[Report 1884] / Medical Officer of Health, Newcastle-upon-Tyne City & County.

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REPORT

ON

THE WATER SUPPLY

OF

NEWCASTLE-UPON-TYNE

AND DISTRICT.

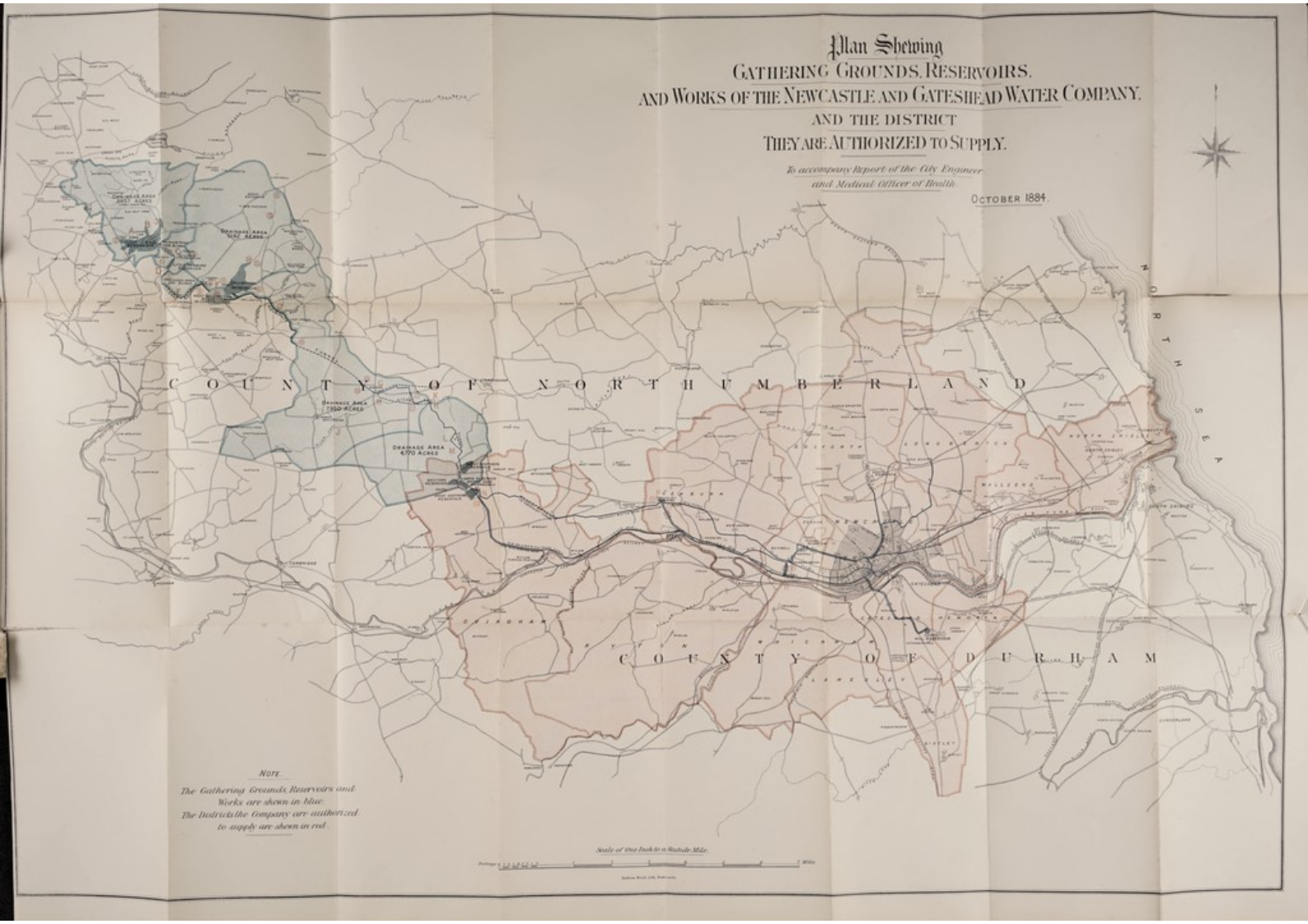
BY

W. GEO. LAWS, City Engineer,

AND

H. E. ARMSTRONG, Medical Officer of Health.

OCTOBER, 1884.


Plan Shewing
GATHERING GROUNDS, RESERVOIRS,
AND WORKS OF THE NEWCASTLE AND GATESHEAD WATER COMPANY,
AND THE DISTRICT
THEY ARE AUTHORIZED TO SUPPLY.
To accompany Report of the City Engineer and Medical Officer of Health.
OCTOBER 1884.
COUNTY OF NORTHUMBERLAND
COUNTY OF DURHAM
NORTH SEA
DRAINAGE AREA 1350 ACRES
DRAINAGE AREA 670 ACRES
Note.
The Gathering Grounds, Reservoirs and Works are shewn in blue.
The Districts the Company are authorized to supply are shewn in red.
Scale of One Inch to a Statute Mile.

TO THE JOINT GAS AND WATER, AND SANITARY COMMITTEES OF THE COUNCIL OF NEWCASTLE-UPON-TYNE.

GENTLEMEN,

At the Council Meeting of January 9th, a letter from Dr. HUNTLEY, of Humshaugh, complaining of sewage contamination to the water supply of Newcastle, was referred to you for consideration. You met to consider this letter on the 29th January and 22nd February, and visited the Water Company's reservoirs at Colt Crag, Little Swinburn, and Hallington, on the 4th and 18th February. At a Special Meeting of the Council, called by requisition to the Mayor, and held on the 27th of February, you presented a Report, and, after some verbal alteration, that Report, containing the following Resolution, was confirmed :—

"That this Committee recommend to the Council, that previous to any independent authority being engaged, the City Engineer and the Medical Officer of Health visit the locality complained of, and examine into and report fully to the Joint Committee upon the present position ; and that they also report on the collection, storage, conveyance, and distribution of the water supply of the City, with a view of securing an ample supply of pure and wholesome water for domestic use."

This is a very comprehensive resolution ; and a Report covering all the ground here indicated must, necessarily, be of considerable length.

There has been much information to collect, and much preliminary work to do, before we could hope to set before you a report that would meet the case.

We have thought it imperative that we should jointly visit the whole of the works, examine generally the various collecting grounds, and minutely the various reservoirs, besides tracing out the chief feeders, and walking over the whole of the aqueduct from its commencement at Colt Crag to Newcastle. This we have done, and have come to the conclusion that the investigation divides itself readily and distinctly into :

1st. The engineering features of the water works, and quality, quantity, and mode of supply.

2nd. The purity of the supply.

We have, therefore, although reporting jointly on the general features of the case, each devoted his attention more particularly to the details of that part which fell naturally under his department.

Thus, while we concur in the report as a whole, it is to be understood that the responsibility for engineering statements rests with myself, and, for sanitary and medical matter, with the medical officer.

The analyses of samples of water taken by us have been made by Mr. J. PATTINSON, and, where other analyses are quoted, the authority is given.

HISTORY OF THE WATER SUPPLY OF NEWCASTLE.

BEFORE discussing the present state of things, it may be interesting briefly to run over the various steps which have, from time to time, been taken to supply Newcastle with water. These date from a very early period, and the first commencement of enterprise in this direction appears to have been by the monks of the various religious houses in the Town, and to have been undertaken for the benefit of themselves, and their monasteries, and retainers. BRAND mentions a spring, at the top of Pandon Bank, supposed to have supplied the house of Carmelites. The Black Friars, about 1264, made a conduit from a spring in the Warden's Close, which supplied their monastery, and was carried forward into the Town. The Grey Friars, about 1342, were granted the sole use of the Seven Head Wells, which seems to have been a spring of some note in those days. Probably these three springs were those mentioned by LELAND, the antiquary, about 1538, where he says: "There be three hedds of condutes for fresch water to the Town."

The population at that time would not exceed 6,000 to 7,000 souls, most, if not all, of whom would be dependents, in some way, of the various religious houses; and, no doubt, these springs supplied the greater part of the inhabitants

with drinking water, whilst water for their general wants was got from the Tyne. There are records, however, shewing that, about 1600, there were several public pants in various parts of the Town. In 1647, one of these pants was "cut off" by order of the Common Council, as being unfit for use. In 1671, there was great scarcity, and the supply was curtailed by the Council. This was owing, in part, to the increase of population, and partly to the failure of some of the springs, which had been drained by colliery workings.

In 1693, CUTHBERT DYKES proposed to supply the Town with water by pumping from the Tyne, at Sandgate, and this scheme was actually carried out, though the works were designated by the Towns-people as "The Folly;" and, no doubt, only great need of water would make them accept it from such a source, contaminated as it was, with sewage.

The next scheme was by WILLIAM YARNOLD, an attorney, of New Woodstock, in Oxfordshire, who appeared before the Mayor, and proposed means for supplying the Town with "good and wholesome water," which were so far satisfactory to the authorities, that they granted him a lease for 300 years of "all waste grounds without the walls, but within the liberties of the Town," including powers for the erection of cisterns, works, &c., and for breaking up the streets to lay down his pipes. He was restricted to thirty taps for private houses, so that the system seems to have been one for public supply by pants in the streets. He was not to get any part of his supply from the Tyne, nor was he to interfere with any of the springs on the Town Moor or Castle Leazes, nor with those that supplied the works of CUTHBERT DYKES, in Sandgate, or Mr. ELLISON, in Pandon, or any of the existing pants in the Town. From this, it would seem that DYKES's "Folly" though nominally deriving its supply from the Tyne, really did so from streams or springs running into it, possibly from the lower part of the Pandon Burn. The Council was also to have power to break into the pipes to get water in case of fires.

YARNOLD, having agreed with the Council, proceeded to get an Act of Parliament in 1698-9, entitled; "An Act for better supplying the Town of Newcastle-upon-Tyne with Water." This Act was granted in a liberal spirit, and gave him ample powers, while protecting him against extortionate claims for compensation. He at once commenced work near Coxlodge, about four miles north of Newcastle, adopting a

spring rising from the borehole of an abandoned colliery. From a small reservoir here, he laid 4-inch wooden pipes over the Moor, and through the Town, across the Tyne Bridge, to HOLMES's Close, in Gateshead, where he built service reservoirs, or ponds, into which the water was pumped from Coxlodge. From HOLMES's Close, the water flowed by gravity, through pipes of wood and lead intermixed, back across the bridge, to Newcastle, to the "Kail Cross," where two leaden service cisterns were erected, and, from these, pipes extending along the chief streets supplied the tenants.

The Coxlodge supply, however, was very variable, small in summer, though plentiful in winter, and YARNOLD rented DYKES's "Folly" works to supplement his own, and even then was unable to give his tenants the stipulated supply of two hours per week. The yield of the Coxlodge spring was only about 75,000 gallons per day at the best, and the pressure from the Gateshead reservoir was too small. Imperfect as his works were, great credit was due to YARNOLD for the energy which induced him to undertake a task which the Corporation had never attempted. He appears to have been shrewd enough to forsee trouble ahead of him, and left the Town after disposing of his undertaking to a small joint-stock company, who carried it on under difficulties till 1739, when a severe frost almost destroyed their pipes, and caused so much damage to the "Folly" works, then in the hands of a Mr. CROW, that he finally abandoned them. The proprietors of YARNOLD's works now tried further afield, and added the Heworth Mills and Springs to their sources of supply, which enabled them to give a better service to each of the various districts into which they divided the Town.

The Castle Garth, Flesh Market, Pilgrim Street, and Groat Market districts were supplied for six hours each on the Sunday in each week from the two supply cisterns at the "Kail Cross."

On the Monday, Westgate had a three hours' supply, Pilgrim Street two hours, and Dog Bank six hours.

On the Tuesday, the Quayside had six hours, the Close and Sandhill two hours, Gateshead four hours, and the Side two hours. During these hours of supply the people had to lay in a stock that would last them for the whole week. In the winter, however, the supply was better, and two services per week were given.

In 1770, RALPH LODGE, on behalf of himself and co-partners in YARNOLD'S works, petitioned the Council for leave to take certain springs belonging to them for the better supply of the Towns. Before granting any leave the Council invited opinions from qualified persons as to the quality of the various waters. This led to a rather animated discussion, and some difference of opinion, between Dr. ROTHERHAM, of Newcastle, and Mr. JAMES TYTLER, chemist, of Gateshead, Dr. ROTHERHAM giving the preference to Tyne water, and Mr. TYTLER to the Coxlodge supply ; Dr. LEWIS, of Kingston-on-Thames, Dr. BLACK, of Edinburgh, and Dr. SAUNDERS, of London, agreed with Mr. TYTLER, and the Council, acting on their opinion, granted the lease to Mr. LODGE and Partners for 227 years of ground at the "south end of the Moor" for reservoirs, with leave to lay pipes to them from Coxlodge.

In 1797, the works were purchased by the "Newcastle Fire Office," who served the Town from then until 1805, when they supplemented the supply by sinking a shaft near the Grand Stand to some old colliery workings, where they found abundant water, and erected a windmill to pump it up, and thence conveyed it by a ten-inch brick culvert, to the Reservoirs on the Moor. This now became the chief source of supply to Newcastle, while Gateshead was served from the Heworth springs ; and the Coxlodge works of YARNOLD were soon abandoned as unnecessary.

These improvements enabled the Newcastle Fire Office Company to serve the Town fairly for about 25 years, though the supply was still limited to three days per week, the daily consumption being between 70,000 and 80,000 gallons. No scarcity was felt till the outbreak of cholera, in 1831, when a large quantity of water was used in flushing and washing the lanes in Sandgate and other crowded parts of the Town, and this exhausted the supply, already smaller than usual in consequence of a mild winter and a small rainfall. The Company were forced to erect an engine, and pump water from the Tyne, and water carts, to the number of 120, were employed daily in conveying water to the Company's tenants. This led to the sinking of another shaft at Coxlodge by the "Fire Office Company," and also, in 1832, to the appearance of a new company, the "Newcastle Subscription Water Company," who proposed to supply the Town entirely from the Tyne. There was in 1833-4 a severe

fight in Parliament between the new and the old Company, the latter pleading that they were the legal successors to WILLIAM YARNOLD, and entitled to the sole right of supplying the Town, under his contract with the Corporation, for 300 years. The Bill of the new Company, however, passed both Houses, and became law in May, 1834.

The new Company proceeded to erect an engine about a mile above the Town, to pump water from the Tyne up to a reservoir on Arthur's Hill, having first filtered it. From this point the Town was supplied.

There was now a strong rivalry between the two Companies, which finally resulted in the purchase, by the New Subscription Company, of the works of the old Company, in 1836, and in an improved supply to the public, so far as quantity went; but the quality was objectionable, and led to a newspaper crusade against the Subscription Company by the *Newcastle Journal*. This was followed by the formation of another Company for obtaining water from Prestwick Carr, and the river Pont. They obtained an Act, but were not successful in buying up the Subscription Company, and they never executed their works.

The Subscription Company continued in possession of the ground, doing their best to meet the increasing demand, until 1845, when a new competitor appeared, in the shape of the "Whittle Dean Water Company," supported by a strong local Directorate, of whom the then Mayor, Mr. Alderman POTTER, became Chairman, Sir WILLIAM, then Mr. W. G. ARMSTRONG, being one of the moving spirits. What they offered to the public, and how they proposed to perform it, will best be seen by a recital of the various Acts of Parliament obtained by them, and a short summary of their provisions, and this will bring the history of the water supply of Newcastle up to date, as this Company which, in 1863, became the "Newcastle and Gateshead Water Works Company," is now supplying the two towns.

Their existence, of now nearly 40 years, has been a somewhat chequered, but on the whole, prosperous one. Several times during these 40 years the demand for water has overtaken the supply, and they have been forced to go further afield to provide for the increasing wants of their district. This has arisen partly from increase of population, but largely, also, from the appreciation by the public of the advantages of a full supply of "pure and wholesome water,"

both for domestic use and manufacturing purposes. The pressure, in times of scarcity, has produced proposals for adopting other sources of supply ; but, as the Company has always been alive to the necessity of meeting the demand, none of these has come to any practical result. As a notice of these various schemes will be necessary in their proper place, it is not needful to do more than mention them here.

Those who wish to go more into detail in the history of the Newcastle Water Supply, are referred to articles in the *Newcastle Journal,* during the years 1834-39, and also in 1840-1, and to the *Tyne Mercury* of the latter dates. In 1851, the *Newcastle Chronicle* published a series of articles on the subject, which were afterwards reprinted ; and, in 1863, Mr. D. D. Main, the late energetic Secretary of the Water Company, read a paper on the "Supply of Water in Newcastle and Gateshead." From these latter sources, the facts above summarised have been largely borrowed.

ACTS AND POWERS OBTAINED BY THE NEWCASTLE AND GATESHEAD WATER COMPANY.

In June, 1845, the Company was first incorporated by the "Whittle Dean Water Works Act," for the purpose of "supplying the Borough and County of Newcastle-on-Tyne, and the Town and Borough of Gateshead and the Parishes and places adjoining thereto respectively, with water from Whittle Dean, in the Parish of Ovingham, and other places in the County of Northumberland."

They were empowered to take and use the waters of the Whittle Dean streams, and of streams near Red Row, in the Township of Throckley, and to convey them to the Arthur's Hill Reservoir, authorised by the same Act ; also, to purchase the undertaking of the Newcastle Subscription Water Company, and to carry on their works, &c.

They were allowed to break up streets and roads for the purpose of laying their pipes, but the Town Surveyor of Newcastle and the Street Authorities in Gateshead had power to prescribe in what part of the streets, &c., the pipes were to be laid.

The Company were bound to provide a constant "supply of pure and wholesome water, amply sufficient for the

domestic use" of all inhabitants "within the limits of the Act," but this was not to include the supply of water for baths, horses or cattle, or for washing carriages, for which purposes, however, the Company might supply water by agreement.

They were bound to lay down pipes to any part of the Towns of Newcastle or Gateshead, where a sufficient number of owners of houses should agree to take a supply of water for three years, which, at the specified rates, would amount to 10 per cent. on the outlay.

They were also, at the request of the Corporation, to supply water for "cleansing and watering the public streets and sewers, at rates to be agreed upon or fixed by arbitration, or by a public officer appointed for the purpose."

Fire plugs were to be fixed in each street where the mains were laid, and also by request and at the expense of owners of manufactories near their works, and water for extinguishing fires was to be supplied free.

Penalties of 20s. per day were provided in case of neglect or refusal to supply water for domestic use or for sanitary purposes, except in case of frost or any unavoidable cause or accident.

Penalties were also enacted for fouling the waters or reservoirs of the Company by bathing or washing therein, or by bathing or washing dogs, or by throwing in filth or other offensive things, or by cleansing or washing cloth, wool, leather, skins, or wearing apparel, or by permitting any filthy water from sinks, sewers, drains, &c., to run into the water or into any springs, drains, or water courses communicating therewith. The penalty for every such offence being, not exceeding £10.

Heavy penalties were also imposed on any makers of gas who should foul the waters in the course of their business, and powers were given to the Company to expose and examine the gas pipes to discover comtamination.

Further powers were obtained by the "Whittle Dean Water Works Amendment Act," of 1853, to provide another reservoir and aqueduct and other works, and to take water from the Pont or its tributaries and from certain streams flowing into the River Tyne, in the Parishes of Chollerton, St. John Lee, Stamfordham, and Ovingham ; and also from the River Tyne, in the Parishes of Newburn and Heddon-on-

the-Wall, to meet "the increasing demand for a supply of water" within the limits of the Act, which were now defined and extended to include the Parishes of Newburn and Wallsend in Northumberland, and Winlaton and Ryton in Durham; in addition to the Boroughs of Newcastle-on-Tyne and Gateshead, and the Townships of Benwell and Fenham, and Parishes of Gosforth and Longbenton in Northumberland, and the Chapelry of Heworth, and Parishes of Lamesley and Whickham in Durham, which formed the "limits" of the former Act.

The Newcastle and Gateshead Water Works Act of 1863, after reciting the previous Acts, and specifying that the Company was then in exercise of its powers taking water from the Whittle Burn, River Pont, Small Burn, Hallington North Burn, Hallington East Burn, Hallow Well, Mootlaw Burn, Fairspring, Quarter Burn, and the River Tyne, above Newburn, which are referred to as the existing "sources of supply," gives powers to the Company to construct a reservoir for impounding the waters of the Small Burn, Hallington North Burn, and Hallington East Burn.

The Act of 1854 was repealed, and the Company re-incorporated as the Newcastle and Gateshead Water Company. Power was given to raise additional capital, and to create debenture stock. The limits of the Act were again defined as before, with the addition of the Township of Birtley, in the Parish of Chester-le-Street, in Durham; and the works to be executed are defined and include the present Hallington Reservoir, with two aqueducts connected therewith, and aqueducts or main pipes leading from Whittle Dean to the Benwell Filter Beds, and from the Filter Beds to the Town, being the present 24-inch main.

Restrictions were placed on the Company not to take water from the Tyne below the west end of Newburn, and empowering the Council of Newcastle to forbid by resolution the supply of Tyne water for domestic use in Newcastle and Gateshead for a limited time, subject to an appeal by the Company to the Board of Trade. Power was given to the Councils of Newcastle and Gateshead to fix on the mains as many hydrants as they may see fit, for the purpose of taking water for extinguishing fires only. The term "supply of water for domestic purposes" was again defined as not including water for cattle, horses, or for washing carriages (where such horses and carriages are kept for hire), or for

steam-engines, or for railway purposes, or manufacturing purposes, or for watering gardens or fountains or any ornamental purpose, or for flushing sewers and drains or for public baths ; but the Company were allowed to supply for other than domestic purposes by agreement.

For preventing waste, powers were given to the Company to prescribe the fittings to be used, and penalties were enacted for misuse of water.

The height to which the Company were bound to supply was limited to 380 feet above high water mark at Tyne Bridge.

The Company was to supply and fix, at their own expense, a service pipe and cock, where required by the owner or occupier of any house in a street where a main was laid.

Power was also given to the Company to sell their undertaking to the Corporation of Newcastle at any time before 2nd June, 1864, at a price to be fixed by arbitration.

In May, 1866, another Act was obtained to extend the time for completion of the works authorised by the Act of 1863, and to authorise certain other works, chiefly mains communicating with the various reservoirs.

They were authorised to rise £50,000 of additional capital, making their share capital £460,000, and borrowing powers £115,000.

A slight alteration was made in the rates for supply of water-closets, which were raised from 6s. to 8s. in houses above £20 per annum.

In the next Act of July, 1870, an important change was made by extending the limits of supply to North Shields, which the Company were authorised to supply with water in bulk, to be distributed by the North Shields Company.

The Parish of Ovingham and Township of Howden were also included within the " limits " of the Act.

A restriction was, however, placed on the supply to North Shields, which was to cease, if at any time between the 1st of May and the 30th September in every year there should be less than 200,000,000 gallons in store in the reservoirs at Hallington and Whittle Dean. The Council of Newcastle were empowered to send some " competent person, not being a member of such Council," to measure the quantity of water in store as above, as a check on the supply to North Shields.

Any water taken from the Tyne for the purpose of distribution was to be "effectually filtered."

An additional share capital of £100,000 and borrowing powers of £25,000 were authorised, raising the totals respectively to £560,000 and £140,000.

In July, 1876, another Act gave further powers to the Company, the most important being ;—

The construction of a reservoir at Upper Swinburn, on the Dryburn and Small Burn Streams.

Also, of the Little Swinburn Reservoir on the Dryburn.

Also, of the "West Hallington Reservoir," adjoining the present Hallington Reservoir on the west.

An enlargement of the Great Northern Reservoir at Whittle Dean by raising its banks.

Also, the construction of a service reservoir at Carr's Hill, Heworth, on part of the site of the Swan Pond Reservoir.

The construction of aqueducts, connecting the Colt Crag, Little Swinburn, and West Hallington Reservoirs.

A deviation of the existing aqueduct, near Ouston Moor, and a line of pipes from the new pumping engine at the Hagg, near Wylam, up to the Great Southern Reservoir at Whittle Dean, and other necessary works.

The Company were authorised to take the waters of Dryburn, Small Burn (north), Reed Sike, Carry Burn, and Small Burn (near Colwell), subject to compensation water to be delivered to Dryburn of 200,000 gallons per day.

Powers were also given to separate the supply for trade purposes from that for domestic use, and the Company were bound to lay, before the end of 1878, sets of pipes for this special purpose on each side of the Tyne, as far as the two Boroughs of Newcastle and Gateshead border thereon respectively.

Further powers were given for preventing pollution of streams and waste of water from cisterns, &c.

The filtration clause is in this Act limited to the water for "domestic purposes."

Except in case of accident to the reservoirs or aqueducts,

seven days notice was to be given to the two Corporations before supplying water for domestic purposes from the Tyne below Hexham.

The Gateshead Council was now put on the same footing as that of Newcastle in the matter of access to the reservoirs for the purpose of measurement, and both were to have powers of taking samples from the reservoirs to ascertain the quality of the water, subject to 24 hours' notice to the Company of time and place.

The Company was also to furnish the respective Councils with monthly statements of the water in stock.

A further creation of capital was authorised of £360,000, with borrowing powers of £90,000, raising their whole powers to £920,000 and £230,000 respectively.

An Act dated July, 1877, authorised the abandonment of the Upper Swinburn Reservoir and the works depending thereon, and the making instead thereof of the present Colt Crag Reservoir with the necessary alterations in the aqueducts and roads to suit the new undertaking. The time for the completion of the West Hallington Reservoir was extended to July, 1886, and the laying of the pipes for trade supply alongside the river in Newcastle and Gateshead was to be finished by September, 1877, instead of the end of 1878. The filtering beds of the Company were to be increased in area to not less than 100,000 square feet by the end of 1877.

This completes the list of the Acts of Parliament obtained by the Company, and contains the chief powers conferred on them and obligations entered into by them, more especially with reference to their relations with the two chief Corporations of Newcastle and Gateshead for the supply of which Towns the Company was first created, and to which their first and chief duties are owing.

In order to clear the ground, it may be well to recapitulate shortly the areas which they are authorised to supply with water with their populations and probable rate of increase. And, also, to sum up the areas of the various districts from which they are allowed to collect water, and the storage-capacity of their reservoirs now made and authorised. To explain these tables the collecting districts, reservoirs, and

the areas to be supplied are shown on a plan accompanying this report :—

TABLE OF TOWNS AND DISTRICTS TO BE SUPPLIED BY THE NEWCASTLE AND GATESHEAD WATER COMPANY, WITH THEIR POPULATIONS AT THE LAST TWO CENSUS OF 1871 AND 1881, AND PROBABLE INCREASE.

Name of Town or Place.	Population.		Increase per cent.	Probable Population in 1901.
	In 1871.	In 1881.		
Act of 1845—Newcastle-upon-Tyne.....	128,443	145,359	13	183,152
,, Gateshead-upon-Tyne.....	48,627	65,041	34	109,268
,, Township of Benwell.....	2,599	4,736	82	12,503
,, Township of Fenham.....	156	157	·7	159
,, Parish of Gosforth	4,043	5,557	37	9,669
,, Parish of Longbenton	17,210	19,136	11	23,345
,, Township of Lamesley	3,817	4,670	22	6,724
,, Parish of Whickham	6,483	7,976	23	11,644
,, Chapelry of Heworth.....	13,755	17,138	25	25,707
Act of 1853—Parish of Newburn.....	5,662	6,451	14	8,257
,, Parish of Wallsend.....	10,458	13,737	31	22,253
,, Parish of Winlaton } ..... ,, Parish of Ryton..... }	12,225	15,255	25	22,882
Act of 1863—Township of Birtley	2,868	3,540	23	5,168
Act of 1870—Town of North Shields	38,941	46,364	11	56,564
,, Parish of Ovingham.....	6,257	8,753	40	15,755
,, Township of Howdon.....	5,185	6,070	17	8,133
Total	306,729	369,940		521,183

TABLE OF COLLECTING AND STORAGE RESERVOIRS MADE AND IN USE BY THE COMPANY UP TO 1884, AND OF THE RESERVOIRS SANCTIONED BUT NOT YET CONSTRUCTED.

Name of Reservoir.	Capacity in million gallons.	Area of Collecting Ground in acres.	Rainfall average of 3 driest consecutive years.
WHITTLE DEAN RESERVOIRS.			
Great Northern Reservoir.....	114		
Northern Subsiding do.	8		
Northern do.	30	Pont.	
Western Subsiding do.	3	7,950	
Western do.	68		22·07
Low do.	104	Whittle.	
Supplementary do.	3	4,770	
Great Southern do.	200		
Hallington Reservoir	686	5,453	
Little Swinburn do.	34	505	27·43
Colt Crag do.	1,070	3,957	
Total existing Storage	2,320	22,635	
YET TO BE CONSTRUCTED.			
West Hallington	722		
Total authorized Storage.....	3,042	22,635	

RAINFALL 1863 TO 1883.

Date.	Hallington.	Whittle Dean.
1863	32·665	27·05
1864	26·27	26·88
1865	25·72	23·08
1866	33·42	25·22
1867	25·07	20·58
1868	28·69	23·77
1869	28·54	23·06
1870	26·19	19·38
1871	30·62	27·01
1872	45·92	39·40
1873	25·27	21·912
1874	28·695	23·734
1875	34·86	28·395
1876	37·68	30·36
1877	42·265	36·095
1878	33·89	25·907
1879	31·545	25·26
1880	31·89	29·21
1881	41·77	30·12
1882	32·50	28·81
1883	28·375	25·53
Total	671·845	560·763
Average	31·992	26·703
Average of three driest consecutive years	27·43	22·07

GENERAL PRINCIPLES GOVERNING WATER SUPPLY.

It will not be amiss before entering upon the details of the Newcastle Water Supply to mention broadly certain principles which govern all water supplies, and which, though thoroughly understood by water engineers and scientific men who have studied the subject, are perhaps not so immediately apparent to the popular mind, which, not unnaturally, only takes in what it sees, and not infrequently misunderstands that.

Thus, there is a popular impression that spring water is derived from some other source than surface water, whereas the same shower may and does produce both, the only distinction being, that while the one part sinks into the ground and finds its way through any previous strata below to reappear at some spot, more or less distant, in the form of a spring, the other runs off the surface at once. The first may be, and usually is altered in quality by leaving some impurities behind, while it gathers others in the course of its natural filtration ; while the second is exposed chiefly to surface contamination and to the purifying influence of the air, which oxidises impurities, and so makes it wholesome.

The first broad principle to be stated is :—

1st. We are dependent upon rainfall for our water supplies.

All the water which comes to us in the form of rain is originally evaporated from large water surfaces, lakes, marshy grounds, &c., but chiefly from the sea. Evaporation goes on at all temperatures, and is dependent solely on the capacity of the passing air for moisture ; but that capacity is variable, and depends on its temperature ; cold air carries little, warm air much, watery vapour. The comparatively warm west winds passing over the Atlantic lick up the moisture and arrive on our western coast saturated, and just able to carry their load ; here they are chilled by the currents of cold air among the first hills they come to ; they become unable to carry the vapour, which is condensed and falls as rain, heavy in proportion to the previous saturation of the air ; hence we have the very heavy rainfall of Cumberland and Westmorland and the West Coast of Scotland, sometimes amounting to 144 inches per annum.

On the East Coast we have the contrary effect. The cold north and east winds have little capacity for carrying vapour and a much shorter distance in which to collect it, nor is there any high land to meet them on the coast. Hence, on the East Coast we have a rainfall of 24 inches per annum, gradually increasing, however, as we go inland.

2nd. The quantity of water which can be collected from any district depends on the area of the water-shed and the amount of rainfall thereon.

This condition follows naturally from the first. It may be taken roughly, that from ½ to ⅔rds of the rainfall on any district is available for collection and storage; there are slight variations due to local conditions, but for the present purpose these are not important.

An obvious inference from the above is, that the West Coast, from its large rainfall, is the most proper place to go to for a large water supply; but this conclusion must be modified by other considerations.

A natural lake is always a very tempting spot for a source of water supply, but its advantages are not so great as would seem at first sight. If more water be taken annually from a natural lake than runs into it, it will soon be drained, and we come back to the fact that we can only get the amount of water that falls on the collecting ground that supplies the lake. No doubt a natural reservoir is an economical advantage, and if its storage-capacity is large it may equalise the supply in variable seasons, but the first and most important enquiry in choosing a collecting district must always be, "How many acres are there of available water-shed, and what is the average rainfall?"

3rd. The quality of a water supply depends on the nature of the collecting ground and its state of cultivation.

It is clear that every impurity lying within the area of a water-shed must be washed by, and partly held in solution or suspension, by the water which flows off that district; and the ultimate purity of the water depends on the amount of the contamination, and the subsequent natural filtration and æration which it receives. Thus, in arable land, the water is a diluted solution of the manures used on the land; in a grazing country it is flavoured by the cattle droppings, which it washes into the earth; in an inhabited district the sewage of villages and houses must taint it; and in every

one of these cases, only subsequent purification, by filtration (natural or artificial), by subsidence in large reservoirs, by æration and oxidation, can be available to remedy the evil. The contamination *must* take place, that is only a question of degree, and the utmost that the water engineer can do is to choose water-sheds, which are as little as possible naturally fouled, and in which the water has the greatest amount of natural filtration before it arrives at the reservoir, is least disturbed while lying there, and is exposed to the greatest amount of sun and air in its subsequent transit to the point of distribution.

The beau-ideal of a collecting ground would be, of course, quite uninhabited, too barren for cultivation, and not growing grass enough for grazing purposes. Such districts do not exist, in England at least, and the nearest approach to them are the heather-clad hills and moors which can feed only sheep, and few of them; and where the only inhabitants are the shepherds, who, for months together in the winter, see no human faces except those of their own family.

4. Storage reservoirs should hold not less than 150 days' supply.

In most collecting districts, the amount of water available in summer, falls very much below the average daily consumption, and, in such cases, it is necessary to provide large storage in which the winter floods may be collected for use during the summer months. In most cases, too, where the head waters of the streams are impounded, Water Companies are bound by their Acts to guarantee a certain minimum quantity of water to the streams which they take, for the benefit of the lands, mills, &c., below their works. They can only do this by collecting the surplus water of the winter months for use in the summer; and, as droughts of 100 days are not uncommon, and occasionally have occurred of 150 days, it is usually considered necessary to provide storage for at least 150 days' ordinary consumption, so that a supply for the five summer months, from May to September inclusive, may always be depended upon independent of the rainfall during that time.

5. The supply of water to a town should be reckoned at 40 gallons per head of the population daily.

In this matter of daily supply per head, there has been much difference of opinion among experts; but the sanitary

education of the people, which has been going on for the last 40 years, has produced a material change in their requirements in this respect, and, whereas 25 years ago 15 gallons per head per day was considered ample provision, now three times that amount is not considered excessive.

A curious confirmation of this change of opinion is given by Mr. MAIN, in his paper read before the British Association, in 1863, when speaking of the clauses in the Act of 1863 for preventing waste, he mentions that some towns have been able to reduce their consumption to 15 gallons per head, and expresses a wish that the Newcastle Company could reduce theirs to even 20 gallons per head, which he considers ample for all legitimate consumption. The daily consumption, in Newcastle and Gateshead, is now about 35 gallons per head.

DESCRIPTION OF THE EXISTING WORKS OF THE NEWCASTLE AND GATESHEAD WATER COMPANY.

Having now cleared the ground of general and historical details, we proceed to describe the existing works of the Company ; and it will be more convenient to commence at the upper end with the collecting grounds and reservoirs, where the water is caught and impounded ; following the course of the aqueducts, and taking up the chief feeders as they come in, until we arrive at the Benwell and Fenham service reservoirs, where the distribution may be said to commence.

To make this description intelligible, a plan has been prepared shewing :—

1st. The group of impounding reservoirs at Colt Crag, Little Swinburn, and Hallington, and their respective collecting grounds with the aqueducts connecting them.

2nd. The main aqueducts from the foot of the Hallington Reservoir, passing through Hallington to the Ryall Tunnel, thence through Matfen to its junction with the Pont River, and thence by Ouston Moor to

3rd. The group of reservoirs at Whittle Dene, consisting of the Great Northern, the Great Southern, the Lower Reservoir, the Western Pond, and several smaller intermediate reservoirs.

4th. The pumping station below Ovingham for pumping Tyne water into the Great Southern Reservoir for the "trade supply," and the pumping main; also the direct 24-inch main from the same reservoir by Wylam, Newburn, and Bell's Close to Newcastle for conveying the "trade supply;" and also, the pumping engine at Newburn, which supplements that at Wylam, in times of great pressure.

5th. The aqueduct from Whittle Dean, open to Bessies's Bog Tunnel, and thence by earthenware pipes to the

6th. Filtering beds at Throckley.

7th. 24-inch main from Throckley to Low Benwell Reservoir and the Low Service Main thence into the Town.

8th. Pumping engine at Low Benwell by which the water is pumped through a 15-inch main up to

9th. The High Service Reservoir at Fenham.

10th. The line of the main pipes through the Town, and by the Redheugh Bridge to Gateshead, and the Carr's Hill Reservoir there.

11th. The main pipes for the supply of the districts beyond the City boundary.

12th. The various districts included in the Acts already quoted, and mentioned in the tables, with their areas and population.

On this plan are also marked the various spots at which samples of the water were taken by us with a number referring to the analysis given in the appendix.

Any point where it is necessary to make any special remark is also indicated on the plan by a letter referred to in the text so as to avoid any doubt as to position.

COLT CRAG RESERVOIR.

Is the largest and most westerly of the impounding reservoirs. It is capable of containing, when full, 1,070 million gallons, and has been formed by raising a dam across the Swinburn Burn. Its area, when full, is 200 acres, and its mean depth, therefore, 19 ft. 9 in., and the greatest depth of dam 66 ft.

It has been formed as is usual with large impounding reservoirs, by merely damming up the natural valley without removing the natural soil or vegetation. The collecting ground which supplies it is coloured blue on the plan, and contains 3,957 acres.

The whole of this area, with slight exception, is grazing ground, and, of course, the water is subject to the natural contamination peculiar to such ground.

On the northern bank, about 100 yards from the reservoir, lies old Colt Crag, a farm house, where about 500 head of stock are kept. The drainage of this farm is intercepted and carried to the north, and the drain mouth was pointed out to us at A; but from the shed of the ground it is clear that, after filtering through the surface soil for some distance, the whole of this drainage must eventually come into the feeder marked B, and so into the reservoir. This feeder was very much swollen by rain on the day of our visit, and so turbid that no sample was taken of it.

Just below the farm, and near the boundary wall of the reservoir, are a couple of cattle troughs, the waste from which flows direct into the reservoir. A few yards above the trough, was a newly-formed manure heap, and cattle droppings were plentiful. About 100 yards east of the farm, is a set of five cattle troughs, which also drain into the reservoir.

On the south side of the lake lies a group of cottages which naturally drain away from it; but, as in the case of old Colt Crag Farm, the drainage, after surface filtration, finds its way back into the reservoir.

Samples 1 and 2 were taken at the south-western and north-western points of the reservoir, and sample No. 3 at the eastern end, where the road to Little Swinburn crosses the reservoir by a causeway.

The Colt Crag collecting ground is not a specially favourable one, the faults being those inseparable from a grazing country, where, as before mentioned, the water must be contaminated by the drainage of byres and the cattle droppings, and is dependent for purification on the amount of natural surface filtration it gets before entering the reservoir. How far this surface percolation removes the impurities is doubtful. That it has some effect is certain; but every means should be taken to prevent the water from flowing directly into the reservoirs, from points where droppings are abundant.

We have thought it well to make some experiments on this matter, but as they will take some time to complete, it is not likely that the results can be included in this Report. If in time, however, they will be added in the Appendix. From the foot of the Colt Crag reservoir, the water is allowed to flow down the bed of the burn, and passes on the left, Short Knowes Farm. Only one horse and one cow are kept here; the natural drainage of this farm is into a small runner at the back, which, however, bends round and returns to the Dryburn at the head of the

LITTLE SWINBURN RESERVOIR.

This reservoir is a small one, holding only 34 million gallons, covering an area of 12 acres, and, therefore, averaging 10 ft. 5 in. in depth, with a dam of about 28 ft. high. The sides of the burn are chiefly rocky, and there is little vegetation except at the upper end. The collecting ground has an area of 505 acres, coloured blue on the plan.

This area includes the Little Swinburn Farm, on the left bank of the reservoir, and close to it. There are about 25 persons on this farm and 200 head of stock. At the time of our first visit (February 10th) the whole of the drainage of this farm and the byres and hemels was passing directly into the head of the reservoir, without any chance of being purified by percolation. To the east of the farm onstead (at C on plan) there is a fine natural feeder coming out of the limestone rock, and this flows past the byres into the farm pond, which serves the water-wheel for driving the farm machinery, and thence goes direct into the reservoir. Part of this stream is diverted to the side of the pond, and passes the hemels from which it receives the soakage; and upon it is formed a sheep-dip. When this is used the whole of the waste water from it must go directly into the reservoir.

All this is as bad as it well can be, and should never have been allowed to exist. Fortunately, there is no great difficulty in curing the evil. The feeder at C is too large and valuable to be allowed to run to waste, but the drainage of the farm and byres, &c., can be intercepted and carried past and into the Swinburn below the dam. At our second visit (March 8th) the work of certain catch drains for this purpose had been commenced, but were not sufficiently far advanced for us to judge of their sufficiency for the purpose

On a third visit (June 8th) the works had been completed and were in action, and with very good effect. The whole area of the farm-yard had been considerably raised and properly metalled with broken stones, and two metal pipes laid from near the large feeder at C to the head of the farm pond, thus protecting the stream from much contamination. A drain had been laid through the whole length of the farm-yard, and alongside the hemels and byres, with proper gullies for receiving the sewage. This drain runs into a catch-pit (into which the sheep-dip is also drained), and from thence through the barns to another catch-pit outside the buildings, from which it is carried over the mill-race in 9-inch iron pipes, and then by sanitary pipes to a third catch-pit or cesspool. A 6-inch sanitary pipe, which is carried up the other side of the farm-yard and collects the house and other sewage, runs into the same cess-pit. From this point a 9-inch sanitary pipe carries the whole of the sewage along the eastern side of the reservoir and well clear of it, and discharges it into the Dryburn below the dam of the reservoir.

These works are, so far as can be examined, soundly constructed, and will entirely remove this cause of contamination.

Sample No. 4 was taken from the large feeder at C, and No. 5 from the same stream after contamination by the drainage of the farm. No. 6 from the lower end of Little Swinburn Reservoir.

At the foot of the Little Swinburn Reservoir, at D on plan, is a valve which allows the water to pass into a short, open canal, with two sluice gates, one of which closes the mouth of the Aqueduct Tunnel to Hallington, and the other closes the bye-wash into the Dryburn. At the time of our first visit in February no water was passing down to Hallington. Here also is an overflow weir and sluice for measuring the compensation water, which the Company is bound to deliver to the Dryburn by their agreement with Mr. FIDDELL and the Act of 1876.

From this point the water enters the tunnel, which conveys it to Nine Wells. This tunnel is driven through the limestone, and is about 1¾ miles in length and 5 ft. in diameter, lined throughout with brick. At the summit, at E, a small feeder passes into it. Here sample No. 7 was taken. No surface contamination is possible, of course, be-

tween Swinburn and Nine Wells, except at the feeder mentioned above, and here there is nothing calling for special remark.

NINE WELLS is a valuable feeder, consisting of several springs, which discharge into a penned and walled collecting pond, in which they deposit a considerable amount of sand, &c., which is periodically cleared out. Just above this pond is a cattle trough, and the drainage from it and the plunge in front of it is said to be carried off *below* the pond.

There is probably some error as to this, as the natural mode of draining it would be round the outside of the pond into the Small Burn.

This should be effectually done, and the drainage from Coldwell Farm above should also be intercepted and carried into the Small Burn, which would not be difficult to do. About 2 to 2½ million gallons per day were going down from Nine Wells to Hallington at the time of our visit, while nothing was coming from above except the water of the small feeder on the tunnel top.

Passing downwards from Coldwell to Fawcet, several 5-inch leader pipes discharge into the aqueduct, and these drain a considerable area of arable land above. One, at least, of these pipes, showed visible signs of contamination. The water from this ground might very well be sacrificed and carried over the aqueduct, instead of into it. This could be done at small expense, and would cause no great loss of water to the Company. It is true that in such a collecting ground as this country side is, it is impossible to avoid drainage from arable ground; but where it lies so close to the aqueduct, it has little chance of purification by percolation, and should be avoided if possible.

At Fawcet Farm, which lies on the left, and above the aqueduct, the drainage is, evidently, partially collected and carried across the aqueduct in a 4-inch metal pipe, but this is not sufficiently done, as there are unmistakable signs of soakage into the aqueduct. The bright, green appearance of the grass in the furrows, makes it very evident that there is some amount of sewage soaking down; and, though the very luxuriance of the vegetation shows that some of this has found its proper use, yet the distance is too short to remove the whole of it. This drainage should be effectually intercepted and carried off, clear of the works.

The waste water, &c., here flows down into a hollow, outside the bank of the Hallington Reservoir, at F, and is carried off by a pipe laid below the reservoir itself. We could, of course, only see the exit end of this pipe, but there is every evidence of its existence for the water accumulating in the hollow above-mentioned drains away, and cannot get into the reservoir the water in which is at a higher level. When the proposed West Hallington Reservoir is made, it will include this hollow, and some other mode of getting rid of this drainage will have to be adopted, and, probably, it will be found better to keep the pipes in such a position near the surface, that they can be examined and kept in repair without running the water out of the reservoir.

Since the above was written, the construction of the West Hallington Reservoir has actually been commenced, and the mode here suggested of carrying the farm drainage off has been adopted, and it will, in future, pass entirely clear of the reservoirs.

This new reservoir, when completed, will be about 120 acres in extent, and will add 722 million gallons to the storage-capacity of the Company's reservoirs, though it does not bring in any fresh gathering ground. Its average depth will be 22 feet. Representing as it does, about 60 days' supply, it will materially relieve the pressure on the Company in dry seasons, such as the present.

Between Nine Wells and Hallington, samples 8 to 11 were taken at the points marked on the plan, viz., No. 8, at Nine Wells; 9 and 10 from leader pipes bringing drainage into the aqueduct; and No. 11 from the aqueduct itself; at the point where it is crossed by the pipe carrying the drainage from Fawcet Farm.

Immediately below Fawcet Farm the aqueduct enters

HALLINGTON RESERVOIR,

Which has a capacity of 686 million gallons, an area of 142 acres, and an average depth, therefore, of 17 ft. 9 in. while the maximum depth of the dam is 47 ft. It has been formed by raising an embankment across the valley of the Hallington Burn on the south and west sides.

The area of the collecting ground which supplies Hallington is 5,453 acres, and the chief feeder is Hallington Burn. This rises about three miles to the north and east, about a quarter

of a mile to the east of Great Bavington Village, a small cluster of houses with about 45 inhabitants. It is not sewered, but the natural drainage is to the Hallington Burn. The Lady Well is the source of this burn, and lies, as before mentioned, about a quarter of a mile east of the village. The water, which is only a small feeder, flows off the top of the limestone, and is pure and bright. Sample 12 was taken here. Another feeder comes in at the side of the road leading to Great Bavington, and a third about a quarter of a mile below. Both these are slightly ferruginous in appearance. Several other feeders come in at intervals, and about half a mile below the source the water has become slightly opalescent, probably from iron. Three other feeders, strongly tinged with iron, come in before Little Bavington is reached. Sample 13 was taken about a quarter of a mile above the village, and was very turbid and full of floating particles.

Little Bavington lies about a quarter of a mile to the left on a hill, and consists of five or six houses only, the hall lying further back. The number of inhabitants is about 50. There is no visible drainage entering the burn, but, as at Great Bavington, this is the natural outlet for it, and for about half a mile here, water soaks in from boggy ground and feeders all along both sides of the burn down to the bridge on the Colwell Road.

From this point the burn has been cleared, penned here and there, and improved; and about a quarter of a mile below the bridge the water appeared quite bright and clear again, all turbidity having disappeared. A considerable feeder comes in on the right from Hamilton and Divet Hill, two farms close to the Colwell Road. The sewage of these must also be washed into the burn.

Following the burn, the head of Hallington Reservoir is reached, and here sample 14 was taken from just below the guage weir. The water was less in quantity than when last visited, and looked clearer and brighter. Sample No. 15 was taken from the same place at our previous visit.

Passing down the east side of the reservoir there are cattle-troughs near the edge, just above the road which crosses the northern end, and again about a quarter of a mile below. These last are much too near the lake, and the cattle can reach the edge of the water. The fence should be altered here to prevent this. There is also another cattle-

trough close to the boat-house, and another again below Cheviot Farm. This farm might be drained away past the reservoir, standing, as it does, on high ground; but there is no sign of this being done. Just below the farm a stone tunnel is carried into the hill and under the road, and brings in a small catch-water aqueduct, shown on the plan, which gathers the water from the ground behind Little Bavington.

This completed the examination of Hallington collecting ground, which is of the same class as that of Colt Crag, viz., all grazing land for both cattle and sheep. The grass was of a better quality, however. Stock was noticed in the fields throughout, and other evidence of their presence was not wanting.

Coming, now, to the outlet of Hallington Reservoir, there is the usual set of valves and a guage weir, with a bye wash for overflow when the water rises above the edge of the dam. Sample 16 was taken from the aqueduct half a mile below the reservoir, and close to Hallington Village, on our second visit (11th April). This was clear and bright. The water in the aqueduct has a faintly yellow opalescent look, which may be from the colour of the bottom, which is in clay here, and not lined or pitched.

Just below Hallington Village (which lies on the right, and drains clear away from the aqueduct) Sharney Burn is crossed in a wooden trough, and a catch-water runs up the side of this burn for about 100 yards and takes almost the whole of the water from it. About half a mile below Sharney Burn another catch-water brings in a branch of the Erring Burn, and from this water sample 17 was taken. Mootlaw Burn and Fairspring Burn are also collected by catch-waters.

The aqueduct now crosses the road from Ryall to Chollerton, and about one third of a mile further on enters Ryall Tunnel, which is about two-and-a-quarter miles in length and five feet in diameter, driven chiefly through the mountain limestone, and not lined with brick except at each end, for a short distance, and where it lies in the shales. The water from the ground above readily finds its way through the limestone and into the tunnel. During construction there was a run from the drift at the Matfen end of the tunnel of 800 gallons per minute, or $1\frac{1}{6}$ million gallons per day, and the ground above, by the time the tunnel was

completed, had sunk 18 inches from the draining off of the water.

The tunnel ends about a quarter of a mile above Matfen, and thence there is an open aqueduct. A clearing-grate and tap-troughs at the Ryall end of the tunnel serve to stop floating matter and heavy debris from entering it.

From near the summit of the tunnel a small burn, or feeder, comes off the top of the pass, and, running above the aqueduct, finally joins it close to Matfen. This burn is unfenced and unprotected, and is liable to disturbance by cattle.

Sample No. 18 was taken from the Ryall end, and No. 19 from the Matfen end of the tunnel, and No. 20 from the burn alongside it.

Through Matfen Village, the aqueduct is lined by a stone-wall on each side, but the greater part of it is unfenced, and open to casual fouling from anything that may be thrown into it, and there was evidence that it was so fouled; bits of old rope, old cans, &c., being among the varieties we noticed lying in the bed of the stream. There is a surface drain alongside the village street, parallel with the aqueduct, which is carried into a cesspool and away to the north of the aqueduct into the River Pont, below the point where the aqueduct leaves it. The drainage of Matfen is, therefore, adequately provided for, and that of Matfen Hall is treated in the same way. These drains are shewn on the plan at G—G and H—H. Matfen Village and Hall have, in all, about 250 inhabitants, and there must be a considerable amount of liquid sewage which has to be disposed of in this way.

It would be very much better if the aqueduct through Matfen, and for a short distance above and below it, were covered in so as to protect it from being made a receptacle for miscellaneous rubbish, as it too evidently is at present.

From below Matfen to the junction with the Pont, there is nothing special to remark. The aqueduct is open but well fenced, and not liable to fouling.

The Pont was examined for about two-and-a-half miles above its junction with the aqueduct. At the Mill, at J, there was manure lying freshly turned out near the stream, and all the drainings from it must soak into the Pont. Eight cows are kept here.

There is but little arable land above this point except at Little Whittington where the stream rises, and where there are 30 or 40 acres. About Matfen there may be 50 or 60 acres, and on the Tunnel Top as much more.

Following down the River Pont, there is a considerable feeder comes in just above Dewlaw Farm, and directly below the farm was a large manure heap, about 10 yards from the water, and the drainage therefrom was soaking visibly into the river, not in large quantities it is true, but strong in quality. This should be remedied, as it is not a proper state of things. There seems to be about 150 to 200 head of stock on this farm.

From this point there is not much to find fault with, and the river is fairly free from fouling. It crosses the road from Matfen to the Main West Turnpike, and then passes through the grounds of Matfen Hall, finally joining the aqueduct at Burnside Farm.

Sample No. 21 was taken from the aqueduct, and No. 22 from the Pont just before they meet.

From this point, for half-a-mile, the River Pont becomes the aqueduct, and is fenced in and protected from fouling. There are, however, three badly constructed watering places alongside it, which should be improved.

At the point K, the aqueduct again leaves the river, and from here to Whittle Dean is properly fenced and guarded from fouling.

At Ouston Moor, at L, there is a tunnel of about half-a-mile, but a deviation has here been made, and an open aqueduct skirts the hill, the water passing by both routes.

This deviation is a carefully made stone-lined channel. At M the two channels join again, and half-a-mile further on we come to the

WHITTLE DEAN

Group of storage and service reservoirs, alongside of which the aqueduct runs with various weirs and sluice-gates for turning the water into any of the reservoirs at pleasure.

The first of these is the Great Northern, lying to the north of the main road. Then come three small ponds, one to the north, and two to the south of the turnpike. Next, is the Western Reservoir, with a small subsiding pond, taking the Welton Burn. Then, the Lower Reservoir, the

Basin, and the Great Southern. The Basin was originally used for the distribution of the water from the various reservoirs, the outlet pipes from all of which entered there, and from it the aqueduct was supplied. Now, this arrangement is slightly modified, and the aqueduct is supplied from the Lower Reservoir, with which all the upper ponds communicate, the Great Southern being reserved for the "trade supply," and being shut off from the rest.

The water-line in these reservoirs is :—

For the Great Northern, 380 ft. above the sea.
Northern, Western, and Lower ..... } 362 ft. „ „
Great Southern, 340 ft. „ „

The arrangement for supplying the water to the Town is as follows :—A 30-inch main passes from the Lower Reservoir through the Basin and outside of the Great Southern to a stone-lined tank or tumbling bay, with steadying walls and a guage weir at the lower end, which form the head of the aqueduct to the Town. Through this the water for the domestic supply *only* flows.

At the gauge weir the water is measured, and a daily record of the gaugings sent to the Company's office in Newcastle, the supply being regulated by a large valve in the tumbling bay, in accordance with instructions sent by telegraph from the Benwell Service Reservoir by the man in charge, or from Newcastle.

The "trade supply" is passed from the Great Southern Reservoir into the Basin, and there enters a 24-inch main, which passes *under* the Great Southern, and thence direct to the Town, by Wylam, Newburn, Bell's Close, Scotswood, and the Scotswood Road.

This, which seems rather a complicated arrangement, has been rendered necessary by the fact that these works were constructed before it was considered necessary to separate the two supplies, and the 24-inch main, which now carries the "trade supply," then carried the domestic supply from the Lower Reservoir. The change was made by cutting off the upper from the lower part of this 24-inch main by means of a valve within the Basin, the upper part being continued as the 30-inch main, before-mentioned, to carry

"domestic supply," and the lower being adopted to carry the "trade supply" from the basin.

At first sight it appeared as if by opening the cut-off valve in the Basin, it would be possible to send Tyne water from the Great Southern Reservoir into the 30-inch "domestic" main, without any one being able to detect it; but a moment's consideration shows that this is not so, for the Lower Reservoir containing the "domestic" water is 22 feet higher than the Great Southern containing the Tyne water, so that the effect of opening the "cut-off" valve would be to run off the "domestic water" from the Lower Reservoir into the Basin and Great Southern, and so into the "trade" main.

It is quite possible to pass Tyne water into the aqueduct, and so on to Throckley Filtering Beds and into the "domestic" main, and that by more than one way; but these are all open to the day, and could not be used without its being seen at once on inspection. The head of the main aqueduct is divided into two parts, just below the tumbling bay and guage weir (at the point N on plan), one prong of the fork end as beforesaid at the tumbling bay, while the other terminates in a dead end near the foot of the Great Southern Reservoir, from which a 24-inch exit pipe runs into it, and is closed by a valve. By opening this valve Tyne water can be passed into the main aqueduct.

The supply-conduit from Hallington, after passing the various reservoirs above the "Basin" then becomes a "bye-wash" for carrying off the surplus water, and passes round the lower end of the Great Southern Reservoir into the Whittle Dean Burn. Rather above the "dead end" above described, a sluice is placed across the bye-wash, and, by closing this, any water passing down may be diverted through a 24-inch pipe into the "dead end," and so into the main aqueduct.

Thus, if all the reservoirs are full, and there is surplus water coming down from Hallington, it can be turned into the main aqueduct by the arrangement above described, instead of being wasted.

In the same way, should the Great Southern Reservoir be so full that water is passing off from it into the bye-wash, that water also could be caught and passed into the "dead end," and so into the main aqueduct. But this is a round-

about way of doing what can be more easily and directly done by the exit pipe from the Great Southern, provided for the purpose.

To return to the " Domestic " Supply. From the tumbling bay and main guage weir the water enters the end of the main aqueduct on its way to the filtering ponds at Throckley. The first mile-and-a-half of its journey is by open channel, stone-lined, well fenced, and protected from fouling. At O it enters the Bessies Bog Tunnel, and from this point travels underground through about a mile of tunnel and two-and-three-quarter miles of earthenware pipes to Throckley, where it is distributed among the nine large filtering beds at P. The mode adopted is that of downward filtration—that is, the water is delivered on to the top of a thick bed of sand (which overlies gravel, and materials gradually increasing in size) through which it sinks, until it finds its way into the culverts, which collect it, and finally unite in the main pipe to the town, or rather, into the two main pipes, viz., the 24-inch, which follows the upper route shewn on the plan, and the 30-inch, which follows the lower, both however, converging at Low Benwell Reservoir, where the one flows directly into the pond and passes directly out of it again to form the low service, and the other is connected with a pumping engine, by which it is raised to the High Benwell, or Fenham Reservoir for the high service.

This engine is capable of pumping 1,200 gallons per minute, or $1\frac{3}{4}$ millions per day. The mains are so connected with each other by circulating pipes and valves that either can be connected with the engine or with the ponds at pleasure. In case of any accident happening to either main the other can take its place, and no delay or interruption of the service need occur. The pumping engines are in duplicate for the same reason. At these two reservoirs at Fenham and Low Benwell distribution may be said to commence, so far as the supply of filtered water for domestic use is concerned.

For the arrangements for the "manufacturing supply" of unfiltered water we must return to the Great Southern Reservoir. The plan shows the position of the 30-inch rising main from the Wylam Pumping Station (at Q). This delivers direct into the Great Southern Reservoir, from which a 24-inch main issues, as before described, following the same route as the rising main to Horsley Wood, and

thence to Wylam, along the Scotswood and Newburn Railway, and the Scotswood Road to the Town.

Through this main the manufactories on the banks of the river receive their supply, and, by this arrangement, in time of scarcity the supply from the collecting grounds can be used entirely for domestic purposes, while Tyne water is pumped up to the Great Southern Reservoir for manufacturing purposes.

The pumping-engines, at Wylam, were erected by the Company in 1876. They are capable of forcing up to the Great Southern Reservoir about three to three-and-a-half million gallons per day, and are now in full work

When these engines were put into operation, the large pumping-engines, at Newburn (which were erected about 1858, and which had since that time been frequently resorted to to meet the failing supply in times of scarcity) were abandoned, but from prudential motives, not dismantled. The wisdom of this course is shewn by the fact that, owing to the exceptional dryness of the present season, and consequent lowness of the stored water at Hallington and Colt Crag, it has been found necessary to prepare again to pump, at Newburn, to supplement the trade supply which, at present, amounts to about five million gallons per day. Of this, about three-and-a-half millions is now pumped from the Tyne, at Wylam, leaving one-and-a-half millions to be supplied from the reservoirs, and, in order to avoid this, it is proposed to pump about one-and-a-half to two millions, at Newburn, into the 24-inch "Trade Main." This will be pumped up to Low Benwell, into a separate reservoir, through an arrangement of mains, shewn at R, and from there will again descend by another pipe to the 24-inch "Trade Main," thus gaining a head sufficient to pass the required quantity through the pipes. This is an awkward and difficult mode of attaining the required end, but is only adopted to meet an emergency.

The Newburn engines, when working to their full capacity, are capable of raising six million gallons per day. As the "Trade" consumption has now reached five millions per day, and no doubt will increase, it is worth the consideration of the Company whether they should not add to their pumping power, at Wylam, by putting down a third engine, and another rising main so as to enable them, in a dry season like the present, to commence pumping the full "trade supply"

not later than the middle or end of June, and so to save the pure water for "domestic use."

It is merely a question of time as to when this or some equivalent mode will have to be adopted.

This completes the description of the collection, storage, and conveyance of the water, and leaves us at the Western Boundary of the Borough, at which point the distribution, so far as Newcastle and Gateshead are concerned, begins. Before entering on that part of the subject, it will be convenient to say a few words on the quality and sufficiency of the supply, and on the future probable requirements of the district.

REMARKS ON QUALITY AND QUANTITY OF PRESENT SUPPLY.

Bearing in mind the principle already stated, that the quality of a water supply depends on the nature and state of cultivation of the district from which it is collected, we have to consider whether the gathering grounds of the Newcastle and Gateshead Water Works are favourable or otherwise. The total area from which the supply is derived is about 22,000 acres, of which fully nine-tenths is pasture and moor land. The number of inhabitants is small, being about 1,320, or 0·06 per acre. The number of stock is, of course considerable, and is estimated by competent authorities at about 11,000 on the average, or 0·50 per acre. While, therefore, by no means an ideal gathering ground, it will bear a favourable comparison with many which are utilised for the supply of towns equal to, or greater in importance, than Newcastle. Taking, for instance, the Thames Valley, from which the chief supply of London is derived, its drainage area above Kingston is about 2,350,000 acres. Of this, about 750,000 acres is arable, or, in round numbers, one-third of the whole, and of the remainder, about 1,200,000 acres is pasture land, the rest being wood, water, waste, roads, &c. The whole population of this district is about 1,000,000, or say 0·45 per acre. The number of stock is about 1,250,000, say in round numbers 0·55 per acre.

Compared with such a drainage area, the Newcastle collecting grounds stand high in reference to population, and favourably even in reference to stock. They will not compare so well, of course, in either particular, with such areas as the Lake Districts of Cumberland or of Northumberland, nor with the slopes of the Cheviots, above Alwinton. On the whole, however, the Whittle Dean and Hallington collecting grounds must be placed above the average. When it is considered that the Newcastle Water Supply is the outcome of successive periods of pressure from water famine, and that the works originally laid out, with a view to a then consumption of under 1,000,000 gallons per day, have been gradually extended under the pressure of a demand, constantly increasing, until it has reached about 13,000,000 gallons per day ; the Town is to be congratulated that, in meeting this demand, the Company has been able to do so from comparatively unobjectionable sources, and has not been driven entirely to the Tyne, as many other towns (London for instance) have been driven to the rivers on which they stand. No doubt, had the probable demand for water that would arise in 40 years been foreseen in 1844, the engineers who projected these works would have grasped the question with broader views, and have so arranged their plans as to permit of their extension, as the necessity arose, into the best and least objectionable districts to be found within practicable reach. Experience, however, must be acquired, and cannot be foreseen.

It is further to be remarked also that, however farseeing may be the views of an Engineer in such matters, he is controlled and limited in his power to carry them out, by the public who have to find the money, and on whom the necessary taxation must fall. The man who, in 1844, had ventured to advise that provision should be made for a possible future supply of 13,000,000 gallons per day, to the Newcastle district, would have been looked on as a wild visionary, and if not taken charge of by his friends, would certainly never have succeeded in getting from the public the funds to secure even 1,000,000. There are several instances on record where large and promising schemes of water supply have been actively and successfully opposed by the ratepaying public, notably the St. Mary's Loch Scheme for the supply of Edinburgh, where the Town Council, having promoted in Parliament a comprehensive Bill, were not only beaten by a ratepayers' opposition, but

surcharged with the costs of promotion (about £17,000), and only after some years succeeded in getting an Act permitting them to pay the costs out of the rates.

To return, however, to the main question of the purity of the present supply of Newcastle. It may be taken that the collecting ground is a fairly good one, that with some exceptions previously mentioned, proper precautions are taken to prevent unnecessary fouling of the feeders, and that these precautions may be still further extended by a moderate expenditure.

The main sources are favourably situated in being nearly 20 miles from the Town. Engineers are agreed that water kept in large reservoirs deposits some of its impurities there, and that it is notably improved in quality by passing through long canals or aqueducts, being thereby freely exposed to the action of the air, which gradually oxidizes organic matters held in suspension or solution, and thereby renders them innocuous. There is considerable difference of opinion as to the distance required to secure complete oxidation of such matter, but none as to the fact that such oxidation does take place. It may be supposed that chemical analysis would enable us to say with certainty, when the purifying action is complete, but this is not so. Ultimate analysis can tell us absolutely what are the constituent parts of a sample of water, but only approximately in what form they exist; and it is that form on which the whole question of "wholesome" or "not wholesome" depends. Thus, the same elements, which in one form of combination are deleterious, or, absolutely poisonous, in another may be quite innocuous, or, even nutritious. As an illustration of this a familiar example may be taken. Carbon, oxygen, and hydrogen, in one form of combination, constitute "sugar." The same three elements, in another combination, constitute "alcohol;" only a chemist could tell us from the ultimate analysis which was which, and yet the "Eau sucreé" of the Frenchman, and the "Whisky and water" of our Scotch neighbours (not altogether unknown perhaps in Newcastle) differ widely in their effects on the human body. Sugar nourishes the infant, and does not hurt anyone. Whisky would poison the child, and—Sir Wilfred Lawson and his disciples tell us—the man also.

Though the action of the air on the running water cannot absolutely remove the constituents of its original impurities,

it can and does oxidize them, and thereby alter their forms of combination, and render them comparatively harmless.

Filtration, again, while it cannot alter or remove matters held in solution, does remove matter held in suspension, and thus renders the water clear and bright. It is necessary, however, with filtering beds that the sand, &c., which is used should be occasionally changed and renewed, and well raked up and exposed to the air at frequent intervals, or it will become so loaded with the retained matter as to be useless for the purpose of purification.

The filtering beds, at Throckley, are well arranged as to facilities for cleansing and renewing the sand, as any one or more of the nine divisions can be stopped off, while the rest remain in action. Their area is three acres, or 130,000 square feet, while the area stipulated in the Act of 1877 is 100,000 square feet. They are capable of filtering 10,000,000 gallons per day.

The water sample taken from the outlet to these filtering beds may fairly be called, so far as analysis can show, a "pure and wholesome" water, and will compare favourably with most of the large water supplies of England; but too much reliance must not be placed on analysis, for the reasons indicated above. It is useful, of course, in its proper place, but is by no means an absolute or infallible criterion of quality.

There is, however, one point worthy of note, and that is that the samples 24 and 25, which were taken on the same day, 24 from the water as it entered the filter, 25 from the filtered water, show absolutely no improvement in quality; but, on the contrary, the filtered water is slightly worse than the same water before filtration. There is slightly more chlorine, more ammonia, and rather more oxygen is absorbed in four hours.

It would be hasty to draw conclusions from a single analysis, but evidently the fact points in the direction of the filtration not being effectual, and either the water as it enters is too pure to be improved by passage through the filters, or the filters are so far saturated with retained impurities that they give off again to the water as much as they remove.

Probably, more frequent changing of the sand, &c., would be beneficial, but before that is done, and, indeed, as a regu-

lar practice, samples of the water should be more frequently taken of the water before filtration, and the indications of their analysis should regulate the length of time which is allowed before changing the sand.

There is one source of impurity from which water supplies may suffer, and from which the Newcastle water has occasionally suffered, and which is very difficult to guard against, viz., contamination by minute forms of *organic* life existing in the Service Reservoirs, and which sometimes become so numerous as to give a distinct smell and taste to the water, especially when heated or kept standing for some time.

A reservoir, occasionally, will be for a whole season so infested with these minute organisms as to be rendered unusable, and quite unfit for containing water for drinking purposes.

They seem to arise and multiply entirely in the Service Reservoirs, after the water has passed the filter beds, though it is possible that their germs may exist in the water in such a form as to pass through the sand. This, however, is not the most probable explanation. Their occurrence in such multitudes in the service reservoirs and pipes shows, at any rate, that there they find a condition of things which is favourable to their existence and reproduction, and the natural inference is that "dirt" of some kind is to blame: not "dirt" in the general acceptance of the term, perhaps, but in the wider sense of "matter in the wrong place." Confervoid growth on the sides and bottom of a pond, for instance. It is certain that thorough cleansing of an infected reservoir has generally got rid of the pest, and this points to the necessity of more frequent cleaning, and of such reservoirs being made in duplicate, so as to allow of this being done without interfering with the supply and distribution of the water.

While on this subject, it may be mentioned that it is considered by experts that the existence of aquatic plants and fish in storage reservoirs is very favourable to purity of the water, and that it is well worth the while of the Company to give some further attention to the stocking of their Colt Crag and Swinburn Reservoirs with fish, as they are certainly not too numerous there.

The further discussion of the quality and purity of the water will be left to the Medical Officer's portion of this

Report, being a matter which, though by no means foreign to the engineering part of a water supply, yet comes more directly within his province.

With respect to the quantity of the present supply and its sufficiency for the probable increase of the demand, a glance at the table showing the present and probable future population of the districts served by the Newcastle and Gateshead Water Company will be instructive.

The present supply to the two towns, and the district within the limits of the Acts, for all purposes—domestic, manufacturing, and public—is about 13 million gallons per day.

The greatest average daily consumption in any one week, as shown by the Company's returns of the daily guagings, has been 12¼ millions, in the week ending September 2nd; but it is probable that this is somewhat under the mark, as, taking their returns to the Council of water in store for the months of July and August, adding to the consumption then shewn, the quantity pumped at Wylam, and also the amount brought in by springs and other sources of supply (estimated at about one million gallons per day) we have the following result :—

	Gallons.
Water in Store on 30th June..... ..	1,550,495,190
Pumped from Wylam from 30th June to 30th August	183,000,000
Produce of Springs, &c.	61,000,000
Total	1,794,495,190
Water in Store on 30th August.....	958,329,811
Total Consumption in 61 days	836,165,379

Or 13¾ millions per day.

Taking the average between this result and that from the guaging, we have 13 millions per day, which will probably be a safe basis for calculation.

The population supplied is given by the census of 1881, at about 370,000, but from this must be deducted for places not yet supplied, 32,000, leaving 338,000. This gives a consumption per head, for all purposes, of 38½ gallons in round numbers. In 1863, Mr. Main gives the consumption at 28 gallons per head, for all purposes. This shows an increase of about 37 per cent. in the amount consumed for each person, due, no doubt, largely to improved habits of cleanliness

among the people. Looking at the fact that baths and W.C.'s, which even then were considered as luxuries, are now regarded as necessities in almost every house of any pretensions to comfort, and to the growing conviction that it is to the still further improvement in the habits of the people; and to increased cleanliness, both of person and dwelling, that we must look for the better health of the community and decreased death-rate that are the objects of all sanitary effort, it is not too much to assume that there will be a still further increase iu the next 20 years in the consumption per head. Put it, say, at 20 per cent., we may fairly assume that it will be necessary to provide for at least 46 gallons per head in 1901 to be even in the same position as we are now.

Supposing the population to increase at the same rate in the future as in the past, there will be 520,000 to provide for in 1901, which, at 46 gallons per head, will require 24 million gallons per day, or nearly double the present supply.

To deal with this would require a storage-capacity of 3,600 million gallons, and reckoning on a minimum average rainfall over three consecutive dry years of 24¾ inches, and allowing for waste, compensation, and evaporation, 15 inches, leaves a nett available rainfall of 9¾ inches, which, to supply 24 millions per day, would require a collecting ground of about 37,000 acres.

Comparing these figures with the existing and projected storage of 3,042 millions, and the available gathering ground of 22,000 acres, it will be seen that before 1901 the Company must extend their works, or otherwise supplement their supply.

It may be objected to this estimate, that 20 years is a long period to looking forward, and that is not incumbent on this generation to consider the requirements of the next. But the history of water enterprise in general, and of this district in particular, has been one long record of underestimation of demand and overestimation of rainfall, and the natural consequences of constantly impending water famine, staved off for a few years at a time only, by the execution of works just sufficient to relieve the immediate pressure. It is abundantly evident, at least, that in the choice of a district for the supply of Tyneside, the very broadest view should be taken of future requirements, although the execution of the works may be judiciously spread over a long period, so

as just to keep fairly ahead of the demand. Thus, the time must come when every available acre of the present district which can be drained into the existent reservoirs will be occupied, then follows the inevitable necessity for winning a new district at a very much larger cost.

It is but fair to point out, however, that the position of the present Company is exceptional in two particulars.

1st. They have the power to supplement the supply for manufacturing purposes by pumping from the Tyne, and the works for this purpose are executed and ready for use at anytime, mains having been specially laid with a view to this contingency, and, in point of fact, they are now in full use.

This will enable them to get over times of great pressure, and, in fact, is equivalent to reducing the demand on their gravitation supply by the whole manufacturing demand, or say by five million gallons per day.

2nd. They can, in times of scarcity, cut off the North Shields supply, and thus tide over a dry season; but this, though it places the other parts of the district in a better position, does little to relieve the Company which, having undertaken to supply Shields, cannot immediately get rid of the obligation thus assumed, but must, at least, give them time enough to procure a supply from another district, and the natural and almost certain result would be that the Newcastle Company would find themselves forced to undertake the finding of this new supply. This, therefore, does not really extend their time.

As matters stand, the Company can hardly consider themselves safe for even the next five years, but should be preparing for winning new collecting grounds, and otherwise improving their position.

It seems hard that a water company, like the "Wandering Jew," can never rest in one place, but must always be "moving on," ever increasing their capital account and spending money in fresh works. But it must not be forgotten that the more water they have to find the more they have to sell, and that each increase in the population means a more than equivalent rise in rateable value, and a larger income.

OTHER SOURCES OF SUPPLY.

It has before been mentioned that various schemes have, from time to time, been proposed for supplying Newcastle from other sources than the existing one. These have naturally come to the front when the present Company were in difficulties from scarcity of water, and have been dropped when those difficulties were surmounted. The long drought of 1867 and 1868 was one of these stimulating causes.

A short description of the chief of these schemes is here given, as coming properly within the scope of this Report.

COQUET HEAD SCHEME.

In 1871, Messrs. W. Geo. and H. Laws, of Newcastle, in conjunction with Mr. Thos. Bouch, of Edinburgh, proposed to impound the head waters of the Coquet, including the Usway and the Alwyn, in a reservoir, to be formed just below Alwinton, where the formation of the ground was favourable, and where a dam of very moderate height would give 2,000 million gallons of storage.

The collecting area was about 36 square miles, and the rainfall being close upon 50 inches, it was considered that, independent of compensation water, about 20 might be reckoned on for impounding, which would have given over 28 millions daily—sufficient to have provided for Newcastle till its population rose to 600,000, which seemed far enough to look forward to.

It was intended that the more peaty streams, of which there were several, should be stored separately, and used as compensation water only.

It was proposed to convey the water to Newcastle, in a covered aqueduct, to avoid contamination and evaporation. This aqueduct would have been 40 miles long, of which five miles would have been by piping, and the water would have been delivered at a height of 400 feet. The estimated cost was £450,000, or £11,000 per mile.

It was suggested that the Corporation should construct these works, bring the water to the Town, and sell it to the

existing Company at 3d. per thousand gallons, which it was calculated would give, on the then consumption, a sufficient return to keep up the works, pay the interests on a loan, and to provide for its redemption in 50 years, while it left an ample margin of profit to the Company for distribution.

The collecting ground was a favourable one, consisting chiefly of hill pasture and moorland, and was mostly a sheep district. The underlying strata were granite and porphyries and some trap rock, which are considered by water engineers to form the best possible substratum.

The main features of the scheme were laid before the late Town Clerk and Mr. SANDERSON, neither of whom approved, and as it was not considered prudent to go to Parliament with both the Corporation and Water Company opposing, the scheme was dropped.

NORTHUMBERLAND LAKES SCHEME.

In 1871 or 72, Mr. T. J. BEWICK suggested the Northumberland Lakes as a source of supply, but the details of his scheme were not published until 1874, when he read a paper on the subject before the Northern Institute of Mining Engineers. He proposed by embanking the Greenlee Lough, Broomlee Lough, and Crag Lough to raise their storage-capacity to 4,350 millions, and by the free use of catch-water aquedúcts to include a gathering ground of 60 square miles, on which he reckoned on an available nett rainfall of nine inches, giving 21 millions per day.

This, he proposed to carry by an aqueduct of 16 miles to Whittle Dean, or by one of 30 miles, direct to Newcastle, using about three miles of piping to cross the North Tyne Valley, and with two or three short tunnels, the longest being about one mile.

To deliver the water at Whittle Dean, he estimated would cost £150,000, and to carry it to Newcastle £130,000 more, or £280,000 in all, about £9,000 per mile.

The whole gathering ground of 60 square miles, only contained 32 dwellings and about 200 inhabitants, and, while admitting the water to be peaty, Mr. BEWICK contended that this was harmless, in confirmation of which opinion he

quoted Mr. BATEMAN, who stated that long storage, and passing through a long canal, got rid of a large part of the colour.

The whole of the reservoirs and gathering grounds were above the 600 ft. contour, so that there was no difficulty as to level.

In the discussion of the paper, the late Professor PAGE raised the objection of the well-known abundance of animalculæ in these lakes, and suggested that it might be necessary to bare the whole of the ground to be occupied by the reservoirs, and clear away all vegetable matter. This had been found necessary in one case in America, where entomostraca had so multiplied that they had to empty the lake, and excavate five to seven feet of the soil below, to get rid of them. This would materially increase the cost of reservoirs. Professor PAGE, however, agreed with Mr. BEWICK in considering peaty colouring quite harmless.

Mr. BEWICK does not appear to have taken any steps to further his scheme, and it dropped.

ULLSWATER SCHEME.

In 1874, Mr. R. S. NEWALL, of Gateshead, proposed to take water for the supply of Newcastle and Tynemouth from the Ullswater Lake, by constructing an aqueduct of 80 miles in length, which was to leave the lake near its outlet at Pooley Bridge, and, passing Penrith, Armathwaite, Milton, Gilsland, Haltwhistle, Corbridge, Whittle Dean, and Newburn, was to deliver water at Newcastle at a level of 400 feet. A branch of seven miles in length to Carlisle, one of eight miles to Tynemouth. and shorter branches, varying from half-a-mile to a mile-and-a-half, for the supply of Haltwhistle, Hexham, Corbridge, and Newburn, completed this bold scheme.

He puts the area of the collecting ground at 95 square miles (which, however, includes more than the Ullswater Water Shed), and the rainfall at 60 to 100 inches per annum. Taking the smaller figure, this would give a daily outflow at Pooley Bridge of nearly 300 million gallons. Mr. NEWALL himself, by a rough gauging of the river Eamont, where it issues from the lake, makes the flow about 500 million gallons per day.

In either case, the amount he proposes to abstract, viz : 20 million gallons per day, is a mere fraction of the supply, so that, in point of quantity, this scheme has the advantage over all others.

Mr. NEWALL refers, in proof of the good quality of the water, to the very favourable analysis given to the Royal Commission on the Water Supply of London.

He also compares its hardness, viz.: 1·9 by CLARKE'S scale, with the Whittle Dean water which he quotes at 20 degrees of the same scale, or 10 to 1 in favour of Ullswater, so far as the consumption of soap goes.

It is only fair to say, however, that the hardness of Whittle Dean water is given by Mr. MAIN as about 13 on the average, as delivered at Newcastle.

A serious objection was raised, however, to the water of Ullswater Lake, on the score of its being contaminated with lead, from the washings from the Greenside Mine, which run in the lake near Patterdale. Mr. NEWALL scouts this idea on the ground that galena, the ore of lead, is only soluble in the very purest water, and then in such minute quantity as to be quite without danger to life. He admits, however, that this water is pure enough to have considerable action on bright lead, but none on tarnished lead. These, however, are rather questions for a Chemist than for an Engineer.

Coming to the question of cost, Mr. NEWALL'S proposal was that the works should be carried out by a Commission, appointed by the various towns served, who were to buy up the Water Companies, make the works, and manage the supply of the district.

He estimated the cost at about £6,000 per mile, or £500,000 in all, which, however, includes the Newcastle supply only. Compared with £11,000 per mile for the Coquet Head Scheme, and £9,000 per mile for the Northumberland Lakes Scheme, this estimate seems small, but Mr. NEWALL has no reservoirs to provide.

In the discussion which followed the reading of Mr. NEWALL'S Paper, Mr. CAIL endorsed the scheme, and supported the estimates as sufficient, while Mr. BURDON SANDERSON admitted the practicability of the Engineering of the scheme, but gave it as his opinion, founded on his experience, that the estimate would be very much exceeded, and that the purchase of the water-works alone would cost

three-quarters of a million. He did not think that the rate-paying public would submit to be taxed to the necessary extent, but would oppose any Bill in Parliament, and instanced the St. Mary's Loch Scheme for Edinburgh, which was upset by the public opposition.

Mr. NEWALL subsequently spent £400 or £500 in preliminary surveys of the grouud, but no application was ever made to Parliament, and the scheme, like others, was dropped for a while.

These are the three chief schemes which have been proposed for the further supply of Newcastle, and, though abandoned for the time, there was sufficient basis of practicability in each of them, to make it more than probable that one or other of them will come up again in any time of water famine.

Each increase of population in the district, while it brings nearer the necessity for an increased water supply, renders it more feasible by giving an extended basis for the inevitable taxation. The time will certainly come, sooner or later, when the present Company will find themselves compelled to go still further afield to keep up with the demand, and possibly to adopt one or other of these schemes. That any of them should be carried out by private enterprise, or even by the Corporation or Corporations, in opposition to so wealthy and powerful a Company as the Newcastle and Gateshead Water Company is improbable, seeing that the first step must be the purchase of their undertaking on equitable terms, which would be a very formidable item in the cost.

There is a very general impression that the water supply of large Towns should be in the hands of their Corporations, and there is much to be said in favour of that view; but it is very doubtful whether, after all, the public, whose welfare must be the first consideration in the matter, would be better served by a Council than by a private Company, and more than doubtful whether it would get as much for the same money. A Council is difficult to move at first, and very apt to move by fits and starts when once set going. It does not and cannot give that close and individual attention to the management of such an enterprise, which a body of Directors, who are personally interested in its commercial success, can do. It must necessarily leave all practical details to permanent officials.

But, as a watching body, a Council is perfect, and quite unfettered by any personal interests, in insisting on the utmost care being taken of the public welfare.

There is, of course, another view, viz., that the profits which go into the pockets of a Water Company, should go into the public purse, and that no person should make a profit out of the public necessity in so essential a requisite of life as water. The latter consideration is, perhaps, outside the limits of this Report, and, as to the former, it is a question if a water enterprize, which has gone through such vicissitudes, and so enormously increased as that of Newcastle, would have had much profit to shew had it been carried out by the Corporation.

This Report has occupied so long in preparation, and has extended to such dimensions, that it has been considered best by both of us to submit our conclusions, so far as we have gone, and to leave the question of Distribution for a further and Supplementary Report. We, therefore, propose to give a short summary of our conclusions on the collection, storage, and conveyance of the Water Supply of Newcastle, and to leave it to the Committee to deal with them as they may please.

On the Engineering part of the subject, then, I think I am warranted in saying :—

1st. That the gathering ground of the Newcastle and Gateshead Water Company is a fairly good one.

2nd. That the reservoirs of the Hallington Group are properly constructed as storage reservoirs, but require to be better protected in some particulars from fouling by cattle.

3rd. That the aqueducts are sufficient and proper for their purpose, but also require better protection against fouling at the places indicated, and particularly at Matfen and along the River Pont.

4th. That the increasing consumption of water makes it certain that, within very few years, the Company must extend their collecting grounds.

5th. That it would be well to make complete provision for the pumping of the whole of the "trade supply" from the Tyne, at Wylam, and not to use the Newburn engine at all. Also, to commence the pumping earlier in the summer.

6th. That the filtering beds at Throckley need more frequent changing of the sand, and more attention should be paid by the Council to the taking of samples there.

7th. That quarterly reports, at least, should be made to the Council, by their own officials, as to the state of the various reservoirs and works.

8th. That a "Water Record" should be kept, embodying these reports, and, also, the various analysis and details of water in store (now scattered through the Council Reports), for ready reference hereafter.

I am, Gentlemen,

Your obedient Servant,

W. GEO. LAWS,

City Engineer.

TO THE CHAIRMAN AND MEMBERS OF THE JOINT GAS AND WATER AND SANITARY COMMITTEES OF THE CORPORATION OF NEWCASTLE-UPON-TYNE.

Gentlemen,

In accordance with a Resolution of the City Council passed on the 27th of February last, I beg to submit herewith my portion of the joint Report on the Water Supply of the City.

I have the honour to be,

Gentlemen,

Your obedient Servant,

HENRY E. ARMSTRONG,

Medical Officer of Health.

Health Department,

Town Hall,

Newcastle-upon-Tyne,

21st October, 1884.

THE WATER SUPPLY

FROM A

HYGIENIC POINT OF VIEW.

In its *pure* state, water consists merely of two gases—oxygen and hydrogen—in chemical combination. In this form it is not available for domestic purposes, but may be prepared, almost perfectly, by distillation in the laboratory of the chemist.

The nearest approach to pure water in nature is rain, the result of natural distillation on a large scale ; but rain, by the time it reaches the earth, is always impregnated with gaseous or other matters, derived from the air through which it has passed.

It is unnecessary to insist on the general hygienic value of water merely as such, the importance of which has been generally admitted from the time of PINDAR, who termed it the "best of all things." It has been said that the excellence of a water supply speaks for itself in the beauty and physical superiority of its consumers. What kind of water is best for sanitary requirements? and how near does the water supplied to the inhabitants of Newcastle come to this standard?

Dietetically, pure (*i.e.*, chemically pure) water is not desirable. It is insipid as a beverage, and its use implies a loss to the body of a large amount of mineral matter, —notably lime (required in the formation of bone), a salt which, at least in the case of young children, is provided but sparingly in other articles of food. Water for drinking and cooking should, however, be *good*, *i.e.*, wholesome, agreeable to taste, colourless, odourless, clear, bright, and free from organisms and zymotic, or animal, contamination. For purposes of personal and domestic cleanliness it should not contain much mineral matter in solution, *i.e.*, should not be what is known as "hard."

Few towns, if any, have water perfect in all respects from source to delivery, and our own is no exception. Water however, in regard of many of the impurities to which it is liable, is generally capable of improvement or remedy, by natural or artificial means. How far is the Newcastle supply benefitted by the operation of such means? It will naturally also be asked: What have been the effects of the water in the past as evidenced by the records of disease, the spread of which is commonly associated with, or attributed to, defects in the quality of the supply?

Inseparable from the hygiene of water are the important questions of amount per person, and continuity of supply necessary for the various demands of health. The foregoing subjects, together with the indications to which they give rise, form the basis of the subsequent pages of the present Report which is accordingly arranged under the following heads: *

1. Contamination.
2. General quality of supply.
3. Means for protection and purification.
4. The water supply and the public health.
5. Sanitary considerations of supply, service, waste, &c.
6. Indications, &c.

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1. CONTAMINATION.

The Sanitary Committee have reported to the Council on the pollutions of the water supply which they observed at the beginning of the year. Some of these have since been remedied, as already described. Other conditions affecting the quality, some of which are unavoidable, have come under the notice of the present reporters. In all, these are:—

1. Vegetation on Bed and Sides of Colt Crag Reservoir.

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* The instruction of the Council with regard to the inquiry is understood as intended to refer to the water as supplied, but not to the consideration of conditions affecting it on domestic premises, which may, if required, be considered at a future time.

2. Drainage into Aqueducts or Reservoirs, from certain Manure Heaps, Droppings near Cattle Troughs, a Farm-yard, Two Cottages, and a Sheep-bath.

The manure heaps in question were noticed on the banks of the River Pont, above Matfen, and also near the aqueduct between Nine Wells and Hallington Reservoir. The droppings near cattle troughs discharge into Colt Crag and Hallington Reservoirs. The farm-yard, together with cottages and sheep-bath referred to, are those at Little Swinburn.

3. Drainage indirectly into Reservoirs, Aqueducts, or Feeders, after Filtration through Land, from certain Farms and Hamlets, viz. :—The farms of Colt Crag, Short Knowes (near Little Swinburn) ; Fawcet and Cheviot (near Hallington) ; and two farms on the upper waters of the River Pont. The hamlets in question are those of Great and Little Bavington, each of which stands above, but is some fields distant from, Hallington Burn.

4. Pollution of Hallington Reservoir by Wild Waterfowl.

The drainage of Little Swinburn has been intercepted by the Water Company, and no longer discharges into the Reservoir. In other respects, the circumstances above detailed are unchanged. What are the extent and significance of the contamination to which they give rise ?

The effect of the organic character of the bed of Colt Crag Reservoir is shewn in the comparatively large proportion of albuminoid ammonia in the water, and the oxygen absorbed (see Table of Analyses, page 57). The amount of submerged vegetation undergoing decomposition varies at different periods with the rise and fall of the water. That below low water-mark will soon disappear altogether, and much of it has probably done so already. Between high and low water-line, weeds grow freely in summer, and in winter decay beneath the surface of the water which consequently becomes charged with vegetable matter liable to decompose under the influence of warm weather, and so to make the water unwholesome or even directly productive of disease. This dead grass, &c., is also undesirable inasmuch as it devitalizes the water by taking up its free oxygen. It has also to do with the yellow tinge,

and probably with the smell sometimes reported by the Analyst.* The Hallington Reservoir, constructed in the same way as that at Colt Crag, viz., by impounding water on land covered with grass, &c., was at first objectionable on this account. The Colt Crag Reservoir will doubtless improve naturally as that at Hallington has done. The growth of weeds between the water-lines should be prevented.

The manure heaps referred to have been removed for farm purposes long ago. Similar accumulations are likely to re-appear there yearly,† unless prohibited, which they should be. The cattle droppings also should not be allowed to flow into the reservoirs, &c.

The hamlets and farmsteads are at a considerable distance from the water-courses, and the sewage from them necessarily undergoes a slow process of land filtration before reaching them. The effect of filtration through land covered with growing plants, as at sewage farms, where the soil is regularly flooded with liquid manure, is well known; when, therefore, as in the case of the hamlets and farms in point, the liquids therefrom have to percolate slowly through the soil of several fields, they are probably innocuous by the time they reach the streamlets into which they discharge.

The pollution of Hallington Reservoir by waterfowl, which congregate there in large numbers, is probably only to be checked by removal of the island, on which the birds gather.

The foregoing constitute all of the contaminations of the water supply known to the writer.

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2. QUALITY.

On various visits to the gathering grounds, reservoirs, &c., samples of the water have been taken for analysis. In all, 32 of such samples were drawn, including specimens from

* See Analysis of sample of water (No. 1) from Colt Crag Reservoir, page 57.

† In 1873, a manure heap was observed by the writer on the bank of the aqueduct below Nine Wells, in about the same place as that noted above.

TABLE A.

	Head of Colt Crag Southern Corner. No. 1.	
Total solid matter in solution	9·400 grs.	
Chlorine	0·607 „	
Ammonia	0·009 „	
Albuminoid Ammonia	0·024 „	
Oxygen absorbed in 15 minutes.	0·175 „	
Oxygen absorbed in four hours.....	0·408 „	
Appearance in two-foot tube.....	Brownish yellow colour and slightly turbid.	
Smell when heated to 100° Fah.	Fusty.	
Microscopical Examination	Satisfactory.	

	From Aqueduct Fawcet Farm, where Sewer Pipe crosses. No. 11.	S
Total solid matter in solution	15·200 grs.	
Chorine	0·910 „	
Ammonia	0·001 „	
Albuminoid Ammonia	0·009 „	
Oxygen absorbed in 15 minutes.....	0·032 „	
Oxygen absorbed in four hours.....	0·111 „	
Appearance in two-foot tube.....	Faint yellow colour and very slightly turbid.	Cl
Smell when heated to 100° Fah.	None.	
Microscopical Examination.....	...	

TABLE A.

HEALTH DEPARTMENT, TOWN HALL,
NEWCASTLE-UPON-TYNE.

NEWCASTLE-UPON-TYNE.

ANALYSES OF WATER SAMPLES BY MR. JOHN PATTINSON, CITY ANALYST.

RESULTS IN GRAINS PER GALLON.

	Head of Colt Crag Southern Corner. No. 1.	Head of Colt Crag, N. W. Corner. No. 2.	Colt Crag, N. E. Point. No. 3.	Outfall from Colt Crag Reservoir No. 3a.	Natural Feeder from Rock at Little Swinburn. No. 4.	Contaminated stream at Little Swinburn. No. 5.	Little Swinburn Reservoir, near Outfall from Byres. No. 5a.	Burn at Little Swinburn Reservoir (right bank) near Barn. No 5b.	Little Swinburn Reservoir (right bank) opposite to Barn door of Farm. No. 5c.	Foot of Little Swinburn Reservoir. No. 6.	Outfall from Little Swinburn Reservoir. No. 6a.	Feeder on top of Tunnel between Nine Wells and Swinburn. No. 7.	Aqueduct below Nine Wells. No. 8.	Outfall Drain Pipe quarter-mile above Fawcet. No. 9.	Aqueduct below Fawcet Farm-house. No. 9a.	Outfall Drain-pipe, Fawcet, near second Bridge. No. 10.
Total solid matter in solution	9·400 grs.	13·000 grs.	11·400 grs.	7·000 grs.	15·900 grs.	15·600 grs.	13·100 grs.	15·400 grs.	7·000 grs.	9·600 grs.	7·000 grs.	18·400 grs.	14·700 grs.	20·800 grs.	14·000 grs.	28·000 grs.
Chlorine	0·607 "	0·819 "	0·364 "	1·062 "	0·303 "	1·062 "	1·062 "	0·850 "	1·062 "	1·062 "	1·062 "	1·062 "	0·637 "	1·123 "	0·910 "	3·459 "
Ammonia	0·009 "	0·002 "	0·005 "	0·014 "	0·001 "	0·005 "	0·015 "	0·001 "	0·006 "	0·008 "	0·009 "	Trace.	0·006 "	Trace.	Trace.	0·100 "
Albuminoid Ammonia	0·024 "	0·014 "	0·015 "	0·041 "	0·011 "	0·014 "	0·017 "	0·020 "	0·034 "	0·022 "	0·019 "	0·009 grs.	0·022 "	0·006 grs.	0·014 "	0·083 "
Oxygen absorbed in 15 minutes	0·175 "	0·097 "	0·135 "	0·080 "	0·063 "	0·120 "	0·106 "	0·201 "	0·079 "	0·167 "	0·064 "	0·060 "	0·126 "	0·014 "	0·076 "	0·114 "
Oxygen absorbed in four hours	0·408 "	0·213 "	0·272 "	0·140 "	0·133 "	0·288 "	0·228 "	0·437 "	0·138 "	0·392 "	0·120 "	0·134 "	0·311 "	0·049 "	0·160 "	0·669 "
Appearance in two-foot tube	Brownish yellow colour and slightly turbid.	Yellow colour and slightly turbid.	Yellow colour and very slightly turbid.	Brownish yellow colour and slightly turbid.	Faint yellow colour and clear.	Faint yellow colour and slightly turbid.	Yellow and turbid.	Yellow and turbid.	Brownish yellow colour and slightly turbid.	Brownish yellow colour and slightly turbid.	Brownish yellow colour and slightly turbid.	Faint yellow colour and slightly turbid.	Yellow and slightly turbid.	Colourless and clear.	Faint yellow and clear.	Brown yellow colour and turbid.
Smell when heated to 100° Fah.	Fusty.	None.	None.	None.	None.	None.	Earthy smell.	Fusty.	None.	None.	None.	None.	Slight earthy smell.	None.	None.	None.
Microscopical Examination	Satisfactory.	Satisfactory.	Satisfactory.	...	Satisfactory.	...	...	...	...	...	...	...	...	...	...	...

	From Aqueduct Fawcet Farm, where Sewer Pipe crosses. No. 11.	Spring at Great Bavington. No. 12.	Quarter-mile above Little Bavington. No. 13.*	Weir at Head of Hallington. No. 14.	Weir at Head of Hallington. No. 15.	Aqueduct half-mile below Hallington Reservoir, above Hallington Village. No. 16.	Catch Water, half-mile below Hallington Village. No. 17.	Weir at West end Ryall Tunnel. No. 18.	Mouth of Ryall Tunnel. No. 19.	Burn alongside Ryall Tunnel Mouth. No. 20.	Aqueduct at Junction with Pont. No. 21.	Pont at Junction with Aqueduct. No. 22.	Below Main Gauge at Whittle Dene. No. 23.	Water as it enters Filtering Beds at Throckley. No. 24.	Filtered Water, Throckley. No. 25.	24-inch Main entering Benwell Reservoir. No. 26.
Total solid matter in solution	15·200 grs.	18·100 grs.	20·400 grs.	18·000 grs.	16·600 grs.	14·800 grs.	22·600 grs.	14·700 grs.	18·200 grs.	19·600 grs.	18·200 grs.	20·400 grs.	20·500 grs.	20·300 grs.	20·200 grs.	19·200 grs.
Chorine	0·910 "	0·759 "	0·789 "	0·910 "	0·576 "	0·971 "	0·971 "	0·941 "	1·032 "	1·032 "	0·971 "	1·062 "	1·001 "	1·032 "	1·062 "	0·971 "
Ammonia	0·001 "	Trace.	0·004 "	Trace.	0·001 "	0·003 "	None.	0·003 "	0·006 "	0·004 "	0·004 "	0·003 "	Trace.	Trace.	Trace.	0·001 "
Albuminoid Ammonia	0·009 "	0·004 grs.	0·007 "	0·009 grs.	0·008 "	0·015 "	0·008 grs.	0·015 "	0·013 "	0·014 "	0·016 "	0·010 "	0·010 grs.	0·010 grs.	0·010 "	0·012 "
Oxygen absorbed in 15 minutes	0·032 "	0·009 "	0·033 "	0·032 "	0·053 "	0·089 "	0·034 "	0·079 "	0·073 "	0·059 "	0·068 "	0·056 "	0·054 "	0·053 "	0·046 "	0·048 "
Oxygen absorbed in four hours	0·111 "	0·014 "	0·060 "	0·064 "	0·113 "	0·154 "	0·067 "	0·150 "	0·134 "	0·104 "	0·125 "	0·094 "	0·095 "	0·094 "	0·104 "	0·085 "
Appearance in two-foot tube	Faint yellow colour and very slightly turbid.	Clear and colourless.	Turbid and very faint yellow colour.	Very faint yellow colour.	Very slight yellow colour and very slightly turbid.	Faint yellow colour.	Clear and nearly colourless.	Faint yellow and clear.	Faint yellow colour and slightly turbid.	Faint yellow and turbid.	Faint yellow colour and very slightly turbid.	Very faint yellow colour and very slightly turbid.	Clear and nearly colourless.	Clear and very faint yellow colour.	Very clear and very faint yellow colour.	Faint yellow colour and clear.
Smell when heated to 100° Fah.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.
Microscopical Examination	...	Satisfactory.	Mineral and vegetable debris satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.

* Matters in suspension { Mineral 1·840 grs. / Organic 0·540 " }

the chief springs and feeders, the reservoirs, aqueducts, and filter-beds, and also after filtration. The results of Mr. PATTINSON's analyses are arranged numerically in order of locality in the opposite Table :—

In regard to the quality of the waters of the different feeders shewn in the foregoing table, it must be borne in mind that these vary with every shower of rain, and even trivial local circumstances may affect the character of any sample drawn from them. Even were it possible to reduce such elements of difference as the foregoing to the same level,—notwithstanding the unquestionable value of chemical analysis within certain limits,—implicit reliance is not to be placed solely upon it, as is too often the case in judging as to the quality of a water supply. Chemical analysis cannot, for example, give indication of the presence of zymotic material, as was shewn by Dr. CORY in his experiments with water purposely polluted, an account of which is detailed by the Medical Officer of the Local Government Board in his Eleventh Annual Report.* Chemistry can, however, measure accurately the inorganic, and some of the organic, constituents of ordinary water, and thus supply information from which certain inferences are deducible. For example : We learn by means of chemistry how much chlorine a water contains. Now, chlorine is found in all spring and river waters in their natural state ; in excess, it is an indication of urinous pollution ; but, except in shewing the total amount, and so enabling us to infer how much is in excess, chemistry affords no means of distinguishing between the chlorine that may be termed natural, and that due to animal contamination.

(*a.*) TRIBUTARIES.—The different samples examined by the Analyst, in connection with the present inquiry, shew the water of Newcastle to be a complex liquid. The various tributaries to it differ so much from each other in composition as well as in amount of yield, and the proportion furnished by each is so liable to fluctuation from time to time, that any attempt to base conclusions as to quality of the general supply on the analysis of samples drawn from

* P. xvii.—The "hydrogen process"—described by the late Dr. ANGUS SMITH, only last year, in his Second Report, under The Rivers Pollution Prevention Act, 1876—"promises," in the words of the discoverer, "to indicate a method of measuring the amount of organic activity amongst the microbes (at least of a certain class) which exist in the waters."

feeders would inevitably end in error. It is necessary, however, to advert to the character of some of these samples. Thus :—

Sample No. 1 (from Colt Crag Reservoir, at southern corner) is noteworthy for the quantity of oxygen it absorbed, an indication of organic matter, probably vegetable. This water was brownish-yellow in colour (peat stain), and fusty in smell.

Sample No. 3.—(Colt Crag Reservoir, N.E. point.) Indications similar to, but less marked than, No. 1.

Sample No. 5.—Contaminated stream at Little Swinburn.	This is from the same stream as No. 4, but below the farm buildings. The increased chlorine and ammonia is evidently from animal matter.
Sample No. 5*a*.—Little Swinburn, near outfall from farm buildings.	Contaminated with organic matter (urine, &c.) Smell, earthy ; yellow and turbid.
Sample No. 5*b*.—Burn near barn (Little Swinburn Reservoir).	Contaminated grossly with organic matter (urine, &c.) Smell, earthy ; yellow and turbid.
Sample No. 6.—Foot of Little Swinburn Reservoir.	More chlorine and organic matter than 3*a* and 4 ; therefore, evidence of some urinous contamination.
Sample No. 6*a*.—Outfall from Little Swinburn Reservoir (drawn a week later than No. 6).	Evidence of some urinous contamination.

Nos. 8 and 9*a*.—The latter was drawn about a quarter-of-a-mile below the former, and on the same day.

Sample No. 11 was drawn a week later from the same aqueduct still lower down. The weather was rather wet, and surface drainage from grass land was flowing freely when this sample was taken.

Sample No. 13.—Streamlet a quarter-of-a-mile above Little Bavington.	This water was turbid from mineral and organic substances. The sample was taken from a lower part of the same stream as No. 12. The turbidity appears to be entirely due to limited local disturbance, possibly from birds or small animals.
Samples No. 16, 18, and 19.—(From Aqueduct). Sample No. 20.—Feeder near mouth of Ryall Tunnel. Sample No. 21.—Aqueduct at Junction with Pont.	Albuminoid ammonia large in all of these specimens, evidence of organic matter in solution. No. 19 shews also a considerable increase of free ammonia.
Sample No. 24.—Water immediately before entering Sample No. 25.—Water immediately after leaving	Filter Beds at Throckley.

The two last-named were drawn on the same day.

N.B.—Compared with the unfiltered sample, the filtered one contains rather less solid matter in solution, but rather more chlorine and free ammonia. The water is therefore a little more pure before it passes through the filter than after.

(*b.*) Water as supplied in Newcastle.—The condition of the water at its various sources is, after all, of less concern to our citizens than its quality on delivery. It is small consolation to tell the consumer who complains of insects, fishy taste, or turbidity in the tumblerful he draws from his tap at Newcastle that the samples collected from springs and streams thirty miles off are excellent. On the other hand it is impossible to secure a store in the reservoirs absolutely free from every trace of organic matter. Still, palpable and preventible pollution should not be countenanced in any part of its course. Allowance is due for the character of the gathering grounds, and such improvements, whether

by natural or artificial means, as the water may undergo on its way to the taps ; and it is only fair to judge of the supply by the quality on delivery in Newcastle.

The results of monthly analyses made during the present year, are therefore given in the opposite Table :—

The analyses require attention under four different heads, viz. : —

Albuminoid Ammonia,
Oxygen absorbed,
Hardness, and
Appearance.

Albuminoid Ammonia. — Professors Parkes and De Chaumont * state that "pure and wholesome" water should not contain more than ·0056 grain per gallon, and "useable" water not more than ·0070 grain per gallon. Water containing above ·0070 grain is termed by them "suspicious," and with above ·0105 grain, "impure."

Prof. Wanklyn † places the limit of albuminoid ammonia in "clean," as distinguished from "unclean," water at ·0049 grain per gallon.

Each Monthly Report of the Analyst for Newcastle shews during the present year an amount of albuminoid ammonia above that of the standard of the authorities just quoted for "useable," or "clean," water ; and in July it was double that quantity (0·015 grain per gallon). The amounts are 0·010 grain for each month except July and September, when it was 0·015 grain, and August, when it was 0·014 grain.

Oxygen absorbed.—Professors Parkes and De Chaumont place the limit of oxygen absorbed at 0·105 grain per gallon for "useable" water. Above that amount is termed by them "suspicious." A recent report of Colonel Sir Francis Bolton, C.E.,‡ Official Water Examiner to the Metropolis, shews the oxygen absorbed by water drawn from the mains of seven of the eight London water companies, during the month of July last, to have ranged from an

* Practical Hygiene.
† Manual of Public Health. Article, "Water."
‡ Water Supply (Metropolis), July, 1884.

TABLE B.

HEALTH DEPARTMENT, TOWN HALL,

NEWCASTLE-UPON-TYNE.

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE.

1884.

ANALYSES OF WATER DRAWN FROM A TAP IN DEAN STREET, MADE AND SUBMITTED TO THE NEWCASTLE COUNCIL DURING THE PRESENT YEAR BY MR. JOHN PATTINSON, CITY ANALYST.

RESULTS IN GRAINS PER GALLON.

	January.	February.	March.	April.	May.	June.	July.	August.	September.
Total solid matter dried at 212° Fah.	21·000 grs.	21·400 grs.	22·000 grs.	21·100 grs.	19·100 grs.	17·200 grs.	15·400 grs.	14·900 grs.	13·700 grs.
Chlorine	0·910 „	1·092 „	1·062 „	1·001 „	1·001 „	1·032 „	0·971 „	0·971 „	0·971 „
Phosphoric Acid	Slight trace.	Slight trace.	Slight Trace.	Slight Trace.	Slight trace.	Slight trace.	Slight trace.	Slight trace.	Slight trace.
Nitrogen as Nitrates	0·059 grs.	0·049 grs.	0·052 grs.	0·033 grs.	0·033 grs.	0·035 grs.	0·026 grs.	0·023 grs.	0·013 grs.
Ammonia	0·001 „	Trace.	Trace.	0·001 „	Slight trace.	Trace.	Trace.	None.	0·001 „
Albuminoid Ammonia	0·010 „	0·010 grs.	0·010 grs.	0·010 „	0·010 grs.	0·010 grs.	0·015 grs.	0·014 grs.	0·015 „
Oxygen absorbed in 15 minutes at 80° Fah.	0·058 „	0·048 „	0·052 „	0·063 „	0·040 „	0·088 „	0·068 „	0·077 „	0·087 „
Oxygen absorbed in four hours at 80° Fah	0·105 „	0·100 „	0·089 „	0·080 „	0·086 „	0·112 „	0·127 „	0·133 „	0·152 „
Hardness before boiling (Clarke's Scale)	16·8 degs.	16·9 degs.	17·4 degs.	16·6 degs.	16·0 degs.	13·2 degs.	12·1 degs.	11·4 degs.	10·4 degs.
Hardness after boiling one hour (Clarke's Scale)	5·2 „	4·9 „	5·9 „	4·6 „	4·7 „	4·4 „	3·7 „	4·2 „	3·8 „
Appearance in two-foot tube	Faint yellow colour and clear.	Faint yellow colour and clear.	Faint yellow colour and clear.	Faint yellow colour and clear.	Faint yellow colour and nearly clear.	Faint yellow colour and clear.	Faint yellow colour and clear.	Faint yellow colour and clear.	Faint yellow colour and clear.
Smell when heated to 100° Fah.	None.	None.	None.	None.	None.	None.	None.	None.	None.
Microscopical Examination	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Satisfactory.	Animalculæ more numerous than usual.*	Satisfactory.	Satisfactory.	Satisfactory.

* In June, the Analyst reported that samples, drawn from the Low Service, had "a slight fish-like odour on being boiled, indicating the presence of the peculiar organism—a kind of Volvox—which has, on two previous occasions, been found in large numbers in the Newcastle Water Supply, and which has caused the water to have a very offensive smell." None of these organisms were found in the sample reported on in June, or since then.

average of 0·012 grain per gallon (minimum) in the case of one company, to an average of 0·051 grain (maximum) in the case of another.

The analyses of the Newcastle water, during the nine months referred to in the preceding Table, shew a range of from 0·080 grain per gallon (minimum), in April, to 0·152 grain (maximum), in September. The amount has gradually increased, each month, from April to September.

Professors PARKES and DE CHAUMONT * say :—"A marked excess of albuminoid ammonia, and of oxygen, required for organic matter, would be fair cause for condemning a water, even if its other characters were good."

HARDNESS.—The hardness before boiling was 17·4 degrees (CLARK'S scale) in March. Since then, it has gradually fallen each successive month to 10·4 degrees in September. The degree of hardness after boiling has decreased similarly.

APPEARANCE.—The water is described each month by the Analyst as being faint yellow in colour, and in every month except one, as being clear. In May, it is reported to be "nearly clear." This colouration is probably due to peat-stain, and is further evidence of the presence of vegetable matter.

The microscopical appearance of the samples is returned as "satisfactory," with one exception (June), when animalculæ were found to be "more numerous than usual."

It is to be inferred from the analyses that there is in general much vegetable matter in the water. What are the effects of such water on health ?

Professors PARKES and DE CHAUMONT record a violent outbreak of diarrhœa produced by well-water laden with vegetable matter, but otherwise pure, and quite harmless when filtered.

Professor WANKLYN † states that at Leek Workhouse

* Practical Hygiene, 5th ed., p. 23.
† Water Analysis.

there was for years a general tendency to diarrhœa, accounted for by the water of a well which was loaded with vegetable matter. The same authority states that it is matter of observation that diarrhœa is frequently prevalent in communities which drink water containing from 0·0070 to 0·0140 grain per gallon of albuminoid ammonia.

The proportion of albuminoid ammonia in Newcastle water has every month exceeded the lowest of these amounts, and has twice (July and September) exceeded the highest.*

The total solids, chlorine, nitrogen as nitrates, and free ammonia, are all rather low in amount.

The water is believed not to have any appreciably solvent action on lead. Its use after passing through lead pipes or storage in lead cisterns is not therefore attended with danger or risk to the consumers on this ground.

It may be objected that the analyses above given are not a sufficient index of the general character of the water supply throughout the City. What are the grounds for this objection?

Samples (four only, in all) of tap-water have been sent to the Health Department during the past summer by complainants. Three of these contained insects and moving creatures visible to the naked eye. Thus, one bottle enclosed a small earth worm; another, the larva of an insect; and a third, maggots. The fourth was a specimen of turbid water.

It would be unfair to assume that everything passing through a water-tap comes from the Water Company's reservoirs. Much of the nastiness of drinking-water is due to sanitary defects in houses. Thus, the maggots above named were found to come from a decomposing pigeon, lying near the edge of an open cistern. The want of a cover to the cistern is a very common defect leading to pollution of water by an accumulation of filth such as most householders little dream of, and few think of removing.†

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* The analysis for July refers to a sample drawn on the eighth of that month. The deaths from diarrhœa, in Newcastle, rose from a total of three in the four weeks ended June 28th, to thirty-five in the four weeks ended July 26th.

† The samples for analysis are drawn direct from the main.

The turbidity of water drawn direct from the main is often due to temporary local causes, such as alteration of pipes. Sediment from rust of iron pipes, together with earthy or vegetable matter, or both, is apt to accumulate in the bends and "dead ends" of the service-pipes, and may give rise to visible impurity.

Notwithstanding the unquestionable benefit of a free use of the senses (common sense included) in detecting contamination of water, these at best uncertain guides tell us little of the hidden dangers against some of which chemistry and the microscope put us on our guard.

Larvæ, insects, and larger animalculæ (those visible to the naked eye, such as cyclops, daphnia, &c.) are not of themselves harmful to water; on the contrary, some of these and probably also some of the microscopical organisms play an important part in its purification. This is no justification for their appearance in the universal beverage.

The water itself varies in character from day to day, and is not of uniform quality or chemical composition throughout the service at any given time. For this reason, it is matter for consideration whether the analyses—referring as they do to four samples each month, two of which are drawn from the high, and two from the low service—are made often enough, and from a sufficient variety of specimens. The analysts employed by the London Water Companies report on the state of the supply of each Company much more frequently. Analyses of the different London waters are also made and reported on by Prof. FRANKLAND once in each month.

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3. MEANS IN OPERATION FOR PROTECTION FROM POLLUTION AND FOR PURIFICATION.

The purity of the water supply depends on the means in operation during its collection, to exclude dirt, and to remove dirt if it should get in. The Water Company have had the first of these in view in the choice of gathering ground and

other important features of their works. Certain particulars in which their appliances for preventing animal pollution fall short of requirements have been specified in a former section and need not be recapitulated here.

The amount of the storage* provided, as also the character of the aqueducts and most of the reservoirs, &c., are proper means for removing impurities, by deposit and by oxidation of organic matter. The water is also passed through the filter beds, at Throckley.

Notwithstanding these different processes of settling, aeration, and straining, it is charged with albuminoid ammonia on its arrival in Newcastle.

The accuracy of the analyses is unquestioned. If this be granted, it follows that the means for protecting the water from pollution, or for purifying it, or both, are in some way inefficient. What evidences are there of this ?

1st. As to Imperfect Measures for Protecting the Water from Fouling.—The presence of albuminoid ammonia in the proportions stated is proof of pollution with organic matter generally admitted to be of a vegetable character, and derived, in part at least, from peat. This vegetable matter is also to a considerable extent due to dead grass and weeds decomposing at the bottom and sides of Colt Crag Reservoir. The inference is that this albuminoid ammonia is largely due to the grass and weeds in question.

The dead vegetable matter in Colt Crag Reservoir below low water-line will, before long, decompose and disappear. That between high and low water-line, unless constant care be taken to prevent it, will be reproduced year after year as often as the surface on which it grows is exposed to the air, and will annually die and rot when submerged beneath the increased water of the reservoir. The difference between the effect of living plants and dead vegetable matter on the water should be borne in mind. The roots of living plants tend to purify contaminated water by seizing on the dissolved organic impurities. On the other hand, dead vegetable matter in water otherwise wholesome, becomes dangerous as decomposition sets in. The malarious nature of swamps, and the danger of drinking surface-water from land alternately wet and dry, are well known to be due to rotting plants and grasses. The shallow parts of a reservoir formed like

* Sufficient for 230 days' supply.

that at Colt Crag become swampy during summer when the contents are reduced; and the amount of risk to health from drinking the water is then probably proportional to the degree of its dilution.

During the present summer the water in the Great Northern Reservoir at Whittle Dean, which is open to the same objection as that at Colt Crag as regards fouling by weeds, &c., was reported to be infected with minute organisms visible to the naked eye, and giving to the water a slightly fishy taste.*

In autumn, the open aqueduct by the side of the wood at Matfen receives large quantities of falling leaves, some of which pass through the rack placed to intercept them, and reach the Whittle Dean Reservoirs. A similar contamination occurs at Fenham.

3rd. Means Adopted for Purifying the Water.—Most, and often nearly all, of the insoluble impurity is removed from the water by deposit or filtration, and part of the dissolved organic matter is rendered harmless by oxidation. Occasionally a perceptible amount of finely divided clay &c., finds its way into the delivery; and every monthly analysis during the year shews an undue amount of organic matter, proving that the methods of purification employed are ineffectual. The ordinary methods of purification are deposit, aeration, and filtration.

* A further sample of water drawn from the outfall of Colt Crag Reservoir in October was found to be yellowish-brown in colour and to contain a large number of animalculæ visible to the naked eye (water flea, &c.)

DEEP SETTLING PONDS, although undoubtedly advantageous, being costly to make, are not always specially provided by water companies. The deposit, therefore, takes place in the ordinary storage reservoirs, and in windy weather, when the supply is low, is apt to be stirred up again, and find its way into the pipes. This was the case with the water from Hallington Reservoir, in 1873,* which was charged with organic matter, and at the time of report was turbid or muddy on delivery. It was also the case with the water supplied to the Town during the cholera epidemic of 1853, as explained by Mr. MAIN, the then Secretary of the Company, and given in evidence before the Cholera Commission.†

AERATION, which is generally admitted to effect an improvement on organically tainted water, is seldom if ever specially provided for by English water companies. *Exposure of water to air in divided currents* by causing it to fall down a series of steps and to pass through wire gauze as it does so, has, according to PARKES, been employed in Russia on a large scale.‡ This mode of purification probably deserves more attention than it has yet received. It is desirable that its effects should be accurately gauged by experiment and analysis, and put on record (if this has not been done already).

FILTRATION is the form of water purification generally relied on, both by purveyors and consumers, in this country. As practised by most companies (our own among others), the process consists of straining the water through sand and gravel. Every one knows that in a properly constructed filter-bed one effect of this is to remove all suspended particles, leaving the water clear and bright. Filtration through sand and gravel also removes some, at least, of the dissolved organic and other substances. On this point the Rivers Pollution Commission§ state that "Sand and gravel filtration, as carried out at Water-works, not only clarifies the water by removing suspended impurities but also diminishes appreciably the proportion of organic matter in

* Report to the Sanitary Authority of the Borough of Newcastle-upon-Tyne on the Water and Water Supply, 1873; by Councillor H. W. NEWTON, the Borough Analyst, and the Medical Officer of Health.

† Report of Cholera Commission, 1853, p. 25.

‡ Practical Hygiene.

§ Sixth Report, p. 217.

solution (organic carbon and organic nitrogen) to an extent dependent upon the thickness of the filtering medium and the rate at which the water passes through that medium."

PARKES,* on the other hand, referring to experiments by himself and others, considers that the amount of organic matter removed by sand and gravel filtration is inconsiderable.

Animal charcoal has the property of removing a large proportion of the organic matter from water, and its use for Town filters is recommended by Dr. FRANKLAND.* The magnetic carbide of iron (SPENCER's patent) is also recommended. The two last named appear to act chemically as well as mechanically.

WANKLYN† gives it as a general conclusion that the filtration is defective when the amount of albuminoid ammonia rises to 0·10 part per million (*i.e.*, ·0070 grain per gallon). In the monthly reports of the present year, the Newcastle water has never contained less than ·010 grains per gallon.

The effect of the filtration at Throckley, as judged by the analyses of the water immediately before and immediately after passing through the filter beds,‡ instead of being beneficial, is rather detrimental, there being a small increase in chlorine and oxygen required for organic matter, in the filtered, as compared with the unfiltered, specimen.

Ocular and less dangerous proof of defective filtration of the merely mechanical kind is given by the occasional presence of small insects visible to the naked eye, finely divided clay, &c., in the water as supplied to the taps.

Lastly, the large sale for domestic filters of every make and price is an argument that few persons who can afford to purchase one are satisfied that the water, when it comes from their taps, is "effectually filtered."§ The water should be delivered in such a state of purity as to render its re-filtering by the consumer unnecessary. A fraction of the sum spent on domestic filters by the well-to-do would

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* Practical Hygiene.

† Water Analysis.

‡ See Table A, Analyses Nos. 24 and 25.

§ "The Company shall effectually filter all water supplied for domestic purposes before the same shall pass into the pipes for distribution."—*The Newcastle and Gateshead Water-works Act*, 1876, *s.* 17.

pay for the purification not only of their own drinking water, but also of that supplied to the poor, who cannot afford such luxuries.

No opinion is offered in this place as to the Filter Beds at Throckley.

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4. THE QUALITY OF THE WATER SUPPLY IN RELATION TO THE PUBLIC HEALTH.

Although the connection between the remotely predisposing, or even the immediately exciting, causes of disease, and disease itself is often difficult or impossible to trace,—and never more so than in cases such as before us—a comparison of the different qualities of the water with the corresponding variations in health during a series of years, in so large a population as ours, should be instructive.

With this view the monthly analyses for the past eleven years have been examined side by side with the vital statistics of the same period. How far the general health of the consumers has borne relation to the quality of the water supply is stated below :—

No. of months in the year during which the water reported on was "pure" or "usable" after the standard of PARKES.	Death-rate of Newcastle per 1,000 population (all causes).	A.D.
12	22·3	1880
11	23·5	1879
10	22·7	1876
10	23·7	1878
9	22·3	1877
9	26·1	1875
8	21·7	1881
7	30·1	1873
6	29·2	1874
6	25·4	1883
5	23·0	1882

It would appear from the above that a comparatively pure state of the drinking water has to a certain degree, though not invariably, been attended by a low general death-rate. This is as far as we are justified in going towards any conclusion as to its general effect on health.

Among the diseases especially associated with impurity or contamination of water are diarrhœa, enteric fever, and cholera. The first of these is frequently prevalent here in the third quarter of the year. The deaths from diarrhœa during the twelve last autumns have been compared with the corresponding analyses of the water supplied to the town.

On different occasions (but not in the majority) the prevalence of that disease has been coincident with the supply of objectionable water and *vice versâ*.

The writer is of opinion that water charged with organic matter is likely to cause diarrhœa, especially in warm weather, when such matter undergoes decomposition.

Enteric (or Typhoid) Fever.—The most fatal year of the past twelve from this disease, was 1874. During that year, 75 deaths from enteric fever were registered, of which more than half occurred in the winter quarter. The drinking water during that quarter was drawn from the river, and had been so for some time before. The analyses shew it to have been suspicious or impure from August to December.

In inquiring into the causes of the disease in question, the subject of specific contagium is to be taken into consideration. The prevailing opinion at the present day is that epidemics of enteric fever, when due to water or milk supply, are always caused in the first place by contamination of such water or milk with the discharges of a person suffering from the disease. Under ordinary circumstances there is no likelihood of such a contamination occurring to the supply for Newcastle. But it is otherwise when water for domestic use is drawn from the Tyne into which flows, above Newcastle, the sewage of a large population liable, like other populations, to occasional epidemics of enteric fever, and perhaps as a whole never entirely free from that disorder. There is reason to view with suspicion the coincidence of the epidemic of 1874, and the supply of water from the river at the time.

Tyne water, if supplied to our taps at any time, is most liable to be so during those months when, owing to prolonged droughts, the river is low, and the sewage in it with any contagium contained therein, is most highly concentrated.

CHOLERA.—The last remaining disease to which reference will be made here is cholera. One conclusion to which the Commissioners appointed to inquire into the outbreak of cholera in Newcastle and neighbourhood, in 1853, arrived on the subject of the drinking water supplied, is expressed in their Report* as follows :—"On the most favourable view we can adopt, it must be regarded with grave suspicion in relation to its influence on the late outbreak." The Report also shews that in the cholera outbreaks of 1831 and 1853 the water had been more or less derived from the Tyne.

Whether the water at the time of these epidemics was specifically contaminated will never be known. But there can be no question that in 1853 it was impure. The Commissioners state that it "was such as ought never to have been distributed."

The first subsidence of the epidemic of that year occurred on the day the use of Tyne water was discontinued, and a steady decline of cases set in from that date.

Fortunately, Newcastle is not likely to be again placed in such an unfavourable position in regard of water supply as in 1853. The river water was then drawn at Elswick ; the pumping station is now at Wylam, several miles higher up.

But water from the river is always unsafe for drinking.

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5. SANITARY CONSIDERATIONS OF SUPPLY, SERVICE, &c.

It is desirable on sanitary grounds that water for domestic use should be abundant in quantity. The amount supplied per head varies in different towns, but it is generally agreed that 40 gallons is a proper quantity for all purposes. If every household in Newcastle were actually and conveniently supplied at this rate, or even at the

* P. xxvi.

present rate of about 32 gallons per head, dwellers in tenemented property would then have the means of keeping themselves and their surroundings clean, and the effect of this on the public health would doubtless soon be felt. As it is, the chief part of the supply goes in other directions, although the occupied tenemented dwellings are much more numerous than private houses.

Constancy of Supply is also an important item from a hygienic point of view, especially with the poor who draw their water directly from the main. Intermission of pressure in the main pipes, to those who have no means of storage on their premises, is incomparably more serious than to the occupants of houses furnished with cisterns. It is alleged that at Jesmond Vale, when the regular tap-water has been "off," the inhabitants have at times been compelled to use the impure water of the Burn.

Intermittence of supply is not without danger to health in another respect, viz., on account of liability of foul air or liquids to be sucked into defective pipes whilst empty. Epidemics of enteric fever in different parts of the country have been traced to this cause.

Although it is not proposed to follow the subject of water supply into general domestic details, a few words on household filters may not be considered out of place here.

All filters tend to become foul with use, and the more impure the water passed through them the more rapidly does this take place. After prolonged use—sometimes even after a month or two—a domestic filter turns very offensive. A short time ago such a one was shewn to the writer. The water passed through it smelt strongly and was in fact highly charged with sulphuretted hydrogen, yielded by the decomposed sulphates of the water, which had stood in the apparatus for some time. Private filters should be thoroughly cleansed every six or eight weeks, or oftener if the water is suspected. This is best done by passing through them Condy's Fluid, weakly diluted with water, until the solution, after filtration, ceases to lose its pink tint. A quantity of clean water (preferably distilled), say three or four gallons, containing about half-an-ounce of dilute hydrochloric acid, should then be passed through the filter, after which it will be again fit to use.

6. INDICATIONS.

SUPPLY.—The consumption of water is increasing; before long the sources of supply must also be extended. Unusual drought should be provided against by the Company, and is no proper excuse for deficiency of water.* The drought to be provided against should be one of under 18 inches of rainfall in the year, as was experienced in 1850.

RESERVOIRS, &c.—The growth of vegetation between high and low water-line in all reservoirs should be prevented.

The pollution of the reservoirs and aqueducts by cattle-droppings, flow from manure heaps, &c., should be strictly prohibited under the powers possessed by the Company.

The Spring at Little Swinburn should be covered over to protect from fouling.

The discharge from Fawcet Farm towards the aqueduct above Hallington should be intercepted.

The wild waterfowl should be prevented from congregating on Hallington Island.

FILTRATION.—As stated frequently by Mr. PATTINSON in his Reports, the water is good if properly filtered; occasional analyses shew it has sometimes attained the high standard of "purity" of PARKES and DE CHAUMONT. This standard should be maintained, and would be so if efficient filtration were always carried out, which should be done.

TYNE WATER for domestic use should be avoided. The Company's other sources of supply should be sufficiently ample to render resort to it for such a purpose unnecessary, even in droughty weather.

EXAMINATION OF WATER.—It is desirable that this should be more frequently done, and that it should be applied to the water in various parts of Newcastle; also, that whenever the Reports indicate that filtration is imperfect, samples, immediately before and immediately after filtration, be analysed for comparison.

It would be well also if the Water-works were from time to time visited by the Sanitary Authority or its representatives.

HENRY E. ARMSTRONG,
MEDICAL OFFICER OF HEALTH.

21st October, 1884.

See Report of Cholera Commissioners, 1853, section 89.

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE.

REPORT

OF THE

MEDICAL OFFICER OF HEALTH

ON THE

Sanitary Condition of Newcastle-upon-Tyne,

WITH

TABULAR RETURNS

OF THE

SICKNESS AND MORTALITY

DURING THE YEAR 1884.

Newcastle-upon-Tyne:
ANDREW REID, PRINTING COURT BUILDINGS, AKENSIDE HILL.

1885.

TO MR. ALD. THOS. WILSON, J.P., CHAIRMAN OF THE SANITARY COMMITTEE OF THE CORPORATION OF NEWCASTLE-UPON-TYNE.

Sir,

I beg to present herewith my Twelfth Annual Report on the Sanitary Condition of Newcastle-upon-Tyne, viz:—that for the year 1884.

The period to which the Report refers is memorable in the Health Department as one of exceptional responsibility and activity. The precautions demanded owing to the danger of the introduction of Cholera from abroad, the unusual prevalence of Scarlet Fever and other Zymotic diseases, the diligent carrying out of the exhaustive Inquiry into the domestic and other circumstances affecting the origin and spread of the different cases of these diseases, and, concurrently with these, the completion of a House-to-House Inspection of the City, and the doubling of the ordinary work done by the Nuisance Officers, represents a year of work not hitherto approached either in amount or importance.

Some changes will be found in the form of the present Report. The classification of diseases has been modified so as to harmonize with the altered form of the Registrar General and that of the Society of Medical Officers of Health.

The Disease Maps hitherto forming part of the Annual Report have this year been omitted, owing to the impracticability of showing accurately, upon plans of ordinary scale, all the cases notified. Instead of these, the number of cases and deaths from each disease are given in alphabetical order from a new street list prepared for the purpose.

The publication in the Report of rates of death in the different Registration Sub-districts has been abandoned. Based, as they necessarily were, on estimates of population for the most part widely erroneous, these rates were always unsatisfactory. They are now replaced by the actual numbers of registered deaths, supplemented by a statement of those returned from each of the large Public Institutions.

I have the honour to be,

Sir,

Your obedient Servant,

HENRY E. ARMSTRONG,

Medical Officer of Health.

Health Department,
Town Hall,
Newcastle-upon-Tyne,
21st April, 1885.

CONTENTS.

APPENDIX A.

APPENDIX B.

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE.

REPORT, 1884.

(A.)—GENERAL STATISTICS.

Births and Deaths (all causes).

DURING the 53 weeks ended 3rd January, 1885, 6,072 births and 3,549 deaths have been registered in the City. The births represent a rate of 40·1 and the deaths a rate of 23·5 per 1,000 of a population of 151,325 at all ages, as estimated by the Registrar General to the middle of the year.

The following is a table of the recorded rates of mortality for previous years :—

RATES OF MORTALITY PER 1,000 POPULATION OF NEWCASTLE-UPON-TYNE.

A.D.	Rate per 1,000.
1868	27·1
1869	27·2
1870	25·4
1871	32·2
1872	26·3
1873	30·1
1874	29·2
1875	26·1
1876	22·7
1877	22·3
1878	23·7
1879	23·5
1880	22·3
1881	21·7
1882	23·0
1883	25·4
1884	23·5

The number of births and deaths in the different Registration Sub-districts of the City during 1884 and the previous year is subjoined :—

REGISTRATION SUB-DISTRICTS.	BIRTHS.		DEATHS.	
	1883.	1884.	1883.	1884.
Westgate	2,351	2,569	1,533	1,429
St. Andrew's	569	616	415	411
St. Nicholas'	285	303	420	401
All Saints'	931	971	676	538
Byker	1,346	1,613	748	770
City	5,482	6,072	3,792	3,549

Deaths in Public Institutions.

The deaths in Public Institutions during the year under report are as follows:—

DEATHS IN PUBLIC INSTITUTIONS IN THE DIFFERENT REGISTRATION SUB-DISTRICTS DURING THE 53 WEEKS ENDED 3RD JANUARY, 1885.

REGISTRATION SUB-DISTRICTS.	INSTITUTION.	DEATHS.	
Westgate	Workhouse	167	
	St. Joseph's House... ...	14	
		—	181
St. Andrew's	Moor Small-pox Hospital...	8	
	Magdalene do. ...	4	
		—	12
St. Nicholas'	Infirmary	166	
	Fever Hospital	12	
	Children's do.	2	
		—	180
All Saints'	*Nil.*		
Byker	*Nil.*		
	Total		373

Deaths from Miasmatic order of Zymotic Diseases.

The condition of the different Registration Sub-districts in regard of mortality from the Miasmatic order* of Zymotic diseases during last, as compared with the preceding year, is as follows:—

SUB-DISTRICTS.	Number of Deaths from Miasmatic Diseases.	
	1883.	1884.
Westgate	243	118
St. Andrew's	93	42
St. Nicholas'	64	30
All Saints'	115	45
Byker	182	108
City	697	343

* See Appendix, Table III. In uniformity with the New Classification of causes of death, adopted by the Registrar-General, Diarrhœal diseases are now excluded from the Miasmatic order of the Zymotic class of diseases.

The mortality from the "chief Zymotic diseases" * during successive seasons of the year, is as follows :—

NUMBER OF DEATHS IN 1884.

	REGISTRATION SUB-DISTRICTS.																								
	WESTGATE.†					ST. ANDREW'S.					ST. NICHOLAS'.					ALL SAINTS'.					BYKER.				
	1st Qr.	2nd Qr.	3rd Qr.	4th Qr.	Total.	1st Qr.	2nd Qr.	3rd Qr.	4th Qr.	Total.	1st Qr	2nd Qr.	3rd Qr.	4th Qr.	Total.	1st Qr.	2nd Qr.	3rd Qr.	4th Qr.	Total.	1st Qr.	2nd Qr.	3rd Qr.	4th Qr.	Total.
Small-pox ...	3	1	...	...	4	..	4	...	...	4	...	...	...	...	...	...	1	...	...	1	1	2	...	...	3
Measles... ...	...	...	...	5	5	...	...	1	1	2	...	...	1	...	1	...	...	...	...	...	6	1	...	...	7
Scarlet Fever (Scarlatina) ..	16	10	11	16	53	10	8	...	4	22	1	...	...	4	5	10	2	7	4	23	13	9	7	24	53
Diphtheria ...	...	1	1	1	3	...	...	...	...	...	...	1	...	...	1	2	...	...	1	3	4	1	1	3	9
WhoopingCough	19	13	6	3	41	1	1	2	...	4	5	3	...	...	8	5	5	...	1	11	3	4	6	8	21
Typhus Fever...	1	...	...	1	2	...	1	...	...	1	...	...	...	1	1	...	1	...	...	1	...	...	...	1	1
Enteric (or Typhoid) Fever...	2	3	3	8	16	...	2	1	...	3	2	1	1	...	4	...	2	4	2	8	3	2	4	7	16
Simple Contd. and Ill-defined Fever	...	...	...	...	...	1	...	...	...	1	1	...	...	...	1	...	...	...	1	1	...	...	...	...	...
Simple Cholera..	...	...	4	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	2
Diarrhœa, Dysentery	4	1	49	16	70	1	...	16	3	20	...	...	6	4	10	1	2	21	3	27	2	3	25	7	37

The most fatal Zymotic disease has been Diarrhœa, from which 164 deaths are returned. Of these, 117 occurred in the third quarter of the year. Diarrhœa.

DEATHS FROM BRONCHITIS AND PNEUMONIA. Bronchitis and Pneumonia.

A.D. 1884.	REGISTRATION SUB-DISTRICTS.					CITY.	Number in previous year (1883.)
	Westgate (Workhouse)	St. Andrew's	St. Nicholas' (Infirmary).	All Saints'.	Byker.		
1st Quarter ...	55	14	5	24	27	125	130
2nd „ ...	43	9	8	19	19	98	138
3rd „ ...	30	10	5	17	20	82	117
4th „ ...	39	21	7	35	40	142	125
Year	167	54	25	95	106	447	510
Number in previous Year (1883) ...	196	48	40	113	113	510	...

* Corrected by distribution of those occuring in the Fever and Small-pox Hospitals to the District from which each patient came.

† Exclusive of Benwell and Fenham.

Infant Mortality.

Infant Mortality.

The number of Infants dying before the completion of the first year of life is 949, as compared with 919, 914, and 820 respectively, in 1883, 1882, and 1881.

REGISTRATION SUB-DISTRICTS.	No. 1. Deaths of Children under 1 year of age.		No. 2. Rates per cent. of Deaths under 1 year to Births registered.	
	1883.	1884.	1883.	1884.
Westgate	369	381	15·7	14·8
St. Andrew's	84	102	14·7	16·6
St. Nicholas'	67	56	23·5	18·5
All Saints'	173	146	18·6	15·0
Byker	226	264	16·8	16·4
City	919	949	16·8	15·6

The following are the most prominent diseases causing the infant mortality :—

	Deaths.	
	A.D. 1883.	A.D. 1884.
Whooping Cough	19	42
Diarrhœa, Dysentery	62	113
Tabes Mesenterica	30	30
Premature Birth	81	64
Convulsions	106	119
Bronchitis	90	82
Pneumonia	38	34
Debility, Atrophy, and Inanition..	205	223
TOTAL	631	707

Uncertified Deaths.

Uncertified Deaths.

That is to say, deaths registered without any proper medical certificate having been given or inquest held, have contributed 128 cases to the general mortality, as compared with 134 during the previous year. See Appendix A, Table IX.

Marriages.

Marriages.

During the year ending March 31st, 1884, the number of marriages registered in Newcastle-upon-Tyne* was 1,902, as compared with 1,872 in the previous twelve months, and 1,428 in the year before that.

* Superintendent Registrars district, which includes the Municipal area and the Townships of Benwell and Fenham.

Cases of Infectious Disease known to the Health Department.

Notification of Infectious Disease.

During the year under report a total of 2,751 cases of Infectious Diseases* have been made known to the Medical Officer of Health by medical practitioners, under the Newcastle-upon-Tyne Improvement Act, 1882, and otherwise,† including the following :—

	Cases known to the Health Department.	
	A.D. 1884.	A.D. 1883.
Small-pox	174	493
Typhus	17	96
Enteric Fever	260	212
Simple Continued Fever	41	45
Scarlet Fever	2,167	1,147
Diptheria	76	31
Puerperal Fever	16	6
Total	2,751	2,030

The following Tables shew the monthly returns of the diseases above named in the respective Parishes, &c., of the City :—

Small-pox in Newcastle-upon-Tyne.

Small-pox in different Parishes, &c., during successive months.

Number of cases known to the Health Department.									
A.D. 1884.	Parishes or Townships.								
	Elswick.	Westgate.	St. Andrew's	St. John's.	St. Nicholas'.	All Saints'.	Jesmond.	Byker including Heaton.	Total.
January ...	...	...	1	...	...	...	...	3	4
February ...	1	5	2	...	1	...	1	4	14
March ...	10	28	11	3	...	4	1	1	58
April	4	7	7	9	...	5	...	...	32
May	...	3	3	3	...	9	3	1	22
June	1	3	2	..	...	4	...	...	10
July	1	1	5	...	...	1	...	...	8
August ...	...	9	...	...	...	1	...	...	10
September ...	2	...	...	...	...	2	...	...	4
October ...	1	1	...	...	...	1	...	...	3
November ...	1	...	...	...	...	2	...	...	3
December ...	1	...	1	...	...	4	...	...	6
Total ...	22	57	32	15	1	33	5	9	174

* A Street List of the cases is given in Appendix A, Table X.

† The total of cases in the Infectious Disease Inquiry Register, for the year under report does not correspond with the number notified during the year owing to the occurrence of cases in certain Public Institutions where special inquiries were not made by the Health Department, and to the fact that many cases of such disease were notified at the beginning of 1884, in houses that had been infected, and the cases inquired into towards the close of 1883.

TYPHUS FEVER IN NEWCASTLE-UPON-TYNE.

Typhus Fever in different Parishes, &c., during successive months.

NUMBER OF CASES KNOWN TO THE HEALTH DEPARTMENT.										
	PARISHES OR TOWNSHIPS									
A.D. 1884.	Elswick.	Westgate.	St. Andrew's.	St. John's.	St. Nicholas'.	All Saints'.	Jesmond.	Byker, including Heaton.	Total.
January	...	...	...	1	...	...	...	1	2
February	...	...	...	...	...	...	...	...	...
March	...	...	...	...	1	...	...	...	1
April	1	...	1	...	...	1	...	...	3
May	...	...	...	...	1	...	...	...	1
June	...	...	...	...	...	...	...	...	...
July	1	...	...	1	...	...	...	1	3
August	2	...	...	...	...	...	...	...	2
September	...	...	...	...	...	...	...	...	...
October	...	...	1	1	...	...	...	...	2
November	1	...	...	...	...	1	...	1	3
December	...	...	...	...	...	...	...	...	...
Total	5	...	2	3	2	2	...	3	17

ENTERIC FEVER IN NEWCASTLE-UPON-TYNE.

Enteric Fever in different Parishes, &c., during successive months.

NUMBER OF CASES KNOWN TO THE HEALTH DEPARTMENT.									
	PARISHES OR TOWNSHIPS								
A.D. 1884.	Elswick.	Westgate.	St. Andrew's.	St. John's.	St. Nicholas'.	All Saints'.	Jesmond.	Byker, including Heaton.	Total.
January	5	1	1	3	2	5	...	4	21
February	7	2	1	...	...	2	...	2	14
March	3	1	1	3	...	3	...	1	12
April	2	4	1	1	...	...	...	...	8
May	1	2	1	3	...	5	...	6	18
June	4	2	1	...	...	5	...	8	20
July	5	4	...	2	...	4	...	1	16
August	3	5	...	1	...	6	...	8	23
September	16	10	2	2	...	4	...	10	44
October	10	8	1	1	1	2	...	9	32
November	11	2	...	...	1	5	1	13	33
December	10	4	1	...	...	1	...	3	19
Total	77	45	10	16	4	42	1	65	260

CONTINUED FEVER IN NEWCASTLE-UPON-TYNE.

Continued Fever in different Parishes, &c., during successive months.

NUMBER OF CASES KNOWN TO THE HEALTH DEPARTMENT.									
	PARISHES OR TOWNSHIPS.								
A.D. 1884.	Elswick.	Westgate.	St. Andrew's.	St. John's.	St. Nicholas'.	All Saints'.	Jesmond.	Byker, including Heaton.	Total.
January	1	1	2	...	...	...	...	...	4
February	...	1	...	...	..	...	...	7	8
March	1	1	...	...	...	...	...	...	2
April	1	...	...	...	...	...	...	...	1
May	...	1	...	...	...	...	...	1	2
June	...	...	...	...	...	...	...	...	...
July	1	...	1	...	...	...	...	...	2
August	...	...	...	...	...	...	...	...	...
September	3	1	...	...	...	...	2	6	12
October	1	1	1	...	...	...	...	2	5
November	1	2	...	...	...	1	...	1	5
December	...	...	...	...	...	...	...	...	...
Total	9	8	4	...	...	1	2	17	41

SCARLET FEVER IN NEWCASTLE-UPON-TYNE.

Scarlet Fever in different Parishes, &c., during successive months.

NUMBER OF CASES KNOWN TO THE HEALTH DEPARTMENT.									
	PARISHES OR TOWNSHIPS.								
A.D. 1884.	Elswick.	Westgate.	St. Andrew's.	St. John's.	St. Nicholas'.	All Saints'.	Jesmond.	Byker, including Heaton.	Total.
January	44	23	24	2	2	51	9	44	199
February	36	22	32	2	...	48	9	45	194
March	28	28	18	6	...	27	6	30	143
April	37	37	16	4	...	15	3	26	138
May	23	17	14	1	2	51	4	16	128
June	34	27	7	...	...	34	2	17	121
July	25	24	10	2	2	37	1	17	118
August	70	15	13	6	2	42	1	12	161
September	87	33	19	...	1	62	11	51	264
October	82	53	12	9	...	53	6	39	254
November	92	39	24	7	1	34	11	38	246
December	61	43	16	6	4	17	13	41	201
Total	619	361	205	45	14	471	76	376	2,167

DIPHTHERIA IN NEWCASTLE-UPON-TYNE.

Diphtheria in different Parishes, &c., during successive months.

NUMBER OF CASES KNOWN TO THE HEALTH DEPARTMENT.									
	PARISHES OR TOWNSHIPS.								
A.D. 1884.	Elswick.	Westgate.	St. Andrew's.	St. John's.	St. Nicholas'.	All Saints'.	Jesmond.	Byker, including Heaton.	Total.
January	...	...	...	...	...	1	...	2	3
February	4	...	...	...	...	1	5	4	14
March	...	2	...	...	...	2	3	4	11
April	2	2	2	...	...	...	...	3	9
May	...	1	1	...	..	1	...	4	7
June	...	1	...	...	1	1	1	2	6
July	1	...	...	...	...	1	...	1	3
August	...	...	...	...	...	1	...	...	1
September	...	...	...	...	...	...	...	2	2
October	...	...	1	...	...	...	2	6	9
November	1	1	...	...	...	1	2	2	7
December	1	...	...	...	...	1	...	2	4
Total	9	7	4	...	1	10	13	32	76

PUERPERAL FEVER IN NEWCASTLE-UPON-TYNE.

Puerperal Fever in different Parishes, &c., during successive months.

NUMBER OF CASES KNOWN TO THE HEALTH DEPARTMENT.									
	PARISHES OR TOWNSHIPS.								
A.D. 1884.	Elswick.	Westgate.	St. Andrew's.	St. John's.	St. Nicholas'.	All Saints'.	Jesmond.	Byker, including Heaton.	Total.
January	...	...	1	...	...	...	...	...	1
February	...	...	...	...	...	...	...	1	1
March	...	...	...	1	...	...	...	...	1
April	...	1	...	...	...	...	...	...	1
May	2	...	..	...	...	...	...	1	3
June	..	1	...	...	...	...	...	...	1
July	...	...	...	...	1	...	1	...	2
August	1	...	...	...	...	...	...	...	1
September	1	...	...	...	...	...	...	...	1
October	...	..	1	...	...	...	...	2	3
November	...	...	...	...	...	...	...	1	1
December	...	...	...	...	...	...	...	...	...
Total	4	2	2	1	1	...	1	5	16

The general mortality of each of the diseases above named, calculated on deaths returned and cases notified during the same period* is:— Relative fatality of Diseases notified.

Small-Pox	7·0	per cent.
Typhus Fever	35·3	„ „
Enteric Fever	18·1	„ „
Continued Fever	7·3	„ „
Scarlet Fever	7·2	„ „
Diphtheria	2·1	„ „
Puerperal Fever	56·2	" „

INFECTIOUS DISEASE INQUIRY.

In previous reports the spread of infectious disease has been shewn in a variety of ways to have been traced to avoidable and unnecessary connection with pre-existing cases. The different channels and media through and by which the public are exposed to danger of contracting such diseases have been illustrated by cases occurring in our midst. The school, the factory, the workroom, the shop, the laundry, the dairy, the tramcar, the railway carriage, and the crowded alley have each in turn been indicated as known, probable, or possible, centres for outbreaks of Small-pox or Fever.

Of all the agencies by which the spread of infection is facilitated, the most powerful is the *tenement house*. Infection and Tenement Dwellings.

In a Special Report† made in 1883, the mischievous character of this class of dwellings as an exciting cause of disease was pointed out; particulars were given of a number of recent instances where the infection of Scarlet Fever during a given period had spread to second cases in the same family, shewing that 80 per cent. of such families lived in tenement dwellings of which upwards of 60 per cent. consisted of two rooms or a single room each.

Again in the Annual Report for 1883,‡ the defective means of isolation in such households was commented on as being one of the most notable facts in connection with the Infectious Diseases Inquiry of that year.

Fully impressed (as everyone must be to whom this subject is at all familiar) with the utter futility of hoping to isolate Fever or Small-pox in the homes of the labouring classes, the Sanitary Authority had sought

*53 Weeks ended 3rd January, 1885.

†On the Increased Death-rate of the City, page 66.

‡Pages 12, 13.

in 1882 for power to deal effectually with infectious disease in such places by the compulsory removal of the cases to Hospital, but were unsuccessful. Since that time, the field of investigation has been greatly enlarged by the compulsory notification of disease, and the collection of a much larger amount of information bearing on the spread of infection than was ever before possible, has been the result.

As stated in the Report on the Increased Death-rate already referred to, a systematic and minute inquiry is made into each case of disease notified in the City. The particulars are entered on printed forms filled in on the spot by the Special Inspector of the district, and include, among other matters, information as to every probable cause of the case or means of spread from it. The returns are afterwards registered. The following particulars among others, have been extracted from the Disease Register for the year 1884 :—

Small-pox in the City.

The undermentioned details refer to the cases of Small-pox during the year 1884 :—

(a) Small-pox in relation to Tenement Houses, &c.

Inquiries were made in 130 households, containing a total of 164 cases. Of the infected houses :—

27, or about 21 per cent., consisted of tenements of 1 room each.								
32	„	25	„	„	„	2 rooms	„	
24	„	18	„	„	„	3	„	„
47	„	36	„	„	„	4	„	(or more)
130								

(b) Isolation of Sick-rooms.

Of the sick-rooms of the 130 different houses infected, no less than 78 are returned as being not at all isolated from the rest of the premises, the family either living in the sick-room or having direct access to it. In 51 of the houses no means were being taken to prevent the spread of infection. In 106 cases removal to Hospital was agreed to and effected.

149 occupants of the infected houses were employed at shops, &c., or in occupations elsewhere, as shown on Table at page 27.

(c) Shops, and Occupations on Infected Premises.

The following businesses were being carried on on infected premises, whereby infection was liable to be communicated to customers :—

Character of Infected Premises, &c.	No. of		Remarks.
	Households.	Cases.	
Shops for sale of Provisions, Green-Groceries, and Sweets	2	4	In one household no precautions were being taken, and the rest of the family had access to the sick-room at the date of inquiry. (3 cases all removed to hospital.)
Tailor and Clothier	1	1	... ...
Public House	1	4	One of the patients was a Confectioner's Assistant.
Lodging Houses	3	3	In one case no precautions were being taken when the inquiry was made. In two cases the patients walked to the Infirmary, and were removed to hospital from thence.
Dairy	1	1	... ...
Dressmaker's workroom	1	1	... ...
Stock-room (Commercial Traveller)	1	1	No precautions were being taken at the time of inquiry. Patient supposed to have brought infection from a neighbouring town. Afterwards removed to hospital.
Restaurant	1	1	No precautions were being taken when the inquiry was made. Patient afterwards removed to hospital.
Overcrowded room	1	1	No isolation or precautions were being taken at the time of the inquiry, and the family were living in the sick-room. Patient afterwards removed to hospital.

Cases illustrating how Infection is believed to have been spread.

Examples of spread of Infection.

Two households were reported infected with Small-pox on March 28th, 1884, at Fleece Court (cases Nos. 46 and 47);* on April 12th, a third (No. 56) at No. — Hill Street. The last-mentioned patient was employed in above court.

On March 6th, a household (case No. 23) in Percy Street, supposed infection from case (No. 11) in Hamilton Street.

Spring Garden Lane—First household reported infected on February 25th, three cases (No. 7); second, on March 11th, one case (No. 32); third, on April 4th, one case (No. 50); fourth, on April 29th, one case (No 71); fifth, on August 5th, one case (No. 112). Total, seven cases.

Factory Yard, Gallowgate—March 11th, one case, concealed at a dairy (see page 18). Five other infected households (Nos. 58, 61—two cases, 63, and 66) connected with this one, came under notice before the end of April.

* These and subsequent corresponding figures are the numbers of the entries of infected households in the Infectious Disease Register.

Examples of spread of Infection.

No. — Portland Road—One case (No. 64), April 16th. Infection was conveyed to Maiden Street (case No. 77), by wife visiting at the foregoing; also on May 5th, to Elswick Street (case No. 78), the patient having acted as bearer at the funeral of the first case, and supposed to have infected a neighbour in Portland Road, May 6th, 2 cases (No. 80); infection also appears to have been taken to Back Edward Street, June 2nd (No. 92), by visiting case No. 78. Total 5.

No. — Hedley Street—May 19th, one case (No. 87), barman from Newgate Street; and June 5th, one case (No. 96) from same bar, patient living at Blenheim Street.

No. — Rye Hill—June 11th, one case (No. 98), infection caught at a neighbouring town which place patient left on June 5th.

No. — Silver Street—June 25th, one case (No. 100), patient had worked at a neighbouring village (where Small-pox was); and on July 4th, one case (No. 103) at Carlton Street, patient worked at the same place. Total, two households.

No. — Stanhope Street—August 5th, one case (No. 111), infection conveyed to Stone Street (No. 114) by patient visiting at Stanhope Street. Two households infected.

No. — Rock Terrace—September 18th, one case (No. 119), arrived from a neighbouring town, 11th September, where his brother had been suffering from Small-pox; September 25th, one case (No. 120).

No. — Gloucester Road—Patient supposed to have caught infection at the same town as the above, which he left on 18th September; October 16th, one case (No. 121) at Cambridge Street, by visiting at the last named (Gloucester Road); October 20th, Westmorland Terrace, patient, a commercial traveller (No. 123), stayed at the above-named town over night, October 14th, 1884; November 4th, Tweed Street, patient (No. 124) supposed to have caught the disease at a village near the above town by visiting there; November 19th, Ellison Terrace, case 125 (prostitute) lately from same town; December 24th, Stockbridge, patient (No. 129), a hawker, had lately come from same town. Total, seven households.

The following cases were specially reported on to the Sanitary Committee :—

Outbreak at the Newcastle Infirmary.

Small-pox at the Newcastle Infirmary.—In March one of the in-patients of the Newcastle Infirmary was notified to be suffering from Small-pox and was removed to the Small-pox Hospital, where he died. Infection spread from this case to twelve other persons, viz., two medical students, two nurses, two servants, and six patients, all of whom were removed to the Small-pox Hospital and made good recoveries.

The first case was that of a patient who had been in the Infirmary a long time, and who had not had any visitors by whom the disease could have been conveyed.

A rumour gained currency that a case of Small-pox had occurred at the farm where the milk supplied to the Infirmary was produced, and that infection had been conveyed from this place by means of the milk. The circumstances were strictly inquired into by the Medical Officer of Health, when it was ascertained that there had been a fatal case of Small-pox at the dairy farm in question, the date of which corresponded with the period at which infection would probably have been contracted by the first case in the Infirmary. But beyond the fact of coincidence as to time there does not appear to be any evidence whatever in support of the supposition that infection was spread in this manner. On the contrary there is reason for believing that precautions were taken at an early stage to prevent such spread. Moreover, there is another explanation of the outbreak in the Infirmary.

The case at the farm was pronounced to be Small-pox on February 23rd, the third day of the patient's illness. *On the same day* a destitute man, suffering severely from Small-pox, was taken to the Infirmary, from whence he was afterwards removed to the Small-pox Hospital.

The occurrence of the first case among the patients in the Infirmary was reported on March 7th, or thirteen days after the visit of the above.

In further proof of the innocuousness of the milk, a list of persons, other than those at the Infirmary, supplied with it was procured and compared with the notifications of Small-pox in the city, with the result of showing absence of the disease among the consumers outside the Institution.

Infection imported.

The first cases of the outbreak of Small-pox occurred in January. One of these was imported directly from a neighbouring town where the disease was prevalent, the patient (a soldier) sickening four days after arrival at the Newcastle Barracks. The second case was that of a railway ticket sorter through whose hands the tickets for the branch railway from that town passed. This patient did not consent to be removed to Hospital. The following report was made in connection with the case :—

Other cases shewing how Infection is spread.

> "The brother of the last named is a railway guard living in the infected house, a tenement of two rooms only, one of which is occupied by the patient and his mother, the other by the rest of the family. The mother is obliged to pass through the latter room to reach the

How Infection is spread.

yard where the 'conveniences' are. The two rooms open directly into each other. A sheet saturated with Condy's fluid was hung over the doorway."

Two weeks later the following report was made:—

"Of the two cases of Small-pox notified, one is that of a railway guard, living at No. — Parker Street, Byker, brother to the case reported last fortnight. Infection was undoubtedly contracted from the case previously in the house, thus proving that it had not been isolated. On the occurrence of the first case, the printed pamphlet urging re-vaccination was, as usual, left at the house, but its recommendation was not acted on by the inmates, hence the extension of the disease."

"The other case is at No. — Harvey Street, Byker. Neither the patient nor her relatives were aware of any source of infection, but it was ascertained on inquiry that she had been in the habit of going to the same Co-operative Store as the members of the family above-named, and had probably contracted the disease in this way."

Small-pox concealed at a Dairy and the result.

Small-pox concealed at a Dairy.—In April the daughter of J. K., No. — Factory Yard, Gallowgate,

"Was found by the Medical Officer of Health to be convalescent, after a severe attack of Small-pox of about six or seven weeks duration. The case had not been under medical treatment, and had not been notified under the Act. Mrs. K. and her children live with the grandmother of the patient, Mrs. W., in a tenement of one room, in which milk vessels were noticed on the day before named. Mrs. W. sells milk.

"On being charged with concealing the disease, Mrs. K. attempted to deny that the case was one of Small-pox; and then said that if it was she did not know it. A neighbour whose child died of the disease last year, stated that she told Mrs. K. the disease was Small-pox, and that it should be reported to the Medical Officer of Health. The same person states that vessels containing milk had several times been taken into Mrs. W's. house whilst the child was ill. Since this case occurred there have been four others in Factory Yard of whom one died, leaving a widow and young family."

Mrs. W. was afterwards prosecuted for failure to notify the case, and was fined 40s. and costs.

Small-pox at a Tailor's Shop.—The following was reported on in March, Mrs. H. (entry No. 16), Hamilton Street, was notified to be suffering from Small-pox.

Small-pox at a Tailor's Workshop.

"The patient's husband is a tailor who does work on the infected premises and has two assistants. The house consists of four rooms. The patient was imperfectly isolated from the tailor's shop. Removal to Hospital was not agreed to; but the husband, on our suggestion, undertook to provide a workshop at a distance from the house."

A fortnight afterwards the following report was made:—

Spread of Infection from the foregoing case.

"As mentioned in last report, the tailor undertook to provide a separate room in which to carry on his business. He has not carried out his undertaking. A nurse who was engaged to attend on the patient has since gone to her own home, where she is now suffering from the same disease. She had not been re-vaccinated, and declines to be removed to Hospital."

Typhus Fever in the City.

Typhus.

The undermentioned details refer to the cases of Typhus Fever during the year 1884.

Inquiries were made in 15 households, containing 15 cases.

Of the infected houses—

3, or 20	per cent.,	consisted	of tenements	of 1	room each.
5, or 33	„	„	„	2	rooms „
3, or 20	„	„	„	3	„ „
4, or 27	„	„	„	4	„ (or more).
15					

Of the sick-rooms in the 15 different houses infected, 9 are returned as being not at all isolated from the rest of the premises, the family either having direct access to or living in the sick-room. In 4 of the houses no means to prevent infection were being taken. In 3 cases removal to Hospital was agreed to.

20 occupants of the infected houses were employed at shops, &c., or in occupations elsewhere, as shewn on page 27.

Enteric Fever in the City.

Enteric Fever.

The undermentioned details refer to the cases of Enteric Fever during the year 1884.

Inquiries were made in 204 households, containing a total of 225 cases.

Of the infected houses—

25, or 12	per cent.,	consisted	of tenements	of 1	room each.
92, or 45	„	„	„	2	rooms „
40, or 20	„	„	„	3	„ „
47, or 23	„	„	„	4	„ (or more).
204					

In relation to—

(a) Tenement Houses, &c.

Of the sick-rooms in the 204 different houses infected no less than 169 are returned as being not at all isolated from the rest of premises, the family either having direct access to or living in sick-room. In 100 of the houses no means to prevent infection were being taken. In 27 cases removal to Hospital was agreed to.

(b) Isolation of Sick-rooms.

228 occupants of the infected houses were employed at shops, &c., or in occupations elsewhere, as shewn at page 27.

(c) Enteric Fever and Shops, &c., on Infected Premises.

The following businesses were being carried on on infected premises, whereby infection was liable to be communicated to customers :—

Character of Infected Premises, &c.	No. of		Remarks.
	Households.	Cases.	
Shops (chiefly small) for Sale of Provisions, Green-Groceries, &c.	6	6	In 5 of these cases the sick-room was not isolated at the time of inquiry. In 1 case the shop was used as a sleeping-room at date of inquiry. In 4 cases no precautions were being taken. In 1 case the shop was in direct communication with sick- room.
Eating-house	1	1	No precautions were being taken. Patient afterwards removed to Hospital.
Public Mangle-house	1	1	No isolation or precautions were being taken.

(d) Enteric Fever in relation to Milk supply.

The households affected were supplied with milk by a large number of dealers, and there is no reason to suppose that any outbreak was attributable to milk. Twenty-six dairies only supplied milk to more than one infected household, viz.:—

1	dairy	supplied	8	households affected.
3	dairies	„	4	„ (each).
9	„	„	3	„ „
13	„	„	2	„ „

All the water supplied to the infected households is reported as being obtained direct from the mains of the Water Company; with one exception, in which the supply was through the cistern (which was not the same as that used for flushing the w.c.)

Enteric Fever and Milk Supply from a Country Dairy. — In July it was ascertained that a retail milk dealer in the city was receiving milk from a dairy farm where Enteric Fever was prevalent. The farm is situated near Horsley, Wylam-on-Tyne. The circumstances were communicated to Dr. Maclagan, Medical Officer of Health of the district, who immediately took steps to stop the delivery of milk from the infected premises.

Continued Fever.

Continued Fever in the City.

The undermentioned details refer to the cases of Continued Fever during the year 1884.

Inquiries were made in 23 households, containing a total of 36 cases.

Of the infected houses—

3, or 13	per cent.,	consisted of	1	room each.
3, or 13	„	„	2	rooms „
6, or 26	„	„	3	„ „
11, or 48	„	„	4	„ (or more).
23				

Of the sick-rooms in the 23 different houses infected 14 are returned as being not at all isolated from the rest of the premises, the family either having access to or living in the sick-room. In 12 of the houses no means to prevent the spread of infection were being taken.

24 occupants of the infected houses were employed at shops, &c., or in occupations elsewhere, as shewn at page 27.

The following businesses were carried on on infected premises, whereby infection was liable to be communicated to customers :—

Character of Infected Premises, &c.	No. of Cases of Infectious Disease.	Remarks.
Provision Shop	1	No isolation or precautions were being taken at the time of the inquiry. Patient an insurance agent.
Jeweller's Shop	1	Patient came lately from the country, and died in Newcastle.

Scarlet Fever in the City.

Scarlet Fever, in relation to—

The undermentioned details refer to the cases of Scarlet Fever during the year ending 31st December, 1884.

Inquiries were made in 1,301 households, containing a total of 1,979 cases.

Of the infected houses— (a) Tenement Dwellings, &c.

153, or about 12	per cent.,	consisted of	tenements of 1	room each.
496, „ 38	„	„	„ 2	rooms „
261, „ 20	„	„	„ 3	„ „
391, „ 30	„	„	„ 4	„ (or more).
1,301				

Of the sick-rooms in the 1,301 different houses infected no less than 935 are returned as being not at all isolated from rest of premises, the family either living in the sick-room or having direct access to it. In 643 of the houses no means to prevent infection were being taken. In 43 cases only was removal to Hospital agreed to. (b) Isolation of Sick-rooms.

1,323 occupants of the infected houses were employed at shops, &c., or in occupations elsewhere, as shewn at page 27.

The following businesses were carried on on infected premises, whereby infection was liable to be communicated to customers:— (c) Shops and Occupations on Infected Premises.

Character of Infected Premises, &c.	No. of		Remarks.
	House-holds.	Cases.	
Shops (chiefly small) for Sale of Provisions, Green-groceries, Confectionery, &c.	34	50	In 12 of these cases the sick-room was not isolated from the rest of the house; 3 single rooms were used as shop, living, sleeping, and sick-room combined. In 1 case the sick-room opened directly into the shop, and was used by a family of 7. In 10 cases no precautions to prevent spread of infection were being taken at the time of inquiry.
Public Houses and Beer Houses ...	23	31	In 1 of these cases the sick-room was not isolated from rest of the house. In 1 case the family were living in the sick-room. In 1 case the sole access to the sick-room was through the public bar. In 3 cases no precautions, to prevent spread of infection were being taken at the time of inquiry. In 1 case the family had access to the sick-room; in another the sick-room opened into the bar, and the mother attended the patient and afterwards served customers. In 1 case there was indirect communication with the sick-room through the "snug" attached to the bar.
Washerwomen	4	4	In none of these cases was there isolation, nor were precautions being taken at the time of inquiry. In 1 case work was suspended on instruction. In 1 case the family lived in the sick-room.
Artificial Flower Maker	1	1	Family living in sick-room (a single-room tenement).
Boot and Shoe Makers	4	7	In 4 cases there was no isolation. In 1 case the family lived in the sick-room; and in 1 case infection was likely to be spread by cobblers' work. In 2 cases no precautions were being taken at time of inquiry.
Boarding School	1	1	Precaution taken and boarders removed.
Mangle-houses	3	3	In all of these cases there was no isolation or precaution taken at date of inquiry. In 1 case the family lived in the sick-room. In 1 case the family had access to sick-room.
Tailors and Drapers	4	4	In 1 case the sick-room was not isolated at the time of inquiry. In 1 case there was a private school and draper's stock-room in the same building. In 1 case no precautions were being taken at date of inquiry.
Dairies	2	2	No isolation in either case, and in 1 case no precautions were being taken at the time of inquiry.
Lodging-house	1	1	No precautions taken at date of inquiry.
Dressmaker	1	1	... ...
Umbrella Repairing, &c.	1	2	The family had access to sick-room at time of inquiry.
Overcrowding	1	1	Family (a shoemaker's) of 7 living in room 17′ 3″ × 11′ 4″ × 8′ = 1,564 cubic feet, or 223·4 cubic feet per inmate. Patient not isolated.

Scarlet Fever and Bailiffs.—Two houses have had the bailiffs put in during the period of infection of Scarlet Fever.

The first of these was reported to the Sanitary Committee in September, as follows:—

Scarlet Fever and Bailiffs seizing Infected Furniture.

"*Bailiffs in Infected House.*—No. —, Gainsboro' Grove. (Four cases.) There are three rooms in the house; the sick-room is not isolated from the house. The bailiffs were in the house on the 9th inst., and the inspector was informed that they were to return on the 13th inst. The Medical Officer of Health wrote to the agent of the house, cautioning him. No reply has been received."

A further report in November on the same case runs as follows:—

"In continuation of the report previously made, the tenant states that the bailiffs came again to his house on the 29th ult., and stayed, although he told them the house was still infected. On the 31st ult. they took away several articles of furniture, including a hair-covered sofa on which one of the children lay whilst suffering from Scarlet Fever, although the owner told them the articles were infected. The furniture was taken to Mr. —— Auction Rooms, in —— Street, and was advertised for sale, but, on the advice of the Medical Officer of Health, was not offered for sale.

"The owner of the infected house called at the Health Department on the 28th October. He asked if the house was disinfected, and was informed that it was not. The bailiffs were put into the house on the following day.

"On the 30th ult., Dr. —— certified that one of the children was still peeling after Scarlet Fever."

Proceedings before the magistrates were ordered to be taken against the principal bailiff. The case was brought on for hearing, but was adjourned, and ultimately withdrawn, owing to want of witnesses, the tenant of the house in question having removed and left no address.

A second case of bailiffs put into an infected house was reported in December. The owner, on being written to by the Medical Officer of Health, undertook to withdraw the bailiffs from the house.

Scarlet Fever in relation to School Attendance.

Scarlet Fever in relation to School Attendance.—Of 1,301 households infected with Scarlet Fever, 987 contained scholars of one or other of 122 day schools in the City. The number of scholars attending any given school from infected households naturally bears relation to the size of the school itself, apart from the question of disease due to school influence. The actual figures, therefore, are only useful as illustrating the possible spread of infection.

In each of five large schools the number of households from which scholars came prior to the occurrence of Scarlet Fever in the respective

families is 50 or upwards during the year, the highest being 72. In another school the number is 45; in two others it is upwards of 30 each; and in nine more it ranges from 20 to 28 each.

In certain schools the households of one or other of the scholars were infected during every month of the year.

On ten different occasions, from 10 to 15 families of the scholars of individual schools were infected during the same month, including two schools twice so affected during the year.

Whenever the number of cases of disease became prominent in connection with any school, the School Authorities were communicated with, and advised to prohibit the attendance of scholars from the infected households.

In February, advice was asked by the Clerk to the School Board respecting the closing of the Board School at Spital Tongues, the attendance having fallen off considerably, owing, as was believed, to the prevalence of Scarlet Fever. As, on inquiry, it was ascertained that the number of absentees from infected households amounted only to 11 in a total of 100 absent from all causes, and as no fresh cases were occurring at the time, the closure of the school was not recommended. The following is an extract from the report of the Medical Officer of Health on the foregoing case:—

> "When children are absent from Public Elementary Schools, whether from infectious sickness or other cause, short of actual closure of the school, the Government Grant is not allowed. Hence a premium is offered to induce children to attend who ought not to do so; as, in the above case, conscientious school principals, the numbers of whose scholars is daily diminishing from causes over which they have no legitimate control, are placed at a disadvantage. It is desirable that some representation, on the part of the Sanitary Authority, should be made to the Education Department on this important subject."

Diphtheria in relation to—

Diphtheria in the City.

The undermentioned details refer to the cases of Diphtheria during the year 1884.

Inquiries were made in 55 households, containing a total of 66 cases.

(a) Tenement Dwellings, &c.

Of the infected houses—

2,	or about	4	per cent.,	consisted of	tenements of 1	room each.
21	„	38	„	„	2	rooms „
12	„	22	„	„	3	„ „
20	„	36	„	„	4	„ (or more).

(b) Isolation of Sick-rooms.

Of the sick-rooms in the 55 different houses infected, no less than 35 are returned as being not at all isolated from the rest of the premises, the

family either having access to, or living in the sick-room. In 28 of the houses no means to prevent infection were being taken. In one case removal to Hospital was agreed to.

61 occupants of the infected houses were employed at shops, &c., or in occupations elsewhere, as shown at page 27.

(c) Shops and Occupations on Infected Premises.

The following businesses were carried on on infected premises, whereby infection was liable to be communicated to customers:—

Character of Infected Premises, &c.	No. of cases of Infectious Disease.	Remarks.
Butcher's Shop	1	No precautions were being taken when the inquiry was made. Removal to Hospital not agreed to.
Public-house...	1	No precautions were being taken, and the family had access to the sick-room at date of inquiry. Removal to Hospital not agreed to.

(d) Milk Supply.

Milk Supply.—The households affected were supplied by a large number of dealers, and in only three cases was milk supplied to more than one infected household by the same dealer. There is no reason to attribute the spread of infection to milk in any case.

Puerperal Fever in the City.

Puerperal Fever.

The undermentioned details refer to the cases of Puerperal Fever during the year 1884.

Inquiries were made in 13 households, containing a total of 13 cases.

Of the infected houses—

5, or about 38 per cent.,	consisted of	tenements of	1 room	each.
5 „ 38 „	„		2 rooms	„
1 „ 8 „	„		3 „	„
2 „ 15 „	„		4 „	(or more).
13				

Puerperal Fever in the Practice of a Midwife.—In May the occurrence of two cases of Puerperal Fever in the practice of a midwife were reported to the Sanitary Committee, who authorised the Medical Officer of Health to arrange with the midwife to cease attending labour cases for a period of two months, and to go to the country, she being compensated for loss incurred. This was done.

Summary of Observations as to means available and precautions taken to prevent spread of infection.

Isolation of the Infected and extent of General Preventive Measures adopted on Infected Premises.—Information as to the structural arrangements of the infected dwellings, and the practicability of isolating the sick from the healthy, together with a return of the ordinary measures for preventing the spread of infection taken by the occupiers, is shewn in the two following Tables (Summaries) :—

1884.—Infectious Disease Inquiry.

(a) Character of Dwellings.

Summary.—Character of Infected Houses.

Disease.	Tenements.			Houses of more than 3 Rooms.	Total Households.
	1 Room Each.	2 Rooms Each.	3 Rooms Each.		
Small-pox	27	32	24	47	130
Typhus	3	5	3	4	15
Enteric Fever ...	25	92	40	47	204
Continued Fever ...	3	3	6	11	23
Scarlet Fever ...	153	496	261	391	1,301
Diphtheria ...	2	21	12	20	55
Totals ...	213	649	346	520	1,728
Rate per cent. to total ...	12 %	38 %	20 %	30 %	...

(b) Isolation and other Precautions.

Summary.—Isolation of Sick-rooms and Precautions Taken, etc.

Disease.	Total Households Infected.	Sick-room not at all Isolated from rest of House.	No Precautions being taken at time of Inspection.	Removal to Hospital agreed to. (Number of Patients.)	Percentage of Cases Removed to Hospital to Total Notified.
					Per Cent.
Small-pox	130	78	51	106	61
Typhus	15	9	4	3	17
Enteric Fever ...	204	169	100	27	10
Continued Fever ...	23	14	12	2	5
Scarlet Fever ...	1,301	935	643	43	2
Diphtheria	55	35	28	1	1·3
Total ...	1,728	1,240	838	182	...
Percentage ...	...	72 %	50 %	...	...

(c) Infected Households in relation to Occupation elsewhere.

Infected households in relation to occupation elsewhere.—Some idea of the degree of liability to which the public are exposed to infection through businesses and occupations carried on or assisted in by persons residing on infected premises and working elsewhere, may be gathered from the following Table :—

SUMMARY OF OCCUPATIONS IN WHICH PERSONS RESIDING ON INFECTED PREMISES WERE ENGAGED ELSEWHERE AT THE TIME OF INQUIRY.

OCCUPATIONS.	Small-pox.	Typhus.	Enteric Fever.	Simple Continued Fever.	Scarlet Fever.	Diphtheria	Puerperal Fever.	TOTALS.
Government of the Country (Postal Officials, Police, etc.)	2	...	4	...	23	...	...	29
Professional Classes, viz :—								
Schoolmasters and Teachers ...	2	1	3	...	11	...	...	17
Medical, etc.	4	...	...	...	2*	...	...	6
Others	...	..	1	...	18	...	...	19
Domestic Service	14	...	4	...	35	3	...	56
Commercial Occupations (Travellers, Clerks, Agents, etc.) ...	9	1	14	5	105	9	1	144
Conveyers of Men, Goods, or Messages	15	1	27	3	110	14	1	171
Occupations about Animals ...	...	...	...	...	1	...	...	1
Workers and Dealers in Books, Prints, etc.	2	1	2	...	25	2	1	33
Workers and Dealers in Machines and Implements	6	6	34	4	145	10	1	206
Workers and Dealers in Houses, Furniture, and Decorations ...	13	...	37	4	155	3	2	214
Persons employed in Shipyards ...	...	...	1	...	27	...	...	28
Workers and Dealers in Chemicals or Compounds	1	...	...	...	2	...	...	3
Workers in Tobacco	...	...	...	...	2	...	...	2
Workers and Dealers in Food and Lodging (Publicans, Butchers, Provision Dealers, etc.) ...	19	2	12	1	101	4	1	140
Workers and Dealers in Textile Fabrics (Drapers, etc.)	5	2	1	...	46	2	...	56
Workers and Dealers in Dress ...	4	...	6	...	40	1	...	51
Do. in Animal Substances (not Food, etc.) ...	4	...	2	...	9	1	..	16
Workers and Dealers in Vegetable Substances (not Food)	...	...	...	...	4	...	...	4
Workers and Dealers in Mineral Substances (Miners, Blacksmiths, etc.)	9	2	14	2	97	4	1	129
Workers and Dealers in Unspecified Commodities, viz :—								
Labourers	14	1	29	3	129	7	3	186
Pawnbrokers	...	..	...	...	3	...	...	3
Enginemen and Firemen (undefined)	...	...	1	...	12	...	...	13
Hawkers	3	...	3	...	4	...	...	10
Contractors	...	...	...	...	5	...	...	5
Engineers, etc. (undefined) ...	1	...	4	...	...	...	...	5
Machinists (undefined) ...	4	...	...	...	...	...	..	4
Workers and Dealers in Refuse Matters (Sweeps & Rag Dealers)	...	...	2	...	4	...	...	6
Without Specific Occupation ...	1	...	...	...	...	...	...	1
Occupation not stated	14	3	27	2	208	1	2	2 7
Prostitutes	3	...	...	...	...	...	..	3
Totals	149	20	228	24	1,323	61	13	1,818
†Totals of Inquiries Made during 1884 at Infected Households ...	130	15	204	23	1,301	55	13	1,741

* One of these is a midwife.

† See *Nota Bene* at page 9 of Report.

Among the facts conveyed by the foregoing statistics, to which attention is desirable, are the following, viz.:—

Deductions.

1.—That 70 per cent. of the infectious disease of the city occurred in tenement property, of which infected premises nearly three-fourths consisted of houses of one or two rooms each.

2.—That in upwards of 70 per cent. of the infected households the sick-rooms were not at all isolated from the rest of the house.

3.—That in 50 per cent. of such households no precautions to prevent the spread of infection were being taken at the time of inquiry.

4.—That in only a small proportion of the cases (in Scarlet Fever barely 2 per cent.) was removal to Hospital consented to by the patient or his friends.

5.—That a large amount of trade and processes of trade is carried on in, and in immediate connection with, infected premises, and at other places attended by persons residing upon infected premises, by all of which means infection is liable to be communicated to the public.

6.—That the spread of a large amount of avoidable disease has actually been traced to the operation of one or other of the foregoing causes.

Here, surely, is sufficient proof of the need of—

(1) Ample Hospital accommodation for infectious diseases;

(2) Compulsory power to remove to Hospital all cases of infectious disease in tenement dwellings; and

(3) Special provision to deal with infected business premises, and to prohibit the attendance at business of employés residing in infected houses where means of isolation is insufficient.

Cholera.

Cholera Precautions.

The prevalence of cholera in foreign countries has given rise to increase of sanitary diligence, and considerable improvement in the way of purification and the carrying out of structural works of a hygienic kind have resulted.

As the liability to the introduction of this disease into Newcastle is largely dependent on ships entering the Port of Tyne, the responsibility falling on the Port Sanitary Authority during the past year has been great. The special action relative to Cholera taken by the Port Authority consisted in the adoption of all available means for gaining full

and early information of the progress of the disease abroad, and of vessels by which infection of it might possibly be brought to British shores. At the same time the staff of inspectors was strengthened, an additional floating Hospital for the reception of cases of Cholera was provided, and several other measures were taken, particulars of which are given in the Annual Report of the Medical Officer of Health of the Port.

Fortunately, no case of the disease has occurred.

Trichinatous Disease.

Case of Trichiniasis.

A case of Trichinatous disease was detected in a dead body at the dissecting-room of the College of Medicine, Newcastle-upon-Tyne.

> "The dead body of E. G., who died in St. Ann's Street, was recently removed to the dissecting-room of the College of Medicine. The muscles were found to be copiously studded with the Trichina Spiralis. The organisms were encysted, and, their cysts being calcified, the case was evidently not one of very recent date. The death of the deceased appears to have been due to other disease. An inquiry was set on foot with the object of ascertaining when and where the Trichinatous disease of E. G. had originated, but little or no information could be gained on account of the poverty of the deceased. Samples of bacon were procured from all of the provision shops in the neighbourhood of the entry in which she had lived. Some forty samples in all were examined microscopically, but without finding any trichinæ among them; which is not remarkable, seeing that the deceased may have been infected from meat eaten many months or even years before. The case is believed to be the first recorded in Newcastle."

Fever and Small-pox Hospitals.

Work at the Hospitals for Infectious diseases.

192 patients have been admitted to the Fever and Small-pox Hospitals—

106	suffering from	Small-pox.
3	„	Typhus.
27	„	Enteric Fever.
43	„	Scarlet Fever.
6	„	Simple Continued Fever (Febricula).
1	„	Diphtheria.
1	„	Roseola.
5	„	Other diseases.

For other details as to the above, see Appendix A, Table XI.

One of the cases of Scarlet Fever contracted Typhus whilst in Hospital.

The Small-pox Hospital has been opened three separate times, and has been in active use during about three-quarters of the year. The Small-pox Convalescent Home at Byker was re-opened on 10th March and was closed on 29th June.

Among the occurrences to be recorded during the year are the following:—

1.—The Sanitary Committee have authorised the free admission to Hospital of all cases of infectious disease occurring in tenemented property, or in the houses of persons in poor circumstances, where removal is necessary to prevent the spread of infection.

2.—A Local Government Board inquiry was held at the Town Hall, on 17th December, respecting the loan of £16,000 for the purpose of erecting a Hospital for Infectious Diseases at Heaton.

Burial of Corpses.

Burials of Corpses under Local Act.

Under the 47th Section of the Newcastle-upon-Tyne Improvement Act, 1882, Orders of Justice have been obtained during the past year as follows:—

For Burial of Corpses from rooms in which persons live or sleep	7
For Burial of Infected Corpses from Fever or Small-pox Hospital	10
For Removal of Corpses to Mortuary and subsequent Burial...	1

Summary of Reports, &c.

Summary of Reports &c., made during the year.

The following is a summary of the principal localities on which reports have been made, or advice given to the Sanitary Committee by the Medical Officer of Health during the year:—

(*a.*)—*Streets, &c.*—

Ryehill (drainage, &c.)

Brandling Place (refuse disposal).

Leighton's Buildings, Ballast Hills (refuse disposal).

Glasshouse Street, St. Peter's do.

Granville Road (complaints of nuisance from sewer ventilators).

Low Bridge (ventilation, conveniences, &c., &c.)

George Street, West, and Back George Street* (general sanitary condition).

Back Copland Terrace (conveniences).

Back Sandyford Road do.

Forth Banks, Pitman's Row, &c. (conveniences).

Private and tenement houses (numerous sanitary defects).

* A copy of the Special Report on these Streets is given in the Appendix.

(*b.*)—*Trades, &c.*—

Bakehouse Regulations.

Nuisance from Tallow Works, Low Friar Street.

Tar Distillery, Teams, Gateshead* (recurring nuisance from).

Cowhouses, Slaughter Houses, &c. (nuisance from existing premises or proposals for new occupation).

(*c.*)—*Water Supply.*—

A special report on the Water Supply of Newcastle was made by the City Engineer and Medical Officer of Health, and submitted in October last.

Royal Commission on Labourers' Dwellings.

The Medical Officer of Health was summoned to give evidence before the Commission in May, and was examined as to the Fever Dens, Cellar Dwellings, Refuse Removal, Water Supply, &c., of the Tenements in Newcastle.

General Work of the Health Department.

General Work of the Health Department.

(*a.*)—*Nuisance Removal.*—12,565 cases of nuisance have been attended to by the Inspectors of the Department during the year; being more than double that of last or any previous year. This great increase of sanitary work is one of the results of the *house-to-house inspection*, which was in active operation during the whole of the year, and included, with one or two exceptions, an examination of all the habitations of the city. A report will be made on it in due time. Meanwhile it may be observed that the number of nuisances detected and dealt with is in some degree an indication of the necessity for the inspection, and the improvements it has led to.

(*b.*)—*Infectious Disease Inquiry and Disinfection.*—2,751 cases of infectious disease have been inquired into by the Special Inspectors, and the houses or room connected therewith disinfected, as compared with 2,045 during the year before. The bedding and other infected articles have been removed to the Disinfecting Station, and after purification they have been returned to the owners. (For list see Appendix A, Tables XIV. and XV.

* In consequence of these works having been reported against several times, complaint was made to the Sanitary Authority of Gateshead, by the Sanitary Authority of Newcastle, and the works were surveyed by the two Committees in December. Since that date there has been less nuisance observed in Newcastle.

Compensation granted on account of Infection.

General Work of the Health Department, *continued.*

In sixteen cases* compensation amounting in the aggregate to £20 4s. has been allowed by the Sanitary Committee to the occupiers of infected houses, viz.:—

For Public Laundry or other work suspended	7 cases.
For Provisions, Fruit, &c., destroyed	9 „
	16

(*c.*)—*Food Inspection.*—The report of Inspector Hedley on suspected and unwholesome *Butchers' Meat* or other flesh examined during the year, is given in Appendix A, Table XII., which shews an increase in the amount of suspected and condemned meat over that of the previous year. A Table of Fish inspected at the Fish Market in the Close is given in Appendix A, Table XIII. The amount of fish delivered at the Close Market, both by boat and rail, is greater than hitherto.

(*d.*)—*Inspection of Dairies and Cowsheds during the year* 1884.—Inspector Hedley reports that during the year 1,450 inspections of cowsheds have been made. Five notices have been served on occupiers to improve the drainage, ventilation, &c., of the cowsheds occupied by them. Four have complied with the notice. In one case the work remains undone. Improvements have been made in several others on verbal notice being given. One person has been summoned before the magistrates for beginning to occupy a building as a cowshed without giving notice to the Local Authority, or making provision for the sanitary condition of the premises. He was ordered to pay the costs and close the place, which was done.

Seven applications have been made to begin to occupy old buildings as cowsheds, of which one was granted and six were declined by the Sanitary Committee after hearing the report of their officers thereon.

Two new buildings have been occupied as cowsheds, plans having previously been submitted to and passed by the Town Improvement Committee.

Four old cowsheds have been pulled down to make way for improvements.

Five outbreaks of infectious disease† have been reported in the families of dairymen, viz., three of Scarlet Fever, and one each of Enteric Fever and Small-pox. On report of the cases they were at once attended

* Scarlet Fever or Small-pox.

† Exclusive of the case reported on page 20.

to, and instructions given to sever all communication between the milk supply and the infected persons or premises. One of the cases occurred in the family of a dairy farmer in the country, who sent milk into the city. The Medical Officer of Health of the district was at once communicated with, and the milk was stopped until the infection ceased. No spread of disease is known to have occurred by means of milk in any of the cases.

(*e.*)—*Inspection of Slaughter Houses and Triperies.*—Inspector Hedley reports that the inspection of slaughter houses and triperies has been carried out under the usual difficulties, owing to the different buildings, &c., being scattered over the city, and the occupiers mostly living at a distance from them. Many of those in the outlying parts are in proximity to dwelling houses, and are more or less in defective sanitary condition.

The block of twenty-three slaughter houses in Dispensary Lane, belonging the Incorporated Butchers' Company of Freemen, has been greatly improved in sanitary condition during the year. One of the yards and several of the slaughter houses have been repaved with stone blocks, and the joints filled with cement. The drainage has been improved, and a water supply is now laid on to each slaughter house. The work is not yet completed.

There are 143 licensed places, viz., 131 slaughter-houses and 12 triperies, of which 84 are licensed for a term of twelve months, and 59, "on account of special sanitary defects," for six months only; 8 slaughter-houses were unoccupied at the end of the year; 3 licenses have been allowed to lapse. One application made to the Sanitary Committee to transfer a license to adjoining premises was granted.

(*f.*)—*Well-Waters Analysed.*—Five samples of well-water have been drawn and submitted for analysis. In none of these did the report of the City Analyst justify the institution of proceedings for the closure of the well.

(*g.*)—*Bakehouse Regulation.*—The systematic inspection of bake-houses is carried out by the officers of the Health Department, under the Factory and Workshops Acts. A printed copy of the provisions bearing on this subject* was forwarded in October to the keeper of each bake-house in the City.

* See Appendix B, page 64.

Houses Built during the Year 1884.

House-building in 1884.

The following return of houses built during the year under report is supplied through the courtesy of the City Engineer :—

Newcastle-upon-Tyne.	Houses Self-contained.	Houses of Two Flats each.
Elswick Township	24 ...	127
Westgate Township	2 ...	47
Byker Township	25 ...	91
Jesmond Township	21 ...	—
Heaton Township	47 ...	61
St. Andrew's Parish	1 ...	27
St. John's Parish	— ...	—
St. Nicholas' Parish	— ...	—
All Saints' Parish	4 ...	6
	124	359
		(for 718 families.)

New accommodation has thus been provided for 842 families, or, at the rate of 5 persons to a family, 4,210 persons, as compared with accommodation estimated for 3,640 persons provided during 1883.

Henry E. Armstrong,

Medical Officer of Health.

Health Department, Town Hall,
Newcastle-upon-Tyne,
April, 1885.

City and County of Newcastle-upon-Tyne,

1884.

APPENDIX A.

TABLE I.

POPULATION (ESTIMATED BY THE REGISTRAR GENERAL TO THE MIDDLE OF THE YEAR)—151,325.

Registration Sub-Districts.	Births Registered in 53 Weeks, ended 3rd January, 1885.					Deaths Registered in 53 Weeks ended 3rd Jan., 1885.		
	Male.		Female.		Total.	Male.	Female.	Total.
	Legitimate.	Illegitimate.	Legitimate.	Illegitimate.				
Westgate	1,275	42	1,199	53	2,569	743	686	1,429
St. Andrew's	305	9	288	14	616	207	204	411
St. Nicholas'	139	8	145	11	303	258	143	401
All Saints'	460	30	457	24	971	265	273	538
Byker	790	38	758	27	1,613	392	378	770
Total ...	2,969	127	2,847	129	6,072	1,865	1,684	3,549

The Births represent a rate of 40·1, and the Deaths a rate of 23·5 per 1,000 estimated population. The increase of births over deaths is 2,523 this year, as compared with 1,690 in 1883. The increase of population of Midsummer, 1884, over that of Midsummer, 1883, is estimated by the Registrar General at 1,861 persons, and the increase of that of Midsummer, 1885, over that of 1884, at 1,884 persons.

TABLE II.

ANNUAL DEATH-RATE PER 1,000 LIVING IN NEWCASTLE FOR EACH OF THE PAST TWO YEARS, COMPARED WITH THE AVERAGE RATE IN THE LARGE TOWNS OF THE UNITED KINGDOM.

	1883.		1884.	
	Annual Average in 28 Towns.	Annual Rate in Newcastle.	Annual Average in 28 Towns	Annual Rate in Newcastle.
1st Quarter	23·8	24·7	21·1	22·9
2nd ,, ...	21·5	23·3	20·8	20·3
3rd ,, ...	19·9	27·0	22·8	24·3
4th ,, ...	21·2	26·6	21·7	26·3
Annual Rate	21·6	25·4	21·6	23·5

TABLE III.

RETURN OF CAUSES OF DEATH IN THE REGISTRATION SUB-DISTRICTS AND ENTIRE CITY DURING THE 53 WEEKS ENDED 3RD JANUARY, 1885.

CAUSE OF DEATH.	REGISTRATION SUB-DISTRICTS.					
	Westgate.	* St. Andrew's.	* St. Nicholas'.	All Saints'.	Byker.	City.
I.—SPECIFIC, FEBRILE, OR ZYMOTIC DISEASES.						
1.—*Miasmatic Diseases.*						
Small-pox	...	9	1	...	2	12
Measles	5	2	1	...	7	15
Scarlet Fever (Scarlatina) ...	51	22	7	23	53	156
Diphtheria	3	...	1	3	9	16
Whooping Cough	41	4	8	11	21	85
Typhus Fever	2	1	2	...	1	6
Enteric or Typhoid Fever ...	14	3	8	8	14	47
Simple Continued and Ill-defined Fever	...	1	2	...	...	3
Other Miasmatic Diseases ...	2	...	...	...	1	3
2.—*Diarrhœal Diseases.*						
Simple Cholera	4	...	...	...	2	6
Diarrhœa, Dysentery	70	20	10	27	37	164
5.—*Venereal Diseases.*						
Syphilis	6	3	4	9	2	24
Gonorrhœa, Stricture of Urethra	...	...	1	...	...	1
6.—*Septic Diseases.*						
Erysipelas	4	1	2	...	3	10
Pyæmia, Septicæmia	3	1	...	...	1	5
Puerperal Fever	3	1	2	...	3	9
II.—PARASITIC DISEASES.						
Thrush	3	...	...	1	1	5
III.—DIETIC DISEASES.						
Starvation & Want of Breast Milk	2	...	...	...	3	5
Chronic Alcoholism, Delirium Tremens	4	1	2	2	3	12
IV.—CONSTITUTIONAL DISEASES.						
Rheumatic Fever and Rheumatism of the Heart	3	1	3	3	...	10
Rheumatism	4	3	1	1	...	9
Gout	1	...	...	...	...	1
Rickets	5	...	...	1	...	6
Cancer, Malignant Disease ...	28	9	15	8	13	73
Tabes Mesenterica	15	12	8	3	16	54
Tubercular Meningitis, Hydrocephalus	36	7	6	8	20	77
Phthisis	133	38	41	49	68	329
Carried forward	442	139	125	157	280	1,143

* The number of Deaths in St. Nicholas' Sub-District is increased by 166 in the Infirmary and 12 in the Fever Hospital, 73 of the former came to that Institution from beyond the City, and in 15 other cases residences were unknown. The number in St. Andrew's is increased by 8 in the Small-pox Hospital.

TABLE III.—Continued.

Return of Causes of Death in the Registration Sub-Districts and Entire City during the 53 Weeks Ended 3rd January, 1885.

CAUSE OF DEATH.	Registration Sub-Districts.					
	Westgate.	St. Andrew's.	St. Nicholas'.	All Saints'.	Byker.	City.
Brought forward	442	139	125	157	280	1,143
IV—Constitutional Diseases. —*Continued.*						
Other Tubercular and Scrofulous Diseases	11	4	13	3	14	45
Purpura, Hæmorrhagic Diathesis	1	...	...	1	...	2
Anæmia, Chlorosis, Leucocythæmia	2	2	...	1	...	5
Glycosuria, Diabetes Mellitus ...	2	1	1	1	...	5
Other Constitutional Diseases ...	...	1	...	...	...	1
V.—Developmental Diseases.						
Premature Birth	41	6	3	2	12	64
Atelectasis	1	2	...	...	...	3
Congenital Malformations ...	3	...	...	...	1	4
Old Age	84	18	8	22	25	157
VI.—Local Diseases.						
1.—*Diseases of Nervous System.*						
Inflammation of Brain or Membranes	16	9	5	8	9	47
Apoplexy, Softening of Brain, Hemiplegia, Brain Paralysis ...	62	14	18	23	28	145
Insanity, General Paralysis of the Insane	...	...	...	...	1	1
Epilepsy	7	2	1	2	3	15
Convulsions	58	16	15	28	36	153
Laryngismus Stridulus (Spasm of Glottis)	...	...	...	1	...	1
Paralysis Agitans. Paraplegia, Disease of Spinal Cord ...	29	5	1	10	8	53
Other Diseases of Nervous System	5	2	1	...	5	13
3.—*Diseases of Circulatory System.*						
Endocarditis, Valvular Diseases of Heart	9	3	2	1	6	21
Pericarditis	1	...	...	...	...	1
Other Diseases of Heart	74	25	31	27	27	184
Aneurism	2	...	7	...	...	9
4.—*Diseases of Respiratory System.*						
Croup	19	4	1	3	10	37
Laryngitis	9	2	5	3	3	22
Bronchitis	98	35	18	68	69	288
Pneumonia...	69	19	7	27	37	159
Pleurisy	4	2	1	1	2	10
Emphysema, Asthma	11	3	1	1	1	17
Other Diseases of Respiratory System	11	3	2	2	5	23
Carried forward	1,071	317	266	392	582	2,628

TABLE III.—Continued.

Return of Causes of Death in the Registration Sub-Districts and Entire City during the 53 Weeks Ended 3rd January, 1885.

CAUSE OF DEATH.	Registration Sub-Districts.					
	Westgate.	St. Andrew's.	St. Nicholas'.	All Saints'.	Byker.	City.
Brought forward	1,071	317	266	392	582	2,628
5.—*Diseases of Digestive System.*						
Dentition	17	4	1	6	9	37
Tonsillitis, &c.	...	...	...	1	1	2
Diseases of Stomach	10	4	...	5	1	20
Enteritis	2	4	1	3	2	12
Peritonitis	10	1	6	1	3	21
Obstructive Diseases of Intestine	5	2	2	2	1	12
Ascites	3	...	...	1	1	5
Cirrhosis of Liver...	14	3	4	1	1	23
Jaundice and other Diseases of Liver	21	10	3	3	7	44
Other Diseases of Digestive System	6	...	2	...	...	8
6.—*Diseases of Lymphatic System.*						
(*e.g.*, of Lymphatics and of Spleen)	...	1	...	1	2	4
7.—*Diseases of Glandlike Organs of Uncertain Use.*						
(*e.g.*, Bronchocele, Addison's Disease)	...	...	...	1	...	1
8.—*Diseases of Urinary System.*						
Nephritis	4	2	...	3	1	10
Bright's Disease, Albuminuria ...	16	4	3	4	4	31
Disease of Bladder and of Prostate	1	1	5	3	2	12
Other Diseases of Urinary System	5	...	9	...	3	17
9.—*Diseases of Re-Productive System.*						
(A) Of Organs of Generation.						
Female Organs	3	...	2	...	...	5
(B) Of Parturition.						
Abortion, Miscarriage	1	1	...	1	1	4
Puerperal Convulsions	2	...	...	...	...	2
Placenta Prævia, Flooding ...	2	...	1	...	1	4
Other Accidents of Childbirth ...	7	...	...	2	4	13
10.—*Diseases of Locomotive System.*						
Caries, Necrosis	3	...	3	...	1	7
Arthritis, Ostitis, Periostitis ...	...	...	1	...	1	2
Other Diseases of Locomotive System	...	...	1	1	...	2
11.—*Diseases of Integumentary System.*						
(*e.g.*, Carbuncle, Phlegmon, Cellulitis)	...	...	...	1	...	1
Other Diseases of Integumentary System	...	...	...	1	...	1
Carried forward	1,203	354	310	433	628	2,928

TABLE III.—Continued.

Return of Causes of Death in the Registration Sub-Districts and Entire City during the 53 Weeks Ended 3rd January, 1885.

CAUSE OF DEATH.	Registration Sub-Districts.					
	Westgate.	St. Andrew's.	St. Nicholas'.	All Saints'.	Byker.	City.
Brought forward	1,203	354	310	433	628	2,928
VII.—Violence..						
1.—*Accident, Negligence, &c.*						
Fracture and Contusion	4	3	31	7	6	51
Gunshot Wound	...	1	...	...	...	1
Cut, Stab	1	...	...	...	...	1
Burn and Scald	3	...	5	2	...	10
Poison	3	...	...	...	...	3
Drowning	...	...	...	2	6	8
Suffocation...	7	1	1	2	4	15
Hernia	2	1	2	...	3	8
Otherwise	...	...	1	...	...	1
2.—*Homicide.*						
Murder and Manslaughter ...	2	...	...	1	...	3
3.—*Suicide.*						
Gunshot Wound	1	1	...	...	...	2
Cut, Stab	1	...	1	...	2	4
Poison	1	1	3	...	...	5
Drowning	2	...	...	...	1	3
Hanging	3	...	...	1	...	4
VIII.—Deaths from Ill-defined and not Specified Causes.						
Dropsy	7	1	1	3	5	17
Debility, Atrophy, Inanition ...	106	23	19	42	82	272
Mortification	4	...	2	1	1	8
Tumour	3	1	1	2	1	8
Abscess	7	2	...	1	1	11
Hœmorrhage	2	...	1	1	1	5
Sudden Death (Cause not ascertained)	...	1	...	2	...	3
Found Dead—Cause not stated ...	4	1	4	5	5	19
Other Causes not specified or ill-defined	63	20	19	33	24	159
Totals	1,429	411	401	538	770	3,549

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE.—1884.

SUMMARY OF TABLE III.

SHEWING ALSO THE INCIDENCE OF MORTALITY FROM THE DIFFERENT ORDERS OF DISEASE, &C., IN THE RESPECTIVE QUARTERS OF THE YEAR.

CAUSE OF DEATH.	REGISTRATION SUB-DISTRICTS.																										
	CITY.					WESTGATE					ST. ANDREW.					ST. NICHOLAS.					ALL SAINTS.					BYKER.				
	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	TOTAL.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	TOTAL.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	TOTAL.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	TOTAL.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	TOTAL.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	TOTAL.
I.—SPECIFIC, FEBRILE, OR ZYMOTIC DISEASES																													
1. Miasmatic Diseases	110	81	56	96	343	40	26	19	33	118	14	19	4	5	42	10	8	5	7	30	17	9	11	8	45	29	19	17	43	108
2. Diarrhœal Diseases	9	6	122	33	170	4	1	53	16	74	1	...	16	3	20	...	...	6	4	10	1	2	21	3	27	3	3	26	7	39
5. Venereal Diseases	2	6	14	3	25	..	...	6	...	6	...	1	2	...	3	2	...	2	1	5	...	4	4	1	9	...	1	...	1	2
6. Septic Diseases	6	4	7	7	24	2	2	2	4	10	1	...	2	...	3	1	1	2	...	4	...	...	...	...	...	2	1	1	3	7
II.—PARASITIC DISEASES	2	...	1	2	5	2	...	1	...	3	...	...	...	...	...	...	...	...	...	...	...	..	...	1	1	...	...	...	1	1
III.—DIETIC DISEASES	6	3	4	4	17	2	2	2	...	6	...	...	...	1	1	1	...	...	1	2	1	...	...	1	2	2	1	2	1	6
IV.—CONSTITUTIONAL DISEASES	158	148	158	153	617	69	58	62	52	241	15	19	28	16	78	18	25	19	26	88	19	16	21	23	79	37	30	28	36	131
V.—DEVELOPMENTAL DISEASES	55	52	57	64	228	29	31	32	37	129	4	4	10	8	26	5	2	2	2	11	5	6	6	7	24	12	9	7	10	38
VI.—LOCAL DISEASES—																														
1. Diseases of Nervous System ...	117	86	114	111	428	49	36	50	42	177	11	12	10	15	48	11	9	10	11	41	20	13	18	21	72	26	16	26	22	90
3. Diseases of Circulatory System ...	56	45	48	66	215	25	20	18	23	86	6	5	4	13	28	14	4	10	12	40	5	6	11	6	28	6	10	5	12	33
4. Diseases of Respiratory System ...	157	125	106	168	556	72	57	44	48	221	18	11	13	26	68	8	10	8	9	35	27	23	18	37	105	32	24	23	48	127
5. Diseases of Digestive System ...	44	35	48	57	184	25	21	19	23	88	6	3	7	12	28	1	4	7	7	19	7	4	7	5	23	5	3	8	10	26
6. Diseases of Lymphatic System ...	...	...	1	3	4	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	1	1	..	...	...	2	2
7. Diseases of Glandlike Organs of uncertain use...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...
8. Diseases of Urinary System ...	14	20	13	23	70	5	8	4	9	26	3	4	...	...	7	4	4	4	5	17	2	2	1	5	10	...	2	4	4	10
9. Diseases of Re-Productive System—																														
(A) Of Organs of Generation ...	4	...	1	...	5	2	...	1	...	3	...	...	...	...	...	2	...	...	...	2	...	...	...	...	...	...	...	...	...	...
(B) Of Parturition	3	6	4	10	23	1	4	3	4	12	...	...	1	...	1	1	...	...	...	1	1	...	...	2	3	...	2	...	4	6
10. Diseases of Locomotive System ...	4	4	1	2	11	2	...	...	1	3	...	...	...	...	...	2	2	1	...	5	...	1	...	...	1	...	1	...	1	2
11. Diseases of Integumentary System	...	...	...	2	2	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	2	2	...	...	...	...	...
VII.—VIOLENCE—																														
1. Accident, Negligence, &c.	19	23	25	31	98	5	8	2	5	20	...	1	4	1	6	8	8	9	15	40	3	1	4	5	13	3	5	6	5	19
2. Homicide	...	...	1	2	3	...	...	...	2	2	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...
3. Suicide	1	7	9	1	18	..	3	4	1	8	...	1	1	...	2	...	2	2	...	4	...	...	1	...	1	1	1	1	...	3
VIII.—DEATHS FROM ILL-DEFINED AND NOT SPECIFIED CAUSES...	98	116	130	158	502	44	42	57	53	196	8	10	14	17	49	7	10	11	19	47	21	25	18	26	90	18	29	30	43	120
TOTAL	865	767	921	996	3549	378	319	379	353	1429	87	90	117	117	411	95	89	98	119	401	129	112	143	154	538	176	157	184	253	770

TABLE IV.

THE FOLLOWING TABLE SHEWS THE WEEKLY NUMBERS OF DEATHS FROM CERTAIN DISEASES, LIABLE TO FLUCTUATION, DURING THE 53 WEEKS ENDED 3RD JANUARY, 1885:—

1885. WEEK ENDED.	Pulmonary Consumption.	Diseases of Respiratory Organs other than Consumption.	SEVEN CHIEF ZYMOTIC DISEASES.							Total of Seven Chief Zymotic Diseases.
			Small-pox.	Measles.	Scarlet Fever.	Diphtheria.	Whooping Cough.	Enteric or Typhoid Fever.	Diarrhœa.	
Jan. 5 ...	5	9	...	..	4	1	1	1	1	8
„ 12 ...	4	13	...	1	4	...	1	1	1	8
„ 19 ...	2	9	...	1	2	...	4	...	..	7
„ 26 ...	7	12	...	1	2	...	2	...	...	5
Feb. 2 ...	7	14	...	1	2	1	4	...	...	8
„ 9 ...	7	10	...	...	3	1	4	2	1	11
„ 16 ...	6	12	...	2	6	...	2	...	...	10
„ 23 ...	7	11	1	...	3	2	2	1	2	11
Mar. 1 ...	9	16	...	...	6	...	2	1	1	10
„ 8 ...	7	14	...	...	6	...	3	...	...	9
„ 15 ...	7	12	1	...	6	...	6	...	1	14
„ 22 ...	9	11	...	...	3	1	1	1	...	6
„ 29 ...	8	14	1	...	3	...	1	...	1	6
April 5 ..	7	17	1	...	2	...	4	...	1	8
„ 12 ...	9	13	3	...	5	...	4	1	...	13
„ 19 ...	6	7	2	1	2	...	2	...	...	7
„ 26 ...	5	11	1	...	...	1	4	...	...	6
May 3 ...	4	9	1	...	3	1	1	2	...	8
„ 10 ...	7	14	...	...	2	1	2	...	...	5
„ 17 ...	4	8	1	...	2	...	3	...	1	7
„ 24 ...	7	12	...	...	5	...	1	1	1	8
„ 31 ...	6	7	...	...	2	...	1	...	...	3
June 7 ...	5	6	...	...	2	...	1	...	...	3
„ 14 ...	7	13	...	...	1	...	...	...	1	2
„ 21 ...	3	2	...	...	2	...	1	4	...	7
„ 28 ...	11	6	...	..	1	..	2	2	2	7
July 5 ...	4	8	...	1	2	...	2	...	4	9
„ 12 ...	4	10	...	1	1	...	...	...	2	4
„ 19 ...	7	12	...	...	2	...	1	...	15	18
„ 26 ...	4	13	...	...	1	...	1	...	14	16
Aug. 2 ...	6	7	...	...	2	1	1	...	6	10
„ 9 ...	9	4	...	...	1	...	...	...	6	7
„ 16 ...	5	6	..	...	1	...	2	1	4	8
„ 23 ...	4	5	...	...	2	...	1	3	10	16
„ 30 ...	4	8	...	...	3	1	1	3	22	30
Sept. 6 ...	8	8	...	...	2	...	...	...	12	14
„ 13 ...	7	10	...	...	2	...	2	...	9	13
„ 20 ...	6	8	...	...	3	...	3	3	9	18
„ 27 ...	4	7	...	...	3	...	...	3	4	10
Oct. 4 ...	15	14	...	...	3	...	2	1	6	12
„ 11 ...	...	14	...	...	5	..	2	...	8	15
„ 18 ...	7	12	...	1	4	...	...	2	2	9
„ 25 ...	4	19	...	...	4	...	...	1	3	8
Nov. 1 ...	6	10	...	...	2	...	2	1	1	6
„ 8 ...	5	12	...	...	4	2	...	1	4	11
„ 15 ...	9	11	...	...	7	2	...	1	3	13
„ 22 ...	4	10	...	...	2	...	...	5	1	8
„ 29 ...	5	8	...	...	3	...	1	1	...	5
Dec. 6 ...	5	7	...	...	3	...	2	...	1	6
„ 13 ...	5	15	...	...	5	...	1	1	...	7
„ 20 ...	11	7	...	...	4	...	...	2	1	7
„ 27 ...	8	11	...	1	2	...	2	...	1	6
Jan. 3 ...	7	18	...	4	4	1	...	1	2	12
Totals ...	329	556	12	15	156	16	85	47	164	495

TABLE V.—Ages at Death.

Periods.	Registration Sub-Districts.					
	Westgate.	St. Andrew's.	St. Nicholas'.	All Saints'.	Byker.	Total in City.
Under 1 Year	381	102	56	146	264	949
1 Year and under 5 Years...	224	60	43	100	136	563
5 Years „ 20 „ ...	116	36	42	39	81	314
20 „ „ 40 „ ...	205	56	104	67	85	517
40 „ „ 60 „ ...	208	76	94	85	92	555
60 „ „ 80 „ ...	262	63	58	91	94	568
80 „ and upwards ...	33	18	4	10	18	83
Total (all ages) dying during 53 weeks ended 3rd Jan., 1885 ...	1,429	411	401	538	770	3,549

TABLE VI.

Births and Deaths in the Different Quarters of the Years 1883, 1884.

	Births.		Deaths.	
	1883.	1884.	1883.	1884.
First Quarter	1,446	1,469	819	865
Second „	1,342	1,480	869	767
Third „	1,315	1,569	1,009	921
Fourth „	1,379	1,554	995	996
Totals	5,482	6,072	3,792	3,549

TABLE VII.

Deaths of Children under 1 Year and Persons over 60 Years in 1881, 1882, 1883, 1884.

	Number of Deaths.							
	Under 1 Year of Age.				Over 60 Years.			
	1881.	1882.	1883.	1884.	1881.	1882.	1883.	1884.
First Quarter	166	190	215	220	189	167	191	158
Second „	182	210	198	169	184	141	141	151
Third „	273	320	277	317	147	126	154	158
Fourth „	199	194	229	243	148	188	181	184
Totals	820	914	919	949	668	622	667	651

TABLE VIII.

DEATHS OF CHILDREN UNDER ONE YEAR OF AGE DURING THE 53 WEEKS ENDED JANUARY 3RD, 1885.

CAUSE OF DEATH.	REGISTRATION SUB-DISTRICTS.					
	Total in City.	Westgate.	St. Andrew's.	St. Nicholas'.	All Saints'.	Byker.
I.—SPECIFIC, FEBRILE, OR ZYMOTIC DISEASES.						
1.—*Miasmatic Diseases.*						
Measles	4	1	1	1	...	1
Scarlet Fever (Scarlatina) ...	11	3	2	...	1	5
Diphtheria	1	...	...	...	...	1
Whooping-Cough	42	19	2	4	6	11
Other Miasmatic Diseases ...	1	1	...	...	...	...
2.—*Diarrhœal Diseases.*						
Simple Cholera	2	...	...	...	...	2
Diarrhœa, Dysentery	113	45	11	5	21	31
5.—*Venereal Diseases.*						
Syphilis	17	5	3	1	7	1
6.—*Septic Diseases.*						
Erysipelas	2	...	...	1	...	1
II.—PARASITIC DISEASES.						
Thrush	5	3	...	...	1	1
III.—DIETIC DISEASES.						
Starvation and Want of Breast Milk	5	2	...	...	...	3
IV.—CONSTITUTIONAL DISEASES.						
Rickets	4	3	...	...	1	...
Tabes Mesenterica	30	7	8	5	2	8
Tubercular Meningitis, Hydrocephalus	25	11	2	...	2	10
Phthisis	1	...	...	...	...	1
Other Tubercular and Scrofulous Diseases	6	1	1	...	...	4
Purpura, Hæmorrhagic Diathesis	1	...	...	...	1	...
Anæmia, Chlorosis, Leucocythæmia	1	1	...	...	...	...
V.—DEVELOPMENTAL DISEASES.						
Premature Birth	64	41	6	3	2	12
Atelectasis	2	1	1	...	...	...
Congenital Malformations ...	4	3	...	...	...	1
VI.—LOCAL DISEASES.						
1.—*Diseases of Nervous System.*						
Inflammation of Brain or Membranes	8	2	3	...	1	2
Apoplexy, Softening of Brain, Hemiplegia, Brain Paralysis ...	6	1	2	1	...	2
Convulsions	119	44	11	10	25	29
Laryngismus Stridulus (Spasm of Glottis)	1	...	...	...	1	...
Other Diseases of Nervous System	3	2	...	...	...	1
3.—*Diseases of Circulatory System.*						
Diseases of Heart	1	...	...	...	...	1
Carried forward	479	196	53	31	71	128

TABLE VIII.—Continued.

Deaths of Children under One Year of Age during the 53 Weeks ended January 3rd, 1885.

CAUSE OF DEATH.	Registration Sub-Districts.					
	Total in City.	Westgate.*	St. Andrew's	St. Nicholas'.	All Saints'.	Byker.
Brought forward	479	196	53	31	71	128
4.—*Diseases of Respiratory System*						
Croup	8	5	1	...	1	1
Laryngitis	3	2	...	...	...	1
Bronchitis	82	26	12	3	15	26
Pneumonia	34	16	2	...	6	10
Emphysema, Asthma	1	...	1	...	...	...
Other Diseases of Respiratory System	4	...	1	1	..	2
5.—*Diseases of Digestive System.*						
Dentition	22	7	4	1	4	6
Diseases of Stomach	1	...	1	...	...	...
Enteritis	1	...	1	...	...	...
Peritonitis	1	1	...	...	...	...
Obstructive Diseases of Intestine	3	2	...	...	...	1
Jaundice and other Diseases of Liver	6	4	...	...	1	1
Other Diseases of Digestive System	3	3	...	...	...	...
6.—*Diseases of Lymphatic System.*						
(*e.g.*, of Lymphatics and of Spleen)	1	...	1	...	...	...
8.—*Diseases of Urinary System.*						
Nephritis	1	...	...	...	1	...
10.—*Diseases of Locomotive System*						
Arthritis, Ostitis, Periostitis ...	1	...	...	1	...	...
11.—*Diseases of Integumentary System.*						
Diseases of Integumentary System	1	...	...	...	1	...
VII.—Violence.						
1.—*Accident, Negligence, &c.*						
Suffocation	14	7	1	1	2	3
Hernia	2	...	...	...	...	2
2.—*Homicide.*						
Murder and Manslaughter ...	1	1	...	...	...	...
VIII.—Deaths from Ill-defined and not Specified Causes.						
Dropsy	4	...	...	1	1	2
Debility, Atrophy, Inanition ...	223	88	19	12	31	73
Abscess	4	2	1	...	1	...
Hœmorrhage	3	1	...	1	1	...
Found Dead—Cause not stated ...	5	2	...	1	1	1
Other Causes not specified or ill-defined	41	18	4	3	9	7
Total	*949	381	102	56	146	264

* Representing a rate of 6·3 per 1,000 per Annum.

TABLE IX.

UNCERTIFIED DEATHS IN EACH SUB-DISTRICT DURING THE 53 WEEKS ENDED 3RD JANUARY, 1885.

ALLEGED CAUSE OF DEATH.	Westgate.			St. Andrew's.			St. Nicholas'.			All Saints'.			Byker.			Total.		
	Under 1 Year.	1 Year and Under 2	2 Years and Above.	Under 1 Year.	1 Year and Under 2.	2 Years and Above.	Under 1 Year.	1 Year and Under 2.	2 Years and Above.	Under 1 Year.	1 Year and Under 2.	2 Years and Above.	Under 1 Year.	1 Year and Under 2.	2 Years and Above.	Under 1 Year.	1 Year and Under 2.	2 Years and Above
Scarlet Fever ...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	1	1
Suppressed Scarlet Fever ...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	1	...	...	1
The results or effects of Scarlet Fever	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
Effects of Whooping Cough	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
Diarrhœa	1	1	...	...	...	...	...	...	...	...	...	...	1	...	...	2	1	...
Cancer	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Tabes Mesenterica ...	..	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1	...
Consumption ...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Premature Birth ...	7	...	...	1	...	...	2	...	...	...	...	..	...	...	...	10	...	...
Old Age	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
Paralysis	...	...	...	...	...	...	...	...	...	...	...	...	..	...	1	...	...	1
Convulsions	8	1	...	3	1	...	4	...	1	8	...	1	1	...	...	24	2	2
A Convulsion Fit ...	2	...	...	...	...	...	...	...	...	..	...	...	...	...	...	2	...	...
A Fit, the result of Measles	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
Heart Disease ...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	2	...	...	2
Heart Disease and Kidney Affection	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1
Capillary Bronchitis	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	1	...	1
Bronchitis & Asthma	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Bronchitis, Convulsions, & Teething	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1	...
Parturition Exhaustion	...	...	1	...	...	...	...	...	...	...	..	...	...	...	...	...	...	1
Debility	3	1	...	6	...	...	...	...	...	2	...	...	3	...	...	14	1	...
Convulsions or some Natural Cause	3	...	2	...	...	...	1	...	...	1	...	...	1	...	...	6	...	2
A Fit or some other Natural Cause	1	...	3	...	...	...	...	...	...	2	1	...	...	...	...	3	1	3
Exhaustion and Decay of Nature	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Exhaustion	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...
From the result of Measles or some Natural Cause	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Believed from Consumption or other Natural Cause	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	2
Heart Disease or some other Natural Cause ...	...	...	2	...	...	...	...	...	1	...	...	...	...	...	...	...	...	3
Suddenly, supposed Apoplexy ...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Carried forward...	26	3	14	11	3	2	7	...	4	13	1	2	7	1	7	64	8	29

TABLE IX.—Continued.

Uncertified Deaths in each Sub-District during the 53 Weeks ended 3rd January, 1885.

Alleged Cause of Death.	Westgate.			St. Andrew's.			St. Nicholas'.			All Saints'.			Byker.			Total.		
	Under 1 Year.	1 Year and Under 2.	2 Years and Above.	Under 1 Year.	1 Year and Under 2.	2 Years and Above.	Under 1 Year.	1 Year and Under 2.	2 Years and Above.	Under 1 Year.	1 Year and Under 2.	2 Years and Above.	Under 1 Year.	1 Year and Under 2.	2 Years and Above.	Under 1 Year.	1 Year and Under 2.	2 Years and Above.
Brought forward...	26	3	14	11	3	2	7	...	4	13	1	2	7	1	7	64	8	29
Scarlet Fever or some other Natural Cause ...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Bronchitis or other Natural Causes	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Bronchitis, or in a Fit, or from some other Natural Cause	...	...	...	...	...	...	...		...	...	...	...	...	1	...	...	1	...
Inflammation of Lungs or other Natural Causes	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Believed from Tubercular Peritonitis	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...
Want of proper attention at Birth	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...
Believed from Serous Effusion or some other Natural Cause ...	...	...	..		...	...	...	...	...	...	...	1	...	...	...	...	...	1
Exhaustion or other Natural Causes	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...
Suddenly, supposed Fever and Inflammation	...	...	...	...	...	1	...	...	..	...	...	...	...	...	...	...	...	1
Apoplexy or some other Natural Cause	...	...	1	...	...	...	...	...	..	...	...	...	...	...	...	...	...	1
Dropsy or other Natural Causes	...	...	1	...	...	...	...	...	..	...	..	...	...	...	...	...	...	1
Believed from some Natural Cause	...	...	...	...	...	...	...	...	...	1	1	2	...	...	...	1	1	2
Some Natural Cause...	4	...	2	1	...	...	...	1	1	...	...	1	1	...	...	6	1	4
Total	31	3	21	12	3	3	7	1	5	15	3	6	9	2	7	74	12	42

TABLE X.

ZYMOTIC DISEASES, A.D. 1884.

STREET LIST OF CASES AND DEATHS FROM THE UNDERMENTIONED DISEASES, CORRECTED BY DISTRIBUTION OF THOSE OCCURRING IN THE FEVER AND SMALL-POX HOSPITALS TO THE STREET FROM WHICH EACH PATIENT WAS REMOVED.

LOCALITY.	* CASES AND DEATHS FROM						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Continued Fever.	Puerperal Fever.	Scarlet Fever.	Diphtheria.
Abinger street	...	...	...	...	...	3	...
Addison road	...	...	3	...	...	1	...
Addison street	...	...	...	...	..	4**	...
Adelaide place (back) ...	...	...	...	...	...	1	...
Albert street	1	...	...	...	...	10	...
Albion row	...	...	1	...	...	9	...
„ Day's buildings ...	...	...	...	...	...	1	...
Albion street	...	...	..	...	...	1	...
Alexander street	1	...	...	...	...	13***	...
„ (back) ...	...	...	..	...	...	1	...
Alexandra place	...	...	...	...	...	3*	...
Alexandra terrace	1	...	...	...	...	...	...
Alice place	...	...	1	...	...	...	...
Alma row	...	...	...	...	...	6	...
Alma street	...	...	...	...	...	1	...
Alma terrace	1*	...	...	..	...	3	...
Ancrum street	...	...	...	...	...	1	...
Argyle street	...	...	...	...	...	4**	...
„ Wilkinson's buildings	...	1*	...	...	...	...	...
Argyle terrace	...	...	...	...	..	1*	...
Ashfield terrace, West ...	...	...	...	...	...	3	...
Back lane—Hindmarsh's yard	...	...	...	...	...	1	...
„ Pace's buildings...	2*	...	...	...	...	4*	...
Bailiffgate	...	...	1	...	...	...	...
Bank side	...	1	...	...	...	...	...
Barker street	...	..	...	...	...	3	...
Barrack road	2	...	1*	...	...	1	...
Barrack square	...	...	1	...	...	1	...
Bath lane	...	...	...	...	...	2	...
Bath lane terrace	...	...	...	...	...	4	...
Bayley street	...	...	1	...	...	5	...
Beaconsfield street	...	...	...	...	...	8	...
Beaumont street	...	...	...	...	...	13*	1
Bedford place	...	...	...	...	...	5	...
Belgrave terrace, Elswick road	...	...	...	...	...	3	...
Belgrave terrace, Mill lane ...	...	...	...	...	..	2	...
Bell street	...	...	...	...	...	11*	...
„ (back)	...	...	...	...	...	1	...
Bell terrace	...	...	3*	...	...	6*	...
Belsay place	...	...	...	...	1*	7	...
Belvidere street	...	...	1*	...	...	...	...
Bentinck road	...	...	...	...	...	1	...
Bentinck street	...	...	...	...	...	9	...

* The asterisks represent deaths and the numerals the total cases in each street.

TABLE X.—Continued.

Street List of Cases and Deaths from the undermentioned Diseases.

LOCALITY.	* Cases and Deaths from						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Continued Fever.	Puerperal Fever.	Scarlet Fever.	Diphtheria.
Bermondsey street	...	...	1	...	...	5	...
Blackett street...	...	...	...	...	...	3	...
Blagdon street...	3	...	1	...	...	4	...
Blandford street	3*	...	...	...	...	15**	...
,, West ...	...	...	...	...	...	1	...
Blenheim street	1	...	3*	...	...	11*	...
Bolton terrace	...	...	..	...	...	3	...
Bolingbroke street	...	...	1	...	...	3	...
Bowman terrace (back) ...	...	...	...	...	...	2	...
Brandling place, East... ...	...	...	...	...	...	2	1*
,, South ...	1	...	...	...	...	3	...
,, West ...	1	...	...	...	...	...	...
Brandling village	1	...	...	..	...	7*	1*
Brougham place	...	...	1	...	...	3	...
Brunel street	...	...	2	...	...	...	...
,, (back)	...	...	1*	...	...	...	...
Brunel terrace	...	...	...	...	...	2	...
Bryson street	...	...	1	...	...	3	...
Bryson terrace	...	...	...	...	...	16*	...
Budle street	...	...	...	...	...	1	...
Buckingham street	1	...	1*	1	1	7*	...
Burdon terrace	...	...	...	...	...	1	...
Burn side	...	...	...	...	...	1	...
Buxton street	...	..	...	...	...	8*	1
,, Chapel buildings	...	...	...	...	...	3	...
Byker bank	...	...	2**	...	...	8*	1
,, Hart's yard ...	...	...	...	...	...	1	...
,, Brough buildings..	...	...	...	...	...	1	...
,, Brewery yard Foundry lane...	...	...	...	...	...	2*	...
,, Byker buildings...	...	...	...	...	1	8**	...
,, Low Fold ...	...	...	3	...	...	...	...
Byker hill, Byker square	...	...	...	...	1	...	...
,, Kidman's buildings	...	...	...	1	...	...	...
Byker street	...	...	...	...	...	1	1
Byron street	...	...	...	...	...	3	...
Byron terrace	...	...	...	...	...	4	...
Callerton place	...	...	...	...	...	1	...
Cambridge street	1	..	...	...	...	3	...
Camden street	...	...	...	...	...	7*	..
Campbell street	...	...	...	...	...	3	...
Canada street	...	...	2*	...	...	7	...
Cannon street	...	...	...	...	...	5	...
Carliol square	1	...	...	...	...	4	...
Carliol street	...	...	...	...	...	5	...
Carlton street	1	...	...	...	...	3	...
,, (back)	...	...	...	...	...	3	...
Centre street	1	...	1	..	...	3*	...
Chapel lane, Westmorland st.	..	...	...	...	...	1	...
Chapel street, High	2	...	...	...	...	...	...

* The asterisks represent deaths and the numerals the total cases in each street.

TABLE X.—Continued.

Street List of Cases and Deaths from the undermentioned Diseases.

LOCALITY.	* Cases and Deaths from						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Continued Fever.	Puerperal Fever.	Scarlet Fever.	Diphtheria
Chatham place	..	...	1	...	...	1	..
Chelsea grove	...	...	...	...	...	4	1*
Chester crescent	1	...	...	...	...	...	...
Choppington street	1	...	1	...	...	...	...
Church street	...	...	...	...	...	7	...
Churchill street	...	...	...	...	...	2**	...
City road	1	...	...	...	...	7	...
„ Egpyt house ..	...	...	1	...	...	...	...
„ Egypt square ...	...	...	...	...	...	1	...
„ Keelman's Hospital..	...	...	...	...	...	2	...
„ Soaphouse Lane ...	...	...	...	...	...	3*	...
Claremont road	...	...	...	...	1*	2	...
Claremont terrace	...	...	...	...	...	1	...
Clarence crescent	...	...	...	...	...	3	...
Clarence place	...	...	...	...	...	1	..
Clarence street	...	...	...	...	...	3	...
Clayton Park road	1	...	...	...	...	5	2**
Clayton Park square	...	...	...	...	...	4	...
Clayton street	...	...	2	...	...	3	...
„ West	...	1*	...	...	...	1	...
Clifford street	...	...	...	...	...	3*	1
Clifton road	...	...	...	...	...	1	...
Close, Phœnix Mill yard ...	...	...	...	...	...	...	1
„ Sweepers' entry ...	...	...	...	...	...	1*	...
„ Trotter's entry ...	...	...	..	...	...	1	...
Clumber street...	...	...	1	...	...	7	...
Collingwood street	...	...	1*	...	...	...	...
Conyer road	...	...	2	...	...	9*	2*
Cook street	...	...	...	...	1	4**	1
„ (back)	1	...	...	...	...	...	...
Copland terrace	...	...	...	...	...	2	...
Corbridge street	...	...	1*	...	...	16***	1
Cottenham street	...	...	...	...	...	13**	...
„ (back) ...	...	...	1	...	...	...	...
Crawhall terrace	...	..	1*	...	...	1*	...
Crescent place	...	...	...	...	...	2*	...
Crispin street	...	...	...	...	...	1	...
„ (back A) ...	...	...	1	...	...	5*	...
Croft street	...	...	...	...	...	3	..
Cromwell street	...	...	...	...	...	13	1
Crown street	...	...	...	...	...	1	...
Cut bank	...	...	1	...	...	4	...
„ Gibb's yard... ...	...	...	...	...	...	1*	...
Dalton street	...	...	...	...	...	2	...
Darn crook	1	...	...	...	...	...	...
Day street	1	1*	...	...	...	5	...
Dean street, Dean court ...	...	...	...	...	...	2	...
De Grey street...	2	...	1	...	...	3*	...
Denmark street	...	...	1	1	...	5	...
Derby street	3	...	...	...	...	...	...
Derwent place...	...	...	...	...	...	2	...

* The asterisks represent deaths and the numerals the total cases in each street

TABLE X.—Continued.

Street List of Cases and Deaths from the undermentioned Diseases.

LOCALITY.	* Cases and Deaths from						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Con-tinued Fever.	Puer-peral Fever.	Scarlet Fever.	Diph-theria.
Devonshire terrace	...	...	...	...	...	2	...
Diana street	2	...	2	...	...	3*	...
Dilston road	...	...	...	...	...	1	...
Dispensary lane	...	...	...	...	1	...	...
Dog bank, Church walk ...	..	...	...	...	...	1	...
Dog Leap terrace	...	...	1	...	...	1	...
Douglass terrace	...	...	...	...	...	7	...
Duke street	1*	...	1	...	...	4	...
Dunn street	...	...	...	1	...	4	...
„ (back)	...	...	...	...	...	2	..
Dunn terrace, Spital Tongues..	1	...	...	...	...	...	...
„ Byker bank ...	...	..	...	...	...	3	...
Durham street	...	...	1	1	...	10	...
East parade	..	...	...	...	...	2	...
Edgeware road...	...	...	1	...	...	5*	...
Edward street	...	...	...	...	...	8	...
„ (back)	...	...	...	...	...	1	...
Edwin street	...	...	1*	...	...	...	...
Eldon lane	1	...	1	...	...	...	...
Eldon street	...	...	...	...	...	11	...
„ (back)	...	...	..	...	...	1	...
Elizabeth street	...	...	...	...	...	2	...
Ellison terrace...	1	...	...	..	...	...	...
Elswick east terrace	1	...	4*	...	...	1	1*
„ Judson place	...	...	...	...	...	6	...
Elswick road	3	...	...	...	...	5	...
Elswick row	1	...	...	...	...	...	1
Elswick street...	1	...	2	...	...	2	...
„ (back)	1	...	...	...	...	...	...
Elvet street	...	...	...	7	...	3**	...
Enfield road	...	...	...	...	...	5	...
Eskdale terrace	...	...	...	...	...	1	..
Essex street	...	...	..	...	...	1	...
Fairless street	...	...	1	...	...	6*	...
Falconar street...	...	...	...	...	...	2	...
Fell street	...	1*	...	...	...	...	...
Fenkle street	...	...	...	...	...	3	...
Fern avenue	...	...	...	...	...	1	...
Flora street	...	...	1	...	...	1	...
Forth banks	...	...	...	...	...	4	...
„ Infirmary ...	13*	1	...	...	...	...	1*
„ Black Bull entry..	...	...	...	...	...	2	...
„ Butcher's entry...	...	...	...	...	...	1	...
„ Gas yard ...	...	...	4	...	...	...	...
Forth street	...	...	...	...	...	1	...
„ Brown's court ...	...	...	...	...	...	2	...
Forth terrace, (back)... ...	...	...	...	...	1*	1	...
Franklin street	...	...	1	...	...	...	...
Friars	...	1	...	...	...	1	...
Friars' green	...	...	3	...	...	...	...
Gainsborough grove	...	...	1	...	...	4	...

* The asterisks represent deaths and the numerals the total cases in each street.

TABLE X.—Continued.

Street List of Cases and Deaths from the undermentioned Diseases.

LOCALITY.	* Cases and Deaths from						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Continued Fever.	Puerperal Fever.	Scarlet Fever.	Diphtheria.
Gallowgate	4	...	1	...	...	2	...
„ Pearce's buildings...	1*	...	...	...	...	1*	...
„ Carnaby's yard ...	...	...	...	...	...	4	...
„ Crosby's buildings...	1	...	...	...	...	...	...
„ Factory yard ...	3*	...	...	...	...	...	...
„ Fleece court ...	2	...	1*	..	...	1	...
„ Mill yard	1	...	...	...	...	...	...
Gardener street	...	...	...	...	...	1	...
Garth heads, Indust. dwellings	...	...	...	...	...	24	...
George's road	...	...	...	...	...	7*	...
George street	...	...	11*	2	...	20*	...
„ (back)	...	...	3*	2	...	3	..
Gibson street	...	...	...	...	...	12*	...
Gladstone street	...	...	...	...	...	2	...
Glasshouse street	...	...	1	...	...	...	...
„ (back) ...	...	...	1	...	...	...	...
Glendale terrace	...	...	...	...	...	1	...
Gloucester road	3	2	...	...	...	17	...
Gloucester street	...	..	...	...	...	13	...
Gloucester terrace	...	...	1	...	...	2	...
Gluehouse lane	..	...	1	...	...	2	...
„ Colliery yard...	...	...	...	...	...	1	...
Glue terrace	...	...	2	...	...	...	...
Gosforth street	1	...	...	...	...	3	...
Gowan villas	...	...	...	...	...	1	...
Grafton street	...	...	...	...	...	8*	1
Graingerville	...	...	...	...	...	6*	...
„ north	...	...	...	...	...	2	...
Granville road	...	...	...	...	...	5	...
Greenhow terrace	...	...	...	...	...	1	...
Grenville street	...	...	2	...	...	1	...
Grenville terrace	...	...	2	...	...	1	...
Grey street	...	...	1	...	...	...	...
Groat market	...	...	...	...	...	1	...
„ Morrison's court	...	...	...	1*	...	...	...
Grove street	...	...	1*	...	...	...	...
Haldane terrace	...	...	...	...	...	4	...
Hamilton street	5*	...	...	1	...	15	...
Hamond street...	...	...	...	...	...	1	1
„ (back)... ...	...	...	...	...	...	2	...
Hamsterley road	...	...	...	...	...	2	1
Handyside street	...	...	...	1	...	4	...
Hanover street...	...	...	1	...	...	2*	...
Hanover square	...	...	...	...	...	1	...
Harbottle street	...	...	...	..	...	6	...
Hare street	...	...	...	...	...	1	...
Harle street	...	...	1	...	...	3	...
Harriett street	...	1	2	...	...	2	...
Harvey street	3*	...	2	...	...	8*	4*
Havelock street	...	...	...	...	...	5	...
Hawes street	...	...	2*	1	...	9	...

* The asterisks represent deaths and the numerals the total cases in each street.

TABLE X.—Continued.

Street List of Cases and Deaths from the undermentioned Diseases.

LOCALITY.	* Cases and Deaths from						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Con-tinued Fever.	Puer-peral Fever.	Scarlet Fever.	Diph-theria.
Hawes street (back)	..	...	...	...	...	2	...
Hawthorn street	...	...	...	...	...	4	...
Hawthorn terrace	...	...	...	...	...	1	...
Headlam street	...	...	1	...	...	2	1
Heaton Park road	...	...	...	1	...	1	...
Heaton road	...	..	...	...	..	9	1
Heaton middle farm	...	...	...	...	...	5	...
Heaton terrace...	...	...	...	...	...	3**	...
Hedley place	...	...	1	1	...	1	...
Hedley street	1	...	...	...	...	...	...
Henry street	...	...	1	...	...	13	...
Herbert street	...	...	1	...	...	13***	...
Hewgill terrace	...	...	...	...	...	3	...
High bridge	...	...	...	..	...	2	...
High Friar street	1	...	...	...	...	3	...
„ Watson's court	...	...	...	...	...	1	...
Hill street	2	...	...	...	...	3	...
Hindhaugh street	...	...	...	...	...	7	...
Holly avenue	...	...	...	2	...	6	2
„ west	...	...	...	...	...	2	...
Howard street	...	...	...	...	...	8	...
Hull street	...	...	...	...	...	6*	...
„ (back)	...	...	...	...	1*	3	...
Hunter road	...	...	...	...	...	4*	...
Ingham place	...	...	1	...	...	...	...
Janet street	...	...	...	...	...	7*	...
James' place	...	...	...	...	...	1	...
Jefferson street	2	...	2	...	...	6	...
Jesmond, North	...	...	...	...	...	...	1
Jesmond dene	...	...	...	...	...	1*	1
Jesmond vale, Kirsop street ...	1	...	...	...	...	1*	...
Jesmond vale terrace	...	...	...	...	1*	6*	...
John street	...	...	...	...	...	8	...
Jubilee road	...	...	...	...	...	2	1
„ Industrial Schools	...	...	...	...	...	1	1*
Kent street	...	...	...	...	...	5*	1
Kirk street	..	...	...	...	...	1	...
Kyle street	...	...	...	...	...	2	...
Lambton place	...	...	...	...	...	8**	...
Lancaster street	...	...	...	...	...	2	...
Langhorn street	...	...	1	...	...	...	...
Laurel street	...	...	...	...	...	5	...
Lawson street	...	...	1	...	...	...	...
Leazes crescent	...	...	...	...	...	2	...
Leazes lane	...	...	...	...	...	2	...
„ Dyers lane ...	2	...	...	...	...	...	...
„ Leazes court ...	...	...	...	...	...	1	...
Leazes terrace	...	...	...	...	...	6	...
Lefroy street	...	...	1*	...	...	...	...
Leighton street	...	...	...	...	1*	3**	...
Lily crescent	...	...	...	...	..	6	...

* The asterisks represent deaths and the numerals the total cases in each street.

TABLE X.—Continued.

Street List of Cases and Deaths from the undermentioned Diseases.

LOCALITY.	* Cases and Deaths from						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Con-tinued Fever.	Puer-peral Fever.	Scarlet Fever.	Diph-theria.
Lime street	...	...	...	...	...	3	...
Lisle street	...	...	...	...	...	6**	...
Little Blagdon street	...	...	...	...	...	7	...
Liverpool street	1	...	...	...	...	...	...
,, Liverpool square	...	...	1	...	...	1	...
Loadman street	...	...	...	...	...	9	...
Long row, Spital Tongues ...	...	...	...	...	...	7*	...
Long row, Byker	...	...	...	...	...	1	...
Lord Byron street	...	...	1	...	...	4	...
Lord Milton street	...	...	...	...	...	2	...
Lovaine place	...	...	...	...	...	4	...
Low Friar street	...	...	1*	...	...	...	..
Malcolm street	...	...	...	...	...	8*	1
,, East	...	...	...	...	...	1	...
Maiden street	1	...	...	...	...	2	...
Malvern street...	...	...	1	...	...	7	...
Manor chare	...	...	...	...	...	1	...
,, Croft stairs ...	...	...	...	...	...	1	...
Manors, Laidlaw's court ...	...	...	2*	...	...	...	...
Mansfield street	...	...	1	1	...	3	...
Maple street	...	1	1	...	...	7**	...
Marianople street	...	...	...	...	...	...	1
Marlborough street (back) ...	...	...	...	...	...	...	1
Mather street	1	...	...	...	...	1	...
Mawson street	...	...	...	...	...	19*	...
Melbourne street	...	...	2*	...	...	11**	...
Meldon street	1	...	1	...	...	1	...
Meldon terrace	...	...	...	...	...	5	...
Middle street	...	...	...	...	...	3	...
Mill lane	2	...	3	1	...	10*	...
Mill street	...	...	...	...	...	5	...
Milton street	...	...	...	...	...	3	...
Minden street	...	..	...	...	...	3*	...
Mitford street	...	...	1	...	...	...	3
Molyneux street	...	...	6	...	...	5*	...
Monday street	1	...	...	...	...	...	...
Monk street	...	...	...	...	...	1	...
Moor street	1	...	...	...	...	1	...
Moor View terrace	...	...	...	...	...	1	...
Morpeth street...	1	...	...	...	...	12***	...
Morrison street	...	..	...	...	...	1	...
Mosley street	1	...	...	...	...	...	...
Mowbray street	...	...	1*	...	...	1	...
Napier street	2	...	...	...	...	6*	...
Nelson street	...	...	...	...	...	3	...
Nesham street	...	...	...	...	...	2	...
Neville street	1	...	...	...	...	...	...
New Bridge street	1	...	..	...	...	...	...
Newcombe street	...	...	...	...	...	7	...
Newgate street	..	...	..	...	..	10	...
,, Barrow's court	...	...	...	...	...	1	...

* The asterisks represent deaths and the numerals the total cases in each street

TABLE X.—Continued.

Street List of Cases and Deaths from the undermentioned Diseases.

LOCALITY.	* Cases and Deaths from						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Con-tinued Fever.	Puer-peral Fever.	Scarlet Fever.	Diph-theria.
Newgate st.—Chamber's crt.	...	...	...	...	...	2	...
„ Hall's court ...	...	...	...	...	...	2	...
„ Taylor's court..	...	...	...	...	...	1	...
Newton street	...	...	...	...	...	4	...
Noble street	...	...	3	...	...	24**	...
Norfolk road	...	...	...	...	...	20*	1
Norfolk street	...	...	...	...	...	2	...
Normanton terrace	...	...	...	...	...	1	...
Northcote street	...	...	...	...	...	4	...
North road	1	...	1*	..	...	7	...
North terrace	...	...	...	...	...	5	...
Northumberland street ...	...	...	1	...	...	...	...
„ Elswick court	...	...	...	...	...	2	...
„ Mackford's entry	...	...	...	...	...	2	...
„ Northumbld. pl.	...	...	...	...	...	2	...
North view	...	...	4*	6	..	1	1
Nun street	1	...	...	...	...	...	...
Oak street	...	...	...	...	...	3	...
Ord street	...	...	..	1	...	3	...
„ (back)	...	...	...	...	...	2	...
Ouseburn	...	...	...	...	...	2	...
Ouse street	...	...	2*	...	...	2	...
Osborne avenue	...	...	...	...	...	7	5
Osborne road	...	...	...	...	...	8	1
Otterburn terrace	...	...	...	...	...	3	...
Oxford street	...	...	...	...	...	3*	...
Oystershell lane	...	...	...	...	...	5*	...
Palace street	...	...	1	1	...	3*	...
Pandon	...	...	...	...	...	2	...
Pandon bank	...	...	...	...	...	4	...
Panmure street	...	...	1	...	...	6	...
Park place	...	...	1	...	...	...	...
Park road	...	..	...	...	...	9**	...
Park terrace	...	...	...	...	...	2**	...
Parker street	2	...	4	...	...	**29***	2*
Pawton Dene terrace	...	...	...	...	...	3	...
Peel street	...	...	1	...	...	...	...
Penn street	...	...	...	...	...	4	...
„ (back)	...	...	...	...	...	1	...
„ Raglan place ...	...	...	1	...	...	...	...
„ Rowell place ...	...	...	...	...	...	4*	...
Percy street	2	...	...	...	...	13	...
„ Patterson's court...	...	...	...	...	...	6	...
„ Percy court ...	3	...	1	...	...	8	...
Picton place	...	...	...	...	...	3	...
Picton terrace	2	...	...	...	...	...	...
Pilgrim street	...	...	1	...	...	6*	...
„ Arcade... ...	...	...	...	...	...	3	...
„ Bell's court ...	...	...	2	1*	...	...	...
„ Low bridge ...	...	...	...	...	...	1	...
„ St. Andrew's crt.	...	...	...	...	...	2	...

* The asterisks represent deaths and the numerals the tota cases in each street.

TABLE X.—Continued.

Street List of Cases and Deaths from the undermentioned Diseases.

LOCALITY.	* Cases and Deaths from						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Con-tinued Fever.	Puer-peral Fever.	Scarlet Fever.	Diph-theria.
Pine street	...	...	...	...	...	1	...
Pink lane	...	...	1*	...	...	2	...
Pitt street	...	...	1	...	...	14**	...
Portland road	4*	...	...	...	...	21	1
Portland street	...	...	1	...	...	6	...
Pottery bank	...	...	1	...	...	2	...
Pottery lane	...	...	...	...	...	5*	...
Princess street	...	...	...	...	...	3*	...
Prospect place...	...	...	...	...	...	2	...
Prudhoe place, No. 1 court ..	...	...	...	...	...	1	...
Prudhoe street	...	1	...	1	...	11*	...
„ Porter's court ...	...	...	...	...	...	1	...
„ (back), Smith's crt.	...	...	...	...	...	5	...
Pudding chare...	...	...	...	...	...	1*	...
Quality row	...	...	...	...	...	**17***	2*
„ Leighton's yard ...	...	...	...	...	...	1	...
„ Pump lane ...	...	...	...	...	...	2	...
Quayside	1	...	1	...	...	...	...
„ Brewery bank ...	...	...	1	...	...	2	...
„ Broad chare... ...	...	...	1	...	...	...	..
Queen square	...	...	...	...	...	1	...
Raby street	...	...	...	...	...	8	...
Race street	...	...	...	...	...	2	...
Raglan terrace...	...	...	...	...	...	1	...
Railway street..	...	...	7	...	...	6*	...
„ Ferguson's court	...	...	...	...	...	2*	...
Railway terrace	...	...	1	...	...	1	...
Ramshaw street	...	..	1	...	...	9	...
Regent street	...	...	...	...	...	1*	...
Regent terrace...	...	...	...	...	...	4*	1
Rendel street	...	...	2*	...	1*	19*	...
Richmond place	1	...	...	...	...	...	...
Richmond street	...	...	...	...	...	7	...
Ridley street	...	...	...	...	...	3	...
Ridley terrace...	...	...	...	...	...	2	...
Ripponden street	...	...	...	...	...	1	1
Robinson street	...	...	1	...	...	3	...
Rock terrace	1	...	...	...	...	2	...
Roger street	...	...	...	...	...	2	...
Ropery terrace...	...	...	...	...	...	2	...
Ropery walk	...	...	...	...	...	6	...
„ Rankin's buildings	...	...	...	...	...	1	...
Rosedale street	1	...	...	...	..	11	...
Rosedale terrace	...	...	1	...	...	4	...
Russell terrace...	...	...	...	...	...	1	...
Rye hill...	1	...	1	...	...	6	...
„ (back)	...	...	...	...	...	1	...
Salisbury street	...	...	2*	...	...	4	...
Sanderson street	...	...	1	...	...	...	...
Sandgate	...	...	...	...	...	2	...
„ Cellar's entry ...	...	...	...	...	...	2*	...

* The asterisks represent deaths and the numerals the total cases in each street

TABLE X.—Continued.

Street List of Cases and Deaths from the undermentioned Diseases.

LOCALITY.	* Cases and Deaths from						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Continued Fever.	Puerperal Fever.	Scarlet Fever.	Diphtheria.
Sandhill	...	...	...	...	...	1	...
Sandyford road	...	..	...	...	1*	3	...
Sarah street (back)	...	...	...	...	...	2*	...
Saville row	...	...	..	...	...	1	...
Scotswood road	2	...	3	...	...	42***	...
Seaham street	1*	...	...	...	...	...	...
Sheraton street	...	...	...	..	...	8**	...
„ (back) ...	...	...	...	...	...	3**	...
Shieldfield green	...	...	...	...	...	1	...
Shieldfield lane	...	...	...	...	...	2	...
Shields road	...	...	1	1	...	10*	1
Shield street	...	...	...	1	...	8	...
Shipley street	...	...	3*	...	...	***18****	2*
Shot Factory lane	...	...	1	...	...	...	...
Side	...	...	...	...	...	1	...
„ Hogg's entry	..	...	...	...	...	2	...
Silver street	2	...	...	...	...	1	1*
Simpson street...	...	...	...	...	...	1	...
Snow street	...	...	...	...	...	9*	1
South view	...	...	..	...	...	1	...
Spring Garden lane	7	...	2	...	...	...	...
St. Andrew's street	3	...	...	...	...	3*	...
St. Ann's row	...	...	...	...	...	4	...
St. Ann's street	...	...	...	...	...	6*	...
„ Crozier's yard	...	...	...	...	...	1	...
St. Anthony's quay	...	...	...	...	...	6	...
„ Bird Nest ...	...	...	...	...	...	1	...
„ Pottery bank	...	...	...	...	...	5	...
„ Pottery houses	...	...	...	...	...	...	1
St. James' place	...	...	1	...	...	...	...
St. Lawrence, Bottle Works' houses	...	...	1*	...	...	...	...
St. Lawrence road	...	...	...	...	...	1	...
St. Lawrence low road							
„ Arnison's buildings	...	...	1	...	...	...	...
„ Stone Cellars lane	...	...	1*	...	...	...	...
St. Mary's place	...	...	...	...	...	1	...
St. Mary street, Anchor bank	...	...	1*	...	...	...	...
St. Mary's terrace	1	...	...	...	...	...	...
St. Nicholas' street	..	...	1	...	...	...	...
St. Paul's terrace	...	...	...	...	...	3	...
St. Stephen's terrace	...	...	...	...	...	3	...
St. Thomas' street	1	...	...	...	...	...	...
Stamfordham place	3	...	...	...	...	...	2
Stanhope street	4	...	...	...	...	39*	...
Stanley street, Crossby terrace	...	...	...	...	...	4*	...
Stanton street	...	...	*	...	...	...	...
Stepney bank	...	...	...	...	...	1	...
Stepney lane	...	...	1	...	...	8	...
Stepney road	...	...	1	...	...	...	...
„ Stepney square	...	...	1	...	...	...	...

* The asterisks represent deaths and the numerals the total cases in each street.

TABLE X.—Continued.

Street List of Cases and Deaths from the undermentioned Diseases.

LOCALITY.	* Cases and Deaths from						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Continued Fever.	Puerperal Fever,	Scarlet Fever.	Diphtheria.
Stockbridge	1	...	1	...	...	...	...
Stoddart street	...	...	...	...	...	3	...
,, Scott's yard ...	...	...	...	...	...	1	...
Stone street	4	...	...	...	...	13	...
Stowell square	...	...	1	...	...	1	...
Stowell street	1	...	...	...	...	5	...
,, Ratcliffe's court	1	...	...	...	...	...	...
,, West Walls ...	...	...	1*	...	...	1	...
Strawberry lane	...	...	...	...	...	2*	...
Strawberry place	4	..	...	...	...	2	...
Strickland street	...	...	...	...	...	3	...
Suffolk street	...	...	4	...	...	7	...
Summerhill street	...	...	...	...	...	4	...
Summerhill terrace	...	...	...	...	..	3	...
Sunderland street	...	...	...	...	...	2	...
Swan street	...	...	...	...	...	2	...
High Swinburne place ...	...	...	...	...	...	1	...
Sycamore street	..	*	2*	...	...	21*	...
,, (back) ...	...	...	...	...	...	1	...
,, Tweddle's court	...	...	..	...	...	3	...
Tamworth road	...	...	...	...	...	6*	...
Tankerville terrace	...	...	...	...	...	...	4
Temperance row	...	...	...	...	...	1*	...
Temple street...	...	...	...	...	...	1	...
Terrace place	...	...	1*	2*	...	1	...
Teynham street	...	...	1	...	1*	...	...
Thompson street	...	...	...	...	...	7	...
Thornborough street	...	...	5*	...	...	13*	2
Thorpe street	...	...	...	...	...	2	...
Tindal street (back)	...	...	...	...	...	1	...
Trafalgar street	...	...	...	...	...	2*	1*
,, (back) ...	...	...	...	...	...	3	...
Tulloch street	...	...	...	...	...	17	...
Tweed street	1	...	...	...	...	...	...
Tyne street, Miller's hill ...	...	...	...	...	...	6*	...
Tyne terrace	...	...	...	...	...	12*	...
Tynemouth road	...	...	...	...	1	2	...
Tyneside terrace	...	...	1	...	...	1*	...
Union street	...	...	1	...	..	17*	...
Union terrace, east	...	...	...	...	...	1	...
Victoria place, Gibson street	...	...	...	...	...	4	...
Victoria square	...	...	2*	...	...	...	...
Victoria street...	...	...	...	...	...	2	...
Victoria terrace	...	...	2*	...	...	...	...
Villa place	1*	...	...	...	...	3*	...
Walker road	...	...	3*	...	...	21	...
,, Maling's pottery	...	...	...	...	...	...	2
Wall Knoll	...	...	1*	...	...	...	...
Warden street	...	...	...	...	...	1	1*
Warkworth street	..	...	...	...	...	3	...
Water street	...	...	2	...	...	1	...

* The asterisks represent deaths and the numerals the total cases in each street.

TABLE X.—Continued.

Street List of Cases and Deaths from the undermentioned Diseases.

LOCALITY.	* Cases and Deaths from						
	Small-pox.	Typhus Fever.	Enteric or Typhoid Fever.	Con-tinued Fever.	Puer-peral Fever.	Scarlet Fever.	Diph-theria.
Waverley terrace	...	...	...	...	...	8	...
Welbeck road	...	...	...	...	...	1	...
Wellington street	...	...	1	...	...	4	...
Wentworth place	...	...	...	...	...	1	...
Wesley street	4*	...	2*	...	...	20*	...
West parade	...	...	...	...	...	4	...
West street	...	...	1	...	...	...	...
Westgate road...	...	...	4*	...	...	15	...
,, Workhouse ...	...	1*	*11**	...	1	30	...
Westmorland lane	...	...	...	...	...	1	...
Westmorland road	...	...	1	...	...	7	...
Westmorland terrace ...	1	...	...	...	...	2	...
Wharncliffe street	2	...	...	...	...	4	...
Wilfred street	...	1	...	...	...	1	1
Wilkie street	1	...	...	...	...	...	...
William street...	1	...	1	...	...	10*	...
Winchester terrace	...	...	1	...	...	...	...
Windsor crescent	...	...	...	...	...	1	...
Windsor street...	...	...	...	...	...	1	...
Windsor terrace	...	...	...	...	...	2	...
Woodbine terrace	...	...	...	...	...	3	...
Worley street	...	...	...	...	...	10	...
Wylam road	...	...	...	...	...	2	1
York street	...	...	1	...	...	9*	...
Yorkshire street	...	...	1	...	...	13	...
Total	174	14	260	38	16	2,167	76

* The asterisks represent deaths and the numerals the total cases in each street.

N.B.—Among the cases notified under the Local Act as Continued Fever, two are certified as having died from Enteric Fever and one from Typhus; and of three cases notified as Typhus, two are certified as having died from Continued Fever and one from Enteric Fever. In each of these cases the certified cause of death only is recorded on the street list.

TABLE XI.

ADMISSIONS TO AND DEATHS AT THE FEVER AND SMALL-POX HOSPITALS FROM 1ST JANUARY TO 31ST DECEMBER, 1884.

DISEASES.	ADMISSIONS.													DEATHS.								
	Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Jan.	Feb.	Mar.	April	May.	Aug.	Nov.	Dec.	Total
Small-pox	1	10	42	22	8	7	7	4	2	2	1	...	106	...	1	2	5	1	...	...	...	9
Scarlet Fever ...	3	5	2	7	2	2	1	4	5	10	1	1	43	...	...	...	...	...	1	1	...	2
Typhus Fever ...	2	...	...	1	...	...	...	...	...	...	...	...	3	...	...	...	1	...	...	...	...	1
Enteric Fever ...	3	3	...	1	2	2	4	3	1	4	1	3	27	...	1	...	...	2	2	...	1	6
Continued Fever ...	1	...	...	...	...	...	...	...	...	...	1	...	2	1	...	...	...	...	...	1	...	2
Diphtheria	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...
Roseola	...	...	...	...	...	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...
Febricula	...	1	...	...	1	1	...	...	...	...	...	1	4	...	...	...	...	...	...	...	...	...
Other Diseases, not febrile ...	...	...	...	...	2	...	...	1	2	...	...	...	5	...	...	...	...	...	...	...	...	...
TOTAL ...	11	19	44	31	15	12	12	12	11	16	4	5	192	1	2	2	6	3	3	2	1	20

TABLE XII.

RETURN OF SUSPECTED AND UNWHOLESOME PROVISIONS INSPECTED DURING THE YEAR 1884.

PROVISIONS INSPECTED.	Amount of Suspected Provisions Inspected.	CONDITION.		BAD—HOW DISPOSED OF.	
		Fit for Food.	Unfit for Food.	Destroyed by Order of Justice.	Destroyed with Owner's Consent.
Carcases of Beef... ...	199	140	59	1	58
Quarters of Beef... ...	8	2	6	...	6
Carcases of Veal... ...	37	10	27	3	24
,, Mutton ...	172	114	58	...	58
,, Pork... ...	84	53	31	...	31
Bacon, Ham	1	...	1	1	...
Hares	130	...	130	15	115
Rabbits	14	...	14	14	...
Chickens	44	...	44	...	44
Ducks	7	...	7	...	7
Cases of Eggs	10	...	10	...	10

Of the 140 carcases of beef returned as fit for food, 47 of the animals had been bruised more or less during transit. The bruised parts were cut off and destroyed.

Four persons have been summoned before the Magistrates, under the Public Health Act, for being the owners of, or having in their possession, unsound provisions intended for human food. Three were fined £5 each and costs, and one was fined 42s. and costs.

One person was proceeded against, under the Newcastle-upon-Tyne Improvement Act, 1882, for having sold a ham that was unfit for human food. He was fined 40s. and costs.

(Signed) WM. HEDLEY, INSPECTOR.

TABLE XIII.

RETURN OF FISH RECEIVED IN NEWCASTLE FISH MARKET, CLOSE, FROM 24TH DECEMBER, 1883, TO 3RD JANUARY, 1885.

DESCRIPTION.	DELIVERED BY BOAT.				DELIVERED BY RAIL.				
	Baskets.	Barrels.	Boxes.	Fish.	Baskets.	Barrels.	Boxes.	Bags.	Fish.
Cod	409	310	...	...	51	434	...	...	...
Gurnet	31	1	...	...	...	7	...	...	...
Haddock	4,886	439	...	...	270	314	...	...	...
Herring	63	693	...	...	143	1,206	...	...	...
Ling	319	484	...	...	259	2,666	...	...	...
Mackerel	...	...	30	...	...	...	1,477	...	...
Salmon	...	...	2	...	...	...	253	...	...
Trout	...	...	...	...	...	...	1	...	...
Black Jack...	56	11	...	...	...	198	...	...	...
Whiting	369	...	...	...	20	2	...	...	...
Hake	...	...	...	27	...	...	...	...	13
Halibut	22	69	...	96	...	44	...	...	...
Plaice	173	823	...	...	9	195	...	...	...
Skate	180	35	...	...	45	289	...	...	...
Soles	46	...	...	...	16	...	...	...	...
Turbot	...	...	...	112	...	...	...	...	15
Cat-fish	...	...	...	296	...	...	...	...	87
Monk-fish	...	4	...	273	...	...	...	...	51
Cockles	...	...	...	...	...	...	...	15	...
Mussels	...	...	...	...	...	...	...	46	...
Crabs	...	5	...	...	...	94	...	...	...
Lobsters	...	...	...	...	...	34	...	...	...
Crayfish	17	...	...	19	...	...	...	...	...
Whelks	...	...	...	...	...	...	...	32	...
Winkles	...	4	...	...	...	240	...	...	...
Shrimps	1	...	...	...	29	...	...	...	...
Prawns	495	...	...	...	200	...	...	...	...
Findon Haddocks... ...	...	...	40	...	...	...	4,935	...	...
Kippers	...	...	136	...	...	...	6,339	...	...
Bloaters	...	...	98	...	...	...	2,496	...	...
Sprats	...	5	...	...	...	245	...	...	...
Oysters	...	...	...	...	...	...	...	...	...
Totals in 1884 ...	7,067	2,883	306	823	1,042	5,968	15,501	93	166
Totals in previous year...	5,105	721	296	882	1,803	7,904	10,692	174	52

Large importations have arrived from Norway. The destruction of Fish has occasionally been necessary, owing to decomposition from heat, close packing, or delay in transit. No diseased Fish has been found.

(Signed) WILLIAM T. CLARKE,

CHIEF INSPECTOR OF NUISANCES AND INSPECTOR OF FISH.

TABLE XIV.

INFECTED ARTICLES DESTROYED AND REPLACED BY THE HEALTH DEPARTMENT DURING THE YEAR 1884.

166 Half Straw Mattresses.	2 Flock Pillows.
21 Straw Beds.	2 Rabbit Down Beds.
2 „ Bolsters.	1 Quilt.
31 Bed Ticks.	1 Bolster Case.
13 Flock Beds.	1 Crib Tick.

INFECTED ARTICLES PURIFIED IN THE DISINFECTING APPARATUS.

FROM THE CITY.	FROM THE FEVER HOSPITAL.
533 Feather Beds.	138 Beds.
613 Flock „	104 Mattresses.
1,304 Mattresses.	210 Pillows.
1,983 Pillows.	5 Bolsters.
1,183 Bolsters.	199 Blankets.
1,132 Blankets.	36 Rugs.
789 Rugs.	34 Counterpanes.
326 Counterpanes.	785 Articles of Wearing Apparel.
280 Bed and Window Curtains.	17 Boxes of Nurses' and Servants' Clothing
124 Cushions.	74 Miscellaneous Articles.
221 Hearth Rugs and Door Mats.	149 Books.
278 Carpets.	
420 Books.	
1,202 Articles of Wearing Apparel	
321 Miscellaneous Articles.	

TABLE XV.

SUMMARY OF CASES DISINFECTED BY THE HEALTH DEPARTMENT DURING THE YEAR ENDED 31ST DECEMBER, 1884.

PARISH OR TOWNSHIP.	NATURE OF DISEASE.							
	Small Pox.	Scarlet Fever.	Diphtheria.	Typhus Fever.	Enteric or Typhoid Fever.	Continued Fever.	Puerperal Fever.	TOTAL.
Elswick	22	619	9	6	77	7	4	744
Westgate	57	361	7	1	45	9	2	482
St. Andrew's	32	205	4	2	10	3	2	258
St. John's...	15	45	...	2	16	...	2	80
St. Nicholas'	1	14	1	1	4	...	...	21
All Saints'	33	471	10	2	42	1	...	559
Jesmond	5	76	13	...	1	2	...	97
Byker	9	376	32	3	65	19	6	510
Total	174	2,167	76	17	260	41	16	2,751
Total Infected Households disinfected during the year								1,741

TABLE XVI.—Nuisance Removal.

Summary of Notices served for Nuisances during the Year ended 31st December, 1884.

Nature of Offence.	No. 1 District.			No. 2 District.			No. 3 District.			No. 4 District.			Total.		
	Informal*	Formal.	Total.	Informal.	Formal.	Total.	Informal.	Formal.	Total.	Informal.	Formal.	Total.	Informal.	Formal.	Total.
Rooms ordered to be closed, as being unfit for human habitation	1	5	6	1	3	4	1	50	51	...	2	2	3	60	63
Rooms cleaned and repaired	6	179	185	47	223	270	5	258	263	31	300	331	89	960	1,049
Overcrowding	1	38	39	2	81	83	1	89	90	...	28	28	4	236	240
Dilapidated yards and passages ...	15	282	297	11	123	134	22	255	277	11	144	155	59	804	863
Dirty yards, passages, staircases, &c.	3	30	33	7	68	75	2	179	181	7	210	217	19	487	506
Defective and badly-constructed drains and sinks, bath, lavatory, and cistern wastes connected to soil-pipes or drain	210	2,623	2,833	162	1,636	1,798	342	852	1,194	61	512	573	775	5,623	6,398
Water-closets choked and defective ...	38	281	319	40	267	307	48	312	360	...	40	40	126	900	1,026
New water-closets	2	4	6	4	38	42	42	68	110	1	3	4	49	113	162
Defective soil-pipes	35	95	130	32	43	75	96	114	210	12	1	13	175	253	428
Defective ash-closets	2	24	26	8	55	63	10	68	78	3	33	36	23	180	203
New ash-closets	3	...	3	...	1	1	...	12	12	...	3	3	3	16	19
Privies and ashpits defective ...	21	235	256	12	138	150	19	211	230	21	433	454	73	1,017	1,090
New privies and ashpits	...	1	1	1	1	2	...	...	...	4	1	5	5	3	8
Offensive accumulations, &c.	6	20	26	3	19	22	1	43	44	3	11	14	13	93	106
Swine and other animals kept ...	...	27	27	2	32	34	...	42	42	...	26	26	2	127	129
Defective water-spouts, causing damp in rooms	2	14	16	15	3	18	1	2	3	4	2	6	22	21	43
Water supply	3	28	31	2	26	28	7	60	67	6	38	44	18	152	170
Smoke nuisance	...	...	...	6	...	...	8	...	...	...	...	...	14	...	...
Other nuisances	5	4	9	6	8	14	7	8	15	5	5	10	23	25	48
Total	353	3,890	4,243	361	2,765	3,126	612	2,623	3,235	169	1,792	1,961	1,495	11,070	12,565

* By "Informal Notice" is to be understood any communication made verbally or by letter. "Formal Notices" are those served under the Statutes.

During the past year 360 ~~convictions~~ *connections* have been made with the common sewers.

It has not been found necessary to resort to Magisterial proceedings for enforcing the abatement of nuisance on any occasion during the year.

TABLE XVII.

1884.—RAINFALL, MEAN TEMPERATURE, &c.

1st Quarter.			2nd Quarter.			3rd Quarter.			4th Quarter.		
Week ended.	Rainfall. Inches.	Mean Temp. Deg. Fahr.	Week ended.	Rainfall. Inches.	Mean Temp. Deg. Fahr.	Week ended.	Rainfall. Inches.	Mean Temp. Deg. Fahr.	Week ended	Rainfall. Inches.	Mean Temp. Deg. Fahr.
1884.											
Jan. 5...	1·19	42·5	April 5...	0·69	46·9	July 5...	0·09	60·0	Oct. 4...	0·06	51·3
„ 12...	0·36	44·5	„ 12...	0·22	46·4	„ 12...	2·58	62·3	„ 11...	0·46	45·3
„ 19...	0·00	46·3	„ 19...	0·41	41·5	„ 19...	0·59	61·0	„ 18...	0·82	50·7
„ 26...	0·65	44·3	„ 26...	0·18	40·5	„ 26...	0·58	55·3	„ 25...	0·00	50·0
Feb. 2...	0·91	39·7	May 3...	0·59	45·0	Aug. 2...	0·19	59·0	Nov. 1...	0·06	49·0
„ 9...	0·15	45·3	„ 10...	0·53	47·5	„ 9...	0·00	60·7	„ 8...	0·62	48·0
„ 16...	0·24	43·0	„ 17...	0·12	56·2	„ 16...	0·16	64·2	„ 15...	0·15	44·7
„ 23...	0·16	42·3	„ 24...	0·00	53·3	„ 23...	0·09	61·7	„ 22...	0·60	41·5
March 1...	0·41	38·3	„ 31...	0·00	49·5	„ 30...	0·72	54·3	„ 29...	0·13	39·0
„ 8...	1·02	40·7	June 7...	0·57	52·5	Sept. 6...	0·07	52·7	Dec. 6...	0·57	40·2
„ 15...	0·77	44·5	„ 14...	0·04	56·3	„ 13...	0·83	57·5	„ 13...	0·52	45·2
„ 22...	0·05	47·3	„ 21...	0·00	54·0	„ 20...	0·08	59·2	„ 20...	0·16	41·2
„ 29...	0·03	41·3	„ 28...	0·02	60·5	„ 27...	0·49	55·8	„ 27...	0·09	37·0
									Jan. 3, '85	0·01	34·5
Total...	5·94	Mean 43·0	Total...	3·37	Mean 50·0	Total...	6·47	Mean 58·7	Total...	4·25	Mean 44·1

Total Rainfall during the Year 1884 = 20·03 inches.

Mean Temperature during the Year 1884 = 48·9 deg. Fahr.

APPENDIX B.

(Copy.)

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE.

NOTICE AS TO BAKEHOUSES.

The attention of all Keepers of Bakehouses is drawn to the following provisions of the Factory and Workshops Acts, of 1878 and 1883:—

Act of 1878, sec. 3. "Every Bakehouse shall be kept in a cleanly state and free from effluvia arising from any drain privy or other nuisance."

Sec. 34. "All the inside walls of the rooms of the Bakehouse, and all the ceilings or tops of such rooms (whether such walls, ceilings or tops be plastered or not) and all the passages and staircases of such Bakehouse shall either be painted with oil or varnished, or be limewashed or be partly painted or varnished and partly limewashed.

"Where painted with oil or varnished there shall be three coats of paint or varnish and the paint or varnish shall be renewed once at least in every seven years and shall be washed with hot water and soap once at least in every six months; where limewashed the limewashing shall be renewed once at least in every six months. A Bakehouse in which there is a contravention of the above provisions shall be deemed not to be kept in conformity with this Act."

Sec. 81 "*and the occupier thereof shall be liable to a fine not exceeding* £10. The Court of Summary Jurisdiction, in addition to or instead of inflicting such fine may order certain means to be adopted by the occupier, within the time named in the order for the purpose of bringing his Bakehouse into conformity with the Act; the Court may upon application, enlarge the time so named; but if, after the expiration of the time as originally named or enlarged by subsequent order, the order is not complied with, the occupier shall be liable to a fine not exceeding £1 for every day that such non-compliance continues."

Sec. 35. "A place on the same level with the Bakehouse and forming part of the same building shall not be used as a sleeping-place unless it is constructed as follows, that is to say:—

(*a.*) Unless it is effectually separated from the Bakehouse by a partition extending from the floor to the ceiling.

(*b.*) Unless there be an external glazed window of at least nine superficial feet in area of which at the least four and a half superficial feet are made to open for ventilation."

"Any person who lets or occupies or continues to let or knowingly suffers to be occupied any place contrary to this section shall be liable to a fine not exceeding for the first offence twenty shillings, and for every subsequent offence £5."

Act of 1883, sec. 15. "It shall not be lawful to let or suffer to be occupied as a Bakehouse, or to occupy as a Bakehouse any room or place which was not so let or occupied before the 1st day of June 1883 unless the following regulations are complied with:—

(i.) No water-closet, earth-closet, privy or ash-pit shall be within or communicate directly with the Bakehouse.

(ii.) Any cistern for supplying water to the Bakehouse shall be separate and distinct from any cistern for supplying water to a water-closet.

(iii.) No drain or pipe for carrying off fœcal or sewage matter shall have an opening within the Bakehouse."

"Any person who lets or suffers to be occupied or who occupies any room or place as a Bakehouse in contravention of this provision shall be liable on summary conviction, to a fine not exceeding forty shillings, and a further fine not exceeding five shillings, for every day during which any room or place is so occupied after a conviction under this provision."

Sec. 16. "Where a Court of Summary Jurisdiction is satisfied on the prosecution of an Inspector or a Local Authority that any room or place used as a Bakehouse (whether the same was or was not so used before the passing of this Act) is in such a state as to be, on sanitary grounds, unfit for use or occupation as a Bakehouse, the occupier of the Bakehouse shall be liable, on summary conviction to a fine not exceeding forty shillings, and on a second or any subsequent conviction not exceeding £5.

"The Court of Summary Jurisdiction, in addition to or instead of inflicting such fine, may order means to be adopted by the occupier, within the time named in the order for the purpose of removing the ground of complaint. The Court may upon application, enlarge the time so named, but if, after the expiration of the time as originally named or enlarged by subsequent order, the order is not complied with, the occupier shall be liable to a fine not exceeding £1 for every day that such non-compliance continues."

And Notice is Hereby Given that proceedings will be taken in all cases where necesssary to carry out the Law.

Dated this 29th day of October, 1884.

By order of the Sanitary Committee,

HILL MOTUM, Town Clerk.

APPENDIX C.

(COPY.)

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE.

SPECIAL REPORT ON THE SANITARY CONDITION OF GEORGE STREET (WEST) AND BACK GEORGE STREET.

BY THE

MEDICAL OFFICER OF HEALTH.

NEWCASTLE-UPON-TYNE: A. REID, PRINTING COURT BUILDINGS, AKENSIDE HILL.

1885.

TO MR. ALD. THOS. WILSON, J.P., CHAIRMAN OF THE SANITARY COMMITTEE OF THE CORPORATION OF NEWCASTLE-UPON-TYNE.

SIR,

In compliance with instructions received from the Sanitary Committee, I beg to submit the following Report on George Street (West) and Back George Street.

I am, Sir,

Your obedient Servant,

HENRY E. ARMSTRONG,

MEDICAL OFFICER OF HEALTH.

Health Department, Town Hall,

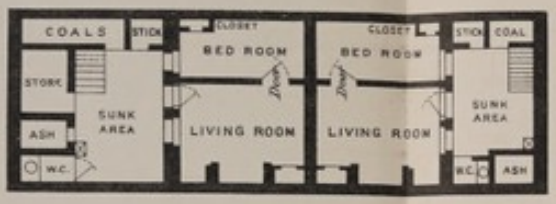
Newcastle-upon-Tyne,

24th December, 1884.

PLA

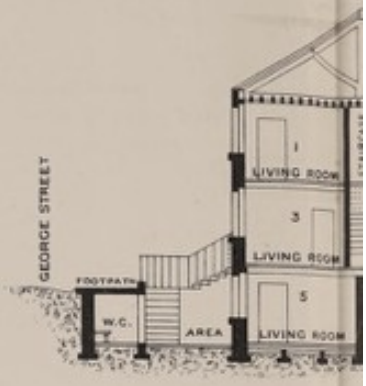
CITY & COUNTY OF NEWCASTLE-UPON-TYNE.

TENEMENT
GEORGE ST
AND BACK GE



BASEMENT PLAN

NOTE. *This plan shews the alterations in the position of doors to bedrooms to improve the ventilation as ordered to be carried out by Sanitary Committee in 1880*

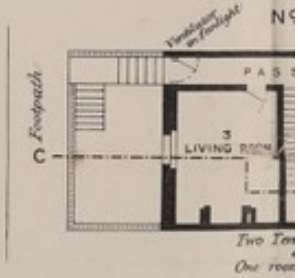


SECTION A-B ON PLA

Nº 4

BASEMENT PLAN

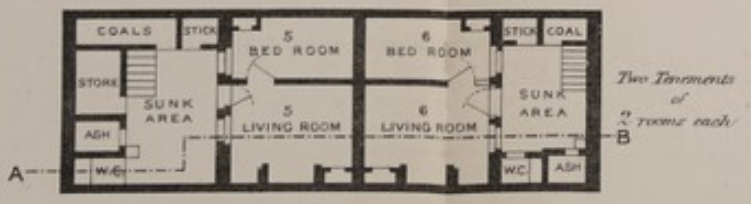
NOTE. *The alterations shewn on this plan are not carried out Except in one or two cases (1884)*



GROUN

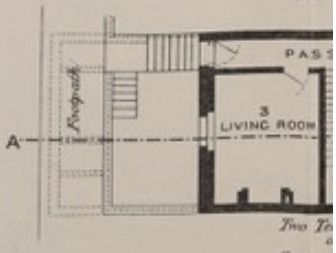
PLANS SHEWING ALTERATIONS SUGG
CONDITION OF HOUSES, I

Nº 1



BASEMENT PLAN

Nº



GROUN

PLANS SHEWING ORIGINAL

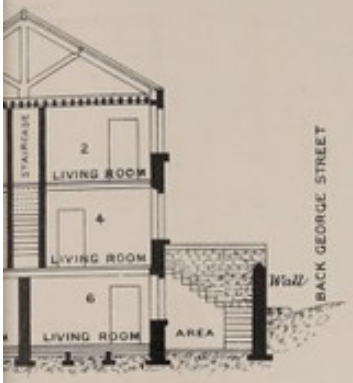
SCALE

Henry S. Armstrong
Med. Officer of Health

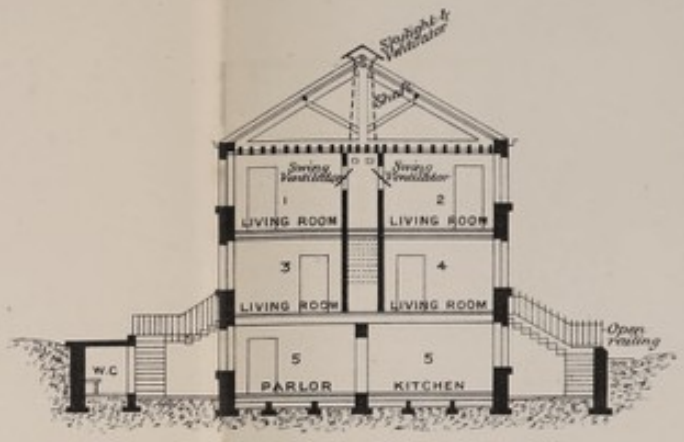
N A.

Reprinted to accompany Special Report on George Street (West) and Back George Street, by the Medical Officer of Health.—Dec., 1884.

PROPERTY,
REET WEST
ORGE STREET.

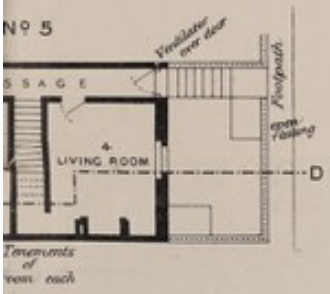


LANS Nos 1.2.3.



SECTION C-D ON PLANS Nos 4.5.6.

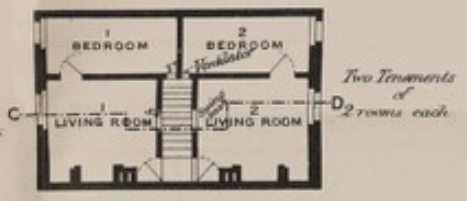
Nº 5



NOTE. *The numbers on plans and Sections, refer to the Tenements*

See Plan B. for details of Ventilators, Swing sashes & Skylight &c.

Nº 6

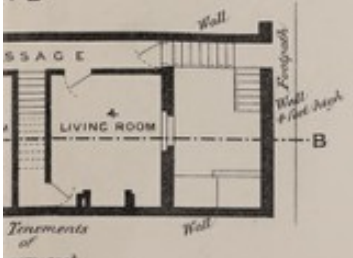


ND PLAN

1ST FLOOR PLAN

GGESTED TO IMPROVE THE SANITARY
, FEBRUARY 25TH 1880.

º 2



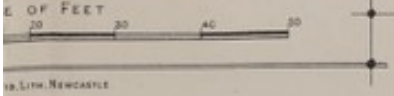
ND PLAN

Nº 3

1ST FLOOR PLAN

AL CONDITION OF HOUSES

E OF FEET



R.F.W. LIDDLE
BUILDING INSPECTOR.

Reprinted to accompany Special Report on George Street (West) and Back George Street, by the Medical Officer of Health.—Dec. 1884.

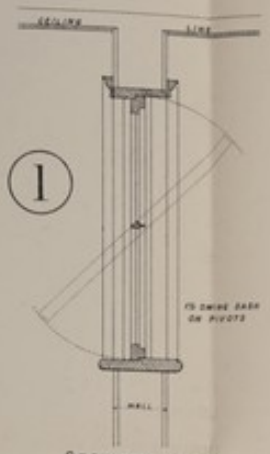
PLAN

CITY AND COUNTY OF NEW

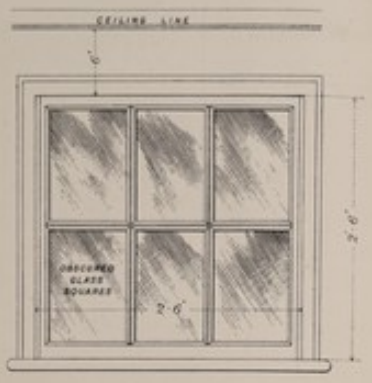
SKETCHES SHEWING SUGGESTED METHO

LIGHTING STAIRCASES IN

JULY, 1



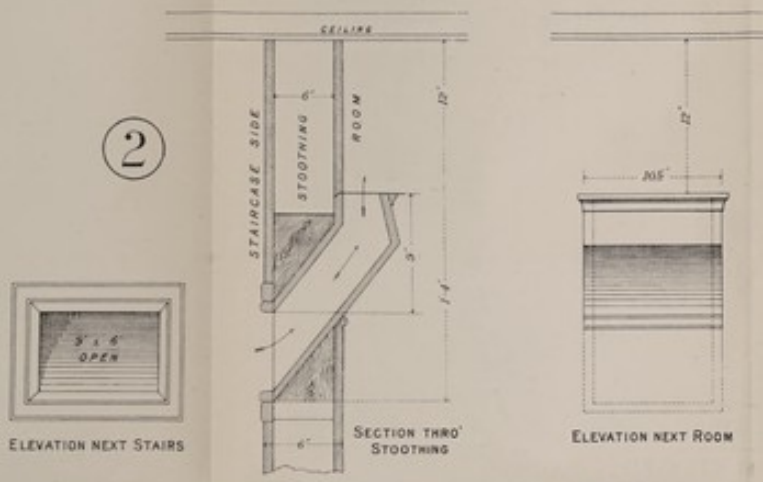
SECTION OF LIGHT



ELEVATION OF LIGHT

SWING LIGHT NEXT STAIRCASE IN LIVING ROOM

Scale one Inch

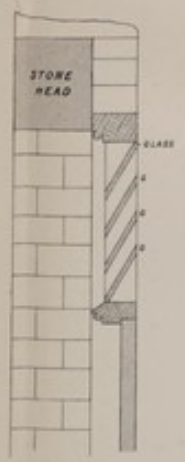


ELEVATION NEXT STAIRS

SECTION THRO' STOOTHING

ELEVATION NEXT ROOM

VENTILATING APERTURE FOR THE ADMISSION OF AIR FROM STAIRCASES INTO WELL ROOMS.



SECTION OF FANLIGHT

Scale one Inch

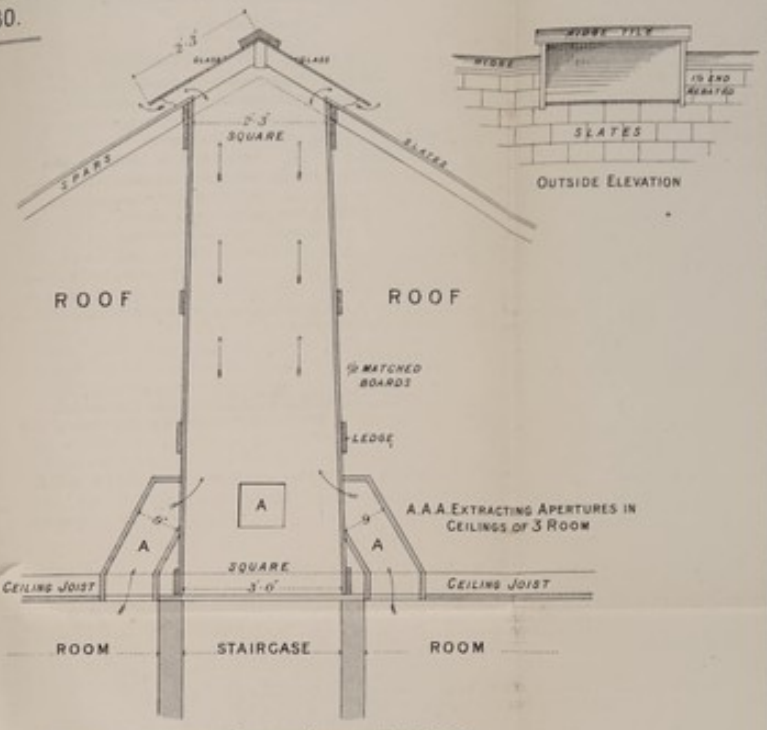
ELEVATION OF FANLIGHT OF FRON
SHEWING GLASS LOUVRES FOR VE

N B.

WCASTLE UPON TYNE

ODS FOR VENTILATING ROOMS AND TENEMENT DWELLINGS.

1880.



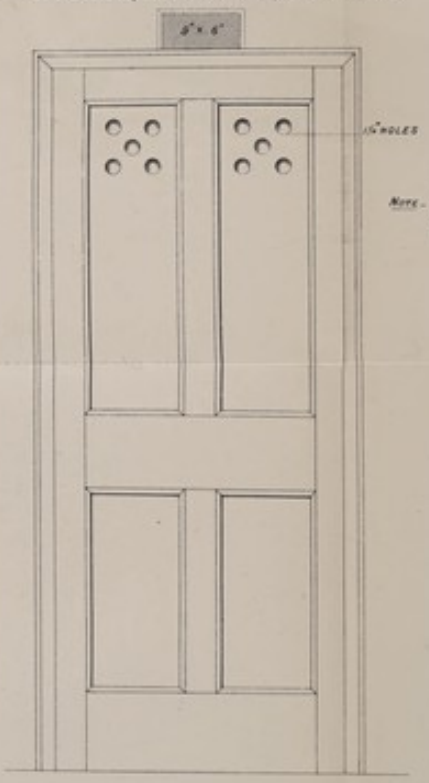
SECTION OF VENTILATING SHAFT AND LIGHT TO STAIRCASES

Scale-Half Inch

NOTE. The Ventilating Shaft and Roof Light shown on the above Drawing may be used in place of the Swing Light Ventilating Apertures and Holes in Door as shown on Sketches Nos 1 2 and 3 on this Sheet if preferred.

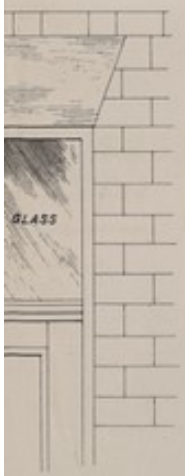
OUTSIDE ELEVATION

NOTE. A 9×6" aperture filled with perforated Zinc may be formed here in place of holes in Door panels if preferred.



NOTE. Similar holes to be bored in panels of back door in passage.

3



NT DOOR
VENTILATION

DOOR BETWEEN WELL ROOM AND LIVING ROOM
SHEWING 1¼ CENTRE BIT HOLES IN TOP PANELS FOR VENTILATION

Scale one Inch

Henry J. Armstrong
Med. Officer of Health

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE.

SPECIAL REPORT

ON THE

SANITARY CONDITION OF GEORGE STREET (WEST), AND BACK GEORGE STREET.

GENERAL DESCRIPTION OF THE AREA.

THE area under report includes three blocks of dwellings, viz., the two sides of Front George Street, and Back George Street which consists of a single row of houses. The whole stands on 4·65 acres of land, and holds a population recently enumerated at 1,373 persons in 339 families, or at the rate of 295 persons in 75 families per acre, the entire city at last census being populated at the rate of 27·1 persons in 5·7 families per acre.

The population of the area consists of—

863 persons aged 12 years and upwards.
510 children under 12 years of age.

The above includes 35 lodgers, of whom, with one exception, all are 12 years old and upwards. This fact, taken in connexion with the working-class character of the population, speaks volumes as to the accommodation available in the tenements, which are too small for the families, let alone lodgers.

The residents occupy 106 houses, or at the rate of nearly 13 persons per house. At last census the entire city was found to average 7·2 persons to each house, a number surpassed by two only of the large English towns.

The three blocks differ considerably from each other in extent, number of inhabitants, and ground-crowding. Thus, the areas of the east and west sides of the front street and the back street are respectively 0·78 acre, 1·2 acre and 0·93 acre, and their respective populations are 367, 766, and 240, or at the respective rates of 470, 638, and 258 per acre. The middle block is therefore the largest and most densely populated.

The east side of the front street comprises 29 houses, of which 6 are self-contained; the west side, 56 houses, of which 20 are self-contained; and the back street, 21 houses, of which 4 are self-contained:—total houses, 30 self-contained and 76 let in tenements.

The 76 tenemented houses are at present occupied by 305 families, or an average of 4 families to each. 71 rooms are occupied singly, 418 are are let in pairs, 54 in tenements of three rooms each, and 7 tenements contain more than three rooms each. In all there are 575 rooms inhabited as tenements by 1,205 persons, or about 2 persons to a room.

The tenements in the respective blocks differ from each other as regards proportion let in single rooms, pair rooms, &c., as appears by the following table:—

GEORGE STREET (FRONT AND BACK.)

BLOCK.	Total Number of Rooms Occupied as Tenements.	PERCENTAGE.		
		Let in Single Rooms.	Let in Pair-rooms.	Let in Tenements of 3 or more Rooms.
East Side of Front Street...	174	22	69	9
West Side of Front Street...	310	17	76	7
Back George Street ...	91	44	47	9

1,091 persons, or 80 per cent. of the total population of the area occupy tenements of one or two rooms each, of these, above 17 per cent. live in single room tenements.

CELLAR DWELLINGS.

The foregoing statistics include a large number of occupied cellar dwellings, which may be considered separately.

There are 84 such dwellings in the area, viz., 30 on the east and 54 on the west of George Street proper. Each consists of two rooms. 362 persons live in these cellars. There are no cellar dwellings in the back street. Plan A shows the general construction (Drawing No. 1).*

The houses on the east side have sunk areas about 10 feet wide in front of the cellar dwellings. The ashpits of the houses are beneath the street foot paths, upon which they are emptied in cleansing.

The houses on the west side, from No. 25 to No. 93, have similar areas about 12 feet in width, to the cellar dwellings facing the front street.

* First published in the Annual Report of the Medical Officer of Health for 1880, with a Report on George Street.

Those at the back, from No. 25 to No. 89, have also areas of about 10 feet in width. Sunk below the street way many of the conveniences in these yards abut on the living rooms, and open within two or three feet of the windows, or even nearer.

Most of the cellar dwellings are arranged in pairs placed back-to-back (see Plan A.) In 67 cellars the bedrooms are of the very bad form known as "wellrooms," and will be described under that heading.

Ventilation of the Area.

A glance at the Map of Newcastle shows that the area under report is situated in what is perhaps the most densely-populated part of the city. The triangle formed by Elswick East Terrace on the west, Marlborough Street on the south, and one side of Westmorland Terrace on the north—through the centre of which George Street crosses—covers an area of about 16 acres, crowded with dwellings, mostly tenements, many of them of low class. The population in this triangle was enumerated during the general house-to-house inspection made by the Health Department during the present year as comprising 1,201 households and 5,118 persons, or at the rate of 74·4 families, and 319 persons per acre.

George Street itself is fairly wide, measuring 70 feet across, including the sunk areas before mentioned (giving 40 feet of street way). Its length is 1,330 feet on the west or longest side.* On this side the means of cross ventilation below Palace Street are (1) an opening of 20 feet wide between the houses, and (2) a covered archway of 15 feet wide, both of which lead to Back George Street, a row of 53 tenements and other buildings without cross ventilation. Many of these buildings are lofty, and only about 23 feet distant from the back main walls of the houses in George Street proper, giving a street way of from 13 to 14 feet in width.

The general ventilation of the area is still further interfered with to the west by Elswick East Terrace, a long street of tenemented dwellings. Those on the east side are from 10 to 30 feet distant from the dwellings in Back George Street. The space between, which consists chiefly of the yards of houses, is closed in at each end.

Sewerage.

There is a Sewer in the narrow back street and another in the front, which join at the low side of the area. The latter is connected directly with the extensive system of sewers of Westmorland Terrace, Lord, Duke,

* From the end of Palace Street to the top of the street (about 320 feet) the houses are self-contained.

Blandford, and Blenheim Streets, and indirectly with those of Marlborough, Churchill, and a large number of other streets of less aristocratic title,* all of which join the main sewer in Forth Banks, and discharge into the Tyne at Skinnerburn.

The ventilation of the sewer in the back street, owing to its narrowness, is likely to be attended with more danger to the inhabitants than in the front street.

I am unable to speak to the condition of the sewers themselves, but as these have been in use for a considerable time they are probably not of the best.

DEFECTS OF INDIVIDUAL DWELLINGS.

The previous description applies generally to the area or its three blocks of dwellings. The intrinsic sanitary evils of the houses and tenements themselves are still more remarkable. Undoubtedly the greatest and most serious is that of

Insufficient Ventilation,

a defect occurring in the three different blocks of George Street to a degree unsurpassed in any other part of the city. It is due to three causes, viz., position, structure, and capacity of rooms.

The position of the cellar dwellings makes through ventilation impossible. With few exceptions, each cellar has another at its back (see Basement Plan A, No. 1) so that air cannot pass through without a communication between the rooms of separate tenants.

It is true the cellars have "areas" of from ten to twelve feet wide; but those looking to the back street are shut in by walls on all sides above street level. Thus there is one in front of the windows, and a cross wall on each side between the roadway and the ground-floor rooms. In such a well as this the insanitary effect of the "convenience"—the exhalations from which are drawn through door and window towards the fireplace—may be imagined, but not described.

In the cellar dwellings the evil above-named is intensified by the shape and size of the rooms. The Basement Plan A (No. 1) shows the general principle on which all of the cellars were originally constructed. Each dwelling contains a space of 2,400 or 2,600 cubic feet (average about 15 feet deep by 20 feet wide, and 8 feet or 8 feet 6 inches high) generally subdivided into a kitchen of from 11½ or 12 feet wide, and a bedroom seldom more than 8½ feet, and in some cases only 6½ feet wide. The bedrooms are without fire-places, and are typical examples of

* All of the streets here named, except Westmorland Terrace, are of the tenement class.

WELL-ROOMS,

i.e., rooms having no other openings than door and window, both being placed at the same corner of a long narrow apartment, which is badly ventilated even when door and window are open, because the air entering by one aperture passes directly out by the other, leaving stagnant the atmosphere of three-quarters of the room.

From the small size of the kitchen, opening either door or window in winter exposes the occupants to cold draughts. The kitchens are commonly used as sleeping rooms for the children at night, when door and window are, as a matter of course, closed.

About four years ago a scheme for the improvement of George Street, involving the alteration of the "well-rooms," was approved by the Sanitary Committee, but was not carried out, owing to objections raised by the owners. A modified scheme was afterwards substituted, under which a little ventilation was got to most of the "well-rooms," but the result has been by no means satisfactory. The particulars of the alterations made will be given presently.

In addition to the condition above-described as existing in the cellars, the "well-room" is very common on other floors of George Street. The total number of such bedrooms on their respective floors are:—

	Part of House.	No. of "Well-Rooms" as Bedrooms.
George Street (Front and Back).	Cellar Kitchens (Front)	24
	„ „ (Back)	17
	On Ground-Floors... ...	7
	On First-Floors	64
	Floor not stated	3
	Total	115

Plan A shows the first-floor tenements (Drawing No. 3).

The "well-rooms" on the upper-floors are similar to those in the cellars. Those of two different tenements are placed end to end (or back to back) a common partition dividing them, through which ventilation cannot be got without interference with privacy. Ventilation of these rooms upon the staircase, over which they meet, has been tried, but the result is unsatisfactory.

The living rooms on the ground and first-floors are not placed back to back as in the basements (see Drawings Nos. 2 and 3) but those on the first-floors are smaller than the others, being commonly about 12 feet square by 8½ feet high (1,152 cubic feet capacity).

The ventilation of many of the rooms, not "well-rooms," is defective.

The kitchens on the first-floors are naturally better ventilated than those in the cellars; but even with the former ventilation is insufficient. The outer air entering by the street door has to find its way through a long narrow passage and up a still narrower stair (seldom more than 3½ feet wide) generally without light or special ventilation, before it reaches the doors of the first-floor tenements. The result is that the air does not circulate when the doors are closed, and there is an unwelcome draught in the rooms when they are opened.

FORMER PROPOSALS FOR IMPROVEMENT OF THE VENTILATION OF ROOMS, AND THE RESULT.

As before stated, an attempt was made a few years ago to improve the ventilation of the different rooms by certain structural alterations. These alterations, as originally suggested and as approved by the Sanitary Committee, are shown in Plan A (Drawings Nos. 4 and 6). It was then proposed to convert each two back-to-back cellar pair-room tenements into one dwelling, as shown in Drawing No. 4; to throw one of the well-bedrooms into the day-room, and ventilate the other; and to secure through ventilation of the dwelling by a doorway through the wall originally separating the two tenements. This proposal was carried out in three instances, but in all others the owners declined.

The alternative required was to make an opening from the "dead-end" of the "well-room" into the kitchen, either by transposing the door to that end (see Basement Plan not numbered) or by putting in an ordinary ventilator there. It will be evident that either of these methods is defective, inasmuch as the only ventilation they afford is that of interchange of air between the two rooms—an insanitary arrangement under all circumstances—and especially bad in case of infectious disease in the house, when the air from the sick would be inevitably wafted where it would be inhaled by other members of the household. In 28 cases of cellar "well-rooms" the owners altered the position of the doors, and in as many more ordinary ventilators were introduced. In 11 instances nothing has been done.

The alterations suggested for improving the ventilation of the first-floor tenements are shown in Drawing A, No. 6, and the Section figured

above it; a sketch of details is also given on a separate sheet (Plan B). The ventilation of the "well-rooms" on the first-floor was to be obtained by an opening from the "dead-end" of each to the staircase, which was itself to be lighted and ventilated from the roof. A swing-sash in the wall between living-room and staircase was to ventilate the former and give additional light to the latter. These alterations were proposed, but, with the exception of the first (*i.e.*, the ventilation of the "well-rooms" from the staircase) were not carried out. The attempt to ventilate the "well-rooms" as intended cannot be called a success, owing to the draughtiness of the staircases (as previously stated); currents of cold air blew upon the occupants of the bedrooms through the newly-made openings, which were speedily papered over.

The fact is the rooms are too small to ventilate without discomfort to the occupants.

DARKNESS AND DAMPNESS OF CELLAR DWELLINGS.

The cellar dwellings in Back George Street are very dark, being overshadowed by the structures opposite. Several (it is impossible to say how many) both in the back and front streets are damp, as may be expected.

State of Rooms in regard of Occupancy.

Four tenements only were empty at the time of inspection. Although the others are closely filled with occupants, two instances only are reported where the accommodation was less than 300 cubic feet per head. In a large number of households, however, the space afforded is not much beyond this. Whatever may be said as to the minimum of capacity per head in rooms where ventilation is good, it may be affirmed that even in the least objectionable of the dwellings described, 500, or even 600 cubic feet of room space, is insufficient for a human being. The cellars and "well-rooms" are intrinsically unhealthy, and double that amount would not, in the writer's opinion, make them fit for habitation.

Water Supply.

There are 162 water taps in the area, viz., 37 indoor and 125 outdoor. Speaking generally. the tenemented houses have a tap in each area (back and front) but none on the upper storeys. To carry upstairs by hand water that might be conveyed there by hydrostatic pressure in the pipes, is a gross waste of time and labour, for which the poor residents have to pay, which they do, not directly and for value received as a Water Rate, but indirectly as a Death Rate, for evil inflicted; since nothing in sanitary administration is more certain than that residents in tenement property

are deterred from keeping clean their premises, clothing, and persons, by the inconvenience of having to carry water, which they seldom do in quantity sufficient for the requirements of health. The water supplied daily to Newcastle amounts to above 30 gallons per head of the entire population. Only one-third of this,* or an average supply of 10 gallons per head per day, carried by hand from the yard taps to the different floors and brought back dirty to the yard sinks in the same way, in George Street, would represent an enormous amount of labour, better understood by noting that 10 gallons are equal to about four pailsful, and that each of these generally means two separate journeys to the yard, as the dirty water has to be returned in the same pail. In a family of five persons, this, in extreme cases, would represent no less than forty journeys a day, which, as a matter of course, workmen's wives would never undertake.

It will perhaps be admitted that to get the work done individually would cost not less than 2d. per 10 gallons of tap water, *i.e.* 4d. per head, which in the population of George Street would mean no less than £22 17s. 8d. a day, or above £8,346 a year.

From its magnitude the foregoing estimate will appear extreme. If the error is thought to be in the quantity of water allowed per head, it should be remembered that this is after all only one-fourth of what is stated by authorities to be sufficient for general purposes; and considering the known large waste of water from yard-taps under existing arrangements (but which would be to a great extent prevented if each tenant had a tap of his own), the amount named is perhaps not very much beyond what goes into the drains of tenements at present. Even at one-tenth of the amount, *i.e.*, 1 gallon per head per day, the estimated cost of labour would be excessive for such a street.

It is no argument against the present case to contend that the time of a workman's wife is her own and not to be charged for. So is her labour, which she can scarcely be expected to expend in carrying water to this extent, and practically she does not do so.

Conveniences.

The conveniences in the area are as follows:—

	No.
Water-closets (indoor)	21
,, (outdoor)	73
Privies	32
Ash-closets	19
	145

* In the Convict Prison at Portsmouth the amount is 11 gallons per head per day.—*Parkes.*

In 12 of the water-closets the soil-pipes are unventilated, and as many more are otherwise defective.

37 ashpits (some of which are connected with privies) are under the street footway,* upon which the refuse is laid when they are being cleansed.

Drainage, etc., of Yards.

Most of the drain grates are outside. 120 of the yard-drains are provided with proper gully traps, and are presumably drained with glazed sanitary pipes. 10 drain inlets are untrapped, and the trapping of 37 is defective. Two of the houses are without sinks.

Houses occupied by 28 families are without yards. Most of the yards are either flagged or cemented; 8 were found defective.

Other Sanitary Defects.

Among other defects of the houses are to be noted interior sinks not disconnected (26 cases), stack-pipes not disconnected or defective (25 cases), cistern wastes not disconnected (8 cases), stagnant water in yards (15 cases), &c.

The tenements in the front street, even of the cellar kitchens, are, generally speaking, clean and tidy; some are remarkably so. The condition of many of the dwellings is highly creditable to the occupants and apt to draw the attention from grave intrinsic defects over which the tenants have no control.

The close packing of the population of George Street is due to the site, which was tolerably central even before the days of building regulations, when these dwellings were erected.

HEALTH OF GEORGE STREET.

Mortality.

The following paragraph and Table respecting the death-rates in George Street, during the seven years 1873–1879, are extracted from the Annual Report for 1880:—

Mortality of George Street.

"During the seven years 1873–9, the rates of mortality from diseases or sets of diseases directly attributable to ground-crowding and defective ventilation and lighting of dwellings, is compared with the corresponding rates in the Borough in the following Table.

* As was mentioned in describing the areas of Cellar Dwellings.

DEATH-RATE PER 1,000 POPULATION.

GEORGE STREET* (MEAN OF SEVEN YEARS, 1873-9).		Borough, 1879.
Pulmonary Consumption	3·4	2·3
Respiratory Diseases	4·7	4·0
Convulsions	1·6	1·2
Tabes Mesenterica, Debility, &c. ...	3·3	1·9
		Rate in Borough (mean of Seven Years, 1873-9).
Scarlet Fever	2·3	1·7
Whooping Cough...	1·3	0·5
Enteric Fever	0·6	0·3
Total rate of three Infectious Diseases...	4·2	2·5

It is thus apparent that the health of George Street, as regards diseases indicating sanitary defect, is considerably below that of the Borough, and that the mortality from infectious disease is excessive. Such areas as this form hot-beds and foci of disease, from which charwomen, washerwomen, errand boys, school children, etc., convey infection over the town."

During 1880-81 the health of George Street shows a temporary improvement in the mortality returns, but as no information is available of the number of residents who have died in most of the public institutions, these and subsequent returns may be and probably are incomplete. Nevertheless, in 1881 the general death-rate of the street was 25·4 per 1,000 against a rate of 21·7 for the entire city. In 1882 the general mortality, as shown by the returns, was but slightly in excess of that of the city, but the rate of mortality from the Miasmatic order of Zymotic diseases was 5·4 per 1,000 against 4·0 in Newcastle. In 1883, the general death-rate rose to 32·9 and the Miasmatic death-rate to 5·9 per 1,000 against 25·4 and 4·5 respectively in the city. During the present year the deaths in George Street from these causes during the first three quarters of the year are equivalent to corresponding annual rates of 29·1 and 5·0 respectively. The mean Miasmatic death-rate for the five years 1880-84† is 4·7 per 1,000 in the street against 3·8 in the city.

* Calculated on population in George Street, enumerated February, 1880.

† The rate for 1884 being estimated on that prevailing during the first three quarters of the year.

During the year 1883, 18 cases of Scarlet Fever (of which 3 died) and 1 of Continued Fever, were notified in the area under report. In addition to these there were 3 deaths from Measles and 1 from Diarrhœa. The number of non-fatal cases of the two last-named diseases is not known.

In the ten months ended 31st October last, no less than 32 cases of infectious disease were notified among 22 families in 17 different houses in the area, including 12 of Enteric, 18 of Scarlet, and 2 of Continued Fever.

In one household there were 4 cases of Scarlet and 1 of Enteric Fever all in the same family; in another, 3 of Enteric and 1 of Scarlet Fever (two different families); in a third 3 cases of Enteric Fever (each in a different family); in a fourth, a case of Scarlet and another of Enteric Fever (each in a different family). There were also 3 cases of Scarlet Fever in each of two families occupying tenements in different houses.

Zymotic disease has, therefore, been so excessively prevalent during both last year and the present in the George Street area as to justify its being termed one of the chief Fever Dens of the city, to which attention was directed in the Special Report on the Increased Death-Rate of Newcastle during the year 1883.

As illustrations of the sanitary state of the dwellings in which disease has prevailed this year the following may be given :—In one of the houses where both Enteric and Scarlet has appeared there was found in the back premises a closet-pail leaking into the yard, and in the front area, near the door of the cellar dwelling, there was a foul unventilated privy, with its midden below the footpath. Another house where the two diseases occurred had three sewer ventilators near it, the furthest being 27 feet distant. In the house in which three families were invaded by Enteric Fever, two of the rooms were "well-rooms," and the ventilator of one had been papered over; in the third tenement the cellar kitchen was damp.

REMEDIES.

As previously stated, a scheme for the structural alteration of the cellars and well-rooms in the area was submitted to, and approved by, the Sanitary Committee in 1880, and was recommended by them to the owners for adoption. This scheme involved the conversion of each front and back pair of cellars into one tenement, together with the ventilation of well-rooms on other floors, the lighting and ventilation of the staircases, &c.

The owners, with one or two exceptions, declined to alter their cellars as recommended, or to ventilate the staircases. The Committee then requested them to carry out a minor scheme of alteration, consisting principally of the removal of the door of each "well-room" in the cellars to the end of the room most distant from the window. The well-rooms on the upper floors were also recommended to be ventilated upon the staircases as originally proposed. These changes were, after some delay and the summoning of several owners before the magistrates, eventually carried out.

That the small alterations named would fail to improve materially the health of the street might have been predicted. The cellar dwellings remain as before, except that the well-rooms were made to ventilate through the kitchens, a bad arrangement at best, and one that would not work at all with the door closed, as it generally will be when the inmates are in bed. The "well-rooms" on the upper floors being ventilated upon draughty staircases, the openings, as might have been expected, were soon in most cases papered over.

The scheme originally proposed would have been undoubtedly more efficacious. It is, however, only a half-measure, and cannot be recommended as sufficient for the remedy of existing evils. For this purpose more radical changes are required, of which the following is an outline :—

The cellars should be done away with as human dwellings.

The "well-rooms" on the upper floors are too small for sleeping apartments, and are incapable of proper ventilation. Those on the first-floors may be thrown into the day rooms, which will then form tenements of one room each, suitable for small families; or the two small tenements on each flat may be converted into one of good size.

The ventilation of staircases and passages should be improved in the way proposed in 1880.

Water taps and sinks should be provided for each landing.

It is desirable that the privies and ashpits should be done away with in favour of some more rapid form of refuse removal, such as either ash-closets after the Nottingham method, or water-closets with removal of ashes, whichever may be found most practicable.

The defects of water-closets, drains, sinks, &c., mentioned, should be remedied in the usual way.

Sewers.

Seeing the density of the population of the area, and the numerous drainage connexions with other streets, it is recommended that

the sewers of George Street be specially treated by flushing from time to time with some powerful disinfectant, such as a solution of Green Copperas, which is cheap and efficacious for such a purpose.

One object of the alterations proposed is to diminish the ground crowding by the removal of the occupants of cellars to other habitations.

The conversion of rooms or tenements on other floors would also contribute to this result.

The number of persons in the cellars so displaced would be 362, for whom accommodation would have to be provided elsewhere. The number displaced from other rooms would depend on the extent to which the alteration of the first floor tenements was carried.

HENRY E. ARMSTRONG,
MEDICAL OFFICER OF HEALTH.

Health Department,
Town Hall,
24th Dec., 1884.

District No.

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE. REGISTER OF HOUSE-TO-HOUSE INSPECTIONS.

Date	LOCALITY.	No. of House.	Part of House.	Number of Rooms occupied by Tenants. Tenants with Common Staircase: 1 Room; 2 Rooms; 3 Rooms; Separate Tenements: 1 Room; 2 Rooms; 3 Rooms; Other wise.	OBSTRUCTIVE. Family: Over 10; Under 10. Lodgers: Over 10; Under 10.	Rent (if a part Figure).	Rent (if a part Figure).	VENTILATION OF ROOMS. Flues Stoppered and Open (W.D.). Flues Stoppered and Open (W.D.).	STATE OF ROOMS. Ill Drain and Bad Water Supply. Dampness. Dirty or Bad State of Repair. Dilapidation. Ceiling too Low. Height Rule Not Kept. Want of Repair. Verminous condition and Dirt. Other.	WANT OF REPAIR. Roofs. Walls and Chimneys. Floors. Staircases, with Handrails. Yards and Courts.	"CONVENIENCES." Water-closet: Inside; Outside; Not Supplied. Privy: Dry; Not Supplied.	(TABULATED AS TO.) Overcrowding. Dampness, Want of Repair, or Defective Drainage in Cellar-rooms. No. of Cellar Rooms Let or Used as Dwellings.	TAXES. Rates Overdue. Claimed at Enquiry. Rates Paid. Ill Arrears of Rates.	DRAINS. Not Trapped. Trapping Defective.	WATER SUPPLY. Defective and Water Unobtainable. Water Obtainable. Distance from House. No. of Houses to a Tap.	NAME AND ADDRESS OF OWNER OR AGENT.	NAME OF OCCUPIER.	NOTICE. On whom served. Date of Service.	SPECIAL DEFECTS, &c.
1	2	3	4	5 6 7 8 9	10 11 12 13	14	15	16	17	18 19 20 21 22 23 24	25 26 27 28	29 30 31 32 33 34	35 36 37 38	39 40 41 42 43	44	45 46 47 48 49	50	51	52	53	54