



Historic Building Recording of Gasholders at the Black Lane Gasholder Station Macclesfield, Cheshire

Report No. 16/210

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OAS/S REPORT FORM

PROJECT DETAILS		OAS/S molanort1-271512
Project title	Historic Building Recording of Gasholders at the Black Lane Gasholder Station, Macclesfield, Cheshire	
Short description	Museum of London Archaeology carried out a programme of historic building recording at the Black Lane Gasholder Station, Macclesfield between June 2015 and September 2016. Recording comprised an enhanced Level 2 photographic record of two gasholders, and associated pipes and structures. Gasholder 1 dated to 1924 and was of a spiral-guided design. It was set into the brick tank of a c1870 column-guided gasholder. Gasholder 2 was constructed by 1884 and was of a column-guided design with twelve cast iron columns. The columns had simple classical detailing and decorative florets were fixed to the frame. Both gasholders have been dismantled to allow redevelopment of the site.	
Project type	Historic Building Survey	
Previous work	Unknown	
Future work	Unknown	
Monument type and period	Late 19th and early 20th-century gasholders	
PROJECT LOCATION		
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Site address	Black Lane, Macclesfield, Cheshire	
NGR	SJ 92040 74240	
Area	0.4 ha	
PROJECT CREATORS		
Organisation	Museum of London Archaeology	
Project brief originator	Montagu Evans on behalf of National Grid	
Project Design originator	Museum of London Archaeology	
Director/Supervisor	Amir Bassir	
Project Manager	Amir Bassir	
Sponsor or funding body	Montagu Evans on behalf of National Grid	
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End date	September 2016	
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Historic Building Recording of Gasholders at the Black Lane Gasholder Station Macclesfield, Cheshire

Abstract

Museum of London Archaeology carried out a programme of historic building recording at the Black Lane Gasholder Station, Macclesfield between June 2015 and September 2016. Recording comprised an enhanced Level 2 photographic record of two gasholders, and associated pipes and structures. Gasholder 1 dated to 1924 and was of a spiral-guided design. It was set into the brick tank of a c1870 column-guided gasholder. Gasholder 2 was constructed by 1884 and was of a column-guided design with twelve cast iron columns. The columns had simple classical detailing and decorative florets were fixed to the frame. Both gasholders have been dismantled to allow redevelopment of the site.

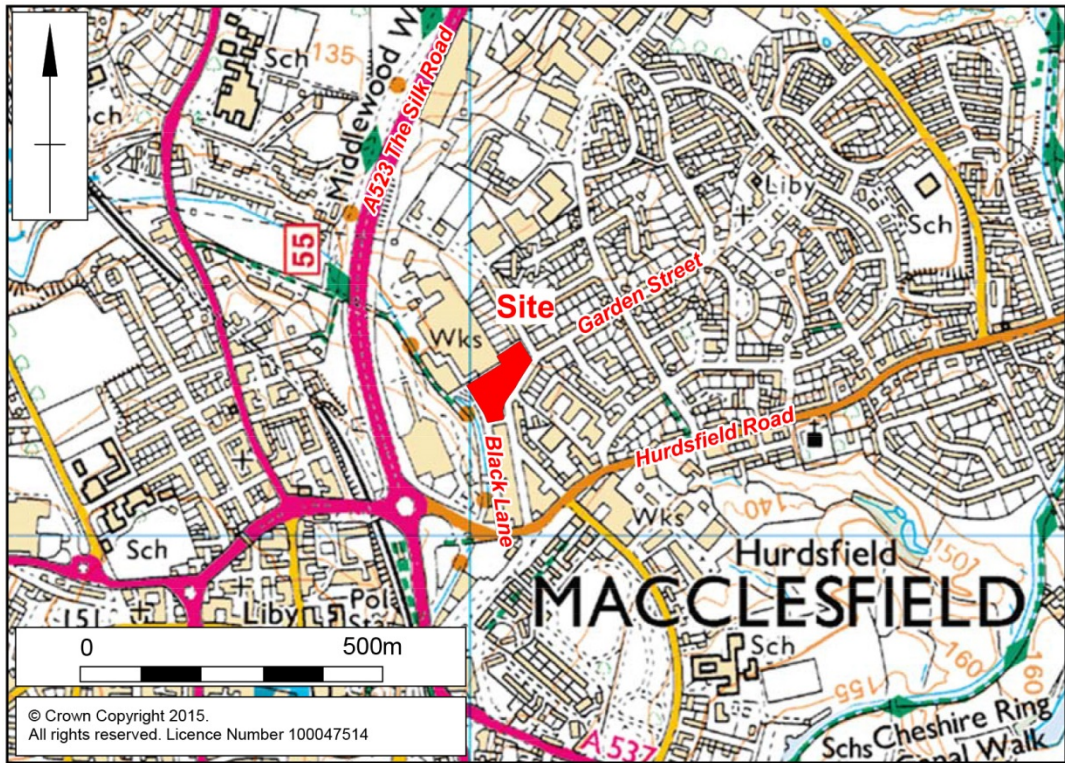
1 INTRODUCTION

MOLA (Museum of London Archaeology) was commissioned in May 2015 by Montagu Evans, acting on behalf of National Grid, to undertake a programme of historic building recording at the Black Lane Gasholder Station, Black Lane, Macclesfield (NGR SJ 92040 74240, Figs 1 and 2).

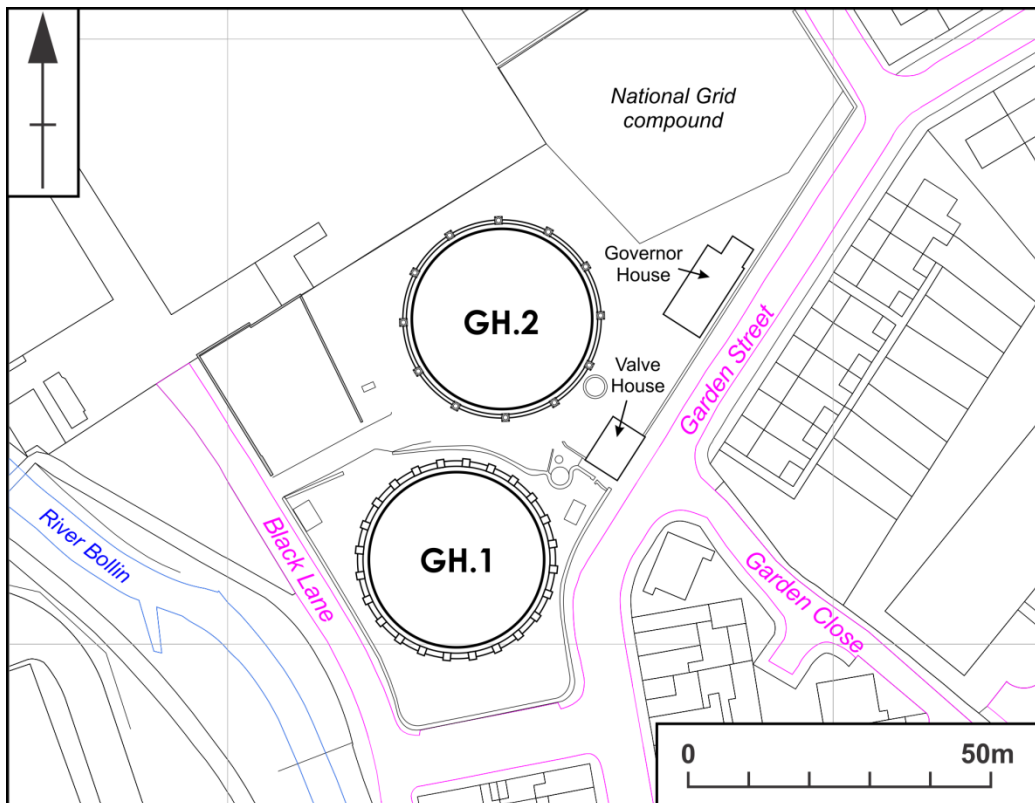
The survey is a voluntary exercise commissioned by National Grid as part of their commitment to the heritage of their broader estate. The gasholders are due to be demolished to allow for future development of the site. This report is in response to a Historic Building Recording brief by Montagu Evans (Montagu Evans 2015) and in accordance with current best archaeological practice as defined in the Chartered Institute for Archaeologists' *Standard and Guidance for the Archaeological Investigation and Recording of Standing Buildings or Structures* (CIfA 2014) and the Historic England documents *Understanding Historic Buildings, a Guide to Good Recording Practice* (HE 2016), and *Management of Research Projects in the Historic Environment* (HE 2015). The survey methodology was set out in an agreed Written Scheme of Investigation (MOLA 2015).

The Black Lane Gasholder Station is located at the south-western edge of the Hurdsfield district of Macclesfield, close to the intersection of the B5470 Hurdsfield Road and the A523 Silk Road (Fig 1). The site fronts onto Garden Street to the south and east and is bound to the west by Black Lane. North of the site is a disused industrial site with large buildings dating to the late 19th century. The surrounding land is of mixed use, both residential and industrial.

The site comprised two gasholders and associated pipework as well as the former Governor House and Valve House. The north-eastern corner of the site was a National Grid compound. Gasholder 1 was spiral-guided and dated to 1924, thus being an early example of its type. This holder replaced an earlier holder of c1870 which formerly occupied the same footprint. Gasholder 2 was a column-guided type dating to 1884.



Site location Fig 1



The survey area Fig 2

2 OBJECTIVES AND METHODOLOGY

The objectives of this survey as set out in the brief were to:

- Produce an illustrated, written document detailing the fabric, appearance and form of the gasholders and associated structures and pipework. Due to the safety constraints associated with gasholders, recording was limited to the exterior of the structures;
- Provide historical survey drawings (or sketches) for comparable investigation relating to building form and function, identification of fixtures and fittings where visible or accessible;
- Provide an account of historic fixtures, fittings and architectural features where visible or accessible;
- Provide a photographic record of the structures in context.

The level of recording was specified as enhanced Level 2 – a descriptive record (English Heritage 2006, 14). This is defined by English Heritage as consisting of:

- A systematic account of the building's origins, development and use;
- A drawn and photographic record to illustrate the building's appearance and structure as well as measured drawings of specific elements of historic or architectural interest.

Recording was carried out in two phases. Phase I encompassed pre-demolition recording of the extant elements of the site whilst Phase II comprised recording of any areas not visible or accessible during Phase I. The demolitions contractor, KDC Ltd, maintained an informal photographic record during their works. This was complemented by formal photography by MOLA at key intervals in the dismantling process.

Phase I recording was carried out in June 2015. The site was photographically recorded to include general shots of the site and structures, placing them within their wider context, and detailed views of any structural, historic and architectural details that will be lost during demolition. Measured plans and elevations of the standard footings were made and these were also photographically recorded with the aim of producing a 3D model of these elements (electronic appendix 1).

Additional recording during dismantling works was undertaken on 7th September 2016. This included photographic recording of the dumpling and below-ground tank, and details of selected roller carriages which were retained for that purpose during dismantling works. Measured elevation drawings were also carried out of the roller carriages.

An example of gasholder 2's decorative florets was set aside and retained by MOLA with the aim of producing a photogrammetric 3D model of this element. Photogrammetric models were also produced of an example column base of gasholder 2, a multiple roller carriage from gasholder 1, and the siphon pit adjacent to the Valve House. The models, which are included in the digital archive, were created using Agisoft Photoscan at a high or medium density resolution point cloud. The models have been outputted as interactive PDF files which require Adobe Acrobat Pro 9 or above to view.

Photography was carried out using Nikon D7000 and D7200 DSLRs equipped with Sigma 35-17mm, Nikon 18-70mm and Nikon 35mm lenses. Black and white 35mm film photography was carried out using a Nikon F80 SLR equipped with a Sigma 10-20mm lens, using Ilford HP5 Plus 400 film. The photos are reproduced on archive quality photographic paper, submitted alongside this report. Additional supplementary photography was carried out by the demolitions contractor, KDC, and consultants, Advisian.

In this report, the former gasworks, located to the south-west of the site, will be referred to as the gasworks and the survey area containing the gasholders will be referred to as the gasholder station.

Throughout the text metric measurements are given for larger dimensions or those which were surveyed by the author. Imperial measurements are used when taken from historic documentation or for fabricated elements which are traditionally described in imperial units.

3 HISTORICAL BACKGROUND

3.1 Development of the Macclesfield Gasworks

Much of the following information about the early history of gas lighting in Macclesfield and the origins of the gas company was obtained from a succinct and detailed article which appears in *A Walk Through the Public Institutions of Macclesfield*, a collation of articles describing the early history and development of various public services, institutions and buildings of the town (The Macclesfield Courier and Herald 1888). The late 19th-century and 20th-century gas minutes held at the Cheshire archives were examined by the author; however these were hand inked and proved extremely difficult to read and were therefore of very limited use for the purpose of this report. Few other literatures referencing the gas company were found during the course of research.

Gas manufacture in Britain, which at its beginnings in the early 19th century consisted mainly of small scale, private works, experimental installations, and novelty public displays, experienced a rapid development and growth and swiftly became a serious alternative source of lighting.

A very fair idea of the rapid progress made by the industry in the first few years may be gained from the writings of Accum. In 1815 he reports that "more than 4000 Argand's lamps now burn coal-gas in this metropolis." and that the total length of mains in London "exceeds twenty-six miles". Four years later he describes the progress made "within these few years" as "uncommonly rapid." According to his estimates the number of gas-lights now in use in London "amounts to upwards of fifty-one thousand" and the total length of mains has risen to "two hundred and eighty-eight miles". "The gas-light illumination has also spread" he records, "far and wide through the country. Establishments for the supply of the new lights are carried on at Edinburgh, Glasgow, Liverpool, Bristol, Bath, Cheltenham, Birmingham, Leeds, Manchester, Exeter, Chester, Macclesfield, Preston, Kidderminster, and in many other towns and places (Chandler and Lacey, 1949, 72).

The earliest attempt at gas lighting in Macclesfield took place in 1813, soon after the establishment of the Chartered Gas Company in London and the lighting of Westminster Bridge. This attempt was carried out by Mr Hankinson whose enterprise

was abandoned in 1815. Although it is not stated where Hankinson's works were located, they were presumably in reasonably close proximity of the later gasworks as it is noted that his gas mains, which were earthenware, were still present at the time of writing (1888) on the site of the Macclesfield Gasworks.

A second, more successful, gas enterprise was begun in 1817 with other towns in surrounding counties soon also setting up gas lighting companies. An attempt, in 1824, to set up a rival company, The Macclesfield United Gas Light Company, was soon abandoned. The threat of opposition however led the company to strengthen its position by successfully obtaining an Act of Parliament in 1826 which effectively gave the company a monopoly of gas production in Macclesfield. The company was in a better position to withstand competition when in 1845 the short-lived rival company, the Sutton Gas Company, was proposed.

A more serious threat to the company emerged in the late 1850s when the Macclesfield Corporation began to consider the purchase of the gasworks or erecting a gasworks of their own.

...in 1858 the Corporation first began to seriously discuss the desirability of obtaining an Act for the purchase of the Gasworks, or, failing an agreement with the Company as to terms, for permission to erect Gasworks of their own. The negotiations were carried on between the Local Board of Health, ably guided by its then Clerk, Mr John May J P, as representing the Corporation, which obtained their Act in 1860; at the outset the difficulties seemed insurmountable. The Gas Company...applied to Parliament for a new Act, and were successfully opposed by the Corporation. Mr May advised the Local Board to make application to Parliament for an Act empowering them to construct new works, and to supply the borough and district with gas, in the event of the Gas Company not agreeing to the a sale of their works on reasonable terms with the Corporation, and an application was made accordingly. The Gas Company having failed to obtain a renewal of their powers through the powerful opposition of the Local Board, were more disposed to reopen negotiations when the Board applied for an Act to construct independent works of their own.

Mr May, as appears by correspondence, laid before the Local Board elaborate calculations and estimates founded upon the evidence of eminent gas engineers who had been consulted, and he strongly advised the purchase of the existing works as preferable to the construction and establishment of a new competing concern...eventually Mr May... submitted to the director's the following basis of agreement as the final ultimate terms, to which the Local Board would assent, namely: "the Corporation to pay £50,000 for the Gasworks, including all the plant, building, and property belonging to the Company". A reference to the files of the Courier shows the extent and at times the bitterness of the negotiations, during which the works were gradually depreciating in value, the Company, in the transitory state of things, and doubtless feeling certain of their ultimate sale, abstaining from any but the most imperative expenditure in their maintenance... the works became the property of the Borough on the 1st July 1861.

That the Town Council paid a good round sum for the works, considering their condition, is generally admitted, indeed many are of the opinion that the figure was an exorbitant one, but that they did the right thing in the interests of the general body of the rate payers in securing the works few will be disposed to dispute. To put the works into an efficient state to supply

the extended and extending requirements of the public, the merest novice could see a large expenditure of public money was required; this could only be done gradually, and the Corporation set to work with good heart, sanguine that success would eventually crown their efforts, and that the public would in the long run reap the benefits (The Macclesfield Courier and Herald 1888).

The earliest mapping obtained during research for this work is an 1860 map of the Gasworks at Hibel Road, which was deposited in the Office of the Clerk of the Peace along with other maps relating to proposals for improvements of the gas service in the township (Fig 3). The gasworks which occupied a triangular plot on the west of the River Bollin, as well as a smaller plot on the opposite bank, comprised a large retort house, a gasometer and three circular tanks, and three unlabeled structures (one labelled as *Offices* on later plans) surrounding the gasometer. The land surrounding the small plot on the eastern side of the river is depicted as comprising a number of residences which have been colour coded in green and blue, and labelled as no.1 and no.2, with the (presumably) landowners named as Lydia Downes' (no.1) and John Hall (no.2). To the north of these, bound by Hibel Road and excluded from the proposals, were two further plots, one labelled as belonging to Mr John Hall, the other to Mr Jeremiah Clarke. A north-to-south road is shown alongside the properties and is labelled as Private Road to Mr Jeremiah Clarke & Executors of Mr Thomas Ward. To the south of the gasworks and no.2 was a small street, North Street, with unlabelled properties (later identified as Gas Mill) beyond. The railway line is not depicted on this map.

By the time of the first edition Ordnance Survey map of 1873 that part of the gasworks on the western side of the river had expanded to fill its limited space, with a number of new buildings along the northern site boundary and along the river, enclosing the northern two tanks (Fig 4). Railway sidings split off from the main line a little to the south of the south and continued on towards a coal yard which was bound to the east by High Road and the gasworks, and to the west by an escarpment which separated the lines and coal yard from residential properties. From here the lines continued on to the north-west, passing below Hibel Road, and entered a tunnel. The eastern side of the gasworks remained largely undeveloped at this time with no buildings depicted that appear to relate to gas manufacture (Fig 5). The surrounding properties comprised a mix of residential dwellings in terraces that ran alongside Hibel Road at the north, and Thorpe Road and Commercial Road to the east. Two large mills were located in the space between the river and the residential terraces. Both are labelled as silk mills, the northern called Hibel Road Mill, and the southern called Gas Mill.

The detached northern part of the site, the gasholder station at Lower Heyes, was shown to comprise at this time a single gasometer which was erected c1870, and an adjacent valve house and well (Fig 4). The gasholder station was located at what was effectively the northern limits of the town and indeed the municipal boundary is shown to have passed immediately adjacent to the north-eastern corner of the site. To the north of the gasholder station was the Lower Heys Mill (later renamed Globe Mill), a cotton mill, the remains of which were still to be seen at the time of this survey. A brick field is shown to the north of the mill. The Macclesfield Bollington & Marple Branch of the railway line, which ran alongside the gasworks to the south, curved past the gasholder station and mill, continuing northwards. Beyond the site to the north and east the area still consisted at this time of enclosed, hedge-lined fields with remnant strips of woodland.

It is recorded that the gasworks was in a fairly dilapidated and inefficient condition at the time of its purchase by the Corporation in 1861 and had not been greatly

improved in the following years, though some early improvement work had been carried out.

By this time [1878]...the antiquated plant had become worn out, leaky and stinky, and completely "used up," the whole of the ground occupied with something or other, the result of a make-shift policy, giving the works a most dilapidated and bankrupt appearance. And when it is remembered that up to this time no part of the £50,000 borrowed for their purchase had been repair, and that nineteen out of thirty years allowed for the repayment had elapsed, that in the winter 1877-8 every retort in the place was at work, and the old plant was being forced to do two or three times the work for which it was made (ibid).

In order to improve the works and make them profitable, a new engineer and manager was appointed. Prior to the appointment of Mr Thomas Moore to this position, the Corporation had carried out some improvements, amongst which was the erection of a new tank and gasholder at Lower Heyes and new 24-inch delivery mains. This new gasholder, Gasholder 2, was completed in 1884.

Mr. Thomas Moore was appointed engineer and manager in May, 1877, and still occupies that responsible position [1888]. Under his able superintendence most extensive alterations and improvements have been carried out in the most satisfactory manner...no complete was scheme [of improvements] was considered or even prepared until 1878, when Mr. Moore was instructed to prepare plans on the improved and modern lines of manufacturing gas for illuminating and heating purposes... The plans designed by Mr. Moore were and are so made that any particular portion of them can be carried out when it is found desirable without taking anything down again, or doing anything twice over, the whole forming a complete gasworks capable of producing one million cubic feet per day.

...One half of the retort house is finished, the other is in a deplorable condition. It is shored and propped up, and is being made to last as long as it will pay to do so. The other half that has been rebuilt is a substantial and pleasing looking structure of red brick, with stone facings and provided with a square noble-looking chimney and two ventilating towers. These latter are a bold departure from the old-fashioned system of ventilating by means of louvers running the whole length of the building...The whole of the manufacturing plant in this part of the retort house is new, as well as the building, and designed upon modern principles, and has proved to answer its purpose in every respect. The building, retorts, retort bench, hydraulic mains, valves, and other manufacturing plant has cost nearly £8,000 (ibid).

The second edition Ordnance Survey map of 1898 shows that the gasworks had changed quite radically by this time as a result of Moore's implemented plans to improve the buildings and plant therein (Fig 7). The three circular tanks and gasometer had been dismantled and the buildings which fronted to Hibel Road and ran alongside the river had also been demolished. The old retort house was replaced with a new building with a new range, containing the station governors and exhausters connecting the retort house to the earlier office building at the south corner of the site.

On the eastern side of the river, the former Hibel Road Mill had been demolished and replaced with a large rectangular building later identified as containing the gasworks purifiers and meters.

The gasholder station valve house and curving retaining wall also date to this phase of expansion and can be seen on the Ordnance Survey map of 1888 (Fig 6). The land to the north and east of the site were yet to be developed for residential dwellings and remained as enclosed fields.

By 1909 the gasholder station had been extended eastwards to allow for the construction of a third, larger gasholder (Gasholder 3) (Fig 8). Little can be seen to have changed on the gasworks site by this date, though High Road, which bounded the gasworks along its western side, had been renamed to Gas Road (Fig 9).

Members of the Manchester and District Junior Gas Association carried out a visit of the gasworks in March of 1923. A number of notes on the works and the developments seen therein were published in the Gas Journal (Gas Journal 1923, National Grid Archive ref, GJ_1923_V161_P693).

The members noted the unusual arrangement of the condensers which were located on the roof of the exhauster house, an arrangement necessitated by the shortage of space on the site. Owing to the strong and well-built roof of this building, the new water-cooled condensers, which replaced the former annular air-cooled condensers, were also located on the exhauster house roof, without the need for the installation of additional reinforcement. The scrubbers had by this time become clogged with tar and ammonia salts which were impossible to clear by the use of solvents or steam.

It was found that the cost of new and larger plant was considerably less than that of putting the existing plant in order. So a new plant of 2,000,000 c.ft. was installed.

A considerable number of installations of water heat boilers has now been supplied to various vertical retort plants...When the question of water heat was considered by us, it was found the heat available was sufficient to generate far more steam than was required for the retorts alone; and it was therefore decided that the waste-heat boilers should work at the same pressure as the coke-fired boilers in the works, so that the two sets of boilers could be connected-up and the whole of the steam generated from the waste gases utilized...With a works site so cramped as Macclesfield, where it is scarcely possible to find room for additional Lancashire boilers, the generation of steam by the waste heat of the vertical retorts becomes a matter of great importance, quite apart from the point of view of fuel economy (ibid).

Gasholder 1, the spiral-guided holder recorded during this survey, was built in 1924 by R & J Dempster and replaced the pre-1870 column-guided gasholder which was also designated Gasholder 1. The existing brick tank of the earlier gasholder was retained and utilised for the new holder.

By 1958 the eastern part of the gasworks had expanded up to Hibel Road and Commercial Road following the demolition of the former terraced houses, though a small group of these remained at the intersection of Commercial Road and North Street. At the gasholder station, Gasholder 3 remained extant until the early 1970s and had been dismantled by the end of that decade (Fig 10).



Plan of the gasworks, November 1860 Fig 3



The gasworks, Ordnance Survey map of 1873 Fig 4



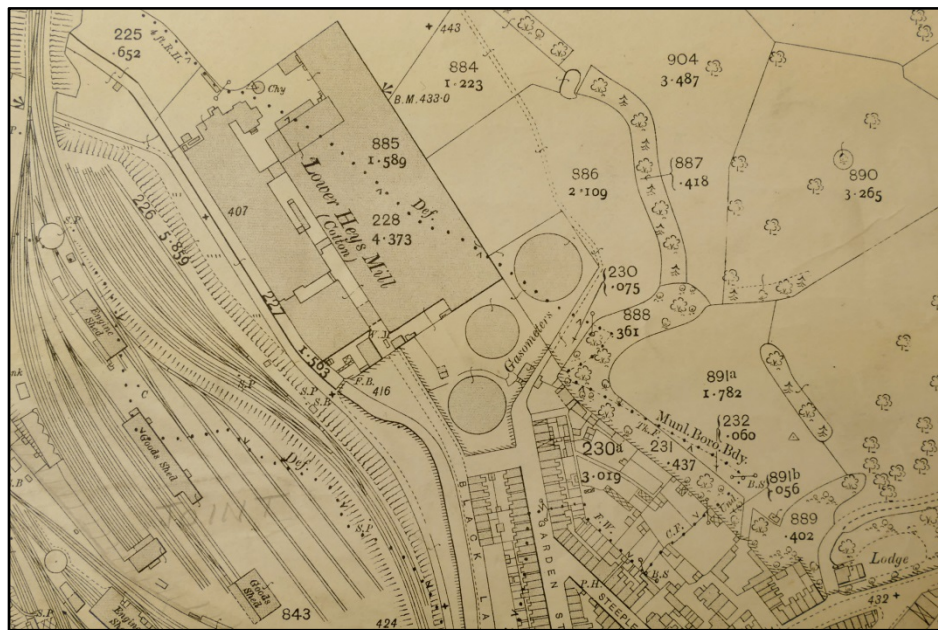
The gasholder station, Ordnance Survey map of 1873 Fig 5



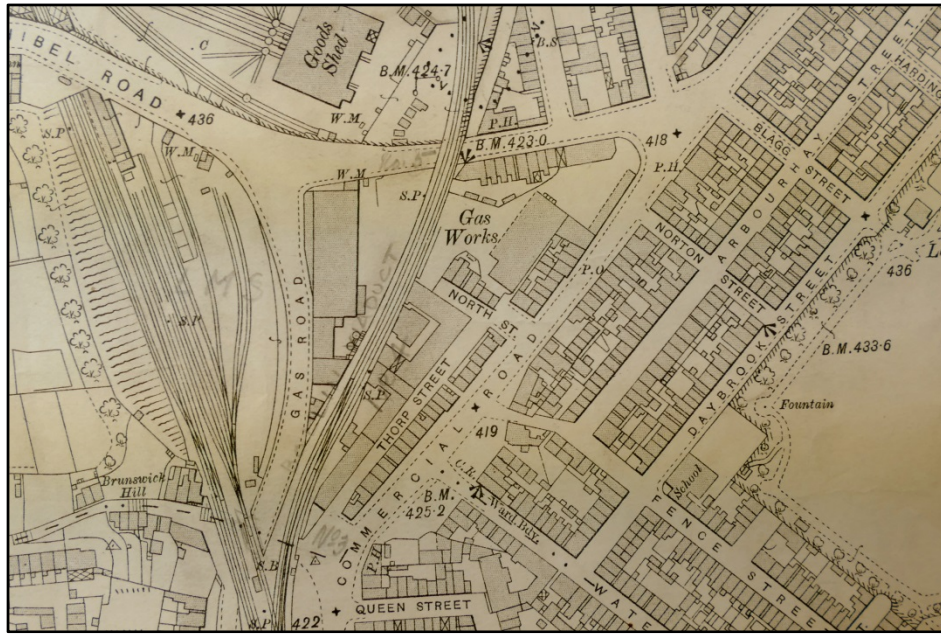
The gasholder station, Ordnance Survey map of 1898 Fig 6



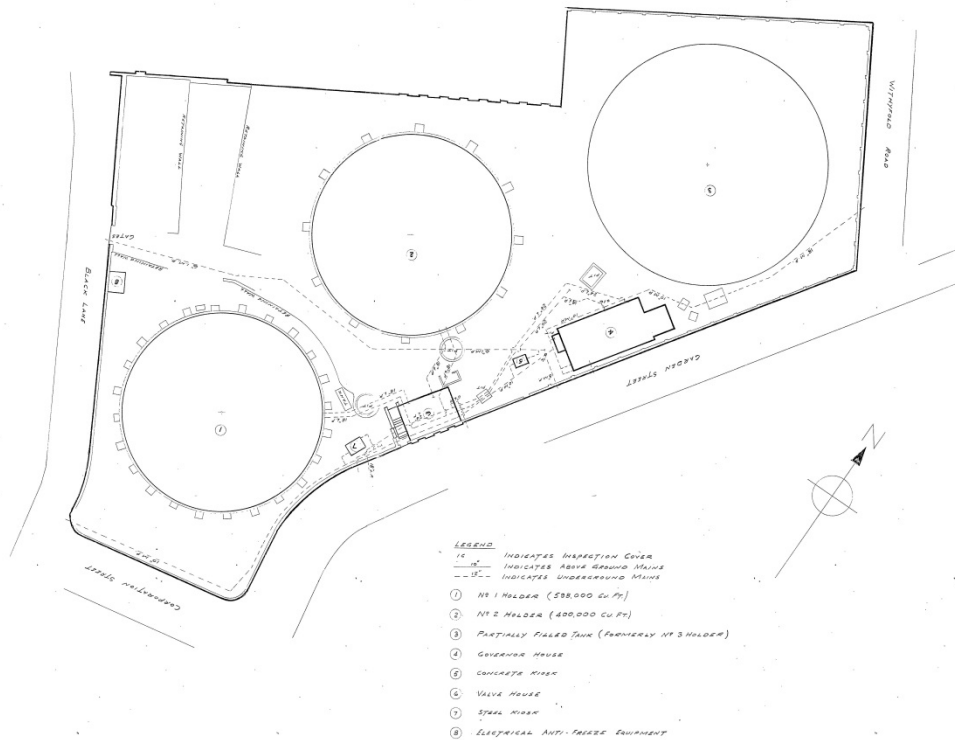
The gasworks, Ordnance Survey map of 1898 Fig 7



The gasholder station, Ordnance Survey map of 1909 Fig 8



The gasworks, Ordnance Survey map of 1909 Fig 9



Plan of the gasholder station, dated 1974 (original image rotated and rearranged for ease of display) Fig 10

The Gasworks article which is found in *A walk through the Public Institutions of Macclesfield*, provides a detailed description of the arrangement of the plant on the site as seen in 1888 and the process of gas manufacturing at that time, and is abridged below.

The gas, after leaving the retort-house, is conducted through a series of vertical condensers formed in columns... These condensers by a novel arrangement are placed on top of the engine-house, one of the principal reasons for this being that amongst other advantages every part of the plant requiring steam power is placed immediately under the eye of the man in charge. The engine and governor house below the condensers...contains two direct acting exhausters and engines combined, arranged to work either in duplicate or together. The size of capacity of these engines, as indeed every other part of the new plant, is calculated on the basis of dealing with one million cubic feet of gas per day.

The engine-room adjoins the pump-room which contains three sets of direct acting reversible pumping engines. One set supplies the works with all the clean water required for manufacturing purposes...The other two engines deal respectively with the tar and ammoniacal liquor lifting and forcing them through various parts of the plant, and finally depositing them into covered trucks on the railway to be sent away and form the raw material for other manufacturers...

Adjoining are the two steam boilers which have been specially designed by the Engineer for the use of coke as fuel. We are informed coke is found to cost less per horse power than engine slack, that it requires less labour, and it is self-evident that it solves the "smoke abatement" question. Here also is a mechanics' shop...The two tower scrubbers are also situated here, and form an imposing structure rising 70ft from the ground line to the floor of the machinery room situated at the top...From the scrubbers the gas passes on to the lime purifiers.

After the gas leaves the lime purifiers it is measured by the large station meter, the quantity made being recorded every hour day and night. It is then stored in the two large holder at Lower Heyes for distribution. These two holders are a most important and valuable portion of the Gas Works plant. They are both the same size, vi., 100ft. in diameter, and when full are each 56ft. high, with a working capacity of about 800,000 cubic feet. They look as well as such structures can be made to do, and are evidently well cared for. The older one was erected in 1870 and the other in 1884, the latter being designed by the present Engineer [Mr Moore], and constructed and erected under his supervision.

The tanks in which these vessels are placed are each 103 feet in diameter, and 32 feet deep, and although alike in general looks, they differ very much in the principle on which they are constructed as a glance at the plans show. In both cases great and unusual engineering difficulties were experienced, an enormous quantity of water and quicksand having to be dealt with...Usually the necessary valves...are fixed underground, but here they are placed in a plain but neat valve-house, and together with the large pipes and connections, are at once seen and get-at-able, and are kept neatly painted and lettered to avoid error in working them.

4 DESCRIPTION OF THE GASHOLDERS AND ANCILLARY BUILDINGS

The survey area is located to the north of central Macclesfield, an area which between the mid-19th to early 20th century represented the north-eastern periphery of the town, the surrounding residential area to the north and east having developed from the 1920s onwards with considerable expansion in the 1950s and 1960s. The site has historically functioned as a gas storage area and was linked to the former gasworks located approximately 200m to the south, between Hibel Road, Commercial Road and the former Gas Road.

The topography of the area is such that the ground slopes down from the north-east. This has necessitated the site to be raised c2m at its southern end in order to create a level area. The ground level adjacent to Gasholder 2 is 130m aOD and 128m aOD at Gasholder 1. A curving ashlar retaining wall curves around the north-eastern edge of Gasholder 1, separating the two parts of the site.

The site is enclosed by a stone-built retaining wall with brick parapet over. Access to the site at the time of this survey was at its north-western corner at the end of Black Lane where the site is secured by steel gates with barbed wire (Fig 12). The retaining wall, which begins at this location, comprises irregularly coursed, squared rubble with larger blocks throughout. Above this is a parapet of red brick in a variation of English Garden Wall Bond, comprising four courses of stretchers between header courses. This is capped by flat, stone coping (Fig 13). On top of this is a modern steel fence with barbed wire. The brick wall has occasional large patches of repair in the form of modern red brick in stretcher bond, likely dating to the 1970s. The brickwork rises to accommodate the pedestrian entrance adjacent on Garden Street, adjacent to the valve house and is interrupted by the south elevation of that building (Fig 14). The stone retaining wall, which has a maximum height of c2m and follows a straight level, tapers out at the valve house due to the slope of the ground. A short distance to the east, roughly half way between the valve house and governor house, is a former rectangular opening in the brick wall, blocked in modern brick (Fig 15). The opening had a stone lintel and stone hinge blocks which remain *in situ*. The stone coping is interrupted over this former opening. A vertical join in the brickwork is visible adjacent to the opening. To compensate for the rising ground level to the east, the wall is constructed in a number of steps, retaining the same rough height (Fig 16). The National Grid compound to the east is accessed via a security gate from Witherfold Drive.

4.1 Gasholder 1 (Figs 17-27)

Gasholder 1 was a water-sealed, spiral-guided gasholder with a capacity of 598,000 cu.ft in two lifts, with a diameter across the tank of c30m and a tank circumference of c98m. The British Gas basic record of Gasholder 1 (Appendix 1) records that it was constructed by R & J Dempster and was completed in 1924. This company was established in 1884 by brothers Robert and John Dempster, and as well as gasholders, manufactured other gaswork plant and related structures such as condensers and exhausters, structural ironwork, pumps and steam engines (http://www.gracesguide.co.uk/R._and_J._Dempster).

The gasholder had a below-ground brick and puddle clay tank which was sunk to a depth of 8.5m. The tank lacked a dumpling and had a fairly flat base with slight slope to the edges. The tank predated the 1924 gasholder and had been constructed to serve the previous column-guided gasholder.

The gasholder lifts were formed of 1/4" thick welded steel sheets, staggered like brickwork, with I-beam vertical stiffeners on the inner face of each lift.

The tank was encircled by twenty-four steel base plates that supported the outer roller carriages. The footings had a fairly plain, rectangular design and were secured by steel bolts at each corner, to the coping that surrounds the top of the tank. The footings plates alternately differed in size so that twelve of the twenty four were longer and also had much larger bolts at the corners. It is likely that these larger footings were at the locations of the twelve columns of the earlier gasholder though it is unclear if they themselves served as column bases.

The gasholder utilised multiple roller carriages instead of the more common dual guide rollers. In this design two pairs of rollers interact with the upper and lower side of the spiral rails. The rollers are *“provided with continuous automatic lubrication, being so designed that the axel runs in a bath of oil formed in the bed-plate of the carriage. ...the bolts securing the carriage are brought as near as possible to their work, thus reducing the strain from leverage upon the tank and the carriage..oil grooves in the axel, and the special packing rings at front and back prevent the lubrication from being lost”* (Meade, 1921, 669). The inner roller carriages had a more compacted design with the carriages affixed to each side of the angular base. The second tank had twelve rollers and the inner tank had eight rollers.

There were three sets of stairs, one for each lift, which, when at rest, lowered to the southern side of the gasholder. The stairs were of a standard design, forming a curving right-angle triangle with vertical, horizontal, and diagonal posts and bracing, with a safety rail on the outer side.

The two anti-freeze supports, which carried both lagged pipework and electric cables, had a tapered, pyramidal form with solid plates to the back and sides and narrow bars between the side plates at regular intervals. Steel cable trays were installed on the outer face of the back plate to carry electric cables. Both were located at the north-western side of the gasholder.

The crown surface had been formed of 3/16" thick tapered steel sheets laid in a staggered pattern with rivets along the edges. The crown was in a good condition with minimal rusting though the surface displayed some warping typical of a disused gasholder. The crown trusses were of a typical design, radiating outward from a central pipe and collar and were formed of flat 4" and 3" steel bars with angled struts. Four rings of purlins connected the trusses. A brick stanchion rose from the centre of the tank floor. The stanchion had a square profile and rose to a height of c4m and was capped with a block of dressed stone onto which the crown framing came to rest when deflated.

The 20" inlet and 24" outlet pipes were located together at the north-east side of the holder, rising through the tank base to the full height of the tank and connected to governor house nearby. Three manholes allowed access to the interior through the crown and a vent was located at the crown's apex.

The gasholder retained a range of standard modern telemetry, electrical, and safety fittings. Steel safety rails were installed at the outer edge of each tank, being formed of hollow, circular-section steel rails and passing through L-section plate posts. In several places the electrical and safety fittings were attached to the safety rails for ease of access.

4.2 Gasholder 2 (Figs 30-54)

This was a fairly small gasholder of a double-order, two-tier design, having a capacity of 400,000 cu.ft in two lifts, with a tank diameter of c30m and a circumference of c94m. It had twelve columns, each c17.8m (58'-3") in height, in a simple Tuscan style, with a continuous straight taper to the apex. Each order was formed of two sections joined by internally flanged butt joints. The columns were set at intervals of 8.4m from each other. The simple toroidal bases concealed bolts to the square cast-iron plinths which were set onto concrete footings or pedestals c0.3m deep. Hexagonal bolts were set at each corner of the footings. The first order column capitals were very simple, flaring outward to meet rounded junction boxes to which the first tier girders attached. The bases of the second order columns attached to the top of the junctions. Above the Tuscan style capitals of the second order columns were hollow, rectangular junction boxes capped with moulded cornices. A shield-like plaque was formerly attached to the outer face of one of the south-eastern columns but had been removed prior to this survey and was not present on the site. In addition to the standard safety rails at the edge of each lift, lengths of iron chain hung between each column from hooks embedded in the sides of the columns.

Writing in 1884, Frederick Colyer, M. Inst, stated that "*when cast-iron columns are used, they should be turned and bored at the joints and at the bases also. Large columns should have internal faced flanges, the size at the joint being sufficient for a man to pass through. When the height of the columns exceeds 20 feet, they should be stayed or braced with wrought-iron ties or light lattice girders at the centre. In this case the columns may be made in two tiers, the girders resting on the caps of the lower tier* (Colyer 1884, 92)."

At the back of the columns, cast iron tees served as guide rails and were held away from the column by at a distance of 300mm by cast iron brackets. The rails spanned the full height of the columns, and rose from just above the tank base to the top of the second order junction box.

The gasholder frame was given lateral stiffness by two tiers of flat lattice girders. These were formed of wrought iron tee-profile double-angle stringers, with a lattice web of flat bars in a repeating cross pattern. Decorative cast iron florets were attached at each cross intersection, on both the exterior and interior face of the girders. Nearly all of the above ground components of the gasholder were given a white, lead-based paint coating.

The outer roller carriages had a cantilever, *goose-neck*, boxed form, with the sides formed of lattice webs of flat, cast iron bars in cross patterns with riveted intersections. The rollers comprised a single cast iron unit with a flat channel that gripped the guide rail at the back of the columns. Spokes or ribs connected the central axle to the outer part of the roller. The lower rollers were of a similar design but attached to short curving plates bolted to the top curb of the tank.

A continuous vertical ladder with a small landing at the first tier was located at the south-east side of the gasholder. The base could have been enclosed to prevent unauthorised access and the ladder was enclosed by a steel safety cage.

The crown was formed of 5/16" thick wrought iron sheets arranged in staggered rings and tapered toward the centre, with a 1/2" thick circular plate at the apex. It was supported by an underlying frame which comprised twelve primary trusses formed of flat lattice girders similar to those used between the columns. These comprised flat lattice bars between tee stringers, with the top and bottom stringers curved to match the crown's rise. The trusses were connected to each other by two rings of girders of

a similar design and a further twelve intermediate trusses span between the rings. The main trusses aligned with each of the twelve columns, supported the roller carriages and connected to the vertical stiffeners. The inner lift was given additional support at the sides and top curb by full height lattice girders, from which triangular supports connected to the trusses. The lift sides were formed of welded 3/16" thick rectangular wrought iron sheets with vertical stiffeners on the inner face of each lift, to which the crown trusses attached. The sheets were not staggered like those of Gasholder 2 but formed vertical and horizontal joints.

Unlike Gasholder 1, this gasholder had a dumpling, in this case fairly steeply sided, with a flat top. At the centre of the dumpling was a round, slightly tapered brick-built stanchion which flared out at the top to meet the crown apex. The stanchion was built on top of a concrete block and was built of pale yellow-pink bricks arranged in three courses of headers to one stretcher course (English Garden Wall bond).

The gasholder tank was faced with pale yellow brick in alternating courses of headers and stretchers (English Bond). The guide rails at the back of the columns descended to the base of the tank and were attached to the tank by flat iron brackets. Rectangular stone blocks projected from the tank edge at the base of each guide rail and small relieving arches were built into the brickwork above each block.

The 24" inlet and outlet pipes were located together at the eastern side of the gasholder and could be accessed externally from a *Livesey Lid* on the crown. The Livesey Lid was an invention of Sir George Livesey and allowed inspection of the inlet and outlet pipes without loss of gas in the process. The pipes passed through the dumpling and rose externally to the gasholder, at a point marked by a circular siphon pit with pump. A 24" pipe with flanged joints rose from the pit and descended back into ground a short distance to the west. The siphon pit was enclosed to the south by a semi-circular rubble-ashlar wall with stone coping, in the same style as the nearby retaining wall.

A range of standard modern telemetry, safety switches, and electrical fittings were installed on the gasholder including sensor units, alarms and electrical trip switches. The anti-freeze system was located adjacent to the access stair and was installed by the Bryan Donkin Company Ltd of Chesterfield. Lagged pipes with switches were carried on steel stanchions to the lifts.

4.3 The Valve House and siphon pit

The gas, which was manufactured at the nearby gasworks, was sent via underground pipes that ran below Garden Street, to the holder station Valve House where it was distributed between the gasholders. Likewise, outlet pipes allowed gas to be drawn from the gasholders and outputted via boosters to the consumer.

The Valve House is located at the south-eastern site boundary, its eastern elevation forming part of the enclosing wall (Fig 14). It is a good quality, well-made building of red brick in English Bond, with blue brick detailing. It has a simple rectangular plan on a north-east to south-west alignment and measures 6.3m by 8.7m, and is c4m in height. The east elevation presents three, tall, blind, arched recesses with blue-brick segmental arches whose springers are in line with a blue-brick string course that spans the full width of the elevation and which continues around the full perimeter of the building. At the base of the wall is a blue brick plinth, angled to compensate for the sloping topography. The cornice comprises projecting, staggered, blue brick dentils, capped with a single course of bricks laid flat. A short parapet is formed around the edge of the roof by a course of stones with *rock-faced* rustication. A doorway to the site is located adjacent to the southern corner of the building. The

doorway is edged with blue bricks with alternating projections every three courses. The door has a cast iron lintel with a recessed panel. Flagstone steps lead from the doorway to the higher ground level of the site.

The room is accessed via a doorway located off-centre in the southern wall (Fig 56). The door is contained within an arched opening with blue-brick detailing and segmental arch level with the string course. The door itself is of blue-painted planks with internal battens and has internal riveted strap hinges. A narrow, arched window, also with blue-brick detailing is positioned adjacent to the door.

The ground level of the site is much higher than at the road and the north elevation is visible up to the level of the string course at the base of the arches. It is evident that the three arches on this side of the building were formerly open, and were later blocked in brick. The central portion of the elevation on this side has been re-built in brick, removing the former central arch and part of the string course. The two arches of the north elevation have also been crudely blocked in brick. A gas pipe runs to or from the building through the easternmost arch of this wall and descends underground a short distance to the north (Fig 57).

The roof is hipped at the north and south and is of rectangular welsh slates with raised slate edging. At the centre is a raised, louvered vent with corrugated roof. It is likely that this is a later addition to an otherwise well-made building.

To the south-west of the valve house is a circular siphon pit, the top of which forms a continuous platform and landing with the valve house stairs (Fig 55). The stairs are edged with a wall of irregular ashlar with stone coping. The wall rises and curves to continue around the edge of the siphon pit. From there it continues around the north-eastern edge of Gasholder 1, serving as a retaining wall between the differing ground levels of the east and west parts of the site. The siphon pit has a circular covering, 3m in diameter, formed of interlocking plates of cast iron, through which rises a siphoning pump with handle. One of the covering plates is hinged in order to allow access to the pit. A smaller manhole is located adjacent to the siphon pit.

Both the Valve House and siphon pit, along with the associated walls and steps are contemporary with Gasholder 2, dating to a phase of expansion that took place between 1873 and 1898. The 1:500 Ordnance Survey Town Plan of 1873 depicts a well in roughly the same position as the siphon pit and it is likely that this well was utilised for the siphon pit. A building shown adjacent to the well was demolished as part of these works.

4.4 Miscellaneous structures

The Governor House is a modern building constructed between 1964 and 1972, following the dismantling of gasholder 3 at the east of the site. It is a very simple, utilitarian structure on a rectangular plan measuring 13.5m x 7m, with a small square ante-room to the east (Fig 59). It is built of red bricks in stretcher bond and has a flat roof covered with bitumen roofing sheets. Ventilated wooden doors are located in the north and western walls. A propane tank, elevated from the ground on a steel platform, is located between the Governor House and Valve House (Fig 58)

The electrical switch room is located to the north-west of Gasholder 1 and is labelled as *Electrical Anti-Freeze Equipment* on the site plan of 1972 (Fig 29). It is a simple rectangular building of fletton brick in stretcher bond, with a corrugated sheet roof.

The safety governor room post-dates 1972 and replaced a *Steel Kiosk* which is shown on the site plan of that date (Fig 28). It is a simple rectangular plan structure,

measuring 2m x 4m and is built of red brick in stretcher bond. Ventilated, wooden double doors are located in the north face and pipes can be seen rising into the room from below.

A methane sparge unit was installed to the north-west of Gasholder 2 (Fig 60). The above-ground component of this was a tall steel box containing a steel tank, and mounted on steel rails. Sparging involves the injection of gas into contaminated water (gasoline, fuel, solvents etc) to promote biodegradation.

5 DISCUSSION

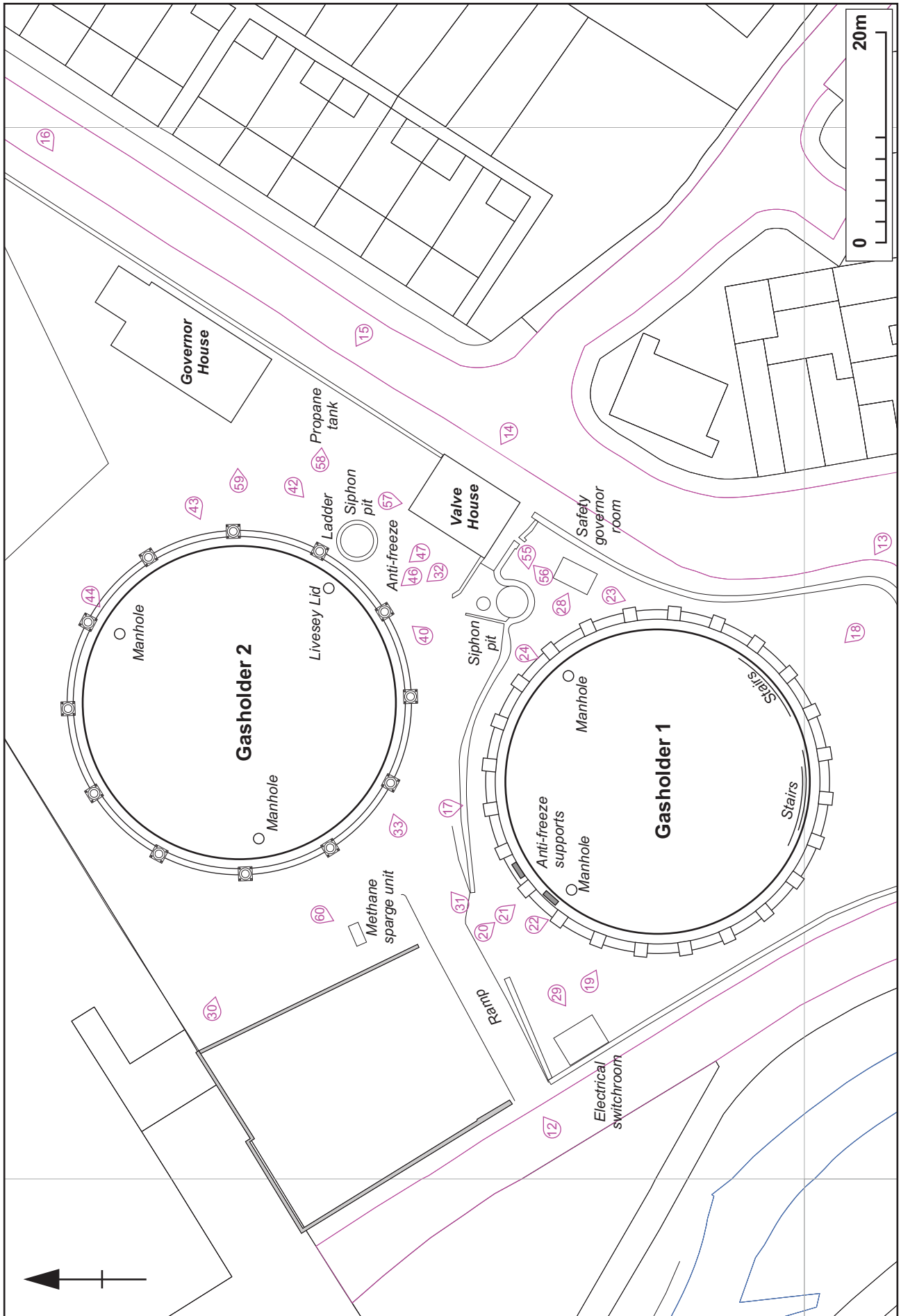
The site of the gasworks at Hibel Road provided access to the river and railway line, and while adequate for the needs of the small early gasworks, provided insufficient space for expansion during the latter part of the 19th century as the gasworks required more and improved plant to meet customer demand. This caused a disconnection between the gasworks and the gasholders which were moved to Black Lane. The cramped nature of the gasworks was noted during a 1923 visit by the Manchester and District Junior Gas Association.

The construction of Gasholder 2 in 1884 increased the works' storage capacity and was part of a wider phase of repair, expansion, and improvement. Between 1898 and 1909 a third gasholder was constructed at the eastern side of the gasholder station. In 1924 the former column-guided Gasholder 1 was dismantled and replaced with a spiral-guided holder, re-using the original tank.

Some thought was given to the aesthetics of Gasholder 2, as well as surrounding contemporary structures and walling. Early gasholders were often designed with decorative iron work and non-functional, purely aesthetic elements, but this became much less common by the end of the 19th century and by the early to mid 20th century they had become purely utilitarian structures with little to no embellishment save perhaps on standard bases or the instalment of commemorative plaques. Very few spiral-guided gasholders received any decorative treatment.

The gasworks was assessed as R/+ under the medium-town gasworks category of Gas Industry Step 3 Report, Part A (Trueman 2002). This defines the site as having some national and regional importance. Gasholder 2 broadly conforms to Type 14 of Tucker's cast-iron column typology, though it lacks tensioning braces between the columns (Tucker 2000). The girders correspond with the Type G I-section lattice style with repeated crosses. The gasholder is described in the report as "*1884 column-guided holder, a slight variant to the double-order double-tier (type 14), with a rounded junction box for the lower tier. Fine example, retaining detailing, and a striking local landmark*".

Gasholder 1 is not mentioned in the report; however, 20th-century gasholders and those of a spiral-guided design are generally excluded from the survey. The gasholder is fairly typical of its type and period, with no elements of historic or architectural significance.



Scale 1:500

Site plan, showing photograph locations Fig 11



The Black Lane site entrance Fig 12



The site boundary, seen from the junction of Garden Street and Black Lane Fig 13



Entrance to the site and eastern elevation of the Valve House Fig 14



Modern blocking in the boundary wall Fig 15



View of the site from Garden Street, looking south-west Fig 16



Gasholder 1, looking south Fig 17



Gasholder 1, looking north, showing the access stairs Fig 18



Gasholder 1, looking south-east, showing the anti-freeze supports Fig 19



Detail of the anti-freeze supports and adjacent signage Fig 20



Detail of multiple roller carriage and top curb of the tank Fig 21



Detail of the lifts, railings and multiple roller carriages Fig 22



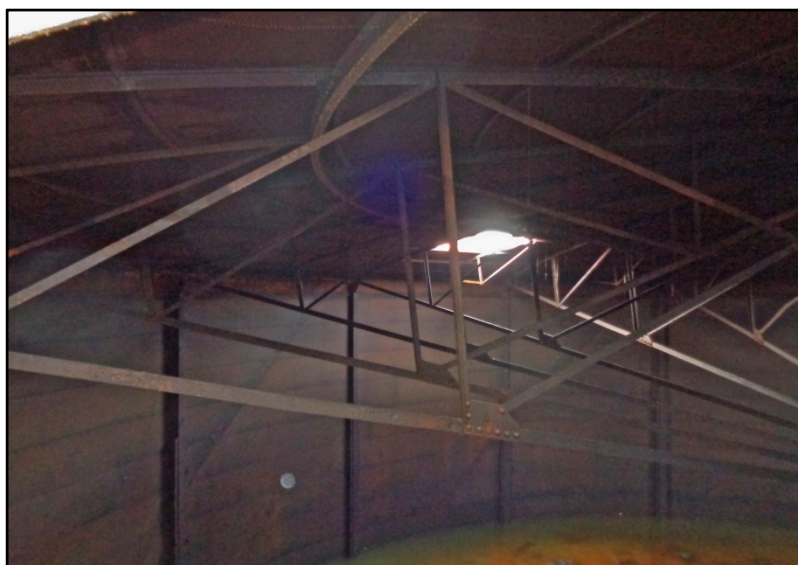
Telemetry and electrical fittings at the north-east side of the gasholder Fig 23



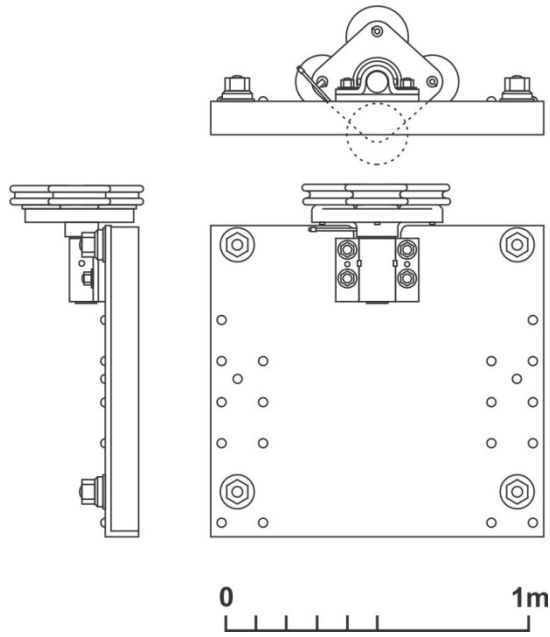
Manhole access through the crown Fig 24



Interior of the gasholder, showing central stanchion and crown frame Fig 25



Detail of the crown frame Fig 26



Gasholder 1, multiple roller carriage, scale 1:25 Fig 27



Safety governor room Fig 28



Electrical switch room Fig 29



Gasholder 2, looking east Fig 30



Gasholder 2, looking north-east Fig 31



Column base, showing scar of removed plaque Fig 32



Column base with roller carriages, also showing gasholder signage Fig 33



Detail of inner lift roller carriage following detachment Fig 34



Detail of outer lift roller carriage Fig 35



Detail of bottom curb roller Fig 36



Detail of first tier junction box, with roller guide Fig 37



Detail of upper junction box Fig 38



Detail of first tier girder with floret decorations Fig 39



View of siphon pit and ladder at the south-east side of the gasholder Fig 40



Detail of ladder Fig 41



Siphon pit adjacent to the gasholder, with detail of *Livesey Lid* access Fig 42



View of the crown, looking north-west Fig 43



Detail of manhole Fig 44



Detail of anti-freeze pipes and controls Fig 45



Detail of gasholder fittings Fig 46



Detail of gasholder fittings Fig 47



View of the dumping with central stanchion, showing crown frame Fig 48



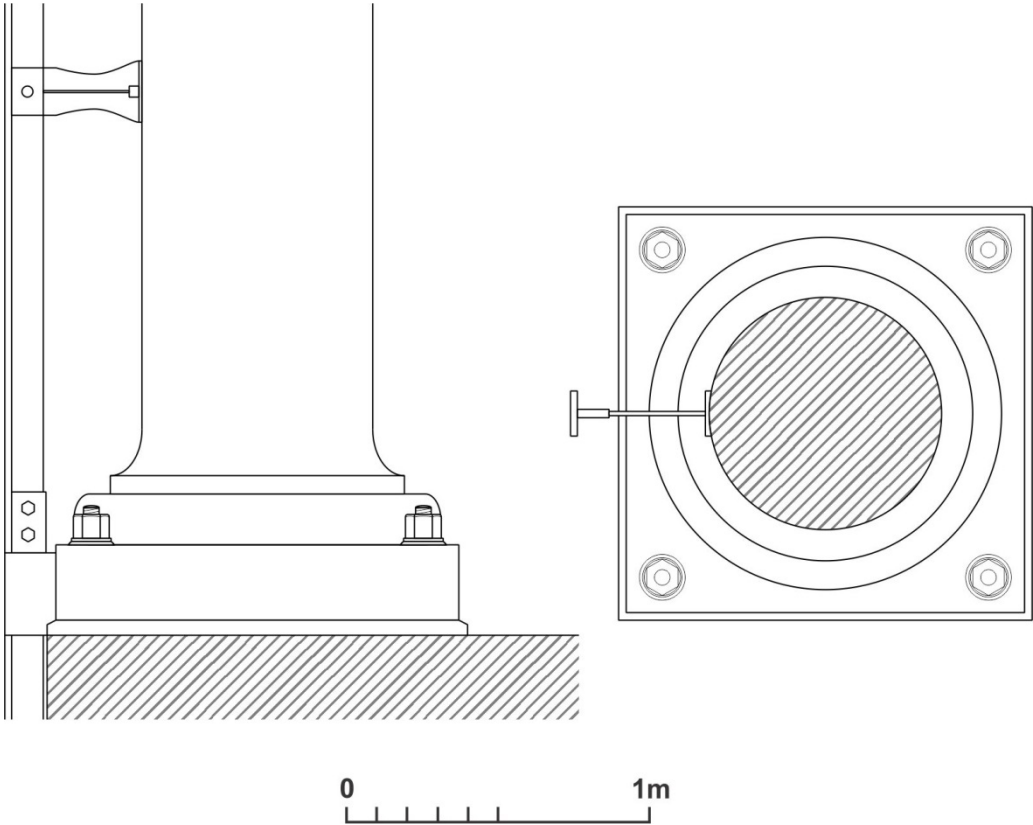
The crown frame, with inlet and outlet pipes in background Fig 49



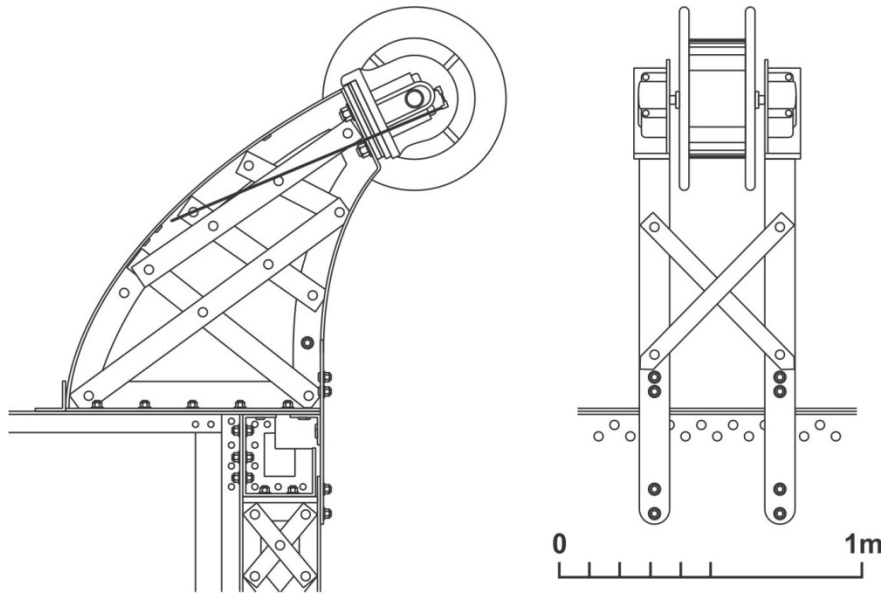
Detail of roller carriage arrangement and underlying support Fig 50



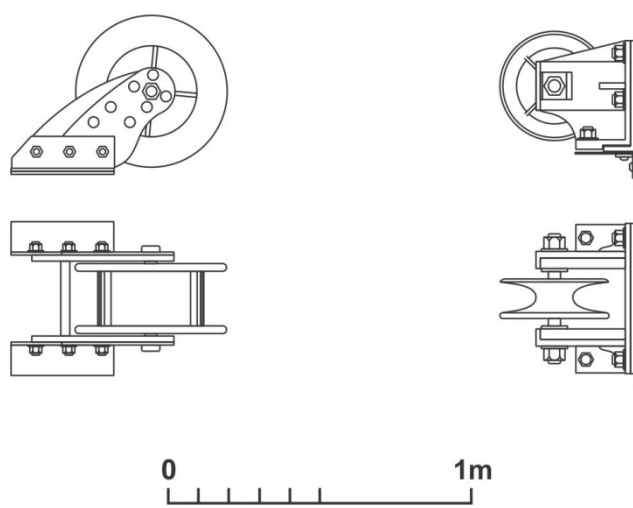
The brick tank, showing roller guides Fig 51



Gasholder 2, column base, scale 1:25 Fig 52



Gasholder 2, roller carriage, scale 1:25 Fig 53



Gasholder 2, roller carriage (left), bottom curb roller (right), scale 1:25 Fig 54



The siphon pit, looking west Fig 55



The Valve House, looking north-east Fig 56



The Valve House, looking south-west Fig 57



Propane tank adjacent to the Governor House Fig 58



The Governor House Fig 59



Methane sparge unit adjacent to Gasholder 2 Fig 60

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MOLA Northampton
16th December 2016

Appendix 1: Gasholder 1, Basic Record

BRITISH GAS
REGIONAL PLANT DEPT.

REPORT OF EXAMINATION OF GASHOLDER
WATER-SEALED TYPE — BASIC RECORD

NAME..... BRITISH GAS NORTH WESTERN EAST AREA
 LOCATION..... MACCLESFIELD SK10 2BD
 GASHOLDER No. 1 Date of inspection
 SITUATION..... -
 HOLDER BUILT BY R. & J. DEMPSTER Date of completion 1924
 TANK BUILT BY UNKNOWN Date of completion NOT KNOWN
 LIFT ADDED BY - Date of completion -
 TYPE (i.e. Column, Spiral or Rope Guided)..... SPIRAL GUIDED IN BRICK TANK
 CAPACITY (exclusive of Crown)..... 598,000 CU.FT. (16,923 CU. METRES)
 CAPACITY OF CROWN 16,892 CU.FT. (478 CU. METRES)

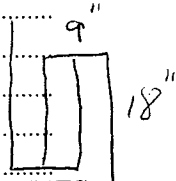
LIFTS

	Top	Second	Third	Fourth	Fifth
Diameter	95'0"	97'0"	100'0"		
Depth	28'0"	28'0"	28'0"		
Pressure (in. w.g.)/backx	6.5	8.5	11.5		
No. of Columns Spiral Guides or Ropes	8	12	24	ALL RAILS 42LBS PER YARD	

GUIDE FRAMING (General Description)..... SPIRAL RAILS ON RAIL PLATES

CROWN—RISE..... 4'9" { Number and Type of Manholes 3 - 20" x 24"
 { Position and Number of Gas and Air Vents 1 x 2" IN CENTRE
 Crown: Outer Row 3/16" Other Rows 10 SWG, 1/4" CENTRE PLATE

SHEETING THICKNESS { Sides: Top Row 1/4" Intermediate Rows 10 SWG
 Bottom Row 1/4"

CUPS & GRIPS (Size and construction, with sketch)..... 9" x 3" CHANNEL. CUP 1'6" DEEP,
 GRIP 1'9" DEEP 

TOP CURB & CROWN FRAMING (Construction—See Sketch Sheet)..... TOP CURB - TWO 4" x 4" x 1/2" ANGLES.
 CROWN FRAMING - 16 MAIN BARS 4" x 4" x 9/16" TEES WITH ONE 3" x 3" x 3/8" ANGLE STRUT
 AND TWO 2 1/2" x 2 1/2" x 3/8" ANGLE STRUTS. TENSION BARS OF 3" x 3/8" + 2 1/2" x 3/8" FLAT BARS
 TYPE OF LADDER..... SPIRAL STAIRS ON TANK AND LIFTS (SEE OVER)

TANK { Diameter 102'0" Depth 28'0" TO REST. Construction MASONRY
 BLOCKS
 Position in Relation to Ground Level: ... COPING AT GROUND LEVEL
 Rest Blocks: NOT KNOWN Number NOT KNOWN Size: NOT KNOWN

MATERIAL USED FOR CONSTRUCTION OF { Gasholder STEEL Riveted
 Tank BRICK AND PUDDLE CLAY

INLET & OUTLET CONNECTIONS { Size: INLET 20" OUTLET 24"
 Position of Each: NORTH EAST Together or separated: TOGETHER

TYPE OF SAFETY SEAL { On Inlet Connection: NOT KNOWN
 On Outlet Connection: NOT KNOWN

SIGNATURE..... DATE.....

CROWN FRAMING CONTINUED:-

MAIN TENSION BARS OF 4" x $\frac{3}{8}$ " FLAT
16 SECONDARY BARS OF 3" x 2" x $\frac{3}{8}$ " ANGLES WITH ONE
2" x 2" x $\frac{1}{4}$ " ANGLE STRUT AND 2" x $\frac{1}{4}$ " FLAT TENSION BARS
MAIN PURLINS 6" x 3" x 14 $\frac{1}{2}$ LBS CHANNEL
OUTER RING OF PURLINS 3" x 3" x $\frac{3}{8}$ " ANGLE
ONE RING OF PURLINS 2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " x $\frac{3}{8}$ " ANGLE
THREE RINGS OF PURLINS 2 $\frac{1}{4}$ " x 2 $\frac{1}{4}$ " x 5/16" ANGLES AND
FOUR RINGS OF PURLINS 2" x 2" x $\frac{1}{4}$ " ANGLE

Appendix 2: Gasholder 2, Basic Record

BRITISH GAS

REGIONAL PLANT DEPT.

REPORT OF EXAMINATION OF GASHOLDER WATER-SEALED TYPE — BASIC RECORD

NAME: BRITISH GAS NORTH WESTERN EAST AREA
 LOCATION: MACCLESFIELD SK10 2BD
 GASHOLDER No. 2 Date of inspection
 SITUATION
 HOLDER BUILT BY UNKNOWN Date of completion 1884
 TANK BUILT BY UNKNOWN Date of completion NOT KNOWN
 LIFT ADDED BY - Date of completion
 TYPE (i.e. Column, Spiral or Rope Guided): COLUMN GUIDED IN BRICK TANK
 CAPACITY (exclusive of Crown) 400,000 CU.FT. (11,327 CU. METRES)
 CAPACITY OF CROWN 17,970 CU.FT. (509 CU. METRES)

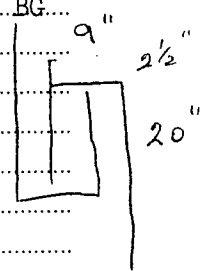
LIFTS

	Top	Second	Third	Fourth	Fifth
Diameter	98'-0"	100'3"			
Depth	27'-4"	28'-4"			
Pressure (in. w.g.)/mmHg	6.5	8.0			
No. of Columns Spiral Guides or Ropes	12	12			

GUIDE FRAMING (General Description) 12 Cast iron columns 58'-3" high on bases 4'-0" x 4'-0". Bottom section of columns approx. 2'-6" diameter. Guides 58'-3" high of 5" x 4 1/2" x 3/4" x 1" tees. 2 tiers of girders 27'0" long x 3'0" deep formed of 4" x 3" x 7/16" double angle stringers and 3" x 1/2" lattice flats. Top plates 8" x 1/2"

CROWN—RISE 4'9" { Number and Type of Manholes 2x 24" dia. + 2 - 30" x 40"
 Position and Number of Gas and Air Vents 1x2" in centre + 1 x 3" outer
 SHEETING THICKNESS { Crown: Outer Row 5/16", 12 radial Other Rows 8 BG 1/8" centre plate
 plates 5/16" Adjoining plate 3/8"
 Sides: Top Row 3/16" Intermediate Rows 9 and 10 BG 9"
 Bottom Row 3/16" 2 1/2"

CUPS & GRIPS (Size and construction, with sketch) 9" x 3 1/2" Channel



TOP CURB & CROWN FRAMING (Construction—See Sketch Sheet) Angle Curb
 Trussed crown. No drawings available.

TYPE OF LADDER Vertical steel ladder attached to framing.

TANK { Diameter 103'-6" Depth 28'-0" Construction Masonry
 Position in Relation to Ground Level: Coping at ground level
 Rest Blocks: Not known Number: Not known Size: Not known

MATERIAL USED FOR CONSTRUCTION OF { Gasholder Wrought iron Rivetted
 Tank Brick & puddled clay

INLET & OUTLET CONNECTIONS { Size: 24" dia.
 Position of Each: East Together or separated: Together

TYPE OF SAFETY SEAL { On Inlet Connection:
 On Outlet Connection: One Livesey box over inlet and outlet.

SIGNATURE DATE



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