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C. O. Bates

H. R. Hendricks

CEDAR RIVER AT CEDAR RAPIDS, IOWA

C. O. Bates and H. R. Hendricks

For thirty-seven years we have noted with regret the gradual increase in the pollution of our river, in fact the increase has been quite rapid during recent years. During that time the inhabitants on the banks have increased three-fold while the amount of pollution that is put into the river has increased probably three-thousand-fold. A third of a century ago the Chlorine as Chlorides was three parts per million, the normal amount for unpolluted water in this region; now it is ten. A half a century ago when the Cedar Rapids water works were first built, raw water was put into the mains and for twelve years used for drinking water by a large per cent of the inhabitants.

The general tendency of the people is to move to cities and to build modern homes. Every home is now expected to dispose of all of its waste by putting it into the river. In fact our municipalities in many instances require us by law to do so; but the municipalities have no right according to the correct interpretation of the common law of riparian rights to destroy the usefulness of the river for the people who live further down. The question before us is a municipal one rather than an individual one. In fact, as our river passes from State to State it becomes a Federal question, and the prevention of its pollution is becoming one of the most important issues of the present time.

The State Board of Health has ordered the Cities of the Cedar River valley to take steps toward keeping our river and its tributaries free from pollution. This is at once a great burden, a mined by time required to kill, but when phenyl methyl has an greatest challenge that has ever been presented to us. Shall we accept the challenge of our State Board of Health and begin at once to educate our people to the necessity of keeping our river free from polluting and poisionus material? The situation is a serious one when we face the facts. We seem to be afraid to look at the matter fairly and squarely.

In order to properly estimate the problem before us, we will glance at the geological features of the Cedar River Valley. The Cedar River has its source in southeastern Minnesota, in Dodge

and Freeborn Counties, twenty to twenty-five miles above the northern boundary of Iowa. It has a length in the general course of 225 miles, and a total drainage area of 7930 square miles. The upper basin of the river has a width of about fifty miles. The lower basin is much narrower and below Cedar Rapids measures only eight and nine miles in width. From its source, the width of the River increases until at Charles City it is from 150 to 200 feet. At Cedar Rapids it is 800 feet. About one-fourth of the inhabitants of the Cedar River Valley live in Cedar Rapids and vicinity.

The following is an approximate tabulation of the slope of the Cedar River. From Cedar Falls to Cedar Rapids, total fall of 124 feet in a distance of 73 miles, giving an average slope of 1.7 feet per mile. From Cedar Rapids to Moscow, total fall of 112 feet in a distance of 47 miles, giving an average slope of 2.38 feet per mile. From Moscow to the mouth at the Iowa River, total fall of 87 feet in a distance of 56 miles, giving an average slope of 1.55 feet per mile.

The U. S. Geological Survey placed three stream gauges on the Cedar River; one at Cedar Rapids, one at Janesville, and one at Clarksville. From these guages some very important data have been gathered.

The one in Cedar Rapids is about a half mile below the dam and 1000 feet above the Eighth Avenue Bridge. The elevation of the zero of the guage is based on levels of the Chicago and Northwestern Railway Bench mark 723.03 feet above sea level. The drainage area at this guaging station is 6640 square miles. The river bed is composed of rock and gravel, is free from vegetation and practically permanent, making it one of the best river beds in the Mississippi Valley.

According to the Government guage at Cedar Rapids the average discharge at Cedar Rapids is about 3300 cubic feet per second which amounts to something of 2,000,000,000 gallons per day. Cedar Rapids uses 5 million gallons daily about $\frac{1}{4}$ of 1% of that amount for her water supply. During the period between 1902 and 1903 the maximum discharge occurred on April 1, 1912, and again on March 26, 1917, amounting to 54,100 cubic feet per second, while the minimum discharge was probably somewhat less than 400 cubic feet per second during the latter part of December 1916.

The surface of the country in the Cedar River Valley is a general undulating prairie, level in some sections with a moderate amount of timber fringed with brush. Peat beds and marshes

are found in the northern counties and there are a few important lakes in this basis; Freeborn and Albert Lea Lakes in Minnesota, and Clear Lake in Iowa.

The section drained by the Cedar River has a drift soil largely a sandy or gravel loam. The entire course of the River is over the firm compact limestone of Devonian formation. The stream and its tributaries are said to have more numerous and extensive exposures of rock along its valley than any of the other Iowa rivers giving the natural means of self purification. The exposures usually appear as rocky banks to the stream, rising as cliffs sometimes to a height of twenty and thirty feet. The drift is well supplied with springs; one of the most prominent of these is the well known McLeod Springs at Cedar Rapids.

It is both significant and suggestive that we as a valley begin this enterprise. It was in valleys that civilization first developed, namely along the Nile and the Euphrates. Community wells and methods of impounding water were in vogue at that time. Water supply may be regarded as the first step in community service. It antedates fire protection, systematic relief for the poor, and even education, as well as many other community activities we now enjoy.

The question of public and private ownership does not enter into this issue. The river is of necessity owned by the public and will of necessity have to be controlled by City, State and National Legislation.

The rising tide of the interest in this question is attested by the action of numerous civic organizations in making requests for public health surveys, by the just complaints of citizens, and by drastic resolutions requesting that the menace of polluting our streams be abated. The devotion of many high-minded, public spirited men, including Secretary Hoover and President Coolidge, have been moved by the imperative need of immediate action to prevent such growing devastating effects, and are giving their best efforts to bring about the needed reform.

The recent action of our State Board of Health has been supported by the medical profession, the fish and game department, the conservation congress, the Isaak Walton League, and especially by the School of Wild Life held at McGregor, Iowa, each summer. Our State Board of Health has in mind as the matter of first importance, the health of the people, second to this, the menace to the fish and wild game of the State, and they have decided not to wait, as many of the older States have done, until the streams are beyond recovery.

They, therefore, request "that no individual waste, sewage, or anything deleterious to public health and to animals, fish or wild game be discharged into our streams and rivers by individuals, communities or industrial corporations, and call upon all public spirited citizens to aid in this matter to support the local authorities in the effort to enforce the laws against stream pollution and prevent the consequences that follow from such pollution." They further specify "that the cities of Cedar Rapids, Waterloo, and the leading industries of their cities as well as the cities of Vinton, Cedar Falls, Waverly and Nashua, shall forthwith proceed to the preparation of plans and specifications for sewage treatment plants." They also demand "that all oily wastes from public and private garages which are discharged into the sewers shall cease, and failure to keep such a demand shall result in prohibition of the use of the sewers and drains."

The question of taking care of all the wastes of a city is no small undertaking. It is a problem of great magnitude, and far reaching in its consequences. It demands our best thought, the application of our scientific knowledge in engineering and chemistry, as well as in bacteriology and hydraulics. It should be entered into with sane and deliberate mthods, taking into consideration the financial aspects in question with reference to the industries, and the cities on which rests the burden of making the required changes.

We can in no better way call attention to the immediate need of protecting our river than by citing the serious condition that now exists. Ice put up from some of the impure tributaries became so foul it had to be thrown away. This happened at Rockford and several other places; also the fish have been killed in several of our smaller tributary streams because of the polluted condition of the water. It is said on good authority that certain game fish from the Mississippi River have not for the past few years come up our river because of the great amount of pollution. All these conditions are having a tremendous effect in arousing public sentiment in favor of some immediate action.

The general condition throughout the country is somewhat similar and in some places is even more aggravated than here. Only about thirty-three per cent of the cities of 100,000 population or over have sewage disposal plants. Of the cities from 25,000 to 100,000 not more than fifteen per cent have sewage disposal plants.

No evil was intended by any one in bringing about this condition of our rivers. It developed naturally on account of the methods in vogue in disposing of waste material, namely: by getting rid of it

in the easiest possible way; dumping all sewage into the river was the easiest way. When all the villages and cities along the river and its tributaries begin doing the same thing it simply converts a river into an open sewer. When the creameries and other industrial plants dispose of their wastes in the same way, it is no wonder that the fish cannot live.

The Cedar River was once considered one of the most attractive and beautiful rivers in this part of the country. The Federal Government has spent a considerable sum of money in stocking it with fish, but it begins to look like such work was to no purpose.

It is certainly time for us to become acquainted with the real conditions of our river. The question has been asked whether or not sewage can be purified. In many instances where the disposal plants have been properly installed, it has been proved that sewage can be satisfactorily purified. The discovery of the underlying principles by which this work has been accomplished is due to the research efforts in chemistry and biology.

It is unfortunate that so many of our scientific achievements are concealed in language far removed from the appreciation of the average person. The fact is, it is a simple matter, as simple as ordinary combustion. The real act of disposing of sewage is pretty much the same as we may dispose of garbage — the garbage is fed to the hogs, the sewage we feed to bacteria. The action of the bacteria is somewhat more complicated inasmuch as they are plants instead of animals.

The science of bacteriology has given us valuable knowledge as to this process. The whole process is best conceived of by considering the action simply as an act of oxidation that may be illustrated by common every day occurrences. Potato peelings when left exposed to the atmosphere will become discolored, will shrivel up and finally disappear owing to the kind of bacteria which take oxygen from the air and causes it to combine with the potato peelings. This is commonly spoken of as slow combustion. It is taking place on a large scale in the slow combustion of the leaves of the forest as they fall to the ground and disappear year after year.

Another kind of action takes place wherein the bacteria do not demand atmospheric oxygen but take their oxygen from the substance that is decomposed. Such combustion may be illustrated by the action of bacteria in canned corn not completely sterilized, where the result of the combustion is shown by the bulging of the can. No atmospheric oxygen was needed for such combustion; only oxygen in the composition of the corn was used. The bac-

teria that demand atmospheric oxygen are called aerobes; those that do not demand atmospheric oxygen but get their oxygen from the substance decomposed are called anerobes. The disposal of waste depends on the proper handling of these two kinds of bacteria. They will purify the worst form of sewage and not only render it perfectly harmless, but also produce a mineralized humus which is useful as a fertilizer.

Under proper conditions the bacteria will do a wonderful amount of work in a few hours. It is said that on an area of a square mile taken almost anywhere the energy developed by bacteria is greater than all other energies combined, whether we measure it in foot-pounds, horse-power, kilo-watts, or any other way.

During the last two decades great interest has been aroused in city and national parks, camping grounds for auto travelers, recreational grounds, community entertainments for the public, etc. Play grounds for our public schools are becoming an integral element in our educational system.

All these services show the temper and trend of our civilization. They also lend their support to the sportsmen who have for a long time been clamoring for help against the death dealing pollution of our streams. Their day has arrived. Among the various organizations that may be denominated as conservationists, the Isaak Walton League has led the way in bringing about a significant legislative act. This occurred upon June 6, 1924, when President Coolidge signed the bill for setting aside three hundred miles of the upper Mississippi River Valley, beginning at Rock Island, for "Wild Life and a Fish Refuge." This is said to be the greatest conservation act in this part of our country.

The beauty and value of our river is passing away. It is losing its attraction and its significance. We are far removed from its primitive purity and pristine beauty. Our forefathers were certainly attracted to this stream on account of its beauty, purity and value.

The time is ripe for a movement to prevent further deterioration of our rivers and streams. Twenty years ago, or even ten years ago, a suggestion of this kind would not have met with approval, but rather would be met with scoff and scorn. Now the idea meets with almost universal approval.

The fact that we exert ourselves to remove the evils of pollution has intrinsic value. Quest as well as conquest has its significance in the evolution of our civilzation. The matter of creating a wholesome and uplifting environment has a great educational value. What we term as a cultured life — or the spiritual life, is

influenced in a great measure by our surroundings. It is a means of conserving, fostering, and creating the finest values of the human spirit. It is said that the soundest spiritual life must have an adequate material basis. We are accused of being materialistic, partly because we have made such progress in the last century in our knowledge of material science. It is a mark of wisdom for us to concentrate on the higher values now, especially it is important for us to get the proper perspective of the scale of values and to realize that the material values belong to the lower order on which we are to build our civilization. This is a period of rapid transition in the political world, religious world, economical, and industrial world. Science is being humanized and made to bear upon every evil. Let us put forth our best efforts to bring back our streams to their primitive, purity, and pristine beauty, not forgetting the fact that to him that hath shall be given, and to him that hath not shall be taken away even that which he hath.

Summary

1. Good water supply antedates good roads.
2. Good water supply means protection of fish life.
3. Good water supply means elimination of water borne diseases.
4. Self-purification of streams is often deceptive.
5. Self-purification of streams is limited to their digestive capacity.
6. Digestive capacity is limited to the amount of dissolved oxygen.
7. We are over-taxing the digestive capacity of our streams.
8. Good water should be rich in dissolved oxygen, contain few bacteria, and have a small amount of organic matter.
9. Polluted streams lower our sense of decency.
10. Converting our streams into open sewers is repulsive.
11. The waste from our cities and industries can be converted into a hygenic and useful product.
12. Stream pollution is a crime of this age.

Cedar Rapids, Iowa.