A Department of Ecology Report

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Chehalis Best Management Practices Evaluation Project--

1995-96 Water Quality Data Report for the Chehalis River Project Area

Abstract

This interim report describes the second year's water quality monitoring results for a site where nonpoint source best management practices (BMPs) will be installed. The site is a dairy located on the east bank of the mainstem Chehalis River at river mile 70.6. The overall study design includes pre- and post- BMP water quality monitoring during the wet season. The Chehalis River upstream and downstream of the BMP site and one tributary in the vicinity of the BMP site were monitored. Monitoring results for all stations exceeded water quality standards for fecal coliform. The tributary adjacent to the BMP site had statistically significant higher levels of conductivity, ammonia nitrogen, organic nitrogen, total persulfate nitrogen, and fecal coliform than the two river stations, and significantly lower nitrite/nitrate nitrogen levels. The report recommends that pre-BMP monitoring be concluded and post-BMP monitoring begin after installation of BMPs.

Introduction

This report presents the results for the 1995-96 wet season water quality monitoring of the Chehalis River project area as part of the Chehalis Best Management Practices Evaluation Project funded by the U.S. Fish & Wildlife Service's Chehalis Fisheries Restoration Program. The purpose of the monitoring is to gather pre-BMP data for a dairy operation adjacent to a tributary on the Chehalis River at river mile (RM) 70.6, and to follow-up on the Upper Chehalis River Dry Season Total Maximum Daily Load (TMDL) Study (Pickett, 1994). This is the second year of pre-BMP monitoring. Monitoring sites are shown in Figure 1.

Methods

Sampling was conducted as described by the Quality Assurance Project Plan (QAPP) and addendum (Sargeant, 1994; 1995a). Nine winter sampling events were conducted.

Field measurements for temperature, pH, and conductivity were made during all surveys as described in the QAPP. Flows were obtained for the tributary using a velocity meter and top-set wading rod. Flows could not be obtained on November 28, 1995,due to flooding in the Chehalis River.

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Laboratory samples were collected at all sites for fecal coliform, nitrite/nitrate nitrogen, ammonia nitrogen, total persulfate nitrogen, and turbidity. Samples were collected from flowing water by subsurface grab from the center channel. Immediately following collection, samples were placed in the dark, on ice, and shipped to Ecology's Manchester Environmental Laboratory within 24 hours after collection. Samples were analyzed in accordance with the QAPP.

Data Analysis

In order to compare 1994-96 data between the three stations, a statistical test for the significance of variations was done using SYSTAT (1991) statistical software. Comparisons were made for each parameter using a non-parametric test, the Kruskal-Wallis one-way analysis of variance. Where a statistically significant difference was noted individual site differences were evaluated using a non-parametric Tukey-type multiple comparison test (Zar, 1984). A statistical significance level of $P \leq 0.05$ was used for both tests.

Results

Implementation of BMPs has not yet begun at the dairy operation. The 1995-96 monitoring results are shown in Table 1. The first year's monitoring results can be found in the Interim Report on the Chehalis River Project Area (Sargeant, 1995b).

The preceding 24 and 48 hour rainfall as measured at the Olympia Airport NOAA Weather Station for each sampling day is shown in Table 2. The average previous 48 hour rainfall for sampling in 1995-96 was 0.81" as compared to 0.50" for 1994-95 sampling.

Flows at the tributary site averaged 3 cfs and ranged from 0.5 to 10 cfs. In 1994-95 only three flow measurements were obtained in the tributary, and average flow was 1 cfs.

Water Quality Characterization

During all sample events, temperature and ammonia levels met water quality standards for all sites. Standards for pH were met at all sites, except on December 10, 1995 when a pH of 6.4 was recorded for the mainstem site at RM 69.7. Taking into account the precision of the field meter, $\pm$ 0.2 units, this exceedance is of minor significance.

Compliance with turbidity standards was not determined because a background station was not sampled. Turbidity levels between the upstream and downstream river stations fell within 3 NTU for all sample events. However turbidity was quite high during storm events reaching a maximum of 90 NTU at the river stations and 85 NTU at the tributary on November 28, 1995.

Fecal coliform levels at all three sites did not meet water quality standards, which was consistent with 1994-95 results. Fecal coliform results are summarized below in Table 3. While none of the sites met fecal coliform standards, the tributary fecal coliform levels were significantly higher than either of the mainstem stations (Figure 2). Differences between the mainstem stations were not statistically significant.

High levels for conductivity, ammonia nitrogen, organic nitrogen, and total persulfate nitrogen were noted in the tributary adjacent to the BMP site, while nitrite/nitrate nitrogen levels were lower than the mainstem stations. Compared to the mainstem stations, the tributary had statistically significant higher levels of conductivity, ammonia nitrogen, organic nitrogen, and total persulfate nitrogen; and statistically significant lower levels of nitrite/nitrate-nitrogen. The two mainstem sites did not statistically differ from each other for these parameters. Higher ammonia and organic nitrogen and lower nitrite/nitrate in the tributary are typical of a dairy waste source and reflect the close proximity of the source. Figure 3 presents nitrogen levels for each station.

Conclusions

The tributary at RM 70.6T exceeded fecal coliform standards. Statistically significant differences in water quality were noted between the tributary and mainstem, with conductivity, fecal coliform, ammonia nitrogen, organic nitrogen, and total persulfate nitrogen higher in the tributary; and nitrite\nitrate nitrogen lower in the tributary. The downstream mainstem site showed no statistically significant differences in water quality from the upstream site.

Recommendations

Continue pursuing BMP implementation to eliminate the source of pollutant loading at RM 70.6T.

Pre-BMP monitoring should be concluded at this time, and post-BMP monitoring begun at the tributary and mainstem sites after BMP implementation has been completed.

References

Pickett, P., 1994. Upper Chehalis River Dry Season Total Maximum Daily Load Study. Environmental Investigations and Laboratory Services Program, Washington State Department of Ecology, Olympia, WA.

Sargeant, D., 1994. Chehalis River Basin Best Management Practices Evaluation Project Quality Assurance Project Plan. Environmental Investigations and Laboratory Services Program, Washington State Department of Ecology, Olympia, WA.

------, 1995a. Addendum to Quality Assurance Project Plan for the Chehalis River Basin Best Management Practices Evaluation Project. Environmental Investigations and Laboratory Services Program, Washington State Department of Ecology, Olympia, WA.

------, 1995b. Chehalis River BMP Evaluation Project Interim Report on the Chehalis River Project Area. Environmental Investigations and Laboratory Services Program, Washington State Department of Ecology, Olympia, WA.

SYSTAT, 1991. SYSTAT version 5.0. SYSTAT, Inc., April 1991.

Zar, J.H., 1984. Biostatistical Analysis, Second Edition. Prentice-Hall, Englewood Cliffs, New Jersey.

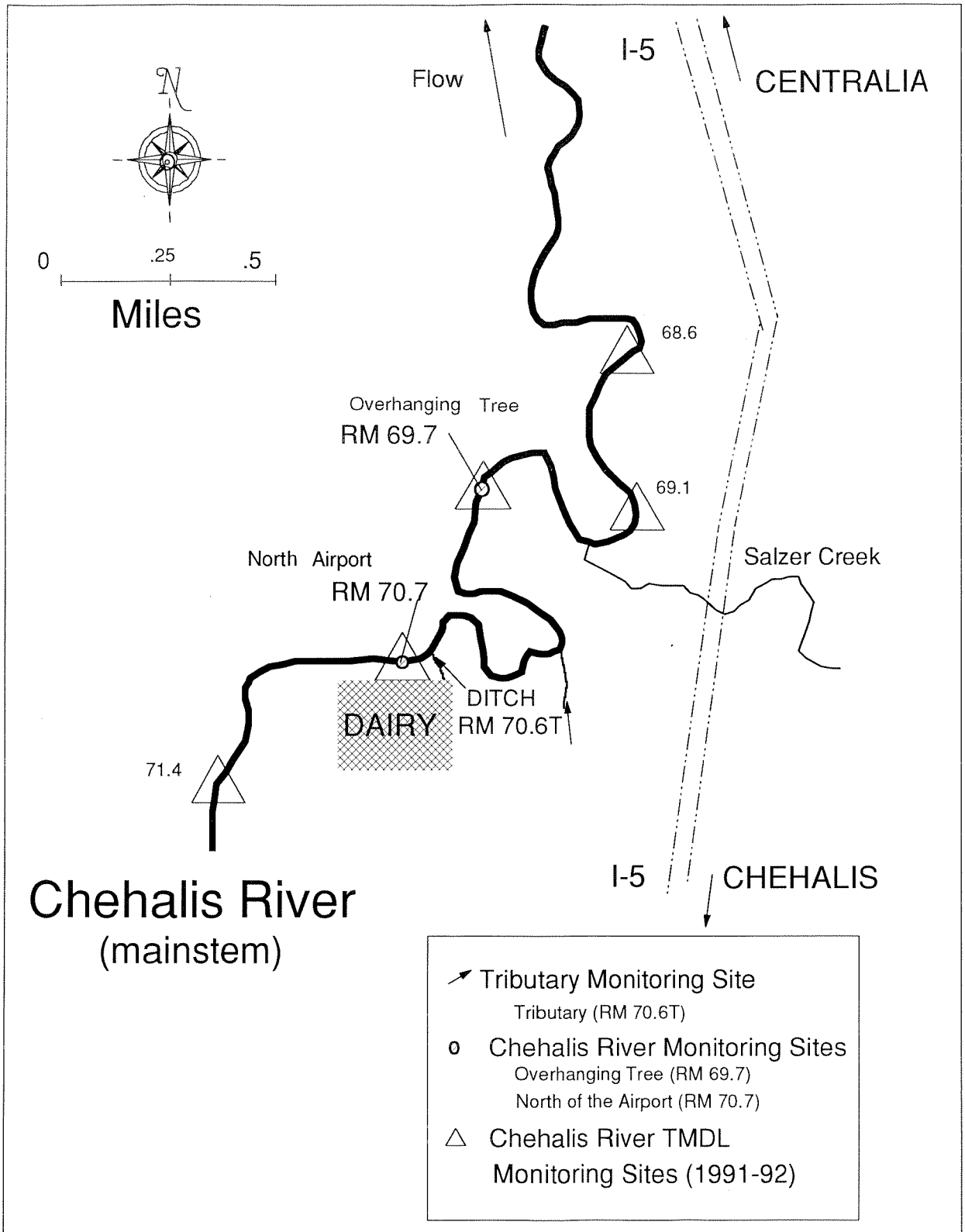

Figure 1. Chehalis River Monitoring Sites.

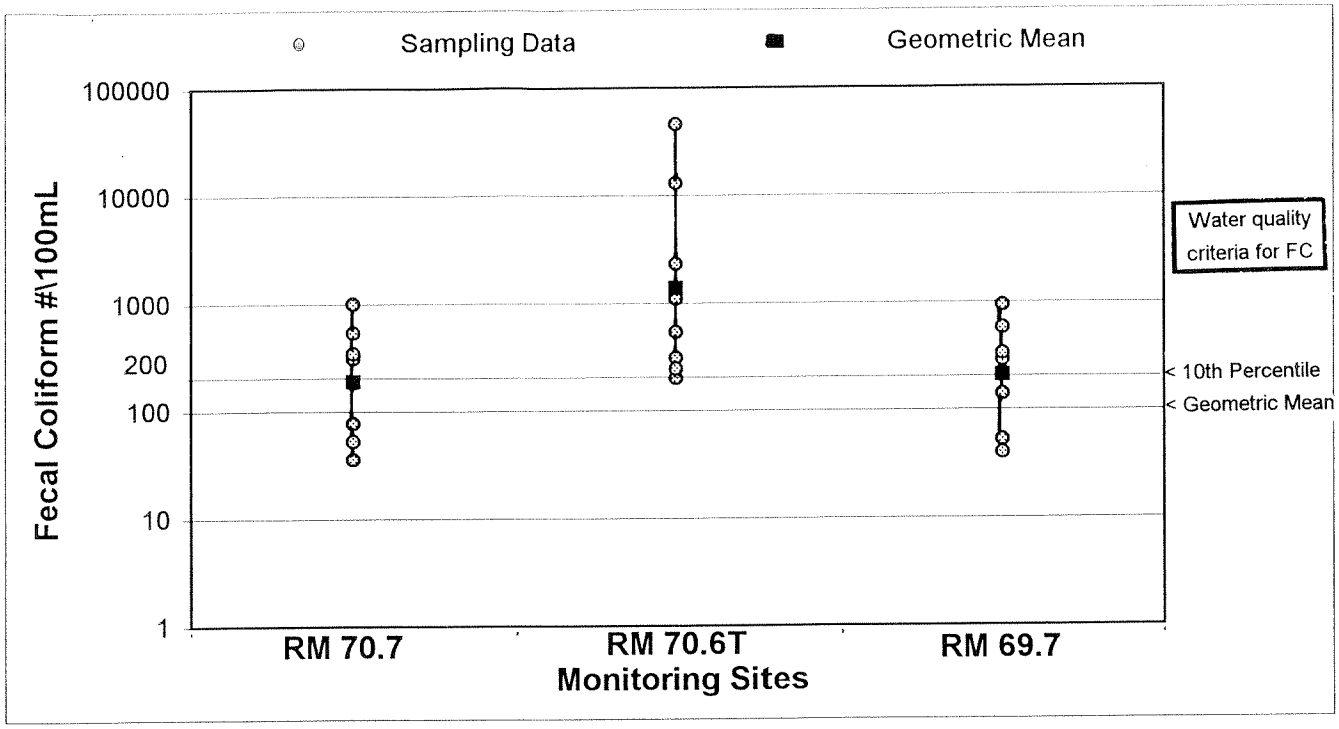

Figure 2. Fecal Coliform Monitoring Results.

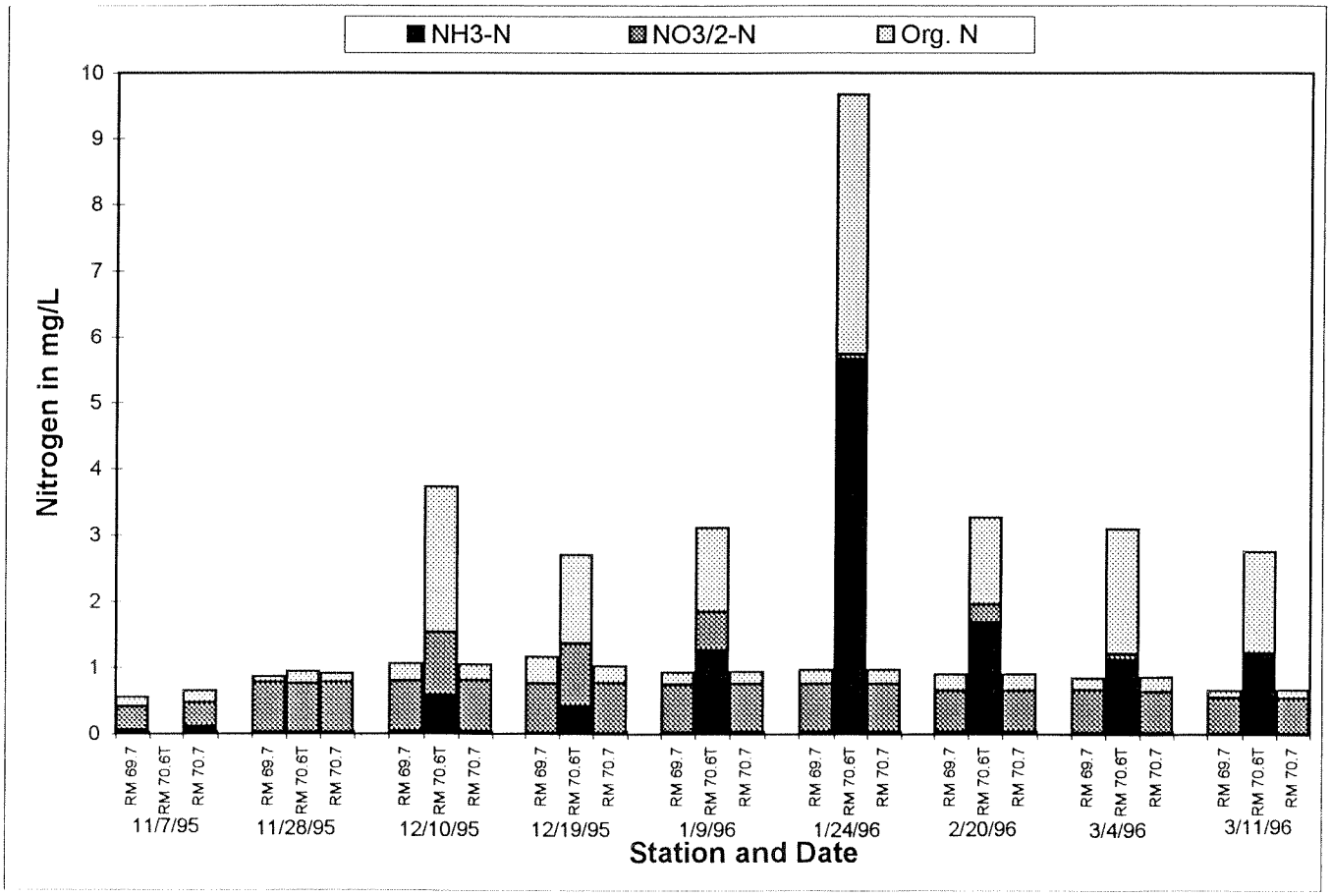

Figure 3. Nitrogen Levels for Chehalis Monitoring Sites.

TABLE 1

Chehalis Mainstem Wet Season Field and Laboratory Data

(paired data represent field duplicates)

Station River Mile Code	Date	Time	Temperature ° C	pH	Conductivity umho/cm*	Turbidity NTU		Ammonia Nitrogen mg/L		Nitrite\nitrate Nitrogen mg/L		Total** Organic Nitrogen mg/L	Total Persulfate Nitrogen mg/L		Fecal Coliform cfu/100 mL	
RM 69.7 (mainstem)	11/7/95	9:05	6.2	7.4	85	3.8		0.055	0.054	0.357	0.350	0.150	0.560	0.558	S 290	
RM 69.7 (mainstem)	11/28/95	11:40	9.7	7.4	50	90		0.017		0.757		0.093	0.867		S 930	
RM 69.7 (mainstem)	12/10/95	12:20	6.0	6.4	59	17		0.042		0.755		0.263	1.06		S 580	S 570
RM 69.7 (mainstem)	12/19/95	11:26	7.9	6.9	61	18		0.014		0.747		0.399	1.16		210	
RM 69.7 (mainstem)	1/9/96	12:30	8.2	7.5	48	29		0.022		0.724		0.182	0.928		S 140	
RM 69.7 (mainstem)	1/24/96	12:45	5.6	8.4	57	14		0.026		0.728		0.212	0.966		S 220	
RM 69.7 (mainstem)	2/20/96	11:30	7.5	7.1	47	75		0.027		0.623		0.249	0.899		330	
RM 69.7 (mainstem)	3/4/96	9:35	6.8	7.2	59	10		0.015		0.648		0.186	0.849		40	39
RM 69.7 (mainstem)	3/11/96	10:35	9.7	7.2	56	8.3		0.013		0.540		0.107	0.660		S 53	
RM 70.6T (tributary)	11/7/95	#	#	#	#	#		#		#		#	#		#	
RM 70.6T (tributary)	11/28/95	11:10	9.6	7.5	48	85		0.019		0.741		0.185	0.945		S 1200	S 1000
RM 70.6T (tributary)	12/10/95	11:50	4.8	7.0	110	13	13	0.586	0.583	0.940	0.939	2.21	2.75	2.83	310	
RM 70.6T (tributary)	12/19/95	10:40	7.0	6.8	90	20		0.434	0.420	0.935	0.938	1.34	2.77	2.63	2300	
RM 70.6T (tributary)	1/9/96	11:55	8.2	7.0	92	35		1.26		0.579		1.28	3.12		S 13000	S 13000
RM 70.6T (tributary)	1/24/96	12:05	4.1	7.7	280	43	45	5.66		0.076		3.94	9.68		S 43000	48000
RM 70.6T (tributary)	2/20/96	11:00	7.9	6.5	210	22		1.68		0.276		1.32	3.28		540	
RM 70.6T (tributary)	3/4/96	9:55	7.4	7.2	190	15		1.12		0.087		1.89	3.10		S 200	
RM 70.6T (tributary)	3/11/96	10:55	11.8	7.1	200	13		1.19		0.038		1.54	2.77		S 245	
RM 70.7 (mainstem)	11/7/95	9:15	6.3	7.6	78	5.9		0.102		0.364		0.182	0.648		77	
RM 70.7 (mainstem)	11/28/95	11:20	9.7	9.7	54	90		0.019		0.762		0.127	0.908		S 1000	
RM 70.7 (mainstem)	12/10/95	12:05	6.0	6.5	57	15		0.040		0.762		0.248	1.05		540	
RM 70.7 (mainstem)	12/19/95	11:05	7.9	6.9	68	16		0.011		0.752		0.267	1.03		S 180	190
RM 70.7 (mainstem)	1/9/96	11:45	8.2	7.2	53	30	29	0.024		0.731		0.186	0.941		S 190	
RM 70.7 (mainstem)	1/24/96	12:30	5.6	8.4	55	13		0.027		0.73		0.208	0.965		310	
RM 70.7 (mainstem)	2/20/96	11:20	7.5	7.1	47	78		0.029		0.619		0.258	0.906		330	365
RM 70.7 (mainstem)	3/4/96	9:48	6.8	7.4	60	11		0.015		0.625		0.227	0.867		S 53	
RM 70.7 (mainstem)	3/11/96	10:45	9.7	7.3	57	9.0		0.010	0.012	0.539	0.541	0.117	0.655	0.680	S 36	

* Specific conductance at 25° C

S Spreader colony present; number reported is likely underestimated.

** Organic nitrogen was calculated by subtracting ammonia nitrogen and nitrite\nitrate nitrogen from total persulfate nitrogen.

Lab results for the ditch at RM 70.6T were not obtained 11/7/95 due to no flow in the ditch.

Table 2. Previous rainfall for Chehalis River Sampling Trips.

Date	Preceding 24 hour rainfall (inches)	Preceding 48 hour rainfall (inches)
November 7, 1995	1.51	1.98
November 28, 1995	1.11	1.16
December 10, 1995	0.63	0.63
December 19, 1995	0.07	0.48
January 9, 1996	0.01	0.45
January 24, 1996	0.20	0.44
February 20, 1996	0.30	0.77
March 4, 1996	0.44	0.87
March 11, 1996	0.17	0.51
Average	**0.49**	**0.81**

Table 3. Fecal Coliform Results for Chehalis River Sampling.

Site Location	Geometric mean below 100 cfu/100 mL?	10% or less of all samples for calculating GM exceed 200 colonies/100 mL?
RM 69.7	No (GM=210)	No, 6 samples out of 9 exceeded 200
RM 70.6Trib	No (GM=1400)	No, 7 samples out of 8 exceeded 200
RM 70.7	No (GM=190)	No, 4 samples out of 9 exceeded 200

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