

regulation of floods at a sufficient maximum height to originate hydraulic energy when required, and for the purposes of navigation. They could also insure sufficient purity to satisfy the requirements of water supply, manufacturing processes, and the preservation of fish.

Should a Water Board be appointed for each river basin, nominated by the county councils within that basin, before they commence their active operations, it will be necessary that the surveyor or engineer obtain for them reliable information as to the height of floods, and that the levels should be recorded on the 6-in. county maps of the ordnance survey. Such information would be greatly enhanced in value, if a record was taken daily of the height of streams on all the county bridges; such observations could be readily obtained if gauges were painted on them in white and black, giving the height in feet above the ordnance datum, of the mean sea level, to facilitate comparison, and the height of the water upon them was daily noted by the county constabulary on their ordinary rounds. At important points self-recording apparatus to ascertain the daily quantity of water carried down might be placed under the direct supervision of the board's official, who should organize a system of flood warnings by telegraph.

In the meanwhile much valuable information may be rescued from oblivion by observers, who will note the height marked by floods at important points, and the height in reference to the ordnance datum given, date and local circumstances recorded. If such a work were undertaken by the leading provincial societies, a valuable mass of facts would soon accrue. The author ventures to think it is also the duty of scientific societies to urge upon the Government the necessity of parliamentary power being given to the county councils, to sanction the small charge that would have to be made to obtain accurate water information, to fix gauges on the county bridges, to inaugurate a system of flood signalling, and to make such contributions, regulated by the area included, as would give funds for the inspection of rain gauges, and the tabulation of the averages of the rainfall of the district over which the board has control. Were such a mass of facts in existence, the Water Board, when appointed, would have a tangible foundation on which to improve their district, increase its wealth, and preserve the health of its inhabitants.

In the past parliamentary inquiries, though carried out with infinite patience and care by committees of both Houses, have been, and must ever be, liable to serious error, schemes being sanctioned that were impracticable, from old mines beneath reservoirs, causing fearful augmentation of local rates; of embankments that were in most unsuitable situations; of volumes of compensation waters ordered to be given out of all proportion to the supply to be obtained. Even in enquiries of the Local Government Board on the spot important interests are often sacrificed by the facts, through the ignorance or apathy of the local authority affected by the proposals dealt with, not being disclosed—as in one case known to the writer, a sewage farm having been sanctioned on the site of springs dried up by the pumping of a public well of another local authority. Again, local authorities can often sink wells, on land they have bought, without a public enquiry of any sort, and in an instance in the writer's experience, they sank a well for an additional supply at a point where it was bound to draw on their own sewage farm, and eventually did so. In all

these cases were Parliament to make it imperative that a preliminary local inquiry be held by the water board of the district, and they be requested to report their opinion on the merits of the case for the decision or inquiry of the Local Government, the dangerous results could not accrue.

The following table gives an approximate estimate of the square miles of each geological formation or group of such in England and Wales:—

	Square Miles.	Hardness of Water. Deg.	
Tertiary .....	4,120	22.0	Bagshots permeable, Thanets partially permeable.
Chalk ..	8,750	23.6	Gault impermeable.
Greensand and gault .....	1,747	20.2	Impermeable except banks.
Weald clay .....	664	27.3	Permeable.
Hastings sands .....	805	20.2	Permeable and supra-permeable.
Oo'ites .....	6,671	24.4	Marlstone partially permeable.
Lias .....	2,837	30.1	Marls impermeable.
Trias .....	7,431	18.8	Permeable.
Magnesian limestone .....	356	59.7	Marls impermeable.
Permian marls and sandstones ..	858	..	Alternating.
Carboniferous rocks .....	10,080	13.1	Permeable.
Carboniferous limestone .....	1,812	19.8	Nearly wholly impermeable.
Old red Devonian, Silurian, Cambrian metamorphic rocks....	11,062	2.5 to 12.0	Occasionally permeable.
Granites .....	393	3	

In the writer's work, "The Water Supply of England," London, 1882, he gives a hydro-geological map facing page 30, in which England and Wales are divided into four areas of geological formation, which for waterworks purposes may be given as follows:

1. *Pervious*.—Suitable for ordinary wells; pollution possible.
2. *Suprapervious*.—Suitable for artesian wells; pollution not possible.
3. *Partially Pervious*.—Suitable for artesian wells; pollution not possible; or for reservoirs, giving good dry-weather results.
4. *Impermeable*.—Suitable for reservoirs catching flood waters only; above limits of possible pollution.

The degree of porosity of a rock varies in direct ratio of the spaces between the grains of sediment of which it is constituted, the water being stored in the interspaces only, just as water may be stored in a tank filled with shingle, the quantity held varying from 0.185 of a gallon (a pint and a half) in a cubic foot content of granite to 1½ gallons in Bath oolite, and 2 gallons in chalk. Chalk and other limestones receive water with great rapidity, but part with it with exceeding slowness, there being a constant struggle between gravity and capillarity. It is important to distinguish between the amount of storage capacity and the actual volume annually absorbed from rainfall, the one appertaining to "water capital," the other to "water revenue."

When bands of permeable and impermeable rocks alternate, each porous band contains a separate sheet