Proceedings of the Iowa Academy of Science

Volume 52 | Annual Issue Article 26

1945

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DEPOSITION OF SEDIMENT IN THE IOWA RIVER AT IOWA CITY, IOWA

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HISTORY AND DESCRIPTION OF THE AREA

The Iowa River in the vicinity of Iowa City (Fig. 1.) is a mature stream which meanders over the Kansan and Iowa till plains in its course to the Mississippi River. The river, gathering water and sediment from the 3,230 square miles of the drainage basin which lies up stream from Iowa City, flows by as a muddy stream with an average discharge of 1,432 cubic feet per second (Crawford, 1942). Although some times heavily charged with sediment, it is on the whole not a heavy suspended sediment carrier as the average concentration of sediment in parts per million over a three year period as tested at Iowa City was 674 (Lane, 1945).

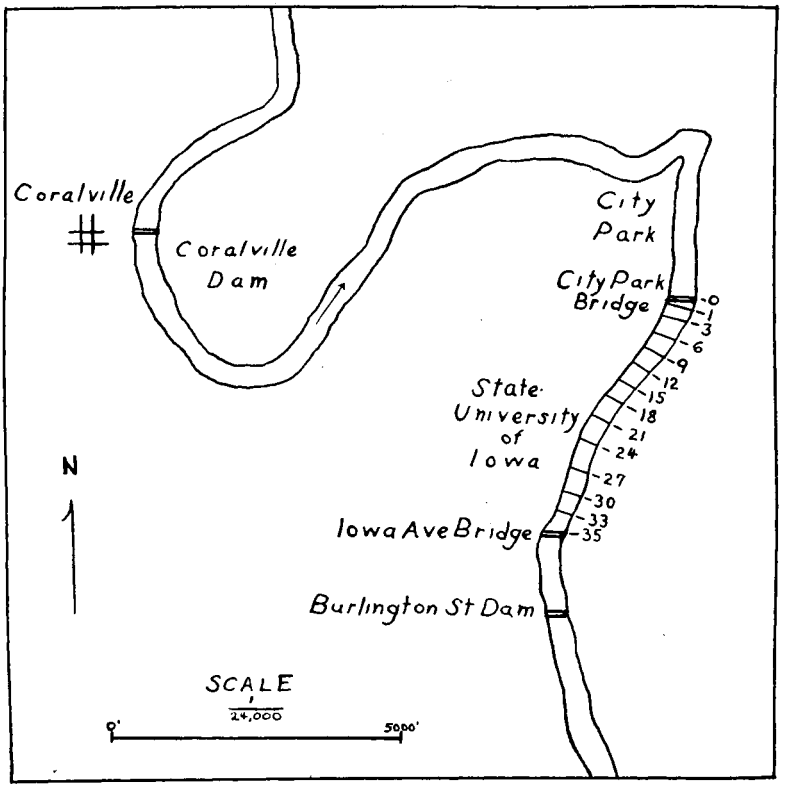

Fig. 1. Index map showing location of pool and ranges at Iowa City, Iowa.

As early as 1843 (Iowa River Report, 1930) attempts were made to dam the Iowa River at Iowa City to utilize the stream's power. At this time a very low, simple dam was constructed of timber, plank and stone at the northern limits of the city to provide power for a grist mill (Fig. 2). This dam, called the Terrill Dam, was partly washed out in 1904 and the remainder removed in 1909. The

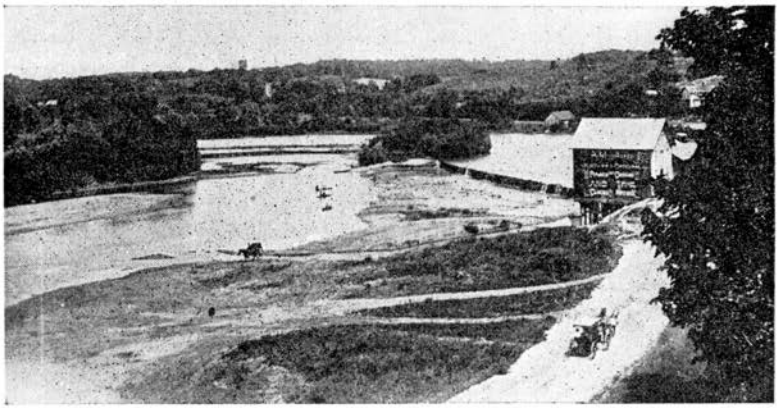

Fig. 2. The old Terrill Dam on the Iowa River at the northern limits of Iowa City, Iowa. About 1900.

dam which forms the present pool at Iowa City was built in 1906 and is referred to as the Burlington Street Dam; it was built and

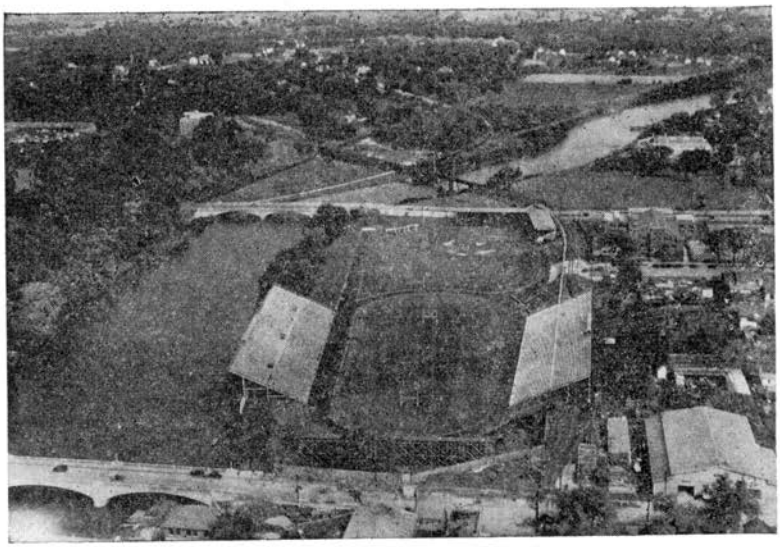

Fig. 3. Air view of the Iowa River looking upstream showing shore line characteristics before modification. Burlington Street Dam and Bridge in lower left. About 1924.

is owned by the State University of Iowa. It is a fixed type of concrete dam 300 feet long creating an average head of 8.5 feet. The pool created has an area of about 150 acres and an elevation of 650.8 feet above sea level. This pool extends upstream about four miles to the Coralville Dam and holds enough water to be a competent reservoir for the power plant near the dam. This power plant has a capacity of 333 cubic feet per second, a supply which the river assures under normal conditions.

Since the building of the dam and the formation of the pool, other man-made artificialities have been forced upon the river in this vicinity (Fig. 3). From 1934 to 1940 the University carried on a project of beautifying that part of the river which flows through the campus by constructing artificial banks in the form of

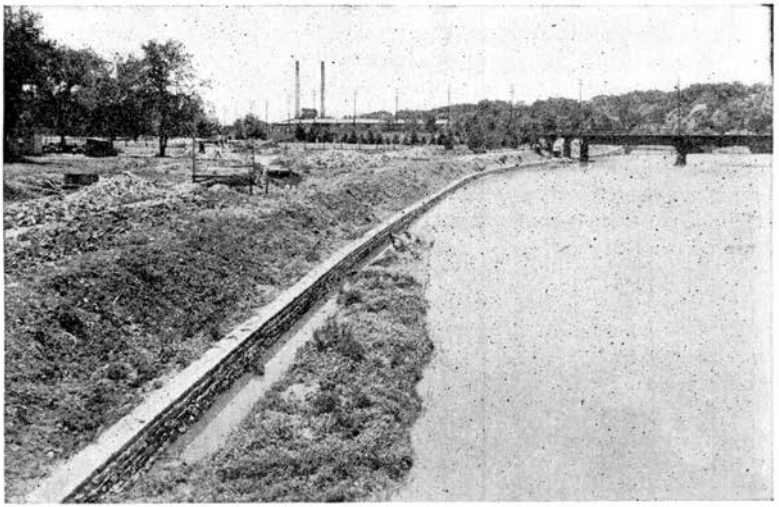

Fig. 4. Downstream view showing east bank of the Iowa River at Iowa City, Iowa. The stone wall was constructed first and then the unsightly material in the river (foreground) was dredged. The Iowa Avenue Bridge is the second bridge in the background. 1935.

stone walls (Fig. 4). These artificial banks were much wider apart than the natural banks; therefore the stream was wider and more shallow than it naturally would be—a factor very favorable for sediment deposition. In 1939 the course of the river was somewhat altered when a cut-off was created through the northern tip of City Park by cutting off a meander. This action was necessary to prevent the river from under-cutting the east bank and endangering state highway No. 218 at the northern limits of the city.

Nature of the Problem

The construction of a dam across the Iowa River at Iowa City,

Iowa created a pool; this study deals with the deposition of sediment in this pool. Any barrier across a stream will create a pond in which deposition is favorable because of the loss of velocity of the transporting medium. A stationary dam which completely blocks the flow, forcing the water over the top is much more favorable for the collection of sediment than is a movable type dam (Péwé, 1944). Reservoirs completely filled with sediment can be found in many places throughout the United States. The nearby dam at Keokuk, Iowa, is of the stationary power type and when built in 1913 had a storage capacity of about 500,000 acre feet; but 15 years later it had reduced its storage capacity by 23 percent by collection of sediment in the pool. Soundings in 1936 showed the storage capacity to be reduced by 30 per cent (Péwé, 1944). If the earlier rate had been kept up, the pool would have been filled in 50 years (Gustafson, 1944).

The reduced capacity of the Iowa City pool is vital because this is the source of the water utilized by the University Power Plant; however the chief drawback of sediment deposition in the lower end of this pool is the destruction of the scenic value of the river. This factor is of little or no importance in most reservoirs; however in this instance continued deposition creates large mudflats and sandbars which are a definite blemish to the beauty of the campus (Fig. 5). This value cannot be measured directly on a monetary

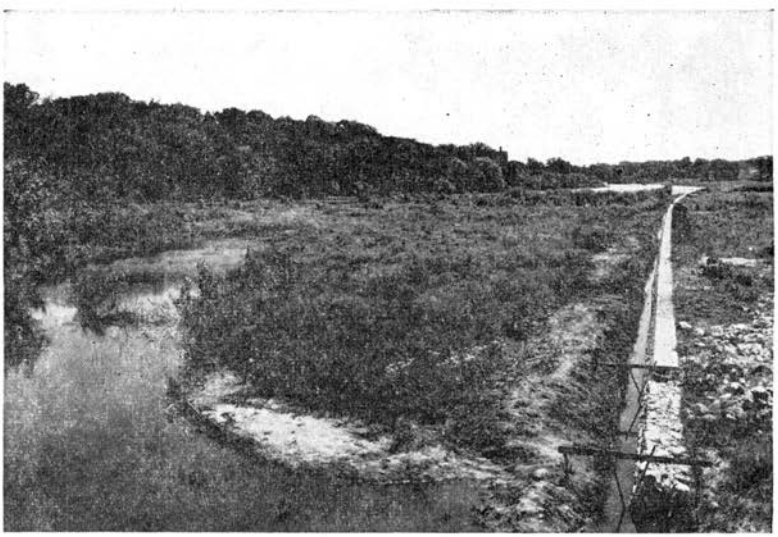

Fig. 5. Downstream view from City Park Bridge showing the enormous deposits along the newly constructed stone walls before the material was dredged to make the river wider. 1935. (By 1942 sediment deposition had built up deposits of approximately the same size and position as those shown in this view).

scale, but when one considers the amount of money spent on the beautification of the river on the campus during the years 1934-1940 it becomes apparent that this intangible factor ranks quite high in the plan to beautify the campus.

The reservoir is not necessary for an adequate supply of water for domestic purposes in Iowa City as the average water consumption by the City for this purpose is approximately one million gallons a day; the lowest natural flow ever recorded in this vicinity on the Iowa River was ten cubic feet per second or over six million gallons a day (Crawford, 1941).

Features of the 1938-1939 Soundings

The sediment accumulation finally reached such a state that the lower portion of the pool was dredged during the Fall of 1938 and the Summer of 1939. The reach dredged was from the dam to the City Park, a distance of one and one-half miles. The material dredged was placed along the banks of the river and held there by stone walls. Much of this material was subjected to high erosion loss until the introduced vegetation gained control. During the same period, the City Park cut-off was created; sediment dredged for the cut was dumped into the abandoned meander.

Before the dredging was started, a series of ranges spaced every 100 feet were established on this reach from City Park Bridge to the dam, a distance of about 4,900 feet. Station or range No. O was placed at the City Park Bridge and station No. 48 was placed a few feet upstream from the dam. These ranges were set up under the direction of Arthur Smith, then head of the Grounds and Building Division of the University. Capped steel pipes with the station numbers stamped on them were permanently placed every 100 feet along both sides of the river about one-half foot behind the rock boundary wall. These served as markers and a cable was strung across the river from them. This cable was marked off in ten foot intervals and the crew in the boat used the cable as an anchor as they took soundings with a rod and weighted line every ten feet across the river.

The soundings of the summer of 1938 were plotted, and after the dredging in 1939 the sounding operations were repeated. These 1939 findings were plotted with the earlier measurements; however, the 1939 soundings were taken only on the first 34 ranges. Therefore, this paper is concerned with only the dredging and deposition which occurred between ranges No. O and 34 or between City Park Bridge and the Iowa Avenue Bridge, a distance of about 3,400 feet.

A study of the soundings taken in 1938-1939 reveal that approximately 84,000 cubic yards of material was dredged from this 3,400 feet measured section. The dredging removed all the unsightly mudflats and sandbars from the river, producing at least for 1939, 1940, and 1941, a stream which was of scenic value to the campus (Fig. 6).

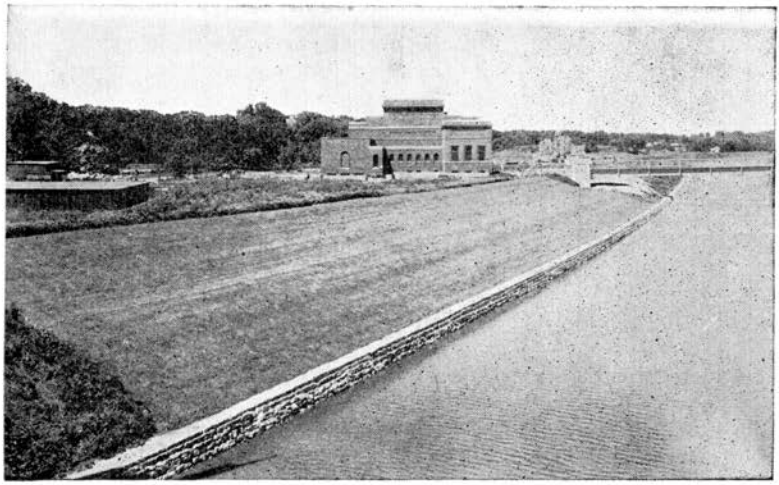

Fig. 6. Upstream view of the river showing the beautiful stream bank created as the result of described modifications. Campus foot bridge in right background.

FEATURES OF THE 1942 SOUNDINGS

By 1942 there were again visible mudflats and sandbars in the reservoir, evidence of the gradual but steady sediment accumulation in the pool (Fig. 7). The conditions seemed to be approaching the

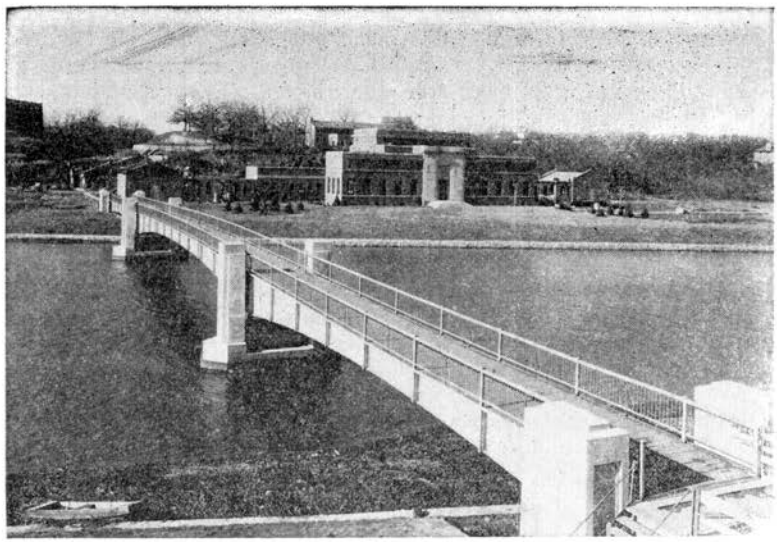

Fig. 7. View of Iowa River and foot bridge taken from the Union Building. This view shows the type of sediment deposit which was apparent again in the river by 1942.

pre-1938 stage, and in order to determine the approximate amount, rate, and position of sediment deposition in this pool, a series of soundings were undertaken by the writer in April 1942 on the ranges previously established between City Park Bridge and the Iowa Avenue Bridge. The 1938 steel pipe markers were practically intact and were used as station markers following the same station numbers established by the preceding work. Because of the extreme limitations of time, equipment, and personnel, only every third range was used, with the exception of the first two and the last one. The stations which were utilized were numbers 0, 1, 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, and 35. (Fig. 1). Soundings were taken every 20 or 30 feet instead of every ten feet. Readings were taken with a five foot rod and a weighted line; no cable was used as the boat was kept on a fairly straight line by sighting shore markers.

The generalized results obtained were compared with the previous soundings and the following conclusions were drawn:

(1) In the three year period between 1939 and 1942 approximately 59,000 cubic yards of sediment was deposited in the measured reach.

(2) It was evident that the stream was rapidly filling the pool with sediment, in fact during less than a three year period over one-half of the amount which had been dredged out of the measured section in 1939 had already been replaced. In some instances the deposition had covered the stone border walls. Further deposition will probably not be so rapid as the early quick-filling period is past. Although perhaps more deposition occurred during the first year after dredging than during the second or third, it can be stated that the reservoir was filled at the average rate of 23,000 cubic yards a year or on the average of 60 cubic yards a day. These figures are computed with the assumption that the period of deposition from 1939 to 1942 was approximately two and one-half years. Assuming that a cubic foot of sediment in place weighs 150 pounds, the material was deposited at an average rate of 133 tons per day for the 1939-1942 period. It is interesting to note that the average figure of tons per day from the three year record (1937-1941) of suspended sediment carried by the Iowa River in the vicinity of Iowa City according to Lane (1945) was 4219 tons per day.

(3) The position where the deposition was the greatest was in the broader and more shallow portions of the reach which occurred in the upstream division of the measured section. In this upper portion the river was about 262 feet wide and five to six feet deep; in the lower portion it was 150 to 170 feet wide and eight to nine feet deep.

Deposition tended to occur in the same relative positions occupied by the pre-dredging deposition. The two greatest areas of accumulation were on the west bank from ranges 0 to 15 and on the east bank from ranges 21 to 33 (Fig. 1). The ranges which recorded the greatest deposits were numbers 0, 1, and 3. (The cross-sections

developed from the 1942 soundings are now located in the Geology Department of the State University of Iowa).

ACKNOWLEDGEMENTS

This study is an outgrowth of a project undertaken in Geology Sedimentation Seminar under Dr. A. C. Trowbridge at the State University of Iowa. Many thanks are due to Mr. Arthur Smith, former head of the University Power Plant, for his cooperation in obtaining information about the 1938-1939 soundings and to Mr. R. J. Phillips, superintendent of the Division of Maintenance and Operation, for his aid in gaining historical data. McMahon manned the boat during the 1942 sounding operations. The drafting of the map was done by Richard F. Peterson and the photographs are through the courtesy of Mr. F. W. Kent.

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