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An assessment of the performance of the Ranger RP1 constructed wetland filter during releases in 1995 and 1996

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AN ASSESSMENT OF THE PERFORMANCE OF THE RANGER RP1 CONSTRUCTED WETLAND FILTER DURING RELEASES IN 1995 & 1996

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Abstract

Keywords: Constructed Wetland Filter, manganese, uranium, magnesium, sulfate, pH, electrical conductivity, ameliorative mechanisms.

Energy Resources of Australia Ltd (ERA) has constructed and maintains a wetland filter in the catchment of Retention Pond 1 (RP1) at the Ranger mine site. The filter comprises eight cells of different sizes with a combined surface area of about 56 000m^2 and volume 45 000m^3. The effective minimum flow path is approximately 1 240 m. The filter was constructed as part of Ranger's water management system, and is designed to remove certain contaminants from the effluent stream of Retention Pond 2 (RP2) before flood irrigation of the amended water elsewhere in the RP1 catchment. Various wetland plants are present, including *Eleocharis* and *Nymphya sp.*

The constituents of RP2 water that are present at greatly elevated concentrations compared with unaffected waters in neighbouring creeks are: magnesium (Mg); sulfate (SO_4^{2-}); manganese (Mn) and radionuclides such as uranium (U) and radium (Ra). The wetland filter is moderately to very effective at removing Mn, moderately effective at removing U and almost totally ineffective at removing Mg and SO_4^{2-}. Manganese, present mainly as Mn^{2+} in influent water is removed principally by oxidation to manganese oxides during passage through the wetland, which then settle from the water column. Uranium is probably removed mainly by adsorption from the water column to iron (Fe) rich particulates. Transit time in the wetland filter is likely to be the main determinant of retention efficiency for U, with influent pH apparently playing a lesser role.

The principal objective of this report is to elucidate the factors responsible for the ameliorative effect of the wetland filter. The behaviour of Ra has not yet been thoroughly assessed and is not discussed further in this report.

Introduction

The location and configuration of the RP1 Constructed Wetland Filter (CWF) are shown in Figures 1 and 2. Its dimensions are given in Table 1.

Cell	Flow Length (m)	Surface Area (m^2)	Volume (m^3)
1	122	2500	2700
2	116	2050	3800
3	31	1140	2650
4	324	17500	13300
5	67	2400	2100
6	159	9000	8200
7	221	11300	6600
8	200	9900	5800
total	**1240**	**55790**	**45150**

Table 1: Dimensions of the RP1 Constructed Wetland Filter (ERA, 1996)

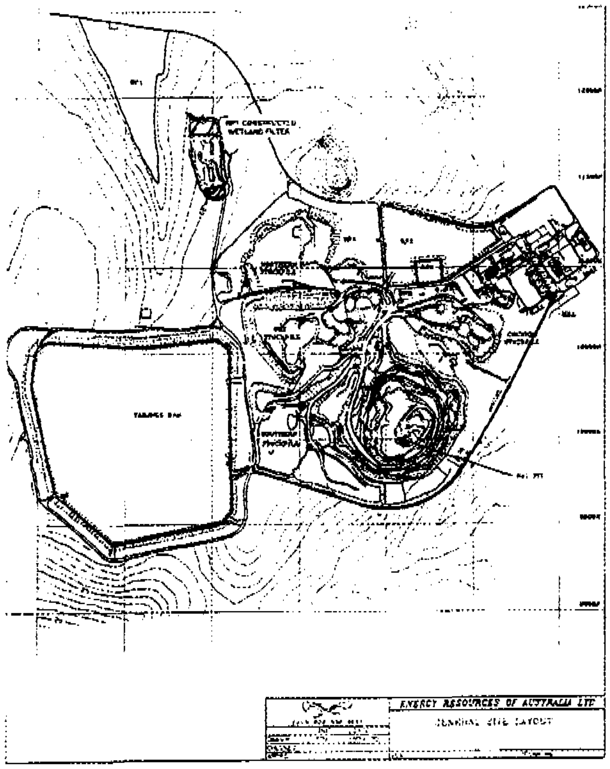

Figure 1: Location map of the RP1 Constructed Wetland Filter (source: ERA 1996)

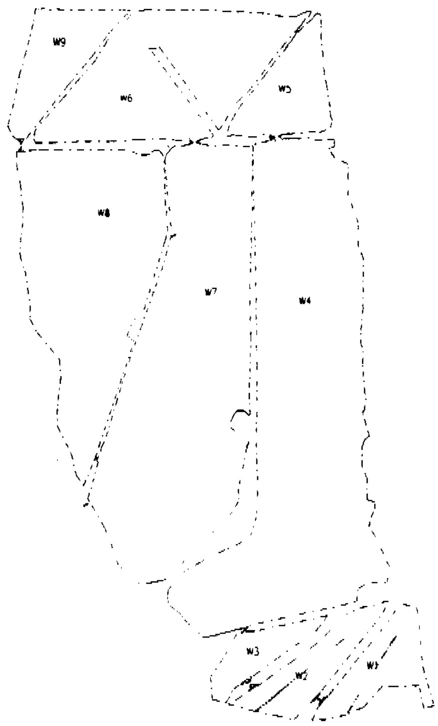

Figure 2: Configuration of the RP1 Constructed Wetland Filter

Modification to a pre-existing experimental wetland system commenced in May 1995 (ERA 1996), comprising bunding and additional excavation of a disused clay borrow pit. The unusually wet 1994-95 Wet Season, which resulted in an abnormally large accumulation of restricted release zone (RRZ) water, provided a major impetus to the development.

ERA had previously used a wetland filter approach to attenuate contaminants in RP4 (non-RRZ) water (RUM Pty Ltd, 1989; Akber *et al.*, 1992). The new wetland filter was designed to ameliorate potentially larger volumes of effluent that contained significantly higher concentrations of contaminants, particularly U and Mn.

The RP1 CWF is termed an immature wetland because, being newly constructed it does not approach equilibrium with respect to biotic processes and steady-state cycling processes. Hence, its performance and internal processes cannot be expected to reflect those of a mature system. Nevertheless, its efficiency has been monitored during the release episodes of 1995 and 1996, to assess its effectiveness in removing potentially harmful contaminants, and the data examined to determine the most likely processes leading to contaminant retention.

Discharge parameters and sampling strategy

In 1995, RP2 water was discharged between 5 July and 1 November, with 450 800 m^3 of effluent passing through the filter (ERA, 1996). In 1996, a total of 163 400 m^3 was discharged between 13 June and 31 August (ERA internal data). In both years, samples were collected from the inlet stream, and at the outflow from each of the eight cells before the sump. All samples were analysed by ERA environmental services for pH, electrical conductivity (EC), turbidity, bicarbonate, sodium, magnesium, chloride, sulfate, manganese, uranium and iron. The latter three were determined in both a total and filtered (<0.4 μm) sample.

The sampling strategy used in 1996 was considerably different from that of 1995. In 1995, an attempt was made to align sample collection with the passage of the discharge pulse through the wetland filter. This was achieved by taking an inlet sample at the time of discharge, and collecting samples at cell outlets an appropriate number of days later. This procedure was repeated approximately weekly. The criteria used to determine retention time is not disclosed in ERA documentation, but presumably EC measurement was used, because the standing water in the wetland before discharge typically has a value of 300-350 $\mu S\ cm^{-1}$ compared with 800-1000 $\mu S\ cm^{-1}$ for RP2 water. Effluent at the outlet to cell 8 had a mean retention time of about 11 days during 1995, and it is this value that has been used here to determine analyte attenuation in discharge pulses, with pro-rata retention times for other cells calculated using proportional flow path lengths. The complete data set is recorded in Appendix 1.

In 1996, rather than attempt to design a sampling program based on the retention time of the discharge, an alternative approach was used. Sampling did not begin until 6 days after effluent discharge commenced. Sampling was then performed at several sites on the one day in somewhat irregular fashion, though at least some sites were sampled about three times per week. Because much less water was discharged during 1996, the retention time was much longer. Figure 3 shows the change in the EC of inlet and outlet (cell 8) water with time. It is evident that outlet water did not achieve inlet water EC values for at least 30 days. A value of 32 days has been used for the mean retention time in the wetland filter for the year. The ERA sampling program for 1996 was somewhat deficient, apparently because of an underestimation of the retention time in the wetland filter as a result of the smaller total discharge volume, compared with 1995. It is evident from the data set (Appendix 2) that many samples from later cells were taken before discharge water had displaced water already present. The results from these samples were discarded from the interpretation of wetland performance.

For the eight cells of the wetland filter, 1.5±0.2 times the cell volume of effluent water was required to achieve steady state electrical conductivity. Flow data are presented in Appendix 3.

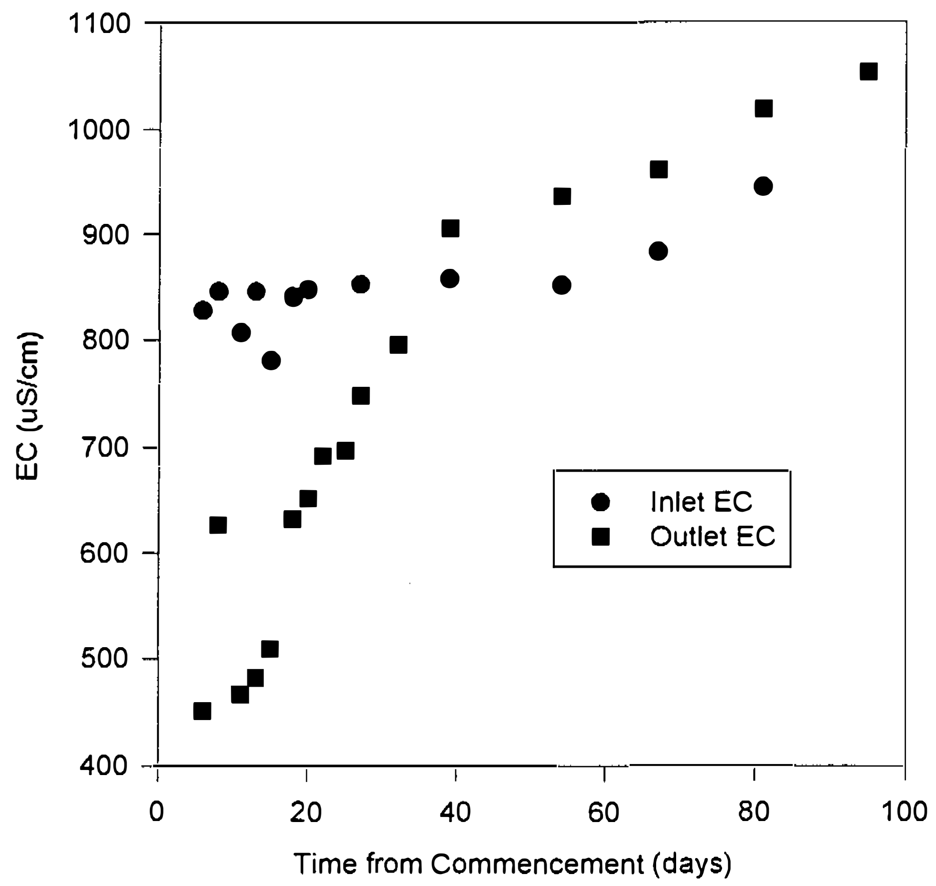

Figure 3: Electrical Conductivity at Wetland Filter Inlet and Outlet, 1996

Discussion of 1995 Dry Season data

Performance characteristics

The inlet concentrations of soluble U, pH, soluble Mn and SO_4^{2-} for samples taken during the release period are shown in Figure 4. Sulfate concentration is relatively constant with no discernible trend during the period. However, the concentrations of the other species are highly variable, with highly significant correlations between them. For example, the correlation coefficient for the regression of U against pH is 0.86 (n=26); for Mn against pH, -0.62 (n=23, with the final three points excluded) and for Mn against U, -0.82 (n=23). Mean wetland efficiency (comparable samples only) for Mn and U removal were about 96% and 54%, repectively.

Input water quality is dominated by a pH excursion between days 35 and 130 of the release, when pH increased from about 7.4 to 9.3, with a relatively rapid subsequent decline to 7.0. The probable explanation for this excursion is the temporary storage of surplus RRZ water in Pit 1. The rocks lining Pit 1 contain significant carbonate mineralisation (chiefly magnesite and dolomite) which probably leached, together with residual uranium, into the stored water. Whether the elevated carbonate alkalinity of the stored water had an active role in leaching uranium from the pit wall cannot be inferred from the available data. The high pH of this water would facilitate the rapid and almost quantitative oxidation of soluble manganese to manganese oxides, leading to the observed negative correlation between Mn and pH (and U). The final three samples were probably taken from water that had resided only in RP2 (pH < 8). The high concentration of soluble Mn in these may reflect an uptake from previously anoxic bottom waters.

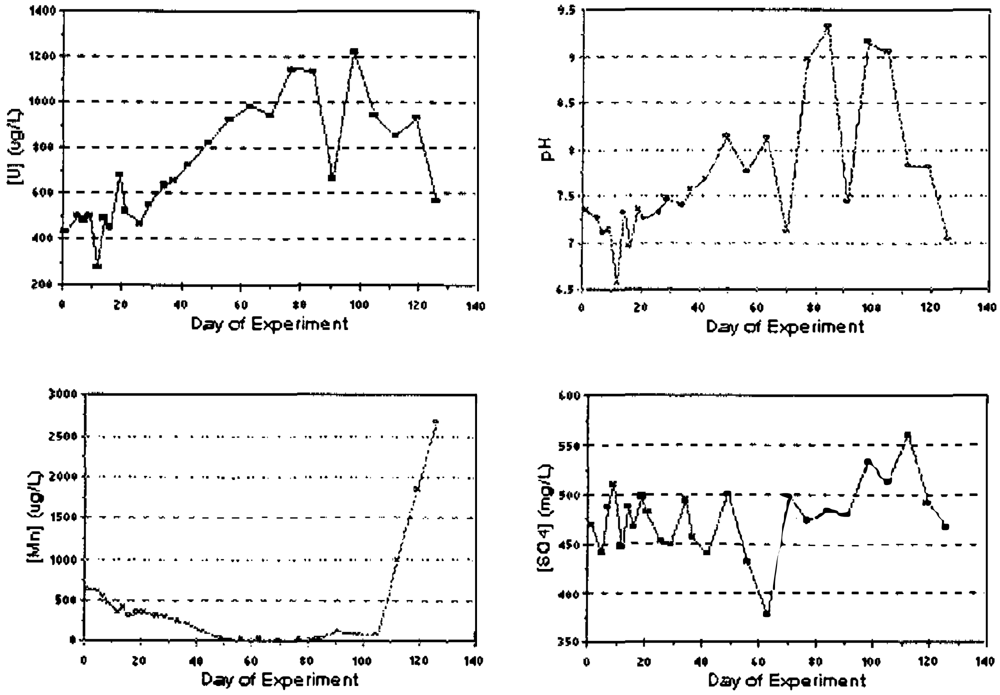

Figure 4 Inlet concentrations of species for duration of release

The wide range of observed pH during the release period provided an opportunity to examine the effect of influent pH on the efficiency of the wetland in removing U. Attenuation of U in successive pulses is shown in Figure 5.

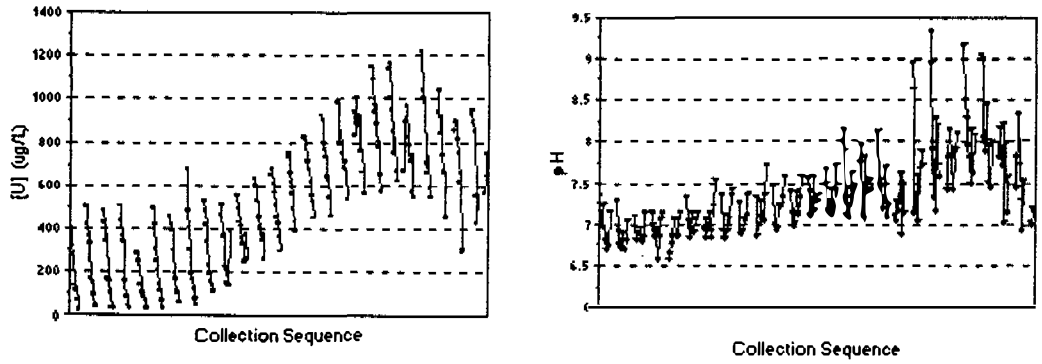

Figure 5 Uranium removal efficiency and pH changes in successive effluent pulses, 1995

This diagram helps explain the variable efficiency of U removal in the wetland during 1995. It is evident, that under the flow conditions prevailing during the release period, the wetland removes approximately 500 μg/L of U, regardless of the influent pH. Of itself, this may be taken to imply that pH is not a determinant of wetland efficiency for U removal. Superficially, this would be surprising because high pH favours the speciation of U as anionic hydroxo and carbonato complexes. These have relatively low adsorptivity onto most natural (mineral and organic) substrates which themselves are usually negatively charged (Hunter 1993), especially at high pH. However, two points need to be considered.

- The wetland is capable of reducing high influent pH values to near neutrality by the time a pulse reaches the outlet. This enables the speciation of the U to change to forms that are more amenable to adsorption and hence removal.
- Pulses with relatively low initial [U] have only a modest U burden by the time they enter cells 7 and 8, so little is available to be removed. In contrast, the data from the high U (and pH) pulses suggest that cells 7 and 8 have considerable *capacity* to remove U, which is superfluous in the case of low concentration pulses.

Therefore, higher influent [U] and pH appears to change the *location* within the wetland of U removal, but not the absolute amount removed. It is probable that the wetland has the capacity to remove greater quantities of U when the influent pH is near neutral, because of the greater ability of the earlier cells to remove U that is not in anionic forms.

Mechanisms of manganese and uranium removal

Table 2 gives comparative mean data for all sampling sites. These means were calculated by excluding data for pulses where not all sites were sampled. That is, data were included in the calculation of the mean only if all sites were sampled as the pulse passed through. This was done to avoid biasing means by including data for which corresponding values were not available for all sampling points.

Site	Distance from Inlet (m)	$[Mn]_{soluble}$ (μg/L)	$[Mn]_{particulate}$ (μg/L)	$[Mn]_{total}$ (μg/L)	$[U]_{soluble}$ (μg/L)	$[U]_{particulate}$ (μg/L)	$[U]_{total}$ (μg/L)	$[Fe]_{soluble}$ (μg/L)	$[Fe]_{particulate}$ (μg/L)	$[Fe]_{total}$ (μg/L)
Wetland Inlet	0	273.9	29.1	303.0	709	10.9	719.6	18.5	96	115
Outlet Cell 1	127	253.0	30.8	283.8	677	10.1	687.2	22.3	80	102
Outlet Cell 2	257	164.8	27.9	192.6	615	11.3	626.2	19.1	83	102
Outlet Cell 3	295	137.5	15.1	152.5	575	7.8	583.2	22.1	78	100
Outlet Cell 4	615	64.8	15.6	80.5	479	5.2	483.9	20.8	52	73
Outlet Cell 5	685	63.0	7.0	70.0	420	8.5	428.0	47.6	121	169
Outlet Cell 6	828	44.7	7.1	51.8	417	4.1	420.8	45.7	98	144
Outlet Cell 7	1068	25.8	4.8	30.6	334	3.1	337.2	39.9	84	124
Outlet Cell 8	1298	9.9	2.5	12.4	324	2.8	327.2	30.0	109	139

Table 2: Mean analytical data for pulses where all sites were sampled

Table 3 records the calculated rate equations for the loss of soluble, particulate and total Mn and U, where D is the distance from the wetland inlet. In all cases the data conforms satisfactorily to first order kinetics.

Rate Equation	Statistical data	Implied k
$\ln[Mn]_{soluble} = -0.0025\ D + 5.74$	r=0.993, n=9	$2.5 \times 10^{-3}\ m^{-1}$
$\ln[Mn]_{sorbed\ (obs)} = -0.0020\ D + 3.56$	r=0.964; n=9	$2.0 \times 10^{-3}\ m^{-1}$
$\ln[Mn]_{total} = -0.0024\ D + 5.85$	r=0.994; n=9	$2.4 \times 10^{-3}\ m^{-1}$
$\ln[U]_{soluble} = -0.00066\ D + 6.57$	r=0.988; n=9	$6.6 \times 10^{-4}\ m^{-1}$
$\ln[U]_{sorbed\ (obs)} = -0.0012\ D + 2.50$	r=0.932; n=9	$1.2 \times 10^{-3}\ m^{-1}$
$\ln[U]_{total} = -0.00066\ D + 6.58$	r=0.989; n=9	$6.6 \times 10^{-4}\ m^{-1}$

Table 3: Rate equations and related data for loss of Mn and U from the RP1 CWF

Two conclusions can be drawn from these data. Firstly, because the rates of loss of total Mn and U are equivalent to the rates of loss of the soluble metals, the rate determining step for loss of both metals is the transformation of the soluble species to sorbed forms. Secondly, although the concentrations of particulate Mn and U are highly correlated ($P = 0.002$; n=9), the scavenging of soluble U by manganese oxides generated by oxidation of soluble Mn *cannot* be the only mechanism for removal of U. This is because the observed rates of loss of *particulate* Mn and U are significantly different ($P = 0.002$; n=9). This conclusion was inferred by an analysis of the regressions of the logarithm of concentrations against distance, using a paired t-test. This result does not imply that no U is removed in this way. However, the analytical concentrations of Mn and U are similar, so there is probably insufficient Mn for its oxides to be efficient scavengers for U.

There are at least two plausible mechanisms for the removal of soluble Mn and U from the water column:

- transformation of soluble species to insoluble ones in the water column, followed by sedimentation of the particulates. In the case of Mn, oxidation of Mn^{2+} to MnO_x is the most likely route. For U, adsorption onto suspended oxides or other particulates, which may also contain an organic coating, is more probable. For both metals, *biological* adsorption or absorption from the water column, for example by algae, is also possible.
- biological uptake and direct adsorption of the soluble species by sediment and the walls of wetland cells.

Implications of mechanism 1 (transformation in the water column)

If the first mechanism is operative, the sequence of reactions is:

$$M_{soluble} \rightarrow M_{suspended} \rightarrow M_{sediment}$$

This is a consecutive mechanism, with the rate constants for the two processes termed k_1 and k_2. It is important to note that k_2 is not equivalent to the implied k given in Table 2 above for loss of particulate metals. This is because the measured concentration of suspended metal is maintained by the conversion of soluble metal (until the latter is exhausted). Therefore, the *observed* rate is much slower than the *inherent* rate of sedimentation. For Mn, this can be inferred because the rate determining step is the loss of soluble metal, despite the *observed* rate of sedimentation being slower than this preceding step. It is evident that if the true rate of loss of particulate Mn was slower than its rate of production, then $Mn_{suspended}$ would accumulate in the water column, contrary to observation. The true value for k_2 can be derived from the following equation (Laidler 1987):

$$[M_{suspended}] = \{[M_{soluble}]_{init} \times k_1 \times (e^{-k_1 t} - e^{-k_2 t})\}/(k_2 - k_1)$$

Although this equation assumes an initial value for $[M_{suspended}]$ of zero, the *inherent* rate of sedimentation is likely to be so rapid that measured $[M_{suspended}]$ will be dominated by particulates formed in the wetland, rather than pre-existing ones, after the first one or two sampling sites. This rate equation was solved for k_2 for both Mn and U, using the measured values of $[M_{suspended}]$. The best fit to the data gave values for k_2 of 0.014 m^{-1} and 0.07 m^{-1}, respectively. Greater emphasis was placed on improving the fit for data from later cells, because these would have a smaller component of suspended metal that was already present at the wetland inlet.

For the mean retention time in the wetland during 1995 (about 11 days), the values of k_2 are equivalent to 1.9×10^{-5} s^{-1} (Mn) and 1.0×10^{-4} s^{-1} (U). The values for k_1 (loss of soluble metal) are 3.4×10^{-6} s^{-1} (Mn) and 9.0×10^{-7} s^{-1} (U).

Implications of mechanism 2 (direct adsorption of solutes to boundary substrates)

If the second mechanism is operative, the values for k_1 are the same (though in this case not describing a soluble-to-suspended process), while k_2 values are those recorded in Table 3 for loss of particulate metals. This is because the deposition of suspended metals is then decoupled from the loss of solute, and forms an independent process. For the mean retention time in the wetland filter, these k_2 values correspond to 2.7×10^{-6} s^{-1} (Mn) and 1.6×10^{-6} s^{-1} (U).

Table 4 records these kinetic data and other relevant information.

Mechanism	k_1 (s^{-1})	k_2 (s^{-1})	$t_{½}$ (solute) (s)	$t_{½}$ (suspend) (s)	Implied diameter (µm)©
adsorption / deposition	3.4×10^{-6} (Mn) 9.0×10^{-7} (U)	1.9×10^{-5} (Mn) 1.0×10^{-4} (U)	200 000 (Mn) 770 000 (U)	36 400 (Mn) 6 900 (U)	~20 µm (Mn) ~40 µm (U)
direct adsorption	3.4×10^{-6} (Mn) 9.0×10^{-7} (U)	2.7×10^{-6} (Mn) 1.6×10^{-6} (U)	200 000 (Mn) 770 000 (U)	254 000 (Mn) 423 000 (U)	~ 8 µm (Mn) ~ 5 µm (U)

©: calculated using Stoke's Law (Dingman, 1984)

Table 4: Kinetic and related data for the two proposed mechanisms for soluble metal loss

These data do not allow an unequivocal decision to be made regarding the mechanism of loss for soluble metals. However, we note that the concentration of electrolyte in the wetland (principally $MgSO_4$) is 10-20 times greater than the *critical coagulation concentration* (ccc) expected for this ionic medium with the dominant particulate substrates found in the wetland (Sposito, 1984). Hart and McGregor (1982) flocculated Retention Pond 4 particulates using $Al_2(SO_4)_3.18H_2O$ at the ccc (~30 mg/L) and observed a $t_{½}$ for settling of about 1 500 s, implying a mean particle diameter of ~80 µm. If this settling rate (and implied particle size) is representative of local conditions, the observations are more consistent with the water-column adsorption mechanism.

Padovan (1994) has cultured several species of local algae, and these have diameters in the 2-8 µm range. Therefore, the data are consistent with the direct adsorption (to benthic and wall substrates) mechanism for soluble metals, with the *pre-existing* particulate Mn and U load adsorbed to algal cells. However, the measured values are less consistent with active adsorption of *soluble* metals by algae in the wetland.

Additional evidence that supports the adsorption/deposition mechanism as predominant is the increase in the mean concentration of particulate U from 5.2 µg/L to 8.5 µg/L in cell 5, with a concurrent increase in the mean particulate Fe concentration from 52 µg/L to 121 µg/L. This contrasts with a generally declining concentration of these and other non-conservative species on passage through the wetland. One explanation for these observations is that a considerable proportion of particulate U is adsorbed onto easily suspended material that is enriched in Fe (either hydrated oxides or oxide coated substrates). This in turn may suggest that the Fe-rich particulates containing U originally deposited from the water column.

Measured concentrations of soluble Fe vary from 18 µg/L to 48 µg/L between cells. It is probable that these <0.45 µm filtrates contain Fe mainly in true solution, because the concentration of colloidal Fe is low in Magela Creek water (Speers, 1995), which has a much lower ionic strength, and hence coagulative capacity, than effluent water in the CWF. Buck (personal communication) has measured Fe^{2+} concentrations of ~250 µg/L in unamended near-bottom waters in cell 3 of the wetland, which may correspond to the observed soluble values in near-surface samples.

Discussion of 1996 Dry Season data

Performance characteristics

The comparative rates of removal of soluble and particulate Mn and U for 1995 and 1996 are shown in Tables 5a and 5b.

Year	k_1^{obs} (soluble)		k_2^{obs} (particulate)	
1995	2.5×10^{-3} m^{-1}	**3.4×10^{-6} s^{-1}**	2.0×10^{-3} m^{-1}	**2.7×10^{-6} s^{-1}**
1996	2.2×10^{-3} m^{-1}	**1.0×10^{-6} s^{-1}**	2.0×10^{-3} m^{-1}	**9.5×10^{-7} s^{-1}**

Table 5a: Comparison of kinetic data for Mn in 1995 and 1996

Year	k_1^{obs} (soluble)		k_2^{obs} (particulate)	
1995	6.6×10^{-4} m^{-1}	**9.0×10^{-7} s^{-1}**	1.2×10^{-3} m^{-1}	**1.6×10^{-6} s^{-1}**
1996	2.2×10^{-3} m^{-1}	**1.0×10^{-6} s^{-1}**	3.3×10^{-3} m^{-1}	**1.6×10^{-6} s^{-1}**

Table 5b: Comparison of kinetic data for U in 1995 and 1996

These data show that the observed rates of loss of soluble and particulate U (s^{-1}) were the same in 1995 and 1996, implying that similar removal processes were probably operative between years. However, the rate of removal of Mn was about three times slower in 1996. This may have been due to faster oxidation of soluble Mn in 1995 because of higher mean pH values at all sites (7.36 for all sites, and 7.40 for the first three cells where most Mn is lost, compared with 7.13 and 7.19 respectively for 1996). Because loss of soluble manganese is presumed to be coupled to the concentration of particulate Mn, the slower rate of loss of the former would lead to a slower observed deposition rate for the latter. The divergent behaviour of the metals, compared with 1995 provides additional evidence that U adsorption to Mn oxides is not a dominant removal mechanism.

The mean efficiency for Mn and U removal during 1996 for comparable samples are recorded in Table 6, together with 1995 values for comparison purposes.

Year	Mn removal	U removal
1995	96%	54%
1996	84%	78%

Calculated as (1-{[cell 8 outlet]/[inlet]})

Table 6: Mean removal efficiency for Mn and U in 1995 and 1996

The major differences between the years are that Mn removal efficiency was greater in 1995 while U removal efficiency was greater in 1996. Indeed, the efficiency of U removal in 1996 increases to 88% if three unusually large outlet values towards the end of the sampling program are excluded. These were accompanied by higher measured pH values at the outlet. These observations may be related to a pulse of high [U], high pH water, because possible *internal* processes leading to an increase in pH, such as the photosynthetic cycle, have not led to similar observations at the wetland outlet on other occasions. No measured inlet values are unusually high for U and pH, but this is probably due to the sporadic nature of sampling during 1996, and the necessity to assign samples to pulses in a somewhat arbitrary fashion. Of potentially greater importance is the possibility that the ability of the wetland to ameliorate high pH values, observed in 1995, may have been reduced in 1996.

The most likely explanation for the differences in relative efficiency between the years is generally lower pH values in 1996 reducing the rate of Mn oxidation (and hence deposition) and the increased retention time affording a greater opportunity for U to adsorb to wetland components. It should be noted, however, that for Mn the presumption of reduced removal efficiency in 1996 relies largely on a small number of samples showing an increase in soluble [Mn] in cell 8 over cell 7, and these may be anomalous.

The behaviour of the pulses was similar in both years, as depicted in Figure 6. Note however the higher pH values measured in later cells for the last two pulses, as discussed above.

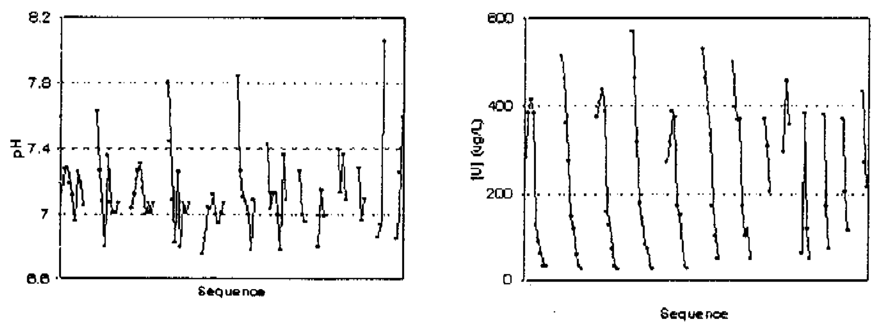

Figure 6 Uranium removal efficiency and pH changes in successive effluent pulses, 1996

Conclusions

The Ranger constructed wetland filter in the catchment of RP1 is efficient at removing soluble Mn from the RP2 effluent stream. Based on 1995 and 1996 data, about 90% should be reliably removed. The likely mechanism for Mn removal is oxidation of Mn^{2+} to higher valance Mn oxides, followed by sedimentation from the water column. The removal of U from the effluent stream is more variable, with the efficiency of the wetland strongly dependent on retention time. Although elevated pH (>8) should reduce wetland efficiency for U removal, this does not seem to be a critical factor for the U loads presented, because of the ability of the wetland to reduce effluent pH as water passes through. However, for high pH effluent, U may be deposited later in the wetland, effectively reducing path length, with an implied potential to remove greater U loads if effluent pH is kept near neutral.

The mechanism for U removal cannot be asserted with the same confidence as for Mn. Co-precipitation with Mn does not seem to be an important mechanism. More likely is adsorption to Fe rich particulates, possibly hydrated oxyhydroxides coated in natural organic matter. The measured kinetic data is more consistent with this occurring predominantly in the water column, followed by sedimentation. The wetland appears to have the ability to generate suspended Fe internally, giving a continuous supply of potential substrates. Whether this situation will continue as lateritic surfaces are progressively occluded by aquatic plants and their degradation products cannot be deduced with present data.

The wetland is almost completely ineffective at removing simple conservative ions, dominated by Mg^{2+} and SO_4^{2-}, and alternative strategies will need to be employed if these species are required to be removed.

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Appendix 1. CWF Analytical data for 1995 arranged to show progress of release pulses

Cell	Date	pH	EC	HCO_3	Turb	Na	Mg	Cl	SO_4	Mn_s	Mn_p	U_s	U_p	Fe_s	Fe_p
Pulse 1															
Inlet	06-Jul-95	7.35	926	24.7	0.0	8.0	99.2	4.6	469	637	3.5	432	8.2	0.0	80
Outlet 1	06-Jul-95	7.00	929	25.6	2.0	7.8	100.7	4.3	474	665	1.7	391	10.6	0.0	56
Outlet 2	06-Jul-95	6.98	922	34.1	3.0	8.0	103.5	4.6	497	602	3.0	314	13.4	12.9	89
Outlet 3	07-Jul-95	7.23	891	32.1	3.0	9.1	106.5	5.2	421	449	3.5	275	7.6	21.9	129
Outlet 4	10-Jul-95	6.80	862	32.3	3.0	9.6	104.7	5.2	416	245	12.1	134	20.1	40.7	120
Outlet 5	10-Jul-95	6.69	860	33.7	4.0	9.9	104.7	6.0	441	240	8.8	114	17.2	48.9	151
Outlet 6	14-Jul-95	6.87	900	25.9	2.0	8.9	101.8	3.3	495	225	1.4	125	3.7	93.9	66
Outlet 7	14-Jul-95	6.74	722	25.5	5.0	8.8	81.7	5.8	408	135	17.3	67	5.5	97.2	148
Outlet 8	21-Jul-95	7.15	802	26.5	5.0	10.3	95.9	7.7	373	36	2.8	24	0.0		
	mean	6.98	868	28.9	3.0	8.9	99.9	5.2	444	359	6.0	209	9.6	39.4	105
	std dev.	0.23	68	4.0	1.6	0.9	7.5	1.2	43	234	5.5	148	6.5	38.8	37
Pulse 2															
Inlet	10-Jul-95	7.27	924	30.4	0.0	9.3	112.4	4.2	441	609	9.8	500	2.2	11.6	19
Outlet 1	10-Jul-95	6.93	921	27.3	0.0	9.3	114.9	4.4	482	563	6.5	419	3.3	15.2	31
Outlet 2	10-Jul-95	6.77	921	40.4	0.0	9.1	113.7	4.3	474	391	4.1	365	3.3	12.2	39
Outlet 3	10-Jul-95	6.71	924	30.6	0.0	9.3	110.9	4.5	444	320	4.1	327	2.9	12.5	22
Outlet 4	12-Jul-95	6.90	908	26.3	1.0	8.9	103.9	4.7	459	248	8.3	168	7.7	28.2	41
Outlet 5	12-Jul-95	6.80	900	26.0	2.0	9.1	105.2	4.8	472	238	4.8	146	7.5	75.3	82
Outlet 6	12-Jul-95	6.70	882	27.1	6.0	8.9	97.0	6.5	480	246	3.6	97	11.4	69.4	211
Outlet 7	17-Jul-95	6.81	874	22.5	2.0	9.8	87.9	6.4	389	93	3.8	41	0.1	81.9	67
Outlet 8	24-Jul-95	7.04	873	23.7	3.0	9.9	106.6	6.5	406	46	1.8	38	4.1		
	mean	6.88	903	28.3	1.6	9.3	105.8	5.2	450	306	5.2	233	4.7	38.3	64
	std dev.	0.18	22	5.3	2.0	0.3	8.8	1.0	33	191	2.5	172	3.5	31.5	63
Pulse 3															
Inlet	12-Jul-95	7.10	925	38.7	0.0	8.7	113.7	4.2	488	548	21.5	482	4.5	10.7	39
Outlet 1	12-Jul-95	6.80	924	39.7	0.0	8.4	109.5	4.0	352	471	10.4	426	4.9	17.2	29
Outlet 2	12-Jul-95	6.90	922	23.2	0.0	8.5	106.6	4.0	435	348	7.7	338	4.0	18.6	31
Outlet 3	12-Jul-95	6.90	925	25.9	0.0	8.5	109.9	4.1	471	301	*8.0*	367	*4.0*	18.3	*31*
Outlet 4	14-Jul-95	6.96	919	24.9	1.0	8.6	106.7	4.4	504	218	5.7	169	5.0	22.8	39
Outlet 5	14-Jul-95	6.81	917	24.5	1.0	8.6	106.9	3.9	493	185	4.4	157	5.5	76.0	75
Outlet 6	17-Jul-95	6.78	907	24.5	1.0	9.5	109.1	5.3	463	186	1.8	105	0.2	185.9	152
Outlet 7	19-Jul-95	6.86	796	22.6	2.0	8.9	77.4	5.8	458	56	2.1	32	0.0	80.3	78
Outlet 8	26-Jul-95	7.14	918	24.2	1.0	9.6	107.9	6.0	463	21	2.6	34	0.0	52.1	67
	mean	6.92	906	27.6	0.7	8.8	105.3	4.6	459	259	7.1	234	3.1	53.5	60
	std dev.	0.13	42	6.7	0.7	0.4	10.7	0.8	45	176	6.2	171	2.3	56.2	40

Pulse 4															
Inlet	14-Jul-95	7.14	923	23.0	0.0	8.0	101.2	4.0	510	459	21.8	503	6.1	13.3	349
Outlet 1	14-Jul-95	7.00	922	22.9	1.0	7.9	103.8	4.0	565	413	12.8	436	6.3	19.2	61
Outlet 2	14-Jul-95	6.86	922	23.0	0.0	8.0	100.4	4.2	580	320	9.5	368	4.2	13.0	43
Outlet 3	14-Jul-95	6.95	921	24.1	0.0	8.3	100.9	3.9	548	263	7.3	334	4.8	13.3	32
Outlet 4	17-Jul-95	6.91	929	23.5	1.0	8.8	108.7	4.5	505	153	9.3	156	0.7	22.8	53
Outlet 5	17-Jul-95	6.57	925	21.2	2.0	9.1	105.6	4.6	482	116	1.4	86	0.4	138.4	269
Outlet 6	19-Jul-95	6.85	919	25.4	1.0	8.4	101.0	4.9	429	154	1.4	84	0.3	219.6	248
Outlet 7	21-Jul-95	7.06	870	25.4	9.0	9.6	106.2	6.4	423	45	2.2	44	7.4	99.1	327
Outlet 8	26-Jul-95	7.14	918	24.2	1.0	9.6	107.9	6.0	463	21	2.6	34	0.0	52.1	67
	mean	6.94	917	23.6	1.7	8.7	103.9	4.7	501	216	7.6	227	3.4	65.6	161
	std dev.	0.18	18	1.3	2.8	0.7	3.3	0.9	57	156	6.8	183	3.0	72.9	134
Pulse 5															
Inlet	17-Jul-95	6.56	863	20.7	1.0	8.3	98.0	4.2	444	353	2.3	280	0.6	80.2	243
Outlet 1	17-Jul-95	6.64	914	20.5	1.0	8.8	105.3	4.1	479	249	3.9	279	0.6	33.8	147
Outlet 2	17-Jul-95	6.76	922	22.2	1.0	8.6	107.2	4.2	481	69	3.1	248	0.2	8.9	27
Outlet 3	17-Jul-95	6.86	934	29.2	0.0	8.9	109.7	4.3	508	49	2.1	224	0.2	12.8	43
Outlet 4	19-Jul-95	7.07	938	23.9	1.0	8.6	102.8	4.4	481	100	13.2	139	8.9	14.2	52
Outlet 5	19-Jul-95	6.85	935	23.2	1.0	8.8	97.0	4.0	429	101	3.7	106	0.4	63.5	236
Outlet 6	19-Jul-95	6.85	919	25.4	1.0	8.4	101.0	4.9	429	154	1.4	84	0.3	219.6	248
Outlet 7	26-Jul-95	7.07	958	25.2	1.0	9.4	118.6	4.7	440	17	4.1	69	3.4	17.8	52
Outlet 8	26-Jul-95	7.14	918	24.2	1.0	9.6	107.9	6.0	463	21	2.6	34	0.0	52.1	67
	mean	6.87	922	23.8	0.9	8.8	105.3	4.5	461	124	4.1	162	1.6	55.9	124
	std dev.	0.20	26	2.7	0.3	0.4	6.7	0.6	28	112	3.5	96	2.9	66.3	95
Pulse 6															
Inlet	19-Jul-95	7.33	917	22.9	1.0	8.6	98.3	4.2	487	419	10.1	490	0.7	6.8	73
Outlet 1	19-Jul-95	7.04	918	22.5	1.0	8.4	112.7	3.8	515	375	10.8	416	0.4	7.7	62
Outlet 2	19-Jul-95	6.83	921	22.5	1.0	8.5	102.7	3.7	509	236	4.5	300	0.3	14.0	73
Outlet 3	19-Jul-95	6.95	927	25.9	1.0	8.2	91.9	3.4	449	161	5.2	246	0.4	16.1	226
Outlet 4	21-Jul-95	7.13	941	25.4	1.0	9.6	124.0	4.7	450	92	5.9	206	6.1	20.8	21
Outlet 5	21-Jul-95	6.89	938	26.3	1.0	9.6	126.3	4.7	460	55	3.5	140	8.1	76.8	114
Outlet 6	21-Jul-95	6.91	936	25.9	2.0	9.4	121.1	4.9	477	76	6.4	111	16.0	71.2	161
Outlet 7	26-Jul-95	7.07	958	25.2	1.0	9.4	118.6	4.7	440	17	4.1	69	3.4	17.8	52
Outlet 8	26-Jul-95	7.14	918	24.2	1.0	9.6	107.9	6.0	463	21	2.6	34	0.0	52.1	67
	mean	7.03	930	24.5	1.1	9.0	111.5	4.4	472	161	5.9	223	3.9	31.5	94
	std dev.	0.16	14	1.5	0.3	0.6	12.1	0.8	27	151	2.8	156	5.4	27.6	63
Pulse 7															
Inlet	21-Jul-95	6.95	892	22.2	1.0	8.7	108.3	3.9	466	309	5.2	450	16.5	20.0	77
Outlet 1	21-Jul-95	7.07	909	22.6	1.0	8.7	112.3	4.1	461	287	5.3	420	0.8	10.6	71

Outlet 2	21-Jul-95	6.83	925	23.8	1.0	8.7	114.1	4.2	463	172	2.7	389	12.5	30.7	66
Outlet 3	21-Jul-95	6.96	927	26.5	0.0	8.9	114.7	4.3	453	116	2.0	297	8.4	19.7	64
Outlet 4	24-Jul-95	7.13	940	25.5	1.0	8.9	118.8	4.6	497	60	6.6	196	5.8	9.9	34
Outlet 5	24-Jul-95	6.84	938	24.4	1.0	9.3	126.3	4.9	493	52	-1.0	167	9.2	35.2	55
Outlet 6	24-Jul-95	6.92	948	24.5	1.0	8.7	116.2	4.8	476	33	11.9	110	8.6	17.2	97
Outlet 7	31-Jul-95	7.22	967	26.1	1.0	9.4	124.0	4.7	520	8	2.6	103	0.0	14.7	22
Outlet 8	31-Jul-95	7.54	973	25.0	6.0	9.5	121.7	5.1	500	7	3.5	61	16.9	16.9	261
	mean	7.05	935	24.5	1.4	9.0	117.4	4.5	481	116	4.3	244	8.7	19.4	83
	std dev.	0.22	26	1.5	1.7	0.3	5.8	0.4	22	116	3.6	149	6.0	8.5	70
Pulse 8															
Inlet	24-Jul-95	7.35	918	23.8	1.0	7.9	105.0	4.2	498	351	15.1	676	0.3	3.7	35
Outlet 1	24-Jul-95	6.92	921	22.5	1.0	7.7	110.3	4.3	475	304	8.6	480	12.2	4.1	40
Outlet 2	24-Jul-95	6.84	922	23.1	1.0	7.8	104.5	4.3	446	202	5.2	405	10.5	7.4	39
Outlet 3	24-Jul-95	6.82	918	26.4	1.0	8.2	111.8	4.5	459	103	2.6	304	7.0	7.0	49
Outlet 4	26-Jul-95	7.12	945	25.9	1.0	9.2	125.3	4.3	504	44	5.9	191	5.2	14.0	27
Outlet 5	26-Jul-95	6.93	945	24.8	1.0	8.8	118.7	4.3	486	30	3.3	169	9.5	23.8	39
Outlet 6	26-Jul-95	7.08	952	25.0	1.0	8.1	107.9	4.6	451	16	11.0	119	7.2	18.3	56
Outlet 7	03-Aug-95	7.34	983	26.9	2.0	10.2	136.9	5.0	579	4	2.5	79	5.0	19.0	57
Outlet 8	03-Aug-95	7.41	996	26.4	4.0	10.3	135.4	5.3	557	4	2.5	49	5.1	33.8	136
	mean	7.09	944	25.0	1.4	8.7	117.3	4.5	495	118	6.3	275	6.9	14.6	53
	std dev.	0.23	29	1.6	1.0	1.0	12.6	0.4	46	135	4.4	210	3.6	10.1	32
Pulse 9															
Inlet	26-Jul-95	7.25	923	23.3	1.0	9.4	124.3	4.4	482	354	13.7	523	11.9	5.5	165
Outlet 1	26-Jul-95	6.89	925	22.9	1.0	9.1	122.5	4.2	503	290	6.3	478	15.4	13.3	39
Outlet 2	26-Jul-95	6.87	927	23.2	1.0	9.1	114.9	4.3	484	164	4.1	421	13.1	13.6	31
Outlet 3	26-Jul-95	6.93	929	23.9	1.0	9.1	119.8	3.9	497	104	4.4	336	13.7	10.2	68
Outlet 4	31-Jul-95	7.06	948	26.1	1.0	9.0	128.2	4.4	452	31	1.6	228	0.0	20.3	12
Outlet 5	31-Jul-95	7.03	940	25.2	2.0	9.2	125.0	4.3	462	56	2.4	195	10.5	63.1	71
Outlet 6	31-Jul-95	7.11	953	25.4	1.0	8.8	113.9	4.6	434	10	4.8	160	0.0	20.3	60
Outlet 7	08-Aug-95	7.35	993	28.7	4.0	9.8	126.3	4.8	496	3	2.1	142	4.1	12.4	181
Outlet 8	08-Aug-95	7.37	1005	29.5	9.0	10.0	125.9	5.0	498	3	2.8	116	4.8	16.9	399
	mean	7.10	949	25.3	2.3	9.3	122.3	4.4	479	113	4.7	289	8.2	19.5	114
	std dev.	0.19	30	2.4	2.7	0.4	5.1	0.3	24	131	3.7	154	6.0	17.0	122
Pulse 10															
Inlet	31-Jul-95	7.32	920	24.1	1.0	8.7	125.5	4.1	452	311	4.0	465	11.6	4.5	25
Outlet 1	31-Jul-95	6.85	916	23.6	2.0	8.7	114.6	4.2	422	444	13.5	507	14.8	107.8	67
Outlet 2	31-Jul-95	6.99	929	23.8	1.0	9.0	115.3	4.1	424	80	0.0	361	4.5	21.9	10
Outlet 3	31-Jul-95	7.09	932	26.0	1.0	9.1	120.9	4.4	457	57	1.8	378	13.2	7.8	26
Outlet 4	03-Aug-95	7.27	958	26.9	1.0	9.8	130.8	4.6	536	14	3.1	224	0.0	12.7	21

Outlet 5	03-Aug-95	7.06	958	26.6	1.0	10.1	128.1	4.5	518	12	1.2	210	0.0	18.6	20
Outlet 6	03-Aug-95	7.05	964	27.2	1.0	9.7	132.7	4.5	535	20	0.0	150	0.0	102.0	80
Outlet 7	08-Aug-95	7.35	993	28.7	4.0	9.8	126.3	4.8	496	3	2.1	142	4.1	12.4	181
Outlet 8	30-Aug-95	7.72	955	34.7	1.0	9.6	132.5	4.9	510	3	1.9	389	0.0	24.4	60
	mean	7.19	947	26.8	1.4	9.4	125.2	4.5	483	105	3.1	314	5.4	34.7	54
	std dev.	0.26	25	3.4	1.0	0.5	6.9	0.3	45	160	4.1	136	6.2	40.3	53
Pulse 11															
Inlet	03-Aug-95	7.47	919	24.8	1.0	9.2	113.0	4.4	449	292	14.9	551	12.7	12.1	26
Outlet 1	03-Aug-95	7.00	919	24.5	1.0	9.3	123.7	4.3	505	256	7.2	491	22.1	8.7	20
Outlet 2	03-Aug-95	6.92	921	25.2	1.0	9.3	121.7	4.2	502	172	4.7	432	15.4	19.4	45
Outlet 3	03-Aug-95	6.96	922	25.2	1.0	9.7	122.7	4.1	481	146	2.2	413	12.4	18.9	28
Outlet 4	08-Aug-95	7.23	950	27.3	1.0	9.8	125.5	4.6	456	32	1.8	355	7.4	12.7	29
Outlet 5	08-Aug-95	7.20	954	26.5	1.0	9.7	121.2	4.4	456	19	1.7	328	5.9	18.6	30
Outlet 6	08-Aug-95	7.24	958	27.1	1.0	9.6	121.6	4.5	481	6	3.9	250	5.7	15.1	93
Outlet 7	16-Aug-95	7.32	946	30.7	1.0	9.6	125.6	4.5	480	7	5.1	370	3.4	18.0	30
Outlet 8	16-Aug-95	7.58	967	30.2	2.0	9.9	129.5	4.9	508	5	2.7	256	2.1	21.2	53
	mean	7.21	940	26.8	1.1	9.6	122.7	4.4	480	104	4.9	383	9.7	16.1	39
	std dev.	0.23	19	2.3	0.3	0.2	4.5	0.2	22	115	4.2	101	6.5	4.2	23
Pulse 12															
Inlet	08-Aug-95	7.40	916	26.0	1.0	8.7	116.9	4.7	494	239	9.1	635	7.2	9.9	36
Outlet 1	08-Aug-95	7.14	915	25.5	1.0	9.2	121.0	4.2	500	205	4.7	602	4.9	10.2	19
Outlet 2	08-Aug-95	6.98	920	25.6	1.0	9.4	118.0	4.2	414	145	2.7	529	5.0	14.4	28
Outlet 3	08-Aug-95	7.01	924	25.9	1.0	9.6	119.7	4.4	420	126	2.7	521	5.2	15.4	24
Outlet 4	11-Aug-95	7.40	935	29.0	1.0	9.7	119.6	4.4	456	53	1.7	453	3.6	0.0	17
Outlet 5	11-Aug-95	7.13	937	28.3	1.0	9.7	124.5	4.6	476	35	2.4	411	4.4	2.6	20
Outlet 6	11-Aug-95	7.10	948	28.9	1.0	10.0	123.2	4.6	478	18	2.7	346	0.3	12.3	39
Outlet 7	16-Aug-95	7.32	946	30.7	1.0	9.6	125.6	4.5	480	7	5.1	370	3.4	18.0	30
Outlet 8	16-Aug-95	7.58	967	30.2	2.0	9.9	129.5	4.9	508	5	2.7	256	2.1	21.2	53
	mean	7.23	934	27.8	1.1	9.5	122.0	4.5	470	92	3.8	458	4.0	11.5	30
	std dev.	0.20	17	2.1	0.3	0.4	4.0	0.2	33	89	2.3	125	2.0	6.9	12
Pulse 13															
Inlet	11-Aug-95	7.57	918	29.6	1.0	9.5	115.7	4.3	455	214	5.5	654	4.5	4.1	29
Outlet 1	11-Aug-95	7.40	915	28.0	1.0	9.4	117.0	4.2	460	199	5.9	679	4.7	5.7	22
Outlet 2	11-Aug-95	7.12	918	28.2	0.0	9.3	122.4	4.3	455	135	3.4	607	5.9	3.2	14
Outlet 3	11-Aug-95	7.12	919	28.6	0.0	9.4	117.0	4.3	461	121	2.1	567	6.6	0.0	55
Outlet 4	16-Aug-95	7.59	931	30.5	0.0	8.8	113.6	4.4	458	29	4.5	511	3.9	29.0	17
Outlet 5	16-Aug-95	7.16	930	29.8	0.0	8.7	113.5	4.6	449	19	3.7	455	3.9	36.5	23
Outlet 6	16-Aug-95	7.34	937	29.8	0.0	9.4	125.4	4.6	471	10	5.7	423	4.3	18.7	18
Outlet 7	23-Aug-95	7.27	942	31.9	1.0	9.9	123.7	4.3	439	4	5.3	363	0.0		

Outlet 8	23-Aug-95	7.36	956	32.2	1.0	10.1	124.9	5.1	458	2	5.5	297	0.0	16.1	37
	mean	7.33	930	29.8	0.4	9.4	119.3	4.5	456	81	4.6	506	3.8	14.2	27
	std dev.	0.18	14	1.5	0.5	0.4	4.8	0.3	9	86	1.3	132	2.3	13.3	13
Pulse 14															
Inlet	16-Aug-95	7.68	913	29.1	0.0	8.7	111.1	4.1	439	117	30.5	729	5.2	24.3	24
Outlet 1	16-Aug-95	7.50	913	28.9	0.0	8.6	112.0	4.4	419	114	22.2	752	6.4	36.5	17
Outlet 2	16-Aug-95	7.16	912	29.2	0.0	8.7	111.7	4.3	453	73	9.2	661	5.5	32.1	22
Outlet 3	16-Aug-95	7.21	911	29.3	0.0	8.6	112.7	4.3	452	65	7.0	613	5.0	32.7	17
Outlet 4	23-Aug-95	7.41	923	31.9	0.0	9.3	118.8	4.4	425	16	8.6	558	0.0	13.5	3
Outlet 5	23-Aug-95	7.11	923	31.8	0.0	9.5	121.8	4.2	477	36	6.4	487	0.0	34.1	24
Outlet 6	23-Aug-95	7.21	936	31.2	0.0	9.9	122.0	4.3	428	4	8.1	431	0.0	7.4	16
Outlet 7	30-Aug-95	7.41	942	34.5	1.0	9.4	130.0	4.8	497	5	3.2	392	0.0	24.1	23
Outlet 8	30-Aug-95	7.72	955	34.7	1.0	9.6	132.5	4.9	510	3	1.9	389	0.0	24.4	60
	mean	7.38	925	31.2	0.2	9.1	119.2	4.4	456	48	10.8	557	2.5	25.5	23
	std dev.	0.22	16	2.3	0.4	0.5	8.1	0.2	33	46	9.4	140	2.9	9.8	15
Pulse 15															
Inlet	23-Aug-95	8.14	901	41.9	1.0	8.3	108.3	4.4	501	30	16.2	824	1.9	0.0	11
Outlet 1	23-Aug-95	7.90	903	31.0	1.0	9.0	114.6	4.4	449	39	17.6	811	0.9	6.5	19
Outlet 2	23-Aug-95	7.32	905	31.2	0.0	8.8	117.8	4.6	456	35	7.7	717	2.5	5.4	29
Outlet 3	23-Aug-95	7.11	902	31.8	0.0	9.0	118.7	4.4	441	34	6.8	712	0.0	5.8	4
Outlet 4	30-Aug-95	7.44	917	37.1	0.0	9.1	121.8	4.7	471	11	3.3	679	0.0	14.9	7
Outlet 5	30-Aug-95	7.09	920	34.4	0.0	8.9	120.3	4.6	452	9	1.1	614	0.0	29.2	18
Outlet 6	30-Aug-95	7.33	928	33.7	0.0	9.2	123.1	4.7	447	2	3.3	554	0.0	8.9	17
Outlet 7	06-Sep-95	7.64	937	37.4	1.0	9.3	115.0	4.2	488	7	*4.0*	522	3.2	22.8	51
Outlet 8	06-Sep-95	7.45	945	37.3	1.0	9.4	112.7	4.2	471	15	4.9	449	3.1	37.1	43
	mean	7.49	918	35.1	0.4	9.0	116.9	4.5	464	20	7.2	654	1.3	14.5	22
	std dev.	0.35	16	3.6	0.5	0.3	4.7	0.2	20	14	5.9	129	1.4	12.6	16
Pulse 16															
Inlet	30-Aug-95	7.76	896	36.5	0.0	9.0	112.4	4.5	431	18	15.1	926	2.8	0.0	6
Outlet 1	30-Aug-95	7.96	902	36.1	0.0	9.1	115.8	4.4	415	19	10.0	905	0.0	0.0	5
Outlet 2	30-Aug-95	7.09	901	34.5	0.0	9.0	113.3	4.5	407	32	3.9	795	0.0	10.9	12
Outlet 3	30-Aug-95	7.07	901	34.5	0.0	8.8	121.2	4.2	436	22	2.6	765	0.0	17.4	12
Outlet 4	06-Sep-95	7.83	919	37.0	1.0	9.1	98.6	4.2	451	4	9.2	733	0.0	16.2	36
Outlet 5	06-Sep-95	7.40	914	37.4	0.0	9.1	108.2	4.3	475	8	6.3	643	3.6	41.9	268
Outlet 6	06-Sep-95	7.57	922	36.6	0.0	9.3	110.1	4.1	475	2	5.6	628	4.6	27.5	36
Outlet 7	13-Sep-95	7.54	950	39.7	1.0	9.4	114.4	4.5	497	9	2.8	541	0.0	24.8	49
Outlet 8	13-Sep-95	7.41	960	39.2	1.0	9.9	122.4	4.5	489	3	1.6	459	3.2	37.3	61
	mean	7.51	918	36.8	0.3	9.2	112.9	4.4	453	13	6.3	711	1.6	19.6	54

	std dev.	0.31	23	1.8	0.5	0.3	7.1	0.2	33	10	4.4	157	1.9	14.8	83
Pulse 17															
Inlet	06-Sep-95	8.13	898	35.1	1.0	5.6	109.6	4.2	377	15	11.8	983	0.0	16.0	37
Outlet 1	06-Sep-95	7.48	900	36.9	0.0	9.0	108.5	4.2	384	31	25.7	800	5.9	32.3	129
Outlet 2	06-Sep-95	7.47	904	36.5	0.0	9.2	108.0	4.2	419	12	4.1	853	0.0	23.6	20
Outlet 3	06-Sep-95	7.55	910	40.0	0.0	9.0	98.8	4.1	444	120	17.1	795	7.2	32.3	53
Outlet 4	13-Sep-95	7.18	921	40.8	1.0	9.5	104.5	4.4	497	21	5.1	749	4.6	33.4	38
Outlet 5	13-Sep-95	7.29	930	40.0	0.0	9.3	112.5	4.4	481	5	1.4	692	0.0	33.9	52
Outlet 6	13-Sep-95	7.71	926	44.0	0.0	9.3	115.0	4.4	478	3	1.8	716	0.0	23.6	40
Outlet 7	20-Sep-95	7.09	953	42.9	0.0	10.4	119.0	4.7	526	2	12.8	675	5.7	11.6	49
Outlet 8	20-Sep-95	7.23	961	42.3	1.0	10.4	119.4	4.7	556	0	2.5	535	0.0	13.2	34
	mean	7.46	923	39.8	0.3	9.1	110.6	4.4	462	23	9.1	755	2.6	24.4	50
	std dev.	0.32	23	3.1	0.5	1.4	6.7	0.2	62	38	8.4	125	3.1	9.0	31
Pulse 18															
Inlet	13-Sep-95	7.11	911	49.5	0.0	9.3	106.2	4.2	499	6	2.5	943	0.0	21.7	24
Outlet 1	13-Sep-95	7.05	906	39.4	1.0	9.2	103.3	4.2	481	87	3.1	830	0.0	48.1	115
Outlet 2	13-Sep-95	7.27	910	39.5	0.0	9.2	99.3	4.3	458	31	2.9	1001	5.5	28.8	34
Outlet 3	13-Sep-95	7.16	910	43.7	0.0	9.2	101.7	4.2	479	142	4.0	872	0.0	74.4	104
Outlet 4	20-Sep-95	7.63	934	51.0	1.0	10.4	122.9	4.5	455	1	13.8	922	5.2	12.1	45
Outlet 5	20-Sep-95	6.88	939	41.4	1.0	10.3	114.6	4.6	530	4	3.9	759	14.6	23.7	78
Outlet 6	20-Sep-95	7.63	939	44.8	1.0	10.3	121.1	4.6	484	0	4.8	759	0.0	9.4	66
Outlet 7	27-Sep-95	7.49	972	43.2	1.0	10.1	121.3	4.7	497	12	3.8	666	4.3	14.7	36
Outlet 8	27-Sep-95	7.13	977	44.1	1.0	10.2	126.4	4.7	512	2	2.2	560	1.7	17.0	40
	mean	7.26	933	44.1	0.7	9.8	113.0	4.5	488	32	4.6	812	3.5	27.8	60
	std dev.	0.27	27	4.0	0.5	0.6	10.4	0.2	24	50	3.5	141	4.8	20.9	33
Pulse 19															
Inlet	20-Sep-95	8.96	926	30.2	2.0	10.1	114.8	4.5	474	18	4.6	1144	8.0	14.2	25
Outlet 1	20-Sep-95	8.63	924	34.6	1.0	9.9	109.6	4.5	473	22	3.3	1088	0.0	14.7	24
Outlet 2	20-Sep-95	7.13	924	40.5	1.0	10.3	104.3	4.3	431	25	6.6	940	7.9	12.4	40
Outlet 3	20-Sep-95	7.21	926	40.3	1.0	10.5	116.3	4.4	496	20	15.6	971	8.5	19.7	68
Outlet 4	27-Sep-95	7.60	957	42.8	1.0	10.7	117.4	4.7	479	4	5.7	884	5.2	14.6	30
Outlet 5	27-Sep-95	7.04	959	42.5	1.0	10.5	116.8	4.6	491	23	3.0	776	11.7	11.7	85
Outlet 6	27-Sep-95	7.69	954	45.4	1.0	10.4	119.2	4.6	505	0	1.7	799	6.2	8.9	28
Outlet 7	04-Oct-95	7.88	994	45.1	1.0	10.9	117.2	4.9	494	17	3.6	652	0.8	27.2	33
Outlet 8	04-Oct-95	7.73	1000	45.3	1.0	11.1	115.8	4.8	497	2	2.5	568	0.8	14.2	42
	mean	7.76	952	40.7	1.1	10.5	114.6	4.6	482	15	5.2	869	5.4	15.3	42
	std dev.	0.66	30	5.2	0.3	0.4	4.7	0.2	22	10	4.2	191	4.1	5.3	21
Pulse 20															
Inlet	27-Sep-95	9.33	958	46.8	2.0	10.8	114.8	4.5	484	30	12.7	1135	9.5	9.5	29

Outlet 1	27-Sep-95	8.94	953	54.9	2.0	10.9	121.4		446	53	12.0	1165	8.4	16.3	30
Outlet 2	27-Sep-95	7.92	949	47.7	1.0	10.4	120.4	4.6	499	99	19.9	1005	13.3	18.5	85
Outlet 3	27-Sep-95	7.33	950	43.1	1.0	10.8	118.1	4.8	516	114	10.6	947	7.7	23.0	70
Outlet 4	04-Oct-95	8.29	985	43.0	2.0	11.3	119.6	4.8	507	7	14.7	853	0.6	24.5	61
Outlet 5	04-Oct-95	7.16	988	45.5	1.0	11.6	116.9	4.8	513	17	2.4	750	7.2	50.7	119
Outlet 6	04-Oct-95	8.21	982	46.9	1.0	10.9	119.3	4.7	439	3	3.5	816	2.0	17.0	35
Outlet 7	11-Oct-95	7.74	1013	46.7	1.0	11.5	125.6	5.0	510	3	17.4	671	6.2	14.2	76
Outlet 8	11-Oct-95	7.59	1015	46.1	1.0	10.9	112.1	4.9	472	0	3.4	621	1.5	12.9	29
	mean	8.06	977	46.7	1.3	11.0	118.7	4.8	487	36	10.7	885	6.3	20.8	59
	std dev.	0.72	26	3.5	0.5	0.4	3.9	0.2	29	43	6.4	193	4.2	12.2	32
Pulse 21															
Inlet	04-Oct-95	7.43	958	40.0	2.0	11.1	118.2	4.8	480	121	1.7	666	0.6	113.9	255
Outlet 1	04-Oct-95	7.81	980	44.3	2.0	11.0	121.1	4.8	516	54	15.8	896	6.1	31.0	108
Outlet 2	04-Oct-95	8.14	979	45.4	1.0	11.4	113.8	4.8	497	20	13.9	968	5.9	25.6	81
Outlet 3	04-Oct-95	7.81	982	51.2	1.0	11.2	119.8	4.8	422	64	13.6	825	1.0	32.2	80
Outlet 4	11-Oct-95	7.84	1006	46.8	2.0	11.9	121.6	5.0	484	3	51.8	784	4.4	20.3	89
Outlet 5	11-Oct-95	7.41	1005	46.6	1.0	11.2	108.8	4.9	481	16	21.3	716	10.8	16.5	110
Outlet 6	11-Oct-95	7.88	1007	47.4	1.0	11.6	121.1	4.9	507	2	13.4	738	5.6	18.9	388
Outlet 7	18-Oct-95	7.91	1061	46.8	1.0	12.3	131.1	5.8	506	37	1.8	571	2.2	40.3	58
Outlet 8	18-Oct-95	8.10	1062	43.8	1.0	12.0	133.0	5.9	510	4	-1.0	541	1.5	22.9	49
	mean	7.81	1004	45.8	1.3	11.5	121.0	5.1	489	36	14.7	745	4.2	35.7	135
	std dev.	0.25	36	3.1	0.5	0.5	7.5	0.4	28	39	15.8	141	3.3	30.2	112
Pulse 22															
Inlet	11-Oct-95	9.16	933	28.0	5.0	12.5	130.8	4.9	533	73	119.7	1221	22.7	5.2	170
Outlet 1	11-Oct-95	8.51	1002	40.1	3.0	12.1	133.9	4.9	530	93	73.4	1037	14.0	35.3	157
Outlet 2	11-Oct-95	8.30	996	44.6	2.0	12.1	140.6	4.9	518	62	65.9	1003	13.5	27.9	132
Outlet 3	11-Oct-95	7.95	996	46.6	2.0	12.4	117.2	4.8	403	95	49.0	987	11.4	41.7	127
Outlet 4	18-Oct-95	7.81	1043	47.0	2.0	12.8	129.5	5.3	519	44	5.8	706	3.3	30.9	48
Outlet 5	18-Oct-95	7.48	1041	47.2	1.0	12.7	128.0	5.5	507	85	3.5	660	11.6	72.6	173
Outlet 6	18-Oct-95	8.15	1033	47.2	1.0	12.0	124.4	5.3	499	4	4.5	734	2.5	17.1	47
Outlet 7	25-Oct-95	7.63	1087	51.2	1.0	13.8	139.4	4.5	547	17	7.4	591	3.3	40.6	89
Outlet 8	25-Oct-95	8.09	1087	51.8	1.0	14.0	140.4	4.2	555	5	1.8	543	1.8	36.4	42
	mean	8.12	1024	44.8	2.0	12.7	131.6	4.9	512	53	36.8	831	9.4	34.2	109
	std dev.	0.51	49	7.2	1.3	0.7	7.9	0.4	45	37	42.4	235	7.1	18.6	54
Pulse 23															
Inlet	18-Oct-95	9.04	1017	24.6	5.0	13.1	125.1	5.1	511	70	107.0	942	76.4	23.4	188
Outlet 1	18-Oct-95	9.00	1018	30.8	5.0	13.0	123.6	5.2	560	74	96.0	1037	32.8	33.7	189
Outlet 2	18-Oct-95	8.05	1022	44.3	3.0	12.9	121.5	5.1	565	140	51.5	842	16.9	45.8	173
Outlet 3	18-Oct-95	7.90	1018	44.0	3.0	12.9	123.4	5.0	514	129	43.5	923	17.1	40.6	172

Outlet 4	25-Oct-95	8.46	1053	41.3	5.0	14.0	130.5	4.1	623	12	125.9	740	15.8	21.4	202
Outlet 5	25-Oct-95	7.51	1057	44.3	4.0	13.8	128.3	4.5	602	26	59.3	675	28.5	49.8	273
Outlet 6	25-Oct-95	7.95	1062	48.0	2.0	13.7	132.8	4.7	532	2	33.3	664	8.0	22.1	147
Outlet 7	01-Nov-95	7.44	1108	49.2	2.0	15.2	140.3	5.4	642	32	3.2	452	4.1	107.1	139
Outlet 8	01-Nov-95	8.01	1106	47.9	2.0	15.3	140.1	5.7	641	17	2.0	459	4.2	41.9	172
	mean	8.15	1051	41.6	3.4	13.8	129.5	5.0	577	56	58.0	748	22.7	42.9	184
	std dev.	0.58	36	8.4	1.3	0.9	7.1	0.5	52	51	44.0	208	22.5	26.3	39
Pulse 24															
Inlet	25-Oct-95	7.82	1012	49.2	8.0	13.0	123.3	4.6	561	979	239.9	854	46.8	33.9	338
Outlet 1	25-Oct-95	8.17	1012	49.6	11.0	13.1	123.1	3.8	558	766	362.7	904	67.4	28.1	464
Outlet 2	25-Oct-95	7.85	1020	47.2	8.0	13.4	128.6	3.1	498	386	428.6	897	107.6	36.2	829
Outlet 3	25-Oct-95	7.73	1027	47.5	7.0	13.7	128.3	3.3	584	177	143.9	812	42.6	37.9	360
Outlet 4	01-Nov-95	8.22	1043	53.6	5.0	13.5	134.4	5.0	494	115	51.4	753	10.4	50.0	202
Outlet 5	01-Nov-95	7.01	1063	55.0	4.0	13.9	130.3	5.4	565	127	17.9	612	32.9	101.2	509
Outlet 6	01-Nov-95	7.99	1072	48.4	2.0	13.8	134.6	5.4	572	6	27.5	665	8.0	46.2	151
Outlet 7	08-Nov-95	7.13	1073	52.3	2.0	14.8	137.7	6.0	531	43	0.0	294	4.8	101.0	247
Outlet 8	08-Nov-95	7.59	1119	51.6	1.0	14.6	139.0	6.2	582	21	0.0	304	0.0	26.6	114
	mean	7.72	1049	50.5	5.3	13.8	131.0	4.7	549	291	141.3	677	35.6	51.2	357
	std dev.	0.42	36	2.8	3.4	0.6	5.8	1.1	34	353	164.9	236	35.3	29.2	222
Pulse 25															
Inlet	01-Nov-95	7.82	1031	58.0	11.0	14.5	125.4	4.9	492	1855	417.1	932	59.2	99.4	529
Outlet 1	01-Nov-95	7.45	1032	58.0	10.0	13.4	124.6	5.1	491	1779	353.3	949	48.1	50.2	427
Outlet 2	01-Nov-95	8.34	1025	57.2	8.0	13.2	126.1	4.9	506	373	387.8	894	15.5	37.2	302
Outlet 3	01-Nov-95	7.74	1030	60.9	4.0	13.6	131.1	4.8	548	452	111.3	851	11.6	29.1	200
Outlet 4	08-Nov-95	7.29	1058	56.2	3.0	13.6	130.5	3.7	580	82	4.9	552	3.8	45.2	136
Outlet 5	08-Nov-95	6.92	1078	58.4	3.0	14.6	132.7	4.8	578	365	2.9	425	18.0	114.1	595
Outlet 6	08-Nov-95	7.53	1070	50.1	1.0	14.0	129.8	5.5	595	3	4.8	554	4.5	42.3	119
	mean	7.58	1046	57.0	5.7	13.8	128.6	4.8	541	701	183.2	737	23.0	59.6	330
	std dev.	0.45	22	3.3	3.9	0.5	3.2	0.5	45	780	194.4	218	21.8	33.1	191
Pulse 26															
Inlet	08-Nov-95	7.03	1008	65.4	6.0	13.1	123.3	4.8	468	2668	72.5	564	12.4	40.9	763
Outlet 1	08-Nov-95	6.99	1018	67.4	5.0	13.3	121.3	4.0	520	2536	45.8	647	24.3	60.0	542
Outlet 2	08-Nov-95	7.18	1031	68.0	4.0	13.4	120.2	3.8	525	1010	68.6	751	15.7	55.2	215
Outlet 3	08-Nov-95	7.17	1045	78.9	2.0	12.8	124.8	5.6	502	751	41.3	683	10.0	29.0	161

Appendix 2. CWF Analytical data for 1996 arranged to show progress of release pulses

Cell	Date	pH	EC	HCO3	Turb	Na	Mg	Cl	SO4	Mns	Us	Fes	Mnt	Ut	Fet
Inlet	19-Jun-96	7.14	828	42.1	2	8.6	95.4	3.7	358	134.9	281.1	14.1	147.8	290.9	118.7
Outlet 1	19-Jun-96	7.28	838	39.7	1	8.6	100.2	3.8	353	150.2	384.6	9.0	165.2	395.0	98.5
Outlet 2	21-Jun-96	7.29	835	41.2	1	8.9	96.4	3.7	396	110.3	415.0	13.1	119.7	421.5	90.9
Outlet 3	21-Jun-96	7.19	830	41.9	1	9.3	99.3	3.8	381	92.0	384.1	13.2	101.2	390.8	93.4
Outlet 4	01-Jul-96	7.12	848	47.7	-1	9.8	103.0	4.0	381	3.7	129.7	9.2	6.5	133.0	46.7
Outlet 5	01-Jul-96	6.96	842	48.8	-1	9.7	102.6	4.0	394	46.0	90.1	30.6	46.0	98.9	110.4
Outlet 6	05-Jul-96	7.26	837	51.4	1	8.9	100.6	4.2	380	7.7	61.4	9.5	10.5	63.7	81.0
Outlet 7	10-Jul-96	7.20	838	55.5	-1	9.1	101.6	4.6	441	5.5	34.3	22.3	8.5	33.3	82.1
Outlet 8	15-Jul-96	7.06	795	58.4	6	8.9	96.5	5.2	331	8.0	32.2	39.2	22.3	34.2	226.6
Inlet	21-Jun-96	7.63	846	40.6	2	9.5	100.9	3.8	393	151.7	515.6	9.5	163.9	521.0	78.1
Outlet 1	21-Jun-96	7.27	844	41.0	1	9.3	97.2	3.7	412	107.2	465.1	11.3	119.0	472.0	109.9
Outlet 2	24-Jun-96	7.08	808	36.9	1	8.9	101.8	3.8	390	135.8	360.1	17.5	148.2	368.3	124.3
Outlet 3	24-Jun-96	6.80	822	47.8	1	8.7	99.5	3.8	423	120.5	274.5	8.3	133.8	280.3	88.5
Outlet 4	03-Jul-96	7.36	860	46.9	-1	9.5	100.8	4.0	421	3.4	149.7	5.6	5.1	152.6	45.2
Outlet 5	03-Jul-96	7.07	859	46.4	-1	9.3	102.2	4.0	403	1.5	120.3	7.5	1.5	123.5	51.7
Outlet 6	08-Jul-96	7.01	852	50.1	-1	9.1	105.6	4.1	351	4.1	59.5	8.3	7.1	60.5	55.6
Outlet 7	15-Jul-96	7.01	874	51.6	-1	10.3	106.1	4.8	426	4.8	31.5	12.4	6.8	30.5	65.7
Outlet 8	22-Jul-96	7.07	906	53.1	1	10.4	106.3	4.7	394	28.9	25.7	54.8	41.4	24.7	259.5
Inlet	24-Jun-96	7.04	807	39.3	1	8.9	93.8	3.7	415	163.6	374.5	17.4	173.3	385.8	114.3
Outlet 1	24-Jun-96	7.13	827	43.7	1	8.5	99.4	3.8	421	54.2	409.3	29.2	65.5	418.1	130.9
Outlet 2	26-Jun-96	7.27	842	41.9	2	9.1	101.6		361	113.9	436.3	20.9	133.4	444.8	158.0
Outlet 3	26-Jun-96	7.31	839	42.2	1	9.6	107.8	3.9	393	81.0	388.8	16.6	99.4	396.9	132.0
Outlet 4	05-Jul-96	7.16	860	46.7	-1	9.6	103.2	4.1	449	3.6	158.0	5.8	4.7	161.6	42.0
Outlet 5	05-Jul-96	7.00	852	46.5	-1	9.5	102.0	4.2	405	6.4	129.6	16.3	6.4	133.7	72.6
Outlet 6	10-Jul-96	7.07	856	49.8	-1	9.5	102.4	4.1	432	1.4	72.2	4.3	5.0	74.2	94.7
Outlet 7	15-Jul-96	7.01	874	51.6	-1	10.3	106.1	4.8	426	4.8	31.5	12.4	6.8	30.5	65.7
Outlet 8	22-Jul-96	7.07	906	53.1	1	10.4	106.3	4.7	394	28.9	25.7	54.8	41.4	24.7	259.5
Inlet	26-Jun-96	7.81	846	41.7	1	9.2	99.9	3.9	416	128.5	569.7	7.2	142.0	571.0	50.2
Outlet 1	26-Jun-96	7.45	843	41.4	2	9.2	100.8	3.7	397	83.8	462.8	18.3	114.3	470.1	111.9
Outlet 2	28-Jun-96	7.09	841	44.6	2	8.9	101.4	3.9	440	102.6	319.1	42.8	128.5	328.4	234.5
Outlet 3	28-Jun-96	6.82	840	50.5	1	8.5	98.0	4.1	457	84.0	180.4	8.9	102.5	186.6	164.8
Outlet 4	08-Jul-96	7.26	865	47.8	-1	9.7	106.0	4.1	405	2.0	142.7	7.3	4.1	144.7	47.9
Outlet 5	08-Jul-96	6.80	865	47.3	-1	9.8	106.2	4.1	450	4.3	81.2	18.3	6.4	84.2	195.8
Outlet 6	10-Jul-96	7.07	856	49.8	-1	9.5	102.4	4.1	432	1.4	72.2	4.3	5.0	74.2	94.7
Outlet 7	15-Jul-96	7.01	874	51.6	-1	10.3	106.1	4.8	426	4.8	31.5	12.4	6.8	30.5	65.7

Outlet 8	22-Jul-96	7.07	906	53.1	1	10.4	106.3	4.7	394	28.9	25.7	54.8	41.4	24.7	259.5
Inlet	28-Jun-96	6.75	780	37.9		8.7	83.9	4.0	381	90.2	270.6	43.7	91.4	280.8	209.4
Outlet 1	28-Jun-96	6.85	837	41.5	2	9.6	110.0	4.1	458	67.1	316.8	79.6	75.3	328.0	229.8
Outlet 2	01-Jul-96	7.05	849	43.8	1	9.8	104.0	3.8	381	61.8	389.2	19.6	75.8	399.0	147.7
Outlet 3	01-Jul-96	7.04	850	44.3	1	9.9	105.1	4.1	379	61.2	375.2	17.9	76.4	384.1	125.1
Outlet 4	10-Jul-96	7.13	869	47.3	-1	10.0	103.9	4.1	421	4.8	172.6	14.3	8.1	174.6	63.8
Outlet 5	10-Jul-96	7.00	868	49.1	2	9.7	103.1	4.2	427	3.5	153.1	26.0	5.7	156.1	98.7
Outlet 6	15-Jul-96	6.95	881	48.7	-1	10.2	108.0	4.2	416	3.9	74.2	12.9	5.7	75.2	56.0
Outlet 7	15-Jul-96	7.01	874	51.6	-1	10.3	106.1	4.8	426	4.8	31.5	12.4	6.8	30.5	65.7
Outlet 8	22-Jul-96	7.07	906	53.1	1	10.4	106.3	4.7	394	28.9	25.7	54.8	41.4	24.7	259.5
Inlet	01-Jul-96	7.85	841	42.0	2	9.9	103.6	3.8	414	63.9	531.9	22.4	85.7	540.7	126.6
Outlet 1	01-Jul-96	7.27	852	42.6	1	9.8	103.2	3.8	384	53.4	465.9	18.3	66.5	476.1	137.8
Outlet 2	03-Jul-96	7.11	850	43.8	1	9.2	102.0	3.9	407	55.4	395.5	22.0	65.9	405.8	159.6
Outlet 3	03-Jul-96	7.08	852	44.6	1	9.5	100.9	3.8	414	70.6	336.2	15.1	79.1	345.4	129.7
Outlet 4	15-Jul-96	7.00	878	47.7	-1	10.4	106.4	4.2	480	2.6	171.9	7.0	4.7	173.9	48.2
Outlet 5	15-Jul-96	6.78	882	48.7	-1	10.8	110.0	4.2	414	4.2	101.9	16.3	6.3	103.9	92.1
Outlet 8	06-Aug-96	7.09	936	52.9	2	11.5	116.5	4.6	410	32.2	48.7	70.6	36.0	47.7	151.3
Inlet	03-Jul-96	7.43	848	41.4	2	10.0	99.5	3.8	384	27.8	502.1	2.6	46.6	510.0	85.1
Outlet 1	03-Jul-96	7.04	853	42.8	1	9.4	99.7	3.9	397	39.8	399.5	29.1	43.5	409.1	150.6
Outlet 2	05-Jul-96	7.14	839	44.2	1	9.5	100.2	4.0	422	64.3	368.0	13.5	71.2	376.8	150.6
Outlet 3	05-Jul-96	7.14	839	43.8	1	9.5	102.6	4.0	422	34.6	371.9	9.7	40.5	381.3	122.0
Outlet 4	15-Jul-96	7.00	878	47.7	-1	10.4	106.4	4.2	480	2.6	171.9	7.0	4.7	173.9	48.2
Outlet 5	15-Jul-96	6.78	882	48.7	-1	10.8	110.0	4.2	414	4.2	101.9	16.3	6.3	103.9	92.1
Outlet 6	22-Jul-96	7.37	908	49.9	1	10.5	107.1	4.2	425	35.1	120.4	18.7	39.6	122.4	86.1
Outlet 8	06-Aug-96	7.09	936	52.9	2	11.5	116.5	4.6	410	32.2	48.7	70.6	36.0	47.7	151.3
Outlet 1	05-Jul-96	7.27	840	42.7	1	9.7	98.9	3.8	422	18.6	371.9	12.8	27.9	381.7	109.4
Outlet 2	08-Jul-96	7.00	863	44.5	1	9.9	105.8	3.8	356	54.7	308.6	24.8	66.4	320.6	189.2
Outlet 3	08-Jul-96	6.96	866	52.1	1	9.6	108.1	3.9	383	52.0	205.1	12.8	71.8	205.1	209.2
Outlet 1	08-Jul-96	6.80	859	45.3	-1	9.7	107.6	3.8	373	40.6	294.9	52.6	42.5	308.9	291.0
Outlet 2	10-Jul-96	7.15	847	44.3	1	10.1	104.2	3.8	378	45.1	459.2	22.6	58.2	467.2	124.9
Outlet 3	10-Jul-96	6.99	854	48.3	1	10.0	104.2	3.9	411	33.5	357.4	11.2	44.3	364.4	99.9
Inlet	10-Jul-96	7.40	852	43.9	2	9.1	79.4	3.9	327	38.4	64.5	23.0	65.3	68.5	67.1
Outlet 1	10-Jul-96	7.14	850	43.6	1	8.4	87.7	3.8	340	10.1	386.2	34.9	39.9	387.2	289.4
Outlet 6	22-Jul-96	7.37	908	49.9	1	10.5	107.1	4.2	425	35.1	120.4	18.7	39.6	122.4	86.1
Outlet 8	06-Aug-96	7.09	936	52.9	2	11.5	116.5	4.6	410	32.2	48.7	70.6	36.0	47.7	151.3

Inlet	22-Jul-96	7.29	858	43.2	1	11.1	101.1	4.0	371	117.5	382.5	40.1	122.0	393.5	215.0
Outlet 6	06-Aug-96	6.97	914	50.3	-1	11.8	110.6	4.4	448	12.8	171.4	20.1	17.4	174.8	89.0
Outlet 8	19-Aug-96	7.10	961	54.3	1	12.0	118.0		503	18.8	74.0	60.2	27.2	76.5	266.7
Inlet	06-Aug-96	6.86	852	39.2	2	11.8	102.3	4.3	388	57.7	371.5	114.1	61.0	397.3	577.5
Outlet 6	19-Aug-96	6.94	935	53.7	-1	11.2	111.0	4.5	432	22.6	205.9	32.4	28.8	210.5	146.6
Outlet 8	02-Sep-96	8.06	1018	56.7	2	14.1	135.3		502	-1.0	115.5	28.8	12.4	118.6	158.0
Inlet	19-Aug-96	6.85	883	90.8	1	11.3	98.5		445	64.7	434.6	46.0	67.5	444.2	200.3
Outlet 6	02-Sep-96	7.26	975	56.4	1	13.6	127.9		467	10.7	273.2	32.0	23.4	279.1	170.3
Outlet 8	16-Sep-96	7.60	1053	60.8	1	14.1	128.2		495	5.2	217.0	32.8	12.6	219.0	142.8

Appendix 4. CWF flow data for 1996

Date	Days	Volume (m^3)	*Cum. Vol. (m^3)*
13-Jun	0	61	*61*
14-Jun	1	2787	*2848*
17-Jun	4	270	*3118*
19-Jun	6	3476	*6594*
20-Jun	7	3484	*10078*
21-Jun	8	4247	*14325*
24-Jun	11	6820	*21145*
26-Jun	13	5270	*26415*
28-Jun	15	680	*27095*
29-Jun	16	6390	*33485*
30-Jun	17	370	*33855*
01-Jul	18	3935	*37790*
02-Jul	19	2245	*40035*
03-Jul	20	2545	*42580*
04-Jul	21	0	*42580*
05-Jul	22	4880	*47460*
06-Jul	23	2165	*49625*
07-Jul	24	10	*49635*
08-Jul	25	0	*49635*
09-Jul	26	5075	*54710*
10-Jul	27	2708	*57418*
11-Jul	28	2671	*60089*
12-Jul	29	2606	*62695*
13-Jul	30	2700	*65395*
14-Jul	31	30	*65425*
15-Jul	32	0	*65425*
16-Jul	33	2824	*68249*
17-Jul	34	2884	*71133*
18-Jul	35	2447	*73580*
19-Jul	36	2560	*76140*
20-Jul	37	2905	*79045*
21-Jul	38	3860	*82905*
22-Jul	39	20	*82925*
23-Jul	40	2212	*85137*
24-Jul	41	234	*85371*
25-Jul	42	2401	*87772*
26-Jul	43	2459	*90231*

27-Jul	44	3519	*93750*
28-Jul	45	3430	*97180*
29-Jul	46	6	*97186*
30-Jul	47	114	*97300*
31-Jul	48	2172	*99472*
01-Aug	49	2132	*101604*
02-Aug	50	2396	*104000*
03-Aug	51	2770	*106770*
04-Aug	52	4030	*110800*
05-Aug	53	490	*111290*
06-Aug	54	3	*111293*
07-Aug	55	2102	*113395*
08-Aug	56	2987	*116382*
09-Aug	57	2408	*118790*
10-Aug	58	2648	*121438*
11-Aug	59	2912	*124350*
12-Aug	60	29	*124379*
13-Aug	61	1831	*126210*
14-Aug	62	1927	*128137*
15-Aug	63	2663	*130800*
16-Aug	64	2160	*132960*
17-Aug	65	2660	*135620*
18-Aug	66	4180	*139800*
19-Aug	67	16	*139816*
20-Aug	68	0	*139816*
21-Aug	69	4	*139820*
22-Aug	70	5023	*144843*
23-Aug	71	4027	*148870*
24-Aug	72	1150	*150020*
25-Aug	73	40	*150060*
26-Aug	74	1993	*152053*
27-Aug	75	1730	*153783*
28-Aug	76	271	*154054*
29-Aug	77	6421	*160475*
30-Aug	78	2920	*163395*
31-Aug	79	5	*163400*