WICHITA RIVER, BIG — POLLUTION

Report of Fisheries Investigations

Pollution Studies in Region 1-B: of the Big Wichita River in North-Cnetral Texas and the Canadian River in the Texas Panhandle.

by

Leo. D. Lewis
Project Leader

Walter W. Dalquest
Asst. Project Leader

Dingell-Johnson Project F-7-R-2, Job C-1, Part 2
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H. D. Dodgen, Executive Secretary

Texas Game and Fish Commission
Austin, Texas

Marion Toole
Coordinator

William H. Brown
Asst. Coordinator

STATE Texas
PROJECT NO. F-7-R-2, Job C-1, Part 2
PERIOD June 1, 1954 - May 31, 1955

JOB COMPLETION REPORT

Leo D. Lewis and Walter W. Dalquest

TITLE

Pollution Studies in Region 1-B: of the Big Wichita River in North-Central Texas and the Canadian River in the Texas Panhandle.

OBJECTIVES

To determine the sources and the nature of the natural and man-made pollutants that affect the fish populations.

SCOPE OF THE PRESENT REPORT

Pollution studies of the waters of the Canadian River, in the Texas Panhandle, have already been reported (Completion Report, F-7-R-2, Job C-1, Part 1).

Natural pollution of the waters of the Big Wichita River is described in detail in the reports on the basic survey and inventory of species of fishes in the Big Wichita River (Completion Reports, combined, F-7-R-2, Jobs A-2 and B-6).

Industrial pollution of the Big Wichita River has proven so important and time-consuming that this report is devoted to that aspect alone. We have had to work out our own approaches to the individual pollution problems we encountered, learning as we went along, often at the cost of considerable wasted time and effort. For this reason we have made this report in considerable detail, in the hope that our mistakes and successes will be helpful to others in similar instances.

Although we have not extended pollution investigations of the Big Wichita River into the 1955-56 year as a separate job, it is expected that investigations begun during the past project year will continue, even if on a reduced scale. The various individuals and associations who have been interested in pollution abatement will continue their activities, we hope, and call on us when they need to do so. Further, unless vigilance is maintained and potential industrial pollution is watched, the situation will revert to the conditions of 1954 and we shall have lost all our gains.

ACKNOWLEDGMENTS

We wish to express our appreciation to Dr. Carl Gray, Soils Scientist of Midwestern University and the Wichita County Water Improvement Districts, for the many and detailed water analyses which have often been the basis of our evidence for and understanding of pollution. Mr. Fred Parkey, General Manager of the Wichita County Water Improvement Districts, has cooperated heartily in all of our efforts at pollution abatement and much of our success in this regard is due to his efforts. Game Warden Morris Stallcup assisted us in the field on many occasions and brought the necessary court

actions when this was unavoidable. Mr. D. C. Norwood, President, and the North Texas Oil and Gas Association, have been most sympathetic and helpful in many instances. Mr. William Black, Executive Vice-president, and the Wichita Falls Chamber of Commerce, have also been helpful, assuming responsibility for pollution abatement in some cases where we were unable to act. We are grateful also to those persons who, when we explained the damage done to the fish populations by their pollutants, went to trouble and expense beyond that required by law to correct and prevent such pollution.

METHODS

Specific instances of industrial pollution were discovered by us in the course of our basic survey of the Big Wichita River or were discovered by fishermen or other interested individuals who complained about such pollution to us or the local game wardens. When such pollution seemed to be chemical in nature, evidence was carefully gathered, as though such data were later to be delivered in court. In actual fact, none of our evidence was so required but we suspect that its very thoroughness, in some cases at least, made court action unnecessary.

Suspected effluents were "walked out" from their confluence with the river to the source of possible pollution. Water samples were taken and immediately labeled at: the suspected source of pollution, of the effluent near its junction with the river, of the river immediately above the junction, and of the river at the first repids below the junction where the waters of the effluent and of the river were thoroughly mixed. The samples were then delivered to Dr. Carl Gray, who immediately placed his own code identifications on the bottles. Careful notes were taken of the conditions at the pollution site, and of the collection of the water samples. Thus we could later swear that the samples went directly from the hands of the collector to the chemist.

Once definite evidence of pollution was at hand, we began efforts to stop the polluton and prevent its occurrence in the future. We kept in mind at all times that our aim was the cleaning up of the river, and not the prosecution of individuals. Our methods varied with circumstances but we attempted in every case to carry our arguments to the owners or persons in ultimate authority of the offending properties. Whenever possible we arranged meetings with such persons, usually on the site of pollution. We also corresponded with them, informing and involving whenever possible the Water Improvement Districts, the Chamber of Commerce, the North Texas Oil and Gas Association, and others who might exert pressure in our behalf. As a result we were usually able to come to amiable understandings that ended the pollution and improved the properties. Only once was court action necessary and in only two additional cases does it seem likely that such action will be required.

The following accounts present only some of the highlights of the work done. We have selected samples of pertinent correspondence for inclusion here. These are letters, in most cases, that seemed most satisfactory in specific instances and we used them as form-letters, changing them only to correspond to the details of new pollution cases. Discussion of individual pollution problems is arranged from the upstream-most case downstream.

JOHNSON OIL FIELD

The Johnson Oil Field is located in the Blain Formation, a rock formation that is responsible for most of the natural salt-water pollution of the Big Wichita River. In the past the oil wells in this region were serious pollution agents but injection wells were installed several years ago and all salt water is now returned to the earth.

However, in one case the water is stored in an open pit before being pumped into the injection well. Vast quantities of salt filter through the ground from this open pit and reach the Wichita River by way of a small creek. The Wichita County Water Improvement Districts took the initiative in efforts to clear up this condition. Our own letter, dated May 19, 1955 and addressed to Mr. Fred Parkey, General Manager of the Water Improvement Districts, is as follows:

"Reference is made to your recent telephone conversation. We are indeed familiar with the stream you mention and keep it on our records as 'Johnson Oil Field Creek.' We have, within the past year, checked the water quality of this stream a number of times. I personally have walked up the stream for some distance, walked downstream from the bridge that crosses the stream on farm road 567 for two miles, and have checked the water quality of the North Fork of the Wichita River above the mouth of the creek, at the mouth of the creek, and at the first rapids below the junction of creek and river.

"Water quality varies, at the bridge, from a minimum of 8.7% total salts (5% chloride) to a maximum of 27.3% total salts (17% chloride). Fluctuation in salt quantity is enormous but even at minimum is higher than the salt content of any natural tributary of the Wichita River with which I am familiar.

"The creek has relatively little surface flow. The flow at the bridge seems rather constant. Walking downstream one finds that the water drops from the surface completely, sometimes for hundreds of feet, only to appear again as a considerable stream. The under-the-sand flow volume must be considerable but I am unable to estimate it.

"A half-mile below the bridge a sizable tributary stream enters the main creek canyon. This too is extremely salty, but less so than the creek. Total salts on January 31 measured only 4.7% (2.7% chloride).

"At the mouth of the creek, on March 13, the creek ran 12.7% total salts (8.1% chloride). The river tested 17,300 p.p.m. total salts (8343 p.p.m. chloride), above the mouth of the creek, but 17,869 p.p.m. total salts below the junction with the creek (8432 chloride). Thus the creek, in spite of its small volume, (exceptionally low on the date tested) is so salty that it appreciably increases the total salts of the river it enters. The increase (569) is sufficient to change pure water to water too salty to drink.

"I am puzzled as to how to go about correcting this creek. The extreme variation in salt content shows pollution from oil field salt. However, I am not able to find evidence that salt pits are leaking to the river. In fact, few pits now contain salt water.

"The only obvious source of salt at present is the holding pit that serves to hold the brine before it is pumped back into the ground. It must be this earthen holding pit that is leaking through the ground and so contaminating the creek. This could be avoided by cementing the holding pits on this property, or by using metal or metal-lined holding tanks. Perhaps it would be practical to pump the water directly into the ground without a temporary holding tank.

"We strongly urge that you encourage and insist that the owners of this property take whatever steps are necessary to stop polluting this stream."

OIL FIELDS OF THE SOUTH FORK

We are well aware that numerous oil wells on the South Fork of the Wichita

River have salt pits, and that some of these leak salt to the river. However, our investigations also indicated that the South Fork is a less important tributary than some other streams. In consequence, we devoted our efforts elsewhere and have never found the time to work on this pollution.

KAMAY OIL FIELDS

In the area between the towns of Kamay and Valley View are located a large number of oil wells, and some of these are the worst offenders, from the standpoint of salt pollution, in the Wichita Valley. Our activities have been too numerous to mention, varying with the particular oil well under consideration. There are oil wells of two types in the Kamay area, deep wells that usually do not produce much salt, and shallow wells that produce but little oil and large quantities of salt. Various oil wells produce from an estimated 15 to 50 barrels of salt water per day. One exceptionally bad well made more than 200 barrels of salt water per day. The salt content varies but little, usually ranging from 15% to 17% salt as the water comes from the well. Wells of the average type thus produce from approximately 800 to 2,500 barrel equivalents of salt each year. Some of the salt pits have been in use for years but contain only a few barrels of salt water, usually less than one day's production of water. They obviously leak all of their salt-water contents onto or through the ground, and directly or indirectly to the river.

Our efforts were devoted to the installation of injection wells and pumps, and the filling and leveling of existing salt pits and depressions. These latter form a "head" of water that forces salt-impregnated water down through the ground that has been saturated with salt for years, and this salt brine drains to the river.

Salt contents of the waste waters of four typical battery pipes leading to holding pits, expressed as sodium chloride, are: 143,691 p.p.m., 164,532 p.p.m., 153,049 p.p.m., and 152,175 p.p.m. Total salts were considerably higher.

The Kamay Oil Field has involved a great deal of correspondence. Typical form letters are given in the following pages. An example of the kind of leter used to initiate action is the following, dated April 25, 1955 and addressed to Mr. Fred Parkey of the Water Improvement Districts.

"In the course of investigations of industrial pollution of the Wichita River in Wichita County, Texas, facts were discovered of which you should be informed.

"On the A. W. Komerak lease, J. J. Perkins, et. al., 100 acres, salt water pollution is occurring, in violation of state law and in a manner affecting the irrigation districts. Salt water in large volume is being collected in a shallow surface pit, and the pit is so poorly maintained that it leaks almost as much salt water as enters, and it leaks on all four sides. As a pollution control, the pit is useless and scarcely does lip service to the state anti-pollution laws. In addition, a large valve on the surface of the ground shows where a large volume of salt water and oil sludge is released directly. The crystalline salt deposits and the course of the oil sludge are clearly shown on the bare ground. The pollutant material has destroyed vegetation for hundreds of feet about the pit area.

"The irrigation districts are concerned in that the waste drains directly to the Wichita River in ditches that are the property of the districts. The districts are

concerned also in that nearby irrigation laterals are below the level of the pollution and doubtless receive large quantities of salt in underground flow.

"The salts from this source are very destructive to fish and other aquatic life. Further, these salts, especially the sodium, flocculate the soil particles and make conditions almost impossible for the growth of agricultural crops. In the irrigation water, the salts in large quantities might be lethal and lead to destruction of agriculture for many years in the fields where deposited. One need only look about the salt pit area to see the effect of the salts on vegetation. Because salts, especially sodium and chloride, most abundant in the polluted waters mentioned, are so soluble, once in the ground they eventually find their way to the river and have a deleterious effect on fish life. The destruction caused by the pollution described here will have its effect for many years to come, even if corrected immediately. The salt water now in the ground and ground water will slide horizontally, polluting the water table, making fresh-water wells impossible, and will in time reach the river to kill fish.

Salt pits are not a suitable control of salt water. We strongly urge that you insist the lessors install injection wells and pumps on this property. Existing pits should be filled and leveled so that standing rain water will not force the salt that now saturates the ground into the water table. Properly managed, this land can again be made useful for agriculture and soil conservation. It might be well to inform the surface-rights holder of this.

"Trusting that you will take swift action on this, I am,"

As a result of the above letter, a meeting was held with Mr. Komerak, Mr. Parkey, and personnel of the Game and Fish Commission on June 1, 1955. Mr Komerak found installation of injection pumps impractical and the well was closed down on that afternoon. He also agreed to fill and level all existing pits and depressions on his lease as soon as the ground was dry enough to permit a bulldozer to work there.

In general the above type of letter was highly successful, but in some cases the individuals responsible for the pollution did not respond. In such cases another and somewhat stronger letter was sent to Mr. Parkey, as the following example, dated June 17, 1955.

"On April 25, I wrote you about the serious pollution occurring on the J. R. Lakey properties, Overby and McFalls lease, near Valley View. At that time you assured me that you would contact the responsible individuals and see that some action was taken.

"On June 1, and again on June 15, I revisited the properties. The conditions are unchanged. I also investigated another lease, J. R. Lakey, Cottam lease. This also is a large area of barren, destroyed land with a large, leaking salt-water pit.

"On June 15, I made a check of the salt water pits belonging to this individual. Salt water flows in excess of one barrel per hour. The salt water runs approximately 15% salt. This means that approximately 1,000 barrels of salt per year are pumped into this pit. The pit holds but a tiny fraction of this amount. I have no idea how many years the pit has been in use but certainly many tons of salt have been pumped into the pit, to sink into the ground or flow out onto the ground, and to eventually reach and pollute the river. The salt water pits of the other leases are even worse.

"I mention this only to emphasize the seriousness of the pollution. The J. R. Lakey properties are among the worst offenders in the Wichita Valley. The salts from the three leases mentioned reach the Wichita River through ditches belonging to the Water Improvement Districts. We insist that you take action in the very near future."

As a result of the above letter, a conference of Water Improvement District and Game and Fish Commission personnel was held with Mr. Lakey on June 29, and plans for pollution abatement were agreed upon.

Whenever owners of polluting properties were local residents, we preferred to address correspondence to the Water Improvement Districts who then threatened civil court action against the lease owners on the basis of damage to land rather than to fish. When the lease owners were non-residents, we wrote them directly and sent carbons of the letters to the Water Improvement Districts, who also wrote to the lease holders. An example of a letter to a non-resident lessor, Mr. J. R. Gilbert of Boulder, Colorado, dated June 18, 1955, is as follows:

"This letter concerns an oil lease owned by you in the Wichita Valley near Valley View. In an area of about 20 acres, some of the worst salt-water pollution in this area is occurring. Destruction of land and fisheries resources in the Wichita Valley, by salt-water pollution, has reached such an extent that immediate action in the abatement of this pollution is imperative.

"The pollution discussed is under the control of four individuals or companies: Coppock and Coleman, Arkansas Fuel and Oil, Cox Drilling Company, and yourself. Mr. Coppock has agreed to reinject all salt water from his wells, and have the existing old pits and depressions that now trap rain water filled and leveled. Cox Drilling Company has installed injection pumps and is returning all salt water to the ground. Mr. Coppock tells me that they have also agreed to the filling and leveling of all pits and depressions. Arkansas Fuel and Oil Company have already taken care of all salt water by the installation of injection pumps.

"The principal remaining offender is your salt pit. This pit now produces salt water of about 15% salt at the rate of one-half barrel per hour, or approximately 500 barrels of pure salt per year. This salt immediately enters into the ground and flows to the drainage ditches through the ground water, destroying the land, polluting the ground water supplies, and eventually reaching the Wichita River to destroy fish and other aquatic life.

"Ordinarily we would act against the Water Improvement Districts who own the drainage ditches and thus are the immediate agents by which the salt reaches the river, leaving the Water Improvement Districts to bring suit against you. In the present case, however, abatement should be very simple. There is an injection well and pump located 100 feet or so from your salt pit. I understand the well is the property of Coppock and Coleman; the pump of Cox Drilling Company. Since I understand Coppock and Coleman is supervising the pumping of your well, they might well be willing to extend pipe to the injection pump and return your salt water to the ground as well as have the pit filled and leveled. I suggest that you undertake to get rid of the salt water produced on your lease in some suitable way in the near future.

"A copy of this letter is going to Mr. Fred Parkey, of the Wichita County Water Improvement Districts, who also will probably wish to contact you."

Mr. Gilbert wrote us, dated July 15, 1955, stating that he had written to Mr. Coppock and asked him to extend pipe to the injection well, and Mr. Gilbert also expressed his wish to cooperate with us in every way in pollution abatement.

In most instances, persons who consented to the correct disposal of salt water also willingly agreed to the filling and leveling of existing old pits, especially when

we were able to meet with them and explain our reasons for such fillings. Sometimes however, a letter about this was required. The following letter to Mr. Parkey, dated June 21, 1955, is an example:

"Reference is made to my communication to you of April 25, and the salt water pollution of the Wichita Valley. Among the properties we complained about are three which now show or have promised major pollution abatement.

"Mr. A. W. Komerak has agreed to close down one well that is making a great deal of salt water and fill and level existing pits and holes that trap rain water. The owners of the several Coppock and Coleman leases have promised to inject all salt water and fill and level all old pits and depressions on their properties that might catch rain water. On the Arkansas Fuel and Oil 'A' lease, all salt water is now being injected and the appearance of this lease is now markedly improved.

"With regard to the latter, however, the existing pits still trap a vast amount of rain water, even though some of the pits have been abandoned for a long period of time. This standing water forms a 'head' which forces salt-impregnated water down and laterally through the ground in the manner of a piston. Salt which has accumulated in the ground for years is thus forced into movement and reaches your drainage ditches and thus the Wichita River.

"If you will walk westward from the site of the injection well on the property under discussion, along your drainage ditch, you will see what I mean. From the injection well westward for a hundred feet the water in the ditch is 'sweet,' and supports minnows and green algae. There is no white salt crust beside the water. At the site of the first old salt pit, salt water seeps are located every yard or so and the salt content of the ditch water is a strong brine. Such salt seeps are found along the ditch the entire length of the two large pits located here. These pits give every evidence of being abandoned for years. As long as these pits remain, salt water will continue to flow to the drainage ditches, perhaps for years.

"We hope you will urge the Arkansas Fuel and Oil Company to fill and level these pits. If the depressions on this land are leveled and filled, rainfall will drain directly to the ditches and to the river without going through the earth. We judge that within a year or so the salt will be leached from the surface soil to a depth great enough to support shallow-rooted vegetation, such as grass, if proper drainage is established soon. We would also judge that the owners would welcome an opportunity to get rid of the numerous stagnant pools that now form an eyesore on this property.

"Trusting that you will take action on this, I am,"

Two weeks later we met with the manager of the properties mentioned in the above letter. He proved most cooperative and promised to request his superiors for funds to carry on the required filling. We have every reason to think that this lease will be cleaned up in the near future.

Our successes to date have been most gratifing. We judge that, as a direct result of our work, 100 or more salt pits have been abandoned or will be abandoned. Approximately half of the salt water pollution in the Valley View and Kamay areas has been stopped. There has been some stalling with regard to compliance with pollution abatement, but no outright refusals. We are continuing to contact the owners of offending properties.

IOWA PARK GARBAGE DUMP

The garbage dump of the city of Iowa Park is located on the very banks of the Wichita River. In times of high water, trash from the garbage dump is washed into the stream and carried downstream for miles. During rains, the water soaks into the garbage, and down through it until it reaches the old land surface beneath and then follows this hard surface to the Wichita River, leaching all the soluble and water-transportable materials into the river. Because action against a municipality is difficult, we discussed the situation with the executive vice-president of the Wichita Falls Chamber of Commerce on May 18, 1955. We were requested to submit a written report and did so on May 19. As a result of this report, the executive vice-president asked one of us to address the executive committee of the Chamber of Commerce at a luncheon meeting on May 28. At that time the association appointed a committee to look into the matter further and take what action seemed desirable to prevent further pollution of the river by the garbage dump. The report, addressed to Mr. William Black, Wichita Falls Chamber of Commerce, Kemp Hotel, Wichita Falls, is as follows:

"This letter is prompted by the newspaper accounts of the good work done by the Chamber of Commerce in cleaning up the Wichita River in Wichita Falls.

"In the course of investigations of pollution of the Wichita River I have traveled much of the river in a flat-bottomed boat. I have thus come upon a situation that will, I think, interest you and the Chamber of Commerce. This is the Iowa Park Garbage Dump.

"This dump is located on the actual banks of the river. Every major rise of the river sweeps refuse, old tin cans, automobile tires, etc., down the river. After heavy rains you may expect to find some of this debris deposited on the newly-sodded banks of the river in Wichita Falls.

"Less apparent but more serious is the nature of the dump. A rain will sink through the light surface cover and the garbage beneath, move horizontally when it strikes the old land surface beneath, and so enter the river. Thus the river receives a distilled essence of Iowa Park Garbage. Are Wichita Falls children going to swim in this in the new river-bank park?

"The state anti-pollution laws, as they pertain to game and fish, do not apply here. We do not know that the garbage dump seepage is killing fish, though it might. However, it is a disgusting situation and probably a health hazard. One would expect that there is a health department law against the establishment of a garbage dump within a certain distance of a public stream.

"We suggest that you investigate this matter further. We hope the city of Iowa Park can be forced to haul their old garbage back a mile or so from the river. We will be happy to hear from you and will assist you in any way we can."

WICHITA FALLS WATER PURIFICATION PLANT POLLUTION

Some of the most serious and disgusting pollution of the Wichita River is done by the water purification plant of the city of Wichita Falls. The gray sludge deposited in the Wichita River by way of Holliday Creek is one of the most prominent features of the lower part of the river. Many fishermen confuse this with sewage and either refuse to fish in the river or discard fish taken as unedible. Chemically the material is not filthy nor especially toxic. This physical pollution was also reported to the Wichita Falls Chamber of Commerce and to their executive committee at a luncheon meeting on May 28, 1955. A committee was appointed by this association and action on abatement has been left to this group. Our report to Mr. William Black, Executive Vice-president of the Chamber of Commerce, date May 19, is as follows:

"The excellent work done by the Chamber of Commerce in cleaning up the Wichita River in Wichita Falls leads us to suggest a similar project which the Chamber of Commerce might sponsor. This is a 'cleanup' of Holliday Creek.

"From Lake Wichita downstream to the entrance of the City Water Purification Plant effluent, Holliday Creek is a pretty stream, deep and relative clean. It contains an abundance of aquatic vegetation and aquatic animals, including mink, muskrats, black bass, channel catfish and other game fishes. Many persons, especially of the colored population, fish in the creek for recreation and food.

"In the past the lower parts of the creek were polluted by various industrial wastes. The Game and Fish Commission has stopped most of this pollution by warning the guilty individuals and firms and, in some cases, threatening court action. Only one principal source of pollution remains and about this we have been unable to obtain any satisfaction. This is the waste from the City Water Purification Plant.

"The plant filters Lake Kickapoo water, flocculating the suspended solids. These solids, all the collected muck from the Lake Kickapoo water and the flocculating agents, are then dumped into Holliday Creek. The sludge is a finely divided, grey-green slime, and is the polluting agent. It enters the creek in great volume and silts up the creek channel so greatly that the stream is a narrow channel through a broad fill of gray, stinking, oozy muck, from the point of pollution to the Wichita River. The muck enters the river in quantity. There it forms a part of the suspended burden of the river water, coloring the water, increasing the turbidity, cutting down light penetration in the rapidly moving parts of the river and forming muck deposits where the river runs more slowly.

"In concentrated form the pollutant is lethal to fish, probably by clogging their gills. The muck rapidly settles out, however, leaving supernatant water of good quality. Nevertheless game fishes are unable to live in the lower parts of Holliday Creek. The shifting silt and muck from the purification plant covers aquatic vegetation, insects and other small animal life, depriving fish of their food. Seining shows clearly that game fish are now absent from the lower creek. Before the filter plant was established, bass and catfish were common in the creek.

"Although our principal interest is in restoring several miles of fishing stream, the Chamber of Commerce may be more interested in the aesthetic aspects of the pollution. Two main highway bridges in Wichita Falls cross Holliday Creek: the Henrietta Highway and the Jacksboro Highway. From the latter the pollution is especially obvious. The stream valley is filthy with purification plant muck.

"Of all agencies, one might expect the water department to be most sensitive to pollution. Apparently, however, their interest extends only to pollution of the water before it reaches the city. When we applied to Mr. Woody Gorham, manager of the plant, we were given only excuses. One, that other cities do the same thing. This is no excuse. Second, that the volume of material made it impossible to dispose of it in any other way! In other words, they have so much filth they must throw it into a public stream to get rid of it. Third, we were told that any other method of disposal would be expensive and impractical. This we deny.

"Our experiments show that the muck settles out of the water with extreme rapidity. The resultant water, free from muck, is of very good quality. It would be very simple to run the sludge into a settling pit, with an alternate, standby settling tank.

If these pits are about one-half acre in surface extent, the muck would settle out and clear water of good quality would run out the other side. When one pit filled, the sludge could be turned into the other pit while the first was cleaned. The dried waste could be used as fill or even as topsoil in city parks. It should be quite productive.

"We are unable to estimate the cost of the control measure suggested but it should be minimal. Certainly it cannot compare with the cost of controlling wastes in refineries and other industrial concerns. If these concerns are compelled to cease pollution in Texas, why should a city be exempt?

"The existing conditions are an open violation of the state anti-pollution laws. When our attempts to obtain satisfaction from Mr. Gorham failed, we consulted with our Austin office. There we learned that bringing a suit against a city is difficult. An injunction would have to be based on existing conditions. In this case, a court order to stop purifying the city water. This is impossible and undesirable, and we appeal to you.

"The present nasty condition of the creek influences persons to further pollute the stream, emptying refuse, etc., into the mud. We feel that if the water plant pollution stops, the attitude of persons living near the creek will also change. If the pollution can be stopped, a few good rains will scour the muck from the creek channel and the water will again be made productive to aquatic plants and fishes. Further, the present eyesore can be turned into a pleasant stream which will attract rather than repell visitors.

"We will be happy to furnish further information as to the conditions described. We hope you will visit the bridge across the Jacksboro Highway and look at the creek. We do, most sincerely, hope that the Chamber of Commerce will bring pressure to bear on the persons responsible for this condition and force them to clean it up."

PLUM CREEK REFINERY POLLUTION

Plum Creek is a small stream that enters the Wichita River from the north just east of Wichita Falls. This stream is used as an effluent by several industrial concerns in this area. Several serious instances of pollution have occurred, three of them taking place during the past project year.

On or about January 10, 1955, the local refinery of the Panhandle Oil Corporation released, prehaps by accident, a toxic material that killed fish from the mouth of Plum Creek to and into the Red River. We were called into the case, in the Red River, by game rangers from Oklahoma. A joint study of the polluted waters and dead fish was made on January 12. Game Warden W. C. Cave, of Wichita Falls, called on the refinery officials and was assured that the pollution was accidental. The County Attorney of Jefferson County, Oklahoma, also visited the refinery but failed to obtain any assurance about future pollution.

On March 17, an oil pipeline belonging to the Texas Pipe Line Company, from which oil was pumped from the Continental Oil Company refinery to the Texas Oil Company, broke at Plum Creek and released several hundred barrels of oil into the river. This oil ignited or was ignited and burned fiercely for several hours. Probably the fire and the oil destroyed fish and other aquatic life, but the remaing oil did even greater damage and this damage is still continuing. Blobs of oil floating on the surface gather dust,

dirt and organic debris until they become heavy and sink to the bottom. There they smother all plant and animal life on the portion of the bottom they cover. The dead protoplasm decays and forms gas bubles that cause the oil blobs to float to the surface again. There the gas bubles expand due to increased temperature and lowered pressure, usually causing the oil blobs to overturn and spill the bubbles. Free of gas bubbles, the blobs again sink. On a warm day thousands of these small blobs can be seen as they rise to the surface, turn over, and sink again. Each time they seem to travel downstream a few yards. At this rate, destruction of aquatic life by this oil will continue for months or perhaps years. No action was taken against either of the companies involved.

On April 12, the Continental Oil Corporation refinery apparently ceased all attempts at pollution control in Plum Creek. Materials were dumped into the creek, and thus into the river, that killed thousands of fish in the Wichita and Red Rivers. We checked the river and took water samples at numerous places. Sometimes we drove our boat through floating rafts of dead fish. Flathead catfish as large as approximately 40 pounds were noted dead on the bank.

On April 18, a meeting was held in the office of the Wichita County Attorney, Donald Short. Present were: Mr. Fred Parkey and Dr. Carl Gray, of the Wichita County Water Improvement Districts; Mr. William Anderson, County Attorney of Jefferson County, Oklahoma; Mr. Hugh Fitzsimmons, County Attorney of Cotton County, Oklahoma; Mr. Woodrow Wilson and Mr. Ernest Lovett, Game Rangers of the Oklahoma Game and Fish Department; and Game Warden Morris Stallcup and the writers, representing the Texas Game and Fish Commission. Warden Stallcup filed an injunction petition in the 89th. District Court against the Continental Oil Corporation as a result of this meeting.

The outcome of the injunction was gratifying. The regional superintendent of the Continental Oil Corporation called on Game Warden Stallcup and promised to install additional oil skimmers, to neutralize all solutions, and in general to place in the Wichita River only purified, clean water. On this basis, on May 17, dismissal of the injunction was requested by Warden Stallcup. Action has not yet been taken on this petition. Excavations have been started on the new water purification apparatus in the refinery.

Analysis of the water in the effluent ditch on April 12 showed: calcium 24 p.p.m., sodium 2,323 p.p.m., chloride 1,058 p.p.m., sulfate 2,706 p.p.m., carbonate 300 p.p.m., bicarbonate none, free hydroxyle 102 p.p.m., and pH 10.30. The following summary of the chemical analysis was furnished by us to Mr. Stallcup for use in his injunction petition:

"The samples were taken on April 12. Lab. No. 591 was taken from the effluent ditch of the Conoco refinery. It was brilliant red in color and contained a suspended precipitate that settled out as a dark red solid in a few hours.

"The Panhandle effluent ditch contained clear water with a trace of oil slick. This is Lab. No. 590.

"The two effluent ditches join just above the Old Charlie Road. The clear water of the Panhandle ditch diluted the red water of the Conoco ditch and the water of the common refinery ditch was pink. A sample was taken at a point below the junction, where waters of the two ditches were well mixed. This is sample No. 589.

"Sample No. 588 was taken where the common ditch enters the Wichita River. This was taken several hours later than the first three samples. The site was visited by boat.

"The water from the Conoco ditch is lethal to fish and other aquatic organisms as well. The pH and the free hydroxyle show the water to be caustic. It would burn the gills of a fish and kill it in a very short time. This caustic material apparently forms some insoluble hydroxides in the mixture of chemicals in the polluted water, accounting for the precipitate that settled out of the sample. This precipitate might well be toxic also. Note that the pH drops from 10.3 in the Conoco ditch to 9.12 in the common refinery ditch, where mixed with Panhandle water, and to normal 8.12 at the river.

"It is impossible to identify organic compounds in such a small sample as was available to the chemist. However, he has done very well with what he had available. He stated (private communication) that he had tasted the water and remarked 'It was the vilest thing I can ever remember having tasted.' This, remember, was only a trace.

"The organic compounds on the basis of boiling range were possibly of the napthalene type, as might also be suspected from their source in a refinery. It is likely that organic compounds of the type found would be extremely poisonous to aquatic life.

"The polluted water was also found to be an extremely efficient reducing agent. It would remove all oxygen from the water and even from the gills of the fish as well.

"In conclusion, the Conoco water might kill fish by caustic action, poisoning from the red precipitate, poisoning from the organic compounds (almost certain) and suffocation due to reduction of oxygen."

SUMMARY

The numerous instances of industrial pollution encountered during the course of our investigations of the Big Wichita River are described in detail, along with samples of pertinent correspondence and an account of actions taken to achieve abatement. To date, nearly every case we have worked upon has resulted in the complete abatement of the pollution or a promise of abatement in the very near future, accompanied by satisfactory guarantees of good faith. Although pollution studies of the Big Wichita River will not be extended into the next project year as a separate job, it is expected that pollution investigations of this stream will continue.