Dr. Blaxall's report to the local government board upon the sanitary condition of the urban sanitary district of Newtown and Llanllwchaiarn, Montgormeryshire.

Dr. Blaxall's Report to the Local Government Board upon the Sanitary Condition of the Urban Sanitary District of Newtown and Llanllwchaiarn, Montgomeryshire.

EDWARD C. SEATON, M.D.,
Medical Department,
March 12, 1878.

Ground of inquiry.

The present inquiry has been directed in view of certain reports received by the Local Government Board from Mr. Smith, late Medical Officer of Health of the locality, and from Mr. Murray Browne, one of the Board's general inspectors: the reports reflecting gravely upon the sanitary condition of the district.

Description.

This urban district comprising the towns of Llanllwchaiarn and Newtown is situated in the upper valley of the Severn, and is surrounded by hills. The river here has a very tortuous course. Approaching Newtown from the south-west, it proceeds for a short distance to the north, then assuming an easterly direction passes between the two towns (Llanllwchaiarn being on the northern and Newtown on the southern side), after which it makes a sharp bend and flows on to the south-east end of Newtown, where it receives the water of a small tributary called the "Green brook," when again taking an easterly course it leaves the district. The river is dammed in two or three places, and leats formed for the purpose of supplying motive power to certain mills situated on its banks. The town of Llanllwchaiarn rises from the north bank of the river, the streets generally leading uphill from south to north, and being intersected by a good broad road running at right angles. It possesses several flannel factories, but the market and principal trade are carried on at Newtown, on the opposite side of the river.

Newtown lies very low, being little above the level of the river which as already indicated forms its northern and eastern boundaries. The chief part of the town including the market-house and best shops being situated in the north-east angle formed by the bend of the river. Some of the streets are broad, notably that leading to the bridge which connects the two towns, while a distinguishing feature of the district is the number of confined courts or yards in which the bulk of the working class reside.

Geology.

The geological formation is grey calcareous shale of the Silurian system, the solid rock cropping up in many places. On the north side of the river the superficial soil is of a clayey character, but being interspersed with stone, is more or less porous, while on the south side it consists principally of gravel and is much waterlogged, water being arrived at almost anywhere within a few feet of the surface. This is probably in part due to the water being kept at a high level in the bed of the river by the weirs that occur in the neighbourhood of the town.

Population.

The population of this urban district in 1871 was returned at 5,886, and is now estimated at 7,000. Besides the ordinary occupations of towns, cloth and flannel manufacturing is extensively carried on, and furnishes the chief employment of the people.

In proceeding to describe the general sanitary conditions of the district as revealed by my recent inspection, I propose to treat of both towns conjointly, making special reference to any points of difference that may present themselves.

Sanitary Conditions of the District.

Excrement removal and disposal.

Formerly *excrement removal and disposal* was effected by means of common cesspit-privies, but within recent years some of these have been abolished, and middens with wooden or metal receptacles, or waterclosets, have been substituted. Owing, however, to

a failure to observe the principles which should govern excrement removal, these new contrivances can scarcely be considered as having resulted in any real improvement on the old system. Thus the receptacles are all too large to admit of their being conveniently lifted for the purpose of emptying, and as no arrangements have been made for the systematic removal of the contents, these are allowed to accumulate for weeks together, sometimes till they overflow, when notice is given to scavengers, who, at their convenience, call round and clear out the receptacles with scoops, with the result of leaving a great deal behind, while if the receptacles be wooden, the contents leak also through the bottoms of the vessels, causing almost as much pollution to the soil as the old cesspit-privies. No absorbent is used, and I have seldom seen more revolting nuisances than are exhibited under this plan of excrement removal. The waterclosets, comparatively few in number, discharge either into closed cesspits or into sewers; there is no adequate means for flushing them, and the soil-pipe is often unventilated. Thus the excrement is liable to lodge in the pipes and drains, while the sewer air finds a ready means of escape through the pan of the closet.

The cesspit-privies remaining are still very numerous and afford examples of aggravated nuisance, the stench arising from them often indicating their position before they come in view. The pits are large, pervious, and unventilated, and the contents are left undisturbed for months, or sometimes even for years, and where, as is often the case, these privies adjoin dwellings, the walls of the latter become saturated with filth, rendering the houses unfit for habitation. Many of the privies are in a very dilapidated and filthy condition, and the amount of privy accommodation is very insufficient, one privy often having to serve for several families, while some houses are totally unprovided. It is satisfactory in the midst of so much that is revolting to be enabled to make exception in favour of one locality, namely Dysart Terrace, consisting of 21 houses. Here the owner has provided each dwelling with a properly fitted earth-closet, and has arranged for the contents being systematically removed, and the closets supplied with fresh earth. I inspected each of these closets, and although all were not in an equally satisfactory condition, yet the majority were in good working order, and where such was not the case, the cause was found to be in damp ashes having carelessly been employed, instead of dry earth, the ashes caking and consequently not shooting properly when the spring was acted upon. On the whole these closets afford examples of a system of excrement removal, that, with ordinary care, can be efficiently worked, and is unproductive of nuisance.

In illustration of the evils attending the usual means in operation in this district, as above described, the following examples may be adduced :—

Examples.

(1.) *Reynold's Cottages, Frankwell.*—Two privies built back to back, one of them situated in a kitchen, the other immediately outside the dwelling, the wall of the kitchen forming the back of both privies, which discharge into a cesspit situated underneath the dwelling; the outer privy is used by four families. (2.) *Francis Yard.*—A cesspit-pit privy used by 11 families. The pit is about 16 feet feet long. (3.) *Veynor Yard.*—Four adjoining privies with large receptacles, all in a filthy condition. One of the said privies is immediately under a pantry window, and the occupant of the dwelling complained to me that the pantry stank as much as the privy. (4.) *Britannia Yard.*—Six or seven privies discharging into one cesspit about 25 feet in length. The privies are used by nine families, and are not more than 20 feet from dwellings. Moreover, the yard in which they are situated is quite closed in, and the people complain that the atmosphere in and around the dwellings is pervaded with stench from the privies. (5.) *Bank Yard.*—Cesspit privy adjoining a dwelling, the contents of the pit percolating into the cellar. In the same yard is a large closed cesspit into which waterclosets drain. (6.) *Market Hall.*—Provided with four privies which discharge into a large closed pit which has been cleared out twice or three times only during the last seven years. (7.) *New Inn Yard.*—Privy with a wooden receptacle placed immediately over a deep pit (probably an old cesspit) which at the time of my visit was half full of liquid filth, partly the result of leakage from the receptacle above; adjoining the privy is a dwelling, the interior of which was remarkably clean, but the poor people complained that sometimes they could hardly live in the house, the stench from the privy was so great. (8.) *Greens Houses, The Frolic.*—A row of foul privies situated in a narrow passage opening into a yard. They all discharge into one long cesspit which is allowed to get so full that sometimes the liquid filth overflows, and may be seen coursing down the gutter in front of the dwellings. The privies at one end of the row adjoin the back of a dwelling in Davis' Court, giving rise to intolerable nuisance; the liquid filth from the cesspit appearing in the ashpit under the fireplace in the living room, to such an extent that it has to be emptied out daily, and the whole house is

rendered unwholesome by the stench. (9.) *Woolpack Yard.*—Cesspit privy used by seven families. The privy adjoins the end house in the yard, and rats run to and fro from the the cesspit to the living room, through holes in the paved floor, which the poor people have endeavoured in vain to stop up. Meanwhile the whole house is pervaded with fæcal odour. (10.) *National School at Newtown.*—Cesspit privies in a neglected and filthy condition, seats, floors, and even the approach being strewn with excrement.

Sewerage.

Hitherto the *sewerage* of the town has been of the most irregular and imperfect description and little definite information can be obtained respecting it. But so far as I have been enabled to learn, the drains and sewers, six or seven in number, vary in construction, some being of rough stone or brick, others of earthenware pipes, either glazed and socketed, or porous and butt-ended. The sewers receive surface-water, also contents of house drains, and privies, and discharge into the Severn. Several privies and drains empty into the Green brook, which is culverted in part of its course through the town. No provision has been made for the ventilation of either the sewers or drains.

The Authority, I am informed, have had under consideration, and have submitted to the Local Government Board, a comprehensive scheme for the complete sewerage of the district, and for the conveyance of the sewage to land situated a few miles down the valley, where they propose to dispose of it by irrigation. If in connexion with this scheme, means were adopted to rid the superficial soil of the water with which it is now filled, it would be a great additional advantage, and the Sanitary Authority would do well to consult a skilled engineer as to the best way of doing this. Experience in other places, notably Salisbury, has shown the beneficial results of subsoil drainage upon health, and the laying down of the new sewers now contemplated would, I think, afford a fitting opportunity for carrying out this further and much-to-be-desired improvement.

Water supply.

A few years ago *water* was introduced into the district from extraneous sources, but this supply is little used, the people continuing, as formerly, to derive their water mainly from a number of shallow wells by means of pumps, three of which are open to the public, namely, one on the Canal Road on the north side of the river, and the Lady Well and Park Road pumps at Newtown. The wells generally are greatly exposed to the risk of pollution from the soil around them being saturated with filth from privies, defective drains, refuse heaps, and slops thrown on the surface in imperfectly paved yards. This danger, it would appear, is recognised by many of the people, for they leave their own pumps, with the surroundings of which they are only too familiar, and have recourse to other wells which, in like manner, are deserted by the persons living in their immediate vicinity. The waters of certain of the wells have from time to time been analysed by Mr. Blunt, the county analyst, with the result that some of them have been found to be highly polluted (*see* Appendix), and on two or three occasions the late Medical Officer of Health connected cases of typhoid fever with drinking the water from one or other of these wells.

With regard to the water from extraneous sources.—In 1871 or 1872 a company was formed who obtained the right to abstract water from the Cwmyrhiehwdre brook, situated on the hills about four miles to the south-west of Newtown, and having a gathering ground of about 2,000 acres. The water of the brook is slightly diverted to a reservoir, whence it is conveyed to the two towns and thence distributed to the different streets; the conduit pipes are of iron, but several of them terminate in dead ends, leaden pipes being used for the subsequent laying on of the water to the houses. The regulations as to the manner of supplying it to closets are the same as those in force in the metropolis. The reservoir is formed from a natural chasm in the rock by means of a substantial bank thrown across the lower end in order to confine the water. It is about 200 feet above the town, and is capable of storing 18,000,000 gallons.

With regard to the purity of the water, I am given to understand there are two or three farms situated within the gathering ground, and that in one or two instances the company have had occasion to exercise the powers with which they are vested to restrain contamination of the water. The people at present are strongly prejudiced against using this water, owing, it would seem, to its occasionally looking turbid and discoloured. Once it was said to have an unpleasant smell, but the cause of this was discovered in trees having fallen into the reservoir, there decaying and polluting the water.

Having examined the results of the analyses of this water, made by Dr. Frankland and Mr. Blunt, and appended to this Report, I am of opinion that this source is calculated, under proper supervision and care, to supply a very urgent necessity of the district; but in order to this, it is imperative that every precaution should be taken to

protect the water from contamination, first, at its source, and during its retention in the reservoir, and, secondly, in its subsequent course to the town, and in its distribution to the streets and houses. Probably the company will recognise the advisability of abolishing the dead ends of the pipes, also of providing filtering beds, which at present, it may be observed, they do not possess.

Offensive trades.

Newtown possesses three or four *tan and skin yards*, situated in the heart of the town, but, so far as I could ascertain from personal inspection, they are, with one exception, not productive of nuisance beyond what is inseparable from the processes of cleansing and preparing the skins, &c. At the same time it is desirable that such business should not be carried on in the midst of populous neighbourhoods. The exception referred to is a tan yard in Skinner Street, which is highly objectionable, containing, in addition to the work buildings, a huge refuse bin, measuring about 480 cubic feet, built up in one corner, within 30 feet of dwellings, while adjoining it, is a most offensive privy for the use of the workmen, 16 in number. At the time of my visit the refuse bin was half full of animal and vegetable matter, and the pavement of the yard was very defective, being full of holes in which filthy water was stagnating.

Slaughter houses.

Slaughter-houses (five in number) are situated in Newtown and are all registered, but beyond this the byelaws respecting them are not enforced. As a consequence, one only is properly paved, and *all* are in a very unwholesome condition. Four out of the five are in close relation to inhabited dwellings, one actually adjoining. The fifth is some distance removed, but this is all that can be said in its favour. The blood is allowed to stand about in vessels just outside the slaughter-houses, till, in summer time, I am told, it becomes alive with maggots. The offal is said to be generally given to pigs, but there was abundant evidence of its being thrown on manure heaps, and in one instance it is usually stored inside the slaughter-house, there to await a favourable opportunity for removal, which causes a stench so horrible that people are obliged to close their doors and windows.

Piggeries and other nuisances.

Pigsties are often met with in close proximity to dwellings, in some instances adjoining them, in others being only a few feet removed, and the evil of such connexion is increased where the houses are situated, as is commonly the case, in confined yards. Manure and refuse of all kinds is allowed to accumulate in the vicinity of dwellings in large open bins provided for the purpose, or, where these do not exist, the surface of the yards and precincts is strewn with every description of filth which the more readily soaks into the soil, from the pavements of the yards and streets being much broken.

Dwellings.

In addition to the danger to which *the dwellings* generally are exposed from their intimate relation to the several insanitary conditions above described, they are rendered unwholesome by reason of other causes, such as dampness, defective ventilation, or want of repair, some indeed being in such a ruinous state as to be unfit for habitation. The houses are usually built back to back, and have no through ventilation, and it would seem that many of them have been devised with a view to preclude the entrance of fresh air, the windows of the lower rooms not being made to open and the opening space of the windows of the upper rooms measuring only about 18 × 12 or 14 inches. The lower rooms are damp through the floors being laid with pebbles, or paved with flag stones, often much broken. Another cause of dampness is to be found in the absence of any eavestroughing, or where such exists in the rainwater pipes discharging on to the surface close to the foundations. The roofs of the dwellings are often unceiled, rendering the bedrooms very cold in winter and very hot in summer. In many cases the lower stories of factories are occupied as dwellings; other habited rooms again (on the Canal Road) are situated immediately over a large stable, with which they have direct communication through holes in the floors; while two or three houses are built over the culverted part of the Green Brook, and the occupants complain loudly of the stench arising therefrom. This brook, as already indicated, is virtually a sewer, and sometimes it overflows and floods the basements of the dwellings. In short, I have seldom in all my experience seen dwellings so generally bad and unwholesome as they are in this district.

Common lodging-houses.

The *common lodging-houses*, three in number, are situated in a terrace at Newtown; they are registered and apparently well kept; but recently stables have been built within 3 feet of the back doors, thereby impeding the free current of air and polluting the atmosphere in the vicinity of the dwellings.

Markets.

The cattle *markets* are held in the streets of Newtown, and are very justly complained of as creating nuisance, the droppings of the cattle befouling the surface and soaking into the soil, while in wet weather the mixture of mud and excrementitious matter, trodden together, is represented as making the streets abominably slushy and almost impassable.

Sickness and Mortality.

The population of this urban district for the seven years 1871–77 may be taken at 6,443, being the mean of the population returned in the census of 1871 (5,886), and the estimated population in 1877 (7,000). During this period the mortality from all causes as shown by the Registrar General's returns amounted to 958 deaths, giving a yearly average of 137, or an annual rate of 21·2 per 1,000 of the mean estimated population. This general death-rate, it may be observed, is greatly in excess of that (16·5) obtaining in the Registrar General's standard group of districts comprising towns with populations varying from 3,000 to 12,000 persons. Of the 958 deaths, 40 are referred to scarlatina, which was epidemic in 1871 and again in 1874; and 143 were due to phthisis, being at the annual high rate of 3·1 per 1,000 of population. Phthisis being a disease often associated with dampness of soil and with unwholesome conditions such as are shown to characterise the dwellings of this district, it would seem that the Sanitary Authority have it in their power to do much to lessen the mortality from this cause. In like manner with regard to other diseases contributing to the high general death-rate, there can be no reasonable doubt that under efficient sanitary administration a considerable reduction would be effected. Lastly, the fact that deaths from typhoid fever have from time to time been recorded, and that last year the Medical Officer of Health connected three such fatal cases with excrementitious pollution of air and water, should further impress the Authority with the vital importance of taking efficient action to improve the sanitary condition of their district.

Sanitary Administration.

Sanitary action and administration.

Both the Medical Officer of Health and the Inspector of Nuisances are under the Order of the Local Government Board of the 11th November 1872. Mr. Hall, Medical Officer of Health, has held the appointment only since June last. No arrangements have been made with the registrars to supply him with the weekly returns of mortality. The inspector of nuisances was appointed about 18 months since; he has not kept either a report book or a continuous record book as required by Section III., Regulation 11, of the Board's Order. The Authority have made no provision in the way of a hospital for the reception of cases of dangerous infectious disease. But it is evident from the scarlatina mortality on the one hand and ill-contrived and otherwise unwholesome dwellings on the other hand, that a suitable place of isolation ready at command is an urgent necessity of the district. With regard to the sanitary state of the district, Mr. Smith, the late Medical Officer of Health, from time to time directed the attention of the Authority in very clear and detailed reports to the unwholesome conditions prevailing throughout their district, pointing out the injurious effect upon health, and strongly recommending, amongst other remedial measures, subsoil drainage, and organised provision for the removal of contents of privies, and refuse and manure from the vicinity of dwellings. In like manner the inspector of nuisances has repeatedly brought under notice of the Authority the existence of many of the evils set forth in this Report, making special mention of the neglected condition of the slaughter-houses, but with little or no practical result, the action hitherto taken having been limited to the employment of scavengers to cleanse the streets, and to remove refuse *when required to do so.* Thus the Authority, in neglecting to adopt the measures recommended by the Medical Officer of Health, and which had for their object to remedy conditions exercising a prejudicial effect upon the public health, have signally failed to fulfil the obligations imposed upon them by the Legislature.

January 1878. F. H. BLAXALL.

Recommendations.

(1.) The Sanitary Authority should take into consideration the best means for dealing with the excrement of the population. Before any conclusion is arrived at as to the adoption of the watercloset system for the town generally, information should be obtained as to how far the Water Company will be able to provide such a supply of water as will insure to each closet ample means of flushing. If any other system should be determined on for any portion of the town, it will be requisite that the Authority should, either by themselves or by arrangements with others, procure the regular removal and the proper disposal of the closet contents. Furthermore, all privies that cause nuisance should

APPENDIX.

The Wyle Cop, Shrewsbury, October 24th, 1876.

ANALYSIS of WATER from "KINGSEY'S WELL," NEWTOWN.

THE water is clear and free from smell.

Total solid contents, per gallon, 56 grains.
Chlorine, per gallon, 9 grains.
Nitric acid, per gallon, 11·13 grains.
Hardness, by Clark's scale, 24°.
Ammonia, per gallon, 0·08 grains.
Albuminoid ammonia, per gallon, 0·017 grains.

This water contains recent sewage matters in considerable quantities, and is also charged with sewage residues in the form of nitrates and chlorides; it is quite unfit for drinking.

(Signed) THOS. P. BLUNT, M.A., F.C.S.

The Wyle Cop, Shrewsbury, November 21st, 1876.

ANALYSIS of WATER for NEWTOWN LOCAL BOARD. WELL in ARTHUR'S YARD.

THE water is not quite clear; it has particles of wood and filmy substances in suspension; it is free from smell.

Total solid contents, per gallon, 80 grains.
Nitric acid, per gallon, 5·57 grains.
Chlorine, per gallon, 13·5 grains.
Hardness, by Clark's scale, 48°.
Ammonia, per gallon, 0·003 grains.
Albuminoid ammonia, per gallon, 0·006 grains.

This water is free from recent organic matter, as shown by the minute quantities of ammonia and albumenoid ammonia found. It contains, however, very large quantities of sewage residues in the shape of nitrates and chlorides, and is also excessively hard. It cannot be condemned as actually unwholesome for drinking at the present time, but it is not a desirable water either for that purpose or for general domestic use; it would be improved by filtration.

(Signed) THOS. P. BLUNT, M.A., Oxon, F.C.S.

ANALYSES of WATER from the NEWTOWN WATERWORKS.

Analysis No. 1 (Company's Water).

Royal College of Chemistry, 315, Oxford Street, W.

GENTLEMEN, NEWTOWN WATER. March 23rd, 1872.

THE analysis of the sample of water which you sent to me on the 6th instant is completed, and I herewith enclose the results.

The water is of excellent quality for all domestic purposes. It is palatable; contains but a very small proportion of organic matter, which is moreover of vegetable origin, and it is quite free from any trace of animal contamination.

It is very soft and therefore well adapted for washing and manufacturing purposes.

I am, &c.

(Signed) E. FRANKLAND.

RESULTS of ANALYSIS expressed in parts per 100,000.

No. of Sample.	Description.	Total Solid Impurity.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total Combined Nitrogen.	Previous Sewage Contamination.	Chlorine.	Hardness.			Remarks.
										Temporary.	Permanent.	Total.	
1,763	Newtown water -	4·62	·104	·020	·003	·007	·029	0	·75	·3	3·2	3·5	Contains floating particles.

Analysis No. 2 (Company's Water), together with Analysis of Water from four other named Sources.

ANALYSIS of FIVE SAMPLES of WATER from the NEWTOWN LOCAL BOARD.

Number and Source.	Solid Contents per gallon.	Chlorine per gallon.	Nitric Acid per gallon.	Hardness, by Clark's Scale.	Ammonia per gallon.	Albuminoid Ammonia per gallon.	General Remarks.
	grains.	grains.	grains.	° ″	grains.	grains.	
1. Park Street well -	11	1	0·82	7 5	0·009	0·005	Water free from smell, while particles covered with conferroid growth float in it.
2. Waterworks Company's water.	8	0·88	0·45	4 5	0·018	0·01	Water free from smell, but not quite clear; a smaller quantity of similar particles to those in No. 1 are observed.
3. Ladywell -	8	1·25	1·14	6 0	0·006	0·005	Water clear, but has a slight odour.
4. Canal-road well -	25	2·88	3·71	16 0	0·004	0·006	Water clear, and free from smell.
5. Model Cottages well	23	2·7	3·71	12 0	0·004	0·004	Water clear; very slight earthy smell developed on keeping.

REMARKS.

Numbers 1, 2, and 3 have a general resemblance to each other, and appear like water from running streams or from the surface. No. 1 contains recent organic matter in sufficient quantity to forbid its use for drinking. It does not appear, however, that the pollution is derived from sewage, since the amount of chlorides and nitrates is normal. These remarks apply equally to No. 2, which is, however, more contaminated than No. 1.

No. 3 is less polluted with recent organic matter than either 1 or 2, and, but for its slight odour, would be a water of fair quality. All three waters are remarkably soft, being less than one-half the average hardness of spring water. They would certainly be much improved by filtration.

Nos. 4 and 5 bear the same kind of general resemblance to one another as is observed in the three first samples, and have the character of water from a well or spring. The chlorides and nitrates indicate slight "previous sewage contamination." In other words, they show that the water has had access to strata slightly polluted with sewage, but the mere traces of recent organic matter indicated by the ammonia and albuminoid ammonia show that efficient filtration had taken place before the water reached the point at which it was drawn. The hardness of 4 is about the average of springs; that of 5 slightly below it. Both waters might be used for drinking and general purposes, No. 5 being slightly the purer and better of the two. No benefit would accrue from filtering either of these two last samples.

(Signed) THOS. P. BLUNT, M.A., Oxon., F.C.S.,
County Analyst.

Analysis No. 3 (Company's Water).

Royal College of Chemistry, South Kensington Museum,
July 1st, 1876.

GENTLEMEN,

HEREWITH I enclose results of analysis of the sample of water now supplied to Newtown.

The water is very turbid, but the suspended particles do not contain any organic matter; they consist chiefly of oxide of iron, derived no doubt from the distributory mains, and are innocuous.

In solution, the water contains a large proportion of peaty, or vegetable matter, and it has in consequence an unpleasant bitter taste. It is altogether inferior in quality to the sample (No. 1,763) which I analysed for you in 1872, but it exhibits no evidence of previous sewage or animal contamination, and it contains nothing unwholesome.

I am, &c.

(Signed) E. FRANKLAND.

Results of analysis expressed in parts per 100,000; Newtown water, June 21st, 1876:—Total solid impurity, 10·70; organic carbon, ·301; organic nitrogen, ·061; ammonia, ·020; nitrogen as nitrates and nitrites, 0; total combined nitrogen, ·077; previous sewage or animal contamination, 0; chlorine, 1·30; hardness, temporary, 0, permanent 6·1, total 6·1; suspended matter, mineral 1·40; organic 0; total 1·40.

Analysis No. 4 (Company's Water).

The Wyle Cop, Shrewsbury, July 14th, 1876.

ANALYSIS of WATER for Messrs. POWELL, BELL, and SWELTENHAM.

The water is slightly clouded; it has a brownish colour, a disagreeable odour, and a taste suggestive of decomposing vegetable matter. On applying heat, brown flocculent particles separate out, consisting principally of oxide of iron.

Total solid contents, per gallon, 8 grains.
Chlorine, per gallon, 0·81 grains.
Nitric acid, per gallon, 0·12 grains.
Hardness, by Clark's scale, 5°·25 (5¼°).
Ammonia, per gallon, 0·016 grains.
Albuminoid ammonia, per gallon, 0·015 grains.

This water is certainly not fit for drinking in its present condition, owing to its bad smell and colour, although it might be difficult to point out any actual harm which would result from its use.

The pollution is entirely of vegetable origin, as shown by the normal proportion of chlorides and the minute quantity of nitrates present. All the objectionable appearances observed might be accounted for by the presence of dead trees in the reservoir, and would probably disappear upon their removal. Even the solution of iron from the mains is very probably due to the same cause, and the water is in all other respects a good one for general domestic use, owing to its freedom from animal contamination and its great softness, which is less than one third the average of spring waters.

(Signed) THOMAS P. BLUNT, M.A., F.C.S.

Analysis No. 5 (Company's Water).

The Wyle Cop, Shrewsbury, August 10th, 1876.

ANALYSIS of TWO SAMPLES of WATER, received through Messrs. POWELL and SWELTENHAM.

(A.) *Water as it enters the Reservoir.*

The water is almost perfectly clear; it is quite free from smell, but has a very slight earthy taste.

Total solid contents, per gallon, 7·8 grains.
Chlorine, per gallon, 1 grain.
Nitric acid, per gallon, 0·185 grains.
Hardness, by Clark's scale, 4°.
Ammonia, per gallon, 0·003 grains.
Albuminoid ammonia, per gallon, 0·009 grains.

This is a fairly good drinking water, which contains a little vegetable matter in solution; it is excellent for general domestic use.

(B.) *Water as it leaves the Reservoir.*

This water has a brown colour, and brownish flocculent particles float about in it, producing turbidity. On agitation it gives off an offensive smell; the taste is disagreeably earthy.

Total solid contents, per gallon, 8 grains.
Chlorine, per gallon, 1 grain.
Nitric acid, per gallon, 0·112 grains.
Hardness, by Clark's scale, 5°·5.
Ammonia, per gallon, 0·022 grains.
Albuminoid ammonia, per gallon, 0·013 grains.

This water is not a desirable one for drinking, owing to its turbidity and bad smell, though it might not be positively deleterious; in other respects it is a good water for domestic use, though somewhat harder than No. 1.

On comparing the results given above, it is evident in the first place that the water takes up considerable quantities of vegetable matters during its passage through the reservoir, to which its bad colour and smell are due, as well as the excess of nitrogenous substances.

In the second place, there is a slight decrease in the quantity (originally very small) of the nitrates. This is a fact worthy of note, since it is in accordance with the most recent views upon the subject of the action of vegetable ferments upon combined nitric acid.

Thirdly, there is an increase of hardness without a corresponding rise in the proportion of solid contents. This is undoubtedly due to the presence of carbonic acid, resulting from the oxidation of the vegetable matter in the water.

(Signed) THOMAS P. BLUNT, M.A., Oxon., F.C.S.,
County Analyst.

Analysis No. 6 (Company's Water).

The Wyle Cop, Shrewsbury, April 4th, 1877.

ANALYSIS of WATER for Messrs. POWELL and SWELTENHAM.

The water is slightly clouded; it acquires a very slight odour when kept some days in a closed vessel.

Total solid contents, per gallon, 6 grains.
Nitric acid, per gallon, 0·22 grains.
Chlorine, per gallon, 0·7 grains.
Hardness, by Clark's scale, 3°·5.
Ammonia, per gallon, 0·001 grains.
Albuminoid ammonia, per gallon, 0.004 grains.

This water is free from the slightest trace of sewage or animal pollution, past or present; it contains faint traces of vegetable matter, to which are due the development of a slight odour on keeping. Its condition would be improved if the cloudiness were removed, either by filtration or subsidence; but it is in all other respects an excellent water, both for drinking and general domestic use; its softness is remarkable, the hardness being less than one quarter the average of springs.

The very slight traces of vegetable matters are of no importance from a sanitary point of view.

No lead or copper is present in the water.

(Signed) THOMAS P. BLUNT, M.A., Oxon., F.C.S.

Analysis No. 7 (Company's Water).

The Wyle Cop, Shrewsbury, September 14th, 1877.

ANALYSIS of a SAMPLE of WATER from the NEWTOWN WATERWORKS MAINS, per Messrs. POWELL and SWELTENHAM.

The water is clear and free from smell.
Total solid contents, per gallon, 9 grains.
Chlorine, per gallon, 0·65 grains.
Nitric acid, per gallon, 0·074 grains.
Hardness, by Clark's scale, 4 degrees.
Ammonia, per gallon, 0·003 grains.
Albuminoid ammonia, per gallon, 0·004 grains.

This is in all respects an excellent water, free from organic matter, and remarkably soft; it is well adapted both for drinking and for general domestic use. No lead or other poisonous metal is present.

(Signed) THOMAS P. BLUNT, M.A., Oxon., F.C.S.

LONDON:
Printed by GEORGE E. EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.
[13643.—100.—3/78.]