JOHN SPELLMAN
Governor

Publication No. 83-e40

WA-25-5010

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504 • (206) 753-2353

MEMORANDUM
December 1, 1983

To: Jon Neel, District Engineer, Southwest Regional Office

From: Lynn Singleton and Gary Bailey, Water Quality Investigations Section

Subject: Longview Diking District Study

INTRODUCTION

A water quality survey was requested on December 21, 1982 by the Southwest Regional Office (SWRO) to provide receiving water quality data on the drainage water system of Longview, Washington. The specific study objectives as requested were:

1. Determine the impact of Weyerhaeuser's discharge on ditch number 3.

2. Evaluate the location and impact of raw sewage bypasses from the city's sewage collection system.

3. Establish background water quality conditions for the ditch system.

4. Survey the ditch system to determine if oil is migrating from the groundwater into the ditch system and to determine the location, size, and quality of the industrial storm and sanitary sewer discharges.

5. Document the diking district operating procedures and make recommendations as to changes which might improve water quality.

6. Determine whether cyanide is present in the ditch system.

In response to this request, a reconnaissance and sampling of the ditches and discharges to the ditch system were conducted on January 25 and 26, 1983. Originally, project completion was scheduled for spring

1983. However, lack of necessary storm events caused postponement of the remaining field work. As an alternative to the original work plan, information collected to date is included in this report. Additional sampling is scheduled for the fall of 1983. A separate report will be available in the spring of 1984.

Background information presented in the following section was obtained from the SWRO, Lynn Clapp of Consolidated Diking Improvement District #1, and Larry Zandi, Longview city engineer.

BACKGROUND INFORMATION

The drainage system in Longview includes approximately 65 miles of ditches, five discharging pump stations, and one booster station. The system is maintained and operated by the Consolidated Diking Improvement District #1. The District maintains the waterway system to collect surface and groundwater drainage from the land within its boundary. In addition, it serves industry for non-contact cooling water and stormwater runoff disposal as well as the City of Longview for the disposal of sanitary sewage when bypasses are necessary. The District is supported by tax assessments on the properties serviced. The main portion of the Diking District and adjacent surface waters is illustrated in Figure 1.

Waters collected or discharged to the system may be pumped to the Columbia River directly by: the Reynolds; the Industrial Way (under construction); and the Oregon Way stations (Figure 1). Waters may also be discharged by the Main station (which is supported by the 48th Avenue booster station) to the Columbia River via Coal Creek slough. A small amount of drainage is diverted to the Cowlitz River by pumps at the Pioneer station.

The total discharge capacity when the Industrial Way pump station is completed will be 578,600 gpm (1,290 cfs). All pump stations have two to four pumps which operate sequentially as water levels increase. In the summer when surface discharge decreases, the pumps at the Pacific Way and Oregon Way pump stations are shut off. Discharge at Pacific Way is then controlled solely by the radial tide gate at Coal Creek Slough.

Locations of 10 of the 11 sanitary sewer overflow sites are shown in Figure 2 (Zandi, 1983; Edtl, 1983). Bypasses are manually controlled and events recorded in a log maintained by the city engineer (Edtl, 1983). The record for 1982 indicates bypasses occur most frequently to ditches 6 and 7 in the north section of town and in ditch 2 in the central section near Hudson Street. Bypasses occur primarily in the months of heavy precipitation; however, none were recorded during the period of this sampling.

Figure 1. SAMPLING LOCATIONS ON LONGVIEW DITCHES. MAP MODIFIED FROM CONSOLIDATED DIKING IMPROVEMENT DISTRICT NO. 1, 1982.

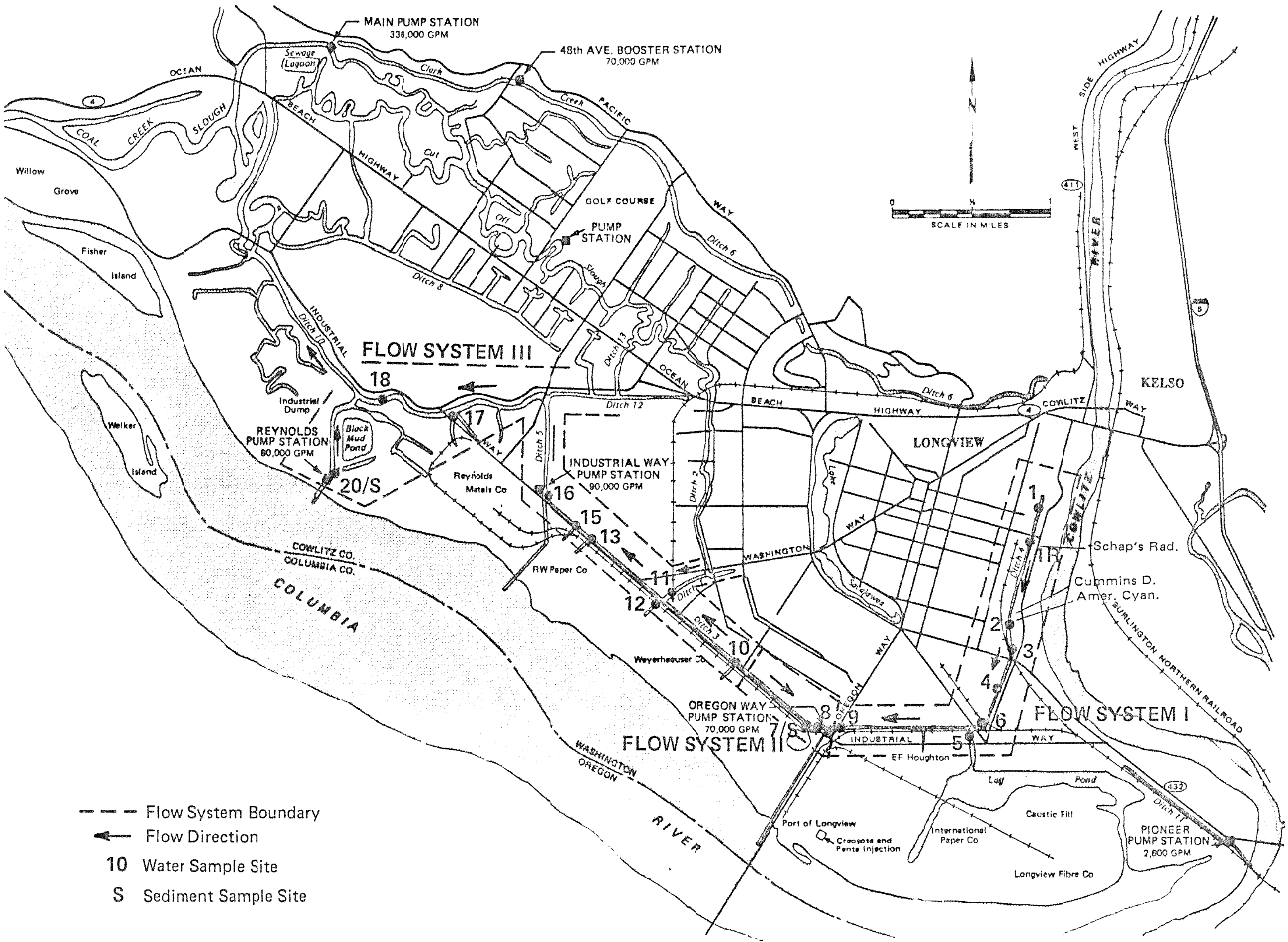
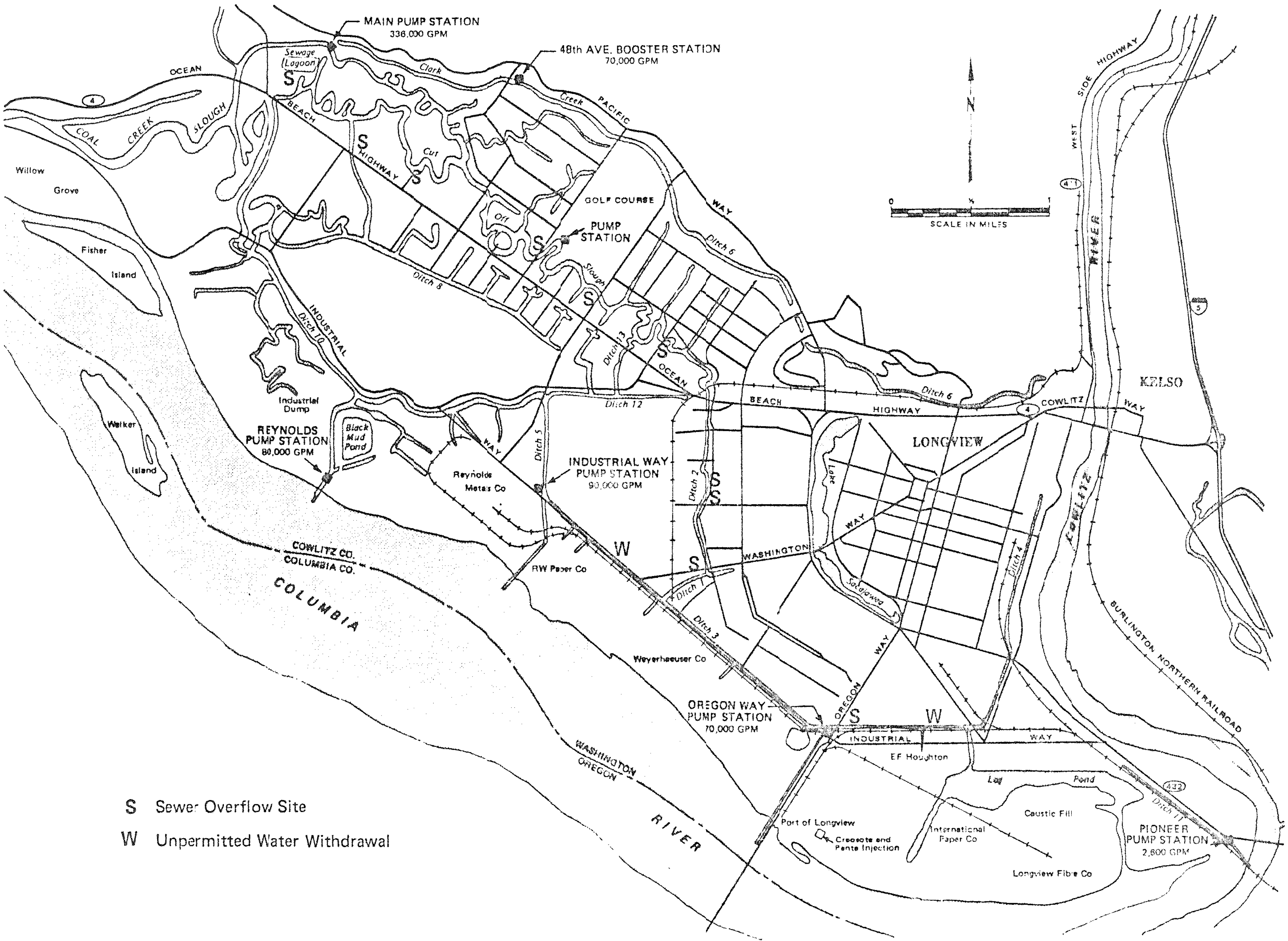


Figure 2. LOCATION OF SANITARY SEWER OVERFLOWS AND UNPERMITTED WATER WITHDRAWALS. MAP MODIFIED FROM CONSOLIDATED DIKING DISTRICT NO. 1, 1982.



Four industries have NPDES permits to discharge non-contact cooling waters or surface runoff water to the Diking Improvement District #1. The companies and the daily average permitted flows are: E.F. Houghton and Co., 10,000 GPD cooling water discharged via storm sewer system to ditch 3 (approximate location in Figure 1); American Cyanamid Co., 530,000 GPD cooling water discharged to ditch 4 (NPDES permit lists ditch 3 as the receiving water); Reynolds Metal Co., 3.3 MGD cooling water discharged to ditch 12; and Weyerhaeuser Co. (no flow limitation specified) for surface runoff and log sort yard runoff discharged from three locations to ditch 3. Smaller industries which discharge intermittently to the ditch system without permits are discussed later in this text.

Maintenance of the ditch channels and banks is performed on a continuous rotation. The ditches are dredged by drag-line and banks cleared of vegetation. Herbicides are used to control both aquatic weed growth in the channels and bank vegetation. The ditches also serve as a solid waste repository for some people who live along the ditches. This solid waste is removed by the Diking District during maintenance and dredging.

Water rights totaling 5.1 cfs are granted for withdrawal from the ditch system. These water rights are located primarily in the northwest area and used primarily for agriculture. No water withdrawal rights are recorded for ditch 3 (Cordell, 1983); however, the presence of pumps in ditch 3 indicates unpermitted water withdrawal is occurring (Figure 2). The withdrawal located between California and Oregon Way is an eight-inch pipe which appears to provide water to a log sort yard.

The direction and velocity of flow of water at any particular point along the ditch system is dependent on which pumps are operating at that time and somewhat on the condition of a particular ditch. For example, the flow in ditches 10 and 14 were observed flowing in opposite directions on two different days. During the summer, the direction of flow is northwest toward the Pacific Way pump station, but could easily be directed toward an alternate pump station. During the winter when all pump stations are operational, the direction of flow cannot be easily controlled or predicted.

By definition, ditch waters in the Diking District are waters of the State and must be protected as per their classification. The Longview ditches have not been specifically classified and therefore as tributaries to the Columbia River (Class A) take on the same designation. Coal Creek Slough is also designated Class A.

METHODS

Surface water samples were collected on January 25 at stations 1, 15, 16, 17, 18, and 20 and on January 26 at stations R and 2 through 13. Sediment samples were collected with an Ekman grab at two stations, 7S and 20. The sample site locations are given in Figure 1 and described in Table 1.

Temperature measurements were made and dissolved oxygen (Winkler method) samples collected in the field. Samples for pH, turbidity, specific conductance, chemical oxygen demand, fecal coliform, nitrate-nitrogen, nitrite-nitrogen, ammonia-nitrogen, orthophosphorus, total phosphorus, total suspended solids, oils and grease, total hardness, phenolics, total cyanide, and metals (Cu, Zn, Ni, Cr, Cd, Pb) were preserved as necessary, packed on ice, and returned to the WDOE Olympia Environmental Laboratory for analysis. Separate samples from stations 3, 4, 5, and 9 were analyzed by the WDOE Redmond Environmental Laboratory for napthalene and pentachlorophenol. Water samples from stations 6, 8, 16, and 20 and sediment samples from stations 7S and 20 were analyzed for acid and base/neutral organic compounds by the EPA Manchester laboratory. It is important to note that any surface samples were taken after surface oils were displaced.

At the time of sampling, the Industrial Way pump station was not operational. The Reynolds pump station was functional; however, not operating during the survey. The observed direction of flow is indicated in Figure 1. Flows in the ditches and in the discharges to the ditch were not measured. Water levels in the ditches on the 26th were about two feet higher than on the previous day due to heavy precipitation on the evening of the 25th and the morning of the 26th.

DISCUSSION

It is important to note that the direction of flow changes from day to day and the designation of "Flow Systems" does not infer constant conditions.

At the time of sampling and within the area sampled, there were three waterway systems separable by flow. Each will be discussed in turn.

Flow System I

Flow System I contains approximately 2-1/2 miles of ditches and includes ditch 4 on the east side of Longview and ditch 3 to the Oregon Way pump station. Samples were collected at five ditch stations and from three

Table 1. Sampling sites for Longview ditches (January 25-26, 1983). It should be noted that these flow systems were present at the time of sampling but are subject to change.

Station	Location
	FLOW SYSTEM I
1	At end of Peardale Lane. Ditch No. 4
1R	Schap's Radiator Shop discharge to Ditch No. 4
2	American Cyanamid discharge boil in Ditch No. 4
3	Tennant Way behind 3rd Avenue storage, Ditch No. 4
4	Upflow side of the railroad crossover, next to log scaler shack. Upstream from California Way, near junction of Ditch No. 3 and Ditch No. 4
5	International Paper Company (IPCO) log pond discharge
6	Upflow side of California Way before IPCO log pond discharge in Ditch No. 3
9	Ditch No. 3, east of Oregon Way pump station
	FLOW SYSTEM II
7	Weyerhaeuser pond discharge
7S	Sediment sample from Ditch No. 3 in Weyerhaeuser pond discharge plume
8	Ditch No. 3 between Weyerhaeuser pond discharge and Oregon Way pump station
	FLOW SYSTEM III
10	Weyerhaeuser oil-water separator near 26th Street
11	Ditch No. 1
12	Weyerhaeuser second oil-water separator
13	Stormwater pipe from R.W. paper
14	Not established
15	Discharge from 60-inch concrete culvert which drains part of the Reynolds Metals Company complex and flows into Ditch No. 10
16	Near pump station at junction of Ditch No. 3 and Ditch No. 5
17	48-inch culvert which drains the Reynolds Metals Company complex and flows into Ditch No. 10. Appears to carry permitted discharge non-contact cooling water.
18	Ditch No. 10
19	Not established
20	Ditch No. 14 at Reynolds pump station

Table 2. Water quality data for Longview ditches (January 25-26, 1983). Units are mg/L unless otherwise stated.

Ditch Number	Station Number	Station Type	Time	Date	Temperature (°C)	Dissolved Oxygen	pH (Standard Units)	Turbidity (NTU)	Specific Conductivity (µmhos/cm)	COD	Fecal Coliform (col/100 mL)	NO_3-N	NO_2-N	NH_3-N	O-PO_4-P	Total Phos.-P	Total Suspended Solids	Recoverable Oil & Grease	Total Hardness (as $CaCO_3$)	Recoverable Phenolics (µg/L as Phenol)	Total Cyanide (µg/L as CN)	Total Recoverable Copper (µg/L)	Total Recoverable Zinc (µg/L)	Total Recoverable Nickel (µg/L)	Total Recoverable Chromium (µg/L)	Total Recoverable Cadmium (µg/L)	Total Recoverable Lead (µg/L)
FLOW SYSTEM I																											
4	1	D	1306	1/25	10.8	--	6.6	54	197	5	35	0.61	0.01	0.09	0.02	0.02	45	2	81	9	<1	<10	25	<20	<10	<2	<20
4	1R	P	--	1/26	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.9c	1100c	80	<10	160	25c
4	2	P/B	--	1/26	9.5	3.8e	6.7	32	84	9	~13	0.02	0.01	0.13	*	0.03	22	<1	50	3	<1	10b	30	<20	<10	<2	<20
4	3	D	0810	1/26	9.4	5.0e	6.6	33	107	9	~68	0.12	0.01	0.08	0.04	0.08	24	6	50	17	<1	10b	41	<20	<10	<2	<20
4	4	D	0840	1/26	--	--	6.6	56	124	9	80	0.11	0.01	0.11	*	0.03	35	3	65	26	<1	<10	33	<20	<10	<2	<20
3	6	D	0920	1/26	--	4.6e	6.6	56	122	18	57	0.13	0.01	0.11	*	0.03	34	2	62	--	<1	<10	21	<20	<10	<2	<20
3	5	P	0900	1/26	--	10.5	7.4	160	147	59	88	0.08	0.01	0.04	*	0.04	66	68	54	27	<1	20a	86b	<20	<10	<2	<20
3	9	D	1110	1/26	--	4.7e	6.7	150e	145	50	120	0.12	<0.01	0.17	0.04	0.06	88	4	62	24	<1	<10	60b	<20	<10	<2	<20
FLOW SYSTEM II																											
3	7	P	--	1/26	--	--	6.3	1100	171	450	320	<0.01	0.02	0.04	*	0.03	570	130	77	185	<1	60a	120b	<20	10	<2	<20
3	8	D	1045	1/26	--	1.0e	6.5	300e	195	130	60	0.10	0.01	0.05	*	0.02	160	3	85	--	<1	20a	55b	<20	<10	<2	<20
FLOW SYSTEM III																											
3	10	P/B	--	1/26	--	3.1e	6.4	410e	191	420	690	<0.01	0.02	0.04	*	0.08	290	6	92	69	<1	20b	150b	<20	<10	2b	<20
1	11	D	1200	1/26	--	7.4e	6.9	46	180	14	180	0.14	<0.01	0.27	*	0.05	17	--	77	--	--	<10	18	<20	<10	3a	<20
3	12	P	1220	1/26	--	6.7	6.7	220	159	190	390	0.07	0.01	0.03	*	0.08	130	--	65	34	<1	20a	130b	<20	<10	6a	<20
3	13	P	1250	1/26	--	--	7.3	75	514	23	~1400e	0.16	0.02	0.64	*	0.03	42	--	150	--	--	--	--	--	--	--	--
3	15	P	1730	1/25	--	--	7.2	14	766	77	~10	0.22	0.01	0.12	0.05	0.06	4	8	110	5	270d	<10	24	<20	<10	4a	<20
3	16	D	--	1/25	--	--	6.6	170e	312	45	~40	0.18	0.01	0.42	0.02	0.02	86	<1	120	--	9d	10b	19	<20	<10	3b	<20
10	17	P	1650	1/25	11.4	--	7.4	10	278	5	~3	0.18	0.01	0.13	*	0.01	11	--	110	5	3	<10	<5	<20	<10	<2	<20
10	18	D	1610	1/25	9.0	--	6.7	85	281	41	240e	0.21	0.07	0.42	*	0.02	44	<1	110	7	20d	<10	12	<20	<10	3b	<20
14	20	D	1540	1/25	8.6	--	6.9	75	275	27	~50	0.08	<0.01	0.51	0.14	0.21	24	<1	110	--	23d	<10	10	<20	<10	<2	<20

* = No data - unknown chemical interference
~ = Estimate - count based on non-ideal conditions
P = Point source at the pipe; P/B = point source boil in ditch; D = ditch sample

a = Exceeds criteria for maximum and 24-hour average
b = Exceeds criterion for 24-hour average
c = In mg/L
d = May exceed maximum or 24-hour average criteria
e = Exceeds Class A criterion

point discharges (Table 1, Figure 1). The E.F. Houghton discharge, which enters in this system, was not sampled during the survey.

Ditch 4 begins about 75 meters above station 1. The waterway collection system is underground above that point. Station 1 was sampled on January 25 during dry-weather conditions when the water level was low. The dry-weather and downstream wet-weather results were reasonable in light of the loading conditions. Station 1 had a slightly higher concentration of NO_3-N, higher specific conductance, and total hardness than downflow stations (Table 2). The elevated levels are probably due to the higher proportion of groundwater inflow at the time of sampling. An oil sheen was present at this site and originated from within the closed system. Metals concentrations were either below detection limits or below criteria (USEPA, 1980a). Table 3 is included as a criteria reference tool. Exact criteria should be calculated from the equations given by USEPA (1980a).

Table 3. Criteria for selected total recoverable metals (USEPA, 1980a). All concentrations are in μg/L.

	Chronic Toxicity Hardness (mg/L $CaCO_3$)		Acute Toxicity Hardness (mg/L $CaCO_3$)	
	50	100	50	100
Cadmium	0.012	0.025	1.5	3.0
Chromium	As low as 44		2200	4700
Copper	5.6	5.6	12	22
Lead	0.75	3.8	74	170
Nickel	56	96	1100	1800
Zinc	47	47	180	320

Schaps Radiator and Automotive (309 Hudson) is adjacent to the ditch and downflow of station 1. The business is an unpermitted discharger to ditch 4 (station 1R). At the time of sampling, the 4-inch plastic pipe was discharging approximately 100 mL/minute, but rivulets on the bank below the pipe indicated flows may occasionally be much higher. Concentrations of copper, zinc, nickel, cadmium, and lead were extremely high in this discharge (Table 2). Samples of the sump liquid and sludge were collected from the radiator shop by Brett Betts and Mike Morhous (SWRO) on January 28, 1983. These sample results confirmed the high metals concentrations (Table 4).

Table 4. Metal concentrations (total as mg/L or mg/Kg dry) in the sump liquid and sludge of Schap's Radiator Shop.

Metal	Sump Liquid	Sump Sludge
Copper	0.26	12,000
Zinc	610	93,000
Nickel	<0.26	45
Chromium	<0.13	370
Cadmium	0.13	34
Lead	10	160,000

No increase in metals concentrations was measured downstream of the discharge, probably because of the small volume of waste discharge relative to the flow in the ditch; however, the sump discharges by a siphon system which means during a discharge cycle approximately 7.5 gallons is discharged to the ditch in a short time (Betts, personal communication). At times of low flow, the waste discharge may be acutely toxic to aquatic life. In addition to the pipe discharge, there were oil drain pans and filters on the ditch bank, creating an oil-soaked area. Two other discharge pipes (not flowing) observed at this location did not appear to be functional (Betts, personal communication).

Cummins Diesel (1153 - 3rd, Figure 1) routes floor wash water to an oil-water separator and then illegally discharges to ditch 4. There were several oily areas on the ditch at this location and several pipes present along the bank. The ditch had just been dredged and oil-laden sediments covered the bank. An inspection of Cummins Diesel was made on January 28, 1983 by Morhous and a sample of the separator discharge collected. Morhous found the separator filled with oil and sludge and advised the operator to have it cleaned as soon as possible. The analytical results of the discharge from the separator for recoverable oil and grease at the time of inspection was >5,000 mg/L. On a second visit on March 21, 1983, Morhous noted the separator still appeared to be losing oil. A sample of the discharge resulted in a concentration of oil and grease of 300 mg/L, which would not be allowed if an NPDES permit were in effect.

The permitted American Cyanamid effluent (station 2) visually appeared very clean during a reconnaissance survey. At the time of sampling, the level of the ditch was above the pipe and only an effluent boil sample was possible. Of the observed parameters, the dissolved oxygen level of 3.8 was noteworthy; however, an upstream sample was not taken and the low value may reflect ditch conditions. The low concentration of recoverable phenolics indicates that American Cyanamid was not a source. Copper exceeded the 24-hour maximum concentration (5.6 µg/L; USEPA, 1980a) at this station and at the next downstream station (3). The source was not readily apparent.

Another potential oil source was noted at 1507 - 3rd Street, located between stations 2 and 3. Approximately 20 diesel oil filters had apparently been discarded and drained on the ditch bank amongst a large volume of other assorted solid waste.

Ditch conditions did not appear to change substantially from station 3 to station 6. In general, the ditch waters at the time of sampling were low in dissolved oxygen (Table 2). Concentrations ranged from 4.6 to 5.0 mg/L and assuming a water temperature of 9.4°C, saturation values ranged from 41 to 44 percent. The low COD at ditch stations 1, 2, 3, 4, and 6 (5 to 18 mg/L) indicates there is no heavy organic loading so the low dissolved oxygen (D.O.) may be due to groundwater inflow, which is typically low in D.O., or sediment oxygen demand.

The nutrient concentrations (NO_3-N, NO_2-N, NH_3-N, O-PO_4-P, total phos-P) were low and there was no discernible increase from station 1 to 4 and 6. The low NH_3-N concentration and fecal coliform counts in this reach also indicate there is no large inflow of organic material (raw sewage).

A heavy oil sheen was present at all stations in Flow System I. A strong hydrocarbon odor was detected at a groundwater seep behind the Country Gas Station (540 California Way); however, no discernible flow or increase in sheen was detected. The results of analyses for recoverable oils and greases at stations 1 to 4 and 6 were less than 10 mg/L. Samples were taken below the water surface and apparently the majority of the oil was confined to the surface. Phenolics, which may be associated with oils, were present; however, concentrations were low in the system in relation to the 2,560 µg/L criterion for phenol.

The discharge from the International Paper Co. (IPCO) log pond (station 5) was oily in appearance and smell (68 mg/L recoverable oil and grease). A visual inspection of the pond did not reveal the presence of large amounts of oil and the flow leaving the pond was approximately the same as the flow at the discharge to the ditch. It is suspected that at the time of sampling there was a high concentration of oil entering somewhere between the pond outlet and the point of discharge to the ditch. The concentration of copper in the discharge exceeded the maximum criterion and the zinc concentration exceeded the 24-hour average criterion (USEPA, 1980a). This, along with the COD and TSS concentrations, was somewhat unusual for an impoundment which receives very little urban runoff.

Concentrations of COD, suspended solids, and zinc increased at station 9. Zinc concentrations (60 µg/L) exceeded the 24-hour criterion of 47 µg/L. It appears that the station 5 discharge contributed to the elevated conditions. Fecal coliform concentrations also exceeded Class A standards at station 9. Another point source between stations 6 and 9 was not sampled. The 48-inch concrete storm sewer pipe was discharging oily water during the reconnaissance and appeared to drain the area at and around 961 International Way and contained the E.F. Houghton and Co. effluent. This company, an NPDES discharger, may contribute to the oily discharge. This discharge may have also contributed to the coliform violation. The waters downflow of station 9 were pumped from the system to the Columbia River via the Oregon Way pump station. As stated earlier, this flow regime changes during the summer months.

The organic compounds in the ditch waters and sediments are evaluated in relation to (1) criteria concentrations (for water) for some compounds, (2) the frequency of occurrence in statewide waters and sediments, and (3) the magnitude of concentrations in other state waters and sediments (Joy, 1983).

For those organic compounds with criteria, concentrations at stations (3, 4, 5, 6, and 9) in Flow System I were less than the criteria concentrations (Table 5). The pentachlorophenol analysis performed at Redmond is not sensitive enough to detect concentrations near the 24-hour criteria so stations 3, 4, and 9 may have exceeded the criteria of 3.2 µg/L. On a statewide comparison, the waters in Flow System I contained nine organic compounds which have been detected infrequently in other state waters. Concentrations of organic compounds in Flow System I waters with the exception of chrysene are generally in the lower to mid-range of the values reported elsewhere in the state (Joy, 1983). Several compounds found in the ditch samples have not been detected in the surface water data included in Joy (1983).

Flow System II

Flow System II extends from about 26th Street to the Oregon Way pump station (approximately .7 mile) and drains residential areas to the north and industrial land belonging to Weyerhaeuser Co. to the south. Samples were collected at one ditch station (water and sediment) and one point discharge.

Weyerhaeuser Co. maintains a ditch system and holding pond for its sort yard runoff. The pond discharges via a standpipe to ditch 3 as per NPDES permit. An oil boom circled the standpipe; however, a sheen was present in the area inside the boom. The pond discharge at the ditch appeared very oily, extremely black, and had a large amount of foam present. Analytical results confirmed these visual observations. The

Table 5. Acid and base/neutral organic compounds (μg/L) in Longview ditch water samples (January 25-26, 1983), and comparisons to statewide sample results (Joy, 1983). Only those compounds having concentrations above detectable limits are reported.

	Station and Medium								Statewide Comparison			Freshwater Criteria	
Constituent	3 Water*	4 Water*	5 Water*	6 Water	9 Water*	8 Water	16 Water	20 Water	Number† Detected	Range	Geo. Mean	Acute	Chronic
Acid Extractables													
pentachlorophenol	<10	<10	<10	0.14	<10		0.48	0.11	0			55	3.2
phenol												10,200	2,560
Base/neutrals													
acenaphthene						0.17	0.03		1	0.1		--	--
1,2-dichlorobenzene				0.06					1	2.83		1,120	763
1,4-dichlorobenzene				0.03					1	2.83		1,120	763
fluoranthene				0.12			0.18	0.04	0			3,980	--
napthalene	2.4	1.4	0.4		0.7	0.28	0.10		5	0.06-0.2	0.11	2,300	620
bis(2-ethylhexyl) phthalate												940	3
benzo(a) anthracene												--	--
benzo(a) pyrene												--	--
3,4 benzo(b)fluoranthene/ benzo(k)fluoranthene				0.14					0			--	--
chrysene				0.10					1	0.02		--	--
acenaphthylene													
anthracene				0.09		0.82	0.16		0			--	--
benzo(ghi)perylene												--	--
fluorene						0.33			0			--	--
phenanthrene												--	--
dibenzo(a,h)anthracene												--	--
ideno(1,2,3-cd)pyrene												--	--
pyrene				0.21				0.05	0			--	--

*Analyzed for naphthalene and pentachlorophenol only (Redmond laboratory).
†Number of samples in which the chemical was detected out of approximately 50 water samples collected statewide.

pond discharge contained the highest concentration of oil (130 mg/L), phenolics (185 mg/L), suspended solids (570 mg/L), and turbidity (1,100 NTU) observed at any station during the sampling period. It also contained the highest COD (450 mg/L) and had significant amounts of copper (60 μg/L) and zinc (120 μg/L).

The sediment sample (7S) taken in the path of the Weyerhaeuser effluent plume contained several organic compounds (Table 6). Although there are no toxic criteria for sediment, the concentration of bis(2-ethylhexyl) phthalate greatly exceeds both chronic and acute criteria for water (Table 5). Other detected compounds do not exceed the criteria for water concentrations, but concentrations are high when compared to concentrations measured in other state waters (Joy, 1983).

Water quality at the nearest downstream ditch station (8) appeared to be impacted by the Weyerhaeuser pond discharge. The COD, total suspended solids, turbidity, and copper concentrations were the highest observed values for any ditch station and the dissolved oxygen concentration of 1.0 mg/L was the lowest. In general, nutrient concentrations at station 8 were low and appeared to result from dilution by the nutrient-poor Weyerhaeuser pond discharge. The observed copper concentration (20 μg/L) exceeded the maximum criterion concentration and zinc (55 μg/L) exceeded the 24-hour average criterion. As stated earlier, concentrations of both metals were elevated in the Weyerhaeuser pond discharge.

Several organic compounds were measured in low concentrations in station 8 water. Four compounds were present at measurable concentrations (Table 5), and five were tentatively identified (Table 7). Of the nine observed compounds, only napthalene has an established freshwater criterion. The concentration at station 8 was well below the criterion.

Waters in Flow System II flowed to the Oregon Way pump station and were pumped to the Columbia River along with the water from Flow System I.

Flow System III

Flow System III includes ditch 3, west of 26th Street; ditch 1; ditch 5; and a portion of ditch 10. Samples were collected at four ditch and five point discharge stations.

The Weyerhaeuser Co. has two permitted oil-water separator discharges entering ditch 3; station 10, and station 12. Both were, in general, poorly maintained. Oil was backed up behind the boom into the discharge pipe for as far as could be seen (approximately 3 meters) at station 10 and a visible sheen was present below the discharge. None was present

Table 6. Acid and base/neutral organic compounds ($\mu g/Kg$ dry weight) in Longview ditch sediment samples (January 25-26, 1983), and comparisons to statewide sample results (Joy, 1983). Only those compounds having concentrations above detectable limits are reported.

Constituent	Station and Medium: 7S Sediment	Station and Medium: 20 Sediment	Statewide Comparison: Number† Detected	Statewide Comparison: Range	Statewide Comparison: Geo. Mean
Acid Extractables					
pentachlorophenol					
phenol	398		12	0.35-500	0.4
Base/neutrals					
acenaphthene	184	T	1	8	
1,2-dichlorobenzene					
1,4-dichlorobenzene					
fluoranthene	1,269	1,713	2	0.07-0.1	0.08
napthalene	1,343	185	3	0.02	0.02
bis(2-ethylhexyl) phthalate	9,204	199	22	0.02-200	3.5
benzo(a) anthracene		438	0		
benzo(a) pyrene		1,315	1	0.02	
3,4 benzo(b)fluoranthene/ benzo(k)fluoranthene		2,988	0		
chrysene		1,534	1	0.06	
acenaphthylene	398		3	0.002-60	1.5
anthracene		120	0		
benzo(ghi)perylene		7,171*	0		
fluorene		60	0		
phenanthrene	2,985	697	0		
dibenzo(a,h)anthracene		1,753*	0		
ideno(1,2,3-cd)pyrene		19,920*	0		
pyrene	1,368	1,514	2	0.03-0.09	0.05
% Solids	40.2	50.2			

T = Detected in sample but not quantified.
* = Estimated
† = Number of samples in which chemical was detected out of approximately 35 sediment samples collected statewide.

Table 7. Tentatively identified compounds in water and sediment samples from Longview ditches (January 25-26, 1983).

Station Number	Medium	Compound
8	Water	2-ethyl-1,4-dimethyl-benzene
8	Water	2,6,6-trimethyl bicyclo[3,1,1]hept-3-en-2-one
8	Water	1,3-dimethyl-naphthalene
8	Water	3,4-dimethoxy-phenol
8	Water	9-methyl-phenanthrene
16	Water	1-methyl-4-(1-methylethyl)-3-cyclohexen-1-ol
16	Water	6-isopropylidene-1-methyl bicyclo[3,1,0] hexane
16	Water	N-ethyl butanamide
16	Water	2,3-dimethyl naphthalene
16	Water	3,5-dichloro-4-methoxy-2,6-dimethyl-pyridine
16	Water	1,2,3,4,4A,9,10,10A octahydro 1,4A-dimethyl-1-phenanthrene carboxaldehyde
20	Water	isopropylbenzene
20	Water	1-methyl-4-(1-methylethyl)-benzene
20	Water	(3-beta)-cholest-5-en-3-ol propanote
7	Sediment	1,6-dimethyl-napthalene

upflow of the point source. The boom at station 12 was suspended above the water surface by a small piling and floating oil was discharged directly to the ditch. As evidenced by the data, both discharges had high concentrations of COD, solids, and turbidity. Data indicate the observed oil was primarily confined to the surface, as little was noted in the sub-surface sample results. Copper, cadmium, and zinc levels at station 10 and zinc at station 12 all exceeded the criteria for 24-hour average concentrations. Cadmium and copper exceeded the maximum concentration at station 12. The excessive color and oil present in both separator discharges aesthetically impacted the ditch.

Ditch 1, represented by station 11, enters ditch 3 between stations 10 and 12. It appears to primarily drain a residential area. The fecal coliform criterion for Class A waters was violated at this site. Station 11 was approximately 1/4 mile downstream of a raw sewage discharge, reported by a maintenance person dredging the ditch. The dredger reported that the pipe had once been unknowingly covered during ditch cleaning and the Dover Street Apartments' manager soon told them it was plugged and had to be uncovered. When unobstructed, sewage material flowed from the pipe. Fecal coliform levels exceeded the Class A criterion and the ammonia-nitrogen concentration at station 11 was slightly elevated compared to ditch 4 stations; however, COD, indicative of organic loading, was low (14 mg/L). A visual inspection of the discharge near the corner of Dover Street and 32nd Street revealed the presence of toilet tissue and other items that confirmed a sanitary waste discharge. The pipe originates from the Dover Street Apartments and enters on the south bank of ditch 2. A sample was not collected during the survey; however, a subsequent inspection and sampling of the pipe by Morhous revealed no visual sewage evidence present. The laboratory results also indicated fecal coliforms were high (estimate of 2100 org/100 mL), but much lower than would be expected from a raw sewage discharge. The combined WDOE observations/data and citizen report indicate that the source is intermittent and the apartment house personnel know of its existence.

Water at station 11 exceeded the maximum criterion for cadmium. The high concentration of cadmium is surprising because this ditch primarily drains a residential area; however, it may be related to the solid waste disposal practices of the residents.

Station 13 is a stormwater pipe which drains the R.W. Paper Co. site (a Weyerhaeuser Co. subsidiary). It is located downflow of the Weyerhaeuser discharges. It was sampled and a limited number of parameters tested. In relation to background conditions, the discharge had a higher-than-average pH, conductivity, bacteria, ammonia, and hardness. This station should be sampled for metals and cyanide during subsequent monitoring. The drain serves a railcar washout area and has been the source of illegal discharges in the past (Betts, personal communication).

Station 15 is a 60-inch culvert which drains Reynolds Metals property. This discharge had the highest levels of cyanide observed during the sampling (270 µg/L) and cadmium levels exceeded the maximum criterion.

Water quality at station 16 was obviously impacted by the upflow discharges. The high metal concentrations at ditch station 16 appear to originate from discharges from stations 10, 12, and 15. The 24-hour average criteria for copper and cadmium were exceeded at station 16.

The cyanide input at station 15 resulted in an instream concentration of 9 µg/L, total cyanide, at station 16. This value may exceed the 24-hour average criterion of 3.5 µg/L free cyanide (U.S. EPA, 1980a) and will be discussed in more detail later in this memorandum.

Five acid and base/neutral organic compounds were detected at station 16. The levels do not exceed criterion, where available; however, many of the compounds have not been reported in Class A waters previously (Joy, 1983).

Station 17 is a culvert which appears to be the Reynolds Metals Co. Electrical Division (Cable) discharge. It is an NPDES-permitted discharge for non-contact cooling water. The quality of this water was generally good for all parameters measured. Cyanide was present, but at a low concentration (3 µg/L).

Station 18 is on ditch 10 and about 1/2 mile downstream from station 17. Fecal coliform numbers were high at this station (240 col/100 mL), the cyanide concentration was high (20 µg/L), and cadmium exceeded the 24-hour average criterion. The source of the coliforms was not readily apparent, but there are several upstream discharges that were not sampled (Figure 1). The high cyanide and cadmium concentrations appear to be a general characteristic of drainage water around the Reynolds Metals Co. land.

As indicated in the discussion of water quality at station 16, there is a discrepancy between the cyanide criterion (USEPA, 1980b) and the current analytical methodology (USEPA, 1979). The cyanide criterion is given as free cyanide which includes hydrocyanic acid (HCN) and the cyanide ion (CN^-); however, no analytical methodology is given for the analysis of free cyanide.

Although free cyanide may be the toxic form to aquatic life, it is highly reactive and probably exists primarily in transition between metallo- and organo-cyanide complexes. The WDOE Environmental Laboratory uses a total cyanide method (USEPA method 335.2) which measures most of the cyanide present whether in the dissociated (potentially toxic) or combined form. This test probably overestimates the potential toxicity of a water when compared to the USEPA cyanide criterion. An alternative method -- cyanides amenable to chlorination (USEPA method 355.1) -- measures those cyanide complexes which are readily dissociated and potentially toxic. This test does not, however, measure the iron cyanide complexes which dissociate in sunlight (APHA, *et al.*, 1975) and so may underestimate the toxicity when compared to the USEPA criterion.

Conventional pollutant concentrations at station 20 were similar to other ditch stations with the exception of the increased phosphorus concentrations. The reason for the increase is not readily apparent.

Three organic compounds were measured in water at station 20 (Table 5). As with previous ditch water samples, the concentrations are much lower than the criteria (for those that have criteria), and the compounds are not frequently found in other state waters. The sediment sample at station 20 (Table 6) contained 14 organic compounds and for eight of these compounds, the values are the highest recorded for the state. The other six had not been previously reported (Joy, 1983). Historically, when the Reynolds pump station operates, water is drawn from ditches 10, 5, 3, 1, and 2. All industries and sources on these ditches could therefore contribute to the chemical buildup in the sediment. Another potential source is the Black Mud Pond operated by Reynolds Metals Co. This unsealed pond is adjacent to station 20, contains a dangerous waste, and is a source of current groundwater contamination. Some seepage is collected and pumped back into the pond (Houck, 1983).

The Reynolds Metals Co. currently monitors free and total cyanide monthly at the request of WDOE (Houck, 1983) in ditch 14 near the station 20 of this study (Figure 1). The results of the cyanide analyses from the Reynolds monitoring for the period July 24, 1980 to November 30, 1982 were: (1) mean free cyanide = 22 μg/L, range of free cyanide = 10 to 70 μg/L; (2) mean total cyanide = 132 μg/L, and range of total cyanide = 40 to 750 μg/L. The mean ratio of free cyanide to total cyanide was .24, but varies from .01 to .44. The Reynolds data show the 24-hour average criterion are being exceeded at their monitoring site and by utilizing the .24 ratio and total CN data (Table 2), it appears that the 24-hour average criterion may also be exceeded at ditch station 18.

SUMMARY BY OBJECTIVE

1. Assess impact of Weyerhaeuser discharge on ditch 3

   The discharge from the Weyerhaeuser complex to ditch 3 is composed of three separate discharges denoted in this survey as stations numbered 7, 10, and 12. The impact of discharge station 7 was assessed by examining water quality at ditch station 8 and the impact of discharge stations 10 and 12 by examining water quality at ditch station 16.

The discharge at 7 had high concentrations of turbidity, suspended solids, COD, fecal coliforms, oil and grease, phenolics, copper, and zinc. This discharge appears to cause Class A water quality standard and USEPA (1980a) criterion violations at station 8, with high concentrations of all the above parameters except fecal coliform bacteria. Phenolics were not measured at ditch station 8.

The discharges at 10 and 12 had high turbidity, suspended solids, COD, fecal coliforms, phenolics, copper, zinc, and cadmium levels. Station 16, approximately one mile downstream, was influenced by the oil-water separator discharges and the discharges from stations 13 and 15.

Specifically, the Weyerhaeuser oil-water separator discharges are responsible for aesthetics (turbidity and surface oil), copper, and in part, cadmium, water quality criteria violations at station 16.

2. Location and impact of sewer bypasses

The locations of the sewer bypasses are given in Figure 2. As noted previously, the bypasses generally occur during the winter months and based on recent records, occur most frequently on the north edge of town to ditch 6. The bypasses are caused in part by groundwater infiltration and inflow during the winter months. The infiltration means that the sewage is diluted at the time of bypass and is subsequently diluted by flow in the ditches. Because ditch and bypass quality and quantity have never been simultaneously determined and there were no bypasses occurring at the time of this sampling, a quantification or estimation of impacts was not possible. It may be possible to quantify impacts during future field work; however, a bypass event will not be a prerequisite for sampling.

Sewage discharges typically increase BOD, nutrient, turbidity, and bacterial loading to the receiving water and may increase other constituents depending on the waste stream in a given service area. It is very likely that such bypasses cause or aggravate Class A water quality criteria violations, and from a public health aspect, raw sewage entering totally accessible, open ditches in a residential area is a situation of serious public health concern.

3. Background or baseline water quality for the ditch system

The background or baseline water quality is best assessed at a point where the impact of pollution sources is minimal. The data for ditch 4 (station 1) are probably the best data for background water quality. This station was sampled prior to a storm event, but the effect of increased precipitation should only be lower NO_3-N, hardness, and specific conductance. Station 17 also appears to have low concentrations of specific pollutants and may serve as a general indicator of background water quality for the area which it drains (ditch 10).

4. Survey the ditch system to determine if oil is migrating through the groundwater to the ditch system and to determine the location, size, and quality of the industrial storm and sanitary sewer discharges

Several discharges and potential discharges of oil were identified during the survey. The problem of oil discharge from both point sources and non-point sources (ditch bank disposal) seems to be most acute along ditch 4 and ditch 3. It is a difficult task to determine the movement of pollutants through a groundwater system and in the case of the ditch system, having so many other oil sources, could not be adequately addressed. If the current oil-water separators on the ditch system were more efficient in design and properly maintained and if other oil waste such as filters on the bank and storm sewer disposal could be controlled, then oil in the ditches would probably be minimal.

The location of the industrial storm water discharges and the water quality of these discharges has been discussed previously. The specific problems vary among discharges and in order to more accurately determine the impact of these discharges on the water quality of the ditch, the flows must be quantified. Flow measurement of selected ditches will be conducted during storm water sampling.

The location and possible impact of the sanitary sewer bypass discharges have been discussed previously.

5. Document the Diking District operating procedures and make recommendations as to changes which might improve water quality

As noted previously, during the months of low precipitation the direction of flow in the ditches is to the northwest to the Main pump station and the tidal gates. This means that all industrial effluent enters Coal Creek Slough. In the months of heavy precipitation, the various pump stations throughout the area activate automatically according to the water elevation in the ditch. The direction of flow at any point is determined by the combination of pumps that happen to be operating at that time and is also influenced by the condition of the ditches.

The water quality in the ditch system would probably be best if the water near the industrial section was pumped to the Columbia River before traveling throughout the system. Higher quality ditch water could also be mixed with poorer quality to mediate potential receiving water impacts. For example, if the pumps at the Reynolds pump station and the Oregon Way pump station were set at a level to activate first, the ditch water from the residential area (ditch 1) would dilute the industrial discharges and then be pumped to the Columbia River.

6. Determine the presence of cyanide in the ditch system

Cyanide was present in all discharges and ditch stations around the Reynolds Metals Co. complex. The cyanide concentration near the pump station (ditch station 20) was 23 µg/L (as total CN). The Reynolds Co. which monitors the cyanide concentration at this station monthly, obtained a 25-month average free cyanide concentration of 22 µg/L. The cyanide criterion (as free CN) is 52 µg/L maximum and 3.5 µg/L as the 24-hour average.

CONCLUSIONS

The major water quality problems within the area at the time of sampling were metals, cyanide, and oil. Other problems included fecal coliform, low dissolved oxygen, turbidity at some stations, and organic compounds (priority pollutants).

High metal concentrations were present at one or more stations in each flow section. The primary metals present were zinc, copper, and cadmium; however, the detection limits for our metals analysis may preclude the detection of some criteria violations.

Cyanide concentrations were significant at most point discharge and ditch stations in the area of Reynolds Metals Co. Concentrations quite probably exceed the 24-hour average criterion most if not all of the time.

Oil was a problem in all areas sampled. Several small sources were noted in Flow System I. However, the largest identifiable contributor to the oil problem, the Weyerhaeuser Co., discharges to Flow Systems II and III. All three Weyerhaeuser discharges were significant sources of oil.

Fecal coliform counts exceeded 100 colonies per 100 mL (Class A standard) in the discharges originating on the Weyerhaeuser property (Stations 7, 10, and 12), and the R.W. Paper Co. property; however, the counts at the downflow stations (stations 8 and 16) did not reflect these high inputs and were less than the Class A standard. Ditch 1 also exceeded the standard. The observed but unsampled Dover Apartments discharge either aggravated the problem at station 11 or was primarily responsible for it. The source of the violation at ditch station 18 is not readily apparent.

Dissolved oxygen was low (less than 6 mg/L) in all ditch stations and most point discharges where measurements were made. The only place where there appears to be a possible relationship between oxygen demand (COD) and low dissolved oxygen is in Flow System II. The discharge at station 7 had a COD of 450 mg/L (D.O. unmeasured) while the downflow ditch station (8) had a COD of 130 mg/L and D.O. of 1.0 mg/L. The low D.O. in the other flow systems is apparently caused by infiltration of groundwater, which is normally low in D.O., and possibly sediment oxygen demand.

The major identifiable sources of turbidity and color in the sample area are the Weyerhaeuser discharges. All have large aesthetic impacts.

Although the water concentrations of organic compounds (priority pollutants) were below criteria concentrations (for those with criteria), the ditch system is one of the few Class A waters of the state having measurable concentrations of many compounds. The extremely high concentration of organic compounds in the sediments indicates a high loading to the ditch waters and the possibility of toxicity to aquatic life.

LRS:GB:cp

Attachments

cc: John Bernhardt
George Houck
Section Files

REFERENCES

APHA, *et al.*, 1975. *Standard Methods for the Examination of Water and Wastewater*. 14th ed. American Public Health Association, Washington, D.C. 1193 pp.

Betts, B., 1983. Washington Dept. of Ecology, Southwest Regional Office, Olympia WA. personal communication.

Cordell, D., 1983. Memorandum to B. Betts.

Edtl, L., 1983. Letter to Wash. Dept. Ecology to M. Morhous, dated April 12, 1983.

Houck, G., 1983. Summary of Reynolds Metal Co. monitoring data for CN and fluoride at Longview, WA. December 29, 1982.

Joy, J., 1983. Draft memorandum to Dick Cunningham. A report on priority pollutant data from the 10EPATOX and BWMP monitoring programs: 1978-1980.

U.S. EPA, 1979. *Methods for Chemical Analysis of Water and Wastes*. EPA-600/4-79-020.

U.S. EPA, 1980a. Appendix A -- Summary of water quality criteria. *Federal Register 45(231)*: 79324-79341

U.S. EPA, 1980b. *Ambient Water Quality Criteria for Cyanides*. EPA 440/5-80-037.

Zandi, L., 1983. City of Longview WA. personal communication.