

HARVEY D. FARGO



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THESIS

Survey of Portion
of the Red Cedar River

H. D. FARGO

J. H. HEDGES

1903

Surveying

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Survey
Thesis--Survey of portion of the Red Cedar River by
H. D. Fargo and J. H. Hedges.

The purpose of our thesis was to investigate the possibilities of the Utilization of a portion of the Red Cedar River for water power, and to determine the best location for a dam. The investigation covered that portion of the river lying between a point four hundred feet west of the bridge, on the road leading south from Harrison Hall, and the east line of the college farm.

Our method of procedure was as follows: In the fall of 1902, we located a line of bench-marks along the entire length of that portion of the river which we were to survey. These bench-marks were located, usually, on the roots of some large, prominent tree, near the water's edge; a large spike was driven in, and the tree liberally blazed, so as to be easily discovered by aid of the notes. The distance between bench-marks varied from five hundred to eight hundred feet, and the elevation of each was referred to a datum plane, one hundred feet below the bench-mark on the north-east corner of College Hall. No work was done in the following winter, but, in the spring of 1903, beginning sometime in April, we proceeded to run, what are known as "back-bone lines", along the course of the river. These lines varied from three hundred feet to one thousand feet in length. The instruments, used in this part of the work, were the Buff and Berger Transit, stadia rod and stakes.

In running our first line, which was at the extreme west end of the survey, one of us set up the instrument at that point, while the other, taking the rod and stakes, proceeded to a point about one thousand feet along the river bank, carefully observing the ground and brush, with respect to open sights across the river. When he had located a suitable point, he raised his rod, the instrument man directed the line of sight on the rod, and, by means of the wires in the instrument, read the intercept on the rod, and, thus obtained the distance. The instrument man also took the bearing of the line between the two points. The rodman, after driving a stake at the point where the rod stood, then came toward the instrument, and, when he had proceeded two hundred or three hundred feet, was "lined in" by the instrument man, and then held the rod vertical again, and the instrument man read off the distance. Planting another stake here, he again proceeded toward the instrument, repeating this operation every two hundred or three hundred feet, until he reached the instrument. The points at the beginning and the end of the line were regular stations, and were marked "Sta. A" and "Sta. B" respectively, while the points between were simply substations, and were not marked.

The instrument was set up successively, at each of the substations, and the line of sight directed at an angle of 90° with the line itself. The rodman, then following the motions of the instrument man, placed himself in the line of sight of the instrument, first down by the water's edge. The instrument man,

having leveled up his instrument, directed the rodman, by motions of his hand, to a point, where the reading on the rod corresponded to the contour which was being taken. We took contours at heights of sixty-seven feet, sixty-nine feet, seventy-one feet, and seventy-three feet, until the dam, south of the college campus, was reached. Here the sixty-seven feet contour had to be abandoned, as it came about three feet below the surface of the water above the dam. The rodman took up successively all the points on the 90° lines, which had elevations of sixty-seven feet, sixty-nine feet, seventy-one feet, and seventy-three feet, the distance from each being duly read from the rod by the instrument man, and recorded in the notes. The elevations were taken thus on both sides of the river, the instrument, however, being set up only once for all the readings at any one station.

When readings had been taken at every sub-station on our line, a new line had to be run, and the rodman again selected a point, another five hundred feet or thousand feet along the bank, as might be convenient, and the process was repeated. For this new line, however, the forward angle between it and the preceding line was noted, together with its bearing and length. This process was repeated until the east line of the college farm was reached.

We then had a complete traverse of that portion of the river, which we were investigating, from which a contour map was drawn. As the work progressed, we noted carefully the distance, along, or at right angles to the river, of all fences, bridges,

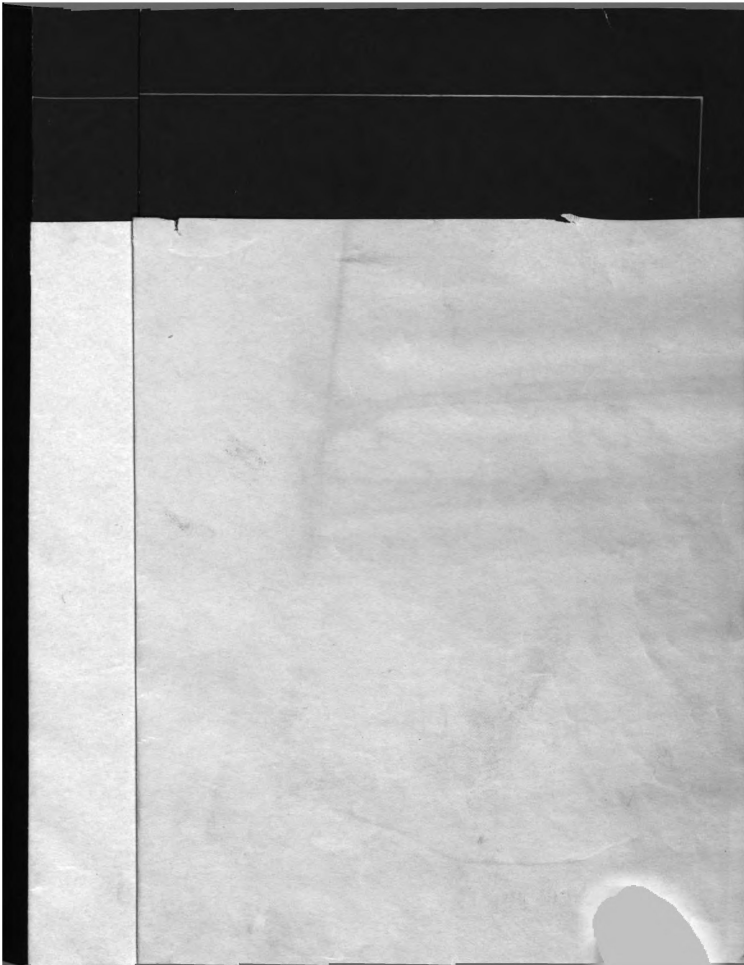
roads, etc. Later the bearings of all fences were taken with a pocket compass, and from this data we plotted a map.

The method of note-keeping adopted was as follows: The red line, extending down the center of each page, was taken as our traverse line; all sketches were made on the right hand page, all tabulations on the left; the height of instrument, obtained direct from our bench-marks, or carried along from the previous station, was tabulated in the center of the left hand page, directly above the station, and encircled by a line to distinguish it from other tabulations. All readings (elevations and distances) taken on the instrument side of the river, were recorded on the left page, opposite the stations, and on the right or left of the center, according as the corresponding points were on the right or left of the line. All readings, taken across the river from the instrument, were recorded on the left margin of the right hand page. Using a scale of two hundred feet per inch, the data obtained in the field was then plotted on detail paper and from this map a tracing and blue prints were made. Owing to the close proximity of the contour lines at many places, they could not be drawn very heavy on the tracing, and some difficulty was experienced in obtaining distinct blue prints. To plot the map, the traverse line was first laid off to the proper scale. Then all substations were located, and the distances, as tabulated in the notes, laid off perpendicular to the line at these points. Then all corresponding points (points of the same elevation) were connected by lines, closely approximating the contour of the land.

We then had a complete contour map of the portion of the river under consideration. These contour lines show what would be the water lines should the surface of the river, by any means be raised to an elevation of sixty-seven feet, sixty-nine feet, seventy-one feet, or seventy-three feet, intermediate elevations, of course, falling between the lines. It may readily be seen, by inspection of the map, what land may be flooded by building a dam of a given height, at any given point.

We have found, by the investigation, that the best location for a dam is at a point opposite "Sta. J", about five hundred feet above the present dam. A dam at this point, of sufficient height to raise the water level to seventy-three feet, would flood very little land, and would give a low water head of about seven feet. Above this point the banks are comparatively high and steep, and the water would, at very few points, extend more than twenty-five feet or thirty feet beyond its present bed. This proposed dam would give an increase of head, over the present dam, of about three and one half feet. At "Sta. J", the seventy-three feet contours are only one hundred ten feet apart, hence, only a comparatively short dam would be required. By emptying the tail water at "Sta. C", the head could be increased eight feet, but this would necessitate excavating a channel, three fifths of a mile in length, and from eight feet to twelve feet deep. It would further necessitate locating the power house, either, on the south side of the river, at the dam site, where the bank is very high, or

at "Sta. C", which is too far from the college for convenience. It is doubtful, whether so small an increase of head, would justify the additional expenditure. The best arrangement would be, to locate the power house at the north end of the dam, where the ground is firm and comparatively level, and discharge the tail water directly below the dam.



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