Water Quality Status Report No. 2

REPORT ON POLLUTION PROBLEMS IN THE MAIN DRAIN
Minidoka Irrigation District
Minidoka County, Idaho
1957 – 1958

November, 1958

State of Idaho
DEPARTMENT OF HEALTH
Engineering and Sanitation Section

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REPORT ON POLLUTION PROBLEMS IN THE MAIN DRAIN

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Report on Pollution Problems in the Main Drain

Introduction

The purpose of this report is to show the results of our investigation concerning the pollution problem in the Minidoka Irrigation District Main Drain.

Four separate studies were made at three-month intervals to obtain a complete yearly picture of the problem. The surveys were made in October of 1957 and in January, April, and July of 1958. During each study, a series of samples were taken at strategic points along the drain from above Rupert to where it empties into the Snake River (see Figure 1). These samples were taken for chemical, bacteriological, and biological oxygen demand analyses. Samples for biological activity analysis were also taken. A record was also kept of the physical appearance of the stream.

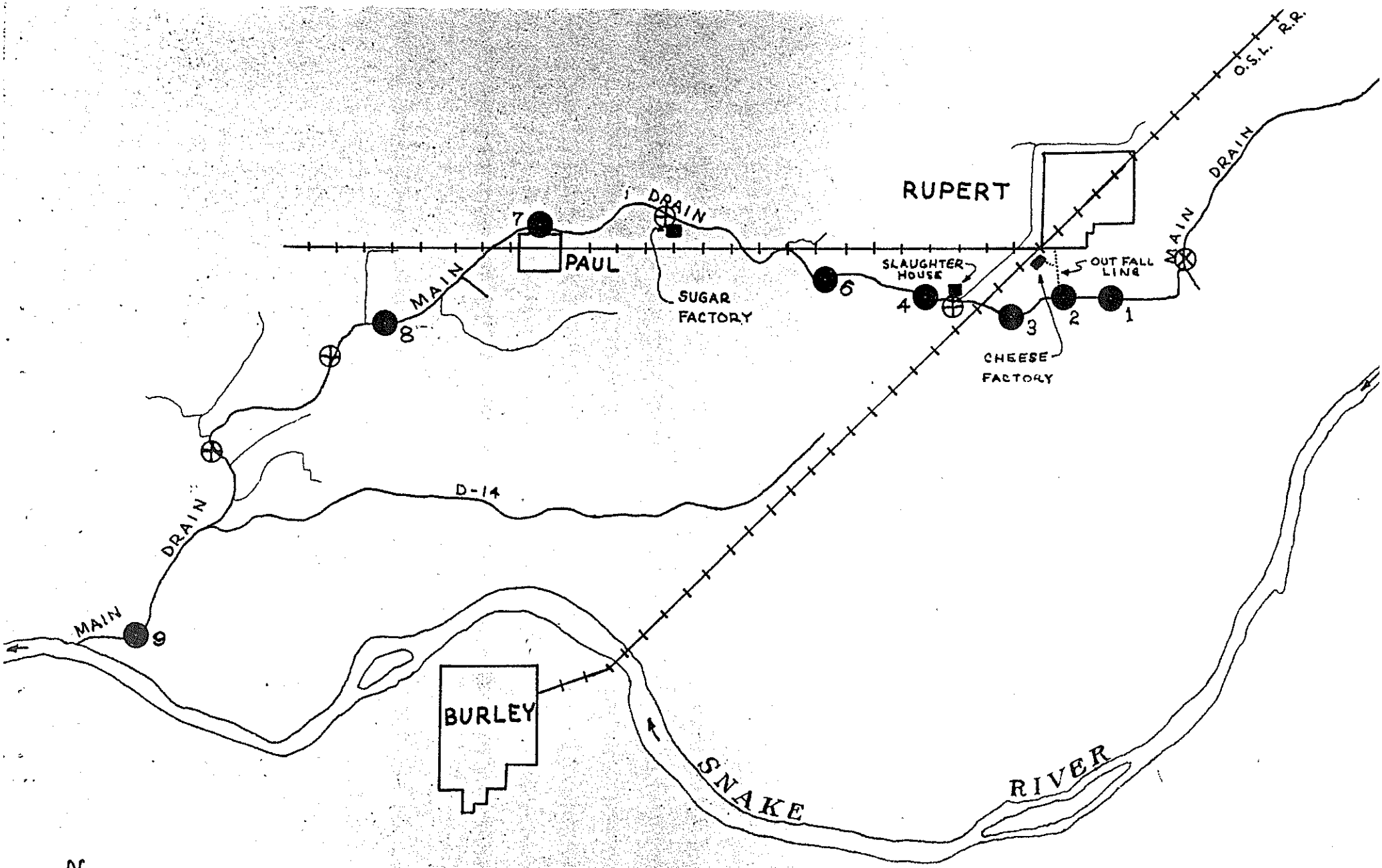
This investigation was conducted by Mr. H. G. Formo, State Public Health Engineer, and Mr. R. P. Olson, State Public Health Biologist. Mr. M. D. Alsager, Assistant Public Health Engineer, assisted on the July survey and in the report preparation.

The Main Drain is located in the southern portion of Minidoka County and extends from east of the City of Rupert to the Snake River in a southwesterly direction for a distance of approximately 18 miles. The surrounding area is practically all under diversified cultivation and the principal use of the drain is for irrigation runoff and seepage.

The drain is used by the communities of Rupert and Paul as a carrier for effluent from sewage treatment plants. The Kraft Cheese plant in Rupert, the Amalgamated Sugar plant at Paul, the Rosecrans slaughterhouse between Rupert and Paul and the A and P Potato Warehouse at Paul also use the stream for waste disposal.

The stream is sluggish and meanders through the countryside, and at places is within 200 feet of residences. The Minidoka Irrigation District has pump

stations along the drain which pump water out of the drain into nearby canals in an effort to lower the water table. (see Figure 1). This results in less dilution water for whatever waste that may enter the drain and, together with a slow flow rate, increases the pollution problem.



MAIN DRAIN

MINIDOKA IRRIGATION PROJECT

STREAM POLLUTION SURVEY 1957-58

IDAHO DEPT. OF HEALTH

FIG. 1

Waste Sources and Waste Handling Facilities

Other than the load placed upon the stream by natural drainage, the major contributors of pollution to the stream are as follows (See Table I):

City of Rupert

The City of Rupert, which has a population of about 4,000, has only primary treatment of its raw sewage and discharges the effluent into the drain. In addition to normal sewage flows, the plant must handle waste water from two potato washing plants. These plants combined will wash from 100 to 300 tons of potatoes per day and put more demand upon the treatment plant which at times runs over its capacity because of ground water seepage into the sewers.

Below the treatment plant the effluent line is intercepted with a waste line from the Kraft Cheese factory. The capacity of the factory is 80,000 pounds of milk per day with approximately 40,000 pounds of whey per day going into the city's discharge line. This whey at the plant is collected in a 50,000-pound holding tank and is discharged at night over an 8-hour period. Approximately one-third of the whey is taken by farmers for hog feed.

Rosecrans Slaughterhouse

Approximately one mile downstream from Rupert is the Rosecrans slaughterhouse. The normal kill is from 15 to 20 animals each week. Slaughtering is done two days a week, usually from 3 to 5 hogs and 3 to 5 cattle each day. The blood from the kill floor and other liquid wastes are discharged directly into the stream without any treatment. Other slaughtering wastes are left on the ground to dry, causing an odor problem.

Amalgamated Sugar Plant

The Amalgamated Sugar Company plant is located near the Main Drain about $3\frac{1}{2}$ miles downstream from Rupert. This operation runs for about one hundred days out of the year. They process about 2,850 tons of sugar beets per day and use approximately 7,000 gallons of water per minute.

A brief description of the operation of the sugar beet factory is as follows:

The whole beets are first washed thoroughly in a continuous washer; next they are sliced into small pieces; the sugar is extracted in a continuous diffuser and purified with carbon dioxide and milk of lime. The sugar solution is then filtered, evaporated, and crystallized under vacuum. The sugar crystals are separated from the molasses by centrifugal action and are dried for packaging. The waste water from the beet washer and the spent lime slurry are both dumped into a settling pond which in time overflows into the Main Drain. Water is added to the spent beets (pulp) in order to give it a consistency which can be pumped. This pulp is pumped and passed over vibrating screens. The screened pulp is discharged into a huge wooden storage pit where it is stored until farmers acquire it for livestock feed. The screen water is discharged to the Main Drain or reused. The storage pit has floor drains which empty into the Main Drain. Thus much of the water that was used for diluting the pulp enters the Main Drain after it has partially leached the pulp of its nutrients.

Village of Paul

The Village of Paul, which has a population of about 600, uses an Imhoff tank for sewage treatment. The effluent from this primary treatment plant goes into the Main Drain.

In the fall of 1957 a great amount of dirt, due to potato cleaning at the A and P potato warehouse, had caused the tank to function improperly. During the time required to clean the tank, the town's sewage was bypassed into the Main Drain. In order to keep dirt out of the Imhoff tank, the potato plant has been disconnected from the sewer and a separate line has been extended to the stream. The potato plant has two screened washing tanks which wash about eight carloads of potatoes per day. There is a catch tank outside the warehouse with the outlet connected directly to the Main Drain.

Table I

Main Drain Stream Pollution Survey
1957 - 1958

Organic Waste Load Discharged to Main Drain

Contributor	Type and Amount of Waste or Product	Est. Lbs. BOD/day in Raw Waste	Type of Treatment	Est. Lbs BOD/day In Treat. Waste	Population Equivalent
City of Rupert					
Municipal Sewers	Raw Sewage (4,000 pop.)	680	Primary	510	3,000
Potato Washers	232 tons potatoes/day	625	Settling; Primary	470	2,760
Kraft Cheese Co.	80,000 lb/day milk 40,000 lb/day whey	* 1,480	none	1,480	8,700
Sub-Total				2,460	14,460
Rosecran's	10,400 lb/wk. (mixed animals)	* 104	none	104	610
Amalgamated Sugar Co.	2,800 Tons/day Beets	*73,600	Lagooning Lime Waste	65,300	384,000
Village of Paul	Raw Sewage (560 Pop.)	95	Imhoff Tank	71	400
A & P Potatoe Washer	160 Tons Potatoes/day	430	Settling	430	2,530
Total				68,365	402,000

* Industrial Wastes - Their Disposal and Treatment, Edited by Willem Rudolfs

Physical Observations

The general appearance of the stream did vary considerably from season to season during the survey. The most noticeable variation was during the summer when, along with high water, an abundance of algae was noted. Dead and decaying algae was seen floating in the stream and was forming mats on the surface of the water where the mouths of culverts were completely submerged. This caused the surface of the water to be stagnant and resulted in odors from the anaerobic decomposition of the algae. The area most affected by bad odors during the summer was that between Stations No. 3 and No. 6. The large amount of algae was indicative of the abundance of nutrients in the stream from the disposed wastes.

During the fall the odors were more pronounced along the drain in the area between the sugar factory and Paul. However, the stream was definitely odiferous in its entirety. In January there was more odor coming from the area between Paul and the stream's junction with the Snake River. In April a definite odor was noticed at Station No. 3 but none at Stations No. 4 and No. 6. However, at Paul and at Station No. 8 there were definite odors noted and indications of septic action.

The flow rates of the Drain varied from approximately 6 c.f.s., in January to 35 c.f.s., in July at Station No. 3 (See Tables II – V). The Drain above Rupert's sewage outfall was in very good condition at all seasons. The water was clear and there was no evidence of pollution.

From Rupert to the Snake River the stream has a soft sludge bottom which varies in depth from one to two and one-half feet. This black sludge is mainly dead and decaying algae and decomposed waste which has settled to the bottom of the sluggish stream. After the layer reaches a thickness to a point where the oxygen from the water cannot be utilized, anaerobic bacteriological growth

begins. This is accompanied with gas formation and bad odors. This problem is more noticeable to the surrounding area when chunks of this sludge break loose from the bottom and float on the surface of the stream. With high water, sludge and dead algae form thick mats on the surface of the water in front of culverts. Anaerobic conditions prevail also between the top of the mat and the surface of the water.

Extensive slime-like fungus growth, Sphaerotilus natans in the stream was prevalent throughout the year but was more in abundance during the summer. This type of growth occurs where there are large amounts of nutrients, especially carbohydrates, available in the water. This growth is a nuisance and can be detrimental to land irrigated with this water.

In October the temperature of the water raised 12 degrees between Station No. 6 and Paul and then dropped 7 degrees before reaching Station No. 8. This also was the case in January when, with the air near 30° F., the temperature of the water increased 10 degrees between Station No. 7 and Paul and then dropped 10 degrees before reaching Station No. 8. These changes in the temperature of the water took place in just a little over six miles. This gives probable evidence to the effect that the volume of the waste water from the sugar factory has upon the Drain. During the spring and summer there were no significant changes in the temperatures throughout the stream. However, due to the sluggish movement of the stream, the temperature of the water was quite warm. This characteristic of the stream also aids in the growth of micro-organisms.

PHYSICAL, CHEMICAL, AND BIOCHEMICAL ANALYTICAL RESULTS

Various samples were taken at each of the stations during the survey. These samples were analyzed in the field and in our laboratory in Boise. A summary of the physical, chemical, and biochemical data from these samples is shown in tables in this report. (See Tables II through V.)

Physical

The total solids in samples of the Drain were found to be practically the same above Station No. 6 during all periods of the study. However, downstream from the sugar factory the total solids were approximately twice as great as upstream during the factory's operation period. This was also true of the suspended solids which were approximately four times as great below the sugar factory during the fall and winter.

Chemical

The dissolved oxygen in the stream (See Figure 3) was near or above the saturation level during the spring and summer surveys, except at Stations No. 3 and No. 7 where septic conditions prevailed. This supersaturation of oxygen was due to the presence of the large quantities of algae, which produces oxygen by photosynthesis.

During the fall and winter, the dissolved oxygen above Station No. 6 was near the saturation level. However, downstream from the sugar factory there was practically no dissolved oxygen in the stream. This resulted in septic action in the drain which produced odoriferous gases.

The pH of the stream samples showed that slightly acid conditions prevailed below the sugar factory during its operations. This was probably caused by organic acids which were produced in the beet pulp silo and were draining into the drain.

During the summer the samples showed that the stream was slightly alkaline downstream from Station No. 3. This is due to runoff from irrigated farm land.

Biochemical

The amount of dissolved oxygen required for satisfactory oxidation of organic material, such as domestic sewage and industrial wastes, is called the biochemical oxygen demand or B.O.D. This is, therefore, a very important test in determining the degree of organic pollution in a stream. The quantity of B.O.D. is also used to determine the population equivalent of wastes (See Table I).

The results of the tests for the five-day B.O.D. at the various stations at different times of the year very clearly show the effects of the wastes discharged to the Main Drain (See Figure 2).

The five-day B.O.D. at Station No. 2 was not extremely high for a drain ditch at the times samples were collected.

At Station No 3, the five-day B.O.D. varied from 17 parts per million during the October survey to greater than 80 parts per million during the April survey. The main reason for this variation would be the dilution factor. The flow in the drain in April was approximately one-sixth of the October flow. This also bears out the fact that the pollution load discharged through the Rupert outfall sewer is fairly constant throughout the year.

At Station No. 6, the five-day B.O.D. varied from 15 parts per million in April to 4 parts per million in July. These five-day B.O.D.'s are not very high and indicate that the stream has practically recovered by the time it reaches Station No. 6. The reason for the low five-day B.O.D. found in July would be due to the dilution factor and the presence of oxygen producing algae.

At Station No. 7 the five-day B.O.D. varied from 1,000 parts per million in January to 8 parts per million in July. The reason for this great variation would be the fact that the sugar plant and the potato washing plants are at the height of their production during the fall and winter months.

At Station No. 9, the point where the Main Drain enters the Snake River, the five-day B.O.D. varied from greater than 500 parts per million in January to 3.5 parts per million in July. This indicates that the stream does not recover before entering the Snake River while the sugar plant is in operation.

Table II

Main Drain Stream Pollution Survey
October 17, 1957

Results of Analytical Determinations

Determination	Station Nos. (Parts per million except as noted)					
	2	3	6	7	8	9
Estimated Stream Velocity f.p.s.*		3		½		
Estimated Flow c.f.s.**		38		40	40	120
Temperature °F.	48	52	54	68	61	50
Total Solids	404	412	426	922	911	662
Suspended Solids	14	9	14	63	32	38
Dissolved Oxygen	6.1	5.4	4.6	0	0	0
Oxygen Saturation - per cent	52.5	48.5	44.0	0	0	0
pH - No. units	7.6	7.6	7.5	6.4	6.5	6.9
5-day B.O.D.		17		675	710	240

* feet per second
** cubic feet per second

Table III

Main Drain Stream Pollution Survey
January 8, 1958

Results of Analytical Determinations

Determination	Station Nos. (Parts per million except as noted)					
	2	3	6	7	8	9
Estimated Stream Velocity f.p.s.*	1	1	1	1	1	1
Estimated Flow c.f.s.**	3	6	9	25	25	36
Temperature °F.	42	45	41	52	40	34
Total Solids	410	470	456	1314		1072
Suspended Solids	14	25	14	112		68
Dissolved Oxygen	8.3	6.9	7.8	0	0	0
Oxygen Saturation - per cent	65.5	58.0	61.0	0	0	0
pH No. Units	7.5	7.3	7.4	6.0	6.5	7.5
5-day B.O.D.	8.5	25.0	12.0	>1000.	1060.	>500.

* feet per second
** cubic feet per second

Table IV

Main Drain Stream Pollution Survey
April 2, 1958

Results of Analytical Determinations

Determination	Station Nos.(Parts per million except as noted)					
	2	3	6	7	8	9
Estimated Stream Velocity f.p.s.*	0.5	1.0	0.67	0.4	0.5	1.0
Estimated Stream Flow c.f.s.**	2	4	4		4.0	18.0
Temperature °F	45	51		55	56	55
Total Solids	420	750		584		596
Dissolved Oxygen	7.8	5.8	6.8	4.5	1.7	12.0
Oxygen Saturation - per cent	65.0	52.0	62.0	43.0	17.5	112.0
pH - No. Units	7.6	7.0		6.9	7.0	7.8
5-day B.O.D.		>80	15	175	145	84

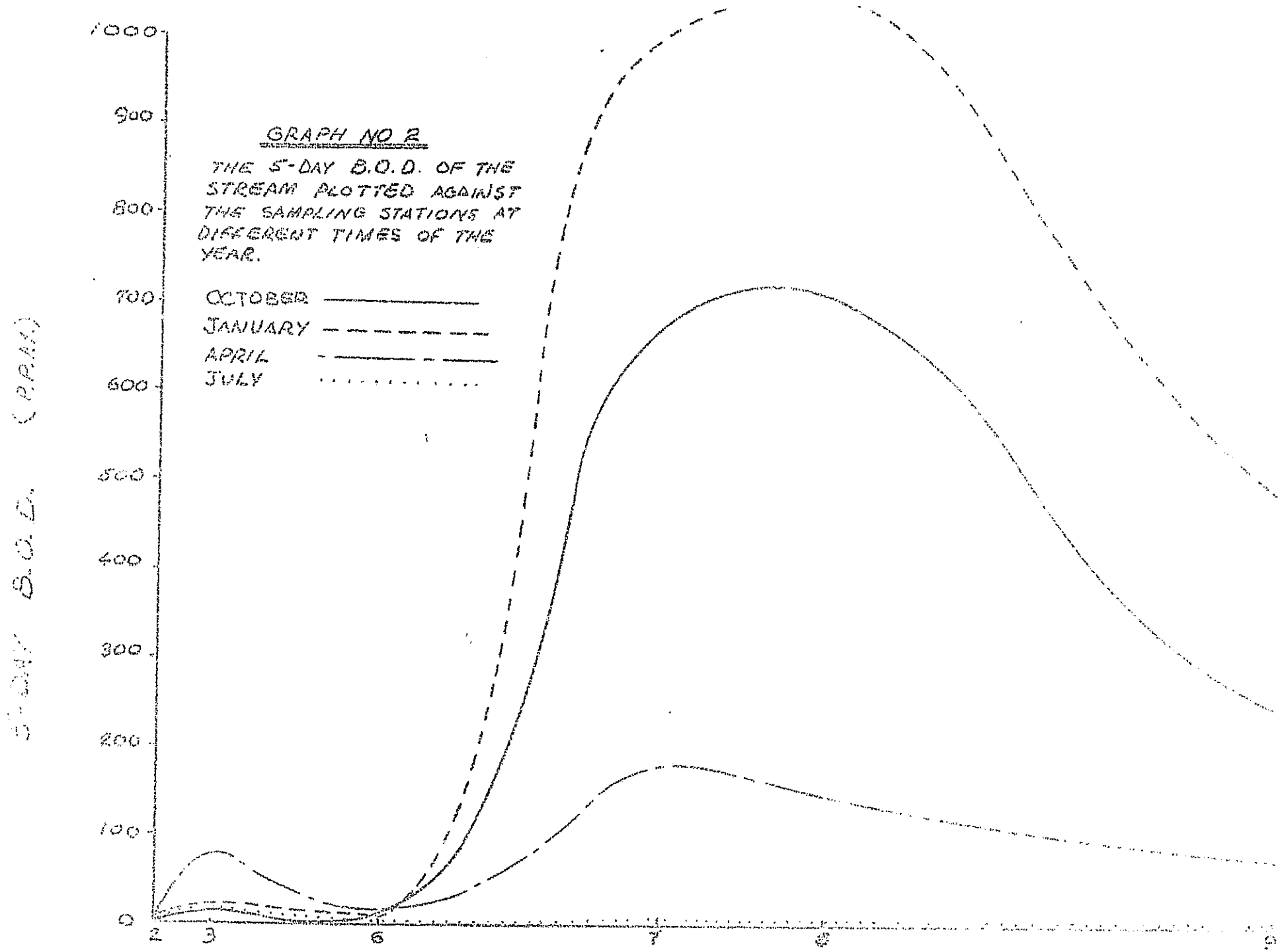
Table V

Main Drain Stream Pollution Survey
July 9-10, 1958

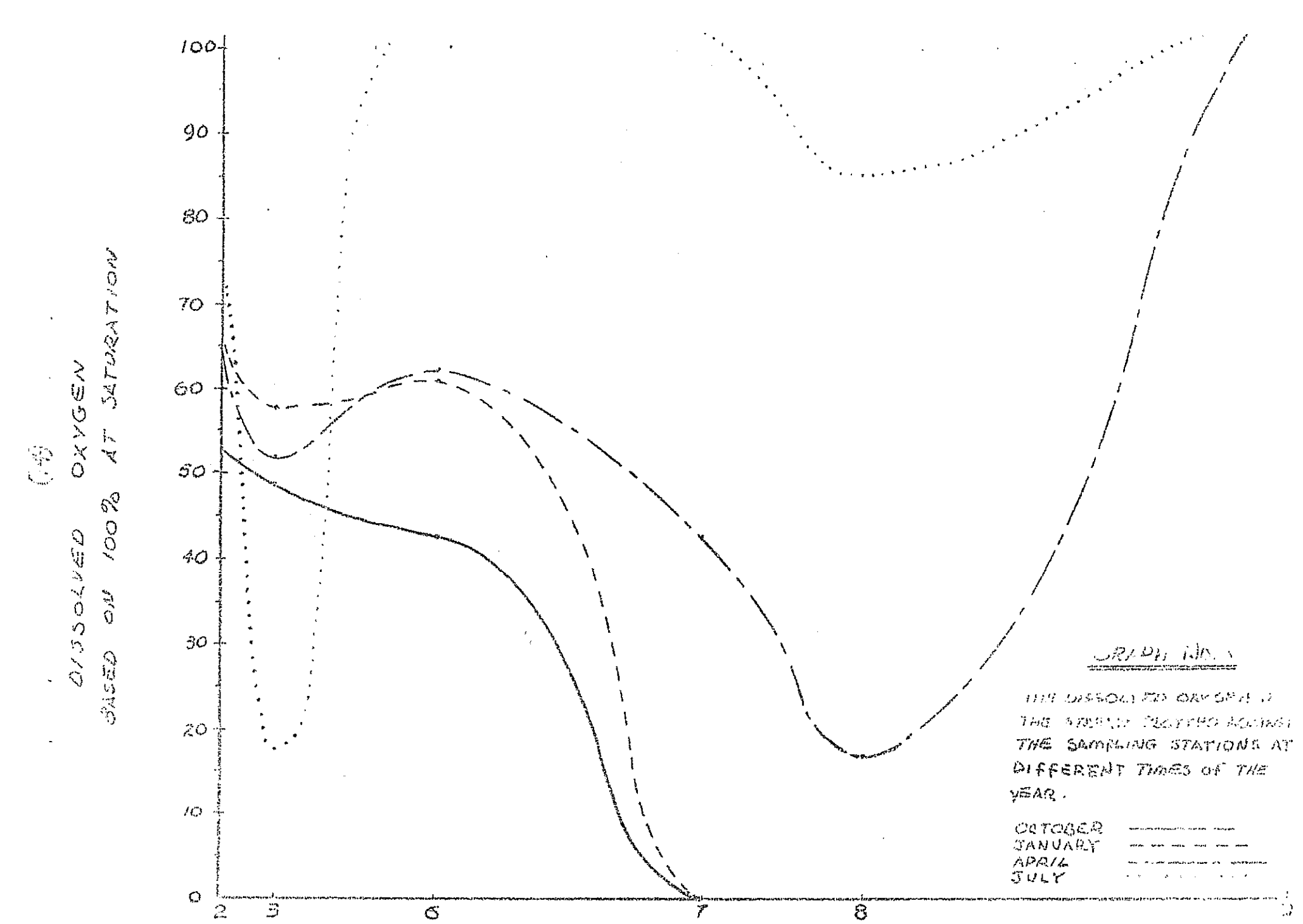
Results of Analytical Determinations

Determination	Station Nos.(Parts per million except as noted)					
	2	3	6	7	8	9
Estimated Stream Velocity f.p.s.*	.67	.7		.25	.67	.4
Estimated Stream Flow c.f.s. **	30	35		20	20	24
Temperature °F	62	62	70	78	74	72
Total Solids	387	400				455
Dissolved Oxygen	7.1	1.8	9.6	8.4	7.3	9.1
Oxygen Saturation - per cent	72.5	17.0	106.0	101.0	86.0	103.0
pH - No. units	7.5	7.3	7.9	8.0	8.0	8.0
5-day B.O.D.	2.5	21.0	4.0	8.0	6.0	3.5

* feet per second
** cubic feet per second



MAIN DRAIN STREAM
POLLUTION SURVEY
1957-58



MAIN DRAIN STREAM
POLLUTION SURVEY
1957-58

DISTANCES BETWEEN STATIONS ARE PROPORTIONAL

FIG. 3

BACTERIOLOGICAL EXAMINATION RESULTS

Samples of the drain water were collected for bacteriological examination for the MPN (most probable number) of coliform organisms per 100 milliliters of sample (See Table VI). The coliform group of organisms are indicators of domestic sewage pollution. These samples were analyzed at the South Central District Health Department laboratory in Twin Falls.

The coliform count in the sample collected in January at Station No. 3 definitely showed the effect of sewage contamination as evidenced by a coliform count of 3,500,000 organisms per 100 milliliters. At Station No. 6 the count was down to 7,900, but was up to 490,000 organisms per 100 milliliters at Station No. 7. Similar results were obtained on the samples collected and examined during the April survey.

The number of coliform organisms found in the samples collected during the July survey were much lower except at Station No. 2. The lower coliform concentrations found in the samples collected below the two sewage outfalls could be due to either one or a combination of the following factors:

1. Greater use of chlorine in disinfecting the effluents from the two sewage treatment plants.
2. The great amount of dilution water present due to irrigation runoff and seepage during the July survey could also account for the lower coliform count.

Table VI

Main Drain Stream Pollution Survey
1958

Results of Bacteriological Examination of Samples

Station Number	Coliform Group, MPN per 100 milliliter of sample		
	January 8	April 2	July 9 - 10
2	530	540	17,000
3	3,500,000	5,400,000	54,000
6	7,900	9,200	7,000
8	240,000	160,000	54,000
9	79,000	170,000	1,400

BIOLOGICAL ASPECTS

Samples were taken from the bottom of the Main Drain at various stations to determine the presence of animal life. General observations of animal and plant life were also made at these stations. The bottom samples were collected with a double-handled, 16-mesh screen, 3 feet by 4 feet and/or an Eckman dredge.

It is known that aquatic animals survive under many varying conditions. One animal may live and thrive in clean water at the right temperature, with the proper amount of sunlight, plenty of dissolved oxygen, sufficient food, with no toxic chemicals or excess silt present, not too many predators, without too much organic material present and other factors that the animal may need or have to cope with to survive. Another different species of aquatic animal may be able to withstand or be tolerant of a wider range of these factors. It may actually thrive under polluted conditions and be unable to exist, or at least thrive, in clean water. These two examples are extremes in reaction of aquatic organisms to different water conditions since there are many intermediate positions of tolerance by aquatic animals. It can be determined, with some accuracy, whether a stream is polluted by obtaining biological samples from the stream above the area of suspected pollution and a short distance down stream from this area. Any variations in the different species present between the two sample stations and the difference in abundance of the organisms may indicate the presence of pollutants.

This type of survey was used on the Main Drain. A biological rating of the stream at the various stations was determined on the basis of known pollution-tolerant and pollution-intolerant organisms coupled with their relative abundance. This information was considered along with the number of different species of organisms found at each station. A summary of this information is given in Tables VII and VIII. The greater the biological rating figure, the more satisfactory the stream is from a non-pollution standpoint. The figures given are

relative only to each other. The greater number of species present indicates more favorable stream conditions for aquatic organisms.

The biological survey indicates that gross pollution existed at various seasons of the year at all stations with the exception of Station No. 2 which is located above the Rupert sewage outlet. Biological recovery of the drain was evident at Station No. 6 with the exception of the April, 1958, survey when it was grossly polluted. The lack of irrigation runoff and less seepage water in the drain in January and April resulted in more concentrated pollutants. Each municipality or industry discharging pollutants into the Main Drain contributed to the resultant biological conditions.

Table VII

Biological Rating of the Main Drain
October, 1957, through July, 1958

Date	Station Numbers									
	No.2		No. 3		No. 6		No. 7		No. 9	
	BR	Sp	BR	Sp	BR	Sp	BR	Sp	BR	Sp
Oct., 1957	25	11	25	5	19	2	19	2	--	--
Jan., 1958	29	10	4	1	25	3	0	0	0	0
Apr., 1958	25	6	0	0	0	0	0	0	0	0
July, 1958	35	10	13	4	29	5	36	7	19	3

BR -- Biological Rating.
Sp -- Number of different species found.

Table VIII

Pollution-Tolerant and Pollution-Intolerant
Organisms Found in the Main Drain
October, 1957, through July, 1958

Organisms found that are known to be pollution tolerant:

1. Segmented worms of the class Oligochaeta.
2. Snails of the genus Physa.
3. Bloodworms of the family Tendipedidae.
4. Carp of the family Cyprinidae.
5. Leeches of the class Hirydinea.
6. A specimen of the rat-tailed maggot of the family Syphridae.

Organisms found that are known to be pollution-intolerant:

1. Green midge larvae of the family Tendipedidae.
2. Mayflies of the order Ephemeroptera.
3. Crustaceans of the class Amphipoda.
4. Clams of the class Pelecypoda.

CONCLUSIONS

From observations of conditions at the various stations in the Main Drain at the four different times of the year, and an evaluation of the different wastes being discharged to the Main Drain and the results of analysis of samples taken during these surveys, the following conclusions are drawn:

1. Conditions in the Main Drain definitely showed the effect of wastes being discharged to the drain ditch. The physical, chemical, biochemical, biological and bacteriological examination of samples collected at Station No. 2 showed a clean water practically free of pollution. The wastes discharged through the City of Rupert outfall sewer definitely degrade the water in the ditch as evidenced by an increase in the 5-day biochemical oxygen content, a decrease in the dissolved oxygen content and an increase in the coliform bacteria count. A partial recovery of conditions in the drain ditch are obtained by the time the water reaches Station No. 6. When the Amalgamated Sugar Company plant is in operation, the industrial wastes discharged by the plant are of such strength and quantity that the water in the ditch remains degraded until it reaches the Snake River. This is evidenced by complete depletion of the dissolved oxygen, extremely high 5-day biochemical oxygen demand and high coliform bacteria count. The discharge of the partially treated sewage from the Village of Paul and waste water from the A and P Potato Warehouse add to the problem.
2. The main problems created by the discharge of the various untreated and partially treated wastes to the Main Drain are as follows:
   a. The odors created by the anaerobic decomposition of wastes discharged to the ditch.
   b. The odors created by the decaying algae on the surface of the stream during the summer months. Most of this problem exists in the

sections of the ditch between Rupert and Paul. This is a secondary effect caused by the wastes discharged to the ditch. Nutrients in the water are necessary for extensive algae growths. The nutrients are found in the wastes which are discharged to the ditch. The flow characteristics in the drain ditch and the numerous road culverts which form restrictions and do not allow the floating algae to be carried down stream all add to the odor problem.

c. There is a health hazard created by the discharge of partially treated domestic sewage from the Cities of Paul and Rupert and the discharge of individual septic tank effluents to the drain ditch.

d. The wastes discharged to the drain ditch interfere with the propagation of fish and wildlife.

e. The wastes discharged to the drain ditch add to the flybreeding problem.

f. Since the Main Drain discharges to the Snake River, the wastes discharged to the drain ditch have an effect of water uses of the Snake River. The main problem encountered here would be the effect on domestic water use. The addition of wastes in the quantity and strength as discharged to the Main Drain promote algae and other aquatic growths in the Snake River which in turn cause difficulties in the treatment of water for domestic use. The high coliform counts in the water discharged to the Snake River also make the water more difficult to treat for domestic use.

g. Water is pumped from the drain ditch at five different places. This water is used for irrigation purposes. This does create a health hazard and can cause nuisance conditions in irrigation use.

h. Deterioration in the quality of water used for livestock watering.

RECOMMENDATIONS

City of Rupert

1. Secondary treatment facilities should be provided. Since the existing primary treatment facilities are evidently overloaded, it will also be necessary to add to these facilities.
2. The whey from the Kraft Cheese Company should either be pretreated so that the effluent will be suitable for the treatment provided at the municipal sewage treatment plant or the whey should be removed from the city sewer and disposed of in a satisfactory manner.
3. Adequate settling of the waste water from the potato wash plants should be provided before discharge to the city sewerage system. Periodic inspection should be made of these units to insure proper operation.

Rosecrans Slaughterhouse

1. Primary and secondary treatment should be provided for the waste water discharged from the slaughterhouse.
2. Blood from the kill floor should be collected and disposed of in a sanitary manner. Paunch manure should also be collected separately and disposed of in a sanitary manner.

Amalgamated Sugar Company

1. To maintain reasonably odor-free conditions in the Main Drain and to maintain a level of dissolved oxygen in the stream which will support fish and desirable aquatic life, it would be necessary to reduce the strength of the wastes, as determined by the 5-day biochemical oxygen demand by approximately 90 per cent. The most feasible way to accomplish this would be to investigate the possibility of making changes and modifications in the process so as to reduce the quantity and strength of the different wastes and then treat the individual wastes -- flume water, pulp water (pulp screen water and pulp silo drainage water) and

the lime waste water individually. Since the greatest quantity of 5-day biochemical oxygen demand results from the pulp waste water, treatment of these wastes should be given first consideration.

2. All domestic sewage should be given primary and secondary treatment with chlorination of the final effluent before discharge to the drain ditch.

A and P Potato Warehouse

1. Effective settling facilities should be provided for the waste water resulting from the potato washing operation and the effluent should be discharged to the city sewer. The existing facilities are not adequate. With satisfactory settling facilities and proper maintenance of these facilities the effluent should not interfere with the proper operation of the city sewage treatment plant.

Village of Paul

1. Secondary sewage treatment facilities should be added to the present plant.

General Recommendations

1. A program for eliminating the discharge of overflows from individual septic tanks to the Main Drain should be carried out. Suitable soil absorption systems or additional treatment should be provided for these wastes.

2. To reduce the problem of odors resulting from decaying algae on the surface of the water during the summer months, the flow characteristics of the drain ditch should be improved. Bridges to replace the present road culverts may be helpful. This problem is quite pronounced in the vicinity of Stations No. 3 and No. 6.

It is also recommended that as mats of algae form in front of the culverts that they be broken up so they will be carried down stream. This will also reduce the odors resulting from the decaying algae.

November 18, 1958.