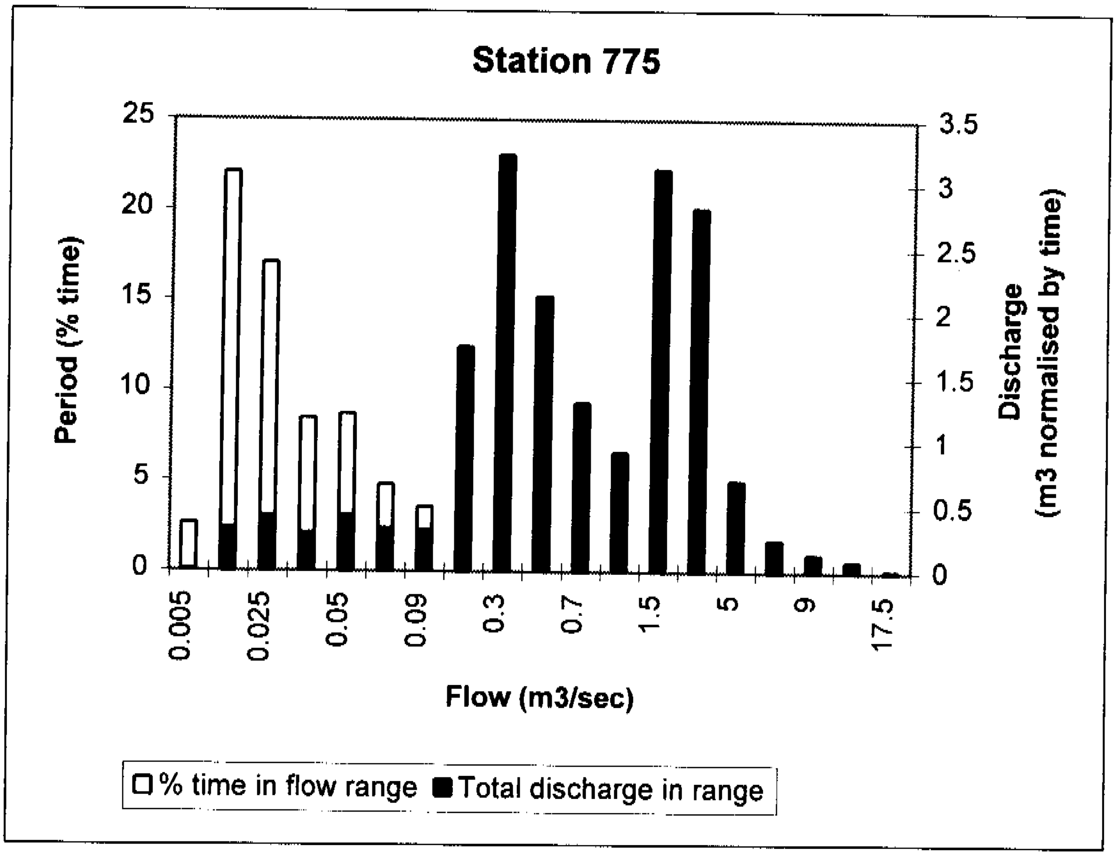

Figure 4.9 Percentage of time in a flow range and total flow within each range for HEC station 775

The Macquarie Harbour–King River Study was initiated in February 1993 and has involved periodic water and sediment sampling of 36 locations in Macquarie Harbour and three locations in the King River over a three year period (Koehnken in press). Typical parameter values for water from two locations within the Harbour during the period of tailings deposition can be seen in table 4.7 (see figure 4.6 for station locations). The last column in table 4.7 presents preliminary data for the first few months after the cessation of tailings discharge. The data are a summary from the DELM Mount Lyell Shutdown Intensive Monitoring Program (see discussion below).

Table 4.7 Macquarie Harbour water quality (total copper–mg/L)

Parameter	Macquarie Harbour station 2			Macquarie Harbour station 9			Macquarie Harbour station 27, post tailings[2]		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
Copper	69	464	2.3	38	166	1	23	87	2
TSS[1]	18	26	14	16	27	0.5	12	22	2.5

1 Total suspended solids

2 Post December 1994 when tailings discharge ceased at MLMRCL

The data indicate dilution of King River water in Macquarie Harbour with increasing distance from the mouth.

The DELM Mount Lyell Shutdown Intensive Monitoring Program was undertaken from December 1994 to May 1995 in response to the closure of the MLMRCL operations. A total of seven locations on the lease site and in the Queen and King Rivers were monitored either at four hourly intervals or daily over a period of five months. Samples were analysed for pH, copper, iron, manganese and aluminium.

The MLMRCL undertook a monitoring program on, and downstream of, the lease site as a part of a regulatory compliance and voluntary monitoring program. A total of 33 stations were monitored periodically (typically monthly) for a range of metal species and other parameters. Similar to the HEC dataset, key parameters such as calcium, magnesium, sodium etc were never analysed. Data from some stations show infrequent sampling and a few sites were sampled only once or twice. A number of stations were sampled on a continuous monthly cycle throughout the five year period of monitoring. A majority of these were regulatory compliance monitoring sites required by DELM. Table 4.8 shows the median and mean concentration of dissolved metal species and other parameters from these stations. See figures 4.5 and 4.6 for locations of monitoring stations.

For all stations, the mean value for zinc was found to be at least two orders of magnitude greater than the median value. A review of the data showed for consistent dates the analyses appeared to be reported as μg/L rather than the usual mg/L, although the stated units were mg/L. These values were corrected by dividing by 1000 prior to recalculating the arithmetic means.

Analyses of the tailings discharge (station 10) showed mean copper and iron values significantly greater than the median values. A review of the raw data confirmed that these values matched those in the database in which copper values prior to mid 1991 were in the order of 0.5 mg/L, after which the data became erratic with values in excess of 600 mg/L. However, after mid 1991 it would appear that total and filtered analyses were mixed in the same column under the heading 'copper'. As the data prior to mid 1991 were very inconsistent the authors approached the laboratory which analysed the samples with a query on their accuracy. The laboratory indicated that the analytical technique prior to 26/8/91 was unsuitable for analysis of tailings and all data prior to this date should be discarded.

The mean value for copper at station 11 was reduced from 4.1 to 1.3 by the removal of a single data point having a value of 135 mg/L. Cross checking with the raw data showed that this entry was incorrect. Due to the number of anomalous data values and inconsistencies in the data and in the absence of apparent trends (except for station 5), it is considered that median values are likely to be more representative of the 'typical' water quality at each monitoring station.

All waters draining the mine area (that were tailings free) contain little suspended solids; are acidic; and analyses for total and dissolved copper are in the same order of magnitude (figure 4.10). Stations 3a and 11 drain catchments that contain overburden rock associated with the mining of Comstock and Cape Horn, respectively. In 1991, water draining from adit 5 into Comstock Creek (station 3a) was redirected into the East Queen River. Just above station 11 there is an uncharacterised source of waste material that produces acidic seepage into the East Queen River. The key water quality parameters for stations 3a and 11 for the period of record are presented in figures 4.11 and 4.12.

The water quality discharging from the upper catchment area of the mine site was determined at station 5 on Haulage Creek (figure 4.13). At station 5 the suspended solids are relatively low, around 10 mg/L, with copper fluctuating around 100 mg/L. Prior to the water reaching the tailings discharge point, just below station 9a, it receives additions from the West Lyell Tunnel (station 6), North Lyell Tunnel (station 7), and mine water and mud from the Conveyor Tunnel (station 8a). The addition from Magazine Creek, the last input prior to the

Table 4.8 Median and mean concentrations of total copper, dissolved metal species (mg/L), flow (L/s) and other parameters calculated from MLMRCL data. Mean values are bracketed.

Station	Fe	Cu(T)	Cu(D)	Zn	Mn	SO_4	pH	TDS[1]	TSS[2]	Flow
3a Comstock Creek below Adit 7	5.07 (12.2)	1.21 (2.9)	1.03 (2.08)	1.61 (3.7)	1.87 (3.1)	40 (95)	3.4 (3.6)	124 (193)	18 (43.8)	98[3]
5 Haulage Ck above West Lyell Tunnel	777 (995)	83 (94)	82.5 (84)	5.9 (5.2)	46 (49)	6430 (6085)	2.4 (2.5)	11350 (13750)	14 (26)	54[4]
6 West Lyell Tunnel	223 (500)	13.4 (15)	14 (13)	4.7 (4.1)	38 (38)	2100 (3770)	2.9 (2.8)	4000 (4413.1)	68 (75.2)	4[5]
7 North Lyell Tunnel	319 (335)	53 (59)	54 (54)	4.6 (3.4)	21 (21)	1655 (1840)	2.8 (2.7)	7020 (2500)	7 (31)	56[3]
8a Conveyor Tunnel	246 (394)	152 (140)	134 (140)	16.6 (11.1)	167 (175)	3995 (4030)	2.8 (2.9)	7020 (6980)	853 (4240)	50[6]
9a Haulage Ck above tailings discharge	421 (410)	107 (120)	89.6 (89.9)	9.3 (8.9)	120 (95)	3975 (3760)	2.7 (2.7)	6890 (6700)	565 (13940)	405[7]
10 Pure tailings before discharge	0.13 (22)	0.3 (76)	0.09 (0.14)	0 (0.03)	0.1 (0.1)	389 (366)	9.1 (9.5)	481 (525)	315000 (230000)	177[8]
11 East Queen River above West Queen River	6.5 (9.2)	1.4 (1.3)	1.3 (1.3)	0.4 (0.66)	0.6 (0.7)	75 (70)	3.3 (3.5)	131 (131.8)	10.5 (16.4)	268[4]
12a Haulage Ck at Slag Dump	145 (260)	137 (154)	42 (33)	5.1 (8.7)	50 (60)	1840 (2030)	3.6 (3.6)	3284 (3279)	92100 (117775)	
14 Queen River at Queenstown	51.6 (57)	10.9 (14)		1.82 (132)	20.55 (24)	769 (755)	3.8 (3.8)	1320 (1365)	7500 (33250)	890

1 total dissolved solids

2 total suspended solids

3 calculated from catchment area post diversion works

4 median flow from continuous monitoring at HEC station 664 (5/93–10/94)

5 median of visually estimated flow; data of poor quality

6 estimated from MLMRCL records

7 median flow at continuous records at HEC station 680 (5/953–10/94)

8 derived from tailings discharge at 200 L/s at 25% solids by weight

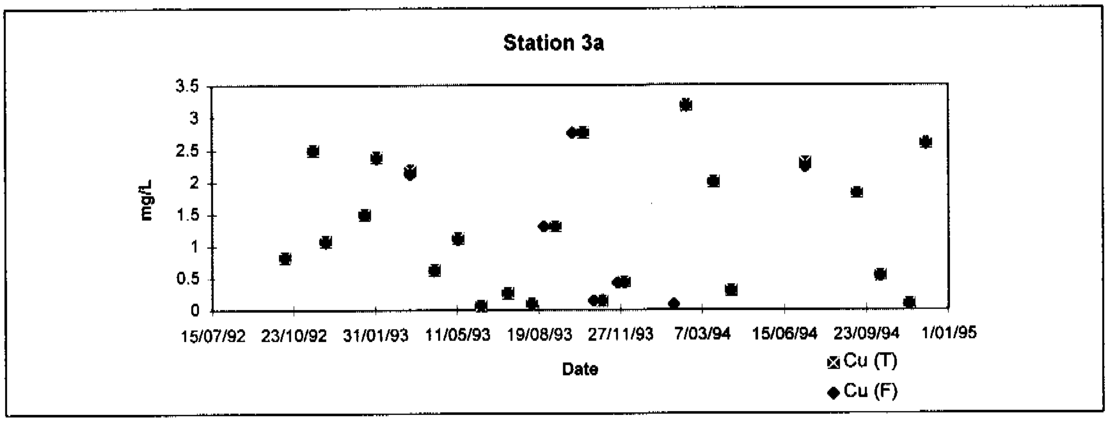

Figure 4.10 Total and filtered copper analyses for Comstock Creek below workings, station 3a (MCMRCL regulatory compliance data)

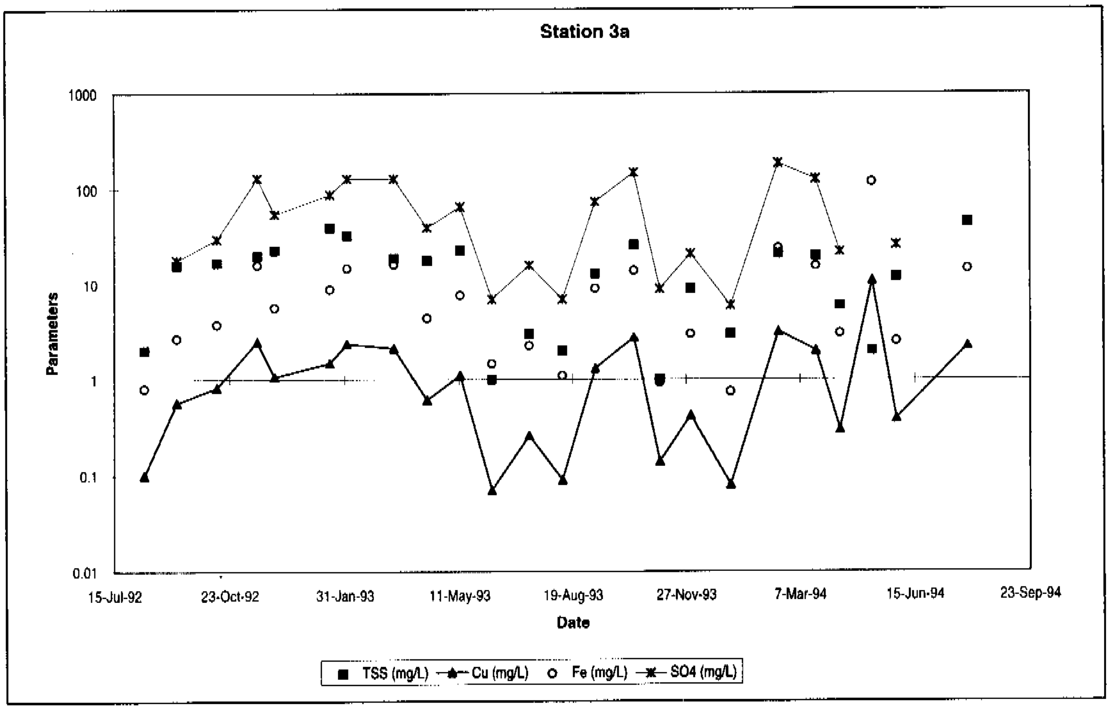

Figure 4.11 Water quality parameters for Comstock Creek below workings, station 3a (MCMRCL regulatory compliance data)

tailings discharge point, has not been monitored. Inputs from the West Lyell Tunnel (figure 4.14) and North Lyell Tunnel dilute the copper concentrations in Haulage Creek, while discharge from the Conveyor Tunnel, at approximately double the copper concentration of station 5, increases the mean total copper concentration to around 107 mg/L at station 9a (figure 4.15).

The relatively short data time series indicates no discernible trends for any station except station 6. The data presented in figure 4.14 indicate that the concentrations of copper, iron and sulphate in this water are decreasing with time. The West Lyell Tunnel drains the upper workings of the southern end of the West Lyell open-cut. This decrease cannot be attributed to dilution and is assumed to represent a decrease in available sites for acid generation.

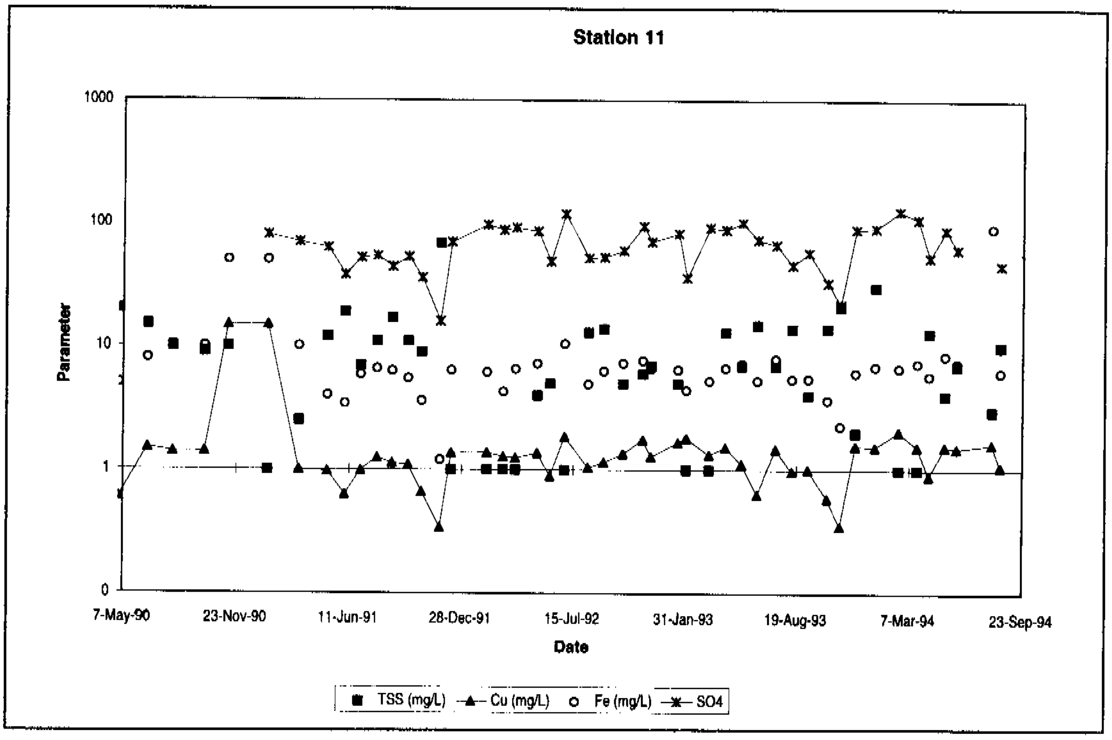

Figure 4.12 Water quality parameters for East Queen River above West Queen River, station 11 (MCMRCL regulatory compliance data)

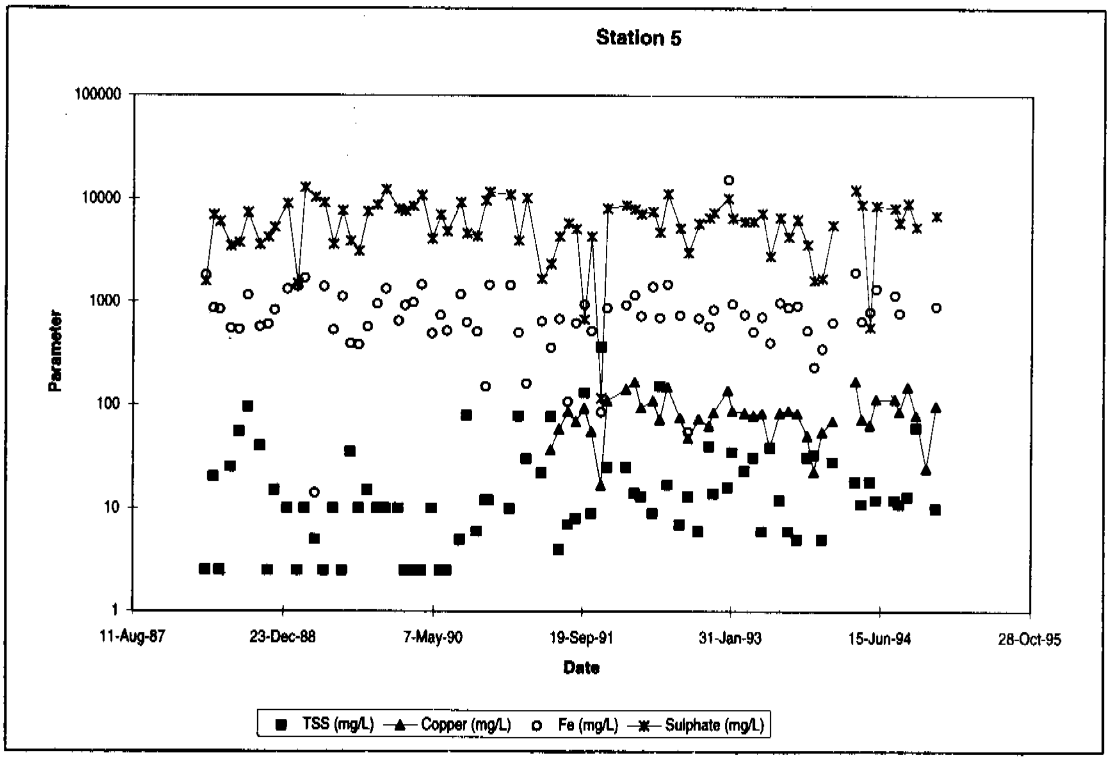

Figure 4.13 Water quality parameters for Haulage Creek above tunnels, station 5 (MCMRCL regulatory compliance data)

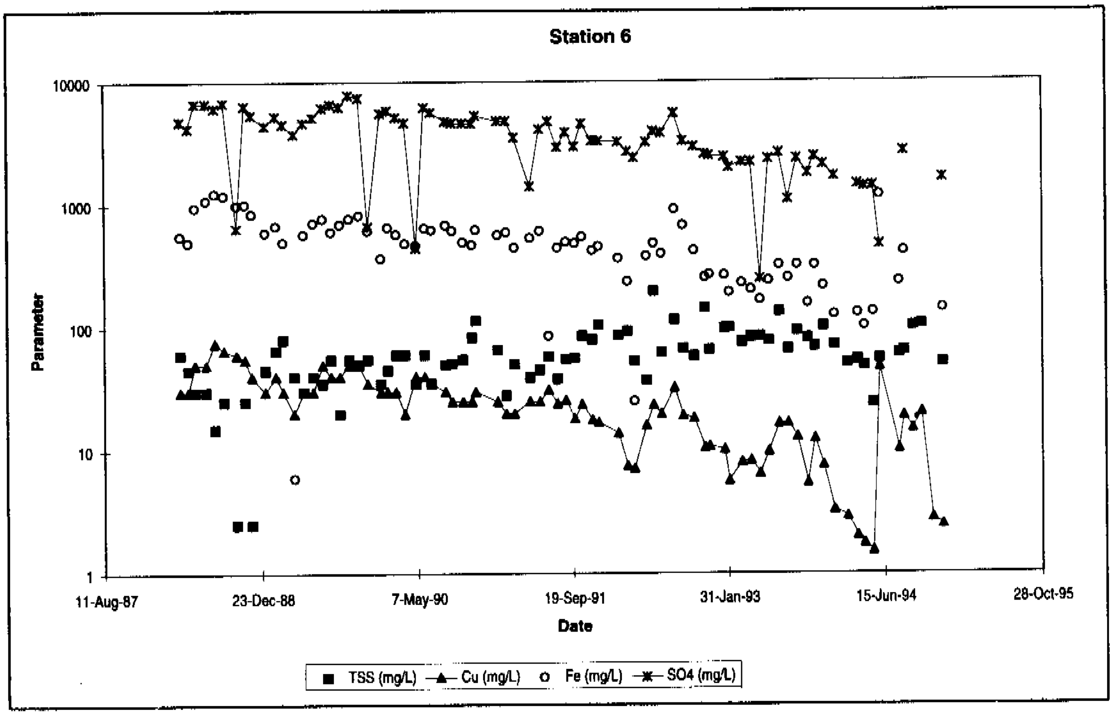

Figure 4.14 Water quality parameters for West Lyell Tunnel, station 6 (MCMRCL regulatory compliance data)

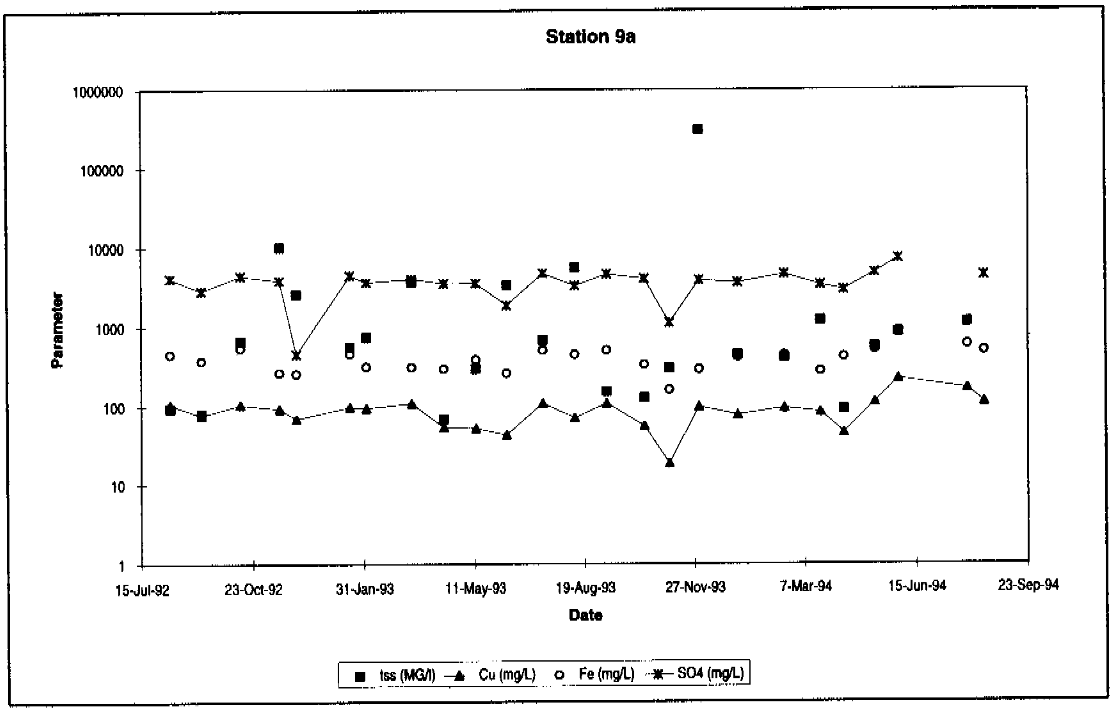

Figure 4.15 Water quality parameters for Haulage Creek at tailings discharge, station 9a (MCMRCL regulatory compliance data)

A significant change in the chemistry of the water that drains the lease site occurred with the cessation of tailings discharge to the river system. Until December 1994, tailings were discharged directly from the flotation plant into Haulage Creek, just below station 9a, at approximately 177 L/s. Median solids content was in excess of 300 000 mg/L and water content comprised around 180 L/s. MLMRCL utilised a conventional flotation process to produce two products, a copper concentrate and a pyrite concentrate, in essentially two stages:

chalcopyrite flotation: with calcium hydroxide (lime) was added in the grinding circuit at an average rate of 1.5 kg per tonne of ore, raising the pH of the process slurry from around 5.5 to 12. This pH ensured adequate depression of pyrite during copper recovery; and

- pyrite flotation: sulphuric acid was added to lower the pH to around 8.6 which increases the sulphate level from around 4 mg/L to over 300 mg/L.

Conventional flotation chemicals (commercial reagents) were used during the flotation process. The chloride content of the water is also increased from around 10 mg/L to about 60 mg/L through the dissolution of chloride containing minerals within the ore.

At station 12a, impact of discharging tailings into Haulage Creek was assessed (figure 4.16). As expected, total suspended solids were diluted from their discharge level of about 270 000 mg/L to around 100 000 mg/L, copper fluctuated around 100 mg/L and pH around 3.5.

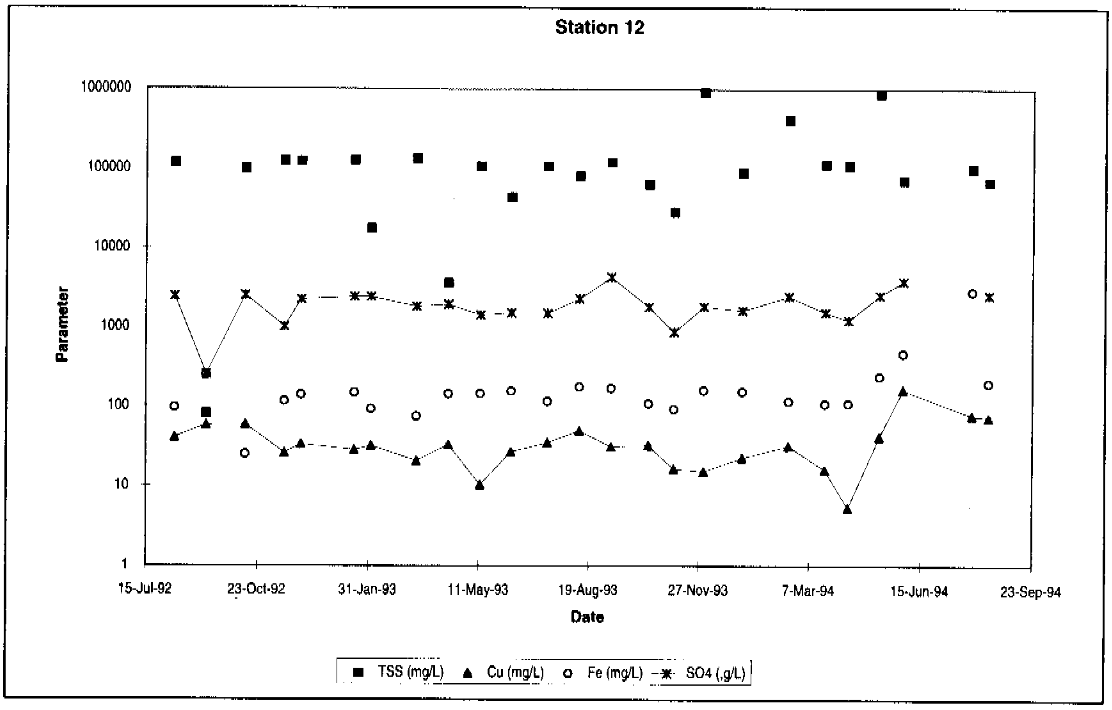

Figure 4.16 Water quality parameters for Haulage Creek at slag dump, station 12a (MCMRCL regulatory compliance data)

The contribution of tailings below site 9a to Haulage Creek had a significant impact on water chemistry. The pH increased from a median value of 2.7 to 3.6. The tailings influx to Haulage Creek also caused increased precipitation by raising the alkalinity and providing a large surface area for the adsorption of metals. From table 4.8 it is evident that station 12a, which lies below the tailings discharge, has a lower dissolved metal concentration than station 9a, and a greater difference between total and dissolved metal concentrations. EGI (1991) found the soluble copper concentrations in acid mine drainage (AMD), tailings, and Queen River water mixtures were significantly less than concentrations calculated on the basis of the individual water bodies. Also, the solubility of most common copper compounds was too high to account for the low copper concentrations reported. EGI concluded the copper concentration was controlled by adsorption reactions rather than precipitation reactions in tailings affected streams. Aluminium behaved in a similar manner to copper although precipitation occurs at a lower pH, commencing at around pH 4.0 while copper precipitation occurs closer to pH 5.0. Iron tends to precipitate at pH 3.5. The effective precipitation of iron is evident in the Queen River, where the river bed is coated with orange iron precipitate. It is expected that iron precipitates as hydroxides or oxides. Iron hydroxide (ferrihydrite) readily adsorbs heavy metals and sulphate, further removing these pollutants from solution. The adsorption of metals onto tailings particles may be controlled by ferrihydrite which coats the particles, increasing their capacity to adsorb metal ions. Tailings material is composed mainly of quartz, muscovite and chlorite which have limited ability to adsorb metals, particularly at low pH. This prompted GH&D (1994) to suggest ferrihydrite has a significant role in coating the tailings particles and increasing their metal adsorption capacity.

Appendix C shows time series plots of key water quality parameters for stations 7, 8a and 10.

Table 4.9 shows the regional water quality for the catchment downstream of the Mount Lyell mine during the period of tailings discharge (calculated from MLMRCL data). In downstream catchments, the level of metallic species and suspended solids are substantially higher and pH has decreased compared with table 4.8. Station 29 has generally a lower pH and higher level of all other parameters than station 28, which is assumed to be the result of re-mobilisation of metals from tailings stored in the delta.

Table 4.9 Water quality characteristics of regional surface water (dissolved metal species and total solids are in mg/L)

Parameter	Queen River at Queenstown MLMRCL–14			King River Teepookana MLMRCL–28			King River delta MLMRCL–29		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
Copper	14	45	2.1	0.6	2.2	0.04	0.93	8.2	0.08
Iron	57	156	6.6	1.6	5.7	0.05	2.44	15	0.05
Manganese	24	71	0.0	1.1	4.8	0.4	1.73	15	0.24
Zinc	132	2530	0.3	0.12	0.7	0.01	0.16	1.57	0.01
SO_4	755	1800	151	54	630	10	73	650	9
TDS[1]	1365	2940	247	90	300	36	139	884	42
TSS[2]	33250	250000	0.5	515	1890	19	800	6900	4
pH (median)	3.8	4.7	2.8	4.7	6.2	3.8	4.6	5.7	3.9
Conductivity (µS/cm)	1300	2590	390	190	760	66	274	1200	58

1 total dissolved solids (mg/L)

2 total suspended solids (mg/L)

During tailings discharge the sediment concentrations in the King River ranged around 100 mg/L with dramatic increases to 10 000 mg/L. Sudden increases in concentration are a response to gate opening and increased water flows from the John Butters Power Station below the Crotty Dam. Sudden increases in flow re-mobilise tailings settled during low flow periods and transport them downstream as a plume. Preliminary sampling in early 1995 showed a sediment concentration of the order of 10–20 mg/L in direct response to the cessation of tailings discharge to Haulage Creek (Locher 1995).

Mounter (1992) found a strong correlation ($R^2 > 0.7$) between conductivity and copper for the HEC monitoring stations in the Comstock and Linda catchments (table 4.10). The MLMRCL data also exhibit similar strong correlations. As sulphate is the major anion in the effluent water, its concentration is strongly correlated with conductivity (figure 4.17). Where the effluent water is derived from a single source there is also a strong correlation between sulphate and copper. However, for monitoring stations that reflect water mixed from a number of sources there is little correlation (figure 4.18). Continuous monitoring of copper concentrations by measurements of conductivity can be achieved relatively cheaply and efficiently where there is an acceptable relationship between conductivity, sulphate and copper.

Table 4.10 Conductivity (μS/cm) and total copper (mg/L) relationships (Mounter 1992)

Monitoring station	Regression equation	R^2
773	Cu=-0133+0.00525×Conductivity	0.77
774	Cu=-0.784+0.00568×Conductivity	0.91
775	Cu=-0.654+0.000976×Conductivity	0.93

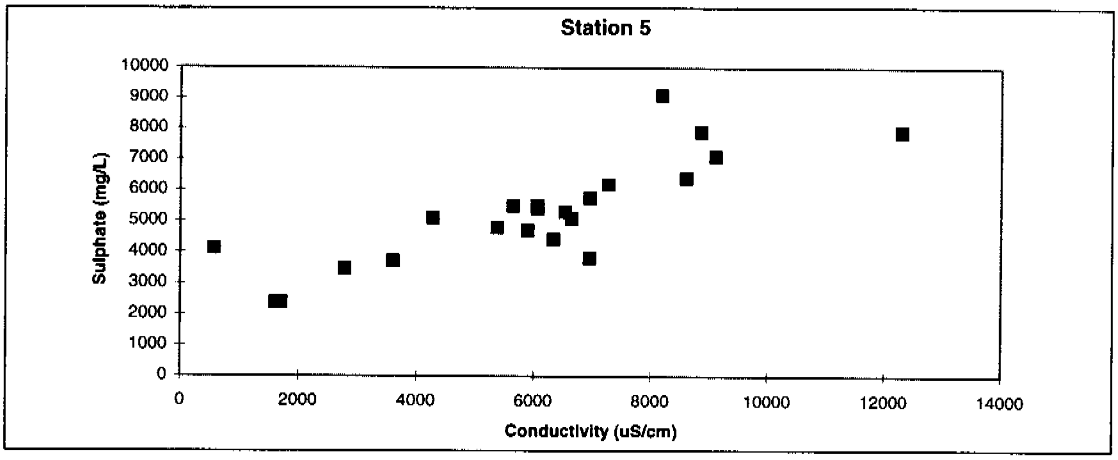

Figure 4.17 Sulphate versus conductivity for Haulage Creek above tunnels, station 5

Typically the MLMRCL dataset show that as flow increases water quality parameter concentrations decrease, however, on occasions this pattern may vary. Both Mounter (1992) and GH&D (1994) showed with HEC rated flow data that there is an inverse relationship between the concentrations of the various water quality parameters and flow. This relationship also suggests that the effluent is diluted by rainfall runoff.

Conversely, in catchments characterised by large volumes of waste rock, seasonal factors may result in increasing concentration with flow. In December 1994, DELM began an intensive monitoring program just below MLMRCL's monitoring station 9a where four hourly water samples were collected using an auto-sampler. The dissolved copper results are plotted in figure 4.19. After 25 March, copper levels in the effluent water increased markedly from around 100 mg/L to in excess of 200 mg/L. This coincided with a period of persistent rain following an exceptionally dry summer. The increase is considered to be due to saturation of the caved area in the Prince Lyell mine and subsequent discharge, via the Conveyor Tunnel, of oxidation products which accumulated in the cave material during the dry summer period. A similar scenario would have occurred in the major waste rock dumps. Under these circumstances, typical dilution with rainfall and increased flows is delayed and preceded by a marked flushing period during which concentrations increase with flow.

4.3.4 Mass load determination

Due to the enormity of the task required to fully remediate the Mount Lyell mine site, funds will need to be directed where the greatest gains in reducing pollution loads to the river system can be derived. In determining the mass pollutant load contribution from specific sources on the mine site to the downstream environment, it is important to have an accurate flow and water chemistry dataset. Lack of quality flow data, particularly for the Conveyor Tunnel which contributes an estimated 60% of the mass pollutant load leaving the lease site, limits the accuracy of determination of mass discharge.

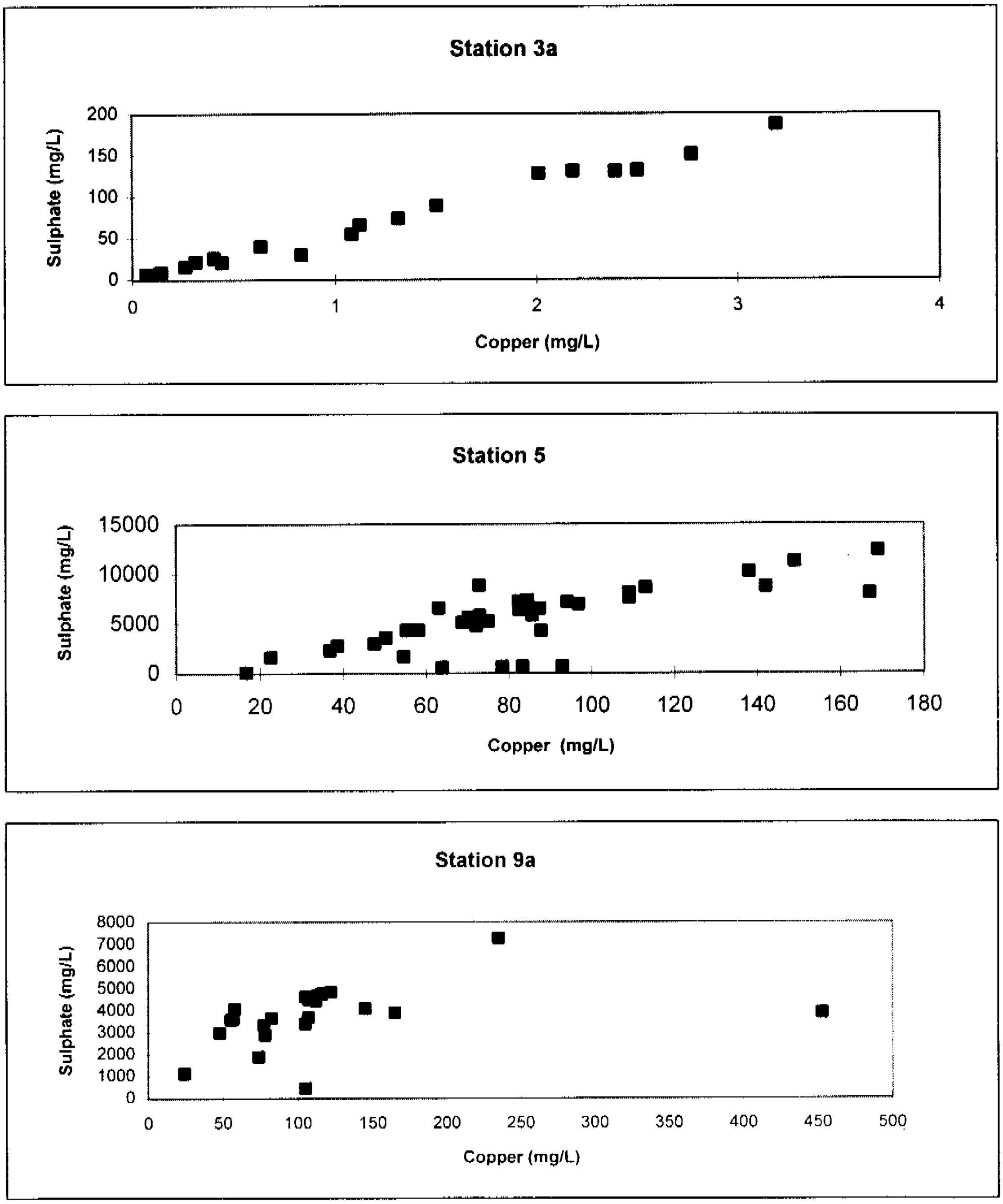

Figure 4.18 Copper (filtered) versus sulphate for stations 3a, 5 and 9a

With the exception of stations 5, 6, 9a and 11, which had flow recorders installed in 1993, all MLMRCL sampling comprised monthly grab samples with estimates of flow from a variety of stations around the lease site and downstream from the mine. The estimate of flow is not considered sufficiently reliable to be used for anything but an indicator of high or low flow.

Previous water quality studies conducted at Mount Lyell (ie EGI 1993, GH&D 1994) utilised MLMRCL recorded data to estimated flow rates for mass load calculations.

In estimating mass loads, EGI (1993) used median flows calculated from mean flow data and mean water quality values. Estimated mean flows were based on catchment size and assuming an annual rainfall of 2500 mm and 100% runoff. The estimated flows compare favourably with the mean measured flows listed in the HEC database.

GH&D (1994) used the EGI calculations for median flows with the exception of sites 5, 6, 9a and 11 which, subsequent to the EGI study, had continuous flow monitors installed. Median values were calculated for parameters of interest in the water quality data, the median being considered a more reliable estimate of the typical flow values than the mean because of the variability in the dataset.

The median flow values from EGI calculated flows, or HEC recorded flows, at these stations were applied to median water quality values to obtain median load values. It is not clear what these values represent but it is almost certainly not median loads. Table 4.11 shows a comparison of the total copper loads using mean and median flow values and median concentrations for three sites: the East Queen River (station 11); Haulage Creek, above the West Lyell Tunnel (station 5); and Haulage Creek, above tailings discharge (station 9a). It is obvious that the copper loads vary distinctly from when using different flow datasets.

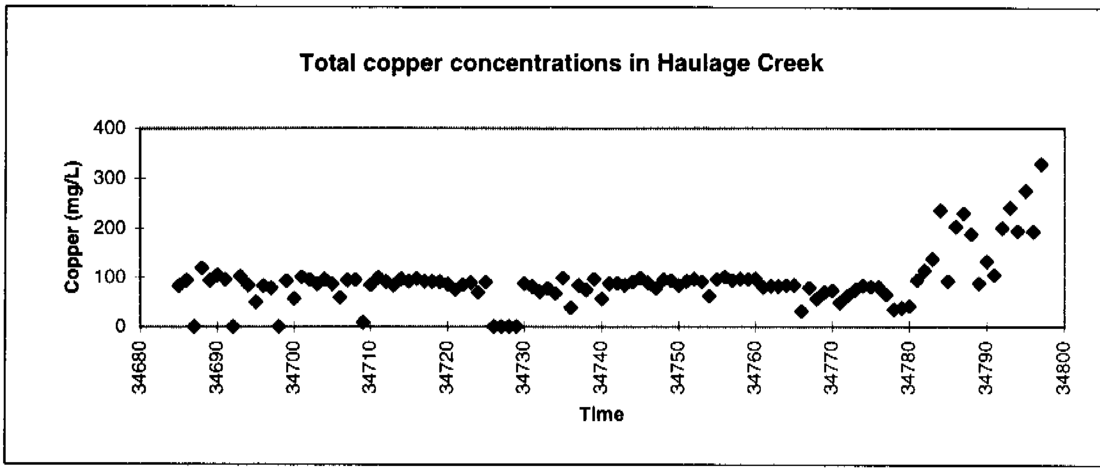

Figure 4.19 Haulage Creek copper concentrations during DELM intensive monitoring program, station 9a

Table 4.11 Dissolved copper loads (kg/d), calculated using various sources of median and mean flow data

Monitoring station	Copper loads (kg/d)[1]	Copper loads (kg/d)[2]	Copper loads (kg/d)[3]	Copper loads (kg/d)[4]
East Queen River (st 11)	348	884	295	273
Haulage Creek above tunnels (st 5)	4455	9900	295	2888
Haulage Creek below tunnels (st 9a)	21593	13440	3300	6541

1 calculated using HEC recorded median flow data

2 calculated using EGI (1993) estimated mean flow data

3 calculated using EGI (1993) estimated median flow

4 calculated using HEC flow equation

In allocating the portions of pollutants to individual sources above the Haulage Creek station 9a, just prior to the tailings discharge point, GH&D assumed that Magazine Creek, for which there are no physically recorded measurements, contributed the unknown quantity in the mass balance. Using copper as an example, table 4.12 shows the mass balance derived by GH&D at Haulage Creek, station 9a.

Table 4.12 Estimated median total copper mass load (L) at Haulage Creek, station 9a, using median concentration and median flow values (modified after GH&D 1994)

Station	Copper load (kg/day)	Copper loading (%)
Haulage Creek above Tunnels (st 5)	340	16.5
West Lyell Tunnel (st 6)	3	0.1
North Lyell Tunnel (st 7)	239	11.6
Conveyor Tunnel (st 8a)	648	31.5
Magazine Creek	829 [1]	40.3
Haulage Creek below Tunnels (9a)	2059	100

1 $L_{Magazine\ Creek} = L_{9a} - (L_5 + L_6 + L_7 + L_{8a})$

From table 4.12, approximately 40.3% of the total copper loads is attributed to the Magazine Creek catchment. A comparison of total copper loads at Haulage Creek station 9a, using median flow values and mean concentrations, is shown in table 4.13. It can be seen that when the sum of median flow inputs is used to derive a mass load for station 9a, the copper load of 2080 kg/d approximates the sum of mass loadings from all respective inputs of 1856.3 kg/d, indicating Magazine Creek is likely to be only a minor contributor of copper loading to Haulage Creek (10%).

Table 4.13 Estimated median total copper mass balance at Haulage Creek, station 9a

Monitoring station	Median flow value (L/s)	Mean copper concentration[7] (mg/L)	Copper mass load (Kg/d)	Copper loading (%)
Haulage Creek, above Tunnels (st 5)	54[1]	83	387.2	18.6
West Lyell Tunnel (st 6)	4[2]	13	4.5	0.2
North Lyell Tunnel (st 7)	56[3]	53	256.4	12.3
Conveyor Tunnel (st 8a)	92[4]	152	1208.2	58.1
Magazine Creek	19[5]	-	214 [8]	10.8
Total			1856.3	100
Haulage Creek, below Tunnels (st 9a)	225[6]	107	2080	

1 median flow from continuous record (5/93–10/94)

2 median of visually estimated flow MLMRCL; flow is consistently low with little variation

3 median flow from continuous record (5/93–10/94)

4 continuous record (4/95–10/95)

5 EGI flow determined from catchment area

6 median flow (F) of site 9a = $F_5 + F_6 + F_7 + F_{8a}$

7 derived from MLMRCL monitoring data

8 $L_{Magazine\ Creek} = L_{9a} - (L_5 + L_6 + L_7 + L_{8a})$

Water pumped from underground via the Conveyor Tunnel is by far the largest copper contributor to Haulage Creek. This reflects the high pyrite and copper content of the ore and waste rock within the active mine area below the West Lyell open-cut.

The West Lyell waste rock dumps are the second greatest contributors to pollutant loads. MLMRCL commissioned ANSTO to monitor oxygen and temperature profiles within these dumps. ANSTO (1994a, 1994b) indicated the dumps are oxidising at the maximum rate possible, with no factor limiting, and this is likely to continue for a period of up to 60 years. Preliminary modelling suggests sulphate loads may continue at a reduced rate for up to 600 years in the absence of remediation strategies.

5.0 Conclusions

A substantial volume of literature has accumulated on the environmental impacts associated with mining at Mount Lyell, with most attention focused on the discharge of acid leachates from the site. The most limiting factor in assessing these impacts is a lack of quality data, particularly in respect of water flows in catchments draining the lease site. Where good data exist they are frequently of short duration, and inadequate to fully represent the range of seasonal variation.

The Comstock–Linda catchments have good quality flow data as a result of monitoring by the Hydro-Electric Commission. Environmental monitoring in these catchments is associated with the development of Lake Burbury and the need to protect the ecological values of this lake, particularly for recreational fishing. In the Queen River catchment, acceptable water quality data are available for stations 5, 11 and the North Lyell Tunnel from 1993 to present, as a result of continuous monitoring at these stations.

EGI has developed reasonable flow estimates for other catchments on the lease site which have not been monitored. Estimates have been derived from the size of the subcatchment and assuming an annual rainfall of 2500 mm and 100% runoff to give a mean flow. Median flows were determined by applying a conversion factor to the mean, consistent with measured HEC data for similar catchments.

The Hydro-Electric Commission has demonstrated a good relationship between catchment areas and median flows. Median flow values have generally been used to calculate mass loads by EGI, HEC and GH&D.

A combination of catchment characteristics and rainfall intensities indicate that up to 80% of runoff may occur in 20% of the discharge period in small lease area catchments. Consequently, the use of median values to represent typical discharge may substantially underestimate mean or total flows. Use of median flows for determining mass loads in these catchments is likely to underestimate total discharges.

The dataset for water quality parameters is highly variable and datasets should be thoroughly checked against laboratory analytical reports where possible. Due to the inconsistencies in the concentration data, median concentrations for water quality parameters are considered appropriate.

Few trends are evident in the monitoring dataset with the exception of station 6, West Lyell Tunnel, which demonstrates a gradual decrease in sulphate, iron and copper in the past five years. The most likely cause of this is thought to be a decrease in the rate of oxidation of sulphates as available sites are oxidised and leached.

Strong correlations exist between conductivity, sulphate and copper concentrations for waters derived from a single source. Conductivity may provide a useful indicator of copper loads in point source streams on the lease site. The correlation tends to break down when effluent sources are mixed.

Both HEC and GH&D data suggest an inverse relationship between water quality parameters and flow, suggesting concentrations may be diluted by rainfall. However, this relationship is not always consistent for catchments containing large volumes of waste rock, where increasing flows associated with rainfall following long dry periods results in peak metal loads associated with flushing of oxidation products.

For streams low in suspended solids and high in acidity typical of the Mount Lyell lease site, total and dissolved parameters are very similar. However, this is not the case for tailing-contaminated waters where the abundance of adsorption sites on tailings particles results in a reduction of dissolved parameters.

For surface catchments there is an obvious relationship between the catchment characteristics related to mining activities and pollutant loads. The major pollutant source is the Conveyor Tunnel in the Haulage Creek catchment, which contributes in the order of 60% of total metal loads to the Queen River. The West Lyell waste rock dumps in this catchment are the second major source of pollutant loading (approximately 20%).

For the single West Lyell waste rock dump monitored by ANSTO (1994b) it was estimated that acid generation will continue for more than 600 years. Measurements have shown that approximately 130 tonnes of copper and 1300 tonnes of sulphate per year leach from a single 25 ha dump below the West Lyell open-cut.

The Mount Lyell mining lease sites are likely to be an ongoing source of pollution as a result of acid drainage to downstream water catchments. There have been insufficient good quality data to accurately quantify and characterise effluent discharges from the lease site, particularly in respect to flows. For environmental assessment, good quality information is required to develop time duration analyses of concentrations and loads, and the current dataset is inadequate for this application.

In order that environmental remediation strategies are effectively targeted for maximum possible benefit, it is critically important that good quality environmental monitoring data are collected. Provision of accurate monitoring data will greatly facilitate future site management decisions.

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