

Glenn Rudman

From: Glenn Rudman
Sent: Wednesday, June 10, 2009 6:29 PM
To: 'Ryan.Parry@yesab.ca'
Cc: 'Stephen.Mills@yesab.ca'; 'ken.McKinnon@yesab.ca'; 'Simon.Mason-Wood@yesab.ca'; 'Dale J Eftoda'; Donald Wilson; 'Wade Stogran'; Scott Davidson; Patricia Randell; Bengt Pettersson; Rick Hoos
Subject: Mactung water quality/quantity sampling events
Attachments: W23101211_002 Mactung WQ Sampling Summary.xls

Hi Ryan,

Following the meeting on June 2, 2009 between YESAB, EBA and NATC please find attached information on the collection events for the water quality and quantity data sets (Tables 1 and 2) for the Mactung property. These are being sent to you in the context of the discussion at the meeting about water sampling frequency and meeting adequacy under YESAA. The numbering provided below matches that in YESAB's Adequacy Review Report.

The tables contain the data collected from 2006 to present. It was suggested by the Executive Committee members present at the meeting that these data sets be forwarded to YESAB for review. Some notes have also been provided below.

5.0 WATER QUALITY AND QUANTITY

5.1 MINE SITE

5.1.1 Surface Water Quality and Hydrology

i) Monthly Flow Data for Tributaries A and C

The history of flow measurements is presented in Table 1: Mactung Project Water Quantity Sampling Events. This schedule of sampling events was established to initiate understanding of the seasonal nature of variations in flow downstream of the anticipated areas of development. The available data covers the period from July 2006 to May 2009. The schedule of sampling events and station locations have been expanded during the project development as additional information was obtained and as an understanding of the water courses increased.

As of February 2009 monthly measurements have been conducted at the Mactung site with the intention of continuing monthly sampling. As flow data is compiled it will be used to check the flow modelling that was developed.

j) Water Quality Sampling and Analysis for all Sampling Locations.

The history of water quality sampling is presented in the attached Table 2: Mactung Project Water Quality Sampling Events. As with the water quantity measurements, this schedule of sampling events was established to initiate understanding of the seasonal nature of water quality downstream of the anticipated areas of development. The available data covers the period from June 2006 to May 2009.

The schedule of sampling events and station locations have been expanded during the project as additional information was obtained and as an understanding of the water courses increased. For example, a sampling station has been added to Trib C immediately downstream of the Warm Spring. Sampling at these locations will continue on a monthly schedule.

NATC believes that, based on the requirements outlined in the proponent's guide, sufficient seasonal information on water quality and quantity is available for the purposes of meeting adequacy requirements and undertaking an environmental and socio-economic assessment. NATC and EBA believe there has been sufficient data collected to give a representation of the monthly water quality and quantity regime to allow for adequacy and continued confirmation sampling.

If you have any questions, please do not hesitate to contact me.

Glenn

6/30/2009

Table 1: Mactung Project Water Quantity Sampling Events

Sampling Dates		2006				2007				2008				2009					
Station #	Location	Jun	Jul	Aug	Sep	Jun	Jul	Aug	Sep	Mar	May	Jun	Jul	Aug	Sep	Feb	Mar	Apr	May
Trib A	Trib A downstream of Trib C		X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Trib C	Trib C near to mouth		X	X	X	X	X	X	X		X	X	X	X	X			X	X
Trib H	South Hess Tributary									X		X	X	X	X			X	X
WQ-1A	Trib C by Warm Spring																		X
Trib C0	Trib C Upstream Ravine																		X

Cold temperatures and safety issues prevented November 2008 hydrology flow measurements
 Frozen conditions prevented accurate measurements at Trib C in early 2009

Table 2: Mactung Project Water Quality Sampling Events

Sampling Dates		2006				2007				2008			2009			
Station #	Location	Jun	Jul	Aug	Sep	Jun	Jul	Aug	Sep	May	Aug	Nov	Feb	Mar	Apr	May
WQ-1	Trib C near mouth	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ
WQ-1A	Trib C by Warm Spring									WQ	WQ	WQ	WQ	WQ	WQ	WQ
WQ-2	Trib A	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ
WQ-2A	Trib A upstream Trib C									WQ	WQ	WQ ¹	WQ ¹	WQ ¹	WQ	WQ
WQ-3	Trib H upstream Trib A	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ
WQ-4	Trib H downstream Trib A	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ	WQ ²	WQ ²	WQ ²	WQ	WQ

Note 1 Water quality sampled 30 m downstream from Trib C confluence instead of above confluence

Note 2 Water quality sampled at Trib H flow monitoring location instead of downstream from Trib A confluence

Upper Trib C Sampling

Sampling Dates		2008			2009			
Station #	Location	May	Aug	Nov ³	Feb	Mar	Apr	May
WQ-Ravine Dam	Trib C at Ravine Dam		WQ	WQ	WQ	WQ	WQ	
WQ-C4	Trib C4							WQ
WQ-C3	Trib C3			WQ				WQ
WQ-C2	Trib C2							WQ
WQ-C1	Trib C1			WQ				WQ
WQ-C0	Trib C upstream of Ravine Dam			WQ				WQ

Notes: 3 November sampling included multiple WQ grab samples from upper Trib C in order to determine local water quality conditions.

From: Ryan.Parry

Sent: Friday, June 12, 2009 8:35 AM

To: 'Glenn Rudman'

Cc: Stephen.Mills; Ken.McKinnon; Simon.Mason-Wood; Dale J Eftoda; Donald Wilson; Wade Stogran; Scott Davidson; Patricia Randell; Bengt Pettersson; Rick Hoos

Subject: RE: Mactung water quality/quantity sampling events

Glenn, could you add another column to the table which refers to the water quality sampling stations as outlined in Figure 4.1.10-11 of the report? I'm having some difficulty in matching up the notations, and I'd like to make sure we're referring to the same locations. Thanks.

Ryan

Ryan L. Parry, CCEP
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Glenn Rudman

From: Ryan.Parry@yesab.ca
Sent: Friday, June 12, 2009 9:18 AM
To: Ryan.Parry@yesab.ca; Glenn Rudman
Cc: Stephen.Mills@yesab.ca; Ken.McKinnon@yesab.ca; Simon.Mason-Wood@yesab.ca; djeftoda@northwestel.net; Donald Wilson; wstogran@natungsten.com; Scott Davidson; Patricia Randell; Bengt Pettersson; Rick Hoos
Subject: RE: Mactung water quality/quantity sampling events

To clarify Glenn, I'm referring to Table 1 and part 2 of table 2. If you have a map with all the locations that would be very helpful.

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Glenn Rudman

From: Ryan.Parry@yesab.ca
Sent: Monday, June 15, 2009 10:51 AM
To: Glenn Rudman
Subject: water sampling

Hi Glenn,

The Executive Committee had the opportunity to discuss the water sampling issue further. Our understanding at this point is that between July 2008 and 2009 there is a 6-month gap for most water quality stations (July08, Sept08, Oct08, Dec08, Jan09, June09), and between a 7 and 11-month gap for Upper Tributary C sampling.

In order to make a decision in relation to water sampling we will need to see the actual data to understand the level of variability currently captured on site. Since the submission of the proposal in December, a number of sampling events have occurred. As such the Executive Committee requests a compilation of both hydrology and water quality sampling data (all sampled periods 2006-2009) presented in a clear, concise format that allows for an appropriate comparison of results, in addition to the map of all sample locations as requested previously.

This information will be particularly helpful to the Executive Committee in determining next steps forward. As always, feel free to give me a call if you wish to discuss. Thanks.

Ryan

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6/30/2009

Glenn Rudman

From: Glenn Rudman
Sent: Thursday, June 18, 2009 11:21 AM
To: 'Ryan.Parry@yesab.ca'
Cc: 'Stephen.Mills@yesab.ca'; 'Simon.Mason-Wood@yesab.ca'; 'ken.McKinnon@yesab.ca'; Donald Wilson; Scott Davidson
Subject: RE: Mactung water quality/quantity sampling events
Attachments: W23101211_002_WaterQuality.pdf

Ryan,

A figure showing the water sampling locations is attached for your reference. The actual data, as requested, will follow.

Glenn

Glenn Rudman B.Sc., M.Sc.

Environmental Scientist

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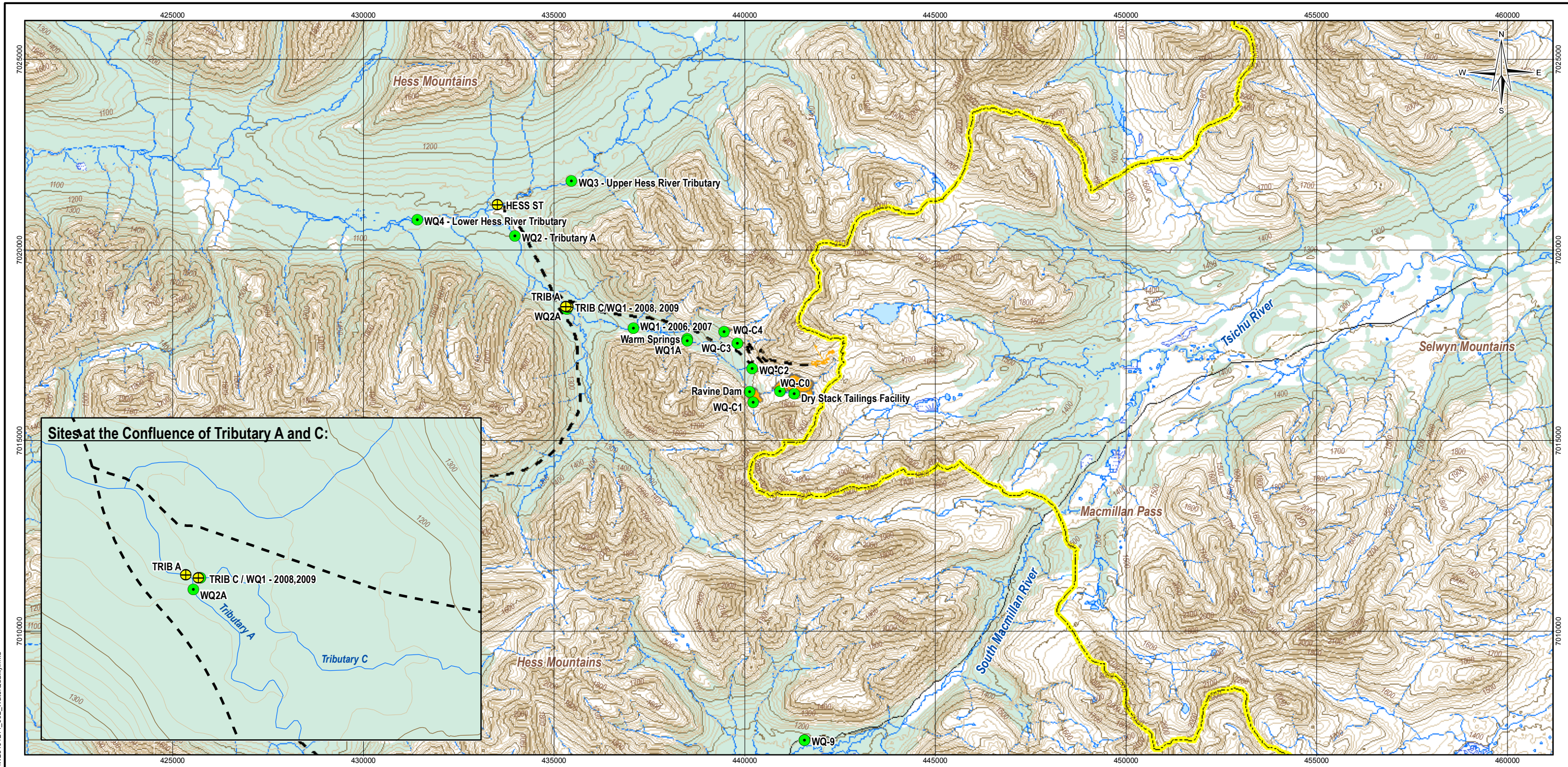
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LEGEND

- Water Quality Station
- ⊕ Flow Monitoring Site
- Proposed Mine Site Infrastructure
- NWT-Yukon Territory Border
- Proposed Access Road
- Index Contours
- Road
- Trail
- Watercourse
- Waterbody
- Wetland
- Vegetation

NOTES
Base data source: 1:50,000 NTS

MACTUNG

Water Quality Sampling Locations

PROJECTION UTM Zone 9	DATUM NAD83
Scale: 1:100,000	



FILE NO. W23101211_002_WaterQuality.mxd	DWN MEZ	CKD SD	REV 0
PROJECT NO. W23101211.002	DATE June 17, 2009	OFFICE EBA-VANC	

Figure 1

ISSUED FOR USE

C:\Vancouver\GIS\ENVIRONMENTAL\W23101211_Mactung\Maps\002\W23101211_002_WaterQuality.mxd

Glenn Rudman

From: Glenn Rudman
Sent: Thursday, June 25, 2009 5:15 PM
To: 'Ryan.Parry@yesab.ca'
Cc: 'Stephen.Mills@yesab.ca'; 'Simon.Mason-Wood@yesab.ca'; 'ken.McKinnon@yesab.ca'; 'Dale J Eftoda'; 'Wade Stogran'; Scott Davidson; Donald Wilson
Subject: Water quality tables
Attachments: W23101211_002 Mactung WQ Data Summary Table.pdf

Ryan,

Please find attached the water quality tables you requested as part of the on-going dialogue regarding section 5.1.1 of the Adequacy Review Report (surface water quality and hydrology).

Glenn

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6/30/2009

TABLE 1: Mactung Project Water Quality Monitoring Results Table

Station	Date	Hardness (as CaCO3)	Carbonate (CO3)	Conductivity	pH	Total Dissolved Solids	Total Suspended Solids	Turbidity	Ammonia as N	Alkalinity, Total (as CaCO3)	Acidity	Bicarbonate (HCO3)	Chloride (Cl)	Fluoride (F)	Sulfate (SO4)	Nitrate (as N)	Nitrite (as N)	Total Organic Carbon	Total Phosphate as P	Phosphorus, Total	Cyanide, Total	Al-T	Sb-T	As-T	Ba-T
WQ-Trib H Flow Station	16-Feb-09		-6	237	7.54	155		-0.1	-0.01	52	-5	60	0.24		69.2	0.07	-0.01		-0.01	0.019		0.101	0.0003	0.0003	0.058
WQ-Trib H Flow Station	21-Nov-08		-6	243	7.6	142		-0.1	-0.01	47	-5	60	0.24		64.2	0.05	-0.01		-0.01	-0.01		0.024	-0.0002	-0.0002	0.034
WQ-Trib A Flow Station	16-Feb-09		-6	377	7.44	265		-0.1	0.05	64	-5	80	0.93		132	0.06	-0.01		-0.01	-0.01		0.0018	0.0003	0.0003	0.074
WQ-Trib A Flow Station	21-Nov-08		-6	340	7	217		5.9	-0.01	23	-10	30	0.28		132	0.06	-0.01		-0.01	0.024		3.83	-0.0002	-0.0002	0.052
WQ-Ravine Dam	19-Apr-09		-6	347	7.24	220		0.2	-0.01	52	-5	60	0.04		109	0.08	0.03		-0.01	-0.01		0.007	-0.0002	0.0006	0.033
WQ-Ravine Dam	19-Aug-08	121	-6	238	7.7	164		-0.1	-0.005	85.5	-40	50	0.06		85.2	0.03	0.02		-0.01	0.02		0.078	-0.0002	0.0011	0.02
WQC4	31-May-09	60.9	-6	118	7.45	87		0.6	0.01	23	-5	30	0.13		31.6	0.08	-0.01		-0.01	-0.01		0.085	0.0002	0.006	0.011
WQC3	31-May-09	135	-6	221	7.72	142		17	0.03	51	-5	60	0.13		57.2	0.18	-0.01		-0.01	-0.01		0.021	-0.0002	0.0003	0.012
WQC3	20-Nov-08		-6	359	7.7	229		-0.1	0.05	57	-5	70	0.05		112	0.15	0.03		-0.01	-0.01		-0.005	-0.0002	-0.0002	0.025
WQC2	01-Jun-09	110	-6	191	7.48	120		6.5	0.02	31	-5	40	0.12		59.5	0.13	-0.01		-0.01	-0.01		0.031	-0.0002	-0.0002	0.0017
WQC1	20-Nov-08		-6	216	7.2	130		-0.1	-0.01	27	-6	30	0.06		66.3	0.15	-0.01		-0.01	-0.01		-0.005	-0.0002	0.0005	0.018
WQC0	31-May-09		-6	162	7.15	99		2.3	-0.01	29	-5	40	0.19		47.5	0.04	-0.01		-0.01	-0.01		0.033	-0.0002	0.0005	0.02
WQC0	19-Nov-08		-6	248	7.4	150		0.7	-0.01	38	-6	50	0.12		72.3	0.04	0.01		-0.01	-0.01		0.019	-0.0002	0.0011	0.024
WQC0	21-Aug-08	126	-6	242	7.8	169		-0.1	-0.005	83.7	-46	60	0.05		83.7	0.03	0.02		-0.01	0.01		0.02	-0.0002	0.0009	0.021
WQ4	31-May-09	67.1	-6	118	7.2	68		6	-0.01	17	-5	20	0.18		35.4	0.07	-0.01		-0.01	-0.01		0.807	-0.0002	0.0007	0.028
WQ4	17-Apr-09		-6	316	6.99	199		8.9	-0.01	37	-5	40	0.27		110	0.06	-0.01		-0.01	-0.01		2.16	-0.0002	0.0003	0.062
WQ4	09-May-08	76.9		165	7.36	113	29.9	7.92	0.0085	24	-5	28	-0.5	0.178	48.7	0.0135	-0.001		-0.01	-0.01		1.01	-0.0005	0.00058	0.042
WQ4	04-Sep-07	90	-5	200	7.5	113	5	7.6	-0.005	23	-5	28	-1	0.12	67.8	0.021	-0.002	1	0.029	0.009	0.0144	1.31	0.00008	0.0005	0.0322
WQ4	14-Aug-07	72	-5	166	7.5	92	5	3.4	0.007	20	-5	25	-1	0.1	54.9	0.017	-0.002	1		0.01		1.09	0.00008	0.00054	0.0317
WQ4	10-Jul-07	58	-5	126	7.5	72	10	11	0.006	21	-5	26	-1	0.08	38.8	0.028	0.003	2		0.013		1.18	-0.0004	0.0008	0.0302
WQ4	17-Jun-07	58	-5	135	7.2	70	10	6.4	-0.005	15	-5	19	-1	0.09	40.9	0.041	-0.002	-1		0.015		0.81	-0.0004	0.001	0.0313
WQ4	20-Sep-06	112	-5	234	7.7	132			-0.005	24	-5	30	-1		76.9	0.02	-0.002	1				1.58	0.00029	0.00047	0.0355
WQ4	06-Aug-06	65	-5	134	7.5	77			0.007	15	-5	18	-1		45.4	-0.1	-0.05	1				1.46	-0.0004	0.0007	0.0301
WQ4	09-Jul-06	49	-5	114	7.4	63			-0.005	14	-5	17	-1	0.06	36.7	0.028	-0.002	1.2	0.024			1.51	0.0005	0.0014	0.0441
WQ4	15-Jun-06	53	-5	115	7.5	61			-0.005	14	-5	17	-1		33.4	0.041	0.002	2	0.04			1.51	0.0005	0.0021	0.0671
WQ3 DUP	04-Sep-07	60	-5	135	7.6	73	-3	5.6	-0.005	21	-5	25	-1	0.07	40.4	0.008	-0.002	1		0.007		0.303	0.00005	0.00054	0.0228
WQ3 DUP	11-Jul-07	42	-5	91.9	7.5	52	9	6.5	-0.005	21	-5	25	-1	0.05	24.6	0.015	0.003	2		0.01		0.77	-0.0004	0.0007	0.0221
WQ3 DUP	17-Jun-07	41	-5	95.9	7.2	49	6	5.8	-0.005	15	-5	18	-1	0.06	25.2	0.029	-0.002	-1		0.012		0.43	-0.0004	0.001	0.0208
WQ3 DUP	20-Sep-06	75	-5	171	7.7	90			-0.005	26	-5	32	-1		48.8	-0.006	-0.002	1				0.155	0.00034	0.00043	0.0253
WQ3 DUP	06-Aug-06	40	-5	84.6	7.5	46			0.006	13	-5	16	-1		24.4	-0.1	-0.05	1				1.09	-0.0004	0.0008	0.0246
WQ3 DUP	09-Jul-06	33	-5	80	7.4	42			-0.005	13	-5	16	-1		22.4	0.022	-0.002	1.2				1.33	-0.0004	0.0014	0.0343
WQ3	31-May-09	52.8	-6	94	7.29	54		20	-0.01	18	-5	20	-0.12		24.5	0.06	-0.01		0.023			0.324	-0.0002	0.0008	0.02
WQ3	17-Apr-09		-6	254	7.2	167		1	-0.01	52	-5	60	0.39		71.4	0.05	0.04		-0.01	-0.01		0.028	-0.0002	0.0004	0.066
WQ3	18-Feb-09		-6	243	7.53	156		0.2	-0.01	52	-5	60	0.27		69.1	0.06	0.02		-0.01	-0.01		0.021	-0.0002	-0.0002	0.056
WQ3	09-May-08	70.5		150	7.32	104	6.4	2.31	0.0105	27.5	-5	26	-0.5	0.081	39.4	0.0087	-0.001		-0.01	-0.01		0.232	-0.0005	0.00068	0.037
WQ3	04-Sep-07	60	-5	135	7.6	74	4	6	0.011	22	-5	26	-1	0.08	40.5	0.008	-0.002	1		0.007	0.011	0.021	0.00005	0.00058	0.0237
WQ3	17-Aug-07	34	-5	80.5	7.4	40	17	10	-0.005	13	-5	16	-1	0.05	20.3	-0.006	0.004	1		0.014		1.09	-0.0004	0.001	0.0264
WQ3	11-Jul-07	42	-5	92.1	7.6	49	8	6.4	-0.005	16	-5	19	-1	0.05	24.6	0.015	0.003	2		0.01		0.67	-0.0004	0.0007	0.0217
WQ3	17-Jun-07	41	-5	95.7	7.1	48	4	4.9	-0.005	14	-5	17	-1	0.06	25.2	0.029	-0.002	-1		0.013		0.45	-0.0004	0.001	0.0207
WQ3	20-Sep-06	83	-5	171	7.7	93			-0.005	27	-5	32	-1		48.8	-0.006	-0.002	1				0.157	0.00021	0.00044	0.0253
WQ3	06-Aug-06	41	-5	84.6	7.5	46			0.006	13	-5	16	-1		24.6	-0.1	-0.05	1				1	-0.0004	0.0007	0.024
WQ3	09-Jul-06	34	-5	92	7.3	42			-0.005	12	-5	14	-1	0.05	22.3	0.023	-0.002	1.2	0.024			1.39	-0.0004	0.0014	0.0363
WQ3	15-Jun-06	39	-5	83.8	7.5	43			-0.005	13	-5	16	-1		21.7	0.027	0.002	1	0.026			1	-0.0004	0.0014	0.0332
WQ2A	31-May-09	91.2	8	160	6.74	94		7	-0.01	6	-5	-5	-0.02		63.4	0.07	-0.01			0.035		2.65	-0.0002	0.0006	0.047
WQ2A	18-Apr-09		-6	306	4.77	212		32	-0.01	-5	-5	-5	0.07		134	0.06	-0.01		-0.01	0.041		5.02	-0.0002	0.0005	0.06
WQ2A	09-May-08	123		275	6.11	177	20.4	16.9	-0.005	2.9	-5	-5	-0.5	0.152	114	0.056	-0.001		0.0246		-0.005	3.5	-0.0002	-0.0005	0.055
WQ2	31-May-09	106	-6	190	6.94	118		18	0.02	14	-5	20	0.17		72.1	0.1	-0.01			0.041		2.67	-0.0002	0.001	0.046
WQ2	17-Apr-09		10	359	6.36	228		22	-0.01	9	-5	-5	0.27		162	0.07	-0.01		-0.01	0.03		5.45	-0.0002	0.0004	0.06
WQ2	16-Feb-09		-6	311	4.83	212		39	0.03	-5	-5	-5	0.18		146	0.05	-0.01		-0.01	0.06		6	-0.0002	0.0005	0.065
WQ2	09-May-08	128		302	7.37	185	23.9	15	-0.005	19.2	-5	-5	-0.5	0.19	113	0.0555	0.0039		0.029		0.0077	4.06	-0.0005	0.0006	0.051
WQ2	04-Sep-07	150	-5	328	6.9	196	24	11																	

TABLE 1: Mactung Project Water Quality Monitoring Results

Station	Date	Be-T	Bi-T	B-T	Cd-T	Ca-T	Cr-T	Co-T	Cu-T	Fe-T	Pb-T	Li-T	Mg-T	Mn-T	Hg-T	Mo-T	Ni-T	K-T	Se-T	Si-T	Ag-T	Na-T	Sr-T	Te-T	Tl-T	Th-T	Sn-T	Ti-T	U-T	V-T	Zn-T	Zr-T	Al-D	Sb-D	As-D	Ba-D	Be-D	Bi-D	
WQ-Trib H Flow Station	16-Feb-09	0.00004		0.011	0.00007	34.5	-0.0004	0.00037	-0.001	0.25	0.0001	0.005	12.8	0.00233	-0.00001	0.00037	0.003	0.8	-0.0006	2.33	-0.00001	1.76	0.092	-0.0001	-0.0001	-0.0001	0.0002	0.006	0.0009	0.0002	0.01	0.2	0.005	0.001	-0.0002	0.049	-0.00004	-0.0001	
WQ-Trib H Flow Station	21-Nov-08	-0.00004	-0.0001	0.009	0.00007	28.5	-0.0004	0.0001	-0.001	0.07	-0.0001	0.003	11	0.0083	-0.00001	0.0003	0.003	0.5	-0.0006	2.14	-0.00001	1.45	0.074	-0.0001	-0.0001	-0.0001	0.0002	0.006	0.0008	-0.00004	0.02	0.2	0.006	0.0005	-0.0002	0.04	-0.00004	-0.0001	
WQ-Trib A Flow Station	16-Feb-09	-0.00004		0.019	0.00077	70.3	0.0011	0.00005	-0.001	0.02	0.0001	0.003	5.48	0.0009	-0.00001	0.00401	0.008	1.4	0.004	3.32	-0.00001	5.18	0.205	-0.0001	-0.0001	-0.0001	0.0005	0.0042	0.00055	0.033	-0.1	0.009	0.0011	0.0003	0.068	-0.00004	-0.0001		
WQ-Trib A Flow Station	21-Nov-08	0.00023	-0.0001	0.007	0.00077	49.6	0.0008	0.00007	0.012	1.72	-0.0001	0.006	8.35	0.00781	-0.00001	0.00232	0.09	0.8	0.0033	3.52	-0.00001	2.27	0.16	-0.0001	-0.0001	-0.0001	0.0005	0.0028	0.00201	0.032	-0.1	0.008	0.0011	0.0003	0.055	-0.00004	-0.0001		
WQ-Ravine Dam	19-Apr-09	-0.00004		-0.005	0.00056	61.5	0.0007	0.00004	-0.001	-0.01	0.0002	-0.001	4.57	0.0002	-0.00001	0.00195	0.01	1	0.0019	2.69	-0.00001	1.08	0.157	-0.0001	-0.0001	-0.0001	0.0004	0.0027	-0.00003	0.037	-0.1	-0.005	0.0006	0.0005	0.031	-0.00004	-0.0001		
WQ-Ravine Dam	19-Aug-08	0.00008	-0.0001	-0.005	0.00024	44.3	-0.0004	0.00118	-0.001	0.051	-0.0001	0.002	2.98	0.0487	-0.00001	0.00091	0.009	0.76	0.0009	2.52	-0.00001	0.8	0.095	-0.0001	-0.0001	-0.0001	0.0004	0.0027	-0.00003	0.037	-0.1	-0.005	0.0006	0.0005	0.031	-0.00004	-0.0001		
WQ4	31-May-09	-0.00004	0.0001	-0.005	0.00007	22.4	-0.0004	0.00028	0.002	0.14	0.0005	0.001	1.19	0.0152	-0.00001	0.00065	0.002	0.7	0.0007	1.64	0.00002	1.03	0.035	-0.0001	-0.0001	-0.0001	0.0016	0.0009	0.0002	0.015	-0.1	0.039	0.0006	0.001	0.018	-0.00004	-0.0001		
WQ3	31-May-09	-0.00004	-0.0001	-0.005	0.00007	50.2	-0.0004	0.00006	0.001	0.03	-0.0001	-0.001	2.26	0.0007	-0.00001	0.00117	-0.001	0.9	0.0016	2.8	0.00002	0.89	0.06	-0.0001	-0.0001	-0.0001	0.0008	0.0011	0.00057	0.01	-0.1	0.008	0.001	0.0003	0.011	-0.00004	-0.0001		
WQ3	20-Nov-08	-0.00004	-0.0001	-0.005	0.00019	65.8	-0.0004	0.00004	-0.001	0.01	-0.0001	-0.001	2.89	-0.0001	-0.00001	0.00131	-0.001	0.9	0.0028	3.02	-0.00001	1.2	0.097	-0.0001	-0.0001	-0.0001	0.0004	0.0006	0.00016	0.007	-0.005	0.002	-0.0002	0.028	-0.00004	-0.0001			
WQ2	01-Jun-09	-0.00004	-0.0001	-0.005	0.00025	40	0.0007	0.00008	-0.001	0.03	-0.0001	-0.001	2.58	0.0012	-0.00001	0.00066	0.003	1	0.0016	2.08	0.00002	0.99	0.069	-0.0001	-0.0001	-0.0001	0.0007	-0.0004	0.00015	0.014	-0.1	0.005	0.0004	-0.0002	0.014	-0.00004	-0.0001		
WQ1	20-Nov-08	-0.00004	-0.0001	-0.005	0.00023	35.7	-0.0004	0.00003	-0.001	0.01	-0.0001	-0.001	2.15	-0.0001	-0.00001	0.00176	0.002	0.3	0.0015	2.37	-0.00001	0.9	0.077	-0.0001	-0.0001	-0.0001	0.0002	-0.0004	-0.00004	0.008	-0.005	0.0017	0.0005	0.02	-0.00004	-0.0001			
WQ0	31-May-09	-0.00004	-0.0001	-0.005	0.00019	33.3	-0.0004	0.00012	-0.001	0.04	-0.0001	-0.001	2.18	0.0108	-0.00001	0.00039	0.002	1.2	0.0009	2.15	0.00002	0.89	0.058	-0.0001	-0.0001	-0.0001	0.0001	0.0002	-0.0004	0.00015	0.016	-0.1	0.012	0.0006	0.0003	0.017	-0.00004	-0.0001	
WQ0	19-Nov-08	-0.00004	-0.0001	-0.005	0.00025	41.9	-0.0004	0.00006	0.001	0.03	0.0006	-0.001	2.4	0.0023	-0.00001	0.00063	0.001	0.8	0.001	2.24	-0.00001	0.82	0.09	-0.0001	-0.0001	0.0001	0.0008	0.0005	0.00011	0.009	-0.005	0.0005	0.0011	0.026	-0.00004	-0.0001			
WQ0	21-Aug-08	-0.00004	-0.0001	-0.005	0.00015	44.2	-0.0004	0.00026	-0.001	0.02	0.0001	0.001	2.56	0.0091	-0.00001	0.00108	0.004	0.83	0.0013	2.4	-0.00001	0.8	0.096	-0.0001	-0.0001	-0.0001	0.0001	0.0004	0.0006	0.00009	0.009	-0.1	0.021	0.0006	0.0012	0.024	-0.00004	-0.0001	
WQ4	31-May-09	0.00008	-0.0001	-0.005	0.00081	16.8	0.0004	0.00224	0.005	0.68	0.0003	0.003	6.09	0.0457	-0.00001	0.00044	0.018	0.7	0.0007	2.1	0.00003	1.11	0.048	-0.0001	0.0001	-0.0001	0.0001	0.0005	0.00077	0.069	0.1	0.029	0.0005	0.0002	0.019	-0.00004	-0.0001		
WQ4	17-Apr-09	0.00016		0.006	0.00314	38.8	-0.0015	0.00553	0.008	0.88	0.0002	0.009	13.2	0.092	-0.00001	0.00082	0.067	0.9	0.0017	2.75	-0.00001	2.18	0.158	-0.0001	-0.0001	-0.0001	0.0001	0.0007	0.00067	0.231	-0.1	0.018	0.0005	-0.0002	0.058	-0.00004	-0.0001		
WQ4	09-May-08	-0.001		-0.1	0.000824	18.2	-0.001	0.00201	0.0052	0.654	-0.0005	-0.005	6.95	0.0553	-0.00002	-0.001	0.0206	-2	-0.001		-0.00002	-2						-0.0005	-0.01	0.00079	-0.001	0.0616	0.142	-0.0005	-0.0005	0.041	-0.001		
WQ4	04-Sep-07	-0.0002	-0.00003	0.003	0.00189	23.1	0.00049	0.0044	0.0113	0.653	-0.00016	0.0053	7.35	0.0732	-0.00002	0.00053	0.0368	0.61	0.0009	2.1	-0.00001	0.733	0.068					0.001	0.0102	0.125	0.0282	0.00008	0.0002	0.0291	-0.0002	-0.00003			
WQ4	14-Aug-07	-0.0002	-0.00003	0.003	0.00139	18.4	0.00029	0.0033	0.0089	0.678	0.00024	0.0046	5.96	0.0478	-0.00002	0.00044	0.03	0.56	0.0009	2.1	-0.0001	0.611	0.0544					0.00086	0.0108	0.0933	0.0357	0.00007	0.0002	0.0264	-0.0002	-0.00003			
WQ4	10-Jul-07	-0.001	-0.0001	-0.02	0.0008	13.3	-0.0008	0.0022	0.006	0.772	0.0003	-0.006	4.1	0.041	-0.00002	0.0006	0.0179	0.6	0.0008	2.3	-0.0004	-1	0.057			-0.0001	0.043	0.0005	0.0014	0.052	0.0468	0.00008	0.00023	0.021	-0.0002	-0.00003			
WQ4	17-Jun-07	-0.001	-0.0001	-0.02	0.0009	15.3	-0.0008	0.0026	0.006	0.637	0.0004	-0.006	5.6	0.052	-0.00002	0.0006	0.021	0.4	0.0008	2.2	-0.0004	-1	0.056			-0.0001	0.0005	0.0009	0.062	0.0353	0.00008	0.0002	0.0217	-0.0002	-0.00003				
WQ4	20-Sep-06	-0.0002		0.005	0.00234	24	-0.0005	0.005	0.0135	0.666	0.00007		8.75	0.0662	-0.00002	0.00077	0.0415	0.5	0.0013		-0.0001	0.746	0.087					0.00101	0.00073	0.124	0.0265	0.00032	0.00019	0.0348	-0.0002	-0.00003			
WQ4	06-Aug-06	-0.001	-0.0001	-0.02	0.0012	12.5	0.0008	0.003	0.008	0.788	0.0003		4.3	0.045		0.0006	0.0245	0.6	0.001		-0.0004	-1	0.061			-0.0001	-0.0004	0.064	0.0006	0.0019	0.063	0.0392	0.00029	0.00021	0.0205	-0.0002	-0.00003		
WQ4	09-Jul-06	-0.001	-0.0001	-0.02	0.0008	12.8	0.0012	0.0027	0.009	1.36	0.0007	-0.006	4.3	0.059		0.0007	0.0184	0.7	0.0006	2.9	-0.0004	-1	0.0517			-0.0001	-0.0004	0.075	0.0007	0.0029	0.051	0.046	0.00017	0.00023	0.0174	-0.0002	-0.00003		
WQ4	15-Jun-06	-0.001	-0.0001	-0.02	0.0001	13.8	0.0017	0.0035	0.009	1.82	0.001		4.4	0.075		0.0013	0.0199	0.7	0.0011		-0.0004	-1	0.0522			-0.0001	-0.0004	0.044	0.0007	0.0053	0.061	0.0386	0.00042	0.00019	0.0217	-0.0002	-0.00003		
WQ3 DUP	04-Sep-07	-0.0002	-0.00003	-0.003	-0.00005	13.6	0.00033	0.0016	0.0015	0.487	0.00022	0.0032	5.69	0.0517	-0.00002	0.0002	0.00569	0.55	0.0002	1.7	-0.0001	0.559	0.0412					0.00046	0.00094	0.0081	0.00004	0.00016	0.0264	0.0367	0.00005	0.00029	0.0177	-0.0002	-0.00003
WQ3 DUP	11-Jul-07	-0.001	-0.0001	-0.02	-0.0002	8.8	-0.0008	0.0008	0.001	0.746	0.0003	-0.006	3.5	0.024	-0.00002	0.0003	0.003	0.6	-0.0004	2.1	-0.0004	-1	0.0323			-0.0001	-0.0004	0.053	0.0004	0.0014	0.008	0.0351	0.00006	0.00029	0.0135	-0.0002	-0.00003		
WQ3 DUP	17-Jun-07	-0.001	-0.0001	-0.02	-0.0002	9.9	-0.0008	0.001	0.001	0.597	0.0004	-0.006	4.5	0.029	-0.0002	0.0003	0.0045	0.4	-0.0004	1.9	-0.0004	-1	0.0301			-0.0001	-0.0004	0.026											

TABLE 1: Mactung Project Water Quality Monitoring Results

Station	Date	B-D	Cd-D	Ca-D	Cr-D	Co-D	Cu-D	Fe-D	Pb-D	Li-D	Mg-D	Mn-D	Hg-D	Mo-D	Ni-D	K-D	Se-D	Si-D	Ag-D	Na-D	Sr-D	Ti-D	Th-D	Sn-D	Tl-D	W-D	U-D	V-D	Zn-D	Zr-D
WQ-Trib H Flow Station	16-Feb-09	0.011	0.00026	33.2	-0.0004	0.00008	0.001	0.014	0.0001	0.009	11.5	0.0071	-0.01	0.00035	0.002	0.9	-0.0006	2.29	-0.00001	2	0.083	0.00001	-0.0001	0.0004	0.0003		0.0008	-0.00004	0.009	-0.0001
WQ-Trib H Flow Station	21-Nov-08	0.012	0.00007	29.8	-0.0004	0.00015	-0.001	0.01	-0.0001	0.004	11.2	0.0092	-0.01	0.0004	0.004	0.5	-0.0011	2.18	-0.00001	1.4	0.083	-0.00001	-0.0001	-0.0001	-0.0001	0.0006	0.0008	-0.00004	0.008	-0.0001
WQ-Trib A Flow Station	16-Feb-09	0.02	0.00078	71.9	-0.0004	0.00004	-0.001	-0.01	-0.0001	0.003	5.31	0.0005	-0.01	0.00355	0.006	1.4	0.0038	3.6	-0.00001	5.7	0.19	-0.00001	-0.0001	-0.0001	0.0004	0.0037	0.00044	0.031	-0.0001	
WQ-Trib A Flow Station	21-Nov-08	0.008	0.00053	50.5	-0.0004	0.00046	0.002	0.023	0.0009	0.007	8.68	0.0045	-0.01	0.00192	0.094	0.9	0.0037	3.11	-0.00001	2.4	0.172	-0.00002	-0.0001	-0.0001	0.0001	0.0007	-0.0004	0.00007	0.272	-0.0001
WQ-Ravine Dam	19-Apr-09	-0.004	0.00055	65.2	-0.0004	0.00004	-0.001	-0.01	-0.0001	-0.001	4.87	0.0002	-0.01	0.00173	0.009	0.8	0.0019	2.78	-0.00001	0.9	0.141	-0.00001	-0.0001	-0.0001	0.0002	0.0026	-0.00004	0.025	-0.0001	
WQ-Ravine Dam	19-Aug-08	-0.004	0.00024	43.7	-0.0004	0.00105	-0.001	-0.01	-0.0001	0.002	2.98	0.0444	-0.01	0.001	0.009	0.75	0.0017	2.47	-0.00001	0.66	0.096	-0.00001	-0.0001	-0.0001	0.0005	0.0012	-0.0004	0.00015	0.01	-0.0001
WQC4	31-May-09	-0.004	0.00047	31.8	0.0046	0.00067	0.002	0.04	0.0002	0.001	2.09	0.0162	-0.01	0.00124	0.01	1.1	0.0012	1.84	-0.00001	0.9	0.062	-0.00001	-0.0001	-0.0001	0.0003	0.0006	0.00006	0.029	-0.0001	
WQC3	31-May-09	-0.004	0.00017	42.6	-0.0004	0.00014	0.001	0.016	0.0002	-0.001	1.99	0.0008	-0.01	0.00095	-0.001	0.8	0.0014	2.42	-0.00001	0.6	0.051	-0.00001	-0.0001	-0.0001	0.0002	0.0009	0.00043	0.006	-0.0001	
WQC3	20-Nov-08	-0.004	0.00023	68.6	0.0005	0.00047	-0.001	-0.01	-0.0001	-0.001	3.03	-0.0001	-0.01	0.00141	-0.001	1	0.0033	3.12	-0.00001	1.1	0.103	-0.00001	-0.0001	-0.0001	0.0006	0.0006	0.00019	0.003	-0.0001	
WQC2	01-Jun-09	-0.004	0.00021	32.2	-0.0004	0.00007	0.001	-0.01	-0.0001	-0.001	2.15	0.0006	-0.01	0.00056	0.002	0.8	0.0012	1.63	-0.00001	0.6	0.061	-0.00001	-0.0001	-0.0001	0.0001	-0.0004	-0.00004	0.007	-0.0001	
WQC1	20-Nov-08	-0.004	0.00028	36.8	-0.0004	0.00031	-0.001	0.012	-0.0001	-0.001	2.18	-0.0001	-0.01	0.00185	0.002	0.3	0.002	2.45	-0.00001	1	0.083	-0.00001	-0.0001	-0.0001	0.0011	-0.0004	0.00008	0.006	-0.0001	
WQC0	31-May-09	-0.004	0.00021	26	-0.0004	0.00012	-0.001	-0.01	-0.0001	-0.001	1.7	0.0094	-0.01	0.00037	0.002	1	-0.0006	1.68	-0.00001	0.7	0.054	-0.00001	-0.0001	-0.0001	0.0001	-0.0004	0.00006	0.008	-0.0001	
WQC0	19-Nov-08	-0.004	0.00026	44.1	-0.0004	0.00002	0.067	-0.01	0.0002	-0.001	2.5	0.0013	-0.01	0.00066	0.001	0.9	0.0006	2.32	-0.00001	0.7	0.099	-0.00001	-0.0001	-0.0001	0.0001	0.0002	0.0005	0.00004	0.041	-0.0001
WQC0	21-Aug-08	-0.004	0.00018	46.1	-0.0004	0.00026	0.001	0.01	0.0002	0.002	2.79	0.0092	-0.01	0.00122	0.004	0.9	0.0023	2.56	-0.00001	0.91	0.102	-0.00001	-0.0001	-0.0001	0.0007	0.0008	0.00014	0.009	-0.0001	
WQ4	31-May-09	0.004	0.00064	12.8	-0.0004	0.00184	0.002	0.042	-0.0001	0.003	4.58	0.0371	-0.01	0.00028	0.015	0.6	-0.0006	1.37	-0.00001	0.6	0.044	-0.00001	-0.0001	-0.0001	0.0002	-0.0004	0.00006	0.042	-0.0001	
WQ4	17-Apr-09	0.005	0.00297	41.7	-0.0004	0.00551	0.002	0.015	-0.0001	0.008	14	0.0894	-0.01	0.00058	0.066	0.9	0.0012	2.76	-0.00001	2.1	0.151	-0.00001	-0.0001	-0.0001	0.0002	-0.0004	-0.00004	0.194	-0.0001	
WQ4	09-May-08	-0.1	0.00077	19	-0.001	0.00178	0.0042	0.169	-0.0005	-0.005	7.18	0.0508	-0.00002	-0.001	0.0197	-2	-0.001	-0.00002	-2	-0.0002	0.73	-0.0002	-0.0005	-0.01	-0.0005	0.0003	-0.001	0.0479	-0.0001	
WQ4	04-Sep-07	0.004	0.00175	23.3	0.0006	0.0043	0.0021	0.018	-0.00005	0.0047	7.33	0.0608	-0.00002	0.00061	0.0363	0.52	0.0011	1.8	-0.0001	0.73	0.0789	-0.0001	-0.0001	-0.0001	0.00008	-0.00005	0.103	-0.0001		
WQ4	14-Aug-07	0.003	0.00128	18.2	-0.0006	0.0031	0.0017	0.015	-0.00005	0.0038	5.86	0.0424	-0.00002	0.00057	0.0293	0.44	0.001	1.7	-0.0001	0.623	0.0607	-0.0001	-0.0001	-0.0001	0.00006	-0.00005	0.0709	-0.0001		
WQ4	10-Jul-07	-0.001	0.00073	13.3	-0.0006	0.0019	0.0021	0.039	-0.00005	0.0027	4.53	0.0318	-0.00002	0.00054	0.0173	0.37	0.0006	1.6	-0.0001	0.475	0.0474	-0.0001	-0.0001	-0.0001	0.00011	0.00008	0.0442	-0.0001		
WQ4	17-Jun-07	0.002	0.00068	13.1	-0.0006	0.0023	0.0019	0.02	-0.00005	0.0028	5.52	0.0402	-0.00002	0.00053	0.0198	0.41	0.0007	1.5	-0.0001	0.412	0.0515	-0.0001	-0.0001	-0.0001	0.00011	0.00007	0.0482	-0.0001		
WQ4	20-Sep-06	0.005	0.00223	24.6	-0.0006	0.0049	0.0023	0.046	-0.00005	0.0049	8.89	0.0655	-0.00002	0.00068	0.0417	0.48	0.0013	-0.0001	0.865	0.0898	-0.0001	-0.0001	-0.0001	0.00009	0.00005	-0.00005	0.104	-0.0001		
WQ4	06-Aug-06	0.003	0.00118	15.5	0.00073	0.0026	0.0018	0.03	-0.00005	0.0024	5.21	0.044	-0.00002	0.00056	0.023	0.43	0.0008	-0.0001	0.539	0.0551	-0.0001	-0.0001	-0.0001	0.00009	-0.00005	0.00075	0.0647	-0.0001		
WQ4	09-Jul-06	0.002	0.00074	11.5	-0.0006	0.0019	0.0016	0.041	-0.00005	0.0016	4.25	0.0333	-0.00002	0.0005	0.0153	0.34	0.0006	1.5	-0.0001	0.428	0.04	-0.0001	-0.0001	0.00009	-0.00005	0.039	0.039	-0.0001		
WQ4	15-Jun-06	0.001	0.0008	11.5	-0.0006	0.0018	0.0013	0.029	-0.00005	0.0029	3.99	0.0324	-0.00002	0.00052	0.0143	0.34	0.0008	0.369	0.0436	0.0436	-0.0001	-0.0001	-0.0001	0.00009	0.00009	-0.00005	0.0384	-0.0001		
WQ3 DUP	04-Sep-07	0.004	-0.00005	13.6	0.0011	0.0014	0.0008	0.01	-0.00005	0.0025	5.6	0.0464	-0.00002	0.00024	0.0055	0.4	0.0002	1.3	-0.0001	0.566	0.0409	0.0055	-0.0001	-0.0001	0.0002	0.0003	-0.00005	0.0084	-0.0001	
WQ3 DUP	11-Jul-07	-0.001	-0.00005	9.12	-0.0006	0.0005	0.0007	0.033	-0.00005	0.0019	3.73	0.0132	-0.00002	0.0003	0.00294	0.34	-0.0001	1.3	-0.0001	0.419	0.0274	-0.0001	-0.0001	0.0001	0.00024	0.00008	0.0051	-0.0001		
WQ3 DUP	17-Jun-07	0.002	-0.00005	8.82	-0.0006	0.0007	0.0008	0.022	-0.00005	0.0016	4.58	0.0182	-0.00002	0.00027	0.00377	0.37	0.0001	1.2	-0.0001	0.362	0.0292	-0.0001	-0.0001	0.0001	0.00023	0.00009	0.0058	-0.0001		
WQ3 DUP	20-Sep-06	0.005	-0.00005	16.4	0.00028	0.0009	0.0007	0.015	-0.00005	0.0015	7.89	0.0304	-0.00002	0.00027	0.00527	0.39	0.0003	-0.0001	0.718	0.0503	-0.0001	-0.0001	-0.0001	0.0001	0.0004	-0.00005	0.0068	-0.0001		
WQ3 DUP	06-Aug-06	0.002	-0.00005	8.51	-0.0006	0.0007	0.0007	0.022	-0.00005	0.0027	3.72	0.023	-0.00002	0.00029	0.0032	0.37	0.0001	-0.0001	0.426	0.0272	-0.0001	-0.0001	-0.0001	0.00018	0.00019	0.00082	0.0056	-0.0001		
WQ3 DUP	09-Jul-06	0.001	-0.00005	7.13	-0.0006	0.0008	0.0008	0.029	-0.00005	0.001	3.43	0.0214	-0.00002	0.00024	0.00361	0.3	0.0002	1.2	-0.0001	0.358	0.0219	-0.0001	-0.0001	0.00018	-0.00005	0.0051	0.0051	-0.0001		
WQ3	31-May-09	0.005	0.00014	9.78	-0.0004	0.00042	0.001	0.065	-0.0001	0.002	4.32	0.0165	-0.01	0.0002	0.003	0.4	-0.0006	1.17	-0.00001	0.7	0.027	-0.00001	-0.0001	0.0002	-0.0004	0.00007	0.006	-0.0001		
WQ3	17-Apr-09	0.007	0.00005	37.8	-0.0004	0.00015	-0.001	0.075	-0.0001	0.005	14.4	0.0205	-0.01	0.00027	0.001	1.4	-0.0006	2.79	-0.00001	2.4	0.093	-0.00001	-0.0001	0.0002	0.0006	-0.00004	0.004	-0.0001		
WQ3	18-Feb-09	0.012	0.0001	34.2	0.0006	0.00012	-0.001	0.012	-0.0001	0.005	11.8	0.0148	-0.01	0.00029	0.002	0.7	-0.0006	2.29	-0.00001	2	0.087	-0.00001	-0.0001	0.0001	0.0002	0.0008	-0.00004	0.006	-0.0001	
WQ3	09-May-08	-0.1	0.000095	16.4	-0.001	0.00071	0.0022	0.361	-0.0005	-0.005	7.14																			