WM796

OPTIMIZATION OF BEST MANAGEMENT PRACTICES FOR BEEF CATTLE RANCHING IN THE LAKE OKEECHOBEE BASIN, Part 2.

PROGRESS REPORT #2

February 13, 2002

by

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Table of Context

Introduction

The previous progress report (#1 dated Nov 7, 2001) described the QA/QC process for the water quality sampling and analysis component of the WM796 stocking rate BMP demonstration project at MAERC. The report also presented summary statistics associated with the nutrient concentration observations at each of the 16 plots. This second progress report focuses on the flow measurements and the nutrient load calculations. Tasks documented in this report include:

1. QA/QC assessment of the water stage and flow measurements.
2. Determination of runoff and inflow volumes for each plot.
3. Date-matching of water quality sampling results and the flow measurements.
4. Determination of net nutrient loads from each plot.
5. Correlation of nutrient loads with grazing treatments and pasture blocks.

Water Flow Measurements

Very little flow data were recorded during the year 2000 due to a severe drought event (25 inches of rainfall compared with the average value of 50 inches per year). There were only two months with rainfall totals exceeding 4 inches. By contrast, in 1999 there were eight months that exceeded 4 inches of rainfall per month. Table 1 and Figure 1 summarize annual inflow, runoff and net flows for each pasture plot and block.

The S1, S2 and S3 plots registered net annual inflows from the Harney Pond Canal into the grazing areas. Given the rainfall deficit of approximately 25 inches it is not surprising that some plots registered net inflows. Most of the inflow occurred between late August and early October while what little runoff that was recorded came from rainfall events on 9/18/2000 and 9/19/2000. Some inflow was even associated with the largest rainfall events. This is because of the high Harney Pond Canal water levels induced by runoff from the upper portions of the canal drainage basin. The flow values recorded at each flume are based upon water level readings taken upstream and downstream of the flume throats

by digital encoders attached to stilling well floats. These water level readings are evaluated by the datalogger program which determines water flow direction and magnitude. The datalogger tracks accumulated flow volume and issues commands to the automatic water sampler at points in time where water samples need to be taken. The success of the flow monitoring is dependent upon the accuracy of the water level measurements registered by the datalogger. Thus to provide QA/QC checks on the sensor–based water level readings, periodically the field technicians take manual water depth measurements for comparison with the datalogger values. The flow direction at the flumes is also recorded in the technician notes. The results of these measurements and the subsequent adjustments to datalogger values is provided in the appendix. For the year 2000 the datalogger and sensor equipment worked well. There were some isolated problems at S1, S2, and S3 flumes on 7/31/00 but these were rectified the next day, 8/1/00. The QA/QC comparisons and the water depth measurements are presented in Tables 1-16 corresponding to plots S1-W8. The datalogger readings matched the manual measurements very well for the period of greatest runoff (9/18/00-10/5/00).

Table 1. Summary of runoff depth in cm and inches for summer and winter pasture plot and blocks in the years 1998, 1999, and 2000.

Station code	Treatment	Runoff Volume					
		1998		1999		2000	
		cm	inches	cm	inches	cm	inches
S1	C	8.7	3.4	10.2	4.0	-1.1	-0.4
S2	20	13.5	5.3	13.0	5.1	-3.0	-1.2
S3	35	14.5	5.7	9.5	3.7	-0.1	-0.1
S4	15	6.6	2.6	15.1	5.9	0.4	0.2
S5	35	14.7	5.8	14.9	5.9	1.2	0.5
S6	15	15.3	6.0	14.2	5.6	2.4	0.9
S7	20	16.0	6.3	20.2	8.0	2.6	1.0
S8	C	14.2	5.6	7.6	3.0	2.1	0.8
Summer average		**12.9**	**5.1**	**13.1**	**5.2**	**0.5**	**0.2**
W1	15	10.5	4.1	6.7	2.6	1.0	0.4
W2	20	15.7	6.2	6.9	2.7	1.3	0.5
W3	35	12.0	4.7	14.8	5.8	0.6	0.2
W4	C	21.5	8.5	10.8	4.3	2.5	1.0
W5	35	24.7	9.7	13.4	5.3	1.8	0.7
W6	15	20.9	8.2	15.7	6.2	0.6	0.2
W7	C	24.4	9.6	15.0	5.9	1.0	0.4
W8	20	20.9	8.2	12.9	5.1	2.0	0.8
Winter average		**18.8**	**7.4**	**12.0**	**4.7**	**1.3**	**0.5**

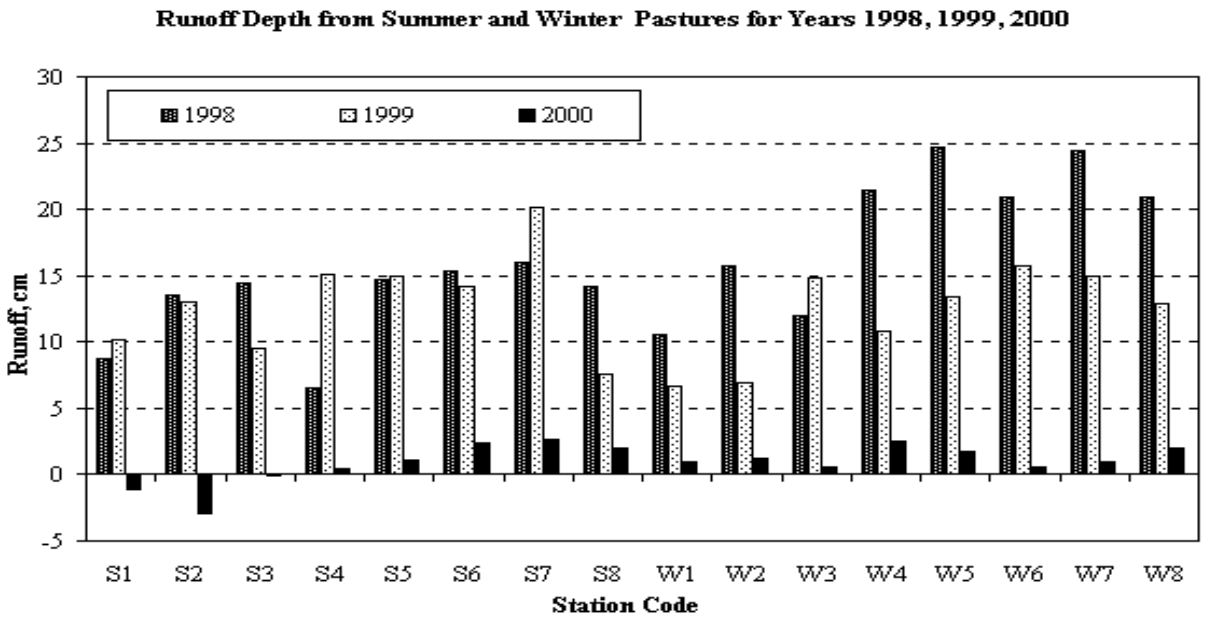


Figure1. Total runoff depth results calculated for summer and winter pastures blocks in the years 1998, 1999, 2000.

Table 2. Summary of backflow, runoff and total flow for each pasture plot and block in the year 2000.

Station code	Treatment	Runoff Volume					
		Back Flow		Runoff		Net flow	
		cm	inches	cm	inches	cm	inches
S1	C	-1.1	-0.4	0	0	-1.1	-0.4
S2	20	-3.0	-1.2	0	0	-3.0	-1.2
S3	35	-0.1	-0.1	0	0	-0.1	-0.1
S4	15	-0.1	0.0	0.6	0.2	0.4	0.2
S5	35	-0.6	-0.2	1.8	0.7	1.2	0.5
S6	15	-0.7	-0.3	3.1	1.2	2.4	0.9
S7	20	-2.3	-0.9	4.9	1.9	2.6	1.0
S8	C	-0.2	-0.1	2.2	0.9	2.1	0.8
Summer average		**-1.03**	**-0.4**	**1.6**	**0.6**	**0.5**	**0.2**
W 1	15	0	0	1.0	0.4	1.0	0.4
W 2	20	0	0	1.3	0.5	1.3	0.5
W 3	35	0	0	0.6	0.2	0.6	0.2
W 4	C	0	0	2.5	1.0	2.5	1.0
W 5	35	0	0	1.8	0.7	1.8	0.7
W 6	15	0	0	0.6	0.2	0.6	0.2
W 7	C	0	0	1.0	0.4	1.0	0.4
W 8	20	0	0	2.0	0.8	2.0	0.8
Winter average		**0**	**0**	**1.3**	**0.5**	**1.3**	**0.5**

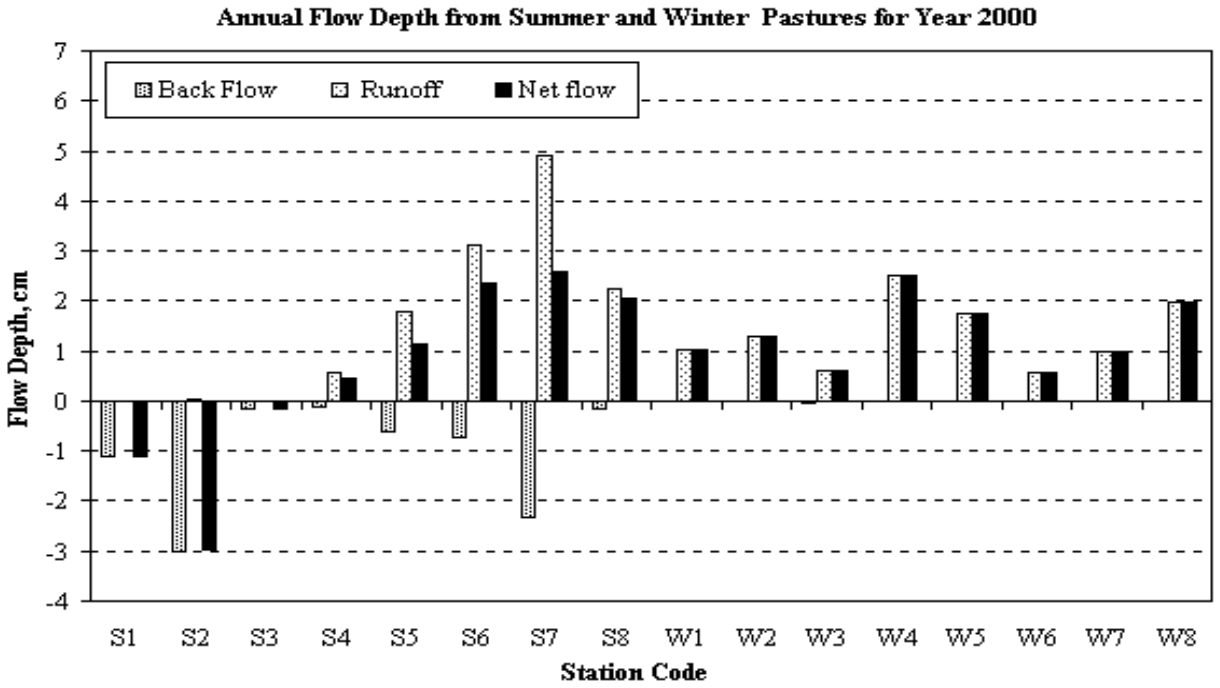


Figure 2. Annual inflow, runoff and net flow for each pasture plot for the year 2000.

Nutrient Concentration Measurement

Table 3 and Figure 3 present the mean TP concentrations for samples associated with periods of inflow and runoff. These comparisons show appropriate inflow TP concentrations of 0.2 mg/L on the summer plots while runoff concentrations are significantly higher, more than double in most cases. While flow volumes for 2000 were very low, total phosphorus concentration in the water was relatively high for the winter pasture plots compared to previous years measurements. The TP requirements on the summer pastures were of comparable magnitude to previous years.

After a prolonged dry period, debris is washed from the pastures and collected by the samplers, therefore the early samples collected after a drought are not necessarily representative of runoff after sustained periods of rain. The result can often be unusually high concentrations of nitrogen or phosphorus in some samples. In Figure 2 concentrations for the year 2000 are much more erratic and unpredictable than in either 1998 or 1999. The low number of samples taken in the year 2000 influences the variability of results. A high reading in one sample has a large bearing on the final mean concentration value, as the total water flow through the samplers was limited.

Table 3. Summary of TP concentrations associated with backflow, runoff and combined flow for each pasture plot and block in the year 2000.

Station Code	Treatment	TP mg/L		
		Inflow	Runoff	Combined
S1	C	0.06		0.06
S2	20	0.17		0.17
S3	35	0.13	0.15	0.14
S4	15	0.20	0.54	0.41
S5	35	0.25	0.61	0.43
S6	15	0.21	0.51	0.39
S7	20	0.15	0.34	0.25
S8	C	0.36	0.98	0.74
Summer average		**0.19**	**0.52**	**0.32**
W1	15		0.18	0.18
W2	20		0.13	0.13
W3	35		0.42	0.42
W4	C		0.12	0.12
W5	35		0.32	0.32
W6	15		0.75	0.75
W7	C		0.24	0.24
W8	20	0.03	0.13	0.10
Winter average		**0.03**	**0.29**	**0.28**

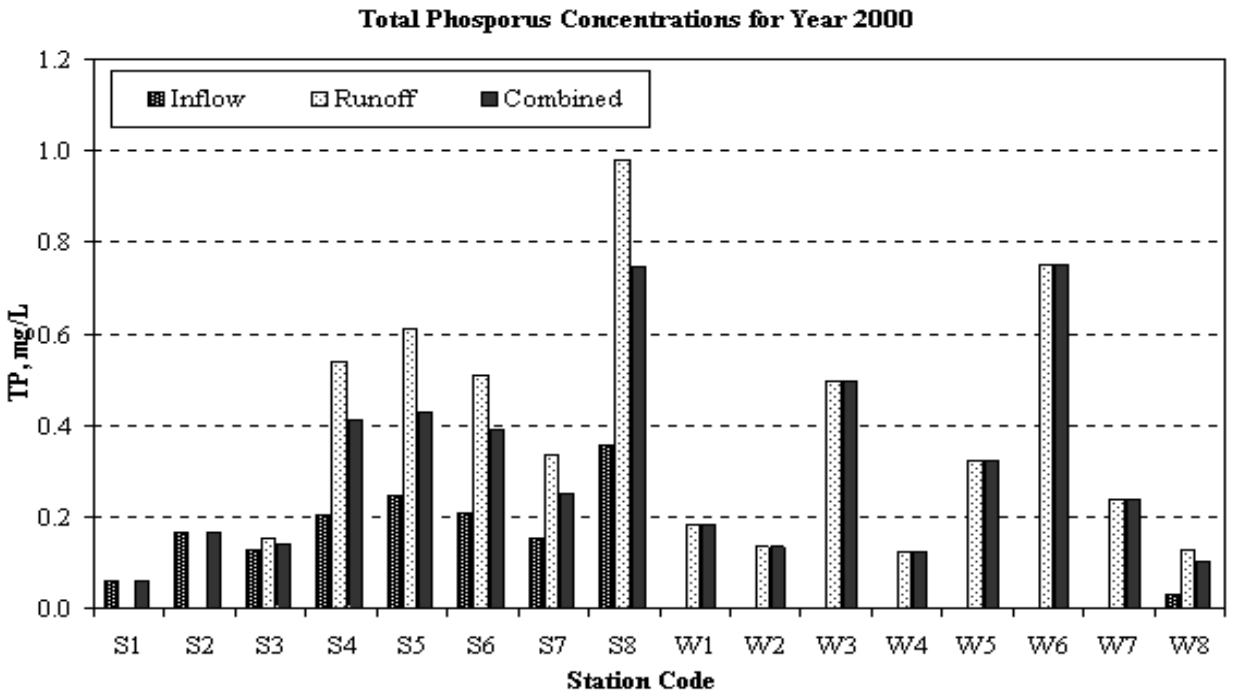


Figure 3. Total Phosphorus mean concentrations for inflow, runoff and combined flow from every summer and winter blocks in the year 2000.

Nutrient Load Assessments

Table 4 and Figure 4 provide a comparison of TP loads for 1998, 1999, and 2000. The TP, NOx, NH4, and TKN loads from each plot are presented in Table 5 and Figures 5 - 9. The runoff TP loads from the winter plots during 2000 were much lower than previous years due to lower runoff volumes and despite the higher TP concentrations observed in the winter pastures.

In the year 2000 backflow events were quite frequent. Water flowed through the flumes into the pastures when the adjoining Harney Pond Canal had higher water levels than the summer and winter plots. This backflow was calculated as negative flow and subtracted from runoff volumes and load calculations. The Summer 2 plot had more backflow than runoff and thus had a net deposition of nutrients into the pasture. This is shown as a negative number in the load data and water flow data. Not all plots experienced equal backflow or runoff. The uneven flow had a significant bearing on results. The combination of low rainfall, variable concentrations, and uneven net flow volumes make it difficult for treatment comparisons between experimental plots.

Table 4. Comparison of nutrient loads calculated using TP concentrations from ISCO and grab samples collected from summer and winter pastures in the years 1998, 1999, and 2000.

Station code	Treatment	TP Load , kg/ha		
		1998	1999	2000
S1	C	0.58	0.55	-0.01
S2	20	0.51	0.89	-0.04
S3	35	0.60	0.47	0.00
S4	15	0.66	0.89	0.03
S5	35	1.17	1.12	0.08
S6	15	0.46	0.64	0.08
S7	20	0.64	1.37	0.21
S8	C	1.25	0.58	0.32
Summer average		**0.73**	**0.81**	**0.08**
W1	15	0.07	0.16	0.04
W2	20	0.07	0.24	0.03
W3	35	0.10	0.18	0.07
W4	C	0.12	0.08	0.06
W5	35	0.14	0.12	0.11
W6	15	0.14	0.12	0.08
W7	C	0.13	0.18	0.04
W8	20	0.10	0.10	0.05
Winter average		**0.11**	**0.15**	**0.06**

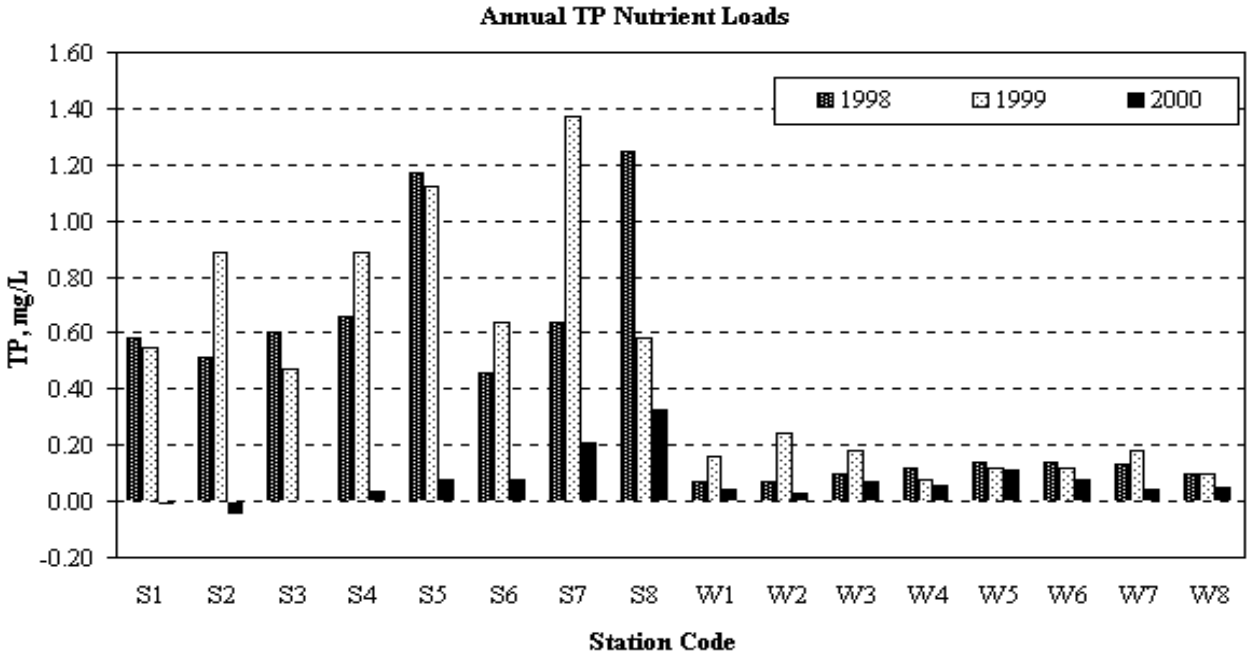


Figure 4. Comparison of nutrient loads calculated using TP concentrations from ISCO and grab samples collected from summer and winter pastures in the years 1998, 1999, and 2000.

Table 5. Comparison of nutrient loads calculated using TP, NOx, NH_4, TKN, ortho-P concentrations from ISCO and grab samples collected from summer and winter pastures in the year 2000.

Station code	Treatment	Nutrient Load, kg/ha				
		TP	NOX	NH4	TKN	ortho-P
S1	C	-0.006	-0.001	-0.016	-0.153	0.000
S2	20	-0.038	-0.003	-0.018	-0.656	-0.025
S3	35	-0.001	0.000	-0.001	-0.024	0.000
S4	15	0.034	0.000	0.006	0.120	0.004
S5	35	0.076	0.001	0.016	0.430	0.025
S6	15	0.079	0.002	0.018	1.069	0.041
S7	20	0.210	0.003	0.032	1.759	0.078
S8	C	0.323	0.002	0.075	1.258	0.008
Summer average		**0.085**	**0.001**	**0.014**	**0.475**	**0.016**
W1	15	0.041	0.005	0.251	0.773	0.004
W2	20	0.030	0.254	0.529	1.426	0.004
W3	35	0.068	0.001	0.103	1.407	0.006
W4	C	0.056	0.023	0.289	1.434	0.034
W5	35	0.108	0.007	0.583	0.252	0.005
W6	15	0.076	0.002	0.049	0.469	0.000
W7	C	0.040	0.008	0.057	0.596	0.019
W8	20	0.048	0.016	0.110	1.163	0.005
Winter average		**0.058**	**0.039**	**0.246**	**0.940**	**0.010**

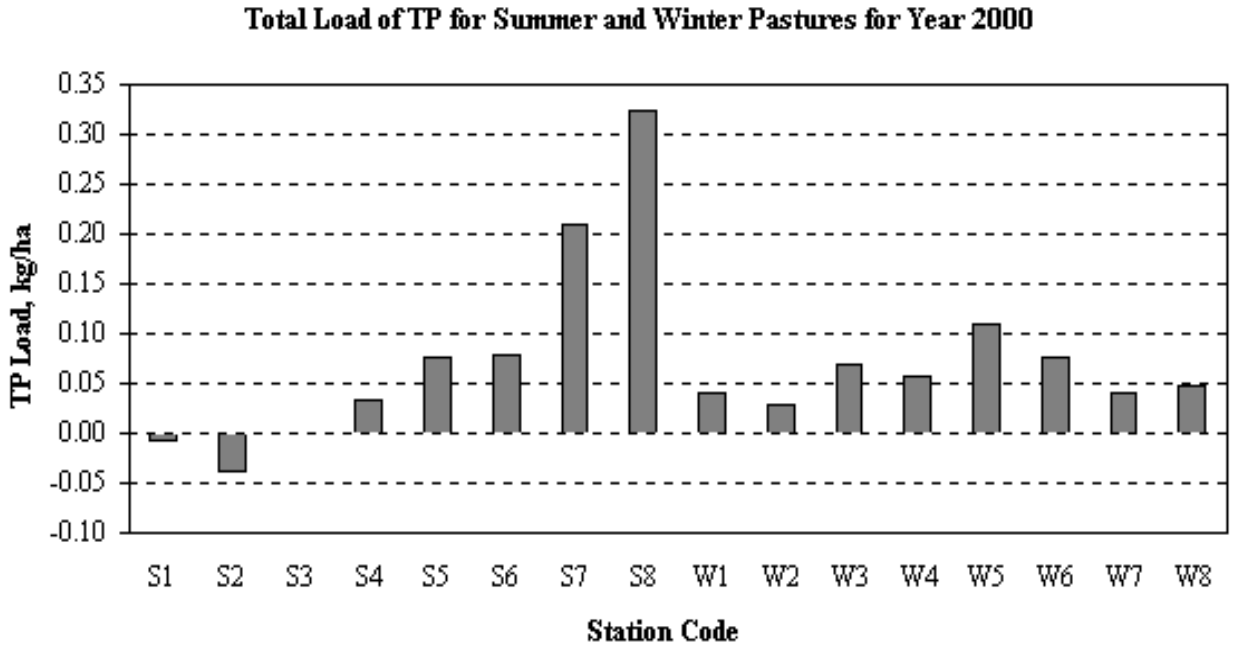


Figure 5. Nutrient loads calculated using TP concentrations from ISCO and grab samples collected from summer and winter pastures in the year 2000.

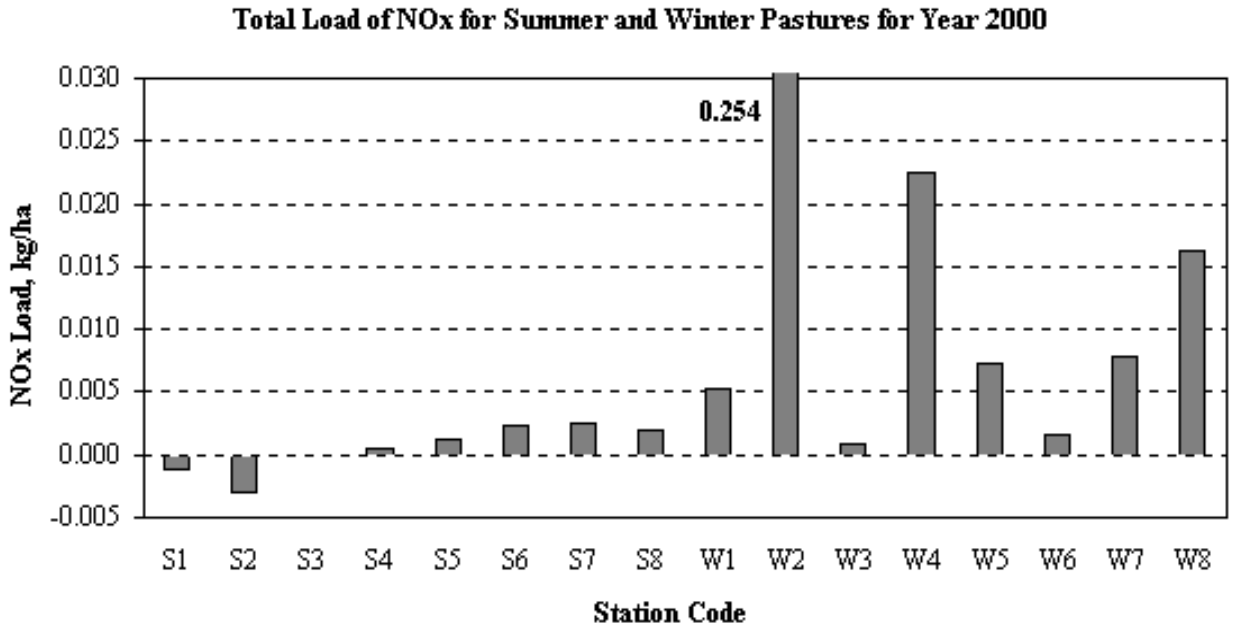


Figure 6. Nutrient loads calculated using NOx concentrations from ISCO and grab samples collected from summer and winter pastures in the year 2000.

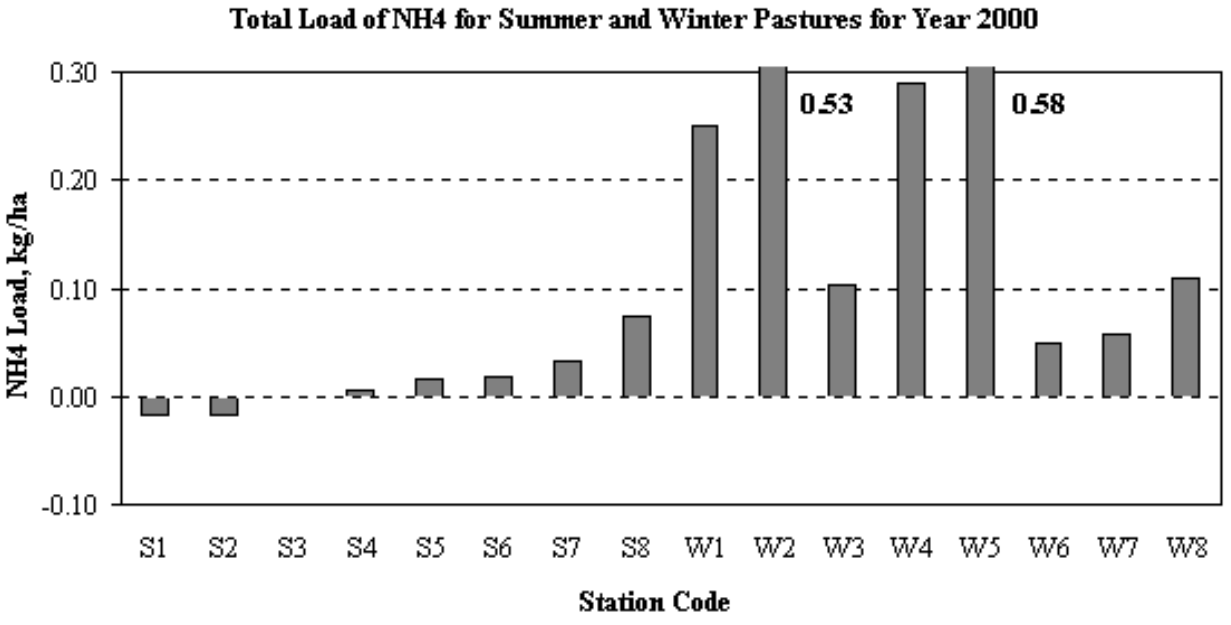


Figure 7. Nutrient loads calculated using NH_4 concentrations from ISCO and grab samples collected from summer and winter pastures in the year 2000.

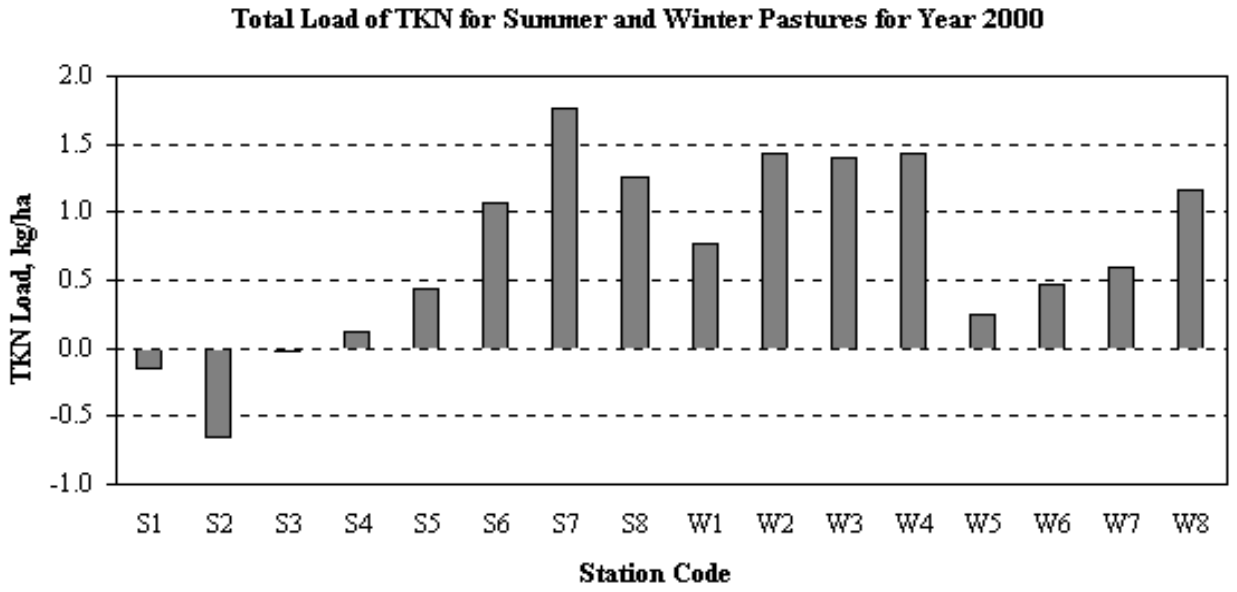
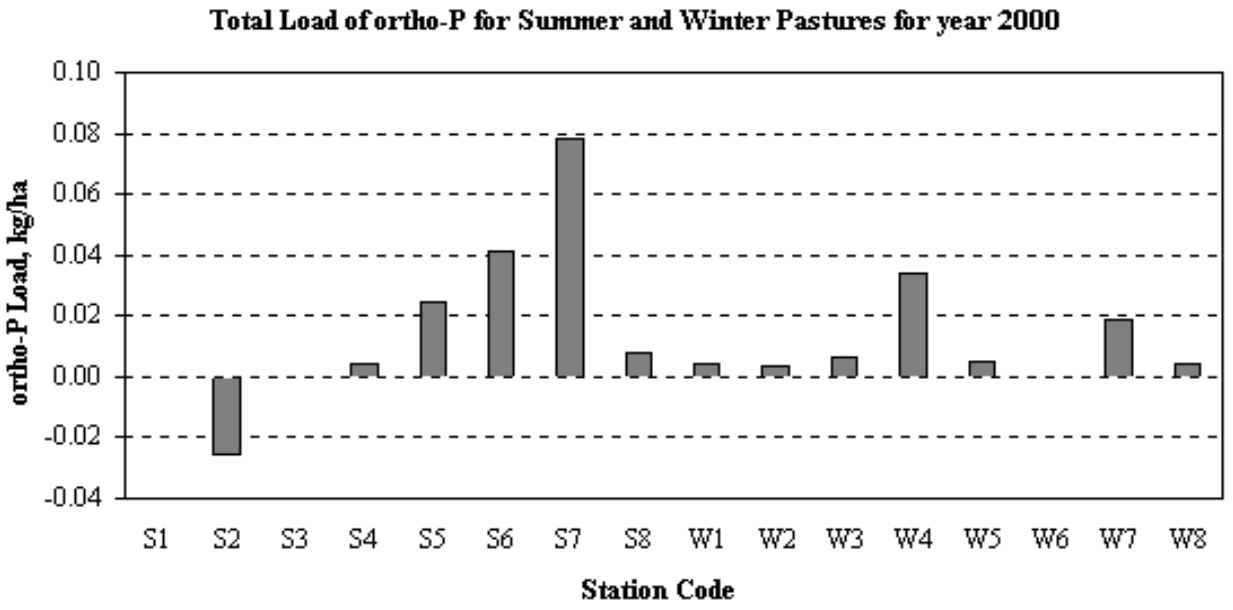


Figure 8. Nutrient loads calculated using TKN concentrations from ISCO and grab samples collected from summer and winter pastures in the year 2000.

Figure 9. Nutrient loads calculated using ortho-P concentrations from ISCO and grab samples collected from summer and winter pastures in the year 2000.



Summary

The year 2000 was characterized by extremely low rainfall. This resulted in limited flow and concentration data being collected. Also, the data produced by the pasture systems were subject to a variety of distortions because of the low rainfall. Some anomalies, could not be explained, such as the very high TP concentrations observed at W6.

The system of dual datalogger and technician manual readings worked well. In most cases the values corresponded closely. However low rainfall resulted in a small number of manual readings being available for comparison. In summary, the system of datalogger and manual readings was sufficiently accurate to provide QA/QC for the flow measurements. However the results for 2000 do not show any major trends between stocking rates.

The soil contains varying amounts of nutrients depending on factors such as landscape, water movement, and past agricultural history. It has been found that phosphorus runoff at these sites is linked to P concentrations in the top 5cm of soil. Therefore meaningful results cannot be expected until the nutrients in the summer pasture topsoil have been 'mined' to a point were P concentrations are low enough to measure the affect of other factors. Under present conditions the anticipated changes in

the soil and vegetation characteristics resulting from cattle grazing have not been effectively measured via water quality monitoring. This is due to differences in P concentrations across the land being more significant than changes induced by cattle grazing and the associated changes to soil properties and nutrient distribution. With time, cattle grazing and runoff should stabilize nutrient concentrations across the property, and allow reasonable comparisons between cattle stock rate and nutrient runoff.

Conclusion

Net nutrient loading from both the summer and winter pasture plots are strongly influenced by annual rainfall totals. The winter pasture nutrient concentrations show an inverse relationship with rainfall/runoff totals. However, it appears that nutrient concentrations in runoff from the summer pastures are not significantly affected by rainfall/runoff totals. This suggests that perhaps the high soil P concentration result in some degree of equilibrium state with the summer pasture runoff waters, while on the winter pastures with their lower soil P levels, ground surface debris wash off phenomenon may be a more important factor in runoff total phosphorus content.

Appendix

Graphs and Tables

Adjusted Flow vs. Manual Readings

Head/Tail Adjusted vs. Manual Readings

Unadjusted Flow vs. Manual Reading

Unajusted Head/Tail vs. Manual Readings

Unadjusted Sensor Values vs. Manual Measurements

Adjusted Flow vs. Conentration Measurements

Nutrient Loads

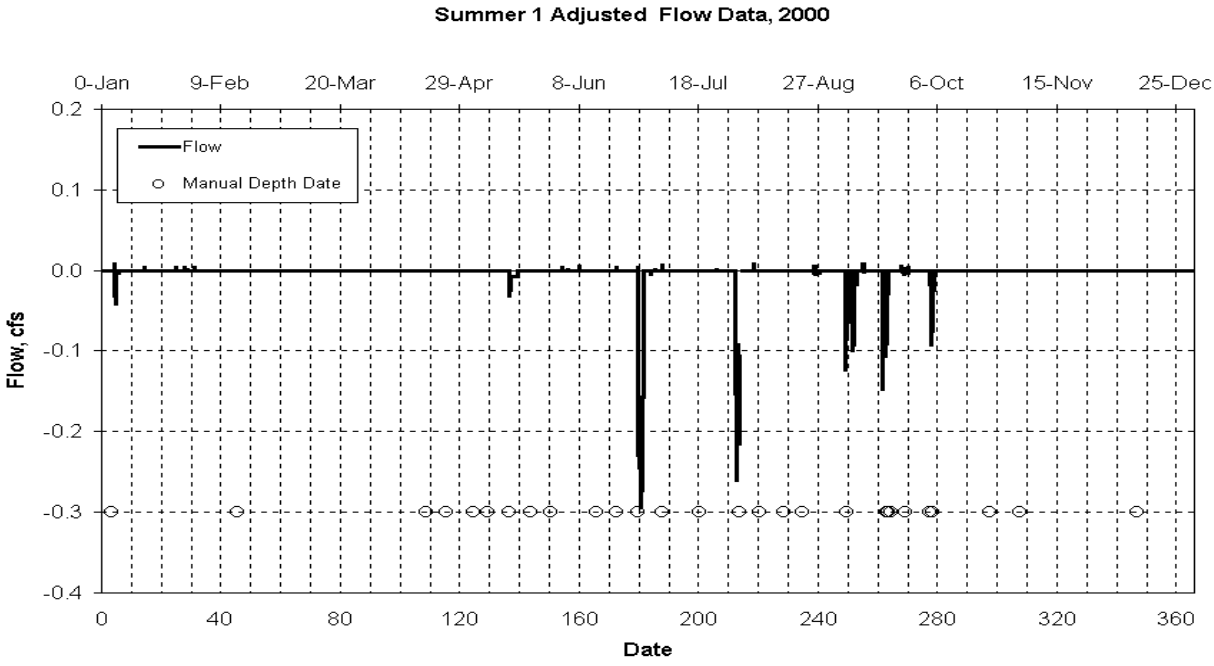


Figure 1a. Flow record for flume at *summer* pasture 1 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

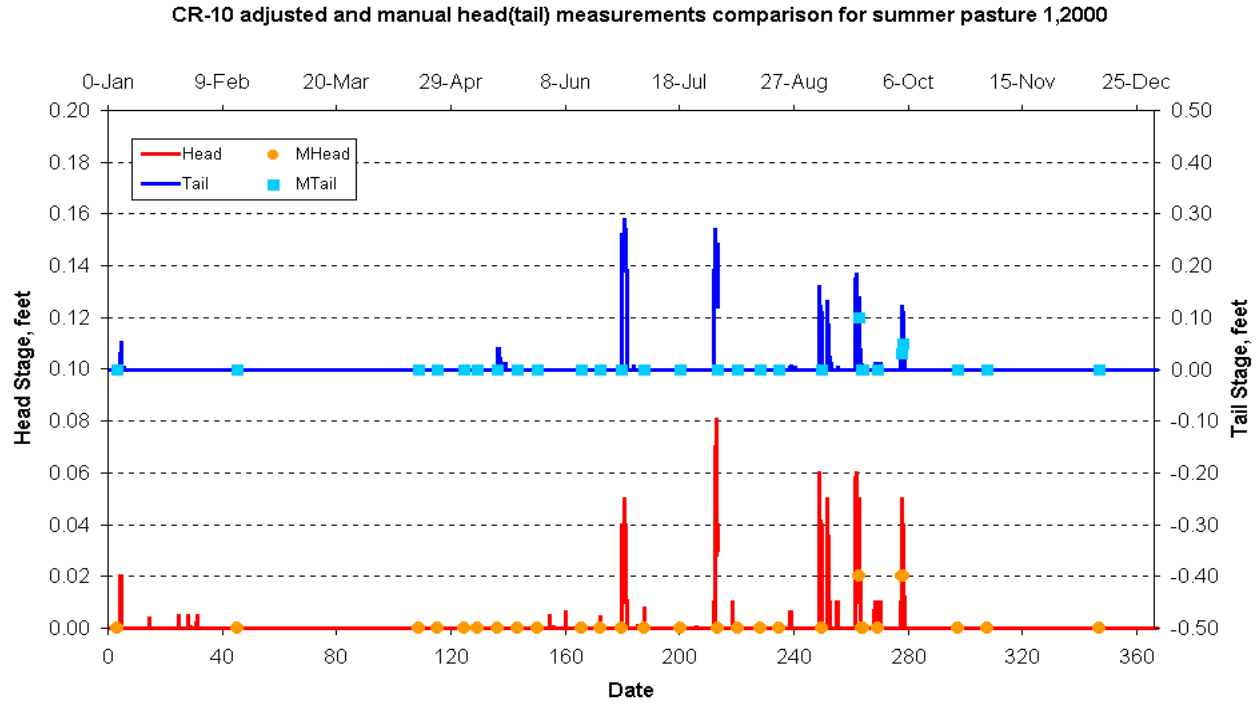


Figure 1b. Flume upstream and downstream stage data for *summer* pasture 1 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 1. Summary of comparisons and adjustment of *summer* pasture 1 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow Cond.
		Man. feet	CR10 feet	Diff feet	Man. feet	CR10 feet	Diff feet	CR10 cfs	Up Error	Dn Error	feet	CR10 feet	cfs	
01/03/00	946	0	0	0	0	0	0	0			0	0	0	D
02/14/00	1128	0	0	0	0	0	0	0			0	0	0	D
04/17/00	1509		err			err		0			0	0	0	BF
04/24/00	1052	0	0.73	-0.73	0	0	0	1.91	-0.77		0	0	0	D
05/03/00	1054	0	0.71	-0.71	0	0	0	1.80	-0.77		0	0	0	D
05/08/00	1016	0	0.70	-0.70	0	0	0	1.74	-0.77		0	0	0	D
05/15/00	957		0.76			0		2.11	-0.77	0.45	0	0.03	-0.02	BF
05/22/00	1135	0	0.72	-0.72	0	0	0	1.86	-0.77	0.45	0	0	0	D
05/29/00	953	0	0.72	-0.72	0	0	0	1.85	-0.77	0.45	0	0	0	D
06/13/00	1332	0	0.75	-0.75	0	0	0	2.03	-0.77		0	0	0	D
06/20/00	906	0	0.77	-0.77	0	0	0	2.16	-0.77		0	0	0	D
06/27/00	1440		0.70			0		1.77	-0.70	0.15	0.02	0.06	-0.05	BF
07/05/00	1552	0	0.04	-0.04	0	0.22	-0.22	-0.19	-0.04	-0.25	0	0	0	D
07/18/00	1000	0	0	0	0	0.16	-0.16	-0.12		-0.25	0	0	0	D
07/31/00	1052		0.04			0.25		-0.22		-0.10	0.04	0.15	-0.11	BF
08/07/00	1133	0	0	0	0	0	0	0			0	0	0.0	D
08/15/00	1139	0	0	0	0	0	0	0			0	0	0.0	D
08/21/00	1559	0	0	0	0	0	0	0			0	0	0.0	D
09/05/00	1432		0.02			0.06		-0.05			0.02	0.06	-0.05	BF
09/18/00	1933	0.02	0.03	-0.02	0.10	0.09	0.01	-0.07			0.03	0.09	-0.07	BF
09/19/00	1323	0	0	0	0	0	0	0			0	0	0.0	D
09/20/00	942	0	0	0	0	0	0	0			0	0	0.0	D
09/25/00	1036	0	0	0	0	0	0	0			0	0	0.0	D
10/03/00	1428	0.02	0.02	0	0.03	0.02	0.02	-0.02			0.02	0.02	-0.02	BF
10/04/00	918	0.02	0.02	0	0.05	0.04	0.01	-0.03			0.02	0.04	-0.03	BF
10/05/00	1127	0	0	0	0	0	0	0			0	0	0.0	D
10/23/00	1049	0	0	0	0	0	0	0			0	0	0.0	D
11/02/00	1017	0	0	0	0	0	0	0			0	0	0.0	D
12/11/00	1527	0	0	0	0	0	0	0			0	0	0.0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

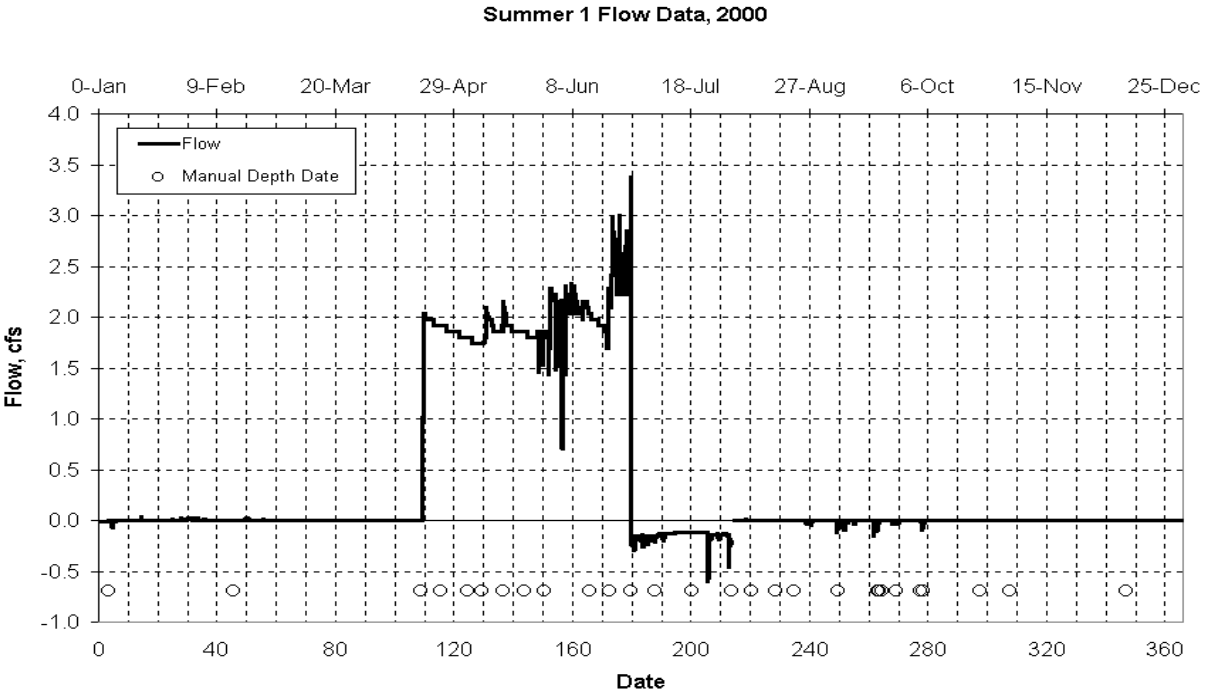


Figure 1c. Comparison of unadjusted flow record and dates of manual stage measurements for *summer* pasture 1 the flume during the year 2000.

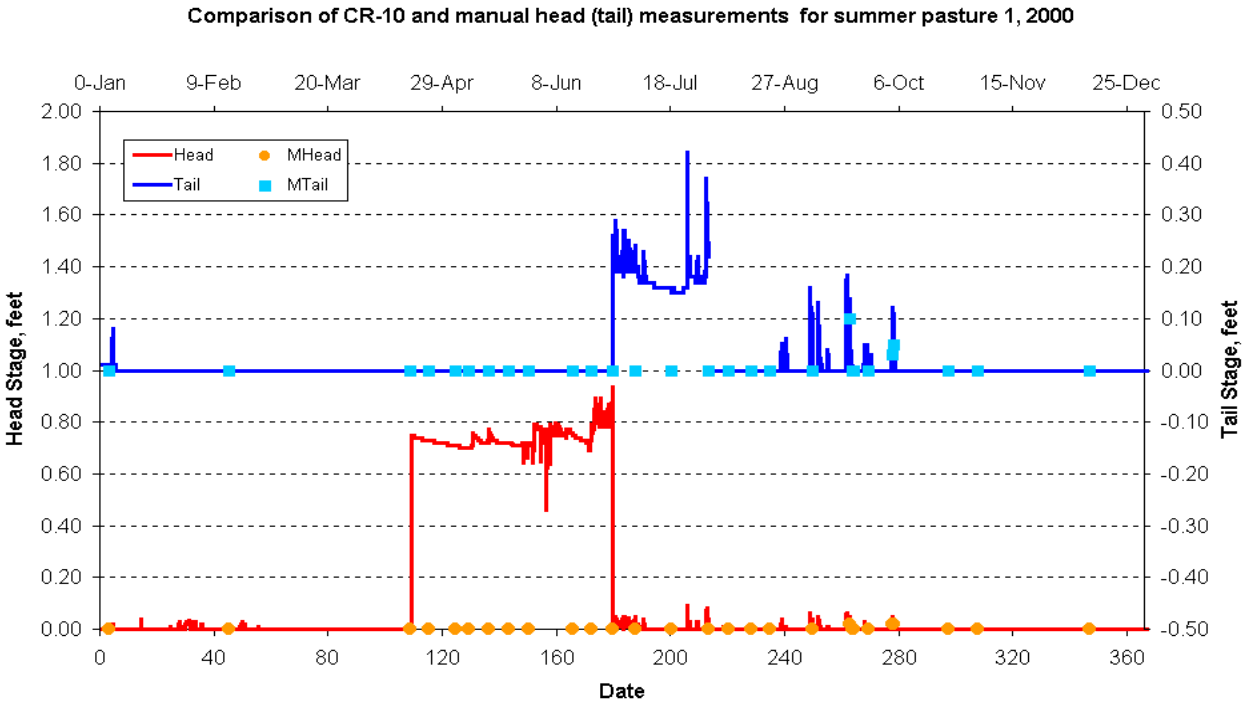


Figure 1d. Unadjusted flume upstream and downstream stage data for *summer* pasture 1 based on comparison between sensor values and manual stage measurements during the year 2000.

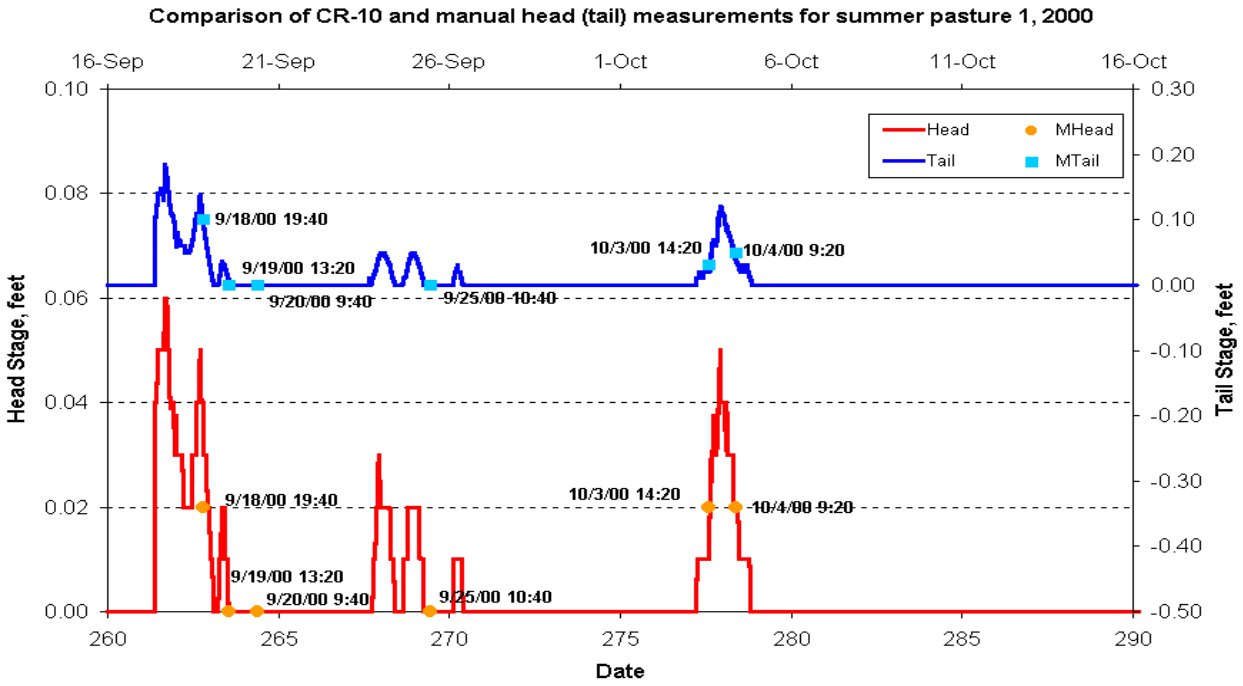


Figure 1e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *summer* 1 pasture during the peak flow period (9/16/00-10/16/00) for the year 2000.

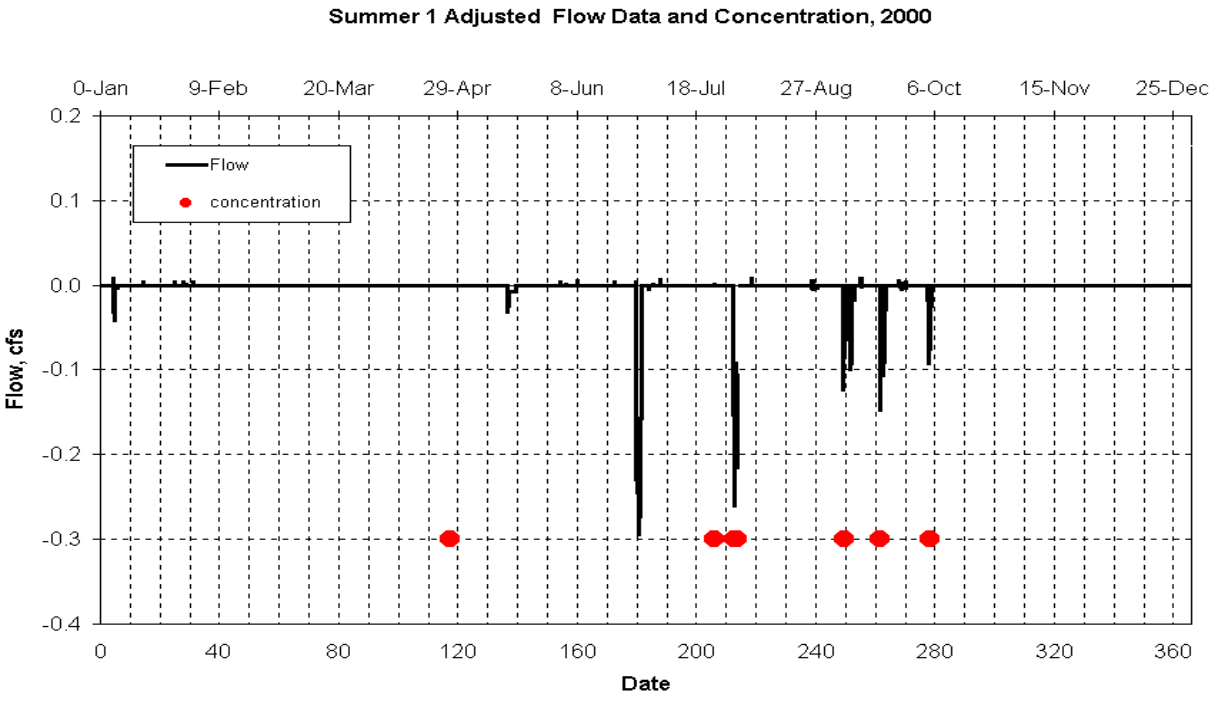


Figure 1f. Flow magnitudes and water quality sample collection dates for *summer* pasture 1 for the year 2000.

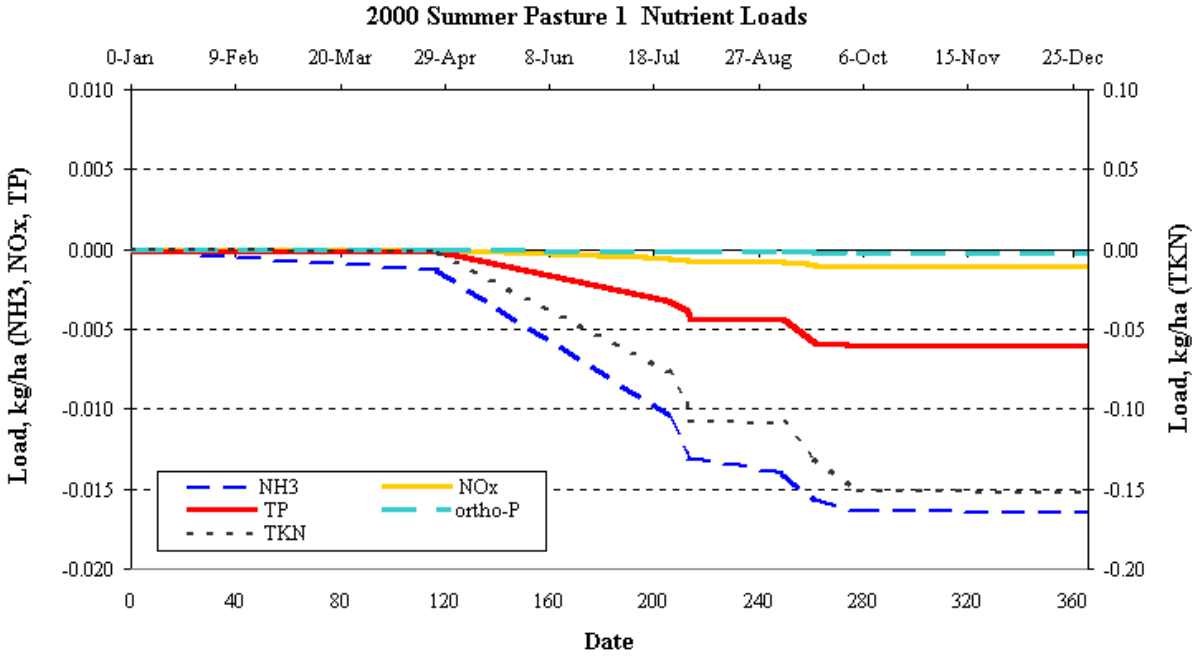


Figure 1g. Nutrient load in kg/ha of elemental N and P as calculated using ISCO and grab samples at summer pasture 2 in the year 2000.

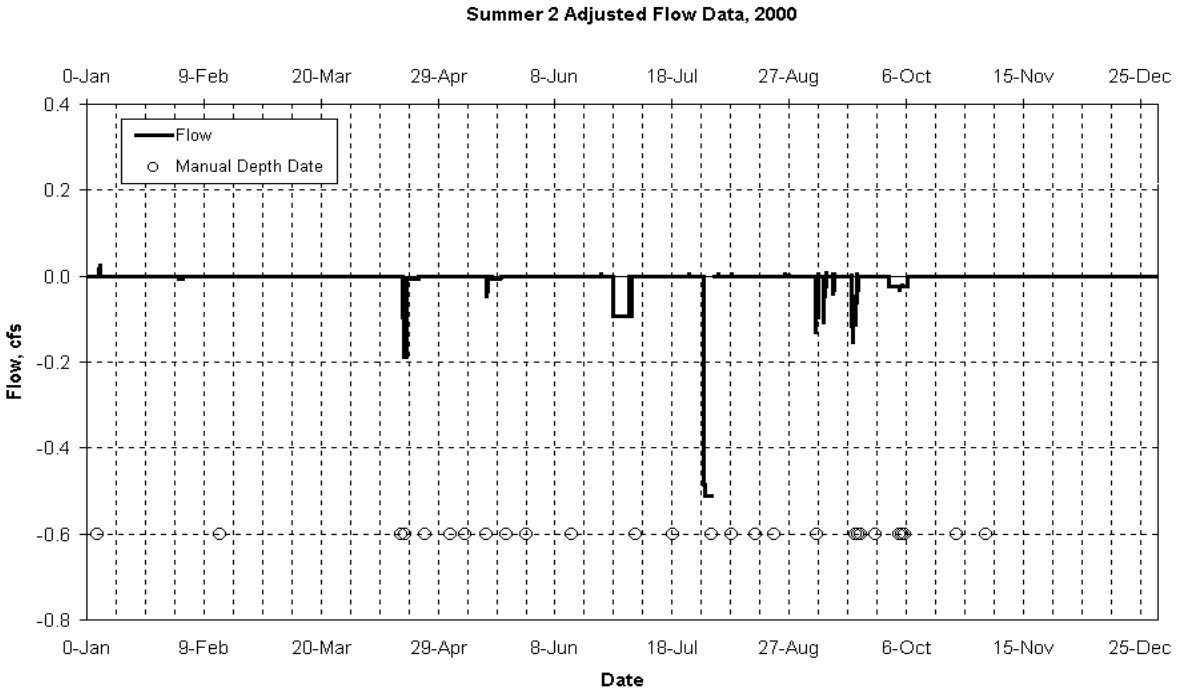


Figure 2a. Flow record for flume at *summer* pasture 2 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

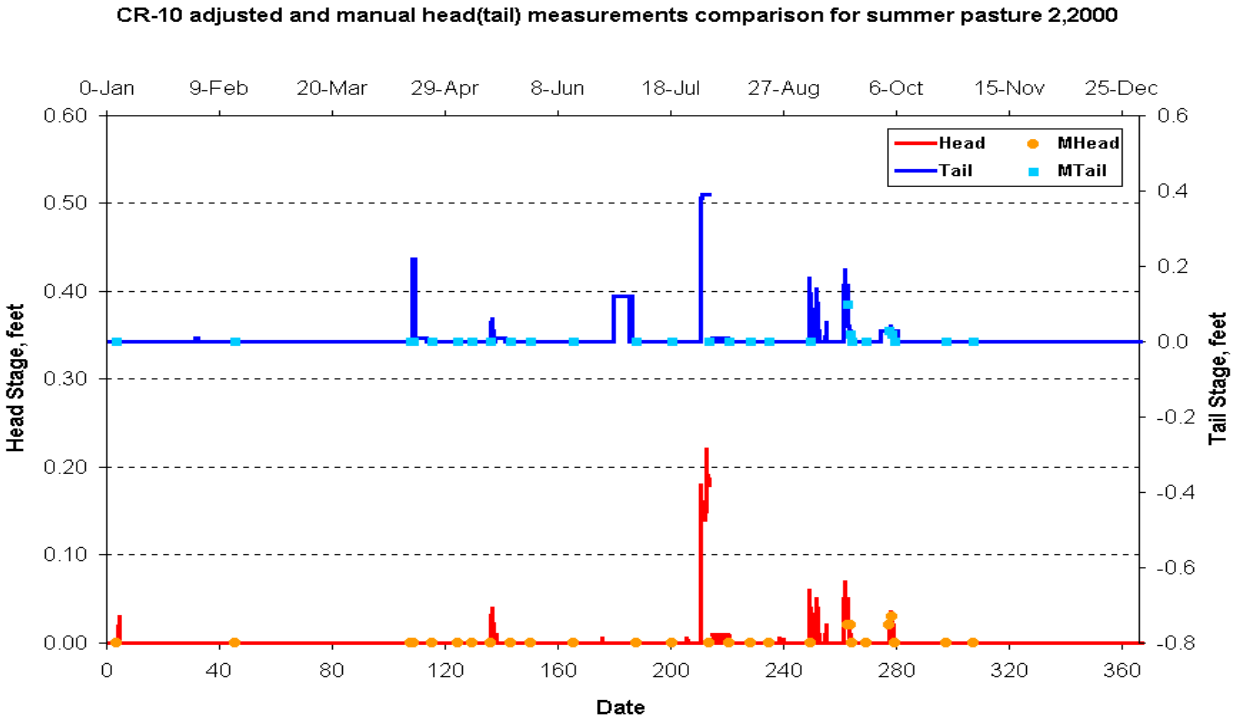


Figure 2b. Flume upstream and downstream stage data for *summer* pasture 2 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 2. Summary of comparisons and adjustment of *summer* pasture 2 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow Cond.
		Man. feet	CR10 feet	Diff feet	Man. feet	CR10 feet	Diff feet	CR10 cfs	Up Error	Dn Error	feet	CR10 feet	cfs	
01/03/00	954	0	0	0	0	0	0	0		0.01	0	0	0	D
02/14/00	1132	0	0	0	0	0	0	0		0.01	0	0	0	D
04/17/00	1515		0			0		0		9.3	0	0.22	-0.19	BF
04/24/00	1106	0	0.51	-0.51	0	0.15	0	0.88	-0.53	-0.15	0	0	0	D
05/03/00	1130	0	0.48	-0.48	0	0.13	0	0.78	-0.53	-0.15	0	0	0	D
05/08/00	1021	0	0.46	-0.46	0	0.12	0	0.71	-0.53	-0.15	0	0	0	D
05/15/00	1000		0.57			0.20		1.11	-0.53	-0.15	0.04	0.05	-0.04	BF
05/22/00	1142	0	0.48	-0.48	0	0.15	0	0.78	-0.53	-0.15	0	0	0	D
05/29/00	956	0	0.46	-0.46	0	0.14	0	0.71	-0.53	-0.15	0	0	0	D
06/13/00	1337	0	0.53	-0.53	0	0.12	0	0.95	-0.53	-0.12	0	0	0	D
06/20/00	910	0	0.51	-0.51	0	0.12	0	0.88	-0.53	-0.12	0	0	0	D
06/27/00	1444		0.58			0.12		1.14	-0.6		0	0.12	-0.09	BF
07/05/00	1628	0	0.58	-0.58	0 err		0	1.16	-0.6		0	0	0	BF
07/18/00	1011	0	0.53	-0.53	0 err		0	0.95	-0.6		0	0	0	D
07/31/00	1113		0.19	-0.19		0.39	-0.39	-0.51			0.19	0.39	-0.51	BF
07/31/00	1120	inserted Rows												
08/07/00	1140	0	0	0	0	0.01	-0.01	-0.01		-0.01	0	0	0	D
08/15/00	1150	0	0	0	0 err		0	0			0	0	0	D
08/21/00	1603	0	0	0	0 err		0	0			0	0	0	D
09/05/00	1439		0.03			0.09		-0.07		-0.02	0.03	0.07	-0.06	BF
09/18/00	1936	0.02	0.04	-0.02	0.10	0.12	-0.02	-0.09		-0.02	0.04	0.10	-0.08	BF
09/19/00	1326	0.02	0	0.02	0.02	0.02	0.00	-0.02			0	0	0	BF
09/20/00	957	0	0	0	0	0.01	-0.01	-0.01		-0.01	0	0	0	D
09/25/00	1046		0.01	-0.01		0.01	-0.01	-0.01	-0.01	-0.1	0	0	0	D
10/03/00	1433	0.02	0.01	0.01	0.03 err		0.03	-0.01		0.03	0.01	0.03	-0.02	BF
10/04/00	932	0.03	0.03	0.00	0.02 err		0.02	-0.02		0.03	0.03	0.03	-0.02	BF
10/05/00	1139	0	0	0	0 err		0	0			0	0	0	D
10/23/00	1057	0	0	0	0 err		0	0			0	0	0	D
11/02/00	1038	0	0	0	0 err		0	0			0	0	0	D
12/11/00	1544	0	0	0	0 err		0	0			0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

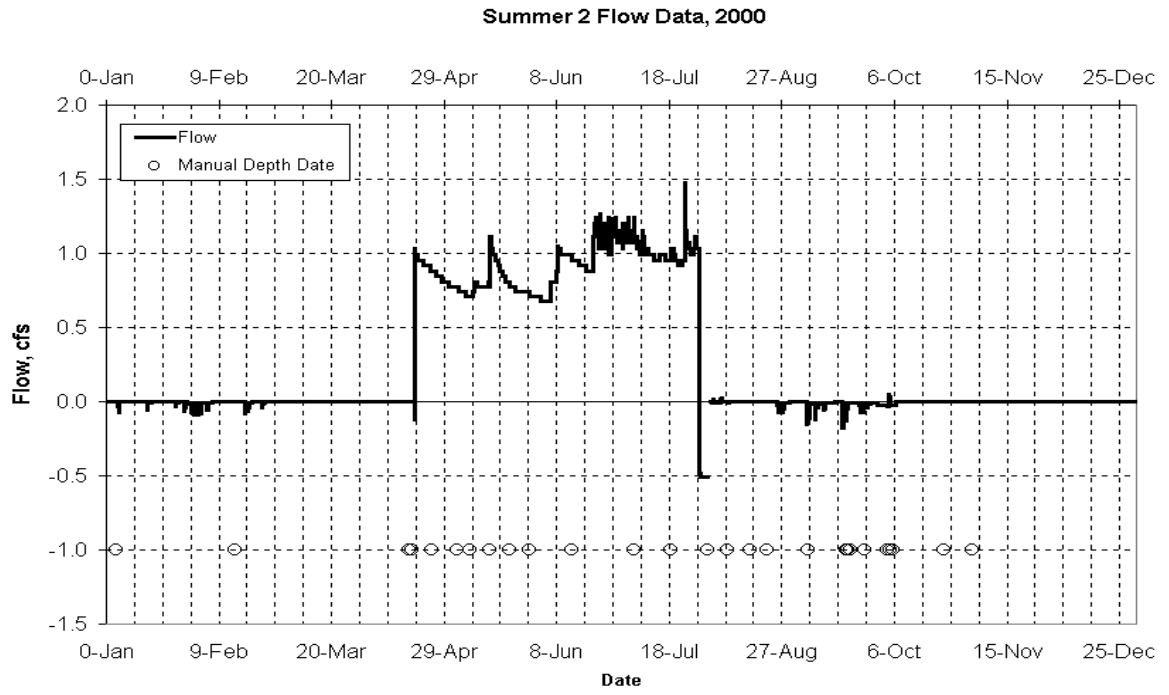


Figure 2c. Comparison of unadjusted flow record and dates of manual stage measurements for *summer* pasture 2 the flume during the year 2000.

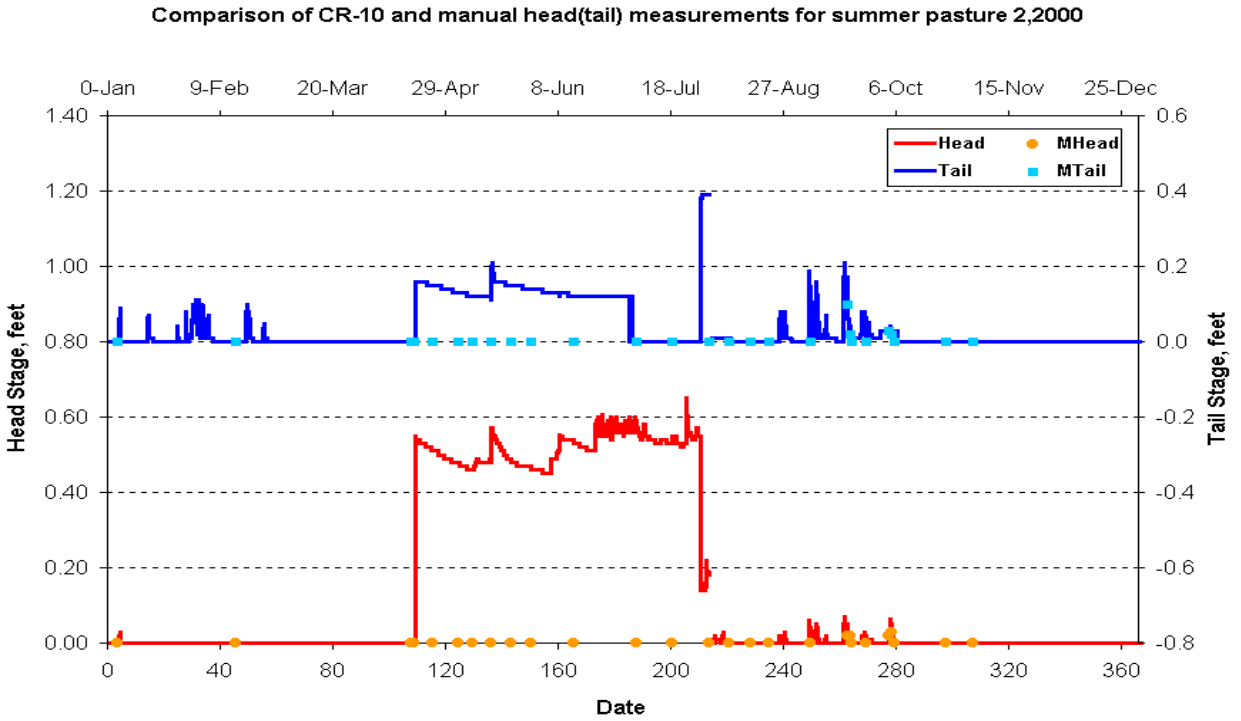


Figure 2d. Unadjusted flume upstream and downstream stage data for *summer* pasture 2 based on comparison between sensor values and manual stage measurements during the year 2000.

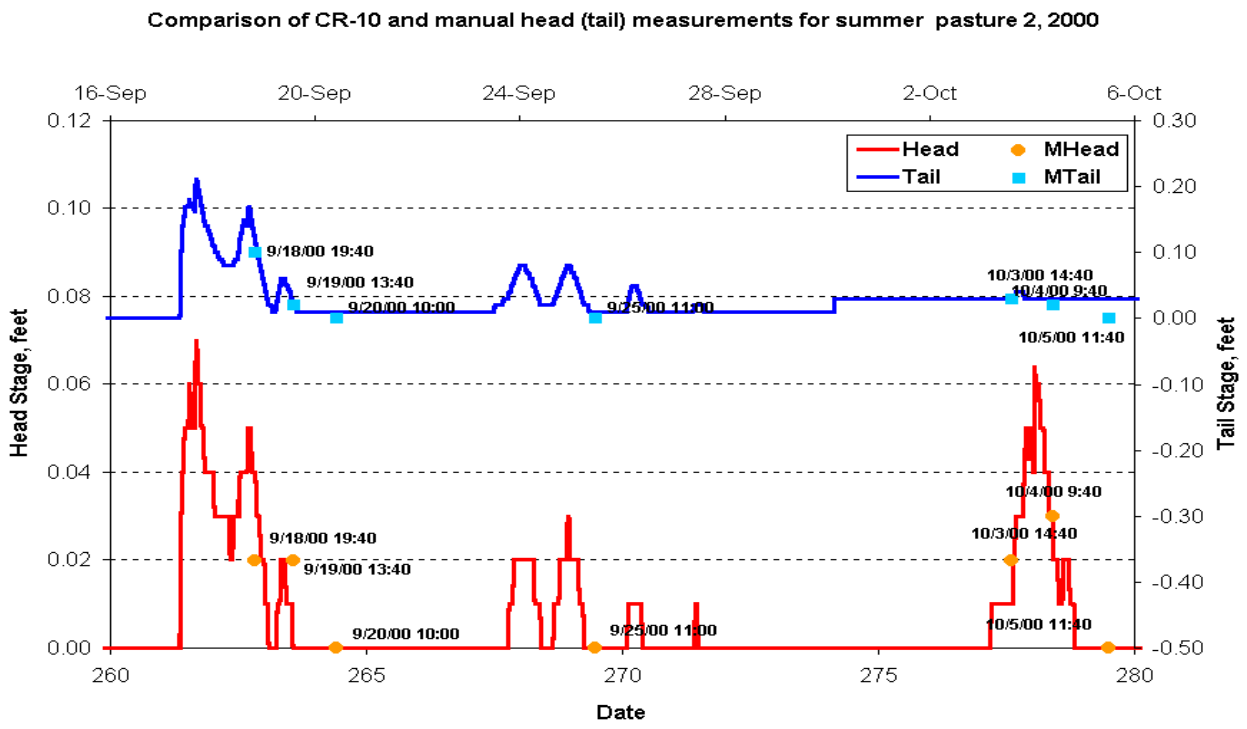


Figure 2e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *summer* 2 pasture during the peak flow period (9/16/00-10/6/00) for the year 2000.

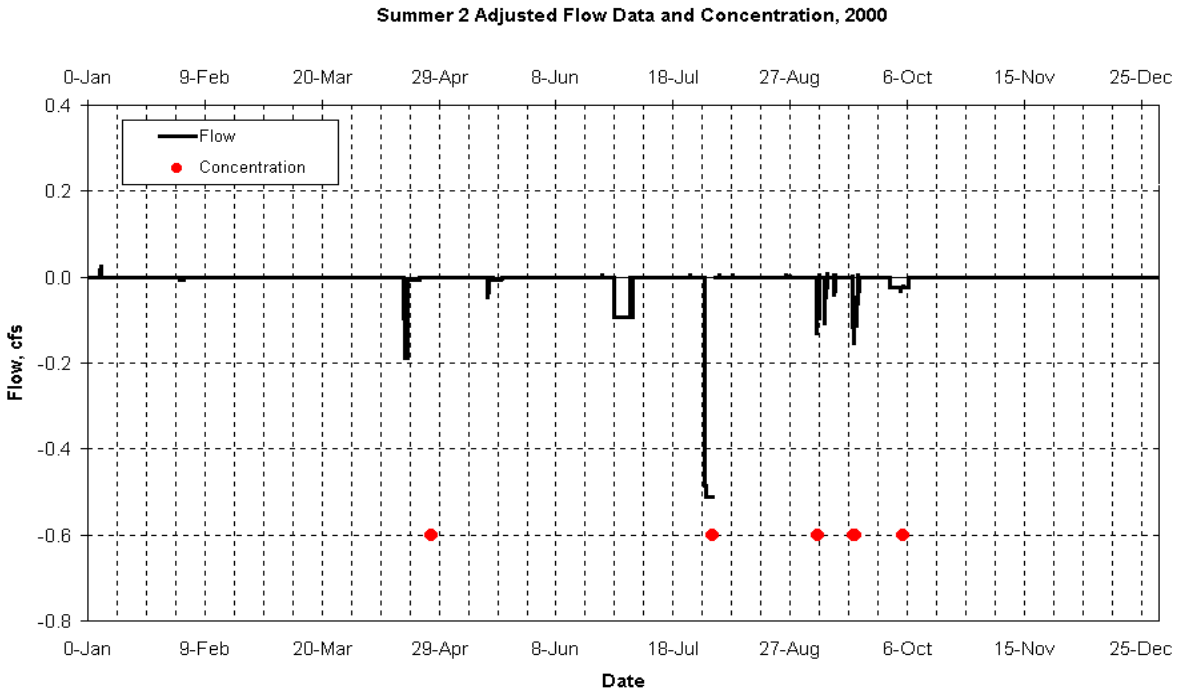


Figure 2f. Flow magnitudes and water quality sample collection dates for *summer* pasture 2 for the year 2000.

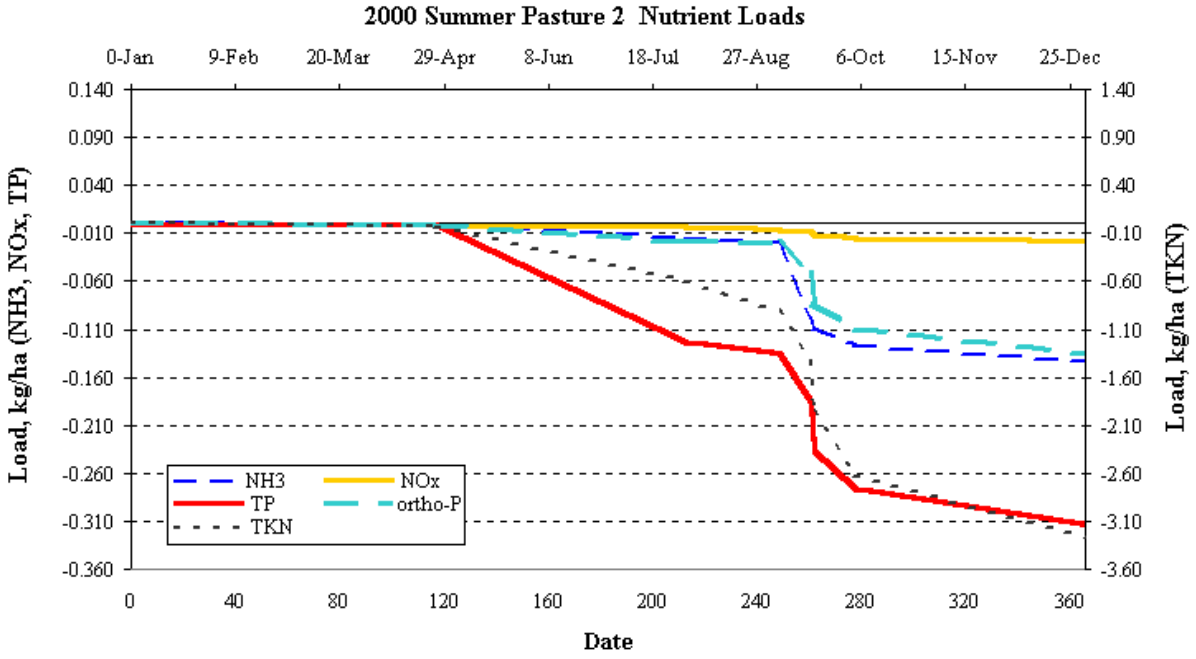


Figure 2g. Nutrient load in kg/ha of elemental N and P as calculated using ISCO and grab samples at summer pasture 2 in the year 2000.

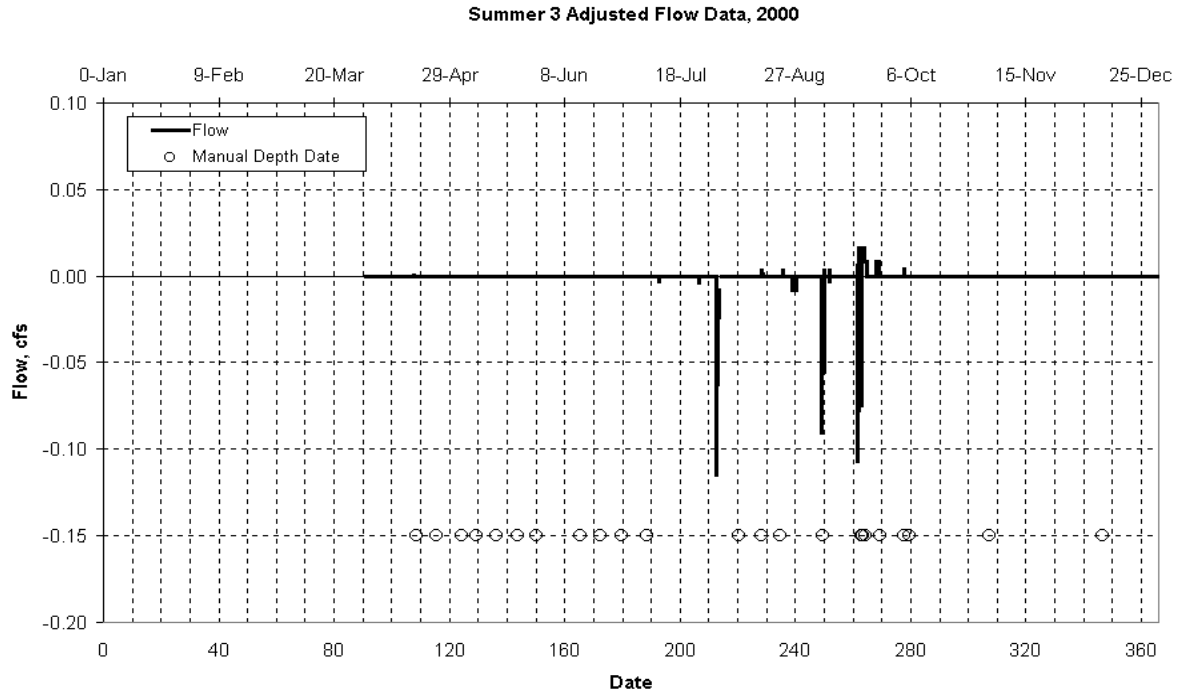


Figure 3a. Flow record for flume at *summer* pasture 3 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

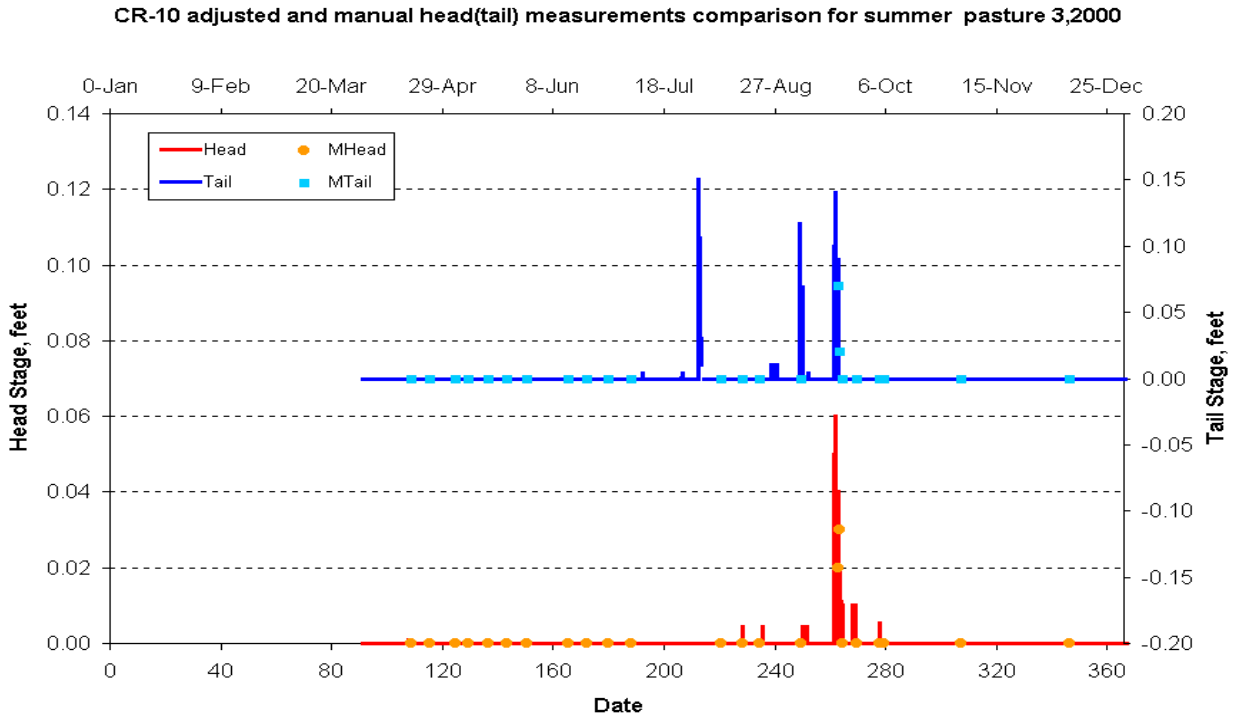


Figure 3b. Flume upstream and downstream stage data for *summer* pasture 3 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 3. Summary of comparisons and adjustment of *summer* pasture 3 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow
		Man.	CR10	Diff	Man.	CR10	Diff	CR10	Up Error	Dn Error		CR10		Cond.
		feet	feet	feet	feet	feet	feet	cfs			feet	feet	cfs	
01/03/00	1002	NO DATA WAS RECORDED FROM DATA LOGER												
02/14/00	1135													
04/17/00	1538	0	0	0	0	0.02	-0.02	-0.02	-0.05	-0.05	0	0	0	D
04/24/00	1111	0	0	0	0	0	0	0			0	0	0	D
05/03/00	1201	0	0	0	0	0	0	0			0	0	0	D
05/08/00	1025	0	0	0	0	0	0	0			0	0	0	D
05/15/00	1003	0	0	0	0	0	0	0			0	0	0	D
05/22/00	1157	0	0	0	0	0	0	0			0	0	0	D
05/29/00	959	0	0	0	0	0	0	0			0	0	0	D
06/13/00	1339	0	0	0	0	0	0	0			0	0	0	D
06/20/00	913	0	0	0	0	0	0	0			0	0	0	D
06/27/00	1551	0	0	0	0	0.13	0	-0.10		-0.20	0	0	0	D
07/06/00	916	0	err	0	0	0.12	-0.12	-0.09		-0.12	0	0	0	D
07/18/00	1025	0	err	0	0	0	0	0			0	0	0	D
07/31/00	1120	0	err	0	0	0.15	0	0		-0.12	0	0.03	-0.02	BF
08/07/00	1144	0	0	0	0	0	0	0			0	0	0	D
08/15/00	1216	0	0	0	0	0	0	0			0	0	0	D
08/21/00	1607	0	0	0	0	0	0	0			0	0	0	D
09/05/00	1443		0.01			0.01		0.01	-0.10		0	0.01	-0.01	BF
09/18/00	1939	0.02	0.03	-0.02	0.07	0.05	0.02	-0.04			0.03	0.05	-0.04	BF
09/19/00	1329	0.03	0.02	0.02	0.02	0	0.02	0			0.02	0	0.02	FF
09/20/00	1004	0	0.01	0	0	0	0	0			0	0	0	D
09/25/00	1051	0	0	0	0	0	0	0			0	0	0	D
10/03/00	1444	0	0.01	0	0	0	0	0	-0.10		0	0	0	D
10/05/00	1143	0	0	0	0	0	0	0			0	0	0	D
10/23/00	1103	0	0	0	0	0	0	0			0	0	0	D
11/02/00	1049	0	0	0	0	0	0	0			0	0	0	D
12/11/00	1552	0	0	0	0	0	0	0			0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

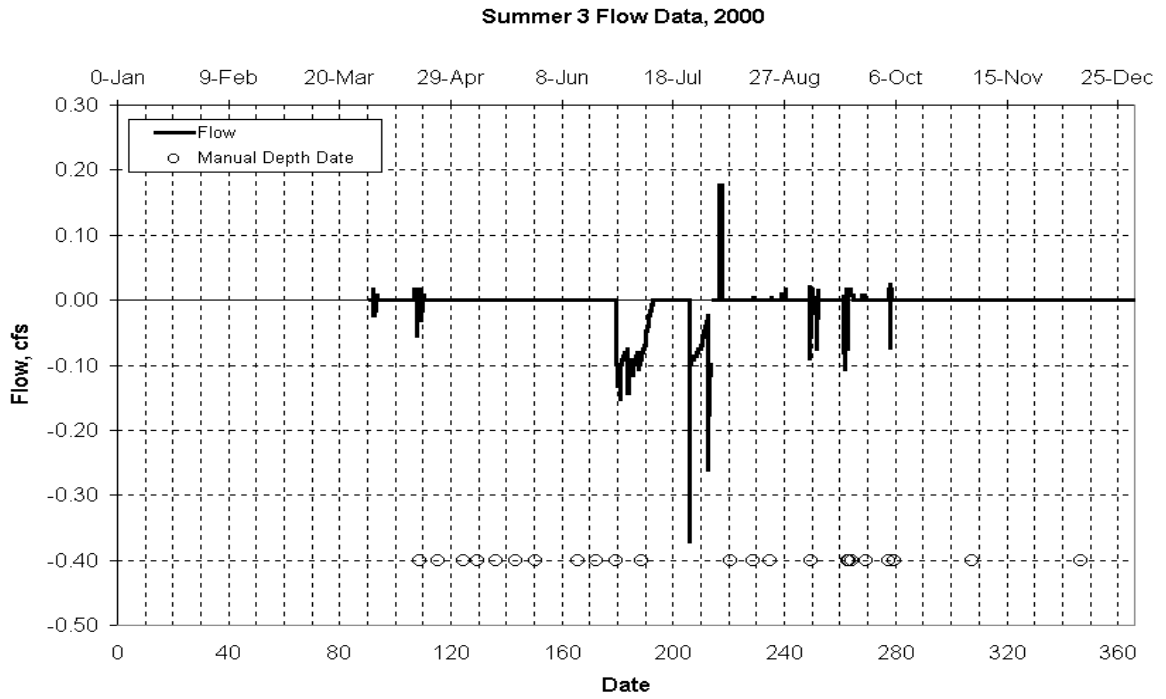


Figure 3c. Comparison of unadjusted flow record and dates of manual stage measurements for *summer* pasture 3 the flume during the year 2000.

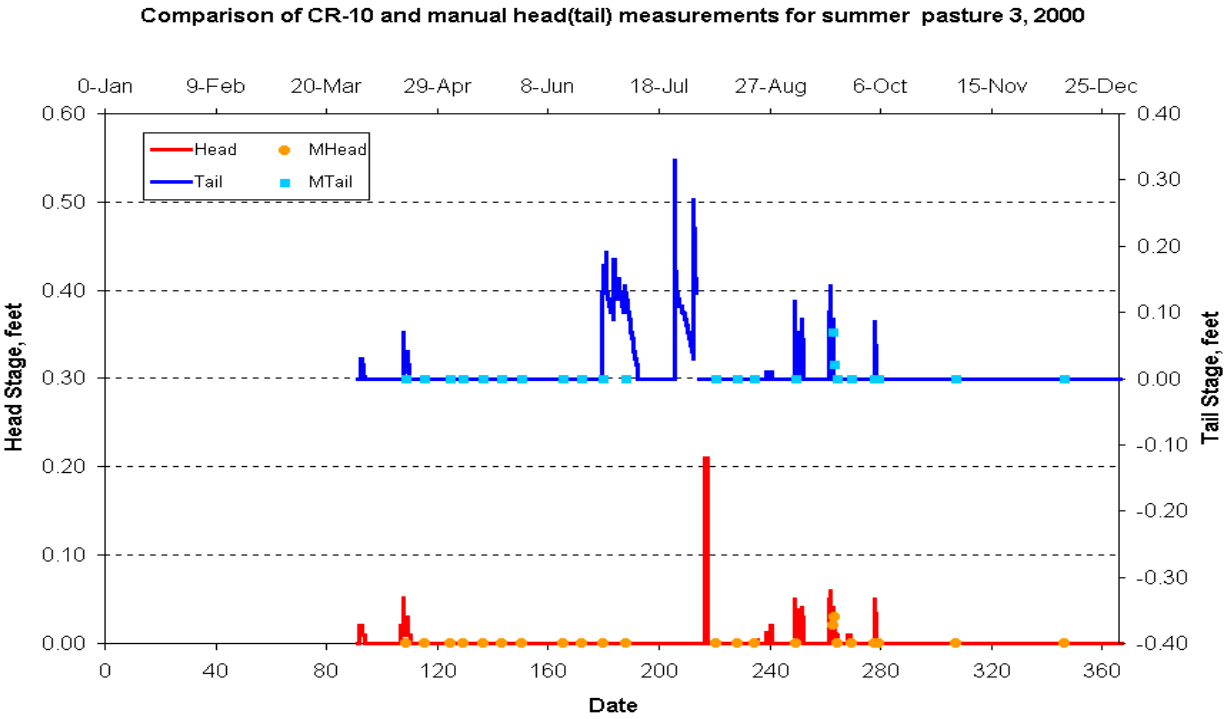


Figure 3d. Unadjusted flume upstream and downstream stage data for *summer* pasture 3 based on comparison between sensor values and manual stage measurements during the year 2000.

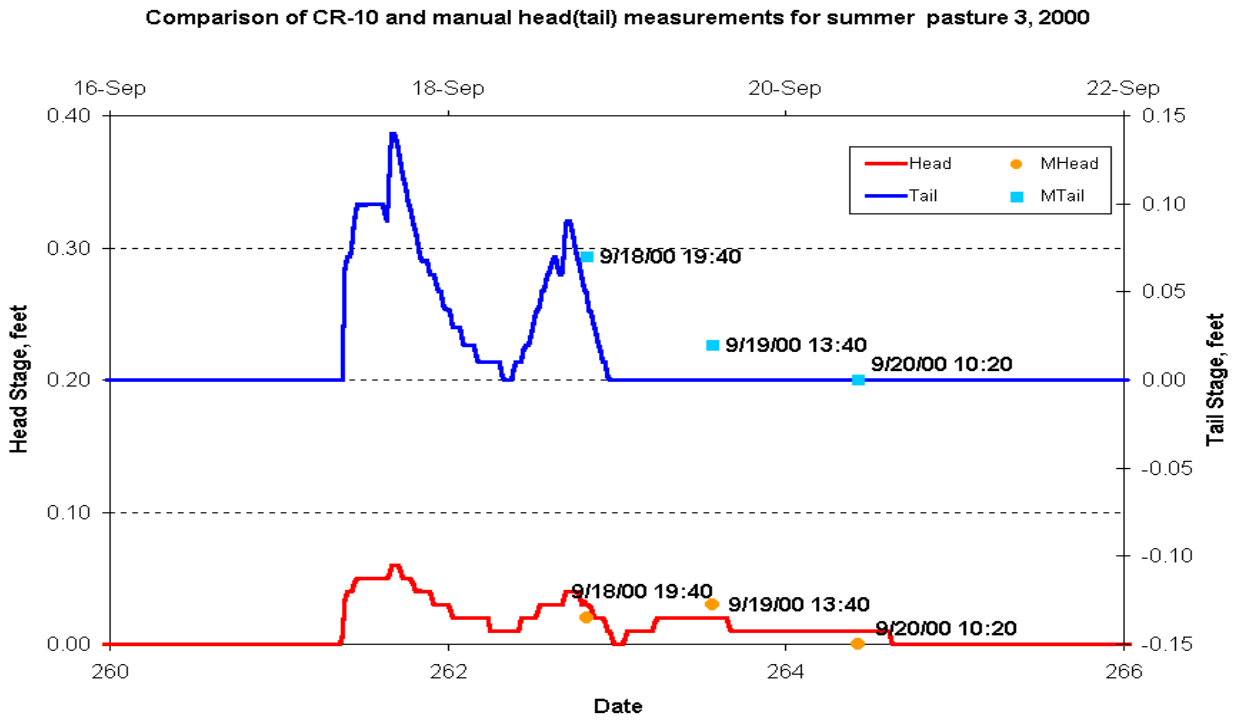


Figure 3e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *summer* 3 pasture during the peak flow period (9/16/00-10/22/00) for the year 2000.

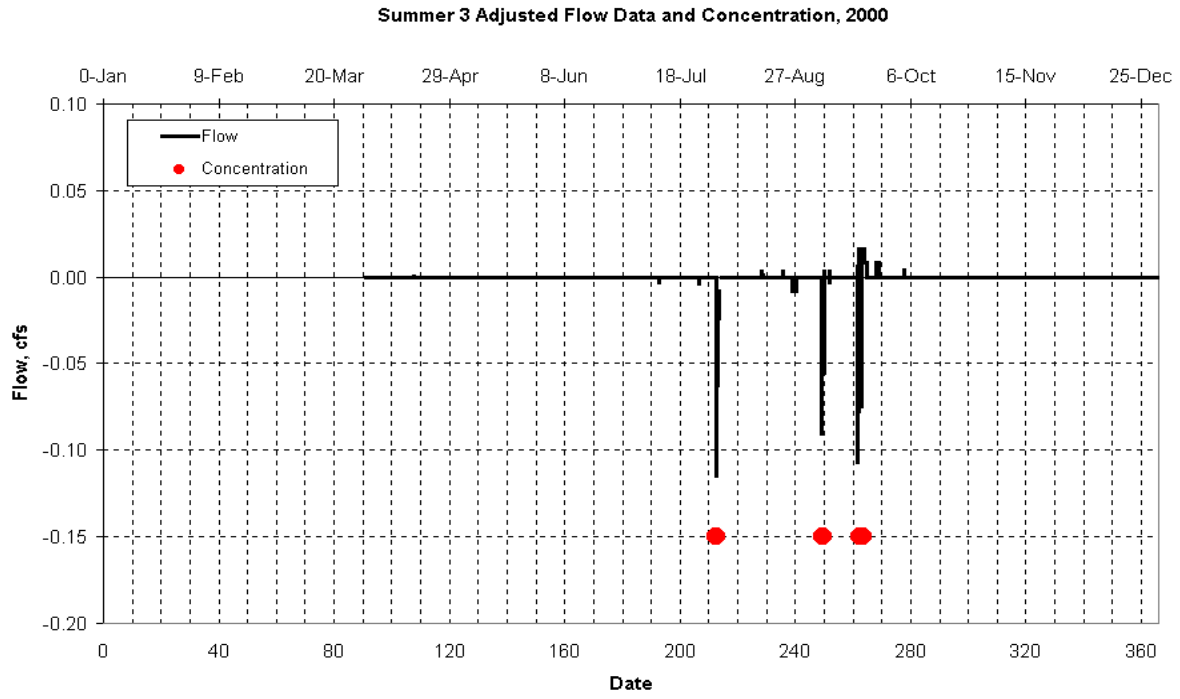


Figure 3f. Flow magnitudes and water quality sample collection dates for *summer* pasture 3 for the year 2000.

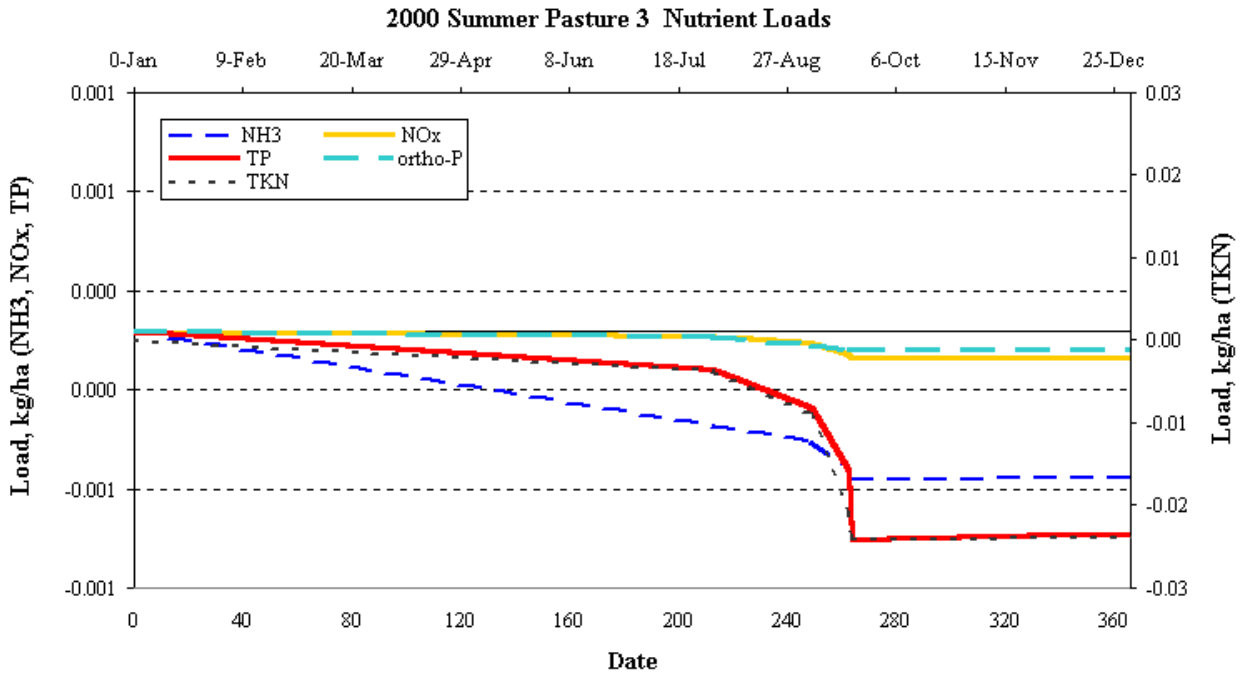


Figure 3g. Nutrient load in kg/ha of elemental N and P as calculated using ISCO and grab samples at summer pasture 3 in the year 2000.

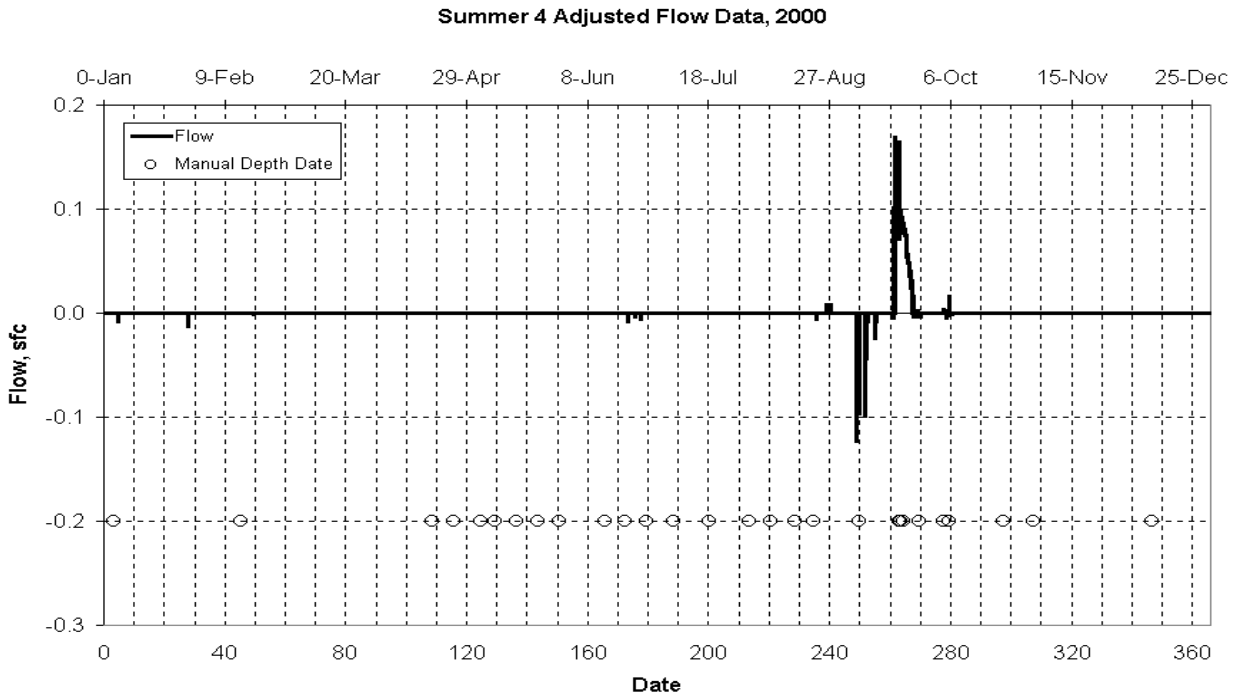


Figure 4a. Flow record for flume at *summer* pasture 4 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

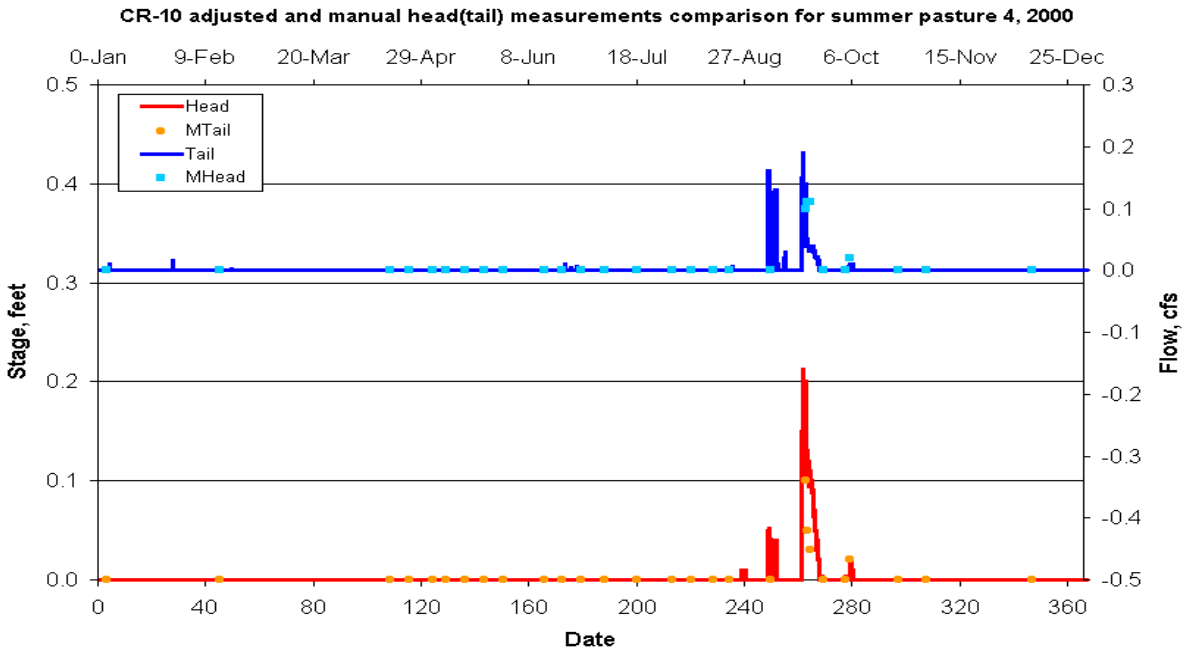


Figure 4b. Flume upstream and downstream stage data for *summer* pasture 4 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 4. Summary of comparisons and adjustment of *summer* pasture 4 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow CR10	Adjustments		Head	Tail	Flow	Flow Cond.
		Man. feet	CR10 feet	Diff feet	Man. feet	CR10 feet	Diff feet	cfs	Up Error	Dn Error	feet	CR10 feet	cfs	
01/03/00	1012	0	err		0	0		0			0	0	0	D
02/14/00	1141	0	err		0	0		0			0	0	0	D
04/17/00	1545	0	err		0	err		0			0	0	0	D
04/24/00	1118	0	0.89	-0.89	0	err		2.99	-0.89		0	0	0	D
05/03/00	1230	0	0.86	-0.86	0	err		2.77	-0.89		0	0	0	D
05/08/00	1029	0	0.85	-0.85	0	err		2.69	-0.89		0	0	0	D
05/15/00	1008	0	0.84	-0.84	0	err		2.66	-0.89		0	0	0	D
05/22/00	1206	0	0.82	-0.82	0	err		2.48	-0.89		0	0	0	D
05/29/00	1002	0	0.81	-0.81	0	err		2.42	-0.89		0	0	0	D
06/13/00	1403	0	0.04	-0.04	0	0.19	0	-0.15	-0.89	-0.22	0	0	0	D
06/20/00	917	0	0.20	-0.20	0	0.22	0	-0.17	-0.89	-0.22	0	0	0	D
06/27/00	1554	0	0.32	-0.32	0	err		0.35	-0.89		0	0	0	D
07/06/00	945	0	0.31	-0.31	0	err		0.32	-0.89		0	0	0	D
07/18/00	1032	0	0.29	-0.29	0	err		0.29	-0.89		0	0	0	D
07/31/00	1140	inserted Rows												D
08/07/00	1151	0	0	0	0	err		0			0	0	0	D
08/15/00	1225	0	0	0	0	0	0	0			0	0	0	D
08/21/00	1616	0	0	0	0	0	0	0			0	0	0	D
09/05/00	1447		0.01			0.05		-0.04			0.01	0.02	-0.04	BF
09/18/00	1943	0.10	0.10	0	0.10	0.10	0	0.01	0.1		0.20	0.10	0.16	FF
09/19/00	1337	0.11	0.12	-0.01	0.05	0.04	0.01	0.09			0.12	0.04	0.09	FF
09/20/00	1011	0.11	0.11	0	0.03	0.04	-0.01	0.09			0.11	0.04	0.09	FF
09/25/00	1055	0	0	0	0	0	0	0.00			0	0	0	D
10/03/00	1453	0	0	0	0	0.02	-0.02	-0.02		-0.02	0	0.02	-0.02	D
10/05/00	1152	0.02	0.01	0.01	0.02	0.01	0.01	0.00	0.01		0.02	0.01	0.02	FF
10/23/00	1116	0	0	0	0	0	0	0			0	0	0	D
11/02/00	1059	0	0	0	0	0	0	0			0	0	0	D
12/11/00	1600	0	0	0	0	0	0	0			0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

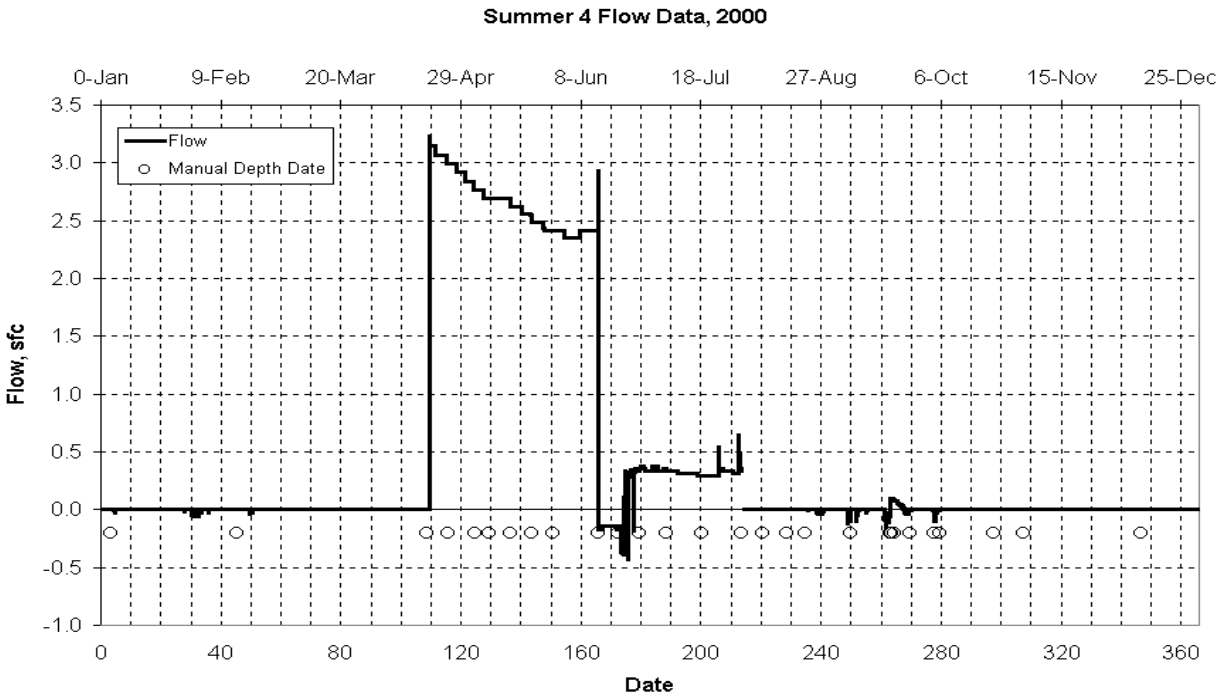


Figure 4c. Comparison of unadjusted flow record and dates of manual stage measurements for *summer* pasture 4 the flume during the year 2000.

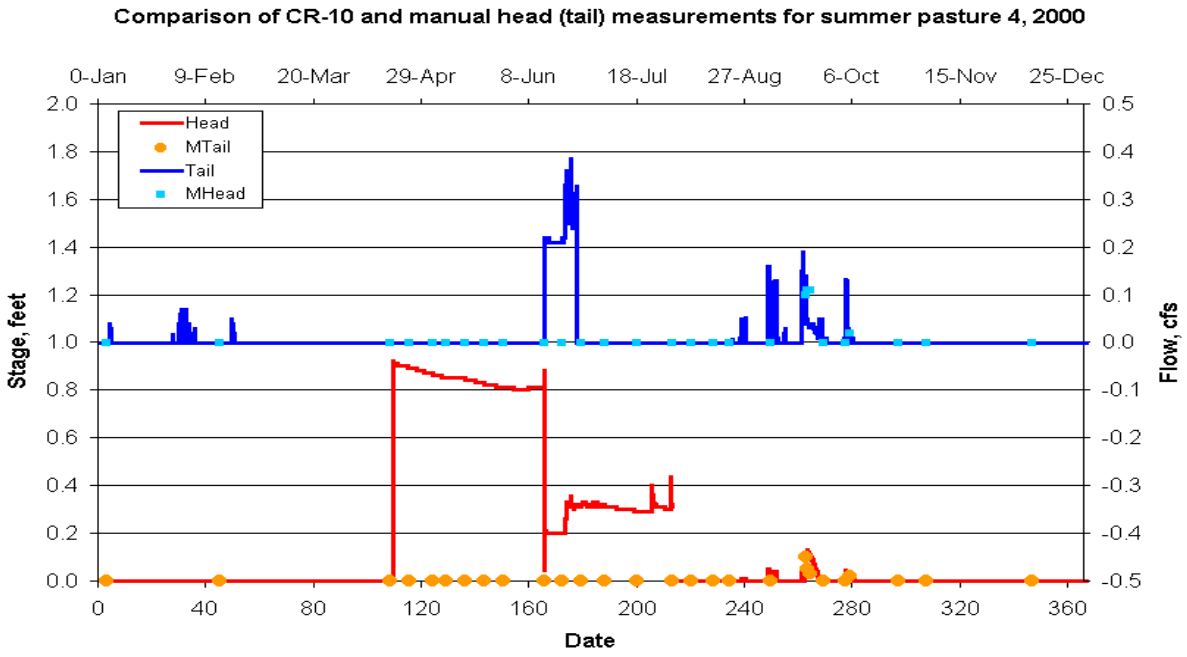


Figure 4d. Unadjusted flume upstream and downstream stage data for *summer* pasture 4 based on comparison between sensor values and manual stage measurements during the year 2000.

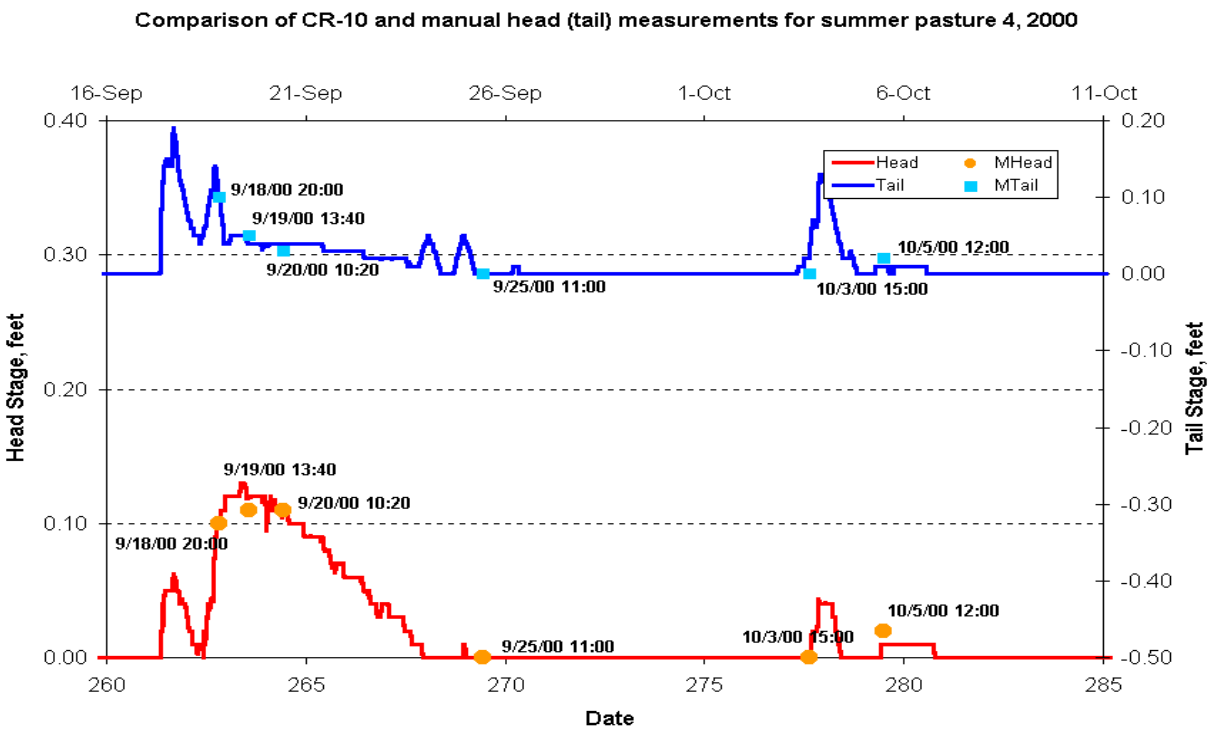


Figure 4e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *summer* 4 pasture during the peak flow period (9/16/00-10/11/00) for the year 2000.

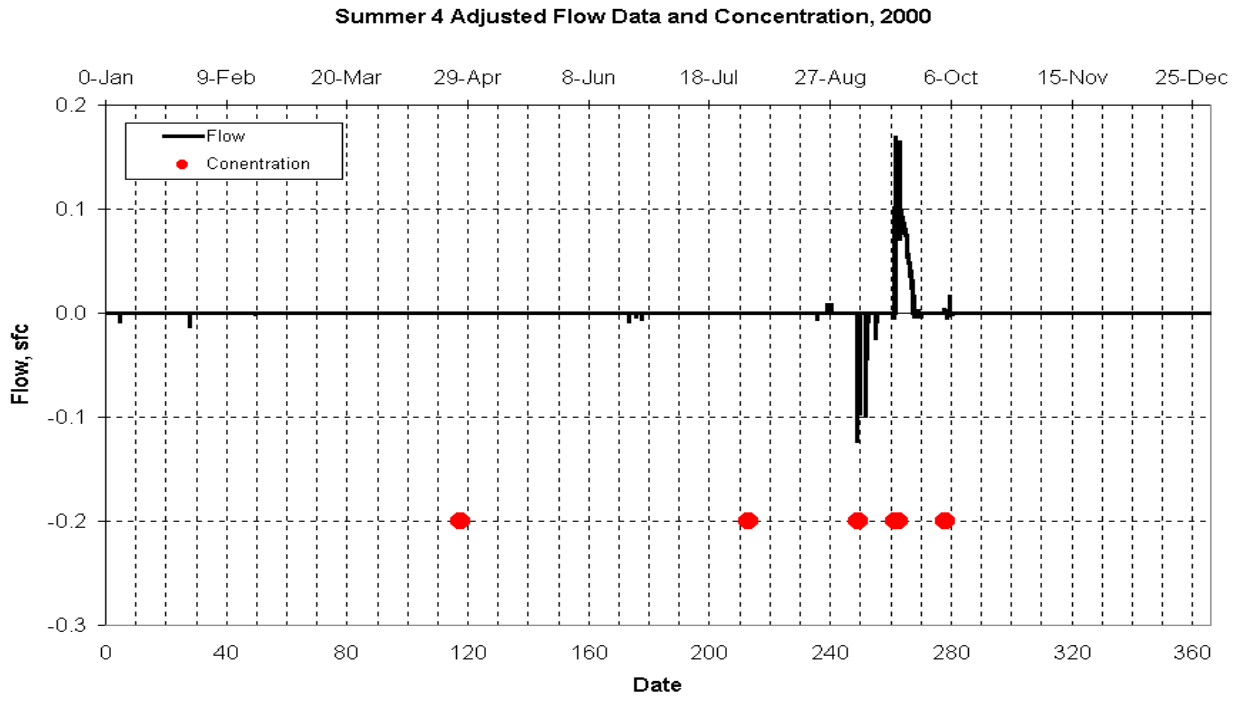


Figure 4f. Flow magnitudes and water quality sample collection dates for *summer* pasture 4 for the year 2000.

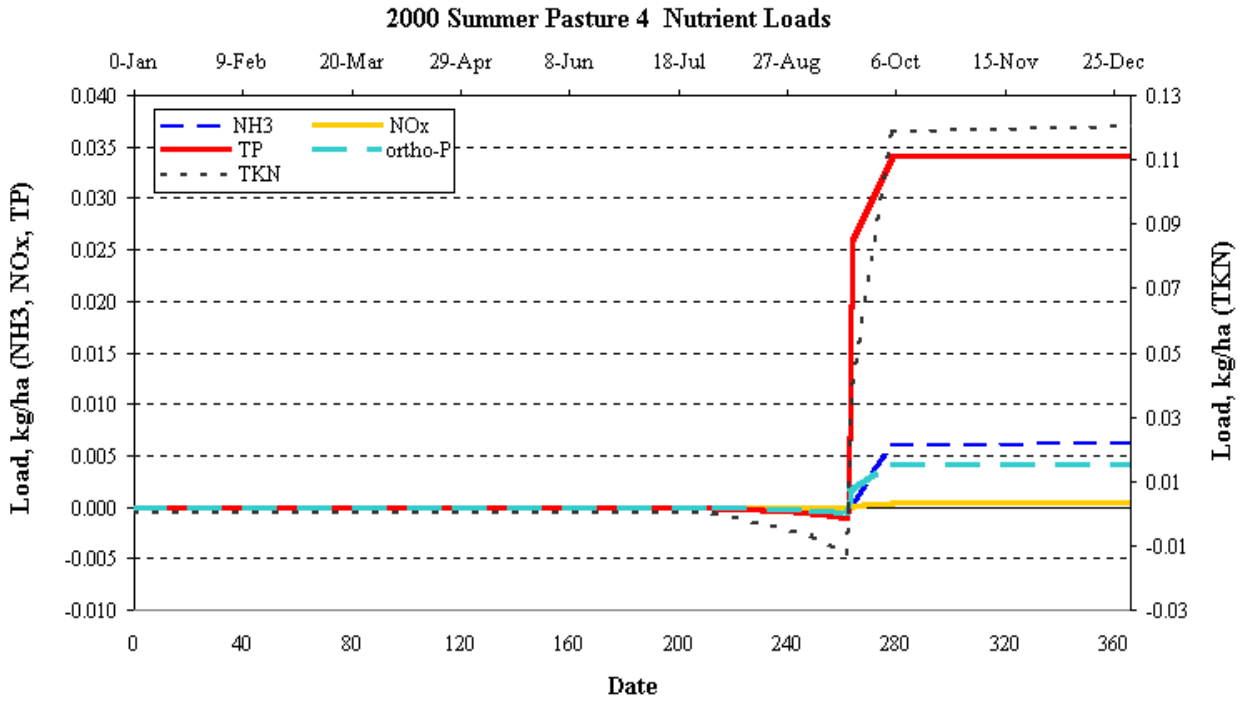


Figure 4g. Nutrient load in kg/ha of elemental N and P as calculated using ISCO and grab samples at summer pasture 4 in the year 2000.

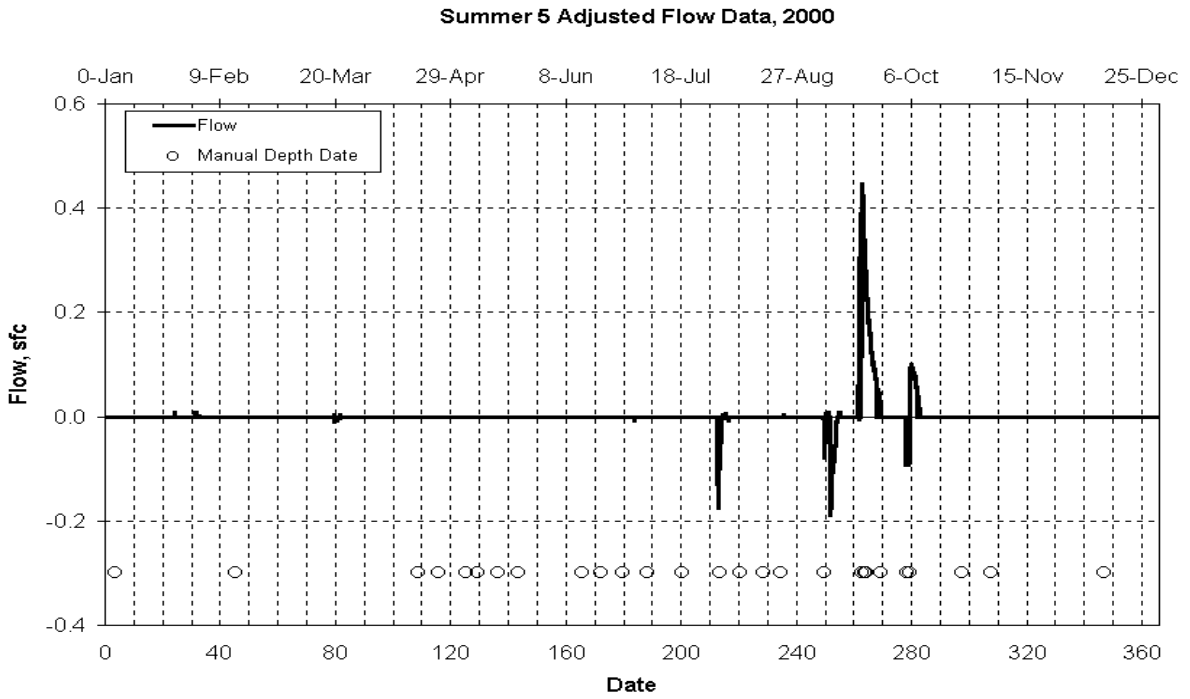


Figure 5a. Flow record for flume at *summer* pasture 5 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

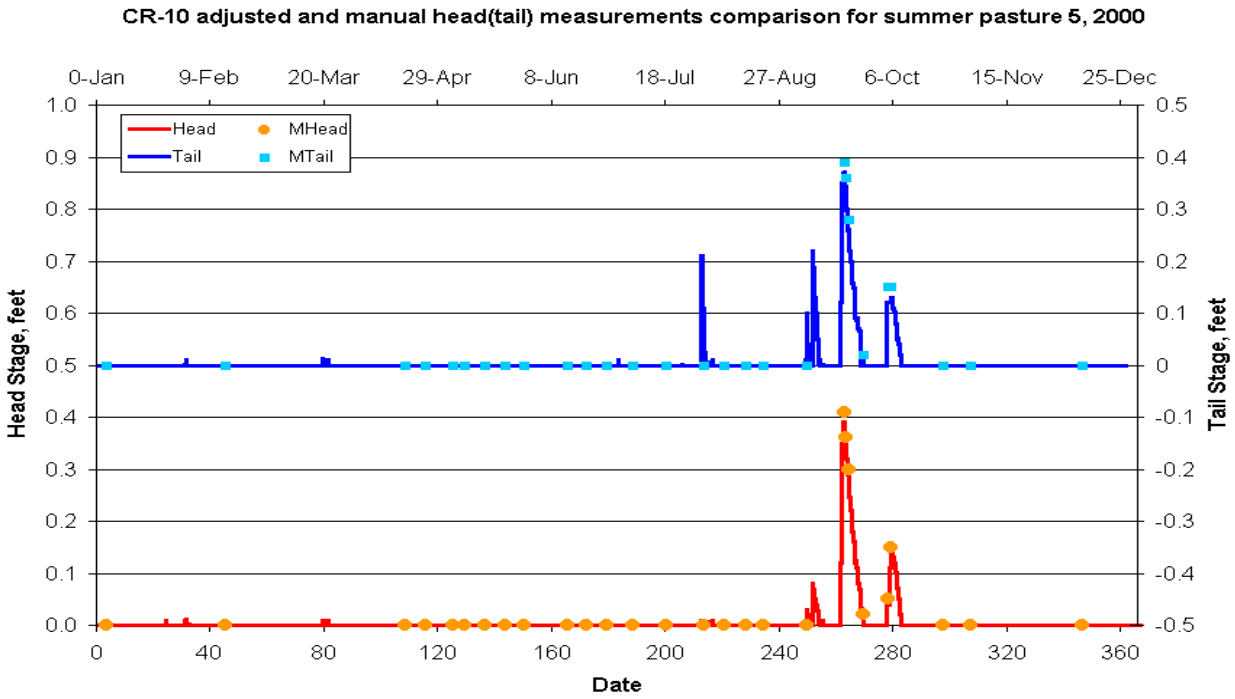


Figure 5b. Flume upstream and downstream stage data for *summer* pasture 5 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 5. Summary of comparisons and adjustment of *summer* pasture 5 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow Cond.
		Man. feet	CR10 feet	Diff feet	Man. feet	CR10 feet	Diff feet	CR10 cfs	Up Error	Dn Error	feet	CR10 feet	cfs	
01/03/00	1023	0	0	0	0	0	0	0			0	0	0	D
02/14/00	1147	0	0	0	0	0	0	0			0	0	0	D
04/17/00	1551	0	0	0	0	0	0	0			0	0	0	D
04/24/00	1127	0	0	0	0	0	0	0			0	0	0	D
05/04/00	926	0	0	0	0	0	0	0			0	0	0	D
05/08/00	1033	0	0	0	0	0	0	0			0	0	0	D
05/15/00	1015	0	0	0	0	0	0	0			0	0	0	D
05/22/00	1216	0	0	0	0	0	0	0			0	0	0	D
05/29/00	1006	0	0	0	0	0	0	0			0	0	0	D
06/13/00	1413	0	0	0	0	0	0	0			0	0	0	D
06/20/00	926	0	0	0	0	0	0	0			0	0	0	D
06/27/00	1519	0	0	0	0	0	0	0			0	0	0	D
07/06/00	1014	0	0.20	-0.20	0	0	0	0.16	-0.3		0	0	0	D
07/18/00	1051	0	0.16	-0.16	0	0	0	0.12	-0.3		0	0	0	D
07/31/00	1145		0.27	-0.27		0.09		0.26	-0.3		0	0.09	-0.07	BF
08/07/00	1156	0	0	0	0	0	0	0			0	0	0	D
08/15/00	1241	0	0	0	0	0	0	0			0	0	0	D
08/21/00	1620	0	0	0	0	0	0	0			0	0	0	D
09/05/00	1456		0.02			0.04		-0.03			0.02	0.04	-0.03	BF
09/18/00	1948	0.41	0.39	0.02	0.39	0.37	0.02	0.43			0.39	0.37	0.43	FF
09/19/00	1353	0.36	0.34	0.02	0.36	0.32	0.04	0.33			0.34	0.32	0.33	FF
09/20/00	1020	0.30	0.28	0.02	0.28	0.25	0.03	0.24			0.28	0.25	0.24	FF
09/25/00	1101	0.02	0.01	0.01	0.02	0.01	0.01	0			0.01	0.01	0	SW
10/03/00	1506	0	0	0	0	0	0	0			0	0	0	D
10/04/00	1000	0.05	0.04	0.01	0.15	0.12	0.03	-0.09			0.04	0.12	-0.09	BF
10/05/00	1204	0.15	0.14	0.01	0.15	0.13	0.02	0.09			0.14	0.13	0.09	FF
10/23/00	1124	0	0	0	0	0	0	0			0	0	0	D
11/02/00	1110	0	0	0	0	0	0	0			0	0	0	D
12/11/00	1608	0	0	0	0	0	0	0			0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

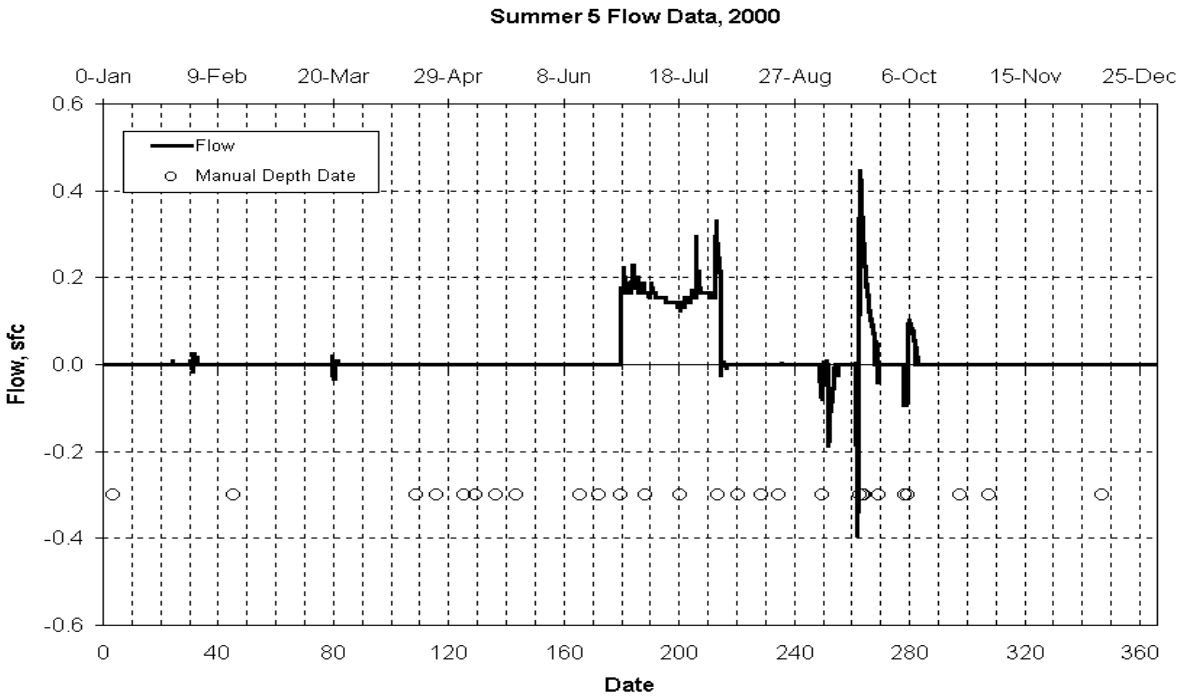


Figure 5c. Comparison of unadjusted flow record and dates of manual stage measurements for *summer* pasture 5 the flume during the year 2000.

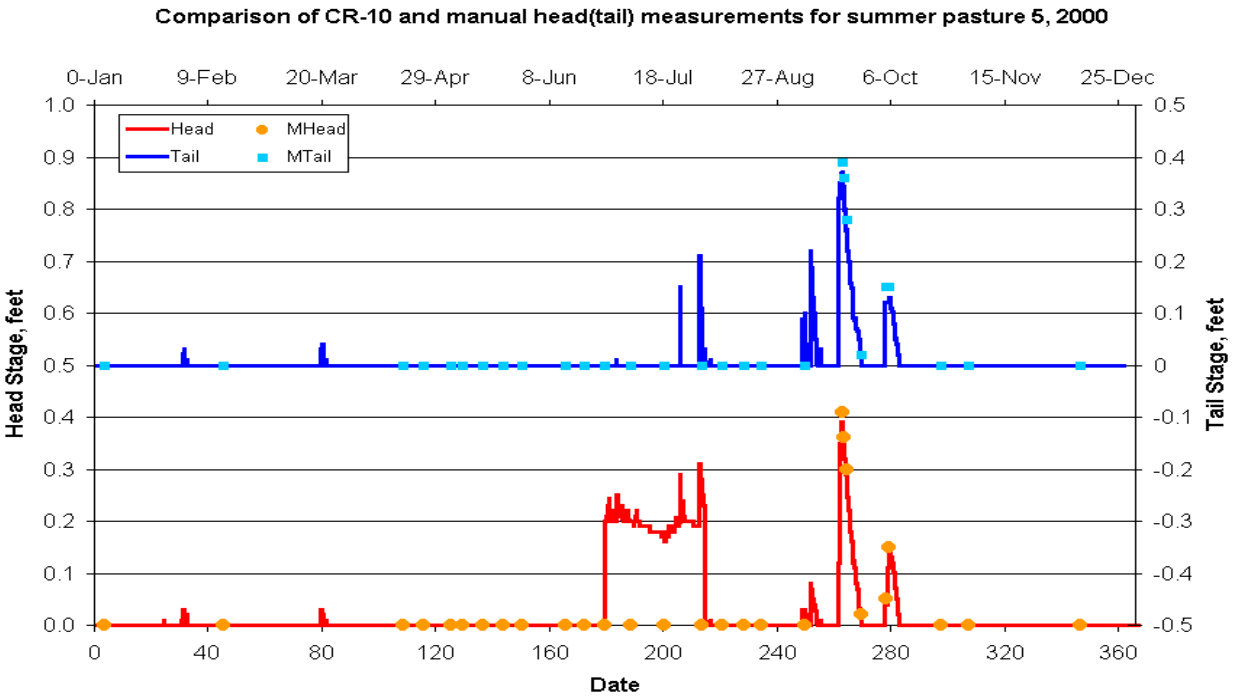


Figure 5d. Unadjusted flume upstream and downstream stage data for *summer* pasture 5 based on comparison between sensor values and manual stage measurements during the year 2000.

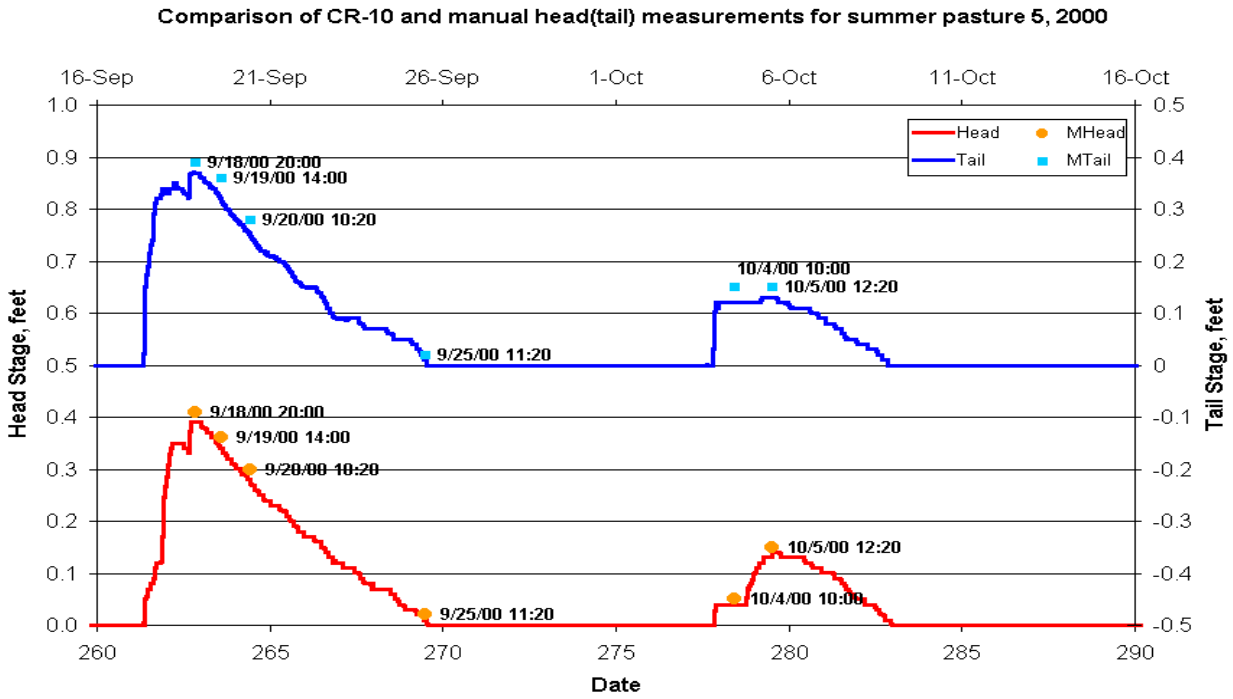


Figure 5e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *summer* 5 pasture during the peak flow period (9/16/00-10/16/00) for the year 2000.

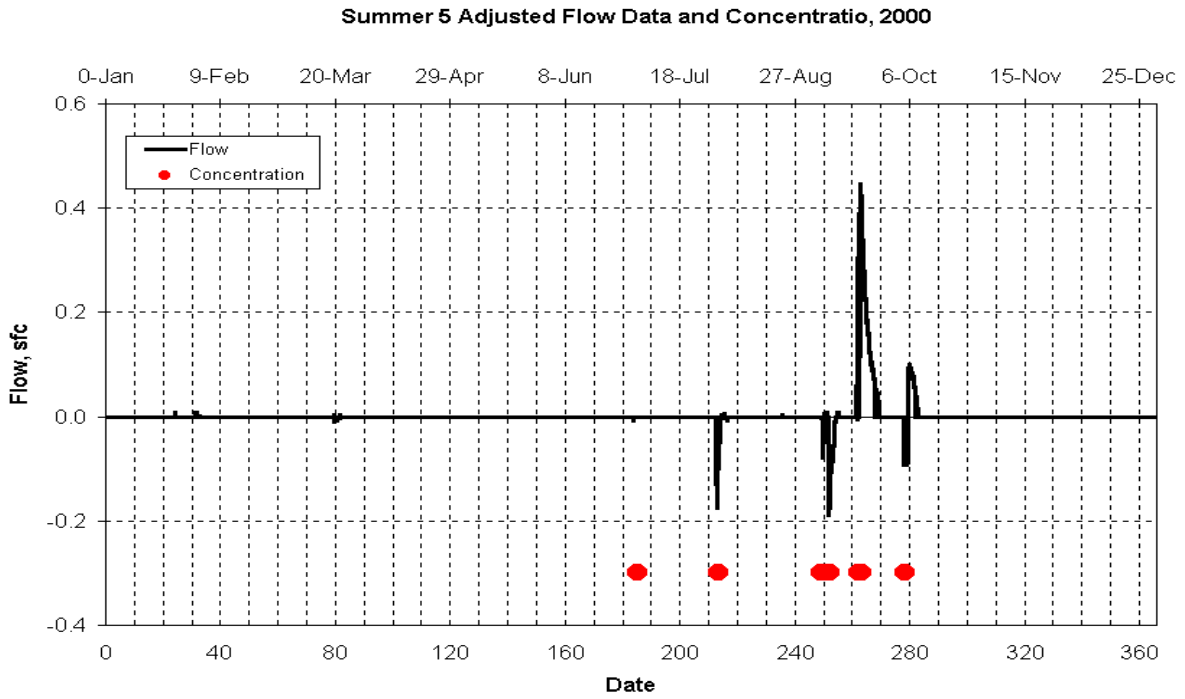


Figure 5f. Flow magnitudes and water quality sample collection dates for *summer* pasture 5 for the year 2000.

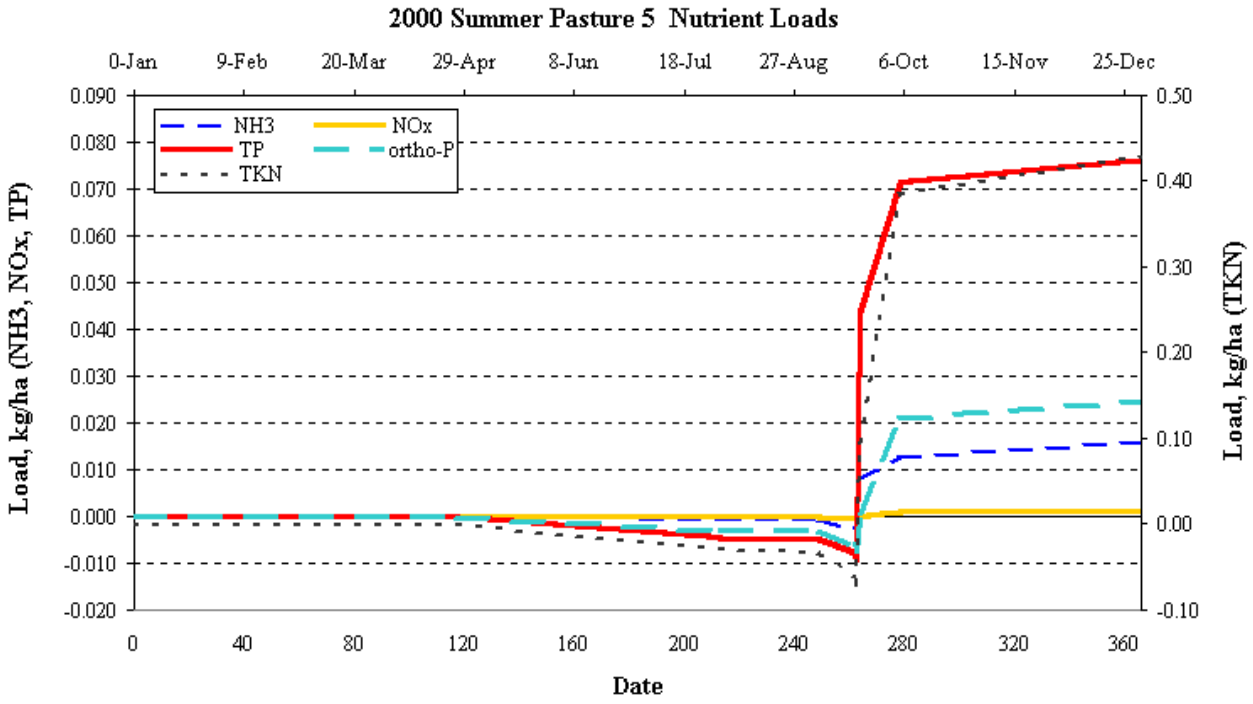


Figure 5g. Nutrient load in kg/ha of elemental N and P as calculated using ISCO and grab samples at summer pasture 5 in the year 2000.

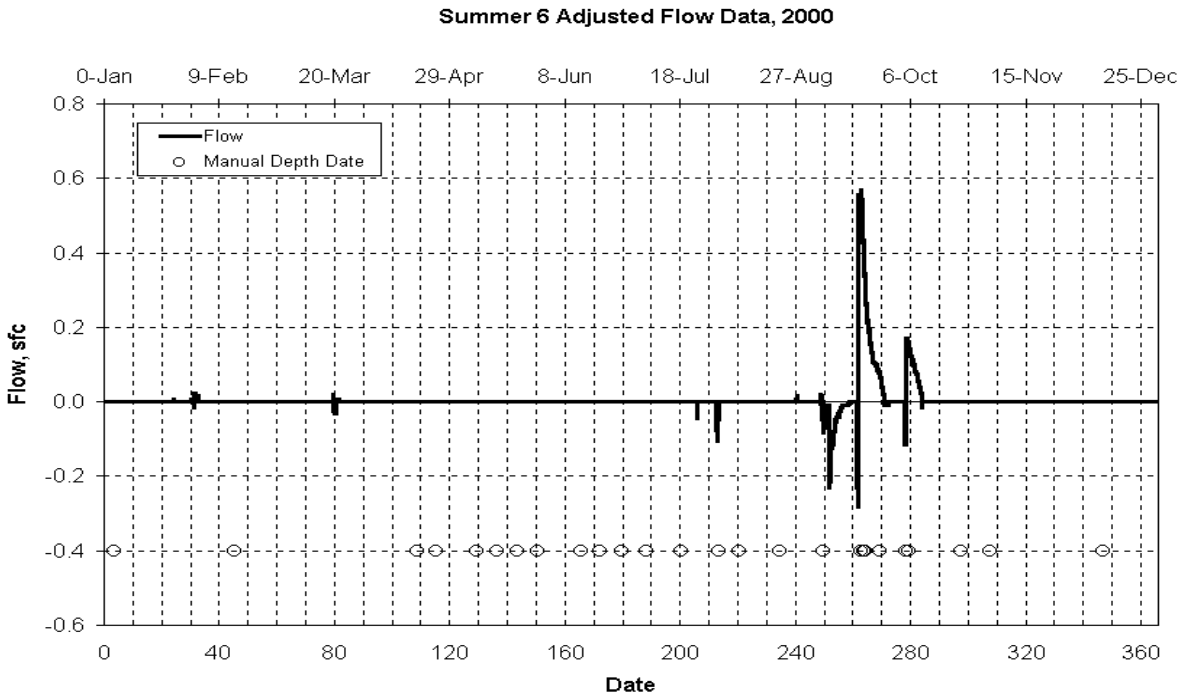


Figure 6a. Flow record for flume at *summer* pasture 6 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

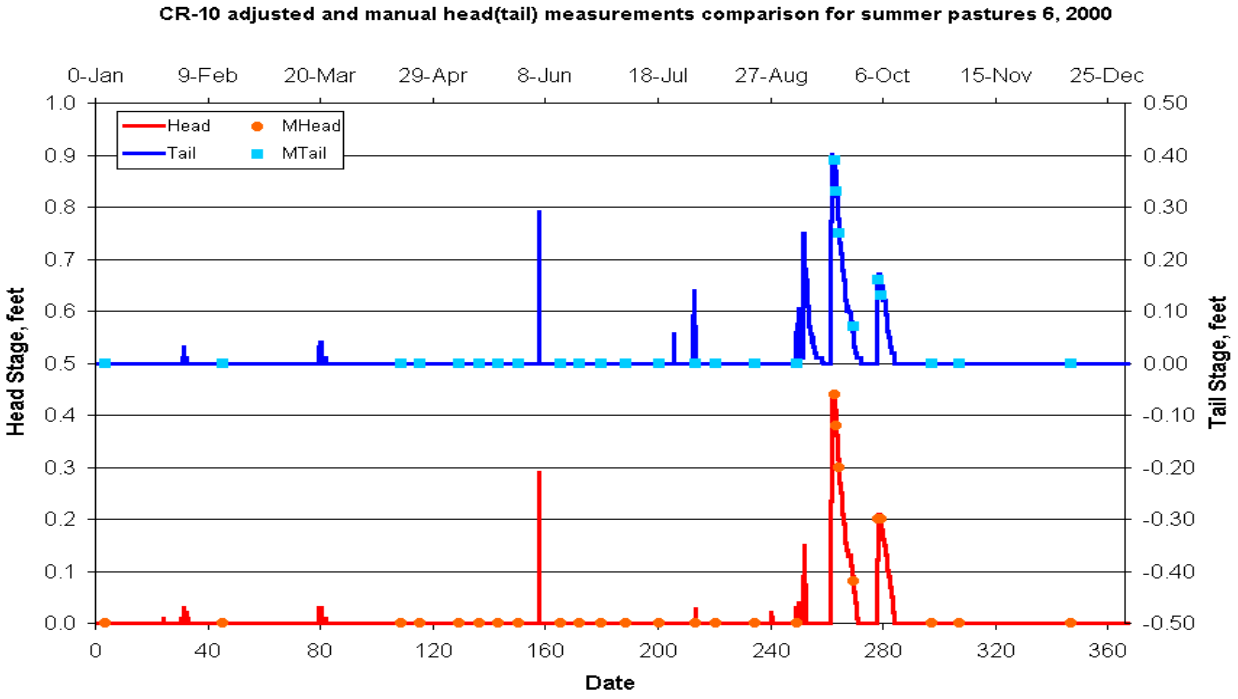


Figure 6b. Flume upstream and downstream stage data for *summer* pasture 6 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 6. Summary of comparisons and adjustment of *summer* pasture 6 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow Cond.
		Man.	CR10	Diff	Man.	CR10	Diff	CR10	Up	Dn		CR10		
		feet	feet	feet	feet	feet	feet	cfs	Error	Error	feet	feet	cfs	
01/03/00	1034	0	0	0	0	0	0	0			0	0	0	D
02/14/00	1151	0	0	0	0	0	0	0			0	0	0	D
04/17/00	1602	0	0	0	0	0	0	0			0	0	0	D
04/24/00	1136	0	0	0	0	0	0	0			0	0	0	D
05/08/00	1038	0	err	0	0	0	0	0			0	0	0	D
05/15/00	1019	0	err	0	0	0	0	0			0	0	0	D
05/22/00	1220	0	err	0	0	0	0	0			0	0	0	D
05/29/00	1009	0	0	0	0	err	0	0			0	0	0	D
06/13/00	1420	0	0.56	-0.56	0	0.30	0	1.07	-0.56	-0.3	0	0	0	D
06/20/00	931	0	0.34	-0.34	0	0.29	0	0.37	-0.56	-0.3	0	0	0	D
06/27/00	1532	0	1.52	-1.52	0	0.60	-0.60	10.37	-2	-1	0	0	0	D
07/06/00	1031	0	1.22	-1.22	0	0.53	-0.53	6.20	-2	-1	0	0	0	D
07/18/00	1105	0	0.10	-0.10	0	0	0	0.08	-0.50		0	0	0	D
07/31/00	1157		0.53		0	0.02		0.95	-0.53		0	0.02	-0.02	BF
08/07/00	1203	0	0.33	-0.33	0	0	0	0.37	-0.53		0	0	0	D
08/15/00	1215	0	0.26	0	0	0	0	0.25	-0.53		0	0	0	D
08/21/00	1624	0	0	0	0	0	0	0			0	0	0	D
09/05/00	1504		0.01			0		0.01		0.03	0.01	0.03	-0.02	BF
09/18/00	1949	0.44	0.43	0.01	0.39	0.36	0.03	0.59		0.03	0.43	0.39	0.55	FF
09/19/00	1356	0.38	0.37	0.01	0.33	0.30	0.02	0.45		0.03	0.37	0.33	0.4208	FF
09/20/00	1028	0.30	0.30	0	0.25	0.23	0.02	0.30		0.03	0.30	0.26	0.28	FF
09/25/00	1108	0.08	0.08	0	0.07	0.02	0.05	0.07		0.03	0.08	0.05	0.071	SW
10/03/00	1539	0	0	0	0	0	0	0		0.03	0	0	0	D
10/04/00	1019	0.20	0.20	0	0.16	0.14	0.02	0.16		0.03	0.2	0.17	0.1554	FF
10/05/00	1213	0.20	0.19	0.01	0.13	0.12	0.01	0.15		0.03	0.19	0.15	0.1493	FF
10/23/00	1132	0	0	0	0	0	0	0			0	0	0	D
11/02/00	1122	0	0	0	0	0	0	0			0	0	0	D
12/11/00	1619	0	0	0	0	0	0	0			0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

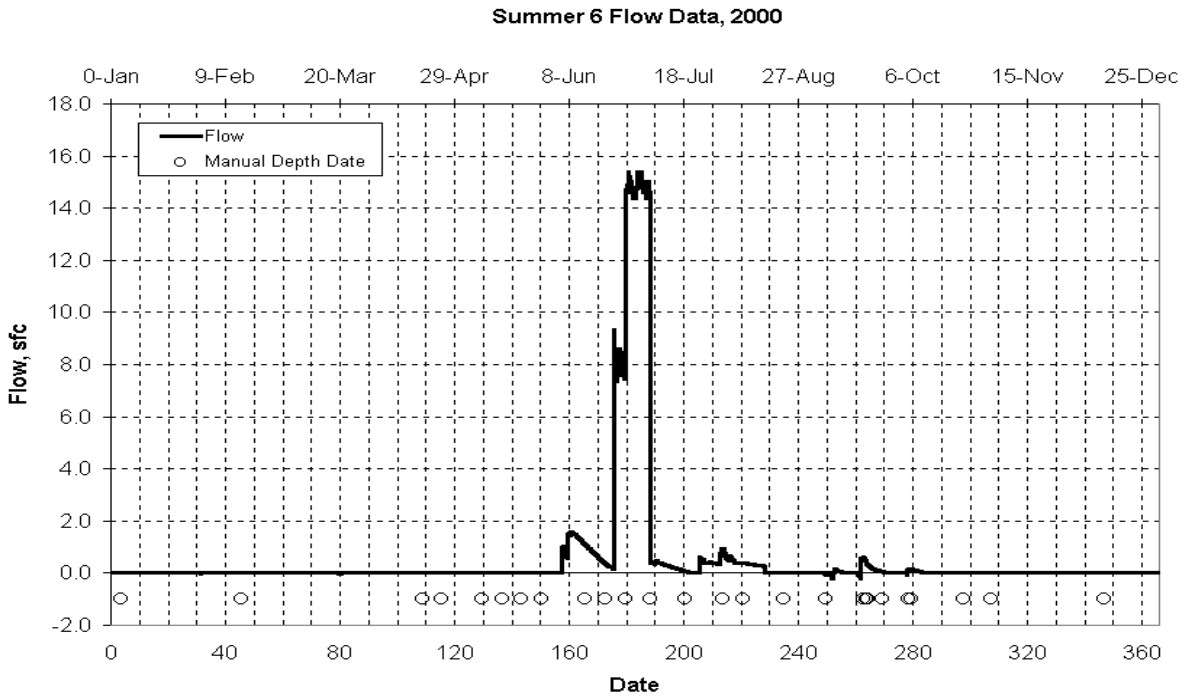


Figure 6c. Comparison of unadjusted flow record and dates of manual stage measurements for *summer* pasture 6 the flume during the year 2000.

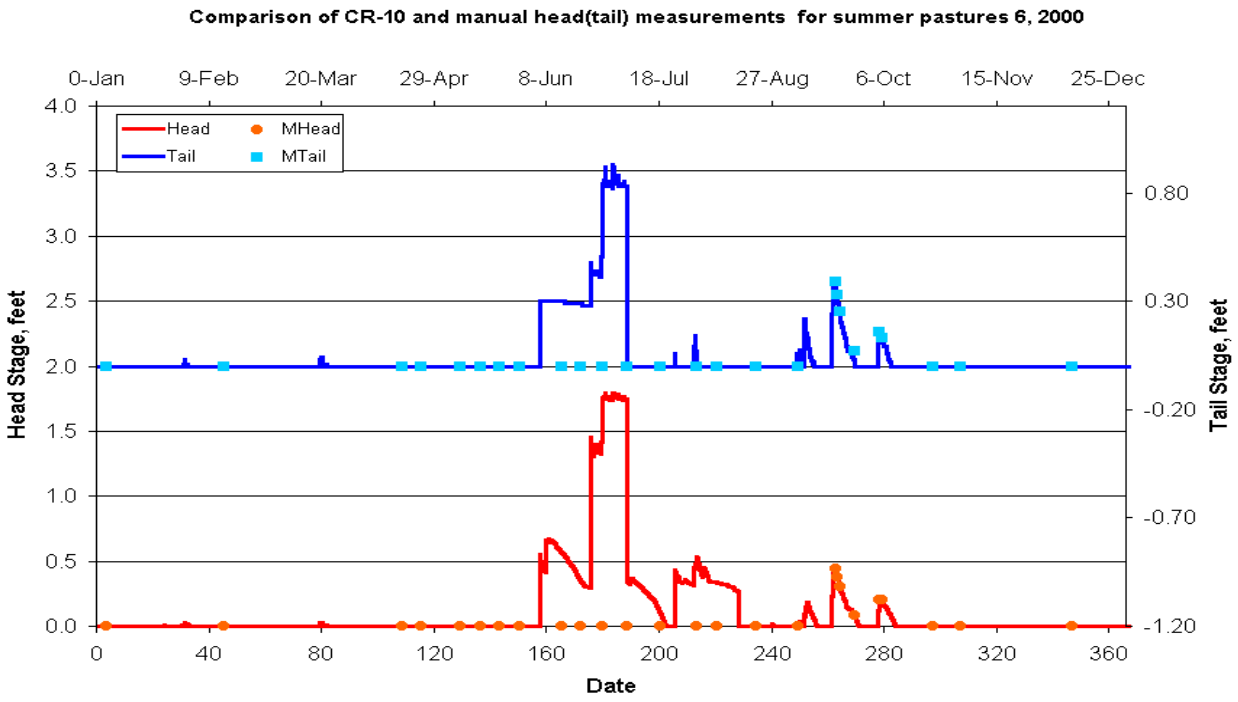


Figure 6d. Unadjusted flume upstream and downstream stage data for *summer* pasture 6 based on comparison between sensor values and manual stage measurements during the year 2000.

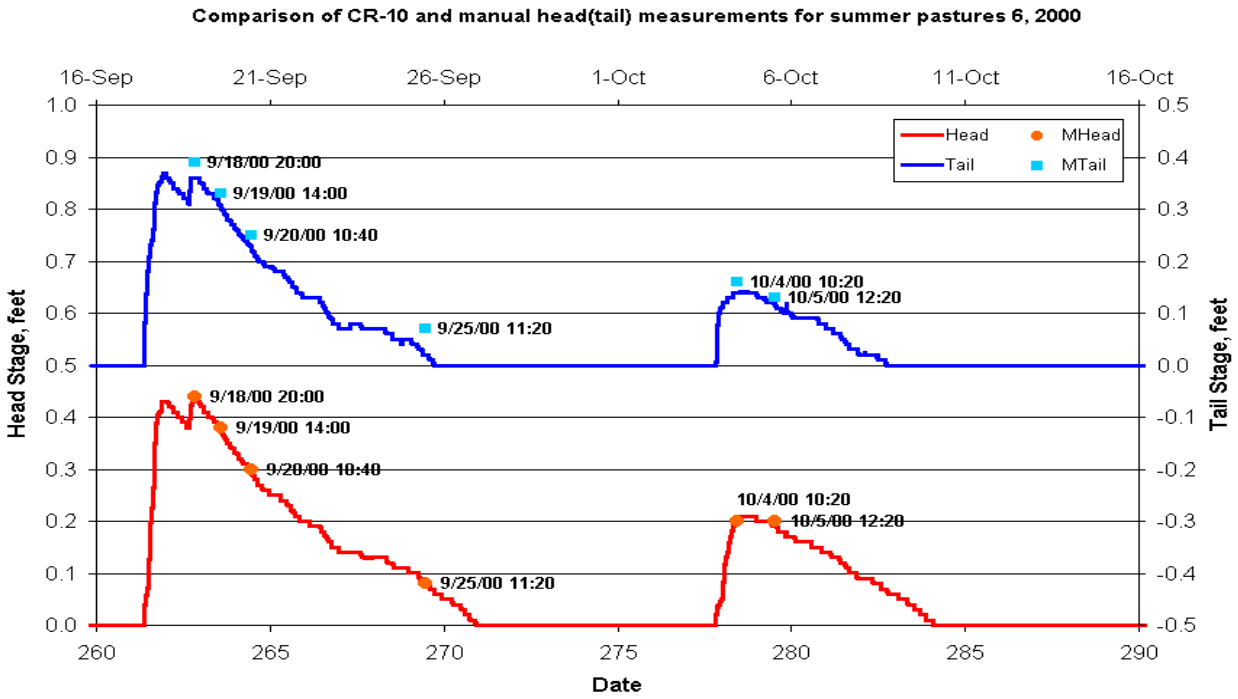


Figure 6e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *summer* 6 pasture during the peak flow period (9/16/00-10/16/00) for the year 2000.

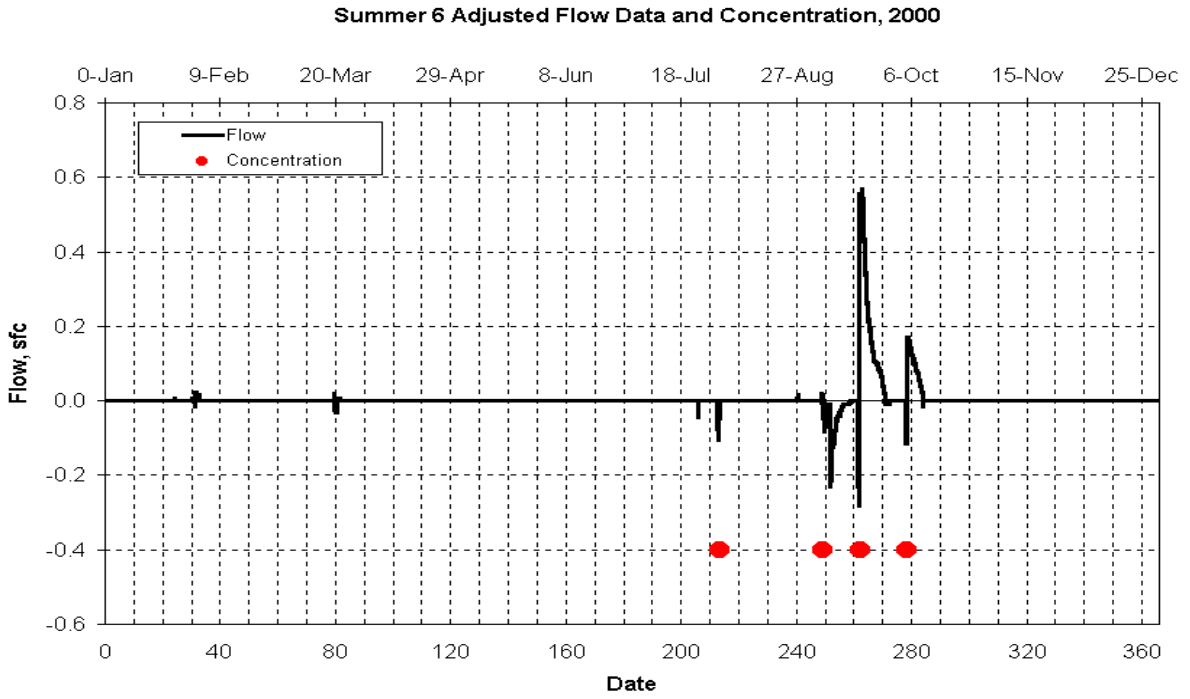


Figure 6f. Flow magnitudes and water quality sample collection dates for *summer* pasture 6 for the year 2000.

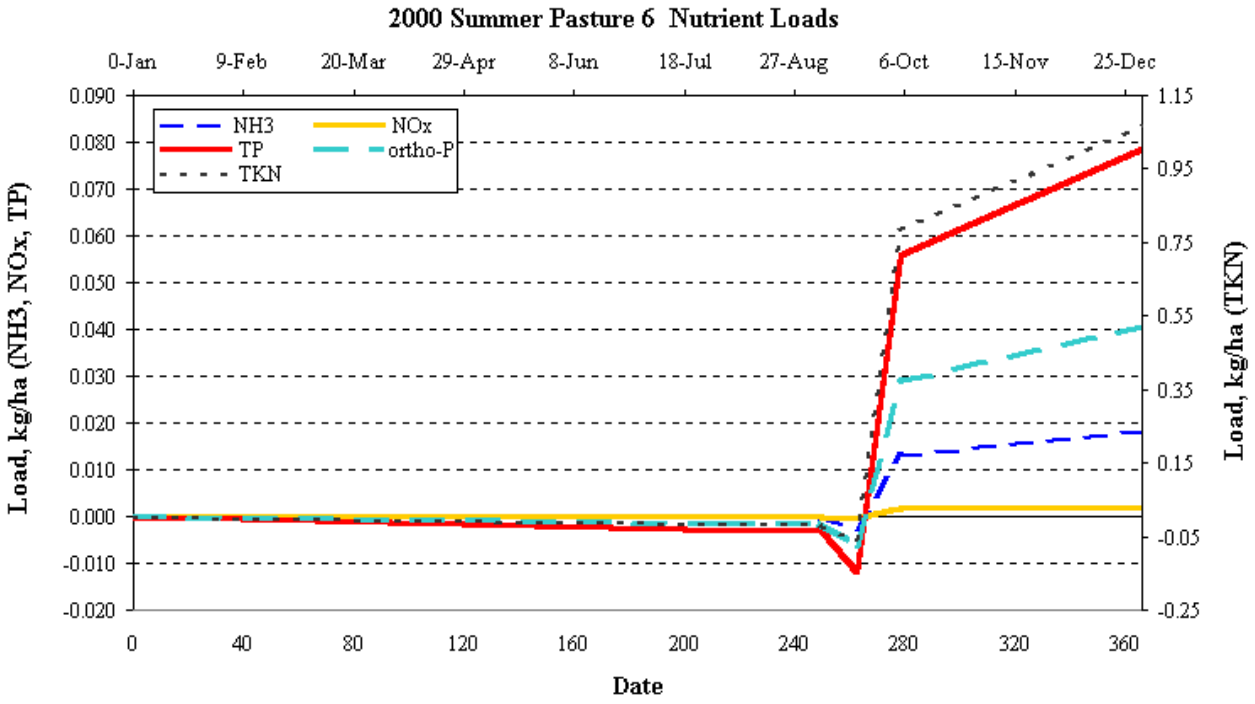


Figure 6g. Flow magnitudes and water quality sample collection dates for *summer* pasture 6 for the year 2000.

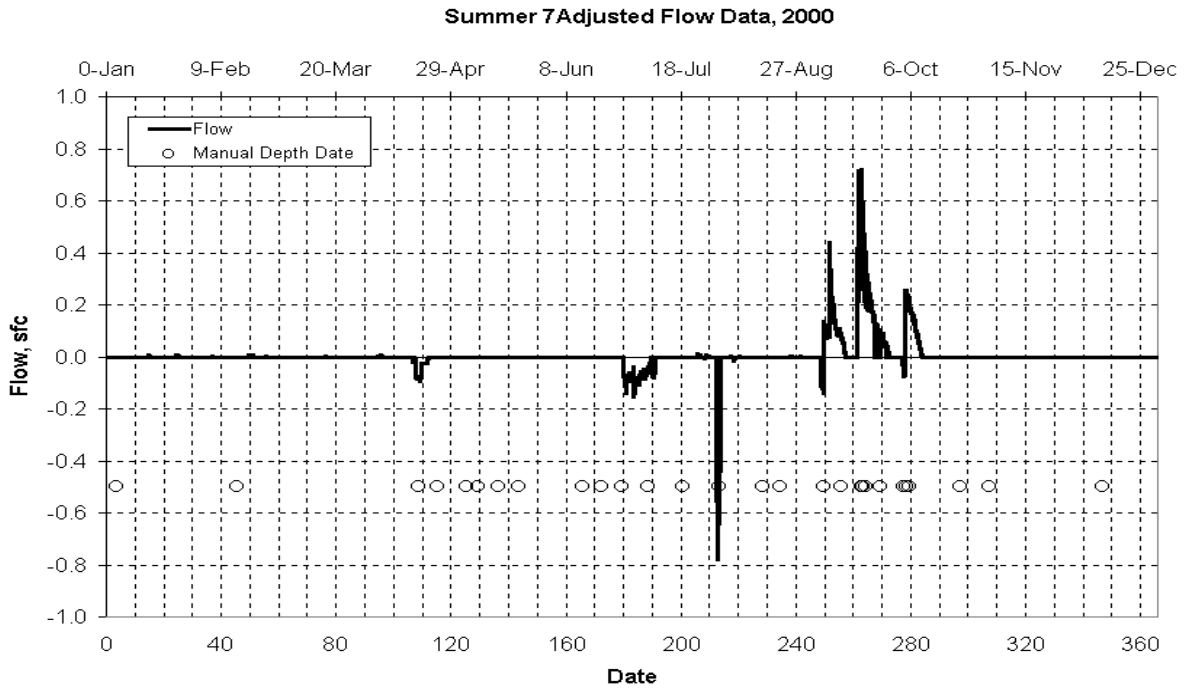


Figure 7a. Flow record for flume at *summer* pasture 7 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

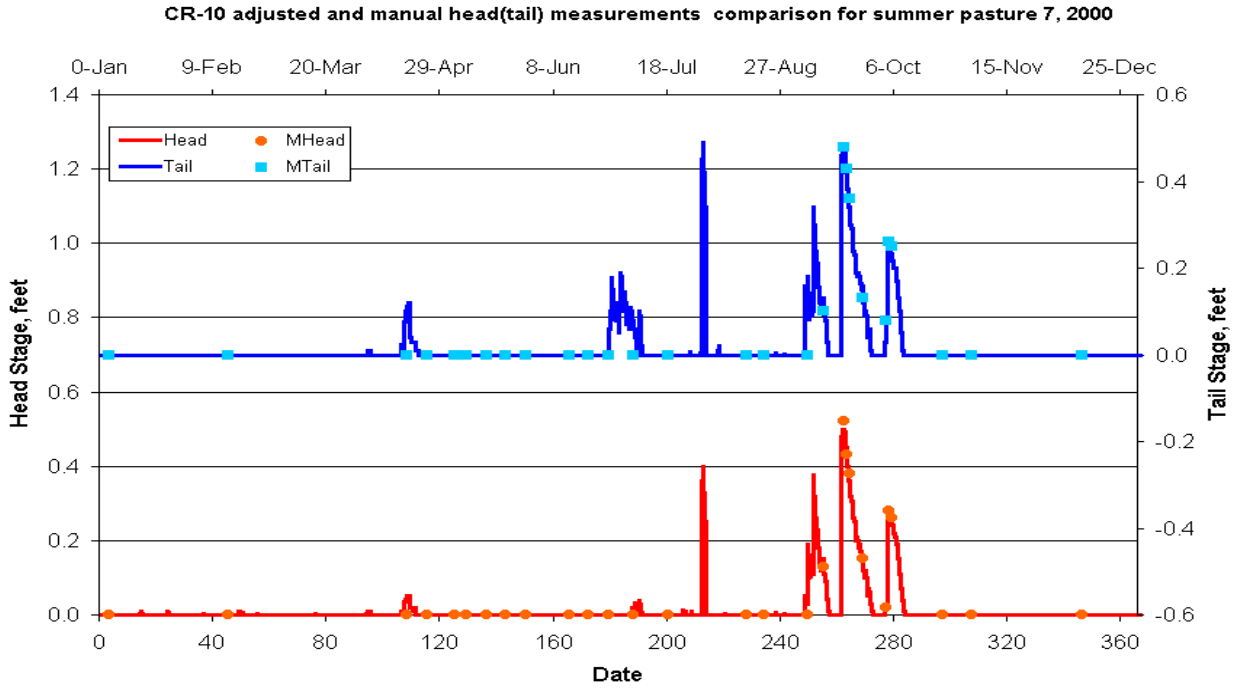


Figure 7b. Flume upstream and downstream stage data for *summer* pasture 7 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 7. Summary of comparisons and adjustment of *summer* pasture 7 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow CR10	Adjustments		Head	Tail CR10	Flow	Flow Cond.
		Man. feet	CR10 feet	Diff feet	Man. feet	CR10 feet	Diff feet	cfs	Up Error	Dn Error	feet	feet	cfs	
01/03/00	1052	0	0	0	0	0	0	0			0	0	0	D
02/14/00	1155	0	0	0	0	0.02	-0.02	-0.02		-0.5	0	0	0	D
04/17/00	1605		0.04			0.15		-0.11		-0.05	0.04	0.10	-0.08	BF
04/24/00	1138	0	0	0	0	0.04	-0.04	-0.03		-0.05	0	0	0	D
05/04/00	1002	0	0	0	0	0.01	-0.01	-0.01		-0.05	0	0	0	D
05/08/00	1040	0	0	0	0	0.01	-0.01	-0.01		-0.05	0	0	0	D
05/15/00	1020	0	0	0	0	0.03	-0.03	-0.02		-0.05	0	0	0	D
05/22/00	1226	0	0	0	0	0.01	-0.01	-0.01		-0.05	0	0	0	D
05/29/00	1012	0	0	0	0	err	0	0			0	0	0	D
06/13/00	1423	0	0.26	-0.26	0	0.04	-0.04	0.24	-0.40	-0.25	0	0	0	D
06/20/00	934	0	0.25	-0.25	0	0.04	-0.04	0.23	-0.40	-0.25	0	0	0	D
06/27/00	1535	0	0.27	-0.27	0	0.08	-0.08	0.26	-0.40	-0.10	0	0	0	D
07/06/00	1100		0.32			0.17		0.35	-0.30	-0.10	0.02	0.07	-0.06	BF
07/18/00	1117	0	0.24	-0.24	0	0.05	-0.05	0.22	-0.30	-0.10	0	0	0	D
07/31/00	1159		0.58			0.37		1.16	-0.30		0.28	0.37	-0.46	BF
08/07/00	1205	0	0	0	0	0.01	-0.01	-0.01		-0.02	0	0	0	D
08/15/00	1310	0	0	0	0	0	0	0			0	0	0	D
08/21/00	1628	0	0	0	0	0	0	0			0	0	0	D
09/05/00	1506		0.03			0.11		-0.09			0.03	0.11	-0.09	BF
09/11/00	1438	0.13	0.11	0.02	0.10	0.10	0	0.08			0.11	0.10	0.08	SW
09/18/00	1950	0.52	0.50	0.02	0.48	0.47	0	0.72			0.50	0.47	0.72	FF
09/19/00	1357	0.43	0.43	0	0.43	0.41	0.02	0.41			0.43	0.41	0.41	FF
09/20/00	1032	0.38	0.35	0.03	0.36	0.34	0.02	0.23			0.35	0.34	0.23	FF
09/25/00	1112	0.15	0.13	0.02	0.13	0.12	0.01	0.09	-0.01		0.12	0.12	0.02	SW
10/03/00	1540	0.02	0.02	0	0.08	0.06	0.02	-0.05			0.02	0.06	-0.05	BF
10/04/00	1025	0.28	0.28	0	0.26	0.25	0.01	0.24			0.28	0.25	0.24	FF
10/05/00	1219	0.26	0.25	0.01	0.25	0.23	0.02	0.20			0.25	0.23	0.20	FF
10/23/00	1135	0	0	0	0	0	0	0			0	0	0	D
11/02/00	1133	0	0	0	0	0	0	0			0	0	0	D
12/11/00	1624	0	0	0	0	0	0	0			0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

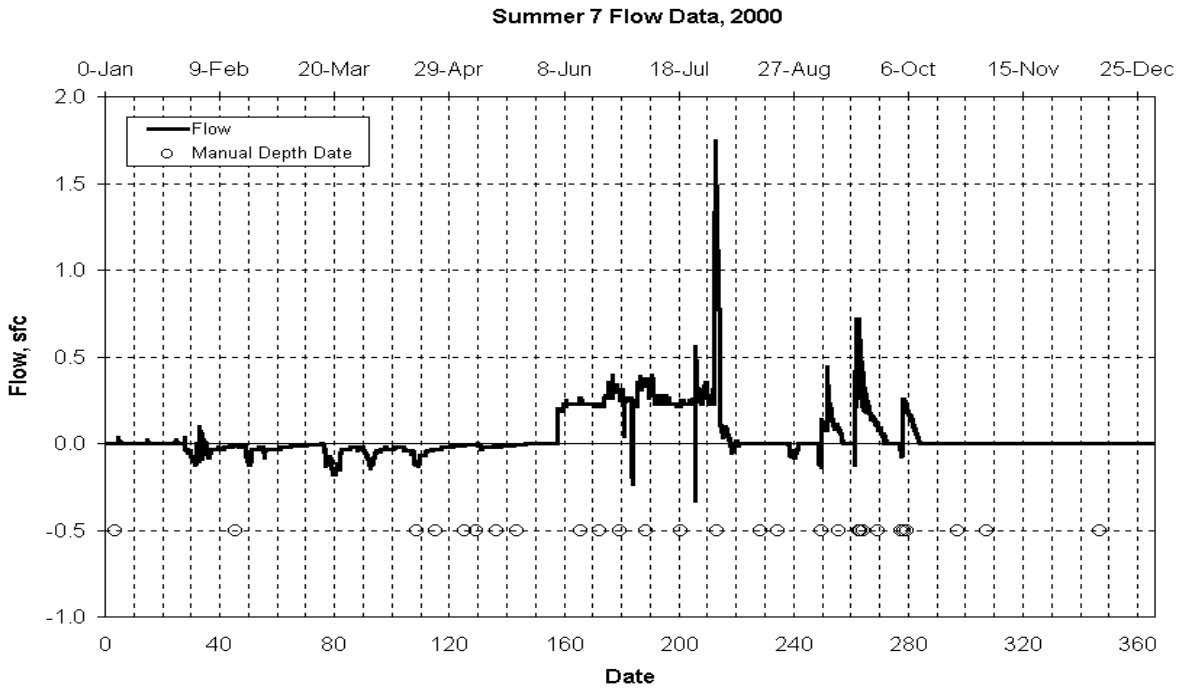


Figure 7c. Comparison of unadjusted flow record and dates of manual stage measurements for *summer* pasture 7 the flume during the year 2000.

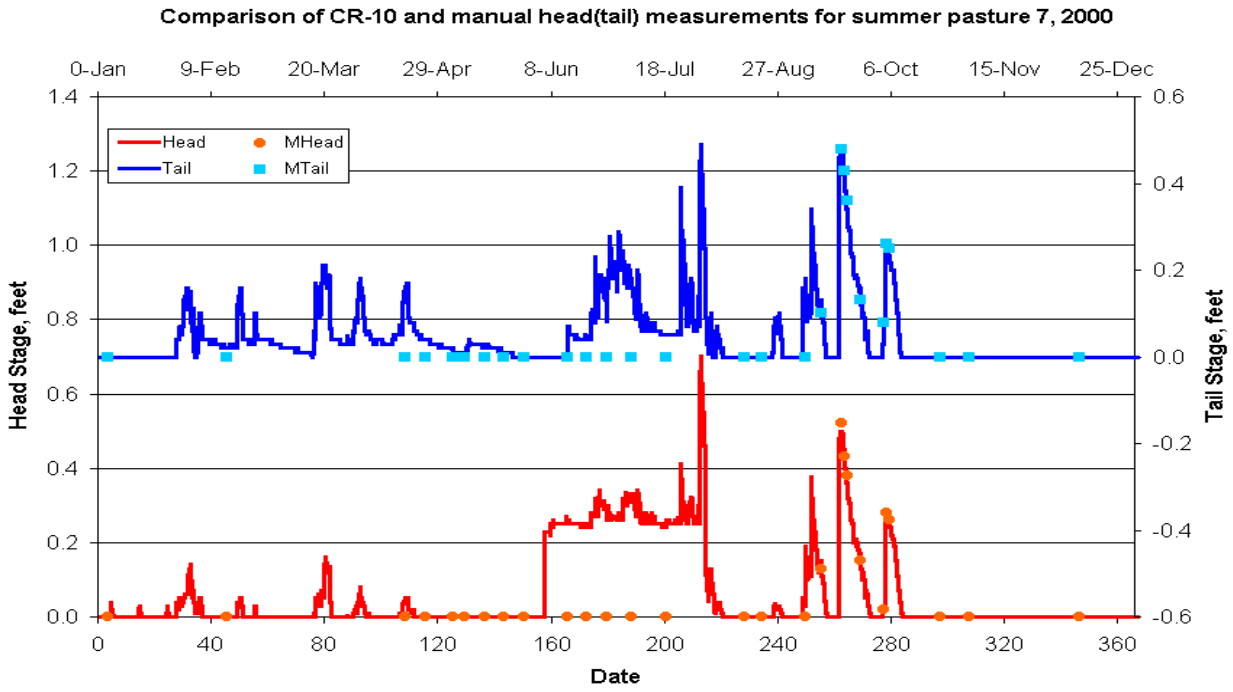


Figure 7d. Unadjusted flume upstream and downstream stage data for *summer* pasture 7 based on comparison between sensor values and manual stage measurements during the year 2000.

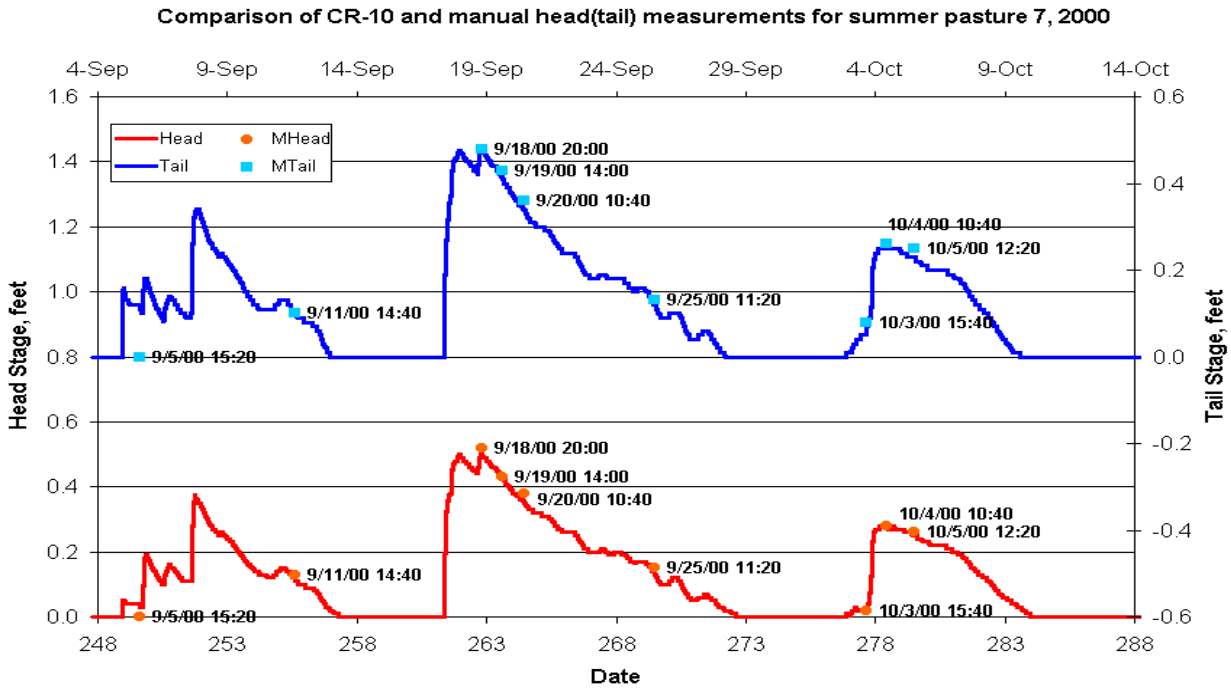


Figure 7e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *summer* 7 pasture during the peak flow period (9/4/00-10/14/00) for the year 2000.

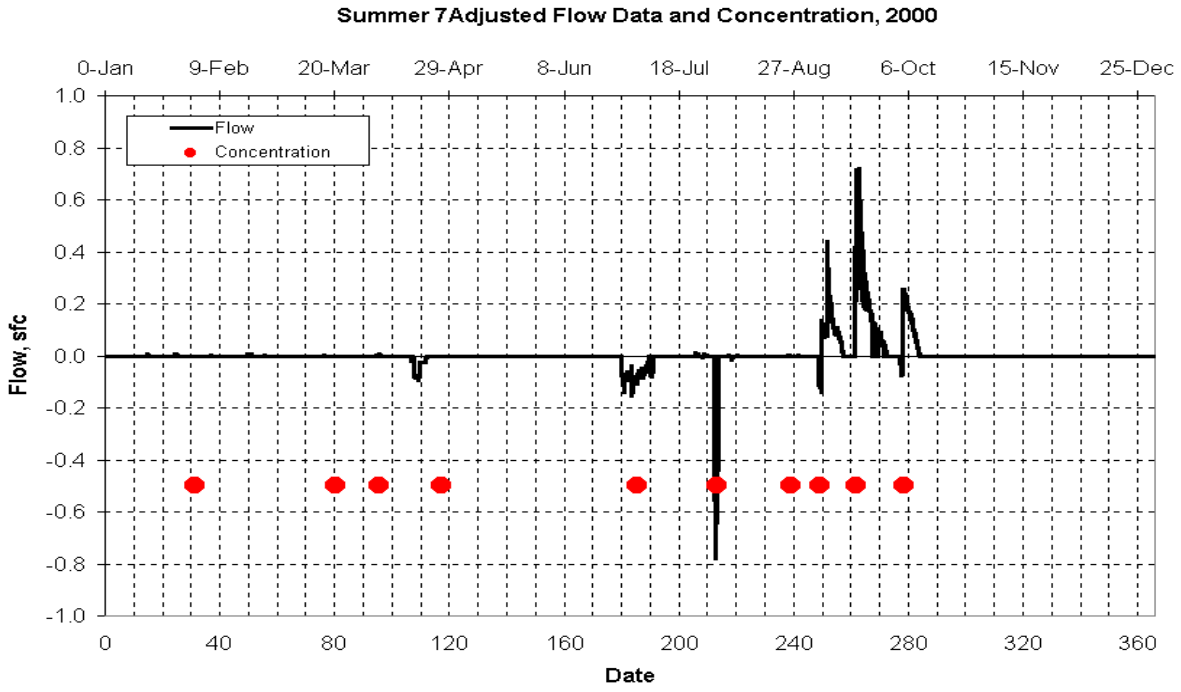


Figure 7f. Flow magnitudes and water quality sample collection dates for *summer* pasture 7 for the year 2000.

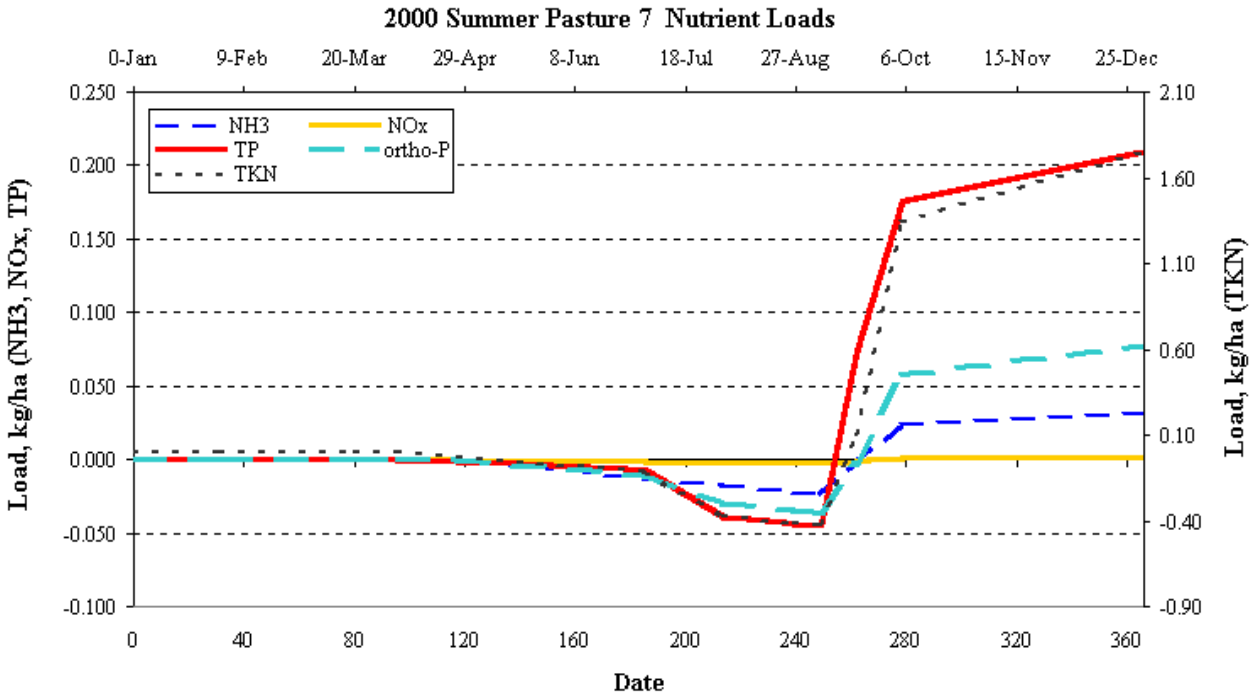


Figure 7g. Flow magnitudes and water quality sample collection dates for *summer* pasture 7 for the year 2000.

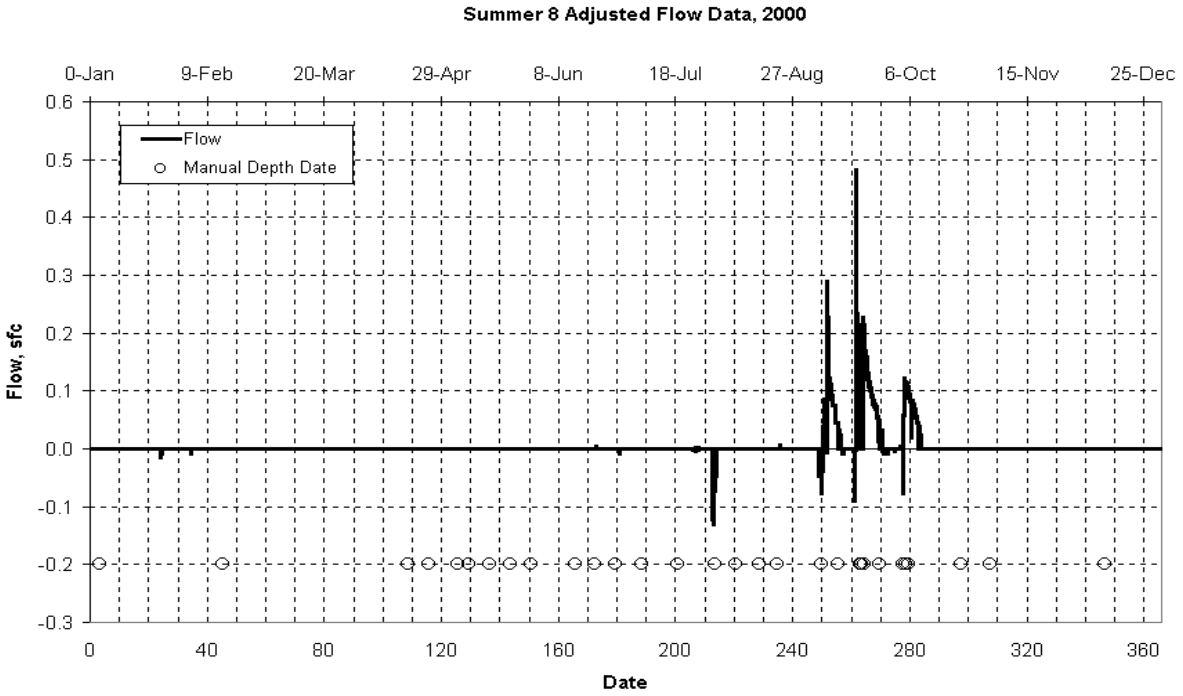


Figure 8a. Flow record for flume at *summer* pasture 8 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

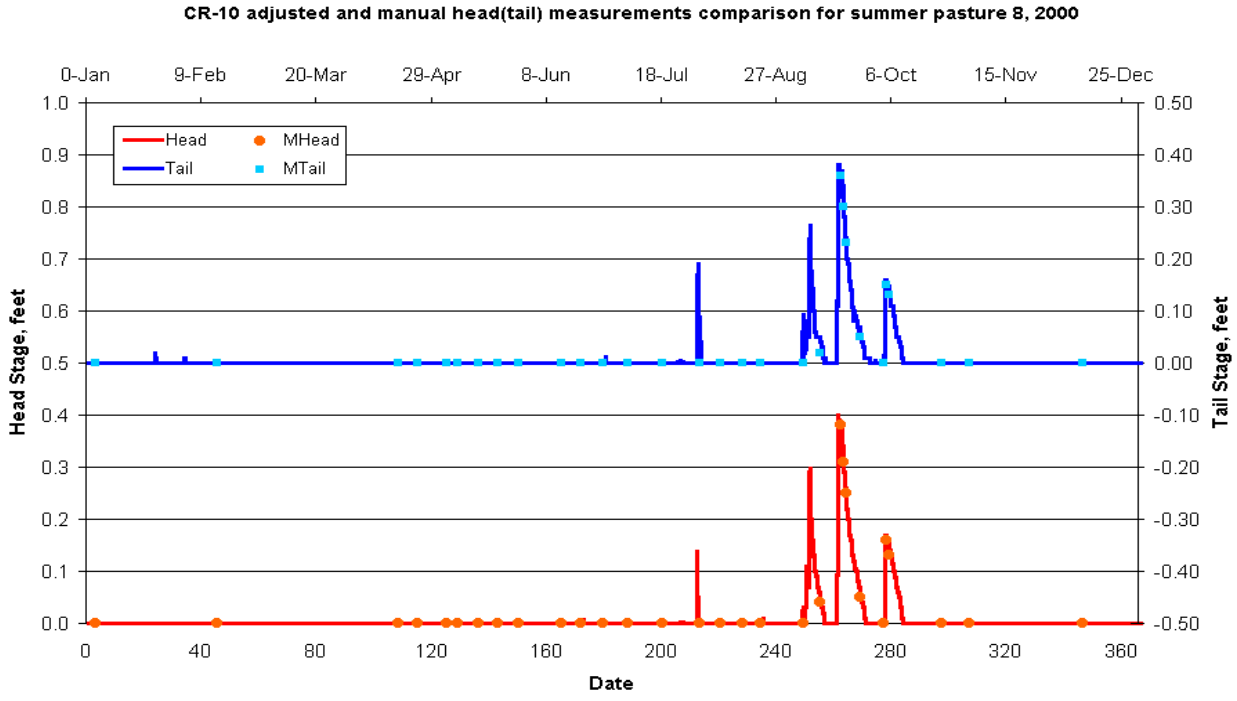


Figure 8b. Flume upstream and downstream stage data for *summer* pasture 8 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 8. Summary of comparisons and adjustment of *summer* pasture 8 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow
		Man.	CR10	Diff	Man.	CR10	Diff	CR10	Up	Dn		CR10		Cond.
		feet	feet	feet	feet	feet	feet	cfs	Error	Error	feet	feet	cfs	
01/03/00	1056	0	0	0	0	0	0	0			0	0	0	D
02/14/00	1203	0	0	0	0	0	0	0			0	0	0	D
04/17/00	1610	0	err	0	0	err	0	0			0	0	0	D
04/24/00	1150	0	0	0	0	0	0	0	-0.10		0	0	0	D
05/04/00	1035	0	err	0	0	err	0	0			0	0	0	D
05/08/00	1045	0	0.04	-0.04	0	err	0	0.03	-0.10		0	0	0	D
05/15/00	1023	0	0.10	-0.10	0	err	0	0.08	-0.10		0	0	0	D
05/22/00	1234	0	err	0	0	err	0	0			0	0	0	D
05/29/00	1015	0	0	0	0	err	0	0			0	0	0	D
06/13/00	1446	0	0.17	-0.17	0	0.06	0	0.13	-0.20	-0.10	0	0	0	D
06/20/00	938	0	0.20	-0.20	0	0.05	0	0.16	-0.20	-0.10	0	0	0	D
06/27/00	1542	0	0.22	-0.22	0	0.06	0	0.19	-0.25	-0.10	0	0	0	D
07/06/00	1155	0	0.21	-0.21	0	0.04	0	0.18	-0.25	-0.10	0	0	0	D
07/18/00	1122	0	0.19	-0.19	0	0.03	0	0.15	-0.25	-0.10	0	0	0	D
731/00	1215		0.44			0.23		0.64	-0.50	-0.20	0	0.03	-0.02	BF
08/07/00	1207	0	0	0	0	0	0	0			0	0	0	D
08/15/00	1330	0	0	0	0	0	0	0			0	0	0	D
08/21/00	1633	0	0	0	0	0	0	0			0	0	0	D
09/05/00	1511		0			0.01		-0.01		0.01	0	0.02	-0.02	BF
09/11/00	1435	0.04	0.04	0.00	0.02	0.03	-0.01	0.03		0.01	0.04	0.04	0.01	SW
09/18/00	1955	0.38	0.38	0	0.36	0.36	0	0.41		0.01	0.38	0.37	0.21	SW
09/19/00	1401	0.31	0.31	0	0.31	0.30	0.01	0.19		0.01	0.31	0.31	0.01	SW
09/20/00	1040	0.25	0.25	0	0.23	0.22	0.01	0.21		0.01	0.25	0.23	0.2	FF
09/25/00	1123	0.05	0.06	-0.01	0.05	0.04	0.01	0.05		0.01	0.06	0.05	0.05	FF
10/03/00	1546	0	0	0	0	0	0	0		0.01	0	0.01	-0.01	D
10/04/00	1035	0.16	0.17	-0.01	0.15	0.15	0	0.12		0.01	0.17	0.16	0.12	FF
10/05/00	1225	0.13	0.15	-0.02	0.13	0.13	0	0.11		0.01	0.15	0.14	0.10	FF
10/23/00	1143	0	0	0	0	0	0	0			0	0	0	D
11/02/00	1146	0	0	0	0	0	0	0			0	0	0	D
12/11/00	1632	0	0	0	0	0	0	0			0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

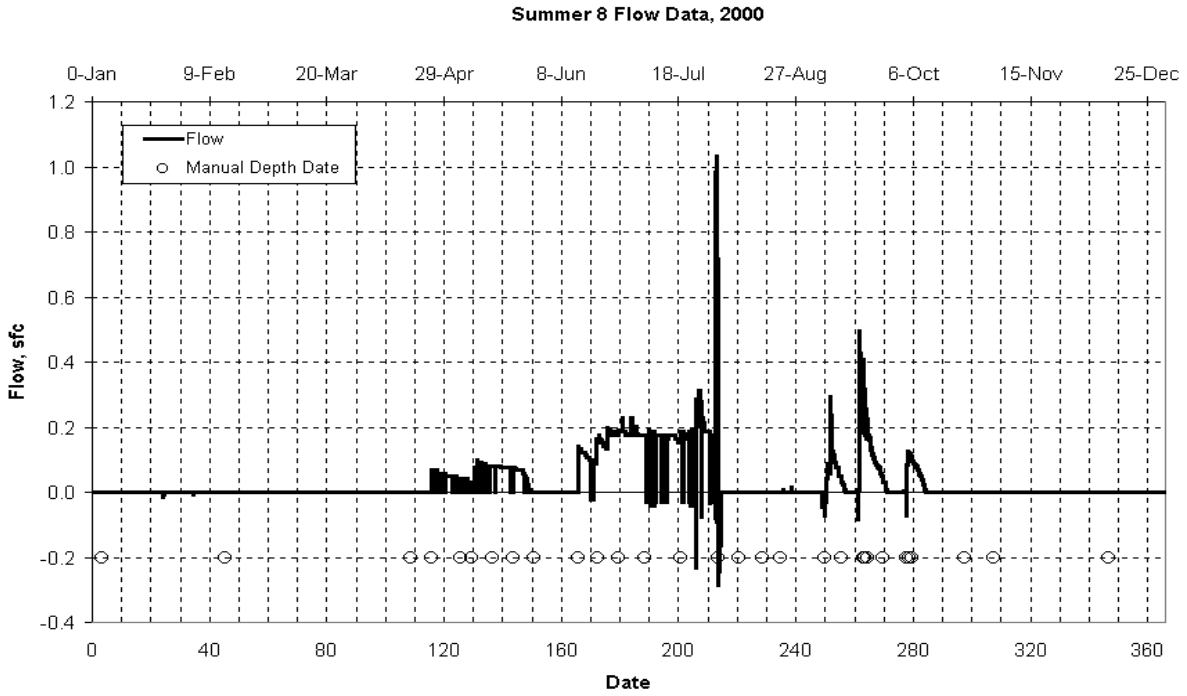


Figure 8c. Comparison of unadjusted flow record and dates of manual stage measurements for *summer* pasture 8 the flume during the year 2000.

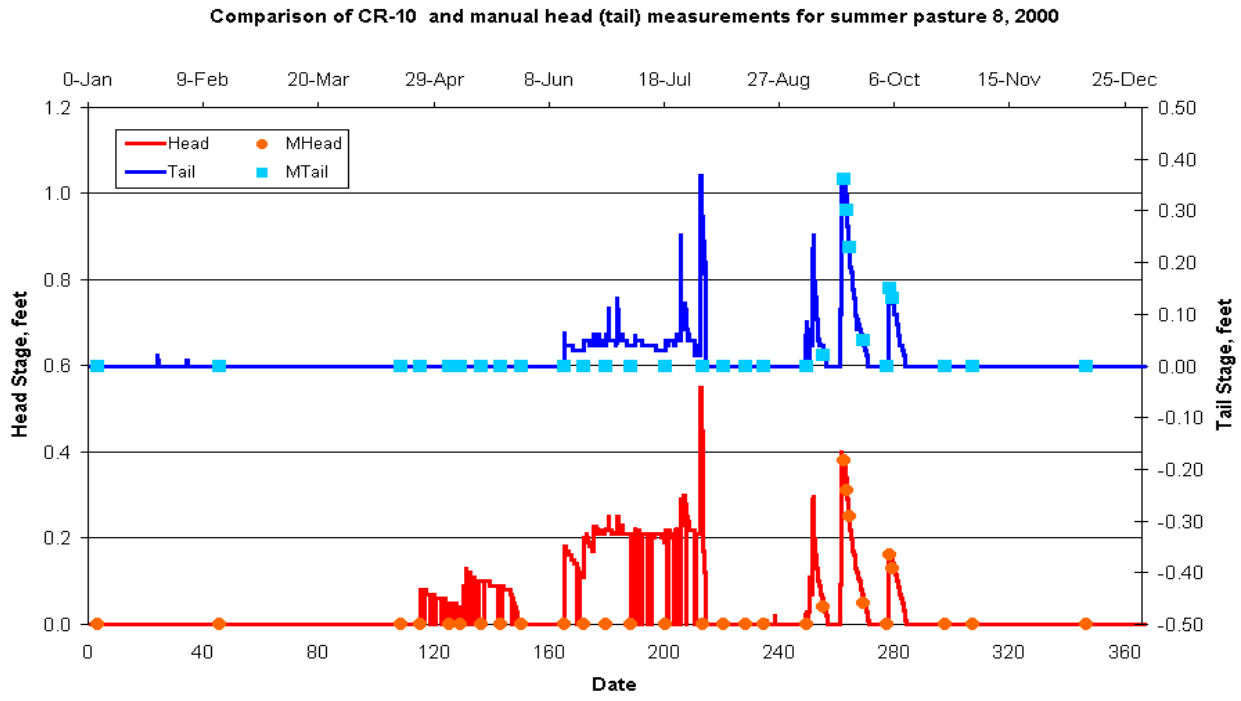


Figure 8d. Unadjusted flume upstream and downstream stage data for *summer* pasture 8 based on comparison between sensor values and manual stage measurements during the year 2000.

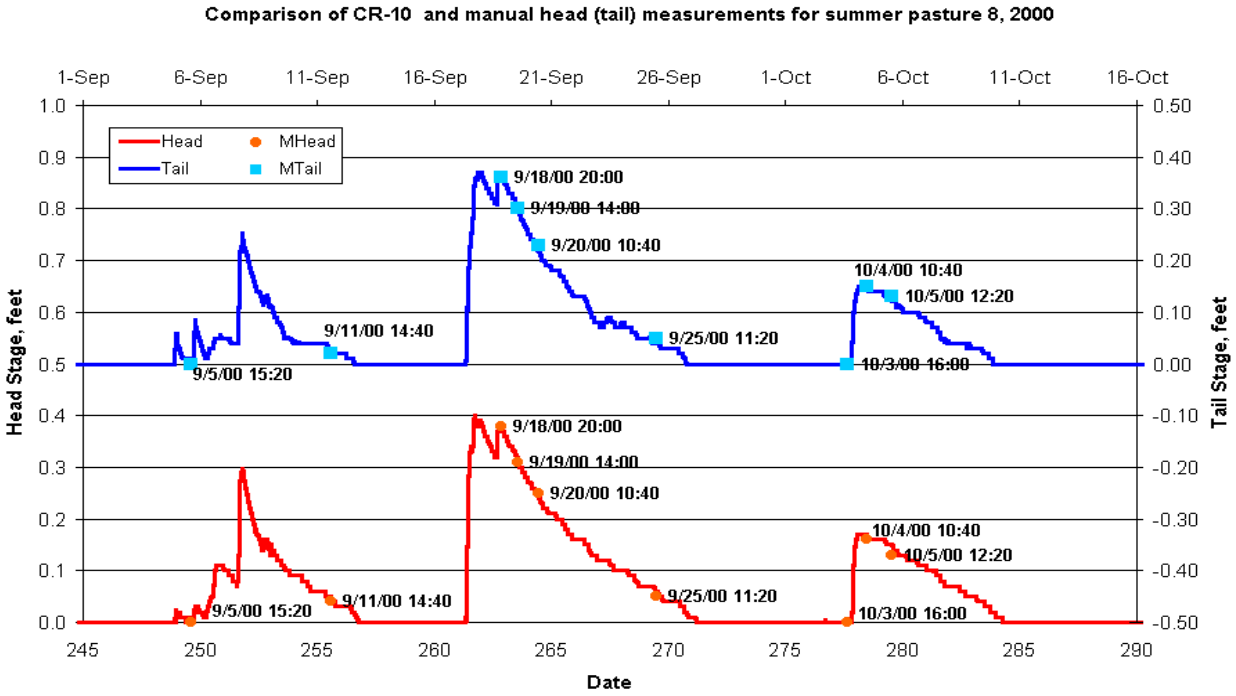


Figure 8e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *summer* 8 pasture during the peak flow period (9/1/00-10/16/00) for the year 2000.

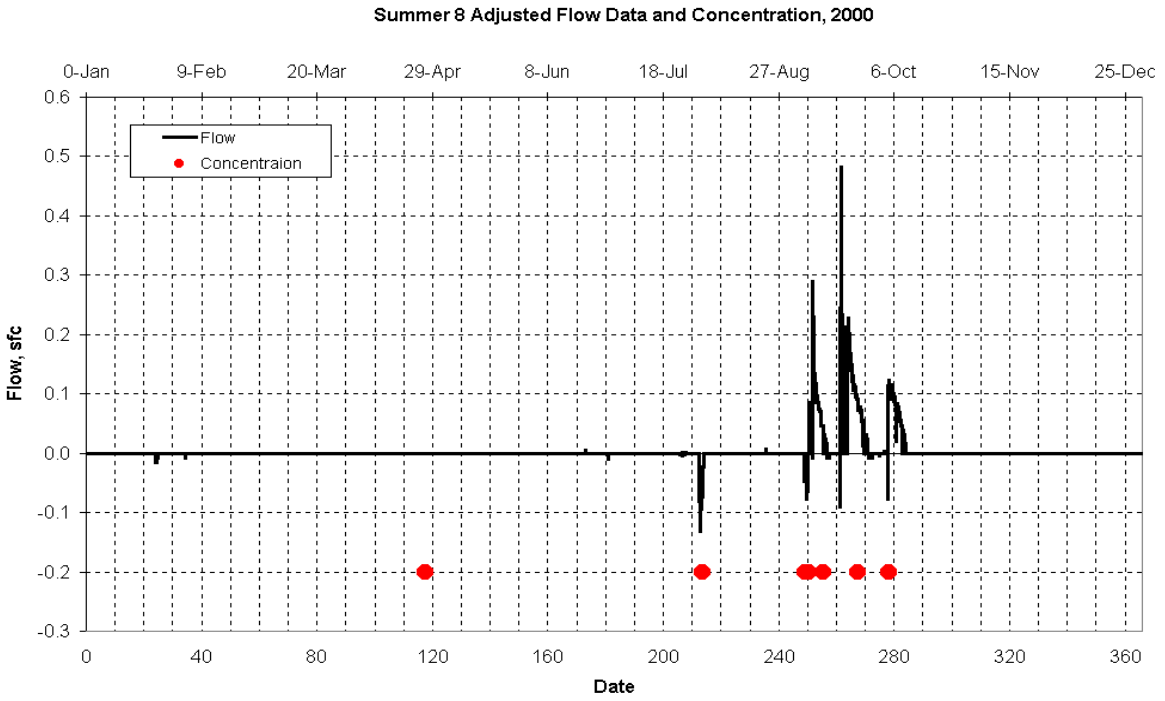


Figure 8f. Flow magnitudes and water quality sample collection dates for *summer* pasture 8 for the year 2000.

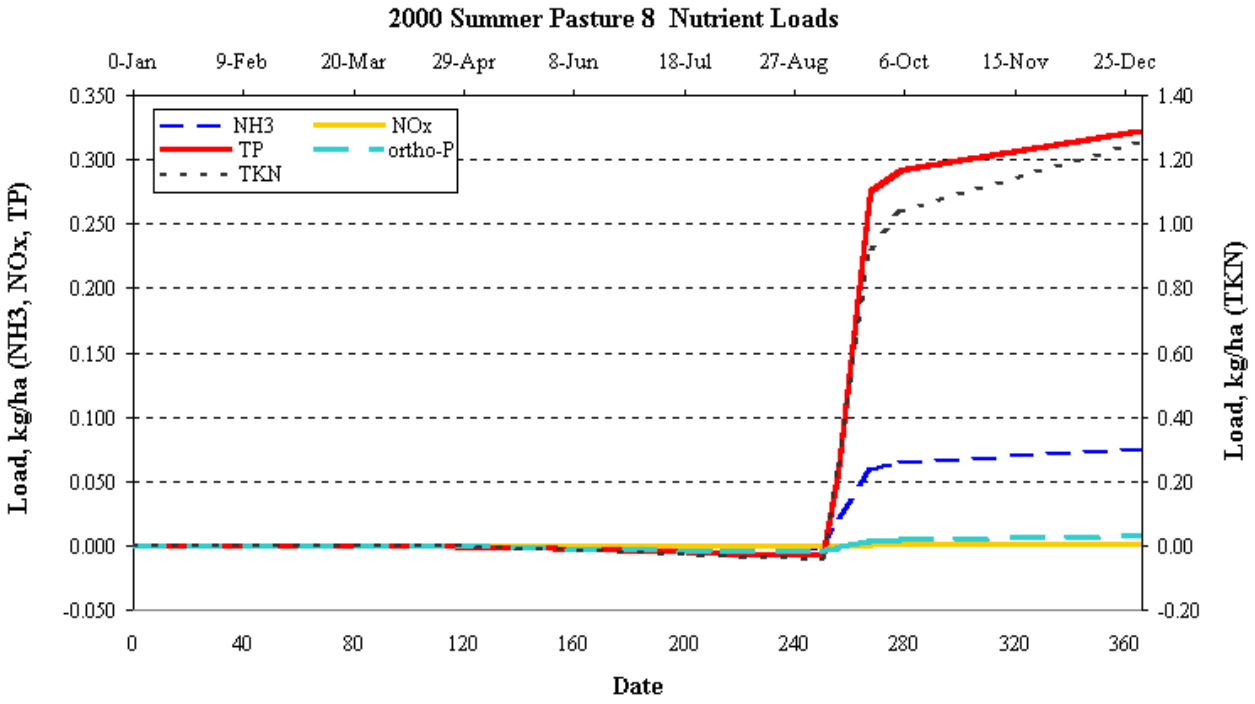


Figure 8g. Flow magnitudes and water quality sample collection dates for *summer* pasture 8 for the year 2000.

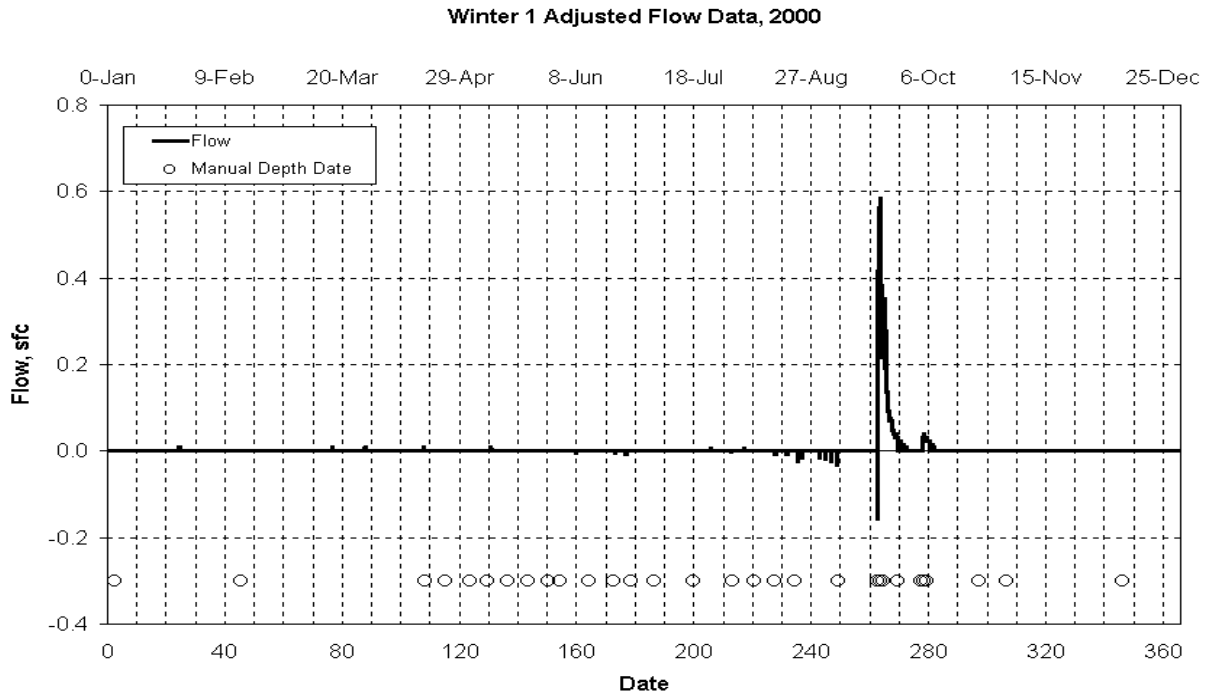


Figure 9a. Flow record for flume at *winter* pasture 1 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

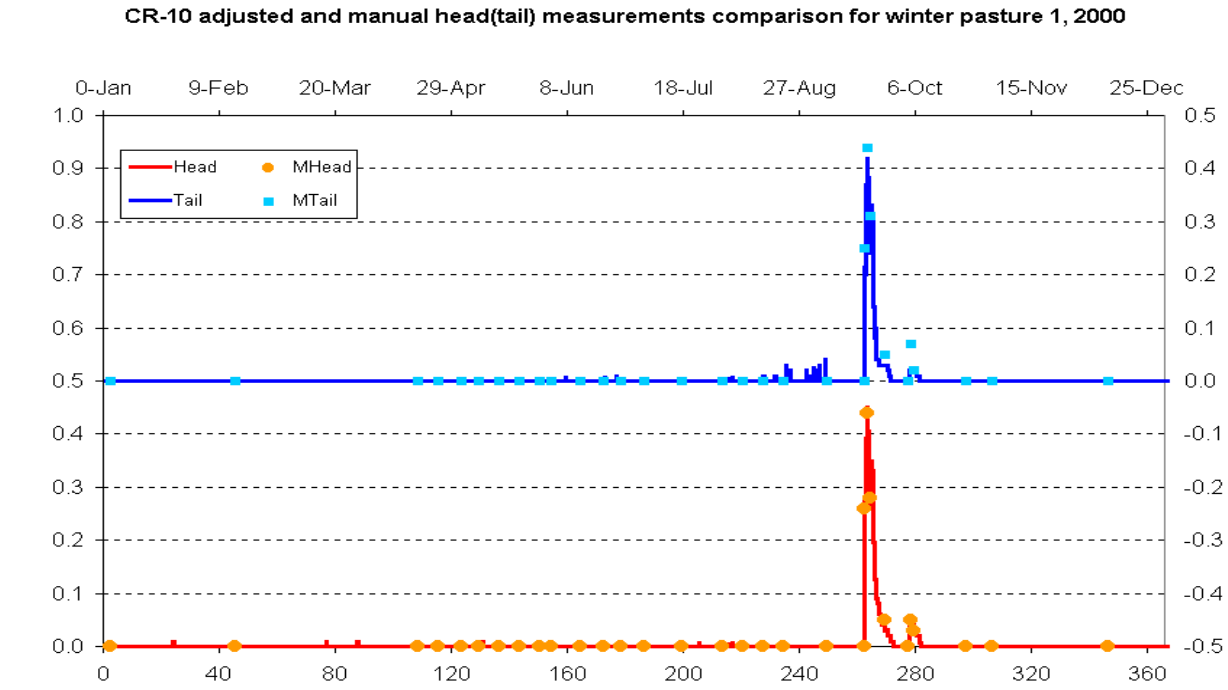


Figure 9b. Flume upstream and downstream stage data for win*ter* pasture 1 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 9. Summary of comparisons and adjustment of *winter* pasture 1 flume stage and flow values.

Date	Watch Time	Head			Tail			Tail/Head		Flow	Adjustments		Head	Tail	Flow	Flow Cond.
		Man.	CR10	Diff	Man.	CR10	Diff	Man.	CR10	CR10	Up	Dn		CR10		
		feet	feet	feet	feet	feet	feet	feet	feet	cfs	Error	Error	feet	feet	cfs	
01/02/00	1011	0	0	0	0	0	0			0			0	0	0	D
02/14/00	1024	0	0	0	0	0	0			0			0	0	0	D
04/17/00	908	0	0	0	0	0	0			0			0	0	0	D
04/24/00	840	0	0	0	0	0	0			0			0	0	0	D
05/02/00	1332	0	0	0	0	0	0			0			0	0	0	D
05/08/00	852	0	0	0	0	0	0			0			0	0	0	D
05/15/00	1111	0	0	0	0	0	0			0			0	0	0	D
05/22/00	923	0	0	0	0	0	0			0			0	0	0	D
05/29/00	854	0	0	0	0	0	0			0			0	0	0	D
06/02/00	922	0	0	0	0	0	0			0			0	0	0	D
06/12/00	951	0	0	0	0	0	0			0			0	0	0	D
06/20/00	1020	0	0	0	0	0	0			0			0	0	0	D
06/26/00	1040	0	0	0	0	0	0			0			0	0	0	D
07/04/00	946	0	0	0	0	0	0			0			0	0	0	D
07/17/00	1511	0	0	0	0	0	0			0			0	0	0	D
07/31/00	924	0	0	0	0	0	0			0			0	0	0	D
08/07/00	947	0	0	0	0	0	0			0			0	0	0	D
08/14/00	950	0	0	0	0	0	0			0			0	0	0	D
08/21/00	956	0	0	0	0	0	0			0			0	0	0	D
09/05/00	1047	0	0	0	0	0	0			0		0.04	0	0	0	D
09/18/00	1527	0	0	0	0	0	0			0		0.04	0	0	0	D
09/18/00	1740	0	0.26	-0.26	0	0.25	-0.25	1	1	0.08		0.04	0.26	0.21	0.23	FF
09/19/00	1010	0	0.44	-0.44	0	0.46	-0.46	1	1	-0.02		0.04	0.44	0.42	0.54	FF
09/20/00	1206	0.28	0.28	0	0.31	0.30	0.01	1	1.08	-0.27		0.04	0.28	0.26	0.24	FF
09/25/00	1323	0.05	0.04	0.01	0.05	0.07	-0.02	1	1.72	-0.06		0.04	0.04	0.03	0.03	FF
10/03/00	953	0	0	0	0	0	0			0		0.04	0	0	0	D
10/04/00	732	0	0	0	0	0	0	1	2	-0.05		0.04	0	0	0	FF
10/05/00	949	0	0	0	0	0	0	1	2	-0.05		0.04	0	0	0	FF
10/23/00	909	0	0	0	0	0	0			0		0.04	0	0	0	D
11/01/00	1431	0	0	0	0	0	0			0		0.04	0	0	0	D
12/11/00	1024	0	0	0	0	0	0			0		0.04	0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

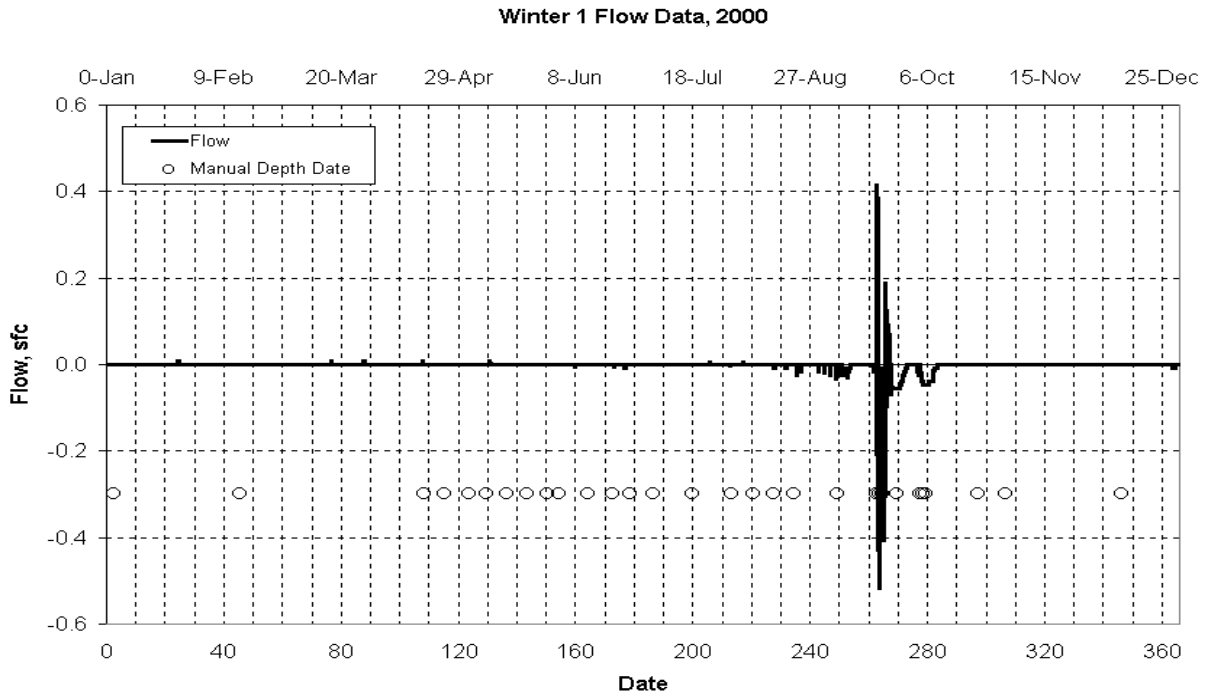


Figure 9c. Comparison of unadjusted flow record and dates of manual stage measurements for *winter* pasture 1 the flume during the year 2000.

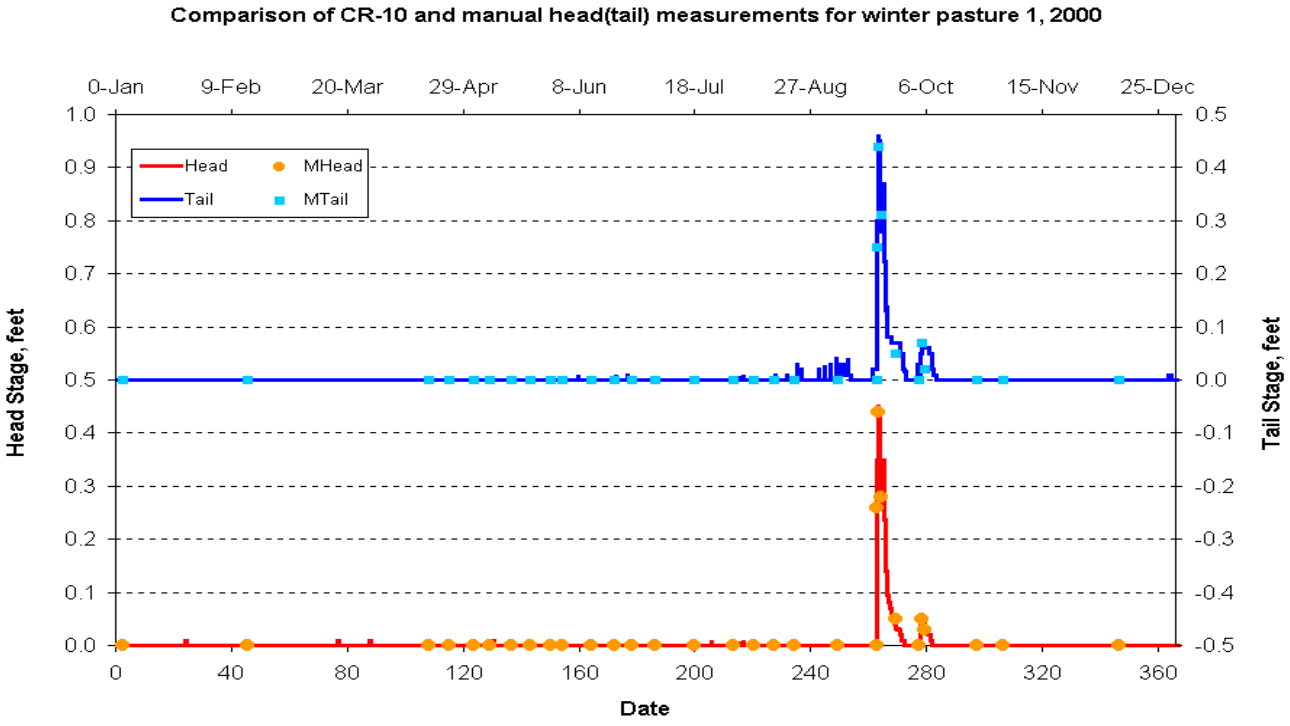


Figure 9d. Unadjusted flume upstream and downstream stage data for *winter* pasture 1 based on comparison between sensor values and manual stage measurements during the year 2000.

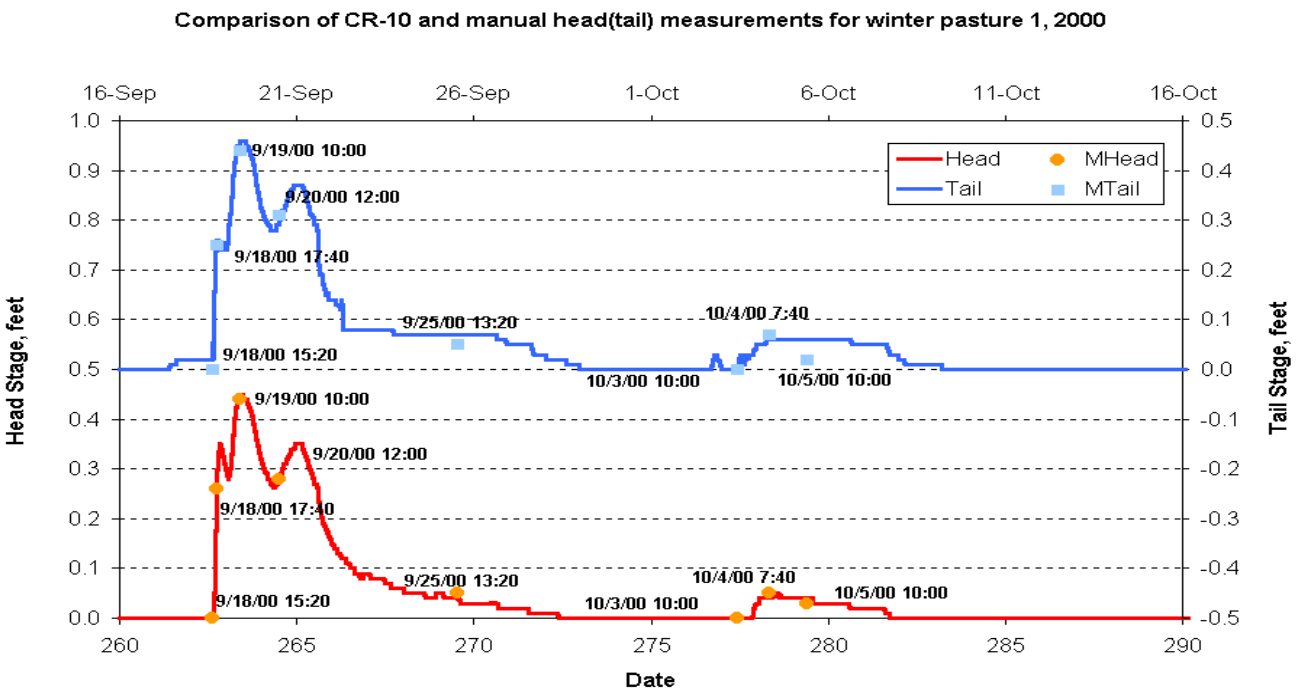


Figure 9e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *winter* 1 pasture during the peak flow period (9/16/00-10/16/00) for the year 2000.

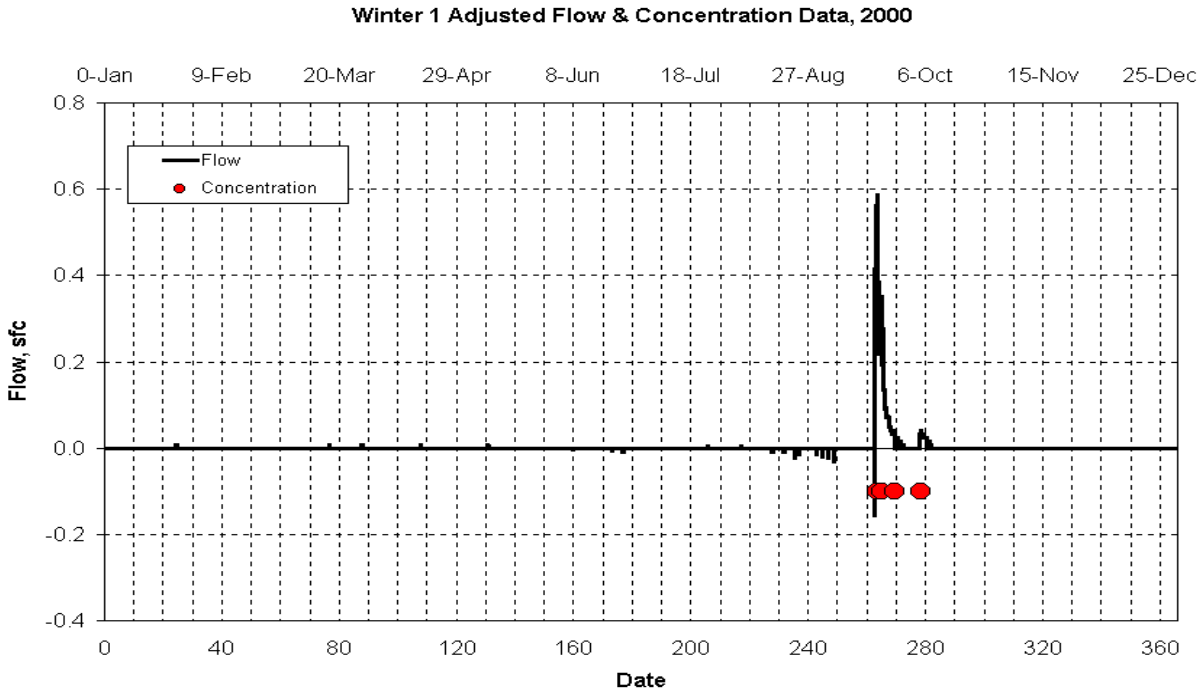


Figure 9f. Flow magnitudes and water quality sample collection dates for *winterer* pasture 1 for the year 2000.

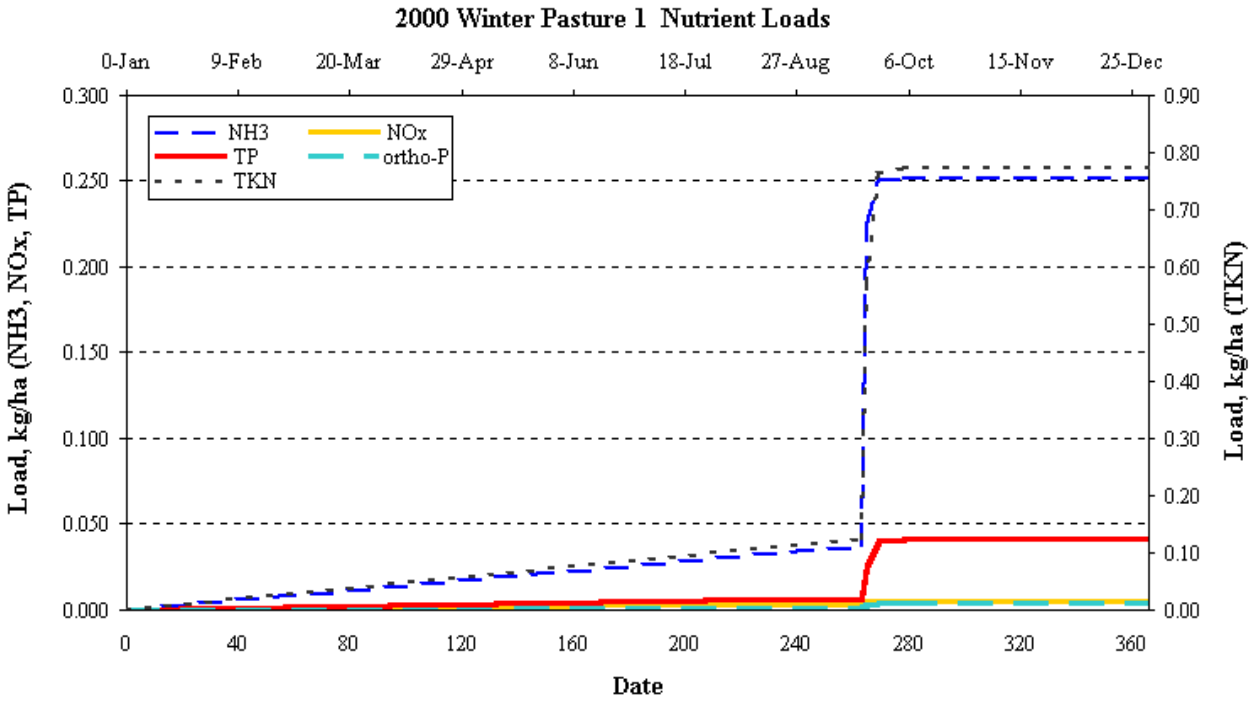


Figure 9g. Flow magnitudes and water quality sample collection dates for *winter* pasture 1 for the year 2000.

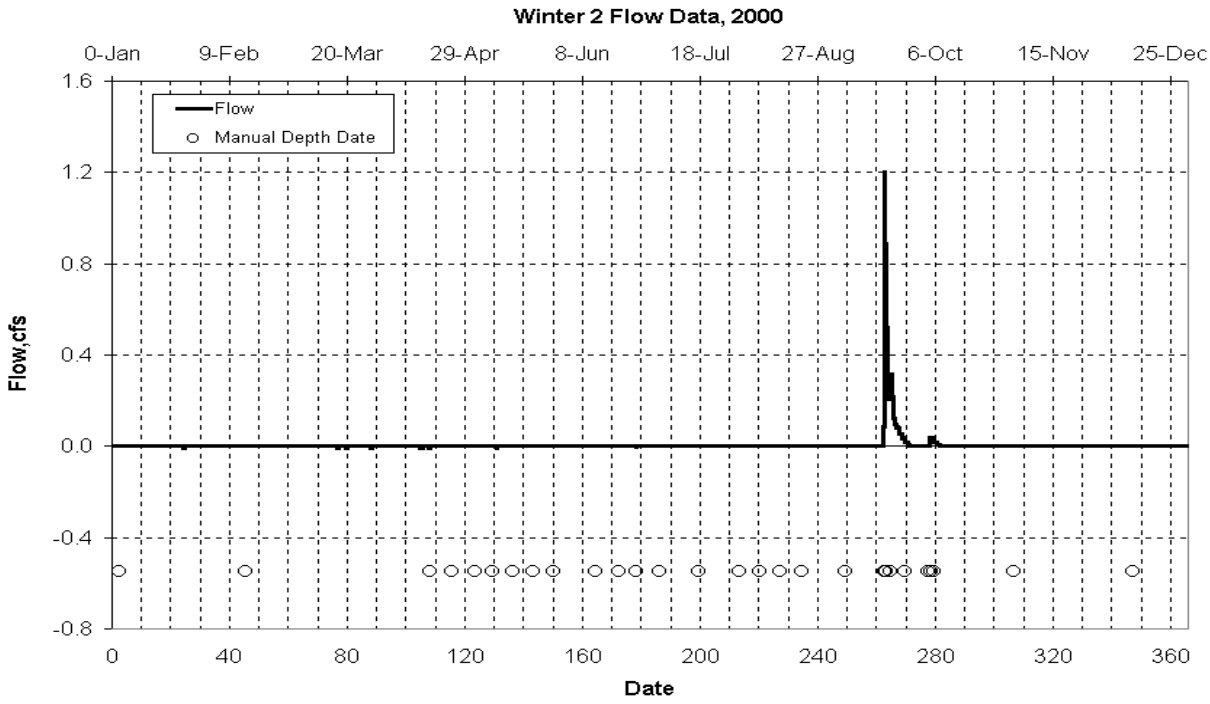


Figure 10a. Flow record for flume at *winter* pasture 2 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

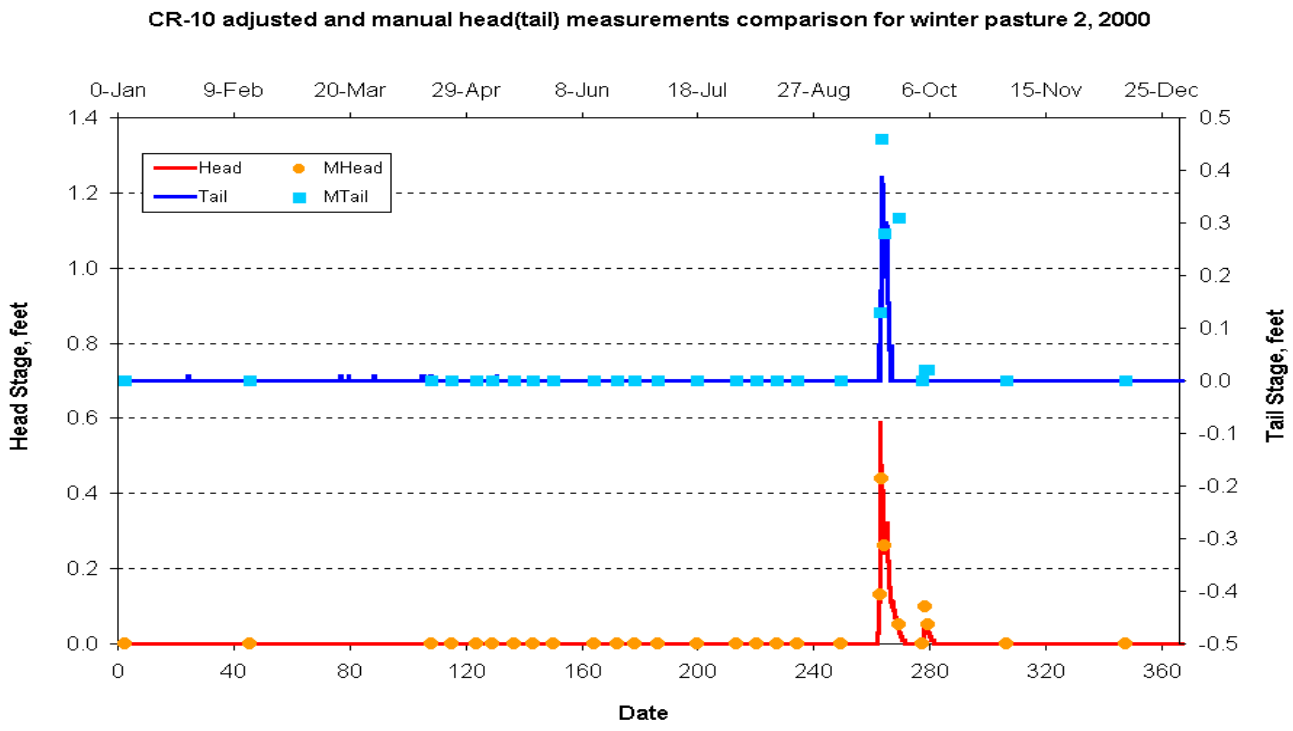


Figure 10b. Flume upstream and downstream stage data for win*ter* pasture 2 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 10. Summary of comparisons and adjustment of *winter* pasture 2 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow
		Man.	CR10	Diff	Man.	CR10	Diff	CR10	Up Error	Dn Error		CR10		
		feet	feet	feet	feet	feet	feet	cfs			feet	feet	cfs	Cond.
01/02/00	1018	0	0	0	0	0	0	0			0	0	0	D
02/14/00	928	0	0	0	0	0	0	0			0	0	0	D
04/17/00	917	0	0	0	0	0	0	0			0	0	0	D
04/24/00	849	0	0	0	0	0	0	0			0	0	0	D
05/02/00	1352	0	0	0	0	0	0	0			0	0	0	D
05/08/00	855	0	0	0	0	0	0	0			0	0	0	D
05/15/00	1114	0	0	0	0	0	0	0			0	0	0	D
05/22/00	930	0	0	0	0	0	0	0			0	0	0	D
05/29/00	900	0	0	0	0	0	0	0			0	0	0	D
06/12/00	1000	0	0	0	0	0	0	0			0	0	0	D
06/20/00	1027	0	0	0	0	0	0	0			0	0	0	D
06/26/00	1049	0	0	0	0	0	0	0			0	0	0	D
07/04/00	1029	0	0	0	0	0	0	0			0	0	0	D
07/17/00	1526	0	0	0	0	0	0	0			0	0	0	D
07/31/00	930	0	0	0	0	0	0	0			0	0	0	D
08/07/00	956	0	0	0	0	0	0	0			0	0	0	D
08/14/00	1030	0	0	0	0	0	0	0			0	0	0	D
08/21/00	1028	0	0	0	0	0	0	0			0	0	0	D
09/05/00	1053	0	0	0	0	0	0	0	0.05		0	0	0	D
09/18/00	1540	0	0.11	0.02	0	0.05	0.09	0.09	0.05		0.11	0	0.09	FF
09/19/00	1017	0.44	0.42	0.02	0.46	0.44	0.02	-0.42	0.05		0.42	0.39	0.52	FF
09/20/00	1220	0.26	0	0.01	0.28	0.27	0.01	-0.24	0.05		0.25	0.22	0.21	FF
09/25/00	1327	0	0	0	0	0.02	0.29	0.03	0.05		0.04	0	0.03	FF
10/03/00	1002	0	0	0	0	0	0	0	0.05		0	0	0	D
10/04/00	755	0.10	0.05	0.05	0.02	0	-0.01	0.04	0.05		0.05	0	0.04	FF
10/05/00	1003	0.05	0.04	0.01	0.02	0	0.00	0.03	0.05		0.04	0	0.03	FF
10/23/00	918	0	0	0	0	0	0	0	0.05		0	0	0	D
11/01/00	1447	0	0	0	0	0	0	0	0.05		0	0	0	D
12/11/00	1041	0	0	0	0	0	0	0	0.05		0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

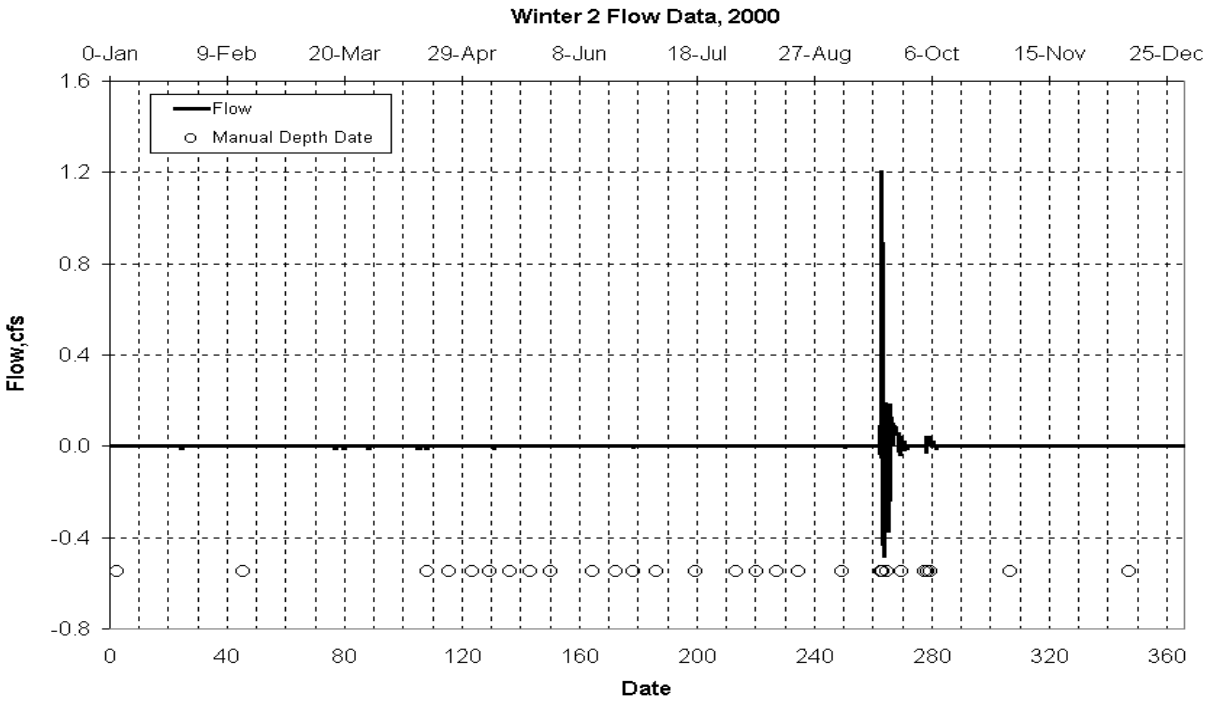


Figure 10c. Comparison of unadjusted flow record and dates of manual stage measurements for *winter* pasture 2 the flume during the year 2000.

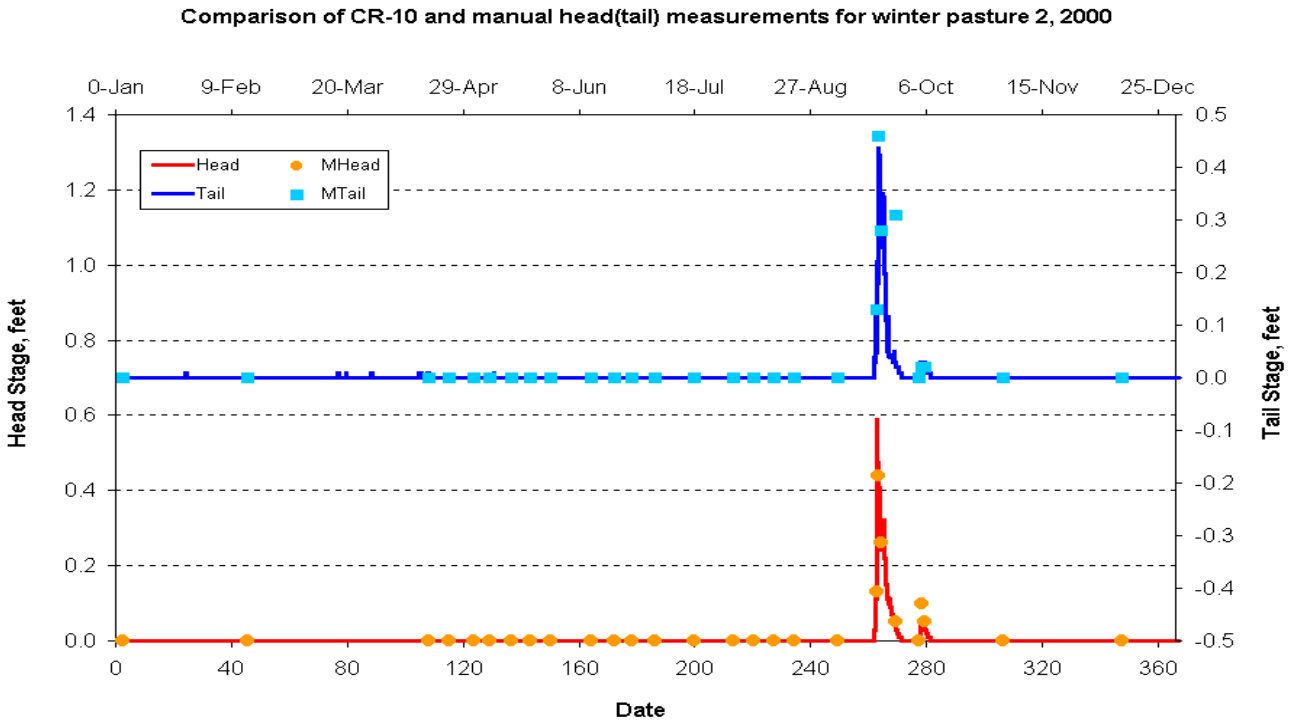


Figure 10d. Unadjusted flume upstream and downstream stage data for *winter* pasture 2 based on comparison between sensor values and manual stage measurements during the year 2000.

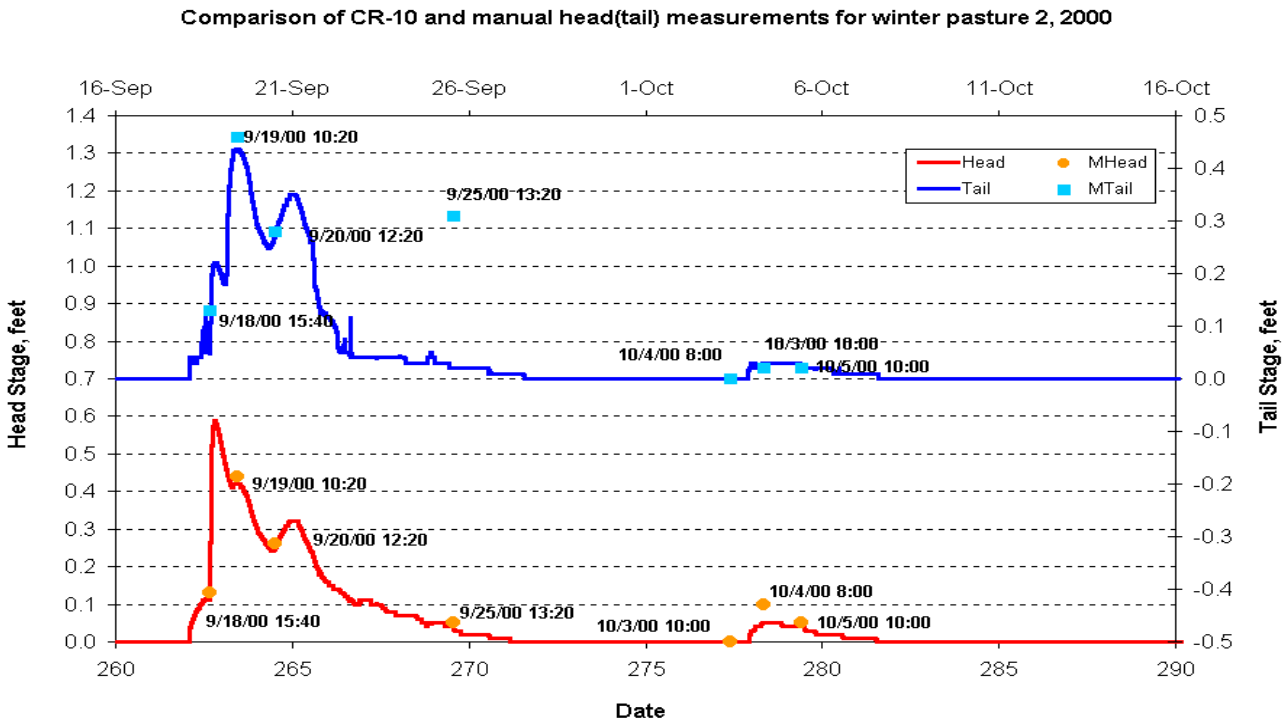


Figure 10e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *winter* 2 pasture during the peak flow period (9/16/00-10/16/00) for the year 2000.

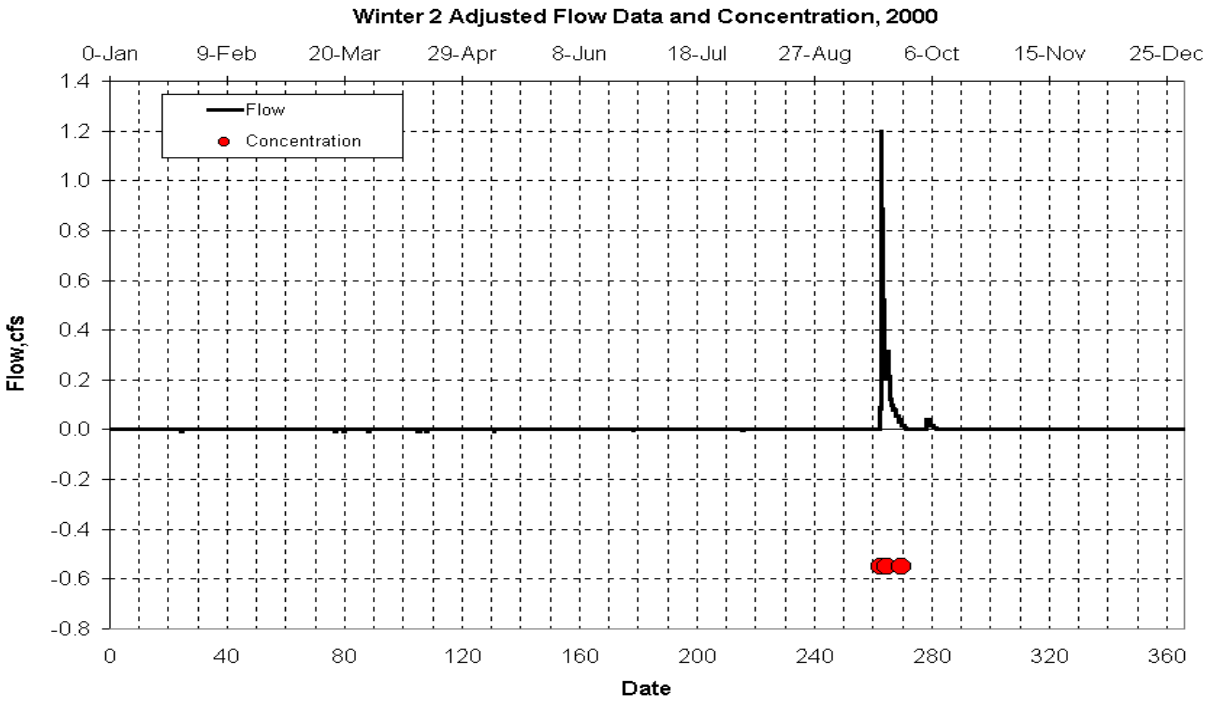


Figure 10f. Flow magnitudes and water quality sample collection dates for *winterer* pasture 2 for the year 2000.

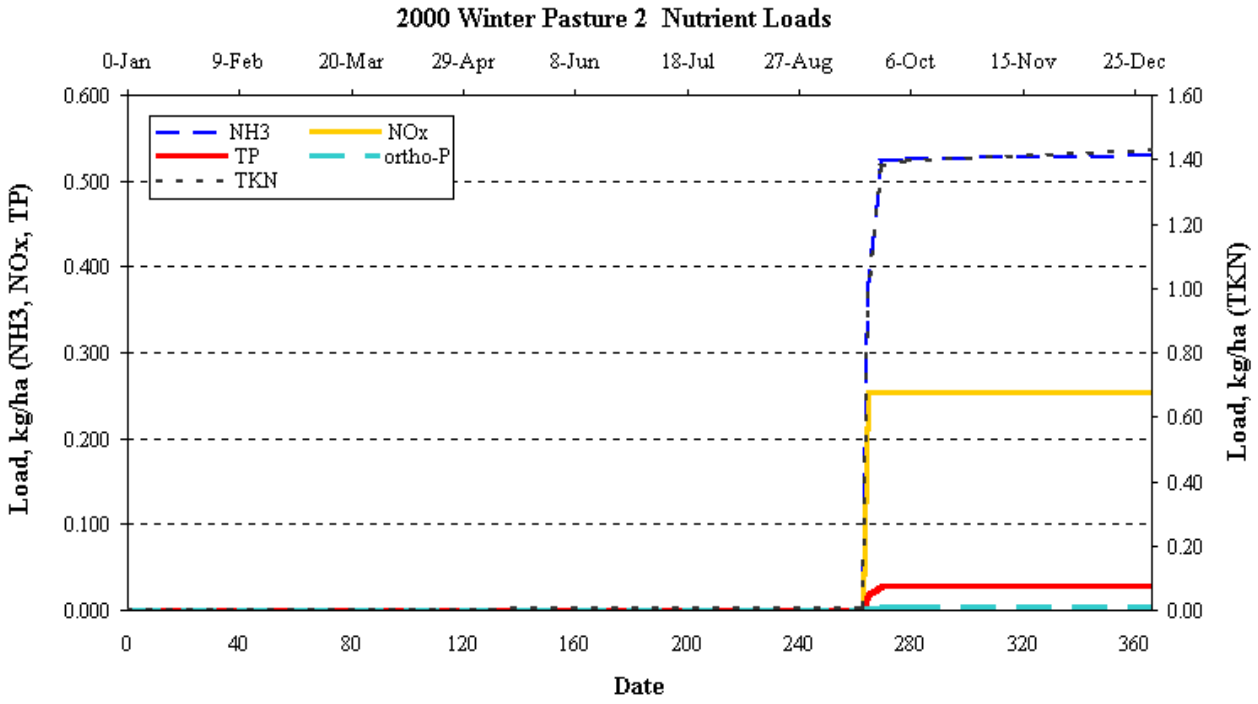


Figure 10g. Flow magnitudes and water quality sample collection dates for *winter* pasture 2 for the year 2000.

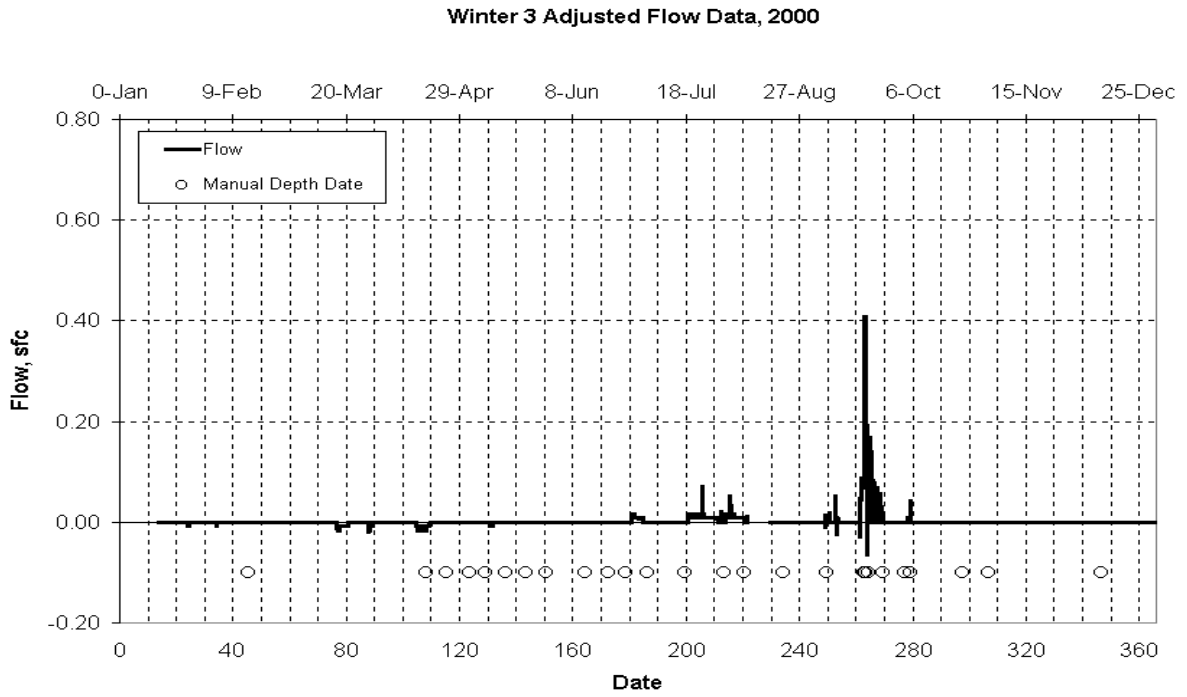


Figure 11a. Flow record for flume at *winter* pasture 3 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

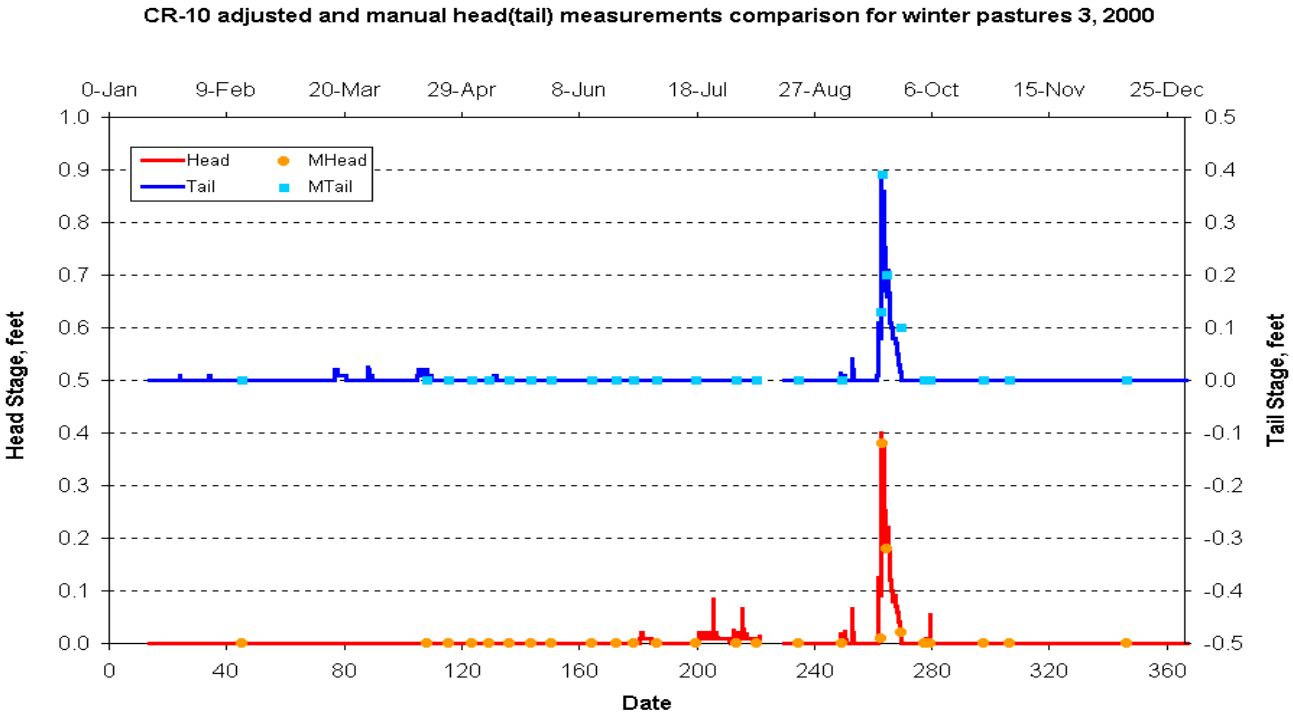


Figure 11b. Flume upstream and downstream stage data for wint*er* pasture 3 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 11. Summary of comparisons and adjustment of *winter* pasture 3 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow
		Man.	CR10	Diff	Man.	CR10	Diff	CR10	Up Error	Dn Error		CR10		Cond.
		feet	feet	feet	feet	feet	feet	cfs			feet	feet	cfs	
01/02/00	1028	0	0	0	0	0	0	0	0.07	0.03	0	0	0	D
02/14/00	942	0	0	0	0	0	0	0	0.07	0.03	0	0	0	D
04/17/00	926	0	0	0	0	0.04	-0.04	-0.03	0.07	0.03	0	0.01	-0.01	D
04/24/00	858	0	0	0	0	0	0	-0.02	0.07	0.03	0	0	0	D
05/02/00	1412	0	0	0	0	0	0	0	0.07	0.03	0	0	0	D
05/08/00	915	0	0	0	0	0	0	0	0.07	0.03	0	0	0	D
05/15/00	1123	0	0	0	0	0	0	-0.02	0.07	0.03	0	0	0	D
05/22/00	942	0	0	0	0	0	0	-0.01	0.07	0.03	0	0	0	D
05/29/00	904	0	0	0	0	0	0	0	0.07	0.03	0	0	0	D
06/12/00	1009	0	0	0	0	0	0	0	0.07	0.03	0	0	0	D
06/20/00	1039	0	0	0	0	0	0	0	0.07	0.03	0	0	0	D
06/26/00	1120	0	0	0	0	0	0	0	0.07	0.03	0	0	0	D
07/04/00	1115	0	0	0	0	0	0	0.06	0.07	0.03	0	0	0	D
07/17/00	1551	0	0	0	0	0	0	0.06	0.07	0.03	0	0	0	D
07/31/00	937	0	0	0	0	0	0	0	0.07	0.03	0	0	0	D
08/07/00	1016	0	0	0	0	0	0	0.07	0.07	0.03	0.01	0	0.01	D
08/14/00	1100	0	0	0	0	0	0	0			0	0	0	D
08/21/00	1053	0	0	0	0	0	0	0			0	0	0	D
09/05/00	1140	0	0	0	0	0	0	0			0	0	0	D
09/18/00	1550	0.10	0.10	0.00	0.13	0.11	0.02	-0.08	-0.01	-0.03	0.09	0.08	0.07	SW
09/19/00	1022	0.38	0.39	-0.01	0.39	0	0	0	-0.01	-0.03	0.38	0.36	0.41	SW
09/20/00	1247	0	0.19	0	0	0	0	0	-0.01	-0.03	0.18	0.16	0.13	SW
09/25/00	1332	0	0	0	0	0	0	0	-0.01	-0.03	0.01	0.01	0	SW
10/03/00	1016	0	0	0	0	0	0	0	-0.01	-0.03	0	0	0	D
10/05/00	1036	0	0	0	0	0	0	0	-0.01	-0.03	0.05	0	0.04	D
10/23/00	930	0	0	0	0	0	0	0	-0.01	-0.03	0	0	0	D
11/01/00	1500	0	0	0	0	0	0	0	-0.01	-0.03	0	0	0	D
12/11/00	1056	0	0	0	0	0	0	0	-0.01	-0.03	0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

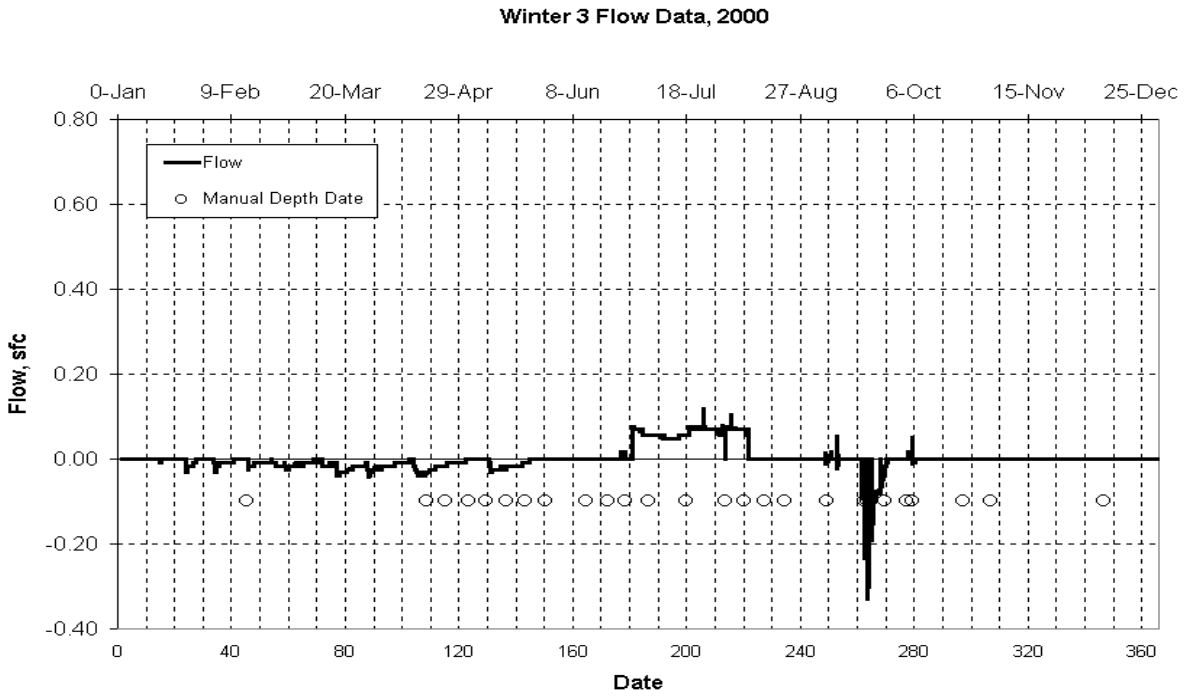


Figure 11c. Comparison of unadjusted flow record and dates of manual stage measurements for *winter* pasture 3 the flume during the year 2000.

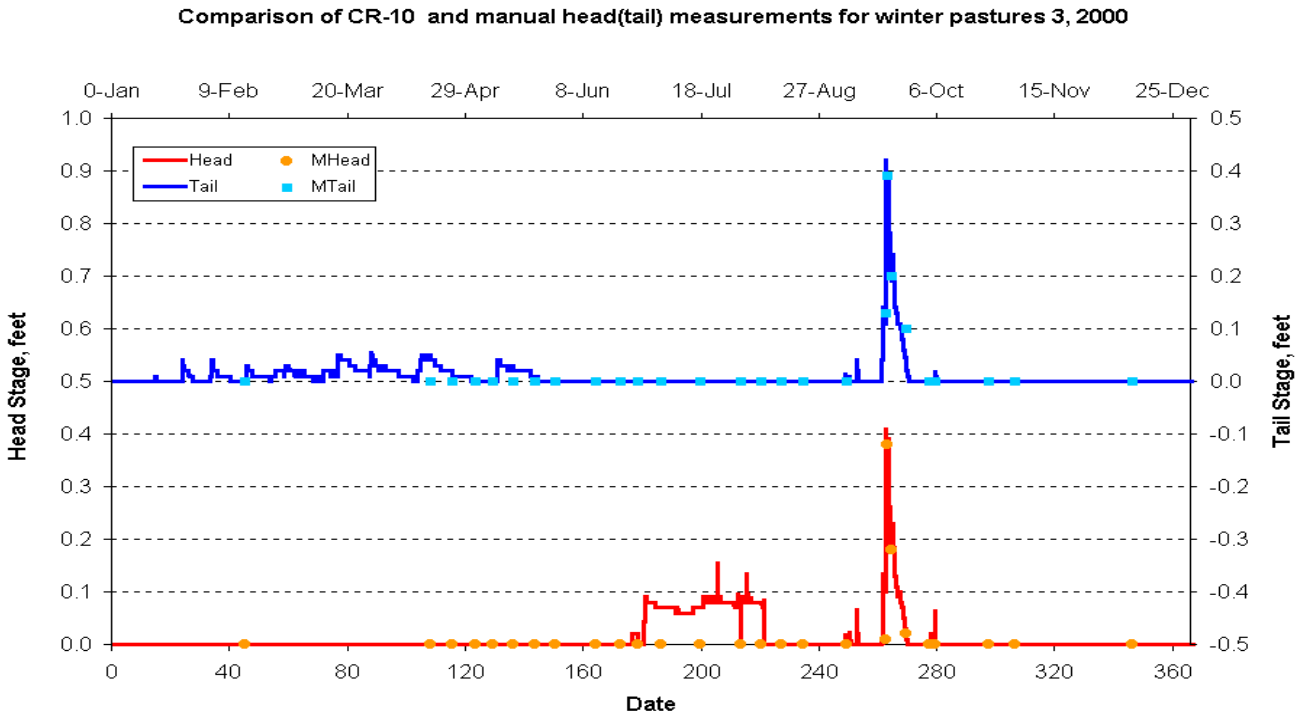


Figure 11d. Unadjusted flume upstream and downstream stage data for *winter* pasture 3 based on comparison between sensor values and manual stage measurements during the year 2000.

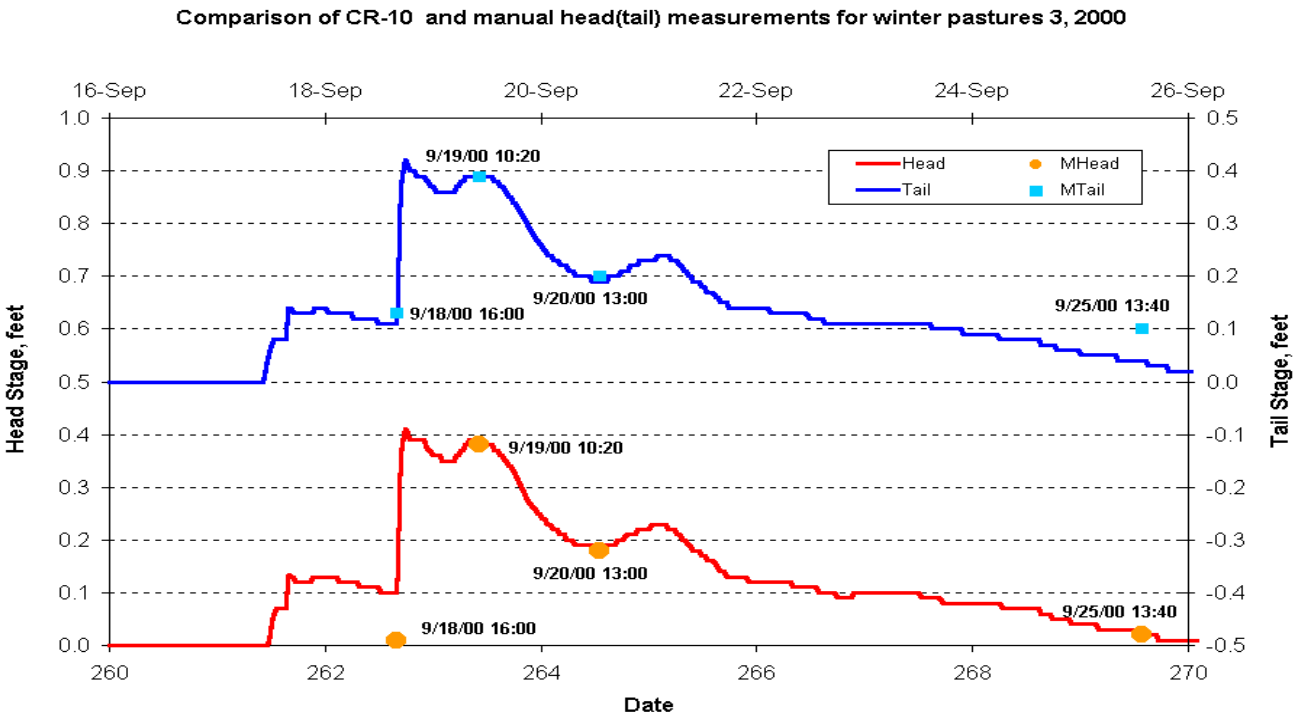


Figure 11e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *winter* 3 pasture during the peak flow period (9/16/00-10/26/00) for the year 2000.

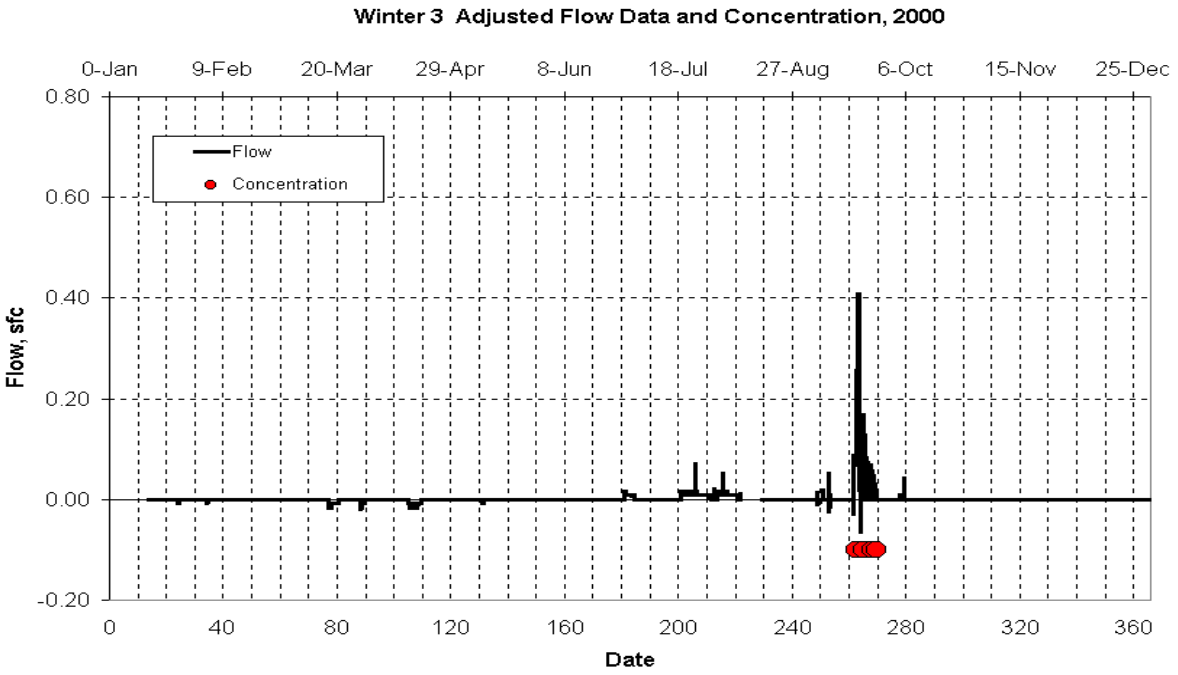


Figure 11f. Flow magnitudes and water quality sample collection dates for *winterer* pasture 3 for the year 2000.

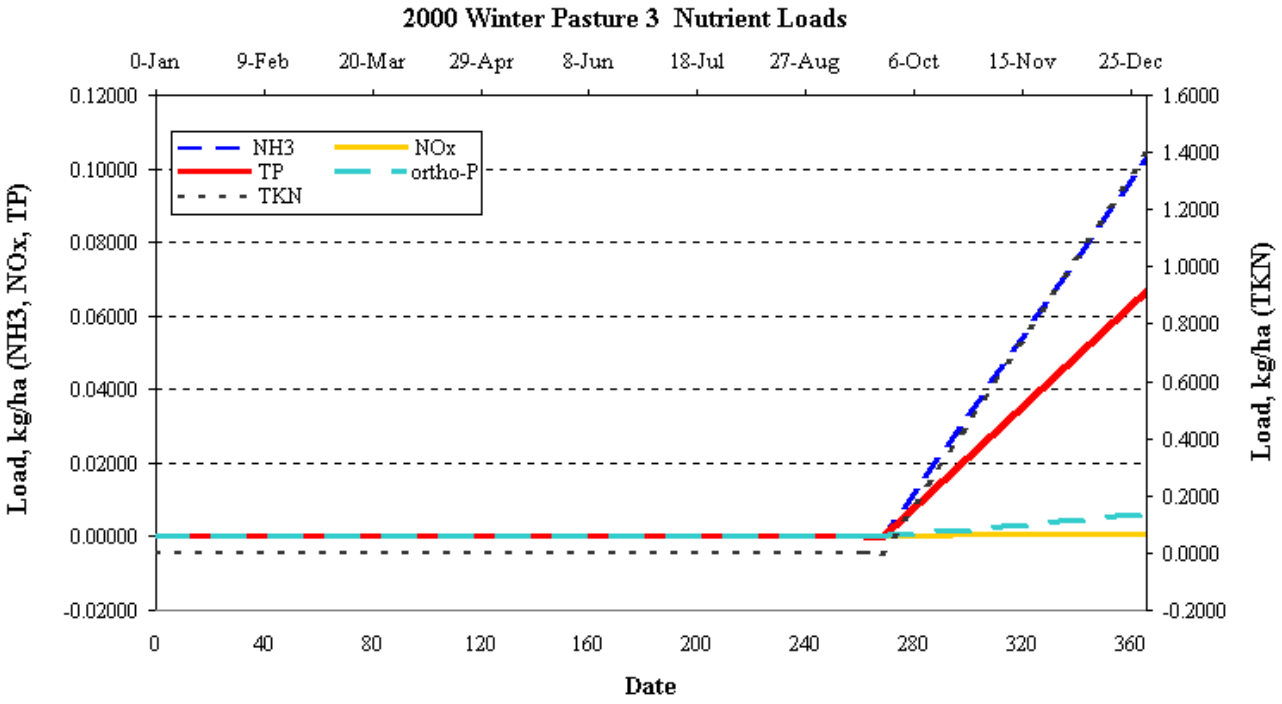


Figure 11g. Flow magnitudes and water quality sample collection dates for *winter* pasture 3 for the year 2000.

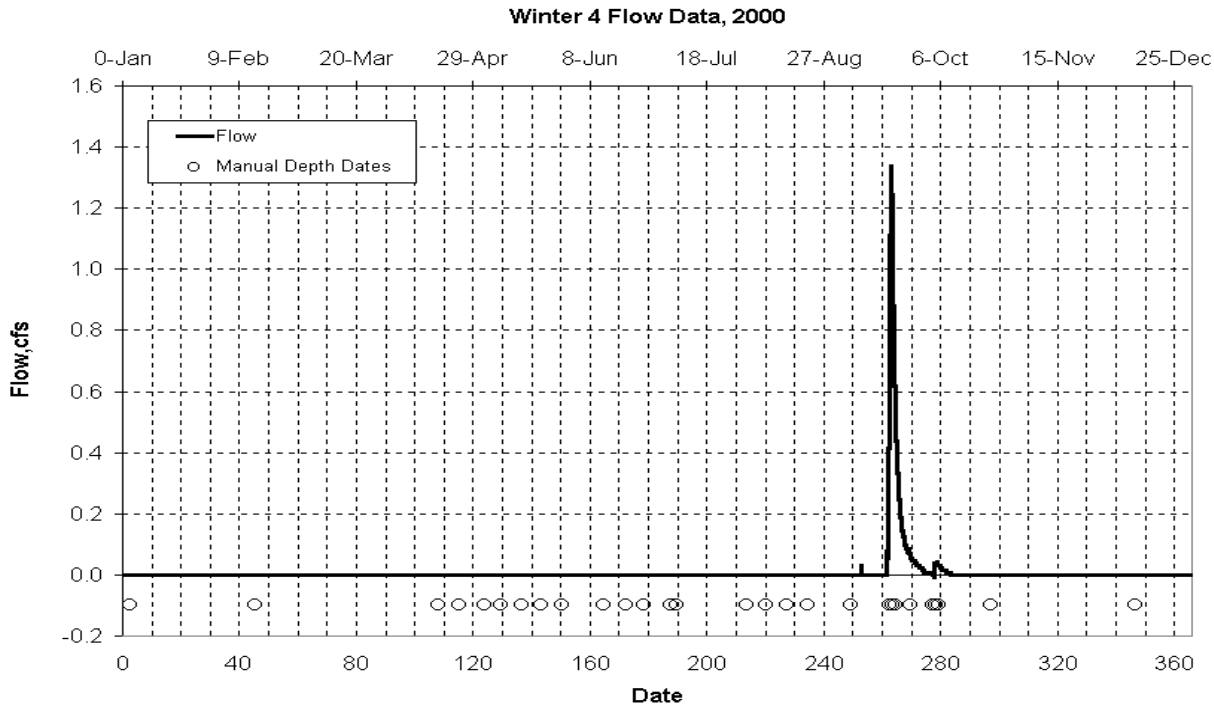


Figure 12a. Comparison of unadjusted flow record and dates of manual stage measurements for *winter* pasture 4 the flume during the year 2000.

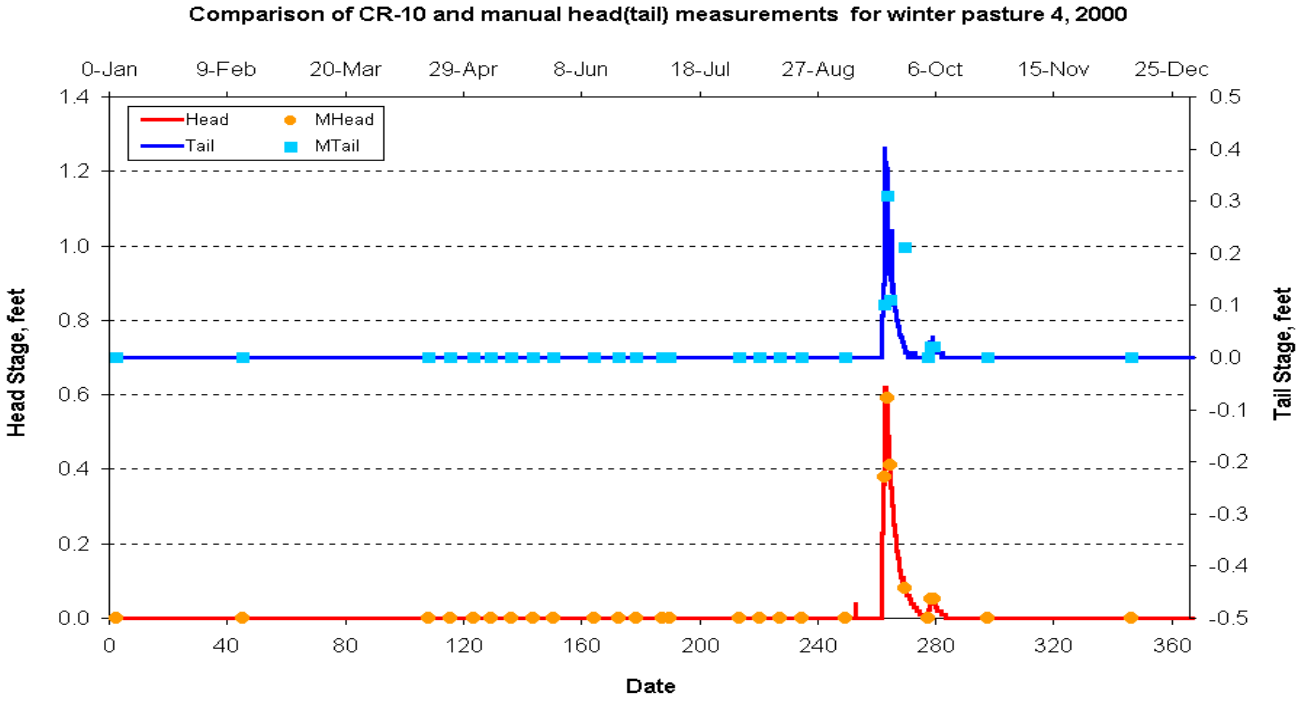


Figure 12b. Unadjusted flume upstream and downstream stage data for *winter* pasture 4 based on comparison between sensor values and manual stage measurements during the year 2000.

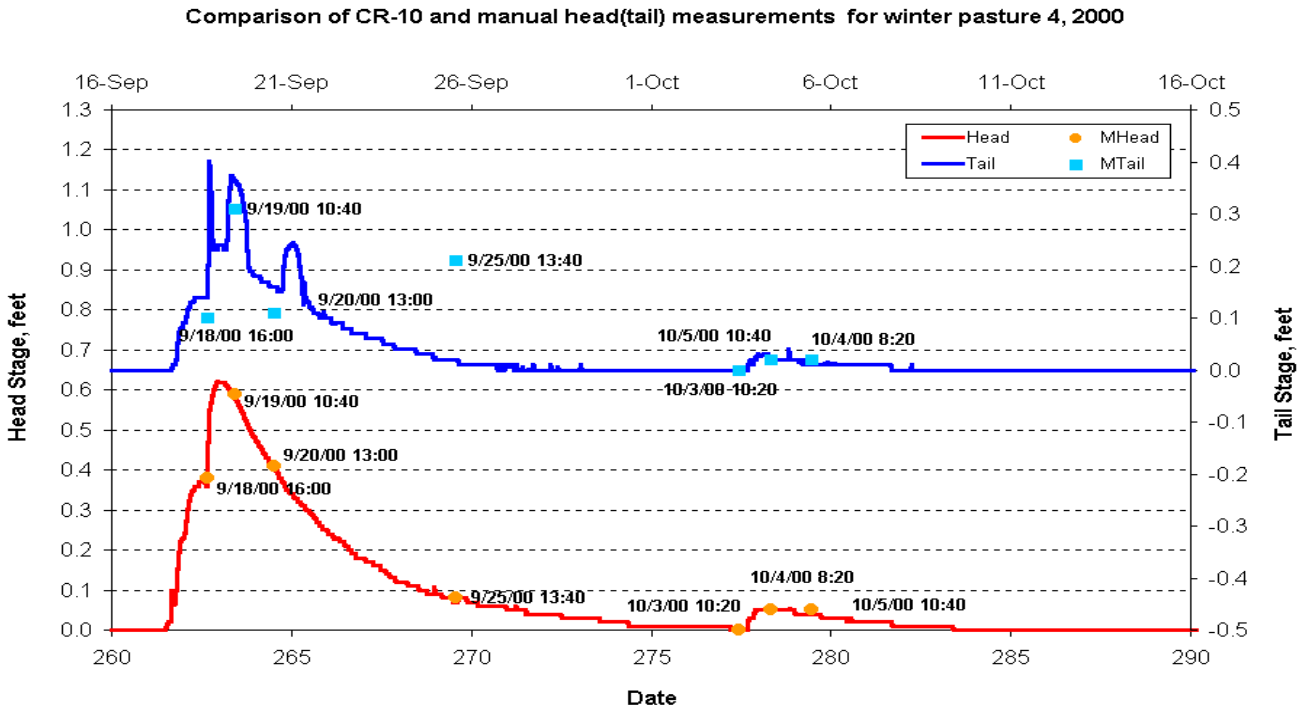


Figure 12c. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *winter* 4 pasture during the peak flow period (9/16/00-10/16/00) for the year 2000.

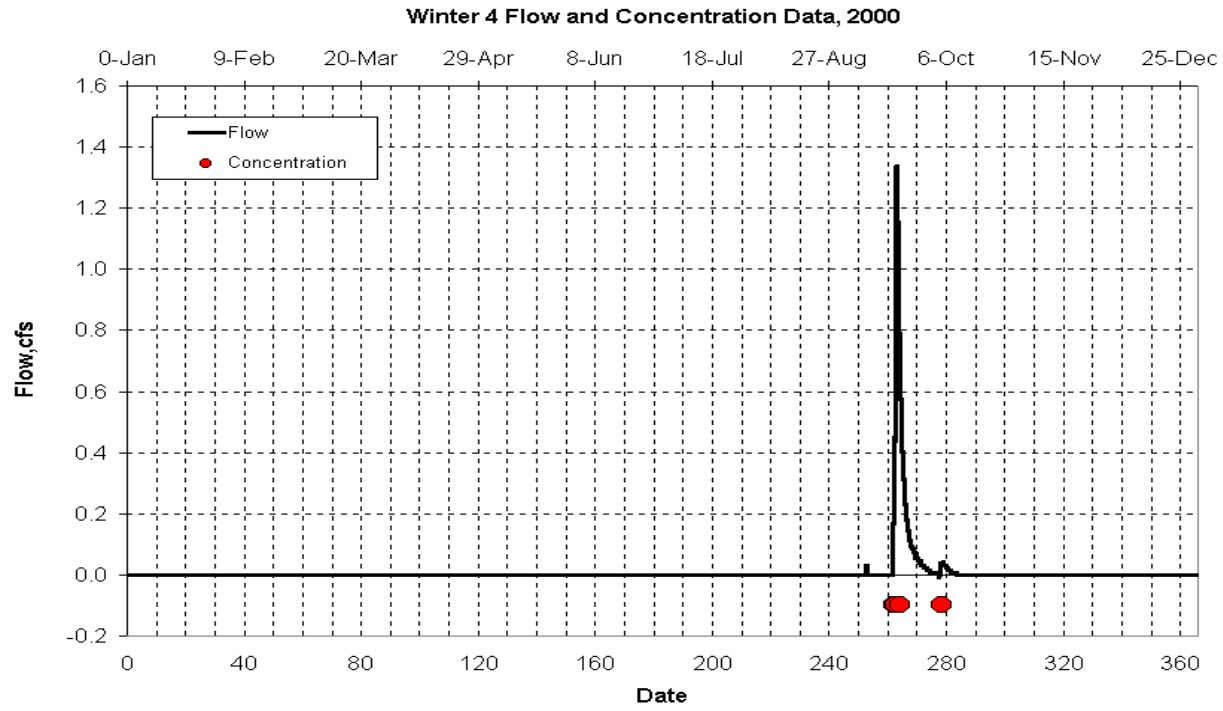


Figure 12d. Flow magnitudes and water quality sample collection dates for *winterer* pasture 4 for the year 2000.

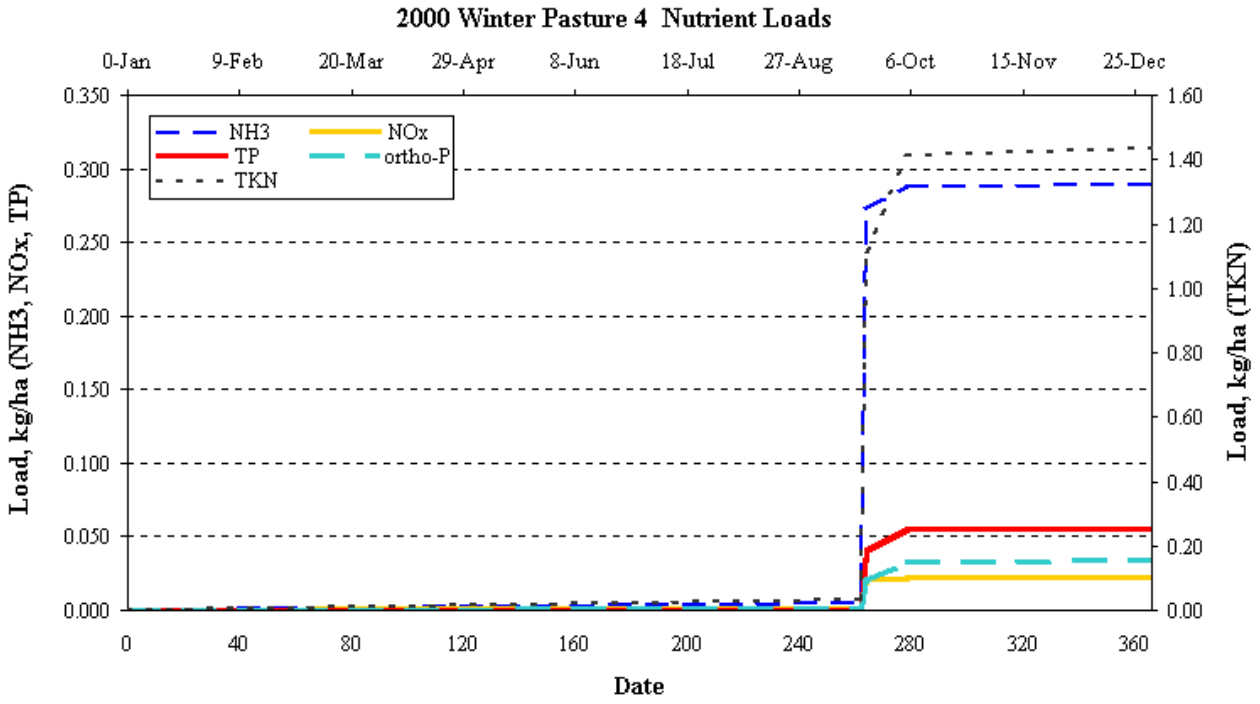


Figure 12e. Flow magnitudes and water quality sample collection dates for *winter* pasture 4 for the year 2000.

Table 12. Summary of comparisons and adjustment of *winter* pasture 4 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow Cond.
		Man.	CR10	Diff	Man.	CR10	Diff	CR10	Up Error	Dn Error		CR10		
		feet	feet	feet	feet	feet	feet	cfs			feet	feet	cfs	
01/02/00	1046	0	0	0	0	0	0	0						D
02/14/00	951	0	0	0	0	0	0	0						D
04/17/00	44	0	0	0	0	0	0	0						D
04/24/00	918	0	0	0	0	0	0	0						D
05/02/00	1501	0	0	0	0	0	0	0						D
05/08/00	923	0	0	0	0	0	0	0						D
05/15/00	1130	0	0	0	0	0	0	0						D
05/22/00	958	0	0	0	0	0	0	0						D
05/29/00	914	0	0	0	0	0	0	0						D
06/12/00	1028	0	0	0	0	0	0	0						D
06/20/00	1049	0	0	0	0	0	0	0						D
06/26/00	1128	0	0	0	0	0	0	0						D
07/05/00	905	0	0	0	0	0	0	0						D
07/17/00	1602	0	0	0	0	0	0	0						D
07/31/00	948	0	0	0	0	0	0	0						D
08/07/00	1024	0	0	0	0	0	0	0						D
08/14/00	1120	0	0	0	0	0	0	0						D
08/21/00	1058	0	0	0	0	0	0	0						D
09/05/00	1149	0	0	0	0	0	0	0						D
09/18/00	1558	0.38	0.36	0	0.10	0.14	0	0.44						FF
09/19/00	1030	0.59	0.58	0.01	0.31	0.36	-0.05	1.16						FF
09/20/00	1254	0.41	0.40	0	0.11	0.16	-0.05	0.54						FF
09/25/00	1337	0	0.07	0	0	0.02	0	0.06						FF
10/03/00	1023	0	0	0	0	0	0	0						D
10/04/00	815	0.05	0.05	0.00	0.02	0.02	0.00	0.04						FF
10/05/00	1041	0	0	0	0	0	0	0						FF
10/23/00	938	0	0	0	0	0	0	0						D
11/01/00	1503	0	0	0	0	0	0	0						D
12/11/00	1114	0	0	0	0	0	0	0						D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

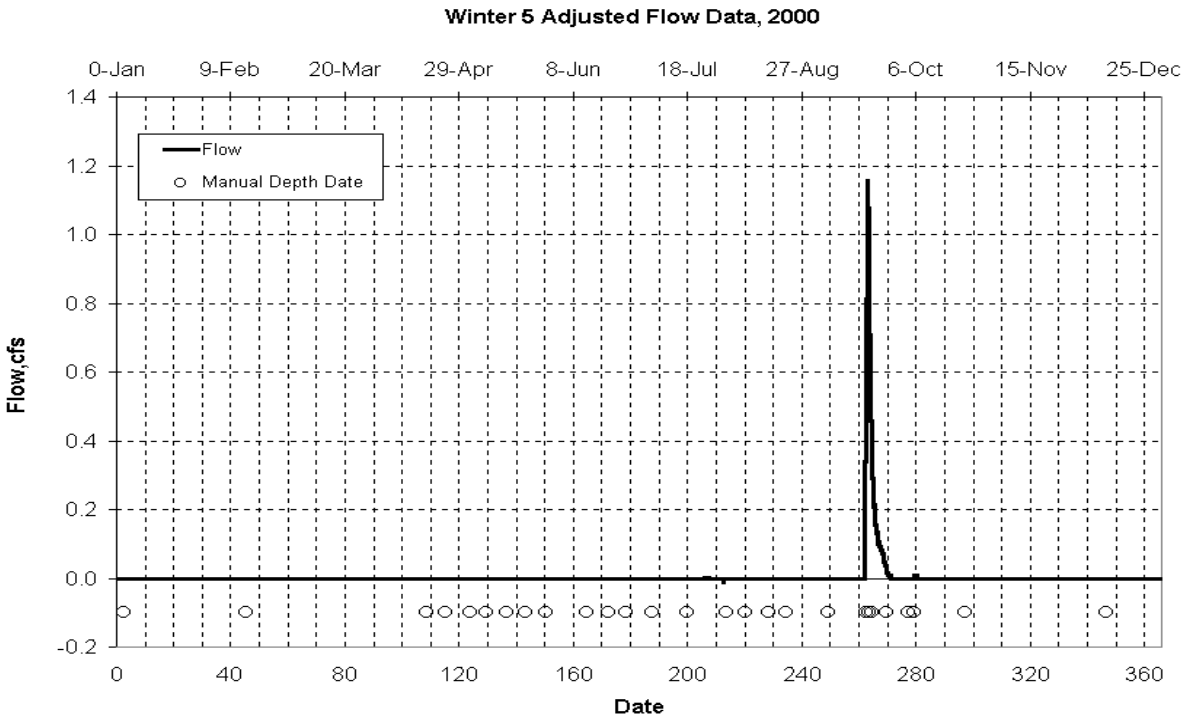


Figure 13a. Flow record for flume at *winter* pasture 5 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measure ments.

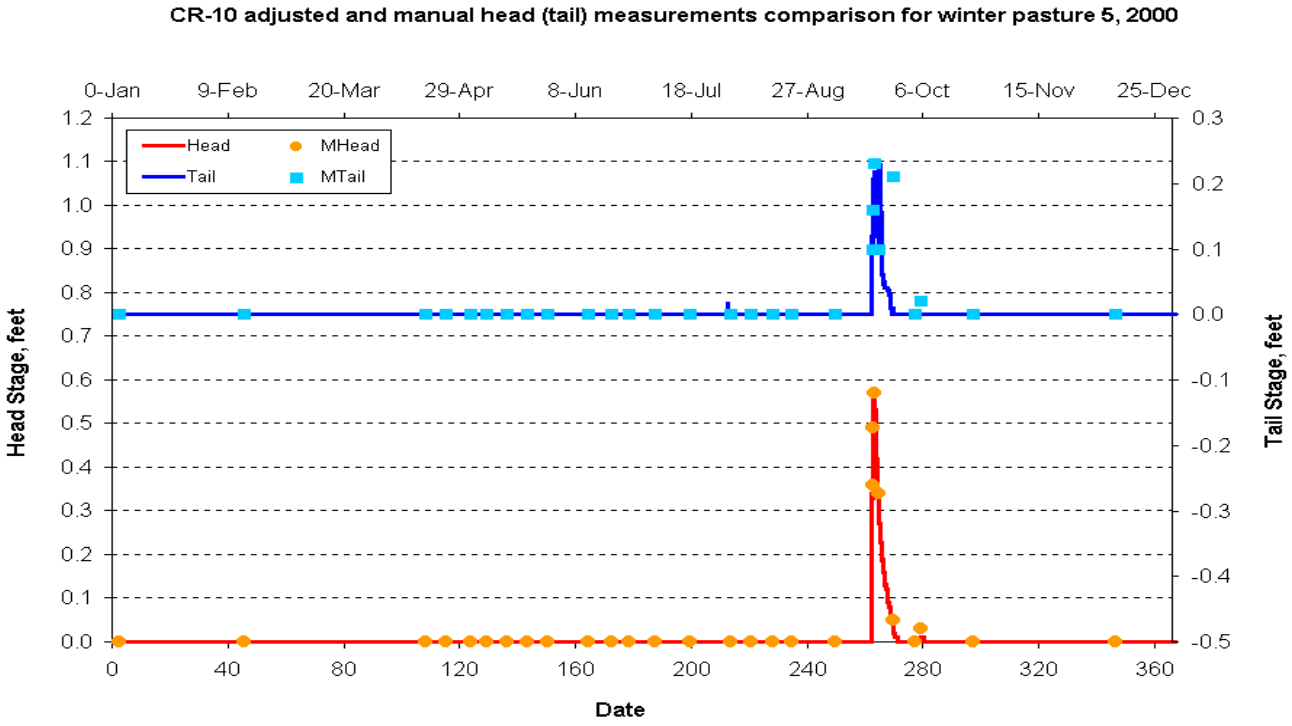


Figure 13b. Flume upstream and downstream stage data for wint*er* pasture 5 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 13. Summary of comparisons and adjustment of *winter* pasture 5 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow
		Man.	CR10	Diff	Man.	CR10	Diff	CR10	Up Error	Dn Error		CR10		Cond.
		feet	feet	feet	feet	feet	feet	cfs			feet	feet	cfs	
01/02/00	1108	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
02/14/00	1000	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
04/17/00	952	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
04/24/00	928	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
05/02/00	1534	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
05/08/00	927	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
05/15/00	1132	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
05/22/00	1007	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
05/29/00	918	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
06/12/00	1030	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
06/20/00	1053	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
06/26/00	1148	0	0	0	0	0	0	0.02	0.16	0.2	0	0	0	D
07/05/00	944	0	0.04	-0.04	0	0	0	0.03	0.16	0.2	0	0	0	D
07/17/00	1611	0	0.03	-0.03	0	0	0	0.02	0.16	0.2	0	0	0	D
07/31/00	955	0	0	0	0	0	0	0	0.16	0.2	0	0	0	D
08/07/00	1034	0	0	0	0	0	0	0			0	0	0	D
08/15/00	845	0	0	0	0	0	0	0			0	0	0	D
08/21/00	1107	0	0	0	0	0	0	0			0	0	0	D
09/05/00	1200	0	0	0	0	0	0	0			0	0	0	D
09/18/00	1600	0.36	0.33	0.03	0.10	0.11	-0.02	0.37			0.33	0.11	0.37	FF
09/18/00	1735	0.49	0.46	0.03	0.16	0.16	0.00	0.71			0.46	0.16	0.71	FF
09/19/00	1035	0.57	0.54	0.03	0.23	0.21	0.02	0.99			0.54	0.21	0.99	FF
09/20/00	1303	0.34	0.33	0.02	0.10	0.12	-0.02	0			0.33	0.12	0	FF
09/25/00	1358	0	0	0	0	0	0	0.03			0	0	0.03	FF
10/03/00	1027	0	0	0	0	0	0	0			0	0	0	D
10/05/00	1052	0.03	0.00	0.03	0.02	0.00	0.02	0			0	0	0	FF
10/23/00	945	0	0	0	0	0	0	0			0	0	0	D
11/01/00	1529	0	0	0	0	0	0	0			0	0	0	D
12/11/00	1133	0	0	0	0	0	0	0			0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

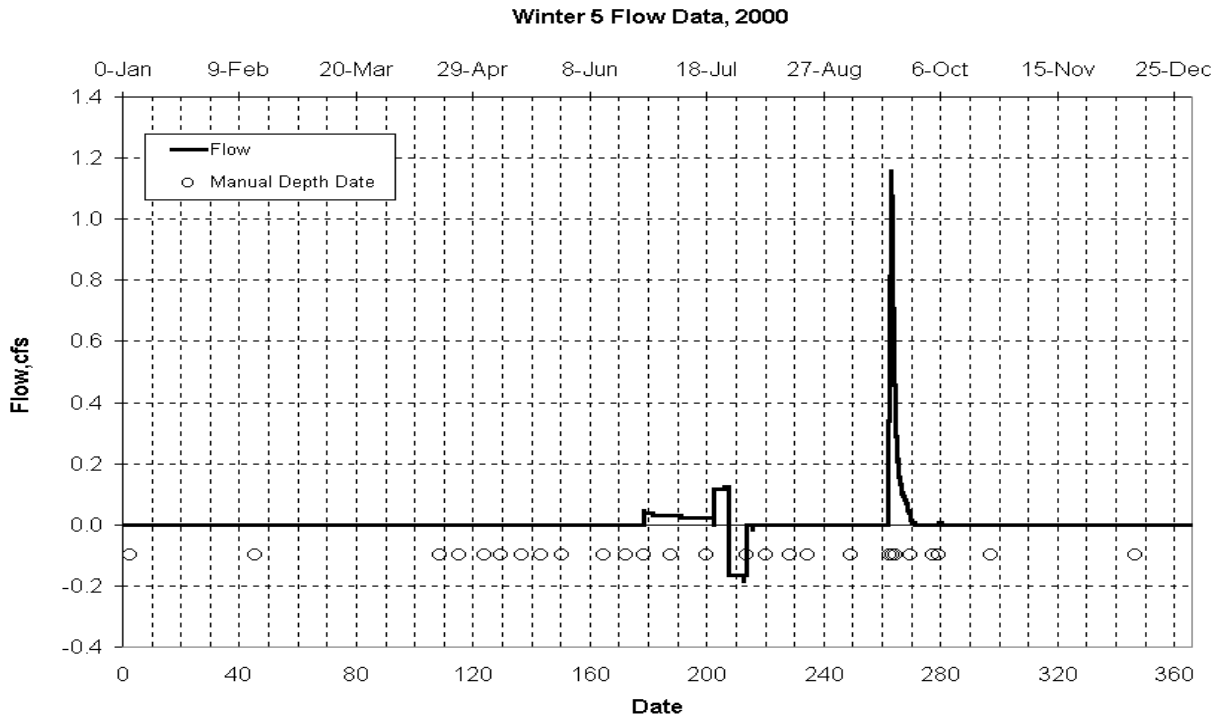


Figure 13c. Comparison of unadjusted flow record and dates of manual stage measurements for *winter* pasture 5 the flume during the year 2000.

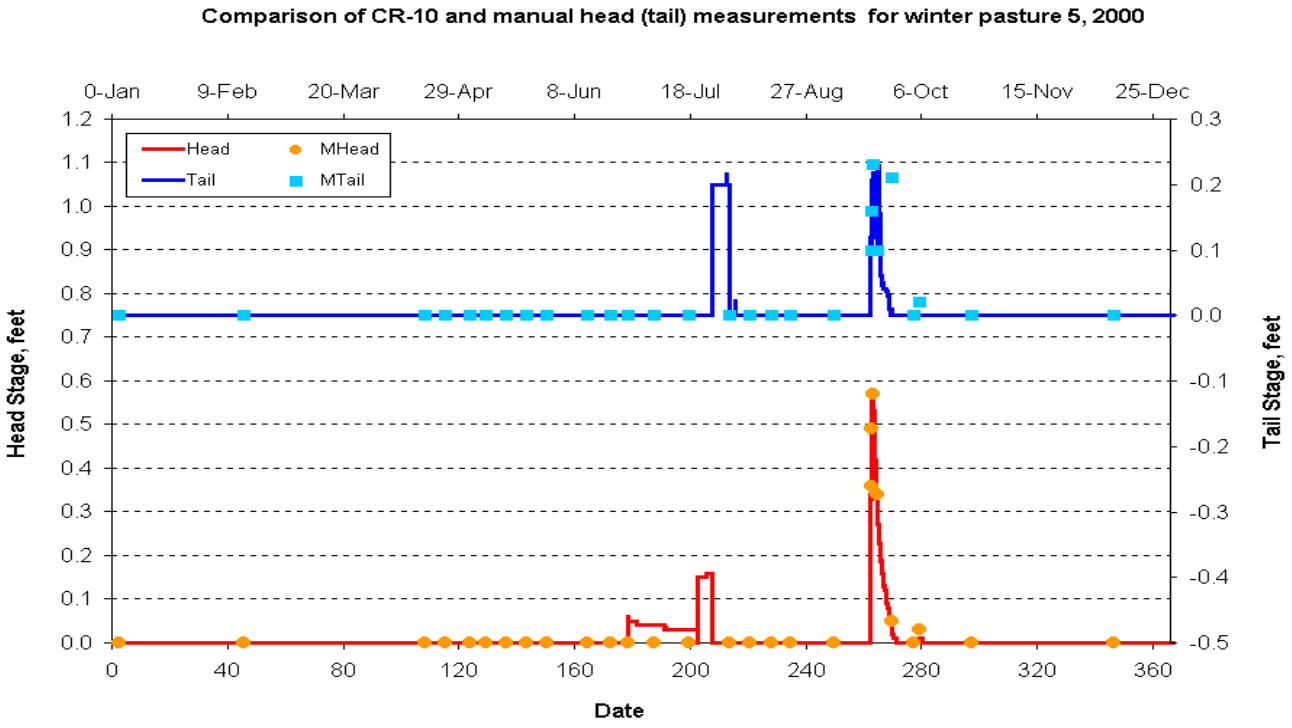


Figure 13d. Unadjusted flume upstream and downstream stage data for *winter* pasture 5 based on comparison between sensor values and manual stage measurements during the year 2000.

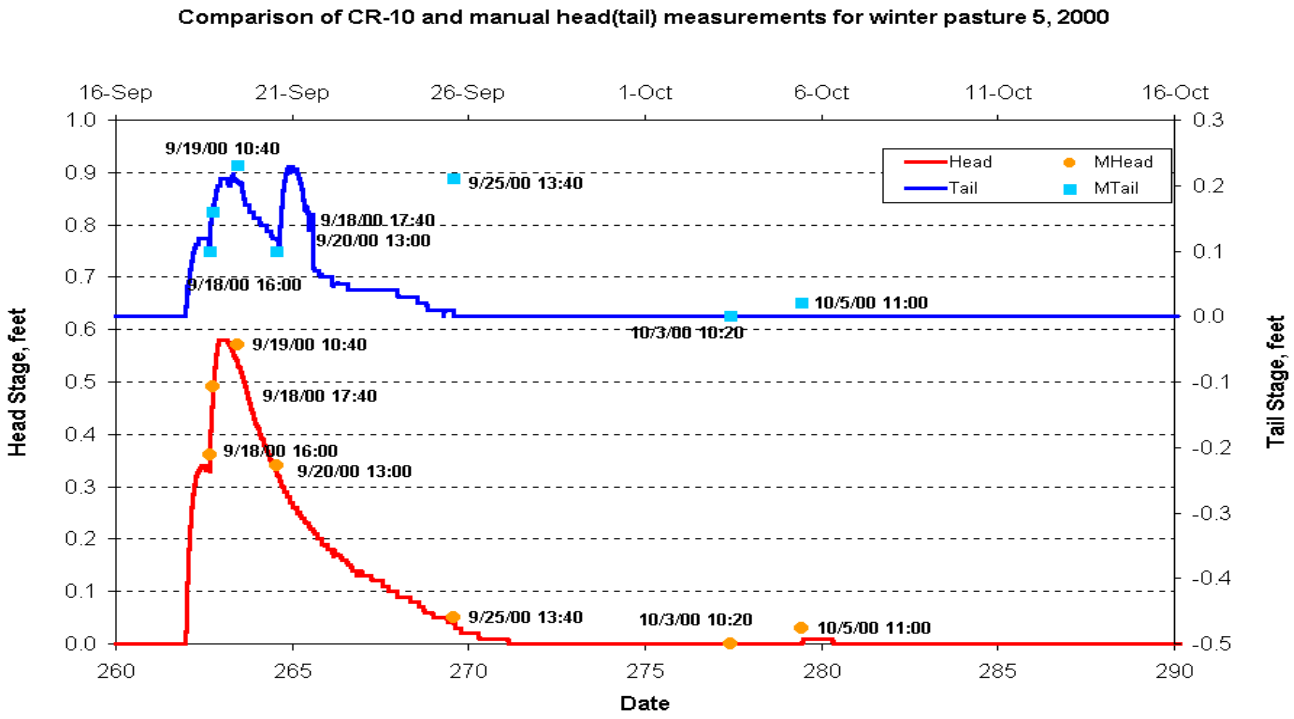


Figure 13e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *winter* 5 pasture during the peak flow period (9/16/00-10/16/00) for the year 2000.

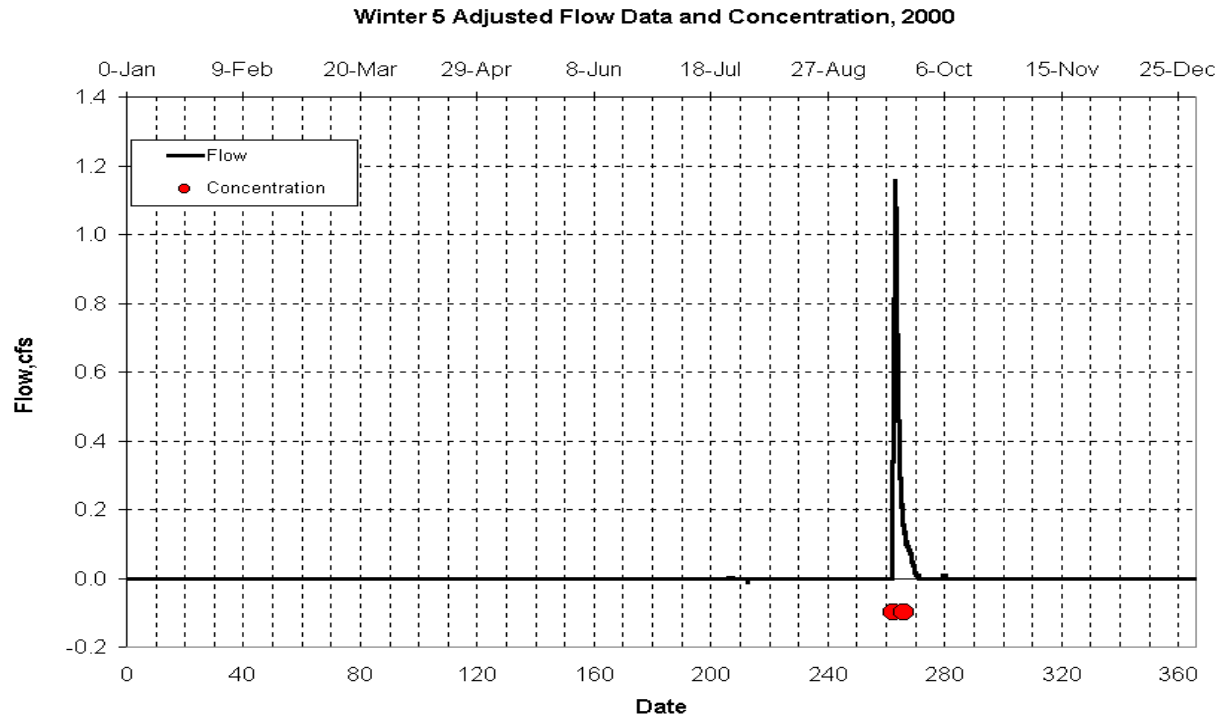


Figure 13f. Flow magnitudes and water quality sample collection dates for *winterer* pasture 5 for the year 2000.

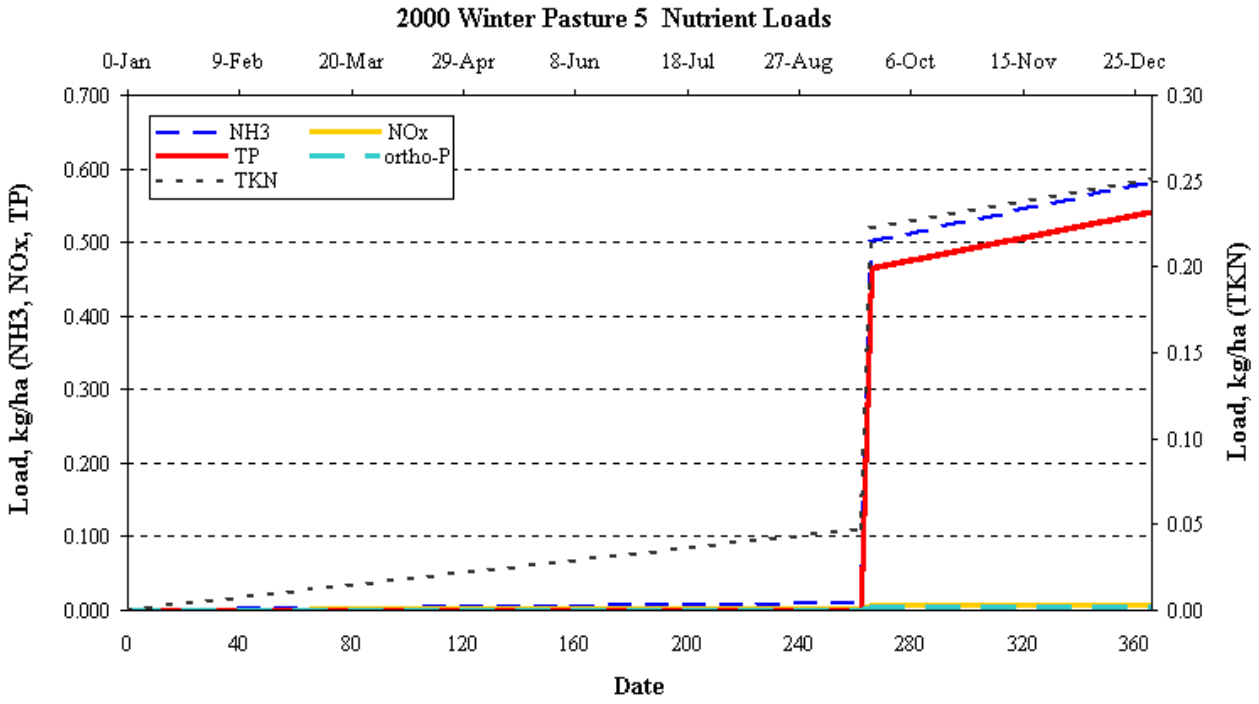


Figure 13g. Flow magnitudes and water quality sample collection dates for *winter* pasture 5 for the year 2000.

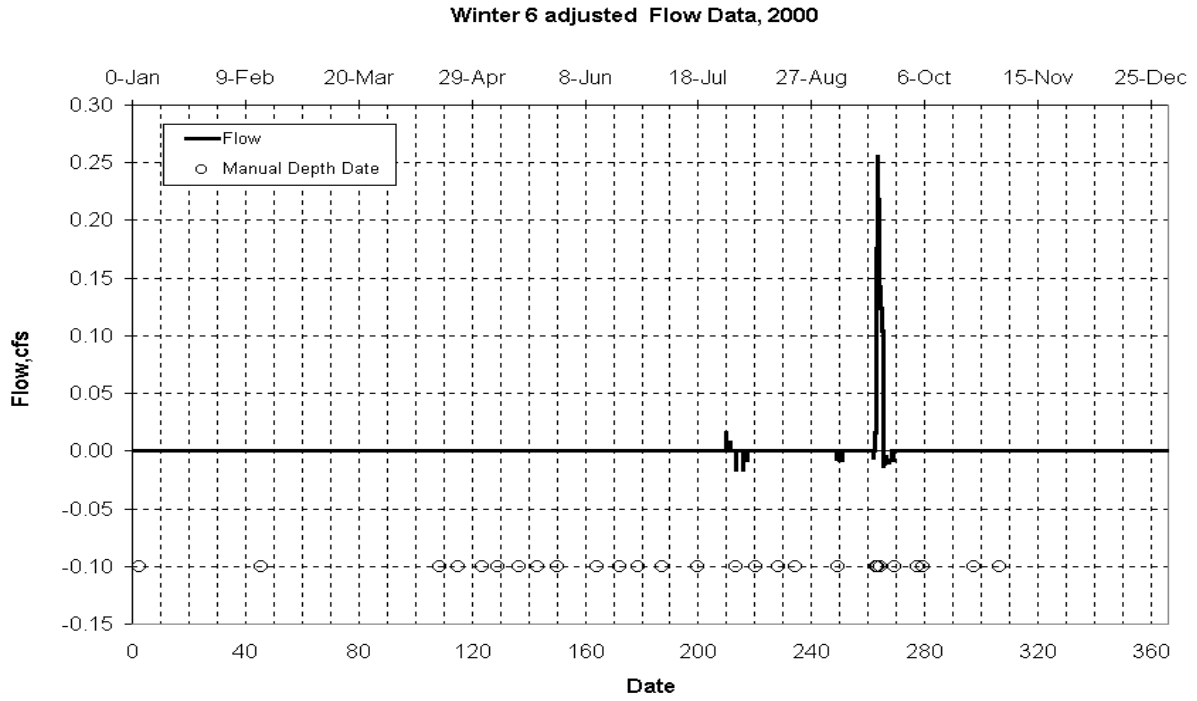


Figure 14a. Flow record for flume at *winter* pasture 6 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

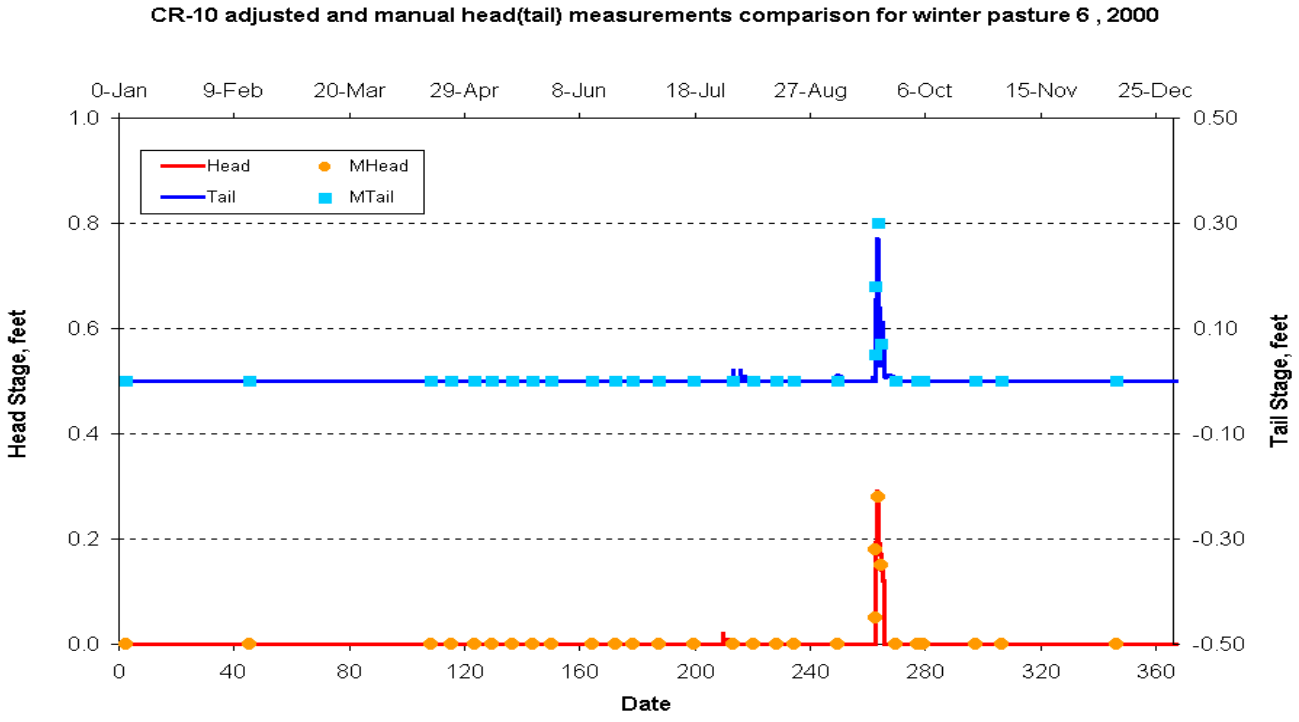


Figure 14b. Flume upstream and downstream stage data for wint*er* pasture 6 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 14. Summary of comparisons and adjustment of *winter* pasture 6 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow
		Man. feet	CR10 feet	Diff feet	Man. feet	CR10 feet	Diff feet	CR10 cfs	Up Error	Dn Error	feet	CR10 feet	cfs	Cond.
01/02/00	1120	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
02/14/00	1012	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
04/17/00	1003	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
04/24/00	937	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
05/02/00	1613	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
05/08/00	933	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
05/15/00	1136	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
05/22/00	1040	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
05/29/00	922	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
06/12/00	1039	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
06/20/00	1057	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
06/26/00	1203	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
07/05/00	1021	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
07/17/00	1632	0	0	0	0	0	0	0	0.2	0.5	0	0	0	D
07/31/00	1000	0	0.20	0.20	0	0	0	0.16	-0.2	0.5	0	0	0	D
08/07/00	1048	0	0	0	0	0	0	0			0	0	0	D
08/15/00	911	0	0	0	0	0	0	0			0	0	0	D
08/21/00	1130	0	0	0	0	0	0	0			0	0	0	D
09/05/00	1208	0	0	0	0	0	0	0			0	0	0	D
09/18/00	1604	0.05	0.00	0.05	0.05	0.01	0.04	-0.01	0.08		0.02	0.01	0.02	FF
09/18/00	1900	0.18	0.10	0	0.18	0.15	0.03	-0.11	0.08		0.18	0.15	0.14	FF
09/19/00	1044	0.28	0.20	0	0.30	0.26	0.04	-0.24	0.08		0.28	0.26	0.24	FF
09/20/00	1315	0	0	0	0	0	0	0	0.08		0.16	0.03	0.12	FF
09/25/00	1413	0	0	0	0	0	0	0			0	0	0	D
10/03/00	1036	0	0	0	0	0	0	0			0	0	0	D
10/05/00	1100	0	0	0	0	0	0	0			0	0	0	D
10/23/00	1003	0	0	0	0	0	0	0		0.5	0	0	0	D
11/01/00	1540	0	0	0	0	0	0	0		0.5	0	0	0	D
12/11/00	1151	0	0	0	0	0	0	0		0.5	0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

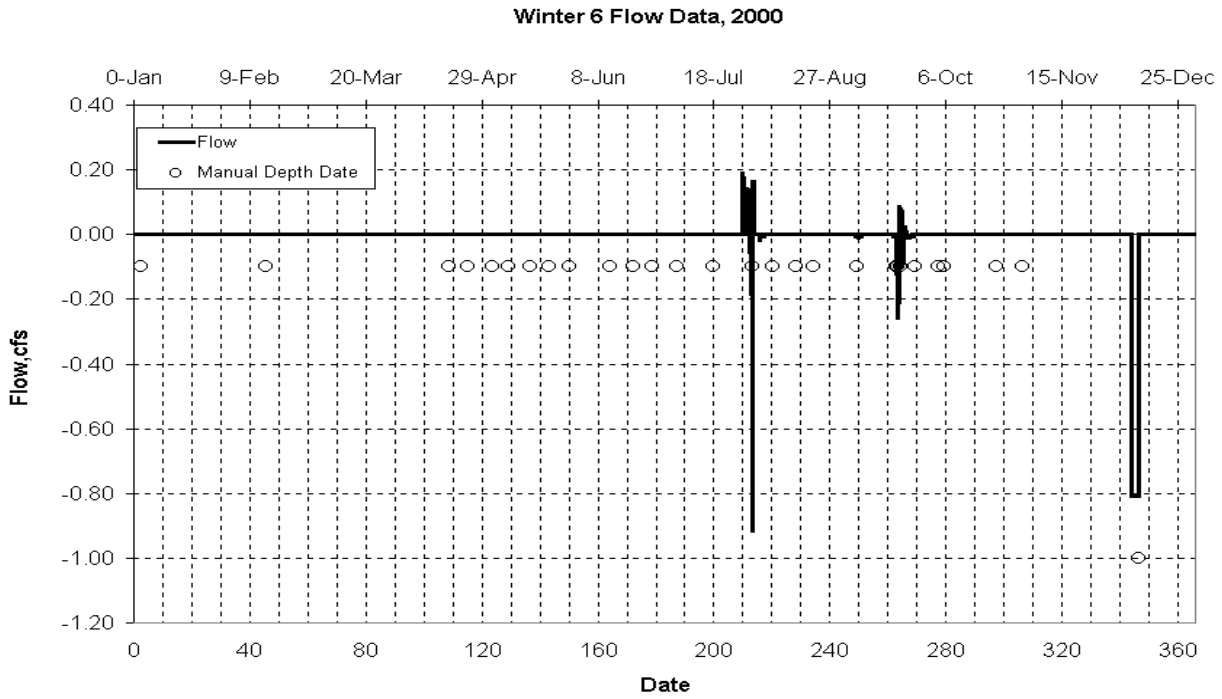


Figure 14c. Comparison of unadjusted flow record and dates of manual stage measurements for *winter* pasture 6 the flume during the year 2000.

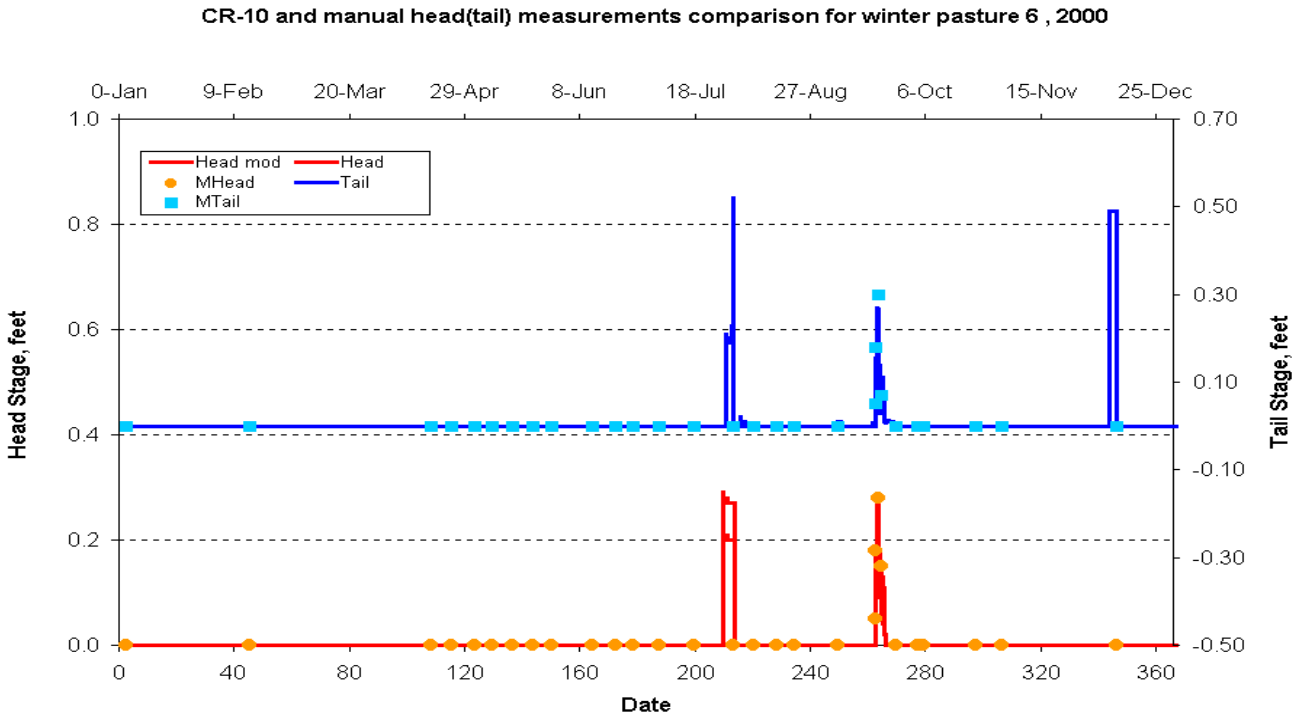


Figure 14d. Unadjusted flume upstream and downstream stage data for *winter* pasture 6 based on comparison between sensor values and manual stage measurements during the year 2000.

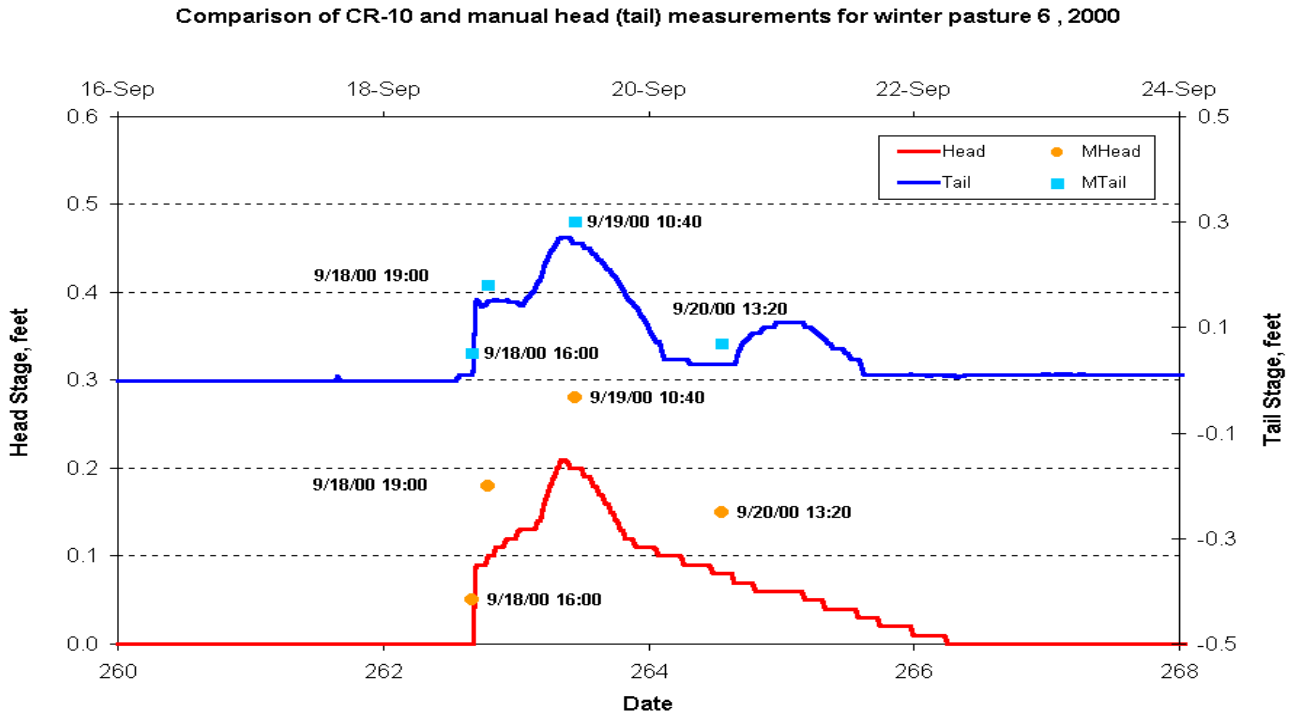


Figure 14e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *winter* 6 pasture during the peak flow period (9/16/00-10/24/00) for the year 2000.

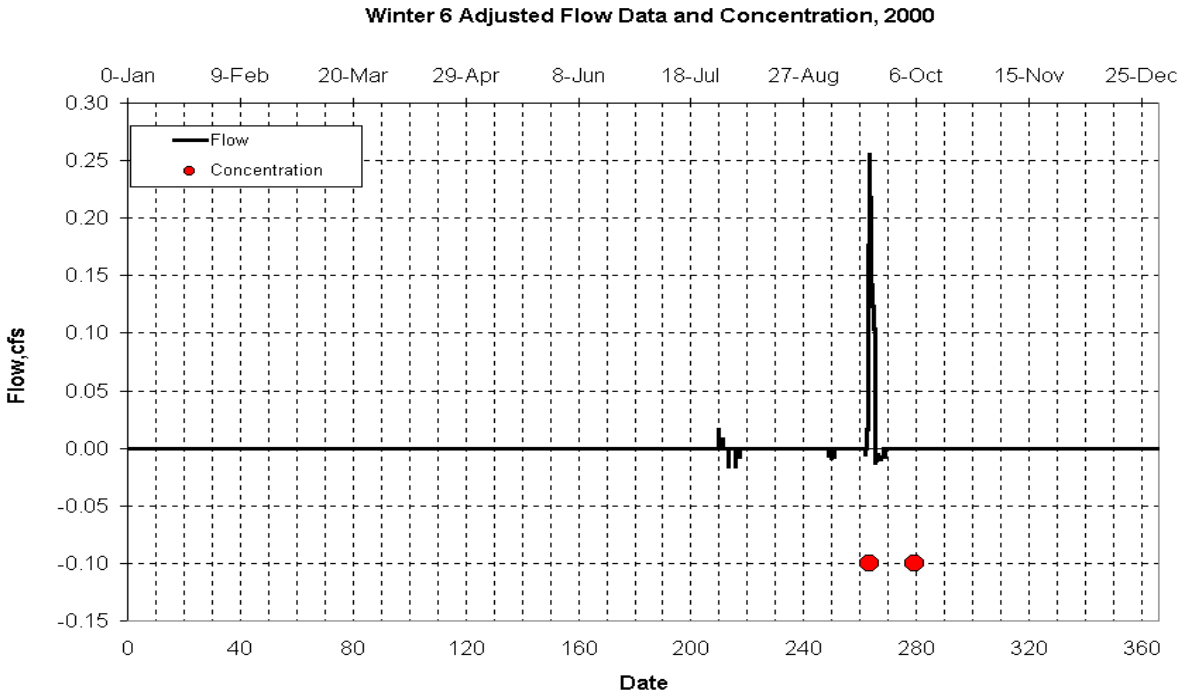


Figure 14f. Flow magnitudes and water quality sample collection dates for *winterer* pasture 6 for the year 2000.

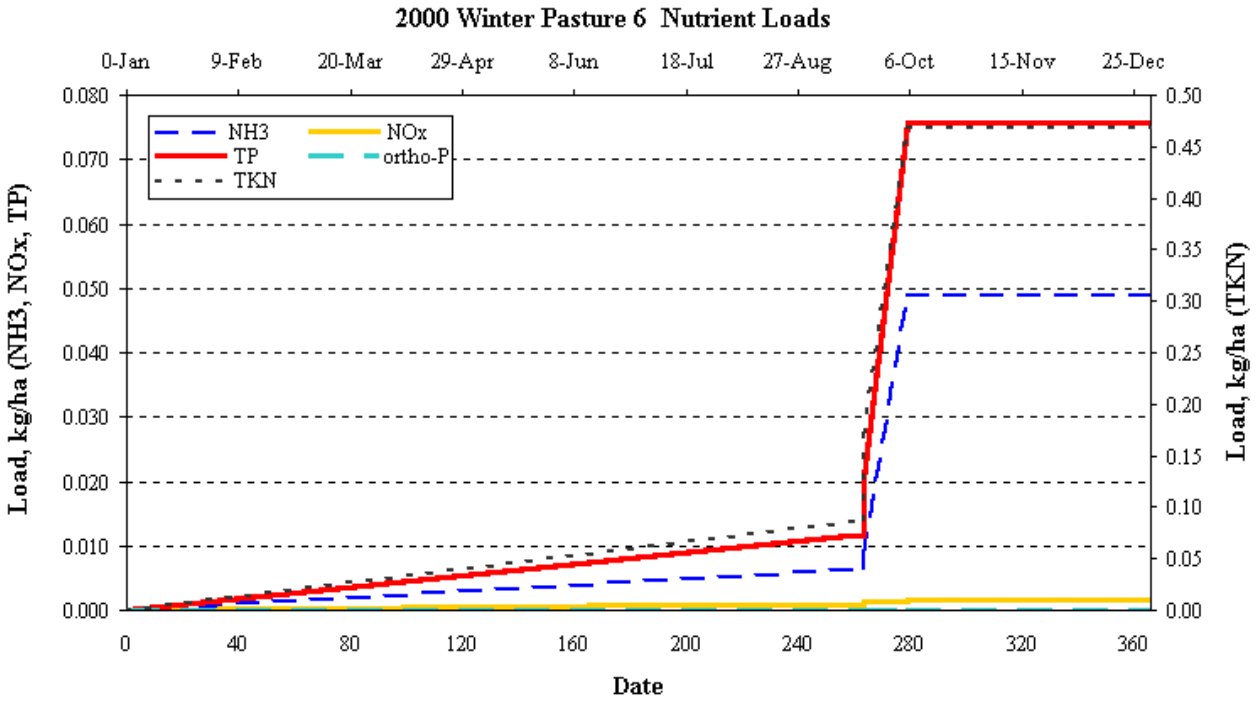


Figure 14g. Flow magnitudes and water quality sample collection dates for *winter* pasture 6 for the year 2000.

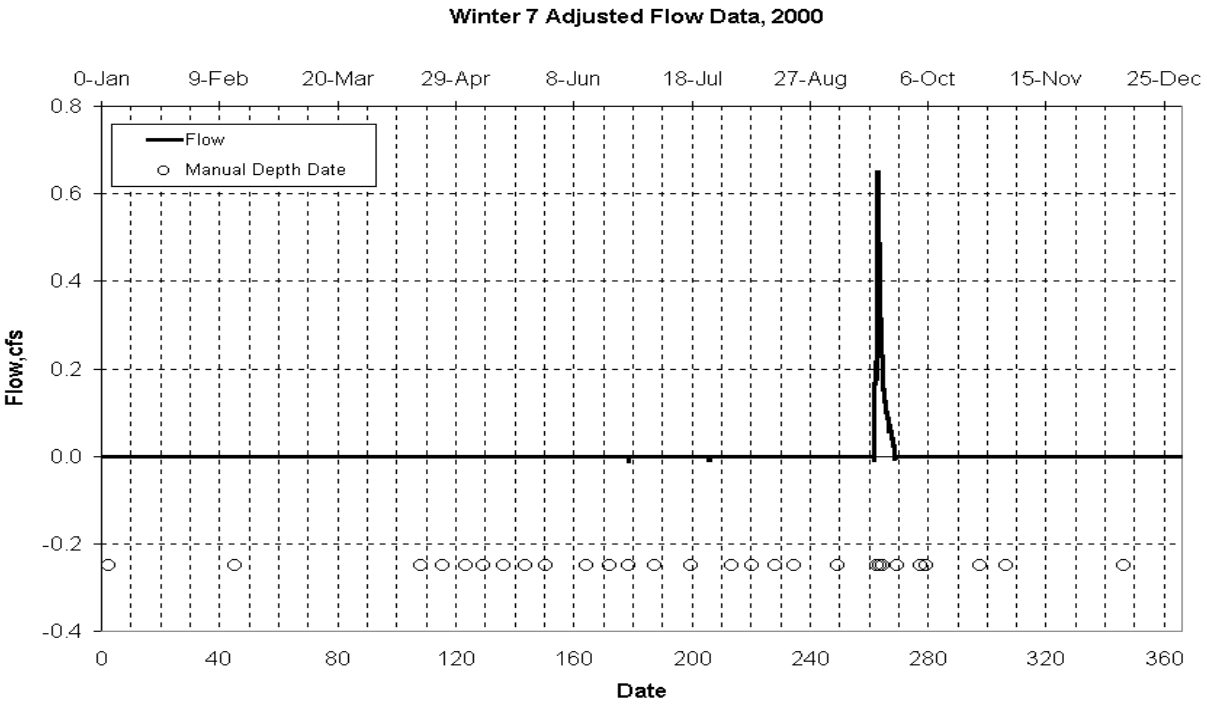


Figure 15a. Flow record for flume at *winter* pasture 7 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

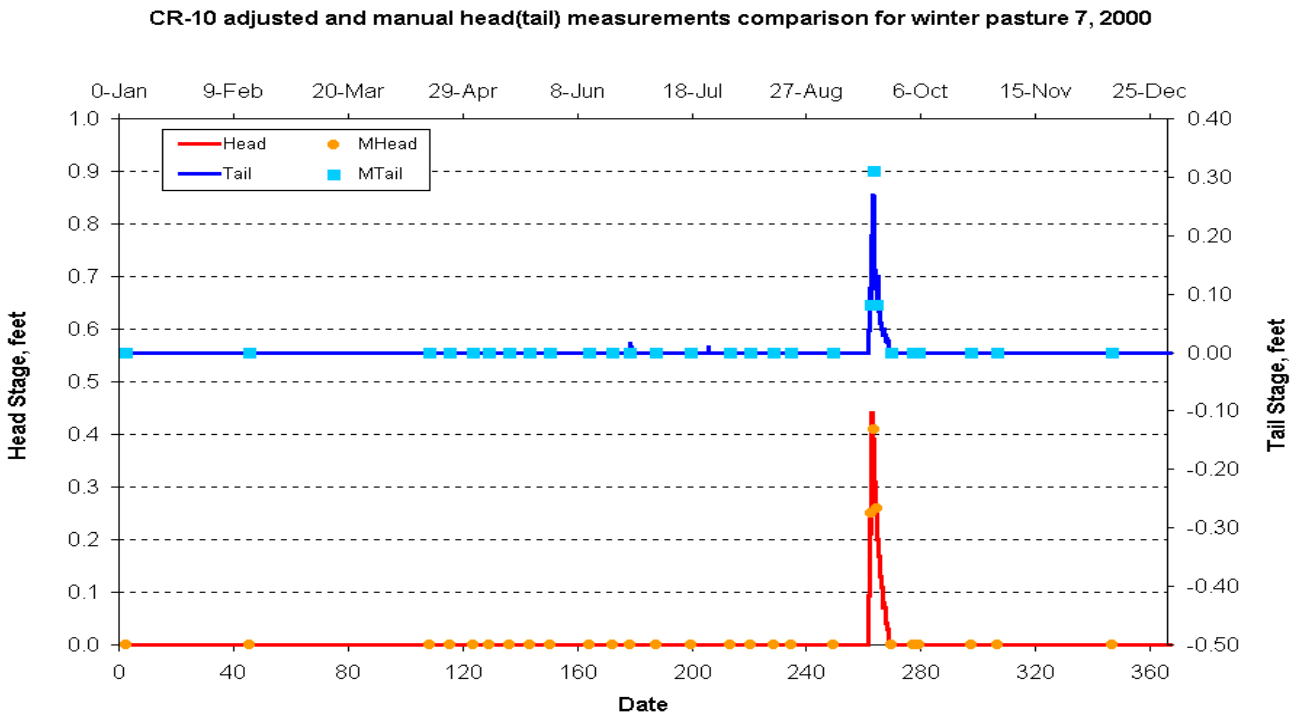


Figure 15b. Flume upstream and downstream stage data for wint*er* pasture 7 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 15. Summary of comparisons and adjustment of *winter* pasture 7 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow
		Man. feet	CR10 feet	Diff feet	Man. feet	CR10 feet	Diff feet	CR10 cfs	Up Error	Dn Error	feet	CR10 feet	cfs	Cond.
01/02/00	1538	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
02/14/00	1021	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
04/17/00	1042	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
04/24/00	946	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
05/02/00	1527	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
05/08/00	954	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
05/15/00	1052	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
05/22/00	1059	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
05/29/00	937	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
06/12/00	1111	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
06/20/00	1004	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
06/26/00	1518	0	0	0	0	0	0	0	0.24	0.22	0	0	0	D
07/05/00	1145	0	0.19	0.19	0	0.19	0.19	0	0.24	0.22	0	0	0	D
07/17/00	1704	0	0.18	0.18	0	0.18	0.18	0	0.24	0.22	0	0	0	D
07/31/00	1027	0	0.17	0.17	0	0.19	0.19	-0.14	0.24	0.22	0	0	0	D
08/07/00	1110	0	0	0	0	0	0	0			0	0	0	D
08/15/00	940	0	0	0	0	0	0	0			0	0	0	D
08/21/00	1143	0	0	0	0	0	0	0			0	0	0	D
09/05/00	1220	0	0	0	0	0	0	0			0	0	0	D
09/18/00	1446	0.25	0.22	0.03	0.08	0.10	0	0.19			0.22	0.10	0.19	FF
09/19/00	1057	0.41	0.38	0.03	0.31	0.26	0	0.47			0.38	0.26	0.47	FF
09/20/00	1200	0.26	0.24	0	0.08	0.10	-0.02	0.21			0.24	0.10	0.21	FF
09/25/00	1433	0	0	0	0	0	0	0			0	0	0	D
10/03/00	1048	0	0	0	0	0	0	0			0	0	0	D
10/05/00	927	0	0	0	0	0	0	0			0	0	0	D
10/23/00	1006	0	0	0	0	0	0	0			0	0	0	D
11/01/00	1547	0	0	0	0	0	0	0			0	0	0	D
12/11/00	1202	0	0	0	0	0	0	0			0	0	0	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

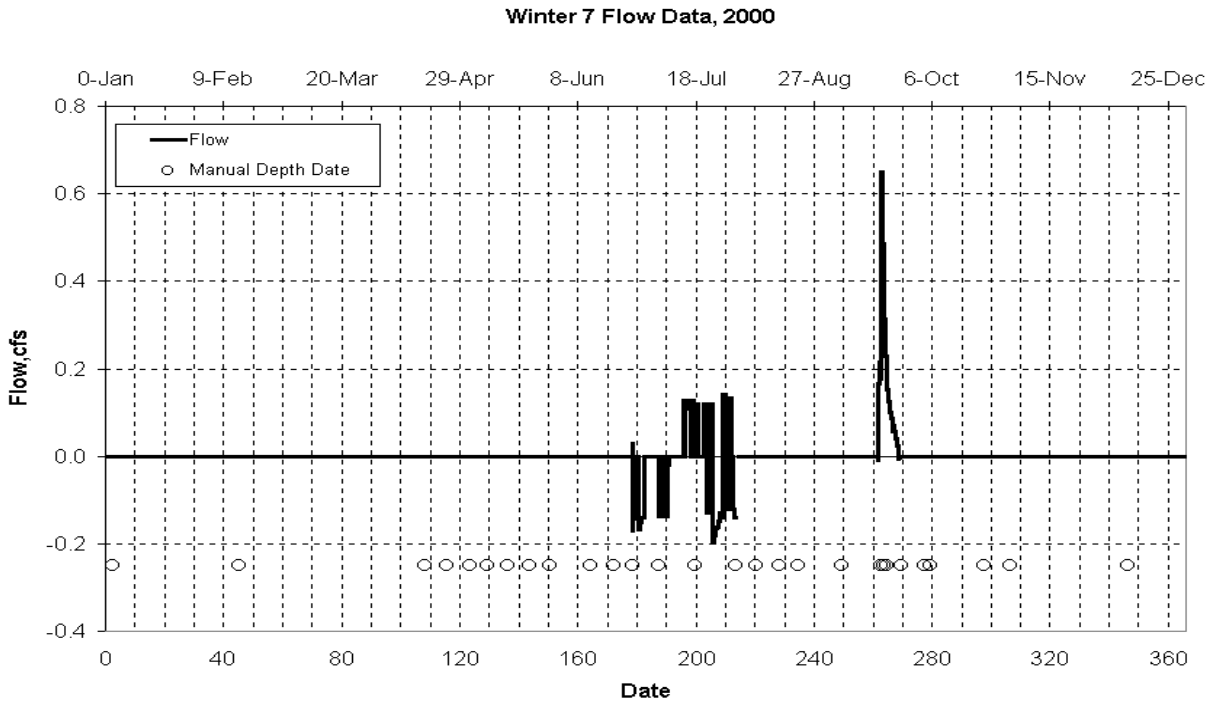


Figure 15c. Comparison of unadjusted flow record and dates of manual stage measurements for *winter* pasture 7 the flume during the year 2000.

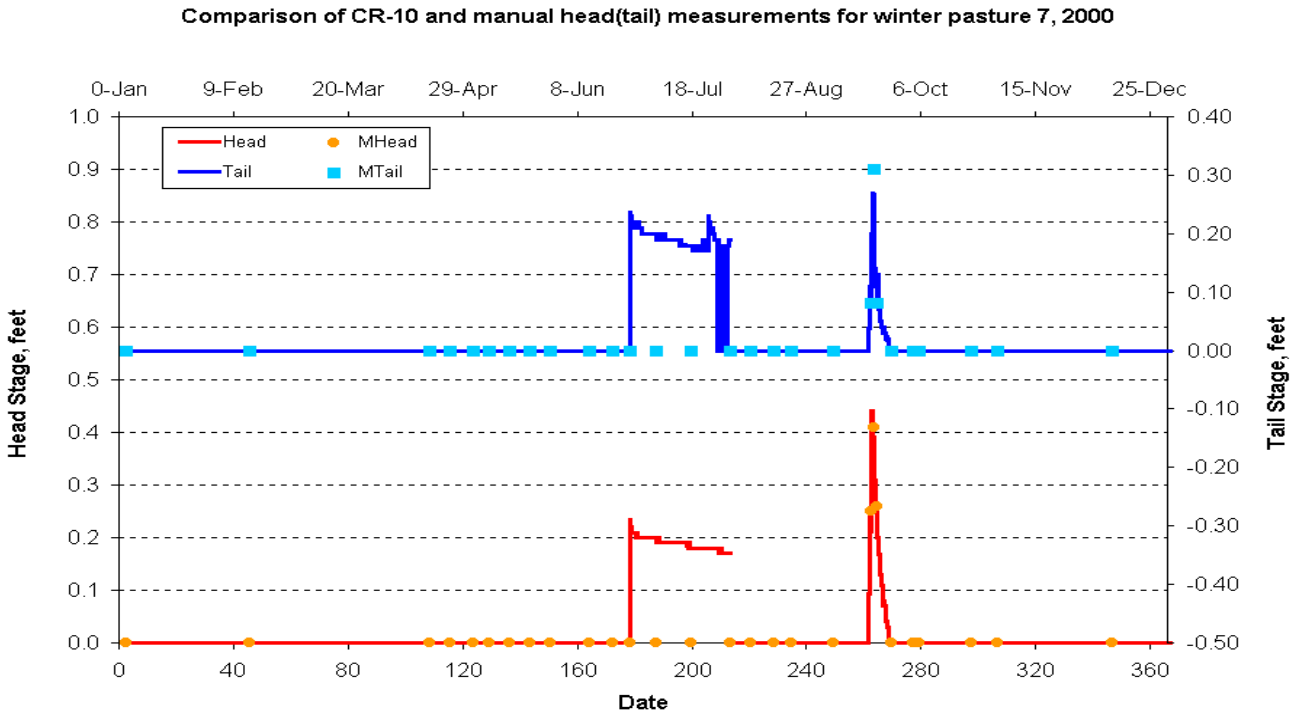


Figure 15d. Unadjusted flume upstream and downstream stage data for *winter* pasture 7 based on comparison between sensor values and manual stage measurements during the year 2000.

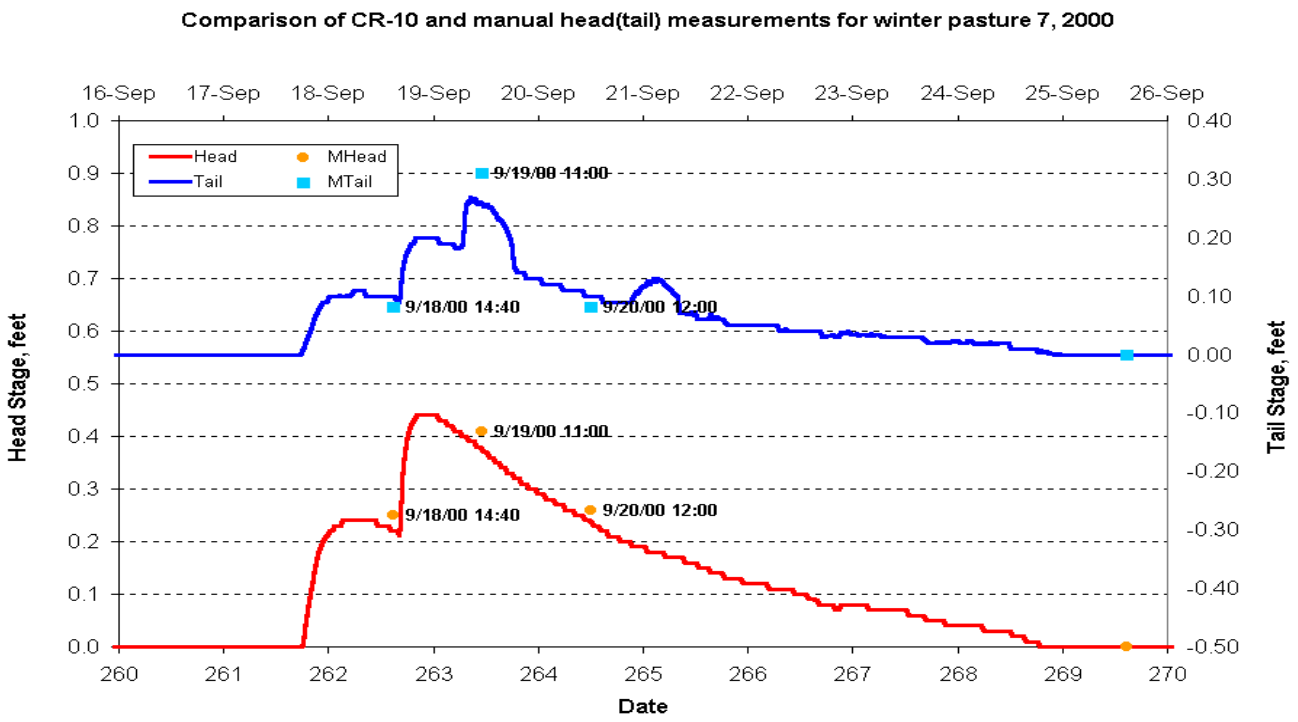


Figure 15e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *winter* 7 pasture during the peak flow period (9/16/00-10/26/00) for the year 2000.

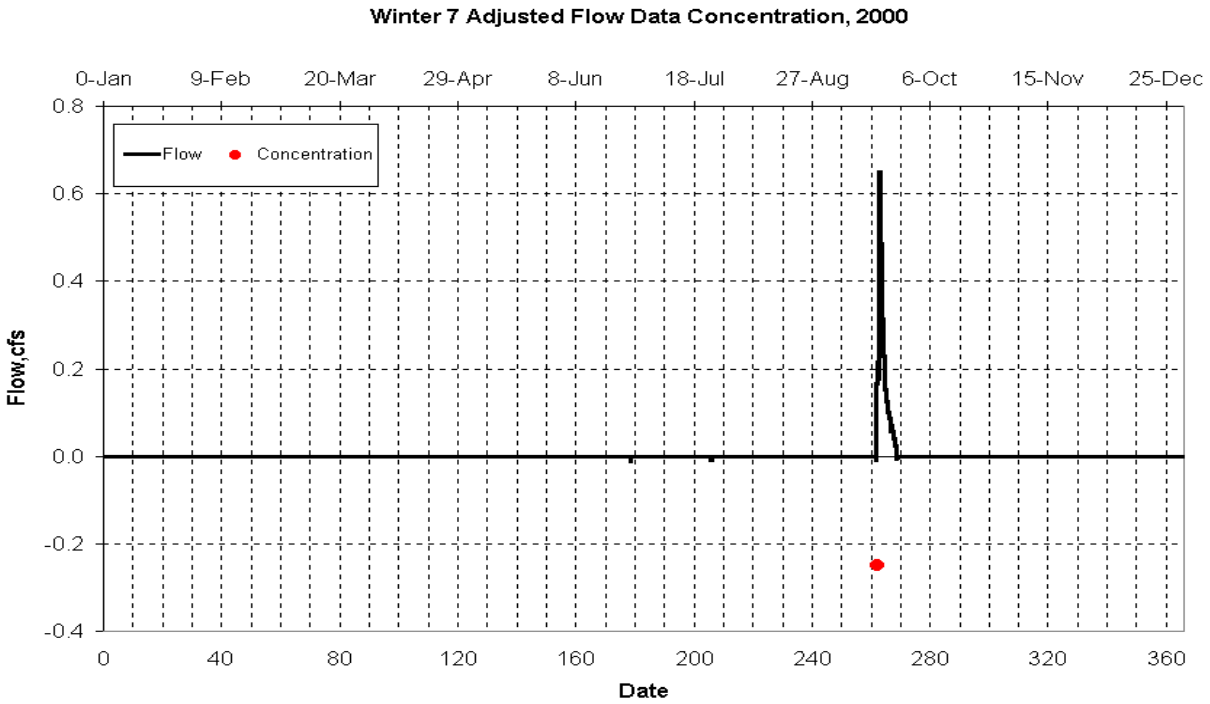


Figure 15f. Flow magnitudes and water quality sample collection dates for *winterer* pasture 7 for the year 2000.

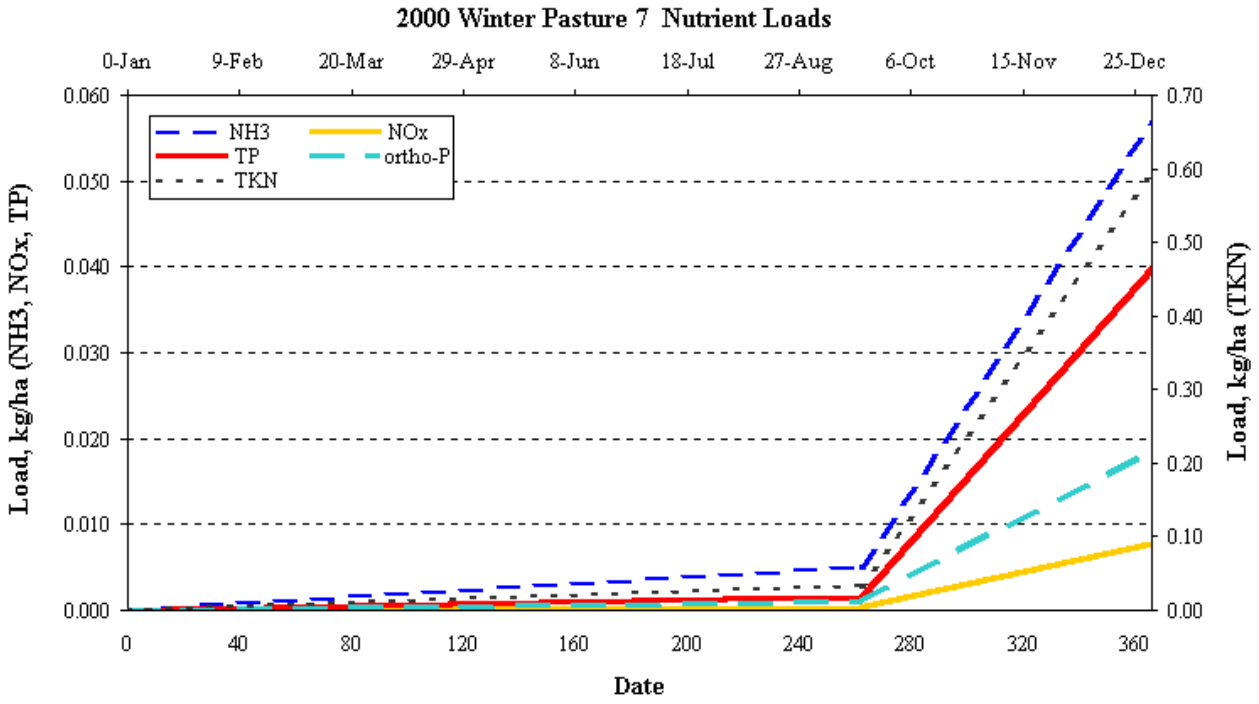


Figure 15g. Flow magnitudes and water quality sample collection dates for *winter* pasture 7 for the year 2000.

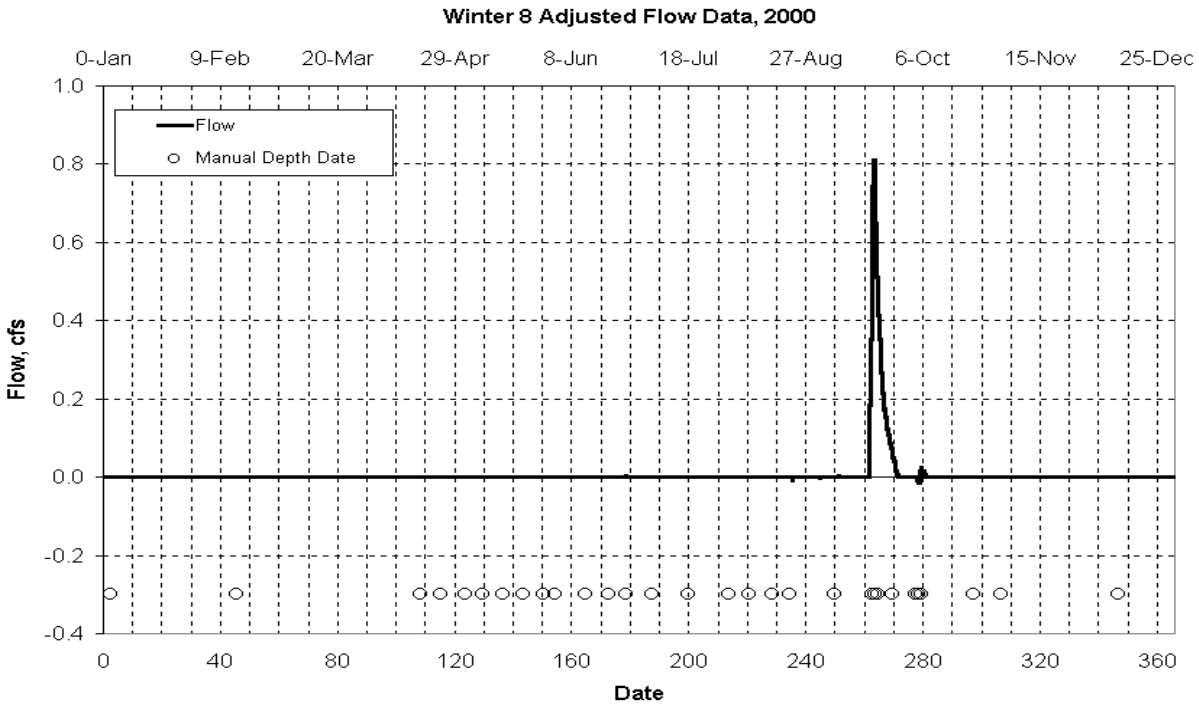


Figure 16a. Flow record for flume at *winter* pasture 8 for the year 2000 after making adjustments to flume stage values based on comparison with manual stage measurements.

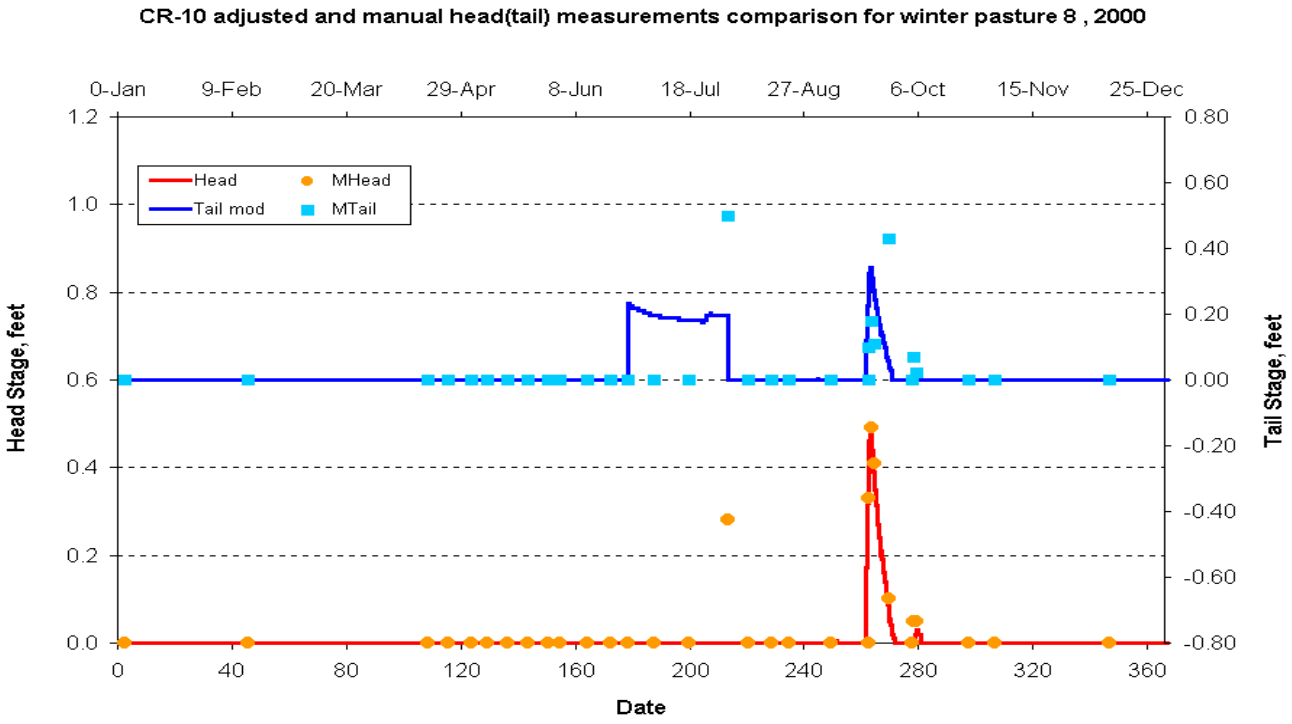


Figure 16b. Flume upstream and downstream stage data for win*ter* pasture 8 during the year 2000 after adjustments based on comparisons between sensor values and manual stage measurements.

Table 16. Summary of comparisons and adjustment of *winter* pasture 8 flume stage and flow values.

Date	Watch Time	Head			Tail			Flow	Adjustments		Head	Tail	Flow	Flow
		Man.	CR10	Diff	Man.	CR10	Diff	CR10				CR10		
		feet	feet	feet	feet	feet	feet	cfs	Up Error	Dn Error	feet	feet	cfs	Cond.
01/02/00	1551	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
02/14/00	1108	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
04/17/00	1054	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
04/24/00	1007	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
05/02/00	1600	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
05/08/00	944	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
05/15/00	1058	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
05/22/00	1110	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
05/29/00	929	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
06/12/00	1132	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
06/20/00	1013	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
06/26/00	1531	0	0	0	0	0	0	**0**	0.33	0.30	0	0	**0**	D
07/05/00	1505	0	0.28	0.30	0	0.48	0.50	**-0.78**	0.33	0.60	0	0	**0**	D
07/17/00	1723	0	0.26	0.30	0	0.43	0.40	**-0.62**	0.33	0.60	0	0	**0**	D
07/31/00	1033	0	0	0	0	0	0	**0**	0.33	0.60	0	0	**0**	D
08/07/00	1117	0	0	0	0	0	0	**0**			0	0	**0**	D
08/15/00	1008	0	0	0	0	0	0	**0**			0	0	**0**	D
08/21/00	1152	0	0	0	0	0	0	**0**			0	0	**0**	D
09/05/00	1244	0	0	0	0	0	0	**0**			0	0	**0**	D
09/18/00	1055	0.33	0.32	0.01	0.10	0	0.10	**0.35**			0.32	0	**0.35**	FF
09/19/00	1100	0.49	0.48	0.02	0.18	0	0.18	**0.78**			0.48	0	**0.78**	FF
09/20/00	1128	0.41	0.38	0.03	0.11	0	0.11	**0.49**			0.38	0	**0.49**	FF
09/20/00	1330	0.41	0.37	0.04	0.11	0	0.11	**0.46**			0.37	0	**0.46**	FF
09/25/00	1458	0.10	0.07	0.03	0.43	0	0.43	**0.06**			0.07	0	**0.06**	FF
10/03/00	1346	0	0	0	0	0	0	**0**			0	0	**0**	D
10/04/00	845	0.05	0	0.05	0.07	0.01	0.06	**-0.01**			0	0.01	**-0.01**	FF
10/05/00	937	0.05	0.03	0.02	0.02	0.02	0	**0.02**			0.03	0.02	**0.02**	FF
10/23/00	1020	0	0	0	0	0	0	**0**			0	0	**0**	D
11/01/00	1608	0	0	0	0	0	0	**0**			0	0	**0**	D
12/11/00	1438	0	0	0	0	0	0	**0**			0	0	**0**	D

Notes :

Man. = flume data based upon manual measurements and observations made by field technicians.
CR10 = flume data as recorded by the CR10 datalogger.
Diff = difference between CR10 and manual measurements.
Final = flume data after adjustments.
Adjustments = corrections applied to CR10 values.
D = dry flume.
FF = forward flow (runoff)
BF = backward flow (inflow)

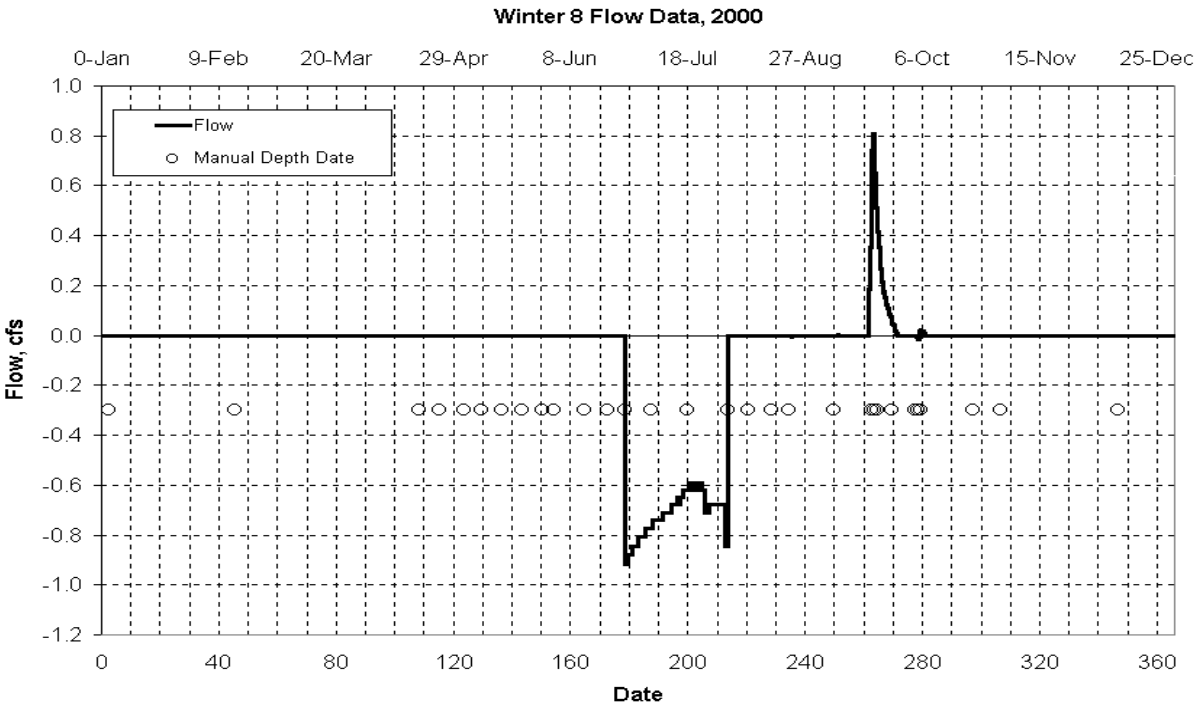


Figure 16c. Comparison of unadjusted flow record and dates of manual stage measurements for *winter* pasture 8 the flume during the year 2000.

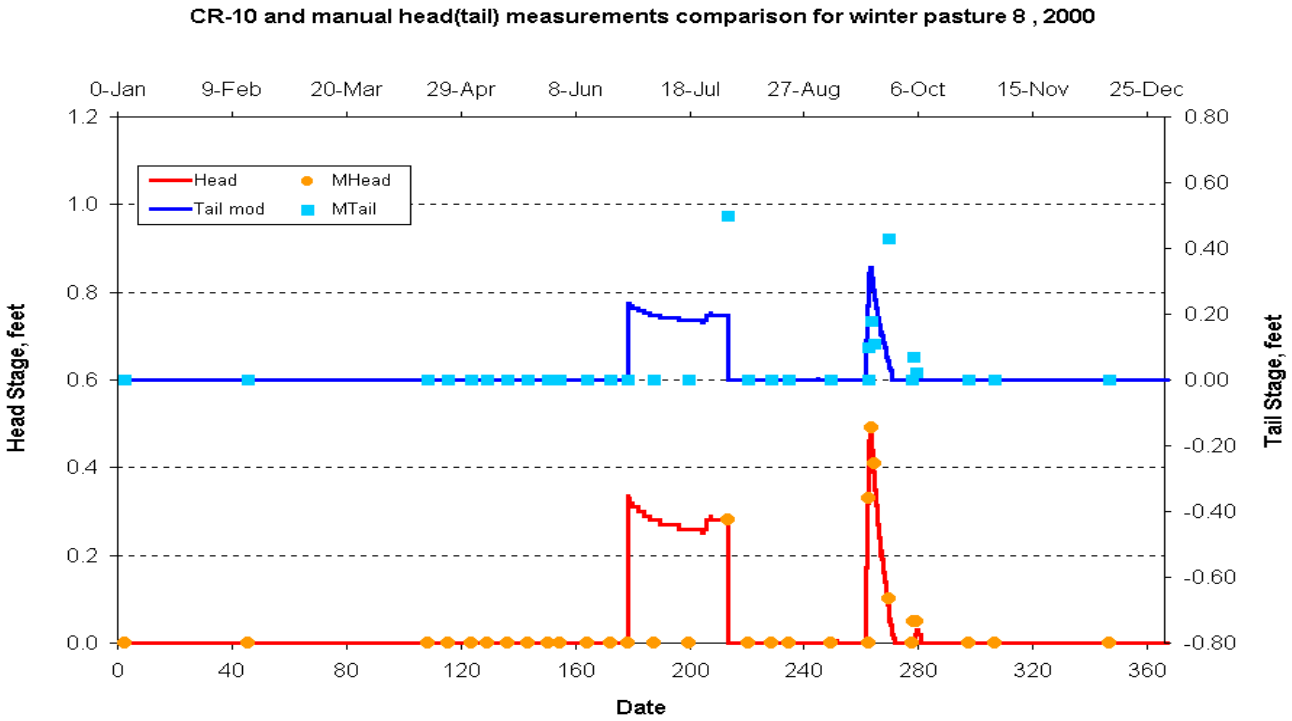


Figure 16d. Unadjusted flume upstream and downstream stage data for *winter* pasture 8 based on comparison between sensor values and manual stage measurements during the year 2000.

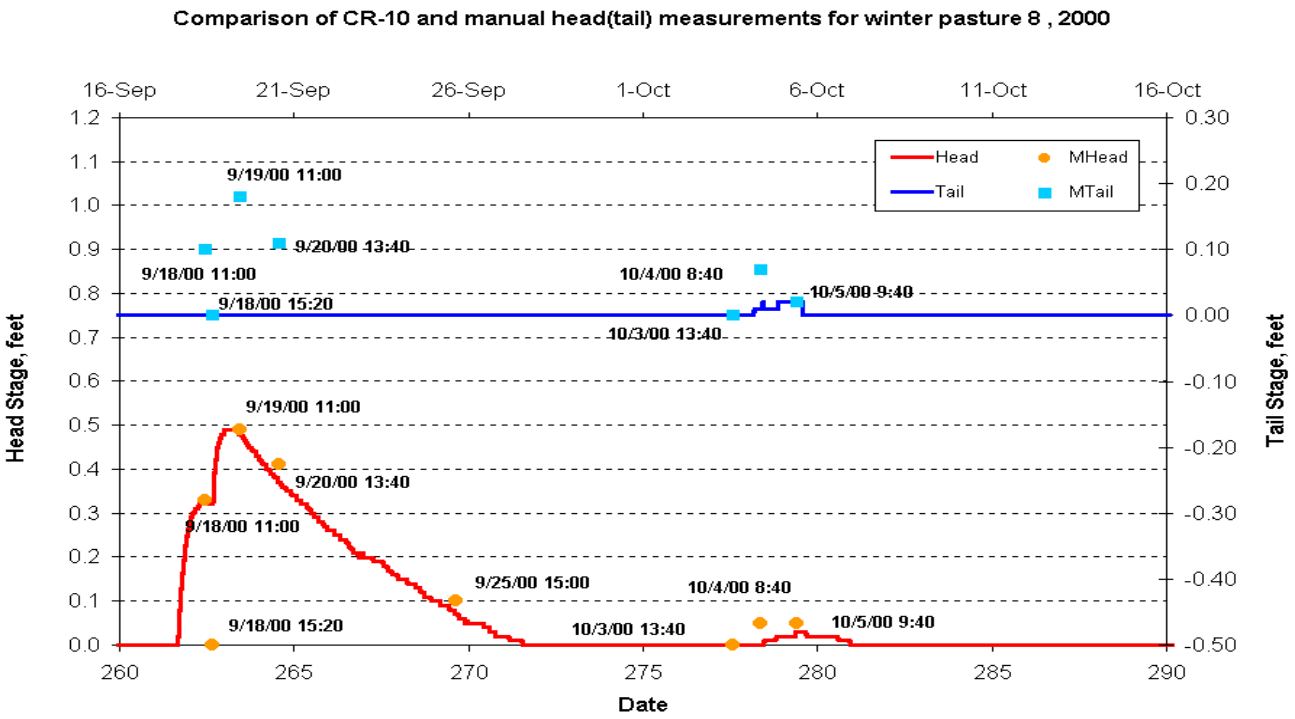


Figure 16e. Comparison of flume upstream and downstream stage data based from unadjusted sensor values and manual stage measurements for *winter* 8 pasture during the peak flow period (9/16/00-10/16/00) for the year 2000.

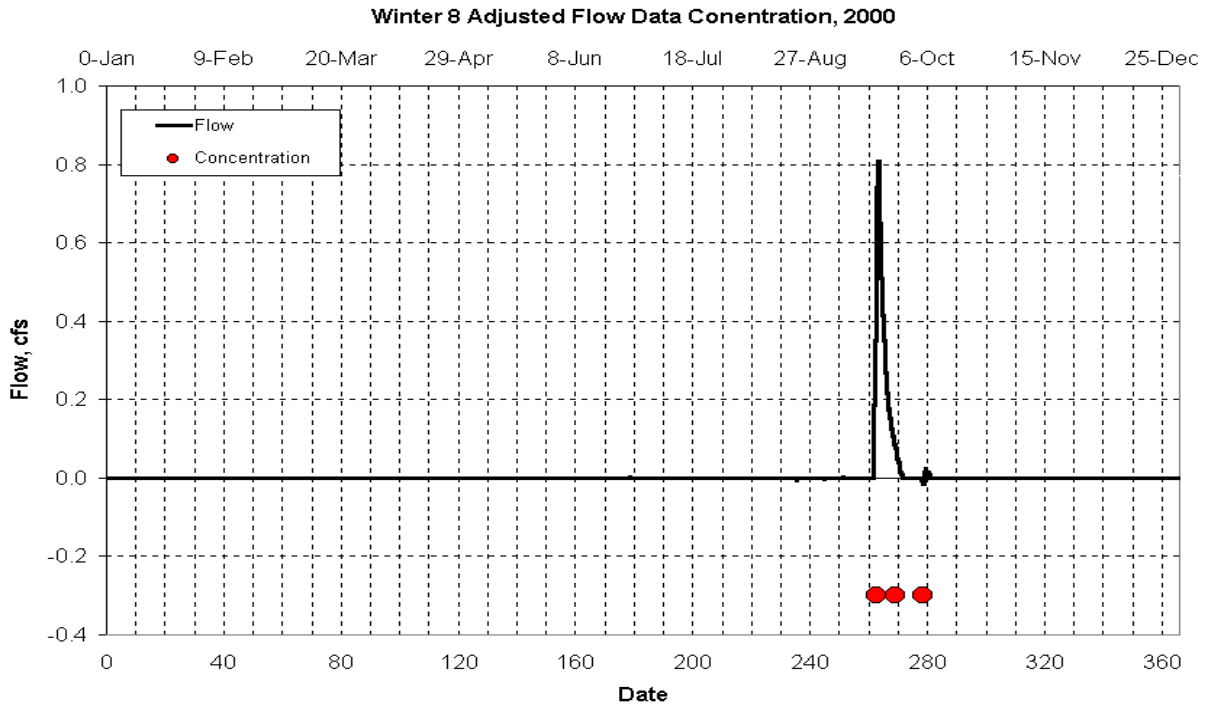


Figure 16f. Flow magnitudes and water quality sample collection dates for *winterer* pasture 8 for the year 2000.

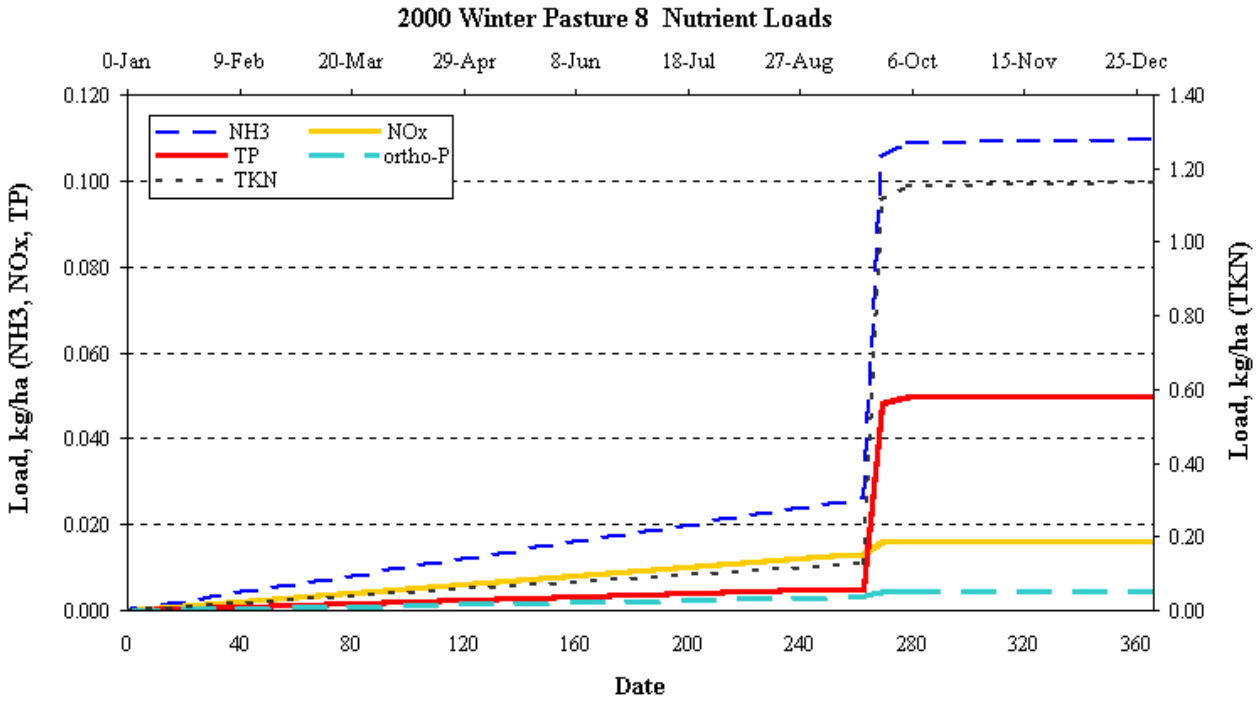


Figure 16g. Flow magnitudes and water quality sample collection dates for *winter* pasture 8 for the year 2000.