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Surrey County Council.



REPORT

ON

THE WEY VALLEY FLOODS

IN

RELATION TO PUBLIC HEALTH

BY THE

CONSULTING MEDICAL OFFICER.

October, 1913.

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Surrey County Council.

REPORT ON THE WEY VALLEY FLOODS IN RELATION TO PUBLIC HEALTH

BY

THE CONSULTING MEDICAL OFFICER,

OCTOBER, 1913.

WEY VALLEY FLOODS REPORT.

PART I.

THE WEY RIVER AND ITS WATERSHED.

The River Wey arises in Hampshire in the neighbourhood of Alton, and partly from small watercourses in the Petersfield (Sussex) direction. It consists at first of two branches, both entering Surrey in the Farnham district and joining at Tilford, which is situate about $3\frac{1}{2}$ miles within the boundary of the County. All visitors to Farnham are familiar with the upper or northern branch. It passes in the direction of Seale, skirting the south side of the picturesque old town of Farnham, its course being parallel to the L. & S.W. Railway for about $3\frac{1}{4}$ miles. At this point there is a rectangular deflection in a southerly direction for about 3 miles to Tilford, where the junction of the northern and southern streams takes place. It will be seen from the map that the two watercourses (each called "The Wey") together form three irregular sides of a square, of which the County boundary is the fourth. From Tilford the River Wey, as it is now unquestionably called, flows with many twists and curves in an easterly direction, through Elstead and Peperharow to Godalming, and thence in a north-easterly and northerly

direction to Guildford, being joined in its passage at Shalford by the Tillingbourne. In the sanitary reports of Surrey frequent reference has been made to this brook. It rises in Abinger parish in the Greensand Hills of the Dorking district, and flows through one of the most beautiful of Surrey valleys, passing in its course the pretty villages of Gomshall, Shere and Albury. From Guildford onwards, the Wey meanders sluggishly through the comparatively flat area of the Bagshot Sands in a northerly direction through Send, Ripley, Byfleet and Weybridge, to join the Thames at Weybridge, which it enters just below Shepperton Lock (1). Its whole course, estimated by Mr. Swarbrick, Assistant Engineer of the Thames Conservancy, with whom I have compared notes, is 43 miles in length. Its total fall, *i.e.*, from its entry into the County of Surrey to its outfall into the Thames, is 200ft., so that its fall per mile averages 4ft. 9in. But, says Mr. Swarbrick, on following the levels down from its upper portion, I find that the fall for the first 10 miles represents nearly 8ft. to the mile, but afterwards the gradient flattens rapidly.

The main characteristic of the river is its curving, twisting course and its sluggish flow.

The average flow of the Wey was estimated by Mr. Brough Taylor (of the firm of Messrs. John Taylor, Sons & Santo Crimp, M.M.Inst.C.E., of 27, Great George Street, Westminster, S.W.), who put it at about 84 million gallons per diem, but like other streams of the same kind which are fed from the surface (and unlike chalk streams, *e.g.*, the Wandle, which is fed from deep springs) are liable to great and immediate variation, in accordance with the rainfall of the current season.

“ During the very dry summer of 1884, the Messrs. Taylors had gauged the flow of the Wey at a point near its mouth, and on the 3rd of July in that year found its volume to be 46½ million gallons per diem. In order to test the effect upon the river of the extreme drought through which the country had lately passed, Mr. Brough Taylor gauged the river on the 14th September, 1898. On that date the flow at Guildford was 20,844,000 gallons per 24 hours, and at a point near to its mouth, 41,337,000 gallons. This last flow is comparable with the 46½ million gallons above given, being the summer flow of the river in 1884. So that the summer flow in 1898 was only 89 per cent. of the volume of the corresponding flow of the dry year of 1884.”

The above passage is quoted from my "Synopsis" introducing Mr. Taylor's Report presented to the Sanitary Committee on October 6th, 1898 (2). This Synopsis I was asked to prepare for the use of the Committee, because I had been for some time then devoting myself to the subject of river and underground water sources in relation to the public health and also because I had been particularly engaged in the preparation of evidence about the Wey Valley Water Bill then before the Committees of Parliament (3). There were other reasons for keeping the whole subject of Public Water Supply within the purview of one who had expert knowledge of the medical and chemical questions involved, as well as those relating to Hydrogeology. The water supply of London, which affected all the counties adjacent thereto, still remained a subject of much discussion. The considerations involved were, therefore, of acute interest to a good many authorities.

Mr. Taylor's report with a geographical description of the River Wey basin is as follows:—

"The catchment is in shape an irregular quadrilateral, bounded on the east by the catchment of the Mole, on the south by the basins of the Rivers Arun and Rother, on the west by the watershed of the River Loddon, and on the north by a portion of the Thames Valley Basin. The boundary line is minutely described, and its measurement stated to be 127 miles." (4).

Mr. Taylor's report was further accompanied by a geological description and map of the area. This was taken from the "Drift" Geological Map of the County, just as my own map illustrative of my Report on Water Supply sources in 1896, was taken from the English Map of Solid Geology. Both maps will be before you at your meeting on Tuesday next, October 21st. The "Drift" or "Surface Soil" Map is, for the purposes of the present report on floods and soil saturation, of great practical value, as it shows the proportion that porous soils bear to impervious soils in the Wey Valley.

"Along the banks of the river is *Alluvium*, which is described as of shallow depth. Below this, taken from north to south, the order of the strata coincides with the order of superimposition, and is as follows:—*Bagshot Sands, London Clay, Woolwich and Reading Beds, Chalk, Upper Greensand, Gault, Lower Greensand, Weald, Hastings Beds.* The *Bagshot Sands* consist of three divisions, viz., the *Upper*

Bagshot and the *Lower Bagshot*, each pervious. Between them is the *Bracklesham Beds*, impervious. Again, between the *Lower Bagshot Sands* and the *Reading Beds*, both pervious, comes the *London Clay*, which is impervious. Between the *Reading Beds* and *Chalk (Upper and Middle)*, all these strata being pervious, above, and the *Upper Greensand*, below, comes the *Chalk Marl*, which is impervious. Between the *Upper Greensand*, pervious, and the *Lower Greensand*, also pervious, comes the *Gault*, which is impervious. Between the *Lower Greensand* and the *Hastings Beds*, pervious, comes the *Weald*, which is impervious. So that in every case water is held up in the spongy beds by a waterproof layer, springs being thrown out at the outcrop or points of junctions on the surface."

"The average rainfall in the neighbourhood of Woking is as low as 23 inches, along the Hog's Back it is 26 to 27 inches, and at the extreme south-west of the Wey Valley basin, it is as high as 36 inches. The greater part of the rainfall is re-evaporated from the surface on which it falls, and a further part is absorbed by vegetation, and ultimately evaporated. Sir A. Binnie, formerly Chief Engineer to the London County Council, shows that on an average of 15 years, two-thirds of the rainfall in the Thames basin was re-evaporated. But the estimate must be modified when applied to the Wey Watershed, in consequence of the larger proportion of pervious beds in this part of the whole basin. The conclusion ultimately arrived at is that 15½ inches is about the average evaporation for the Wey Watershed, as compared with about 18 inches for the whole Thames basin."

"The amount of percolation varies according to the nature of the soil, that of Alluvial soils being 19 inches, Lower Greensand 15 inches, Reading Beds 12 inches, Outcropping Chalk 9 and 10 inches, and Upper Greensand only 5 inches. The above figures must be taken to include the modifying effects of the subsoil overlying the actual strata, as each outcrop is covered with a surface consisting of humus and subsoil, which undoubtedly exerts a considerable effect on the amount of rainfall actually absorbed by each particular stratum."

In connection with the above, I may here quote the following passages from my Report on "The Water Supply of the County," published in 1897. (5).

“ Sources of Water Supply.

“ It may be desirable to add a word on the subject of sub-soil and ground water. It has been said that the action of the soil in regard to water is in reality of a threefold nature :—

“ (1) It may transmit water as in the case of exceedingly permeable, coarse gravels.

“ (2) It may imbibe the moisture. Clay exhibits this property of imbibing water in a high degree, but on the other hand, it is very slightly permeable.

“ (3) Water may be held by rock, or a more porous, permeable formation, at a certain rest level, in the same manner as water is held by a sponge immersed in water, which flows from it when the sponge is lifted out. This has been described as a saturation of a rock, and in the case of the rocky water-bearing strata such as the New Red Sandstone or the Chalk, it constitutes what is generally known as the ground water. The coarser the grain of any rock, the more freely will water travel through it, and the springs which it feeds will be more quickly affected by rainfall. The great water-bearing strata in which the water is derived from this rest level or plain of saturation, are the Chalk, the Oolites, and the New Red Sandstone.”

A large proportion of the Wey Catchment Basin is composed of those kinds of soil numbered 1 and 2, thus much of the rain water reaches the Wey through the pervious adjoining soils or otherwise assists the flooding by the unabsorbed rain which, having fallen on comparatively impervious soil, flows gradually off the surface of the ground.

I do not propose at the present time to enter upon a discussion of the causes of fogs and mists in their relation to the soil in the Wey Valley. It is an interesting subject on which J. A. Rickman, Esq., J.P., of Addlestone, has made observations in the Weybridge and Chertsey districts, as I myself have done at Godalming and Farncombe. I may, however, remark that while agreeing with Mr. Rickman that fogs are partly dependent on the nature of the soil, their prevalence in certain localities is also affected by the configuration of the ground.

The SANITARY AUTHORITIES DISTRICTS through which the River Wey flows in Surrey are Farnham Urban (Dr. Sloman, M.O.H.), Farnham Rural (Dr. Tanner, M.O.H.), Godalming Borough (Dr. Bird, M.O.H.), Hambledon Rural (Dr. George Hall, M.O.H.), Guildford Borough, Guildford Rural and Woking Urban (Dr. Pierce, M.O.H.), Chertsey Rural and Weybridge Urban (Dr. Brind, M.O.H.).

References:—

- (1) *County Map.*
- (2) *Synopsis, p. 6.*
- (3) *Wey Valley Water Act, 61 and 62 Vict.*
- (4) *Synopsis, p. 2.*
- (5) *Annual Report, C.M.O.H., 1896, p. 48.*
- (6) *County Sanitary Districts Map*

PART II.

THE EFFECTS ON HEALTH OF FLOODS AND CONSEQUENT
DAMPNESS OF SOIL.

We now come to the most essential part of this report, viz., the health aspect of the Drainage Problem as a whole.

My official knowledge of the River Wey dates back from 1890, when I was first asked by the Council to examine and report on the condition of the river from Godalming to Guildford. At that time the sources of pollution were numerous and very serious. Crude sewage and road drainage passed into the river direct, a consideration of magnitude having regard to the Thames water of London and suburban Surrey to the supply of which the river contributed. It is not necessary at the present day to enter into the history of the establishment of sewerage schemes for the populated areas from Godalming down to the passage of the stream into the Thames near Weybridge. Suffice it to say that, in one most important respect, the stream has been greatly improved. The sewerage systems have, on the whole, proved efficient, and the Thames Conservancy,

with its added sphere of influence, has successfully maintained a high standard of purification for the effluents of the up-river towns, large villages, and residential neighbourhoods. So far, therefore, as the safeguarding of the public water supply of a vast population within the area of Greater London is concerned, the object of the increased powers of the Thames Board has been in great measure achieved. Provided that the Authority continues its surveillance of the large volumes of effluents which are daily poured into the contributing rivers and streams, Health Authorities generally might well be satisfied even if less attention were paid to occasional minute pollutions of ditches or watercourses. Many of these are so far remote that it would be practically impossible to shew that they were, "in the existing state of knowledge," dangerous to public health.

The "Drainage Problem," however, is a much wider one than that, and, from the point of view of that part of it which directly affects the health of the riparian districts, viz., the Prevention of Floods, has hitherto been untouched. The solution of the problem involves the maintenance of watercourses in such a condition as to amply provide for a sufficiently unobstructed flow of a volume of water. This is every year liable to be increased by the effluents of well-sewered and well-paved towns and roads, as well as by the sub-drainage of agricultural districts. It is this kind of direct injury to public health that has now to be considered.

In making my enquiries during the last two or three months I have, as a Consulting Medical Officer, proceeded on the plan I have always followed, viz., that of conferring with the Medical Officers of Health of the Districts concerned. I have also received a great deal of assistance from a purely voluntary Association, viz., "The River Wey Floods Prevention Association," (7) which is presided over by H. H. Lancaster, Esq., of Sendholme. It has constituent members for Weybridge, Chertsey, Byfleet, Pyrford, Send, Ripley, Woking and Guildford, besides co-opted members of special knowledge and representatives of nearly all the Local Sanitary Authorities in the Valley. The Surrey County Council is separately represented by Patrick White, Esq., J.P., and the Hon. Sec. of the Association is J. A. Shirer, Esq., LL.B., Heath House, Send. Mr. Spooner, a very old resident at Send, is the Hon. Inspector. He knows a great deal about the district. I wish to thank both him and Mr. Shirer for the information and assistance they have given to me during the two months I have been at work on this subject.

In discussing the influence of Floods on Health, it hardly needs much argument to demonstrate their ill-effect when the dwellings of populous areas are partly submerged, and when the necessaries of life have to be provided for by the help of boats. Such was the flood which visited Nottingham in the summer of 1876. Its height is recorded on the Trent Bridge. A large proportion of the dwellings in the meadows flat region of the borough were, except for the upper living rooms, submerged. Typhoid was not at that time specially prevalent, and the season was previous to the annual recurrence of Epidemic Diarrhœa. Had it not been for that, the zymotic death-rate in the area would have been increased. It may be generally assumed that floods of this kind, even in a far less degree, are injurious to health, though they do not cause epidemics of such diseases as Scarlet Fever and Measles. The comparatively recent example of Norwich is sometimes quoted, as if the effects of floods on health were exaggerated because some people are so ill-informed as to predict epidemic illness of all kinds as an immediate consequence. The truth is that floods of far less magnitude than those just mentioned, the floods, for example, that annually recur at Old Woking and Send, constitute not only an acute source of discomfort for the unfortunate residents, but leave behind them the foundations of illness of many kinds, and often of a chronic nature. It hardly requires a *Medical Officer of Health* to pronounce an opinion on a matter in which the inhabitants of the district can so well judge for themselves. Nothing but dire necessity can attach people to such localities. It is one of the greatest wants of the present day that floods, which are gigantic "Nuisances injurious to Public Health," should be reduced.

But the extent to which ill-health arises is not confined to such occurrences as those just noticed. There are conditions of the soil which sometimes lead to and sometimes follow floods which are liable to become continuing causes of disease. They are the saturation and wetness of the earth upon and near to the surface which have long been recognised as the underlying causes of illness, either directly or indirectly, sometimes through the medium of insect life. The classical Reports of the Medical Department of the Privy Council may be referred to on this subject. (10).

Dr. Pierce in a letter to the River Wey Floods Association, refers to the remarkable lesson taught us by the experiences of the Fen Districts of Lincolnshire and Cambridgeshire. (8). There ague was formerly prevalent. When the Great Land Drainage Systems came

into operation the disease practically disappeared. I have had personal experience of this disease still nearer home, viz., in marshy districts of Kent.

Bristowe, formerly a great medical authority, who also knew very well indeed the housing conditions in the South London of the 'sixties, used to emphatically declare that dampness of dwellings was more productive of and conducive to illness than any other condition even in that comparatively insanitary period. To wit, nerve illness (neuralgia) (9) and (sciatica), rheumatoid illness affecting the joints and circulation system in a chronic way, as well as bronchial and respiratory troubles generally.

The possible relationship of some of the zymotic diseases was fully described by the late Sir Richard Thorne-Thorne, K.C.B., F.R.S., in his Milroy Lectures, and in an address given to a Medical Society when he was Medical Officer of the Local Government Board. The late Dr. Ballard, F.R.S., proved that rise of temperature as shewn by earth thermometers in damp soils is an essential link in the causation of epidemic diarrhœa. Later information proved, as Dr. Newsholme, the present Medical Officer of the Board, shewed at Brighton in 1910, by comparing the experiences of Nottingham and Leicester, that the dirty conditions attaching to the pan or pail systems of filth collection, disposal and removal are mainly at fault. It is the maintenance of those systems in the first-mentioned of these two towns that of late years enables Leicester (where they have been entirely replaced by the Water Carriage system) to present a markedly better record of infant mortality. This is owing to the great reduction of those fatal epidemics of diarrhœa, from which it formerly suffered so severely. The direct dependence of this epidemic disease (*cholera infantum*, as it was called in old medical books) on municipal cleanliness is thus held to be proved.

Thorne-Thorne, in his book on diphtheria, also dwelt on the possible connection of that disease with the soil, according to the theory of the late Dr. Adams, of Maidstone, the well-known Medical Officer of Health and County Analyst of Kent.

The late Miss Florence Nightingale (who did such great work in the Crimean War and became the founder of "Modern Nursing," whose statements are therefore bound to be received with respectful consideration) was a firm believer in the baleful influence of a damp and filthy soil in the actual production of the zymotic diseases.

So much for a class of still widely prevalent infectious diseases.

PULMONARY TUBERCULOSIS.

I have left the consideration of the most widely prevalent of all the diseases which have long been regarded as preventible to the last. I refer to Phthisis, Consumption, or, as it is now called, *Pulmonary Tuberculosis*. The *great* discovery by Koch of the Tubercle Bacillus and the part it takes in the propagation of pulmonary disease has somewhat obliterated the teachings of Simon's Classical Reports, especially that in which he put forward the never-to-be-forgotten discovery published in 1866, of the late Sir George Buchanan, F.R.S. He proved that the mortality from Phthisis was influenced to a remarkable extent by the subsoil drainage of towns which was, at that time, being rapidly proceeded with. It was found that the death-rate from Tuberculosis had fallen as the subsoil water became lowered in consequence of large drainage operations. The observations made in England were too numerous to admit of the coincidence being explained otherwise than by the connection of the "drying of the top soils" and the reduction of "phthisis" in the relation of cause and effect. The importance of the discovery was immense, but it was rendered additionally striking by the fact that a similar discovery, applying to the very large populations of the United States, was made by Bowditch. The purely independent investigations of Buchanan here, and those of Bowditch in America, were published almost simultaneously without either one or the other being aware of the nature of the research on which they had both been separately and for some time engaged. The value of these synchronous observations has been generally recognised, as shown by several text books and treatises on Medicine, Hygiene and Public Health. It is not too much to say that drainage operations have constituted a considerable factor in the reduction of the Phthisis death-rate during the past 40 or 50 years. (11).*

As years went on, local observations in different parts of the country as well as abroad, were found to accord with the conclusions arrived at in 1866. I may refer in this place to two or three such investigations on a comparatively small scale in the Midlands. In 1873, as Medical Officer of Health for Nottingham, it fell to me to report on the vital statistics of 1872. In that document, printed for general distribution in a small volume, I discussed with much care and at some length the incidence of Phthisis in two large areas of that manufacturing town. They were chosen especially for their

* *The Address to the College of Physicians on Monday, March 30, 1896, by the President, Sir J. Russell Reynolds, Bart., M.D., LL.D., F.R.S.*

fitness for comparison in all respects save one, viz., their condition as regards soil saturation. I named them separately, as (1) The St. Ann's area or region, and (2) the Meadows area or region, the latter being a part of the Borough already becoming populous, the dwellings being erected on the flat low-lying part of the Trent Valley, and repeatedly subjected to floods. The population suffered much from these inundations and their consequences, the more especially as the local regulations and building bye-laws had omitted to provide for the artificial raising of the ground or ground storeys, so as to prevent damp foundations of dwellings. The following passages of my first report, dated July 17th, 1873, are here reproduced:—

“ The estimation of the amount of Phthisis, or Consumption, in a district is very important as a means of testing its hygienic state. In the obscurity which generally surrounds the early origin of this disease, no prudent physician would think of making a statement that any one condition was the cause of the malady evolved; but there is nothing in the whole science of medicine more clearly established than the dependence of this disease on certain sanitary defects. One class of these I have described when speaking of the dwellings of the Old Town. The air contained in these rooms, polluted with carbonic acid, and reeking with the exhalations from the lungs and skins of many occupants, is just such as is likely to cause the development, or to urge on the course of this insidious disease. When the seeds of the malady are existent it requires only fostering conditions like these for their growth.

“ There is another condition which has recently been proved to have a direct connection with the causation of Consumption. The saturation of the soil with moisture, or its *wetness*, has been shown of late years to favour the development of this disease. I must ask you, then, to pay particular attention to the rate of mortality from Phthisis in the different parts of the town. In the first two tables you will be unable to detect the effects of this cause, on account of the arbitrary nature of the areas comprised in the different Wards; but in the third Table I shall be able to show you facts which have a direct bearing on this point.”

“ I now come to the next stage of this enquiry. Having obtained, with tolerable accuracy, the rate of mortality in the several Wards, it appeared to be most desirable that I should submit to your consideration that which exists in other less

arbitrary areas. Instead of calculating the death-rate in a Ward, parts of which were placed in very different circumstances, Social and Sanitary, I thought it advisable to estimate them in districts, which I could map out for myself. I, accordingly, applied to you for leave to obtain from the Registrars information with regard to the Enumeration Sub-districts in their Ward, which has enabled me to calculate the population for areas of my own manufacture. By separately recording the deaths in these areas, I have been able to arrive at the rate of mortality in each. The following are my four districts:—

“ 1. SHERWOOD. Population, 13,502. Comprises all that part of Sherwood Ward which lies in the New Enclosure, and, also, that part of Park Ward which lies west of Park Row. Dwellings: Villa-residences and superior-class houses.

“ 2. ST. ANN'S. Population, 21,158. Comprises all the new part of St. Ann's and Byron Wards. Dwellings: Chiefly built to comply with the Enclosure Act and with sufficient curtilage.

“ 3. THE MEADOWS. Population, 7,480. Comprises the new and growing portions of Castle and Exchange Wards. Dwellings: Chiefly built to comply with the Enclosure Act; foundations of some of them not raised to a sufficiently high level. Saturation of the soil, great.

“ 4. THE OLD TOWN. Population, 44,473. Comprises the old portions of St. Ann's and Byron, Castle and Exchange, with the whole of St. Mary's. Dwellings: Chiefly back-to-back. (N.B.—There were as many as 8,000 back-to-back houses in Nottingham at that time. E.C.S., 1913).

“ This Table is by far the most valuable of the three, and I must call attention to some of the facts that are elicited. In the first place, in the case of the total death-rate, the most striking differences are apparent in the several districts, while, in Sherwood it is as low as 14·9, in the Old Town it is as much as 31·2. The Sherwood district is, for reasons that I have explained, not quite fairly comparable with the others, but the St. Ann's may, certainly, fairly be compared with the Old Town and 'the Meadows.' In the first two of these the contrasts are prodigious. In the one there is a mortality but little above the healthy standard, in the other the proportionate number of deaths is frightfully in excess. In the latter there is exhibited a death-rate below five years of age that is nearly double that of the

former; and it appears that zymotic diseases, or those that are mostly preventible, number twice as many victims in the Old Town as they do in this portion of the New Town.

“ The figures that show the mortality from Consumption are of melancholy interest. Here, as might be expected, the deadly effects of a poisoned atmosphere are abundantly evident; and the deaths occurring from this lingering disease are nearly twice as many in the Old Town as they are in the St. Ann’s district. But of equally sad import is the recorded death-rate in ‘ the Meadows ’ district. I would not willingly attach too much importance to figures founded on deaths occurring in one year only, but, knowing the excessive dampness of the soil in the district, knowing, too, that many of the houses have been built, in this neighbourhood, without any precautions being taken to obviate the dangers arising from this condition, I cannot look on it otherwise than as a fact of grave significance, that the death-rate from this disease in ‘ the Meadows ’ is largely in excess of that in the St. Ann’s district, which resembles it in every respect except this important one—soil saturation.” (12).
Report to the Town Council of Nottingham, 1873.

The Bye-laws were amended by the Nottingham Improvement Act, 1874, and since then it has been illegal to build below a certain level above Ordnance datum. But no very material improvement of previously existing houses was feasible. For many years now the proportion of these has been gradually improving, and, *pari passu*, the regional prevalence of Phthisis has been lessened. Still, the Trent is a frequently overflowing river, and the ill-effects of the original want of foresight in the construction of dwellings in former years remain in evidence to some degree even to the present day. On this point I have recently received an interesting and important letter from Dr. Boobbyer, who succeeded Dr. (now Sir Arthur) Whitelegge, K.C.B., of the Home Office, who replaced me on my return to London at the end of 1884, and who was, on his promotion, in turn, replaced, as far back as 1889, by the present Medical Officer. Dr. Boobbyer is a prominent member of the Council of the Royal Sanitary Institute, and has now officially presided over the Health Department of Nottingham for the exceptionally long period of 23 years. His opinion on public Hygiene and Administration is greatly valued by the Society of Medical Officers of Health, as well as by Teaching Authorities and Examining Boards. I reproduce his letter just as I have received it.

“ HEALTH DEPARTMENT,
 “ GUILDHALL,
 “ NOTTINGHAM.

“ 8th October, 1913.

“ DEAR DR. SEATON,

“ I hope to see the result of your inquiry into the effects of flooding in the Wey Valley district on the public health, when published, but, owing to the discontinuance of cellars and the raising of the building level in the Meadows and other low-lying districts of Nottingham in recent years, the evil effects of floods are not so evident now-a-days as they were at the time you refer to (1876 and thereabout).

“ I have been into the figures of particular death-rates in the several divisions of the City, and find that, while there is a good deal of in and out variation in respect of the acute specifics generally, the phthisis rate has been uniformly higher on the Meadow flats than elsewhere. The excess of the death-rate from phthisis upon this region over that for the City as a whole has been, usually, about 0·5 per 1,000 persons living, and during the five years 1908-12 the average excess was almost exactly 0·5 per 1,000. The average phthisis rate for the City during this period was 1·23 per 1,000, and that for these Meadows flats 1·72 per 1,000. (13).

“ Yours, &c.,

“ (Signed) PHILIP BOOBYER.”

It should be noted that, in the above letter, comparison is made of the “ Meadow flats region ” with the *whole* City which now includes “ the Park ” and other residential quarters as far away to the north as the Bulwell Forest.

As to the significance of the extra death-rate of 0·5 per 1,000 persons living, it is sufficient to observe that the Surrey death-rate from Pulmonary Tuberculosis, recorded by Dr. T. Henry Jones, the County Medical Officer of Health, for the period 1905-1911, was 0·74 per 1,000 persons living. Consequently the difference between the soil saturated region and “ the Whole Town ” of Nottingham amounts to two-thirds of the whole Phthisis mortality rate of our county.

I now come to the case of Leicester, in which the general death-rate has been remarkably reduced since the establishment of a system of drainage which has for some years been held up as a model for other towns similarly situated as regards their levels. The sanitary history of that city is very remarkable and instructive, as Dr. Killick Millard, the present Medical Officer, will no doubt show in his forthcoming

Lectures under the Chadwick Trust of the University of London. I must not anticipate these in any way, but I have recently had the advantage of conferring with, and have permission to quote, an eminent townsman of Leicester, G. C. Franklin, Esq., F.R.C.S., LL.D. Mr. Franklin had an extensive practice both in the town (of which he was a native) and the county around. Before his retirement to Fareham, in Hants, a short time ago, he had risen to the position of Senior at the Leicester Royal Infirmary, to which he is still attached as Consulting Surgeon. He was also formerly President, and is now a Vice-President of the British Medical Association. In the year 1875, Mr. Franklin, together with Dr. Buck, was commissioned by the Town Council to conduct an inquiry into the sanitation and social circumstances of the town in relation to the prevalence of an epidemic disease. The opinion he has arrived at as the result of his long experience is that the remarkable lowering of the total death-rate which has been accompanied by a reduction of the Phthisis death-rate is in large measure ascribable to great improvements in the drainage of this thriving manufacturing centre—Leicester. I have just received the following letter from Dr. Franklin:—

“ 18, HIGH STREET,
 “ FAREHAM,
 “ HANTS.
 “ October 14th, 1913.

“ MY DEAR SEATON,

“ The Flood Scheme was carried out under the skilful direction of Mr. Gordon, C.E., in the late 'eighties. By that the low-lying parts of Leicester have been practically freed from flooding!

“ Of course it involved 'improved drainage generally,' whereas, before the present system came into operation, many acres of land were not only water-logged, but parts of it sewage-logged as well. Now the water gets away quickly through the town and goes on in the Soar to flood Loughborough and the Soar Valley.

“ Gordon was appointed from Leicester as Chief Engineer to the London County Council, in succession to Sir A. Binnie. He, Gordon, died not long after his appointment. He was one of the cleverest public officials that we ever had in Leicester and his Flood Scheme has been the means of saving large numbers of lives in my opinion. It really was a case of 'improved drainage.'

“ Yours, &c.,

“ (Signed) GEO. C. FRANKLIN.”

Returning to the case of Surrey, I have to say that, in the long and often sparsely populated track of the River Wey alluvial and adjacent soils, it is practically impossible to obtain materials for statistical investigation on the lines of the above-mentioned. But that, in the time at my disposal, I have diligently inquired into several typical examples of ill-health, as well as great personal inconvenience to people of all classes. Naturally, some of these do not wish to decry the value of their property, which is otherwise (especially in the summer) so charmingly situated, and other poor people have nowhere to go to in the present dearth of cottages in rural districts. The places I have visited have included Godalming and Farncombe, Guildford (Millmead), Woking, Send, Ripley, Newark and Pyrford.

The contention that I have sometimes heard in these neighbourhoods that floods have their counterbalancing advantages may be dismissed as ridiculous. Flood water (with its consequent fogs, mists and miasms) should be got away as quickly as possible. Much land in regions of the Valley of the Thames and its tributaries, which is at present almost uninhabitable, could in time be reclaimed by well considered comprehensive measures having for their object the unimpeded flow of water right away from its outlet to the tidal river at Teddington Weir at times of threatened floods in its higher reaches. This object should be kept steadily in view, and its even partial achievement by means of the co-operation of local sanitary authorities with the Thames Conservancy should be attainable. It would thus, in my experience, by the removal of a potent factor in disease, prove an immense boon to the country generally, including certain parts of Surrey.

I must now conclude this part of my report by observing that, while fully recognising the high prospective value of Tuberculosis research and sanatorium benefit, and while realising the imperative nature of the regulations now already established for the control of infection, I would point out once more that other fundamentally important factors in the reduction and possible prevention of the disease must not be lost sight of. Among these are the planning of labourers' dwellings and workshops with due regard to health requirements, and the sufficient drainage of low-lying, damp and sometimes at present uninhabitable regions, thereby reclaiming them for the public good.

References:—

- (7) *Prospectus of the Association (Mr. Shirer).*
- (8) *Dr. Pierce's Letter (Mr. Shirer).*
- (9) *Letter by Tansley Luddington, Esq., J.P., Plantation House, Littleport, Isle of Ely.*
- (10) *Simon's Reports to Privy Council, edited by Seaton.*
- (11) *Simon's Reports to Privy Council, edited by Seaton.*
- (12) *Report of M.O.H. for the Borough of Nottingham, 1873, Nottingham City Council.*

REMEDIAL MEASURES.

I have already dealt with the subject that was referred to me as Consulting Medical Officer. But I hardly like to take leave of it at this point. I believe the conditions that give rise to the gigantic nuisance arising from floods can be mitigated immediately and that at relatively small cost, while as regards more drastic and costly measures the sooner the questions involved come to be discussed in Parliament the better it will be. For these reasons I consider it my duty to afford the Committee all the information I have hitherto acquired on the general subject.

(1) *Immediate steps towards improvement.* I think the River Wey Floods Prevention Association is an excellent body for promoting inquiry into the best means of getting the water away at seasons of heavy rainfall. I am also of opinion that all the district Sanitary Authorities in the Watershed—right up to Alton—should be represented on the Association. There would then be a Council of voluntary workers, all concerned with a common object, stimulating local action in a proper direction and in a systematic way. Such action would include (a) the removal of trees fallen or about to fall and other obstructions to the stream which require attention forthwith. A remarkable instance of such need for action exists at the present time in the "Old River" below Brooklands. (b) The flow of the river in many stretches of the Wey is much obstructed by the profuse growth of weeds. Very good—even if only partial and temporary—results have been attained at Old Woking by weed-cutting. I have witnessed the effect on the lowering of the river water level in that village and I would strongly recommend the adoption of the weed-cutting system right away up the Old River

and the Canal as well. The attention of the local Sanitary Authorities might, if found necessary, be directed to the condition of the banks of the watercourse just mentioned. It would be for the Association to arrange for the times of the year when weed-cutting should take place by agreement among its constituent members. (c) In places the curves or twists of the Old River Channel divert its straight course in so sudden and marked a degree that in wet seasons ponding up of water in the soil of neighbouring fields takes place in consequence. This is what has happened near the sewage outfall works for Byfleet. It has necessitated works for short-circuiting the channel stream at one spot in order to lower the level of the subsoil water and thus render land for sewage disposal available for its intended purpose. A loan for cutting a fresh channel was sanctioned after inquiry by the Local Government. The work has been rapidly proceeded with this dry summer and has, I understand, now been completed in a manner which it is hoped will be found satisfactory. If this be so I trust that the feasibility of cutting fresh channels where they seem most needed to facilitate flow will be taken into serious consideration by the Floods Association. (d) The Locks and their *Weirs* require constant attention and improvement. There should be organized supervision of Locks along the whole course of the Wey. The occurrence of heavy rainfall in its upper reaches should be immediately signalled to those below. The improvement in construction of Weirs so that the water coming down the stream may at times be let off more freely and rapidly is a matter of urgency. It has already partly taken place in a measure and now only needs to be made as complete as possible. The following Table kindly supplied to me by the Manager of the River Wey Navigation, shows whereabouts the Navigable River is liable to be held up in a distance of 19 miles from its outlet to the River Thames.

RIVER WEY NAVIGATION.

DISTANCE TABLE FROM RIVER THAMES.
1911.

	M.	F.	CH.
Thames Lock	0	0	9
Weybridge Bridge	0	6	5
Weybridge Lock	0	6	6
Black Boy Bridge	1	0	6
Coxes Railway Bridge	1	3	5
Coxes Lock	1	4	0

	M.	F.	CH.
Newhaw Bridge	2	2	5
Newhaw Lock	2	2	6
Mouth of Basingstoke Canal	2	7	8
Byfleet Railway Bridge	3	0	0
Parvishes Bridge	3	3	8
Murray's Bridge	4	0	0
Dodd's Bridge	4	2	6
Pyrford Bridge	4	7	5
Pyrford Lock	4	7	6
Pigeon House Bridge	5	2	8
Walsham Bridge	5	7	4
Walsham Gates	5	7	6
Newark Lock	6	4	2
Nowark Bridge	6	5	7
Paper Court Bridge	7	2	2
Paper Court Lock	7	2	4
Tanyard Bridge	7	5	6
High Bridge	8	0	7
Cart Bridge	8	4	7
Ashburton Bridge	8	5	6
Worsfold Gates	8	6	9
Worsfold Gates Bridge	8	7	2
Chamberland's Bridge	9	2	0
Trigg's Lock	9	5	2
Wareham's Bridge	9	6	3
Send Church Bridge	10	2	1
Broad Oak Bridge	11	0	3
Bowers Lock	11	5	8
Bowers Bridge	11	7	1
Stoke Lock	12	7	6
Stoke Bridge	13	2	8
Wood Bridge	14	1	6
Dapdune Railway Bridge	14	3	7
Dapdune Wharf	14	4	3
Onslow Bridge	15	1	1
Guildford Wharf	15	1	6
Guildford Bridge	15	1	8
Mill Mead Lock	15	3	1
Quarry Hill Footbridge	15	4	7
S. Catherine's Ferry	16	0	4
S. Catherine's Lock Bridge	16	3	9

	M.	F.	CH.
S. Catherine's Lock	16	4	0
South Eastern Railway Bridge	16	6	3
Broadford Bridge	17	1	0
Mouth of Wey and Arun Canal	17	2	4
Brighton Railway Bridge	17	3	6
Unstead Lock	17	6	2
Unstead Bridge	18	0	6
Trowers Bridge	18	5	8
Catteshall Bridge	19	0	2
Catteshall Lock	19	0	5
Godalming Wharf	19	4	0

In the above section (dealing with immediate measures) I have not discussed the Bournes and smaller tributaries of the Wey, of which there are 15 in number, some of them unnamed or named with doubtful propriety. This report is not intended to be exhaustive of the whole subject. In omitting, for the present, descriptions of small tributaries of the Wey I have been partly influenced by the consideration that works of flood prevention to be successful must be proceeded with from below upwards. That is why the improvement of the Wey river itself in its lowest reaches should come first.

(2) *Future Measures.* Having now briefly considered the immediate measures of improvement, which it is hoped may soon be accomplished, it remains to refer in a few words to the subject which must before long engage the attention of the highest authorities, if constantly recurring floods in the valley of the Thames and its tributaries are to be not only controlled but actually prevented.

I have quite lately, at the suggestion of A. C. Pain, Esq., J.P., C.A., representative of the County Council on the Thames Conservancy Board, conferred with the Secretary and Engineer of the Up-River part of the Thames. I find that we have independently arrived at the same conclusions on questions of principle both as regards the constitution of Executive Authorities for River Basins and Watersheds, and the system best adapted for their supervision and protection by carrying out works for that purpose. Such a comprehensive system would need to be planned irrespective of County Boundaries and the Areas of Sanitary Authorities, however large and populous. This is because River Basins and Watersheds often belong to separate adjacent Counties, as in the instance of the comparatively small stream or river that we have now been considering. With a

view to the Prevention of Floods, *Systematic Dredging* of all the Beds of Rivers from below upwards, *i.e.*, from the Tidal River or Sea which it ultimately joins, would be one of the main objects of such Authorities. I believe I may say that in accordance with its powers the Thames Conservancy has already decided to carry out its dredging operations more thoroughly and systematically than it has ever done before and that such advanced measures will be hailed with satisfaction by the population of the riparian districts from Richmond-upon-Thames up to Oxford.

Your obedient Servant,

EDWARD C. SEATON,

Consulting Medical Officer.

October 16th, 1913.

*To the Members of the Public Health Committee,
Surrey County Council.*

[Addendum to Report, dated October 16th, 1913, and issued to each Member of the Public Health Committee before the Committee Meeting on October 21st, 1913.]

The subject of the above report was brought before the Public Health Committee by Lieut.-General Sir Edmond Elles, G.C.I.E., K.C.B., C.C. (Member of the Committee) at their meeting in July and was subsequently referred to me for investigation at the end of that month. I found the subject to be one of the most important of those that I have been called upon to deal with in my long official experience in the County and elsewhere. It has taken me two whole months to investigate and to prepare for report. In the time at my disposal, I have acquired a large amount of information in addition to that I already possessed; but there are still some points which may need some further examination and consideration. In the meanwhile the Chairman of the Committee deems it desirable that the health aspect of so important a matter as the general effect of Floods should be at once before the Local Association and the Sanitary Authorities immediately concerned. I was accordingly requested to see that the report was printed in a form suitable for their use

The County Council formerly exercised a wide influence in connection with that branch of sanitary administration which concerns Water Supply and Drainage, including the protection of underground sources and the preservation of supplies generally. It is now necessary to consider the over abundance of water in times of very heavy rainfall which leads to the destruction of property and health due to the overflow of the drainage from the main channels of the River Thames and its tributaries. "The Drainage Problem," as it has been called, is a wider one than that of sewerage, house connections, and surface road drainage.

At the Committee Meeting of the 21st inst., Sir Edmond Elles brought forward a report to him by J. A. Shirer, Esq., of Send, on behalf of the Wey Valley Floods Prevention Association of which he (Mr. Shirer) is the Hon. Sec. This deals chiefly with the more or less immediately practicable measures of control. Amongst these is the regulation of the WEIRS of the Navigable River and Canal. On this important part of the whole subject Sir Edmond moved for an adjournment of its consideration in order that he might confer with the Clerk to the Council and secure his valuable opinion on the legal questions involved. He has invited me to assist at the conference.

With regard to a different point which arises out of my special investigation, I have already referred to a letter from Mr. Tansley Luddington, J.P., a life-long resident of Ely and its neighbourhood, in which he describes in general terms the nature of the Cambridge-shire Fen District Drainage works so productive of good results. Among the various manifestations of illness attributable to formerly bad conditions of the soil was one locally known as Brow-Ague. With regard to this affection of the nervous system, Dr. Goodman, now a member of the Surrey County Council, who knows the medical history of the Fens, has kindly favoured me with a note on the nature of "brow-ague," in the course of which he says, "I have never been sure that brow-ague was not either supra-orbital neuralgia or migraine." These are both sometimes due to dampness. In this connection the report, made long ago, by Dr. Julian Hunter (Vol. I., Simon's Series of Reports already cited) on the kinds of illness prevalent among the workers in the undrained fen districts, may be consulted.—E.C.S., October 24th, 1913.]