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ATHABASCA RIVER
WATER QUALITY MODELLING
1990 UPDATE

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EXECUTIVE SUMMARY

The calibrated DOSTOC, NUSTOC and UNSTOC models from 1989 were used effectively to simulate measured 1990 Athabasca River water quality. Changes in effluent loadings at the two pulp mills and an increase in river flows in the lower Athabasca Basin accounted for some noticeable improvements in water quality from that reported in Noton and Shaw (1990).

Dissolved oxygen simulations for 1990 incorporated ultimate BOD and kinetic rate information from the long-term BOD laboratory measurements. The laboratory results indicated that at Millar Western, ultimate BOD amounts were substantially reduced from 1989 measurements, and as well the BOD oxidation rate was significantly lower. A lower oxidation rate combined with a reduced BOD ultimate loading accounted for most of the improvements in observed river dissolved oxygen concentrations. Weldwood ultimate BOD levels were also reduced on the sampling date, however, there was not a significant change in the oxidation rate.

Sediment oxygen demand measured in 1990 was not appreciably different from measurements in 1989 despite substantial reductions in BOD loadings. There was, however, insufficient information to modify the modelling approach and consequently SOD was assumed to change proportionately with BOD.

Phosphorus was modelled as particulate, dissolved and as total (the sum of two forms). Changes in total phosphorus concentrations in the river were greater below Millar Western than Weldwood. The total phosphorus levels measured and simulated for 1990 were lower than previously measured.

The simulation of nitrogen included organic nitrogen, nitrate, ammonia and total nitrogen. An ammonia oxidation rate was derived using the loss of ammonia and gain in nitrate with river distance. Difficulty arose over the mass balance of

ammonia and nitrate at Whitecourt where measured downstream concentrations were greater than the sum of the Millar Western effluent and Macleod River contributions. Total nitrogen levels simulated and measured in the Athabasca River compare with other measured levels (Noton and Shaw 1990).

Colour was modelled as a conservative parameter. Measured and simulated colour levels in the upper Athabasca River were lower in the 1990 survey than 1989 due to reduced colour inputs from Weldwood.

Suspended solids simulations included settling of material below the two mill discharges. Millar Western's influence on river suspended solids appears to be reduced from 1989, however the longitudinal river pattern is similar.

Following the modelling approach used for the Peace and Wapiti/Smoky River systems, the WASP model was configured for the Athabasca River and used to simulate two representative organic compounds, 2,4,6 trichlorophenol (TCP) and dehydroabietic acid (DHA). The WASP simulations predict concentrations in the water column and the sediments, as dissolved or sediment sorbed phases. Results indicate differences between TCP and DHA in their behaviour in the receiving waters. Expected concentrations in the benthic sediments or water column are lower than conventional analytical techniques could detect.

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1.0 INTRODUCTION

Water quality in the Athabasca River basin has received considerable attention over the last five years due to its potential for industrial development. Simulation modelling of water quality resulting from various levels of development began in 1986. Information gaps were identified in the initial modelling work and largely addressed by Alberta Environment during the winter of 1989. Following the 1989 winter surveys, the water quality simulation models were calibrated against the three 1989 water quality surveys and the two less intensive 1988 surveys. Particular emphasis was placed on dissolved oxygen (Macdonald and Hamilton, 1989).

In 1988 the only pulp and paper discharge was from Weldwood at Hinton. Millar Western was on line during the three 1989 surveys but its wastewater treatment facility was not operating particularly well (around 7 kg/ADMt). River flows in 1989 were also low and the cold winter created an extensive ice layer on the river. These factors combined to reduce oxygen levels in the Athabasca River at Smith to less than 6.0 mg/L in 1989. Alberta Environment conducted another water quality survey in the winter of 1990. This winter was warmer, flows were higher and Millar Western had its wastewater treatments system operating at greater efficiency.

The best test of a model calibration is to simulate a condition which is significantly different from the calibration condition, but for which there is measured data to verify predictions against. The 1990 survey provides this information. The objective of this study was to test the model calibrations described in Macdonald and Hamilton (1989), against 1990 measured river water quality. If results indicated that the simulation did not adequately describe the measured water quality, then the cause of these discrepancies were to be investigated and a re-calibration of the model carried out. This iterative approach to refining model calibrations is the most effective technique although it can take several years of data collection to obtain a substantial range of river and loading conditions against which model results can be tested.

Two indicator parameters, trichlorophenol and dehydroabietic acid were selected to test modelling of organic contaminant fate. This modelling included both water column and sediment phases. A similar approach was taken on the Peace and Wapiti/Smoky Rivers (Macdonald and Taylor 1990).

2.0 MODELLING APPROACH

Three modules, DOSTOC, NUSTOC and UNSTOC of the Stochastic River Quality Model (HydroQual and Gore & Storrie, 1989) were again used to simulate dissolved oxygen, nitrogen, phosphorus, colour and suspended solids. In addition, the water quality fate model WASP (Ambrose et al., 1988) was configured to simulate the fate of 2,4,6-trichlorophenol and dehydroabietic acid.

Generally the approach was to follow the procedures used in a previous modelling report (Macdonald and Hamilton 1989). This involved revising river hydrology, headwater and tributary quality and effluent loadings to those measured during the 1990 Alberta Environment Survey. Each of these are discussed in detail in the following sections. Physical model structure (Figure 2.1) and river hydraulic definitions remain as per Macdonald and Hamilton (1989), and have also been adapted for the WASP model configuration.

All of the models were run in steady-state mode, meaning that input parameters such as mill load and river flow were set to single values representing the condition at the time of sampling (calibration) or for the design criteria (future).

2.1 HYDROLOGY

Alberta Environment, Hydrology Branch measured tributary and river discharge at numerous locations within the basin, concurrent with the water quality sampling survey. For accurate water quality modelling, all of the measured flow in the mainstem river must be accounted for. While flows at the mouths of most major tributaries were measured, the sum of the measured inflows frequently did not equal the measured downstream Athabasca River flow. To achieve a water balance these ungauged inflows have been assigned to river reaches (M. Mustapha memo May 29,1990) but not to specific locations.

FIGURE **2.1** WATER QUALITY MODELLING SCHEMATIC

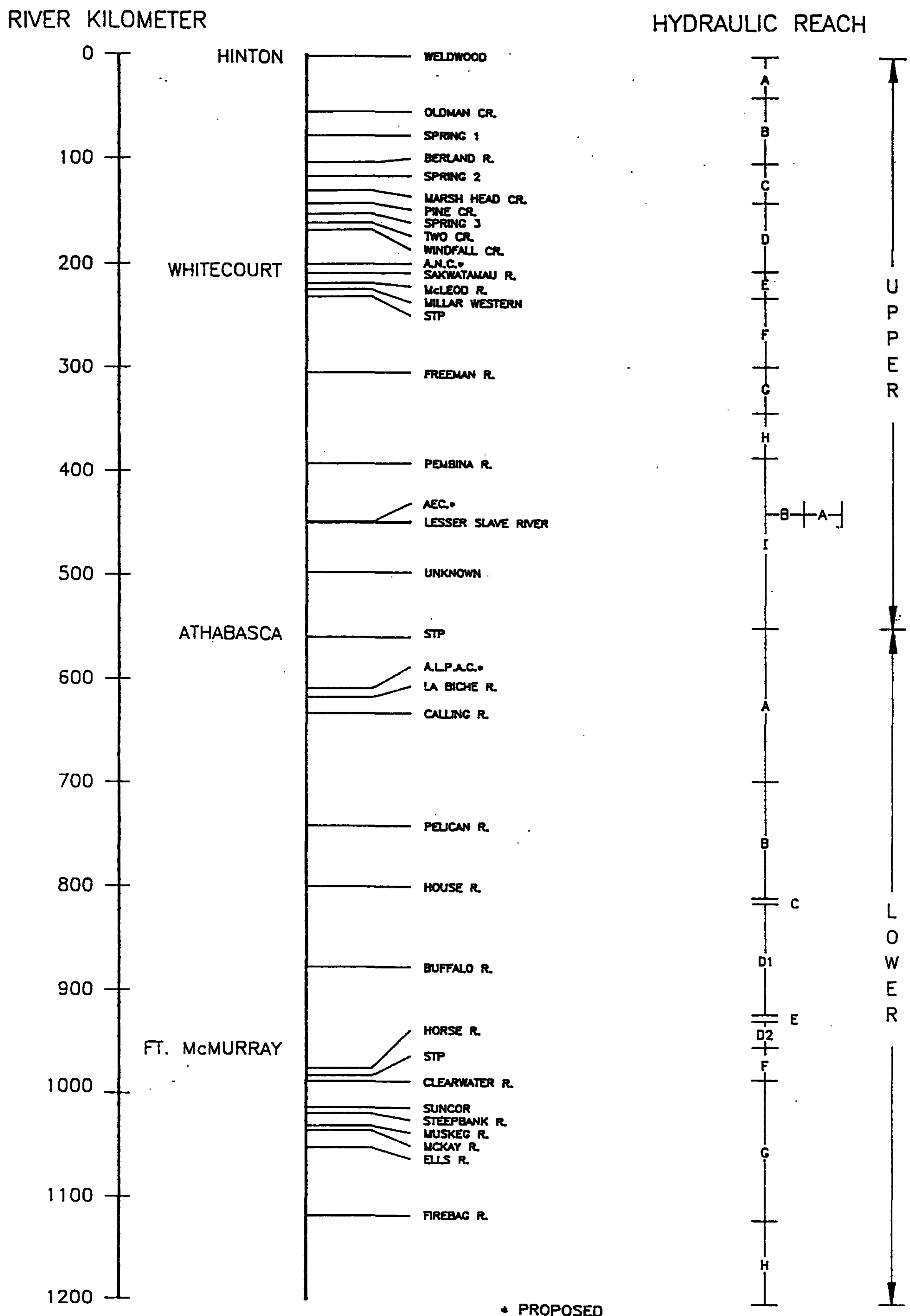

Table 2.1 lists the estimated flow balance from the measured flows and the modelled flow distributions for 1990. Differences between measured and modelled flows for any tributary are the result of assigning ungauged flows to known inflow locations.

By comparison to the flows observed in 1989, the Hinton flows are similar, however the 1990 flows increase over 1989 with distance downstream due to greater tributary contributions (Figure 2.2).

2.2 HEADWATER TRIBUTARY AND EFFLUENT WATER QUALITY

Water quality was measured with approximate time-of-travel from Hinton to Embarras starting on February 14 and ending on March 21, 1990. Sampling was conducted by Environmental Quality Monitoring Branch of Alberta Environment with analysis by the Environmental Centre in Vegreville and Chemex Labs.

The water quality used for the 1990 modelling are shown in Table 2.2. Generally these values are as measured, with the exception of some adjustments in the mill loadings and allocation of quality to unmeasured tributary inflows. Adjustments in mill loadings are discussed along with the modelling results for each parameter. Assignment of quality to unmeasured tributary inflows was based primarily on proximity to a similar measured tributary.

As shown in Table 2.1, tributary flow rates were adjusted to account for unmeasured inflows. This has the effect of assigning the measured tributary quality to the unmeasured inflow. While this seemed to be appropriate for most of the inflows, the House River was an exception. Here flows increased from 1.6 m^3/s to 17 m^3/s and the House River has very different quality than the Athabasca River. As a consequence, the model results showed increases in Athabasca River parameter concentrations that did not correspond with the observed values. To correct for this, the quality assigned to the House River is the flow-weighted average of the

TABLE 2.1. Athabasca River flow balance (all values in m3/s).

SITE	BALANCED ATHABASCA FLOW	BALANCED TRIBUTARY FLOW	MODELLED ATHABASCA FLOW	MODELLED TRIBUTARY FLOW
ATHABASCA U/S HINTON	33		33	
ATHABASCA 36 KM D/S HINTON	33.8		33	
OLDMAN CREEK		1.1		2.4
SPRING 1				0.6
ATHABASCA 60 KM D/S HINTON	35.4		36	
ATHABASCA U/S BERLAND	36		36	
BERLAND RIVER		8.9		8.9
MARSH HEAD CREEK		0.3		0.3
PINE AND TWO CREEKS				3.6
ATHABASCA D/S TWO CREEK	48.8		48.8	
WINDFALL CREEK		0.9		1.9
ATHABASCA U/S WHITECOURT	50.7		50.7	
SAKWATAMAU RIVER		0.9		0.9
McLEOD RIVER		10.1		10.2
ATHABASCA 10 KM D/S McLEOD	61.8		61.8	
ATHABASCA AT BLUE RIDGE	61.9		61.8	
ATHABASCA D/S FIVE MILE ISLAND	62.8		61.8	
FREEMAN RIVER		0.8		2.6
ATHABASCA AT FT. ASSINIBOINE	64.4		64.4	
ATHABASCA U/S PEMBINA	66.2		64.4	
PEMBINA RIVER		6.8		8.9
ATHABASCA U/S SMITH	73.3		73.3	
LESSER SLAVE RIVER		43.7		43.7
ATHABASCA AT ATHABASCA	117		117	
LA BICHE RIVER		2.3		5.3
CALLING RIVER		0.1		0.7
ATHABASCA NEAR McMILLAN LAKE	123		123	
PELICAN RIVER		0.8		2
ATHABASCA U/S HOUSE	125		125	
HOUSE RIVER		1.6		17
ATHABASCA U/S HORSE	142		142	
CLEARWATER RIVER		58.6		62.8
MUSKEG RIVER		0.4		0.4
ELLS RIVER		1.8		1.8
ATHABASCA NEAR BITUMONT	207		207	
FIREBAG RIVER		10.2		11
ATHABASCA NEAR OLD FORT	218		218	

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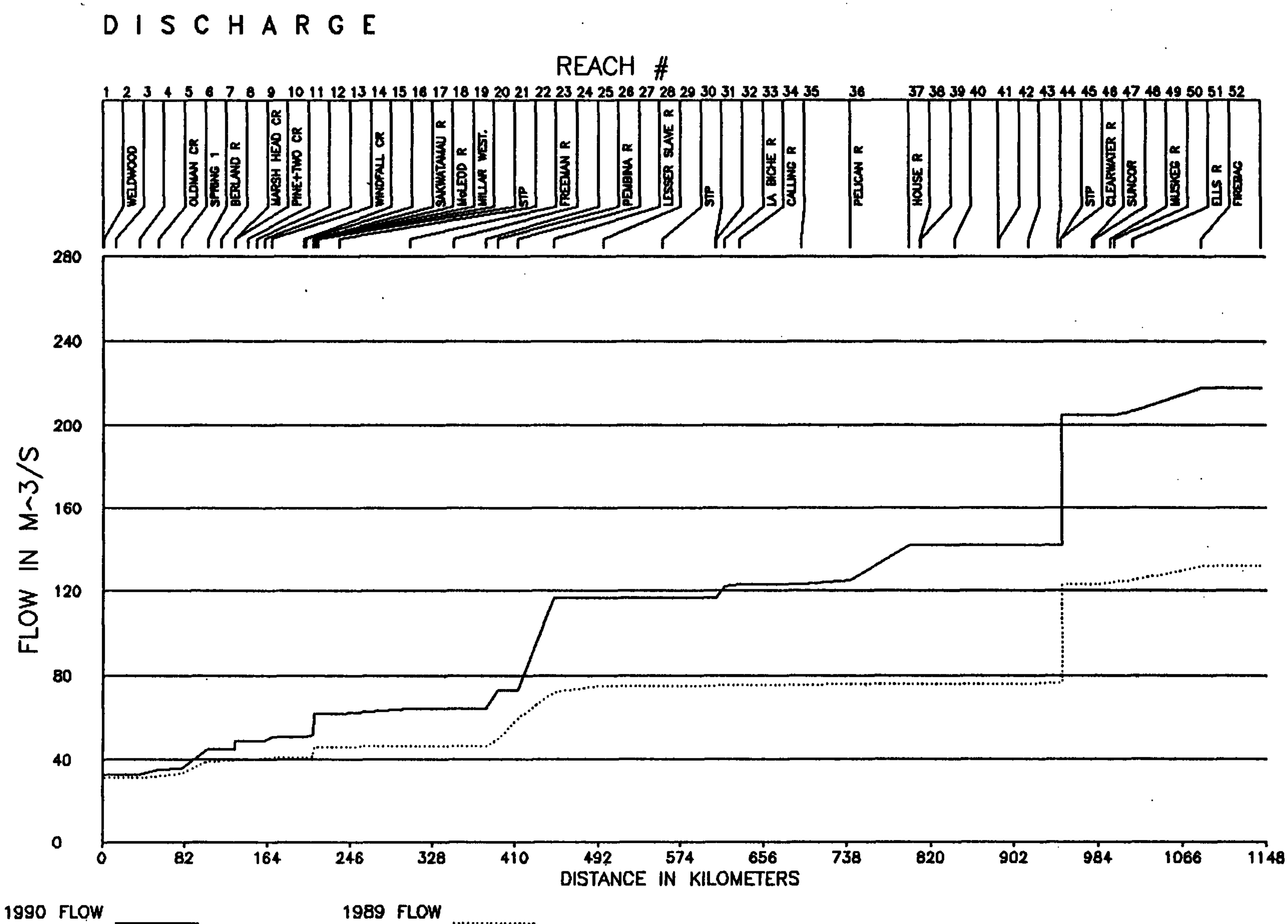

Figure 2.2 June 25 , 1991	ATHABASCA RIVER 1989 AND 1990 FLOW	Environmental Management Associates

Table 2.2 Surface and Effluent Water Quality and Flows Used in Model Calibration

SITE	PHOSPHORUS TOTAL	PHOSPHORUS PARTICULATE	PHOSPHORUS DISSOLVED	NITROGEN TOTAL	NITROGEN ORGANIC	NITROGEN AMMONIA	NITROGEN NITRATE+NITRITE	TRUE COLOUR	SUSPENDED SOLIDS	DISSOLVED OXYGEN	BOD (5 DAY)	FLOW
ATHABASCA U/S OF WELDWOOD	0.008	0.007	0.001	0.122	0.000	0.020	0.102	2	1	11.6	0.36	33
WELDWOOD	0.245	0.196	0.049	4.375	4.023	0.326	0.025	891	41	10.1	53	0.784
OLDMAN CREEK	0.011	0.003	0.008	0.199	0.040	0.010	0.149	4	2	12.8	1.2	2.4
SPRING	0.011	0.004	0.007	0.257	0.160	0.020	0.077	5	1	11.9	0.9	0.6
BERLAND RIVER	0.006	0.002	0.004	0.134	0.050	0.010	0.074	1	2	9.8	0.85	8.9
MARSH HEAD CREEK	0.013	0.010	0.003	0.331	0.180	0.020	0.131	10	2	12.0	0.7	0.3
PINE AND TWO CREEKS	0.011	0.004	0.007	0.257	0.160	0.020	0.077	5	1	11.9	0.9	3.6
WINDFALL CREEK (a)	0.013	0.010	0.003	0.266	0.160	0.020	0.086	10	4	11.3	0.7	1.9
SAKWATAMAU RIVER	0.010	0.007	0.003	0.253	0.160	0.020	0.073	10	6	10.0	0.5	0.9
MCLEOD RIVER	0.009	0.004	0.005	0.526	0.295	0.035	0.196	11	3	8.5	0.55	10.2
MILLAR WESTERN	6.800	5.440	1.360	16.040	15.380	0.750	0.040	797	121	4.6	30	0.136
WHITECOURT STP (b)	4.500	0.180	4.320	9.895	0.800	7.800	1.295	35	4	4.4	5.3	0.035
FREEMAN RIVER	0.018	0.011	0.007	0.326	0.220	0.040	0.066	14	5	8.7	0.2	2.6
PEMBINA RIVER	0.044	0.015	0.028	0.980	0.570	0.040	0.370	52	1	3.3	0.75	8.9
LESSER SLAVE RIVER	0.019	0.007	0.012	0.471	0.390	0.040	0.041	13	7	12.4	0.9	43.7
ATHABASCA STP (b)	6.100	0.350	5.750	26.900	4.600	20.000	2.300	51	9	5.0	15.3	0.012
LA BICHE RIVER	0.094	0.056	0.038	1.260	0.830	0.120	0.310	28	15	4.9	0.4	5.3
CALLING RIVER	0.059	0.045	0.014	1.570	0.890	0.360	0.320	28	6	11.6	0.3	0.7
PELICAN RIVER	0.088	0.068	0.019	3.310	1.320	1.980	0.010	145	9	12.3	3.3	2
HOUSE RIVER	0.133	0.018	0.040	1.290	0.695	0.045	0.197	23	10	11.6	0.3	17
FORT MCMURRAY STP (b)	2.500	0.600	1.900	25.685	6.000	18.700	0.985	41	15	5.0	71.1	0.088
CLEARWATER RIVER	0.055	0.029	0.026	0.536	0.300	0.060	0.176	33	7	11.9	0.2	62.8
SUNCOR (c)	0.205	0.099	0.106	0.970	0.520	0.280	0.170	19	22	5.0	1.9	0.241
MUSKEG RIVER	0.032	0.019	0.013	1.130	0.580	0.340	0.210	61	4	11.2	0.6	0.4
ELLS RIVER	0.030	0.015	0.015	0.770	0.490	0.030	0.250	44	5	10.9	0.6	1.8
FIREBAG RIVER	0.061	0.019	0.042	0.441	0.225	0.045	0.171	32	3	6.3	0.5	11

All values in mg/L except flow in m^3/s and true colour in relative units.

(a). Phosphorus concentrations from Marsh Head Creek.
(b). 1989 effluent concentrations.
(c). Phosphorus concentrations averages of 1989 surveys.

actual House River quality and flow (1.6 m^3/s) and the additional flow (15.6 m^3/s) assumed to have a quality equal to the Athabasca River just upstream of the House River confluence.

3.0 DISSOLVED OXYGEN

Primary factors controlling dissolved oxygen in the Athabasca River during the winter months are pulp mill effluent BOD, sediment oxygen demand, river flow, degree of ice-cover and tributary oxygen levels. These are discussed with respect to model calibration and application in Macdonald and Hamilton (1990).

The greatest differences between the 1989 calibration and the conditions in 1990 are the mill effluent loadings. Millar Western maintained production levels, but reduced BOD loadings from greater than 5000 kg/d to less than 1000 kg/d.

3.1 LONG-TERM BOD ANALYSIS

Measurement of long-term oxygen demand in bottled effluent was undertaken in 1989 and 1990. In both cases samples were monitored for greater than 100 days to gain information on the oxygen demand and to determine the ultimate amount of oxygen demanding material.

Raw laboratory data from Chemex Laboratories Ltd., Millar Western and Weldwood were compiled in a computer database. Results from effluent samples which were diluted with a seed water were corrected for the dilution and the oxygen consumed in the seed water blank. The results were analyzed using the non-linear regression routines in the statistical program SYSTAT.

Table 3.1 shows the results of the statistical analysis from Millar Western and Weldwood samples collected in the winter of 1988/89 reported in Macdonald and Hamilton (1989). The 1990 results are shown in Table 3.2. As well, Millar Western and Weldwood conducted their own long-term BOD assessments following Alberta Environment protocols. Their results were also analyzed statistically and are included in Table 3.3.

Table 3.1 Athabasca River Project - Summary of 1989 BOD ultimate analysis for pulpmill waters (Preliminary)

Source: Macdonald and Hamilton (1989)

SAMPLE	DATE	DILUTION	L_1	K_1	MEASURED*		CALCULATED**	
					BOD_5	BOD_u/BOD_5	BOD_5	BOD_u/BOD_5
MILLAR WESTERN	88 10 24	3	422	0.059	116	3.6	108	3.9
	88 10 24	5	399	0.072	121	3.3	121	3.3
	88 10 14	10	350	0.052	109	3.2	80	4.4
	88 11 16	3	978	0.045	299	3.3	197	5.0
	88 11 16	3	959	0.054	304	3.2	227	4.2
	88 11 16	5	664	0.051	222	3.0	149	4.4
	88 11 16	5	645	0.056	226	2.9	158	4.1
	88 11 16	10	584	0.055	199	2.9	140	4.2
	88 11 16	10	598	0.048	192	3.1	128	4.7
	88 12 09	3	479	0.035	98	4.9	77	6.2
	88 12 09	5	468	0.039	89	5.3	83	5.6
	89 01 12	1	2102	0.078	716	2.9	679	3.1
	89 01 12	1	2265	0.065	714	3.2	628	3.6
	89 01 12	3	2007	0.043	494	4.1	388	5.2
	89 01 12	3	2043	0.043	499	4.1	395	5.2
	89 01 26	1	1708	0.036	325	5.3	281	6.1
	89 01 26	1	1588	0.038	324	4.9	275	5.8
	89 01 26	3	1405	0.042	310	4.5	266	5.3
	89 01 26	3	1324	0.044	318	4.2	261	5.1
	89 02 16	1	2422	0.035	493	4.9	389	6.2
	89 02 16	1	2922	0.029	536	5.5	394	7.4
	89 02 16	3	2712	0.042	580	4.7	514	5.3
	89 02 16	3	2776	0.037	556	5.0	469	5.9
	MILLAR WESTERN AVERAGES			0.048		4.0		5.0
WELDWOOD	88 12 02	10	222	0.035	49	4.5	36	6.2
	88 12 02	15	253	0.034	55	4.6	40	6.4
	88 12 02	20	233	0.036	52	4.5	38	6.1
	89 01 09	3	141	0.038	40	3.5	24	5.8
	WELDWOOD AVERAGES			0.036		4.3		6.1

L_1 BOD ultimate
K_1 BOD oxidation rate (day^{-1}, 0°C);
* measured at Alberta Environmental Centre, Vegreville;
** as derived from first order equation

TABLE 3.2. Summary of 1990 BOD ultimate analysis for pulpmill waste waters. (Alberta Environment Monitoring)

						MEASURED		CALCULATED	
SAMPLE	DESCRIPTION	DATE	BOTTLE	L1	k1	BOD5	BODu/BOD5	BOD5	BODu/BOD5
137-1A	Weldwood 5% Unfiltered	Mar 8/90	1	93.7	0.050	14.4	6.5	20.6	4.5
			2	84.3	0.047	13.6	6.2	17.5	4.8
137-1B	Weldwood 10% Unfiltered	Mar 8/90	1	87.1	0.052	18.2	4.8	20.0	4.4
			2	77.8	0.060	17.9	4.3	20.3	3.8
251-1A	Weldwood 5% Unfiltered	Mar 23/90	1	121.7	0.037	17.0	7.2	20.4	6.0
			2	115.4	0.035	15.9	7.3	18.5	6.2
251-1B	Weldwood 10% Unfiltered	Mar 23/90	1	133.5	0.037	20.3	6.6	22.5	5.9
			2	128.1	0.042	21.9	5.8	24.5	5.2
	WELDWOOD AVERAGES			105.2	0.045	17.4	6.1	20.5	5.1
187-1A	Millar Western 2.5% Unfiltered	Mar 15/90	1	901.8	0.013	44.6	20.2	56.8	15.9
			2	857.2	0.012	41.0	20.9	51.5	16.6
187-1B	Millar Western 5% Unfiltered	Mar 15/90	1	825.4	0.016	60.5	13.6	64.1	12.9
			2	718.4	0.015	60.5	11.9	52.9	13.6
251-2A	Millar Western 2.5% Unfiltered	Mar 23/90	1	791.0	0.011	2.6	304.2	43.6	18.1
			2	754.6	0.012	9.2	82.0	42.3	17.8
251-2B	Millar Western 5% Unfiltered	Mar 23/90	1	750.8	0.014	28.3	26.5	51.2	14.7
			2	724.2	0.017	32.7	22.1	58.0	12.5
3107-1A	Millar Western 5% Unfiltered	Feb 23/90	1	685.9	0.008	13.1	52.4	25.3	27.2
			2	693.2	0.007	8.6	80.6	23.1	29.9
3107-1B	Millar Western 5% Unfiltered	Feb 23/90	1	599.4	0.007	8.6	69.7	21.2	28.3
			2	608.4	0.007	10.2	59.6	20.7	29.3
3107-1C	Millar Western 2.5% Unfiltered	Feb 23/90	1	664.6	0.006	8.6	77.3	20.1	33.0
			2	656.0	0.007	6.9	95.1	22.1	29.7
3107-1D	Millar Western 2.5% Unfiltered	Feb 23/90	1	669.5	0.006	7.8	85.8	19.0	35.3
			2	905.3	0.003	7.4	122.3	15.1	59.9
	MILLAR WESTERN AVERAGES			737.9	0.010	21.9	71.5	36.7	24.7

TABLE 3.3. Summary of BOD ultimate analysis for pulpmill waste waters.
(Pulpmill Monitoring)

						MEASURED		CALCULATED	
SAMPLE	DESCRIPTION	DATE	BOTTLE	L1	k1	BOD5	BODu/BOD5	BOD5	BODu/BOD5
W3	Weldwood 11% unfiltered	Apr 25/90	1	132	0.0391	24.4	5.4	23.4	5.6
W6	Weldwood 33% unfiltered	Aug 28/90	1	66.2	0.0271	2.4	27.6	8.4	7.9
	WELDWOOD AVERAGES			99.1	0.0	13.4	16.5	15.9	6.8
MW2	Millar Western 10% unfiltered	Apr 9/90	1	328.8	0.0221	28.33	11.6	34.4	9.6
MW3	Millar Western 6.25% unfiltered	Apr 9/90	1	350	0.0126	10.59	33.1	21.37	16.4
MW4	Millar Western 3.3% unfiltered	Apr 9/90	1	130.6	0.026	7.9	16.5	15.92	8.2
MW5	Millar Western 10% filtered	Apr 9/90	1	245.7	0.0184	22.63	10.9	21.6	11.4
MW6	Millar Western 14% filtered	Apr 9/90	1	232.4	0.0207	27.61	8.4	22.85	10.2
MW8	Millar Western 10% unfiltered	Jul 17/90	1	211	0.0095	0		9.79	21.6
MW9	Millar Western 6.25% unfiltered	Jul 17/90	1	711	0.0023	1.6	444.4	8.13	87.5
	MILLAR WESTERN AVERAGES			315.6	0.0	14.1	87.5	19.2	23.5

When comparing results from year to year and even sample to sample, both the ultimate BOD (L_1) and the oxidation rate (K_1) must be considered. In 1989, Millar Western effluent averaged around 2000 mg/L of BOD_u which oxidized at an average rate of 0.048 (1/day). Following upgrades to their treatment facilities these were reduced to 800 mg/L BOD_u with an oxidation rate of 0.010 (1/day) in 1990 (Table 3.2). This indicates that the improved treatment has likely removed the material which is more easily oxidized and what remains is a smaller fraction of ultimate BOD which is harder to oxidize (lower oxidation rate).

The Weldwood results (Table 3.2) indicate reductions in ultimate oxygen demand as well, from 200 mg/L (1988/89) to 100 mg/L (1990) with a corresponding increase in oxidation rates from 0.036 to 0.045 (1/day). Sample sizes, however, were small and results quite variable.

Comparisons between mill monitored ultimate BOD and Alberta Environment results are difficult because samples were not collected on the same day. Generally speaking, the Millar Western results (particularly April, 1990) seem to have lower ultimate BOD values and higher oxidation rates (Table 3.3) than Alberta Environment (Table 3.2). With respect to Weldwood, Alberta Environment and mill data are comparable.

On Tables 3.1 to 3.2 there are two columns titled "Measured" and "Calculated". Within each column is the heading BOD_5, these values are the oxygen demand measured on day 5 of the test, or calculated for day 5 based upon the best fit regression. The other columns are the ratio of BOD_u to BOD_5. For both ratios, the BOD_u value used was the one derived from the regression analysis. Also of note is the substantial change in the BOD_u:BOD_5 ratio for Millar Western from 1988/89 to 1990. Using the calculated BOD_5, the average ratio changed from 5.0 in 1988/89 (Table 3.1) to 24.7 in 1990 (Table 3.2). This increase is indicative of the higher level of effluent treatment currently being conducted at Millar Western.

Graphs of the measured and regression fit long-term BOD are included in Appendix III. These include both the Alberta Environment and the mill collected data.

3.2 SEDIMENT OXYGEN DEMAND

Previous Athabasca River modelling (Macdonald and Hamilton 1989) made assumptions regarding the relationship between mill BOD load and sediment oxygen demand (SOD). It was assumed that SOD increased or decreased linearly with mill BOD load. This assumption was based on the theory that sediment oxygen demand was a function of the organic material discharged by the mills and deposited downstream, coupled with elevated nutrient levels which would promote biologically mediated decay. This theory is supported by the fact that there is a substantial difference in SOD between upstream and downstream mill effluent discharges (Casey, 1990 and Casey and Noton, 1989).

Further investigation by Casey (1990) involving replication of the 1989 SOD measurements in 1990 suggest that despite significant changes in the mill BOD loadings, SOD measurements were very similar between the two years, thereby refuting the assumption that SOD increased with BOD load.

Casey (1990) also found evidence that sediment oxygen demand increases through the winter months. For example, at Whitecourt SOD increased from 0.1 - 0.2 $gO_2/m^2/day$ in January to 0.6 $gO_2/m^2/day$ in March.

SOD and its effects on modelling are discussed in Section 3.3.

3.3 MODELLING RESULTS

For the purpose of modelling, the Alberta Environment measured BOD ultimates were used to define the loads from Millar Western and Weldwood. The BOD oxidation rate below Millar Western was reduced from 0.05 to 0.01 1/day based upon the change in the observed bottle oxidation rate from 1988/89 to 1990. Tributary, headwater and other municipal and industrial BOD were converted to ultimate BOD as in Macdonald and Hamilton (1989).

The 1990 sediment oxygen demand measurements bring into question the validity of using a variable SOD (based upon BOD landing) as a modelling and evaluation approach (see Section 3.2). Although the information refutes the approach, it is insufficient to displace the theoretical hypothesis that there is a linkage. In light of this information, this relationship clearly needs further research. For the following modelling, the SOD/BOD relationship described in Macdonald and Hamilton (1989) has been used.

Figure 3.1 shows simulated and observed dissolved oxygen concentrations for 1990 assuming BOD loadings and oxidation rates as discussed above, and a reduction in SOD, equivalent to the reduction in BOD. The dissolved oxygen depletion rate below Weldwood is similar to that observed in 1988/1989, however, below Millar Western there is a considerable reduction in the depletion rate reflecting the lower BOD loadings. There is a good match between the simulated and measured results along the entire length of the river.

As an indication of the total rate of BOD removal from the water column that is to say oxidation plus settling, the BOD ultimates for the river samples were plotted against time-of-travel (Figure 3.2). Note that the BOD ultimate is expressed as a mass versus a concentration to account for dilution. The anticipated result is a gradual decline in mass below each mill as BOD is oxidized or settles from the water column. This can be seen below Millar Western but not clearly below Weldwood (Figure 3.2). In either case, there is considerable scatter in the data and some surprising high values downstream at Smith (Hour 14).

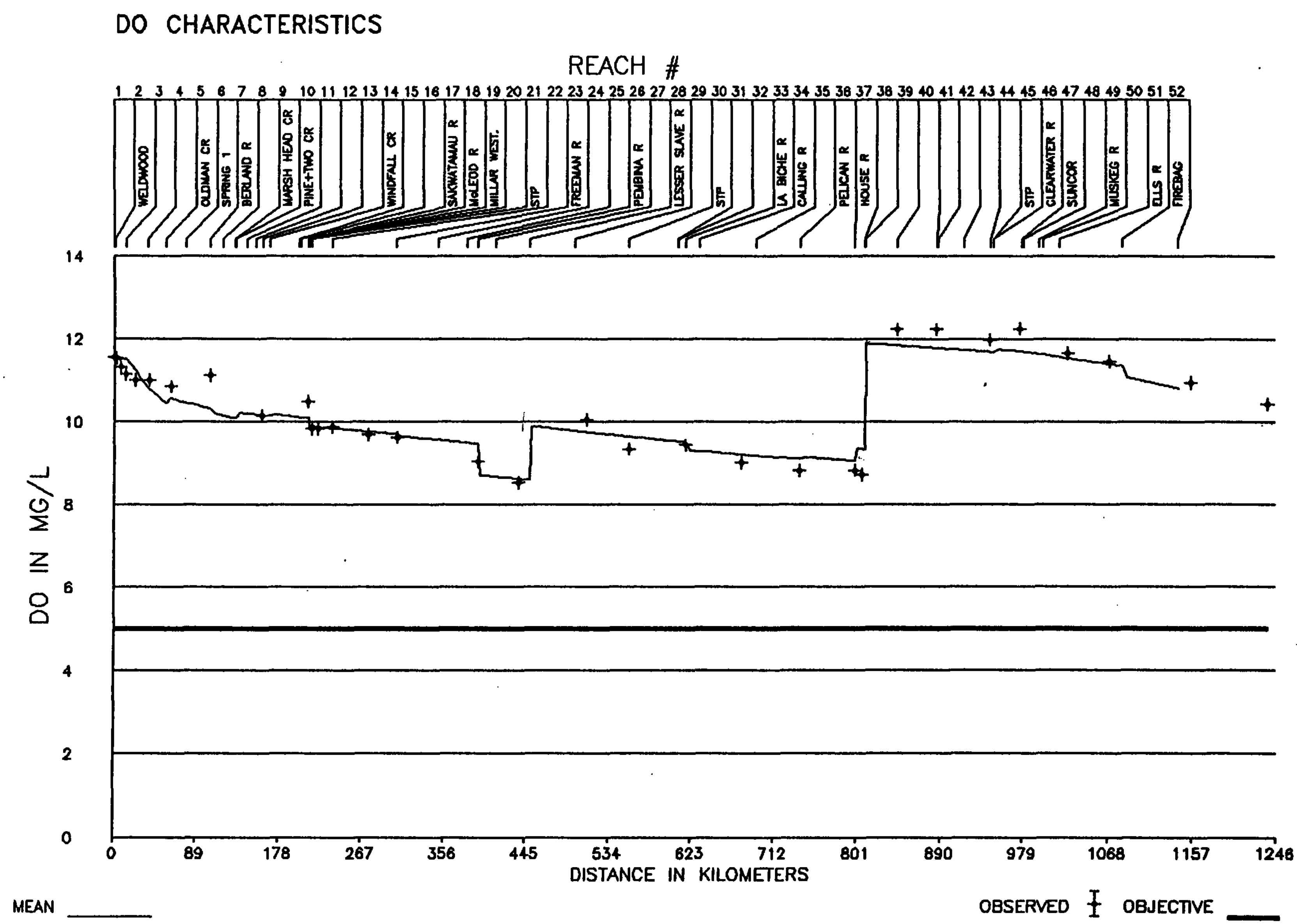

Figure 3.1 June 18 , 1991	ATHABASCA RIVER 1990 CALIBRATION	Environmental Management Associates

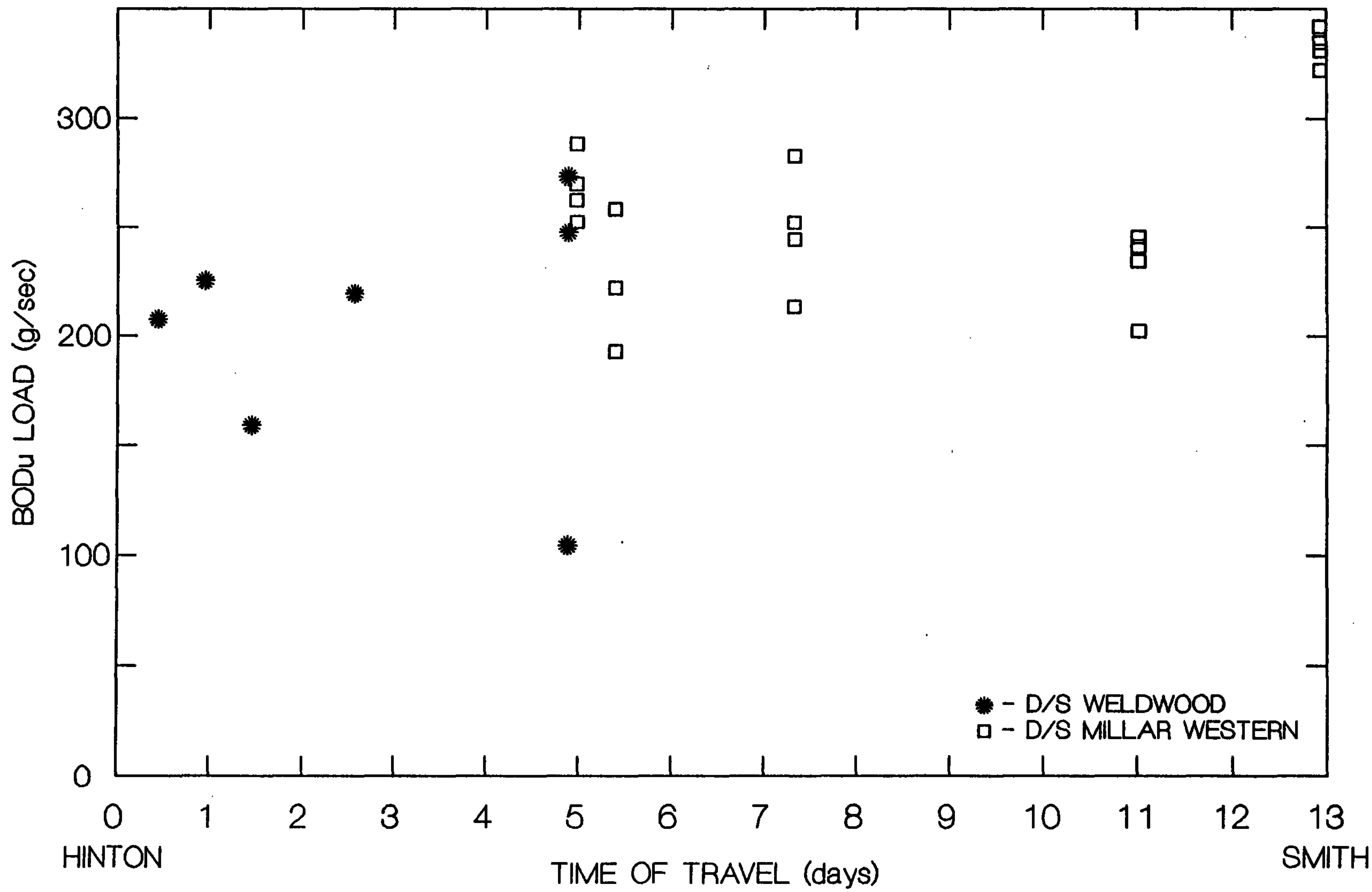

Figure 3.2	ATHABASCA BODu VS TRAVEL TIME 1990 DATA	Environmental Management Associates

Modelling done to date has assumed that the SOD is a function of the BOD loading assumed for each mill. This BOD loading is the measured load for the day of the Alberta Environment synoptic survey. Thus the SOD is actually equated to daily loading whereas in reality it is more likely a function of the seasonal or monthly BOD loading. By linking SOD to daily BOD the modelling is likely more sensitive to changes in BOD loading than the river. While this does not seem to have affected the calibrations, likely because synoptic measurements were representative of monthly measurements, it would be noticeable when deriving loading limits. In this case monthly measurements should be used.

In summary, modelling of the 1990 condition, verifies the earlier dissolved oxygen calibration of Macdonald and Hamilton (1989) and supports the use of the model for wasteload allocation evaluations.

4.0 PHOSPHORUS

Phosphorus was modelled as particulate and dissolved forms and the results summed to give total phosphorus. The model (NUSTOC) simulates settling of particulate P for 75 - 100 km downstream of pulp mill effluents outfalls. Over the same distance, biological uptake of dissolved phosphorus was assumed to occur. Rates were determined during calibration to two 1989 data sets, and applied here with the exception that the zone for particulate settling was extended by approximately 50 kilometres below Weldwood.

Figures 4.1 through 4.3 show the simulated and observed results for dissolved, particulate and total phosphorus respectively. The mill effluent samples were analyzed for total phosphorus only; the dissolved and particulate fractions were estimated from downstream river measurements, i.e., change in concentrations of P fractions immediately below the effluents. River concentrations of total phosphorus downstream of the two mills were greater than that originally simulated. To achieve a mass balance at both mills, phosphorus concentrations in the two effluents had to be doubled. Roughly one-third of Weldwood's effluent phosphorus is dissolved, compared with two-thirds at Millar Western. Total phosphorus loading, as seen by the increases in river phosphorus (Figure 4.3), is greater at Millar Western than at Weldwood.

The total phosphorus levels measured in 1990 below each of the mills were lower than measured in 1989 due to decreases in mill effluent contributions.

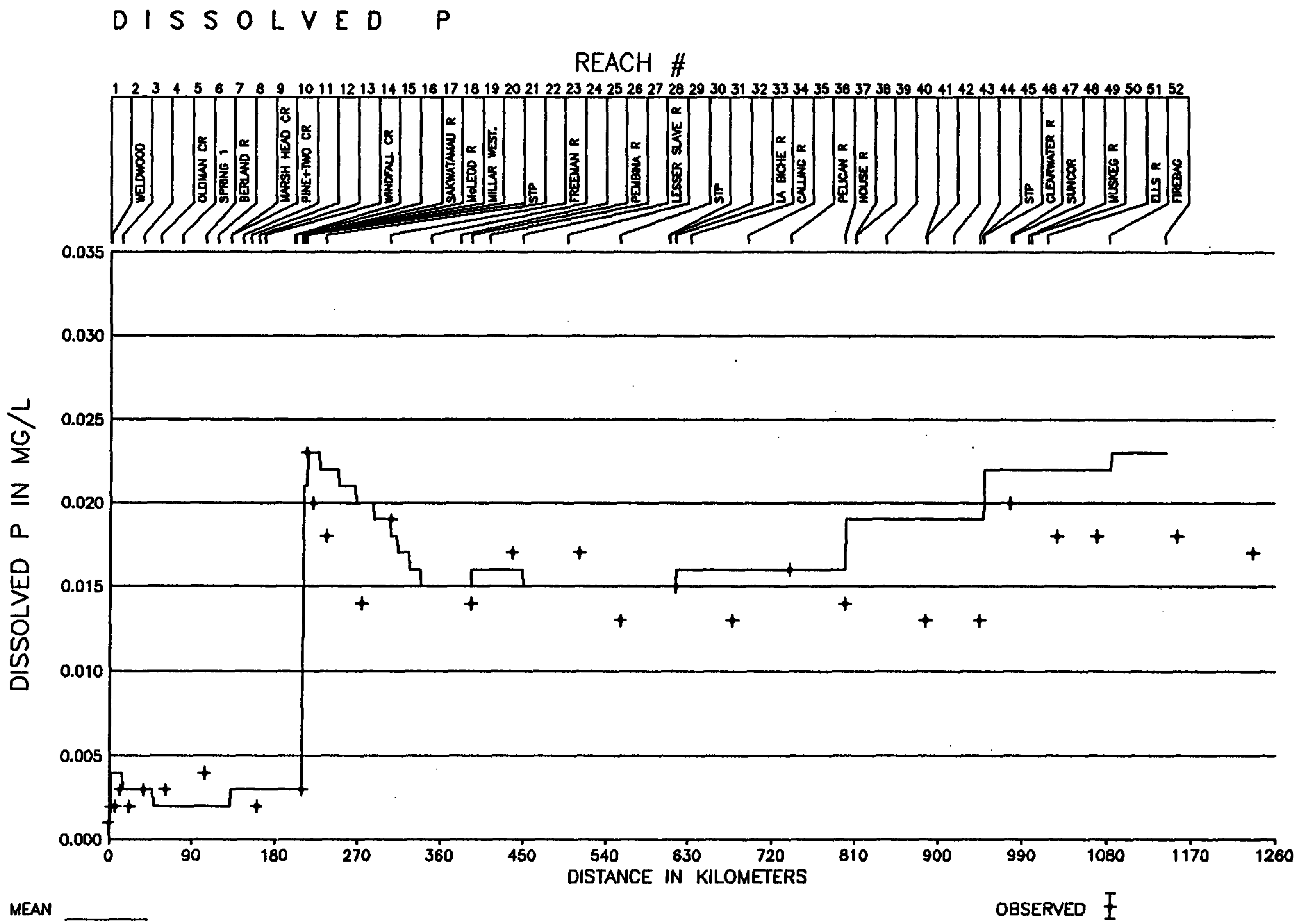

Figure 4.1 June 18 , 1991	ATHABASCA RIVER 1990 CALIBRATION.	Environmental Management Associates

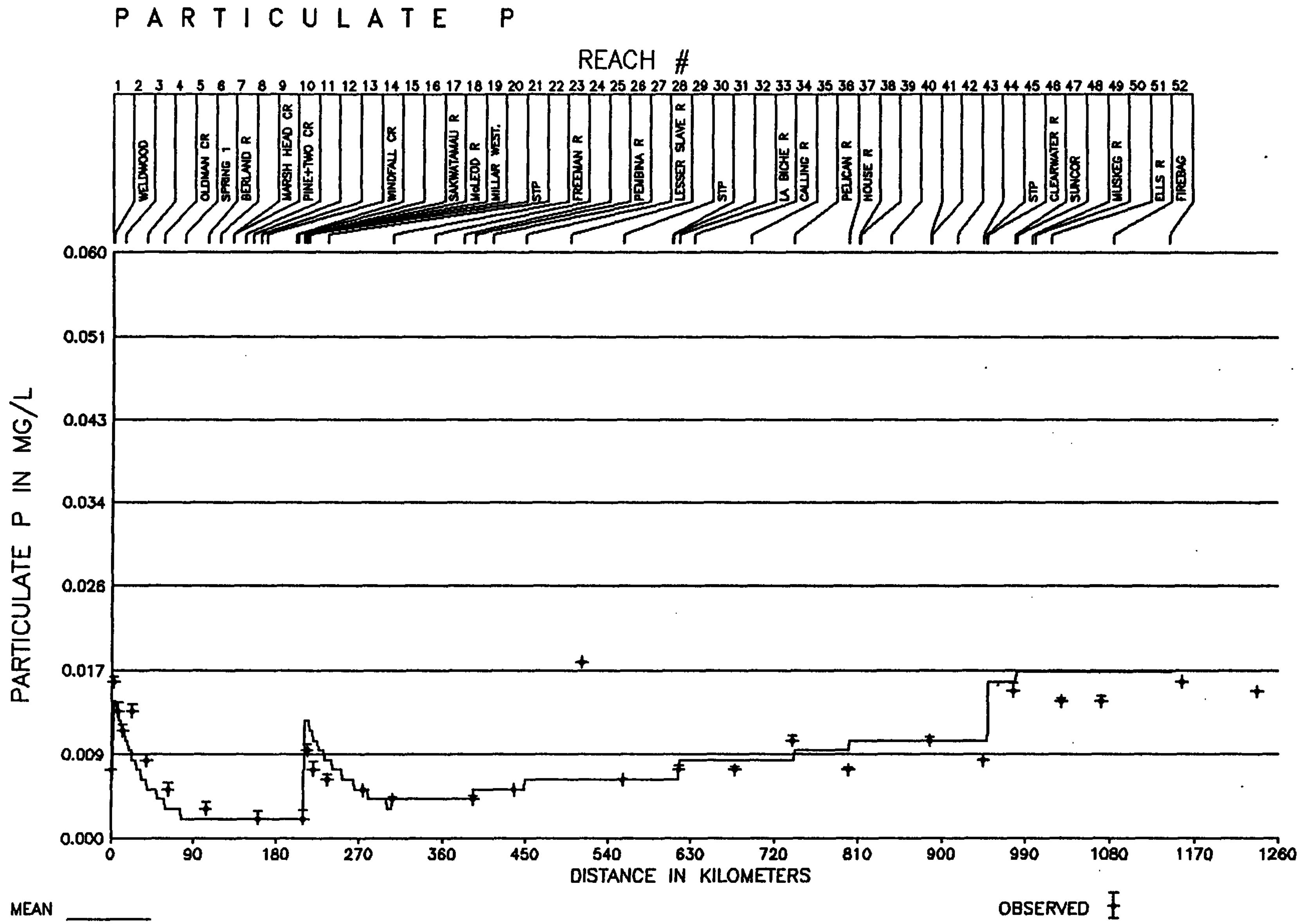

Figure 4.2 June 18 , 1991	ATHABASCA RIVER 1990 CALIBRATION	Environmental Management Associates

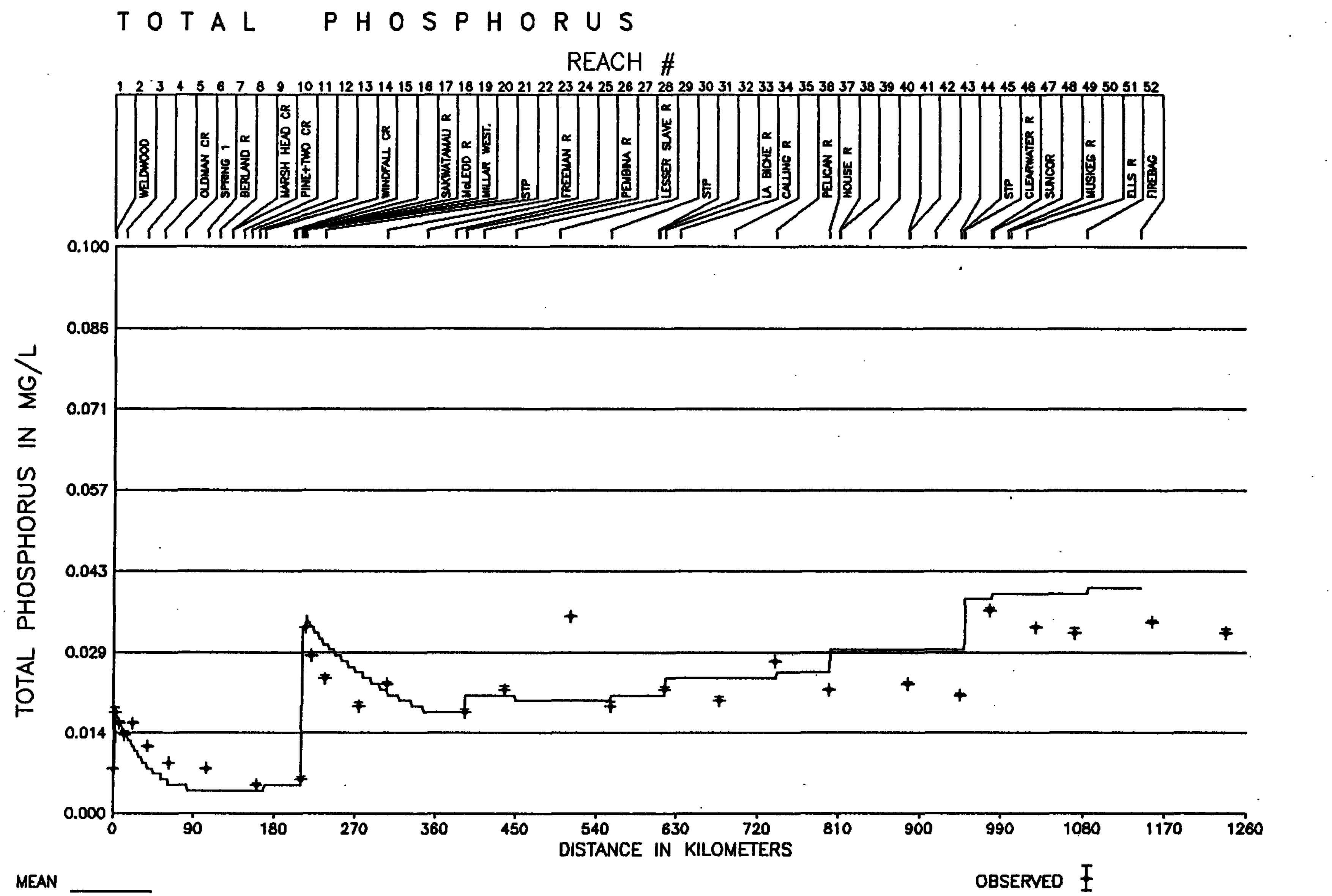

Figure 4.3 June 18 , 1991	ATHABASCA RIVER 1990 CALIBRATION	Environmental Management Associates

5.0 NITROGEN

Simulations of nitrogen considered the three important aquatic forms, ammonia, nitrate and organic nitrogen. Total nitrogen is reported as the sum of these three fractions. In the model, ammonia is oxidized to nitrate at a rate determined by the rate of ammonia loss and nitrate gain in the observed data. Organic nitrogen hydrolysis was not considered as this depends upon biological activity which should be minimal under winter ice, however, the measured SOD rates indicate a level of biological activity. Organic nitrogen was assumed to be particulate, and therefore was allowed to settle for 75 - 100 km below pulp mill effluent outfalls.

The measured organic nitrogen (Figure 5.1), ammonia (Figure 5.2), nitrate (Figure 5.3) and total nitrogen (Figure 5.4) are similar in longitudinal pattern and concentration to previous measurements in the Athabasca River (Noton and Shaw, 1989). Generally, there is agreement between measured and simulated results. The following paragraphs discuss each of the parameter simulations.

Organic nitrogen concentrations increase below the two pulp mills, and below the Pembina and Lesser Slave Rivers. Much of the load from the pulp mills appears to be settleable particulate material, as indicated by the decline in organic nitrogen below the two mills. A settling rate of 0.25 1/day was assumed in each of these zones.

The ammonia simulation (Figure 5.2) required some adjustments to the loadings in order to get simulated and measured concentrations to match. The greatest discrepancy was below Whitecourt. At Whitecourt two factors strongly affect ammonia levels. Firstly the Mcleod River enters carrying a flow of 10.1 m^3/s and 0.07 mg/L of ammonia. Secondly, the Millar Western mill discharges effluent with a measured ammonia concentration of 0.12 mg/L. Despite these two loads, the simulated river concentrations did not equal the measured 0.07 mg/L level; rather,

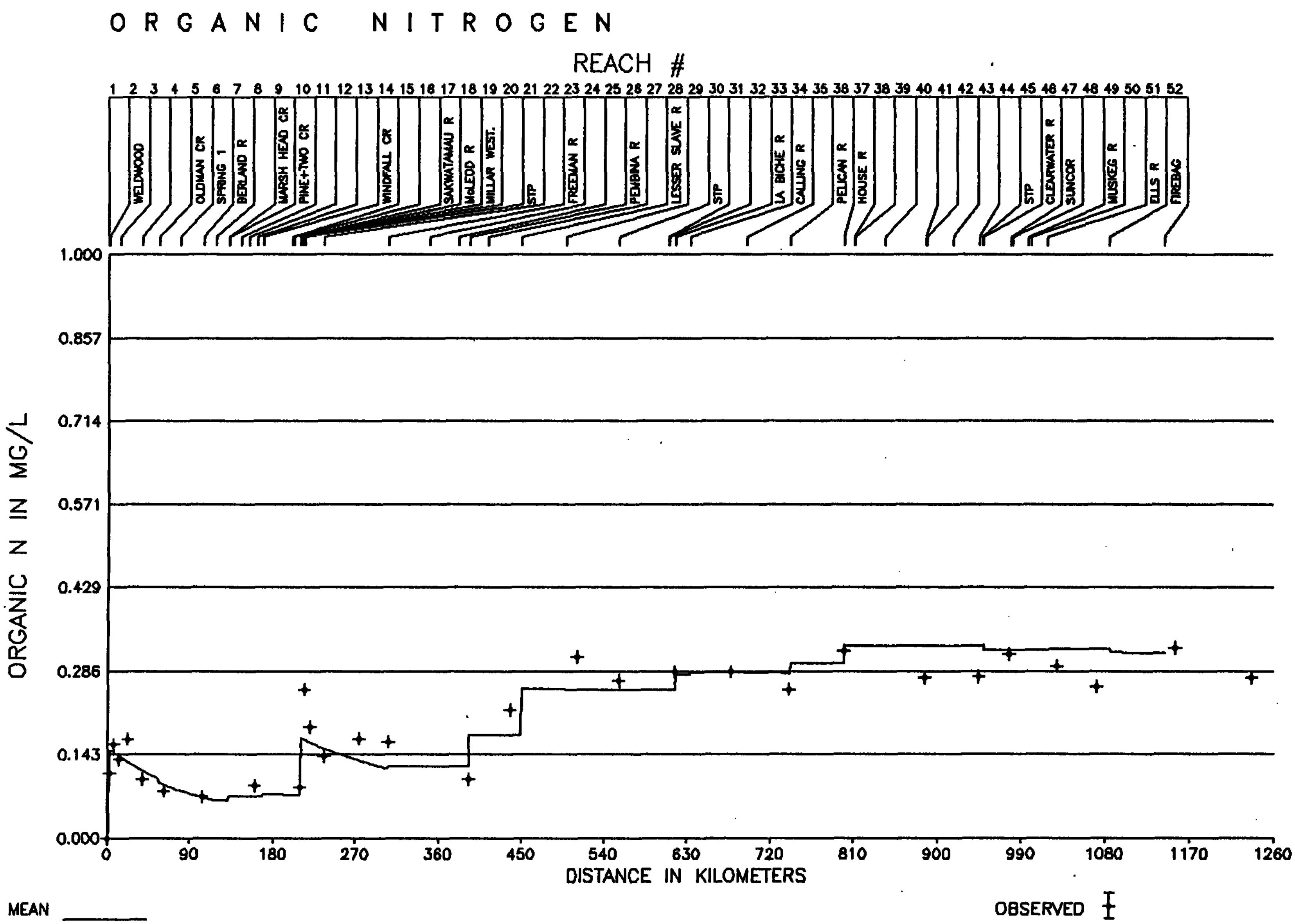

Figure 5.1 June 18 , 1991	ATHABASCA RIVER 1990 CALIBRATION	Environmental Management Associates

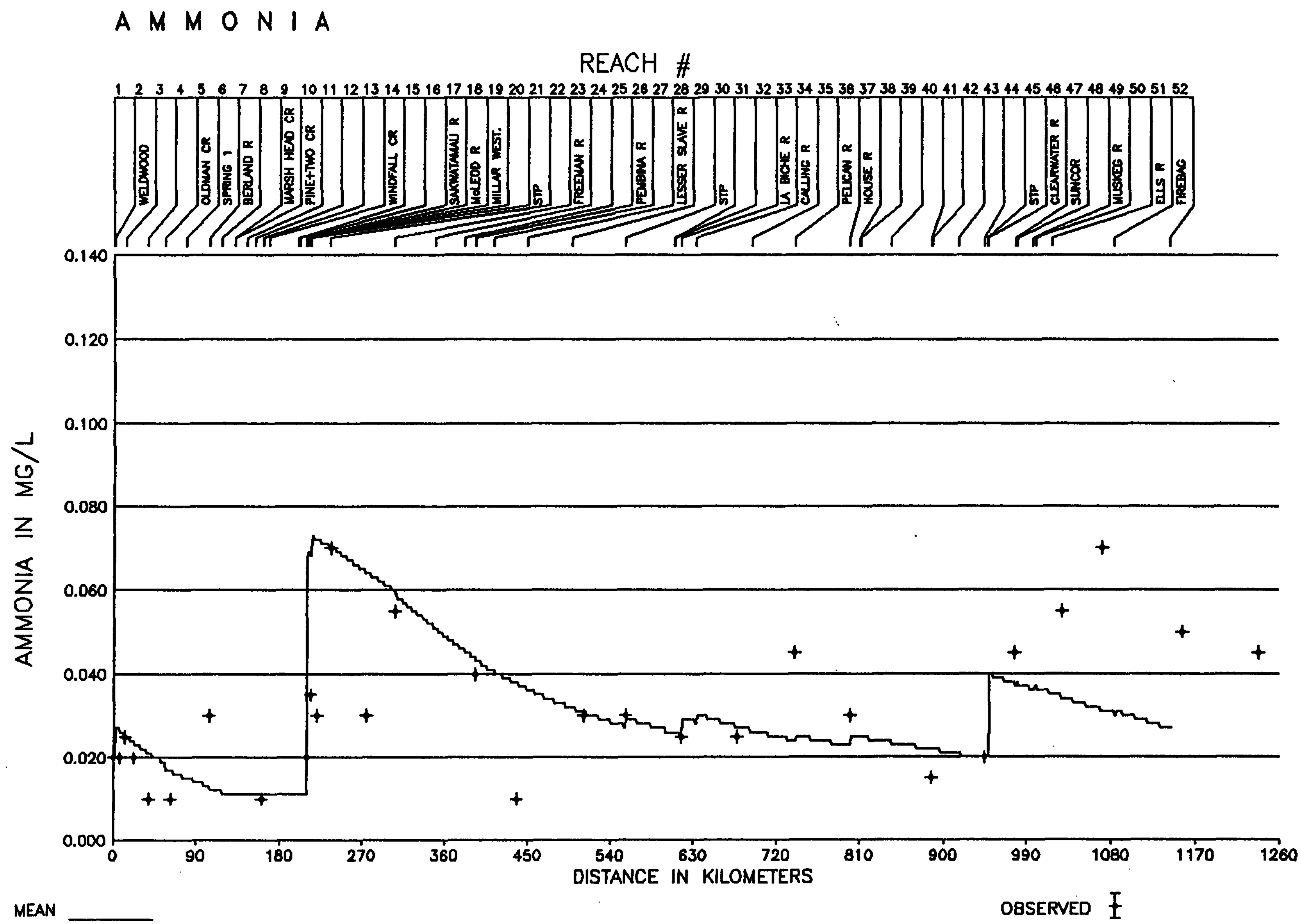

Figure 5.2 June 18 , 1991	ATHABASCA RIVER 1990 CALIBRATION	Environmental Management Associates

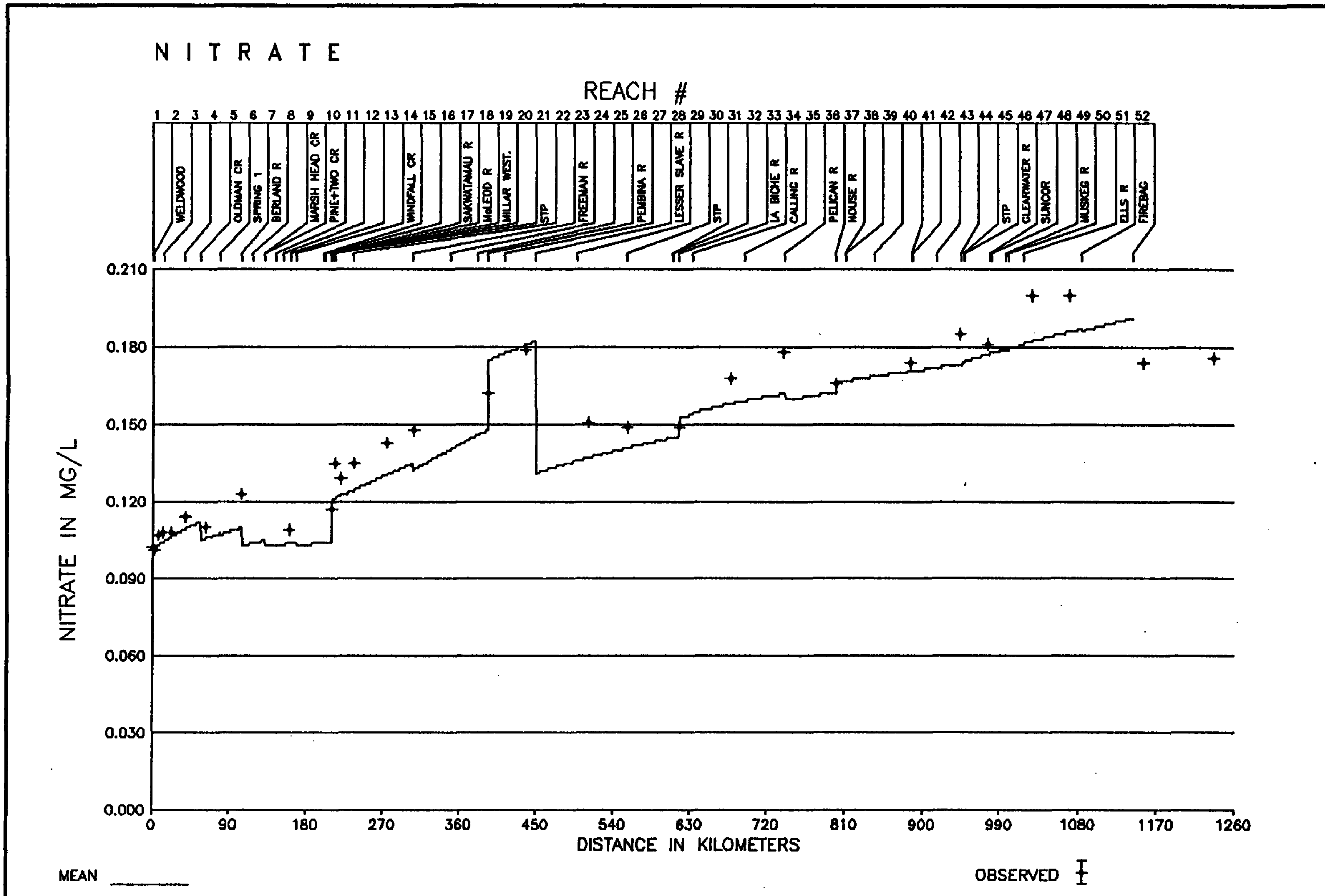

Figure 5.3 June 18 , 1991	ATHABASCA RIVER 1990 CALIBRATION	Environmental Management Associates

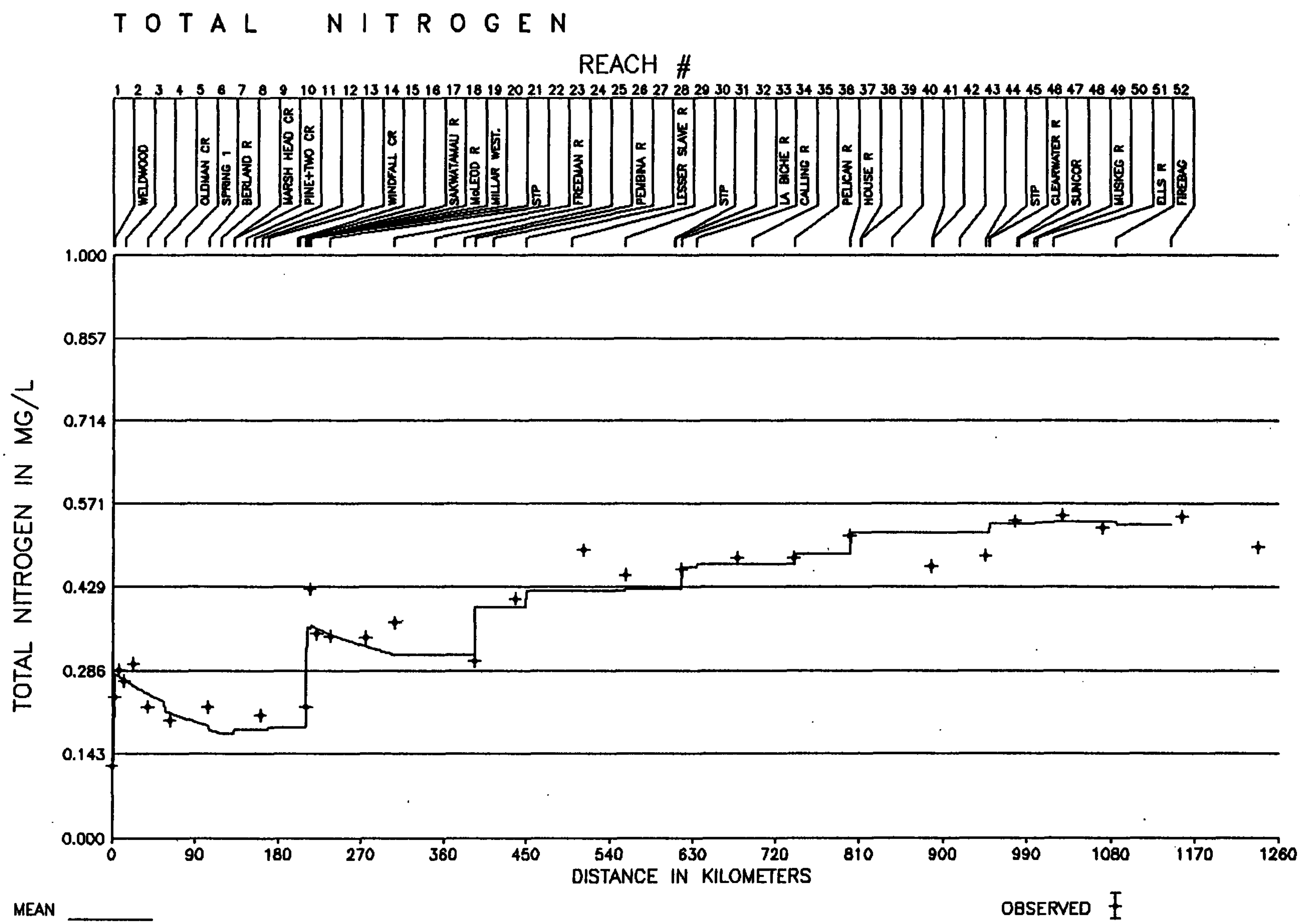

Figure 5.4 June 25 , 1991	ATHABASCA RIVER 1990 CALIBRATION	Environmental Management Associates

the model predicted a concentration of around 0.04 mg/L. To compensate for this difference the Millar Western effluent concentration was increased to 0.75 mg/L (reflecting a winter average value) and the Mcleod River was increased to 0.35 mg/L. This increase in the Mcleod River concentration places it beyond levels previously measured in the winter.

The other unresolved discrepancy in the results occur towards the downstream end of the river. Below Fort McMurray, ammonia increases beyond the levels that could be attributed to measured tributary or sewage treatment plant inflows. These high ammonia levels were also measured in 1989 but were attributed to a coincident change in analytical technique. Decreases in ammonia concentrations along the river length are due to the transformation of ammonia to nitrate. The nitrification rate is supported by the corresponding increases in nitrate concentration with river distance (Figure 5.3).

Figure 5.4 shows the results for total nitrogen, the sum of the previous results. It clearly shows the general increase in nitrogen concentration along the Athabasca River from 0.13 mg/L at Hinton to 0.5 mg/L at Embarras.

6.0 COLOUR

In the simulations colour is treated as a conservative substance; i.e. colour levels are affected only by dilution, not by decomposition. This is a reasonable assumption, given that most colorants are persistent organic compounds which do not decay readily, and colour changes from pulp mill effluents are known to persist far downstream.

Colour levels observed below Hinton could not be simulated with the measured effluent value of 891 units as the results were always greater than measured. For the calibration, the effluent value was a reduced to 500 units to match the river concentrations.

True colour in the Athabasca River increases sharply from around 2 units above Hinton to 15 units below Hinton (Figure 6.1). Below Millar Western, there is only a small increase of around 2 units. Colour levels in the two effluents are comparable (600 to 700 units at Weldwood and Millar Western, respectively), however, effluent discharge at Weldwood (0.7 m^3/s) is considerably greater than at Millar Western (0.1 m^3/s). The Athabasca River colour levels measured below Hinton in 1990 are approximately half of those measured in 1988-89 (Noton and Shaw, 1990).

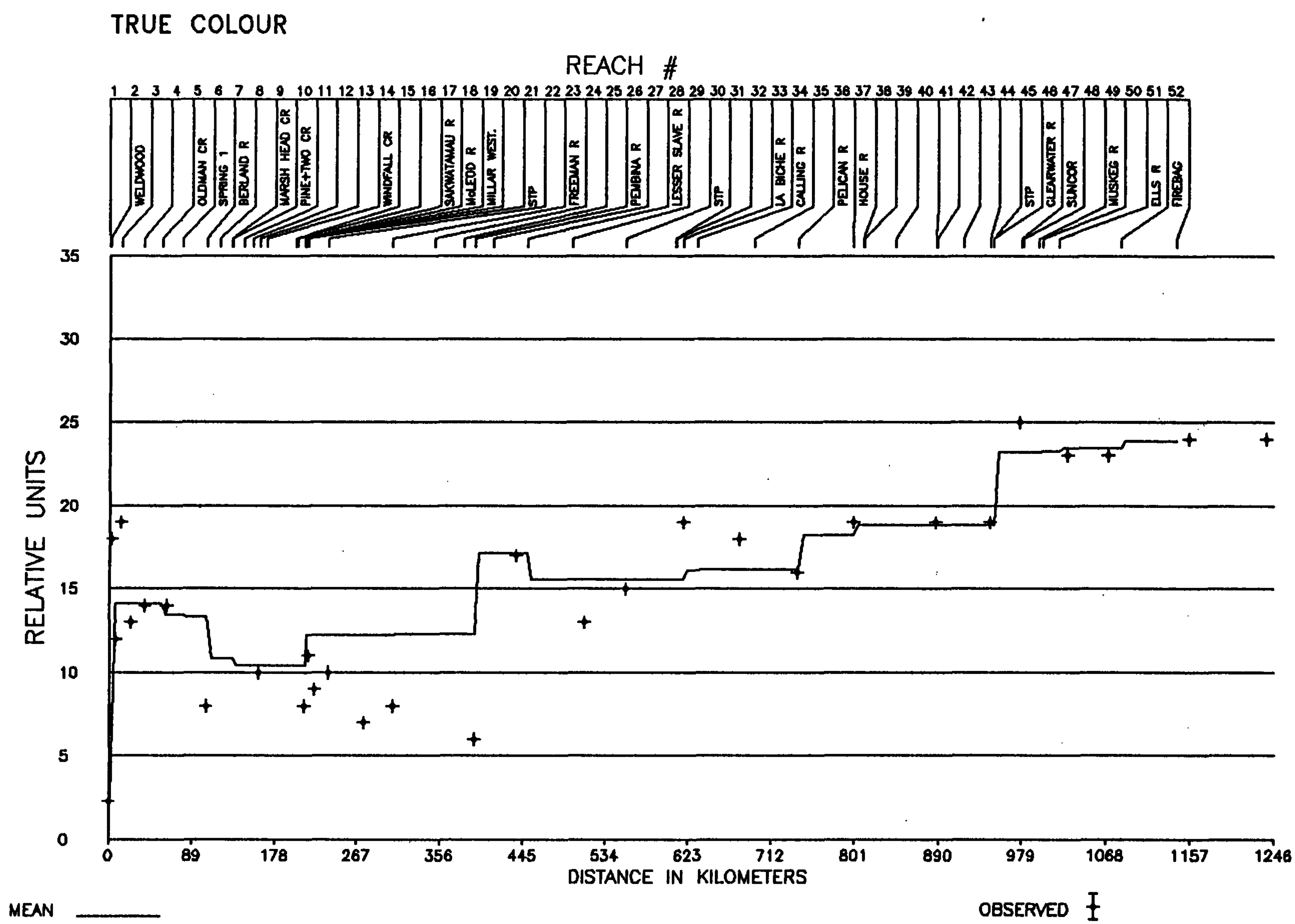

Figure 6.1 June 18 , 1991	ATHABASCA RIVER 1990 CALIBRATION	Environmental Management Associates

7.0 SUSPENDED SOLIDS

Modelling of suspended solids assumed settling is the major process controlling river concentrations of biosolids from pulp mills. This would perhaps be slightly conservative if decomposition were active, but biological decay is low in winter. For Weldwood, the settling rate as set at 0.9 d^{-1}, for 75 km downstream; for Millar Western a rate of 0.4 d^{-1} was assumed for 140 km downstream. Differences in settling rates for the two mills reflect differences in density and particle size of solids from the two pulping processes.

Figure 7.1 shows the similarity between simulated and measured results. Increases of 6 mg/L below Weldwood and 1-2 mg/L below Millar Western are less than the increases observed in 1989, particularly for Millar Western. Suspended solids levels at Millar Western have been reduced from around 2000 mg/L in 1989 (Noton and Shaw, 1990) to 120 mg/L in 1990. In the 1990 simulation an increase in the effluent concentration at Weldwood from 41 to 160 mg/L was required in order to obtain a mass balance below Hinton.

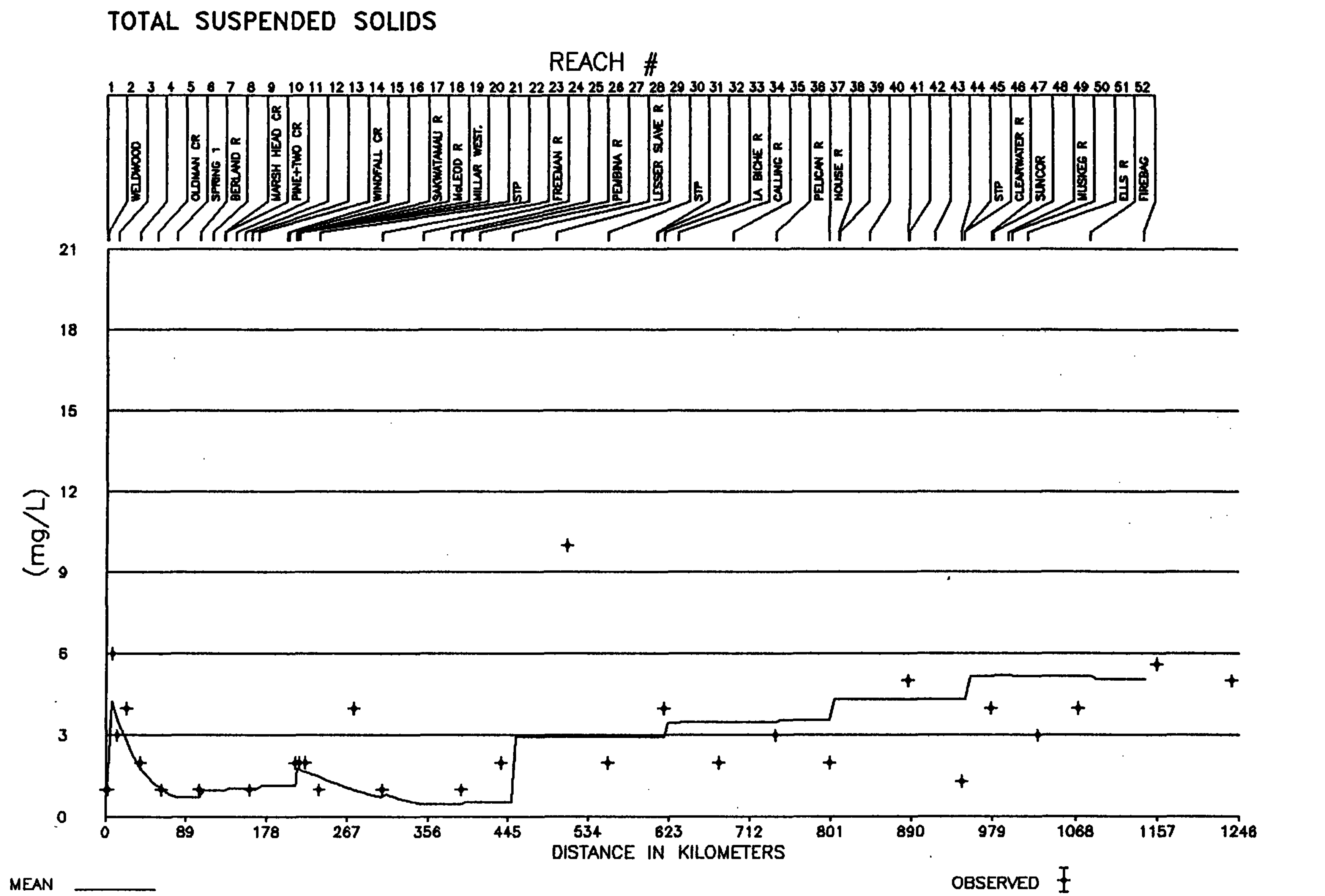

Figure 7.1 June 24 , 1991	ATHABASCA RIVER 1990 CALIBRATION	Environmental Management Associates

8.0 ORGANIC COMPOUNDS

The water quality fate model WASP was applied to the Athabasca River in order to more adequately simulate the water column and sediment concentrations of organic contaminants released from the Weldwood and Millar Western mills. This is the first time that the fate of pulp mill effluent organic contaminants has been simulated in the Athabasca River. As such the modelling presented here is developmental and intended to evaluate the information requirements, model capabilities and scope potential sediment and water column concentrations.

Modelling studies for the Peace and Wapiti/Smoky river systems focused on three representative compounds for modelling, dehydroabietic acid, trichlorophenol, and trichloroguaiacol. It was intended that these three compounds should also be simulated for the Athabasca River. However, trichloroguaiacol surprisingly was not detected in Weldwood and Millar Western effluent analysis reviewed. Consequently, it was not modelled in the Athabasca River.

The WASP modelling assumed a similar physical structure used for the inorganic parameters (Figure 2) with the exception that a sediment layer was included below each water column segment. The model was run in steady-state mode meaning that resulting sediment concentrations are principally a function of water column concentrations versus net accumulation from settling. The latter can only be addressed through dynamic modelling. The following sections describe the modelling and modelling results for dehydroabietic acid and trichlorophenol.

8.1 TRICHLOROPHENOL

Phenols are a large and extremely varied group of simple compounds, characterized by a benzene ring substituted with one or more hydroxyl groups. There are 15 - 20 known phenolic compounds in kraft pulp mill effluent (AEC, 1987), many of which have environmental concerns. Various phenols may be directly toxic, impart unpleasant odours and flavours to the water or taint fish flesh. They have been measured in pulp mill effluent at concentrations which have the potential to cause effects.

Chlorinated phenols are much more toxic and cause odours and off-flavours at much lower concentrations (as much as several orders of magnitude) than the parent form. Taste and odour problems may arise from chlorinated phenolics at concentrations from 50 $\mu g/L$ to < 1 $\mu g/L$, depending on the compound.

Trichlorophenol (TCP), specifically 2,4,6-TCP, was selected for modelling because of the relatively high effluent concentration and for comparability with other modelling studies. TCP has only been measured in the Weldwood effluent and would not be expected in the Millar Western CTMP effluent.

TCP has been well-researched; Table 8.1 summarizes literature-derived characteristics. The dominant fates of TCP in the aquatic environment are microbial decomposition and photolysis. Photolysis has a strong pH dependence, with highest rates at pH > 7 (Jones, 1984). At this pH, the phenol molecule is present mostly as chlorophenolate ions. Photolysis would be reduced under ice because of reduced light penetration.

The literature on decomposition of phenols is large and complicated. Despite its three chlorine atoms, 2,4,6-TCP decays relatively quickly, because chlorine atoms *ortho* to the hydroxyl group allow for rapid bacterial decay (Jones, 1984; Blades-Fillmore et al., 1982). 2,4,6-TCP has a chlorine in both *ortho* positions and therefore decays rapidly. Decomposition in sterile environments or under anaerobic conditions is zero (Jones, 1984, 1981; Blades-Fillmore, 1982; Baker and Mayfield, 1980).

TABLE 8.1. 2,4,6-Trichlorophenol Information.

Molecular weight	197.4	
Dissociation Constant	pKa = 6.1 = 6.1 - 6.15 = 6.21	Verschueren, 1983 Schellenberg et al., 1984 Xie et al., 1986
Solubility	S = 800 mg/L, - 4 x 10^{-3} moles/L Log S = 2.90 Log K_{ow} = 3.61 = 3.61 = 3.72 = 3.75 = 3.69 = 2.89 4.03	 Verschueren, 1983 Reckhow and Chapra, 1989 Verschueren, 1983 Reckhow and Chapra, 1989 Schellenberg et al., 1984 Xie et al., 1984 Xie et al., 1984 (pH 7) Xie et al., 1986 Saarikoski and Viluksela, 1982
Photolysis	K = -0.587 day^{-1}	Frietag et al., 1982
Henry's Law Constant	He = 3.9 x 10^{-6} He = 4.0 x 10^{-6} atm.m^3/ mol	Reckhow and Chapra, 1989 Kolset and Heiberg, 1988
Vapour Pressure	= 3.83 Pa @ 25°C = 1.59 Pa	Bidleman and Renborg, 1985 Kolset and Heiberg, 1988
Adsorption	K_{oc} 830 (lake sediments, 9.4% organic carbon) = 1310 (river sediments, 2.6% organic carbon) = 1070 (aquifer, 0.8% organic carbon)	 Schellenberg et al., 1984
Biodegradation	K = -0.107 d^{-1}	Blades-Fillmore et al., 1982

Adsorption data are inconsistent, but TCP does not appear to adsorb strongly to sediments. Adsorption depends strongly on the organic carbon content of the sediments. In Delaware River water, < 5% of total TCP adsorbed to benthic river sediments (Blades-Fillmore et al., 1982).

Volatilization of TCP is pH-dependent, because it is a weak acid. Lower rates occur at pH > 7.. At the basic pH values expected in Alberta rivers, all of the TCP will be ionized and not susceptible to volatilization (Jones, 1984). Frietag et al. (1983) reports that at 25°C, loss after five days was 0.1% in basic water.

For modelling the following were assumed:

- the only source of TCP is Weldwood mill effluent
- volatilization equals zero under ice-cover
- $K_{oc} = 1070$
- photolysis = -0.294^{-1}
- biodegradation = -0.09 day^{-1} @ 0°C

The simulated concentrations of total and sorbed TCP, assuming an effluent concentration of 5.0 μg/L, are shown in Figure 8.1 along with the WASP simulation of suspended solids.

TCP (total) concentrations reach 0.1 μg/L immediately below the Weldwood discharge and approach 0.0 μg/L within 500 kilometres downstream of the mill due to dilution and instream processing. Benthic concentrations are also shown in Figure 8.1 as bar charts to be read against the right hand scale. Benthic concentrations of TCP peak at around .0015 μg/kg and reduce to near zero by kilometre 400. The slight increase in sorbed chemical concentration below kilometre 200 is due to the increased sediment load from Millar Western.

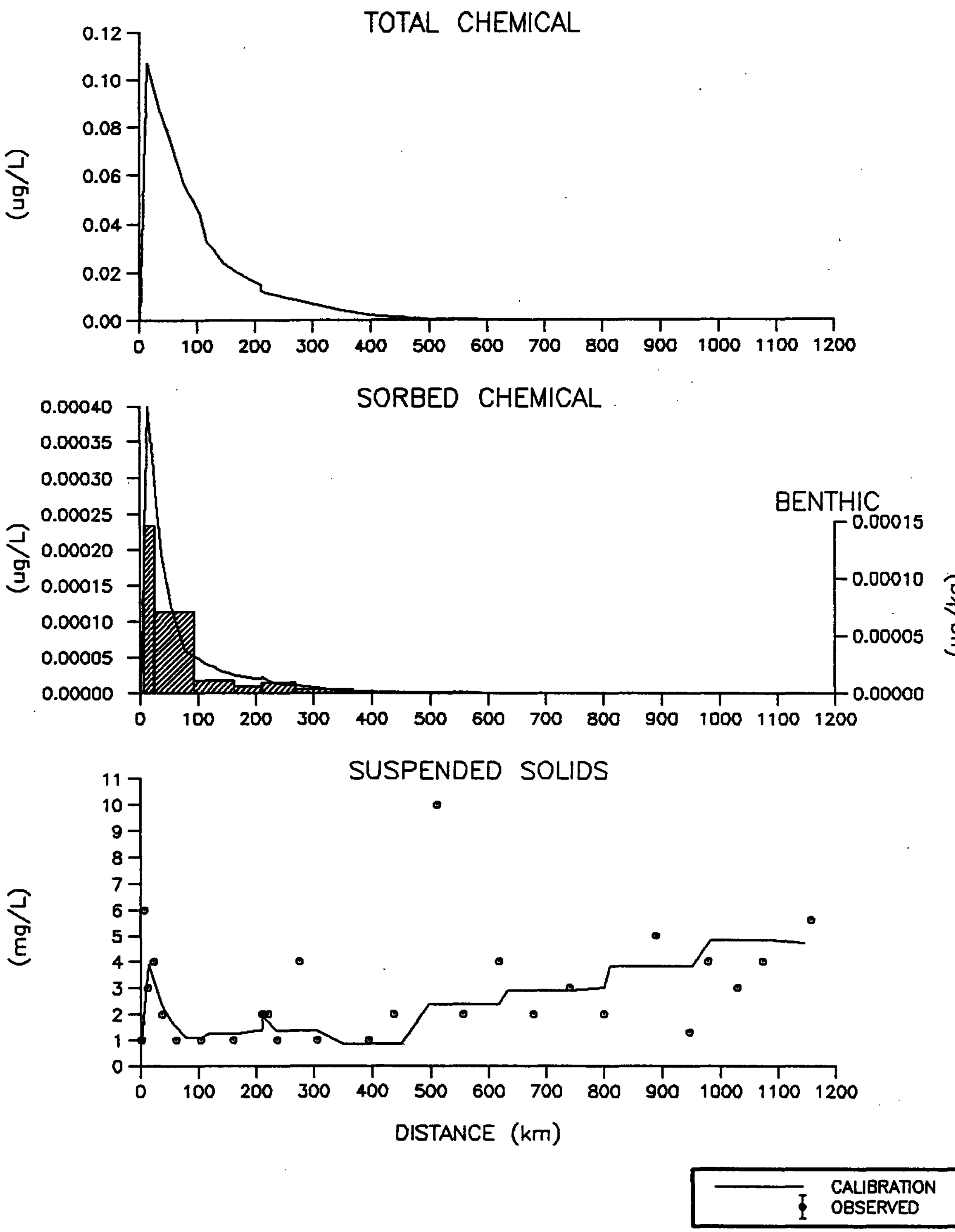

Figure 8.1 June 25 , 1991	2,4,6 TRICHLOROPHENOL 1990 CALIBRATION – ATHABASCA RIVER	Environmental Management Associates

Immediately below Weldwood, approximately 5% of the total TCP is sorbed to sediment. The percentage reduces with downstream distance as the sediment sorbed fraction settles from the water column.

All predicted concentrations are below the current analytical detection limits.

8.2 DEHYDROABIETIC ACID

Dehydroabietic acid is the most prominent compound in the resin acids group. Resin acids are both acutely and chronically toxic, and are one of the major toxic components of pulp mill effluents, often accounting for > 50% of the toxicity of the whole effluent. Resin acids are readily bioaccumulated and have measurable physiological effects at quite low concentrations (< 50 μg/L).

DHA is not chlorinated, but nevertheless it is quite persistent in river water and especially in sediments. DHA is usually the only resin acid found in fish tissue or in river water any appreciable distance downstream of pulp mill outfalls. It is therefore, a logical choice as a key compound for modelling.

The physico-chemical characteristics of DHA are listed in Table 8.2. Although the fates of DHA are known in general terms, rate constants are largely unknown. Determination of physical constants is complicated too, because DHA is an acid and its properties vary with pH. Dominant fates are sediment binding and microbial decomposition.

While DHA is known to be strongly attracted to sediments (Taylor et al., 1987), there are no quantitative measures. Using relationships derived by Schellenberg et al. (1984) for phenols, an octanol-carbon coefficient can be calculated. The result seems proportionally correct given the high K_{ow} of DHA.

TABLE 8.2 Dehydroabietic Acid Information

Molecular weight	297	
Dissociation Constant	pKa = 7.25	Taylor et al., 1987
Solubility	S = 8 mg/L Log K_{ow} = 5/8 (extrapolated from abietic acid)	Taylor et al., 1987
Photolysis	K = -0.402	Gigante et al., 1989
Henry's Law Constant	unknown	
Adsorption	K_{oc} = 60,255	(from equations in Schellenberg et al., 1986)
Biodegradation	K = -0.02 d^{-1}	Brownlee et al., 1977

Decomposition of DHA is slow in water and virtually nil in sediments (Brownlee et al., 1977). DHA decomposition requires oxygen (McFarlane and Clark, 1988; Kutney et al., 1988). DHA is not known to be susceptible to photodecay, although Gigante et al. (1989) reports decay of methyl-DHA to 7-oxo-DHA (nontoxic, first decay product) under UV light at a rate equal to $K = 0.402$ day^{-1}.

As with TCP, it was assumed for modelling that the only sources of DHA were the two pulp mills. Unlike TCP, DHA is found in appreciable quantities in CTMP mill effluent. Other assumptions for modelling include:

- no volatilization or photolysis
- octanol-carbon coefficient equal to 60,255
- biodegradation rate of -0.008 1/day at 0^oC

Simulated DHA concentrations as total and sediment sorbed, are shown in Figure 8.2. The simulations assume concentrations of 20 μg/L at Weldwood and 38 μg/L at Millar Western. Total DHA concentrations are greatest below Weldwood (0.45 μg/L), decrease with dilution, settling and biodegradation along most of the river. The increase of 0.1 μg/L is simulated below Millar Western.

Sediment sorbed DHA represents about 20% of total DHA below Weldwood, which is indicative of its high affinity for suspended solids. Benthic concentrations reach 0.3 μg/kg below Weldwood and 0.1 μg/kg below Millar Western.

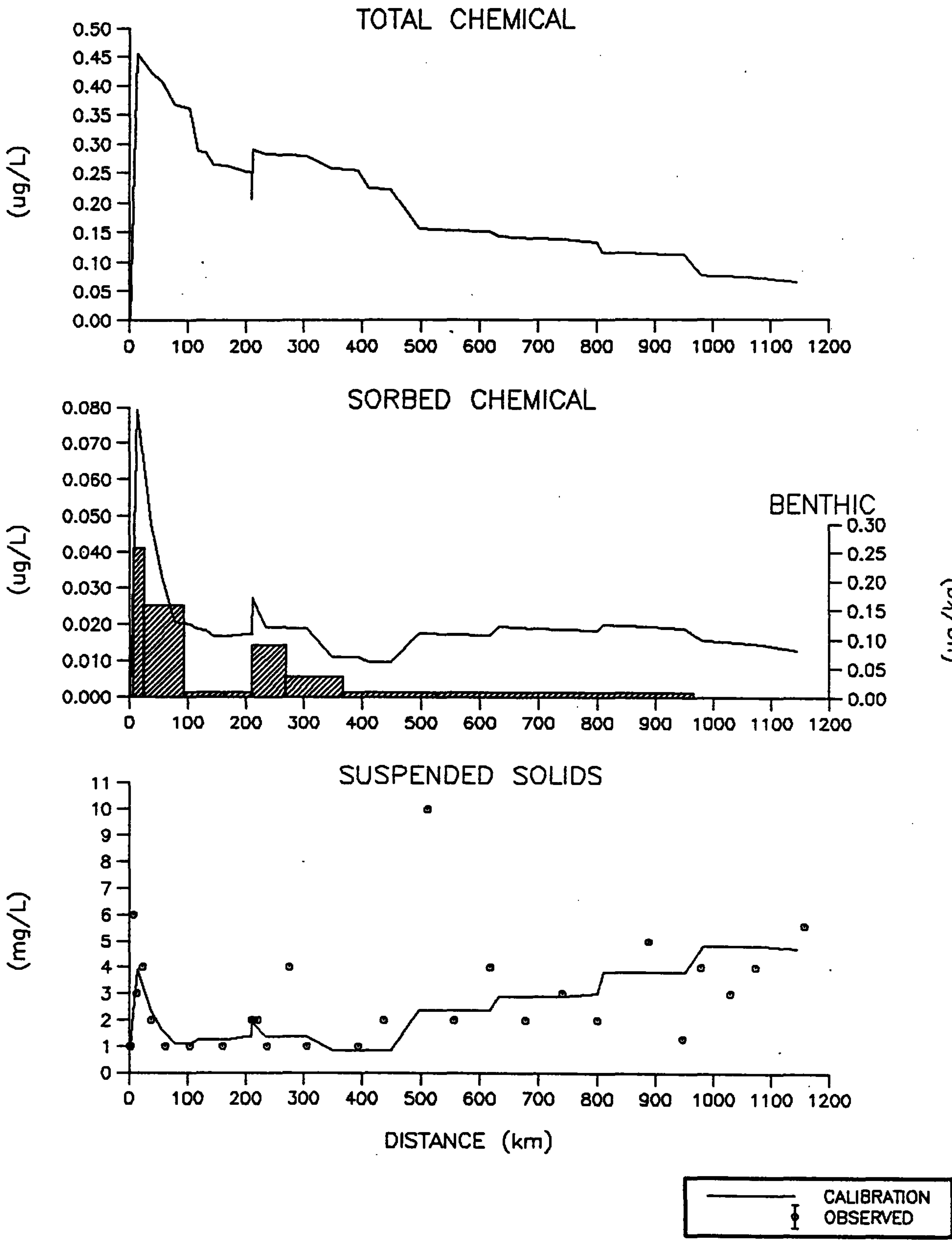

Figure 8.2 June 25 , 1991	DEHYDROABIETIC ACID 1990 CALIBRATION – ATHABASCA RIVER	Environmental Management Associates

9.0 REFERENCES

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APPENDIX I

MODEL INPUT FILES

ATHABASCA - SURVEY 1,1990 CALIBRATION <== MARCH 26, 1990

NRT	NTRIB	MAXTR	MAXRI	MAXPT	NSTP	NVAR
56	1	4	52	52	25	9

GROUP 2 (ONE LINE FOR EACH REACH)

IRCH	UP1	IUP2	X	Q	QLD	SOURCE NAME
1	0	0	1.7	33.0	0.000	
2	1	0	12.2	32.216	0.784	WELDWOOD <==OPEN
3	2	0	23.6	33.0	0.000	
4	3	0	18.6	33.0	0.000	
5	4	0	22.5	33.0	2.400	OLDMAN CR
6	5	0	25.8	35.4	0.600	SPRING 1
7	6	0	13.3	36.0	8.900	BERLAND R
8	7	0	13.8	44.9	0.000	
9	8	0	0.2	44.9	0.300	MARSH CR
10	9	0	12.7	45.2	3.600	PINE CR+TWO CREEK
11	10	0	9.2	48.8	0.000	
12	11	0	8.0	48.8	0.000	
13	12	0	7.0	48.8	0.000	
14	13	0	32.0	48.8	1.900	WINDFALL
15	14	0	2.0	50.7	0.000	
16	15	0	6.7	50.7	0.000	
17	16	0	1.1	50.7	0.900	SAKWATAMAU
18	17	0	0.1	51.6	10.200	McLEOD R
19	18	0	1.5	61.664	0.136	MILLAR WEST.<==OPEN
20	19	0	2.1	61.8	0.000	
21	20	0	21.1	61.765	0.035	WHITE STP
22	21	0	70.0	61.8	0.000	
23	22	0	44.6	61.8	2.600	FREEMAN R.
24	23	0	31.5	64.4	0.000	
25	24	0	11.5	64.4	0.000	
26	25	0	20.0	64.4	8.900	PEMBINA
27	26	0	36.1	73.3	0.000	
28	27	56	48.7	117.0	0.000	LESSER SLAVE
29	28	0	58.4	117.0	0.000	
30	29	0	53.0	116.988	0.012	ATHAB STP
31	30	0	1.0	117.0	0.000	
32	31	0	7.4	117.0	0.000	
33	32	0	15.5	117.0	5.300	LA BICHE
34	33	0	61.5	122.3	0.700	CALLING
35	34	0	47.3	123.0	0.000	
36	35	0	58.3	123.0	2.000	PELICAN
37	36	0	10.8	125.0	17.000	HOUSE
38	37	0	1.0	142.0	0.000	
39	38	0	33.3	142.0	0.000	
40	39	0	43.2	142.0	0.000	
41	40	0	1.0	142.0	0.000	
42	41	0	28.7	142.0	0.000	
43	42	0	28.9	142.0	0.000	
44	43	0	2.7	142.0	0.000	
45	44	0	0.6	142.0	0.088	FT McM STP
46	45	0	30.4	142.0	62.8	CLEARWATER
47	46	0	2.1	204.559	0.241	SUNCOR

48	47	0	15.8	204.8	0.000	
49	48	0	3.9	204.8	0.400	MUSKEG
50	49	0	17.4	205.2	0.000	
51	50	0	65.8	205.2	1.800	ELLS
52	51	0	58.9	207.0	11.000	FIREBAG
53	0	0	8.0	43.7	0.000	
54	53	0	1.0	43.7	0.000	
55	54	0	24.7	43.7	0.000	
56	55	0	19.8	43.7	0.000	

GROUP 3 (ONE LINE FOR EACH POINT SOURCE INFLOW)

STNAM	INST
WELDWOOD	2
OLDMAN CR	5
SPRING 1	6
BERLAND R	7
MARSH HEAD CR	9
PINE+TWO CR	10
WINDFALL CR	14
SAKWATAMAU R	17
McLEOD R	18
MILLAR WEST.	19
STP	21
FREEMAN R	23
PEMBINA R	26
LESSER SLAVE R	28
STP	30
LA BICHE R	33
CALLING R	34
PELICAN R	36
HOUSE R	37
STP	45
CLEARWATER R	46
SUNCOR	47
MUSKEG R	49
ELLS R	51
FIREBAG	52

GROUP 4 (RIVER NAME FOR PLOT FILE, MAX. 7 CHARACTERS)
RNAM
****
ATHABASCA RIVER

GROUP 5 (ONE LINE FOR EACH TRIBUTARY, OMIT IF NO TRIBUTARIES)
TNAM INTR
****
LESSER SLAVE

GROUP 6 (ONE LINE FOR EACH REACH, IN INCREASING ORDER BY REACH)

REACH	XLD1	XLD2	XLD3	XLD4	XLD5	XLD6	XLD7	XLD8	XLD9
1	0	0	0	0	0	0	0	0	0
2	105.2	10.05	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0

4	0	0	0	0	0	0	0	0	0
5	0	12.8	7.58	0	0	0	0	0	0
6	0	11.87	5.76	0	0	0	0	0	0
7	0	9.8	5.78	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	11.97	4.48	0	0	0	0	0	0
10	0	11.87	5.76	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0
14	0	11.3	4.48	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0
17	0	10.00	4.48	0	0	0	0	0	0
18	0	8.5	3.52	0	0	0	0	0	0
19	122.0	4.60	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
21	10.6	4.4	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0
23	0	8.7	1.28	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0
26	0	4.65	4.48	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0
30	30.6	5.0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
33	0	4.86	2.56	0	0	0	0	0	0
34	0	11.56	1.92	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
36	0	12.33	21.12	0	0	0	0	0	0
37	0	11.55	1.92	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0
45	827.90	5.0	0	0	0	0	0	0	0
46	0	11.9	1.28	0	0	0	0	0	0
47	3.8	5.0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0
49	0	11.23	3.84	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0
51	0	10.9	0.6	0	0	0	0	0	0
52	0	6.3	3.2	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0

GROUP 7 (ONE LINE FOR EACH HEADWATER)

X01	X02	X03	X04	X05	X06	X07	X08	X09
0.0	11.57	2.35	0	0	0	0	0	0
0.0	12.36	5.76	0	0	0	0	0	0

GROUP 8 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH)

REACH	XK1	XK2	XK3	XK4	XM1	XM2	XM3	XRES	XDS	XP
1	0.044	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
2	0.044	0.58	.010	.020	.00	.00	.000	.17	13.0	.001
3	0.044	0.001	.010	.020	.00	.00	.000	.25	13.0	.001
4	0.044	0.001	.010	.020	.00	.00	.000	.25	13.0	.001
5	0.044	0.001	.010	.020	.00	.00	.000	.25	13.0	.001
6	0.044	0.001	.010	.020	.00	.00	.000	.17	13.0	.001
7	0.044	0.001	.010	.020	.00	.00	.000	.17	13.0	.001
8	0.044	0.001	.010	.020	.00	.00	.000	.17	13.0	.001
9	0.044	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
10	0.044	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
11	0.044	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
12	0.044	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
13	0.044	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
14	0.044	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
15	0.044	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
16	0.044	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
17	0.044	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
18	0.044	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
19	0.010	1.63	.2	.020	.00	.00	.000	.40	13.0	.001
20	0.010	0.001	.2	.020	.00	.00	.000	.40	13.0	.001
21	0.010	0.001	.2	.020	.00	.00	.000	.40	13.0	.001
22	0.010	0.001	.2	.020	.00	.00	.000	.40	13.0	.001
23	0.010	0.001	.2	.020	.00	.00	.000	.01	13.0	.001
24	0.010	0.001	.2	.020	.00	.00	.000	.01	13.0	.001
25	0.010	0.001	.2	.020	.00	.00	.000	.001	13.0	.001
26	0.010	0.001	.2	.020	.00	.00	.000	.001	13.0	.001
27	0.010	0.001	.2	.020	.00	.00	.000	.001	13.0	.001
28	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
29	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
30	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
31	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
32	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
33	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
34	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
35	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
36	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
37	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
38	0.010	0.001	.000	.020	.00	.00	4800.0	.001	13.0	.001
39	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
40	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
41	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
42	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
43	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
44	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
45	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
46	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
47	0.010	0.001	.000	.020	.00	.00	.000	.15	13.0	.001

48	0.010	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
49	0.010	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
50	0.010	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
51	0.010	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
52	0.010	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
53	0.010	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
54	0.010	0.001	.000	.020	.00	.00	.000	.05	13.0	.001
55	0.010	0.001	.000	.020	.00	.00	.000	.05	13.0	.001
56	0.010	0.001	.000	.020	.00	.00	.000	.15	13.0	.001

GROUP 9 (AVERAGE RIVER TEMPERATURE)
TEMPER
****
0.0

GROUP 10 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH NUMBER)

REACH	REFQ	T	HEXN	VEXN	RFDGR
1	50	.045	.516	.353	0.
2	50	.281	.512	.344	0.
3	50	.624	.516	.353	0.
4	50	.448	.550	.346	0.
5	50	.543	.550	.346	0.
6	50	.622	.550	.346	0.
7	50	.297	.540	.266	0.
8	50	.308	.540	.266	0.
9	50	.004	.540	.266	0.
10	50	.284	.540	.266	0.
11	50	.202	.551	.326	0.
12	50	.176	.551	.326	0.
13	50	.154	.551	.326	0.
14	50	.704	.551	.326	0.
15	50	.044	.551	.326	0.
16	50	.147	.551	.326	0.
17	50	.022	.463	.362	0.
18	50	.002	.463	.362	0.
19	50	.021	.463	.362	0.
20	50	.041	.463	.362	0.
21	50	.414	.463	.362	0.
22	50	1.940	.536	.274	0.
23	50	1.799	.523	.288	0.
24	50	1.426	.512	.350	0.
25	50	0.463	.512	.260	0.
26	50	0.805	.512	.260	0.
27	50	1.453	.512	.260	0.
28	50	1.960	.512	.260	0.
29	50	2.350	.512	.260	0.
30	50	2.009	.592	.295	0.
31	50	.038	.592	.295	0.
32	50	.280	.592	.295	0.
33	50	.587	.592	.295	0.
34	50	2.331	.592	.295	0.
35	50	1.524	.598	.335	0.
36	50	1.878	.598	.335	0.
37	50	.348	.598	.335	0.

38	50	.010	.505	.292	0.
39	50	1.077	.627	.358	0.
40	50	1.397	.627	.358	0.
41	50	.011	.632	.294	0.
42	50	1.066	.555	.257	0.
43	50	.827	.687	.252	0.
44	50	.077	.687	.252	0.
45	50	.020	.543	.136	0.
46	50	.994	.543	.136	0.
47	50	.069	.543	.136	0.
48	50	.516	.543	.136	0.
49	50	.127	.543	.136	0.
50	50	.569	.543	.136	0.
51	50	2.151	.543	.136	0.
52	50	2.901	.354	.254	0.
53	50	.180	.555	.351	0.
54	50	.023	.555	.351	0.
55	50	.557	.555	.351	0.
56	50	.471	.536	.289	0.

GROUP 11 (ONE LINE FOR EACH RIVER OR TRIBUTARY)
FNAM
****

ATHA90
LSR90

ATHABASCA - SURVEY 1,1989 CALIBRATION <== JUNE 13,1989

NRT	NTRIB	MAXTR	MAXRI	MAXPT	NSTP	NVAR
56	1	4	52	52	33	9

GROUP 2 (ONE LINE FOR EACH REACH)

IRCH	UP1	IUP2	X	Q	QLD	SOURCE NAME
1	0	0	1.7	31.1	0.000	
2	1	0	12.2	30.13	0.970	WELDWOOD <==OPEN
3	2	0	23.6	31.1	0.000	
4	3	0	18.6	31.1	0.000	
5	4	0	22.5	31.1	0.700	OLDMAN CR
6	5	0	25.8	31.8	0.130	SPRING 1
7	6	0	13.3	31.93	5.670	BERLAND R
8	7	0	13.8	37.6	2.205	SPRING 2
9	8	0	0.2	39.805	0.066	MARSH CR
10	9	0	12.7	39.871	0.019	PINE CR
11	10	0	9.2	39.89	0.000	
12	11	0	8.0	39.89	2.200	SPRING 3
13	12	0	7.0	42.09	0.010	TWO CREEK
14	13	0	32.0	42.1	0.503	WINDFALL
15	14	0	2.0	42.603	0.000	
16	15	0	6.7	42.603	0.000	
17	16	0	1.1	42.603	0.560	SAKWATAMAU
18	17	0	0.1	43.163	4.760	McLEOD R
19	18	0	1.5	47.782	0.141	MILLAR WEST.<==OPEN
20	19	0	2.1	47.923	0.000	
21	20	0	21.1	47.887	0.036	WHITE STP
22	21	0	70.0	47.923	0.000	
23	22	0	44.6	47.923	0.480	FREEMAN R.
24	23	0	31.5	48.403	0.000	
25	24	0	11.5	48.403	0.0000	
26	25	0	20.0	48.403	3.597	PEMBINA
27	26	0	36.1	52.0	0.0000	
28	27	56	48.7	79.1	0.0000	LESSER SLAVE
29	28	0	58.4	79.1	6.2	UNKNOWN
30	29	0	53.0	85.288	0.012	ATHAB STP
31	30	0	1.0	85.3	0.0000	
32	31	0	7.4	85.3	0.0000	
33	32	0	15.5	85.3	4.725	LA BICHE
34	33	0	61.5	90.029	0.031	CALLING
35	34	0	47.3	90.06	0.0000	
36	35	0	58.3	90.06	2.344	PELICAN
37	36	0	10.8	92.4	1.2	HOUSE
38	37	0	1.0	93.6	0.0000	
39	38	0	33.3	93.6	0.0000	
40	39	0	43.2	93.6	0.0000	BUFFALO
41	40	0	1.0	93.6	0.0000	
42	41	0	28.7	93.6	0.0000	
43	42	0	28.9	93.6	0.0000	
44	43	0	2.7	93.6	0.415	HORSE
45	44	0	0.6	93.796	0.219	FT McM STP
46	45	0	30.4	94.015	51.54	CLEARWATER
47	46	0	2.1	145.266	0.289	SUNCOR

48	47	0	15.8	145.555	0.318	STEEPBANK
49	48	0	3.9	145.873	0.707	MUSKEG
50	49	0	17.4	146.58	0.210	MCKAY
51	50	0	65.8	146.79	0.842	ELLS
52	51	0	58.9	147.64	9.76	FIREBAG
53	0	0	8.0	27.1	0.	
54	53	0	1.0	27.1	0.	
55	54	0	24.7	27.1	0.	
56	55	0	19.8	27.1	0.	

GROUP 3 (ONE LINE FOR EACH POINT SOURCE INFLOW)

STNAM	INST
**	
WELDWOOD	2
OLDMAN CR	5
SPRING 1	6
BERLAND R	7
SPRING 2	8
MARSH HEAD CR	9
PINE CR	10
SPRING 3	12
TWO CREEK	13
WINDFALL CR	14
SAKWATAMAU R	17
McLEOD R	18
MILLAR WEST.	19
STP	21
FREEMAN R	23
PEMBINA R	26
LESSER SLAVE R	28
UNKNOWN	29
STP	30
LA BICHE R	33
CALLING R	34
PELICAN R	36
HOUSE R	37
BUFFALO R	40
HORSE R	44
STP	45
CLEARWATER R	46
SUNCOR	47
STEEPBANK R	48
MUSKEG R	49
MCKAY R	50
ELLS R	51
FIREBAG	52

GROUP 4 (RIVER NAME FOR PLOT FILE, MAX. 7 CHARACTERS)
RNAM
****
ATHABASCA RIVER

GROUP 5 (ONE LINE FOR EACH TRIBUTARY, OMIT IF NO TRIBUTARIES)
TNAM INTR
****

LESSER SLAVE

GROUP 6 (ONE LINE FOR EACH REACH, IN INCREASING ORDER BY REACH)

REACH	XLD1	XLD2	XLD3	XLD4	XLD5	XLD6	XLD7	XLD8	XLD9
1	0	0	0	0	0	0	0	0	0
2	156.0	7.1	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	12.57	6.4	0	0	0	0	0	0
6	0	11.69	7.04	0	0	0	0	0	0
7	0	8.71	5.76	0	0	0	0	0	0
8	0	11.7	0.64	0	0	0	0	0	0
9	0	10.47	5.12	0	0	0	0	0	0
10	0	10.61	1.92	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	0	10.76	1.28	0	0	0	0	0	0
13	0	7.91	7.68	0	0	0	0	0	0
14	0	9.15	8.32	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0
17	0	12.57	6.4	0	0	0	0	0	0
18	0	5.28	10.24	0	0	0	0	0	0
19	2520.0	7.39	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
21	12.8	4.4	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0
23	0	5.22	3.2	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0
26	0	2.75	2.88	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0
29	0	11.69	7.04	0	0	0	0	0	0
30	76.92	5.0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
33	0	1.45	5.76	0	0	0	0	0	0
34	0	10.85	5.12	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
36	0	12.85	19.84	0	0	0	0	0	0
37	0	10.56	5.76	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
40	0	13.3	7.68	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0
44	0	13.3	7.68	0	0	0	0	0	0
45	108.49	5.0	0	0	0	0	0	0	0
46	0	12.35	5.76	0	0	0	0	0	0
47	24.68	5.0	0	0	0	0	0	0	0
48	0	13.44	8.32	0	0	0	0	0	0
49	0	10.75	10.88	0	0	0	0	0	0
50	0	12.24	9.6	0	0	0	0	0	0

51	0	13.03	5.76	0	0	0	0	0	0
52	0	5.76	11.2	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0

GROUP 7 (ONE LINE FOR EACH HEADWATER)

X01	X02	X03	X04	X05	X06	X07	X08	X09
0.0	11.74	6.4	0	0	0.00	0	0	0
0.0	13.28	7.04	0	0	0.000	0	0	0

GROUP 8 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH)

REACH	XK1	XK2	XK3	XK4	XM1	XM2	XM3	XRES	XDS	XP
1	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
2	0.035	0.58	.01	.020	.00	.00	.000	.04	13.0	.001
3	0.035	0.001	.01	.020	.00	.00	.000	.06	13.0	.001
4	0.035	0.001	.01	.020	.00	.00	.000	.06	13.0	.001
5	0.035	0.001	.01	.020	.00	.00	.000	.06	13.0	.001
6	0.035	0.001	.01	.020	.00	.00	.000	.06	13.0	.001
7	0.035	0.001	.01	.020	.00	.00	.000	.04	13.0	.001
8	0.035	0.001	.01	.020	.00	.00	.000	.04	13.0	.001
9	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
10	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
11	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
12	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
13	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
14	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
15	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
16	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
17	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
18	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
19	0.050	1.63	.2	.020	.00	.00	.000	.10	13.0	.001
20	0.050	0.001	.2	.020	.00	.00	.000	.10	13.0	.001
21	0.050	0.001	.2	.020	.00	.00	.000	.10	13.0	.001
22	0.050	0.001	.2	.020	.00	.00	.000	.10	13.0	.001
23	0.050	0.001	.2	.020	.00	.00	.000	.002	13.0	.001
24	0.050	0.001	.2	.020	.00	.00	.000	.002	13.0	.001
25	0.050	0.001	.2	.020	.00	.00	.000	.001	13.0	.001
26	0.050	0.001	.2	.020	.00	.00	.000	.001	13.0	.001
27	0.050	0.001	.2	.020	.00	.00	.000	.001	13.0	.001
28	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
29	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
30	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
31	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
32	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
33	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
34	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
35	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
36	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
37	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
38	0.050	0.001	.000	.020	.00	.00	4760.3	.001	13.0	.001
39	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001

40	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
41	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
42	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
43	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
44	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
45	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
46	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
47	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
48	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
49	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
50	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
51	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
52	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
53	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
54	0.050	0.001	.000	.020	.00	.00	.000	.05	13.0	.001
55	0.050	0.001	.000	.020	.00	.00	.000	.05	13.0	.001
56	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001

GROUP 9 (AVERAGE RIVER TEMPERATURE)
TEMPER
****
0.0

GROUP 10 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH NUMBER)

REACH	REFQ	T	HEXN	VEXN	RFDGR
1	50	.045	.516	.353	0.
2	50	.281	.512	.344	0.
3	50	.624	.516	.353	0.
4	50	.448	.550	.346	0.
5	50	.543	.550	.346	0.
6	50	.622	.550	.346	0.
7	50	.297	.540	.266	0.
8	50	.308	.540	.266	0.
9	50	.004	.540	.266	0.
10	50	.284	.540	.266	0.
11	50	.202	.551	.326	0.
12	50	.176	.551	.326	0.
13	50	.154	.551	.326	0.
14	50	.704	.551	.326	0.
15	50	.044	.551	.326	0.
16	50	.147	.551	.326	0.
17	50	.022	.463	.362	0.
18	50	.002	.463	.362	0.
19	50	.021	.463	.362	0.
20	50	.041	.463	.362	0.
21	50	.414	.463	.362	0.
22	50	1.940	.536	.274	0.
23	50	1.799	.523	.288	0.
24	50	1.426	.512	.350	0.
25	50	0.463	.512	.260	0.
26	50	0.805	.512	.260	0.
27	50	1.453	.512	.260	0.
28	50	1.960	.512	.260	0.
29	50	2.350	.512	.260	0.

30	50	2.009	.592	.295	0.
31	50	.038	.592	.295	0.
32	50	.280	.592	.295	0.
33	50	.587	.592	.295	0.
34	50	2.331	.592	.295	0.
35	50	1.524	.598	.335	0.
36	50	1.878	.598	.335	0.
37	50	.348	.598	.335	0.
38	50	.010	.505	.292	0.
39	50	1.077	.627	.358	0.
40	50	1.397	.627	.358	0.
41	50	.011	.632	.294	0.
42	50	1.066	.555	.257	0.
43	50	.827	.687	.252	0.
44	50	.077	.687	.252	0.
45	50	.020	.543	.136	0.
46	50	.994	.543	.136	0.
47	50	.069	.543	.136	0.
48	50	.516	.543	.136	0.
49	50	.127	.543	.136	0.
50	50	.569	.543	.136	0.
51	50	2.151	.543	.136	0.
52	50	2.901	.354	.254	0.
53	50	.180	.555	.351	0.
54	50	.023	.555	.351	0.
55	50	.557	.555	.351	0.
56	50	.471	.536	.289	0.

GROUP 11 (ONE LINE FOR EACH RIVER OR TRIBUTARY)
FNAM
****
ATHA1
LSR1

ATHABASCA - SURVEY 3,1989 CALIBRATION <== JUNE 13, 1989

NRT	NTRIB	MAXTR	MAXRI	MAXPT	NSTP	NVAR
56	1	4	52	52	33	9

GROUP 2 (ONE LINE FOR EACH REACH)

IRCH	UP1	IUP2	X	Q	QLD	SOURCE NAME
1	0	0	1.7	31.3	0.000	
2	1	0	12.2	30.28	1.020	WELDWOOD <==OPEN
3	2	0	23.6	31.3	0.000	
4	3	0	18.6	31.3	0.000	
5	4	0	22.5	31.3	0.950	OLDMAN CR
6	5	0	25.8	32.25	1.230	SPRING 1
7	6	0	13.3	33.48	5.520	BERLAND R
8	7	0	13.8	39.0	0.490	SPRING 2
9	8	0	0.2	39.49	0.173	MARSH CR
10	9	0	12.7	39.663	0.310	PINE CR
11	10	0	9.2	39.973	0.000	
12	11	0	8.0	39.973	0.490	SPRING 3
13	12	0	7.0	40.463	0.014	TWO CREEK
14	13	0	32.0	40.477	0.503	WINDFALL
15	14	0	2.0	40.98	0.000	
16	15	0	6.7	40.98	0.000	
17	16	0	1.1	40.98	0.490	SAKWATAMAU
18	17	0	0.1	41.47	4.630	McLEOD R
19	18	0	1.5	45.976	0.124	MILLAR WEST.<==OPEN
20	19	0	2.1	46.10	0.000	
21	20	0	21.1	46.065	0.035	WHITE STP
22	21	0	70.0	46.10	0.000	
23	22	0	44.6	46.10	0.590	FREEMAN R.
24	23	0	31.5	46.69	0.000	
25	24	0	11.5	46.69	0.0000	
26	25	0	20.0	46.69	2.91	PEMBINA
27	26	0	36.1	59.6	0.0000	
28	27	56	48.7	72.3	0.0000	LESSER SLAVE
29	28	0	58.4	72.3	3.0	UNKNOWN
30	29	0	53.0	75.288	0.012	ATHAB STP
31	30	0	1.0	75.3	0.0000	
32	31	0	7.4	75.3	0.0000	
33	32	0	15.5	75.3	0.426	LA BICHE
34	33	0	61.5	75.726	0.022	CALLING
35	34	0	47.3	75.748	0.0000	
36	35	0	58.3	75.748	0.154	PELICAN
37	36	0	10.8	75.902	0.272	HOUSE
38	37	0	1.0	76.174	0.0000	
39	38	0	33.3	76.174	0.0000	
40	39	0	43.2	76.174	0.014	BUFFALO
41	40	0	1.0	76.188	0.0000	
42	41	0	28.7	76.188	0.0000	
43	42	0	28.9	76.188	0.0000	
44	43	0	2.7	76.188	0.390	HORSE
45	44	0	0.6	76.49	0.088	FT McM STP
46	45	0	30.4	76.578	46.3	CLEARWATER
47	46	0	2.1	122.637	0.241	SUNCOR

48	47	0	15.8	122.878	0.274	STEEPBANK
49	48	0	3.9	123.152	0.501	MUSKEG
50	49	0	17.4	123.653	0.625	MCKAY
51	50	0	65.8	124.278	0.670	ELLS
52	51	0	58.9	124.948	6.73	FIREBAG
53	0	0	8.0	22.7	0.	
54	53	0	1.0	22.7	0.	
55	54	0	24.7	22.7	0.	
56	55	0	19.8	22.7	0.	

GROUP 3 (ONE LINE FOR EACH POINT SOURCE INFLOW)

STNAM	INST
WELDWOOD	2
OLDMAN CR	5
SPRING 1	6
BERLAND R	7
SPRING 2	8
MARSH HEAD CR	9
PINE CR	10
SPRING 3	12
TWO CREEK	13
WINDFALL CR	14
SAKWATAMAU R	17
McLEOD R	18
MILLAR WEST.	19
STP	21
FREEMAN R	23
PEMBINA R	26
LESSER SLAVE R	28
UNKNOWN	29
STP	30
LA BICHE R	33
CALLING R	34
PELICAN R	36
HOUSE R	37
BUFFALO R	40
HORSE R	44
STP	45
CLEARWATER R	46
SUNCOR	47
STEEPBANK R	48
MUSKEG R	49
MCKAY R	50
ELLS R	51
FIREBAG	52

GROUP 4 (RIVER NAME FOR PLOT FILE, MAX. 7 CHARACTERS)
RNAM
****

ATHABASCA RIVER

GROUP 5 (ONE LINE FOR EACH TRIBUTARY, OMIT IF NO TRIBUTARIES)
TNAM INTR
****

LESSER SLAVE

GROUP 6 (ONE LINE FOR EACH REACH, IN INCREASING ORDER BY REACH)

REACH	XLD1	XLD2	XLD3	XLD4	XLD5	XLD6	XLD7	XLD8	XLD9
1	0	0	0	0	0	0	0	0	0
2	104.5	7.09	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	12.82	4.48	0	0	0	0	0	0
6	0	11.55	6.4	0	0	0	0	0	0
7	0	9.53	6.4	0	0	0	0	0	0
8	0	12.07	4.48	0	0	0	0	0	0
9	0	11.66	4.48	0	0	0	0	0	0
10	0	12.16	3.2	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	0	11.42	3.84	0	0	0	0	0	0
13	0	10.45	4.48	0	0	0	0	0	0
14	0	10.92	2.56	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0
17	0	12.82	4.48	0	0	0	0	0	0
18	0	5.76	5.12	0	0	0	0	0	0
19	2228.0	7.39	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
21	10.6	4.4	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0
23	0	9.6	7.68	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0
26	0	1.46	8.96	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0
29	0	12.82	4.48	0	0	0	0	0	0
30	30.6	5.0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
33	0	3.24	13.44	0	0	0	0	0	0
34	0	11.45	3.84	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
36	0	13.01	10.24	0	0	0	0	0	0
37	0	9.08	3.84	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
40	0	13.15	4.48	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0
44	0	12.95	2.56	0	0	0	0	0	0
45	142.30	5.0	0	0	0	0	0	0	0
46	0	12.52	2.24	0	0	0	0	0	0
47	3.8	5.0	0	0	0	0	0	0	0
48	0	13.09	5.12	0	0	0	0	0	0
49	0	5.95	3.84	0	0	0	0	0	0
50	0	11.95	5.12	0	0	0	0	0	0

51	0	12.41	3.84	0	0	0	0	0	0
52	0	5.25	5.12	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0

GROUP 7 (ONE LINE FOR EACH HEADWATER)

X01	X02	X03	X04	X05	X06	X07	X08	X09
0.0	11.14	6.4	0	0	0	0	0	0
0.0	12.94	2.56	0	0	0	0	0	0

GROUP 8 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH)

REACH	XK1	XK2	XK3	XK4	XM1	XM2	XM3	XRES	XDS	XP
1	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
2	0.035	0.58	.010	.020	.00	.00	.000	.17	13.0	.001
3	0.035	0.001	.010	.020	.00	.00	.000	.25	13.0	.001
4	0.035	0.001	.010	.020	.00	.00	.000	.25	13.0	.001
5	0.035	0.001	.010	.020	.00	.00	.000	.25	13.0	.001
6	0.035	0.001	.010	.020	.00	.00	.000	.25	13.0	.001
7	0.035	0.001	.010	.020	.00	.00	.000	.17	13.0	.001
8	0.035	0.001	.010	.020	.00	.00	.000	.17	13.0	.001
9	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
10	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
11	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
12	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
13	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
14	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
15	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
16	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
17	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
18	0.035	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
19	0.050	1.63	.2	.020	.00	.00	.000	.40	13.0	.001
20	0.050	0.001	.2	.020	.00	.00	.000	.40	13.0	.001
21	0.050	0.001	.2	.020	.00	.00	.000	.40	13.0	.001
22	0.050	0.001	.2	.020	.00	.00	.000	.40	13.0	.001
23	0.050	0.001	.2	.020	.00	.00	.000	.01	13.0	.001
24	0.050	0.001	.2	.020	.00	.00	.000	.01	13.0	.001
25	0.050	0.001	.2	.020	.00	.00	.000	.001	13.0	.001
26	0.050	0.001	.2	.020	.00	.00	.000	.001	13.0	.001
27	0.050	0.001	.2	.020	.00	.00	.000	.001	13.0	.001
28	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
29	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
30	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
31	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
32	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
33	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
34	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
35	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
36	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
37	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
38	0.050	0.001	.000	.020	.00	.00	3461.2	.001	13.0	.001
39	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001

40	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
41	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
42	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
43	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
44	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
45	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
46	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
47	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
48	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
49	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
50	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
51	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
52	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001
53	0.050	0.001	.000	.020	.00	.00	.000	.001	13.0	.001
54	0.050	0.001	.000	.020	.00	.00	.000	.05	13.0	.001
55	0.050	0.001	.000	.020	.00	.00	.000	.05	13.0	.001
56	0.050	0.001	.000	.020	.00	.00	.000	.15	13.0	.001

GROUP 9 (AVERAGE RIVER TEMPERATURE)
TEMPER
****
0.0

GROUP 10 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH NUMBER)

REACH	REFQ	T	HEXN	VEXN	RFDGR
1	50	.045	.516	.353	0.
2	50	.281	.512	.344	0.
3	50	.624	.516	.353	0.
4	50	.448	.550	.346	0.
5	50	.543	.550	.346	0.
6	50	.622	.550	.346	0.
7	50	.297	.540	.266	0.
8	50	.308	.540	.266	0.
9	50	.004	.540	.266	0.
10	50	.284	.540	.266	0.
11	50	.202	.551	.326	0.
12	50	.176	.551	.326	0.
13	50	.154	.551	.326	0.
14	50	.704	.551	.326	0.
15	50	.044	.551	.326	0.
16	50	.147	.551	.326	0.
17	50	.022	.463	.362	0.
18	50	.002	.463	.362	0.
19	50	.021	.463	.362	0.
20	50	.041	.463	.362	0.
21	50	.414	.463	.362	0.
22	50	1.940	.536	.274	0.
23	50	1.799	.523	.288	0.
24	50	1.426	.512	.350	0.
25	50	0.463	.512	.260	0.
26	50	0.805	.512	.260	0.
27	50	1.453	.512	.260	0.
28	50	1.960	.512	.260	0.
29	50	2.350	.512	.260	0.

30	50	2.009	.592	.295	0.
31	50	.038	.592	.295	0.
32	50	.280	.592	.295	0.
33	50	.587	.592	.295	0.
34	50	2.331	.592	.295	0.
35	50	1.524	.598	.335	0.
36	50	1.878	.598	.335	0.
37	50	.348	.598	.335	0.
38	50	.010	.505	.292	0.
39	50	1.077	.627	.358	0.
40	50	1.397	.627	.358	0.
41	50	.011	.632	.294	0.
42	50	1.066	.555	.257	0.
43	50	.827	.687	.252	0.
44	50	.077	.687	.252	0.
45	50	.020	.543	.136	0.
46	50	.994	.543	.136	0.
47	50	.069	.543	.136	0.
48	50	.516	.543	.136	0.
49	50	.127	.543	.136	0.
50	50	.569	.543	.136	0.
51	50	2.151	.543	.136	0.
52	50	2.901	.354	.254	0.
53	50	.180	.555	.351	0.
54	50	.023	.555	.351	0.
55	50	.557	.555	.351	0.
56	50	.471	.536	.289	0.

GROUP 11 (ONE LINE FOR EACH RIVER OR TRIBUTARY)
FNAM
****
ATHA3
LSR3

ATHABASCA - 1990 CALIBRATION FEB-MAR SURVEY - INCREASED MILL LOADINGS OF PP,DP,ON,NH3,NO3

NRT	NTRIB	MAXTR	MAXRI	MAXPT	NSTP	NVAR
56	1	4	52	52	25	16

GROUP 2 (ONE LINE FOR EACH REACH)

IRCH	UP1	IUP2	X	Q	QLD	SOURCE NAME
1	0	0	1.7	33.0	0.000	
2	1	0	12.2	32.216	0.784	WELDWOOD <==OPEN
3	2	0	23.6	33.0	0.000	
4	3	0	18.6	33.0	0.000	
5	4	0	22.5	33.0	2.400	OLDMAN CR
6	5	0	25.8	35.4	0.600	SPRING 1
7	6	0	13.3	36.0	8.900	BERLAND R
8	7	0	13.8	44.9	0.000	
9	8	0	0.2	44.9	0.300	MARSH CR
10	9	0	12.7	45.2	3.600	PINE CR+TWO CREEK
11	10	0	9.2	48.8	0.000	
12	11	0	8.0	48.8	0.000	
13	12	0	7.0	48.8	0.000	
14	13	0	32.0	48.8	1.900	WINDFALL
15	14	0	2.0	50.7	0.000	
16	15	0	6.7	50.7	0.000	
17	16	0	1.1	50.7	0.900	SAKWATAMAU
18	17	0	0.1	51.6	10.200	McLEOD R
19	18	0	1.5	61.664	0.136	MILLAR WEST.<==OPEN
20	19	0	2.1	61.8	0.000	
21	20	0	21.1	61.765	0.035	WHITE STP
22	21	0	70.0	61.8	0.000	
23	22	0	44.6	61.8	2.600	FREEMAN R.
24	23	0	31.5	64.4	0.000	
25	24	0	11.5	64.4	0.000	
26	25	0	20.0	64.4	8.900	PEMBINA
27	26	0	36.1	73.3	0.000	
28	27	56	48.7	117.0	0.000	LESSER SLAVE
29	28	0	58.4	117.0	0.000	
30	29	0	53.0	116.988	0.012	ATHAB STP
31	30	0	1.0	117.0	0.000	
32	31	0	7.4	117.0	0.000	
33	32	0	15.5	117.0	5.300	LA BICHE
34	33	0	61.5	122.3	0.700	CALLING
35	34	0	47.3	123.0	0.000	
36	35	0	58.3	123.0	2.000	PELICAN
37	36	0	10.8	125.0	17.000	HOUSE
38	37	0	1.0	142.0	0.000	
39	38	0	33.3	142.0	0.000	
40	39	0	43.2	142.0	0.000	
41	40	0	1.0	142.0	0.000	
42	41	0	28.7	142.0	0.000	
43	42	0	28.9	142.0	0.000	
44	43	0	2.7	142.0	0.000	
45	44	0	0.6	141.912	0.088	FT McM STP
46	45	0	30.4	142.0	62.8	CLEARWATER
47	46	0	2.1	204.559	0.241	SUNCOR

48	47	0	15.8	204.8	0.000	
49	48	0	3.9	204.8	0.400	MUSKEG
50	49	0	17.4	205.2	0.000	
51	50	0	65.8	205.2	1.800	ELLS
52	51	0	58.9	207.0	11.000	FIREBAG
53	0	0	8.0	43.7	0.000	
54	53	0	1.0	43.7	0.000	
55	54	0	24.7	43.7	0.000	
56	55	0	19.8	43.7	0.000	

GROUP 3 (ONE LINE FOR EACH POINT SOURCE INFLOW)

STNAM	INST
WELDWOOD	2
OLDMAN CR	5
SPRING 1	6
BERLAND R	7
MARSH HEAD CR	9
PINE+TWO CR	10
WINDFALL CR	14
SAKWATAMAU R	17
McLEOD R	18
MILLAR WEST.	19
STP	21
FREEMAN R	23
PEMBINA R	26
LESSER SLAVE R	28
STP	30
LA BICHE R	33
CALLING R	34
PELICAN R	36
HOUSE R	37
STP	45
CLEARWATER R	46
SUNCOR	47
MUSKEG R	49
ELLS R	51
FIREBAG	52

GROUP 4 (RIVER NAME FOR PLOT FILE, MAX. 7 CHARACTERS)
RNAM
****
ATHABASCA RIVER

GROUP 5 (ONE LINE FOR EACH TRIBUTARY, OMIT IF NO TRIBUTARIES)
TNAM INTR
****
LESSER SLAVE

GROUP 6 (ONE LINE FOR EACH REACH, IN INCREASING ORDER BY REACH)

REACH	XLD1	XLD2	XLD3	XLD4	XLD5	XLD6	SXN	SYN	SZN	SXP1	SYP	SXS	RN12	RN13	RN14	RP
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	6.000	0.326	0.095	0.367	0.122	160	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

4	0.06	0.01	0.149	0.002	0.008	2	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0.16	0.02	0.077	0.003	0.007	1	0	0	0	0	0	0	0	0	0	0
7	0.07	0.01	0.074	0.002	0.003	2	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0.18	0.02	0.131	0.01	0.002	2	0	0	0	0	0	0	0	0	0	0
10	0.16	0.02	0.077	0.003	0.007	1	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0.16	0.02	0.086	0.01	0.002	4	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0.16	0.02	0.073	0.006	0.003	6	0	0	0	0	0	0	0	0	0	0
18	0.26	0.35	0.196	0.004	0.005	3	0	0	0	0	0	0	0	0	0	0
19	30.00	0.72	1.00	4.53	8.00	121	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	.8	7.8	1.295	.18	4.32	4.0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0.22	0.04	0.066	0.011	0.007	5	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0.57	0.04	0.37	0.015	0.028	1	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0.39	0.04	0.041	0.007	0.012	7	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	4.6	20	2.300	.35	5.75	9	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0.83	0.12	0.31	0.055	0.038	15	0	0	0	0	0	0	0	0	0	0
34	0.89	0.36	0.32	0.045	0.013	6	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	1.32	.097	0.01	0.068	0.019	9	0	0	0	0	0	0	0	0	0	0
37	0.55	.045	.197	0.018	0.039	10	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	6	18.7	.9850	.6	1.9	15	0	.10	.015	0	0	0	0	0	0	0
46	0.3	0.06	0.176	0.028	0.026	7	0	0	0	0	0	0	0	0	0	0
47	0.52	0.28	0.17	0.99	0.106	22	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0.58	0.34	0.21	0.018	0.013	4	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0.49	0.03	0.25	0.014	0.015	5	0	0	0	0	0	0	0	0	0	0
52	0.225	0.045	0.171	0.018	0.041	3	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

GROUP 7 (ONE LINE FOR EACH HEADWATER)

X01	X02	X03	X04	X05	X06	SXON	SYON	SZON	SXOP	SYOP	SXOX	RN02	RN03	RN04	RPO
0.01	0.02	0.102	0.0063	0.0011	1	0	0	0	0	0	.816496	0	0	0	0
0.39	0.04	0.041	0.007	0.012	7	0	0	0	0	0	0	0	0	0	0

GROUP 8 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH)

REACH	B1	B3	DL4	BN	FRT	ABC	AF1	AGR	ARR	GM5	BP	AF2	KP	GM6	DIFS
*															
1	0.09	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
2	0.29	0.01	.250	.000	.5	.020	.000	.050	0.00	0.900	.000	1.00	.000	1.000	.001
3	0.29	0.01	.250	.000	.5	.020	.000	.050	0.00	0.900	.000	1.00	.000	1.000	.001
4	0.29	0.01	.250	.000	.5	.020	.000	.050	0.00	0.700	.000	1.00	.000	0.800	.001
5	0.29	0.01	.250	.000	.5	.00	.000	.050	0.00	.700	.000	1.00	.000	.000	.001
6	0.29	0.01	.250	.000	.5	.00	.000	.050	0.00	.500	.000	1.00	.000	.000	.001
7	0.29	0.01	.250	.000	.5	.00	.000	.050	0.00	.400	.000	1.00	.000	.000	.001
8	0.29	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
9	0.09	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
10	0.09	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
11	0.09	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
12	0.09	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
13	0.09	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
14	0.09	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
15	0.09	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
16	0.09	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
17	0.09	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
18	0.09	0.01	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
19	0.09	0.001	0.25	.000	.5	.040	.000	.050	0.00	1.0	.000	1.00	.000	1.0	.001
20	0.09	0.001	0.25	.000	.5	.040	.000	.050	0.00	1.0	.000	1.00	.000	1.0	.001
21	0.09	0.001	0.25	.000	.5	.040	.000	.050	0.00	1.0	.000	1.00	.000	0.8	.001
22	0.09	0.001	0.14	.000	.5	.040	.000	.050	0.00	0.5	.000	1.00	.000	0.5	.001
23	0.09	0.001	.000	.000	.5	.040	.000	.050	0.00	.001	.000	1.00	.000	.1	.001
24	0.09	0.001	.000	.000	.5	.000	.000	.050	0.00	.001	.000	1.00	.000	.1	.001
25	0.09	0.001	.000	.000	.5	.000	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
26	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
27	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
28	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	0.25	.001
29	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	0.25	.001
30	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
31	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
32	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.000	.001
33	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
34	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
35	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
36	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
37	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
38	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
39	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
40	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
41	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
42	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
43	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
44	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
45	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
46	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001

47	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
48	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
49	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
50	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
51	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
52	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
53	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
54	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
55	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001
56	0.09	0.001	.000	.000	.5	.00	.000	.050	0.00	.001	.000	1.00	.000	.05	.001

GROUP 8 correlations among various aspects of algal growth and nitrogen uptake
6 lines in all
****
0.0 0.0 0.0 0.0
0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0
0.0
0.0

GROUP 9 (AVERAGE RIVER TEMPERATURE)
TEMPER
****
0.0

GROUP 10 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH NUMBER)

REACH	REFQ	T	HEXN	VEXN	RFDGR
1	50	.045	.516	.353	0.
2	50	.281	.512	.344	0.
3	50	.624	.516	.353	0.
4	50	.448	.550	.346	0.
5	50	.543	.550	.346	0.
6	50	.622	.550	.346	0.
7	50	.297	.540	.266	0.
8	50	.308	.540	.266	0.
9	50	.004	.540	.266	0.
10	50	.284	.540	.266	0.
11	50	.202	.551	.326	0.
12	50	.176	.551	.326	0.
13	50	.154	.551	.326	0.
14	50	.704	.551	.326	0.
15	50	.044	.551	.326	0.
16	50	.147	.551	.326	0.
17	50	.022	.463	.362	0.
18	50	.002	.463	.362	0.
19	50	.021	.463	.362	0.
20	50	.041	.463	.362	0.
21	50	.414	.463	.362	0.
22	50	1.940	.536	.274	0.
23	50	1.799	.523	.288	0.
24	50	1.426	.512	.350	0.
25	50	0.463	.512	.260	0.
26	50	0.805	.512	.260	0.

27	50	1.453	.512	.260	0.
28	50	1.960	.512	.260	0.
29	50	2.350	.512	.260	0.
30	50	2.009	.592	.295	0.
31	50	.038	.592	.295	0.
32	50	.280	.592	.295	0.
33	50	.587	.592	.295	0.
34	50	2.331	.592	.295	0.
35	50	1.524	.598	.335	0.
36	50	1.878	.598	.335	0.
37	50	.348	.598	.335	0.
38	50	.010	.505	.292	0.
39	50	1.077	.627	.358	0.
40	50	1.397	.627	.358	0.
41	50	.011	.632	.294	0.
42	50	1.066	.555	.257	0.
43	50	.827	.687	.252	0.
44	50	.077	.687	.252	0.
45	50	.020	.543	.136	0.
46	50	.994	.543	.136	0.
47	50	.069	.543	.136	0.
48	50	.516	.543	.136	0.
49	50	.127	.543	.136	0.
50	50	.569	.543	.136	0.
51	50	2.151	.543	.136	0.
52	50	2.901	.354	.254	0.
53	50	.180	.555	.351	0.
54	50	.023	.555	.351	0.
55	50	.557	.555	.351	0.
56	50	.471	.536	.289	0.

GROUP 11 (ONE LINE FOR EACH RIVER OR TRIBUTARY)
FNAM
****
A90C.OUT
L90C.OUT

ATHABASCA - 1990 SYNOPTIC SURVEY TSS(NFR) CALIBRATION <== MAR 26/91 - WELWOOD LOAD INCREASED

NRT	NTRIB	MAXTR	MAXRI	MAXPT	NSTP	NVAR
56	1	4	52	52	25	2

GROUP 2 (ONE LINE FOR EACH REACH)

IRCH	UP1	IUP2	X	Q	QLD	SOURCE NAME
1	0	0	1.7	33.0	0.000	
2	1	0	12.2	32.216	0.784	WELDWOOD <==OPEN
3	2	0	23.6	33.0	0.000	
4	3	0	18.6	33.0	0.000	
5	4	0	22.5	33.0	2.400	OLDMAN CR
6	5	0	25.8	35.4	0.600	SPRING 1
7	6	0	13.3	36.0	8.900	BERLAND R
8	7	0	13.8	44.9	0.000	
9	8	0	0.2	44.9	0.300	MARSH CR
10	9	0	12.7	45.2	3.600	PINE CR+TWO CREEK
11	10	0	9.2	48.8	0.000	
12	11	0	8.0	48.8	0.000	
13	12	0	7.0	48.8	0.000	
14	13	0	32.0	48.8	1.900	WINDFALL
15	14	0	2.0	50.7	0.000	
16	15	0	6.7	50.7	0.000	
17	16	0	1.1	50.7	0.900	SAKWATAMAU
18	17	0	0.1	51.6	10.200	McLEOD R
19	18	0	1.5	61.664	0.136	MILLAR WEST.<==OPEN
20	19	0	2.1	61.8	0.000	
21	20	0	21.1	61.765	0.035	WHITE STP
22	21	0	70.0	61.8	0.000	
23	22	0	44.6	61.8	2.600	FREEMAN R.
24	23	0	31.5	64.4	0.000	
25	24	0	11.5	64.4	0.000	
26	25	0	20.0	64.4	8.900	PEMBINA
27	26	0	36.1	73.3	0.000	
28	27	56	48.7	117.0	0.000	LESSER SLAVE
29	28	0	58.4	117.0	0.000	
30	29	0	53.0	116.988	0.012	ATHAB STP
31	30	0	1.0	117.0	0.000	
32	31	0	7.4	117.0	0.000	
33	32	0	15.5	117.0	5.300	LA BICHE
34	33	0	61.5	122.3	0.700	CALLING
35	34	0	47.3	123.0	0.000	
36	35	0	58.3	123.0	2.000	PELICAN
37	36	0	10.8	125.0	17.000	HOUSE
38	37	0	1.0	142.0	0.000	
39	38	0	33.3	142.0	0.000	
40	39	0	43.2	142.0	0.000	
41	40	0	1.0	142.0	0.000	
42	41	0	28.7	142.0	0.000	
43	42	0	28.9	142.0	0.000	
44	43	0	2.7	142.0	0.000	
45	44	0	0.6	141.912	0.088	FT McM STP
46	45	0	30.4	142.0	62.8	CLEARWATER
47	46	0	2.1	204.559	0.241	SUNCOR

48	47	0	15.8	204.8	0.000	
49	48	0	3.9	204.8	0.400	MUSKEG
50	49	0	17.4	205.2	0.000	
51	50	0	65.8	205.2	1.800	ELLS
52	51	0	58.9	207.0	11.000	FIREBAG
53	0	0	8.0	43.7	0.000	
54	53	0	1.0	43.7	0.000	
55	54	0	24.7	43.7	0.000	
56	55	0	19.8	43.7	0.000	

GROUP 3 (ONE LINE FOR EACH POINT SOURCE INFLOW)

STNAM	INST
WELDWOOD	2
OLDMAN CR	5
SPRING 1	6
BERLAND R	7
MARSH HEAD CR	9
PINE+TWO CR	10
WINDFALL CR	14
SAKWATAMAU R	17
McLEOD R	18
MILLAR WEST.	19
STP	21
FREEMAN R	23
PEMBINA R	26
LESSER SLAVE R	28
STP	30
LA BICHE R	33
CALLING R	34
PELICAN R	36
HOUSE R	37
STP	45
CLEARWATER R	46
SUNCOR	47
MUSKEG R	49
ELLS R	51
FIREBAG	52

GROUP 4 (RIVER NAME FOR PLOT FILE, MAX. 7 CHARACTERS)

RNAM

****

ATHABASCA RIVER

GROUP 5 (ONE LINE FOR EACH TRIBUTARY, OMIT IF NO TRIBUTARIES)

TNAM INTR

****

LESSER SLAVE

GROUP 6 (ONE LINE FOR EACH REACH, IN INCREASING ORDER BY REACH)

REACH	XLD1	XLD2
1	0	0
2	160	0
3	0	0

4	0	0
5	2.0	0
6	1.0	0
7	2.0	0
8	1.0	0
9	0	0
10	2.0	0
11	0	0
12	0	0
13	0	0
14	4.0	0
15	0	0
16	0	0
17	6.0	0
18	3.0	0
19	121	0
20	0	0
21	4.0	0
22	0	0
23	5.0	0
24	0	0
25	0	0
26	1.0	0
27	0	0
28	0	0
29	0	0
30	9	0
31	0	0
32	0	0
33	15	0
34	6	0
35	0	0
36	9	0
37	10	0
38	0	0
39	0	0
40	0	0
41	0	0
42	0	0
43	0	0
44	0	0
45	15	0
46	7	0
47	22	0
48	0	0
49	4	0
50	0	0
51	5	0
52	3	0
53	0	0
54	0	0
55	0	0
56	0	0

GROUP 7 (ONE LINE FOR EACH HEADWATER)

X01	X02
1.0	0
7.0	0

GROUP 8 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH)

REACH	XK1	XK2	XK3	XK4
1	0.000	0.000	0.000	0.000
2	0.000	0.900	0.000	0.000
3	0.000	0.900	0.000	0.000
4	0.000	0.900	0.000	0.000
5	0.000	0.900	0.000	0.000
6	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000
19	0.000	0.400	0.000	0.000
20	0.000	0.400	0.000	0.000
21	0.000	0.400	0.000	0.000
22	0.000	0.400	0.000	0.000
23	0.000	0.400	0.000	0.000
24	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000
27	0.000	0.000	0.000	0.000
28	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000
31	0.000	0.000	0.000	0.000
32	0.000	0.000	0.000	0.000
33	0.000	0.000	0.000	0.000
34	0.000	0.000	0.000	0.000
35	0.000	0.000	0.000	0.000
36	0.000	0.000	0.000	0.000
37	0.000	0.000	0.000	0.000
38	0.000	0.000	0.000	0.000
39	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000
41	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000
43	0.000	0.000	0.000	0.000
44	0.000	0.000	0.000	0.000
45	0.000	0.000	0.000	0.000
46	0.000	0.000	0.000	0.000
47	0.000	0.000	0.000	0.000

48	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000
50	0.000	0.000	0.000	0.000
51	0.000	0.000	0.000	0.000
52	0.000	0.000	0.000	0.000
53	0.000	0.000	0.000	0.000
54	0.000	0.000	0.000	0.000
55	0.000	0.000	0.000	0.000
56	0.000	0.000	0.000	0.000

GROUP 9 (AVERAGE RIVER TEMPERATURE)
TEMPER
****
0.0

GROUP 10 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH NUMBER)

REACH	REFQ	T	HEXN	VEXN	RFDGR
1	50	.045	.516	.353	0.
2	50	.281	.512	.344	0.
3	50	.624	.516	.353	0.
4	50	.448	.550	.346	0.
5	50	.543	.550	.346	0.
6	50	.622	.550	.346	0.
7	50	.297	.540	.266	0.
8	50	.308	.540	.266	0.
9	50	.004	.540	.266	0.
10	50	.284	.540	.266	0.
11	50	.202	.551	.326	0.
12	50	.176	.551	.326	0.
13	50	.154	.551	.326	0.
14	50	.704	.551	.326	0.
15	50	.044	.551	.326	0.
16	50	.147	.551	.326	0.
17	50	.022	.463	.362	0.
18	50	.002	.463	.362	0.
19	50	.021	.463	.362	0.
20	50	.041	.463	.362	0.
21	50	.414	.463	.362	0.
22	50	1.940	.536	.274	0.
23	50	1.799	.523	.288	0.
24	50	1.426	.512	.350	0.
25	50	0.463	.512	.260	0.
26	50	0.805	.512	.260	0.
27	50	1.453	.512	.260	0.
28	50	1.960	.512	.260	0.
29	50	2.350	.512	.260	0.
30	50	2.009	.592	.295	0.
31	50	.038	.592	.295	0.
32	50	.280	.592	.295	0.
33	50	.587	.592	.295	0.
34	50	2.331	.592	.295	0.
35	50	1.524	.598	.335	0.
36	50	1.878	.598	.335	0.
37	50	.348	.598	.335	0.

38	50	.010	.505	.292	0.
39	50	1.077	.627	.358	0.
40	50	1.397	.627	.358	0.
41	50	.011	.632	.294	0.
42	50	1.066	.555	.257	0.
43	50	.827	.687	.252	0.
44	50	.077	.687	.252	0.
45	50	.020	.543	.136	0.
46	50	.994	.543	.136	0.
47	50	.069	.543	.136	0.
48	50	.516	.543	.136	0.
49	50	.127	.543	.136	0.
50	50	.569	.543	.136	0.
51	50	2.151	.543	.136	0.
52	50	2.901	.354	.254	0.
53	50	.180	.555	.351	0.
54	50	.023	.555	.351	0.
55	50	.557	.555	.351	0.
56	50	.471	.536	.289	0.

GROUP 11 (ONE LINE FOR EACH RIVER OR TRIBUTARY)
FNAM
****

A90C.OUT
L90C.OUT

ATHABASCA - FEB-MAR 1990 CALIBRATION TOTAL COLOR - MAR 27/91 - WELDWOOD LOAD REDUCED

NRT	NTRIB	MAXTR	MAXRI	MAXPT	NSTP	NVAR
56	1	4	52	52	25	2

GROUP 2 (ONE LINE FOR EACH REACH)

IRCH	UP1	IUP2	X	Q	QLD	SOURCE NAME
1	0	0	1.7	33.0	0.000	
2	1	0	12.2	32.216	0.784	WELDWOOD <==OPEN
3	2	0	23.6	33.0	0.000	
4	3	0	18.6	33.0	0.000	
5	4	0	22.5	33.0	2.400	OLDMAN CR
6	5	0	25.8	35.4	0.600	SPRING 1
7	6	0	13.3	36.0	8.900	BERLAND R
8	7	0	13.8	44.9	0.000	
9	8	0	0.2	44.9	0.300	MARSH CR
10	9	0	12.7	45.2	3.600	PINE CR+TWO CREEK
11	10	0	9.2	48.8	0.000	
12	11	0	8.0	48.8	0.000	
13	12	0	7.0	48.8	0.000	
14	13	0	32.0	48.8	1.900	WINDFALL
15	14	0	2.0	50.7	0.000	
16	15	0	6.7	50.7	0.000	
17	16	0	1.1	50.7	0.900	SAKWATAMAU
18	17	0	0.1	51.6	10.200	McLEOD R
19	18	0	1.5	61.664	0.136	MILLAR WEST.<==OPEN
20	19	0	2.1	61.8	0.000	
21	20	0	21.1	61.765	0.035	WHITE STP
22	21	0	70.0	61.8	0.000	
23	22	0	44.6	61.8	2.600	FREEMAN R.
24	23	0	31.5	64.4	0.000	
25	24	0	11.5	64.4	0.000	
26	25	0	20.0	64.4	8.900	PEMBINA
27	26	0	36.1	73.3	0.000	
28	27	56	48.7	117.0	0.000	LESSER SLAVE
29	28	0	58.4	117.0	0.000	
30	29	0	53.0	116.988	0.012	ATHAB STP
31	30	0	1.0	117.0	0.000	
32	31	0	7.4	117.0	0.000	
33	32	0	15.5	117.0	5.300	LA BICHE
34	33	0	61.5	122.3	0.700	CALLING
35	34	0	47.3	123.0	0.000	
36	35	0	58.3	123.0	2.000	PELICAN
37	36	0	10.8	125.0	17.000	HOUSE
38	37	0	1.0	142.0	0.000	
39	38	0	33.3	142.0	0.000	
40	39	0	43.2	142.0	0.000	
41	40	0	1.0	142.0	0.000	
42	41	0	28.7	142.0	0.000	
43	42	0	28.9	142.0	0.000	
44	43	0	2.7	142.0	0.000	
45	44	0	0.6	141.912	0.088	FT McM STP
46	45	0	30.4	142.0	62.8	CLEARWATER
47	46	0	2.1	204.559	0.241	SUNCOR

48	47	0	15.8	204.8	0.000	
49	48	0	3.9	204.8	0.400	MUSKEG
50	49	0	17.4	205.2	0.000	
51	50	0	65.8	205.2	1.800	ELLS
52	51	0	58.9	207.0	11.000	FIREBAG
53	0	0	8.0	43.7	0.000	
54	53	0	1.0	43.7	0.000	
55	54	0	24.7	43.7	0.000	
56	55	0	19.8	43.7	0.000	

GROUP 3 (ONE LINE FOR EACH POINT SOURCE INFLOW)

STNAM	INST
WELDWOOD	2
OLDMAN CR	5
SPRING 1	6
BERLAND R	7
MARSH HEAD CR	9
PINE+TWO CR	10
WINDFALL CR	14
SAKWATAMAU R	17
McLEOD R	18
MILLAR WEST.	19
STP	21
FREEMAN R	23
PEMBINA R	26
LESSER SLAVE R	28
STP	30
LA BICHE R	33
CALLING R	34
PELICAN R	36
HOUSE R	37
STP	45
CLEARWATER R	46
SUNCOR	47
MUSKEG R	49
ELLS R	51
FIREBAG	52

GROUP 4 (RIVER NAME FOR PLOT FILE, MAX. 7 CHARACTERS)
RNAM
****
ATHABASCA RIVER

GROUP 5 (ONE LINE FOR EACH TRIBUTARY, OMIT IF NO TRIBUTARIES)

TNAM	INTR
LESSER SLAVE	

GROUP 6 (ONE LINE FOR EACH REACH, IN INCREASING ORDER BY REACH)

REACH	XLD1	XLD2
1	0	0
2	500	0
3	0	0

4	0	0
5	4	0
6	5	0
7	1	0
8	0	0
9	10	0
10	5	0
11	0	0
12	0	0
13	0	0
14	10	0
15	0	0
16	0	0
17	10	0
18	11	0
19	797	0
20	0	0
21	35	0
22	0	0
23	14	0
24	0	0
25	0	0
26	52	0
27	0	0
28	13	0
29	0	0
30	51	0
31	0	0
32	0	0
33	28	0
34	28	0
35	0	0
36	145	0
37	23	0
38	0	0
39	0	0
40	0	0
41	0	0
42	0	0
43	0	0
44	0	0
45	41	0
46	33	0
47	19	0
48	0	0
49	61	0
50	0	0
51	44	0
52	32	0
53	0	0
54	0	0
55	0	0
56	0	0

GROUP 7 (ONE LINE FOR EACH HEADWATER)

X01	X02
2.3	0
13.0	0

GROUP 8 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH)

REACH	XK1	XK2	XK3	XK4
1	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000
22	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000
27	0.000	0.000	0.000	0.000
28	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000
31	0.000	0.000	0.000	0.000
32	0.000	0.000	0.000	0.000
33	0.000	0.000	0.000	0.000
34	0.000	0.000	0.000	0.000
35	0.000	0.000	0.000	0.000
36	0.000	0.000	0.000	0.000
37	0.000	0.000	0.000	0.000
38	0.000	0.000	0.000	0.000
39	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000
41	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000
43	0.000	0.000	0.000	0.000
44	0.000	0.000	0.000	0.000
45	0.000	0.000	0.000	0.000
46	0.000	0.000	0.000	0.000
47	0.000	0.000	0.000	0.000

48	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000
50	0.000	0.000	0.000	0.000
51	0.000	0.000	0.000	0.000
52	0.000	0.000	0.000	0.000
53	0.000	0.000	0.000	0.000
54	0.000	0.000	0.000	0.000
55	0.000	0.000	0.000	0.000
56	0.000	0.000	0.000	0.000

GROUP 9 (AVERAGE RIVER TEMPERATURE)
TEMPER
****
0.0

GROUP 10 (ONE LINE FOR EACH REACH IN INCREASING ORDER OF REACH NUMBER)

REACH	REFQ	T	HEXN	VEXN	RFDGR
1	50	.045	.516	.353	0.
2	50	.281	.512	.344	0.
3	50	.624	.516	.353	0.
4	50	.448	.550	.346	0.
5	50	.543	.550	.346	0.
6	50	.622	.550	.346	0.
7	50	.297	.540	.266	0.
8	50	.308	.540	.266	0.
9	50	.004	.540	.266	0.
10	50	.284	.540	.266	0.
11	50	.202	.551	.326	0.
12	50	.176	.551	.326	0.
13	50	.154	.551	.326	0.
14	50	.704	.551	.326	0.
15	50	.044	.551	.326	0.
16	50	.147	.551	.326	0.
17	50	.022	.463	.362	0.
18	50	.002	.463	.362	0.
19	50	.021	.463	.362	0.
20	50	.041	.463	.362	0.
21	50	.414	.463	.362	0.
22	50	1.940	.536	.274	0.
23	50	1.799	.523	.288	0.
24	50	1.426	.512	.350	0.
25	50	0.463	.512	.260	0.
26	50	0.805	.512	.260	0.
27	50	1.453	.512	.260	0.
28	50	1.960	.512	.260	0.
29	50	2.350	.512	.260	0.
30	50	2.009	.592	.295	0.
31	50	.038	.592	.295	0.
32	50	.280	.592	.295	0.
33	50	.587	.592	.295	0.
34	50	2.331	.592	.295	0.
35	50	1.524	.598	.335	0.
36	50	1.878	.598	.335	0.
37	50	.348	.598	.335	0.

38	50	.010	.505	.292	0.
39	50	1.077	.627	.358	0.
40	50	1.397	.627	.358	0.
41	50	.011	.632	.294	0.
42	50	1.066	.555	.257	0.
43	50	.827	.687	.252	0.
44	50	.077	.687	.252	0.
45	50	.020	.543	.136	0.
46	50	.994	.543	.136	0.
47	50	.069	.543	.136	0.
48	50	.516	.543	.136	0.
49	50	.127	.543	.136	0.
50	50	.569	.543	.136	0.
51	50	2.151	.543	.136	0.
52	50	2.901	.354	.254	0.
53	50	.180	.555	.351	0.
54	50	.023	.555	.351	0.
55	50	.557	.555	.351	0.
56	50	.471	.536	.289	0.

GROUP 11 (ONE LINE FOR EACH RIVER OR TRIBUTARY)
FNAM
****
A90C.OUT
L90C.OUT

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1136 - ATHABASCA RIVER SURVEY #1 1990 - MAY 9, 1991
        2,4,6 - TRICHLOROPHENOL
 KSIM NSEG NSYS ICRD MFLG IDMP NSLN INTY ADFC   DD HHMM       A:MODEL OPTIONS
    0   65   02    0    1    1    0    1  0.0    1 0000    5    1   33    0.00
    1
      0.2       40.0
    1
     10.0       40.0
    0    0
    2    *    +    *    +    *    +    *    +    *    +    *    B:EXCHANGES
    0                                                          (WATER COLUMN DISPERSION)
    1     1000.       1.0
   51
    1339.9       .69    2   57
    2692.0       .77    3   58
    1860.2       .79    4   58
    2266.7       .82    5   58
    2603.7       .83    6   61
    1617.4       .73    7   61
    1678.2       .73    8   61
      24.4       .74    9   61
    1569.6       .77   10   61
    1216.4       .71   11   61
    1057.7       .71   12   61
     925.5       .71   13   62
    4250.8       .72   14   62
     265.7       .72   15   62
     891.9       .73   16   62
     144.7       .66   17   62
      13.6       .72   18   62
     203.6       .72   19   59
     285.1       .72   20   59
    2864.6       .72   21   59
   10015.3       .98   22   60
    6450.8      1.44   23   60
    6856.7      1.05   24   63
    2250.5      1.07   25   63
    3914.0      1.07   26   63
    7276.4      1.14   27   63
   10920.4      1.45   28   63
   13095.5      1.45   29   64
   12116.4      1.30   30   64
     228.6      1.30   31   64
    1691.7      1.30   32   64
    3561.3      1.34   33   64
   14139.3      1.34   34   64
   12296.5       .97   35   64
   15172.5       .98   36   64
    2834.8      1.06   37   64
     151.1       .61   38   64
    9729.3       .93   39   64
   12621.9       .93   40   64
     277.5       .37   41   64
   15704.1       .64   42   64
   10569.3       .74   43   64
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```
   987.4      .74   44   64
   227.6      .92   45   64
 12970.5     1.12   46   65
   896.0     1.12   47   65
  6741.2     1.12   48   65
  1665.0     1.12   49   65
  7428.6     1.12   50   65
 28170.8     1.13   51   65
 23989.6     1.51   52   65
  2
   1E-08      0.     1E-08      100.
  0    0
  2    0      0.0   +    *    +    *    +    *    +    *    C: VOLUMES
  1000.0      1.0
       1        0        1     148.4    .110    .353    .126    .516
       2       57        1     923.1    .131    .344    .115    .512
       3       58        1    2060.6    .110    .353    .126    .516
       4       58        1    1476.4    .124    .346    .116    .550
       5       58        1    1869.9    .124    .346    .116    .550
       6       61        1    2167.8    .124    .346    .116    .550
       7       61        1    1186.2    .183    .266    .094    .540
       8       61        1    1230.8    .183    .266    .094    .540
       9       61        1      17.9    .183    .266    .094    .540
      10       61        1    1204.1    .183    .266    .094    .540
      11       61        1     859.9    .147    .326    .083    .551
      12       61        1     747.8    .147    .326    .083    .551
      13       62        1     654.3    .147    .326    .083    .551
      14       62        1    3069.1    .147    .326    .083    .551
      15       62        1     191.8    .147    .326    .083    .551
      16       62        1     650.3    .147    .326    .083    .551
      17       62        1      95.2    .143    .326    .106    .463
      18       62        1       9.7    .143    .326    .106    .463
      19       59        1     145.7    .143    .326    .106    .463
      20       59        1     204.0    .143    .326    .106    .463
      21       59        1    2049.3    .143    .326    .106    .463
      22       60        1    9772.8    .143    .274    .107    .536
      23       60        1    9286.4    .093    .288    .163    .523
      24       63        1    7230.6    .065    .350    .125    .512
      25       63        1    2411.2    .104    .260    .127    .512
      26       63        1    4193.5    .104    .260    .127    .512
      27       63        1    8330.1    .104    .260    .127    .512
      28       63        1   15883.8    .104    .260    .127    .512
      29       64        1   19047.5    .104    .260    .127    .512
      30       64        1   15802.3    .096    .295    .078    .592
      31       64        1     298.2    .096    .295    .078    .592
      32       64        1    2206.4    .096    .295    .078    .592
      33       64        1    4768.1    .096    .295    .078    .592
      34       64        1   18994.7    .096    .295    .078    .592
      35       64        1   11976.3    .097    .335    .055    .598
      36       64        1   14920.7    .097    .335    .055    .598
      37       64        1    3008.7    .097    .335    .055    .598
      38       64        1      92.3    .362    .292    .050    .505
      39       64        1    9093.8    .088    .358    .042    .627
      40       64        1   11797.3    .088    .358    .042    .627
      41       64        1     101.8    .325    .294    .016    .632
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        42        64         1   10002.9     .114      .257      .041      .555
        43        64         1    7795.3     .151      .252      .025      .687
        44        64         1     728.3     .151      .252      .025      .687
        45        64         1     208.8     .208      .136      .062      .543
        46        65         1   14514.4     .208      .136      .062      .543
        47        65         1    1002.6     .208      .136      .062      .543
        48        65         1    7543.7     .208      .136      .062      .543
        49        65         1    1865.2     .208      .136      .062      .543
        50        65         1    8321.6     .208      .136      .062      .543
        51        65         1   31707.4     .208      .136      .062      .543
        52        65         1   36125.3     .087      .254      .228      .354
        53         0         1     714.2     .130      .351      .245      .555
        54         0         1      89.3     .130      .351      .245      .555
        55         0         1    2205.1     .130      .351      .245      .555
        56         0         1    1849.9     .157      .289      .175      .536
        57         0         3    6699.3      0.         1.       0.1       .1
        58         0         3   34094.6      0.         1.       0.1       .1
        59         0         3   16766.7      0.         1.       0.1       .1
        60         0         3   50076.7      0.         1.       0.1       .1
        61         0         3   48836.4      0.         1.       0.1       .1
        62         0         3   32460.9      0.         1.       0.1       .1
        63         0         3  156089.7      0.         1.       0.1       .1
        64         0         3  691876.6      0.         1.       0.1       .1
        65         0         3  344455.8      0.         1.       0.1       .1
  1    3    +    *    +    *    +    *    +    *    +    *   D: FLOWS
 20       1.0       1.0                 (water column field)
 54        HEADWATER FLOW
      1.0   0    1        1.0   1    2       1.0   2    3       1.0   3    4
      1.0   4    5        1.0   5    6       1.0   6    7       1.0   7    8
      1.0   8    9        1.0   9   10       1.0  10   11       1.0  11   12
      1.0  12   13        1.0  13   14       1.0  14   15       1.0  15   16
      1.0  16   17        1.0  17   18       1.0  18   19       1.0  19   20
      1.0  20   21        1.0  21   22       1.0  22   23       1.0  23   24
      1.0  24   25        1.0  25   26       1.0  26   27       1.0  27   28
      1.0  28   29        1.0  29   30       1.0  30   31       1.0  31   32
      1.0  32   33        1.0  33   34       1.0  34   35       1.0  35   36
      1.0  36   37        1.0  37   38       1.0  38   39       1.0  39   40
      1.0  40   41        1.0  41   42       1.0  42   43       1.0  43   44
      1.0  44   45        1.0  45   46       1.0  46   47       1.0  47   48
      1.0  48   49        1.0  49   50       1.0  50   51       1.0  51   52
      1.0  52   53        1.0  53    0
  2
   33.00        0.     33.00       100.
 50        OLDMAN CREEK
      1.0   0    5        1.0   5    6       1.0   6    7       1.0   7    8
      1.0   8    9        1.0   9   10       1.0  10   11       1.0  11   12
      1.0  12   13        1.0  13   14       1.0  14   15       1.0  15   16
      1.0  16   17        1.0  17   18       1.0  18   19       1.0  19   20
      1.0  20   21        1.0  21   22       1.0  22   23       1.0  23   24
      1.0  24   25        1.0  25   26       1.0  26   27       1.0  27   28
      1.0  28   29        1.0  29   30       1.0  30   31       1.0  31   32
      1.0  32   33        1.0  33   34       1.0  34   35       1.0  35   36
      1.0  36   37        1.0  37   38       1.0  38   39       1.0  39   40
      1.0  40   41        1.0  41   42       1.0  42   43       1.0  43   44
      1.0  44   45        1.0  45   46       1.0  46   47       1.0  47   48
```

```
     1.0   48   49       1.0   49   50       1.0   50   51       1.0   51   52
     1.0   52   53       1.0   53    0
  2
    2.40        0.     2.40        100.
 49          SPRING 1
     1.0    0    6       1.0    6    7       1.0    7    8       1.0    8    9
     1.0    9   10       1.0   10   11       1.0   11   12       1.0   12   13
     1.0   13   14       1.0   14   15       1.0   15   16       1.0   16   17
     1.0   17   18       1.0   18   19       1.0   19   20       1.0   20   21
     1.0   21   22       1.0   22   23       1.0   23   24       1.0   24   25
     1.0   25   26       1.0   26   27       1.0   27   28       1.0   28   29
     1.0   29   30       1.0   30   31       1.0   31   32       1.0   32   33
     1.0   33   34       1.0   34   35       1.0   35   36       1.0   36   37
     1.0   37   38       1.0   38   39       1.0   39   40       1.0   40   41
     1.0   41   42       1.0   42   43       1.0   43   44       1.0   44   45
     1.0   45   46       1.0   46   47       1.0   47   48       1.0   48   49
     1.0   49   50       1.0   50   51       1.0   51   52       1.0   52   53
     1.0   53    0
  2
    0.60        0.     0.60        100.
 48          BERLAND RIVER
     1.0    0    7       1.0    7    8       1.0    8    9       1.0    9   10
     1.0   10   11       1.0   11   12       1.0   12   13       1.0   13   14
     1.0   14   15       1.0   15   16       1.0   16   17       1.0   17   18
     1.0   18   19       1.0   19   20       1.0   20   21       1.0   21   22
     1.0   22   23       1.0   23   24       1.0   24   25       1.0   25   26
     1.0   26   27       1.0   27   28       1.0   28   29       1.0   29   30
     1.0   30   31       1.0   31   32       1.0   32   33       1.0   33   34
     1.0   34   35       1.0   35   36       1.0   36   37       1.0   37   38
     1.0   38   39       1.0   39   40       1.0   40   41       1.0   41   42
     1.0   42   43       1.0   43   44       1.0   44   45       1.0   45   46
     1.0   46   47       1.0   47   48       1.0   48   49       1.0   49   50
     1.0   50   51       1.0   51   52       1.0   52   53       1.0   53    0
  2
    8.90        0.     8.90        100.
 46          MARSH HEAD CR
     1.0    0    9       1.0    9   10       1.0   10   11       1.0   11   12
     1.0   12   13       1.0   13   14       1.0   14   15       1.0   15   16
     1.0   16   17       1.0   17   18       1.0   18   19       1.0   19   20
     1.0   20   21       1.0   21   22       1.0   22   23       1.0   23   24
     1.0   24   25       1.0   25   26       1.0   26   27       1.0   27   28
     1.0   28   29       1.0   29   30       1.0   30   31       1.0   31   32
     1.0   32   33       1.0   33   34       1.0   34   35       1.0   35   36
     1.0   36   37       1.0   37   38       1.0   38   39       1.0   39   40
     1.0   40   41       1.0   41   42       1.0   42   43       1.0   43   44
     1.0   44   45       1.0   45   46       1.0   46   47       1.0   47   48
     1.0   48   49       1.0   49   50       1.0   50   51       1.0   51   52
     1.0   52   53       1.0   53    0
  2
    0.30        0.     0.30        100.
 45          PINE CREEK + TWO CREEK
     1.0    0   10       1.0   10   11       1.0   11   12       1.0   12   13
     1.0   13   14       1.0   14   15       1.0   15   16       1.0   16   17
     1.0   17   18       1.0   18   19       1.0   19   20       1.0   20   21
     1.0   21   22       1.0   22   23       1.0   23   24       1.0   24   25
```

```
      1.0   25   26       1.0   26   27       1.0   27   28       1.0   28   29
      1.0   29   30       1.0   30   31       1.0   31   32       1.0   32   33
      1.0   33   34       1.0   34   35       1.0   35   36       1.0   36   37
      1.0   37   38       1.0   38   39       1.0   39   40       1.0   40   41
      1.0   41   42       1.0   42   43       1.0   43   44       1.0   44   45
      1.0   45   46       1.0   46   47       1.0   47   48       1.0   48   49
      1.0   49   50       1.0   50   51       1.0   51   52       1.0   52   53
      1.0   53    0
  2
    3.60        0.    3.60        100.
 41         WINDFALL CREEK
      1.0    0   14       1.0   14   15       1.0   15   16       1.0   16   17
      1.0   17   18       1.0   18   19       1.0   19   20       1.0   20   21
      1.0   21   22       1.0   22   23       1.0   23   24       1.0   24   25
      1.0   25   26       1.0   26   27       1.0   27   28       1.0   28   29
      1.0   29   30       1.0   30   31       1.0   31   32       1.0   32   33
      1.0   33   34       1.0   34   35       1.0   35   36       1.0   36   37
      1.0   37   38       1.0   38   39       1.0   39   40       1.0   40   41
      1.0   41   42       1.0   42   43       1.0   43   44       1.0   44   45
      1.0   45   46       1.0   46   47       1.0   47   48       1.0   48   49
      1.0   49   50       1.0   50   51       1.0   51   52       1.0   52   53
      1.0   53    0
  2
    1.90        0.    1.90        100.
 38         SAKWATAMAU RIVER
      1.0    0   17       1.0   17   18       1.0   18   19       1.0   19   20
      1.0   20   21       1.0   21   22       1.0   22   23       1.0   23   24
      1.0   24   25       1.0   25   26       1.0   26   27       1.0   27   28
      1.0   28   29       1.0   29   30       1.0   30   31       1.0   31   32
      1.0   32   33       1.0   33   34       1.0   34   35       1.0   35   36
      1.0   36   37       1.0   37   38       1.0   38   39       1.0   39   40
      1.0   40   41       1.0   41   42       1.0   42   43       1.0   43   44
      1.0   44   45       1.0   45   46       1.0   46   47       1.0   47   48
      1.0   48   49       1.0   49   50       1.0   50   51       1.0   51   52
      1.0   52   53       1.0   53    0
  2
    0.90        0.    0.90        100.
 37         McLEOD RIVER
      1.0    0   18       1.0   18   19       1.0   19   20       1.0   20   21
      1.0   21   22       1.0   22   23       1.0   23   24       1.0   24   25
      1.0   25   26       1.0   26   27       1.0   27   28       1.0   28   29
      1.0   29   30       1.0   30   31       1.0   31   32       1.0   32   33
      1.0   33   34       1.0   34   35       1.0   35   36       1.0   36   37
      1.0   37   38       1.0   38   39       1.0   39   40       1.0   40   41
      1.0   41   42       1.0   42   43       1.0   43   44       1.0   44   45
      1.0   45   46       1.0   46   47       1.0   47   48       1.0   48   49
      1.0   49   50       1.0   50   51       1.0   51   52       1.0   52   53
      1.0   53    0
  2
   10.20        0.   10.20        100.
 32         FREEMAN RIVER
      1.0    0   23       1.0   23   24       1.0   24   25       1.0   25   26
      1.0   26   27       1.0   27   28       1.0   28   29       1.0   29   30
      1.0   30   31       1.0   31   32       1.0   32   33       1.0   33   34
      1.0   34   35       1.0   35   36       1.0   36   37       1.0   37   38
```

```
     1.0  38  39     1.0  39  40     1.0  40  41     1.0  41  42
     1.0  42  43     1.0  43  44     1.0  44  45     1.0  45  46
     1.0  46  47     1.0  47  48     1.0  48  49     1.0  49  50
     1.0  50  51     1.0  51  52     1.0  52  53     1.0  53   0
  2
    2.60      0.    2.60      100.
 29         PEMBINA RIVER
     1.0   0  26     1.0  26  27     1.0  27  28     1.0  28  29
     1.0  29  30     1.0  30  31     1.0  31  32     1.0  32  33
     1.0  33  34     1.0  34  35     1.0  35  36     1.0  36  37
     1.0  37  38     1.0  38  39     1.0  39  40     1.0  40  41
     1.0  41  42     1.0  42  43     1.0  43  44     1.0  44  45
     1.0  45  46     1.0  46  47     1.0  47  48     1.0  48  49
     1.0  49  50     1.0  50  51     1.0  51  52     1.0  52  53
     1.0  53   0
  2
    8.90      0.    8.90      100.
 31         LESSER SLAVE RIVER
     1.0   0  53     1.0  53  54     1.0  54  55     1.0  55  56
     1.0  56  28     1.0  28  29     1.0  29  30     1.0  30  31
     1.0  31  32     1.0  32  33     1.0  33  34     1.0  34  35
     1.0  35  36     1.0  36  37     1.0  37  38     1.0  38  39
     1.0  39  40     1.0  40  41     1.0  41  42     1.0  42  43
     1.0  43  44     1.0  44  45     1.0  45  46     1.0  46  47
     1.0  47  48     1.0  48  49     1.0  49  50     1.0  50  51
     1.0  51  52     1.0  52  53     1.0  53   0
  2
    43.7      0.    43.7      100.
 22         LA BICHE RIVER
     1.0   0  33     1.0  33  34     1.0  34  35     1.0  35  36
     1.0  36  37     1.0  37  38     1.0  38  39     1.0  39  40
     1.0  40  41     1.0  41  42     1.0  42  43     1.0  43  44
     1.0  44  45     1.0  45  46     1.0  46  47     1.0  47  48
     1.0  48  49     1.0  49  50     1.0  50  51     1.0  51  52
     1.0  52  53     1.0  53   0
  2
    5.30      0.    5.30      100.
 21         CALLING RIVER
     1.0   0  34     1.0  34  35     1.0  35  36     1.0  36  37
     1.0  37  38     1.0  38  39     1.0  39  40     1.0  40  41
     1.0  41  42     1.0  42  43     1.0  43  44     1.0  44  45
     1.0  45  46     1.0  46  47     1.0  47  48     1.0  48  49
     1.0  49  50     1.0  50  51     1.0  51  52     1.0  52  53
     1.0  53   0
  2
    0.70      0.    0.70      100.
 19         PELICAN  RIVER
     1.0   0  36     1.0  36  37     1.0  37  38     1.0  38  39
     1.0  39  40     1.0  40  41     1.0  41  42     1.0  42  43
     1.0  43  44     1.0  44  45     1.0  45  46     1.0  46  47
     1.0  47  48     1.0  48  49     1.0  49  50     1.0  50  51
     1.0  51  52     1.0  52  53     1.0  53   0
  2
    2.00      0.    2.00      100.
 18         HOUSE RIVER
```

```
    1.0   0  37      1.0  37  38     1.0  38  39     1.0  39  40
    1.0  40  41      1.0  41  42     1.0  42  43     1.0  43  44
    1.0  44  45      1.0  45  46     1.0  46  47     1.0  47  48
    1.0  48  49      1.0  49  50     1.0  50  51     1.0  51  52
    1.0  52  53      1.0  53   0
 2
  17.00      0.   17.00      100.
 9        CLEARWATER RIVER
    1.0   0  46      1.0  46  47     1.0  47  48     1.0  48  49
    1.0  49  50      1.0  50  51     1.0  51  52     1.0  52  53
    1.0  53   0
 2
  62.80      0.   62.80      100.
 6        MUSKEG RIVER
    1.0   0  49      1.0  49  50     1.0  50  51     1.0  51  52
    1.0  52  53      1.0  53   0
 2
   0.40      0.    0.40      100.
 4        ELLS RIVER
    1.0   0  51      1.0  51  52     1.0  52  53     1.0  53   0
 2
   1.80      0.    1.80      100.
 3        FIREBAG RIVER
    1.0   0  52      1.0  52  53     1.0  53   0
 2
  11.00      0.   11.00      100.
 0                                   (pore water)
 4   4.0e-06    1.000      (SS settling)
 1                                      WELDWOOD ZONE 1
1.34e06   2  57            (all zones doubled)
 2
   1.38      0.     2.0     365.
 3                                      WELDWOOD ZONE 2
2.69e06   3  58  1.86e06   4  58  2.26e06   5  58
 2
    2.0      0.     2.0     365.
 3                                      MILLAR   ZONE 1
0.20e06  19  59  0.29e06  20  59  2.86e06  21  59
 2
   2.00      0.    2.00     365.
 2                                      MILLAR   ZONE 2
0.02e06  22  60  6.45e06  23  60
 2
   2.00      0.    2.00     365.
 0   0   0
    21   +   *   +   *   +   *   +   *   +   *   boundaries
    1.0      1.0                           (chemical 1)
 1   2       HEADWATER
    0.0      0.     0.0      100.
 5   2       OLDMAN CREEK
    0.0      0.     0.0      100.
 6   2       SPRING 1
    0.0      0.     0.0      100.
 7   2       BERLAND RIVER
    0.0      0.     0.0      100.
```

```
   9    2         MARSH HEAD CR
      0.0         0.        0.0        100.
  10    2         PINE + TWO CR
      0.0         0.        0.0        100.
  14    2         WINDFALL
      0.0         0.        0.0        100.
  17    2         SAKWATAMAU
      0.0         0.        0.0        100.
  18    2         MCLEOD
      0.0         0.        0.0        100.
  23    2         FREEMAN
      0.0         0.        0.0        100.
  26    2         PEMBINA
      0.0         0.        0.0        100.
  28    2         LESSER SLAVE
      0.0         0.        0.0        100.
  33    2         LA BICHE
      0.0         0.        0.0        100.
  34    2         CALLING
      0.0         0.        0.0        100.
  36    2         PELICAN
      0.0         0.        0.0        100.
  37    2         HOUSE
      0.0         0.        0.0        100.
  46    2         CLEARWATER
      0.0         0.        0.0        100.
  49    2         MUSKEG
      0.0         0.        0.0        100.
  51    2         ELLS
      0.0         0.        0.0        100.
  52    2         FIREBAG
      0.0         0.        0.0        100.
  53    2         MOUTH
      0.0         0.        0.0        100.
       21    +    *    +    *    +    *    +    *    +    *    boundaries
      1.0        1.0                                 (SS 3)
   1    2         HEADWATER
      1.0         0.        1.0        100.
   5    2         OLDMAN CREEK
      2.0         0.        2.0        100.
   6    2         SPRING 1
      1.0         0.        1.0        100.
   7    2         BERLAND RIVER
      2.0         0.        2.0        100.
   9    2         MARSH HEAD CR
      2.0         0.        2.0        100.
  10    2         PINE + TWO CR
      1.0         0.        1.0        100.
  14    2         WINDFALL
      4.0         0.        4.0        100.
  17    2         SAKWATAMAU
      6.0         0.        6.0        100.
  18    2         MCLEOD
      3.0         0.        3.0        100.
  23    2         FREEMAN
```

```
     5.0        0.      5.0        100.
 26    2        PEMBINA
     1.0        0.      1.0        100.
 28    2        LESSER SLAVE
     7.0        0.      7.0        100.
 33    2        LA BICHE
    15.0        0.     15.0        100.
 34    2        CALLING
     6.0        0.      6.0        100.
 36    2        PELICAN
     9.0        0.      9.0        100.
 37    2        HOUSE
    10.0        0.     10.0        100.
 46    2        CLEARWATER
     7.0        0.      7.0        100.
 49    2        MUSKEG
     4.0        0.      4.0        100.
 51    2        ELLS
     5.0        0.      5.0        100.
 52    2        FIREBAG
     3.0        0.      3.0        100.
 53    2        MOUTH
     6.0        0.      6.0        100.
       9         *   +   *   +   *    (CHEMICAL1) +    *    F: LOADS
     1.0        1.0
  2    2        WELDWOOD MILL - KRAFT
   .3390         0.   .3390        100.
 15    2        ANC - CTMP
     0.0         0.     0.0        100.
 19    2        MILLAR WESTERN - CTMP
  0000.0         0.  0000.0        100.
 21    2        WHITECOURT STP
    00.0         0.    00.0        100.
 30    2        ATHABASCA STP
    00.0         0.    00.0        100.
 31    2        ALPAC - KRAFT
   000.0         0.   000.0        100.
 45    2        FT MCMURRAY STP
  0000.0         0.  0000.0        100.
 47    2        SUNCOR
    00.0         0.    00.0        100.
 54    2        AEC - CTMP
   000.0         0.   000.0        100.
       9                              (SS)
     1.0        1.0
  2    2        WELDWOOD MILL - KRAFT
 10838.0         0. 10838.0        100.
 15    2        ANC - CTMP
   000.0         0.   000.0        100.
 19    2        MILLAR WESTERN - CTMP
  1463.6         0.  1463.6        100.
 21    2        WHITECOURT STP
    13.8         0.    13.8        100.
 30    2        ATHABASCA STP
     7.8         0.     7.8        100.
```

```
   31    2        ALPAC - KRAFT
    000.0          0.    000.0        100.
   45    2        FT MCMURRAY STP
    116.6          0.    116.6        100.
   47    2        SUNCOR
    456.2          0.    456.2        100.
   54    2        AEC - CTMP
    000.0          0.    000.0        100.
        0                                                    (NPS LOADS)
        2    +    *    +    *    +    *    +    *    +    *    G: PARAMETERS
FOC     7         .90 TEMP    3       0.0
        1
FOC     7         1.0 TEMP    3       1.0
        2
FOC     7         1.0 TEMP    3       1.0
        3
FOC     7         1.0 TEMP    3       1.0
        4
FOC     7         1.0 TEMP    3       1.0
        5
FOC     7         1.0 TEMP    3       1.0
        6
FOC     7         1.0 TEMP    3       1.0
        7
FOC     7         1.0 TEMP    3       1.0
        8
FOC     7         1.0 TEMP    3       1.0
        9
FOC     7         1.0 TEMP    3       1.0
       10
FOC     7         1.0 TEMP    3       1.0
       11
FOC     7         1.0 TEMP    3       1.0
       12
FOC     7         1.0 TEMP    3       1.0
       13
FOC     7         1.0 TEMP    3       1.0
       14
FOC     7         1.0 TEMP    3       1.0
       15
FOC     7         1.0 TEMP    3       1.0
       16
FOC     7         1.0 TEMP    3       1.0
       17
FOC     7         1.0 TEMP    3       1.0
       18
FOC     7         1.0 TEMP    3       1.0
       19
FOC     7         1.0 TEMP    3       1.0
       20
FOC     7         1.0 TEMP    3       1.0
       21
FOC     7         1.0 TEMP    3       1.0
       22
FOC     7         1.0 TEMP    3       1.0
```

```
        23
FOC      7       1.0 TEMP     3      1.0
        24
FOC      7       1.0 TEMP     3      1.0
        25
FOC      7       1.0 TEMP     3      1.0
        26
FOC      7       1.0 TEMP     3      1.0
        27
FOC      7       1.0 TEMP     3      1.0
        28
FOC      7       1.0 TEMP     3      1.0
        29
FOC      7       1.0 TEMP     3      1.0
        30
FOC      7       1.0 TEMP     3      1.0
        31
FOC      7       1.0 TEMP     3      1.0
        32
FOC      7       1.0 TEMP     3      1.0
        33
FOC      7       1.0 TEMP     3      1.0
        34
FOC      7       1.0 TEMP     3      1.0
        35
FOC      7       1.0 TEMP     3      1.0
        36
FOC      7       1.0 TEMP     3      1.0
        37
FOC      7       1.0 TEMP     3      1.0
        38
FOC      7       1.0 TEMP     3      1.0
        39
FOC      7       1.0 TEMP     3      1.0
        40
FOC      7       1.0 TEMP     3      1.0
        41
FOC      7       1.0 TEMP     3      1.0
        42
FOC      7       1.0 TEMP     3      1.0
        43
FOC      7       1.0 TEMP     3      1.0
        44
FOC      7       1.0 TEMP     3      1.0
        45
FOC      7       1.0 TEMP     3      1.0
        46
FOC      7       1.0 TEMP     3      1.0
        47
FOC      7       1.0 TEMP     3      1.0
        48
FOC      7       1.0 TEMP     3      1.0
        49
FOC      7       1.0 TEMP     3      1.0
        50
```

```
FOC        7        1.0 TEMP     3        1.0
          51
FOC        7        1.0 TEMP     3        1.0
          52
FOC        7        1.0 TEMP     3        1.0
          53
FOC        7        1.0 TEMP     3        1.0
          54
FOC        7        1.0 TEMP     3        1.0
          55
FOC        7        1.0 TEMP     3        1.0
          56
FOC        7        1.0 TEMP     3        1.0
          57
FOC        7        1.0 TEMP     3        1.0
          58
FOC        7        1.0 TEMP     3        1.0
          59
FOC        7        1.0 TEMP     3        1.0
          60
FOC        7        1.0 TEMP     3        1.0
          61
FOC        7        1.0 TEMP     3        1.0
          62
FOC        7        1.0 TEMP     3        1.0
          63
FOC        7        1.0 TEMP     3        1.0
          64
FOC        7        1.0 TEMP     3        1.0
          65
FOC        7        1.0 TEMP     3        1.0
    +    *    +    *    +    *    +    *    +    *    +    *    H: CONSTANTS
>CHEMICAL1         5
GENERAL            1
    molwt         81       197.4
VOLATALIZA         5
       kv        136        0.00    wtype         2       0.0
    theta        138       1.047    henry       137   4.0E-06
    atmos          8        0.00
PHOTOLYSIS         1                (50% of literature value .59)
       kf        287        0.30
BIODEGRADA         1                (temp corrected lit value .23 by 16%)
      kbw        141        0.04
SORPTION           1
     lkoc        101        3.03
>SEDIMENT1         0
>   GLOBAL         0
         0                                        I:time functions
CHEMICAL 1                              3  0.0    1.0E08    J:INITIAL CONC.
   1:     1E-05       1.0   2:    1E-05       1.0  3:       1E-05  1.0
   4:     1E-05       1.0   5:    1E-05       1.0  6:       1E-05  1.0
   4:     1E-05       1.0   5:    1E-05       1.0  6:       1E-05  1.0
   4:     1E-05       1.0   5:    1E-05       1.0  6:       1E-05  1.0
   4:     1E-05       1.0   5:    1E-05       1.0  6:       1E-05  1.0
   4:     1E-05       1.0   5:    1E-05       1.0  6:       1E-05  1.0
```

4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	6:	1E-05	1.0
4:	1E-05	1.0	5:	1E-05	1.0	57:	1E-05	0.0
58:	1E-05	0.0	59:	1E-05	0.0	61:	1E-05	0.0
61:	1E-05	0.0	62:	1E-05	0.0	63:	1E-05	0.0
64:	1E-05	0.0	65:	1E-05	0.0			
SS1					3 2.50	1.0E08		
1:	1.00	0.0	2:	1.00	0.0	3:	1.000	0.0
4:	1.00	0.0	5:	1.00	0.0	6:	1.000	0.0
7:	1.00	0.0	5:	1.00	0.0	9:	1.000	0.0
10:	1.00	0.0	11:	1.00	0.0	12:	1.000	0.0
13:	1.00	0.0	14:	1.00	0.0	15:	1.000	0.0
16:	1.00	0.0	17:	1.00	0.0	18:	1.000	0.0
19:	1.00	0.0	20:	1.00	0.0	21:	1.000	0.0
22:	1.00	0.0	23:	1.00	0.0	24:	1.000	0.0
4:	2.00	0.0	5:	2.00	0.0	6:	2.000	0.0
4:	2.00	0.0	5:	2.00	0.0	6:	2.000	0.0
4:	2.00	0.0	5:	2.00	0.0	6:	2.000	0.0
4:	2.00	0.0	5:	2.00	0.0	6:	2.000	0.0
4:	2.00	0.0	5:	2.00	0.0	6:	2.000	0.0
4:	2.00	0.0	5:	2.00	0.0	6:	2.000	0.0
4:	2.00	0.0	5:	2.00	0.0	6:	2.000	0.0
4:	2.00	0.0	5:	2.00	0.0	6:	2.000	0.0
4:	2.00	0.0	5:	2.00	0.0	6:	2.000	0.0
4:	2.00	0.0	5:	2.00	0.0	6:	2.000	0.0
4:	2.00	0.0	5:	2.00	0.0	57:	1250000.0	0.0
58:	1250000.0	0.0	59:	1250000.0	0.0	61:	1250000.0	0.0
61:	1250000.0	0.0	62:	1250000.0	0.0	63:	1250000.0	0.0
64:	1250000.0	0.0	65:	1250000.0	0.0			

```
1136 - ATHABASCA RIVER SURVEY #1 1990 - MAY 9, 1991
       DEHYDRABIETIC ACID
 KSIM NSEG NSYS ICRD MFLG IDMP NSLN INTY ADFC   DD HHMM      A:MODEL OPTIONS
    0   65   02    0    1    1    0    1  0.0    1 0000     5   1   33    0.00
    1
      0.2       40.0
    1
     10.0       40.0
    0    0
    2    *    +    *    +    *    +    *    +    *    +    *   B:EXCHANGES
    0                                                        (WATER COLUMN DISPERSION)
    1     1000.       1.0
   51
    1339.9       .69    2   57
    2692.0       .77    3   58
    1860.2       .79    4   58
    2266.7       .82    5   58
    2603.7       .83    6   61
    1617.4       .73    7   61
    1678.2       .73    8   61
      24.4       .74    9   61
    1569.6       .77   10   61
    1216.4       .71   11   61
    1057.7       .71   12   61
     925.5       .71   13   62
    4250.8       .72   14   62
     265.7       .72   15   62
     891.9       .73   16   62
     144.7       .66   17   62
      13.6       .72   18   62
     203.6       .72   19   59
     285.1       .72   20   59
    2864.6       .72   21   59
   10015.3       .98   22   60
    6450.8      1.44   23   60
    6856.7      1.05   24   63
    2250.5      1.07   25   63
    3914.0      1.07   26   63
    7276.4      1.14   27   63
   10920.4      1.45   28   63
   13095.5      1.45   29   64
   12116.4      1.30   30   64
     228.6      1.30   31   64
    1691.7      1.30   32   64
    3561.3      1.34   33   64
   14139.3      1.34   34   64
   12296.5       .97   35   64
   15172.5       .98   36   64
    2834.8      1.06   37   64
     151.1       .61   38   64
    9729.3       .93   39   64
   12621.9       .93   40   64
     277.5       .37   41   64
   15704.1       .64   42   64
   10569.3       .74   43   64
```

```
    987.4      .74   44    64
    227.6      .92   45    64
  12970.5     1.12   46    65
    896.0     1.12   47    65
   6741.2     1.12   48    65
   1665.0     1.12   49    65
   7428.6     1.12   50    65
  28170.8     1.13   51    65
  23989.6     1.51   52    65
 2
   1E-08       0.      1E-08      100.
 0    0
 2    0        0.0    +     *    +     *    +     *    +     *    C: VOLUMES
   1000.0      1.0
        1        0          1     148.4      .110      .353      .126      .516
        2       57          1     923.1      .131      .344      .115      .512
        3       58          1    2060.6      .110      .353      .126      .516
        4       58          1    1476.4      .124      .346      .116      .550
        5       58          1    1869.9      .124      .346      .116      .550
        6       61          1    2167.8      .124      .346      .116      .550
        7       61          1    1186.2      .183      .266      .094      .540
        8       61          1    1230.8      .183      .266      .094      .540
        9       61          1      17.9      .183      .266      .094      .540
       10       61          1    1204.1      .183      .266      .094      .540
       11       61          1     859.9      .147      .326      .083      .551
       12       61          1     747.8      .147      .326      .083      .551
       13       62          1     654.3      .147      .326      .083      .551
       14       62          1    3069.1      .147      .326      .083      .551
       15       62          1     191.8      .147      .326      .083      .551
       16       62          1     650.3      .147      .326      .083      .551
       17       62          1      95.2      .143      .326      .106      .463
       18       62          1       9.7      .143      .326      .106      .463
       19       59          1     145.7      .143      .326      .106      .463
       20       59          1     204.0      .143      .326      .106      .463
       21       59          1    2049.3      .143      .326      .106      .463
       22       60          1    9772.8      .143      .274      .107      .536
       23       60          1    9286.4      .093      .288      .163      .523
       24       63          1    7230.6      .065      .350      .125      .512
       25       63          1    2411.2      .104      .260      .127      .512
       26       63          1    4193.5      .104      .260      .127      .512
       27       63          1    8330.1      .104      .260      .127      .512
       28       63          1   15883.8      .104      .260      .127      .512
       29       64          1   19047.5      .104      .260      .127      .512
       30       64          1   15802.3      .096      .295      .078      .592
       31       64          1     298.2      .096      .295      .078      .592
       32       64          1    2206.4      .096      .295      .078      .592
       33       64          1    4768.1      .096      .295      .078      .592
       34       64          1   18994.7      .096      .295      .078      .592
       35       64          1   11976.3      .097      .335      .055      .598
       36       64          1   14920.7      .097      .335      .055      .598
       37       64          1    3008.7      .097      .335      .055      .598
       38       64          1      92.3      .362      .292      .050      .505
       39       64          1    9093.8      .088      .358      .042      .627
       40       64          1   11797.3      .088      .358      .042      .627
       41       64          1     101.8      .325      .294      .016      .632
```

```
       42        64         1   10002.9     .114     .257     .041     .555
       43        64         1    7795.3     .151     .252     .025     .687
       44        64         1     728.3     .151     .252     .025     .687
       45        64         1     208.8     .208     .136     .062     .543
       46        65         1   14514.4     .208     .136     .062     .543
       47        65         1    1002.6     .208     .136     .062     .543
       48        65         1    7543.7     .208     .136     .062     .543
       49        65         1    1865.2     .208     .136     .062     .543
       50        65         1    8321.6     .208     .136     .062     .543
       51        65         1   31707.4     .208     .136     .062     .543
       52        65         1   36125.3     .087     .254     .228     .354
       53         0         1     714.2     .130     .351     .245     .555
       54         0         1      89.3     .130     .351     .245     .555
       55         0         1    2205.1     .130     .351     .245     .555
       56         0         1    1849.9     .157     .289     .175     .536
       57         0         3    6699.3      0.       1.      0.1      .1
       58         0         3   34094.6      0.       1.      0.1      .1
       59         0         3   16766.7      0.       1.      0.1      .1
       60         0         3   50076.7      0.       1.      0.1      .1
       61         0         3   48836.4      0.       1.      0.1      .1
       62         0         3   32460.9      0.       1.      0.1      .1
       63         0         3  156089.7      0.       1.      0.1      .1
       64         0         3  691876.6      0.       1.      0.1      .1
       65         0         3  344455.8      0.       1.      0.1      .1
    1   3    +    *    +    *    +    *    +    *    +    *    D: FLOWS
   20        1.0       1.0                 (water column field)
   54        HEADWATER FLOW
        1.0   0   1       1.0   1   2       1.0   2   3       1.0   3   4
        1.0   4   5       1.0   5   6       1.0   6   7       1.0   7   8
        1.0   8   9       1.0   9  10       1.0  10  11       1.0  11  12
        1.0  12  13       1.0  13  14       1.0  14  15       1.0  15  16
        1.0  16  17       1.0  17  18       1.0  18  19       1.0  19  20
        1.0  20  21       1.0  21  22       1.0  22  23       1.0  23  24
        1.0  24  25       1.0  25  26       1.0  26  27       1.0  27  28
        1.0  28  29       1.0  29  30       1.0  30  31       1.0  31  32
        1.0  32  33       1.0  33  34       1.0  34  35       1.0  35  36
        1.0  36  37       1.0  37  38       1.0  38  39       1.0  39  40
        1.0  40  41       1.0  41  42       1.0  42  43       1.0  43  44
        1.0  44  45       1.0  45  46       1.0  46  47       1.0  47  48
        1.0  48  49       1.0  49  50       1.0  50  51       1.0  51  52
        1.0  52  53       1.0  53   0
    2
    33.00        0.   33.00       100.
   50        OLDMAN CREEK
        1.0   0   5       1.0   5   6       1.0   6   7       1.0   7   8
        1.0   8   9       1.0   9  10       1.0  10  11       1.0  11  12
        1.0  12  13       1.0  13  14       1.0  14  15       1.0  15  16
        1.0  16  17       1.0  17  18       1.0  18  19       1.0  19  20
        1.0  20  21       1.0  21  22       1.0  22  23       1.0  23  24
        1.0  24  25       1.0  25  26       1.0  26  27       1.0  27  28
        1.0  28  29       1.0  29  30       1.0  30  31       1.0  31  32
        1.0  32  33       1.0  33  34       1.0  34  35       1.0  35  36
        1.0  36  37       1.0  37  38       1.0  38  39       1.0  39  40
        1.0  40  41       1.0  41  42       1.0  42  43       1.0  43  44
        1.0  44  45       1.0  45  46       1.0  46  47       1.0  47  48
```

```
      1.0   48   49       1.0   49   50       1.0   50   51       1.0   51   52
      1.0   52   53       1.0   53    0
   2
    2.40        0.    2.40        100.
  49        SPRING 1
      1.0    0    6       1.0    6    7       1.0    7    8       1.0    8    9
      1.0    9   10       1.0   10   11       1.0   11   12       1.0   12   13
      1.0   13   14       1.0   14   15       1.0   15   16       1.0   16   17
      1.0   17   18       1.0   18   19       1.0   19   20       1.0   20   21
      1.0   21   22       1.0   22   23       1.0   23   24       1.0   24   25
      1.0   25   26       1.0   26   27       1.0   27   28       1.0   28   29
      1.0   29   30       1.0   30   31       1.0   31   32       1.0   32   33
      1.0   33   34       1.0   34   35       1.0   35   36       1.0   36   37
      1.0   37   38       1.0   38   39       1.0   39   40       1.0   40   41
      1.0   41   42       1.0   42   43       1.0   43   44       1.0   44   45
      1.0   45   46       1.0   46   47       1.0   47   48       1.0   48   49
      1.0   49   50       1.0   50   51       1.0   51   52       1.0   52   53
      1.0   53    0
   2
    0.60        0.    0.60        100.
  48        BERLAND RIVER
      1.0    0    7       1.0    7    8       1.0    8    9       1.0    9   10
      1.0   10   11       1.0   11   12       1.0   12   13       1.0   13   14
      1.0   14   15       1.0   15   16       1.0   16   17       1.0   17   18
      1.0   18   19       1.0   19   20       1.0   20   21       1.0   21   22
      1.0   22   23       1.0   23   24       1.0   24   25       1.0   25   26
      1.0   26   27       1.0   27   28       1.0   28   29       1.0   29   30
      1.0   30   31       1.0   31   32       1.0   32   33       1.0   33   34
      1.0   34   35       1.0   35   36       1.0   36   37       1.0   37   38
      1.0   38   39       1.0   39   40       1.0   40   41       1.0   41   42
      1.0   42   43       1.0   43   44       1.0   44   45       1.0   45   46
      1.0   46   47       1.0   47   48       1.0   48   49       1.0   49   50
      1.0   50   51       1.0   51   52       1.0   52   53       1.0   53    0
   2
    8.90        0.    8.90        100.
  46        MARSH HEAD CR
      1.0    0    9       1.0    9   10       1.0   10   11       1.0   11   12
      1.0   12   13       1.0   13   14       1.0   14   15       1.0   15   16
      1.0   16   17       1.0   17   18       1.0   18   19       1.0   19   20
      1.0   20   21       1.0   21   22       1.0   22   23       1.0   23   24
      1.0   24   25       1.0   25   26       1.0   26   27       1.0   27   28
      1.0   28   29       1.0   29   30       1.0   30   31       1.0   31   32
      1.0   32   33       1.0   33   34       1.0   34   35       1.0   35   36
      1.0   36   37       1.0   37   38       1.0   38   39       1.0   39   40
      1.0   40   41       1.0   41   42       1.0   42   43       1.0   43   44
      1.0   44   45       1.0   45   46       1.0   46   47       1.0   47   48
      1.0   48   49       1.0   49   50       1.0   50   51       1.0   51   52
      1.0   52   53       1.0   53    0
   2
    0.30        0.    0.30        100.
  45        PINE CREEK + TWO CREEK
      1.0    0   10       1.0   10   11       1.0   11   12       1.0   12   13
      1.0   13   14       1.0   14   15       1.0   15   16       1.0   16   17
      1.0   17   18       1.0   18   19       1.0   19   20       1.0   20   21
      1.0   21   22       1.0   22   23       1.0   23   24       1.0   24   25
```

```
        1.0   25   26      1.0   26   27      1.0   27   28      1.0   28   29
        1.0   29   30      1.0   30   31      1.0   31   32      1.0   32   33
        1.0   33   34      1.0   34   35      1.0   35   36      1.0   36   37
        1.0   37   38      1.0   38   39      1.0   39   40      1.0   40   41
        1.0   41   42      1.0   42   43      1.0   43   44      1.0   44   45
        1.0   45   46      1.0   46   47      1.0   47   48      1.0   48   49
        1.0   49   50      1.0   50   51      1.0   51   52      1.0   52   53
        1.0   53    0
   2
   3.60        0.     3.60       100.
 41         WINDFALL CREEK
        1.0    0   14      1.0   14   15      1.0   15   16      1.0   16   17
        1.0   17   18      1.0   18   19      1.0   19   20      1.0   20   21
        1.0   21   22      1.0   22   23      1.0   23   24      1.0   24   25
        1.0   25   26      1.0   26   27      1.0   27   28      1.0   28   29
        1.0   29   30      1.0   30   31      1.0   31   32      1.0   32   33
        1.0   33   34      1.0   34   35      1.0   35   36      1.0   36   37
        1.0   37   38      1.0   38   39      1.0   39   40      1.0   40   41
        1.0   41   42      1.0   42   43      1.0   43   44      1.0   44   45
        1.0   45   46      1.0   46   47      1.0   47   48      1.0   48   49
        1.0   49   50      1.0   50   51      1.0   51   52      1.0   52   53
        1.0   53    0
   2
   1.90        0.     1.90       100.
 38         SAKWATAMAU RIVER
        1.0    0   17      1.0   17   18      1.0   18   19      1.0   19   20
        1.0   20   21      1.0   21   22      1.0   22   23      1.0   23   24
        1.0   24   25      1.0   25   26      1.0   26   27      1.0   27   28
        1.0   28   29      1.0   29   30      1.0   30   31      1.0   31   32
        1.0   32   33      1.0   33   34      1.0   34   35      1.0   35   36
        1.0   36   37      1.0   37   38      1.0   38   39      1.0   39   40
        1.0   40   41      1.0   41   42      1.0   42   43      1.0   43   44
        1.0   44   45      1.0   45   46      1.0   46   47      1.0   47   48
        1.0   48   49      1.0   49   50      1.0   50   51      1.0   51   52
        1.0   52   53      1.0   53    0
   2
   0.90        0.     0.90       100.
 37         McLEOD RIVER
        1.0    0   18      1.0   18   19      1.0   19   20      1.0   20   21
        1.0   21   22      1.0   22   23      1.0   23   24      1.0   24   25
        1.0   25   26      1.0   26   27      1.0   27   28      1.0   28   29
        1.0   29   30      1.0   30   31      1.0   31   32      1.0   32   33
        1.0   33   34      1.0   34   35      1.0   35   36      1.0   36   37
        1.0   37   38      1.0   38   39      1.0   39   40      1.0   40   41
        1.0   41   42      1.0   42   43      1.0   43   44      1.0   44   45
        1.0   45   46      1.0   46   47      1.0   47   48      1.0   48   49
        1.0   49   50      1.0   50   51      1.0   51   52      1.0   52   53
        1.0   53    0
   2
  10.20        0.    10.20       100.
 32         FREEMAN RIVER
        1.0    0   23      1.0   23   24      1.0   24   25      1.0   25   26
        1.0   26   27      1.0   27   28      1.0   28   29      1.0   29   30
        1.0   30   31      1.0   31   32      1.0   32   33      1.0   33   34
        1.0   34   35      1.0   35   36      1.0   36   37      1.0   37   38
```

```
     1.0  38  39     1.0  39  40     1.0  40  41     1.0  41  42
     1.0  42  43     1.0  43  44     1.0  44  45     1.0  45  46
     1.0  46  47     1.0  47  48     1.0  48  49     1.0  49  50
     1.0  50  51     1.0  51  52     1.0  52  53     1.0  53   0
  2
   2.60      0.    2.60      100.
 29        PEMBINA RIVER
     1.0   0  26     1.0  26  27     1.0  27  28     1.0  28  29
     1.0  29  30     1.0  30  31     1.0  31  32     1.0  32  33
     1.0  33  34     1.0  34  35     1.0  35  36     1.0  36  37
     1.0  37  38     1.0  38  39     1.0  39  40     1.0  40  41
     1.0  41  42     1.0  42  43     1.0  43  44     1.0  44  45
     1.0  45  46     1.0  46  47     1.0  47  48     1.0  48  49
     1.0  49  50     1.0  50  51     1.0  51  52     1.0  52  53
     1.0  53   0
  2
   8.90      0.    8.90      100.
 31        LESSER SLAVE RIVER
     1.0   0  53     1.0  53  54     1.0  54  55     1.0  55  56
     1.0  56  28     1.0  28  29     1.0  29  30     1.0  30  31
     1.0  31  32     1.0  32  33     1.0  33  34     1.0  34  35
     1.0  35  36     1.0  36  37     1.0  37  38     1.0  38  39
     1.0  39  40     1.0  40  41     1.0  41  42     1.0  42  43
     1.0  43  44     1.0  44  45     1.0  45  46     1.0  46  47
     1.0  47  48     1.0  48  49     1.0  49  50     1.0  50  51
     1.0  51  52     1.0  52  53     1.0  53   0
  2
   43.7      0.    43.7      100.
 22        LA BICHE RIVER
     1.0   0  33     1.0  33  34     1.0  34  35     1.0  35  36
     1.0  36  37     1.0  37  38     1.0  38  39     1.0  39  40
     1.0  40  41     1.0  41  42     1.0  42  43     1.0  43  44
     1.0  44  45     1.0  45  46     1.0  46  47     1.0  47  48
     1.0  48  49     1.0  49  50     1.0  50  51     1.0  51  52
     1.0  52  53     1.0  53   0
  2
   5.30      0.    5.30      100.
 21        CALLING RIVER
     1.0   0  34     1.0  34  35     1.0  35  36     1.0  36  37
     1.0  37  38     1.0  38  39     1.0  39  40     1.0  40  41
     1.0  41  42     1.0  42  43     1.0  43  44     1.0  44  45
     1.0  45  46     1.0  46  47     1.0  47  48     1.0  48  49
     1.0  49  50     1.0  50  51     1.0  51  52     1.0  52  53
     1.0  53   0
  2
   0.70      0.    0.70      100.
 19        PELICAN  RIVER
     1.0   0  36     1.0  36  37     1.0  37  38     1.0  38  39
     1.0  39  40     1.0  40  41     1.0  41  42     1.0  42  43
     1.0  43  44     1.0  44  45     1.0  45  46     1.0  46  47
     1.0  47  48     1.0  48  49     1.0  49  50     1.0  50  51
     1.0  51  52     1.0  52  53     1.0  53   0
  2
   2.00      0.    2.00      100.
 18        HOUSE RIVER
```

```
     1.0    0   37       1.0   37   38       1.0   38   39       1.0   39   40
     1.0   40   41       1.0   41   42       1.0   42   43       1.0   43   44
     1.0   44   45       1.0   45   46       1.0   46   47       1.0   47   48
     1.0   48   49       1.0   49   50       1.0   50   51       1.0   51   52
     1.0   52   53       1.0   53    0
  2
   17.00        0.     17.00        100.
  9          CLEARWATER RIVER
     1.0    0   46       1.0   46   47       1.0   47   48       1.0   48   49
     1.0   49   50       1.0   50   51       1.0   51   52       1.0   52   53
     1.0   53    0
  2
   62.80        0.     62.80        100.
  6          MUSKEG RIVER
     1.0    0   49       1.0   49   50       1.0   50   51       1.0   51   52
     1.0   52   53       1.0   53    0
  2
    0.40        0.      0.40        100.
  4          ELLS RIVER
     1.0    0   51       1.0   51   52       1.0   52   53       1.0   53    0
  2
    1.80        0.      1.80        100.
  3          FIREBAG RIVER
     1.0    0   52       1.0   52   53       1.0   53    0
  2
   11.00        0.     11.00        100.
  0                                             (pore water)
  4   4.0e-06     1.000         (SS settling)
  1                                                  WELDWOOD ZONE 1
1.34e06     2   57              (all zones doubled)
  2
    1.38        0.       2.0       365.
  3                                                  WELDWOOD ZONE 2
2.69e06     3   58   1.86e06    4   58   2.26e06    5   58
  2
     2.0        0.       2.0       365.
  3                                                  MILLAR   ZONE 1
0.20e06    19   59   0.29e06   20   59   2.86e06   21   59
  2
    2.00        0.      2.00       365.
  2                                                  MILLAR   ZONE 2
0.02e06    22   60   6.45e06   23   60
  2
    2.00        0.      2.00       365.
  0    0    0
      21    +    *    +    *    +    *    +    *    +    *   boundaries
     1.0       1.0                                    (chemical 1)
  1    2        HEADWATER
     0.0        0.       0.0        100.
  5    2        OLDMAN CREEK
     0.0        0.       0.0        100.
  6    2        SPRING 1
     0.0        0.       0.0        100.
  7    2        BERLAND RIVER
     0.0        0.       0.0        100.
```

```
 9    2        MARSH HEAD CR
    0.0        0.       0.0        100.
10    2        PINE + TWO CR
    0.0        0.       0.0        100.
14    2        WINDFALL
    0.0        0.       0.0        100.
17    2        SAKWATAMAU
    0.0        0.       0.0        100.
18    2        MCLEOD
    0.0        0.       0.0        100.
23    2        FREEMAN
    0.0        0.       0.0        100.
26    2        PEMBINA
    0.0        0.       0.0        100.
28    2        LESSER SLAVE
    0.0        0.       0.0        100.
33    2        LA BICHE
    0.0        0.       0.0        100.
34    2        CALLING
    0.0        0.       0.0        100.
36    2        PELICAN
    0.0        0.       0.0        100.
37    2        HOUSE
    0.0        0.       0.0        100.
46    2        CLEARWATER
    0.0        0.       0.0        100.
49    2        MUSKEG
    0.0        0.       0.0        100.
51    2        ELLS
    0.0        0.       0.0        100.
52    2        FIREBAG
    0.0        0.       0.0        100.
53    2        MOUTH
    0.0        0.       0.0        100.
     21    +    *    +    *    +    *    +    *    +    *    boundaries
    1.0       1.0                             (SS 3)
 1    2        HEADWATER
    1.0        0.       1.0        100.
 5    2        OLDMAN CREEK
    2.0        0.       2.0        100.
 6    2        SPRING 1
    1.0        0.       1.0        100.
 7    2        BERLAND RIVER
    2.0        0.       2.0        100.
 9    2        MARSH HEAD CR
    2.0        0.       2.0        100.
10    2        PINE + TWO CR
    1.0        0.       1.0        100.
14    2        WINDFALL
    4.0        0.       4.0        100.
17    2        SAKWATAMAU
    6.0        0.       6.0        100.
18    2        MCLEOD
    3.0        0.       3.0        100.
23    2        FREEMAN
```

```
     5.0        0.       5.0       100.
  26   2        PEMBINA
     1.0        0.       1.0       100.
  28   2        LESSER SLAVE
     7.0        0.       7.0       100.
  33   2        LA BICHE
    15.0        0.      15.0       100.
  34   2        CALLING
     6.0        0.       6.0       100.
  36   2        PELICAN
     9.0        0.       9.0       100.
  37   2        HOUSE
    10.0        0.      10.0       100.
  46   2        CLEARWATER
     7.0        0.       7.0       100.
  49   2        MUSKEG
     4.0        0.       4.0       100.
  51   2        ELLS
     5.0        0.       5.0       100.
  52   2        FIREBAG
     3.0        0.       3.0       100.
  53   2        MOUTH
     6.0        0.       6.0       100.
       9         *    +    *    +    *     (CHEMICAL1) +    *     F: LOADS
     1.0        1.0
   2   2        WELDWOOD MILL - KRAFT
   1.355        0.    1.355       100.
  15   2        ANC - CTMP
     0.0        0.      0.0       100.
  19   2        MILLAR WESTERN - CTMP
    .453        0.     .453       100.
  21   2        WHITECOURT STP
    00.0        0.     00.0       100.
  30   2        ATHABASCA STP
    00.0        0.     00.0       100.
  31   2        ALPAC - KRAFT
   000.0        0.    000.0       100.
  45   2        FT MCMURRAY STP
  0000.0        0.   0000.0       100.
  47   2        SUNCOR
    00.0        0.     00.0       100.
  54   2        AEC - CTMP
   000.0        0.    000.0       100.
       9                                   (SS)
     1.0        1.0
   2   2        WELDWOOD MILL - KRAFT
 10838.0        0.  10838.0       100.
  15   2        ANC - CTMP
   000.0        0.    000.0       100.
  19   2        MILLAR WESTERN - CTMP
  1463.6        0.   1463.6       100.
  21   2        WHITECOURT STP
    13.8        0.     13.8       100.
  30   2        ATHABASCA STP
     7.8        0.      7.8       100.
```

```
   31    2       ALPAC - KRAFT
    000.0        0.    000.0       100.
   45    2       FT MCMURRAY STP
    116.6        0.    116.6       100.
   47    2       SUNCOR
    456.2        0.    456.2       100.
   54    2       AEC - CTMP
    000.0        0.    000.0       100.
         0                                              (NPS LOADS)
         2    +    *    +    *    +    *    +    *    +    *    G: PARAMETERS
FOC      7       .90 TEMP    3      0.0
         1
FOC      7       1.0 TEMP    3      1.0
         2
FOC      7       1.0 TEMP    3      1.0
         3
FOC      7       1.0 TEMP    3      1.0
         4
FOC      7       1.0 TEMP    3      1.0
         5
FOC      7       1.0 TEMP    3      1.0
         6
FOC      7       1.0 TEMP    3      1.0
         7
FOC      7       1.0 TEMP    3      1.0
         8
FOC      7       1.0 TEMP    3      1.0
         9
FOC      7       1.0 TEMP    3      1.0
        10
FOC      7       1.0 TEMP    3      1.0
        11
FOC      7       1.0 TEMP    3      1.0
        12
FOC      7       1.0 TEMP    3      1.0
        13
FOC      7       1.0 TEMP    3      1.0
        14
FOC      7       1.0 TEMP    3      1.0
        15
FOC      7       1.0 TEMP    3      1.0
        16
FOC      7       1.0 TEMP    3      1.0
        17
FOC      7       1.0 TEMP    3      1.0
        18
FOC      7       1.0 TEMP    3      1.0
        19
FOC      7       1.0 TEMP    3      1.0
        20
FOC      7       1.0 TEMP    3      1.0
        21
FOC      7       1.0 TEMP    3      1.0
        22
FOC      7       1.0 TEMP    3      1.0
```

```
        23
FOC      7        1.0 TEMP    3       1.0
        24
FOC      7        1.0 TEMP    3       1.0
        25
FOC      7        1.0 TEMP    3       1.0
        26
FOC      7        1.0 TEMP    3       1.0
        27
FOC      7        1.0 TEMP    3       1.0
        28
FOC      7        1.0 TEMP    3       1.0
        29
FOC      7        1.0 TEMP    3       1.0
        30
FOC      7        1.0 TEMP    3       1.0
        31
FOC      7        1.0 TEMP    3       1.0
        32
FOC      7        1.0 TEMP    3       1.0
        33
FOC      7        1.0 TEMP    3       1.0
        34
FOC      7        1.0 TEMP    3       1.0
        35
FOC      7        1.0 TEMP    3       1.0
        36
FOC      7        1.0 TEMP    3       1.0
        37
FOC      7        1.0 TEMP    3       1.0
        38
FOC      7        1.0 TEMP    3       1.0
        39
FOC      7        1.0 TEMP    3       1.0
        40
FOC      7        1.0 TEMP    3       1.0
        41
FOC      7        1.0 TEMP    3       1.0
        42
FOC      7        1.0 TEMP    3       1.0
        43
FOC      7        1.0 TEMP    3       1.0
        44
FOC      7        1.0 TEMP    3       1.0
        45
FOC      7        1.0 TEMP    3       1.0
        46
FOC      7        1.0 TEMP    3       1.0
        47
FOC      7        1.0 TEMP    3       1.0
        48
FOC      7        1.0 TEMP    3       1.0
        49
FOC      7        1.0 TEMP    3       1.0
        50
```

```
FOC        7        1.0 TEMP     3        1.0
          51
FOC        7        1.0 TEMP     3        1.0
          52
FOC        7        1.0 TEMP     3        1.0
          53
FOC        7        1.0 TEMP     3        1.0
          54
FOC        7        1.0 TEMP     3        1.0
          55
FOC        7        1.0 TEMP     3        1.0
          56
FOC        7        1.0 TEMP     3        1.0
          57
FOC        7        1.0 TEMP     3        1.0
          58
FOC        7        1.0 TEMP     3        1.0
          59
FOC        7        1.0 TEMP     3        1.0
          60
FOC        7        1.0 TEMP     3        1.0
          61
FOC        7        1.0 TEMP     3        1.0
          62
FOC        7        1.0 TEMP     3        1.0
          63
FOC        7        1.0 TEMP     3        1.0
          64
FOC        7        1.0 TEMP     3        1.0
          65
FOC        7        1.0 TEMP     3        1.0
    +    *    +    *    +    *    +    *    +    *    +    *    H: CONSTANTS
>CHEMICAL1          5
GENERAL             1
     molwt         81       297.0
VOLATALIZA          5
        kv        136        0.00      wtype        2       0.0
     theta        138       1.047      henry      137   2.0E-04
     atmos          8        0.00
PHOTOLYSIS          1
        kf        287        0.00
BIODEGRADA          1                  (lit value * 50 %)
       kbw        141       0.005
SORPTION            1
      lkoc        101        4.78
>SEDIMENT1          0
>   GLOBAL          0
         0                                        I:time functions
CHEMICAL 1                                 3  0.0    1.0E08   J:INITIAL CONC.
   1:     1E-05       1.0   2:     1E-05      1.0  3:      1E-05  1.0
   4:     1E-05       1.0   5:     1E-05      1.0  6:      1E-05  1.0
   4:     1E-05       1.0   5:     1E-05      1.0  6:      1E-05  1.0
   4:     1E-05       1.0   5:     1E-05      1.0  6:      1E-05  1.0
   4:     1E-05       1.0   5:     1E-05      1.0  6:      1E-05  1.0
   4:     1E-05       1.0   5:     1E-05      1.0  6:      1E-05  1.0
```

```
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0  6:      1E-05  1.0
    4:     1E-05      1.0   5:     1E-05      1.0 57:      1E-05  0.0
   58:     1E-05      0.0  59:     1E-05      0.0 61:      1E-05  0.0
   61:     1E-05      0.0  62:     1E-05      0.0 63:      1E-05  0.0
   64:     1E-05      0.0  65:     1E-05      0.0
SS1                                         3 2.50    1.0E08
    1:      1.00      0.0   2:      1.00      0.0  3:      1.000  0.0
    4:      1.00      0.0   5:      1.00      0.0  6:      1.000  0.0
    7:      1.00      0.0   5:      1.00      0.0  9:      1.000  0.0
   10:      1.00      0.0  11:      1.00      0.0 12:      1.000  0.0
   13:      1.00      0.0  14:      1.00      0.0 15:      1.000  0.0
   16:      1.00      0.0  17:      1.00      0.0 18:      1.000  0.0
   19:      1.00      0.0  20:      1.00      0.0 21:      1.000  0.0
   22:      1.00      0.0  23:      1.00      0.0 24:      1.000  0.0
    4:      2.00      0.0   5:      2.00      0.0  6:      2.000  0.0
    4:      2.00      0.0   5:      2.00      0.0  6:      2.000  0.0
    4:      2.00      0.0   5:      2.00      0.0  6:      2.000  0.0
    4:      2.00      0.0   5:      2.00      0.0  6:      2.000  0.0
    4:      2.00      0.0   5:      2.00      0.0  6:      2.000  0.0
    4:      2.00      0.0   5:      2.00      0.0  6:      2.000  0.0
    4:      2.00      0.0   5:      2.00      0.0  6:      2.000  0.0
    4:      2.00      0.0   5:      2.00      0.0  6:      2.000  0.0
    4:      2.00      0.0   5:      2.00      0.0  6:      2.000  0.0
    4:      2.00      0.0   5:      2.00      0.0  6:      2.000  0.0
    4:      2.00      0.0   5:      2.00      0.0 57:  1250000.0  0.0
   58: 1250000.0      0.0  59: 1250000.0      0.0 61:  1250000.0  0.0
   61: 1250000.0      0.0  62: 1250000.0      0.0 63:  1250000.0  0.0
   64: 1250000.0      0.0  65: 1250000.0      0.0
```

APPENDIX II

OBSERVED FILES

0	0.36	0.36	0.36
3	1.4	1.4	1.4
7.5	2.75	2.75	2.75
12.9	1.15	1.15	1.15
22.9	0.9	0.9	0.9
38.6	2.15	2.15	2.15
62.2	1.3	1.3	1.3
103.8	1.16	1.16	1.16
160.5	0.7	0.7	0.7
209.8	0.4	0.4	0.4
214	0.6	0.6	0.6
221.1	0.35	0.35	0.35
236.2	0.5	0.5	0.5
274.4	0.25	0.25	0.25
305.8	0.2	0.2	0.2
393.4	0.4	0.4	0.4
437.5	0.4	0.4	0.4
437.5	0.25	0.25	0.25
511.1	1.15	1.15	1.15
556.4	0.46	0.46	0.46
617.4	0.4	0.4	0.4
677.9	0.2	0.2	0.2
740.4	0.3	0.3	0.3
799.9	0.16	0.16	0.16
887.5	0.5	0.5	0.5
945.8	0.33	0.33	0.33
978.2	0.35	0.35	0.35
1029	0.5	0.5	0.5
1072	0.35	0.35	0.35
1156.8	0.4	0.4	0.4
1238.7	0.45	0.45	0.45

0	11.57	11.57	11.57
3	11.53	11.53	11.53
7.5	11.33	11.33	11.33
12.9	11.15	11.15	11.15
22.9	11	11	11
38.6	11	11	11
62.2	10.85	10.85	10.85
103.8	11.12	11.12	11.12
160.5	10.16	10.16	10.16
209.8	10.49	10.49	10.49
214	9.84	9.84	9.84
221.1	9.84	9.84	9.84
236.2	9.88	9.88	9.88
274.4	9.7	9.7	9.7
305.8	9.63	9.63	9.63
393.4	9.03	9.03	9.03
437.5	8.53	8.53	8.53
511.1	10.06	10.06	10.06
556.4	9.34	9.34	9.34
617.4	9.44	9.44	9.44
677.9	9.01	9.01	9.01
740.4	8.82	8.82	8.82
799.9	8.83	8.83	8.83
807.6	8.73	8.73	8.73
844.9	12.23	12.23	12.23
887.5	12.23	12.23	12.23
945.8	11.98	11.98	11.98
978.2	12.25	12.25	12.25
1029	11.66	11.66	11.66
1072	11.46	11.46	11.46
1156.8	10.95	10.95	10.95
1238.7	10.45	10.45	10.45

0	0.001	0.001	0.001
3	0.002	0.002	0.002
7.5	0.002	0.002	0.002
12.9	0.003	0.003	0.003
22.9	0.002	0.002	0.002
38.6	0.003	0.003	0.003
62.2	0.003	0.003	0.003
103.8	0.004	0.004	0.004
160.5	0.002	0.002	0.002
209.8	0.003	0.003	0.003
214	0.023	0.023	0.023
221.1	0.020	0.020	0.020
236.2	0.018	0.018	0.018
274.4	0.014	0.014	0.014
305.8	0.019	0.019	0.019
393.4	0.014	0.014	0.014
437.5	0.017	0.017	0.017
511.1	0.017	0.017	0.017
556.4	0.013	0.013	0.013
617.4	0.015	0.015	0.015
677.9	0.013	0.013	0.013
740.4	0.016	0.016	0.016
799.9	0.014	0.014	0.014
887.5	0.013	0.013	0.013
945.8	0.013	0.013	0.013
978.2	0.020	0.020	0.020
1029	0.018	0.018	0.018
1072	0.018	0.018	0.018
1156.8	0.018	0.018	0.018
1238.7	0.017	0.017	0.017

0	0.0082	0.008	0.008
3	0.0188	0.018	0.018
7.5	0.0164	0.016	0.016
12.9	0.0147	0.014	0.014
22.9	0.0162	0.016	0.016
38.6	0.0121	0.012	0.012
62.2	0.009	0.009	0.009
103.8	0.0081	0.008	0.008
160.5	0.0053	0.005	0.005
209.8	0.0065	0.006	0.006
214	0.033	0.033	0.033
221.1	0.0286	0.028	0.028
236.2	0.0246	0.024	0.024
274.4	0.0197	0.019	0.019
305.8	0.0233	0.023	0.023
393.4	0.0185	0.018	0.018
437.5	0.0227	0.022	0.022
511.1	0.0351	0.035	0.035
556.4	0.0199	0.019	0.019
617.4	0.0225	0.022	0.022
677.9	0.0207	0.020	0.020
740.4	0.0271	0.027	0.027
799.9	0.0222	0.022	0.022
887.5	0.0234	0.023	0.023
945.8	0.0213	0.021	0.021
978.2	0.0365	0.036	0.036
1029	0.0332	0.033	0.033
1072	0.0328	0.032	0.032
1156.8	0.0342	0.034	0.034
1238.7	0.0327	0.032	0.032

0	0.007	0.007	0.007
3	0.0165	0.016	0.016
7.5	0.0139	0.013	0.013
12.9	0.0116	0.011	0.011
22.9	0.0137	0.013	0.013
38.6	0.0086	0.008	0.008
62.2	0.0057	0.005	0.005
103.8	0.0037	0.003	0.003
160.5	0.0028	0.002	0.002
209.8	0.0029	0.002	0.002
214	0.0096	0.009	0.009
221.1	0.0079	0.007	0.007
236.2	0.0065	0.006	0.006
274.4	0.005	0.005	0.005
305.8	0.0042	0.004	0.004
393.4	0.0043	0.004	0.004
437.5	0.005	0.005	0.005
511.1	0.0181	0.018	0.018
556.4	0.0061	0.006	0.006
617.4	0.0075	0.007	0.007
677.9	0.0074	0.007	0.007
740.4	0.0105	0.010	0.010
799.9	0.0073	0.007	0.007
887.5	0.0104	0.010	0.010
945.8	0.0081	0.008	0.008
978.2	0.0159	0.015	0.015
1029	0.0143	0.014	0.014
1072	0.0145	0.014	0.014
1156.8	0.016	0.016	0.016
1238.7	0.0151	0.015	0.015

0	0	0	0
3	0.11	0.11	0.11
7.5	0.16	0.16	0.16
12.9	0.135	0.135	0.135
22.9	0.17	0.17	0.17
38.6	0.1	0.1	0.1
62.2	0.08	0.08	0.08
103.8	0.07	0.07	0.07
160.5	0.09	0.09	0.09
209.8	0.087	0.087	0.087
214	0.255	0.255	0.255
221.1	0.19	0.19	0.19
236.2	0.14	0.14	0.14
274.4	0.17	0.17	0.17
305.8	0.165	0.165	0.165
393.4	0.1	0.1	0.1
437.5	0.22	0.22	0.22
511.1	0.31	0.31	0.31
556.4	0.27	0.27	0.27
617.4	0.285	0.285	0.285
677.9	0.285	0.285	0.285
740.4	0.255	0.255	0.255
799.9	0.32	0.32	0.32
887.5	0.275	0.275	0.275
945.8	0.277	0.277	0.277
978.2	0.315	0.315	0.315
1029	0.295	0.295	0.295
1072	0.26	0.26	0.26
1156.	0.325	0.325	0.325
1238.	0.275	0.275	0.275

0	0.02	0.02	0.02
3	0.3	0.3	0.3
7.5	0.02	0.02	0.02
12.9	0.025	0.025	0.025
22.9	0.02	0.02	0.02
38.6	0.01	0.01	0.01
62.2	0.01	0.01	0.01
103.8	0.03	0.03	0.03
160.5	0.01	0.01	0.01
209.8	0.02	0.02	0.02
214	0.035	0.035	0.035
221.1	0.03	0.03	0.03
236.2	0.07	0.07	0.07
274.4	0.03	0.03	0.03
305.8	0.055	0.055	0.055
393.4	0.04	0.04	0.04
437.5	0.01	0.01	0.01
511.1	0.03	0.03	0.03
556.4	0.03	0.03	0.03
617.4	0.025	0.025	0.025
677.9	0.025	0.025	0.025
740.4	0.045	0.045	0.045
799.9	0.03	0.03	0.03
887.5	0.015	0.015	0.015
945.8	0.02	0.02	0.02
978.2	0.045	0.045	0.045
1029	0.055	0.055	0.055
1072	0.07	0.07	0.07
1156.8	0.05	0.05	0.05
1238.7	0.045	0.045	0.045

0	0.102	0.102	0.102
3	0.101	0.101	0.101
7.5	0.107	0.107	0.107
12.9	0.108	0.108	0.108
22.9	0.108	0.108	0.108
38.6	0.114	0.114	0.114
62.2	0.11	0.11	0.11
103.8	0.123	0.123	0.123
160.5	0.109	0.109	0.109
209.8	0.117	0.117	0.117
214	0.135	0.135	0.135
221.1	0.129	0.129	0.129
236.2	0.135	0.135	0.135
274.4	0.143	0.143	0.143
305.8	0.148	0.148	0.148
393.4	0.162	0.162	0.162
437.5	0.179	0.179	0.179
511.1	0.151	0.151	0.151
556.4	0.149	0.149	0.149
617.4	0.149	0.149	0.149
677.9	0.168	0.168	0.168
740.4	0.178	0.178	0.178
799.9	0.166	0.166	0.166
887.5	0.174	0.174	0.174
945.8	0.185	0.185	0.185
978.2	0.181	0.181	0.181
1029	0.2	0.2	0.2
1072	0.2	0.2	0.2
1156.8	0.174	0.174	0.174
1238.7	0.176	0.176	0.176

0	0.122	0.122	0.122
3	0.241	0.241	0.241
7.5	0.287	0.287	0.287
12.9	0.268	0.268	0.268
22.9	0.298	0.298	0.298
38.6	0.224	0.224	0.224
62.2	0.2	0.2	0.2
103.8	0.223	0.223	0.223
160.5	0.209	0.209	0.209
209.8	0.224	0.224	0.224
214	0.425	0.425	0.425
221.1	0.349	0.349	0.349
236.2	0.345	0.345	0.345
274.4	0.343	0.343	0.343
305.8	0.368	0.368	0.368
393.4	0.302	0.302	0.302
437.5	0.409	0.409	0.409
511.1	0.491	0.491	0.491
556.4	0.449	0.449	0.449
617.4	0.459	0.459	0.459
677.9	0.478	0.478	0.478
740.4	0.478	0.478	0.478
799.9	0.516	0.516	0.516
887.5	0.464	0.464	0.464
945.8	0.482	0.482	0.482
978.2	0.541	0.541	0.541
1029	0.55	0.55	0.55
1072	0.53	0.53	0.53
1156.8	0.549	0.549	0.549
1238.7	0.496	0.496	0.496

0	2.3	2.3	2.3
3	18	18	18
7.5	12	12	12
12.9	19	19	19
22.9	13	13	13
38.6	14	14	14
62.2	14	14	14
103.8	8	8	8
160.5	10	10	10
209.8	8	8	8
214	11	11	11
221.1	9	9	9
236.2	10	10	10
274.4	7	7	7
305.8	8	8	8
393.4	6	6	6
437.5	17	17	17
511.1	13	13	13
556.4	15	15	15
617.4	19	19	19
677.9	18	18	18
740.4	16	16	16
799.9	19	19	19
887.5	19	19	19
945.8	19	19	19
978.2	25	25	25
1029	23	23	23
1072	23	23	23
1156.8	24	24	24
1238.7	24	24	24

0	1	1	1
3	1	1	1
7.5	6	6	6
12.9	3	3	3
22.9	4	4	4
38.6	2	2	2
62.2	1	1	1
103.8	1	1	1
160.5	1	1	1
209.8	2	2	2
214	2	2	2
221.1	2	2	2
236.2	1	1	1
274.4	4	4	4
305.8	1	1	1
393.4	1	1	1
437.5	2	2	2
511.1	10	10	10
556.4	2	2	2
617.4	4	4	4
677.9	2	2	2
740.4	3	3	3
799.9	2	2	2
887.5	5	5	5
945.8	1.3	1.3	1.3
978.2	4	4	4
1029	3	3	3
1072	4	4	4
1156.8	5.6	5.6	5.6
1238.7	5	5	5

APPENDIX III

LONG TERM BOD RESULTS

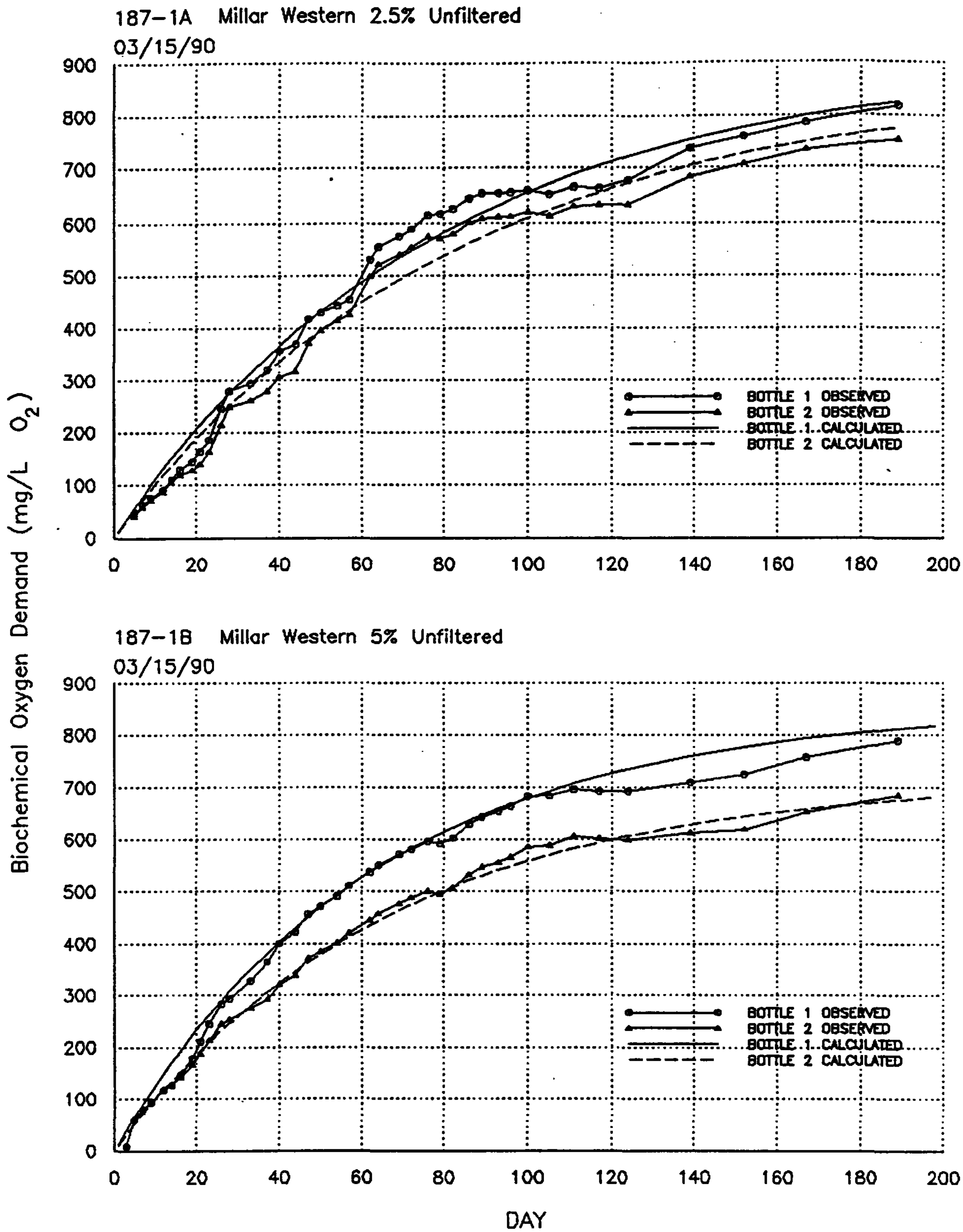

Figure A1 June 25 , 1991	MILLAR WESTERN LONG TERM BOD OBSERVED AND CURVE FITTED DATA	Environmental Management Associates

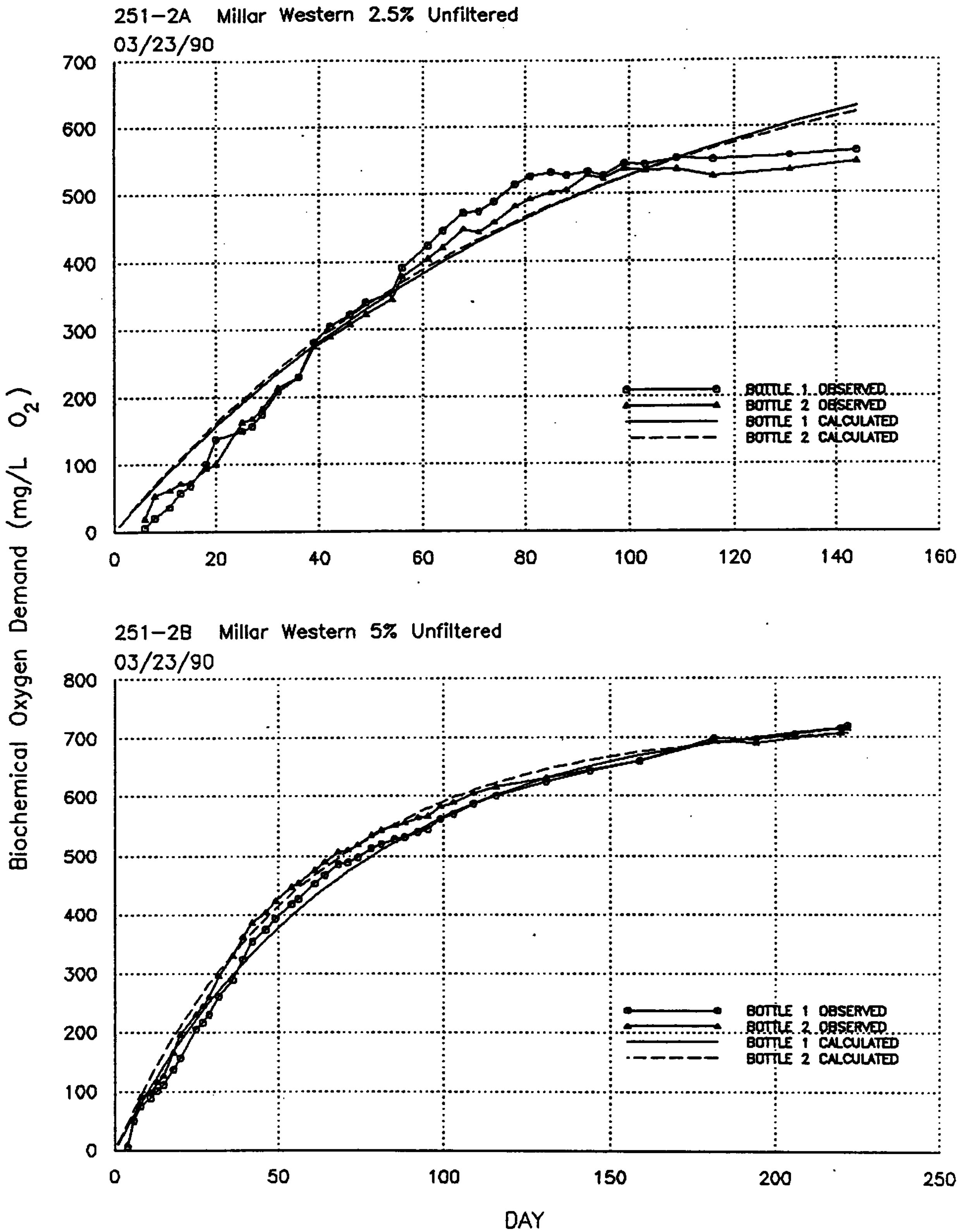

Figure A2 June 25 , 1991	MILLAR WESTERN LONG TERM BOD OBSERVED AND CURVE FITTED DATA	Environmental Management Associates

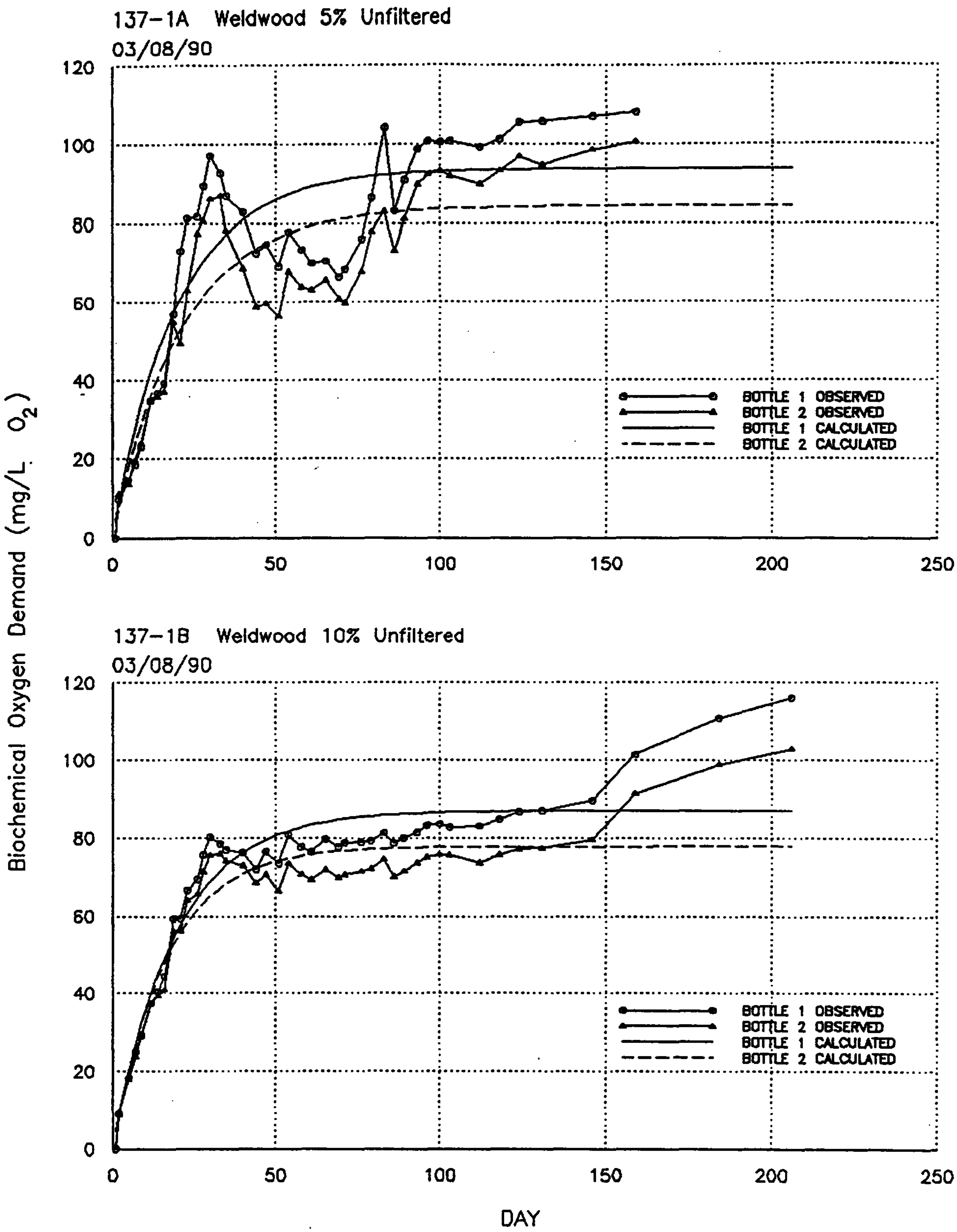

Figure A3 June 25 , 1991	WELDWOOD LONG TERM BOD OBSERVED AND CURVE FITTED DATA	Environmental Management Associates

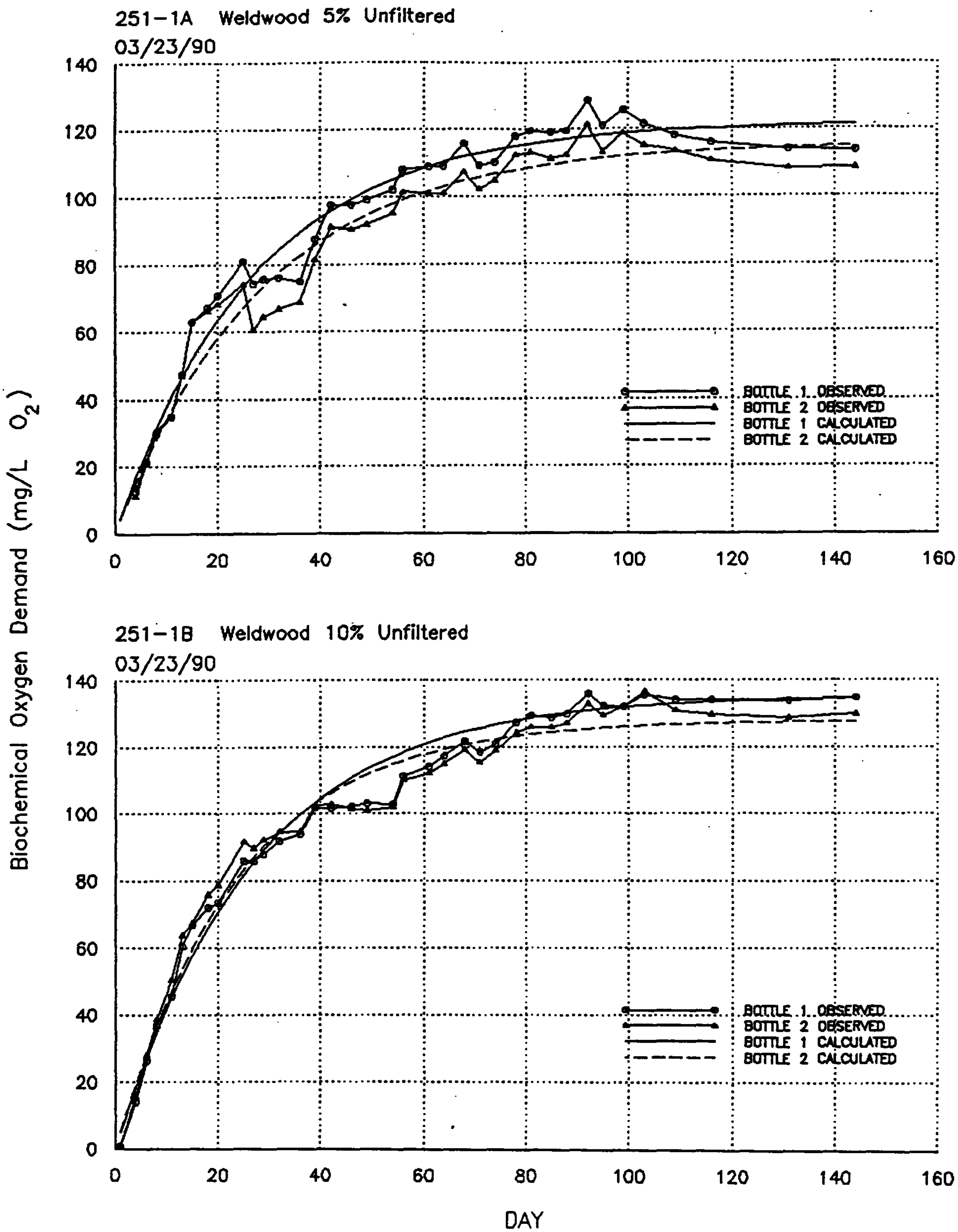

Figure A4 June 25, 1991	WELDWOOD LONG TERM BOD OBSERVED AND CURVE FITTED DATA	Environmental Management Associates

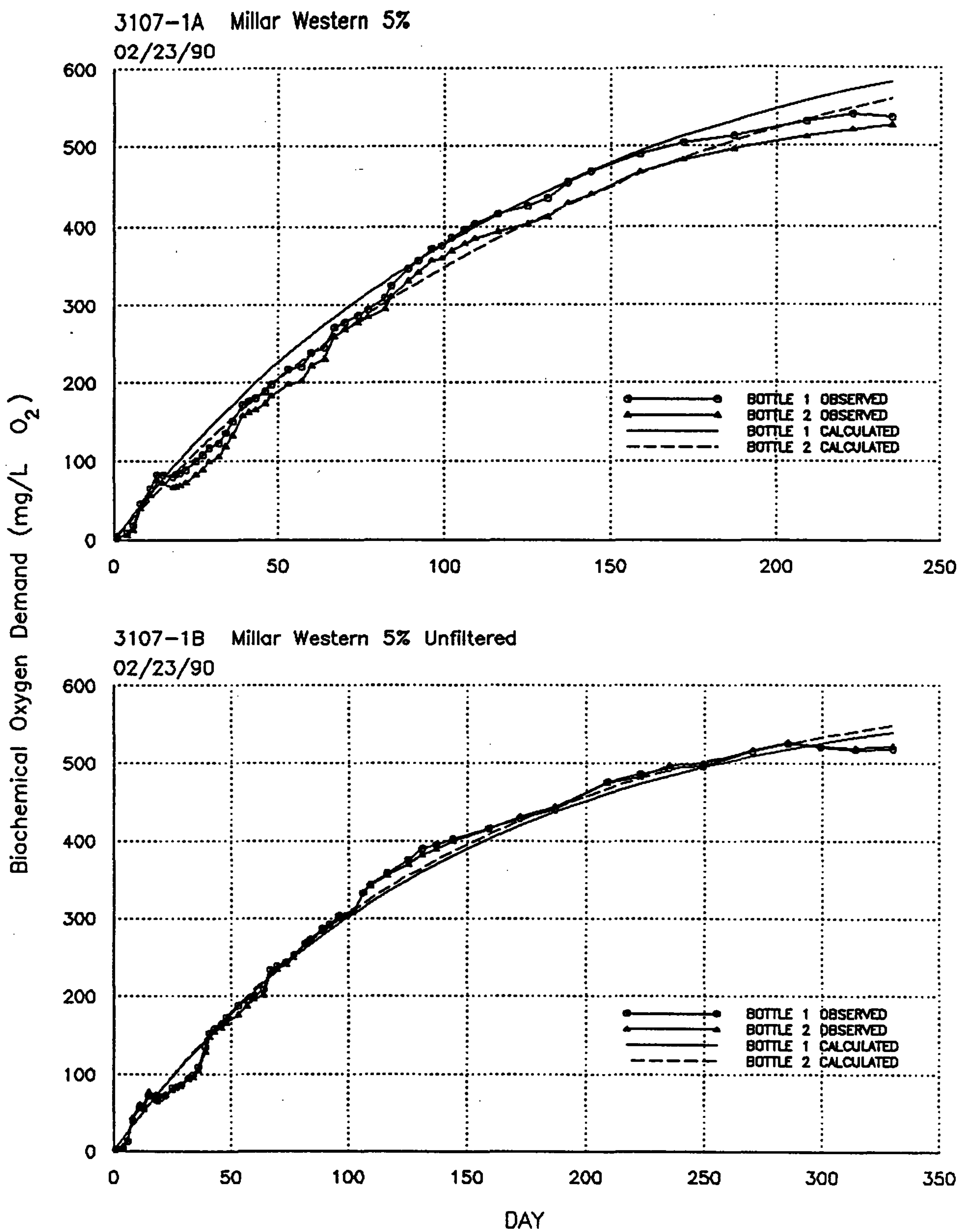

Figure A5 June 25 , 1991	MILLAR WESTERN LONG TERM BOD OBSERVED AND CURVE FITTED DATA	Environmental Management Associates

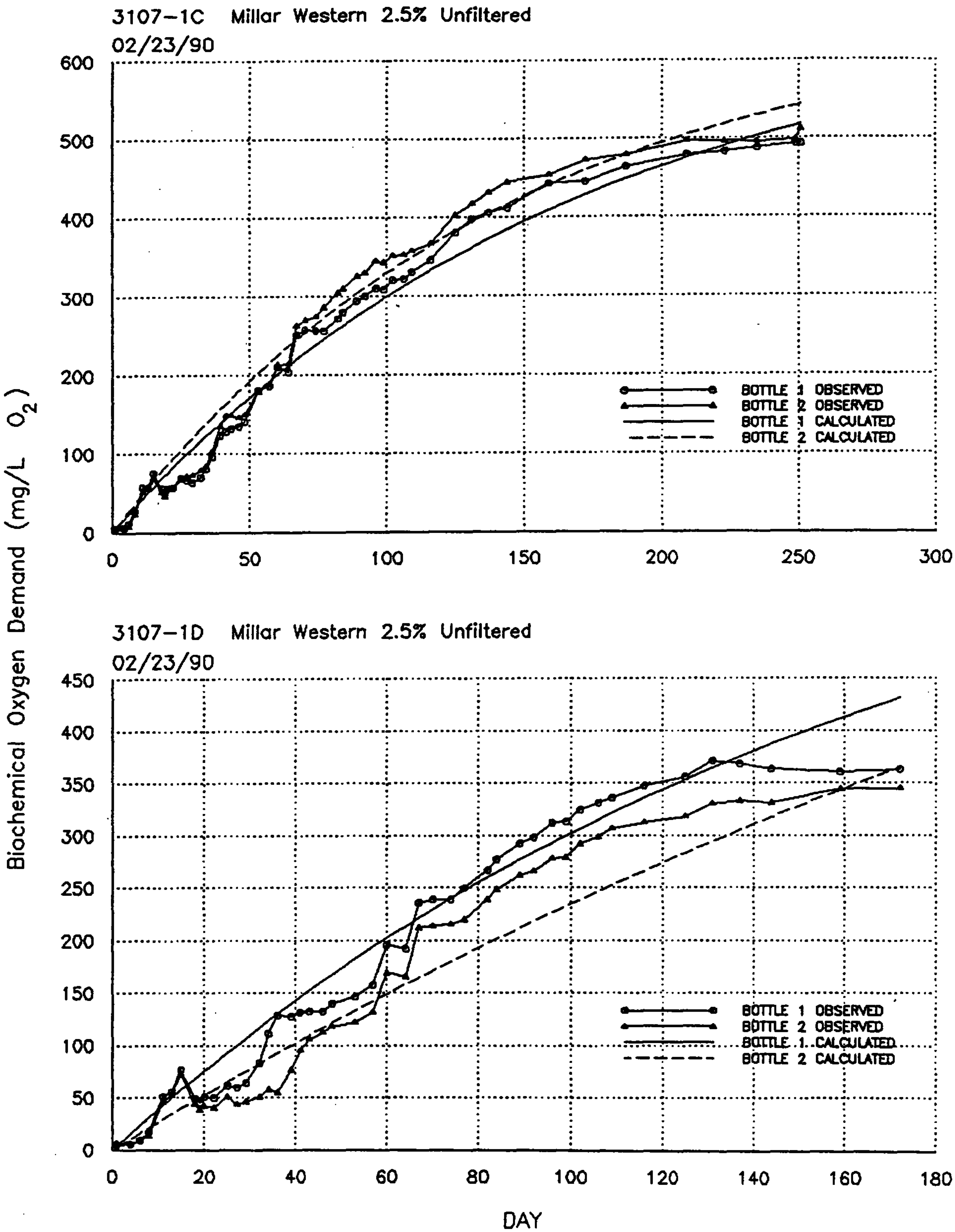

Figure A6 June 25 , 1991	MILLAR WESTERN LONG TERM BOD OBSERVED AND CURVE FITTED DATA	Environmental Management Associates

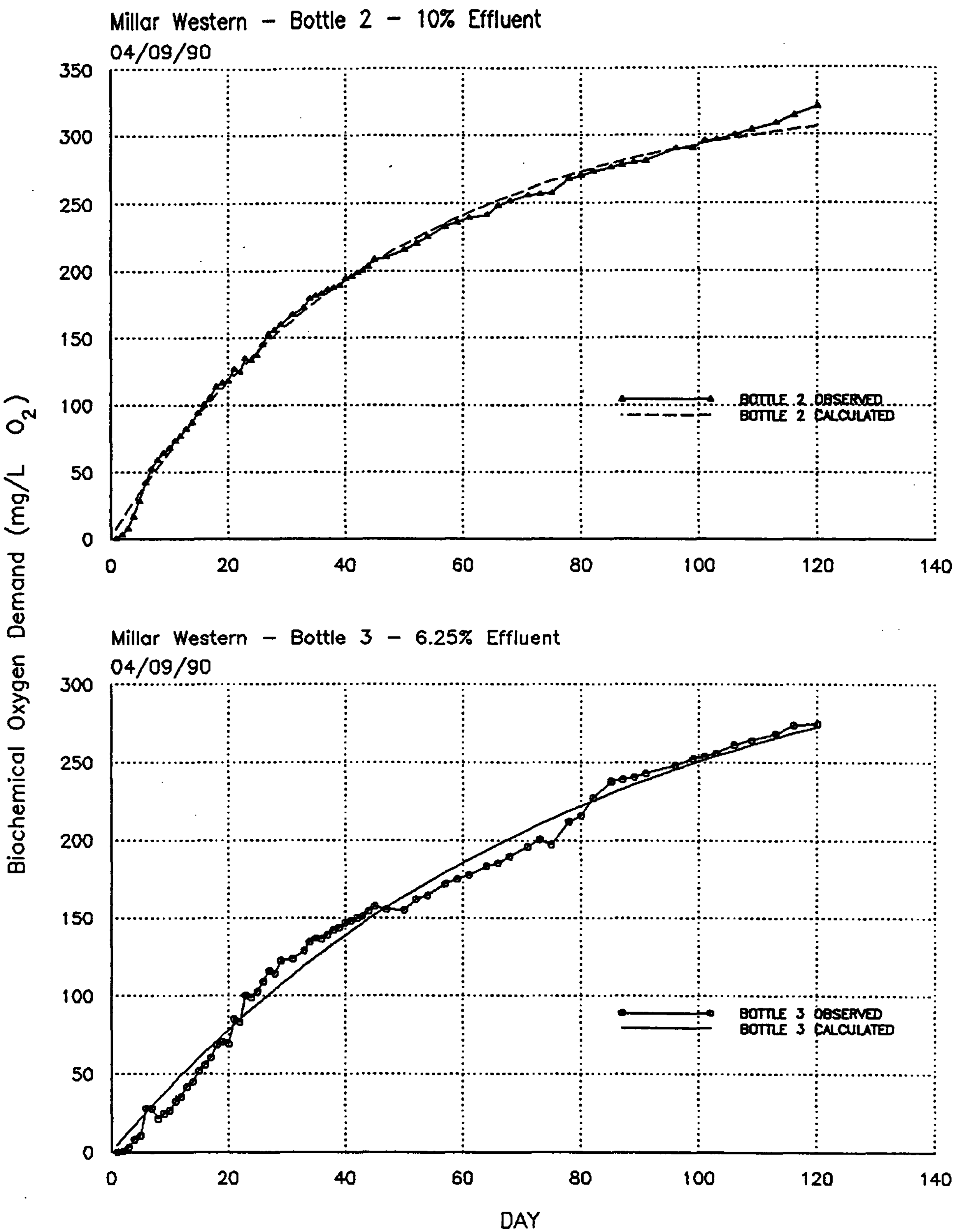

Figure A7 June 25 , 1991	MILLAR WESTERN LONG TERM BOD OBSERVED AND CURVE FITTED DATA	Environmental Management Associates

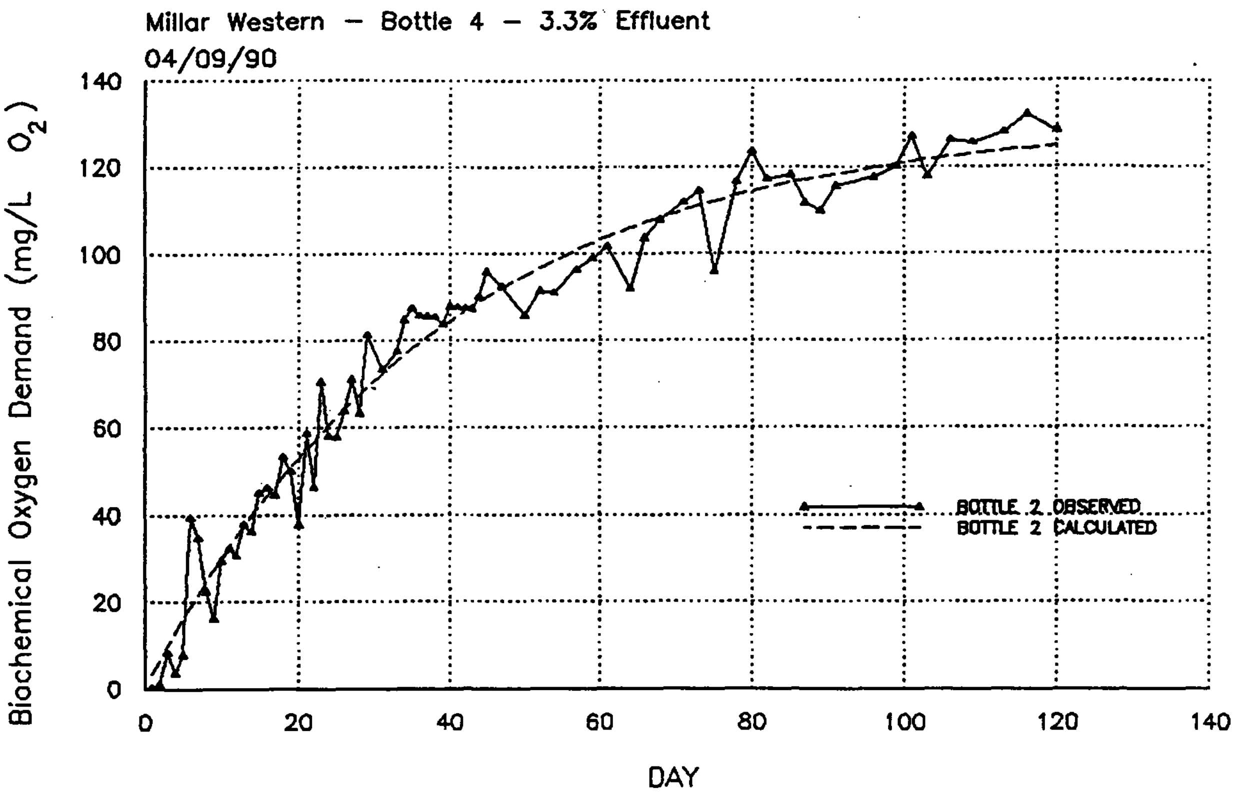

Figure A8 June 25 , 1991	MILLAR WESTERN LONG TERM BOD OBSERVED AND CURVE FITTED DATA	Environmental Management Associates

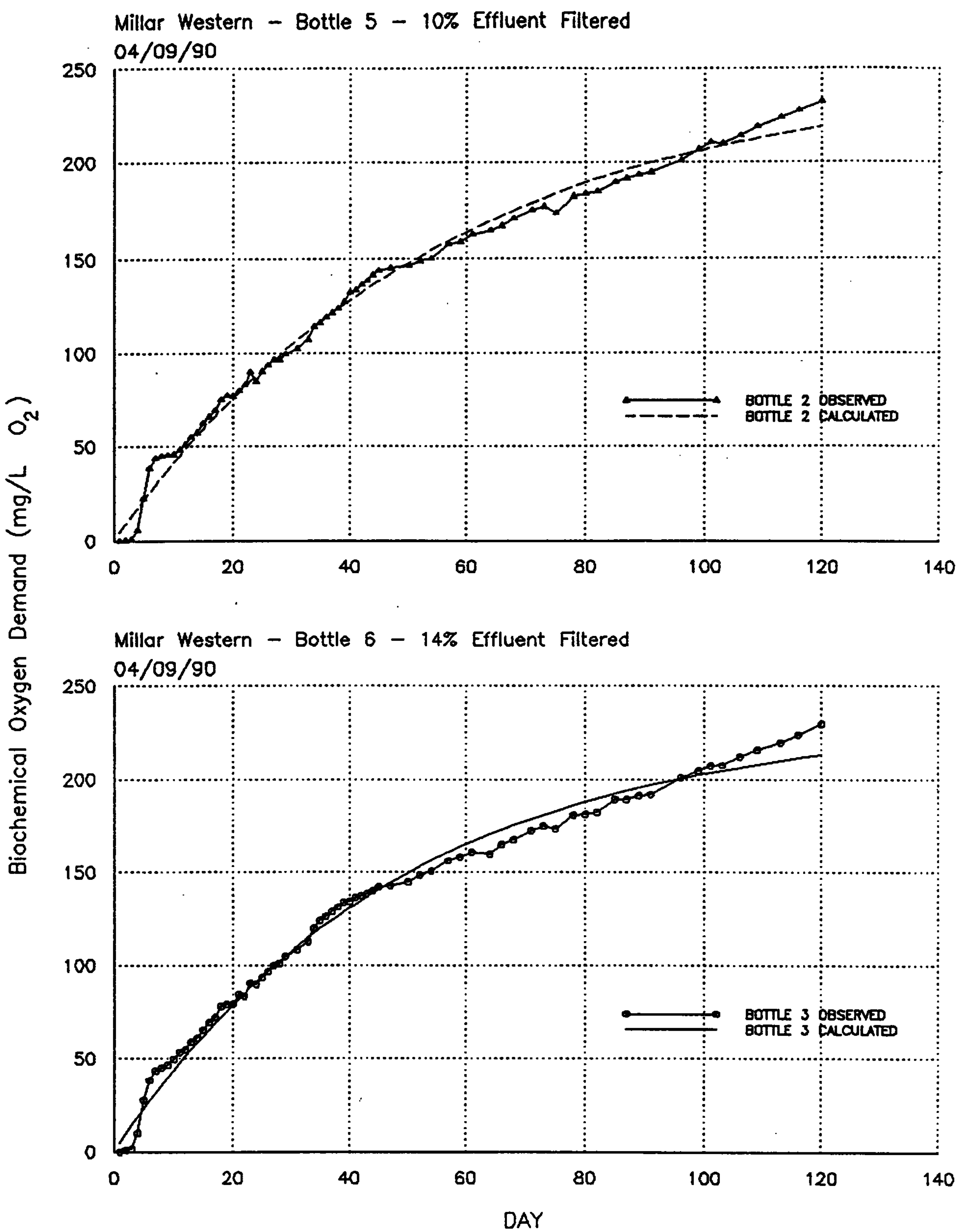

Figure A9 June 25 , 1991	MILLAR WESTERN LONG TERM BOD OBSERVED AND CURVE FITTED DATA	Environmental Management Associates

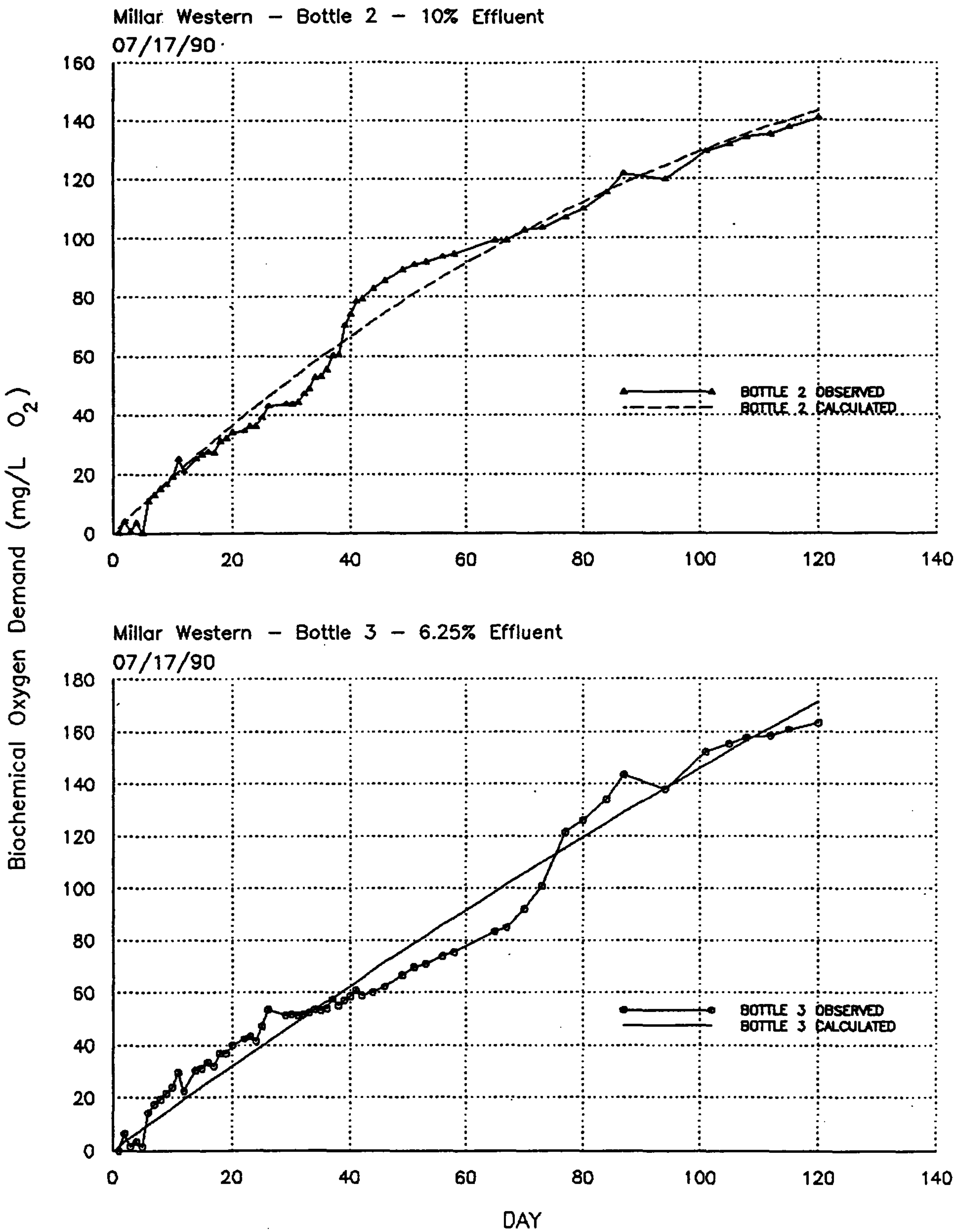

Figure A10 June 25 , 1991	MILLAR WESTERN LONG TERM BOD OBSERVED AND CURVE FITTED DATA	Environmental Management Associat

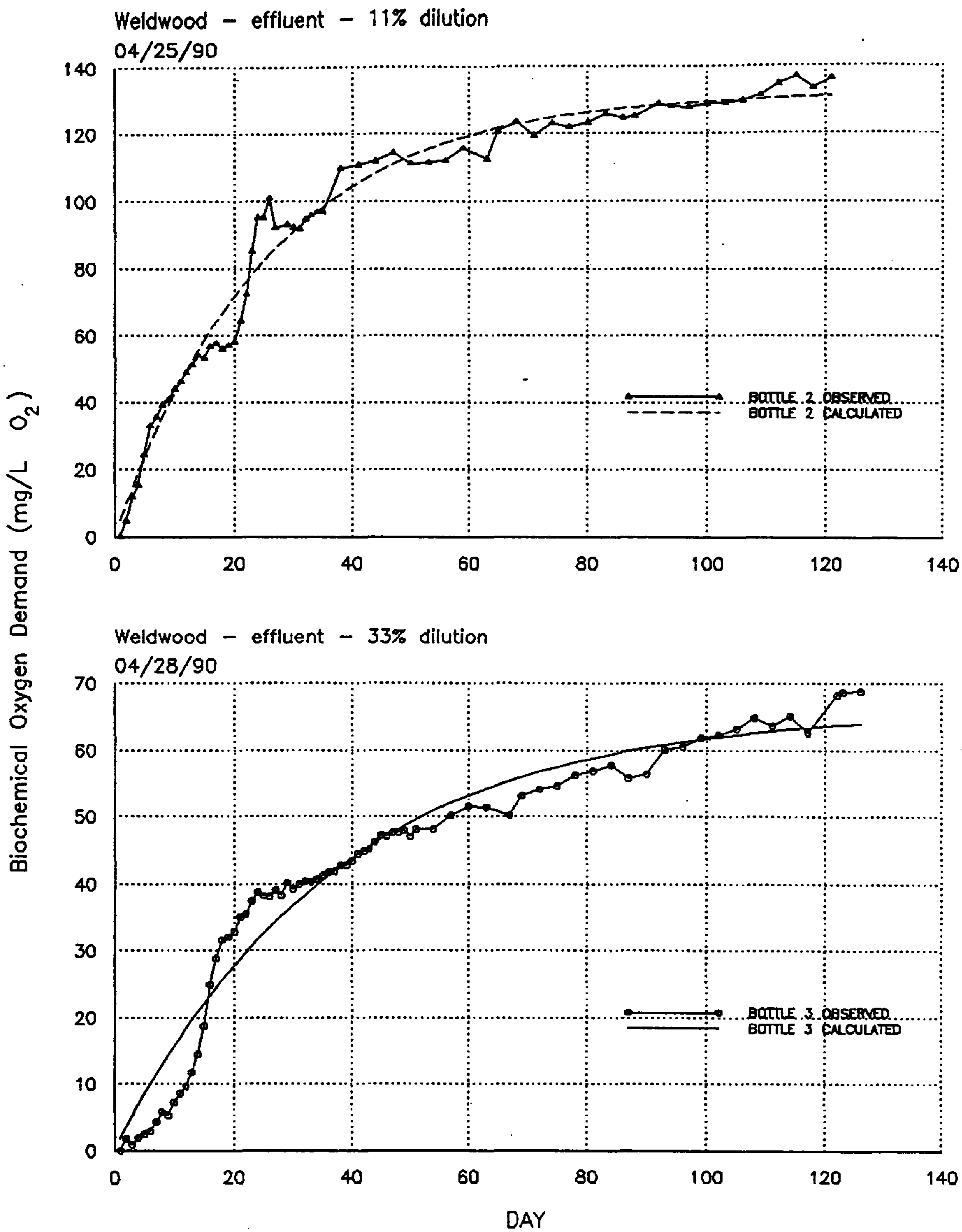

Figure A11 June 25 , 1991	WELDWOOD LONG TERM BOD OBSERVED AND CURVE FITTED DATA	Environmental Management Associates