THE WATERWORKS OF SOUTH WALES AND THE WEST OF ENGLAND.

The source of the water supply of South Wales and the West of England is really the south-west wind that blows over that area for a large portion of the year. It arrives on the coasts of the counties of South Wales, and of Somerset, Cornwall, Devon and Dorset in the West of England after traversing a large extent of sea, from which it has absorbed a large quantity of moisture. It also arrived usually at a moderately high temperature. It is the warm wind of the district, very much as the "Chinook" is of Western Canada. It will be remembered that the capacity of atmospheric air for absorbing moisture varies with the temperature, increasing very rapidly with increased temperature. Thus, at 40 degs. each cubic foot of air can absorb three grains of moisture; at 60 degs. it is able to absorb six grains; at 80 degs. eleven grains. On the arrival of the south-west wind on the coast it commences to get rid of its moisture, and it is very instructive to note the way in which the rainfall of the district follows the course of the wind and the elevation of the country. Mr. R. H. Wyrill, the Swansea waterworks engineer, has traced the effect of the rise of the country in the path of the wind in a very interesting manner. At Swansea the average annual rainfall is 40 inches; at Morriston, a little higher up, a suburb of Swansea, it is 45 inches; at Ystalyfera, some miles inland and at a considerably higher elevation, the average annual rainfall is 62 inches. Still higher, at Nantyrwydd, it is 75.15 inches; at Bwlch it is 112.9 inches. From this point, which is the highest in the watershed, the rainfall begins to decrease. At the Cray reservoir, No. 1, of the Swansea waterworks, it is 75.69 inches; at Cray No. 2 it is 71.78 inches; at Maescarnog it is 68.11 inches; at Brecon it is 48.5 inches, and at Hereford it is only 30.0 inches. It should be explained that in going to the places named above we are receding from the coast at Swansea. We are ascending until we reach what is called the pass or saddle of the Bwlch, and then we begin to descend, still receding from Swansea, and gradually descending until we reach the comparatively low-lying land of Hereford.

The writer has given the above figures, as it appears to him to illustrate the matter so well. The moisture-charged south-west winds meet the hills in their track and become cooled by contact with them, the heat of the air being abstracted by the colder ground of the high lands, and the winds are gradually cooled, and are made to deliver up more and more of the moisture they have carried. After passing the highest elevation, where presumably they have been cooled to the greatest extent, they begin to get warmer, owing to the sheltering action of the mountains over which they have passed, and also having been so largely deprived of their moisture in their passage over the highest portions of the mountains they have not as much to part with, and hence the deposit becomes less and less, and with it the rainfall. The same thing rules pretty well upon every part of the coast, and the whole configuration of the coasts of South Wales, of Somerset, Devon and Cornwall, though varying very much from point to point, has a great similarity. The mountains of South Wales are very much higher, and extend very much farther back than the hills of Somerset and Devon, but there is the same action going on. The hills of Somerset and Devon trap the moisture of the south-west winds, just as the mountains of South Wales do. The hills of Somerset and Devon, however, not extending so far back as the mountains of South Wales, the south-west winds are able to pass over them without the same deposit of moisture as rules in South Wales, and hence the gathering grounds for the cities and towns of the western English counties and those a little inland are not as good as those for the Welsh towns. So much so is this, in fact that one of the largest cities of the Midland counties, Birmingham, has brought its water from the Welsh mountains, just at the back of the district mentioned, the Bwlch, where the rainfall is so great.

Methods of Collecting the Water for the Towns.

There are two methods employed, both in South Wales and in the Western English counties, for collecting the water by making use of the springs that are formed in the higher grounds, and sometimes in the lower grounds, and by damming up one or more valleys and collecting the whole of the water which falls upon the hills opening on to the gorge that is dammed, and thereby creating a reservoir. For the reservoirs of Bath springs are almost entirely used, and for the earlier reservoirs of Cardiff springs were also largely employed. In the high lands above Bath there are two sets of springs, one set at a high level, and another at a considerably lower level. The surface of the ground in the neighborhood of Bath is largely covered by the Oolite formation, the Bath stone, for which the district is famous, and of which large quantities are employed in building. The Oolite formation is an exceedingly porous rock. It is stated by geologists to have been formed by the action of marine animals, who lived in enormous numbers, myriads, and who dies on the spot, and it is their carcasses which go to form the porous mass. On the high ground around Bath, under the Oolite formation, is a layer of the substance known as fuller's earth, which is able to arrest the water which is deposited on it in rainy seasons for a certain time, but is not able to retain it permanently. Some distance below the fuller's earth is the lias formation, a close and almost impervious clay, which retains a very large portion of the water that descends to it from the higher ground. In rainy weather the water descending upon the downs around Bath is first arrested by the fuller's earth formation, and the springs which rise from that are then very prolific for a short time. Shortly afterwards the fuller's earth allows the bulk of the water to pass onwards, and it is trapped by the lias clay lower down. Instances of the difference in the delivery of water from the higher springs will be interesting. One of the springs on one of the higher downs, immediately after rainy weather, will deliver as much as 1,000,000 gallons per day, and shortly afterwards will only deliver about 7,000 gallons per day. Another spring on the high downs varies from 230,000 to 300,000 gallons per day. The lower springs also vary in the quantity of water they deliver, but they are very much more reliable and very much more uniform than the higher springs. They can practically always be depended upon for a certain quantity, except in dry seasons.

In the neighborhood of Bath, however, the variability in the rainfall has obliged the corporation to establish reservoirs, which are really what their name implies, and not what the other class of reservoir really is, a gathering tank. The Bath Corporation have two or three reservoirs, one in particular having a capacity of 51,000,000 gallons, and occupying a water area of nine acres, but it is only drawn upon when the springs fail.

Another perhaps interesting point in connection with the distribution of water to consumers in Bath and its neighborhood is the fact that for several of the districts supplied the water has to be pumped to distributing tanks. The city of Bath and its suburbs occupies a somewhat peculiar position, from the point of view of the waterworks engineer. The city of Bristol occupies a somewhat similar position. The business portion of the city occupies the lower ground in the neighborhood of the river, but the residential portion and some of the limited manufacturing portion in Bath has climbed up through the many valleys opening out of the main valley through which the river passes and right up on to the down above, which are from 500 to 700 feet above sea level. The storage tanks into which the springs deliver are generally a long way below the elevation of the higher parts of the suburbs, and, therefore, the water from some of the springs is pumped to what are practically service tanks, at sufficient elevation to supply the districts at the high elevations by gravity.

The total yield of the springs from which the Corporation obtain their supply ranges from 1,500,000 gallons per day as a maximum to 1,116,000 gallons per day as a minimum. The average daily consumption is about