JOHN SPELLMAN
Governor

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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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MEMORANDUM
November 16, 1982

To: Howard Steeley, S.W. Regional Office

From: Art Johnson and Shirley Prescott

Subject: Chehalis River Water Quality Data Collected July-September, 1980

Between July and September, 1980, Shirley Prescott and I conducted four field investigations of water quality in the Chehalis River reach between Chehalis and Centralia. The object of this work was to describe the dissolved oxygen (D.O.) regime in the river and determine the cause(s) of low D.O. documented in WDOE historical data.

At your request, I have summarized these data in the four attached tables. Our conclusions on reviewing these data are as follows:

1. Surface D.O. was not a problem during the periods studied.

2. This reach became stratified during late summer, resulting in low D.O. in the bottom waters.

3. Water temperature sometimes exceeded levels considered safe for salmonids.

4. Nitrogen was limiting during late July and August, 1980.

5. Salzer Creek was polluted with organic matter on July 30 and August 5, but was not causing significant water quality problems in the Chehalis River because of low creek flow.

6. No evidence of direct adverse impacts from the Chehalis STP effluent was found. (As noted by Bill Yake in his September 25, 1980, Class II report, the STP's contribution of inorganic nitrogen to the system may indirectly contribute to low D.O. in the bottom waters by increasing algal production, the products of which later sink and decompose.)

7. The results of a 24-hour D.O. study on August 7-8, 1980, and early-morning D.O. measurements on August 5, 1980 (not shown in the attached tables), did not show significant diurnal variation of D.O. in the water column.

It appears to us that the fluctuations in physical/chemical parameters we observed in this sluggish reach of the Chehalis River are typical of many eutrophic Western Washington lakes -- except that nitrogen rather than phosphorus was limiting.

AJ:SP:cp

Attachments

cc: Section Files
John Bernhardt

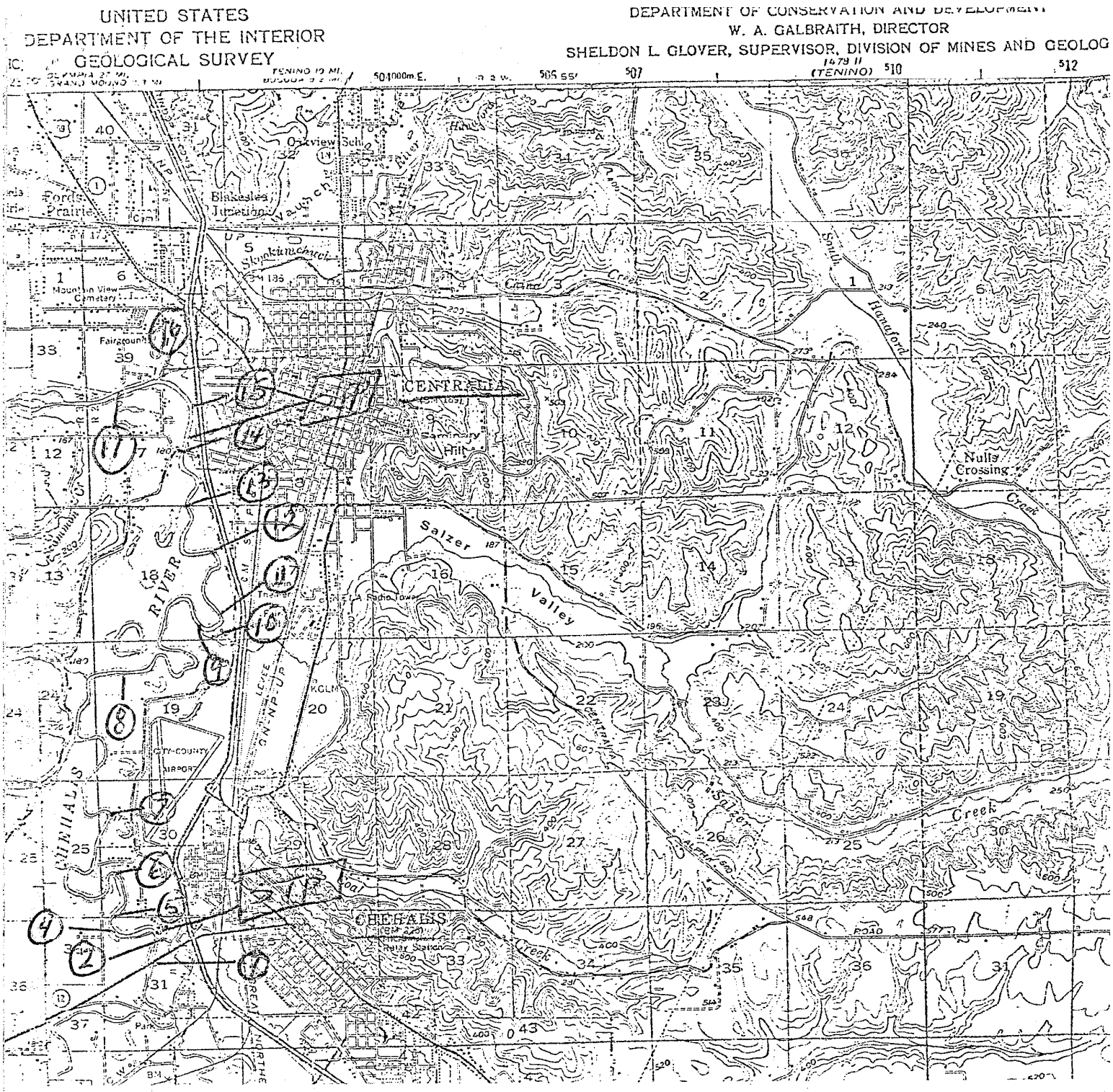

Figure 1. Station locations for July-September, 1980 surveys of water quality in the Chehalis River.

Table 1. Chehalis River and tributaries, 1015 - 1400 hours, July 15, 1980: temperature and dissolved oxygen in surface and bottom waters.

Station Number	Station Description	River Depth (meters)	Sample Depth	Temp. (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen % Sat.
1	Highway 12 bridge	2	Surface	19.0	8.8	94
2	Dillenbaugh Creek	--	--	--	4.1	--
4	Below Chehalis STP	2	Surface	18.5	8.6	91
			Bottom	18.5	8.5	90
5	--	3-1/2	Surface	18.0	8.4	88
			Bottom	18.0	8.3	87
6	--	5-1/2	Surface	18.5	8.3	88
			Bottom	18.0	8.1	85
6-7	--	6	Surface	19.5	8.6	92
			Bottom	18.0	7.8	82
7	Golf Course	4-1/2	Surface	18.5	8.2	87
			Bottom	18.5	8.0	85
7-8	--	4-1/2	Surface	18.5	8.2	87
			Bottom	18.5	8.0	85
8	--	3-1/2	Surface	18.5	8.0	85
			Bottom	18.0	7.7	81
8-9	--	6-1/2	Surface	18.5	8.0	85
			Bottom	18.0	7.5	79
8-9	--	6	Surface	19.0	7.9	84
			Bottom	18.5	7.5	79
8-9	--	4-1/2	Surface	19.0	8.0	85
			Bottom	18.5	6.9	73
9	Above Salzer Creek	4	Surface	19.5	7.7	83
			Bottom	18.5	7.5	79
10	Salzer Creek	--	--	17.4	6.0	63
11	Below Salzer Creek	7	Surface	19.0	8.2	87
			Bottom	18.5	7.5	79
12	Midway Meats	8	Surface	19.0	8.1	86
			Middle	18.5	7.3	77
			Bottom	18.0	6.3	66
13	--	7-1/2	Surface	18.5	8.5	90
			Middle	18.5	7.0	74
			Bottom	18.0	6.1	64
14	Mellen Street bridge	4	Surface	18.5	8.5	90
			Bottom	18.5	8.0	85
15	Below STP	3-1/2	Surface	18.5	8.7	92
			Bottom	18.5	8.5	90
16	Skookumchuck River	--	--	15.6	10.7	91
17	Boat launch below river	2	Surface	17.0	8.8	91
			Bottom	17.0	8.7	90

- Measurements made with Hydrolab; Winkler samples later indicated the above D.O. values were low by 0.6 - 0.9 mg/L.

- Flows at time of survey:
  Chehalis River - 250 cfs (Mellen Street gage)
  Dillenbaugh Creek - 3 cfs, field measurement
  Skookumchuck River - 130 cfs, field measurement

Table 2. Chehalis River and tributaries, July 30, 1980 - general water quality parameters at selected stations.

Station Number	Station Description	River Depth (meters)	Sample Depth (meters)	Temp. (°C)	Diss. Oxygen (mg/L)	Diss. Oxygen % Sat.	pH (SU)	Sp. Cond. (μmhos/cm)	NH_3-N (mg/L)	NO_2-N (mg/L)	NO_3-N (mg/L)	O-PO_4-P (mg/L)	T-PO_4-P (mg/L)	COD (mg/L)	Chlor. a/ Pheo. a (mg/L)
1	Highway 12 bridge	2	0.5	22.5	8.8	101	6.8	115	.07	<.01	.01	.02	.07	8	2.4/2.6
			1.5	22.4	8.9	91	--	--	--	--	--	--	--	--	--
2	Dillenbaugh Creek	--	--	20.0	4.6	50	--	130	.06	<.01	.01	.08	.15	16	--
7	Golf Course	4-1/2	1	--	9.3	--	--	--	.01	<.01	.03	.13	.18	--	26.0/3.8
			4	--	8.1	--	--	--	--	--	--	--	--	--	--
10	Salzer Creek	--	--	20.3	1.4	15	6.7	705	1.3	.10	<.1	.04	.06	60	--
12	Midway Meats	7	1	22.5	10.4	119	7.4	118	.04	<.01	<.01	.10	.15	--	13.0/4.1
			3	21.5	8.5	96	--	--	--	--	--	--	--	--	--
			6	18.0	0.5	5	6.2	--	--	--	--	--	--	--	--
13	Midway-Mellen	6-1/2	1	22.0	10.0	114	--	120	--	--	--	--	--	--	--
			3	21.5	9.5	107	--	--	--	--	--	--	--	--	--
			4	20.5	0.7	8	--	--	--	--	--	--	--	--	--
			6	17.5	0.3	3	--	--	--	--	--	--	--	--	--
14	Mellen St. Bridge	3-1/2	1	22.0	9.9	113	8.0	116	--	--	--	--	--	--	--
			2	22.0	10.0	114	--	--	--	--	--	--	--	--	--
			2.5	22.0	8.9	101	--	--	--	--	--	--	--	--	--
			3	20.5	6.1	67	--	--	--	--	--	--	--	--	--

- Temperature, D.O., and pH data taken with Hydrolab.

- Data collected on Chehalis and Centralia STP effluents on same day by Bill Yake's group.

- Chehalis River flows:
  Above Highway 12 - 116 cfs, field measurement
  Mellen St. Br. - 125 cfs, USGS gage

Table 3.

ble 3. Chehalis River and tributaries, August 5, 1980, 1415 - 1810 hours, receiving water samples during Class II inspection.

ation nber	Station Description	River Depth (m)	Sample Depth (m)	Temp. (°C)	D.O. (mg/L)	D.O. % Sat.	pH (S.U.)	Sp. Cond. (µmhos/cm)	BOD_5 (mg/L)	COD (mg/L)	Kjeld. -N (mg/L)	NH_3-N (mg/L)	NO_2-N (mg/L)	NO_3-N (mg/L)	O-PO_4-P (mg/L)	T-PO_4-P (mg/L)	TOC (mg/L)	TSS (mg/L)	Turb. (NTU)	F. Coli. (col/100 ml)	Chlorophyll a/ pheophytin a (mg/L)	Secchi Depth (feet)
1	Highway 12 Bridge	2	0.5	20.0	8.5	92	7.1	107	<2	16	--	.06	<.01	.03	.01	.10	10	12	3	27	2.3/1.6	2
			1.5	20.0	8.2	92	7.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2	Dillenbaugh Creek	--	--	17.8	4.6	49	6.7	113	<2	22	--	.04	<.01	.02	.04	.10	--	8	4	69 est.	--	--
4	1/4 mile below STP	1-1/2	0.5	20.0	8.9	97	7.1	113	--	12	.26	.03	<.01	.11	.12	.19	5	10	3	25	--	1-1/2
			1.5	20.0	8.8	96	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5	1/2 mile below STP	3-1/2	0.5	20.0	8.7	95	7.3	113	--	--	--	.05	<.01	.14	.14	.19	--	8	2	--	--	1-1/2
			2	20.0	8.1	88	7.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			3	20.0	7.9	86	7.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6	1 mile below STP	5-1/2	0.5	20.0	8.1	88	7.1	111	--	--	.30	.05	<.01	.10	.08	.12	--	7	2	15 est.	1.2/1.2	--
			2	19.5	7.3	78	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			4.5	19.5	7.0	75	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
7	2 miles below STP (golf course)	6-1/2	0.5	20.5	8.6	95	7.1	112	--	10	.38	.04	<.01	.14	.10	.14	9	8	2	--	6.3/1.0	1-1/2
			1	20.5	8.1	89	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			2	20.0	7.7	84	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			3	19.5	7.2	77	6.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			4	19.5	6.9	74	6.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			5	19.5	6.8	73	6.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			6	19.5	6.6	71	6.8	117	--	18	.34	.04	<.01	.09	.08	.12	9	--	--	--	1.3/1.5	
8	4 miles below STP	3-1/2	0.5	21.0	9.8	109	7.2	--	--	18	.52	.01	<.01	.04	.08	.13	7	8	2	50	19/0.7	1-1/2
			2	20.0	7.5	82	6.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			3	20.0	7.1	77	6.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
9	Above Salzer Creek	3-1/2	0.5	22.0	12.8	145	8.1	120	2	--	--	<.01	<.01	<.01	.06	.12	--	--	--	--	--	--
			2	20.5	8.1	89	7.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			3	20.5	7.7	85	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
0	Salzer Creek	--	--	18.8	1.4	15	7.1	705	18	50	--	1.3	<.01	<.05	.15	.15	--	22	5	290	--	--
1	1/4 mile below Salzer Creek	7	0.5	21.5	12.6	142	8.0	120	--	--	.43	<.01	<.01	<.01	.06	.12	--	--	--	--	--	--
			2	20.5	9.1	100	7.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			4	20.5	7.7	85	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			6	17.5	0.5	5	6.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
2	Midway Meats	8	0.5	21.5	12.8	144	7.9	123	--	16	.37	<.01	<.01	<.01	.05	.11	7	10	2	--	21/3.4	1
			2	20.5	10.0	110	7.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			4	20.5	8.6	95	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			6	19.0	1.6	17	6.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			7.5	14.0	0.2	2	6.5	140	--	16	.45	<.01	<.01	<.01	.05	.11	10	16	4	--	12/6.5	
	Midway-Mellen	9	0.5	21.5	11.2	126	7.3	122	--	--	--	<.01	<.01	<.01	.05	.11	--	--	--	--	--	1
			2	21.0	9.4	104	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			4	20.5	5.5	60	6.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			6	17.5	0.5	5	6.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			8	15.0	0.1	1	6.6	187	--	--	--	--	--	--	--	--	--	--	--	--	--	
	Mellen Street Bridge	4-1/2	0.5	21.0	12.4	138	7.6	--	2	24	.65	<.01	<.01	<.01	.06	.13	11	12	1	54	18/5.6	1
			2	20.5	9.4	103	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			3	19.5	8.1	87	6.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			4	18.5	1.7	18	6.7	--	--	20	1.2	.74	.05	.69	.61	.71	7	12	4	--	9.6/6.4	
	Below STP	3-1/2	0.5	22.5	12.2	139	7.4	123	--	20	--	.01	<.01	<.01	.06	.17	--	9	2	7 est.	--	1
			2	22.0	10.9	124	7.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			3	19.5	7.8	84	6.8	130	--	--	--	--	--	--	--	--	--	--	--	--	--	
	Skookumchuck River	--	--	16.8	--	--	--	80	--	--	--	.01	<.01	.31	.01	.07	--	--	--	20	.8/1.5	--
	Boat Launch	<2	0.5	19.0	10.9	116	7.2	112	--	--	--	.04	<.01	.22	.09	.12	--	7	1	28	--	1-1/2
			1.5	19.0	10.9	116	7.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	

ows:

Chehalis River above Highway 12	112 cfs
Dillenbaugh Creek	3.6 cfs
Salzer Creek	0.9 cfs
Chehalis River at Mellen Street	145 cfs 8/4/80; 145 cfs 8/5/80; 125 cfs 8/6/80
Skookumchuck River	99 cfs

Table 4 Chehalis River, tributaries, and Chehalis STP effluent, September 16, 1980, 1030 - 1410 hours, repeat sampling of August, 1980.

Station Number	Station Description	River Depth (m)	Sample Depth (m)	Temp. (°C)	D.O. (mg/L)	D.O. % Sat.	pH (S.U.)	Sp. Cond. (µmhos/cm)	BOD_5 (mg/L)	COD (mg/L)	Kjeld. -N (mg/L)	NH_3-N (mg/L)	NO_2-N (mg/L)	NO_3-N (mg/L)	O-PO_4-P (mg/L)	T-PO_4-P (mg/L)	TOC (mg/L)	TSS (mg/L)	Turb. (NTU)	Chlorophyll a/ Pheophytin a (mg/L)
1	Highway 12 Bridge	2	0.5	16.0	10.1	106	7.6	110	<2	7	.17	.02	<.01	.08	.03	.03	13	--	1	0.6/1.1
			1.5	18.0	10.1	106	--	--	--	--		--	--	--	--	--	--	--	--	--
2	Dillenbaugh Creek	--	--	16.0	5.7	57	6.8	135	<2	15	--	.03	<.02	.01	.05	.06	9	7	2	--
4	1/4 mile below STP	2	0.5	17.5	9.6	100	7.3	108	--	15	.22	.02	<.01	.24	.09	.10	11	7	1	0.5/0.7
			1	17.5	9.6	100	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			1.5	17.5	9.6	100	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5	1/2 mile below STP	3-1/2	0.5	17.5	9.5	99	7.3	105	--	--	--	.02	<.01	.26	.09	.12	8	--	--	--
			1	17.5	9.5	99	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2	17.5	9.5	99	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			3	17.5	9.5	99	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6	1 mile below STP	5	0.5	17.5	9.2	96	7.1	110	--	--	--	.02	<.01	.18	.05	.08	8	--	--	--
			1	17.5	9.2	96	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2	17.0	9.2	95	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			3	17.0	9.2	95	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			4	17.0	9.2	95	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7	2 miles below STP (golf course)	4-1/2	0.5	17.5	9.6	100	7.3	115	--	16	.26	.02	<.01	.29	.09	.12	7	--	--	0.8/0.7
			1	17.5	9.6	100	7.3	--	--	--	--	--	--	--	--	--	--	--	--	--
			2	17.0	9.5	98	7.3	--	--	--	--	--	--	--	--	--	--	--	--	--
			3	17.0	9.4	98	7.3	--	--	--	--	--	--	--	--	--	--	--	--	--
			4	17.0	9.4	98	7.1	108	--	15	--	.02	<.01	.28	.09	.12	8	--	--	0.4/0.8
8	4 miles below STP	3-1/2	0.5	17.5	9.2	96	7.3	110	--	7	.25	.03	<.01	.21	.09	.12	8	--	--	0.4/0.8
			1	17.5	9.0	94	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2	17.0	8.9	92	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			3	17.0	8.9	92	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9	Above Salzer Creek	3-1/2	0.5	17.5	8.0	83	7.0	120	<2	11	--	.05	<.01	.26	.11	.11	--	--	--	--
			1	17.5	7.9	82	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--
			2	17.5	7.9	82	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--
			3	17.5	7.9	82	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--
10	Salzer Creek	--	--	16.5	8.6	88	7.0	125	<2	15	--	.12	.03	.21	.08	.08	9	--	--	--
11	1/4 mile below Salzer Creek	7	0.5	17.5	8.1	84	7.0	117	--	--	--	.06	<.01	.25	.09	.11	--	--	--	--
			1	17.5	8.1	84	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2	17.0	7.8	80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			3	17.0	7.8	80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			4	16.5	7.8	80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			5	16.5	7.8	80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			6	16.0	3.2	32	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			6.5	16.0	1.6	16	6.9	122	--	--	--	--	--	--	--	--	--	--	--	--
12	Midway Meats	7-1/2	0.5	18.0	8.0	84	7.0	117	--	15	.23	.05	<.01	.28	.09	.10	10	--	--	1.2/0.8
			1	17.5	7.9	82	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2	17.5	7.8	81	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			3	17.5	7.8	81	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			4	17.5	7.8	81	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			5	17.5	7.7	80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			6	16.5	7.6	78	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			7	15.0	1.4	14	6.6	130	--	15	--	.22	.01	.61	.12	.12	7	--	--	0.7/1.8
13	Midway-Mellen	7-1/2	0.5	17.5	7.7	80	6.9	115	--	--	--	.06	<.01	.29	.09	.09		--	--	--
			1	17.5	7.6	79	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2	17.5	7.6	79	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			3	17.5	7.6	79	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			4	17.5	7.5	78	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			5	17.0	6.6	68	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			6	15.5	3.5	35	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			7	15.5	1.1	11	6.7	140	--	--	--	--	--	--	--	--	--	--	--	--
14	Mellen Street Bridge	5-1/2	0.5	17.5	7.8	81	7.0	110	<2	7	.27	.06	<.01	.26	.08	.12	7	8	1	1.7/1.0
			1	17.5	7.7	80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2	17.5	7.6	79	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			3	17.5	7.5	78	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			4	17.5	7.5	78	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			5	17.5	7.4	77	7.0	100	--	9	--	.06	<.01	.26	.08	.10	8	--	--	1.2/1.3
15	Below STP	4-1/2	0.5	17.5	7.8	81	7.1	120	--	15	--	.06	<.01	.26	.08	.11	10	6	1	1.6/0.8
			1	17.5	7.7	80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2	17.5	7.7	80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			3	16.5	7.6	78	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			4	15.5	1.3	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16	Skookumchuck River								--- No Samples ---											
17	Boat Launch	2-1/2	0.5	16.0	9.2	92	7.1	120	--	15	--	--	--	--	--	--	--	--	--	--
			1	16.0	9.2	92	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			2	16.0	9.1	91	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Chehalis STP Effluent*	--	--	18.0	7.4	78	6.3	418	78	69	5.0	1.2	<.10	17	9.0	9.7	TS 340	TNVS 220	TSS 15	THVSS 3

	F.Coli. 1 est.	Turb 3
Effluent*		

- Flows:

Chehalis River at Highway 12	136 cfs - field measurement
Dillenbaugh Creek	3.6 cfs - field measurement
Salzer Creek	2 cfs - field measurement
Chehalis River at Mellen Street	145 cfs - USGS gage

*24-hour composite, September 16-17, 1980, 1400-1400 hours.