

Report of the County Medical Officer on the water supplies derived or derivable from the new red sandstone formation in West Riding / West Riding County Council.

Contributors

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Yorkshire
West Riding County Council.

REPORT

OF THE

COUNTY MEDICAL OFFICER

ON THE

WATER SUPPLIES

DERIVED OR DERIVABLE FROM THE

New Red Sandstone Formation in the
West Riding.

*Presented to the West Riding Sanitary Committee, 14th December, 1903
(in pursuance of Minute No. 1695, 6th April, 1903).*

General Assembly

1890

County of ...

Warrant

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REPORT OF THE COUNTY MEDICAL OFFICER

ON THE

Water Supplies derived or derivable from the New Red Sandstone Formation in the West Riding.

(Prepared by direction of the Committee, Minute No. 1695, 6th April, 1903.)

Part I.

General Location.—The New Red Sandstones occupy a large area in the West Midland Counties, extending across Cheshire and South Lancashire to the sea, and also running down by a narrow tongue to the Bristol Channel and Devonshire. The same formation runs Northward from the Midlands right through Yorkshire to the Tees. Roughly speaking, it occupies all that part of the West Riding which lies to the East of a line drawn Northwards from Tickhill to Ulleskelf and North-Westwards from Ulleskelf to Ripon (see Map at the end of this Report).

Water-bearing Character.—With regard to the general suitability of the New Red Sandstones as a source of water supply, a great deal of evidence was collected by the Royal Commission on River Pollution in 1868, and it may be well to give at once a few of their conclusions.

Shallow Wells.—After stating that these rocks and the porous drift overlying them are a very fertile source of shallow well-waters, and one which has been largely developed in the past, the Report states:—"Nevertheless the sources of pollution surrounding shallow wells are so general, numerous, and potent as to leave but few of the many samples (examined and reported on) of sufficient purity for safe domestic use, although most of them were clear and palatable."

Spring Waters.—"The unpolluted spring waters from the New Red Sandstones are clear, bright, colourless, palatable and wholesome. They contain but a very small quantity of organic matter, and are well adapted for all domestic purposes except washing, for which most of them are too hard."

Deep Well Waters.—"The New Red Sandstone is one of the best water-bearing strata in Great Britain, and many deep wells are sunk into it, from which large volumes of water are raised. The unpolluted waters from deep wells in the New Red Sandstone are almost invariably clear, sparkling and palatable, and are amongst the best and most wholesome waters for domestic supply in Great Britain. They contain as a rule but a moderate amount of saline impurity, and either none or but the merest traces of organic impurity. The hardness is usually moderate, and only when the water is derived from originally impure sources does it become excessive. There is every reason to believe that a vast quantity of hitherto unutilised water of most excellent quality is to be had at a moderate expense from this very extensive geological formation."

Area in the West Riding.—Having given the above references by way of preface, I propose to consider in more detail the New Red Sandstone area in the West Riding, the population residing thereon, and the measures which have been taken or proposed for supplying them with water from this source.

The area with which we are thus concerned is about 440 square miles, but a very large part of this is covered with drift, composed of clays, sands, and gravels, which conceal the formation, so that it only appears at the surface in isolated patches (coloured dark-brown on the Map herewith and marked f 2), of which the following are the chief examples:—

- (1) At Hambleton Hough and Brayton Barff, near Selby, where there is an area of some $5\frac{1}{2}$ square miles exposed.
- (2) A narrow strip of $9\frac{1}{2}$ square miles between Beal and Snaith, on which are erected the Pontefract Waterworks and also the Goole New Waterworks.
- (3) A patch of about one-third of a square mile on which the town of Thorne stands.
- (4) Several patches between Armthorpe and Thorne, comprising together about 15 square miles.
- (5) Other patches of larger aggregate area situate between Doncaster and Bawtry.

It will be shown later that these exposed sandstone areas are the points where bore-holes may be made with most advantage, and it would seem that the southern portion of the tract in the West Riding is better provided with these points than the northerly part

Population.—The number of people inhabiting the 440 square miles of the West Riding occupied by the New Red Sandstone may be given at about 112,500. The following is a list of the West Riding Sanitary Districts which are wholly or partly embraced within this area, showing approximately the population included. The list is arranged roughly in geographical order from north to south :—

<i>Sanitary District.</i>				<i>Population living (1901) on the New Red Sandstone Formation.</i>
Ripon Rural (<i>small part</i>)	...	...	...	841
Great Ouseburn Rural (<i>greater part</i>)	...	...	...	8,858
Wetherby Rural (<i>small part</i>)	...	...	...	1,408
Bishopthorpe Rural...	...	...	...	1,960
Tadcaster Rural (<i>part</i>)	...	...	...	2,718
Selby Urban	...	...	...	7,786
Selby Rural	...	...	...	5,822
Goole Urban	...	...	...	16,576
Goole Rural	...	...	...	7,937
Pontefract Rural (<i>part</i>)	...	...	...	3,725
Hemsworth Rural (<i>small part</i>)	...	...	...	132
Thorne Rural	...	...	...	7,246
Doncaster Rural (<i>part</i>)	...	...	...	8,133
Doncaster Borough...	...	...	...	28,932
Balby-with-Hexthorpe Urban	...	...	...	6,781
Wheatley Urban	...	...	...	3,580
				<hr/> 112,435 <hr/>

Part II.—EXISTING WATER SUPPLIES DERIVED FROM THE NEW RED SANDSTONE.

In considering the present water supplies of the West Riding communities living on this formation, it will be well to first dispose of the shallow wells and then refer in more detail to the other existing means of supply.

Shallow Wells.—In all the Rural Districts on the list the majority of the villages depend on shallow wells which, speaking generally, fully merit the adverse conclusions arrived at by the Royal Commission, and quoted on the previous page. Such wells are frequently situated in undesirable proximity to dwellings, middens, manure heaps, farm-yards, etc., and even where they have not been positively condemned by the Local or County Medical Officer, their purity is more than doubtful. My reports on the Sanitary Survey of the Rural Districts of Wetherby, Selby, Pontefract, Goole, and Thorne contain detailed descriptions and analyses relating to many such wells.

Other Supplies.—Deep wells, however, are not uncommon on this area, borings having been made in numerous localities with various results as regards the quantity and quality of water yielded. In the following list mention is made of some of the principal supplies at present in use on the New Red Sandstone area other than shallow wells :—

RIPON RURAL.—Only a very small part of this district is on the Sandstones (population 841). We have no information of any deep borings in this part.

GREAT OUSEBURN RURAL.—There is a public artesian well in the market place at Boroughbridge, which is about 256 feet deep, and in recent years quite a number of bore-wells have been put down in other parishes, from which good supplies are obtained. Thus eight bores were sunk in 1900, including two at Poppleton; in 1901 seven other bore-wells were constructed. It should also be mentioned that the Yorkshire Inebriates Act Joint Committee have this year completed a bore-well on their estate at Cattal, in this district. The well itself is 75 feet deep, and the boring is carried to a depth of 200 feet from the surface. Trial pumpings continued for 19 consecutive days and nights, during which the rest-level of the water did not fall below 17 feet from the surface, and the volume of water delivered was as follows :—

Pumps working at 90 lbs. pressure = 79,000 gallons per day.

" " " 85 " " = 60,000 " "

" " " 80 " " = 43,000 " "

The complete cost of the boring and well-sinking was £238 13s. 6d.

WETHERBY RURAL.—An artesian well stated to be 200 feet deep, supplying a brewery at Tockwith, is the only example of a deep boring of which we have any note in the small portion of this district which is situate on the New Red Sandstones.

BISHOPTHORPE RURAL.—Polluted shallow wells in this district have been largely substituted by the York public water supply, in consequence of pressure by the West Riding Sanitary Committee in 1897. One deep well exists.

TADCASTER RURAL.—A bore-hole at Bilbrough, 240 feet deep, supplies water to the town of Tadcaster, with a population of about 3,000.

SELBY URBAN.—In 1853-4 this district was provided with water from a well and bore-hole in the town, 333 feet deep, from which 243,000 gallons per day were pumped. In 1885 a new bore-hole (close to the old one) was sunk to a depth of 390 feet, and this was deepened in 1894-5 to 674 feet, and gave a yield of 250,000 gallons per day. There are numerous private bore-wells in Selby supplying water for trade purposes, and at the time of the Sanitary Survey (1901) it was ascertained that the yield of water from 10 of the principal wells in the town was 558,000 gallons per day, equal to about 72 gallons per head of the population. The town's supply has, however, been diminishing in recent years, and the District Council sought advice on the matter. Expert opinion attributed the diminution chiefly to the fact that the available area of absorption around Selby is too small to continue to yield so large a quantity as is being pumped there. The remedy suggested consists of making a boring on one of the exposed patches or outcrops situate about $2\frac{1}{4}$ miles from Selby, and the District Council are now taking steps to that end.

SELBY RURAL.—The villages have generally to rely on shallow wells which are notoriously polluted (see Survey Report). Mr. J. Villiers, Well Engineer, Beverley, has supplied me with details of several bore-wells constructed by him for private persons in this district (see Appendix, pp. 7 and 8). These borings are from 100 to 150 feet deep, lined with tubes down to 60 or 90 feet, and good supplies have been obtained, the water rising to from 4 to 12 feet from the surface.

GOOLE URBAN.—Formerly Goole was supplied from a well at Rawcliffe Bridge, 52 feet deep, but when seeking to augment this supply by deepening the boring, the underlying Marl Beds were pierced, with the result that although the supply became practically inexhaustible the water was rendered hard and turbid. Thereupon the Council, acting upon expert advice, determined to go to one of the outcrop areas already referred to (near Pollington in the Goole Rural District). Here a well was sunk 80 feet deep with a boring down to 215 feet. The trial pumping gave 600,000 gallons per day and I am informed by the Waterworks Manager (Mr. T. E. Franklin) that the present average yield is 420,000 gallons and the population supplied is 17,000. There are a number of private borings in Goole supplying a considerable volume of water for trade purposes.

GOOLE RURAL.—The village of Airmyn is the only one having a public supply and this is pumped from a deep boring into a cistern from which it is served to a population of about 400. There are several other borings in this district belonging to private owners, or serving other districts (see Goole Urban).

PONTEFRACT RURAL (part).—Shallow wells afford the chief source of supply, but there are a number of private borings. It may be mentioned that the Pontefract Corporation Waterworks are situate at Roall in this district (Kellington Parish).

HEMSWORTH RURAL.—Only a very small portion of this district overlies the sandstones and no deep borings are recorded. Several parishes, however, are supplied with water by the Pontefract Corporation derived from their deep borings at Roall.

THORNE RURAL.—There is no public supply in this district except at Thorne, where the filtered Canal water is piped to the public pumps in the town. In 1896, the Authority attempted to improve the supply by sinking a tube well (122 feet) at the north-end of Thorne town. It gave an abundant supply of water which was, however, so cloudy, hard and chalybeate in character that it was little used. The Rural Council have several times taken engineering advice as to providing a supply by boring, and reference will be made to the opinions of the engineers at page 4, under the head of "water supplies derivable." There are quite a number of private bore-wells in the rural district, some of which are referred to in the appendix.

DONCASTER RURAL.—Numerous bore-holes have been sunk in this district from which good private supplies have been obtained. (See appendix for data).

DONCASTER BOROUGH, BALBY-WITH-HEXTHORPE URBAN, WHEATLEY URBAN.—The Doncaster public supply serves these places. It is derived from surface-catchgrounds outside the area under consideration. There are doubtless many deep wells in Doncaster used for trade purposes. Particulars of a bore-well in the Balby district are given in the appendix.

Outside Districts supplied from New Red Sandstones.—It only remains to mention a few West Riding communities not located on this formation but obtaining their supply therefrom. These are Pontefract Borough, Knottingley Urban District, and the parishes of Ackworth and Kirk Smeaton in the Hemsworth Rural District. All these places are supplied from the waterworks of the Pontefract Corporation which are situate at Roall, 7 miles to the east of the borough.

The case of Tadcaster comes in the same category. The town is situate just off the sandstones and is supplied from a 240 feet boring at Bilbrough.

Part III.—WATER SUPPLIES DERIVABLE FROM THE NEW RED SANDSTONES.

In carrying out the Committee's instruction to report on this phase of the subject, all that is necessary is to record a few opinions of geological experts, consulting engineers, or Local Government Board Inspectors who have investigated this matter from time to time.

Shallow Wells and Springs.—These may be here left out of account, the first because of the general condemnation, and the second in view of the low-lying flat character of the greater portion of the New Red Sandstone tract in the West Riding. In some of the northerly parts, however, springs might be made use of. Dr. C. E. Lownds (Medical Officer of Health for the Great Ouseburn Rural District) has for several years pointed out that there are some excellent springs in the parishes of Low Dunsforth and Aldborough, of such capacity as would, in his opinion, supply the whole of that Rural District.

Deep borings.—If therefore a satisfactory supply is to be obtained from underground sources it is to the deep well waters of this formation that most of the communities living thereon must look.* The capacity of the New Red Sandstones to furnish vast quantities of excellent water at moderate cost, is not only vouched for by the Royal Commission of 1868, and by a large volume of subsequent expert opinion, but it is supported by the actual experience in connection with waterworks already constructed.

Mr. Geo. Hodgson, C.E., of Westminster and Loughborough, in advising the Pontefract Corporation in 1886, stated that "In the geological formation referred to there can be no doubt that at suitable points water may be obtained in very large volumes at low cost, "sufficient to supply Knottingley, Pontefract, Ferrybridge, Carleton, Ackworth, Featherstone, "Purston, Streethouse, Glass Houghton, Sharlston, and, if necessary, Castleford." In a subsequent report the same Engineer said (1887):—"The whole body of the rock is saturated "with water and the quantity obtainable is to a great extent a question of the depth of "sinking." Pontefract acted on the advice obtained, and at the present moment the Corporation are supplying a considerable population with a satisfactory water. Their works are situate at Roall on one of the patches referred to on page 1, where the New Red Sandstones rise through the post-tertiary beds.

The Goole Urban Council, as already mentioned, have recently gone to the same area, and secured an average daily yield of 420,000 gallons. Selby, in like manner, are about to act on the advice of Mr. Kendall and Mr. Percy Griffiths to augment their present supply by boring at or near the outcrop at Brayton Barff or Hambleton Hough.

Outside the West Riding experience runs in the same direction, viz., that borings at or near the outcrop afford satisfactory results at comparatively small depths. Thus the Retford Corporation, acting under skilled advice, some ten years ago, sought a suitable place for a boring at a distance of eleven miles from the town, where a supply was obtained at a depth of only 73 feet. Gainsborough on the other hand has made borings close by the town, although they are situate some 7 miles from the outcrop. Here they have had to sink great depths to reach the pebble beds, one bore being 1100 feet and the other 1515.

By the kindness of numerous engineers, officials, and private owners I have been supplied with details of borings in various localities, all supporting the same general statement that the further from the outcrop, the deeper the boring required. In order to keep this report within reasonable limits, I refrain from giving these details here, but in the appendix will be found particulars of many such bore-holes. Fortunately, the question of depth of boring is much simplified, so far as the West Riding is concerned, by the existence (particularly in the southern part) of the convenient exposed patches of the new red sandstones (f2) referred to on page 1. As already mentioned, it is to such places that several Authorities have gone with success (Pontefract, Goole, Tadcaster, Retford) and that others have been advised to go (Selby, Thorne). Thus Messrs. Fairbank, in advising the Thorne Rural Council, suggest boring 200 feet at Thorne or 150 at Hatfield, and they point out that to endeavour to tap the lower pebble beds would necessitate great expense and would not ensure a supply of such good

* In this report I have not considered the relative advantages of supplies from other than underground sources, nor have I concerned myself with speculations as to the remote future of the Sandstones, e.g. as affected by possible Coal-mines. J.R.K.

quality as that obtainable from a comparatively shallow bore into the sandstone rock at Hatfield. Mr. C. Fox Strangeways, of the Government Geological Office, recently gave his opinion that "these beds may be expected to furnish a fair supply, say 400,000 gallons a day," and Dr. R. J. Reece, of the Local Government Board, is "inclined to think that a well and boring on or near this outcrop would afford the best prospect of obtaining a satisfactory supply of water."

Conclusion.—It is quite unnecessary for me to add to the foregoing opinions as to the water supplies *derivable* from this formation. All that remains for me to do is to express my thanks to those gentlemen who have supplied me with some of the valuable data appearing in the appendix, and whose names are given there. I am particularly indebted to Mr. County Councillor Dunston, M.I.M.E., of Thorne, Mr. J. Villiers, of Beverley, and Messrs. Thistlewood, of Doncaster.

A large office map has been prepared showing the whole of the new red sandstone area in the West Riding and the position of the chief borings thereon. To assist in the reading of this report a small-scale map is inserted at the end, giving roughly the same information.

JAMES ROBT. KAYE,
County Medical Officer.

Wakefield,
November, 1903.

APPENDIX.

Geological Data concerning various deep borings in the New Red Sandstones.

N.B.—The numbers in Column 1 correspond with the numbers shown in red on the Map.

No.	Location of Boring. — Parish.	STRATA PASSED THROUGH.				Remarks.	
		Description.	Thickness.		Depth to Base.		
			Ft.	in.	Ft.	in.	
1	Cattal ... (Gt. Ouseburn R.)	Soil ...	1	0	1	0	Inebriates Home, 1903
		Boulder clay ...	17	0	18	0	
		Sandstone, New red ...	184	0	202	0	
2	Bilborough ... (Tadcaster R.)	Clay ...	30	0	30	0	Tadcaster Public Supply, 1903
		Red sandstone ...	66	0	96	0	
		Sandstone, variegated ...	145	0	241	0	
3	Cawood ... (Selby R.)	Sand ...	3	0	3	0	Steam Flour Mill
		Clay ...	57	0	60	0	
		Quicksand ...	30	0	90	0	
		Sand. red ...	4	0	94	0	
		Sandstone, soft ...	240	0	334	0	
4	Selby ...	Warp ...	6	0	6	0	Public Waterworks, 1885
		Warpy clay ...	4	0	10	0	
		Very compact clay in layers ...	13	0	23	0	
		Sand in clay in layers ...	1	6	24	6	
		Fine sand like silt ...	2	6	27	0	
		Clay ...	26	0	53	0	
		Quicksand ...	3	0	56	0	
		Hard pan sand ...	19	0	75	0	
		Sandstone ...	4	0	79	0	
		Marl ...	0	3	79	3	
		Sandstone (soft at bottom) ...	42	3	121	6	
		Clay ...	1	0	122	6	
		Soft sandstone and marl ...	5	6	128	0	
		Very fine sand ...	5	0	133	0	
		Sandstone ...	47	0	180	0	
		Marly sandstone ...	73	0	253	0	
		Hard clean sandstone ...	37	0	290	0	
		Marly sandstone (hard) ...	25	0	315	0	
		Hard clean Sandstone ...	16	6	331	6	
		Marl ...	1	0	332	6	
		Soft sandstone ...	16	0	348	6	
		Soft red marl ...	0	6	349	0	
		Hard sandstone ...	26	0	375	0	
		Soft red marl ...	0	6	375	6	
		Clean sandstone...	5	0	380	6	
		Soft red marl ...	0	4	380	10	
		Hard marly sandstone ...	9	2	390	0	
		Sandstone ...	90	0	480	0	
		Marl ...	8	0	488	0	
		Sandstone ...	54	0	542	0	
		Marl ...	7	6	549	6	
		Sandstone ...	5	4	554	10	
		Marl ...	3	2	558	0	
		Sandstone ...	5	0	563	0	
		Marl ...	1	6	564	6	
		Sandstone ...	3	6	568	0	
Marl ...	1	0	569	0			
Sandstone ...	17	0	586	0			
Marl ...	1	0	587	0			
Red rock ...	25	0	612	0			
Red marl ...	1	0	613	0			
Red rock ...	7	0	620	0			
Red marl ...	1	0	621	0			
Red rock ...	31	0	652	0			
Red marl ...	1	0	653	0			
Grey rock ...	2	0	655	0			
Red marl ...	19	0	674	0			
					—Supply of 1854 taken from depth of 330 feet. 6½ in. bore produced 243,000 gallons per day		
					—Supply of 1885 taken from depth of 390 feet, 12½ in. bore		
					—Supply of 1895 taken from depth of 674 feet, yielding 250,000 gallons per diem		

No.	Location of Boring. — Parish.	STRATA PASSED THROUGH.			Remarks.
		Description.	Thickness. Ft. in.	Depth to Base. Ft. in.	
5	Selby	Yellow warp ...	11 0	11 0	Scott's Mill, 1887
		Blue warp ...	46 0	57 0	
		Yellow warp and sand ...	3 0	60 0	
		Land sand ...	33 6	93 6	
		Hard sand ...	15 0	108 6	
		Marl ...	1 0	109 6	
		Red sandstone ...	4 0	113 6	
		Marl ...	0 6	114 0	
		Red sandstone ...	15 0	129 0	
		Marl ...	0 3	129 3	
		Sandstone ...	60 0	189 3	
6	Selby	Top soil ...	2 0	2 0	Dent & Co.'s boring (Water level 6 feet from surface)
		Sandy warp ...	5 0	7 0	
		Blue clay ...	10 0	17 0	
		Peat ...	1 0	18 0	
		Blue clay ...	6 0	24 0	
		Peat ...	2 0	26 0	
		Gravel ...	1 6	27 6	
		Warp clay ...	15 0	42 6	
		Running sand ...	16 0	58 6	
		Rock sand ...	11 0	69 6	
		Red sandstone ...	17 0	86 6	
		Red marl ...	1 0	87 6	
		Red sandstone ...	6 0	93 6	
		Red marl ...	1 6	95 0	
		Red sandstone ...	28 0	123 0	
7	Brayton (Selby R.)	Top soil ...	8 0	8 0	Brayton Vicarage, 1902 (Tubed with 3 inch tubing to 84 feet. Water level 12 feet from surface.)
		Warp clay ...	10 0	18 0	
		Sandy warp ...	6 0	24 0	
		Running sand ...	20 0	44 0	
		Rock sand ...	10 0	54 0	
		Red sandstone ...	68 0	122 0	
8	Burn ... (Selby R.)	Made ground ...	1 0	1 0	Henwick Hall, 1888
		Black peat ...	1 6	2 6	
		Black sand ...	2 0	4 6	
		Warp ...	1 0	5 6	
		Strong clay ...	20 0	25 6	
		Sand ...	9 6	35 0	
		Clay ...	25 0	60 0	
		Sand ...	6 0	66 0	
		Pan sand ...	10 0	76 0	
		Sandstone ...	15 0	91 0	
		Red marl ...	1 0	92 0	
		Sandstone ...	37 0	129 0	
		Red marl ...	1 0	130 0	
		Sandstone ...	28 0	158 0	
9	Burn ... (Selby R.)	Top soil ...	1 0	1 0	Henwick Cottages, 1888
		Sand ...	3 0	4 0	
		Clay ...	8 0	12 0	
		Sand ...	19 0	31 0	
		Clay ...	24 0	55 0	
		Sand ...	6 0	61 0	
		Sand and pebbles ...	4 0	65 0	
		Pan sand ...	33 0	98 0	
		Soft sandstone ...	3 0	101 0	
		Sandstone ...	35 0	136 0	
		Marl ...	1 0	137 0	
		Sandstone ...	21 8	158 8	
10	Barlow (Selby R.)	Top soil ...	2 0	2 0	Barlow Grange, 1888
		Clay ...	56 0	58 0	
		Sand ...	10 0	68 0	
		Pan sand ...	6 0	74 0	
		Red sandstone ...	59 0	133 0	

No.	Location of Boring. — Parish.	STRATA PASSED THROUGH.			Remarks.
		Description.	Thickness. Ft. in.	Depth to Base. Ft. in.	
11	Long Drax (Selby R.)	Top soil ... Clay warp ... Sandy warp ... Green sand warp ... Brown warp ... Dark warp ... Dark sand ... Red marl sand ... Sandstone ...	4 0 12 0 8 0 22 0 7 0 5 0 10 0 30 0 72 0	4 0 16 0 24 0 46 0 53 0 58 0 68 0 98 0 170 0	Langrick Well, 1899
12	Gateforth (Selby R.)	Top soil ... Sand ... Warp clay ... Dark sand ... Warp clay ... Red sand ... Red sandstone ...	1 0 9 0 12 0 5 0 14 0 9 0 74 0	1 0 10 0 22 0 27 0 41 0 50 0 124 0	Mr. Barras' Farm, 1902 (Tubed with 3 inch tubing to 66 feet. Water level four feet from surface)
13	Carlton (Selby R.)	Running sand ... Pan sand ... Red marl ... Sandstone ... Marly sandstone ... Soft sandstone ... Harder stone ...	19 0 31 0 2 0 5 0 38 0 10 0 50 0	19 0 50 0 52 0 57 0 90 0 100 0 150 0	Carlton Towers, 1895 (Not a very hard good stone)
14	Airmyn (Goole R.)	Top soil ... Sand ... Black peat ... Clay and warp ... Dark sand ... Pan sand ... Sandstone ...	1 6 7 6 1 6 29 0 15 0 46 0 ...	1 6 9 0 10 6 39 6 54 6 100 6 ...	1884
15	Hook... (Goole R.)	Warp ... Sandy warp ... Sand ... Clay ... Gravel ... Blue marl ... Do. ... Red marl ...	2 0 17 0 11 0 1 0 12 0 16 0 3 0 4 0	2 0 19 0 30 0 31 0 43 0 59 0 62 0 66 0	1886
16	Goole...	Drift 28 ft. { Warpy sand ... Warpy clay ... Peat ... Fine stiff clay ... Red clay ... Rough gravel ... Warpy clay ... Red sand ... Hard coarse light red sand ... Red marl ... Hard sand ... Red marl ... Hard sand ... Red marl ... Hard sand ... Red marl ... Hard sand ... Red marl ... Hard coarse sandstone with small pebbles ... Red sand and marl mixed ... Red sand ... Stiff red marl ... Marl and red sand ... Red sandy marl...	4 4 0 6 0 6 6 8 5 0 8 0 3 0 6 0 24 0 10 0 11 0 3 0 26 0 1 0 61 0 3 0 3 0 84 0 22 0 2 2 22 1 59 9	4 4 4 10 5 4 12 0 17 0 25 0 28 0 34 0 58 0 68 0 79 0 82 0 108 0 109 0 170 0 173 0 176 0 260 0 282 0 284 2 306 3 366 0	Trial boring for Waterworks Boothferry Road, Goole

No.	Location of Boring. — Parish.	STRATA PASSED THROUGH.			Remarks.
		Description.	Thickness. Ft. in.	Depth to Base. Ft. in.	
17	Goole	Drift 75 feet (Top sand ... Peat ... Clay ... Gravel ... Red clay ... Sand ... Hard sand ... Gravel and sand ... Clay and cobbles ... Red sandstone ...)	4 0 2 0 22 0 7 0 5 0 6 0 10 0 9 0 10 0 125 0	4 0 6 0 28 0 35 0 40 0 46 0 56 0 65 0 75 0 200 0	Pemberton's Brewery
18	Goole	Sand and clay ... Sandstone, soft ...	15 0 36 0	15 0 51 0	Plenty of good water
19	Goole Fields (Goole R.)	Made ground ... Yellow sand ... Warp ... Peat ... Warp clay ... Sandy warp ... Sand and gravel ... Rock sand ... Red sandstone ...	1 0 6 0 4 0 0 6 24 0 21 0 3 0 12 0 29 6	1 0 7 0 11 0 11 6 35 6 56 6 59 6 71 6 101 0	White House Farm, 1903 (water level 8 feet from surface)
20	Goole	Warp clay ... Running sand ... Rock sand ... Sandstone ...	30 0 10 0 10 0 62 0	30 0 40 0 50 0 112 0	Perey Lodge, 1902 (water level 5 feet from surface)
21	Reedness (Goole R.)	Drift 69 feet, 8 ins. (Dark Soil ... Yellow sandy warp ... Dark blue warp ... Fine blue warp ... Blue sandy warp ... Light grey sand, with water ... Black moor earth with rotten wood ... Strong blue clay ... Grey sand, with water ... Black gravel and quicksand, very sharp ... Red sand ... Grey sand and gravel ... Red sand ... Gravel and sharp sand ... Red marl with grey specks ... Red sandstone with alabaster and some thin hard lists ... Strong blue stone with thin white beds ... Dark red bind with white beds of alabaster ... Strong blue stone ... Red bind with thin beds of blue stone ... Blue stone ... Red bind with thin white beds and hard lists of blue stone ... Blue bind ... Red bind with thin hard lists of blue stone and thin beds of alabaster ... Red stone ... Red bind with hard lists of stone and white alabaster ... Blue stone ...)	1 6 3 3 4 6 6 0 6 0 9 0 11 9 3 3 0 9 10 3 1 5 5 4 3 4 3 4 3 2 8 1 9 2 18 3 1 8 10 3 4 10 8 6 2 0 7 7 8 8 16 10 4 4	1 6 4 9 9 3 15 3 21 3 30 3 42 0 45 3 46 0 56 3 57 8 63 0 66 4 69 8 72 10 80 11 90 1 108 4 110 0 120 3 125 1 133 7 135 7 143 2 151 10 168 8 173 0	

No.	Location of Boring. — Parish.	STRATA PASSED THROUGH.			Remarks.
		Description.	Thickness. Ft. in.	Depth to Base. Ft. in.	
21	Reedness, continued	Red bind with thin beds of alabaster ...	17 11	190 11	
		Blue bind ...	1 9	192 8	
		Red bind with thin beds of alabaster ...	6 8	199 4	
		Blue stone and white partings	0 2	199 6	
		Red stone and blue lists in it	19 8	219 2	
		Red bind with thin beds of alabaster ...	22 6	241 8	
		Red stone ...	5 6	247 2	
		Blue stone ...	4 0	251 2	
		Red bind with hard lists of stone and white partings ...	6 6	257 8	
		Red stone with thin white partings ...	5 6	263 2	
		Blue stone with thin beds and blue bind partings ...	6 6	269 8	
		Blue bind with thin beds of blue stone ...	16 6	286 2	
		Red bind with thin beds of alabaster ...	11 0	297 2	
		Blue bind with soft beds of alabaster ...	8 3	305 5	
		Dark soft red bind ...	32 5	337 10	
		Blue stone ...	4 0	341 10	
		Red sandstone soft at top and gets harder lower down ...	169 6	511 4	
		Red bind ...	2 0	513 4	
		Red sandstone ...	16 6	529 10	
		Red bind with lists of blue stone ...	3 6	533 4	
		Red sandstone ...	233 6	766 10	
		Red bind with bright shining specks ...	3 2	770 0	
		Dark red bind ...	2 10	772 10	
		Red sandstone ...	11 6	784 4	
		Dark red bind ...	1 0	785 4	
		Red sandstone ...	19 6	804 10	
		Red bind ...	2 3	807 1	
		Red stone ...	74 3	881 4	
		Red bind ...	1 0	882 4	
		Red stone ...	24 6	906 10	
		Soft red bind ...	3 10	910 8	
		Red sandstone ...	20 2	930 10	
		Dark red bind ...	1 0	931 10	
		Red sandstone ...	24 0	955 10	
		Dark red bind ...	1 3	957 1	
		Red sandstone ...	38 3	995 4	
		Light red sandstone ...	3 0	998 4	
		Red sandstone ...	30 8	1029 0	
21A	Kellington (Pontefract R.)	Drift sand and gravel ...	15 0	15 0	Pontefract Waterworks (Roall)
		New Red Sandstone ...	205 0	220 0	
22	Pollington (Goole R.)	Soil ...	2 0	2 0	Goole Public Supply, average yield 420,000 gallons per day
		Sand ...	10 0	12 0	
		Soft red sandstone ...	34 0	46 0	
		Red marl ...	1 4	47 4	
		Red sandstone ...	32 8	80 0	
		Fine red sandstone ...	31 6	111 6	
		Marly sandstone ...	0 6	112 0	
		Fine red sandstone ...	20 6	132 6	
		Marly sandstone ...	6 6	139 0	
		Fine red sandstone ...	11 0	150 0	
		Grey marl ...	1 0	151 0	
		Red sandstone ...	21 0	172 0	
		Grey marl ...	6 6	178 6	
		Fine red sandstone ...	42 6	221 0	

No.	Location of Boring. — Parish.	STRATA PASSED THROUGH.				Remarks.		
		Description.	Thickness.		Depth to Base.			
			Ft.	in.	Ft.	in.		
23	Snaith (Goole R.)	Top clay	...	7	0	7	0	Bever Bridge
		Warp clay	...	14	0	21	0	
		Grey sand	...	8	0	29	0	
		Gravel	...	1	0	30	0	
		Running sand	...	10	0	40	0	
		Pau sand	...	7	0	47	0	
		Red marl	...	22	0	69	0	
		Red sand	...	1	0	70	0	
		Red sandstone	...	30	0	100	0	
		Sandstone	...	34	0	134	0	
		Red Marl	...	6	0	140	0	
		Sandstone	...	17	6	157	6	
24	Rawcliffe Bridge (Goole R.)	Soil	...	2	0	2	0	Goole Old Waterworks
		Sand	...	9	0	11	0	
		Clay	...	22	6	33	6	
		Sand, gravel and boulders	...	3	0	36	6	
		Sandstone	...	325	6	362	0	
		Red marl	...	4	0	366	0	
		Sandstone	...	30	0	396	0	
		Marl	...	2	0	398	0	
		Sandstone	...	25	0	423	0	
		Marl	...	27	0	450	0	
		Sandstone	...	275	0	725	0	
		Marl	...	3	0	728	0	
		Sandstone	...	72	0	800	0	
		Marl	...	7	0	807	0	
		Sandstone	...	88	0	895	0	
		Grey rock	...	1	0	896	0	
		Marl	...	5	0	901	0	
		Sandstone	...	20	6	921	6	
		Marl	...	3	6	925	0	
		Sandstone	...	11	0	936	0	
		Marl	...	4	0	940	0	
		Sandstone	...	57	0	997	0	
		Marl	...	3	0	1000	0	
25	Rawcliffe (Goole R.)	Soil and sand	...	4	0	4	0	1888
		Strong clay	...	23	0	27	0	
		Sand	...	15	0	42	0	
		Pan sand	...	18	0	60	0	
		Soft sandstone	...	125	0	185	0	
		Red marl	...	2	0	187	0	
		Soft sandstone	...	11	0	198	0	
		Marl	...	1	0	199	0	
		Sandstone	...	30	0	229	0	
		Red Marl	...	1	0	230	0	
		Sandstone	...	33	0	263	0	
		26	Rawcliffe (Goole R.)	Soil and sand	...	4	0		4	0	24 inch bore hole, 1889
Warp clay	...			23	0	27	0	
Sand and gravel...	...			15	0	42	0	
Pan sand	...			18	0	60	0	
Soft sandstone	...			54	0	114	0	
Red marl	...			1	0	115	0	
Marly stone	...			10	0	125	0	
Red sandstone	...			110	0	235	0	
Red marl	...			1	0	236	0	
Red sandstone	...			50	0	286	0	
Coarse red sandstone	...			24	0	310	0	
Hard red stone	...			1	0	311	0	
Sandstone	...			20	0	331	0	

No.	Location of Boring. — Parish.	STRATA PASSED THROUGH.			Remarks.
		Description.	Thickness. Ft. in.	Depth to Base. Ft. in.	
27	Rawcliffe (Goole R.)	Made ground ... Warp ... Sand ... Gravel and sand... Pan sand ... Red sandstone ... Red marl ... Red sandstone ... Red marl ... Red sandstone ...	3 6 20 0 8 0 6 0 10 0 78 0 1 6 20 0 1 0 106 0	3 6 23 6 31 6 37 6 47 6 125 6 127 0 147 0 148 0 254 0	Sugar Works, 1889
28	Rawcliffe (Goole R.)	Made ground ... Warp ... Sand ... Gravel ... Pan sand ... Soft red sandstone	3 6 30 0 10 0 6 0 10 0 60 6	3 6 33 6 43 6 49 6 59 6 120 0	Royal Hotel
29	Thorne (Thorne R.)	Warp clay ... Sand ... Strong clay ... Sand and gravel... Red sand ... Red sandstone ...	25 0 12 0 10 0 12 0 5 0 48 0	25 0 37 0 47 0 59 0 64 0 112 0	Moorend Cottages, 1903 (water level 3 feet from surface)
30	Thorne (Thorne R.)	Peat ... Sand ... Clay, sand and gravel Sandstone ...	17 0 10 0 29 0 28 0	17 0 27 0 56 0 84 0	Moorend
31	Fenwick (Doncaster R.)	Top soil ... Sandy clay ... Sand and gravel ... Rock sand ... Red sandstone ...	2 0 19 0 31 0 10 0 46 0	2 0 21 0 52 0 62 0 108 0	Went Farm 1902 (water level 8 feet from surface)
32	Fenwick (Doncaster R.)	Loamy clay ... Do. (soft) ... Gravel and sand ... Fine sandy warp ... Clay, stones, and sand ... Blue clay ... Clay and stones ... Sand ... Clay ... Gravel ... Clay ... Soft sandstone ...	16 0 8 0 3 0 5 0 8 0 30 0 5 0 2 0 13 0 1 0 3 0 56 0	16 0 24 0 27 0 32 0 40 0 70 0 75 0 77 0 90 0 91 0 94 0 150 0	Ladythorpe Farm, 1903 (water level 8 feet from surface)
33	Moss ... (Doncaster R.)	Warp clay ... Sand ... Strong clay ... Shaly clay ...	20 0 7 0 10 0 10 0	20 0 27 0 37 0 47 0	1895
34	Moss ... (Doncaster R.)	Clay ... Sandy clay ... Rough gravel ... Rough sand ... Sand clay ... Rubble stone ...	22 0 2 0 1 0 25 0 20 0 10 0	22 0 24 0 25 0 50 0 70 0 80 0	
35	Thorne (Thorne R.)	Alluvial deposit ... Sandstone (bunter)	16 0 284 0	16 0 300 0	Brewery

No.	Location of Boring. — Parish.	STRATA PASSED THROUGH.			Remarks.
		Description.	Thickness. Ft. in.	Depth to Base. Ft. in.	
36	Thorne (Thorne R.)	Earth and sand ... Strong clay ... Sand and marl ... Sandstone ...	3 0 3 6 25 6 22 0	3 0 6 6 32 0 54 0	Clifton Lodge
37	Stainforth (Thorne R.)	Sand ... Gravel ... Sandstone ... Sandstone (light) ...	9 0 4 0 46 0 19 0	9 0 13 0 59 0 78 0	Grange, 1895 (plenty of good water)
38	Hatfield (Thorne R.)	Sand ... Sand and gravel ... Sandstone red ... Sandstone green ...	17 0 9 0 7 0 41 0	17 0 26 0 33 0 74 0	Five boreholes (plenty of good water)
39	Hatfield (Thorne R.)	Sand ... Sandstone ...	13 0 54 0	13 0 67 0	Woodhouse, 1891 (plenty of water)
40	Hatfield (Thorne R.)	Sand ... Sandstone ...	11 0 28 0	11 0 39 0	Woodhouse Grange, 1901 (good supply of good water)
41	Arksey (Doncaster R.)	Sand ... " yellow and clay ... " brown ... Clay ... Sand ... " and gravel ... " and clay ... Clay blue (with coal 1 inch) ... " (with sand) ... Sand variegated... " clay and small coal ... " dark grey ... " " (clay and coal) ... " fine ... Clay hard ... Sand ... Clay with little coal ... " dark blue ... " and gravel... " " with little coal ... Sandstone hard ... Gravel light ...	6 6 6 0 7 6 1 6 3 3 19 0 3 0 8 0 4 6 12 6 10 9 11 0 8 9 13 6 8 0 4 4 4 2 1 6 2 0 6 6 4 6 4 0	6 6 12 6 20 0 21 6 25 0 44 0 47 0 55 0 59 6 72 0 82 9 93 9 102 6 116 0 124 0 128 4 132 6 134 0 136 0 142 6 147 0 151 0	Plough Inn, 1903
42	Bentley (Doncaster R.)	Sand ... Clay ... Sand, light ... Sandstone, soft ... " very soft ... " dark red ... " hard, light ... " light ...	22 0 3 0 6 0 8 0 3 0 16 0 3 0 11 0	22 0 25 0 31 0 39 0 42 0 58 0 61 0 72 0	(1900) — good stream of water — second stream of good water
43	Armthorpe (Doncaster R.)	Soil ... Clay ... Sandstone ...	6 0 13 0 20 0	6 0 19 0 39 0	Plenty of good water
44	Kirk Sandal (Doncaster R.)	Clay ... Gravel ... Pan sand ... Sandstone ...	4 0 16 0 22 0 78 0	4 0 20 0 42 0 120 0	Sandal Beat, 1894 (water level 3 feet from surface)

No.	Location of Boring. Parish.	STRATA PASSED THROUGH.			Remarks.
		Description.	Thickness. Ft. in.	Depth to Base. Ft. in.	
45	Balby - with - Hexthorpe	Top soil ...	1 6	1 6	Balby Carr, 1890
		Peat ...	0 6	2 0	
		Warp ...	8 0	10 0	
		Clay ...	3 0	13 0	
		Sand ...	8 0	21 0	
		Pan sand ...	20 0	41 0	
		Marl ...	1 0	42 0	
		Pan sand ...	12 0	54 0	
		Marl ...	1 0	55 0	
		Pan sand ...	5 0	60 0	
		Marl ...	0 6	60 6	
		Pan sand ...	1 0	61 6	
		Marl ...	10 0	71 6	
46	Cantley (Doncaster R.)	Earth ...	2 0	2 0	Vicarage, 1896 (a good supply of water)
		Sand and gravel ...	25 0	27 0	
		Sandstone ...	62 0	89 0	
47	Rossington (Doncaster R.)	Sand ...	15 0	15 0	1900 (a supply of good water)
		Sand and gravel... ..	7 0	22 0	
		Sandstone ...	53 0	75 0	
		Sandstone, soft ...	56 0	131 0	
48	Rossington (Doncaster R.)	Sand ...	6 0	6 0	Hunster Grange, 1901 (a supply of good water)
		Clay ...	94 0	100 0	
		Sand and gravel... ..	29 0	129 0	
49	Austerfield (Doncaster R.)	Sand ...	19 0	19 0	(Plenty of good water, 1902)
		Sandstone, red ...	88 0	107 0	

OUTSIDE THE WEST RIDING:—

50	Newton-on-Ouse (North Riding)	Top soil ...	1 0	1 0	March, 1888. (Water level 32 feet from surface)
		Red clay ...	3 0	4 0	
		Warp ...	7 0	11 0	
		Sand ...	25 0	36 0	
		Sand and warp ...	20 0	56 0	
		Warp clay ...	16 0	72 0	
		Yellow clay ...	1 0	73 0	
		Light sandstone... ..	17 0	90 0	
		Soft red sandstone	24 6	114 6	
		Red marl ...	0 6	115 0	
		Soft sandstone ...	105 0	220 0	
51	York City	Red sand ...	7 0	7 0	North Riding Lunatic Asylum Water stands 17 ft. from the surface after pumping at the rate of 7,000 gallons per hour; 70,000 gallons per day have been pumped without lowering the water level
		Peat ...	1 0	8 0	
		Drift 44 ft. Blue clay ...	13 0	21 0	
		Boulder drift ...	23 0	44 0	
		Red sand ...	10 0	54 0	
		Soft red sandstone and layers of grey marl (slate) ...	16 0	70 0	
		White sandstone ...	23 0	93 0	
		Red sandstone with quartz, pebbles, and layers of red clay and soft slate ...	25 0	118 0	
		White sandstone ...	10 0	128 0	
		Red clay ...	0 6	128 6	
		Red sandstone ...	20 0	148 6	
		White sandstone ...	8 0	156 6	
		Red clay ...	1 0	157 6	
		White sandstone ...	15 0	172 6	
		Red sandstone ...	3 0	175 6	
		White sandstone, containing much water ...	2 0	177 6	
		White sandstone ...	11 0	188 6	
		Red sandstone ...	42 0	230 6	

No.	Location of Boring. — Parish.	STRATA PASSED THROUGH.			Remarks.
		Description.	Thickness. Ft. in.	Depth to Base. Ft. in.	
52	York City	... Clay and stones... ... Quicksand Sandstone, fine Parting with water Sandstone, fine ...	... 24 0 ... 60 0 ... 204 0 ... 0 2 ... 279 0	... 24 0 ... 84 0 ... 288 0 ... 288 2 ... 567 2	Walmgate
53	Dunnington (East Riding)	... Top soil Soft sand Sharp sand Sand and gravel full of water... ... Dark coloured clay Strong blue clay with large boulders in ...	... 1 6 ... 4 6 ... 2 0 ... 7 6 ... 2 6 ... 6 6	... 1 6 ... 6 0 ... 8 0 ... 15 6 ... 18 0 ... 24 6	(1903)
54	Naburn (East Riding)	... Top soil Red clay Sand and gravel Red clay Boulder clay Blue clay Red sand Light sandy greystone, very soft Grey sandstone ...	... 4 6 ... 7 6 ... 5 0 ... 10 0 ... 14 0 ... 29 0 ... 12 0 ... 18 0 ... 60 0	... 4 6 ... 12 0 ... 17 0 ... 27 0 ... 41 0 ... 70 0 ... 82 0 ... 100 0 ... 160 0	New cottages, 1894. (Water level 10 feet from surface)
55	Naburn (East Riding)	... Warp clay Dark clay Stronger clay Sand and gravel Warp clay with bands blue marl ... Red sand Soft, light, sandy greystone Grey sandstone ...	... 20 0 ... 20 0 ... 6 0 ... 7 0 ... 11 0 ... 16 0 ... 24 0 ... 56 0	... 20 0 ... 40 0 ... 46 0 ... 53 0 ... 64 0 ... 80 0 ... 104 0 ... 160 0	Naburn Lock, 1894. (Water level 6 feet from surface)
56	Riccall (East Riding)	... Sand Clay Grey sand Blue clay Red clay Warp Marly stone Red marl Marly stone Red marl Marly stone Red sandstone Marl Red sandstone ...	... 9 0 ... 4 0 ... 16 0 ... 33 0 ... 9 0 ... 4 0 ... 32 0 ... 1 0 ... 33 0 ... 7 0 ... 6 0 ... 20 0 ... 8 0 ... 51 0	... 9 0 ... 13 0 ... 29 0 ... 62 0 ... 71 0 ... 75 0 ... 107 0 ... 108 0 ... 141 0 ... 148 0 ... 154 0 ... 174 0 ... 177 0 ... 228 0	1889
57	Osgodby (East Riding)	... 25 ft. Loamy soil Clay Sand Clay Red sandstone	... 2 0 ... 4 0 ... 4 0 ... 15 0 ... 175 0	... 2 0 ... 6 0 ... 10 0 ... 25 0 ... 200 0	
58	Cliff Common (East Riding)	... Warp clay Grey sand Strong clay Grey sand Soft grey sandstone	... 40 0 ... 12 0 ... 16 0 ... 10 0 ... 88 0	... 40 0 ... 52 0 ... 68 0 ... 78 0 ... 166 0	Maltkiln, 1902 (Water level 10 feet from surface)

No.	Location of Boring. — Parish.	STRATA PASSED THROUGH.			Remarks.
		Description.	Thickness. Ft. in.	Depth to Base. Ft. in.	
59	Crowle (Linc.)	Blue Clay	60 0	60 0	New Trent Brewery (Water level 5 feet from surface)
		Rock, water and alabaster	2 6	62 6	
		Clay	15 0	77 6	
		Rock	5 0	82 6	
		Clay	15 0	97 6	
		Rock	5 0	102 6	
		Clay	15 0	117 6	
		Rock	5 0	122 6	
		Clay	15 0	137 6	
		Rock	2 6	140 0	
		Clay	5 0	145 0	
60	Crowle (Linc.).	Sand	10 0	10 0	(Good supply of good water, 1887)
		Gravel	3 0	13 0	
		Water stone	114 0	127 0	
61	Finningley (Notts.)	Clay	10 0	10 0	Bank End, 1902.
		Sand, fine	17 0	27 0	(Good supply of good water)
		Sandstone, with little limestone	59 0	86 0	
62	Garthorpe (Linc.)	Sand	17 0	17 0	(Good supply of good water, 1890)
		Sandstone	12 0	29 0	
		Sand, soft	11 0	40 0	
		Sandstone and gravel	32 0	72 0	
63	Southcar (Linc.)	Soil	1 6	1 6	Mineral bore continued to 3186 feet, but excellent water was found between 740 feet and 1018 feet.
		Sand	8 0	9 6	
		Sand and clay	6 6	16 0	
		Sandy clay	3 6	19 6	
		Sand	9 0	28 6	
		Sandy clay	0 6	29 0	
		Sand and gravel	3 0	32 0	
		Marl, red and blue	3 0	35 0	
		" " with gypsum	10 6	45 6	
		Sandstone, grey... ..	1 0	46 6	
		Limestone, grey... ..	1 6	48 0	
		Marl, red and blue, sandy with gypsum	40 7	88 7	
		Marl, red and blue, with gypsum	4 0	92 7	
		" blue, with gypsum	15 0	107 7	
		" red and blue, with gypsum and sandstone	24 0	131 7	
		" red	6 0	137 7	
		Sandstone, red and grey	105 8	243 3	
		" " with marl	30 11	274 2	
		" "	158 1	432 3	
		" " with blue shale	34 0	466 3	
		Sandstone, red and grey	15 0	481 3	
		" " " with shale and marl	98 4	579 7	
		Sandstone, red and grey	13 0	592 7	
		" " " with shale and marl	78 1	670 8	
		Sandstone, red	75 6	746 2	
		" " with pebbles	206 10	953 0	
		" " " and marl	10 0	963 0	
		" " with pebbles	55 1	1018 1	
		" " with marl	11 6	1029 7	
		" "	35 5	1065 0	
		" " with marl	115 6	1180 6	
		Marl, red, and grey with gypsum	1 0	1181 6	

No.	Location of Boring. — Parish.	STRATA PASSED THROUGH.			Remarks.
		Description.	Thickness. Ft. in.	Depth to Base. Ft. in.	
64	Gainsborough (Linc.)	Marl ...	709 0	709 0	Town's supply. (Pump fixed 300 feet below surface)
		Light red marl ...	16 0	725 0	
		Very fine red sandstone ...	25 0	750 0	
		Coarser " " ...	50 0	800 0	
		Fine " " ...	20 0	820 0	
		Red marl ...	10 0	830 0	
		Light red sandstone and pebbles ...	40 0	870 0	
		Red marl ...	10 0	880 0	
		Light red sandstone ...	26 0	906 0	
		Red marl ...	5 0	911 0	
		Light red sandstone ...	19 0	930 0	
		Micaceous sandstone with pots of marl ...	20 0	950 0	
		Light red sandstone with pebbles ...	10 0	960 0	
		Sandstone with marl pots ...	28 0	988 0	
		Sandstone and pebbles ...	50 0	1038 0	
		Coarse sandstone ...	75 0	1113 0	
		" " with pebbles ...	25 0	1138 0	
		Fine sandstone with hard beds ...	50 0	1188 0	
		Coarse sandstone ...	44 0	1232 0	
		Sandstone, with pebbles ...	31 0	1263 0	
		Fine red sandstone ...	16 0	1279 0	
		Marl ...	7 0	1286 0	
		Coarse red sandstone ...	26 0	1312 0	
		Red sandstone with pebbles ...	125 0	1437 0	
		Fine sandstone ...	50 0	1487 0	
		" " with marl pots ...	28 0	1515 0	
65	Scunthorpe (Linc.)	Soil ...	1 0	1 0	Quantity of water ample, but highly charged with mineral matter
		Running sand ...	20 3	21 3	
		Rhaetics ...	0 10	22 1	
		Keuper marls ...	863 11	886 0	
		Grey sandstones ...	4 0	890 0	
		Keuper sandstones ...	367 0	1257 0	
		Red and blue marls ...	7 0	1264 0	
		Red sandstones ...	203 0	1467 0	
		" " (Bunter with pebbles) ...	300 6	1767 6	
66	East Retford (Notts.)	Soft red marl and sandstone ...	11 6	11 6	Coal Company ...
		Red and grey marlstone and grey pumice ...	30 6	42 0	
		Red sandstone ...	123 0	165 0	
		Grey and red marl ...	3 0	168 0	
		Red sandstone ...	92 6	260 6	
		Red sandstone and gravel ...	1 6	262 0	
		Red sandstone ...	220 0	492 0	
		Red marl and gravel ...	1 6	493 6	
		Red sandstone ...	142 6	636 0	
		Pebbles or conglomerate ...	8 0	644 0	
		Red sandstone ...	70 0	714 0	
		Red marl ...	3 0	717 0	
		Red sandstone ...	69 0	786 0	
		Red and grey marl mixed with red and white sandstone ...	99 0	885 0	
		Red marl and limestone ...	7 0	892 0	
67	Scarle (Notts.)	River gravel ...	21 0	21 0	Permian, 519 feet.
		Lias clay and limestone ...	29 0	50 0	
		Rhaetic shales and sand stones ...	15 0	65 0	
		Keuper marls with gypsum ...	688 0	753 0	
		Keuper sandstones (water bearing) ...	205 6	958 6	
		Bunter pebble beds ...	318 6	1277 0	
		Lower bunter, marl, &c. ...	223 0	1500 0	
		Marls ...	118 6	1618 6	
		Magnesium Limestone ...	43 6	1662 0	
		Marl and sandstone ...	150 0	1812 0	
		Magnesium Limestone ...	68 0	1880 0	
		Sand stone ...	20 0	1900 0	
		Marl slates ...	118 0	2018 0	
		Coarse Grit and Breccia ...	1 0	2019 0	
		Coal measure shales ...	12 0	2031 0	

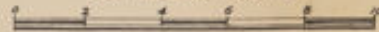
Name of Person	Rank	Service	Remarks
1. John Smith	Private	1st Regt. Inf.	Discharged
2. James Brown	Private	2nd Regt. Inf.	Discharged
3. William Jones	Private	3rd Regt. Inf.	Discharged
4. Robert Taylor	Private	4th Regt. Inf.	Discharged
5. Thomas White	Private	5th Regt. Inf.	Discharged
6. Charles Black	Private	6th Regt. Inf.	Discharged
7. Henry Green	Private	7th Regt. Inf.	Discharged
8. George Hall	Private	8th Regt. Inf.	Discharged
9. Edward King	Private	9th Regt. Inf.	Discharged
10. Frank Lewis	Private	10th Regt. Inf.	Discharged

Name of Person	Rank	Service	Remarks
11. Daniel Miller	Private	11th Regt. Inf.	Discharged
12. John Wilson	Private	12th Regt. Inf.	Discharged
13. James Moore	Private	13th Regt. Inf.	Discharged
14. William Taylor	Private	14th Regt. Inf.	Discharged
15. Robert White	Private	15th Regt. Inf.	Discharged
16. Thomas Black	Private	16th Regt. Inf.	Discharged
17. Charles Green	Private	17th Regt. Inf.	Discharged
18. Henry Hall	Private	18th Regt. Inf.	Discharged
19. George King	Private	19th Regt. Inf.	Discharged
20. Edward Lewis	Private	20th Regt. Inf.	Discharged
21. Frank Miller	Private	21st Regt. Inf.	Discharged
22. Daniel Wilson	Private	22nd Regt. Inf.	Discharged
23. James Moore	Private	23rd Regt. Inf.	Discharged
24. William Taylor	Private	24th Regt. Inf.	Discharged
25. Robert White	Private	25th Regt. Inf.	Discharged
26. Thomas Black	Private	26th Regt. Inf.	Discharged
27. Charles Green	Private	27th Regt. Inf.	Discharged

SKETCH GEOLOGICAL MAP OF THE EASTERN PORTION OF THE WEST RIDING OF YORKSHIRE.

SCALE:

Four Miles to One Inch.



REFERENCE.

County Boundary

Alluvial Deposits

New Red Sandstone

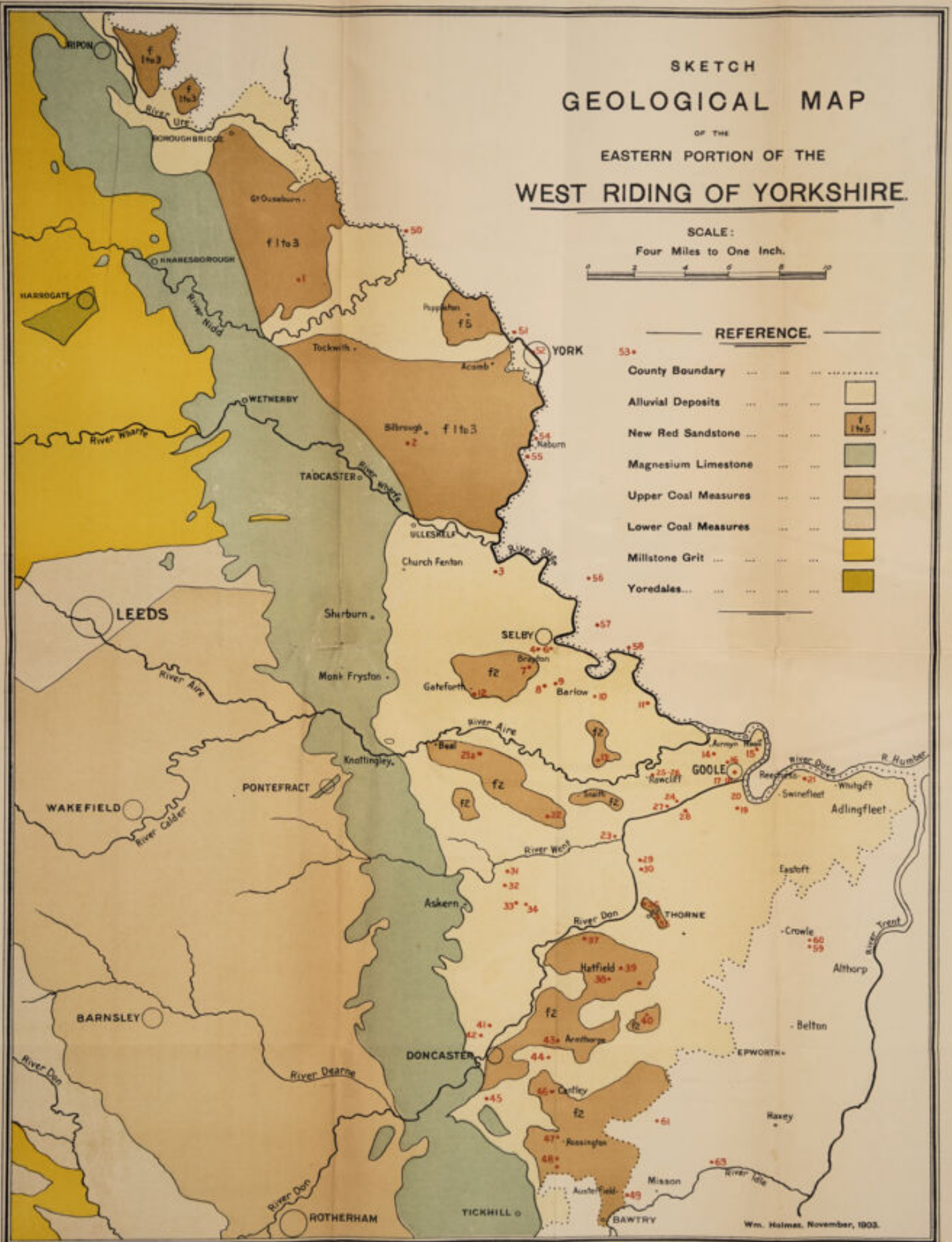
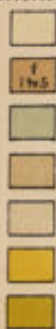
Magnesium Limestone

Upper Coal Measures

Lower Coal Measures

Millstone Grit

Yoredales



Wm. Holmes, November, 1903.

