

Water Supply Problems of Bloomington, Indiana

STEPHEN S. VISHER, Indiana University

Most of the world has water supply problems; fully one-fourth of the land is arid and another one fourth is semi-arid, about one fifth of the land, although for the year as a whole the total rainfall is sufficient to raise it above the semi-arid level, has pronounced dry seasons. Dry summers are characteristic of the Mediterranean climates, of which California is the American representative; dry winters are features of the Monsoon climates and also of considerable of interior Asia and North America. About one eighth of the land is so cold in winter that pure water is obtained only with difficulty, perhaps by melting snow or ice. Hence less than one fourth of the world is humid nearly all the year, but even there, dry spells occur occasionally in all seasons. In Indiana, for example, nearly every summer has two consecutive weeks with little or no rainfall; sometimes almost no rain falls for a month (1). Comparative studies reveal that Indiana is more fortunate in this respect than are most of the so-called humid regions (2).

The great increase in the demand for water associated with increased population, higher per capita demand, industrialization, and the desire for more adequate water supplies for crops and domestic animals has resulted in water supply problems in many places which formerly seldom had a water shortage. Despite the considerable progress which has been made to alleviate water shortages, it appears highly probable that increased difficulties will arise very widely.

One way to prepare for the future is to make local studies of the past and present. This paper presents information concerning water supply problems of Bloomington, Indiana, and of the methods taken to alleviate them. Bloomington's average annual precipitation of about 45 inches normally well distributed among the twelve months supplies enough water, if it were all available, to more than meet human needs. Unfortunately much of the rainfall swiftly runs away. Moreover, spells with little or no rain are fairly frequent in summer and occasional in autumn and winter. Much of the total rainfall occurs rapidly, in downpours which frequently almost merit the appellation "cloudburst" often applied to them. Of the year's total downfall, fully a third is of this type, another third is moderately heavy rain, and the remainder falls as gentle rains, which although they occur during many more hours than do the torrential rains, yield a smaller total of water (4).

The percentage of the rain which runs away has increased as a result of the loss of much of the absorbent forest litter which formerly was widespread in this naturally wooded region, and with the removal by soil erosion of considerable or all of the comparatively spongy topsoil from the large percentage of land which has considerable slope in this unglaciated area. Rain which falls on clay subsoil or upon bare rock necessarily nearly all runs away.

Man has increased the runoff also by the construction of drainage works, by the paving of streets, sidewalks and even of alleys, and by the construction of rain-shedding buildings.

The water supply needs of Bloomington have increased enormously with the growth of the city, with increased per capita needs, and with the demand for more water for industries, fire protection and sewage disposal.

Accompanying the increasing needs and decreasing natural supply, there have been significant changes in the sources of Bloomington's supply. During the town's early years (1816-1890) one of the assets often mentioned was the numerous springs, maintained by water which had entered sink holes at somewhat higher altitudes surrounding the town. But as the population grew, and spread from the depression in which the town was established the water entering the sink holes during and shortly after rains soon became contaminated. For many decades Bloomington had a relatively high death rate from typhoid fever (3), which fact stimulated the abandonment of the springs which had been so prized in early years. Wells failed to yield a safe water supply largely because the limestone upon which Bloomington is situated is cavernous, and hence the water flowing through it is not properly filtered. At a depth below the limestone, the rock formations contain relatively little water and that normally is bitter or saline (5).

Cisterns were built by many of the more substantial citizens of Bloomington after they were convinced that springs or well water was unsafe or undrinkable. However, the dry spells which, as already remarked, occur rather frequently in summer and autumn, rendered small cisterns inadequate, and the fact that the rock is close to the surface made the construction of large cisterns expensive.

Hence Bloomington sought a city water supply. It so happens that southwest of Bloomington there are a series of ponds, locally called lakes, in large sink holes, the downward outlets of which had been sealed by the stiff clay which is derived from the decomposition of the limestone. These ponds are fed by springs, the outlets of rain water which had entered lesser sink holes at a higher altitude. As the ponds were all shallow and contained only a small amount of water, dams were constructed across their surface outlet to raise the water level to increase their storage capacity. The first such pond used is just west of the present city limits; the next are about a mile further southwest, the so-called Twin Lakes; about a mile still further away is Weimer's Lake, and a couple miles further is Leonards Spring Lake. The city constructed a dam to raise the water level in each of these ponds, the first in 1894, and others in 1907, 1909, and 1915. Unfortunately, shortly after the water level was raised by the dam, the increased pressure of the water cleared the sealing clay from some crack in the cavernous limestone and hence much water escaped through the cavity. Various influential citizens refused to accept the conclusions of geologists that reservoirs in the limestone were not feasible. As each new reservoir served for a time (until some crack was cleared of its plug of clay)

the city made renewed efforts to store water in that limestone area by constructing additional dams.

In especially dry summers and autumns the water shortage became so acute that serious consideration was given in other parts of the state of the desirability of moving Indiana University to some other city. However, the University's president, a native of Bloomington, opposed the plan to move the University, and called upon two professors of geology and a professor of physics for advice as to what could be done (6). Fortunately the limestone beds upon which Bloomington is situated extend only a short distance east of the city. In the shale which out crops east of the limestone margin a reservoir which does not leak can be constructed. The University built "the University Dam" in 1910 and it proved successful. Although the reservoir was far too small to serve the city, the lessons taught by the failure of the reservoirs in the limestone and the success of the one on the shale led the city to construct a far larger dam across Griffy Creek some 3 miles northeast of the city in 1925, and to increase greatly the height of the dam in 1940. However, the demand for water grew rapidly with the great growth of the University and the coming to Bloomington of the electronics industry established by a highly talented immigrant. That industry itself requires little water, but the workers and those who supply services of various sorts to employees and students desire much water, as did those who constructed the many new buildings, streets, etc. By 1952 a severe water shortage again occurred, in an exceptionally dry summer. Fortunately for Bloomington, a favorable site for a dam across a quite sizable stream (Bean Blossom Creek) is present about 12 miles northeast of Bloomington. A progressive young mayor succeeded in having the dam constructed (completed in 1953), and now Bloomington has enough water to last for a long time. The expense of bringing the water to the city is lessened by the fact that Bean Blossom Creek happens to come within about two miles of the city dam across Griffy Creek. The water is permitted to flow down Bean Blossom Creek to that point, and then is raised by pumping only a few score feet to the main city filtration and pumping system just below the Griffy Creek dam.

The fact that Bloomington is on a drainage divide between the East Fork and West Fork of White River results in its being some distance from a sizable stream, and makes it necessary to raise the water some 250 feet from the reservoir to the storage tanks in the city. But this situation on a divide reduces flood danger to a minimum, and made the site more healthful in early years when malaria was wide-spread on poorly drained land in Indiana.

Literature Cited

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4. VISHER: "Geographic Variations in Death Rates in Indiana," *Indiana Academy of Science Proceedings*. **33 (1925)**:55-61; **34**:154-156; **44 (1934)**:168-173.
5. BEEDE, J. W., "Geology of the Bloomington Quadrangle," *39th Indiana Geological Survey Report*, (Indianapolis 1915) :190-312.
6. President W. L. Bryan called upon J. W. Beede, E. R. Cumings, geologist and A. L. Foley, physicist. Foley was president of the Indiana Academy of Science in 1909 and Cumings in 1925.