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DOANE CREEK

WATER QUALITY INVESTIGATION

1964

By

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INTRODUCTION

Area Description

Doane Creek is a small stream originating immediately west of College Place, near Walla Walla, Washington (Figure 1). It drains approximately three square miles of the fertile Walla Walla valley into lower Mill Creek which inturn flows into the Walla Walla River at mile 35. The drainage area is relatively flat and consists almost entirely of irrigated truck crops and some grain.

Doane Creek is partially spring fed but during the summer months the major flow is contributed by the Walla Walla sewage treatment plant through the Blalock Irrigation District Number 3, located north and east of the stream.

Water from the sewage treatment plant via the irrigation district is also discharged into Cold Creek, another stream running approximately one-fourth mile north and parallel to Doane Creek. The water flows from the irrigation district into Blalock Lake, a small 6-acre reservoir just inside the west boundary of the district. The effluent from the lake forms lower Cold Creek which ultimately flows into Mill Creek (Figure 1).

Blalock Irrigation System and Background

A court decision, in 1926, gave the Blalock Irrigation District Number 3 a water right to the Walla Walla sewage treatment plant effluent. This effluent consists of treated industrial waste and domestic sewage. The industrial waste is received at the plant from the various food canneries in the area.

Water for the irrigation district is obtained from a diversion box at the sewage treatment plant which receives a large percentage of the treated wastes, both industrial and domestic, along with water from Mill Creek. The district can obtain either straight industrial or domestic waste, water from Mill Creek or any combination of these by manipulation of a series of valves within this diversion structure. Additional water is obtained from wells scattered throughout the district.

The water is then carried to the irrigation district through a series of underground pipes and open shallow ditches. It is used to irrigate a variety of truck crops such as corn, spinach, cauliflower, carrots and onions. Onions are the main cash crop. Each land owner in the district is allowed irrigation water every nine days for a period of 49 hours.

The farmers in the district do not want nor do they need water on their onion fields during the onion harvest in June and July. However, water must still be supplied to farmers irrigating carrots and other crops. The entire system, in order to accomplish this, must run near capacity because of its age and type of construction. Consequently, a large quantity of unused water is released into Doane Creek.

The major problem in Doane Creek occurs during the pea processing season, although cannery wastes from a variety of fruits and vegetables are alsoa contributing factor. The onion harvest and the pea processing season occur approximately the same time each year. The cannery pea waste has not been adequately treated at the Walla Walla sewage treatment plant and as a result the water used by the Blalock Irrigation District has a relatively high Biochemical Oxygen Demand (B.O.D.). The high B.O.D. water plus siltation from ridge and rill irrigation has prompted many complaints from the property owners along Doane Creek.

The fields in the irrigation district are fertilized and flooded with

water usually by the first week in August to prepare them for the planting of spinach. The pea processing season is normally completed by this time, but flooding the fields and then releasing this water results in an abnormal amount of silt being discharged into Doane Creek.

The Pollution Control Commission has been receiving complaints, since 1946, from the residents along Doane Creek regarding objectionable odors, foaming and slime growths, and silting of private ponds. Landowners, in addition, have been apprehensive of using the stream for stock watering purposes. Dissatisfaction in the quality of the water received from the sewage treatment plant has also been indicated by the water users within the Blalock Irrigation District, even though water needs are often critical.

A new treatment facility was designed for the sewage treatment plant in 1960, in an attempt to alleviate the industrial waste problem and resulting complaints. Before the structure was completed in 1962, the canneries had substantially increased their capacity. Consequently, the sewage treatment plant continues to be overloaded during the food processing season, particularly when the canneries are processing peas.

Sampling Stations

The sampling stations and their descriptions are given in Table I. Station locations are illustrated in Figure 1.

Water from the Blalock Irrigation District is discharged into Doane Creek at Stations 2a and 2b (Figure 1). The major flow from this part of the district may be discharged at one or the other or both of these two locations. During the July survey the station having the most flow was used as the sampling point. For the August sampling, both stations were used since a substantial flow was being discharged into Doane Creek at each point.

Purpose

The purpose of this study was to determine the water quality of Doane Creek and to correlate this condition with the sources of waste.

TABLE I

STATION DESCRIPTIONS

Station Number	Description
1	At the diversion box used for the control of water to the Blalock Irrigation District. Approximately 100 yards west of the Walla Walla sewage treatment plant.
2a	Discharge from Blalock Irrigation District No. 3 into Doane Creek approximately ½ mile east of the Harry Johnson property (Figure 1).
2b	Discharge from Blalock Irrigation District No. 3 into Doane Creek approximately ½ mile east of the Harry Johnson property (Figure 1).
3	Doane Creek above the springs located on the Harry Johnson property.
4	Doane Creek at Last Chance Road crossing.
5	Cold Creek at Last Chance Road crossing.
6	Cold Creek near the Jacob Harding property approximately ½ mile west of Blalock Lake.
7	Influent to Blalock Lake.
8	Doane Creek influent to small mill pond in Whitman Mission National Park.

SUMMARY

The results of the investigation presented in this report indicated that the overall water quality of Doane Creek is markedly impaired by the discharge of excess water from the Walla Walla sewage treatment plant and the Blalock Irrigation District No. 3. The following is a summary and discussion of what these investigations indicate:

1. The water temperatures are high at the Walla Walla sewage treatment plant and remain stable as the water flows through the district. Although cooled slightly by spring water, the temperature remained high at both stations on Doane Creek. These temperatures are not favorable for a balanced aquatic biota.
2. The water that is discharged into Doane Creek, during the pea processing season, is relatively high in Biochemical Oxygen Demand (B.O.D.). As a result, there is an immediate oxygen demand exerted upon the creek, as indicated by the low dissolved oxygen values. These factors, along with the high nutrient load, contribute to the heavy bacterial slime growth and generally poor biological quality of Doane Creek. The data shows that the waste loading from the sewage treatment plant is reduced as the water flows through the irrigation district.
3. The B.O.D. values are much lower after the pea processing season, when the fields are being prepared for spinach planting. As a result, the dissolved oxygen levels in Doane Creek indicate a decrease in oxygen demand.
4. The August data shows that the settleable and total solids increase as the water flows through the irrigation district. The amount of

solids seems to vary depending upon the water usage. Settleable and fixed inorganic solids are the chief waste discharged into Doane Creek by the irrigation district. These are mostly fixed inorganic solids which settle to the bottom of the creek filling the spaces between the rocks and gravel. The growth of bacterial slime, low dissolved oxygen and the solids load, virtually eliminate the growth of bottom organisms in Doane Creek. In addition, these solids have almost filled the small pond on the Dillard York property.

5. Very little aquatic life is present in Doane Creek at Station 3. There is a slight improvement downstream as indicated by the increase in the number of aquatic organisms found at Station 4.
6. The biological quality of Cold Creek is considerable better than Doane Creek. This is primarily due to the presence of Blalock Lake which essentially serves the same purpose as a sewage lagoon. The solids are settled and the B.O.D. and nutrients are reduced by biological activity in the lake.
7. The MPN values are high and indicative of a polluted condition. The number of coliform organisms increase as the water flows through the district. This is attributed to the high water temperatures and nutrient load which are ideal for the growth of bacterial organisms. Truck crops such as carrots, spinach, onions, etc. are irrigated with this highly contaminated water. The crops are in turn sent to both local and national markets. From a public health standpoint, this is not a healthy practice.

RESULTS

Temperature

The water temperature at the sewage treatment plant ranged from 19.0°C. to 22.0° C. and remained relatively stable as it passed through the irrigation district. The water was cooled to a range of 17.1° C. to 20.3° C., at Station 3, by the presence of a number of small springs.

The water temperature ranged between 18.3° C. and 26.0° C. at Station 4. This increase in temperature is due to the fact that Doane Creek is generally a slow moving stream throughout its length and that below Station 3 the water is again used for irrigation purposes. The creek expands into a shallow pond at the Dillard York property which also aids in raising the water temperature.

Biochemical Oxygen Demand (B.O.D.)

Biochemical Oxygen Demand values showed a high of 87 mg/l at Station 1 and 63 mg/l at Station 2a during the July sampling. This oxygen demand correlates readily with the low dissolved oxygen levels of 1.5 mg/l and 2.9 mg/l found in Doane Creek at Station 3. The irrigation district was receiving water containing a high percentage of pea processing waste, during this period, from the sewage treatment plant. In addition, the onion harvest was at its peak and irrigation was very limited.

The reverse was true during the August sampling. The B.O.D. at Station 1 was 5 mg/l and at Station 2a it was 18 mg/l. At Station 3 the B.O.D. was 7.8 mg/l. These values correspond to the higher dissolved oxygen levels of 5.4 mg/l to 6.2 mg/l at Station 3. The pea processing season had been completed prior to this period and the water being received by the irrigation district from the sewage treatment plant was primarily treated domestic sewage and Mill Creek water. Consequently, in contrast to the July sampling, the farmers in the

district were intermittently irrigating with large quantities of water to prepare their fields for the planting of spinach.

M.P.N.*

The M.P.N. values during the July sampling, ranged from 1500 at Station 4 to over two million at Station 2b. During the August sampling, however, the values were considerably lower. They were as low as 360 at Station 1, and as high as 93,000 at Station 2a and 43,000 at Station 4.

The data shows that an increase in coliform organisms occurs as the water flows through the irrigation district. It is improbable that this increase is due to the uptake of some of the soil representatives of the coliform group as the water passes through the district. If this were so, it would be expected that the MPN values would be higher during the August sampling when the water use in the irrigation district had increased and the load on the sewage treatment plant had decreased.

The increase in coliforms is more logically due to an after growth, since bacteria are not readily given up by the soil and the high water temperatures and heavy nutrient load during the pea processing season are ideal for the growth of bacteria. This is further substantiated by the profuse growth of bacterial slime during the pea season, both in Doane Creek and within the irrigation district itself.

Total and Settleable Solids

The August data (Table IV) shows that the settleable solids increased from 0.1 ml/l at Station 1 to 1.3 ml/l at Station 2a. The total solids (Table V) increased from 240 mg/l at Station 1 to 1,105 mg/l at Station 3.

* Most Probable Number of coliform organisms per 100 milliliters of water.

The July data, on the other hand, indicates that the total solids remained relatively stable as the water passed through the district.

An evaluation of the solids data shows that fixed inorganic and settleable solids are the major source of waste from the Blalock Irrigation District and that the amount of solids varies depending upon the water usage. The water in Doane Creek was turbid and the bottom of the stream was heavily silted.

Aquatic Organisms

A qualitative examination of aquatic organisms was made in both Doane Creek and Cold Creek for the purpose of determining the effect of the sewage treatment plant effluent and the discharge from Blalock Irrigation District upon the biological quality of these two streams. The results of these examinations are presented in Table VI. The samples were obtained with the aid of a simple hand screen.

Crane fly larvae (Tipulidae) and sludge worms (Tubificidae) were the only two species of organisms found in Doane Creek at Station 3. The stream bottom and branches of vegetation dipping into the creek were covered with a heavy growth of bacterial slime. Beneath the slime, along the edge of the stream, considerable silt and top soil had been deposited. The water had a turbid, milky color and contained noticeable amounts of floating slime.

Five species of bottom organisms were found in Doane Creek at Station 4, indicating a slight recovery. The predominant species of bottom organisms were blackfly larvae (Simuliidae), chironomid midges and sludge worms. A considerable number of small speckled dace, were also present, along with a heavy growth of the aquatic plant Potamogeton vaginatus and the filimentous green algae, Cladophora. The water here was mostly clear and contained no floating slime.

Conditions seemed to be somewhat better in Cold Creek at Station 5 and Station 6 than in Doane Creek, even though it receives the same quality of water from Blalock Irrigation District. The biological quality in Cold Creek, above Blalock Lake, appeared to be the same as it did in Doane Creek at Station 3. Bottom organisms were not sampled but visual observations indicated that the only organisms present were sludge worms. The water was milky and turbid and contained noticeable amounts of floating slime.

The increase in the numbers of species of bottom organisms at Station 5 and Station 6, below Blalock Lake, indicate an improvement in the overall water quality of Cold Creek. Mayfly nymphs were present at both stations. These organisms generally occur where the dissolved oxygen levels are high and the solids loading and siltation are low.

TABLE II

DATA TABULATION

Station Number		1	2a	2b	3	4	5
Date	Parameter						
7/7	Time	1240	1300	--	1315	1355	1410
7/7	Temperature °C.	22.0	21.0	--	20.3	26.0*	21.0
7/7	B.O.D. mg/l	76.5	63.0	--	> 60	12.5	2.7
7/7	D.O. mg/l	5.7	3.7	--	2.9	5.9	8.1
7/7	MPN	≤ 23**	460,000	--	240,000	1,500	4,600
7/7	Turbidity	53	57	--	45	> 25	> 25
7/7	Total Solids mg/l	--	--	--	852	386	343
7/7	Vol. Solids				127	101	129
7/7	Fixed Solids				725	285	214
7/7	Spec. Conductance	7,140	7,259	--	8,211	17,850	21,658
7/7	Hardness mg/l	80.0	90.0	--	121.0	115.0	169.0
7/7	pH	6.6	6.8	--	6.8	7.6	7.8

* Air temperature 107.0° F.
** Sodium thiosulphate was added to all MPN samples taken at Station 1 with the exception of this particular sample.

TABLE III

DATA TABULATION

Station Number		1	2b	3	4	5	7
Date	Parameter						
7/8	Time	1220	1240	0800	0830	0845	1300
"	Temp. °C.	22.0	22.4	19.0	19.1	17.0	20.0
"	B.O.D. mg/l	87.0	> 60	> 60	16.5	2.5	> 60
"	D.O. mg/l	5.1	2.7	1.5	4.8	8.1	2.3
"	MPN	240,000	≥2,400,000	1,100,000	2,400	11,000	460,000
"	Turbidity	--	--	--	--	--	--
"	Total Solids mg/l	481	437	486	390	371	437
"	Vol. Solids	175	151	115	83	98	151
"	Fixed Solids	306	286	371	307	273	286
"	Spec. Cond.	19,278	21,896	24,157	23,086	24,276	19,040
"	Hardness mg/l	65.0	65.0	115.0	112.0	168.0	126.0
"	pH	6.7	6.9	6.8	7.4	7.7	6.3
"	N as NO_3^- mg/l	1.25	0.22	1.06	0.37	1.76	2.01
"	Cl^- mg/l	135.0	108.0	89.5	89.5	60.0	96.0
"	PO_4= mg/l	2.95	1.82	1.89	5.16	1.42	--

TABLE IV

DATA TABULATION

Station Number		1	2a	2b	3	4	5	7
Date	Parameter							
8/7	Time	1045	1140	1205	1215	1300	1335	1410
"	Temp. °C.	19.6	20.4	20.0	19.2	22.3	18.0	17.0
"	D.O. mg/l	7.0	6.7	7.0	5.2	6.2	7.5	7.3
"	MPN	360	4,300	2,300	9,300	930	1,500	9,300
"	Set'ble Sol. ml/l	0.1	1.3	0.4	0.7	0.1	trace	> 0.1
8/8	Time	0840	0915	0930	1000	1015	1030	1110
"	Temp. °C.	19.2	19.5	15.3	17.1	18.3	16.0	17.0
"	B.O.D. mg/l	5.0	18.0	--	7.8	--	--	3.2
"	D.O. mg/l	6.7	6.8	8.3	5.4	6.7	7.5	6.5
"	MPN	3,600	93,000	43,000	43,000	2,100	11,000	23,000
"	Set'ble Sol. ml/l	0.1	0.9	0.7	0.5	0.1	trace	0.2
"	Spec. Cond.	2,306	2,306	4,566	3,676	3,196	4,630	4,643
"	Hardness mg/l	61.2	67.6	*	18.0*	120.7	165.0	
"	pH	6.5	7.0	7.4	7.2	7.5	7.8	7.0
8/9	Time	0715	0745	--	0830			
"	Temp. °C.	19.0	18.8		17.5			
"	D.O. mg/l	7.3	7.4		6.2			
"	MPN	≤ 230	1,500		9,300			
"	Set'ble Sol. ml/l	0.2	0.25		0.4			

* Interference encountered with these samples.

TABLE V

RESULTS OF SOLIDS SAMPLES TAKEN IN DOANE CREEK

ON THE JOHNSON PROPERTY

August 1964

August	Station	Settleable Solids ml/l	Total Solids mg/l			Suspended Solids mg/l		
			Total	Fixed	Vol.	Total	Fixed	Vol.
10	3	0.6						
11	3	0.65						
12	3	2.5						
13	3	1.6						
13	3	1.2	1,105	948	165	877	804	73
13	1	0.1	240	161	79	30	19	11
14	3	2.25						
15	3	5.5						
16	3	2.0						
17	3	3.5						
18	3	0.25						
19	3	0.1						
20	3	0.4						
21	3	0.4						
22	3	0.3						
23	3	0.5						

The above samples were taken by Mr. Gary Krahmer, Supervisor of the Walla Walla Sewage Treatment plant, and Mr. Harry G. Johnson, property owner on Doane Creek.

TABLE VI

QUALITATIVE ANALYSIS OF AQUATIC ORGANISMS

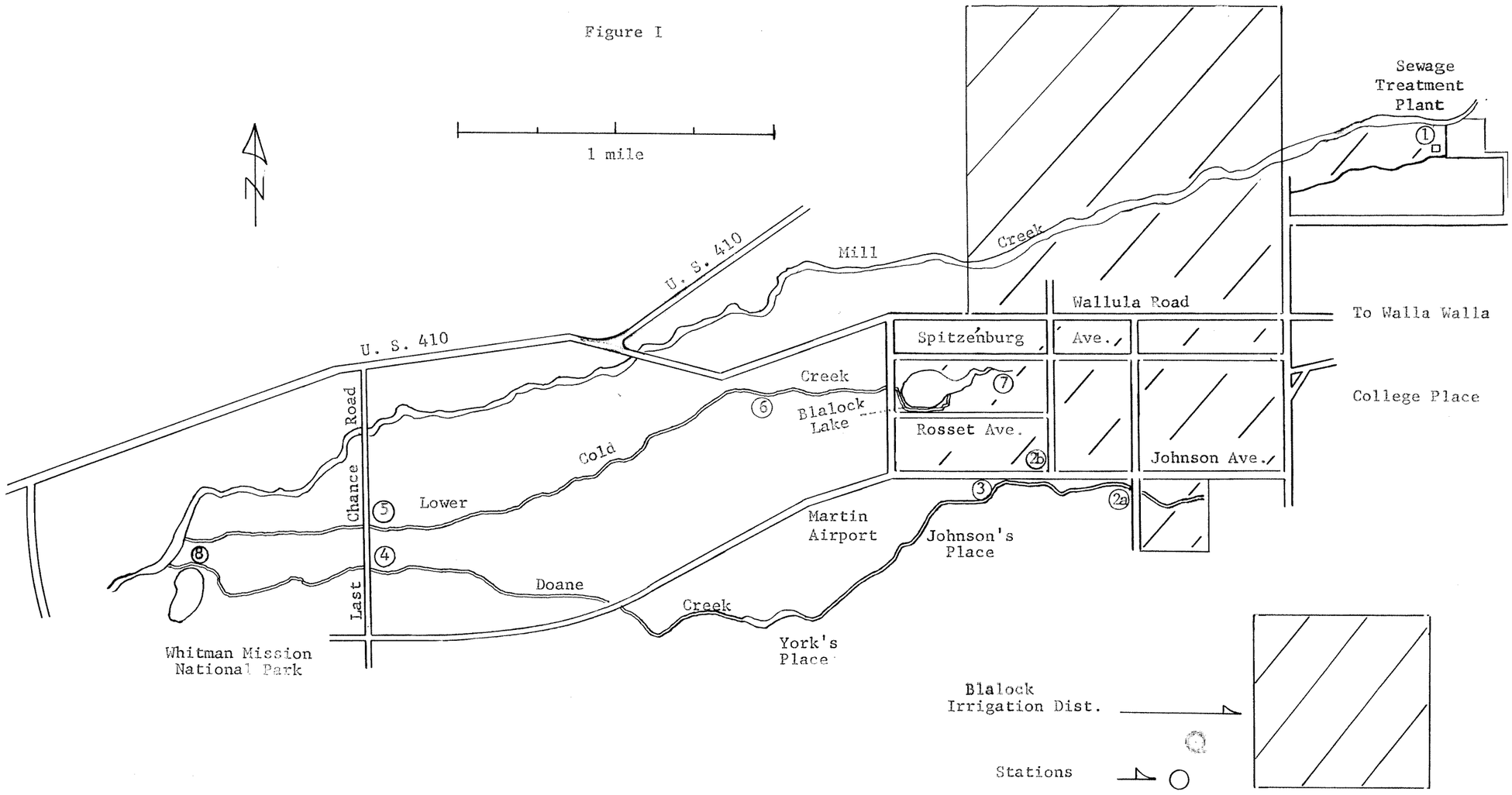
IN DOANE CREEK AND COLD CREEK

SPECIES AND OCCURRENCE

Organism	Station Number			
	3	4	5*	6*
Ephemeroptera (Mayflies)				
Heptageniidae			x	x
Diptera (Flies and Midges)				
Simuliidae		x	x	x
Chironomidae		x	x	x
Tipulidae (Crane flies)	x			
Amphipoda (Scuds & Sideswimmers)			x	
Gammaridae				x
Decapoda (Grayfish)				
Astacidae			x	
Annelida (Segmented worms)				
Tubificidae (sludge worms)	x	x	x	x
Lumbricidae (Aquatic earthworms)		x	x	x
Hirudinea (Leech)				
Gastropoda				
Lymnaeidae (Pond snails)		x		
Total Number of Species	2	5	7	6

* Cold Creek Stations

Figure I



DOANE CREEK INVESTIGATION AREA