

# EDWIN CHADWICK AND THE FIRST LARGE-SCALE ORDNANCE SURVEY OF LONDON

BY IDA DARLINGTON, M.A., F.S.A., F.L.A.

Between 1800 and 1840 the population of London doubled. There was a boom in house building, but the supply could not keep pace with the demand and in working class areas more and more families crowded into the already overcrowded tenements. Neither in the older built-up areas, where sewage collected in cesspools under the houses, nor in the newer streets and squares of Belgravia and Marylebone, where it flowed sluggishly through house drains into the main sewers and so ultimately into the River Thames, were there any adequate arrangements for its disposal. During hot summers in the 1830's and 1840's cholera spread through the town, and the 'noxious effluvia', which were thought to be its source, became painfully obvious even in St. James's. Outside the City responsibility for the drainage of London was divided among seven Commissions which did what they could with inadequate powers and a total lack of co-ordination to cope with an impossible situation. In 1847 a Royal Sanitary Commission was appointed to enquire into the matter, and its report, prepared with exemplary expedition, urged the necessity of unified control and an entire replanning of the main drainage system. In advance of legislation some unity was achieved by the simple device of appointing the same 23 commissioners to sit for each of the seven commissions, and in December 1847 the first Metropolitan Commission of Sewers met.

Edwin Chadwick, although he already had his hands full in organising the newly-formed Board of Health, was the moving spirit both on the Royal Sanitary Commission and on the first Metropolitan Commission of Sewers. He was convinced that no satisfactory drainage plan could be produced unless there was an accurate survey of the metropolitan area showing levels, and with his usual thoroughness and persistence he set out convincing his fellow commissioners of the need for such a survey. 'We expect that the first work which a consolidated Commission must see the necessity of directing to be proceeded with would be the general survey by the officers of the Royal Engineers, under the direction of the Board of Ordnance', says the 1847 Report. It is the authentic voice of Chadwick.

At the first meeting of the Metropolitan Commission of Sewers on 6th December 1847 Chadwick outlined his proposals in more detail and an order was issued that 'application be immediately made to Her Majesty's Board of Ordnance to direct a Survey on the larger scale of the Survey recently made of Liverpool, Manchester and other towns in Lancashire and Yorkshire', and that 'Sir Henry De La Beche and Mr. Chadwick be authorised to report respecting the insertion of such particulars in the Survey as may best adapt it for the requirements of the Public Service'. They, together with Richard Lambert Jones,<sup>1</sup> were deputed to invite the Commissioners for the City of London (who still maintained their independent existence outside the Metropolitan Commission) to join in the application.

Chadwick moved swiftly; he at once got in touch with Colonel Hall, the Superintendent of the Ordnance Survey. He had some difficulty in convincing him that what was immediately required was an accurate block plan showing streets and alleys, 'with a proper system of levels recorded in convenient situations by a sufficient number of bench marks',

not a minutely detailed plan showing every house, garden and post such as the Board had recently completed for Dublin; but by 10th January he was able to report that he had obtained an estimate of cost. This was £36,829 for a block plan of the metropolis and of the suburban districts within a radius of eight miles of St. Paul's on the scale of five feet to the mile. Of this sum £24,215 was for the survey and the remainder for engraving the plan on copper. At the same time Chadwick, in his other capacity as a member of the Royal Sanitary Commission had been making representations to the Government on the urgency of this work and had obtained assurances that the expense could be defrayed 'from the annual votes of Parliament, the execution of the Survey in other parts of the kingdom being in consequence spread over a longer period of time'.

At the meeting of the Sewer Commissioners on 27th January 1848, Chadwick was given authority to go ahead. Rooms and equipment in two of the offices of the Commission, at No. 1, Greek Street and in Great Alie Street, were set aside for the use of the draughtsmen to be employed on the Survey, while the two senior clerks who had their official residences in these two houses offered to give up some of their accommodation for the use of the officers carrying out the triangulation. By March the men of the Corps of Sappers and Miners were already attracting public notice by setting up their theodolites in the streets of Westminster. All seemed to be set fair, but Chadwick's authoritarian efficiency was apt to provoke opposition, and the case of the survey was no exception.

When the estimates came up for debate in the House of Commons Mr. James Wyld rose to enquire why the general taxpayer's money was to be spent on a survey which would be of benefit only to the metropolis, a survey, moreover, which was quite unnecessary in view of the many existing parish surveys which had already been made at the public expense. In private life the Honourable Member was a map publisher and map seller, so that his protest could not be considered entirely disinterested; nevertheless it had its effect and it soon became apparent that the government was likely to withdraw its support.

Chadwick refused to be intimidated, though dissident voices were also raised in the Commission. He called in a consulting engineer, Henry Austin, to answer the objectors. Austin submitted his report to the General Purposes Committee on 25th March. His general comment was shrewd. He thought the opposition to the survey either had 'its origins in motives unconnected with the public interests, or in total want of perception of the immense eventual economy' which would accrue from it. He stated that what was required was a complete triangulation of the area and the preparation of a connected skeleton outline of the streets and public ways, with notes on 'the relative levels of the whole surface'.

This work, the foundation of a correct Survey of the metropolis, does not now exist in any shape, nor can a trustworthy plan be possibly prepared until this preparatory labour has been executed under the surest guarantee of its perfect accuracy. It is true that many public and private surveys of parishes and properties do exist; some of them to a large scale and some no doubt accurate and trustworthy . . . [but] the attempt to connect these different surveys into a whole would be utterly futile . . . : they never could be fitted accurately together . . . From the time of Horwood to the present, there can be no doubt that more money has been wasted in repeated Surveys of large portions of the metropolis than would have produced a perfect detailed plan of the whole area . . . under general arrangements; Horwood's map, concocted some half century ago, probably in the same faulty manner to which it is now desired by some to resort, is known to be trigonometrically wrong, and has consequently never been trusted.

This was a hit at James Wyld, who had in hand a scheme for a new and revised edition of Horwood's map. Austin ended his report by urging that any delay in the execution of the

survey would be expensive not only in monetary terms but also in respect of the health and even the lives of the inhabitants of London. The Committee approved Austin's report and resolved to recommend to the Court of Commissioners that 'if Her Majesty's Government shall not sanction the continuance of the Survey of the metropolis out of its regular turn by the Ordnance out of the Consolidated Fund, the Ordnance [should be requested] to continue the triangulation, which they alone have the means of doing effectively, the Court undertaking the repayment of the expense of the same, if necessary'.

The opposition of the 'vested interests' was not, however, finally disposed of. In May 1848 the Commissioners received a letter from 'The Managing Committee of the Surveyors Association', saying that if a completely new survey of the metropolis had to be made there was no need to call in the military, since there were civilians trained and experienced as surveyors who were competent to carry out the task. The terms of the letter made it quite obvious that the 'Association' was an *ad hoc* body called into being for the specific purpose of getting a contract from the Commissioners; and when, after due consideration, their application was turned down on the grounds that they had not the experience or the authority of the Ordnance Corps to carry out the work, the 'Association' quickly dissolved.<sup>2</sup>

There was yet one further difficulty to be overcome before the execution of the Survey was secure. According to the terms of the Commissions under which the Commissioners were acting, the cost of any work could be charged only on the district benefiting from such work, and, on taking the advice of Counsel on the subject, the Commissioners were told that this regulation must be strictly applied to the costs of the survey. Fortunately the Board of Ordnance was willing to comply with this requirement, though it must have complicated the accounts considerably. In September 1848 an Act was passed which authorised the continuance of the Metropolitan Commission of Sewers for two years and which contained a clause authorising the making of 'a Survey of the Area within the limits of their Commission, and of any adjoining Parts which the Commissioners may think necessary'.

The surveying staff of the Board of Ordnance, under the direction of Captain Yolland, had in the meantime been forging ahead on the practical work of the survey with the minimum of fuss. On 22nd April 1848 *The Illustrated London News* carried an article on the 'crow's nests' which were appearing on Westminster Abbey and other churches to serve as observation posts, and readers were exhorted to welcome the surveyors under their leader, Colour-Sergeant Smith, as 'harbingers of great and glorious changes, from which must spring much physical and moral improvement of the people'. Pictures of the 'crow's nest' on Westminster Abbey and of some of 'the people' closely watching a soldier cutting a bench mark in the paving of what looks like one of the alcoves of old Westminster Bridge accompanied the article. A further article in the issue of 24th June 1848 described and illustrated the observatory which had been erected over the cross of St. Paul's Cathedral and explained its use for taking bearings in connection with the triangulation of the metropolitan area which was the first stage of the survey. Both the triangulation and the levelling had to be related to the survey which had already been carried out in the north of England in preparation for the six-inch Ordnance Survey maps, and, considering all the difficulties (the relation of the levels to the datum line at Liverpool was in itself a technical feat of no mean order), it was carried out with astonishing speed. Two hundred and fifty men excluding the draughtsmen, were employed on it, and in March 1849, just a year after its commencement, Captain Yolland was able to report that the ground survey was completed and the levellings almost so. There was some discussion among the Commissioners as to how much

detail should be put on the finished maps and as to the advisability of having them engraved, but it was finally agreed that the original scheme of outline maps with the minimum of detail apart from the levels should be adhered to, and that it was desirable that the sheets should be engraved on copper, both as a means of saving the original drawings from wear and tear and so that copies could be supplied to other public bodies or private persons who might require them. The estimated cost of engraving, based on one sheet which had been prepared as an experiment, was stated by Captain Yolland to be:

	£	s.	d.
The Copper Plate (weight 42½lbs. @ 1/7d. per lb.)	3	7	3½
Tracing the sheet for transfer to the Copper Plate		10	0
Cost of Engraving: Outline	£1	1	6½
Figures		5	9
Letters	£3	11	0
		4	18 3½
		£8	15 7

By November 1849, 79 sheets had been engraved and a number more were in hand. In July 1850 Captain Yolland reported that the engraving of the whole survey was almost finished<sup>3</sup> and that the saving effected on the original estimate of £24,215 was sufficient to cover the cost of an extra one hundred copies, in addition to the ten copies already ordered, and of the preparation and engraving 'of an Index or General map on the scale of 12ins. to the mile in 44 sheets'. The index map was completed by March 1851. A year or so later another set on the scale of 6ins. to the mile was engraved.

While the majority of the Commissioners were persuaded that Chadwick was right in thinking that the preparation of the large-scale maps was of paramount importance, they were anxious to take some practical steps for the improvement of the sewers pending the complete replanning of the drainage system. Chadwick was ready with two suggestions: first, he wanted the flushing of the sewers, particularly in the Westminster area, to be continued and increased so as to remove the foul deposits which were the source of the 'effluvia'; second, he wanted the Commission's own officers to undertake a 'subterranean survey' so that they could plot the position of the existing sewers on the Ordnance maps when these were ready. Both these suggestions, which he promoted with his usual vigour and determination, were adopted. Unfortunately his first idea was a mistaken one and led to much trouble. Like most of his contemporaries Chadwick, though so go-ahead in some matters, had entirely failed to appreciate the significance of Dr. John Snow's discovery that cholera was waterborne, and he did not realise that his flushing operations were in fact making matters worse, since they increased the danger of polluting the water supplies and were turning the River Thames into an open sewer.

Chadwick's second proposal, however, was eminently practical. The Westminster Commission did possess plans showing the lines of the main sewers under its supervision, though in many cases the levels were not accurately shown and the force (or even in some cases the direction) of flow in the side branches were unknown. In the areas covered by most of the other Commissions no accurate plans existed even of the main sewers. The position was particularly bad south of the river, where the Surveyor reported in 1849 that when flooding or other damage occurred his men had to 'dig down and search' in the roads to find where the sewers ran. The Commissioners approved the idea of the 'subterranean survey'

and in June, after a conference with Colour-Sergeant Smith, it was agreed that he should be transferred to the Commission to take charge of the work, and that two levellers at £2. 2s. od. a week each, two labourers to take charge of the instruments at 3s. od. a day, and two marksmen, for making the bench marks and driving in the bolts at 3s. 6d. a day, should be specially engaged for the purpose, labourers already in the service of the Commission being employed 'for finding and opening the Sewers'. A few weeks later the staff was increased so that two more parties could be at work at the same time. Their job was by no means an enviable one. Many of the sewers contained deposits of foul matter several feet in thickness and some of the men narrowly escaped death by drowning or from explosions of sewer gas. In March 1849 Henry Austin, Consulting Engineer, and Joseph Smith, Assistant Surveyor to the Commission, made a general report on the 'rotten state' of the sewers in the City of Westminster:

In the more modern district of Belgrave and Eaton Squares, although the brick-work of the sewers is generally sound and good, they contain faulty places and abound with noxious matter, in many cases stopping up the house-drains and smelling horribly; that in the district of Grosvenor, Hanover and Berkeley Squares, considerable deposit is found in the sewers, emitting much effluvia; . . . that much of the work north of Oxford Street about Cavendish, Bryanstone, Manchester and Portman Squares, is in such a state of rottenness and decay, there is no security for its standing from day to day; that there is a large amount of the most loathsome deposit in these sewers, but the act of flushing might bring some of them down altogether; that even throughout the New Paddington district, the neighbourhood of Hyde Park Gardens and the costly squares and streets adjacent, the sewers abound with the foulest deposit, from which the most disgusting effluvia arise, and that amidst the whole of Westminster District of Sewers the only little spot which can be mentioned as being in at all a satisfactory state is the immediate neighbourhood of Seven Dials.

This somewhat surprising conclusion was probably due to the fact that few of the inhabitants about Seven Dials yet enjoyed the benefits of a water-closet, and so less house drainage was washed down to pollute the sewers than in the more fashionable quarters.

The 'subterranean survey' is much more fully documented than the ground survey, for the field note-books, letters, and copper plates of the latter were all lost when the library of the Ordnance Survey Office at Southampton was destroyed during the last war. The field note-books of the surveyors employed by the Commission on the 'subterranean survey' have however almost all survived. They are of considerable interest both for the light they throw on the way the practical problems of the survey were tackled and for the information they give on the state of the streets and sewers at the time. The results of the 'subterranean survey' were plotted on the engraved sheets of the large-scale map as they were received from the Board of Ordnance. Most of these sheets have also survived, and they show in detail the courses of the old sewers and the progress of alterations as they took place.

One other by-product of the 1849-51 survey must be mentioned. Members of the Commission were much concerned over the unsatisfactory state of house drainage in the west end of London, where flushing had not brought the satisfactory results which Chadwick had anticipated. In 1849 the Commission decided that, as the skeleton map gave insufficient detail and was of too small a scale for the insertion of house drainage, they would as an experiment get their own surveyors and draughtsmen to lay down certain parts of the survey of Westminster on the scale of 10 ft. to the mile and to fill in thereon the details of all houses and other buildings. Thirteen sheets were drawn in this way covering the riverside area upstream from the Houses of Parliament. Later fifteen sheets covering Holland House and grounds and the neighbouring streets in Kensington was also drawn. All the sheets are now

in the London County Record Office. They are meticulously drawn and coloured, and their high standard of draughtsmanship is probably due to the fact that they were drawn under the supervision of Joseph Smith, who had been trained under the Board of Ordnance and who signed each sheet. Except for one experimental sheet, these maps were never engraved and they have been hidden away unused among the working plans of the Commission for many years. They are of considerable intrinsic interest since they show accurately and in great detail two areas of London twenty years before the publication of the first detailed large-scale Ordnance map and at a period when they were in process of rapid development. The production of these sheets was also important in that it influenced the decision to produce surveys on the 10 ft. scale of other large towns.

The Metropolitan Commission of Sewers did not survive long enough, nor in fact had it sufficient powers, to carry out the replanning of the main drainage of which the Metropolitan area was so badly in need. In 1855 it was superseded by the Metropolitan Board of Works, which in ten years revolutionised sanitary conditions by building five main intersecting sewers from west to east to drain the whole of London and to discharge at the Northern and Southern Outfall works at points which were then well beyond the built-up area. This work, which has stood the test of time (for much of it is still in service after nearly a century), would not have been possible without the accurate maps and levelling which Chadwick had so strongly advocated or without the surveying and engineering staff who had been trained under the Commission. London owes much to Sir Joseph Bazalgette who planned and carried through the construction of the main drainage system, but its debt to Edwin Chadwick, whose foresight made his work possible, is equally great.<sup>4</sup>

#### NOTES

- 1 Sir Henry De La Beche was a member of the Commission from 1847 to 1857. He served on several of its committees and was chairman of the Ordnance Survey Committee when this was set up in 1849. Richard Lambert Jones was one of the members appointed to the Commission by the City of London.
- 2 The [Royal] Institution of Chartered Surveyors came into being in 1868.
- 3 There were 847 sheets in all.
- 4 Except where otherwise stated the information in this paper is derived from the records of the Metropolitan Commission of Sewers in the London County Record Office.