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WATER POLLUTION INVESTIGATION
OF
HUMBOLDT-WRIGHT DRAINAGE DITCH NO. 3-47
AND THE
BOONE RIVER

Below Renwick, Iowa

Division of Public Health Engineering

IOWA STATE DEPARTMENT OF HEALTH

Des Moines, Iowa

February, 1961

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WATER POLLUTION INVESTIGATION
HUMBOLDT-WRIGHT DRAINAGE DITCH NO. 3-47
AND
BOONE RIVER
BELOW RENWICK, IOWA

I. INTRODUCTION

This water pollution investigation of the Humboldt-Wright Drainage Ditch No. 3-47 and of the Boone River below Renwick was formally initiated following receipt of a petition under date of October 4, 1960, from the Trustees of Liberty Township, Wright County. This petition states that it has been called to the attention of the Trustees that the sewage from the Town of Renwick that is being dumped south of town into the open dredge ditch west of state highway 60 is creating a terrible odor and may be a health hazard for the local residents. It further states that the sewage surely has an unfavorable affect on fish and wildlife along the Boone River into which the ditch drains. The Trustees requested that this Department examine the conditions and recommend measures to change some of the practices that cause the condition.

Prior to receipt of the aforementioned petition, another petition was submitted under date of August 3, 1955, to this Department from ten residents of the state. This petition requested in part as follows,"petitions the Board (of health) to investigate the waters of a dredge ditch which flows through the north side of Townships 92-27 and 92-26, and flowing in the Boone River. It is believed that raw sewage and waters from the Town of Renwick causes pollution to the water in the dredge ditch and river which are injurious to humans, livestock and fishlife."

Prior to receipt of the petition under date of August 3, 1955, a complaint from Mr. Norman T. Peer, which was submitted to this Department under date of September 11, 1953, relative to conditions in the aforementioned dredge ditch was referred to the Renwick town council for its investigation and correction.

Following receipt of the petition submitted under date of August 3, 1955, a report, dated October 28, 1955, of the investigation of conditions in the dredge ditch conducted by this Department was submitted to the Renwick officials. This report described the conditions found in the dredge ditch and substantiated the complaints of the petitioners concerning a nuisance.

During the latter part of 1955 a consulting engineer was retained by the Town of Renwick to conduct a study of its needs relative to a sanitary sewer system and sewage treatment facilities. The report of the engineer's study was presented to the town officials early in 1956. To date the town has not proceeded with the construction as recommended in the report.

II. CONTRIBUTORS OF POLLUTION

During the course of this investigation, it was determined that the Town of Renwick does not have a comprehensive sanitary sewer system and sewage treatment plant. As a result all water carriage wastes originating within the corporate limits are discharged through private individual septic tanks and building sewer lines to the various tile lines of two drainage districts. A local policy requires that each individual home be provided with a septic tank for primary treatment. The overflow tile from each septic tank connects to a tile line of the nearby north or south, as the case may be, drainage district.

It is estimated that approximately thirty (30) percent of the homes in Renwick, including the school, drain to the north in the drainage tile of District #4-78. This drainage system outlets into Prairie Creek north and east of Renwick at a point near the center of Section 30 approximately 1000 feet above the confluence of the Boone River and Prairie Creek.

The partially treated sewage and wastes from the majority of homes and business establishments in the town, including the Renwick Community Creamery, drain to the south in the drainage tile lines of District # 99. The outlet of the tile system for District #99 discharges into the drainage ditch of Humboldt-Wright #3-47 at a point approximately 2500 feet above the confluence of the ditch and the Boone River.

The aforementioned drainage ditch of Humboldt-Wright #3-47 is the same dredge ditch referred to in the petition submitted by the Liberty Township Trustees, Wright County and the petition submitted by ten (10) residents and received by this Department under date of August 3, 1955.

III. SCOPE OF INVESTIGATION

This investigation includes the collection of samples from the Humboldt-Wright County Drainage Ditch #3-47, Prairie Creek and the Boone River for distance approximately four miles below the confluence of the drainage ditch and the river.

Observations of physical conditions were made of and samples were collected from the Drainage Ditch #3-47, Prairie Creek, Boone River and the outlet of the tile for Drainage District #99 referred to in this report as Station S.O. (South outlet). No samples were collected directly from the tile outlet of Drainage District 4-78, referred to as N.O. in this report, inasmuch as the outlet was found during all surveys to be submerged by impounded waters of Prairie Creek.

IV. DESCRIPTION OF RECEIVING STREAMS AND RIVER

The Humboldt-Wright Drainage Ditch #3-47 starts at a point approximately two miles west of the point of discharge of the Renwick wastes carried by the Humboldt Drainage tile #99, Station S.O. The drainage ditch above Station S.O. is generally dry throughout a great portion of the year. Consequently the water carried by the ditch consists of the sewage and wastes from Renwick and storm water tributary to District #99 tile.

The upper half of the total length of the open ditch is shaded by foliage and it is understood that the gradient of the ditch is normal.

Drainage ditch #3-47 in the area below Station S.O. flows through the Peer farm in which hogs and cattle have access to the water. The Peer residence is located approximately 300 feet from the drainage ditch.

The Renwick wastes collected by the drainage tile of District #4-78 discharge into Prairie Creek at a point approximately 1000 feet above the confluence of the creek and the Boone River. During the course of this investigation it was noted that the stream was impounded due to the presence of beaver dams. An established park and picnic area is located on Prairie Creek below the point of discharge of wastes from #4-78, Station N.O.

It is reported by the Conservation Commission that the Boone River immediately below Renwick is not utilized extensively for fishing. However, this reach of stream is considered very important due to its value as a nursery for forage fish development, particularly minnows and chubs. Some spawning of game fish can also be anticipated in this area.

V. SAMPLING STATIONS

The stream sampling stations utilized in this investigation are described in Table I on page 4 and are shown in the location map, Figure I on page 5.

All stations numbers with a prefix of "B" are located in the Boone River. Stations on Drainage Ditch #3-47 are described numerically. Stations on Prairie Creek have a prefix of "P".

The outlet of District #99 is referred to as Station S.O. and the outlet of District #4-78 is referred to as N.O.

VI. SCOPE OF TESTS

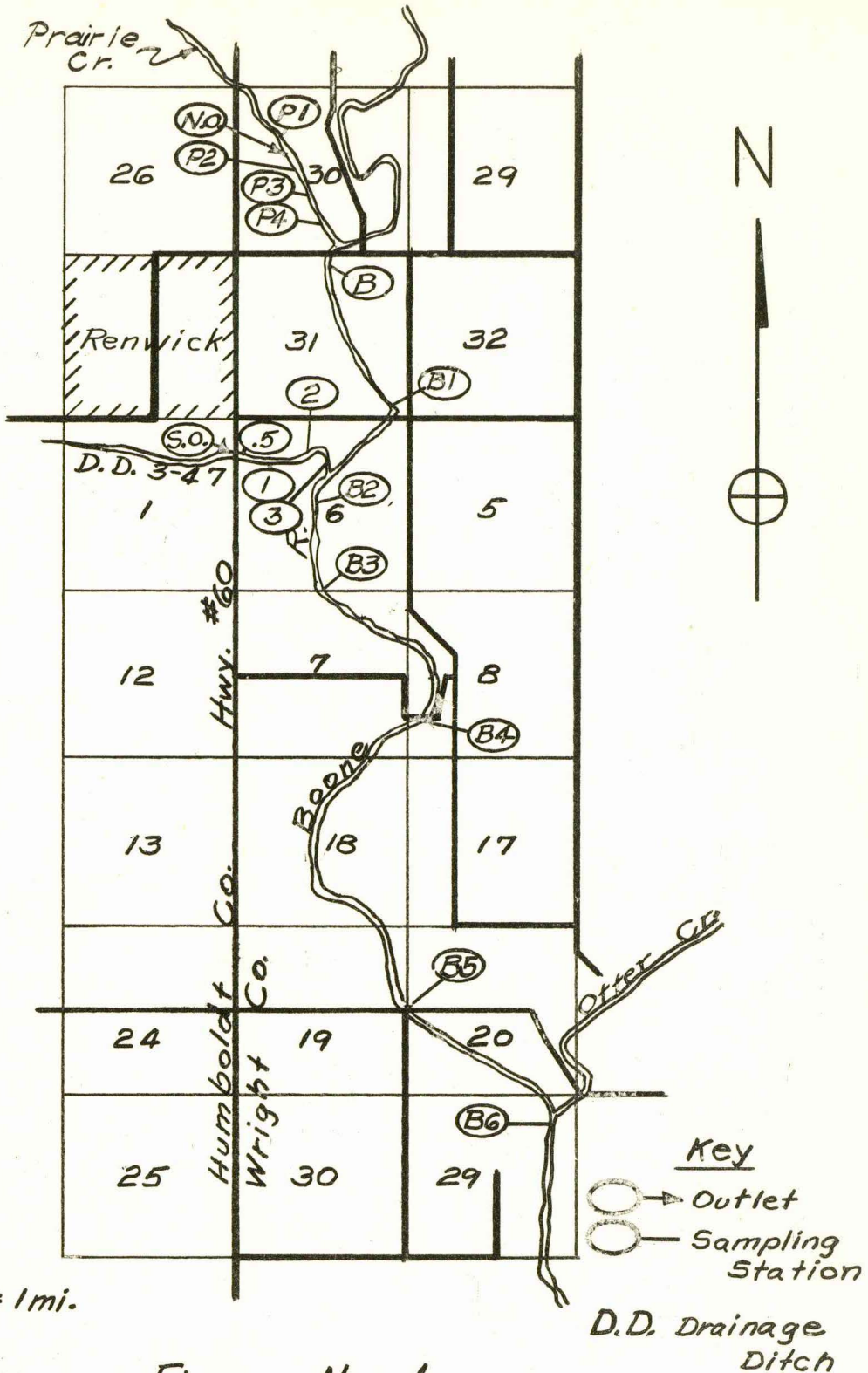
Determinations made on samples consisted of those made in the field at the time of sampling and those made in the State Hygienic Laboratory in Des Moines, Iowa. The field work included observations of the temperature and pH and the stabilizing of a portion of the samples for determination of dissolved oxygen in the laboratory.

The physical condition of the stream and outlets as to evidence of pollution at the time of sampling was also observed and recorded.

Samples of dissolved oxygen, biochemical oxygen demand, and for bacterial determinations were kept under refrigeration in the field and were either transported directly to the laboratory or iced and shipped to the State Hygienic Laboratory where the determinations were conducted.

TABLE I
LOCATION OF SAMPLING STATIONS

STATION NO.	DESCRIPTION
S.0	Outlet of drainage district tile-Humboldt #99 in Sec. 1, Lake twp.
0.5	Immediately below S.0. in drainage ditch (D.D) 3-47 in Sec. 1, Lake twp.
1.0	Approximately 150' below S.0. in D.D. 3-47 in Sec. 6, Liberty twp.
2.0	Approximately 700' below S.0. in D.D. 3-47 in Sec. 6, Liberty twp.
3.0	Approximately 3/4 mile below SO in DD 3-47 in Sec.6, Liberty twp, immediately above confluence of Drainage Ditch and Boone River
B	Boone River below confluence of Prairie Creek.
B-1	Boone River @ Co. Road bridge between Sec. 31, Boone twp and Sec 6, Liberty twp, Wright County above mouth of Drainage Ditch #3-47.
B-2	Boone River immediately below confluence of drainage Ditch in Sec. 6, Liberty twp.
B-3	Boone River approximately 1/2 mile below confluence in Section 7, Liberty twp.
B-4	Boone River approx. 1 mile below confluence at Co.road bridge between Sections 7 and 8, Liberty twp.
B-5	Boone River approximately 3 miles below confluence at Co. road bridge in Sec. 20, Liberty twp.
B-6	Boone River approx. 4 miles below confluence in Sec. 29, Liberty twp. below junction of Otter cr. and River.
<hr/>	
P-1	Prairie Creek above N.O. in Section 30, Boone twp.
N.O.	Outlet of drainage tile of District #4-78.
P-2	Prairie Cr., immediately below outlet in Sec. 30, Boone twp.
P-3	Prairie Cr., Approximately 800' below N.O. in Sec.30, Boone twp.
P-4	Prairie Cr., Approximately 1/4 mile below N.O. in Sec. 30, Boone twp.



Scale: 1" = 1mi.

Key
 ○ → Outlet
 ○ · Sampling Station
 D.D. Drainage Ditch

Figure No. 1
Location of Sampling Stations
Boone River, Prairie Cr., & D. D. 3-47
Below Renwick

All tests in the field and in the laboratory were conducted in accordance with the procedures as set forth in the current edition of "Standard Methods for the Examination of Water, Sewage and Industrial Wastes" published jointly by the American Public Health Association, American Water Works Association, and the Water Pollution Control Federation.

VII. DEFINITIONS AND SIGNIFICANCE OF THE VARIOUS PHYSICAL, CHEMICAL AND BACTERIOLOGICAL TESTS USED IN SURVEY:

Temperature (°C): The temperature values are of the stream water at the point of sampling and are reported in degrees centigrade. Temperature of water governs the solubility of oxygen in the stream and influences the rate of purification.

pH: Hydrogen ion concentration, or pH, indicates the relative acidity or alkalinity of a water. A value of 7 is considered to be neutral; whereas values above 7 are alkaline and those below 7 are acid.

Dissolved Oxygen (DO): Oxygen in dissolved form is essential to the natural purification of streams and the maintenance of aquatic life. This oxygen is drawn upon to support biochemical oxidation of organic wastes and is replaced by absorption from the atmosphere and photosynthetic action of some water vegetation including algae. A deficiency of dissolved oxygen below the saturation level indicates the presence of polluting organic substances which are absorbing oxygen from the stream water. The degree of this deficiency is a measure of the deoxygenating effect of the polluting matter and hence an index of the degree of pollution in a particular stream zone. If there is a sufficient quantity of oxygen present in the water, the organic material will be oxidized without creating any objectionable odor nuisance or destruction of aquatic life. However, if there is not a sufficient amount of oxygen present, anaerobic decomposition takes place and the organic material present in the water undergoes putrefaction with an accompanying foul odor and dark appearance of the water which is indicative of a heavily polluted stream.

Five-Day Biochemical Oxygen Demand at 20°C (BOD): This determination indicates the amount of dissolved oxygen which may be expected to be utilized in five days at 20°C to support the biochemical oxidation of the organic matter in the sample at that time.

Coliform Bacteria (MPN): The result of this determination is expressed as the most probable number (MPN) of coliform bacteria per 100 milliliters of sample. This examination is perhaps the most delicate and specific test for pollution by sewage inasmuch as it shows the approximate density of a group of bacteria which is always present in large numbers in sewage and relatively few in number in other stream pollutants. Coliform bacteria are normal inhabitants of the intestines of warm-blooded animals and are discharged in large numbers in human feces, which constitute the principal source of these bacteria in sewage. These bacteria may also be found in varying amounts in certain industrial wastes.

Fungus Growths: As decomposition becomes established following the entrance of organic wastes into a stream, certain typical growths appear. These growths are referred to as sewage fungi. However, bacteria, fungi, and protozoans are among the organisms that make up this growth. These growths form dense masses and cling to bottom mud and stones, to stream obstructions, and to submerged plants. Newly developed forms may be white; whereas, older forms tend towards a putty grey color.

Growths of the type mentioned above are important in stream pollution work since they occur only in streams which are polluted with organic wastes. They are, therefore, considered to be good indicators of the pollution conditions.

VIII. SIGNIFICANCE OF POLLUTION

In accordance with the Iowa Stream and Lake Pollution Law, pollution is defined as follows:

"----- pollution means such contamination, or other alteration to the physical, chemical or biological properties, of such waters of the state, or such discharge of such liquid, gaseous or solid substances into such water of the state as will create a nuisance or render such waters harmful or detrimental or injurious to public health, safety or welfare or to domestic, commercial, industrial, agricultural, and recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life."

During the course of this investigation, the following conditions pertaining to the aforementioned definition were found to exist:

1. The organic solids in the partially treated sewage and industrial wastes were found to be settling to the bottom of Drainage Ditch #3-47. As a result the ditch in the affected areas was covered with a blanket of organic material which was undergoing anaerobic decomposition. Foul odors are associated with such decomposition and the ditch in the affected areas is a nuisance to persons residing near or frequenting the drainage ditch.

Numerous bacteria, some of which may be pathogenic (disease producing), are present in the sludge deposits formed by the aforementioned settled sewage and industrial waste solids. A potential health hazard exists to persons coming into contact with these deposits.

During most surveys of this investigation, deposits of settled sewage and industrial wastes were found in the Boone River immediately below the confluence with Drainage Ditch #3-47. Such deposits in the river tend to interfere with the development of stream vegetation and other aquatic life which serves as food for fish in the affected area.

2. Large numbers of bacteria, some of which may be pathogenic, are discharged into Prairie Creek and Drainage ditch #3-47 and subsequently into the Boone River. As a result, a potential health hazard exists to persons coming into contact with the waters of the ditch, the creek and the river.

Dairy animals having access to the stream waters present another potential health hazard inasmuch as disease producing bacteria may be mechanically transferred from the bodies and udders to the milk during the milking process.

3. The partially treated sewage and industrial wastes contain unstable organic material which, in being stabilized, utilizes the oxygen that is dissolved in the stream waters.

In the absence of oxygen in the stream water, anaerobic decomposition of the organic material results with subsequent development of obnoxious odors and the dark (ink-black) appearing water. Such odors constitute a nuisance to persons in the vicinity of the stream.

It is generally agreed that if fish life is to be normally maintained there must be from 3-5 ppm of dissolved oxygen in the water at all times. Some fish may survive at concentrations less than 3 ppm for limited periods at low temperatures when activities are at a minimum. However, it appears that a minimum of 4 ppm dissolved oxygen is required for prolonged activity of some fish at summer temperatures. During three surveys of this investigation the dissolved oxygen in the Boone River immediately below the mouth of Drainage Ditch #3-47, Station B-2, was depleted. During two surveys the oxygen values at Station B-3, approximately 1/2 mile below the confluence, were 0.0 and 0.2 ppm.

IX. PHYSICAL CONDITION OF THE RECEIVING STREAM AND OF THE BOONE RIVER

During the course of this investigation the physical conditions of the receiving stream and of the Boone River were observed and recorded at the sampling stations.

At Station S.O., the outlet from Drainage District #99, the flow characteristic varied from a whitish-grey color with a slight disagreeable odor to a greenish-yellow color with a very disagreeable odor. The latter characteristic is typical of milk wastes and more specifically of whey. This extreme characteristic generally lasted for approximately 2-1/2 hours. During other periods the waste appeared to contain milk wastes and normal domestic sewage. The normal flow from this outlet was estimated to be approximately 40 gpm, whereas the flow when the milk wastes were heaviest, was estimated to be in the magnitude of 80 gpm.

Station 0.5 represents the flow in the drainage ditch at a point immediately below Station S.O. Inasmuch as no flow was observed above this station, the flow at Station 0.5 consists primarily of sewage and milk wastes. Deposits of settled sewage and milk wastes solids were observed in the channel.

At Station 1.0, approximately 150 feet below S.O., the flow in the ditch continued to be white in color. Heavy deposits of sewage and milk waste solids, varying in depths from 6-8 inches, were generally observed. Odors of decomposition of the sewage and wastes were prevalent.

The ditch waters at Station 2, approximately 700 feet below S.O., were black in appearance. Heavy sludge deposits covered the ditch bottom and decomposition of these solids was occurring as evidenced by the rising gas bubbles in the water. The ditch at this station passes near the Norman Peer farm buildings and within 300 feet of his residence.

From Station 2 in Drainage Ditch #3-47 to its mouth, the flow becomes more sluggish with deeper sludge deposits. Active decomposition of the sludge deposits was generally observed as evidenced by the gasification. The flowing water appeared to be black in color due to the fine decomposing particles in the stream.

At Station P-1 in Prairie Creek, above the tile outlet from District #4-78, Station N.O., the creek water was observed to be clear and free from any evidence of pollution.

The outlet from District #4-78, Station N.O., was always found to be submerged due to the beaver dams located further downstream. The stream immediately below the outlet was observed to have some moderate sludge deposits. Generally there were no objectionable odors of decomposition observed at this point.

At Stations P-3 and P-4, approximately 800 feet and 1/4 mile respectively below the outlet, algae growth was quite general and evidence of pollution was not visible.

The Boone River at Station B, immediately below the confluence of the Boone River and Prairie Creek was observed to be in satisfactory condition. There was generally no indication of visible pollution at this station from wastes being discharged into Prairie Creek.

At Station B-1, on the Boone River approximately 1 mile below the mouth of Prairie Creek and approximately 1/4 mile above the confluence of Drainage Ditch #3-47 and the Boone River, the stream showed no visible signs of pollution.

The Boone River at Station B-2, immediately below the mouth of Drainage Ditch #3-47 was found to have deposits of black digesting sludge. Active decomposition of the settled sewage and milk waste solids was observed as evidenced by the rising of gas to the water surface. Odors of decomposing sewage and milk wastes were noticed.

At Station B-3 on the Boone River, approximately 400 feet below the mouth of ditch #3-47 the stream continued to show signs of pollution as evidenced by the sludge deposits and the white discoloration of the water due to milk wastes.

From a visual standpoint, the Boone River generally appeared to be normal at Stations B-4, B-5 and B-6 which are located 1, 3 and 4 miles below the junction of Drainage Ditch #3-47.

X. INTERPRETATION OF CHEMICAL AND BACTERIOLOGICAL DATA

The data contained in Table II on page 11 confirms in a chemical and bacteriological way the observations made relative to the physical conditions in the receiving streams and the Boone River.

The BOD values of sewage and milk wastes being discharged from Station S.O. into Drainage Ditch #3-47 were found to be very high. They ranged from 390 ppm to 19,000 ppm. During all surveys the BOD values were higher than for untreated domestic sewage which is generally in the magnitude of 200 ppm. The high BOD values of 14,000, 18,000 and 19,000 ppm indicate the presence of milk wastes and more specifically the presence of whey which has a very high oxygen demand. MPN values were generally quite high.

At Station 0.5, immediately below Station S.O., the BOD values generally remained very high and, due to lack of flow in the ditch above the point of discharge were generally quite similar to the BOD values of the waste being discharged from the tile.

At Station 1.0, approximately 150 feet below S.O., the stream continued to show signs of pollution was evidenced by continued high BOD values and low dissolved oxygen (D.O.) values. DO values varied from a minimum of 0.0 to 13.3 ppm. MPN values were generally high during all surveys varying from 600,000 to greater than 70,000,000 bacteria per 100 milliliters.

At Stations 2 and 3, approximately 700 feet and 3/4 mile respectively below S.O., the dissolved oxygen values of the water were generally depleted. During the three surveys in August 1958 and September and October of 1960, the DO values at both stations were zero. During other surveys, the highest DO value recorded was 3.2 ppm during the July 11, 1958 survey. The depleted oxygen condition at these stations account for foul, obnoxious odors in the vicinity of the drainage ditch.

The sample collected of Prairie Creek above the tile outlet of District #4-78 (N.O.) indicated the creek to be generally in satisfactory condition. A relatively low MPN value of 6200 was recorded and the BOD value of 5 is considered to be somewhat high for a normal clean stream but is generally satisfactory.

The samples collected at P-2 immediately below N.O. indicate that the partially treated sewage from the north part of Renwick has a slight affect on the stream at this point. BOD values ranged from 16 to 50 ppm at this station. MPN values ranged from 6,000 to 6,200,000, thereby indicating that domestic waste was being discharged at this point.

STREAM POLLUTION SURVEY
 HUMBOLDT-WRIGHT DRAINAGE DITCH NO. 3-47
 AND
 BOONE RIVER
 Below Renwick
 February 27, 1958 to October 13, 1960
 CHEMICAL AND BACTERIOLOGICAL DATA

TABLE II

Sta. No.	Temp °C	pH	Dissolved Oxygen ppm	Percent Saturation	Bod ppm	Oxygen Balance	Coliform Bacteria MPN per 100 ml
February 27, 1958							
P-2	1	-	10.1	70	50	-39.9	23,000
S.O	5	-	7.6	-	450	-	6,200,000
1.0	1	-	10.7	73	65	-54.3	2,300,000
April 2, 1958							
P-2	8	7.4	6.8	57	16	-9.2	6,000
P-4	8	7.8	10.2	86	11	-0.8	2,300
B	8	8.4	11.7	99	6	5.7	2,300
S.O.	10	<6.0	1.6	-	14,000	-	460,000
1.0	8	<6.0	13.3	110	2,800	-2786	24,000,000
2.0	10	6.0	2.0	17.4	2,100	-2098	<450,000
B-2	11	7.0	0.4	3.6	710	-709	240,000
B-4	9	7.2	6.7	58	6	0.7	600
B-5	8	7.2	5.7	48	6	-0.3	24,000
July 11, 1958							
S.O	16	<6.0	1.5	-	2,700	-	2,300,000
.5	17	<6.0	3.8	40	3,100	-	6,200,000
1.0	18	7.0	6.4	67	190	-	>7,000,000
2.0	16	6.8	2.1	21	670	-	>7,000,000
3.0	21	7.4	3.2	35	10	-	>700,000
B-2	21	7.4	3.9	42	17	-	>700,000
B-3	21	7.4	3.2	35	12	-	700,000
August 26, 1958							
P-2	18	7.4	2.0	21	25	-23	6,200,000
P-4	18	8.2	6.8	71	5	1.8	<4,500
B	19	8.2	11.2	120	6	5.2	70,000
S.O	20	7.0	0.6	-	390	-	>70,000,000
.5	18	7.0	0.0	0.0	450	-450	>70,000,000
1.0	18	7.2	1.9	20	640	-638.1	>70,000,000
2.0	19	7.2	0.0	0.0	300	-300	>7,000,000
3.0	20	7.2	0.0	0.0	530	-530	24,000,000
B-2	21	7.2	0.0	0.0	560	-560	7,000,000
B-3	19	7.3	3.7	39	170	-166.3	7,000,000
B-4	24	8.8	13.3	156	5	8.3	>70,000
B-5	20	8.2	5.7	62	6	0.3	>70,000

Sta. No.	Temp. °C	pH	Dissolved Oxygen ppm	Percent Saturation	BOD ppm	Oxygen Balance	Coliform Bacteria MPN per 100 ml
September 9, 1960							
B-1	15	7.8	3.0	29	4	-1	240,000
S.O	21	<6.0	0.0	-	18,000	-	600,000
.5	21	<6.0	0.0	0.0	16,000	-16,000	600,000
1.0	20	<6.0	0.0	0.0	17,000	-17,000	600,000
2.0	23	-	0.0	0.0	3,900	-3,900	6,200,000
3.0	19	7.6	0.0	0.0	1,100	-1,100	2,300,000
B-2	19	7.6	0.0	0.0	65	-65	230,000
B-3	18	7.7	0.2	2.2	25	-24.8	620,000
B-4	18	8.0	2.9	30	9	-6.1	23,000
B-5	18	8.2	7.2	76	7	0.2	13,000

October 13, 1960

P-1	17	8.2	5.8	60	5	0.8	6,200
P-2	17	8.0	6.6	68	16	-9.4	2,400,000
P-3	17	7.8	4.1	42	9	-4.9	6,000
P-4	15	7.6	1.0	9	8	-7.0	6,000
B	17	8.0	7.5	77	7	0.5	6,000
B-1	16	7.9	1.9	11	7	-5.1	<4,500
S.O	18	3.9	0.0	-	19,000	-	<450,000
.5	18	3.9	0.7	7.4	15,500	-15,500	<450,000
1.0	18	3.9	0.1	1.5	20,000	-20,000	<450,000
2.0	18	4.3	0.0	-	10,000	-10,000	<450,000
3.0	17	-	0.0	-	100	-100	1,300,000
B-2	15	7.6	0.0	0.0	450	-450	230,000
B-3	15	7.6	0.0	0.0	230	-230	<45,000
B-4	17	7.5	7.6	78	9	-1.4	6,000
B-5	17	7.5	5.5	56	10	-4.5	<4,500
B-6	17	7.5	5.0	51	10	-5.0	6,000

BOD values at Stations P-3 and P-4, approximately 800 feet and 1/4 mile respectively below N.O. are higher than would be generally expected for a clean normal stream. Values varied at these stations from 5 to 11 ppm. MPN values were generally low ranging from 2,300 to 6,000 ppm.

BOD values at B and B-1 which are on the Boone River and below the junction of Prairie Creek ranged from 4 to 7 ppm. MPN values varied from a low of 2,300 to a maximum of 240,000. DO values at B-1 during two surveys were low at 1.9 and 3.0 ppm.

The Boone River at Station B-2, immediately below the mouth of Drainage Ditch #3-47 clearly demonstrated the effect of the wastes from the tile outlet of District #99 (S.O.). BOD values during this investigation varied from a low of 17 ppm to a maximum of 710 ppm. During three surveys the dissolved oxygen content was depleted. On one survey a low value

of 0.4 ppm was recorded. During the July 11, 1958, survey a DO value of 3.9 was recorded. During all surveys the dissolved oxygen was less than generally agreed necessary to maintain fish life.

At Station B-3 in the Boone River, approximately 1/2 mile below the mouth of Drainage Ditch #3-47, the stream continued to show signs of pollution as evidenced by high BOD values which varied from a low of 12 ppm to 230 ppm. Dissolved oxygen values continued to be very low ranging from 0.0 ppm to 3.7 ppm. Bacterial values were high with the minimum being recorded as less than 45,000 and the maximum being 7,000,000.

The Boone River at B-4, approximately 1 mile below the junction of Drainage Ditch #3-47 generally showed signs of recovery as evidenced by lower BOD and MPN values and increased DO values. BOD values were high, but considerably less than the previous stations. The values varied from a low of 5 ppm to a high of 9 ppm. Bacterial values ranged from a low of 600 to a high of greater than 70,000.

Continued improvement was noted at Station B-5, approximately 3 miles below the mouth of Drainage Ditch #3-47. DO values were much higher with the minimum being 5.5 and the maximum being 7.2. BOD values were generally high but not significantly so with a maximum of 10 and a minimum of 6.

XI. CONCLUSIONS

1. The Humboldt-Wright County Drainage Ditch #3-47 below the tile outlet of Drainage District #99, Station S.O., and the Boone River below the mouth of Drainage Ditch #3-47 were found to be grossly polluted as evidenced by the presence of deposits of sewage and milk waste solids, deficient oxygen conditions in the streams, foul odors due to the anaerobic decomposition of the sewage and milk waste solids and the high numbers of coliform bacteria.

2. The pollution of Drainage Ditch #3-47 and of the Boone River was found to be due to the discharge of partially treated domestic sewage and milk wastes which originate from within the Town of Renwick and which are being discharged from the tile system of the Humboldt County Drainage District #99.

3. The extensive deposits of settled domestic sewage and milk waste solids in Drainage Ditch #3-47 and the depleted oxygen condition of the water in the ditch result in anaerobic decomposition with subsequent development of foul odors. These odors constitute a nuisance to persons residing near the ditch.

4. The depleted, as well as the deficient, dissolved oxygen values found in the Boone River below Drainage Ditch # 3-47 are detrimental to fish and aquatic life.

5. Due to high numbers of bacteria in Drainage Ditch #3-47 and the Boone River, a potential health hazard exists to persons coming into contact with the waters.

6. Partially treated domestic sewage from within the Town of Renwick is being discharged into Prairie Creek through the tile system of Drainage District #4-78. Inasmuch as an established park and picnic area is located adjacent to and contiguous to Prairie Creek in the vicinity of Station P-4, a potential health hazard exists to park visitors who may come into contact with the creek water.

XII. RECOMMENDATIONS

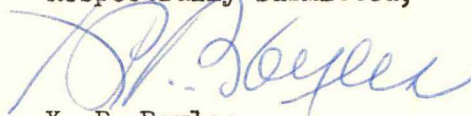
1. It is recommended that treatment facilities adequate to correct the present gross pollution condition and to prevent recurrence of the condition be provided.

2. Such treatment facilities should be provided singly or in combination to treat adequately the residential and commercial sewage of the Town of Renwick and the industrial wastes from the Renwick Community Creamery.

3. As an alternate to Recommendation No. 2, each residence and each commercial and industrial establishment must provide adequate treatment of its waste in individual treatment facilities.

However, it must be recognized that this alternate is generally very difficult, if not impossible, to execute due to lack of adequate area and suitable soil conditions on individual properties. It is also usually found that existing building drain lines and septic tanks are poorly located with respect to providing adequate individual secondary treatment facilities. In this regard, the local officials must exercise adequate control over the construction, operation and maintenance of such individual systems.

Respectfully submitted,



X. P. Boyles
Public Health Engineer

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