MISSISSIPPI

STATE GEOLOGICAL SURVEY

CIRCULAR 4

WATER--MAN

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Mississippi State Geological Survey

Water--Man

Of the proportion of rainwater that follows each of the three routes open to it--evaporation, runoff, sinking--man can increase the amount of evaporation by exposing great surface areas of water in artificial lakes and reservoirs, thereby depleting surface water and ground water potentialities by that amount; he can also increase the runoff by removing trees and other vegetable forms, thus leaving a smaller proportion to sink into the ground as beneficial ground water; he can increase the amount that soaks into the ground by protecting forest and other plant growth, whereby he not only increases the ground water supply, but he reduces flood waters and the chances of floods at the same time--the only real flood control.

A sky view, as from the Mississippi Geological Survey Helicopter, proves beyond the shadow of a doubt, the great value of Forest growth in water conservation. The West Branch and the main stem of Hatchie River from Ripley through Tippah County and Alcorn County to the Tennessee State line flowed clear and sparkling, notwithstanding three years of drouth. In some stretches even swampy conditions prevailed. Although the area is sandy, it is not so distinctly so as in the Holly Springs environs; and, although springs contribute some water as they do so remarkably in the Holly Springs region, the water comes from more extensive forest seepage areas where the rainwater was caught and held back by forest growth, sank into the ground, and was protected from continuous evaporation.

Were it not for such underground storage as in the Holly Springs area and along the Hatchie Valley, which slowly yielded up the water through three long years, many of the large reservoirs would be even more nearly dry than they are.

Similar stream conditions as along the Hatchie prevail along much of the Tuscumbia River system in Alcorn County, where forests hold back the rain water, allow much of it to sink into the ground as ground water, and there retain some of it for slow seepage even for three long years of drouth. In small areas of cultivation small streams contribute a small amount of muddy water to otherwise clear river waters.

Also along Indian Creek and Yellow Creek in Tishomingo County, where much of the surface rock is slightly more indurated Tuscaloosa gravel and Eutaw sand and where completely indurated Paleozoic rocks lie at shallow depths, these streams in wooded areas run clear and cool.

Likewise along Mackys Creek in the southwestern quarter of Tishomingo County, across the southeastern corner of Prentiss County, and into northern Itawamba County, the clear water still flows in the wooded areas even after this prolonged drouth.

Along most stretches of these streams--Hatchie, Tuscumbia, Indian, Yellow, and Mackys--the course is through wooded areas. And along most such stretches the streams flow, even if in small amounts, and they flow clear.

Across Itawamba, Lee, Pontotoc, and Lafayette Counties, the flight showed the stream channels in the cultivated areas, for the most part, to be dry--certainly abundant evidence of the disastrous effects of the complete removal of the vegetable cover.

So the water problem resolves itself into two practices: remove the vegetable cover, especially on the slopes, allow the rapid runoff waters to wash away

the soil, erode gullies, carry down sand, silt, and mud, deposit such material upon rich bottom lands, and flood them; or retain the trees and other plants, hold back the runoff, give the water time to sink and become ground water for future use, and at the same time prevent floods, or, at least greatly reduce them.

In all these studies in which forest growth is emphasized as an important factor in ground-water recharge, the nature of the soil, subsoil, and the rest of the mantle rock must likewise be considered. The Meridian sand and other sand formations in the Holly Springs area provide a sandy soil that readily absorbs rainwater, but the forests themselves develop a receptive soil--so that forests and other plant growth can still be considered one of the most important factors in recharging the ground water aquifer.

The exact amount of flow (discharge) of several streams, mostly small, in the Holly Springs area has been measured and the surprisingly heavy flow has been recorded in Circular 3, "Water Sources." One of the most astonishing flowing streams is Chewalla Creek in Marshall County. For comparison, a much bigger stream, the Yocona River, in Lafayette County, has just been measured (November 4). Opposite Tula, not many miles from the source of the river, the Yocona flowed only 942 gallons per minute (g.p.m.), as compared with the 25,200 g.p.m. of Chewalla Creek, thus proving quantitatively the essential accuracy of surface observations.

A flight down the lower stretches of the Yocona to the Enid Reservoir, down the lower stretches of the Yalobusha to the Grenada Reservoir, down the Big Sandy to Greenwood, across other streams to Jackson, thence up the Pearl, up the headwaters of the Big Black to Vaiden, and down the Batupan Bogue to Grenada, showed the same distressingly dry condition to exist. The major streams flowed but little in the bottom of their channels; the

channels of the smaller streams, for the most part, were dry.

At this point, the problem of the depth to the ground-water table and the length of time necessary for the recharging of the zone from the surface to the ground-water table needs some consideration.

In rebuilding the bridges in the Yocona Valley from Highway 7 below the Oxford Airport to the opposite side near Taylor, County Engineer Roger S. Myers found no moisture till his auger reached 16 feet. The State Geological Survey drill likewise encountered no moisture to a depth of 16 feet about midway of the valley. Up the valley, about 12 miles, along a side road to Tula the Survey drill found some moisture but no water to a depth of 14 feet.

Along the base of the left Yocona Valley wall between Tula vicinity and Oxford Airport-Taylor vicinity, a Mississippi State Geological Survey test well found 130 feet of silt and sand in the Ackerman formation at a depth of 95 to 225 feet which was saturated with water--perhaps the same acquifer as in the Tula School well.

Near U.S. Highway 51 in Panola County, 2 miles south of Como 1), the State Highway Department made a power auger test without the use of drilling water, for the State Geological Survey and found little if any moisture in 5 feet of silty sand, 26 feet of clayey silt, and 19 feet of silty sand to a total depth of 50 feet. At a slightly higher nearby Hilltop location 2), the Highway men, with the same equipment, found 5 feet of silty material, 15 feet of red silty clay, 22 feet of yellow silty clay, 8 feet of yellow silty sand to a total depth of 50 feet, likewise with little moisture. Some 7 miles farther north along the Illinois Central Railroad tracks, at a point 1 1/2 miles south of Senatobia 3), the same auger penetrated 9 feet

of red clayey silt, 11 feet of sand and small gravel, 12 feet of silty clay, and 18 feet of silty sand, containing water in the lower foot or so of the 50 feet.

Even though much of the 50 feet in these three auger test wells is fine clayey and silty material, and, accordingly, should contain some water, the borings reveal the depleted water condition of these materials, and something of the time that will be required for recharge. Some older farm wells near these auger tests had found water at greater depths than 150 feet, and one of them near the second auger test found water only a few feet deeper than 50 feet. The second auger test is about 20 to 30 feet higher than the first which accounts for the different water levels.

Along the Ackerman terrane-lined part of the Yocona Valley, the silt and fine sand of the Ackerman formation would, no doubt, yield a small amount of water for local irrigation. Along the terrace-like stretches of U.S. Highway 51 from Sardis to Senatobia, silts and fine sands would likewise yield some water for irrigation purposes. The gravel and sand in these terrace-like stretches would, of course, yield a greater quantity.

Later (November 23, 24, 26, 1954) two deeper test holes were drilled by the Mississippi Geological Survey to determine the water content, thickness, and characteristics of these terrace-like sands and gravels. At the first drill hole location, 2 1/2 miles south of Como (NW.1/4, NW.1/4, Sec.15, T.7 S.,R.7 W. Panola County), near auger test 1, the drill went through the gravel at 93 feet, and, as interpreted from the electric log, only the lower 5 or 6 feet of the gravel is saturated. The hole was drilled to a total depth of 158 feet where drilling was discontinued because of "lost circulation." From 108 to 152 feet is a clean, medium to coarse, sand. From 152 to 158 feet is probably a more prolific zone of the same sand, but, of

course, no sample was obtainable, This sand is believed to be water-bearing because of information obtained on an old producing well at that depth in the near vicinity. Two conclusions might be drawn from this test hole: 1) The zone from 152 to 158 feet has a large coefficient of transmissibility, and 2) the water in the sand is under very little, if any, hydrostatic pressure. The second drill test hole was located about one mile north of Como along U.S. Highway 51 (NE.1/4, Sec.32, T.6 S.,R.7 W. Panola County). This hole was drilled to a total depth of 130 feet, and, being at a somewhat lower elevation, the base of the gravel was reached at 70 feet.

A comparison of the logs of the two test holes drilled by the Mississippi Geological Survey indicates a slight basal-gravel gradient toward the north in the direction of the second drill test hole north of Como. Therefore, the ground water level in the second hole would seem to lie between 42 and 50 feet, indicating a thick saturated gravel zone from 42 to 70 feet.

By this time the complexity of the problem must be evident to the reader. Surface gradient is one of the most important factors. Forest and other plant cover is another major factor. The texture of the mantle rock as well as the texture of the underlying beds is likewise a major factor. The interrelation of these three factors makes the problem of ground water supply difficult--a problem for only trained men.

Another problem brought to the attention of the scientists is the chemical reaction of deep well water on the surface soils. According to Prof. Kyle Engler of the Department of Agricultural Engineering, University of Arkansas, Stuttgart rice growers claim that surface waters (streams) now produce 5 to 20 bushels more rice than do the well waters--a claim he considers well founded. According to Professor Engler: "The use of well water in our Grand

Prairie Rice Region around Stuttgart undoubtedly has raised the pH of the soil but in so doing these soils are now able to produce such crops as lespedeza, soybeans, corn, cotton and sorghums that were out of the question under the higher acid soils found in the virgin state."

Notwithstanding all these considerations, still another remains, the explanation of the belt of extreme drouth of the Ozark region extending from Missouri, Arkansas, and Louisiana, across the Mississippi River into Kentucky, Tennessee, and Mississippi.

An August-September automobile trip across Tennessee Kentucky, Ohio, Pennsylvania, and New York to Buffalo, across Ontario to Toronto, to Cochrane, thence a train trip to Moosonee on Moose River--James Bay and return to Cochrane, thence an automobile trip to Winnipeg, thence across Minnesota, South Dakota, Nebraska, Missouri, and Arkansas revealed the copious rainfall belt of northern United States and southern Canada (Ontario) in contrast to the dry parched Ozark belt--a dry belt yet to be explained.

The State Geological Survey in all these circulars is not claiming there is insufficient water for irrigation; there is sufficient for local areas. As a State Agency, serving all the people, it is pointing out the inadequacy of the supply if all choose to use it. Removal of more than the one-in-three ground water proportion of the 50 inches of rainfall must result in depletion. If an excess is withdrawn, it can only be continued through the underground draining of adjacent lands. Certainly the total 50 inches of rainfall sets definite limits: 1) to the total amount subject to evaporation; 2) to the total amount subject to runoff; and 3) to the total amount left for ground-water recharge. Excess withdrawal must come from adjoining areas--in short from the neighbors.

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