the full capacity of the land. It has been stated that a successful crop, one that has escaped damage by the flood, does not occur oftener than once in seven years. In fact, so completely is this river in possession of its bottom lands that very little effort is made to utilize it in any way, and at the present time it might well be considered mere waste land.

Before the uplands were reclaimed by tiled drains, a rainy season of even a week's duration produced but a slight increase in the flow of the channels of these streams. This was due to the fact that the rain collected in enormous areas of marsh and lowlands and reached these river courses by a very slow and tedious process. The experience of the past summer while making topographic surveys along the Kaskaskia River, shows that a rain of twenty-four hours will now raise the stream from 4 to 10 feet. An explanation of this is readily found in the fact that with the present system of tile drainage and the excellent outlets thereto, water from such a rain is carried quickly from the fields and poured immediately into the upper courses of these steams, and the multiplication of these feeders has forced upon the streams a burden entirely beyond their present capacity. As a result the numerous floods have rendered thousands of acres of the best farming land of the State practically worthless. It will be easily seen that the responsibility for the improvement of the channels of these rivers rests equally upon the farm holders on the upper courses of these rivers with those located nearer their outlet. The principle of general assessment, so thoroughly recognized in legislation providing for drainage districts, can be applied with justice to these larger problems of reclamation which cover all land within individual drainage basins.

The methods used in making these drainage maps are very similar to those of the topographic branch of the United States Geological Survey, the principal difference being that because of the contour interval used, the enlarged scale, and the object of the work itself, a greater amount of detailed work is necessary. As bases for the maps the primary traverse transit lines of the United States Geological Survey are used for position and the primary level lines of the same survey for elevation, in addition to the steel tape measurements along township lines. With these lines for control, a plane table buggy traverse is run along the first ridge road outside the bottom on each side of the river, and as often as possible cross roads, which tie the work together, are run in the same way. Since the distance between roads crossing the river is so great, it has been found necessary, at intervals of from 1½ to 2 miles, to traverse from the outside roads to the river, where points are left for the purpose of being tied on by the stadia traverse of the river. While the wheel method of measurement may be considered crude and inaccurate, a practical test will prove that for scales even longer than the one used in this work, and controlled equally well, it will fully meet all requirements. The accumulative error is slight, and when larger errors are made, they are readily located after the traverse has been tied to itself or to another line.

Over the same roads, and others when necessary, spirit levels are run and numerous elevations painted at summits, bridges, road corners, and other convenient points, while at intervals scarcely exceeding a quarter mile, substantial bench marks are left. The level work is so planned that elevations determined by stadia need not be carried for distances greater than 1½ miles. Experience during the past summer indicates that levels may be successfully carried with this instrument for distances of 3 or 4 miles. The instrument is similar to the ordinary stadia except that it is provided with an attachment which simplifies the reading of elevations at an angle. It has been in use on the United States Geological Survey the last few years, the idea for the improvement having originated with members of that survey.

The frame work of traverse and level lines, together with the stadia traverse of the river and other streams, is adjusted to the land lines and the other available control, after which it is ready for the topographer. This topographic sketching is by far the most difficult work connected with the making of a map, because of the necessity of carrying innumerable stadia lines through the dense jungles of the bottoms. Starting from convenient bench marks, these lines zigzag through the bottoms, the sight being through the openings of greatest length in the general directions of the traverse. The importance of these lines being closely run is clearly shown by a glance at the finished map, for the great number of lakes, sloughs, marshes and isolated hills are features that cannot be reliably mapped except by actual survey. Being hidden, as they are, by dense woods they must be hunted, and the meandering traverse line is the method by which they are found.

On the drainage maps, such features have been carefully traversed and their elevation determined, and in addition to the numerous cross sections at short intervals, a mass of isolated elevations have been left throughout the bottom lands. These stadia lines, as carried through the bottoms, are usually run with great difficulty because of the heavy undergrowth, and especially is this true in midsummer, when, in addition to the dense foliage, the intense heat and mosquitoes make work both difficult and disagreeable. In fact, because of this condition in the bottoms, the problem of keeping help is a very serious one, and the best solution seems to be in the bringing of help from such a distance that quitting at will is made more difficult. Few men will submit long to the physical sufferings met with in the bottoms, even at wages from two to three times the price they can receive elsewhere, if they are where they may reach home within a few hours.

Along with the stadia traverse and levels the relief of the river bottoms and the country adjoining the bottom lands has been carefully sketched. This map of the relief with 5-foot contours should greatly facilitate the study of the river problem. Mere location of the stream course and elevations, be they ever so numerous, does not bring to the eye of the engineer the actual figuration of the surface. It is thought that it will be necessary to inspect most minutely the local physiographic conditions before a successful plan of improvement can be determined. It has been planned, therefore, to present to the engineer who studies this great problem the most complete possible data for his use. It is not claimed that this form of map is the most inexpensive one, even under the favorable conditions under which it was accomplished last season, but it is believed that in the end it will justify itself on the ground of economy in the saving of time and of additional work for the engineer. It also seems that in a study of the carrying capacity of the channel, the effect of possible dike construction and of the control of lateral streams, the topographic features of the map will appeal very strongly to the engineer.

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