjacent to dredging operations at Bige.	-5.9635	141.1304	52	778	Sand/Gravel, Forested
FRS13	Entisol	Recently deposited mud from bank surface along the floodplain of the Lower Fly River.	-7.7507	141.5809	8	291	Backwater, Swamp Grass
Active Floodpain Soils							
Upper Fly							
FRS20	Inceptisol	Soil profile from cut bank on the Upper Fly River. Sparsely vegetated by small trees and some grass.	-6.1486	141.2717	23	725	Sand, Forested
Upper-Middle Fly							
FRS19	Inceptisol	Soil profile from cut bank along upper Middle Fly just below D'Albertis Junction.	-6.2270	141.0722	21	689	Sand, Forested
Lower-Middle Fly							
FRS10	Inceptisol	Augered soil from bank of Middle Fly River with relatively low weathering.	-7.2241	141.1392	13	451	Backwater, Swamp Grass
FRS12	Entisol	Soil profile from cut bank from lower Middle Fly River	-7.5849	141.3251	22	354	Backwater,

		at Obo above Everill Junction. Vegetated with thick grasses.					Swamp Grass
Lower Strickland							
FRS18	Inceptisol	Soil profile from cut bank on the Lower Strickland River. Vegetated by grasses, bamboo and palm trees.	-7.5597	141.3938	11	341	Backwater, Swamp Grass
Lower Fly							
FRS17	Alfisol	Soil profile from cut bank composed of partially weathered alluvium.	-7.7507	141.5809	11	300	Backwater, Swamp Grass
FRS16	Inceptisol	Soil profile from cut bank composed of partially weathered alluvium.	-7.7394	141.5763	12	291	Backwater, Swamp Grass
FRS15	Entisol	Soil profile from cut bank composed of relatively unweathered alluvium. Evidence of pedogenesis.	-7.7499	141.5779	9	291	Backwater, Swamp Grass
Relict Floodplain Soils							
FRS08b	Ultisol	Soil profile from cut bank along Middle Fly River desiccated at the surface and predominantly unvegetated.	-7.2227	141.0175	21	451	Backwater, Swamp Grass
FRS09	Ultisol/ Oxisol	Augered soil profile bank along Middle Fly River on island in Bossat Lagoon.	-7.2370	141.0755	17	451	Backwater, Swamp Grass
FRS11	Ultisol	Soil profile from cut bank along the lower Middle Fly River near Obo. Evidence for some soil development.	-7.5873	141.3255	22	354	Backwater, Swamp Grass
FRS14	Ultisol/ Oxisol	Soil profile from cut bank along the Lower Fly River below Everill Junction with some soil development.	-7.7507	141.5809	11	291	Backwater, Swamp Grass

Captions: Sample Codes are from Moore (2011); soil classification according to Bleeker (1983); Lat., latitude in decimal degrees; Lon., longitude in decimal degrees; Alt., altitude in meters (m) above mean sea level; Distance, distance from river mouth in kilometers (km).
River Zone, Reach classification based on Dietrich et al., 1999 and Pickup and Marshall, 2009.

Table 2. Bulk compositional parameters (average ± standard deviation) of Fly River soils.

Soil Type	n	Cu (mg/g)	SA (m^2/g)	%OC (wt%)	%N (wt%)	%IC (wt%)	IC/OC (molar)	OC/N (molar)	$\delta^{13}C_{org}$ (‰)
Highland Soils									
$Rendoll_{Oh}$ (RE_{Oh})	2	664±608	14±2	19±6.4	1.18±0.41	1.59±1.59	0.1±0.1	18±0.1	-28.0±2.8
$Rendoll_{Min}$ (RE_{Min})	3	18±n.a.	12±3	1.02±0.32	0.09±0.02	5.22±0.35	6.0±1.5	16±8.3	n.m.±n.a.
$Inceptisol_{Oh}$ (IN_{Oh})	2	28±4	18±5	2.72±0.87	0.19±0.06	0.00±0.00	0.0±0.0	16±0.3	-28.3±0.5
$Inceptisol_{Min}$ (IN_{Min})	4	10±4	19±5	0.76±0.61	0.08±0.04	0.09±0.07	0.4±0.4	7.2±3.0	-26.3±0.7
$Ultisol_{Oh}$ (UL_{Oh})	1	209±n.a.	4±n.a.	25±n.a.	1.13±n.a.	0.00±n.a.	0.0±n.a.	25±n.a.	-29.6±n.a.
$Ultisol_{Min}$ (UL_{Min})	4	60±3	89±26	1.78±0.47	0.12±0.04	0.20±0.12	0.2±0.1	19±2.6	-27.5±0.7
Alluvium (A)	3	503±n.a.	7±3	0.37±0.18	0.03±0.02	1.00±0.17	4.7±1.6	17±3.9	-25.0±1.0
Active Floodplain Soils									
Upper Fly (UF)	4	69±44	23±4	1.54±0.20	0.12±0.02	0.72±0.12	0.5±0.2	15±0.3	-27.7±0.6
upper-Middle Fly (post-mine) (uMF_{po})	4	968±290	22±6	0.80±0.12	0.07±0.01	0.60±0.11	0.9±0.3	13±2.2	-26.4±0.8
upper-Middle Fly (pre-mine) (uMF_{pr})	7	79±65	48±3	0.91±0.19	0.07±0.02	0.31±0.25	0.4±0.4	15±0.7	-24.8±1.1
Middle Fly (post mine) (MF)	10	1087±145	22±5	1.26±0.87	0.14±0.09	0.03±0.03	0.0±0.0	11±1.7	-27.7±0.9
Lower Strickland (LS)	6	28±12	25±3	0.84±0.42	0.10±0.03	0.17±0.15	0.2±0.2	9.0±2.1	-23.8±2.2
Lower Fly (LF)	16	113±87	27±4	1.05±0.59	0.12±0.06	0.23±0.22	0.2±0.2	10±2.4	-25.5±1.9
Relict Floodplain Soils (RF)	26	26±15	43±16	0.54±0.68	0.06±0.05	0.05±0.21	0.0±0.2	8.4±4.8	-21.7±3.3

Captions: Oh and Min subscripts refer to averages calculated for the O-horizons and the mineral horizons at each site where clear differentiation was evident. In the case of the upper-Middle Fly site (FRS19), we have separated the post-mine and pre-mine horizons based on the concentrations of copper (Cu) measured (see text for details). SA, mineral surface area; %OC, weight percent organic carbon; %N, weight percent nitrogen; %IC, weight percent inorganic carbon; IC/OC, molar organic carbon inorganic carbon ratio; OC/N, molar organic carbon nitrogen ratio; $\delta^{13}C_{org}$, stable isotopic composition of organic carbon; n, refers to the number of samples in each category. Data for individual soil horizons are tabulated in Electronic Annex II.

Table 3. Radiocarbon composition data of organic matter in

Soil Sample	Depth (cm)	Soil Type	$\Delta^{14}C$ (per mil)	^{14}C Age (ybp)	F_{mod}
Highland Soils					
FRS05	0-5	IN_{Oh}	27.0	>Mod	1.0
Alluvium					
FRS04	surface	A	-696.3	9520.0	0.3
Active Flodplain Soils					
FRS19	6-30	uMF_{po}	-55.7	405.0	1.0
FRS12	0-6	MF	-104.4	830.0	0.9
FRS18	0-12	LS	-197.4	1710.0	0.8
FRS16	0-4	LF	-99.1	780.0	0.9
FRS15	0-5	LF	-343.1	3320.0	0.7
Relict Floodplain Soils					
FRS08b	0-10	RF	61.6	>Mod	1.1
FRS09	0-5	RF	68.8	>Mod	1.1
FRS11	0-11	RF	43.7	>Mod	1.1

Site numbers and soil types as in previous tables.
F_{mod}, fraction moder (see text for details).

Table 4. Average biomarker concentrations and compositional ratios of Fly River soils.

		Biomarker Concentrations (mg/100 mg OC)				Terrestrial Biomarker Ratios					
Soil Type	*n*	VP	SP	CP	CA	SP/VP	CP/VP	CA/VP	[Ad/Al]v	[Ad/Al]s	w-OH/CA
Highland Soils											
RE_{Oh}	2	2.76±0.54	1.50±0.03	0.40±0.05	0.07±0.02	0.57±0.10	0.16±0.05	0.03±0.01	0.73±0.13	0.66±0.13	0.08±0.03
RE_{Min}	2	0.49±0.28	0.44±0.13	0.20±0.10	0.01±0.01	1.11±0.36	0.43±0.05	0.02±0.02	0.50±0.04	0.31±0.11	n.m.±n.m.
IN_{Oh}	2	3.20±0.87	2.28±0.64	0.36±0.04	0.20±0.01	0.71±0.01	0.12±0.02	0.07±0.02	0.72±0.10	0.50±0.18	0.24±0.00
IN_{Min}	0	n.m.±n.m.	n.m.±n.m.	n.m.±n.m.	n.m.±n.m.	n.m.±n.m.	n.m.±n.m.	n.m.±n.m.	n.m.±n.m.	n.m.±n.m.	n.m.±n.m.
UL_{Oh}	1	2.08±n.a.	1.29±n.a.	0.19±n.a.	0.04±n.a.	0.62±n.a.	0.09±n.a.	0.02±n.a.	0.63±n.a.	0.65±n.a.	0.03±n.a.
UL_{Min}	3	2.72±0.91	1.78±0.67	0.25±0.06	0.58±0.25	0.61±0.06	0.11±0.02	0.24±0.06	0.48±0.11	0.38±0.06	0.07±0.02
Alluvium (A)	3	1.26±0.56	1.01±0.41	0.10±0.05	0.18±0.17	0.95±0.18	0.06±0.03	0.09±0.08	0.95±0.33	0.68±0.24	n.m.±n.m.
Active Floodplain Soils											
UF	4	2.77±0.36	2.22±0.26	0.29±0.06	0.60±0.06	0.81±0.04	0.11±0.02	0.22±0.02	0.85±0.22	0.69±0.18	0.12±0.01
uMF_{po}	4	3.01±0.21	2.17±0.33	0.45±0.15	0.82±0.24	0.72±0.11	0.16±0.06	0.28±0.08	0.74±0.20	0.60±0.13	0.16±0.02
uMF_{pr}	5	1.15±0.13	0.64±0.09	0.20±0.07	0.40±0.23	0.57±0.05	0.17±0.04	0.33±0.15	0.70±0.03	0.59±0.03	0.14±0.05
MF	10	2.80±0.50	2.44±0.65	0.98±0.44	0.51±0.19	0.88±0.23	0.35±0.15	0.18±0.06	0.53±0.18	0.45±0.14	0.19±0.05
LS	6	1.08±0.53	0.82±0.68	0.23±0.16	0.11±0.06	0.70±0.24	0.22±0.07	0.11±0.04	0.86±0.36	0.62±0.21	0.15±0.12
LF	7	1.39±0.86	1.13±0.82	0.38±0.38	0.17±0.14	0.77±0.19	0.28±0.21	0.18±0.20	0.68±0.26	0.52±0.22	0.30±0.15
RF Soils	6	1.34±0.85	1.10±0.82	0.23±0.10	0.57±0.47	0.73±0.20	0.23±0.12	0.93±1.27	0.81±0.10	0.60±0.17	0.31±0.16

Captions: Soil type categories are as in previous tables. Data for relict floodplain (RF) soils represent data from 0-40 cm horizons. VP, vanillyl phenols; SP, syringyl phenols; CP, cinnamyl phenols; LP, lignin phenols(LP = VP + SP + CP); CA, cutin acids; [Ad/Al], acid/aldehyde ratios of vanillyl and syringyl phenols (v,s); w-OH/CA, ratio of terminal hydroxy to total cutin acids. n, refers to the number of samples in each category. Data for individual soil horizons are tabulated in Electronic Annex III.

Table 5. Concentration and compositional data of suspended particles from Fly River system.

Sample	Sampling Date	Elevation (m)	Distance (km)	TSS (mg/L)	POC (mg/L)	PON (mg/L)	PIC (mg/L)	%POC (wt%)	%PN (wt%)	%PIC (wt%)	POC:PN (molar)	$\delta^{13}C_{org}$ (‰)
Ok Tedi												
FRW06	1/6/2007	573	877	119	1.43	0.13	10.5	1.21	0.11	8.83	13	-27.9
FRW07	1/7/2007	442	865	51	0.41	0.04	n.d.	0.79	0.08	n.d.	12	-28.2
FRW09	1/7/2007	381	858	9530	14.02	2.06	90	0.15	0.02	0.94	7.9	-27.7
FRW14	1/8/2007	52	778	345	0.82	0.14	2.73	0.24	0.04	0.79	6.8	-28.2
FRW51	1/16/2007	17	697	279	0.99	0.13	3.61	0.36	0.05	1.29	8.9	-28.3
Highland Tributaries												
FRW11	1/8/2007	331	834	67	2.89	0.31	0.15	4.29	0.46	0.23	11	-28.4
FRW12	1/8/2007	261	818	462	8.71	0.73	4.54	1.89	0.16	0.98	14	-28.4
Upper Fly												
FRW56	1/17/2007	22	750	49	1.56	0.11	n.d.	3.23	0.23	n.d.	17	-29.0
FRW57	1/17/2007	25	747	33	0.98	0.08	n.d.	2.92	0.25	n.d.	14	-29.0
FRW17c	1/17/2007	27	731	24	0.82	0.07	0.23	3.43	0.3	0.97	14	-29.0
FRW52i	1/16/2007	22	729	12	0.40	0.05	n.d.	3.29	0.42	n.d.	9.3	-28.8
FRW52ii	1/16/2007	22	729	12	0.30	0.04	n.d.	2.49	0.36	n.d.	8.8	-29.4
*FRW53i	1/16/2007	22	729	28	0.67	0.08	1.33	2.35	0.28	4.68	9.8	-28.9
*FRW53ii	1/16/2007	22	729	28	0.80	0.1	n.d.	2.82	0.34	n.d.	9.3	-29.2
FRW18	1/9/2007	22	707	14	0.60	0.07	n.d.	4.14	0.49	n.d.	10	-29.7
Middle Fly												
FRW19	1/9/2007	27	702	76	1.03	0.14	n.d.	1.35	0.18	n.d.	8.6	-27.9
FRW48	1/15/2007	21	689	33	0.39	0.05	n.d.	1.17	0.15	n.d.	9.1	-29.9
*FRW49	1/15/2007	21	689	172	1.33	0.15	1.92	0.77	0.09	1.12	10	-28.3
FRW45	1/15/2007	16	683	94	1.56	0.11	n.d.	1.66	0.12	n.d.	17	-29.4
FRW44	1/15/2007	20	644	36	0.62	0.07	n.d.	1.69	0.19	n.d.	10	-29.8
FRW43	1/15/2007	15	612	38	0.54	0.06	n.d.	1.44	0.17	n.d.	11	-30.3
FRW42	1/15/2007	22	576	31	0.47	0.05	n.d.	1.51	0.16	n.d.	11	-30.8
FRW41	1/15/2007	19	547	30	0.46	0.07	n.d.	1.52	0.24	n.d.	7.7	-30.2

FRW40	1/15/2007	17	515	37	0.80	0.09	n.d.	2.14	0.23	n.d.	10	-30.2
*FRW20	1/10/2007	18	483	249	2.89	0.32	1.31	1.16	0.13	0.52	11	-28.9
FRW22	1/10/2007	18	483	42	0.50	0.06	n.d.	1.19	0.15	n.d.	9.7	-28.8
FRW23	1/11/2007	11	478	23	0.33	0.05	n.d.	1.41	0.21	n.d.	7.7	-30.8
FRW25	1/11/2007	13	451	72	0.70	0.08	n.d.	0.98	0.11	n.d.	10	-28.5
FRW26	1/11/2007	15	409	131	2.27	0.2	n.d.	1.73	0.15	n.d.	13	-28.5
*FRW28i	1/12/2007	15	354	378	3.68	0.39	4.8	0.97	0.1	1.27	11	-28.2
*FRW28ii	1/12/2007	15	354	378	3.95	0.39	1.94	1.04	0.1	0.51	12	-28.1
FRW29	1/12/2007	15	354	71	0.68	0.07	n.d.	0.97	0.11	n.d.	11	-28.6
Lowland Tributaries												
FRW55	1/17/2007	25	750	18	0.50	0.06	n.d.	2.84	0.32	n.d.	9.7	-29.4
FRW47i	1/15/2007	18	596	115	2.06	0.18	n.d.	1.8	0.16	n.d.	13	-30.0
FRW47ii	1/15/2007	18	596	115	2.00	0.2	n.d.	1.75	0.17	n.d.	12	-30.3
FRW21	1/10/2007	18	483	3	0.43	0.06	n.d.	17.21	2.53	n.d.	8.4	-31.6
FRW23	1/11/2007	13	451	5	1.93	0.18	n.d.	42.08	3.88	n.d.	13	-28.4
Lower Strickland												
*FRW36i	1/14/2007	10	341	1818	17.12	2.41	22.44	0.94	0.13	1.23	8.3	-26.6
*FRW36ii	1/14/2007	10	341	1818	17.29	2.47	19.11	0.95	0.14	1.05	8.2	-26.8
FRW35	1/14/2007	10	341	1412	10.23	1.79	n.d.	0.72	0.13	n.d.	6.7	n.m.
Lower Fly												
FRW34	1/13/2007	10	333	501	3.43	0.42	n.d.	0.69	0.08	n.d.	9.5	-27.2
*FRW32i	1/13/2007	11	291	889	8.02	1.2	8.75	0.9	0.13	0.98	7.8	-27.2
*FRW32ii	1/13/2007	11	291	889	11.40	1.05	5.5	1.28	0.12	0.62	13	-27.3
FRW33	1/13/2007	11	291	177	1.88	0.25		1.06	0.14	n.d.	8.8	-27.4
Floodplain Water Bodies												
FRW58	1/17/2007	23	736	32	1.27	0.15	n.d.	3.94	0.47	n.d.	9.9	-31.8
FRW24	1/11/2007	13	451	1	0.80	0.1	n.d.	61.68	7.52	n.d.	9.3	-30.7
FRW31	1/12/2007	12	354	3	0.46	0.07	n.d.	13.65	2.21	n.d.	7.7	-30.3

Captions: TSS, total suspended sediment concentrations; %POC, particulate organic carbon content; %PN, particulate nitrogen content; %PIC, particulate inorganic carbon content; n.d., not detectable; n.m., not measured; all other symbols as in previous tables. i' and "ii" identify duplicate samples; "*" identify depth-integrated samples. Shaded rows highlight samples from same location along the river.