A GENERAL REPORT UPON THE INITIATION AND CONSTRUCTION OF THE TUNNEL UNDER THE EAST RIVER, NEW YORK, TO THE PRESIDENT AND DIRECTORS OF THE EAST RIVER GAS COMPANY

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A General Report Upon the Initiation and Construction of the Tunnel Under the East River, New York, to the President and Directors of the East River Gas Company by Various

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A GENERAL REPORT

UPON THE INITIATION AND CONSTRUCTION

OF THE

TUNNEL UNDER THE EAST RIVER,

NEW YORK,

TO THE

PRESIDENT AND DIRECTORS

OF THE

EAST RIVER GAS COMPANY.

NEW YORK.

1894.

OFFICERS AND DIRECTORS

OF THE

EAST RIVER GAS COMPANY

OF LONG ISLAND CITY.

EMERSON MCMILLIN, - - - *President.*
EMANUEL LEHMAN, - - - *1st Vice-President.*
RICHARD N. YOUNG, - - - *2nd Vice-President.*
GEORGE G. HAVEN, JR., - - *Secretary and Treasurer.*
S. L. CROMWELL, - - - - *Ass't Sec'ty and Ass't. Treasurer.*
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A. D. JUILLIARD,
EMERSON MCMILLIN,
R. T. WILSON.

GENERAL REPORT

UPON THE

INITIATION AND CONSTRUCTION

OF

TUNNEL UNDER THE EAST RIVER,

NEW YORK.

The East River Gas Company of Long Island City was a corporation chartered under the Laws of the State of New York, to supply gas in Long Island City, N. Y. During 1891–1892, application was made to the State Legislature to grant a new and wider charter whereby gas may be supplied from works situated in Long Island City to the City of New York, which rights were granted without the application attracting any general attention.

Mr. Emerson McMillin, President, in the early part of May, 1892, took under advisement the feasibility of constructing a tunnel under the two channels of the East River and Blackwell's Island, between Long Island City and New York, through which the gas mains of the Company might be laid.

Preliminary Investigation.

Having been instructed to investigate this question, I immediately instituted preliminary survey and examination between the Company's works, situated at the foot of Webster avenue, Long Island City, and New York. The result of this examination was to determine that the most advantageous route would be from the southwest corner of the then property of the Company at Ravenswood, to between Seventieth and Seventy-first streets, East River,

New York, taking the south side of that block as the best location for the New York shaft.

On this line then I directed more detailed examination, and made drill soundings in order to ascertain, as well as possible, the conditions under the bed of the river. The shaft locations on both ends disclosed bed rock a few feet below the surface, and solid rock was visible at the water lines of the rivers, as well as on Blackwell's Island. The current running in these river channels is exceptional, being at spring tides as high as nine knots per hour on flood and ebb tides; and running with but little abated flow almost until the turn; allowing only some fifteen minutes of anything approaching still water for each tide, and even then the under current runs later than the surface, so that while it may be still water on the surface, the tide may be running strong at the bottom. It was found, too, that in some localities anchorage was impossible, as the anchors dragged over what seemed to be an almost smooth rock bottom.

It will thus be seen that to make core borings was not feasible, even allowing that such an impediment to the narrow water-way would have been permissible, and therefore it was determined to make drill soundings.

The drill used consists of 2-inch diameter hollow steel rods, having a water-pressure hose attachment at the top end and a hardened steel X bit point with $\frac{3}{4}$-inch perforations. In still water, any derrick-lifting attachment may be used for the purpose of sounding, as the rods are coupled with inside flush joints in 5-feet lengths. In this case, however, where so short a time is available for a sounding, and, where the depth of water is considerable, it is desirable to use a high floating pile-driver. This arrangement was adopted, and bringing the pile-driver into each position, as nearly as possible, a little while before the turn of tide,

gauged the depth of water, coupled sufficient lengths together between the guides of the machine, and at still water brought it up to exact location and made the sounding, using at the time a water pressure of 150 pounds per square inch.

Four soundings were thus made in the east channel and five in the west channel. In the former there appeared to be some two to five feet of sand and gravel overlying the rock; while in the latter there did not appear as great a quantity. In no case was there any evidence that the drill was striking on any boulder, or anything but solid bed rock, and I concluded that with very little doubt solid rock extended the whole distance across; and, as an added safeguard, I designed the roof grade of tunnel profile so that the least cover should be 40 feet below the bed of the river, which is itself 71 feet below the level of high water in the deepest part of the west channel; thus making a total depth of 111 feet between the crown of the tunnel and the level of mean high water at this point.

On this assumption I submitted to the President my report.

I thereupon received instructions to obtain bids on the work, which I immediately did, receiving from Messrs. McLaughlin, Reilly & Co. the most favorable proposal.

Before the contract was awarded it was found that the property on the south side of block in New York could not be acquired on favorable terms, and, therefore, the adjoining plot fronting on Seventy-first street was purchased, and the alignment of tunnel changed to that shown on the map and profile hereto attached, on which the tunnel has been constructed.

The bid of Messrs. McLaughlin, Reilly & Co. was accepted June 15, but the contract was not signed until June

25th, owing to delay arising from acceptance of their bond.

Four months after signing the contract, it was considered that the height of heading as arranged would be rather cramped for future developments, and it was determined to increase it from 7 feet to 8½ feet, retaining the original width of 10 feet.

Commencement of Work.

On June 28th, the contractors commenced work on the Ravenswood shaft, clearing away the surface, setting the top sill and excavating the top soil. Bed rock was found at 9½ feet below the surface of ground, and consisted of a very hard, compact gneiss, almost approaching granite.

On the New York side, the property which was required had not been transferred, and we were not put in possession until July 7th, when the shaft was staked out on location back of the proposed exterior street, which is to front on the river. On July 10th the contractors commenced work on this site. Here they had to cut down the high sloping street bank for a shaft-head landing, and had to build up a dry retaining wall from the street to use as a dump-car track. Bed rock on this location was found at about the street grade, and was the regular micaceous gneiss, known as the New York rock.

The contractors were delayed considerably with their work owing to non-arrival of their machinery, particularly the boilers and air compressors.

Work throughout on the shafts was very slow, and the contractors were repeatedly warned to expedite their progress.

The rock in the New York shaft was straight-grained, with dip about 10 degrees off vertical and strike nearly north and south, becoming harder in quality as the depth increased, but throughout of the same formation. No water or difficulties of any sort were experienced in sinking this shaft,

the bottom of which, 139½ feet below the original surface, was reached during the week ending October 29th.

At Ravenswood, however, the rock, at all times hard and of about the same kind, was more irregular in formation and seamy. About 25 feet below the surface fresh water was struck, and this constantly increased in quantity as the depth increased. As soon as fissures yielding water were plugged, it would flow elsewhere, and as it found its outlet at greater depths the water ceased flowing above. This water, although tried for a considerable time in the boilers, was most injurious to them, as the carbonate of lime and sulphate of magnesia were excessive, and its use had to be stopped. The difficulty of obtaining fit water for boiler purposes was a constant trouble and source of delay. This water, although not in any degree salt, was quite unfit for use, and the quantity in such narrow limits made the shaft sinking on this side tedious and difficult. The bottom was, however, reached and heading turned during the week ending November 12, 1892.

Great care was necessary in arranging for the alignment of the two headings, as work was to proceed from each end, to meet at some intermediate point; while the heading, only ten feet wide, was to be worked to its full width, and the small size of the shafts allowed of only an extremely short base line. **Instrumental Work.**

Careful triangulation was made determining the shaft centres as 2,516.4 feet apart.

The width of the channels of the river, combined with the inability to obtain equal back sights, made it somewhat risky to use a Y-level to determine the level benches on either side, and therefore resort was had to the level of the river at dead slack water. Float readings were taken on a number of days consecutively at the same moment on